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Stated Preference of Michigan Residents for Great Lakes Coastal Wetland Program Characteristics

By

Melissa Ann Gibson

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ABSTRACT

STATED PREFERENCE OF MICHIGAN RESIDNETS FOR GREAT LAKES COASTAL WETLAND PROGRAM CHARACTERISTICS

By

Melissa Ann Gibson

Wetlands are unique and important ecosystems, and policy makers want to develop appropriate conservation programs. Trade-offs must always be made when developing environmental programs. This thesis presents the results of a state-wide, stated choice questionnaire concerning programs for protecting and restoring Great Lake coastal wetlands. The survey questionnaire was designed and implemented as part of a wetland ecosystem economics research program at Michigan State University. The survey questionnaire was mailed to potential respondents in spring 2004 and had a 44% response rate. This thesis describes wetlands, their functions, research methods used in this study, and results of the stated choice section of the survey. Stated choice methods estimate preferences by developing statistical relationships between people's choices and the characteristics of the alternatives they choose among. Preferences were estimated for characteristics of Great Lakes coastal wetland programs such as the ecological services the program focuses on, the program's mix of preservation and restoration, and the land acquisition method. Since the literature review did not uncover previous research on public preferences for coastal wetland programs, this research provides a first step toward filling this gap. Knowledge gained from this study can aid policy makers in evaluating current policies and programs and in developing new coastal wetland programs that are in-line with public preferences.

To my family, my husband Daniel, my parents Michael and Marilyn Savard, my sisters, and all the rest. Thank you for everything.

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CHAPTER 1

INTRODUCTION

Wetlands are unique and important ecosystems. They support a diverse group of plants and animals and perform important ecological functions such as water filtration and water supply storage (Keating, 1995). Great Lakes coastal wetlands provide a variety of environmental services including the support of non-game species; provision of open space; protection of water quality; flood control; provision of fish and waterfowl habitat; as well as maintenance of biodiversity.

In the United States, the development of wetlands is federally regulated by the Clean Water Act and The Rivers and Harbors Act (Denison and Schmid, 1997; Gaddie and Regens, 2000). The U.S. Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) were given the authority to regulate the pollution of waters in the United States under the 1972 amendments to the Federal Water Pollution Control Act (National Research Council, 2001). While the amendments included regulation of U.S. wetlands, their narrow construction only covers 15% of the total wetland acreage.

Based on demographic information, it is predicted that by the early 21st century over 70% of the United States population will live within the coastal regions of the oceans and the Great Lakes (Vernberg, et al., 2001). Although various Federal and State laws regulate the use of wetlands in Michigan, they do not necessarily protect particular wetland services, and coastal wetland functions in Michigan are still being degraded and lost. Currently, there is newly proposed legislation in Congress, the Great Lakes Water Quality Indicators and Monitoring Act, which would assess the health of the Great Lakes

(United States Senate, 2005). Private organizations and state agencies have programs that attempt to overcome some of the shortfalls of government regulations, and protect or restore additional wetland acreage and services. There are around thirty programs protecting or restoring wetlands in Michigan. They vary from programs that focus on a providing a single service such as protecting waterfowl habitat to programs that are broadly aimed at acquiring high quality coastal land.

Problem Statement:

Current wetland programs vary in their scope and method for protection and restoration. At the present, little is known about the public's preference for program characteristics regarding Great Lakes coastal wetlands. With limited funding available, programs need to focus their efforts. Research into preferences for wetland programs can aid in determining which trade-offs to make when developing coastal wetland programs, and can provide information on how well current programs fit the needs of the public.

Objectives:

1. To learn about programs, and the characteristics of programs, protecting coastal wetlands in the state of Michigan.
2. To gain information, through the use of a questionnaire, on individuals' preferences for Great Lakes coastal wetland programs.
3. To estimate, through statistical analysis, the relationship between particular coastal wetland program characteristics and Michigan residents' preferences for Great Lakes coastal wetland programs.

The focus of this study was to elicit individual's preferences for particular Great Lakes coastal wetland programs through the use of a stated choice questionnaire. The questionnaire was designed to gain information on three different dimensions of possible coastal wetland programs: primary focus of the program (i.e., which environmental service is the top priority for the program), the mix of preservation and restoration used by the program, and the method of land acquisition for the program.

The thesis continues with defining Great Lakes coastal wetlands, and is followed by a description of their functions. Next, Chapter 2 will go over current laws and regulations protecting wetlands in Michigan, and will review various wetland protection program characteristics and how they can be utilized. The end of Chapter 2 provides a review of literature on preference studies, environmental valuation, as well as the stated choice method. Chapter 3, Methods, discusses the survey design and implementation. The stated choice question is presented in Chapter 4, along with estimation of the model and interpretation of the results. Conclusions and a summary make up Chapter 5. The appendix contains copies of each letter sent to respondents and the survey questionnaire.

COASTAL WETLANDS

Michigan Coastal Wetlands

Wetlands are biologically diverse and ecologically important. Due to their changing nature, wetlands are difficult to identify so it is best to begin with a legal definition.

> "Michigan's wetland statute, Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, defines a wetland as '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.' The definition applies to public and private lands regardless of zoning or ownership" (Michigan Department of Environmental Quality, 2005 (a)).

All wetlands have three main features. First, they have a pronounced presence of water at the surface or root level, and may have periods when they are dry. Second, wetlands have unique soil conditions, including accumulation of organic plant material, which is substantially different from surrounding lands. Third, the vegetation in a wetland is specifically adapted to wet conditions (hydrophytes) (Denison and Schmid, 1997; Hey, et al., 1999). If there are plants present that require dry conditions, the area is probably not a wetland, just an area inundated with water because of some external factors affecting it temporarily (Mitsch, 2000).

Great Lakes coastal wetlands are wetlands directly connected to the Great Lakes, and have water levels that rise and fall with the level of the Great Lakes (Mitsch, 2000). Wetlands a distance in from the shore, half a mile for example, may be considered a coastal wetland if its water level is connected to the water level of the Great Lakes. On the other hand, a wetland very close to the shore is not necessarily a coastal wetland because it is possible that its water level is not affected by the level of the Great Lakes.

There are six main types of Michigan coastal wetlands: lagoon/ barrier, embayed and shoreline, riverine, deltas, dune and swale, and manmade dikes (Albert, 2003; Michigan Sea Grant, 2002). Lagoon/ barrier wetlands are the most common, but embayed and shoreline wetlands are the most visible (Canadian Wildlife Service, 2002).

Shoreline wetlands in Michigan are currently more visible now due to the low water levels of the Great Lakes, creating more beaches. This recently exposed beach is covered with wetland vegetation and a constant presence of water.

The coastline of the Great Lakes is not made of an insignificant amount of land. In fact, including the islands present in the Great Lakes, there are 9,941 miles of coastline between the United States and Canada on the five lakes. This is only 2,442 miles fewer than the oceanic coastline for the entire United States, including Hawaii and Alaska, of 12,383 miles (World Atlas, 2004). Michigan alone has 2,138 miles of mainland shoreline (Jaworski and Raphal, 1978). In 1972, coastal wetlands comprised only 3.5% of Michigan's total wetland acreage, however, they made up a larger percentage of total habitat, 11-21% for different species (Jaworski and Raphal, 1978). In the 70's, coastal wetlands comprised 16% of the Michigan shoreline, with the highest percentage of Michigan's coastal wetlands around Lake Erie and Lake Huron, with a majority around Lake Huron (Jaworski and Raphal, 1978). Four counties around Saginaw Bay (on Lake Huron) contain 33% of Michigan's total coastal wetlands (Jaworski and Raphal, 1978).

Functions of Michigan Coastal Wetlands

Michigan coastal wetlands have many functions that are important to our environment and us. They help improve water quality by absorbing nutrients and chemicals that would otherwise be released into the environment and lead to poor water quality. Wetlands filter sediment, reducing turbidity and making the water clearer (Hey, et al., 1999). Wetlands provide an important function by recharging groundwater

supplies. They also provide an area for storage of flood waters, as well as supplies of water during drought (Hey, et al., 1999).

Great Lakes coastal wetlands provide habitat for fish, birds, and other wildlife. The spawning and nursery grounds that coastal wetlands supply are extremely important for sustaining our Great Lakes fish populations. They support small fish used as food by recreational and commercial fish. At least 75% of all Great Lakes fish use coastal wetlands during their life span, for one reason or another (Canadian Wildlife Service, 2002). Coastal wetlands also provide necessary breeding and feeding grounds for waterfowl. Michigan's coastal wetlands are very important for fall and spring bird migrations. Some species of waterfowl are only found in specific areas of Michigan's coastal wetlands.

Biological diversity provided by wetlands is another important function. Coastal wetlands may contain rare or uncommon fauna and flora that are not found in other environments. Wetlands hold concentrations of many species, including threatened and/or endangered species that could become extinct if their habitat continues to diminish. More wildlife and plants are supported by wetlands than any other habitat type in Michigan (Michigan Sea Grant, 2002).

These few examples of wetland functions are not meant to be exhaustive, but simply highlight some of the functions and services provided by wetlands. Other wetland functions include timber production, educational and research values, and open space and aesthetic values (Dennison and Schmid, 1997). Understanding the ecological functions and services provided by Great Lakes coastal wetlands is an important step in

determining public preferences for wetland programs and insures that informed decisions can be made.

CHAPTER 2

RULES, REGULATIONS AND PROGRAMS

Wetland Policies and Regulations in the United States

Between the late 1700's and the mid-1980's, 53% of the wetlands in the continental United States were lost (Dennison and Schmid, 1997). The Swamp Land Acts of 1849, 1850, and 1860 were the beginning of relevant federal regulations regarding agricultural drainage (Hey, et al., 1999). Drainage of "swamps" was believed to be a public benefit. In the 1890's the Rivers and Harbors Act was enacted which gave the Corps regulatory authority over work done on navigable waters, although environmental impacts were typically not considered in decision making (National Research Council, 2001). Through the Reclamation Act of 1902, land drainage had active government involvement and in 1936 the Flood Control Act was passed and land/waterways were either cleared, dredged or channels created in the name of flood protection (Hey, et al., 1999).

While previous regulations were aimed at clearing and draining land for other uses, in 1962, PL87-732 began to change the constant support of drainage for agricultural purposes. Wetland drainage in Minnesota and the Dakotas could no longer be financially supported by the USDA if the Secretary of the Interior determined that wildlife preservation would be harmed by drainage of the land (Hey, et al., 1999). In 1977, all cost-sharing for wetland drainage between farmers and the USDA was halted.

The Water Pollution Control Act of 1948 encouraged states to control water pollution although no funding was provided and enforcement was left up to the individual states; however, in 1956 states were authorized to set up water quality standards (Gaddie and Regens, 2000). The Wetlands Loan Act of 1961, which provided interest free loans for wetland acquisition and easements, was strengthened in 1965 by congress. The Fish and Wildlife Coordination Act, as amended in 1958, required that wildlife be given equal importance with other aspects of development when deciding on development of water resources (Hey, et al., 1999).

The Water Bank Act of 1970 was in essence a small scale wetlands protection policy with the goal of protect migratory waterfowl habitat. In exchange for not draining wetlands along the Mississippi, landowners received financial compensation (Hey, et al., 1999). This act, however, extended no further than the Mississippi river wetlands.

The National Environmental Policy Act (NEPA) of 1970 established, among other things, the Council on Environmental Quality. One of the requirements of the NEPA is that the effect on the environment must be considered in any major Federal action (Hey, et al., 1999).

The first international treaty regarding natural resource conservation and use was the Ramsar Convention in 1971, including the wise use of wetlands (Barbier, 1997). In 1972, amendments to the Federal Water Pollution Control Act (FWPCA) gave the U.S. Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) the authority to regulate the pollution of waters in the United States (Gaddie and Regens, 2000; National Research Council, 2001). FWPCA was touted as the single most important federal act protecting and restoring wetlands in the U.S. (Hey, et al., 1999).

The goal was to clean up the surface waters of the U.S., making them "fishable and swimmable" and to eliminate pollution discharge by 1985. The act gave the majority of the authority over development of wetland areas and wetland protection to the U.S. Environmental Protection Agency (EPA), except for the issuance of development permits (section 404), which is controlled by the Secretary of the Army, through the Corps of Engineers. Section 404(b) gives the EPA the ability to set the standards, and section 404(c) gives the EPA veto power over Corps permits (Hey, et al., 1999).

An amendment to the FWPCA, section 404 (PL95-217), known as the Clean Water Act, placed no limits to the jurisdiction of section 404 (Hey, et al., 1999). The Clean Water Act, specifically sections 404 and 401, and the Rivers and Harbors Act, Section 10, are the primary federal laws regulating development of wetlands (Denison and Schmid, 1997). The Endangered Species Act of 1973 (National Research Council, 2001), the National Environmental Policy Act (NEPA), the Coastal Zone Management Act (CZMA), and the Swampbuster provisions of the Food Security Act of 1985, as amended in 1990 and 1996, among others, are additional federal laws that may apply to development of wetlands, depending on the circumstances (Denison and Schmid, 1997).

From the 1970's through the 1980's, 54% of the wetland loss was due to agricultural conversion. The Swampbuster provisions of the Food Security Act in 1985 was designed to slow the conversion of wetlands to agricultural uses, and there is evidence that wetland loss due to agriculture has slowed (Dennison and Schmid, 1997). About 90,000 wetland acres were added nation wide from 1987 to 1990, due to programs designed to restore wetlands, under the Food Security Act (Dennison and Schmid, 1997).

The North American Wetlands Conservation Act of 1986 was written to protect, enhance, restore and create six million acres of wetland for waterfowl in North America (Hey, et al., 1999). A "no net loss" goal was announced by President George H. W. Bush in 1989, who then established an interagency task force to determine what would be necessary to achieve that goal (Hey, et al., 1999).

Michigan began regulating dredging, filling and discharging activities into the Great Lakes in 1966 (Gaddie and Regens, 2000). In the state of Michigan, the Geomare-Anderson Wetlands Protection Act was passed in 1979, and subsequently became Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Michigan Department of Environmental Quality, 2005 (b)). Coastal wetlands may also be protected under Part 323 (of the same Act), Shorelands Protection and Management (Michigan Department of Environmental Quality, 2005 (b)).

In 1984, Michigan was given the authority to manage the Federal Clean Water Act through out much of the state (Michigan Department of Environmental Quality, 2005 (b)). The Michigan Department of Environmental Quality (MDEQ) is allowed to issue permits pertaining to wetland alteration, instead of requiring applicants to file a federal application (Gaddie and Regens, 2000). While MDEQ has jurisdiction over in-land wetlands, overlapping regulation in coastal zones requires a joint permit with the federal government, and the U.S. Army Corps of Engineers retains jurisdiction over the Great Lakes and its coastal wetlands in conjunction with MDEQ (Michigan Department of Environmental Quality, 2005 (b)).

While state and federal regulations require permits, local governments may also regulate small wetlands not covered by the federal government or the State (Dempsey

and Kaplowitz, 2002). Almost forty townships and cities in Michigan have local wetland regulations that require permit applications to be made with the local community (Department of Environmental Quality, 2005 (b)).

Protecting Wetlands in Michigan: Programs and their Foci

Aside from laws and regulations, coastal wetlands are protected through a variety of programs with various methods for conserving wetlands. There are around thirty Federal, State, and private-organization programs protecting wetlands and wetland services in the state of Michigan, all of which are voluntary. Table 1 is a list of programs protecting or restoring wetlands in Michigan (Bailey, 2003).[1] The programs have been classified into six categories based on their primary focus: wetlands, waterfowl, natural resources, water/ watersheds, wildlife habitat, and coastal land. These categories are not mutually exclusive, and many programs have interests in more than one.

There are also other programs in the State of Michigan which aid the conservation of Great Lakes coastal wetlands through the dissemination of information. These types of programs, such as U.S. Geological Survey Great Lakes Science Center (which provides information about biological functions in the Great Lakes Basin, including information on wetlands), the Great Lakes Information Network and the Great Lakes Sea Grant Network are not presented here.

[1] To the best of my knowledge, the list is as inclusive as possible, and much of the information is based on work conducted by Deb Baily, 2003.

Table 1. List of Wetland Protection Programs Covering Michigan Coastal Wetlands.

Federal Programs	**Classification**
United State Army Corps of Engineers	
Continuing Authority Programs (CAP)	Water/ watersheds
U.S. Department of Agriculture (USDA)	
Natural Resource Conservation Service (NRCS)	
Wetland Reserve Program	Wildlife habitat
Wildlife Habitat Incentive Program	Wildlife habitat
Farm Service Agency (CRP)	
Conservation Reserve Program	Wetlands
Michigan Conservation Reserve Enhancement Program (CREP)	Water/ watersheds
United States Fish and Wildlife	
Coastal Program	
Great Lakes	Wildlife habitat
Coastal Zone Management Program (CZM)	Coastal land
Division of Bird Habitat Conservation (NAWCA)	Waterfowl
United States Environmental Protection Agency's Great Lakes National Program Office	Wetlands
State Programs	
Michigan Department of Environmental Quality (MDEQ)	
Coastal Management Program, Section 306 and 306A	Coastal land
Restoration / Enhancement Programs	Water/ watersheds
Coastal Restoration Grants	Coastal land
NOAA Coastal Management Fellowship Project	Coastal land
Michigan Department of Natural Resources	
Trust Fund (MNRTF)	Natural resources
Michigan Natural Features Inventory	Wildlife habitat

Table 1. (cont'd)

Non-Profit Programs	Classification
The Conservation Fund	
Great Lakes Revolving Loan Fund	Coastal land
Michigan Dune Alliance	Coastal land
Ducks Unlimited	
Partnership with FSA/MDA CREP	Waterfowl
North American Wetland Conservation Act	Waterfowl
Great Lakes Commission	
Coastal Wetlands Study Project	Water/ Watersheds
Great Lakes Aquatic Habitat Network and Fund	Water/ watersheds
The Great Lakes Wetlands, Conservation Action Plan	Wetlands
Great Lakes Wetland Policy Consortium	Wetlands
Hampton Township, Bay County	Coastal land
The Nature Conservancy	Wildlife habitat
The National Wildlife Federation Great Lakes Field Office	Water/ watersheds

Programs associated with the category "wetlands" refer to those with foci such as protecting environmentally sensitive areas, maintaining environmental integrity, protecting economic and aesthetic values, increasing public awareness, protecting, maintaining, or restoring chemical, biological, and physical habitats, etcetera. The Great Lakes Wetlands Conservation Action Plan is one program with the goal of securing, protecting and rehabilitating coastal wetlands in the lower Great Lakes, and does so through the purchase of land or easements as well as by working with private landowners (Ontario Nature, 2003). Other programs in this category involve land and easement

purchases, although the Farm Service Agency's Conservation Reserve Program uses ten to fifteen year contracts with cost sharing (Bailey, 2003). All programs identified as "wetland" programs deal with private landowners.

Programs focusing on preserving, restoring, and recreating waterfowl habitat are categorized under "waterfowl". Priorities include waterfowl migration, wintering habitat, enhancing wetland habitat diversity, and benefiting waterfowl. The programs listed deal with private landowners. Ducks Unlimited uses ten year agreements and provides financial incentives, and its North American Wetlands Conservation Act uses cost-share funding (Ducks Unlimited, 2003). Programs listed as "Waterfowl" all involve purchasing of land or easements, and the U.S. Fish and Wildlife NAWCA deals with the purchase of land or easements exclusively (Bailey, 2003).

"Natural resource" programs focus on the protection of natural resources and open space. Priorities include promotion of better understanding, conservation and use of the Great Lakes resources, and use of community based projects in achieving results in clean air, climate change, clean water, and nature. The MNTRF requires 25% matching funding on acquisition or development projects and involves the purchase of land (Bailey, 2003).

Programs focusing on restoring, recreating, and protecting "water/watersheds" and wetlands include priorities such as addressing the threat of water diversion, education of the public about effects of toxic substances, and protection of endangered species and habitats. Over half of these programs deal with private landowners, and several programs deal primarily with education. The Army Corp of Engineers Continuing Authority Programs vary from year to year, and was intended to allow the Secretary of the Army,

through the Corps, to conduct certain types of water resources improvements as necessary (Bailey, 2003). One of the "water/watershed" programs uses fourteen to fifteen year contracts, sign-up incentives, and a set level of cost-sharing. Other programs are local grassroots initiatives with limited funding, focusing more on education than purchase of land.

"Wildlife habitat" programs in Michigan primarily focus their attention on rehabilitation, conservation, and protection. Priorities include: all natural resources and working lands, especially with greatest wetland function and optimal wildlife habitat; coastal wetlands and lake plain, prairies, open dunes, fens, etcetera; coastal habitat to conserve fish and wildlife; and contaminated sediment remediation, stewardship and runoff control to protect habitat. Three programs deal with private land owners, and the Wetland Reserve Program (USDA, NRCS) program utilizes ten year cost-sharing, thirty year conservation easements, and permanent easement restoration (landowners control access). The Wildlife Habitat Incentives Program utilizes five to ten year cost-share payments (Bailey, 2003).

Programs in Michigan that protect "coastal lands" focus on advancing coastal management objectives including: maintaining and strengthening coastal management capabilities of coastal lakes, rivers mouths, bays, floodplains, etcetera; high quality coastal land acquisition; and conservation sites of high ecological significance. Two programs included in this category are the Great Lakes Revolving Loan Fund and the Michigan Dune Alliance, both run by the Conservation Fund (The Conservation Fund, 2003 (a); The Conservation Fund, 2003 (b)). Most programs listed as "coastal lands" utilize land purchases; two involve the purchase of easements, while three deal with

private landowners. The MDEQ's Coastal Management Program gives one-third of the money from the Federal Government (given to the state for DEQ programs) to local communities of the Great Lakes shoreline (Michigan Department of Environmental Quality, 2003). The DEQ receives $2.4 mill per year that must be matched 1:1 with state and local funds. Enforcement is given to local communities (as with many of the projects). Another program, MDEQ's Coastal Restoration Grants, only requires 25% matching funds (Bailey, 2003).

PROGRAM ELEMENTS

The programs discussed in the previous section utilize an assortment of methods for preserving or restoring wetlands with a range of main objectives. While the previous section presented programs that all protect wetlands in Michigan, they vary on the environmental service that they focus on preserving or protecting. Here, the primary focus of a program refers to the wetland function that is prioritized by the program. The programs in the previous section were categorized by their primary focus, and will not be re-visited here.

The programs presented above also differ from each other in their approach to protecting wetlands, whether it is preservation or restoration (both described in the following section) of wetlands or some combination of the two. Aside from the focus of the program and the type of protection, the programs differ in the methods they use for acquiring land that will be preserved or restored. Many of the programs acquire land through the purchase of property, while others utilize easements or land contracts. Most utilize a combination of methods to secure wetland acreage. In what follows,

descriptions of various program elements seen in actual programs in Michigan are discussed in order to further lay the ground work for the use of these program elements to create new coastal wetland protection programs in the state of Michigan.

Preservation and Restoration

Programs protecting wetlands can focus on either preserving the current condition of a wetland by preventing its degradation, or on restoring wetlands that have previously been harmed. Preservation of wetlands is just what it implies, preserving a wetland in its current state, preventing further degradation. Wetlands of varying size and with varying functions are preserved at their current levels. No effort is inputted into increasing the wetlands' functions.

Restoration of wetlands involves taking a degraded or destroyed wetland and restoring its functions, or some of its functions, to some previous level of quality. One example of restoration of wetlands is its use in mitigation projects (Mitsch and Wilson, 1996). Mitigation involves restoring a wetland (or creating a new one) in one location to compensate for the loss or degradation of a wetland in another location. Restoration projects take time and should be critiqued as success or failure only after a sufficient amount of time has passed, such as fifteen to twenty years or more (Mitsch and Wilson, 1996).

There is currently a debate over what entails proper restoration efforts, such as what the ending point should be, what sort of functions need to be included and at what level (Mitsch and Wilson, 1996; Higgs, 1997). Multiple definitions of wetland restoration are available, from the very general to the very specific, but a consensus does

not exist on what exactly defines proper restoration (Higgs, 1997). Both preservation and restoration programs typically involve some sort of monitoring to make sure the wetland in not being damaged or degraded any further.

Currently in the U.S. efforts from the Great Lakes Commission are attempting to influence Congress to accept nine specific goals to guide legislative action, enforce current laws and appropriate funding accordingly (Great Lakes Commission, 2005). Among other things, the Great Lake Commission would like to see funding approved for activities such as those to restore and enhance coastal lands.

Michigan Senators Carl Levin and Debbie Stabenow proposed new legislation in the 109th Congress on January 31, 2005. They, along with support of other senators, propose a bill to amend the Federal Water Pollution Control Act, the Great Lakes Water Quality Indicators and Monitoring Act, which would result in science-based assessment of the health of the Great Lakes. The proposal might also increase the focus on ecological restoration activities in the Great Lakes.

Land Acquisition

Projects attempting to protect the environment, by their nature, can only target a small number of people, in a small area, for a limited time frame (Kiss, 2002). Non-project approaches, as they are sometimes referred, are those that offer something, such as a financial benefit, to individuals to enable them to attain specific goals without telling them how to go about it (Kiss, 2002). Financial incentives may be in the form of the purchase of land or specific right to the land, as well as tax breaks for preservation. Non-

project approaches to environmental conservation include land purchase, conservation easements, tax-credits, and subsidies.

In the United States, conservation organizations such as The Nature Conservancy and the Conservation Fund preserve land primarily through direct purchase, leasing, or easements of the land (Ferraro and Kiss, 2002). There are many methods that can be utilized for land acquisition for the purpose of conservation. In the U.S. and most industrialized countries, the purchase of land, easements, leasing, and subsidies are the most commonly used methods for conservation (Ferraro and Kiss, 2002). Below are a few options program designers have, and the benefits and drawbacks of each.

Purchase of Property

The most widely known method of land acquisition for conservation purposes is the purchase of property. Market value of the land is typically paid, the land changes hands, and becomes controlled by an agency or organization. Because full value of the land is required to purchase it for conservation, the costs are relatively high. There are, however, relatively few subsequent costs. Enforcement and monitoring costs are relatively nil since the land is now owned by the conserving group (Boyd, et al., 1999).

Conservation Easements

Conservation easements are the purchase of particular rights for an area of land (Ferraro and Simpson, 2001). Public agencies, as well as private organizations, can purchase specific rights to land but not purchase the land itself. An easement may

purchase development rights, limit possible development by the owner, or have provisions to allow for public access (Parker, 2004). Conservation easements are typically a permanent purchase of specific rights to the land. The landowner is usually bound by contract to maintain the property, and prevent ecological degradation. The group or agency purchasing the easement is often contractually free from pre-existing liabilities, such as previous environmental contamination of the land work (Boyd, et al., 1999).

According to Morrisette, conservation easements offer the best, and sometimes only instrument, for preservation of private lands (Morrisette, 2001). Because easements are voluntary, they are easier for land owners to accept than direct regulations restricting land use (Boyd, et al., 1999). Conservation easements are less expensive than out-right purchase of the land, and allows the current owner (and subsequent owners, depending on the contract) to continue using the land in accordance with the provisions of the conservation easement contact. The costs associated with conservation easements, above the price for the specific rights, are in monitoring and enforcement as well as the cost of contracting for the land. Administrative burdens for conservation easement, while greater than for the out-right purchase of land, are lower than for most other methods, such as tax incentives or tradable development rights (Boyd, et al., 1999).

Conservation easements are becoming increasingly preferred as the primary preservation method, over the direct purchase of land. Land trusts, protecting various elements of our environment, currently preserve more land by conservation easements than outright land ownership (Parker, 2004). Land trusts are more likely to obtain land through conservation easements when the goal of the conservation is for services such as

creating scenic amenities, working lands, or conserving large areas of land (Parker, 2004). Parker also notes that land trusts preserving or enhancing wetlands, water quality, and rare species are just as likely to use conservation easements as purchase of land (Parker, 2004).

Land Contracts

While the purchase of land is fairly straight-forward, and permanent easements are the purchase of specific rights to land without actual possession of it, land contracts vary greatly in their scope and duration. Land contracts are less expensive than the land acquisition methods previously mentioned because they are usually for a specific period of time (such at ten or fifteen years), and do not go on indefinitely. Private organizations utilizing land contracts are only purchasing specific rights to the land for a specific period of time. The landowner agrees to restrict their use of the land for a specific period of time, in exchange for financial re-imbursement. In regards to preventing the conversion or degradation of a wetland, there is no guarantee of what will happen to the wetland once the land contract has expired.

Land contracts can also involve cost-sharing between the land owner and the organization or agency holding the land contract. For example, the U.S. Department of Agriculture has a voluntary Conservation Reserve Program (CRP) that provides rental payments and cost-share assistance (for approved conservation practices) to conserve resources on private land (Bailey, 2003). The contracts last ten to fifteen years.

RANKING AND VALUING ENVIRONMENTAL SERVICES

Michigan Coastal Wetlands

Federal and State laws and regulations, as well as wetland protection programs, attempt to protect wetlands (Bailey, 2003; Dennison and Schmid, 1997; Gaddie and Regens, 2000; Michigan Department of Environmental Quality, 2005 (b)). When developing their programming, organizations seeking to protect wetlands often pick a primary focus for wetland protection that reflects what they value most, or the functions they perceive to be undervalued in the current market and in need of protection. The optimal level of protection of wetlands depends upon the values society places upon the wetlands and their functions. If wetlands had no values (ecologically, in use or non-use) there would be little desire to protect them. Undervaluation of environmental amenities can lead to overexploitation or conversion of the resource.

Coastal wetlands have many uses and values that are often difficult to estimate (Woodward and Wui, 2001). As previously mentioned, wetlands provide water quality improvement, flood storage, water supply, and erosion protection, as well as other important functions (Keating, 1995). Michigan's coastal wetlands have recreational fishing and hunting values that can be estimated through the willingness of the sportsmen to pay for licenses and fees. Revenue from bird hunting licenses in a particular area is one way to try and estimate the wetlands value for waterfowl, but this approach could exclude non-hunted birds, bird-watching values, and values for photography. The value of water quality improvements can be estimated by replacement cost, such as considering how much it would cost to build and run a water treatment facility that provides the same

level of clean water, but this method does not include values that wetland provides for things such as wildlife habitat.

Michigan's coastal wetlands also have value not necessarily captured in the price of land, in the value of the licenses people buy, or related to the cost to re-create the functions lost. People often times do not have full information about the benefits of wetlands, and even when the benefits are known, they are very difficult to value accurately (Farber and Costanza, 1987). Non-use values, such as existence and option value, are also an important part of the total value of a wetland, or any environmental amenity. Values, such as non-consumptive recreation (bird-watching, nature study, etc.) are an essential element in the total value of a wetland, even though they are difficult to quantify (Jaworski and Raphal, 1978). Non-use values such as existence value and bequest value are even more difficult to estimate because many people who value wetlands for these reasons may not even visit a wetland in their lifetime. Non-use values cannot be estimated using market valuation techniques, because an individual's value for non-consumptive uses may not be noticed in the marketplace. Other methods are required to obtain a more accurate estimate of coastal wetlands value.

Environmental Valuation

There are multiple methods for valuing or ranking environmental amenities. Many valuation methods focus on market values. Others focus on non-market values such as use values which can be estimated by travel cost method, hedonic price analysis, and replacement cost estimation, among others. Revealed Preference (RP) methods look at actual real-world activity by individuals in determining people's preferences and

willingness to pay for particular amenities or services (Adamowicz, et al., 1998 (a)). Hedonic price method and travel cost method studies fall under the category of RP.

RP methods address actual, rather than stated, activity and are beneficial because the values and preferences revealed are based on observable behavior, and not based on hypothetical situations. This, however, is also a shortcoming as many interesting areas of research are hypothetical or can not be seen in the marketplace, and therefore no data from actual activity can be collected.

Stated Preference Modeling

Estimation of non-use values is a relatively new (around three decades) addition to environmental valuation (Loomis, et al., 2000; Woodward and Wui, 2001). Non-use values of environmental amenities or services are not revealed through RP studies. A person may value a wetland for its existence alone, but because they never visit it, the value they place upon it might not be counted. Stated Preference (SP) methods can incorporate total value, including the non-use value, by surveying a wide range of individuals, not necessarily just those who use the wetland. Preferences for environmental amenities, revealed by various types of SP studies, indicate relative value for those amenities. SP methods allow researchers to look at hypothetical situations, in a controlled environment.

Introduction to Attribute-Based Stated Choice Methods by Wiktor Adamowicz, et al, 1998, looks at how SP methods are used in the valuation of environmental services. Estimating non-use values for environmental services results in a "ranking" of services. SP methods include a wide range of research, from Open-ended Contingent Valuation to

Stated Choice (SC) methods, which includes Contingent Valuation (CV) and attributed based methods (Adamowicz, et al., 1998 (a)). CV is a SP method which incorporates a monetary value into the presented scenario (Adamowicz, et al., 1998 (a)). It is the most widely used SP method for valuing the environment (Carson, et al., 1994).

Stated Choice Method

There are multiple methods for valuing and ranking environmental amenities. Many CV studies measuring the value of particular services provided by wetlands (such as recreational values) are available, however, numerous studies value only a single function (Whitehead, 1993). CV is very useful in determining the monetary value of the damage, but Adamowicz et al. state it may not be as appropriate for determining the most preferred combination of resource attributes. Adamowicz et al. look at attribute based SC methods for valuing environmental damage, and for determining the attributes that could compensate for a lost or degraded resource (Adamowicz, et al., 1998 (a)). Choice methods are different than CV methods in that environmental attributes are varied, based on an experimental design (Blamey, et al., 1999; Boxall, et al., 1996). Attribute based SC methods provide individuals with two or more sets of attributes to choose among, and their choices can be used to rank the attributes presented. A SC ranking of preferences for environmental attributes provides and indication of what people value most, without the need to include a monetary value.

Attribute based SC method allows researchers to determine the relative importance of the program attributes based on the choices made by individuals (Morrison, et al., 1999). Choice experiments are based on random utility theory

(Morikawa, et al., 2002), and utility maximization (Adamowicz, et al., 1998 (a)) which assumes that individuals will select a set of attributes that provides them with the most utility. SC studies collect data from individuals by asking them to choose between a set of alternatives. Their choices are based on the attributes presented in the alternatives. Through the summation of individual choices and the experimental design, ranking of the attributes becomes possible. Ranking of attributes may be preferred by some researchers or policy-makers who are opposed to monetarily valuing the environment (Blamey, et al., 1999).

SC methods avoid many of the problems present in other methods that look at actual real world activity (observations of choices that are actually made). First, the choice set is clearly identified in the questionnaire. Second, the design of the model avoids the problem of co-linearity between variables by generating orthogonal attribute data. Third, the design of the survey produces a sufficient number of observations for all attributes (Adamowicz, et al., 1998 (b); Earnhart, 2001).

Choice modeling is ideal for estimating respondent's ranking of various attributes. When a monetary attribute is involved, it provides a technique for estimation of use and/or non-use values that is both flexible and cost-effective, especially when involving multiple alternatives (Blamey, et al., 1999). The SC method provides one method for ranking attributes. Values people place on particular environmental amenities indicates what their preferences are for those amenities. Monetary values give an indication of preference, and preferences give an indication of relative value.

Examples of the Stated Choice Method

Studies valuing freshwater ecosystems are somewhat limited in scientific literature (Costanza, et al., 1998) and additional research in valuing freshwater amenities would provide further insight into the value that individuals have for our environment. In recent years more studies valuing environmental non-use values using SP methods have been conducted. Stated Choice methods were first developed in marketing and transportation literature (Louviere and Hensher, 1982; Louviere and Woodworth, 1983). Not until recently have Stated Choice methods been used in environmental valuation (Adamowicz, et al., 1998 (a); Adamowicz, et al., 1998 (b); Adamowicz, et al., 1994; Boxall, et al., 1996; Swallow, et al., 1994).

Projects comparing SP methods to RP methods have demonstrated that SP methods provide accurate estimates of value. Adamowicz et al., compared results from a SP study to those of a RP study to evaluate the effect on recreational fishing values from water resource development. After correcting for error variances, both methods resulted in similar preference structures (Adamowicz, et al., 1994). Another study conducted by Adamowicz, in combination with Swait, Boxall, Louviere and Williams, estimates RP, SP and a combined RP and SP model of recreational site selection (Adamowicz, et al., 1997). After accounting for variance heterogeneity, it was found that RP and SP methods were similar and that the combined method of RP and SP performed the best (much better than RP by itself). There are, however, high costs associated with the joint RP and SP method, and that cost needs to be weighed against the possible benefits from joint analysis.

As previously mentioned, CV is the most widely used SP method. Adamowicz et al. evaluated SC experiments by comparing the results from a study estimating the passive use values for an environmental amenity using SC methods with the results from the CV method (Adamowicz, et al., 1998 (b)). The estimated models for the choice experiment performed well (Adamowicz, et al., 1998 (b)). When comparing the choice experiment and CV method, while accounting for error variances, there is not a significant difference in preference over income between the two methods. This gives credence to both methods, indicating that they perform equally well under the given circumstances.

Boxall et al. examined the effect a change in environmental quality on non-market recreational use values (Boxall and et al., 1996). The estimation of the CV approach and the Choice approach resulted in different estimates at first, but after corrections were made for respondents not taking into account substitute possibilities, the estimates in both methods were similar (Boxall and et al., 1996).

A choice experiment on wetland mitigation, conducted by Lupi, Kaplowitz and Hoehn, related the characteristics of a drained and a restored wetland to the acceptance of a mitigation project (Lupi, et al., 2002). It revealed that the public is concerned with the attributes of wetlands. Among other things, they discovered that habitat was and important attribute to the public (Lupi, et al., 2002).

A study conducted by Morrison et al. estimates the non-use values provided by Macquarie Marshes in Australia using choice modeling with costs attached to each option (Morrison, et al., 1999). The results of their study were statistically significant variables with high explanatory power, consistent with expectations, giving credibility to the

employment of choice modeling in valuing environmental non-use values. Another study found utilized a choice experiment valued the water supply in the Australian Capital Territory (Blamey, et al., 1999). This is study provides a ranking of program options.

WETLAND VALUATION

While the literature is somewhat limited, studies valuing wetlands are growing in number (Woodward and Wui, 2001). Valuation of specific wetlands has been conducted by multiple studies, but most do not provide insight into the relative values of wetland types, functions or services (Hoehn, et al., 2003). Estimated wetland values vary greatly across studies, and estimate various services (Woodward and Wui, 2001).

Farber and Costanza state that the cost of slowing or reversing wetland loss must be weighed against the social value of the wetlands they are trying to protect (Farber and Costanza, 1987). They estimate the willingness-to-pay for wetland services in Louisiana's coastal zone, attempting to value the entire wetland system. Their research estimates the value per acre people are willing to pay at above the current price of a wetland acre, $590 compared to $200.

A study conducted by Azevedo, Herriges and Kling models the recreational demand for wetlands in Iowa, and combines the use of revealed and stated preference methods (Azevedo, et al., 2003). They utilized the travel cost method, and a contingent behavior question by asking people how many times they would visit a wetland if the cost for visiting increased to X dollars. Their results found no consistency between the RP and SP methods. Data between the two methods was inconsistent, with results on

wetland value from each model being different. The source of the inconsistency is not known, and could be the fault of either RP or SP data, as well as differences in their estimation methods.

Woodward and Wui estimated the value of wetland services (a meta-analysis) and found that wetlands have a high value of consumptive (such as recreational fishing) and non-consumptive (such as flood control) services (Woodward and Wui, 2001).

In reference to coastal wetland valuation studies, those found were for the valuation of saltwater wetlands, and these dealt primarily with only one aspect, such as the value of oyster production (Batie and Wilson, 1978), the value of hurricane wind damage protection (Farber, 1987), and the value for waste treatment (Gosslink, et al., 1974).

A compilation of studies, by Wilson, showed that there have been 30 published studies from 1971 to 1997 valuing non-market goods for freshwater systems in the U.S. (Wilson, 1999). Valuation methods utilized by the various studies were the Travel Cost method, Hedonic method and CV method (Wilson, 1999). Whitehead looked at multiple methods that have been used for wetland valuation. Methods included in the study were the Net Factor Income approach, CV, Travel Cost, Hedonic Price, and Damage Cost methods (Whitehead, 1993). None of the studies or methods reviewed estimate value for freshwater systems using Stated Choice methods. While none of the studies utilized SC methods, their value estimates provide an indication of the public's preferences for the amenities. Those amenities with the highest valued would be the most preferred. However, because many studies are narrowly constructed to value one or only a few functions, it is difficult to rank a range of attributes.

More recently, Morrison conducted a study estimating the value of improved wetland quality in the Macquarie Marshes through Choice Modeling (Morrison, 2002). Morrison asserts that it is possible to estimate preferences for various wetland attributes, to estimate how these preferences vary across different groups, and to estimate what level of community support might be received for particular management programs (Morrison, 2002).

Because it is difficult to estimate values for an entire wetland system, there is little information about wetlands overall value (Farber and Costanza, 1987). Farber and Costanza state that more research into values of wetlands is needed to increase the accuracy of estimates (Farber and Costanza, 1987).

Great Lakes Wetland Valuation

Currently, there are no known studies (to the best of my knowledge) estimating preferences for Great Lakes coastal wetland program characteristics using the Stated Choice method. In fact, no studies were found utilizing the State Choice method in regard to any Great Lakes coastal wetland functions or values.

Adamowicz et al. assert that estimating people's preferences for particular resource attributes is necessary to determining adequate compensation for resource degradation or loss, by compensating for the loss or degradation in ways the public most values (Adamowicz, et al., 1998 (a)). Research determining preferences for wetland protection, and estimating the value, including non-use value, of wetlands is important and necessary to developing programs that will further protect our Great Lakes coastal wetlands. There is a large gap in information regarding preferences for Great Lakes

coastal wetland (or really any wetland) programs. Stated Choice studies have only recently been utilized for environmental valuation, and have yet to be used in Great Lakes coastal wetland studies. This study attempts to fill in some of that gap.

CHAPTER 3

SURVEY METHODS

Survey Questionnaire Design

The survey questionnaire was designed to be as "user-friendly" as possible, so respondents could easily understand and follow it (See Appendix for the complete questionnaire). The questionnaire consisted of fifty-three questions, organized under twenty-four headings. The first section of the questionnaire was designed to gather information on respondents' knowledge of and experience with Great Lakes coastal wetlands. Questions also collected information on respondents' knowledge of the types of program characteristics associated with wetland protection and restoration.

Survey booklet question number eight, the focus of this research, was a "stated choice question," which will be explained in detail later. This question was designed to gain information on the respondents' preferences for the characteristics of Great Lakes coastal wetland programs by asking respondents to choose between two program alternatives. The previous pages in the questionnaire provided the respondents with the information on the various parts of the program alternatives, so that they were able to differentiate between the two programs.

Question nine of the survey booklet was a contingent valuation question, designed to gather information on the values respondents place on particular wetland program attributes. Question nine took the program presented as Program A in question eight and included varying monetary values. Survey booklet question ten prompts respondents for

input as to their reasoning behind their answer in question nine. This information can be used to gain insight as to the respondent's basis for their decision. The remainder of the survey booklet questions asked for background information on the respondents (e.g., demographic characteristics). This information is a valuable tool for indicating validity of the sample, by determining if the respondents are a representative sample of the statewide population.

SURVEY QUESTIONNAIRE PRE-TESTING

High quality survey instruments typically go through pre-testing as part of the design and development process (Kaplowitz, et al., 2004). Pre-testing helps to ensure that the questionnaire language is understandable and that the questions asked are realistic and meaningful. For the Great Lakes coastal wetland survey, two different types of pre-testing were used.

First, pretest interviews were conducted using intercept interviews with participants randomly selected in public venues. For this, the researchers used two different "food courts" at shopping malls as the pre-testing locations and successfully completed twenty pre-testing sessions. Interviewers approached individuals in the food court areas, and asked them if they would be interested in filling out a public policy survey. Potential participants were told that they would receive an honorarium of ten dollars for participating. After participants agreed to the pretest interview, they received the ten dollar stipend as a good faith gesture. Participants next completed a draft of the survey questionnaire. After they finished the survey questionnaire, they were asked a

series of questions (see Table 2 below) pertaining to the questionnaire, its design, and their opinion of it.

Table 2. Interview Discussion Guide.

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 your 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 do each of these mean to you?
F. How would the program affect you?
G. Was the program realistic to you?
3. Other

The questions asked of respondents during the pre-test interviews were designed to determine if respondents understood the information and questions in the questionnaire, as well as to determine if the correct amount and type of information was

provided to respondents. The pre-testing surveys were also intended to evaluate whether the stated choice and non-market valuation were designed properly and resulted in a range of useful feedback.

The second pretest interviews were conducted using telephone recruitment of randomly selected individuals in mid-Michigan. The interviewees were invited to the Michigan State University campus for scheduled individual interviews. Three sessions of individual pre-test interview were used, the first on November 20, 2003, the second on December 4, 2003 and the third on December 10, 2003. The week before the individual interview sessions, interviewers made telephone contact with randomly selected residents in mid-Michigan. Interviewers asked each potential interviewee their age, education level, and gender. They then terminated any calls for which the demographic had been filled, to avoid over sampling any one particular group of individuals. Targets were set so to that only one person from the eighteen to twenty-five year old age group, and no one with an education level of a Masters degree or beyond were recruited. Individuals who possess a masters degree or beyond were not recruited because they were not a group of concern when testing the questionnaire for respondent comprehension, as well as the fact that the sampling was conducted in a university town, where there was more likely to be individuals with advanced degrees. Recruiting also sought to achieve an even distribution of males to females, to correspond with the close to even ratio of males to females in the state's population.

Each person contacted by phone was asked if they would be interested in participating in an interview regarding public policy at Michigan State University. They were told that they would be asked to complete a survey questionnaire and then

individually discuss their answers. Potential participants in the on campus pretest interviews were offered a twenty dollar honorarium for their time and effort. As in the case of the intercept pretest interviews, on campus interviewees were asked to complete a self administered written questionnaire and were then interviewed about their experience with the survey instrument. In total, twenty-three on campus pretest interviews took place, with questionnaire administration taking about ten minutes and with each interview lasting roughly twenty minutes. Based on the pre-testing interviews, modifications to the survey questionnaire were made for the purpose of clarity and to improve the overall design.

IMPLEMENTATION

The initial sample for the mail survey consisted of 1,650 individuals randomly drawn from a list of names and addresses obtained from the Michigan office of the Secretary of the State. The list was made up of a random selection of Michigan residents, twenty-one years or older, who possess a valid drivers license or State identification card. A stratified random sample was drawn from this list, with sample strata that corresponded to the seven most populous counties in Michigan (See Table 3). The 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 drawn from each county directly corresponds to the percentage of the state population that 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 in the population, no weights are needed in the

analysis of the stratified sample data (i.e., the weights to adjust for the stratified sampling all equal one).

Table 3. Stratified Random Sample, Depicting the Seven Most Populous Counties.

County	County Number	% of States Population	Stratified Sample Drawn	% of overall Sample
Genesee	25	4.31%	71	4.30%
Ingham	33	2.91%	48	2.91%
Kent	41	5.61%	92	5.58%
Macomb	50	8.15%	135	8.18%
Oakland	63	12.17%	201	12.18%
Washtenaw	81	3.43%	56	3.39%
Wayne	82	20.2%	334	20.24%
All other counties		43.21%	713	43.21%
Total		100%	1,650	100%

Dilman's survey steps were utilized by this survey to achieve the best response rate possible (Dillman, 2000). The self-administered survey was implemented through the mail using the Tailored Design Method (Dillman, 2000). As advocated by the Tailored Design Method, a respondent-friendly questionnaire was developed, with the survey utilizing a five contact format.

The mail survey implementation consisted of five contacts: a pre-notice letter, a questionnaire, a reminder postcard, a replacement questionnaire, and a final contact with

an additional replacement questionnaire. To the extent possible, each contact was personalized. All letters were addressed directly to respondents and printed on high quality, watermarked paper. Letters and postcards were hand signed, and the large format questionnaires were printed in color on glossy paper. An incentive, consisting of three first class stamps, was included with the first questionnaire for half of the respondents for the purpose of achieving higher response rate (Dillman, 2000).

The first of the five mailing contacts was a pre-notice letter designed 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 March 29, 2004.

The second contact was a survey questionnaire packet, which consisted of a questionnaire, a hand-signed cover letter, a business reply envelope for respondents to return the questionnaire, and an incentive of three first class stamps included in half of the sample. This second wave was mailed to participants first class on April 6, 2004.

The third contact with respondents was a hand signed reminder postcard, and was mailed to respondents on April 13, 2004. Dillman recommends that this contact be mailed a few days to a week after the questionnaire (Dillman, 2000). The postcard asked them to please fill out and return the questionnaire, and thanked them if they had already done so.

The fourth contact was mailed April 19th. 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. Dillman suggests this wave be mailed two to four

weeks after the third wave, but this wave was mailed earlier because the previous booklet was found to contain an error in the valuation section of the questionnaire (Dillman, 2000). The error involved the dollar amounts that appeared several times in the booklet, and the values did not always match when they were supposed to in some versions of the booklet. A new booklet was sent as soon as possible to correct for the error.

The fifth and final mailing included a questionnaire, business reply envelope, and a cover letter indicating that this was the final contact. The entire sample was split into two groups, half that would receive the final mailing with the regular postage, and half that would receive the questionnaire packet in a priority envelope, in an attempt to increase the response rate. The fifth wave was mailed May 11th, within the two to four weeks after the fourth wave that is recommended by the Tailored Design Method (Dillman, 2000).

DATA ENTRY AND RESPONSE RATE

Each of the five mailings were carefully documented. Mailing dates, mail returned dates and post-mark dates were all recorded, and information on returned mail and responses were all recorded and coded.

The American Association for Public Opinion Research (AAPOR) standards were followed in data entry and in determining response rates (AAPOR, 2004). The AAPOR code system was utilized by our survey, with some minor modifications and condensing of categories. A Final Disposition code was recorded for each individual in the survey sample. All categories, with the exception of 2.31, were condensed to the tenth decimal place. A coding of 2.31 indicated that the individual was deceased, and for the purposes

of this study, the deceased were not counted as being valid possible responses. Table 4, on the following page, depicts the condensed categories from the AAPOR final disposition codes for mail surveys that were utilized in determining the response rate. The minimum response rate is determined by the formula presented in table 4.

The response rate presented here is Response Rate (RR2), which includes partial interviews. It is the number of completed questionnaires divided by the total completed plus the total number of non-interviews (minus the deceased) plus the number of cases of unknown eligibility.

Table 4. Response Rate Coding.

RR2 = (I+P) / ((I+P) + (R+NC+O) + (UH+UO))			
RR	=	*Response rate*	*# of Sample*
I	=	Complete interview (coded 1.1)	540
P	=	Partial Interview (coded 1.2)	0
R	=	Refusal and break-off (coded 2.1)	22
NC	=	Non-contact (coded 2.2)	0
O	=	Other (coded 2.32)[2]	9
UH	=	Unknown if household occupied HU (coded 3.1)	645
UO	=	Unknown, other (coded 3.2)	4
	=	Invalid (coded 3.3, 3.4 or 4.1 including 2.31-the deceased)	430
		Total	1650

[2] "Other" includes individuals with language problems or incapacitated persons (both coded as 2.32 here). AAPOR includes those that have passed on as being valid possible respondents under O (coded 2.31). For this study, those who are discovered to be dead are not counted as being valid for response rate purposes.

Of the 1,650 persons in the initial sample, 430 had invalid addresses. Invalid means that the researchers received at least one notification that the address was not correct (e.g. wrong address, moved). Removing these invalid yielded a sample with 1,220 valid addresses. In total, 540 completed questionnaires were returned yielding an overall response rate for the survey of 44.26%. Of the 540 completed questionnaires, only 538 were available for data analysis (2 questionnaires that were entered as received in incoming mail were subsequently lost), hence, results are based on 538 completed questionnaires.

The details of the survey questionnaire responses by mailing are as follows:

- 1,650 survey questionnaires were mailed in wave two (the first mailing of the questionnaire). Of those mailed, 356 questionnaires were returned completed, and 408 questionnaires, pre-notice letters or post cards (wave one and three) were returned with a bad address (or were found to be deceased) and coded as invalid, which give us a 28.66% response rate for wave two.
- 1,239 questionnaires were mailed in the fourth wave (the second mailing of the survey questionnaire). Not all of the notices of bad address from wave one, two and three had been received prior to mailing out the second survey questionnaire. In addition to the 408 invalid questionnaires from wave one through three, 12 questionnaires were returned invalid in this wave. 137 additional questionnaires were returned completed. The response rate for wave four was 15.91%.
- 813 questionnaires were mailed in wave five, the final mailing of the survey questionnaire to non-respondents. This wave resulted in an additional 7 addresses

being invalid and 47 additional questionnaires returned as completed. The response rate for wave 5 was 6.69%

- Overall response rate for the survey questionnaires was 44.26% (540/1220)

Demographic Characteristics of the Sample

Survey samples should be representative of the population for which they are claiming to estimate values. Table 5 depicts how respondents to this survey questionnaire compare demographically to the general population of Michigan (U.S. Census Bureau, 2000).

As can be seen in Table 5, the demographic characteristics of the survey sample respondents are reasonably similar to those of Michigan's general population (Lupi, et al., 2004). Respondents to the questionnaire did not have a substantially different average household size than the State of Michigan's average (2.76% and 2.56% persons respectively). The average age of respondents (49.8%) is slightly higher than the average for Michigan residents (46.4%). Survey respondents had a lower median household income ($42,500) than the States median household income ($46,986).

Survey respondents, on average, were slightly more educated than Michigan's population, 63.7% compared to 61.6% respectively for attainment of a high school education or higher, and 30.7% compared to 21.8% respectively with a bachelor's degree or higher.

Table 5. Comparison between Survey Respondents and Census Results for Michigan

	Survey Sample	State of Michigan
Average Household size	2.76	2.56[3]
Average age	49.8	46.4[4]
Household Median income	$42,500	$46,986[5]
Education		
High school graduate or higher	63.7%	61.6%[6]
Bachelor's degree or higher	30.7%	21.8%
Ethnicity		
White	89.3%	80.7%[7]
African-American	4.7%	13.0%
Hispanic, Latino or Spanish	1.2%	2.7%
Female	52.4%	51.8%[8]

Most survey respondents reported being 'white', 89.3%, more than the States' population of 80.7%. Minorities were under represented in the sample. Fewer respondents indicated they are 'African-American' (4.7% compared to 13.0% for Michigan) or 'Hispanic, Latino or Spanish' (1.2% compared to 2.7% in the state). Other

[3] U.S. Census Bureau, Census 2000. Table DP-1 Profile of General Demographic Characteristics: 2000. Geographic area: Michigan.
[4] 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.
[5] 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.
[6] Educational information obtained from 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.
[7] 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/.
[8] 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/

minority groups, not presented in the table above, include: 'Hawaiian or other Pacific Islander' (0.6%), 'Asian' (0.8%), 'American-Indian or Alaska native' (0.6%) and 'other' (2.9%) (Lupi, et al., 2004).

The distribution of male to female respondents is very similar to the State population (52.4% and 51.8% respectively). Overall, respondents to the survey questionnaire measure up reasonably well with census data for Michigan residents (Lupi, et al., 2004).

CHAPTER 4

STATED CHOICE MODEL

Stated Choice

Trade-offs between environmental services must always be made, as funds are not unlimited. Programs requiring the financial inputs need to be protecting or restoring a service that is valued by society in an amount equal to or greater than the cost of the program to make it economically justified (Barbier, 1997). Discovering people's preferences for a service gives an indication to the relative value of the services.

It can be very difficult for policy makers and program planners to prioritize environmental services when designing a wetland policies or programs. To address this need for prioritizing services, a stated choice questionnaire was designed to elicit people's preferences over alternative coastal wetland programs. Stated choice methods develop statistical relationships between people's choices and the attributes of the alternatives they choose among. This research sought to identify the particular environmental services provided by Great Lakes Coastal wetlands which were top priorities to Michigan residents, what sort of mix people prefer between preservation and restoration activities, and the desirability of alternative mechanisms for acquiring land for wetland preservation and restoration.

For the stated choice question, respondents were presented with a scenario, or choice set. In order to obtain responses that are as accurate as possible, respondents must believe that the program offered is realistic and that they could actually be voting for or

against a particular program. If the program is not realistic, responses to the questions might not be realistic either. The scenario consisted of two program alternatives from which respondents were asked to choose. The two program alternatives were presented side by side for easy comparison and labeled program A and program B.

The choice question was a binary discrete choice question in which respondents were asked to choose whether they preferred program A or program B, based on the attribute levels given. Table 6, below, depicts the general scenario given to respondents. Each program alternative contained three attributes, with attribute levels that varied from program to program. In total, there were ninety-eight different programs, making up forty-nine different scenarios, evenly distributed across the sample. The number of programs needed was determined by the number of attributes in the model, and will be discussed further in the section on the experimental design.

The stated choice method provides a means of turning choices, such as in table 6, into quantitative estimates of peoples' preferences. By varying the attributes across people, their effect on peoples' choices can be determined. The stated choice method is based on random utility theory (Adamowicz, et al., 1998 (a)), discussed below. Random utility theory is utilized to model individual's preferences for Great Lakes coastal wetland programs, including modeling preferences for the individual attributes of the programs.

Table 6. Example Survey Questionnaire Page Showing One Version of the Stated Choice Question (Scenario).

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 wetland provide, which is the program's highest priority?		
Primary Focus	**Water Quality and Flood Control**	**Non-Game Species**
How the program effort and resources are divided		
Preservation of high quality coastal wetlands	**40% Preservation**	**60% Preservation**
Restoration of coastal wetlands in poor condition	**60% Restoration**	**40% Restoration**
How the program gets coastal wetland sites from volunteers		
Pays for purchase, permanent easement, or ten-year contract	**Purchase Property**	**Permanent Easements**

1. **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

In any survey, there are a limited number of options that can be offered to respondents. In this survey questionnaire there were three attributes offered in each of the two programs. The three attributes that made up each program were program "priority", program "mix" of effort divided between preservation and restoration of coastal wetlands, and the program "tool" used to implement the program. Each attribute was made up of levels: "priority" contained six levels, "mix" had seven levels, and "tool" had three levels. Table 7 shows the different wetland priorities.

Table 7. Priority: The Program's Primary Focus.

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

"Priority" refers to the six different program priorities presented in the programs. It is the priority offered to respondents as the program's primary focus. Each individual has two programs from to choose between, and each program contains one of the six priorities presented above. The experimental design of the choice model pre-determines which priorities are in a given scenario.

Table 8. Mix: Effort Devoted to Preservation and Restoration.

Mix:
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

Table 8 shows the preservation / restoration mix. "Mix" refers to the division of effort between preservation and restoration activates offered in each program. The programs vary between the seven levels presented. The "mix" shows how each program's resources would be split between the two activities.

Table 9. Tool: Land Acquisition Method.

Tool:
Purchase Property
Permanent Easements
Ten Year Contracts

Table 9 shows the three different tools that could be utilized for implementing the program. "Tool" refers to the method utilized for acquiring acreage for coastal wetland preservation or restoration. The "tool" is how the program gets coastal wetland sites from volunteers.

Experimental Design of the Stated Choice Question

The experimental design of a stated choice question refers to the method for combining the attribute levels into alternative programs, and how these are then combined to create the choice scenarios to be presented in the questionnaire. In order to estimate the response of the choice probability to the X's (the attribute levels), the attribute levels must vary within the survey. A full factorial design is one in which every level of every attribute can be combined with every level of all other attributes. Program "priority" contained six levels inputted into both program A and program B options. Program "mix" contained seven levels, and "tool" was made up of 3 levels, which also appear in both program options. To determine the number of combinations that would be necessary for a full factorial design, the number of levels of each attribute are squared (to account for them being included in both program A and B) and then multiplied by the other squared attribute level counts. The full factorial design for this study would result in $6^2x7^2x3^2$, 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, were independent of each other. A main effects plan generates variables that are linearly independent, within and across alternatives. In a main effects design, only the first order interactions among variables can be identified. The main effects design resulted in 49 pairs of alternatives requiring 49 questionnaire versions, or 49 different choice sets, far fewer and easier to manage than the 15,876 needed for a factorial design.

THE MODEL

Next, a little math background is needed. In order to estimate a choice experiment, some initial groundwork must be laid, to set out the theory and basic assumptions behind a choice model. The section begins with random utility theory and its assumptions, and then presents the statistical model used to estimate preference parameters.

First, the stated choice model is based on the standard economic assumption that individuals will try to maximize their utility, U (Adamowicz, et al., 1998 (a)). Put differently, it is assumed that individuals will pick the alternative they like best, and each level of each attribute contributes to the total utility level in its own way. That is, an individual, i (i = 1,...,N) will choose alternative a over alternative b if:

$$U_{ai} > U_{bi}. \tag{1}$$

The subscripts a and b refer to program alternative a and program alternative b in the choice experiment, and U_{ai} is the utility of the a^{th} alternative for the i^{th} individual (Louviere, et al., 2000). Based on the attribute levels given in each program, one program will provide the individual with a higher level of utility than the other. The model also assumes that U_{ai} has two components, a systematic or 'representative utility' component, V_a, which is deterministic, and an additive random component, ε_a, which is the stochastic term, as follows:

$$\begin{aligned} U_{ai} &= V_a + \varepsilon_a \quad \text{for alternative } a, \text{ and} \\ U_{bi} &= V_b + \varepsilon_b \quad \text{for alternative } b. \end{aligned} \tag{2}$$

By combining equations, it can now be seen that alternative *a* is chosen when

$$(V_a + \varepsilon_a) > (V_b + \varepsilon_b) \tag{3}$$

which can also be written as

$$(V_a + \varepsilon_a) - (V_b + \varepsilon_b) > 0. \tag{4}$$

V_a, the representative utility component is an expression in terms of the attributes of the question, a vector of all attributes in a choice.

Since, the choice an individual makes is based on the vectors of attributes given them (X), the usual specification is followed by writing V as a linear-in-parameters function of the attributes (Louviere, et al., 2000) as follows:

$$V_a = \beta X_a \qquad \text{and} \qquad V_b = \beta X_b, \tag{5}$$

where β is the vector of the preference parameters associated with the attributes, X, that make up alternatives *a* and *b*. Substituting the βX's into equation (4) gives:

$$(\beta X_a + \varepsilon_a) - (\beta X_b + \varepsilon_b) > 0. \tag{6}$$

Then, collecting terms results in,

$$\beta(X_a - X_b) + \varepsilon_a - \varepsilon_b > 0. \quad (7)$$

Again, the above equation would be true if, and only if, option *a* is chosen.

At this point, the probability that option *a* is chosen over option *b* can be written as

$$\text{Prob}(U_a > U_b) = \text{Prob}\,(\beta(X_a - X_b) + \varepsilon_a - \varepsilon_b > 0) = P_a, \quad (8)$$

where P_a equals the probability that alternative *a* is preferred to *b*. A dummy variable is used to indicate choice, equaling 1 when alternative *a* is chosen, and 0 when alternative *b* is chosen (a binary choice).

To achieve the desired goal of estimating the β's, an assumption about the errors must be made. A common approach involves assuming that the errors, ε's, are independent and identically distributed from a type I extreme value distribution (Louviere, et al., 2000) with a mean of zero and scale factor α, which yields the logit form for the choice probabilities as follows:

$$P_a = F(\beta X) = 1 / (1 + e^{-(\beta X/\alpha)}), \quad (9)$$

with $X = X_a - X_b$ in our model. This logit form is the basic choice model estimated, and this is the most widely used form of the random utility model for stated choice data. In a logit model, as a consequence of the errors assumptions (McFadden, 1973), there is an assumption of 'positivity,' meaning that the probability that a given program alternative

is chosen must be greater than zero (Louviere, et al., 2000). When estimating β's using the logit form, it is not possible to separately identify the scale factor (due in part to the discrete nature of the dependent variable). The estimated β's from equation (9) are thus estimates of β/α. For this reason, it is often assumed that $\alpha=1$. Consequently, one cannot directly compare β's across data sets because α is directly connected to the estimated β's in the data set. However, it would be appropriate to compare ratios of the β's among alternate data sets because the scale factor cancels out of such calculations.

ESTIMATION OF THE MODEL

The model is estimated by Maximum Likelihood estimation (MLE). Theory behind MLE for random samples implies that MLE is consistent, asymptotically normal, and asymptotically efficient, and MLE is the estimation method most commonly used for logit models (Louviere, et al., 2000; Wooldridge, 2000).

The exact specification of the model in terms of the specific variables is given by:

$$\begin{aligned} V = \beta X = \; & \beta_1 \textit{Non Game Species} + \beta_2 \textit{Water Quality and Flood Control} + \\ & \beta_3 \textit{Fish Habitat} + \beta_4 \textit{Waterfowl Habitat} + \beta_5 \textit{Biodiversity} + \\ & \beta_6 \textit{Purchase Property} + \beta_7 \textit{Permanent Easements} + \\ & \beta_8 \textit{Percent Preservation} + \beta_9 \textit{Percent Preservation}^2. \end{aligned} \quad (10)$$

The specific variables in equation (10) are all defined in Table 10. The goal was to estimate the β's which indicate the effect that each of the variables has on utility, and consequently, through equation (9), relate the probability that individuals prefer one program to another given the attributes of the two programs. To estimate the model, the

levels for the "priority" and "tool" variables were converted to binary variables due to the fact that they were not continuous (see Table 10).

Table 10. Variables Used in the Estimation of the Utility Function.

	Variable	Variable Definition
"Priority"	*Non Game Species*	A dummy variable indicating whether *Non Game Species* is the program's top priority.
	Water Quality and Flood Control	A dummy variable indicating whether *Water Quality and Flood Control* is the program's top priority.
	Fish Habitat	A dummy variable indicating whether *Fish Habitat* is the program's top priority.
	Waterfowl Habitat	A dummy variable indicating whether *Waterfowl Habitat* is the program's top priority.
	Biodiversity	A dummy variable indicating whether *Biodiversity* is the program's top priority.
	Open Space Near Cities	The baseline for comparison of priority variables. Not reported in Table 10.
"Tool"	*Purchase Property*	A dummy variable indicating whether or not *Purchase Property* was the approach used to acquire wetland acreage.
	Permanent Easements	A dummy variable indicating whether or not *Permanent Easements* was the approach used to acquire wetland acreage.
	Ten Year Contracts	The baseline for comparison of tool variables. Not reported in Table 10.
"Mix"	*Percent Preservation*	A continuous variable representing the percentage of program effort devoted to preservation.
	Percent Preservation^2	A continuous variable representing the percentage of program effort devoted to preservation, squared, to show the non-linear effects.

When running a logit regression with binary variables, one level of each of the attributes must serve as the baseline for the remaining levels of that attribute. The "priority" and "tool" attribute levels that are included in the regression must be interpreted relative to the levels of the variable that served as the baseline. *Open Space near Cities* was the level omitted from the regression for program priorities, and was therefore the baseline for program priorities. Coefficients resulting from the logit regression for the remaining program priorities are interpreted as the effect on the choice probability, relative to the effect on the choice probability that *Open Space near Cities* has. *Ten Year Contracts* was the variable omitted from the regression for program tools, and was likewise the baseline for program tools. All remaining attribute levels for program priorities and program tools were included as variables, and their estimated parameters must be interpreted as the effect they have on utility relative to the omitted attribute of their group.

The attribute "mix" (see Table 10) was represented by the continuous variable, *Percent Preservation*. *Percent Preservation* is based solely on the preservation level of the mix attribute because the percent preservation and percent restoration levels for a program always add to 100%. The variable *Percent Preservation* takes on seven levels, ranging from 10% to 90% (see Table 8). *Percent Preservation*^{2} was also included in the logit regression to estimate any non-linear effects the preservation level might have had on the choice probability. Estimating non-linear effects enables us to view any peaks in preference for the level of preservation; it may not be the case that more preservation is always preferred to less.

ESTIMATION RESULTS

Out of the 540 responses to the questionnaire, only 512 were valid for estimation. Two questionnaires were lost, and 26 respondents did not answer the stated choice question (question number 8), hence, the estimation of the logit choice model was based on the 512 observations that had valid responses for the choice question. The estimation results for the logit model are presented in Table 11. The estimated coefficients (the β's) associated with each of these variables (the attributes of X) tell about the effect the variable has on the choice probability (the utility level). A positive β indicates that, holding other variables constant, the variable has a positive effect on the choice probability.

Table 11. Estimated Parameters from the Stated Choice Model.

Variable (X)	**Coefficient (β)**	**t-stat**	**p-value**	**Means of X's**
Purchase Property	0.662	3.768	0.0002	0.09
Permanent Easement	0.342	2.084	0.0371	-0.063
Percent Preservation	0.044	3.941	0.0001	-0.078
Percent Preservation Squared	-0.0003	-3.152	0.0016	20.801
Non-Game Species	0.234	1.129	0.2590	0.043
Water Quality and Flood Control	0.938	3.713	0.0002	-0.002
Fish Habitat	0.299	1.191	0.2335	-0.004
Waterfowl Habitat	0.537	2.260	0.0238	-0.031
Biodiversity	0.873	3.561	0.0004	0.021

The means presented in Table 11 represent the differences between the attributes of program A and B presented to respondents (as in equation 9). Each program is made

up of different characteristics, and the means show the average difference of the individual attributes use in the choice set. For example, the mean of 0.09 for *Purchase Property* indicates that it was presented as the primary focus for respondents for program A slightly more often than for program B.

One way to assess the logit model performance is to examine the percent correctly predicted, depicted in Tables 12 and 13. Table 12 compares the actual choice made (selection of program A or program B) with the predicted choice using the estimated parameters. One indicates program A has been selected (or predicted to be selected) and 0 indicates program B.

Table 12. Frequencies of Actual and Predicted Outcomes.

		Predicted		**Total**
		0	1	
Actual	0	182	77	259
	1	92	161	253
Total		274	238	512

The percent correctly predicted classification, presented in table 13 below, refers to the percentage of times in the actual data that the predicted choice corresponds with what the respondent actually selected. For the estimated logit model, the percent correctly predicted classification is 67% overall and its performance is well-balanced for both Program A and Program B predictions. Moreover, with a Chi^2 estimate of 64.55 with 8 degrees of freedom, the hypothesis that all parameters are 0 is rejected, indicating the model is highly significant.

Table 13. Percent Predicted Correctly.

Prediction Success:	
Sensitivity = actual 1s correctly predicted	66.64%
Specificity = actual 0s correctly predicted	70.27%
Correct prediction = actual 1s and 0s correctly predicted	66.99%
Analysis of Binary Choice Model Predictions Based on Threshold	0.50

An R^2 is a measure of fit in a linear regression model and is based on comparing the fitted values with the actual values (it is the percent variance explained by the regression). However, in discrete choice models there are no residuals to compute due to the binary nature of the dependent variable, and it is not possible to estimate variances (because they are directly related to the unidentified scale factor). Hence, there is no measure that can be interpreted as explaining a percentage of the variance. An alternative method for measuring the goodness of fit in the binary discrete model is the pseudo R^2, ρ, or 'likelihood ratio index' or the "McFadden R^2"

$$\rho = 1 - L(\beta^*) / L(0).$$

L(0) is the value of the log-likelihood function when all variables are equal to 0 and $L(\beta^*)$ is the value when the log-likelihood function has been maximized (Pindyck and Rubinfeld, 1998; Wooldridge, 2000). A pseudo R^2 is only good for comparisons within a data set. The pseudo R^2 is not a comparable measure from one data set to another, because the pseudo R^2 is a function of the size and variance of the particular data set (L(0)) and alternative data sets have different sizes and variances (Wooldridge, 2000). The estimated model above has a McFadden's R^2 of 0.091.

Interpretation of Estimated Parameters

For each estimated parameter, Table 11 also presents the t-values and p-values for the hypothesis test that the parameter is equal to zero. Seven of the nine variables are statistically significant at the 5% level (that is, they have p-values smaller than 0.05). Only *Non-Game Species* and *Fish Habitat* are not statistically significant. However, the low statistical significance of *Fish Habitat* and *Non-Game Species* does not reflect a lack of effect on the probability of selecting A. It just means that they do not have a statistically different effect on the choice probability than does the baseline level for program priority, *Open Space Near Cities*. The three priorities are not statistically different from each other in their effect on choice probabilities.

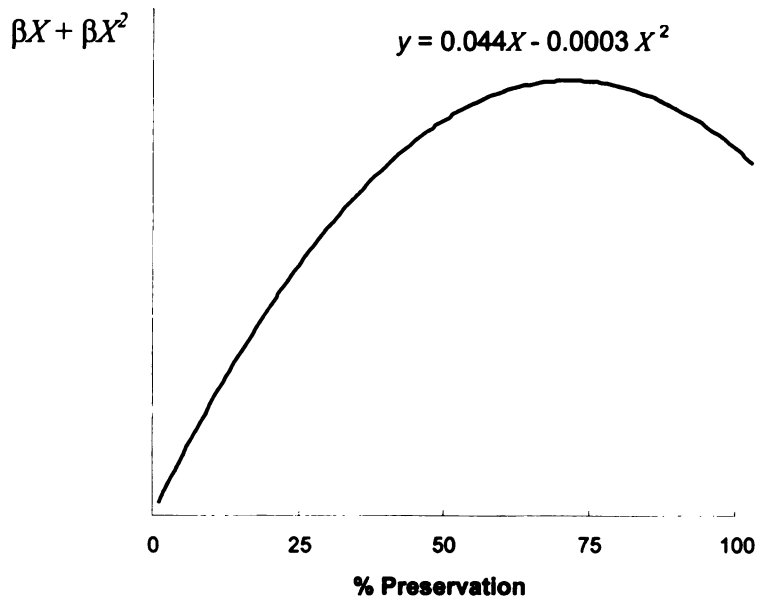
A positive coefficient has a positive effect on the representative utility function, which affects the probability of program A being selected. Both *Purchase Property* and *Permanent Easement* have positive coefficients, 0.662 and 0.342 respectively. The positive coefficients imply that each variable has a positive effect on the choice probability, compared to the baseline tool of *Ten Year Contracts*, holding all other variables constant. *Non-Game Species, Water Quality and Flood Control, Fish Habitat, Waterfowl Habitat,* and *Biodiversity* all have positive coefficients of 0.234, 0.938, 0.299, 0.537, and 0.873 respectively. Their positive coefficients imply that each variable has a positive effect on the choice probability, compared to the baseline priority of *Open Space Near Cities*, holding all other variables constant.

Percent of effort devoted to preservation, *Percent Preservation*, has a positive coefficient of 0.044, implying a positive effect on the choice probability, holding all other variables constant. Increasing the *Percent Preservation* has a positive effect on the

choice probability. People prefer preservation over restoration, and tend to vote for programs that will provide for more preservation of Great Lakes coastal wetlands, but only up to a point.

Percent Preservation^2 is a nonlinear form of the variable *Percent Preservation.* It is used to capture the potentially different marginal effects of preservation effort. *Percent Preservation* is graphed in Figure 1, to show how the percent devoted to preservation begins to diminish in its increasingly positive effect on estimated utility.

Figure 1. The Nonlinear Effect that Percent Preservation has on Estimated Utility



Every level of preservation is preferred to 100% restoration, but the most preferred level of preservation is 73%. A program with a 73% preservation mix would be preferred over all other preservation mixes (all else equal), but beyond 73%, the effect is declining (yet still positive). One hundred percent preservation and 47% preservation

were equally preferred by respondents. Below a 47% preservation level, 100% preservation would be preferred; however, 100% preservation would not be preferred to levels of preservation between 47% and 100%.

In interpreting the regression results presented in Table 11, the magnitude of the coefficient is in direct proportion to the effect that a change in the variable will have on the choice probability (the utility level). The larger the variable's coefficient, the greater the effect on the choice probability. However, only when the variables are significantly different from each other should they be determined to have a significantly greater or smaller effect on the choice probability. Variables that are not significantly different from each other should not be regarded as having a significantly different effect on the choice probability.

To start interpreting the variables and their relative significance, look first at the "base line" variables. Because *Open Space Near Cities* and *Ten Year Contracts* are the "base line" for their respective attributes, and because all their respective remaining levels have positive coefficients, the two base lines are of the lowest ranking order; however, variables that are not significantly different than them may also be of the lowest ranking order.

All "tool" variables are significantly different from each other, and can be ranked based on their effect on the choice probability. *Purchase Property* is most preferred as a program tool, followed by *Permanent Easements*, then *Ten Year Contracts*. In order to determine if the model parameters were significantly different from each other in their effect on the choice probability, a hypothesis test asserting that the attribute levels *Purchase Property* and *Permanent Easements* are equal to each other was conducted.

The result was p-value of 0.0415, so the hypothesis that they are equal was rejected at a 5% level of significance.

The order for "priorities" is complicated by the fact that several of the variables are not significantly different from one another. To illustrate this, table 14 displays the p-values for the pair wise tests of parameter equality for the "priority" variables. It depicts which pairs of attribute levels are significantly different from each other in their effect on the utility level, and at what level.

Table 14. Choice Model Parameters Tests of Equality: P-values for Priority Variables and Levels of Significance.

	Water Quality and Flood Control	*Biodiversity*	*Waterfowl*	*Fish Habitat*	*Non-Game Species*	*Open Space Near Cities*
Water Quality and Flood Control	--					
Biodiversity	0.8034 (NS)	--				
Waterfowl	0.0910 (*)	0.1703 (NS)	--			
Fish Habitat	0.0158 (**)	0.0211 (**)	0.3379 (NS)	--		
Non-Game Species	0.0013 (***)	0.0027 (***)	0.1419 (NS)	0.7648 (NS)	--	
Open Space Near Cities	0.0002 (***)	0.0004 (***)	0.0238 (**)	0.2335 (NS)	0.2590 (NS)	--

NS = Not significant at 10% or lower, * = significant at 10%, ** = significant at 5%, and * = significant at 1%.

NS stands for not significant at a 10% level or lower, which means the two attribute levels are not significantly different from each other in their effect on the choice

probability. One asterisk indicates that the two attribute levels are significantly different from each other at the 10% level; two asterisks indicate they are significantly different from each other at the 5% level, and three asterisks indicate significance at the 1% level. The lower the significance level percentage, the more accurate the measures, meaning the more confident one has that attribute levels are significantly different from each other.

Based on the model parameters, the pair wise tests of equality and the corresponding significance levels, the rank of preference for "priority" variables can be determined. *Water Quality and Flood Control* and *Biodiversity* are the two top program priorities. *Water Quality and Flood Control* and *Biodiversity* are significantly better than *Non-Game Species, Fish Habitat*, and *Open Space Near Cities* as program priorities at 5% and 10% significance levels (shown in table 14 above). *Water Quality and Flood Control* is also significantly better than *Waterfowl* at a 10% significance level.

Waterfowl, next in order of preference (third in ranking), is significantly more preferred than *Open Space Near Cities* as a program priority, at a significance level of 5%. However, *Waterfowl* is not significantly different than *Biodiversity, Fish Habitat*, and *Non-Game Species* in its effect on the choice probability.

Fish Habitat, Non-Game Species, and *Open Space Near Cities*, would be next in order of preference, based solely on their attribute levels coefficient; however, they are not significantly different from each other (as can be seen in table 14), so no exact order can be made among the three. They all have the lowest effect on the choice probability. The low significance levels of *Fish* and *Non-Game Species* imply they are not statistically different from the priority *Open Space Near Cities*, it does not mean their

effect on the choice probability is not significant when compared to other possible priorities.

As mentioned previously, the variance in the data is not identified. Because of this, it is not possible to determine the standard deviations in this model. This makes the β's that result from the logit regression incomparable to β's in other studies. While the β's are incomparable, the marginal effects of the individual variables can be compared to other studies marginal effects. The marginal effects, presented in Table 15, are the effect each variable has on the probability of program A being selected (the probability that Y = 1) from a one unit change in the variable (such as the given variable being utilized by a program). If a given variable is included in program A, the presented marginal effect is how that variable, all else equal, affects the probability of program A being selected evaluated at the mean of the *X*'s for all other variables.

Table 15. Marginal Effects on the Probability of A.

	Variable (*X*)	**Marginal effects**
"Tool"	*Purchase Property*	0.16534
	Permanent Easement	0.08535
"Mix"	*Percent Preservation*	0.01098
	Percent Preservation Squared	-0.00008
"Priority"	*Non-Game Species*	0.05853
	Water Quality and Flood Control	0.23434
	Fish Habitat	0.07469
	Waterfowl Habitat	0.13421
	Biodiversity	0.21824

The marginal effect of 0.05853 (see table 15) for *Non Game Species* signifies that, all else equal, the inclusion (or removal) of *Non Game Species* in a program (such as in program A) increases (or decreases) the probability that program A will be selected by 5.9%. The overall probability changes in probability from one attribute level being removed from a program and replaced with an alternative attribute level depends on which variable is being inputted and which is being replaced. For example, if program A contained *Water Quality and Flood Control* as its program priority and it was replaced with *Fish Habitat* as the priority, based on the marginal effects of 0.23434 and 0.07469, respectively, the probability of program A being selected, all else equal, would increase to about 16% (0.23434-0.07469).

It is worth while to point out that even though the marginal effect for *Percent Preservation* and *Percent Preservation Squared* seem small comparatively, the "Mix" variable is a continuous variable, unlike the binary variables of the remaining attributes. This means that there are many units of change possible for the "Mix" variable. For example, a 20% increase in the relative level of preservation can have a large effect on the choice probability. For example, using the average difference for all variables, increasing program A's preservation level by 20 percentage points over that of program B increases the probability of program A being select by 0.18. The effect of this 20 point increase in preservation would be similar to the effect *Biodiversity* has on the choice probability).

CHOICE EXAMPLES

The estimated coefficients presented above can be used to get an indication of the relative importance of each attribute level, as can also be seen by the marginal effects of each variable. By inputting the relevant coefficients and attribute levels into the probability model, a comparison of two separate programs becomes possible. The model indicates the probability of one program being selected over another, given the attributes of each.

The predicted probability of selecting program A is determined by the random utility probability model (equation 9), $P_a = F(\beta X) = 1 / (1 + e^{-(\beta X)})$, with $X = X_a - X_b$ in our model. By simply inputting the values for the attribute levels (in their form as the binary variables for "priority" and "tool" from Table 10) and their corresponding coefficient from the logit regression, the probability of selecting program A results (Louviere, et al., 2000). Changes in probability can also be indicated by the variable being omitted and the variable being inputted marginal effects. To more completely show how the probability of selecting a program changes with the various attribute levels, several example choice sets are presented, along with predicted probability of selecting a program.

Table 16. Predicted Choice Example 1.

	Program A	**Program B**
Priority	*Water Quality and Flood Control*	*Open Space Near Cities*
Mix	*73% Preservation* *27% Restoration*	*0% Preservation* *100% Restoration*
Tool	*Purchase Property*	*Ten Year Contracts*

Table 16 presents two possible programs alternatives and their attributes. Based on the attribute levels presented, and their corresponding estimated coefficients from Table 11, it is apparent that each attribute level presented in program A are the most preferred attributes levels, while program B is comprised of the least preferred attribute levels. Here, program A will be the most preferred program because each of its attributes are more preferred to those presented in program B. As previously mentioned, the probability of selecting program A is determined by inputting the attribute levels and their corresponding coefficients, as presented in Table 11, into the random utility probability model. Based on the attribute levels and their corresponding coefficients, the probability of selecting program A is about 0.96. This indicates that about 96% of respondents would prefer program A to program B. The high likelihood of program A being selected is the result of the most preferred program attribute levels being compared with the least preferred program attribute levels.

Table 17 presents two alternative program options. As with the previous example, the probability of program A being selected by a respondent can be determined by utilizing the probability model. This example differs from the previous in that the attribute levels presented in program A are not all clearly preferred to those attributes presented in program B. In this way, the model can be useful in predicting which programs are most preferred, based on the attribute levels within a program as a whole, and not individually.

Table 17. Predicted Choice Example 2.

	Program A	**Program B**
Priority	*Non-Game Species*	*Water Quality and Flood Control*
Mix	*25% Preservation* *75% Restoration*	*10% Preservation* *90% Restoration*
Tool	*Purchase Property*	*Permanent Easement*

By evaluating the program attributes in Table 17 using the probability model, the probability of a respondent selecting program A is about 0.53, or about a 53% chance program A is preferred. Here, neither program is clearly preferred, and neither program is comprised entirely of attribute levels clearly preferred to the other.

The example presented in Table 17 can also be used to demonstrate how the choice probability changes when a particular attribute changes. If program B had *Ten Year Contracts*, instead of *Permanent Easements*, for its "tool" in Table 17, the probability of choosing program A, holding all other variables constant, would be about 0.61. The example demonstrates how use of *Permanent Easements,* as opposed to *Ten Year Contracts,* increases the probability that program A is preferred by about 8%, all else equal. This change in probability can also be seen in the marginal effect of *Permanent Easements* of 0.08535, or an effect of about 8.5% (see table 15). *Ten Year Contracts* is the baseline attribute level for land acquisition method, hence, does not have a marginal effect that would need to be taken into account in determining probability changes. By changing only one variable, from *Ten Year Contracts* to *Permanent Easements*, the resulting change in probability is about 8.5%.

If, instead of the attributes presented in Table 17, program A had *Ten Year Contracts* (which has no marginal effect as it is the baseline tool) rather than *Purchase*

Property (with a 0.16534 marginal effect) for its "tool" (while program B retained *Permanent Easements* for its tool), the predicted probability that program A would be preferred would drop to about 37%, holding all other variables constant. So, while *Permanent Easements* are around 8% more likely to be chosen as a program "tool" than *Ten Year Contracts*, and *Purchase Property* is about 8% more likely to be chosen as a program "tool" than *Permanent Easements* (see the marginal effect reported in Table 15), the net effect of a change from *Ten Year Contracts* to *Purchase Property* is a about 0.16, or 16% (compared to the marginal effect for *Purchase Property* of 0.16534), all else equal.

Table 18. Predicted Choice Example 3.

	Program A	**Program B**
Priority	*Open Space Near Cities*	*Open Space Near Cities*
Mix	*25% Preservation* *75% Restoration*	*40% Preservation* *60% Restoration*
Tool	*Permanent Easement*	*Ten Year Contracts*

Table 18 presents another set of possible programs. The probability of selecting program A for the set of choices presented is about 0.5, or about 50% chance that program A is preferred to program B. Both programs provide respondents with the same level of utility; hence, respondents would tend to be indifferent between the two. When looking at the individual attributes, both programs contain the same program "priority", while program B has a preferred level as its "mix" and program A has a preferred level for its "tool". Based on the individual attributes presented, there is no clear indication of which program would be preferred. The utilization of the probability model allows us to

see which would be preferred, and in this created scenario the two programs are equally preferred even though the individual attributes are not. Preferences are determined by the entire mix of attributes within the programs, not on the individual attribute comparisons.

Using Table 18, and the attribute levels it presents, as a starting point, the effect that changing the program "priority" has on the choice probability can be illustrated. First, if program A focused on *Water Quality and Flood Control* instead of *Open Space Near Cities*, the probability that program A is preferred would increase to about 0.71 (about a 21% increase in the probability of program A being selected). This corresponds to the marginal effects of 0.23434 for *Water Quality and Flood Control*, and because "*Open Space Near Cities*" is the baseline priority and has no marginal effect in this model, the full effect of *Water Quality and Flood Control*'s marginal effect would be seen by its inclusion. A second option would be changing the "priority" of program A to *Biodiversity* (with a marginal effect of 0.21824) instead of *Open Space Near Cities* (with no marginal effect), resulting in about a 20% increase in the probability of program A being selected, from a 0.5 probability, to a 0.7 probability. If, on the other hand, program A utilized *Waterfowl Habitat* (with a marginal effect of 0.13421) as the program "priority" as opposed to *Open Space Near Cities*, then the probability of program A being chosen would increase to about 0.62 (about a 12% increase in the probability of program A being selected). If, for another comparison, program A utilizes *Fish Habitat* instead of *Open Space Near Cities*, the probability of program being selected increases to only 0.56, or about a 6% increase in the chance that program A is preferred. Finally, if program A focused on *Non Game Species* instead of *Open Space Near Cities*, the probability of

program A being preferred would increase to about 0.55, indicating about a 5% increase in the chance that program A is preferred.

The few examples presented are simply illustrating the point that changing one attribute effects the probability of program A being selected, based on the estimated coefficients and in a non-linear fashion. For example, when a program "priority" that is preferred to the priorities currently offered in the choice set is substituted into program A, the probability that program A will be selected will increase based on the variables parameter estimates, all else equal. This is simply another way of illustrating the information presented above in Table 15 on the marginal effects of each of the model variables.

By utilizing the model, program attributes can be modified in order to create programs more in line with public preferences. These choice examples illustrate how the model results can be applied to evaluate potential support for programs.

CHAPTER 5

SUMMARY AND CONCLUSIONS

The reported research asked Michigan residents about their experience with Great Lake coastal wetlands and asked them to make trade-offs between protection programs with different protection foci, levels of preservation and restoration effort, and land acquisition methods. The results reveal, among other things, public preference for protection program characteristics. Since estimation of preferences for Great Lakes coastal wetland programs has not previously been reported in the literature, this research provides a fist glance into peoples' preferences for Great Lakes coastal wetland programs

Based on the estimated parameters for the model, it is possible to rank respondents preferences for particular Great Lakes coastal wetland program attributes. Results indicate that respondents prefer the purchase of property to the use of permanent easements, and both the purchase of property and permanent easements are preferred to land contracts. The exact reason for this preference was not elicited, but two possibilities are noted here. First, in stating a preference over wetland programs, there was no cost to the respondent for the programs. If purchase of property is viewed as a less risky alternative compared to the use of easements and these are viewed as less risky than the use of 10-year land contracts, then the preference ordering might be revealing a preference for the more secure land acquisition method given that there is no difference in cost to the respondent. Second, respondents were not equally familiar with the three land acquisition methods. Information gained through the questionnaire and reported in Lupi et al. (2004) indicated that respondents were more familiar with the purchase of

property than permanent easements and least familiar with land contracts as land acquisition methods. Specifically, 33% of respondents were familiar with purchase of property, 25% were familiar with permanent easements, and 16% were familiar with 10-year contracts. The degree to which respondents are familiar with the land acquisition methods may be a contributing factor to the order of preference. Future research efforts might seek to explain some of the reasons for the preference ordering for the land acquisition approaches that was revealed by this research.

The findings also demonstrate a trend in preferences for the method of conservation. People tended to prefer programs which devoted more effort towards the preservation of high quality coastal wetlands, as opposed to the restoration of low quality wetlands. However, this effect was highly non-linear with the most preferred level being a mix of 73% preservation and 27% restoration. In other words, people preferred programs that were not focused solely on either of these two approaches but favored more preservation in the mix. Survey results on people's familiarity with these two approaches were somewhat similar with 49% of respondents indicating they were familiar with preservation and 42% indicating familiarity with restoration (Lupi et al, 2004). Thus, the familiarity with the approaches is unlikely to explain the preference. It may be that some of the preference for preservation over restoration is due to people's uncertainty about restoration activities, such as what the end result will actually be. If the focus of Great Lakes wetland programs is to be on restoration, educating the public about such activities could increase the acceptance and support for restoring wetlands.

The research also allowed wetland programs to focus on the provision of alternative environmental services. Programs were given a specified environmental

service which served as the program's primary focus. The findings reveal that *Water Quality and Flood Control* and *Biodiversity* are the two program priorities most preferred by respondents. *Waterfowl Habitat* is third in order of preference, being statistically significantly less preferred than *Water Quality and Flood Control.* Because they are not significantly different from each other (see table 14), the remaining variables are considered to be of similar order; that is, no statistically significant ordering can be made between *Fish Habitat, Non-Game Species*, and *Open Space Near Cities*.

The review of current wetland programs in the Great Lakes found that there is a large supply of funding and effort devoted to waterfowl habitat. While the findings indicate that waterfowl habitat was a highly ranked program priority, people actually preferred programs that prioritize water quality and flood control, as well as biodiversity, to waterfowl habitat. NGO's such as Ducks Unlimited that focus on waterfowl habitat have been very successful in protecting wetlands and serve as an example of private provision of a public good. The findings here might suggest that there is potential for NGO's to build on the example of Ducks Unlimited and develop programming stressing the provision of features such as biodiversity or water quality and flood control. That said, it may be that it is easier to organize and fundraise for the provision of waterfowl habitat because users and beneficiaries are easier to identify and may have larger values for the feature than does the general public, whereas values for other features might be more dispersed and more susceptible to free rider effects. Alternatively, the findings may indicate that the public sees features such as water quality and flood control or biodiversity as being relatively scarce as program priorities, when compared to the

exiting suite of wetland programs, and therefore would prefer programs that focus on these features.

One question that has arisen during the course of the research has to do with whether or not respondents favored water quality and flood control as a program priority because it seemed to be providing more services than priorities composed of a single feature (e.g., fish habitat). No indication of this was revealed in the qualitative pretest interviews but the issue is unresolved. Future work might consider breaking down the program priority categories even further by separating water quality and flood control into two separate priorities.

Another area for future research involves identifying segments of the population with different preferences. The present research provides estimates of the average preference revealed by respondents' choices. With the use of the multiple questions presented in the survey, as well as the demographic information, it would be possible to determine if any particular group of individuals (such as those who never visited a wetland, live in the city, or are of a particular political persuasion) have identifiable differences in preferences. Such efforts can aid decision makers interested in targeting programs to gain support of particular groups and may also identify groups where communication and education effort might best be focused.

The model and findings reported here can be used to estimate what residents "really want" in protection programs. Due to limited resources available for wetland programs, it is important to know what coastal wetland services are most prized by the public so program funding can be focused on the areas the public values most. Policy makers can utilize this model to evaluate how current Great Lakes coastal wetland

programs or regulations measure up to resident's desires, as well as to develop programs and regulations that are aligned with resident's preferences. Decision-making concerning the Great Lakes coastal ecosystems can benefit from incorporating public preferences for coastal wetlands and wetland services. The reported research provides a first step towards a better understanding of what the public values about Great Lakes coastal wetlands and those programs designed to protect and restore them.

APPENDIX

This appendix contains:

1. Pre-notice Letter – used in the first mailing
2. First Cover Letter – used in the second mailing, first questionnaire mailing
3. First Cover Letter – With Incentive – used in second mailing, first questionnaire
4. Reminder Post Card – used in the third mailing
5. Second Cover Letter – used in the fourth mailing, second questionnaire mailing
6. Final Cover Letter – used in fifth mailing, third and final questionnaire mailing
7. Survey Questionnaire

All documents except the postcard were printed on 8.5 by 11 inch paper and have been scaled down to meet thesis formatting requirements.

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.

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
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MICHIGAN STATE
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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.

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.

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Sincerely,

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Resource Development
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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:

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
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MICHIGAN STATE
UNIVERSITY

Michigan Great Lakes Wetlands Trust: 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.

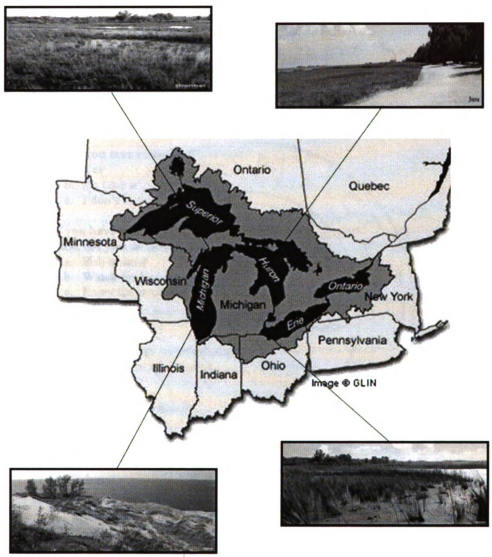
This booklet begins by explaining about Great Lakes coastal wetlands and what they do. It then focuses on how programs can preserve high quality coastal wetlands and restore poorly functioning coastal wetlands. You are then asked about a proposed wetland protection program.

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

Some of Michigan's important natural resources are Great Lakes coastal wetlands. These 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, and 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. Fish or hunt
   b. Watch for birds or other wildlife
   c. Enjoy the outdoors
   d. 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 as wood ducks, mallards, 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 helping to provide and maintain... (Mark ☒ one response for each function)

	Importance of Great Lakes wetlands at providing...	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 of adverse impact on 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 to a pre-existing condition. The restored wetlands would then be preserved. Coastal wetlands 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 voluntarily programs to get wetlands for preservation and restoration:

- **Purchase Property from Willing Owners**
  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 willing property owners.
- **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 protect wetlands on their property. Contracts cost less than easements and land purchases. When the contract period is over, the owner has no obligation to continue protecting wetlands.

7. **In your opinion, how familiar are you with the idea of programs or agencies purchasing property?** (Mark ☒ one response)

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 easement?	☐	☐	☐	☐	☐
c.	Short-term contracts (15-years)?	☐	☐	☐	☐	☐

ALTERNATIVE COASTAL WETLAND PROGRAMS

We would like your input on alternative approaches to protecting Michigan's coastal wetlands. Please review the elements of the 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 number and health of coastal wetlands has decreased by **70%** in the last 150 years.

PROGRAM PRIORITIES

Wetland protection programs can not do everything. They must prioritize their efforts in order to accomplish their goals with their limited resources. Michigan coastal wetland programs may prioritize:

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

When wetland programs prioritize a particular feature, other wetland features associated with the primary focus will also be provided.

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
How coastal wetland services are prioritized by program		
Primary Focus	**Non-Game Species**	**Waterfowl Habitat**
How the program effort and resources are divided		
Preservation of high quality coastal wetlands	**70% Preservation**	**50% Preservation**
Restoration of coastal wetlands in poor condition	**30% Restoration**	**50% Restoration**
How the program gets coastal wetland sites from volunteers		
Purchase, voluntary easement, or short term contract	**Purchase Property**	**Ten-year Contracts**

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

PROPOSED STATE-WIDE PROGRAM

Now, we would like your input on one of the two proposals you have just considered. This proposed program would go into effect if voters approve it in a special referendum. Please review the elements of the ballot proposal before answering Question 9.

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.

PROGRAM IMPLEMENTATION

The proposed program would build on existing wetland programs by providing funds for the preservation and restoration of Michigan's coastal wetlands.

- The proposed program would be implemented if voters approve it in a special referendum.
- The program would not be implemented if voters do not approve it.

PROGRAM FUNDING

Wetland preservation and restoration cost money. The proposed program will be funded by using a **one-time only, income tax payment** that would depend on a household's income.

The cost to **your** household will be a one-time, **$90** payment that will be added to your 2005 state income tax.

All monies collected will be spent on coastal wetland protection.

PROPOSED COASTAL WETLAND PROGRAM AND COST

	PROGRAM A
Primary Focus	**Non-Game Species**
Preservation effort	**70%**
Restoration effort	**30%**
Get Program Sites	**Purchase Property**
Total acres in program	**5000 acres**
One-time only payment	**$ 90, one time**

HOW WOULD YOU VOTE?

9. **While there may be other possible program, we want to know how you would vote on the ABOVE program.**

   If asked to vote in a state-wide election on a ballot issue for the coastal wetland program described above, how would you vote? (Circle one response)

   a. Yes
   b. No
   c. I don't know

HELP US UNDERSTAND YOUR VOTE

10. Please help us understand some of the reasons you voted the way you did.

a. If you answered "Yes" to the proposed program in Question 8, please share with us some of the reasons you did so

b. If you answered "No" to the proposed program in Question 8, please share with us some of the reasons you did so.

c. If answered "I Don't Know" to the proposed program in Question 8, please share with us some of the reasons you did so.

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 in years?** (Circle one response)

    a. 18 to 25 years
    b. 26 to 35 years
    c. 36 to 45 years
    e. 46 to 55 years
    f. 46 to 65 years
    g. 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
b. High school degree
c. Some college
d. Associate degree, 2 year college
e. College degree, 4 year 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
b. Working part-time
c. Going to school
d. A homemaker
e. Retired
f. Other: _____

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

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

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

a. Construction
b. Forestry
c. Education
d. Real estate
e. Farming
f. Government
g. Transportation
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
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

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