PUBLIC PREFERENCES AND ECONOMIC VALUES FOR RESTORATION OF THE EVERGLADES/SOUTH FLORIDA ECOSYSTEM

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ABSTRACT

The Everglades/South Florida region is a unique, globally significant ecosystem that has been altered by drainage and water control structures. These alterations have changed the overall quantity, quality, and temporal distribution of freshwater flows and impacted wildlife species throughout the region. Under state and federal legislative directives, restoration of the ecosystem is being planned yet little research has been conducted to identify public preferences and economic values for alternative restoration plans. This report describes the application of a multiattribute utility survey of nearly 500 South and Central Florida residents to evaluate tradeoffs between natural and social system dimensions of the restoration problem. Both hydrological and wildlife species attributes were used to represent alternative states of the ecosystem along with possible effects on municipal water supplies, farmland, and annual household taxes. Statistical results show that respondents indicated strong preferences for Everglades restoration but the responses varied depending on how the alternative states of the ecosystem were represented. Also, these preferences were tempered by concern for the consequences of restoration decisions on municipal water users and farmland acreage. Willingness to pay measures derived from the sample indicate a maximum annual benefit from "full restoration" of approximately \$60 - \$70 per household per year over a ten-year period. Extrapolating these results to the Florida population yields annual benefits of \$342.2 - \$406.5 million or \$3.42 - \$4.07 billion over a ten year period. These benefits, however, decline rapidly and turn negative if restoration imposes high costs in the form of water supply restrictions, losses in farmland acreage, and annual household taxes. This survey represents an initial effort to document Floridians' preferences and economic values for restoration of the Everglades/South Florida ecosystem. Multiattribute utility analysis provides a flexible research tool to frame the decision problem, evaluate public preferences for alternative plans, and develop measures of economic value. This type of social science research is an essential part of an adaptive management approach to restoration planning and can be used to objectively evaluate how the perceptions and economic values of Floridians and others change as new information becomes available about the effects of restoration actions.

KEY WORDS: Multiattribute utility, decision analysis, economic valuation, ecosystem restoration planning, survey research, Everglades/South Florida.

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EXECUTIVE SUMMARY

The Everglades/South Florida region is a unique, globally significant ecosystem encompassing over 69,000 square kilometers. For more than 100 years, the natural flow of water through the Everglades has been altered by drainage and water control structures, in order to provide flood control and water supplies for the rapidly growing human population and large agricultural industry in the South Florida region. These alterations have lead to harmful changes in the overall quantity, quality, and temporal distribution of freshwater inflows to the Everglades, saltwater intrusion into aquifers in coastal areas, invasion by exotic plant species causing changes in plant community structure, and dramatic declines in certain wildlife species typical of the Everglades.

Under state and federal legislative directives, restoration of the Everglades/South Florida ecosystem is now in progress under the leadership of the US Army Corps of Engineers and the South Florida Water Management District. Proposed plans for restoration are expected to require decades to complete with costs in excess of $6 billion. Despite considerable efforts to base restoration decisions on sound science, there has been relatively little formal research to inform the decision-making process about public expectations for the restoration, or willingness to pay for restoration costs. The purpose of the present study was to quantitatively evaluate the perceptions and preferences of the general public in Florida regarding alternative possible outcomes for restoration of the Everglades/South Florida ecosystem, and to use these results to estimate economic values associated with alternative restoration plans.

Multiattribute utility theory has been widely applied to problems involving tradeoffs between multiple conflicting elements. This study was designed as an application of multiattribute utility theory in order to accommodate the inherent tradeoffs between natural and social system dimensions of the restoration problem. After extensive consultation with agency staffs and two focus group sessions with the public, the many different aspects of Everglades restoration were represented in terms of nine independent attributes, as shown in the following table. A group of three hydrologic attributes represented water levels and timing in different geographic portions of the Everglades: Lake Okeechobee, the Water Conservation Areas, and Everglades National Park. Another set of three attributes represented different groups of species and habitat types: wetland species, dryland species, and estuarine species. Finally, three attributes were used to represent the social services and costs associated with restoration: restrictions on water use by households, changes in farmland acreage in South Florida, and the annual cost to households. Each of the attributes had three levels associated with complete restoration, intermediate restoration, and no restoration as a baseline case. The values for each level of the attributes corresponded to expected outcomes based on various hydrologic or biological models, agency planning documents, or consensus views of experts consulted. The hydrologic and wildlife species attribute levels were specified in relation to "historic" levels.

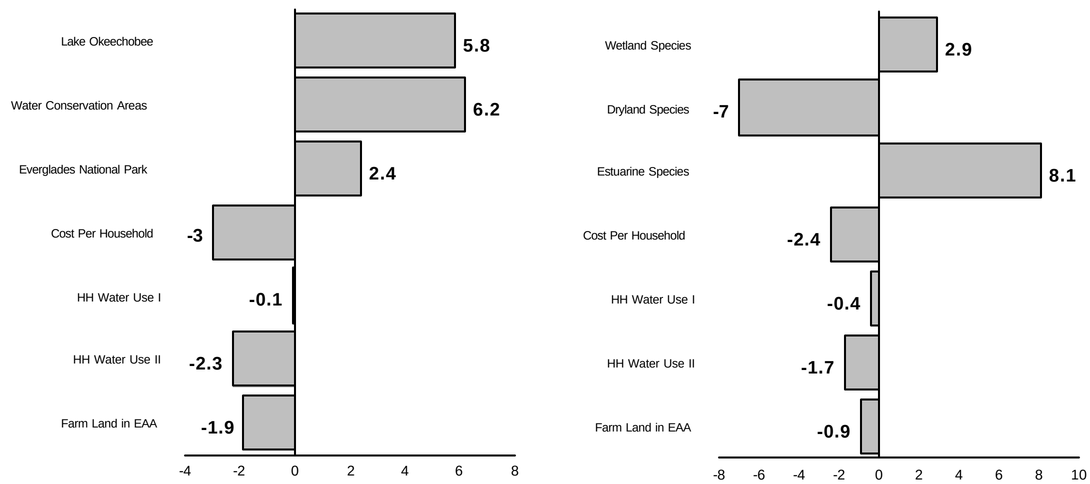
Attribute Names, Descriptions and Alternative Levels for Multiattribute Analysis of Everglades Restoration.

	Attributes/Description	Attribute Levels
Hydrologic Model Attributes	**Lake Okeechobee.** Percentage of time that water levels and timing in Lake Okeechobee are similar to historic, predrainage conditions	60%* 75% 90%
	Everglades Water Conservation Areas. Percentage of area in the Everglades Water Conservation Area having water levels and timing similar to historic, predrainage conditions	50%* 75% 90%
	Everglades National Park and Florida Bay. Percentage of the area in Everglades National Park and Florida Bay that has water levels and timing similar to historic, predrainage conditions	50%* 75% 90%
Species Model Attributes	**Wetland Dependent Species.** Percentage of historic, predrainage population levels of wetland dependent species such as wading birds and alligators	20%* 50% 80%
	Dry Land Dependent Species. Percentage of historic, predrainage population levels of dry land dependent species such as deer, hawks and songbirds	50%* 60% 70%
	Florida Bay Dependent Species. Percentage of historic, predrainage population levels of Florida Bay dependent species such as pink shrimp, mullet and sea trout	60%* 75% 90%
Socio-Economic Attributes (both Hydrologic and Species Models)	**Annual cost per household.** Additional annual cost per household for water utilities	$0* $25 $50
	Restrictions on Household Water Use. Number of days per week that outdoor water use allowed during dry years, and percentage reduction in indoor water use	3/10%* 2/25% 1/40%
	Farm land Reduction. Area (acres) of farm land that would be reduced in the Everglades Agricultural Area and western portions of Palm Beach, Broward and Dade counties	0* 100,000 200,000

* Denotes baseline condition currently

Primary information in this study was collected through personal interview surveys of 480 randomly selected households in five south and central Florida metropolitan areas (Miami, West Palm Beach, Fort Meyers, Tampa and Orlando). Interviews were conducted in respondent's homes by an independent market research firm. The survey samples were representative of their respective county populations and the state as a whole in terms of sociodemographic characteristics such as income, race, age, education, household size and political affiliation. The interview included presentation of an 11 minute informational video about the Everglades/South Florida ecosystem in order to orient respondents to key issues addressed in the survey. Survey respondents were given a pairwise choice task in which pairs of systematically-generated combinations of six attributes were presented, and the respondent was asked to choose the preferred attribute set. Either the hydrological or species attribute specifications were presented to half of the respondents in each county, in order to compare preferences for alternative restoration plans based on different representations of the ecological dimensions of the problem. Responses from the pairwise choice tasks were used to statistically estimate multiattribute utility functions for the hydrological and species attribute sets. Results of the statistical analysis and evaluation are summarized in the figure below.

Relative Weightings of Attributes in the Multiattribute Models



Hydrological Model Species Model

- The hydrological multiattribute utility model indicated that respondents gave positive weights to all three hydrological attributes and preferred potential restoration plans that would lead to water levels and timing more similar to historical conditions in all three of the South Florida hydrologic regions. However, the social service and cost attributes in the model revealed that higher levels of annual cost, water restrictions, or reductions in farmland acreage were negatively weighted.
- The species multiattribute utility model showed positive weightings for wetland and estuarine species attributes indicating that restoring these species populations to be more comparable to historical levels was preferred. However, a significant negative weighting on the dryland species attribute indicated that restoration of these species was not preferred. Also, the preferences for restoring wetland and estuarine species were tempered by negative weightings for the annual cost, water restrictions, and farmland reduction attributes.
- The negative sign and magnitude of weightings assigned to the annual cost, water restriction, and farmland reduction attributes in both the hydrological and species multiattribute models were generally similar indicating that respondents expressed consistent preferences regardless of the type of attribute used to represent the ecological dimensions.
- Higher levels of the wetland and estuarine species attributes were consistently preferred across the sample indicating that the general public would more readily identify with a restoration program that emphasizes species restoration rather than hydrological management.

Weightings for the multiattribute utility models were used to evaluate various hypothetical full and partial restoration plans, both with and without social service and cost components.

- The results presented in the following table showed that Floridians expressed strong preferences for plans that fully restore the hydrological conditions and wetland/estuarine species populations of South Florida. Net willingness to pay amounts for the full restoration plans of $59 and $70 annually for the hydrological and species multiattribute models, respectively, provide measures of the maximum annual benefits per household.

- While the results for the hypothetical restoration plans indicated generally strong support for restoration, respondents would not support a restoration plan that imposed high costs on Floridians. Hypothetical restoration plans that included annual costs of $50 per household (or $500 over 10 years) coupled with either farmland reductions of 100,000 or more acres or severe restrictions on municipal water use during dry years received poor rankings and less than majority support. Moreover, the net willingness to pay values for these high cost plans were negative suggesting a potential loss in economic welfare. On the other hand, intermediate cost levels were clearly not viewed as too overbearing, such as moderate restrictions on water use, or annual costs of $25 per household.
- When the results were extrapolated to estimate the aggregate benefits of alternative Everglades/South Florida restoration plans for the Florida population, the net willingness to pay for full hydrological restoration without costs was $342.2 million annually, or $3.42 billion over a ten-year period. Similarly, for full wetland/estuarine species restoration without costs the aggregate willingness to pay was $406.5 million annually, or $4.07 billion over ten years. A more realistic restoration plan which provided full hydrological restoration with annual costs of $25 per household, a 100,000 acre reduction in farmland, and moderate water restrictions had a net willingness to pay of $15.60 per household annually, or $907.9 million for the Florida population over ten years.

This survey represents an initial effort to document Floridians' preferences and economic values for restoration of the Everglades/South Florida ecosystem. This type of social science research is an essential part of an adaptive management approach to restoration decisions in which scientists and the public learn about the effects of management actions. Future surveys of Floridians are necessary to objectively evaluate how public perceptions and economic values may change over time. In light of the national significance of the Everglades/South Florida ecosystem, additional surveys are necessary to quantify the preferences and economic values of citizens in other regions of the U.S.

Evaluation of Selected Restoration Plans for the Hydrological and Species Multiattribute Models.

Plan Description	Percent of Respondents in Favor	Net Willingness to Pay
Hydrological Multiattribute Model		
Partial Hydrologic Restoration without Costs	71.7	$34.32
Full Hydrologic Restoration without Costs	71.7	$58.79
Partial Hydrologic Restoration with Minimized Costs	44.3	$9.32
Full Hydrologic Restoration with Minimized Costs	54.3	$15.60
Full Hydrologic Restoration with Full Costs	31.1	-$61.09
Species Multiattribute Model		
Partial Wetland Wildlife Restoration without Costs	92.7	$34.93
Full Wetland Wildlife Restoration without Costs	92.7	$69.86
Partial Dryland Wildlife Restoration without Costs	17.9	-$11.95
Full Dryland Wildlife Restoration without Costs	17.9	-$23.90

Full Wetland Wildlife Restoration with Minimized Costs 67.9 $26.63

SECTION 1. INTRODUCTION

1.1 The Study Area and Problem Setting

The southern portion of Florida is a complex mosaic of hydrologically interrelated terrestrial, freshwater, and marine ecosystems. The entire regional ecosystem is linked through surface and ground hydrology from the Kissimmee River watershed, through Lake Okeechobee, through water conservation areas, the Big Cypress Swamp, and the Everglades, and out through Florida Bay and the passes between the Florida Keys to the offshore corals reefs (Figure 1). The uniqueness of the region has been recognized through the designation of a number of state and federal parks and sanctuaries including Big Cypress National Preserve, Biscayne Bay National Park, Everglades National Park, Pennekamp Coral Reef State Park, and the Florida Keys National Marine Sanctuary. Also, Everglades National Park has been designated an international Biosphere Reserve, a World Heritage ecosystem, and a Wetland of International Importance (Maltby and Dugan 1994). The entire area covers more than 69,000 square kilometers and is larger than nine states. More than one-third of the land area is in public ownership.

For more than 100 years, the flow of water through this network of habitats and ecosystems has been modified from its natural conditions to satisfy the demands of a growing human population within the region. More than half of the original Everglades system has been drained and water management structures now channel more than four times as much freshwater to the Atlantic Ocean as natural drainage flows (Davis and Ogden 1994). While many warned of the consequences of these interventions (e.g. Beard 1938; Douglas 1947), a series of ecological and institutional crises over the past two decades has focused scientific and public attention on the problems of the region and efforts to restore the ecosystems (Light et al. 1995).

Restoration efforts for the Everglades/South Florida ecosystem have been proceeding under state and federal legislative directives. The Everglades Forever Act of 1994 (Chapter 373.4592, Florida Statutes) outlined a general plan to restore the ecosystem by improving the quantity and distribution of freshwater, reducing the amount of phosphorus enriched agricultural storm water entering the system (from agricultural production areas south of Lake Okeechobee), removing exotic plant species, and setting time deadlines. The South Florida Water Management District is responsible for overall coordination and administration of these efforts and has developed a planning document that describes restoration projects over the next two decades (South Florida Water Management District 1994).

The Water Resources Development Act of 1992 (Public Law 580, 102nd Congress) authorized the U.S. Army Corps of Engineers to initiate a study to determine whether the existing Corps' Central and Southern Florida Project (and the water control structures built by the Corps) should be modified to improve the quality of the environment, improve protection of the aquifer, and improve conservation of urban water supplies. The Central and Southern Florida Project (C&SFP) dates back to the Flood Control Act of 1948 and has been the focal point of federal efforts to provide flood control, drainage, water control, navigation, water supply for Everglades National Park, and other purposes (U.S. Army Corps of Engineers 1994, Appendix J). The objectives and accomplishments from the earlier years of this Project have been cited by scientists as the source of many of the environmental problems throughout the region (e.g. Light and Dineen 1994).

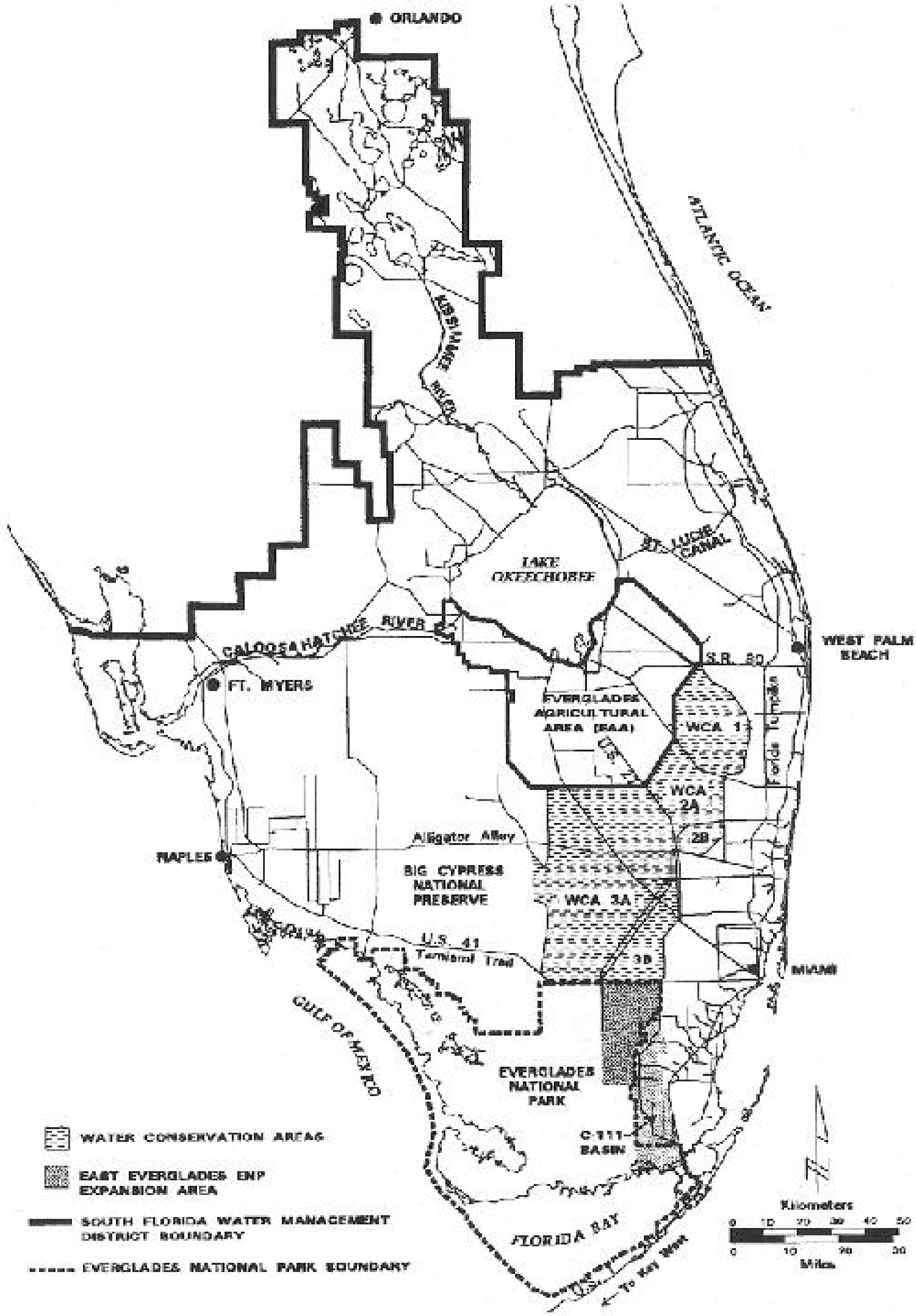

ORLANDO
ATLANTIC OCEAN
KISSIMMEE RIVER
LAKE OKEECHOBEE
ST. LUCIE CANAL
CALOOSAHATCHEE RIVER
FT. MYERS
WEST PALM BEACH
S.R. 80
EVERGLADES AGRICULTURAL AREA (EAA)
WCA 1
WCA 2A
2B
Florida Turnpike
Alligator Alley
NAPLES
BIG CYPRESS NATIONAL PRESERVE
WCA 3A
3B
U.S. 41
Tamiami Trail
MIAMI
GULF OF MEXICO
EVERGLADES NATIONAL PARK
C-111 BASIN
FLORIDA BAY
To Key West
WATER CONSERVATION AREAS
EAST EVERGLADES ENP EXPANSION AREA
SOUTH FLORIDA WATER MANAGEMENT DISTRICT BOUNDARY
EVERGLADES NATIONAL PARK BOUNDARY
Kilometers
Miles

Figure 1-1 The South Florida Ecosystem and Its Components

The first phase of the Corps' study was a *Reconnaissance Report* that identified problems and opportunities, described alternative plans, and recommended further studies (U.S. Army Corps of Engineers 1994). The report presented ten basic restoration plans that ranged from changes in operating procedures with existing physical structures to major redesign of canals, levees, and flowways throughout the system. No specific restoration plan was recommended. At about the same time, other restoration plans were proposed including: *The Greater Everglades Ecosystem Restoration Plan* by the Everglades Coalition (1994), the *Action Plan, South Florida Ecosystem Restoration* by the U.S. Fish and Wildlife Service (1993), and the *Federal Objectives for The South Florida Restoration* by the Science Sub-Group of the South Florida Management and Coordination Working Group (1993).

The Water Resources Development Act of 1996 (Public Law 303, 104th Congress) directed the Corps to proceed from the reconnaissance phase to the development of a comprehensive plan for the purpose of restoring, preserving and protecting the Everglades/South Florida ecosystem. The plan also would address other water related needs of the region such as water supplies and flood control (Section 309(1)). The Corps and the South Florida Water Management District (as local sponsor) must present the plan to Congress by July 1999. Under the Act, cost sharing would be 50/50 between state and local government.

As this planning effort (commonly referred to as "the Restudy") proceeds, it is useful to describe the major planning problem as the choice of restoration goals. While a great deal has been written about the need to restore the ecosystem, little has been offered to help the public understand what would be achieved with restoration (Vogel 1998). In this regard, it is helpful to understand that the choice of goals for a restoration project is equivalent to a choice of ecological endpoints. *Ecological endpoints* are defined as those characteristics of the ecosystem that if changed, would constitute a change in the health of the ecosystem (Harwell and Long 1992; Harwell et al. 1992). These endpoints represent vectors of functions and services from the ecosystem that have both biological and social importance (Russell 1995). The dilemma arises from the fact that choosing endpoints is in part an ecological issue and in part a social issue. The essence of the problem is clearly identified in the Corps' Reconnaissance Report:

> The vision of the future wetlands in south Florida is influenced by different views of how we determine restoration goals for the system. The future Kissimmee River, Lake Okeechobee, Everglades, Big Cypress, and Florida Bay ecosystems can be, to some extent, what we want them to be, based on our value systems, and our decisions about what conditions and components constitute a restored ecosystem (U.S. Army Corps of Engineers 1994, p. 109).

This dilemma might be resolved solely at an administrative level by agencies participating in the planning process. But as Russell (1993) points out, public preferences and economic values for alternative endpoints must be considered since restoration projects compete with other public projects for funds. And, economic values for alternative endpoints cannot be easily measured since many of the possible endpoints involve environmental goods that are not valued in traditional markets or directly related to observable human behavior. Hence, any complete feasibility analysis of alternative restoration plans must consider public preferences and values for alternative ecological endpoints.

Recognizing the need for information about public preferences and values for alternative ecological endpoints does not, however, readily translate into a well-defined research program. Most economic studies of environmental goods have focused on a single dimension or endpoint while assuming (most often implicitly) that other endpoints were fixed in time or irrelevant (Russell 1993). Studies that have considered multiple alternative endpoints (e.g. Crocker 1985; Hoehn and Loomis 1993; Loomis et al. 1990; Opaluch et al. 1993) encountered the well-known principle that individuals ability to make consistent choices decreases as the number of options increases (Miller 1956). Professionals from both the natural and social sciences who have considered the current state of affairs have concluded that research should focus on identifying the ways that individuals (nonscientists) think about environmental problems and begin to evaluate the effectiveness of alternative value elicitation procedures involving multiple ecological endpoints (Green and Tunstall 1991; Harwell et al. 1992; Russell 1993).

While there are many ways to characterize ecological endpoints for ecosystem restoration (Bratton 1992; Cairns 1988; Harwell and Long 1992), two broad classifications are "structural" endpoints and "functional" endpoints. Structural endpoints focus on the number and diversity of individual species, and may include keystone species or other distinctions to differentiate the species (Paine 1980, Westman 1985, Wilson 1992). For the Everglades/South Florida ecosystem, these species indicators might include bird populations, fish populations, and/or populations of endangered species such as the Snail Kite and Wood Stork. On the other hand, functional endpoints emphasize broad ecosystem processes and dynamic properties (Holling 1987, Westman 1985, 1991). In an uplands/wetlands ecotone such as the Everglades, these endpoints might include hydroperiod levels and timing, salinity fluctuations, spatial extent, and fire frequency (Harwell and Long 1992, Holling et al. 1994). While the exact linkages between these alternative endpoint classifications are not well known, in general the two sets of endpoints represent different dimensions of an ecosystem. Ecosystem management based on one set of endpoints may lead to different restoration decisions than for the alternate endpoints (May 1973, McNaughton 1988, Westman 1985, 1991).

1.2 Study Purpose and Objectives

The purpose of this study was to develop and implement a public survey elicitation procedure that could be used to evaluate public perceptions of alternative ecological endpoints for what may well be the ‘granddaddy’ of all ecosystem restoration efforts, the Everglades/South Florida region. The elicitation procedure would also provide estimates of individual's economic value (willingness to pay) for bundles of environmental goods that could result from alternative restoration plans. Results from the survey could then be used to rank alternative restoration plans and provide measures of the economic benefits (net willingness to pay) associated with alternative ecological endpoints. This study also contributes to the state-of-the-art in ecosystem valuation methodology by evaluating respondents' perceptions of alternative representations of environmental functions. Specifically, this will involve a test of the hypothesis that sets of wildlife species population levels (species endpoints) elicit the same preferences for ecosystem restoration as functional endpoints such as the level and timing of water flows in different areas within the region. Specific objectives for this study were:

1) To develop a public survey instrument for eliciting preferences for alternative restoration plans using a multiattribute utility framework.

Rationale: Management of a complex ecosystem such as the Everglades/South Florida ecosystem involves hydrologic, vegetative, and faunal processes that imply multiple objectives and multiple alternatives for human decision making. Multiattribute utility theory (MAUT) provides a well-known analytical framework in which the attributes of decision alternatives can be arrayed and statistical procedures can be used to measure respondents' preferences for different alternatives (Keeney and Raiffa 1976; von Winterfeldt and Edwards 1986). MAUT can be implemented in a discrete choice framework (McFadden 1986) to evaluate alternatives using several different response formats such as paired comparisons (e.g. Opaluch et al. 1993) or multiple rankings (e.g. Beggs et al. 1981). For example, Opaluch et al. (1993) evaluated public preferences for alternative landfill locations based on site attributes such as acreage of the landfill and adjacent land uses and location attributes such as proximity to residential areas, access roads, and hauling costs. In addition, the MAUT approach can be used to derive estimates of economic value for changes in attribute levels (Louviere 1988; Swallow et al. 1994).

2) To develop two representative sets of ecological attributes based on functional and structural endpoint concepts for use in a multiattribute utility survey instrument.

Rationale: Ecosystem management has often focused on the levels of individual species within an area as an indicator of ecosystem health (Wilson 1984, 1992; Bratton). Laws such as the Endangered Species Act direct wildlife management efforts to species level protection and these laws focus public perceptions on changes in specific ecosystems. In fact, declines in the number of nesting colonies for the endangered Wood Stork and Snail Kite have been one of the primary factors driving current efforts for South Florida Ecosystem/Florida Bay restoration (Odgen 1994). An alternative, though not necessarily conflicting approach to ecosystem management is to focus on broad ecosystem functions (Holling 1987). In this approach, individual species endpoints are less important than overall functional endpoints such as the periodicity of wetland flooding and drying or the diversity of micro and meso habitats within the overall ecosystem (Holling et al. 1994). With this approach, species levels may be less stable (although potentially more productive) than with a structural endpoint focus. The significance of these two approaches to endpoint indicators is that they convey different conceptual models of ecosystems that may influence individuals' perceptions of restoration and the choice of actions that would be undertaken as part of an actual restoration.

3) To implement the multiattribute utility theory (MAUT) survey to measure Floridians' preferences for South Florida Ecosystem/Florida Bay restoration; to test whether structural endpoints or functional endpoints influence individuals' preferences for restoration; and, to determine whether there are geographical or other sociodemographic differences in preferences.

Rationale: Hypothesis tests based on multiattribute utility survey responses can be used to understand Floridians' preferences for restoration initiatives. This information may influence the choice of specific restoration plans. A primary hypothesis for this research is that individuals' preferences for restoration alternatives will not be influenced by the use of structural or functional endpoints to represent alternative restoration plans. This hypothesis can be tested using a split sample survey design whereby different groups of respondents are presented with either structural or functional endpoint choice sets. The results from this analysis will provide information about the structure of public preferences for restoration and the specific attributes of restoration plans that are most important to the public. A secondary hypothesis is that individuals' preferences are the same regardless of where they live in Florida or their sociodemographic characteristics (e.g. age, income). This hypothesis can be tested using a representative sample of respondents in different regions of Florida.

4) To use the results of the multiattribute utility survey of Floridians to rank alternative restoration plans and to estimate economic values associated with these restoration plan alternatives.

Rationale: With the multiattribute utility survey results it is possible to rank alternative plans based on the type and degree of change in endpoints provided by a specific ecosystem restoration plan. These rankings can provide guidance to restoration planners and elected officials about the relative merits of alternative plans. Differences in rankings can also be identified for various sociodemographic groups. Survey results also provide measures of willingness to pay for specific restoration plans and the marginal economic value individuals assign to attribute endpoints. These values can be used to measure the economic benefits of alternative restoration plans to Floridians. Also, the marginal value of endpoint attributes can provide information about the economic benefits of individual components of a restoration plan.

1.3 Overview of the Report

This report is organized as follows. Section 2 provides an overview and description of multiattribute utility theory and how it can be used as a tool for ecosystem restoration planning. Section 3 describes the selection of functional attributes based on hydrological properties of the ecosystem and structural attributes based on species populations. This section explains the basis for selecting these attributes and how alternative levels for these attributes were specified based on a variety of information sources including the U.S. Army Corps of Engineers, the South Florida Water Management District, and scientists from various agencies and universities around the state of Florida. Also, this section provides a description of the procedures used to combine the selected functional and structural attributes into alternative "plans" to be used in personal household interviews with Florida residents. In Section 4, the interview process and the materials used in the interviews are described. Procedures followed to identify a stratified, random sample of residents in three South Florida counties (Dade, Lee, and Palm Beach) and two Central Florida counties (Hillsborough and Orange) are also described. This is followed by a summary of results from the interview surveys for sociodemographic and other descriptive information about the respondents.

More detailed information about statistical modeling of the multiattribute choice process used in this survey is presented in Section 5. This section also provides statistical results for various analytical models estimated from the survey data along with an interpretation of the results of the statistical analysis. Section 6 extends the statistical results presented in the previous chapter to develop rankings and willingness to pay measures for alternative restoration plans based on relative scores from the multiattribute utility models. Rankings are presented for the functional (hydrological) attribute models and the structural (species) attribute models based on results for all survey respondents and for various sociodemographic subgroups within the sample. Section 7 concludes the report with a summary of the survey design and results of the analysis. This section also provides a discussion of possible uses of this information in Everglades/South Florida restoration planning along with a discussion of the limitations of the survey and results. Appendices to this report provide complete copies of the questions and materials used in the interviews along with other detailed information to support results provided in the main sections of the report.

SECTION 2. MULTIATTRIBUTE UTILITY THEORY AS A PLANNING TOOL

2.1 Multiattribute Utility Theory

Multiattribute utility theory (MAUT) is a method among a class of procedures known as "multi-criteria decision making" which are used for analysis of problems that have a number of disparate dimensions that must be considered simultaneously. Basically, a multiattribute problem consists of one or more decision alternatives that are evaluated by a decision maker(s) based on a set of attributes that are deemed essential to the problem. The decision maker's choices reflect an implicit weighting assigned to each attribute that reflects the importance of each attribute to the decision maker.

A primary strength of MAUT is in evaluating alternatives where there are tradeoffs, i.e. where one or more alternatives are superior in one respect while inferior in another. Such tradeoffs are involved in many, perhaps most, real world decisions. MAUT may be used to identify a single "best" option, to rank the options in order of preference, or to identify a subset of acceptable or nondominated options for further analysis. A virtue of the methodology is that attributes may be either quantitative or qualitative in nature, and it is able to accommodate important but ill-defined or subjective dimensions of a problem.
MAUT is suitable for problems in which there is uncertainty about the realization of different alternatives. In cases where there is not any consideration of uncertainty, the methodology is known as "multiattribute valuation" (MAV). MAUT and MAV techniques have been applied in numerous settings, including technology selection, energy and transportation planning, strategic business planning, product marketing and environmental management (Giocoechea, Hansen and Duckstein, 1982; Hwang and Yoon, 1981; Keeney, 1980; Keeney and Raiffa, 1976; Mollaghasemi and Pet-Edwards; Nijkamp, Rietveld and Voogd, 1990; Saaty, 1980; Szidarovsky, Gershon and Duckstein, 1986; von Winterfeldt and Edwards, 1986).

To illustrate the basic principles of MAUT, consider the decision by a consumer to purchase an automobile. Two possible models (A,B) may differ in terms of a number of attributes such as price, fuel economy (miles per gallon), passenger seating capacity, performance (horsepower, maximum speed, acceleration), safety, handling characteristics, appearance, and so forth. These attributes can be arrayed to provide a direct comparison between attributes as in Table 2.1. A vehicle which has a lower price may have fewer safety features while a vehicle that has superior performance may have lower fuel economy. The decision as to which vehicle to purchase depends upon the relative weightings the individual gives to the different attributes and the cumulative value or "score" assigned to each alternative. If an individual attribute is strongly weighted, the choice may be determined in favor of the vehicle that is rated most highly on this attribute. Alternatively, if there
are only weak differences in weightings among attributes, several or all attributes may influence the decision.

Table 2-1. Example of a Multiattribute Decision Problem for Purchase of an Automobile.

Attribute	Model A	Model B
Price (new)	$25,000	$15,000
Safety	Has air bags	No air bags
Performance (Horsepower)	250 Hp	200 Hp
Fuel Economy	20 miles per gallon	30 miles per gallon
Seating Capacity	6 persons	4 persons

Solution of a MAU or MAV problem typically involves the following steps (von Winterfeldt and Edwards, 1986):

- Respondents assign relative weights to the attributes.
- Develop utility or value functions for individual attributes.
- Respondents evaluate each alternative separately against each attribute.
- Aggregate the weighted evaluations to obtain an overall evaluation of each alternative by means of an appropriate aggregation rule.

The selection of meaningful, appropriate attributes for the decision is one of the most critical and difficult steps for solving multiattribute problems. The attributes must be essential to the decision problem, but each attribute should reflect independent dimensions to the degree possible to avoid redundancy (Keeney and Raiffa 1976; Louviere 1988). The attributes must be measurable and must also be understood by decision makers. Theoretically, any number of attributes may be used in a multiattribute decision problem. The literature, however, indicates that in practice only seven to nine attributes can be meaningfully evaluated by decision makers due to limited cognitive skills and memory capacity of most individuals (Saaty 1980; Miller 1956; de Palma et al. 1994).

2.2 Multiattribute Utility Preference Elicitation Methods

Elicitation of the preferences of decision makers involves weighting the relative importance of the attributes and an assessment of the utilities of different levels of the attributes. Because of the subtlety and complexity of this information, it is typically gathered through extended personal interviews with individual decision makers. The preference elicitation procedure is repeated for several choices in order to assure consistency of the preferences expressed. There is much experimental evidence to indicate that as the complexity of the decision increases, the reliability and consistency of respondent judgements decreases (Borcherding, Eppel and von Winterfeldt 1991; Boxall et al 1996; De Palma et al. 1994; Mazzotta and Opaluch, 1997). Therefore, properly designed multiattribute surveys present the task to the decision maker in clear and simple terms and provide opportunities to learn about the task through practice decisions before the actual decision choices are presented. Also, the total number of times the decision task is repeated is limited to avoid respondent fatigue.

A variety of techniques have been used to assess multiattribute utility or value functions. These techniques differ in the degree of difficulty and the nature of the preference information expressed (Keeney and Raiffa 1976; Giocoechea Hansen and Duckstein 1982). Perhaps the simplest technique is the pairwise choice, i.e. to choose the preferred alternative or attribute from a set of two choices given. A slightly more difficult task is to rank-order a set of three or more alternatives in order of preference. These techniques provide information on the order of preferences among a set of alternatives but do not indicate the strength or intensity of preferences.

To assess the strength of preferences among alternatives or attributes, different techniques are used. In the simple rating method, the respondent is asked to estimate a numerical value that represents his value or utility at various levels of the attribute based upon some arbitrarily chosen scale. These values are then normalized so that the sum of all weights equals unity. For example, the respondent may be asked to first choose the most important attribute which is assigned a value of 100. Then all other attributes are rated on a scale of 1 to 100. Another class of techniques involves establishing equally preferred conditions to which the respondent is indifferent. In a technique known as "value splitting" or "bisection", the decision maker is first asked to determine the upper and lower bounds for the value of an attribute which are assigned utilities of 1 and 0, respectively. Then the respondent is asked to identify a value for the attribute which represents the utility midpoint, i.e. a value that represents a utility exactly halfway between the upper and lower bound, and this value is assigned a utility of 0.5. The procedure can be continued to further split intervals of the utility function, until a reasonable approximation of the utility curve is obtained. A similar approach, known as the difference standard sequence, involves asking the respondent to construct a series of equal marginal value intervals. These methods may be used to assess utility or value functions that are suspected to be non-linear, since a minimum of three points are sufficient to define a simple utility curve that may be linear, convex or concave in shape. A convex or concave utility function represents a risk-averse or risk-seeking strategy, respectively. In the more sophisticated cross-attribute strength method, the attribute weightings are determined by matching the strength of preference in one attribute to a strength of preference in another. Similarly, the cross-attribute indifference method involves systematically varying alternatives in two attributes to generate simple equations that can be solved for the attribute weights.

For estimating individual utility functions that explicitly consider uncertainty, various types of lottery scenarios are used. For example, in the variable probability method, respondents are asked to choose between two alternatives, one with a certain given value, the other with specified probabilities for either a higher or lower value. The values of the specified probabilities are adjusted until the respondent is indifferent, i.e. the utility is equal, then a set of equations can be solved to determine the utilities at different levels of the attribute. A related approach is the variable certainty equivalent technique in which respondents are asked to select a certain payoff value for which they would be indifferent to a lottery with a 50% chance of a higher payoff amount and 50% chance of zero payoff. Then, by adjusting the value of the higher payoff amount and observing the change in the respondent's certainty equivalent, the utility function can be derived.

Conjoint analysis is a multiattribute decision technique that combines the elicitation of preferences among both attributes and alternatives into a single step (Louviere, 1988). A series of multiple attribute alternatives are presented to the decision maker in which specified levels are given for all attributes. The respondent then chooses or rank-orders the preferred alternative(s). The advantage of this approach is that the choice task is set in the more realistic context of choosing directly among alternatives with the complete set of associated attributes. A drawback is that the most important attributes used by decision makers to select the preferred alternative are not revealed directly. A relatively large number of choices must be made with carefully constructed combinations of attribute levels to determine the attribute weightings that were implicitly used by the respondent.

2.3 Scoring and Ranking Alternatives with Multiattribute Utility Theory

Once a set of individual choice decisions have been made involving a small number or a large sample of decision makers, the individual evaluations are aggregated to give an overall value or score for each alternative. The simplest general form of a utility aggregation function is described mathematically as follows:

$$U(x_j) = \sum_{I=1}^{n} W_i\, U_i(x_{ij}), \quad \text{for } j = 1, 2, 3, ..., n,$$

where $U(x_j)$ is the utility of the jth alternative, W_i is the weight of the ith attribute, U_i is the utility function for attribute I, and x_{ij} is the score given to the jth alternative on the ith attribute. The alternative with the highest value would be the most preferred option. The above function is additive with a linear combination of the weighted values of each attribute. This functional form is valid when there is mutual preferential independence among the attributes, i.e. when the preference for different values of any pair of attributes does not depend on the level of other attributes. In cases where this does not hold, a more complex multiplicative model may be used. However, in practice the additive form is generally used for convenience because it reduces the number of choice repetitions required to derive acceptable statistical results.

The output of a MAU or MAV procedure may be a cardinal (ratio scale) or ordinal ranking of the alternatives. In the cardinal ranking, specific numerical values are given to each alternative that permits a quantitative comparison of how much better or worse one alternative is versus another. With an ordinal ranking, the utility model results only indicate that a particular alternative is more or less preferred than another, but not by how much. In economic valuation studies, the marginal willingness to pay (MWTP) for changes in a nonmonetary attribute can be estimated from the marginal utility coefficient. The marginal utility coefficient for an attribute represents the change in utility corresponding to a unit change in the level of the attribute. The MWTP is calculated by dividing the marginal utility coefficient for an attribute by the marginal utility coefficient of a monetary attribute as follows:

$$MWTP(I) = (\partial U_i / \partial I) / (\partial U_m / \partial m)$$

where MWTP(I) is the marginal willingness to pay for changes in attribute I, $\partial U_i/\partial I$ is the marginal utility coefficient of attribute I, and $\partial U_m/\partial m$ is the marginal utility coefficient of the monetary attribute. The net economic value of various alternatives can then be calculated by summing the MWTPs for changes in the attributes for each alternative.

2.4 Design of Multiattribute Utility Studies

When multiattribute utility studies are conducted to characterize the preferences of a large group or population, it is important that the set of attribute choice combinations is presented in a statistically representative manner. This assures that the maximum amount of information is revealed by the study and the information is unbiased. A variety of orthogonal factorial experimental design procedures are available to assist in this task (Addelman, 1962). In a full factorial experimental design, all possible combinations of attributes and levels are used. For example, in a study with 6 attributes (factors) with three levels for each attribute, there are 3^6 or 729 possible attribute combinations. With a full factorial design, all factor-level combinations can be tested and all possible main effects and nth-order interactive effects can be evaluated in a statistical model. But, with a pairwise choice technique, a full factorial design study with six attributes and three levels would require more than 360 choice decisions. Such a large number of choices is impractical for most multiattribute studies.

Limitations in time, resources, and respondent attentiveness lead to the use of fractional factorial designs to create a balanced sample of possible attribute combinations with some loss of information. For example, a one-half fractional design for a study with 6 attributes and 3 levels for each attribute would require only 3^3 or 27 choice decisions. This design provides a significant savings in time and research costs yet still allows the estimation of all main effects and first-order interactive effects. Several software packages are available for construction of optimized fractional factorial experimental designs such as the SAS "Factex" procedure (SAS Institute).

SECTION 3. ATTRIBUTES AND TRADEOFFS FOR EVERGLADES RESTORATION

3.1 Endpoints, Attributes and Ecosystem Restoration

Restoration of ecosystems presents one of the most difficult challenges in contemporary science and environmental decision-making. Numerous technical questions arise over methods and procedures to improve the ecological health of ecosystems that have been impacted by anthropogenic stresses. Moreover, there is considerable uncertainty about what the recovery path of these systems will be in response to existing, and potentially new, stressors (Cairns, 1988).

Equally, if not more, vexing is the problem of deciding what the objectives of restoration will be. Several alternative points of view may exist about the services of the ecosystem that are most important and what constitutes a 'restored' ecosystem (Bratton, 1992). The decision process to deal with these problems requires natural science models of ecosystem processes and responses as well as social science research to identify the importance of different ecosystem services to society and the public's preferences for different levels of restoration (Milon et al 1997).

One way to consider the goals of ecosystem restoration is to describe ecological endpoints. The endpoints represent characteristics of the ecosystem that, if changed, would indicate a change in the health of the ecosystem (Harwell and Long 1992; Suter and Barnthouse 1993). These endpoints are not fixed points but reflect multiple possible states of an ecosystem that can be observed and monitored through one or more performance measures. In this sense, ecological endpoints are comparable to the concept of attributes in multiattribute utility theory. One possible ecological endpoint such as population levels of a species within an ecosystem can be conceptually related to the attributes of a consumer product such as a car's safety or performance. While some may question the comparison of nature with manufactured products, the decision of what and how much ecological restoration is desirable is ultimately a social decision. And, the public's ability to understand ecosystem attributes as well as the meaning of changes in these attributes can play a major role in determining the type and level of restoration.

While there are many ways to characterize ecological endpoints for ecosystem restoration (Bratton 1992; Cairns 1988; Harwell and Long 1992), two broad classifications are "structural" endpoints and "functional" endpoints. Structural endpoints focus on the number and diversity of individual species, and may include keystone species or other distinctions to differentiate the species (Paine 1980, Westman 1985, Wilson 1992). For the Everglades/South Florida ecosystem, these species indicators might include bird populations, fish populations, and/or populations of endangered species such as the Snail Kite and Wood Stork. On the other hand, functional endpoints emphasize broad ecosystem processes and dynamic properties (Holling 1987, Westman 1985, 1991). In an uplands/wetlands ecotone such as the Everglades, these endpoints might include hydroperiod levels and timing, salinity fluctuations, spatial extent, and fire frequency (Harwell and Long 1992, Holling et al. 1994). While the exact linkages between these alternative endpoint classifications are not well known, in general the two sets of endpoints represent different dimensions of an ecosystem. Ecosystem management based on one set of endpoints may lead to different restoration decisions than for the alternate endpoints (May 1973, McNaughton 1988, Westman 1985, 1991).

An additional consideration in this discussion of defining attributes to represent different types and levels of ecosystem restoration is the distinction between endpoints and the means to achieve them. Changing hydrological conditions may require a number of engineering projects and/or management regulations. The exact combination of these projects and regulations is not directly related to the consideration of endpoints. While decisions about these projects and regulations do influence the cost and even the technical feasibility of various endpoints, the details of these relationships are usually not part of the process of describing attributes in a multiattribute study.

3.1.1 Public Perceptions and Focus Groups

To help understand how the general public perceived the Everglades and the idea of ecosystem restoration of this region, focus group sessions were conducted in Miami and West Palm Beach. Both sessions were administered by a private marketing firm using a trained focus group facilitator (Rife Market Research, Inc. 1998). Participants were recruited by the firm to represent a diverse cross-section of the respective communities. As part of the sessions, participants were asked to explain what they thought of when someone mentioned the term 'Everglades' and what personal experiences they had in visiting places they identified with the Everglades. To facilitate this exercise, participants were asked to draw a picture to show how they would describe the Everglades to someone who had never been to Florida. They also were asked to describe what they thought of when someone talked about the concept of Everglades 'restoration.'

The focus groups were helpful in establishing several points to consider about the selection of attributes to represent the Everglades ecosystem. First, the participants' knowledge of the region varied from those who knew little more than that the Everglades were located in South Florida (but not quite sure where) to others who had closely followed events surrounding the Everglades over the years and had personal recreational experiences (fishing, hunting, etc.) throughout the Everglades region. This variety of backgrounds implied that the geographic dimensions of the problem and any attribute descriptions used in a survey of the general public would need to be simple and clearly defined to provide a common basis. Second, some participants had relatively strong opinions. A few thought of the Everglades as little more than a "mosquito infested swamp" while others talked about the unique flora and fauna and endangered species. Third, the picture drawing exercise revealed that most participants thought of the Everglades in terms of both water and wildlife. Most drew pictures of relatively flat, watery landscapes with different animals such as alligators, birds, and snakes. Very few included open prairies or vegetation other than trees (mostly palms) in their drawings. Finally, some participants expressed an understanding of the linkages between water levels in different areas of the Everglades and various wildlife species. In general most participants were only loosely aware of this linkage. These differences in knowledge once again indicated that some basic level of information about the functioning of the ecosystem would be necessary to provide a common basis for the general public to understand how the water management system was related to the ecology of the region.

Finally, the focus groups revealed that the term "restoration" was confusing and often misunderstood. Many focus group participants expressed concerns that they thought this meant areas that had been developed would be converted to wetlands. Others thought it would not be possible to "restore" a system that had been altered so extensively as South Florida. Still others associated restoration with the controversial constitutional amendment campaign to impose a tax on sugar produced in the Everglades Agricultural Area. These participants thought that water quality was the principal problem in the Everglades and the system would be healthy if this problem was corrected. These varied perceptions of the term restoration indicated that this was not a useful word to describe changes in the system and might potentially bias the results of a public survey.

3.2 Functional/Hydrological Attributes and Levels

To develop a set of functional attributes to represent different hydrological endpoints for Everglades/South Florida restoration in this study, a number of planning documents from the Restudy process were considered. For example, the *Reconnaissance Report* (U.S. Army Corps of Engineers 1994) described the use of different hydrological and ecological performance measures to evaluate the effects of alternative restoration plans. These plans were combinations of engineering structures and drainage system design modifications to the existing C&SFP infrastructure.

One of the most important hydrological performance measures was a comparison between the effects of a plan as measured by the South Florida Water Management Model (SFWMM) and the Natural Systems Model (NSM). The SFWMM is a mathematical engineering model that represents current hydrological conditions throughout the area of South Florida from Lake Okeechobee south to Florida Bay (see Figure 1). The model includes existing engineering structures such as canals, pump stations, well fields, etc. and can be modified to represent new structures or the removal of existing structures (U.S. Army Corps of Engineers 1999, Appendix B). The NSM is also a mathematical engineering model for a comparable area that was developed to depict hydrological conditions of "predrainage" South Florida based on rainfall patterns from 1965 to 1995. The NSM includes none of the existing engineering structures. Estimates of overland flow rates and water levels that would have occurred in a predrainage Everglades are based on assumptions about topography, rainfall, and evapotranspiration (Fennema et al. 1994). Since neither accurate hydrological or rainfall data exist for earlier periods, there is no way to know with any degree of precision how well the NSM actually represents predrainage conditions (U.S. Army Corps of Engineers 1999, Summary pp. xv). Also, since the SFWMM and the NSM only consider hydrological conditions, no information is provided about predrainage or current ecological conditions in the region (Fennema et al. 1994).

Performance measures based on a comparison between existing/projected conditions and "historical" conditions provide a convenient way to describe ecosystem restoration endpoints and are consistent with general concepts of ecosystem restoration (Bratton 1992). Moreover, this type of comparison provides a strong linkage between attributes that can be understood by the public and the hydrological performance measures used in the Restudy planning process. The difficulty with the use of this type of information in a multiattribute study is knowing what existing levels of the attribute might be and how these might change under possible restoration scenarios. Fortunately, the South Florida Water Management District had conducted studies to characterize hydrological conditions in key subregions of South Florida as part of the Lower East Coast water supply planning process (South Florida Water Management District 1997). This information can be used to characterize baseline conditions with existing (1990) hydrological conditions and expected near-term (2010) conditions given expected water demands and water system infrastructure. Unfortunately, since the Restudy process was developing and evaluating alternative restoration plans up through early 1999 (U.S. Army Corps of Engineers 1999), there was no way to know with any precision how future (beyond 2010) hydrological conditions resulting from these plans might change in relation to historical conditions (as represented by the NSM).

Therefore, to represent possible future hydrological conditions, hydrological attribute descriptions were developed and three levels for each attribute were selected based on available information about near-term and possible future conditions. The hydrological attributes were developed for three subregions: Lake Okeechobee, the Water Conservation Areas, and Everglades National Park including Florida Bay (Figure 1). These three subregions were selected because the current management system had identified them as distinct areas within the overall Everglades/South Florida region. And, the Restudy planning process has identified hydrological problems and restoration alternatives that were unique to each subregion (U.S. Army Corps of Engineers 1994). Also, information was available about hydrological conditions in these regions based on comparisons between the SFWMM and the NSM (South Florida Water Management District 1997).

Other areas that are part of the Everglades/South Florida region such as the Caloosahatchee River and estuary, the St. Lucie River and estuary, and the Big Cypress National Preserve were not included for two reasons. First, relatively little information was available about "predrainage" conditions in these areas. Therefore, planning objectives have not been based on the same types of comparisons between the SFWMM and the NSM that were used for the three subregions selected for this study. Second, the addition of more areas into the multiattribute problem would have significantly increased the dimension of the tradeoffs to be evaluated and required increases in the number of pairwise choices made by each respondent and/or increases in sample size (see Section 2.4). The relative loss of comprehensiveness in this study relative to the broader Restudy planning process was necessary given the available information and budget.

The actual hydrological attribute descriptions for the three subregions along with the levels selected for each attribute are presented in Table 3-1. The attribute for each subregion was described in terms of how *too much* or *too little* water impacts the primary habitats that characterize each subregion. Then, the role that *a plan to change the South Florida water management system* was introduced as a mechanism to control water levels and fluctuations in each subregion to be similar to *historic, predrainage conditions*. This description of the attribute allowed the concept of "ecosystem restoration" to be introduced through changes in hydrological conditions without actually using the term restoration.[1] Respondents could then consider changes in the level of each attribute based on their own understanding and evaluation of the merits of historic, predrainage conditions. To provide a common reference point for all respondents about the role of water levels and timing in the Everglades ecosystem, an informational video about the Everglades/South Florida region was presented prior to the description of the attributes (see Section 4.1; Appendix D provides the full script for the video). Note that no specific state or federal agency was mentioned in the attribute descriptions or in the video. This was done to avoid any feelings, either positive or negative, individuals might have toward specific agencies that would influence their judgment about the merits of the attribute alternatives.

[1] As discussed in Section 4, the term 'restoration' may have caused a bias against the status quo.

Table 3-1. Description of Attributes and Levels for the Hydrological Multiattribute Model

Attribute Descriptions	Levels
Water Levels in Lake Okeechobee -- The water management system controls the water levels and fluctuations in Lake Okeechobee. Too much water in the lake causes flooding of the shoreline and marsh areas. Too little water causes these areas to dry out. Part of a plan to change the South Florida water management system could include ways to control the levels of the lake and timing of fluctuations to be similar to historic, predrainage conditions. The possible water level controls that could be included in the plan are:	60%, 75%, and 90% of the time, lake levels are similar to historic, predrainage conditions
Water Levels in Water Conservation Area -- The water management system controls the water levels and fluctuations in Water Conservation Areas. Too much water in these Areas causes flooding of wetlands, upland areas and tree islands. Too little water causes these areas to dry out. Part of a plan to change the South Florida water management system could include ways to control water levels and fluctuations in the Water Conservation Area to be similar to historic, predrainage conditions. The possible water level controls that could be included in the plan are:	50%, 75%, and 90% of the time, water levels in the Water Conservation Area are similar to historic, predrainage conditions
Water Levels in Everglades National Park -- The water management system controls the water levels and fluctuations in Everglades National Park and the flow of fresh water to the Florida Bay. Too much water causes flooding of wetlands, upland areas and tree islands. Too little water causes these areas to dry out and increase the salinity in Florida Bay. Part of a plan to change the South Florida water management system could include ways to control the water levels and fluctuations in the Park to be similar to historic, predrainage conditions. The possible water level controls that could be included in the plan are:	50%, 75%, and 90% of the time, water levels in Everglades National Park are similar to historic, predrainage conditions

The attribute levels presented in Table 3-1 denote the baseline and possible alternative levels of each attribute. The baseline levels for each attribute are based on information presented in the *Lower East Coast Water Supply Plan* (South Florida Water Management District 1997). As discussed above, performance criteria in the *Plan* were based on the percent of time the current water levels and hydroperiods (as represented by the SFWMM) would be comparable to predrainage conditions (as represented by the NSM). Baselines represent the current system given expected service area demands in the year 2010[2] and the completion of ongoing habitat restoration (e.g. Kissimmee River restoration) and water quality improvement projects as mandated by the Everglades Forever Act (Florida Statutes 373.4592) of 1994 (South Florida Water Management District 1997, pp. III-3–III-5). Alternative levels of the attributes were based on hypothetical changes in the water management system so that the subregions would approximate predrainage water levels and hydroperiods 75 or 90 percent of the time. These endpoints were selected because: a) they represent clear differences from the baseline for each area, b) they represent 'partial' and 'full' changes in the current system relative to predrainage conditions, and c) they avoid the notion that '100 percent' restoration of the ecosystem is possible given the land use and engineering modifications that have occurred in the region over the past century. These attribute levels were not intended to represent any specific restoration plan and, as

[2] It is important to note that this definition of the baseline for the hydrological attributes differs from the concept of a baseline in the Restudy planning process. In the Restudy, the baseline is service area demands projected for the year 2050.

discussed in Section 3.1, the means by which the endpoints would be achieved were not considered as part of the attribute description or in the multiattribute decision process.

3.3 Structural/Species Attributes and Levels

The problem of developing a set of structural attributes to represent animal and fish endpoints for Everglades/South Florida restoration was complicated by a number of factors. First is the sheer magnitude of the potential candidates. Due to the tropical and subtropical climate, the region includes habitats for more than 350 bird species, 50 reptile species, 35 mammals, and more than 500 fish species (U.S. Army Corps of Engineers 1994). Of these, more than 62 have been listed as endangered or threatened under the Endangered Species Act. Second, information on historic and existing population levels for many species is limited. Changes in populations of some species such as wading birds have been well-documented (e.g. Ogden 1994) yet there is little consensus on how drainage over the past century has impacted other populations such as deer, raptors and marine fishes. Third, one of the most critical elements of uncertainty in the entire Everglades/South Florida restoration process is the linkage between hydrological changes and ecosystem response (U.S. Army Corps of Engineers 1999, pp. O-13–O-17). This problem was recognized early in the Restudy planning process and led to efforts to develop the Across Trophic Level Simulation System (ATLSS) to predict the effects of hydrological changes on species and species groups (U.S. Army Corps of Engineers 1994). Unfortunately, output from ATLSS was not available during the attribute development stage of this study.[3] Therefore it was necessary to rely on the limited published literature and discussions with various fish and wildlife professionals from universities and agencies around Florida to develop a set of structural/species attributes for this analysis. Table 3-2 presents the three species groupings that were selected as species attributes and the levels associated with each attribute.

The wetland species group, which included wading birds and alligators, was selected since it represented a broad, yet clearly defined, assemblage that most people would associate with wetlands in South Florida.[4] The dryland species group was similarly easy to associate with upland and prairie habitats with different foraging and nesting requirements than wetland species. The third group, Florida Bay and estuarine species, represented marine crustaceans and fishes that would most likely be impacted by changes in hydrology in the lower Everglades region. Note that none of these groupings explicitly identify endangered or threatened species such as the Florida Panther that many people may associate with Everglades/South Florida fauna. This was done to avoid excessive concern that an individual may place on a particular species in the overall consideration of each attribute.

[3] As of April 1999, detailed results from ATLSS were available only for a few of the species models; these models apparently were not a primary evaluation tool in the Restudy planning process (U.S. Army Corps of Engineers 1999, Section 7).

[4] Based in part of focus group discussions conducted as part of this study.

Table 3-2. Description and Results for the Species Multiattribute Model

Attribute Descriptions	Levels
Wetland Species-- The water management system affects the food supplies and nesting areas available for animals and birds that live wetlands, marshes and tree islands. Part of a plan to change the South Florida water management system could include ways to influence wetland habitat quality to increase populations of birds such as herons, spoonbills and wood storks and other animals such as alligators to levels similar to historic, predrainage conditions. The population levels that are possible to include in the plan are:	20%, 50%, and 80% of historic, predrainage population levels
Dryland Species -- The water management system affects the amount of dry land and the food supplies available for animals and birds that live in pine forests, hardwood hammocks, and prairies. Part of a plan to change the South Florida water management system could include ways to influence dry land habitat quality to increase the populations of species such as deer and racoons and birds such hawks, mockingbirds and jays to levels similar to historic, predrainage conditions. The population levels that are possible to include in the plan are:	50%, 60%, and 70% of historic, predrainage population levels
Florida Bay Species -- The water management system affects the flow of fresh water into Florida Bay and fishes that are dependent on mangrove swamps and sea grasses in the Bay. Part of a plan to change the South Florida water management system could include ways to influence the habitat quality of Florida Bay to improve the populations of pink shrimp and fishes such as mullet, sea trout and redfish to be similar to historic, predrainage populations levels. The population levels that are possible to include in the plan are:	60%, 75%, and 90% of historic, predrainage population levels

Baseline and possible future levels for the wetland species attribute group in Table 3-2 were based on Ogden's (1994) studies of wading bird nesting in the Everglades. The reductions in wading bird nesting have been frequently cited as a primary indicator of Everglades ecosystem health (e.g. U.S. Army Corps of Engineers 1999, Summary, pp. iii). Possible future population levels for this attribute, such as the 80 percent of historic, predrainage populations, were based on experts' opinions and the assumption that land use and hydrological conditions in areas surrounding the remaining undeveloped parts of the Everglades ecosystem would not significantly impair the recovery of wetland species populations. If these changes, such as the loss of wetlands and mangroves around Biscayne Bay, do constrain wetland species populations in the Everglades, the 80 percent level would be unrealistic.

In contrast to wading birds and wetland species, historical data on fish and marine life populations in Florida Bay are limited. Available time series data do suggest some overall decline, particularly for pink shrimp populations during periods of low rainfall when salinity levels in the Bay increase (Bohnsack et al. 1994). While it is difficult to use these fishery-dependent data to compare to historic, predrainage conditions, they do suggest that fish and marine life populations have not declined as dramatically as wading bird populations. This is certainly the case for spiny lobster populations (as measured by commercial harvests) which have remained relatively stable since the 1950s (Labiskey et al. 1980; Milon et al. 1998).[5] Moreover, the loss of mangrove

[5] The primary nursery area for juvenile spiny lobster in the Florida Keys is Florida Bay. While the Bay provides important habitat during the life cycle, spiny lobster larvae in Florida Bay may recruit from a variety of locations throughout the Caribbean (Ehrhard 1994; Hunt 1994).

and seagrass habitat in and around Florida Bay has been significantly less than the loss of wetland habitat in other areas (U.S. Army Corps of Engineers 1999, Sections 2 and 3). Therefore, levels for the Florida Bay species attribute in Table 3-2 have a higher baseline level than wetland species (60 percent of historic, predrainage conditons compared to 20 percent) and it is assumed that overall Florida Bay species populations could recover to 90 percent of historic levels.

The dryland species attribute in Table 3-2, which includes deer, racoons, and a variety of songbirds, is the most difficult to characterize in terms of historic population levels. Large areas of pine forests and hardwood hammocks along the eastern coastal ridge of South Florida have been converted to farm land and urban development. Yet, some prairie areas are much drier now than they were prior to drainage in the 1940s and '50s (Light and Dineen 1994). Therefore, it was assumed that the current baseline level for dryland species was 50 percent of historic levels. This reduction roughly matches the area of upland habitat converted to other uses. The highest possible level for this attribute was set at 70 percent of historic levels to reflect the loss of habitat.

In evaluating the species attributes in Table 3-2, it is important to note that simultaneous increases in the levels of all three attributes are not likely under any restoration plan. Changes in hydrology and habitat quality that favor wetland species in the Everglades/South Florida region are not likely to also benefit dryland species except in isolated areas. This aspect of the species attribute combinations is different than the hydrology attributes which could all increase to higher levels relative to the baseline. The significance of this difference will be more obvious when the multiattribute survey results are applied to the evaluation of hypothetical restoration plans in Section 6.

3.4 Annual Cost, Farmland and Water Use Restriction Attributes

Restoration of hydrological and/or ecological conditions in the Everglades/South Florida region cannot be considered in isolation from competing uses for water supplies and the costs of restoration plans. While there is a broad range of alternative ways to describe these considerations, the attribute descriptions and levels presented in Table 3-3 were selected for this study. These attributes were considered to be important to the planning problem regardless of the way ecological endpoints were described. Therefore, the attributes described in Table 3-3 were used in combination with both the hydrological and species attributes presented above in Tables 3-1 and 3-2.

The annual cost per household attribute in Table 3-3 establishes that all Floridians could have to pay for an Everglades/South Florida restoration plan. As with the hydrological and species attributes, these costs are presented in the context of *a plan to change the South Florida water management system*. A general utility tax was used as the 'payment vehicle' (Mitchell and Carson 1989) for a plan since this type of tax is the most broadly based tax that could be assessed under Florida's tax system.[6] A broad based tax is important in this study because it helps to avoid respondent 'free-riding' in which respondents express preferences for public programs knowing that they will not have to pay for these programs. Moreover, since one of the

[6] A commonly used payment vehicle in public surveys is an income tax (Mitchell and Carson 1989). The Florida Constitution prohibits income taxes.

objectives of this survey was to measure Floridians' preferences and economic values for Everglades/South Florida restoration (Section 1.2), a broad based tax applicable to all Floridians was necessary. Also, in order to estimate economic values from multiattribute survey results, a measure of the tradeoff between personal costs and other attributes was necessary (see Section 2.3).

Table 3-3. Description of Attributes and Levels for Cost, Farmland and Water Use Restrictions

Attribute Descriptions	Levels
Annual Cost per Household --All Florida residents pay utility taxes as part of their water, electric and telephone bills. Part of a plan to change the South Florida water management system could include additional taxes and all Floridians would pay for these changes over the next 10 years. Proceeds from these taxes would go into a special trust fund that would be used only to change to South Florida water management system. Possible tax payments that could be included in the plan are:	No change in utility taxes; $25 increase per year; $50 increase per year.
Farmland -- Farmland acreage can be converted to water storage to increase the flexibility of the water management system, increase the extent of natural areas, and reduce irrigation demand for water. Part of a plan to change South Florida water management system could include reductions in existing farmland acreage in the Everglades Agricultural Area in western portions of Broward and Dade counties that are adjacent to the Water Conservation Areas and Everglades National Park. The possible levels of farm land reductions that could be included in the plan are:	No change in farm land acreage; 100,000 acre reduction; 200,000 acre reduction.
Restrictions on Water Use -- Changes in the water management system can affect the availability of water for households in South Florida. The primary effect would occur during years with low rainfall. These dry years occur, on average, in 1 out of every 5 years. Possible levels of restrictions on outdoor and indoor water use that could be included in the plan are:	3 days per week outdoor use and 10% reduction in indoor use; 2 days per week outdoor use and 25% reduction in indoor use; 1 day per week outdoor use and 40% reduction in indoor use.

The levels for the annual cost per household attribute in Table 3-3 were based on a no-cost ($0), low-cost ($25), and high-cost ($50) hierarchy. All annual costs apply over ten years, the planning horizon used in this survey. The full attribute descriptions provided to survey respondents emphasized that the tax payments would apply over ten years (see Appendices B and C). The $25 and $50 levels were selected because they are readily understandable intervals and they roughly correspond to initial estimates of Floridians' per capita costs for Everglades restoration.[7]

The farmland attribute description and attribute levels presented in Table 3-3 reflect the possibility that farmland could be converted to meet the objectives of *a plan to change the South Florida water management system*. The specific areas where farmland acreage could be reduced were identified as the Everglades Agricultural Area (see Figure 1-1) and western portions of Broward and Dade counties. The acreages identified as possible levels for the attribute (0, 100,000 acres and 200,000 acres) reflect plan alternatives

[7] The initial *Reconnaissance Report* (U.S. Army Corps of Engineers, 1994) estimated restoration costs could vary between $3 – $6 billion depending on the extent of restoration. Cost-sharing between Florida and the federal government for Everglades restoration under the Water Resources Development Act of 1996 would be 50/50. Using an estimate of 5.7 million households in Florida, annual payments of $25 or $50 per household for a ten year period would amount to approximately $1.5 – $3.0 billion.

included in the *Reconnaissance Report* (U.S. Army Corps of Engineers 1994) and alternatives identified in discussions with Restudy planning staff.

The last attribute described in Table 3-3 addresses the possibility that *a plan to change the South Florida water management system* could influence the severity of water restrictions on outdoor and indoor household water uses in South Florida during dry years (about 1 of every 5 years). The possibility of water use restrictions as part of an Everglades restoration plan is necessary since domestic water users account for a majority of existing and projected water demands (South Florida Water Management District 1997). The attribute descriptions and levels were based on water shortage rules previously established for South Florida households (South Florida Water Management District 1991). The baseline level (outdoor uses restricted to 3 days per week, 10 percent reduction in indoor use) corresponds to Phase I (moderate) water shortages. This level of restrictions is common in South Florida, and other regions of Florida, during dry periods. The second level (outdoor uses restricted to 2 days per week, 25 percent reduction in indoor use) corresponds to Phase II (severe) water shortages. The third level (outdoor uses restricted to 1 day per week, 40 percent reduction in indoor use) is comparable to Phase III (extreme) water shortages.[8]

3.5 Attribute Combinations and Plan Alternatives

Combining either the three hydrological or three species attributes with the annual cost, farmland, and water use restriction attributes results in six attributes and 3^6 (729) unique combinations of all levels for the six attributes. As discussed in Section 2.4, this many attribute/level combinations is too large for personal interview surveys. To reduce the number of attribute combinations, an optimized factorial design was employed which could be used to evaluate all main and first-order interactive effects. This resulted in 27 possible attribute/level combinations for either the hydrological or species representations of plan attributes. Pretesting indicated that more than ten pairwise choices were too burdensome for respondents. Therefore the 27 attribute combinations were split into two groups of seven pairwise choices (2 groups x 7 pairwise choices equals 28 alternatives with one alternative repeated in each group). With this design, each respondent only made 7 pairwise choices from the preselected attribute combinations.

To evaluate how respondents' selection of preferred plans varied with the description of attributes, a split sample design was utilized. This meant that a respondent only considered the hydrological attribute combinations or the species attribute combinations. An example of a pairwise choice between alternative plans using the hydrological attribute combinations is presented in Table 3-4. Plans A and B each represent one of the 27 possible combinations of the six hydrological attribute and levels selected with the factorial design. Respondents were informed that these plans were unique and none of the plans had been already selected by public officials. After a set of practice exercises to familiarize respondents with the pairwise choice process, one of the 7 sets of attribute combinations was described to respondents. Respondents were instructed to carefully consider each plan combination and then asked to select their preferred alternative. This process was repeated for each of the 7 attribute combinations. More complete details on the interview process are provided in Section 4.

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[8] The Phase IV (critical) water shortage plan restrictions were not included in the possible attribute levels.

A comparable example of a pairwise choice between alternative plans with the species attribute combinations is presented in Table 3-5. The same process of describing the attribute levels for each pair of possible plans was followed in the interviews using the species attribute combinations.

Table 3-4. Example of Pairwise Choice for the Hydrological Multiattribute Model

Plan Component	A	B
Lake Okeechobee, Water Levels and Timing.	**60%** of the time, lake levels and timing are similar to historic, predrainage conditions	**60%** of the time, lake levels and timing are similar to historic, predrainage conditions
Everglades Water Conservation Areas, Water Levels and Timing.	**50%** of areas have water levels and timing similar to historic, predrainage conditions	**50%** of areas have water levels and timing similar to historic, predrainage conditions
Everglades National Park and Florida Bay, Water Levels and Timing.	**90%** of the area has water levels and timing similar to historic, predrainage conditions	**50%** of the area has water levels and timing similar to historic, predrainage conditions
Annual Cost Per Household	**Increased $25 per year**	**No change**
Restrictions on Household Outdoor and Indoor Water Use.	Outdoor use limited to 2 days per week; indoor use **reduced 25%**	Outdoor use limited to 3 days per week; indoor use **reduced 10%**
Farm land (acres) in the Everglades Agricultural Area and Western Portions of Palm Beach, Broward and Dade Counties.	Reduce farm land acreage by **100,000 acres or 15% of farmed area**	**No change** in farm land acreage

Table 3-5. Example of Pairwise Choice for the Wildlife Multiattribute Model

Plan Component	A	B
Wetland Dependent Species Such as Wading Birds and Alligators	**20%** of historic, predrainage population levels	**20%** of historic predrainage population levels
Dry Land Dependent Species Such as Deer, Hawks and Songbirds	**70%** of historic, predrainage population levels	**50%** of historic, predrainage population levels
Florida Bay Dependent Species Such as Pink Shrimp, Mullet and Sea Trout	**60%** of historic, predrainage population levels	**60%** of historic, predrainage population levels
Annual cost per household	Utility taxes increased **$25** per year or $250 over 10 years	**No change** in utility taxes
Restrictions on outdoor and indoor household water use	In dry years, outdoor uses **restricted to 2 days per week** and indoor uses **reduced by 25%**	In dry years, outdoor uses **restricted to 3 days per week** and indoor uses **reduced by 10%**
Farm land in the Everglades Agricultural Area and western portions of Palm Beach, Broward and Dade counties	**Reduce** farm land acreage by **100,000 acres (15% of farmed area)**	**No change** in farm land acreage

3.6 Other Attributes Not Included

The multiattribute survey process provides a flexible tool to simultaneously consider a number of important attributes of a decision. The design of attributes for this survey was intended to incorporate as many of the key issues and tradeoffs in the choice combinations as was feasible given limits on respondent's time and ability to consider complex choices. But, other key issues being considered in the context of Everglades/South Florida restoration were excluded.

First, water quality issues were not included in the attribute set due to the variety of existing and potential problems in different subregions. This issue was particularly troubling since a highly contentious and well-publicized campaign to amend the Florida Constitution had occurred in 1996 to assess a 1 cent per pound tax on sugar produced in the Everglades Agricultural Area (EAA). Proceeds from the proposed tax, which failed to get a statewide majority, would have been used to pay for improved water quality for water flowing from the EAA into the Everglades. Initial focus groups conducted in 1997 indicated that many people in South Florida considered water quality as the major environmental problem in the Everglades.

Since the attribute combinations used to represent restoration plans in this survey focused only on changes in the water management system to enhance hydrological (water levels and timing) or structural (species) attributes, it was necessary to deal with the water quality issue if respondents asked about how it would be addressed under the plans described in the pairwise choice process. If this issue was raised, interviewers were instructed to inform respondents that water quality problems were being addressed under a different plan that had already been established by the State of Florida.[9] The plans each respondent was asked consider would not interfere with this plan. Therefore respondents were asked to not consider water quality issues in their selection of preferred alternatives.

A second issue that was not considered in the multiattribute survey was the potential effects of structural modifications in the C&SFP on local areas and communities in South Florida. Given the focus on endpoints, the external effects of achieving these endpoints were not considered. These effects, such as the impacts of water storage reservoirs or water tables on community development patterns, may be a strong influence on the selection of projects to achieve restoration objectives. Due to the potentially large number of local concerns and the lack of a specific restoration plan to consider, this issue was excluded.

[9] Although not explained to respondents, the plan being referred to is the Everglades Forever Act (EFA) of 1994 which established water quality targets and timetables for the Everglades Protection Area. It is assumed for the purposes of this survey that these targets and timetables will be achieved and that future modifications to the C&SFP would conform to the requirements of the EFA.

SECTION 4. SURVEY DESIGN AND RESPONDENT PROFILE

4.1 Description of the Interview Process

This survey was designed to be conducted through household personal interviews because of the large amount of detailed information to be presented and gathered. Interviews consisted of five parts in the following order: 1) explanation of the nature and purpose of the survey; 2) questions about the respondents' general attitudes toward environmental and public policy issues; 3) presentation of an informational video about the Everglades and water management in South Florida; 4) a paired choice task to select preferred water management plans to change ecosystem attributes; and, 5) questions about respondent's socio-economic characteristics.

Respondents who were selected to participate in the survey (see Section 4.2 below) were told that the purpose was to determine public opinions about *proposed changes in the water management system for South Florida*. The term "restoration" was not used in the interview process because focus groups conducted in the early stages of the study indicated that the public had many different definitions of the term and ideas about what it meant for South Florida. Also, there was concern that use of the term "restoration" might impart a negative image to the status quo and thereby bias the plan choice process.

Questions about public policy issues and environmental attitudes included a series of questions about spending priorities for State of Florida programs, questions about drinking water, and a series of statements about the environment that the respondents were asked to either agree or disagree with. Questions about socio-demographic characteristics included political party affiliation and voting history, educational attainment, place of birth and years residency in Florida, age, household size, racial/ethnic background, donations to environmental groups, and household income. The paired choice task to select conjoint sets for water management plans in South Florida consisted of 3 practice choices and 7 test choices for either the water management or wildlife management multiattribute sets described in the previous section. The complete set of interview questions is provided in Appendix A.

The informational video, approximately 11 minutes in length, was a key part of the survey. The video was designed to provide a common frame of reference about the issues surrounding the Everglades and South Florida water management, and to enable respondents to clearly understand and answer survey questions. The video was displayed either on the respondent's video player or on a portable player provided by the interviewer. Major sections of the video included the history of the Everglades, its hydrology and wildlife, alteration of the natural hydrologic patterns, the current water management system, uses of water in the region, and modern environmental problems. The narrative script for the video is presented in Appendix D.

Interviews were conducted by an independent market research firm (Rife Market Research, Inc. Miami, FL) subcontracted by the University of Florida to implement the survey. Bilingual interviewers were used in sampling areas of South Florida with a high percentage of Hispanic residents. An incentive of $10 was paid to respondents as compensation for their time and cooperation to encourage participation in the survey. Survey respondents were screened to be at least 18 years of age and a legal Florida resident for at least 6 months. All respondents signed a consent form describing the conditions of the interview and their rights in the interview process prior to the start of the formal interview.

The interviews averaged 57 minutes in duration and ranged from 20 minutes to nearly 2 hours. All interview materials were organized in a set of notebooks that contained graphic representations of response possibilities and were color-coded for the two multiattribute choice protocols (Appendices B and C). Interviewers asked the respondent questions and recorded his or her answers on a separate coding sheet. Interviewers also rated the respondents in terms of their seriousness about the survey, level of distraction or attentiveness to the task, and understanding of the material, as well as recording any general comments that were made about the survey.

4.2 Respondent Selection

A total of 480 randomly selected households were interviewed for the survey. Respondents were drawn from selected Census tracts in 5 metropolitan areas: Miami (Dade County), West Palm Beach (Palm Beach County), Ft. Meyers (Lee County), Tampa (Hillsborough Co.) and Orlando (Orange Co.). The first three counties were chosen to represent the opinions of citizens most directly affected by the restoration project since they were located within the South Florida Water Management District. The other areas represented the opinions of urban residents outside South Florida. The margin of error was ± 4.5 percent for estimation of a binomial variable within the overall sample with a 95 percent level of confidence and ± 10 percent within each county.

In each of the target sample areas, 96 households were sampled from 6 or 7 selected U.S. Census tracts. The Census tracts in the study area were stratified by median household income and racial/ethnic composition. The three strata for median annual household income were: less than $25,000, $25,000 to $39,999, and $40,000 or greater. The two strata for racial/ethnic composition were based on the population of non-white and Hispanic minorities as a percentage of the county population: less than 25 percent and greater than or equal to 25 percent. These stratifications gave a total of 6 (3x2) strata combinations. Each stratum was represented in the sample for each county by random selection from the universe of Census tracts for that county.

The final selection of households for the survey was made by interviewers in the field following a prescribed procedure to assure randomness. In each targeted Census tract, a typical street was selected from two different Census blocks. A listing of all addresses on the street was made and numbered consecutively. Then a random number table was consulted to randomly select 8 of the addresses as primary target households for interviews and 4 as alternate households. At least two attempts were made to contact the residents of the selected primary households at different times of day before accepting an alternate address to avoid systematic bias in the selection based on daily work-activity patterns. Additional sets of alternate households were generated as needed to complete the sample of 8 from each block group. Approximately 10 percent of households contacted refused to participate.

4.3 Respondent Socio-Demographic Profiles

Socio-demographic characteristics of the respondents interviewed for the survey are summarized in Tables 4.1 and 4.2. Comparable figures are also provided for the state population based on official Census statistics and the Florida Annual Policy Survey (FAPS) conducted by Florida State University. While this survey sample was not designed to be representative of the Florida population, the target areas represent a major share of the total resident population in Florida.

In general, the characteristics of the survey sample closely matched the Florida population. Table 1 shows that respondent gender was 48.5 percent male and 51.5 percent female. Respondent ages were: 18 to 24 years - 6.6 percent, 25 to 44 years - 43.0 percent, 45 to 64 years - 25.0 percent, and 65 years or older - 25.4 percent. The highest level of education attained by survey respondents was: primary school (no high school diploma) - 12.2 percent, high school - 30.3 percent, some college - 27.8 percent, college graduates - 19.6 percent, and post-graduate work - 9.9 percent. This represented a slightly higher share of sample respondents with advanced education, and a correspondingly lower share with only primary education than the state population (Table 4.1). The number of respondents who indicated they were not born in Florida (79 percent) was slightly greater than the state population (71 percent). Also, respondents who had lived in Florida less than 5 years (31 percent) were somewhat more frequent than the state population (17.5 percent), while those who had been residents over 21 years (30 percent) were less frequent (37 percent).

The racial/ethnic composition of sample respondents was: white - 82.9 percent, black - 11.9 percent, Hispanic (included in either white or black) - 22.9 percent, and other - 4.3 percent. Racial composition of the sample in each county surveyed closely matched that of the county as a whole (Table 4.2). Political party affiliation of respondents was: Republican - 24.6 percent, Democrat - 37.4 percent, Independent or other party - 16.7 percent, and no preference - 21.3 percent. The proportion of respondents who indicated that they voted in the last 3 years (62.6 percent) was slightly less than the population (72.7 percent). In terms of donations made annually to environmental groups, 53.1 percent of respondents did not make any, 33.3 percent donated less than \$100, 9.0 percent donated \$100 to \$500, and 1.5 percent reported donating more than \$500. Annual household income was less than \$20,000 for 23.3 percent of respondents, \$20,000 to \$50,000 for 42.9 percent, over \$50,000 for 23.1 percent; 10.6 percent refused to disclose household income levels (Table 4.1). The estimated median household income for the survey sample in each county ranged from \$25,000 in Hillsborough County to \$46,250 in Palm Beach County, but were similar to the county population *in toto* (Table 4.2). The mean household size reported by respondents was 2.7 persons as compared to 2.46 for the state population (Table 4.1).

As part of the interview, respondents were asked to indicate their support for state expenditures in 12 major program areas. These questions were identical to those contained in the FAPS in 1996 and provide a useful benchmark for comparison. The results are summarized in Table 4.3.

Table 4-1. Socioeconomic Characteristics for the Survey Sample and Comparisons to the Florida Population.

Socioeconomic Characteristic		Survey Sample (Percent)	Florida Population* (Percent)
Gender	Male	48.5	47.8
	Female	51.5	52.2
Age	18-24	6.6	10.6
	25-44	43.0	38.3
	45-64	25.0	26.9
	65 plus	25.4	24.2
Educational Attainment	No High School Diploma	12.2	25.6
	High School Graduate	30.3	31.0
	Some College	27.8	26.0
	College Graduate	19.6	12.0
	Post-Graduate Work	9.9	6.3
Born in Florida	Yes	21.0	28.8
	No	79.0	71.2
Years Residency in Florida	Less than 5	31	17.5
	6 to 10	16	16.9
	11 to 20	23	26.9
	Over 21	30	37.1
Race/Ethnicity (may sum to greater than 100 percent)	White (Hispanic, nonhispanic)	82.9	85.9
	Black (Hispanic, nonhispanic)	11.9	12.5
	Hispanic	22.9	12.8
	Other (Asian, American Indian Pacific Islander)	4.3	1.8
Political Party Affiliation	Republican	24.6	42.9
	Democrat	37.4	48.4
	Independent/Other	16.7	8.7
	No Preference	21.3	
Voted in Last 3 Years	Yes	62.6	72.7
	No	36.6	27.3
Amount of Donations Annually to Environmental Groups	None	53.1	45.8
	Less than $100	33.3	32.6
	$100 to $500	9.0	12.4
	More than $500	1.5	1.8
	NA	3.1	7.5
Annual Household Income	Less than $20,000	23.3	22.9
	$20,000-$50,000	42.9	48.8
	Over $50,000	23.1	28.4
	Refused	10.6	
Household Size (mean)		2.70	2.46

* Source for Florida Population values: Florida Annual Statistical Abstract 1997 (Floyd et al. 1998).

Table 4-2. Race/Ethnicity and Median Household Income for the Survey Sample, by County, and Comparisons to the County Population.

County	Race/Ethnicity (Percentage of Survey Sample or Population)				Median Household Income	
	White, non-Hispanic		Minority, other			
	Sample	Population*	Sample	Population*	Sample	Population*
Dade	35.4	30.4	64.6	69.6	$40,625	$33,117
Lee	87.5	88.4	12.5	11.6	$32,273	$29,734
Palm Beach	77.1	79.4	22.9	20.6	$46,250	$36,013
Hillsborough	81.3	72.9	18.8	27.1	$25,000	$27,466
Orange	72.9	73.4	27.1	26.6	$34,444	$31,277
All Counties	70.8	58.5	29.2	41.5	$33,942	$31,628

* County population characteristics from 1990 US Census.

Public schools were rated as the top priority by 31.7 percent of respondents, followed by crime (18.5 percent), health care (11.9 percent), the environment (11.0 percent), the elderly (7.9 percent), low income families (5.2 percent), endangered species (3.5 percent), highways (3.1 percent), colleges/universities (2.5 percent), industrial development (2.3 percent), prisons (1.5 percent) and tourism (0.6 percent). These rankings were very similar to those of the Florida population as measured by the 1996 FAPS. For public schools, 79.4 percent of respondents indicated that public funding should be increased in this area, 16.5 percent said it should remain the same and 3.8 percent wanted it decreased. Again these results closely matched the Florida population. For programs for the environment, a somewhat higher percentage of survey respondents (66.7 percent) desired an increase in funding as compared to the state population (57.6 percent). A lower percentage wished it to remain the same or to decrease. A similar pattern of results was found concerning priorities for funding programs for endangered species. The percentage of survey respondents who supported increased funding was also greater than the population for health care, highways, low income families, the elderly, and tourism, but were lower for prisons and colleges/universities.

Respondents were also read statements about the environment and water supply issues and asked whether they (strongly or somewhat) agreed or disagreed with each statement. Table 4.4 shows that generally there was a very high level of concern and support expressed for statements about the environment. Over 90 percent of respondents either “strongly agreed” or “somewhat agreed” with the statements “the environment is easily upset” and “interference with the environment often causes disaster.” These results are highly consistent with other statewide surveys of Floridians attitudes about the environment (Milon et al. 1998). Respondents also expressed strong support for water conservation as in the statement “water conservation practices are a good idea.” Conversely, nearly two thirds of respondents disagreed with the statement “humans have the right to change the environment to suit their needs.” There was a somewhat lower level of agreement with statements regarding water supply: “water will always be available for my community,” “water will always be available for anybody who wishes to move to Florida,” or “water supply needs are a top priority.” A majority of respondents disagreed with the statement “protection from flooding is adequate in my community.”

Table 4-3. Priorities for State of Florida Expenditures by Program Area by Survey Sample Respondents and Comparisons to the Florida Population.

Program Area	Sample or Population*	Top Rated Priority (Percent)	Funding Change Indicated (Percent of Respondents)			
			Increase	Remain Same	Decrease	No Answer
Crime	Sample	18.5	71.3	23.3	4.4	1.0
	Population	16.4	70.5	21.8	4.5	3.2
Public schools	Sample	31.7	79.4	16.5	3.8	0.4
	Population	35.4	78.5	15.0	3.0	3.5
The Environment	Sample	11.0	66.7	29.2	3.1	1.0
	Population	8.6	57.6	33.0	6.3	3.1
Industrial development	Sample	2.3	26.3	45.2	26.5	2.1
	Population	4.3	24.4	43.0	27.4	5.2
Endangered Species	Sample	3.5	57.7	32.3	8.3	1.7
	Population	na	51.1	36.3	9.3	3.4
Health care	Sample	11.9	65.8	28.5	5.4	0.2
	Population	7.6	55.0	32.1	8.6	4.3
Colleges/universities	Sample	2.5	50.0	42.3	7.1	0.6
	Population	3.9	55.3	34.3	5.8	4.6
Highways	Sample	3.1	43.3	45.6	10.2	0.8
	Population	3.7	35.5	52.9	9.4	2.2
Low income families	Sample	5.2	48.5	40.0	10.8	0.6
	Population	6.0	36.5	40.9	16.2	6.4
Elderly	Sample	7.9	64.2	31.5	4.0	0.4
	Population	9.6	49.7	38.8	6.6	4.9
Prisons	Sample	1.5	31.5	42.3	24.8	1.5
	Population	2.9	33.7	39.5	21.5	5.2
Tourism	Sample	0.6	23.3	47.1	28.5	1.0
	Population	1.0	20.8	53.6	23.5	2.1

* Population estimates are from the 1996 Florida Annual Policy Survey (Florida State University).

Table 4-4. Survey Respondent Attitudes about the Environment and Water Supply.

Statement	Percent of Respondents Choosing				
	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree	No Answer
Water will always be available for anyone who comes to my community.	38.3	32.5	18.8	6.3	4.2
Water will always be available for anyone who comes to Florida.	40.4	32.1	15.8	7.7	4.0
Water supply needs are a top priority.	38.5	27.3	20.4	12.9	0.8
The environment is delicate and easily upset.	63.1	28.3	5.6	1.5	1.5
Interference with the environment often causes disaster.	60.8	32.3	4.2	1.9	0.8
Protection from flooding in my community is adequate.	9.6	25.8	19.6	38.3	6.7
Humans have the right to change environment to suit their needs.	6.0	21.0	24.0	46.9	2.1
Water conservation practices are a good idea.	66.3	27.3	3.3	2.7	0.4

SECTION 5. STATISTICAL RESULTS

5.1 Statistical Modeling of Pairwise Choices

The pairwise choice (PC) approach to multiattribute utility analysis involves the elicitation of responses to a pair of alternative choices. In an environmental choice setting such as described in Section 3, this method uses attributes and levels to represent possible alternative states (endpoints) of the environment. Pairwise choices can be described in a utility maximizing framework based on random utility theory (Louviere 1988; McFadden 1986). For each individual, the utility level of each alternative, I, in the pair of choices may be represented by:

(1) $$U_i = x_i + \varepsilon_i$$

where x_i is a set of attributes for alternative choice I and $,_i$ is a random error term. If an individual chooses alternative I consisting of a set of attributes over alternative j, the decision indicates that utility to that individual from alternative I (U_i) is greater than utility from j (U_j).

In a pairwise multiattribute setting, a respondent compares the attributes of alternatives *A* and *B* and selects the alternative that provides a higher level of utility or, in symbolic terms,

(2) $$U(X^A) > U(X^B)$$

where *U(.)* represents a respondent's utility function and X^A, X^B represent sets of attributes for alternatives *A* and *B*. Utility can be decomposed into a systematic component, *v(.)* determined by the attributes, and a random component, , such that

(3) $$U(X) = v(X) + ,$$

The probability that a respondent chooses A rather than B depends on the probability that the difference between the systematic component of A and B is greater than the difference between the random components, such that the probability of choosing A is

(4) $$Pr(A) = Pr\,(D_U > *)$$

where $D_U = v(X^A) - v(X^B)$ *and* $* = ,^A - ,^B$

With data from a representative sample of individuals, the difference in the systematic component in the utility functions (D_U) can be estimated using statistical techniques such as the conditional logit model (Ben-Akiva and Lerman 1985; Greene 1997). The conditional logit model for data consisting of choice-specific attributes can be expressed as the probability of observing response Y_I:

(5) $$Prob(Y_i = j) = \frac{\exp(x_i\,\beta_j)}{\sum_{j=1}^{J} \exp(x_i\,\beta_j)}$$

where the $s are estimated coefficients (weights) for the attributes and exp represents the exponential function.

Considering the hydrological attributes choices described in Section 3 (Tables 3-1 and 3-3), the conditional logit model can be specified as:

(6) $$D_{U_H} = \beta_0 + \sum_{i=1,6} \beta_i (X_i^A - X_i^B)$$

where β_i are the estimated coefficients and X_i are the attributes of the alternatives in the choice sets with X_1 the Lake Okeechobee attribute, X_2 the Water Conservation Areas attribute, X_3 the Everglades National Park attribute, X_4 the Annual Cost attribute, X_5 the Water Use Restrictions attribute, and X_6 the Farmland attribute.

Similarly, the species attributes choices (Tables 3-2 and 3-3) can be specified as:

(7) $$D_{U_W} = \beta_0 + \sum_{i=1,6} \beta_i (X_i^A - X_i^B)$$

where X_1 is the Wetland Species attribute, X_2 is the Dryland Species attribute, X_3 is the Estuarine Species attribute, X_4 is the Annual Cost Attribute, X_5 is the Water Use Restrictions attribute, and X_6 is the Farmland attribute.

In addition to identifying respondents' weighting of different attributes, it may also be desirable to evaluate whether socioeconomic characteristics such as age, income, or geographic location influence the attribute weights. The conditional logit model can be used to evaluate socioeconomic interactions with the attributes variables (Swallow et al. 1994). A comparable specification for either the hydrological attributes or species attributes models that includes socioeconomic variables interacting with the attributes can be expressed as:

(8) $$D_{U_r} = \sum_{i=1,6} \beta_i (X_i^A - X_i^B) + \sum_{i=1,6} \sum_{m=1,8} \alpha_{mi} S_{mi} (X_i^A - X_i^B)$$

where X_i denotes the ith attribute, β_i are estimated coefficients for the main effects of each attribute, α_{mi} are estimated coefficients for interactive variables with attributes and eight socioeconomic characteristics, S_{mi}, that include political party affiliation, region of the state, donations to environmental causes, gender, years living in Florida, income, and two ethnic groupings.

5.2 Sample Data

Using the survey design and split sample process described in Sections 3 and 4 resulted in 480 completed interviews which were divided evenly between the hydrological attributes and species attributes formats. The 480 completed interviews provided 1,680 choices for each attribute set (7 choices times 240 respondents). Based upon the interviewer's appraisal that some respondents lacked attentiveness and seriousness during the interview, 21 respondents were removed from the hydrological attributes respondent sample and 6 respondents were removed from the species attributes sample. This resulted in a total of 1,533 observations (choices) for the hydrological attributes model and 1,638 observations for the species attributes model. See Appendix E for complete data on interviewer evaluations of respondents.

Table 5-1 reports descriptive statistics for the attributes and socioeconomic variables for the hydrological and species sample groups used in the analysis. As discussed in detail in Section 3, the attribute variables are expressed in terms of the percentage of historic levels. The mean, minimum, and maximum values for the attributes reflect the statistical design.

Table 5-1. Variable Definitions and Summary Statistics for the Hydrological and Species Attribute Models.

Attribute/Variable	Definition	Hydrological Attribute Models				Species Attribute Models			
		Mean	S. D.	Min	Max	Mean	S.D	Min	Max
Lake Okeechobee	Percentage of historic level	0.74	0.12	0.6	0.9				
Water Conservation Area	Percentage of historic level	0.72	0.17	0.5	0.9				
Everglades National Park	Percentage of historic level	0.71	0.17	0.5	0.9				
Wetland Species	Percentage of historic level					0.49	0.25	0.2	0.8
Dryland Species	Percentage of historic level					0.60	0.08	0.5	0.7
Estuarine Species	Percentage of historic level					0.76	0.12	0.6	0.9
Annual Cost	Annual increase in utilities tax for 10 years	25	20.02	0	50	25	20.03	0	50
Water Restriction 1	Outdoor uses restricted to 2 days per week and 25% reduction in indoor consumption	0.36	0.48	0	1	0.36	0.48	0	1
Water Restriction 2	Outdoor uses restricted to 1 day per week and 40% reduction in indoor consumption	0.32	0.47	0	1	0.32	0.46	0	1
Farmland	Farm land acreage in EAA and South Florida (‘000 acres)	99.84	80.19	0	200	99.88	80.19	0	200
Political Party	1 if Republican, 0 all others	0.25	0.44	0	1	0.27	0.44	0	1
Region	1 if Central Florida, 0 South Florida	0.41	0.49	0	1	0.39	0.49	0	1
Donations	1 if donated to environmental groups, 0 otherwise	0.42	0.49	0	1	0.49	0.50	0	1
Gender	1 if male, 0 female	0.48	0.50	0	1	0.48	0.50	0	1
Years in Florida	Number of years as resident	20.24	14.09	1	73	18.71	12.69	1	71
Income	1 to 9 by $10,000 increments (i.e. 1=less than $10,000, 2=$10,000 to $19,999, etc.)	4.07	2.06	1	9	4.26	2.08	1	9
Ethnic 1	1 if White-Hispanic or Black-Hispanic, 0 otherwise	0.14	0.35	0	1	0.12	0.33	0	1
Ethnic 2	1 if White-Non-Hispanic, 0 otherwise	0.74	0.44	0	1	0.73	0.45	0	1

Since the choice combinations were randomly distributed across the sample groups, the means for each attribute are approximately the midpoint of the upper and lower levels.

For the purpose of this statistical analysis, the three levels for the water use restrictions attribute (see Table 3-3) were converted into two dummy variables. The variable " Water Restriction 1" was defined as the second level of the attribute that would restrict outdoor uses to two days per week with a 25 percent reduction in indoor use during dry periods. The variable "Water Restriction 2" was defined as the third level of the attribute that would restrict outdoor uses to one day per week with a 40 percent reduction in indoor consumption. The first level of the attribute was defined as the base and included in the estimated intercepts of the statistical models. As indicated in Table 5.1, Water Restriction 1 was included in approximately one third of the choices in each sample group and Water Restriction 2 was also included in about one third of the choices. These proportions are as expected given the sample design.

Table 5-1 also presents the socioeconomic variables that were included in the statistical models. Several of the socioeconomic variables (originally described in Table 4-1) were redefined as 0,1 variables as presented in Table 5-1. A comparison of the means for the socioeconomic variables in the two sample groups shows that the two groups were very similar. This indicates that the alternative attribute formats (hydrological and species) were randomly distributed across the total sample.

5.3 Statistical Results for the Multiattribute Models

The first multiattribute models estimated with the survey data were basic models that included only the choice attributes as defined previously in this section in Equations (6) and (7). The basic model was specified with and without an intercept term to test whether there was an order bias in respondents' choices between alternative plans. The null hypothesis that the intercept ($\$_0$) equals zero indicates whether respondents based their choices on whether a plan was on the left- or right-hand side of the page (see Table 3-5) when they were asked to choose between alternative plans. If the order of presentation did influence respondents' decisions, then any information about the relative weighting given to different attributes would be questionable. This is because multiattribute analysis assumes that responses as based solely on the levels of the attributes.

The estimated coefficients and related statistics for the hydrological and species multiattribute models are presented in Tables 5-2 and 5-3, respectively. The tables also include estimates of the marginal willingness to pay (WTP) for changes in each attributes. The WTP for each attribute was calculated with the formula:

$$(\$_i (A_{i1}) - \$_i (A_{i2})) / \$_c$$

where $\$_i$ is the estimated coefficient for attribute I, A_{i1} is the base level of attribute I, A_{i2} is the next level of the attribute, and $\$_c$ is the estimated coefficient for the annual cost attribute. By dividing the marginal change for each attribute by the cost attribute, the estimated WTPs provide a measure of the relative weighting assigned to each attribute. This weighting is a monetary measure of the utility derived from each attribute. The WTP measure is appropriate for benefit-cost analysis of alternative plans (Johnson and Desvousges 1997; Roe et al. 1996). Because the basic utility function specification is additive, the marginal WTPs are constant (linear) for each attribute with the exception of the water restrictions attribute that was decomposed into two separate effects. Given the description of the annual cost attribute in the analysis (see Table 3-3), the annual WTPs would apply over a ten year period. A comparable approach can be used to estimate WTP values in the multiattribute model with socioeconomic interactions (Equation (8). The basic difference is that marginal values must be calculated for each individual in the sample because the coefficients ($\$_i$) for each attribute vary across socioeconomic characteristics.

5.3.1 Basic Hydrological Multiattribute Model Results

Table 5-2 presents statistical results for the hydrological multiattribute model. The coefficient for the model estimated with an intercept term was statistically insignificant indicating that this subsample of respondents' choices were not influenced by the order of presentation of the plan alternatives. Several other coefficients, however, were statistically significant in the model estimated without an intercept. The Lake Okeechobee and Water Conservation Areas attributes were both positive and statistically significant indicating that respondents preferred plans that had higher levels of these attributes. The Everglades National Park attribute was also positive but not statistically significant.

The Annual Cost and Farmland attributes were also statistically significant but had a negative sign indicating that respondents preferred plans that had lower levels of these attributes. The water supply restriction attributes provided interesting results. The Water Restriction 1 attribute was negative but not statistically significant. The Water Restriction 2 attribute, however, was highly significant and the estimated coefficient indicates that respondents placed a large negative weight on this attribute.

These statistical results indicate that higher levels of the hydrological attributes increased the likelihood that respondents would select a plan that included higher levels of those attributes. On the other hand, higher levels of the Annual Cost and Farmland attributes and the Water Restriction 2 attribute decreased the likelihood of selecting a plan. The full effects of respondents' preferences for each attribute across the sample are reflected in the marginal WTP values. The Water Conservation Areas attribute had the highest positive WTP ($17.63) indicating that respondents derived the most satisfaction (utility) from an increase (e.g. 50 percent to 75 percent) in this attribute. The Lake Okeechobee and Everglades National Park attribute WTPs were also positive but relatively smaller.

The relatively large negative marginal WTP (-$37.10) associated with the Water Restriction 2 attribute indicates the strong aversion respondents had to this component of a plan. On the other hand, the Water Restriction 1 attribute had a relatively small negative WTP indicating that respondents would be willing to experience some restrictions on water use for desirable changes in hydrological conditions in the Everglades areas. The relatively large negative WTP associated with the Farmland attribute (-$16.39), however, indicates that respondents would not prefer that these desirable changes in hydrological conditions were accompanied by large reductions (100,000 or more acres) in farmland acreage in South Florida.

Table 5-2. Coefficient Estimates for the Hydrological Multiattribute Models.

Attribute/Variable	Model with Intercept		Model without Intercept		
	Coefficient	Standard Error	Coefficient	Standard Error	Marginal Willingness to Pay (WTP)
Intercept	-0.1066	0.0756	-	-	-
Lake Okeechobee	0.3639	0.4724	0.7876*	0.3675	$9.68
Water Conservation Areas	0.9797*	0.2808	0.8606*	0.2666	$17.63
Everglades National Park	0.4445	0.3383	0.3419	0.3310	$7.01
Annual Cost	-0.0136*	0.0031	-0.0122*	0.0029	-
Water Restriction 1	0.0354	0.1143	-0.0220	0.1063	-$1.80
Water Restriction 2	-0.4048*	0.1030	-0.4539*	0.0973	-$37.10
Farmland	-0.0001*	0.0001	-0.0001*	0.0001	-$16.39
Log Likelihood Function for the Model	-999.36		-1000.36		
Unrestricted Log Likelihood Function	-1162.59		-1162.59		
Chi-squared (7 degrees of freedom)	326.32*		324.46*		

* Indicates significance at the 0.05 level

5.3.2 Basic Species Multiattribute Model Results

Table 5-3 presents statistical results for the species multiattribute model estimated with and without an intercept term. The intercept in this model was also statistically insignificant indicating that this subsample of respondents was not influenced by the order of presentation of the choice alternatives. Most of the other coefficients, however, were statistically significant. The Wetland and Estuarine Species attributes were positive and significant while the Dryland Species attribute was negative. The marginal WTPs associated with these attributes indicates that respondents placed the most value on higher levels of Estuarine Species ($27.34) and the least value on higher levels of Dryland Species (-$29.87). Clearly respondents were expressing strong preferences for plans that would improve habitat for wading birds and various marine fishes in the Everglades and Florida Bay.

As in the hydrological multiattribute models, higher levels of the Annual Cost and Farmland attributes and the Water Restriction 2 attribute decreased the likelihood of selecting a plan. The coefficients for all three of these attributes were negative and statistically significant. Moreover, it is also interesting to note the similarity in the estimated WTPs for the Water Restriction 2 attribute in the hydrological attributes model (Table 5-2) and the species attributes model. The relatively small difference (-$37.10 vs -$34.96) indicates that both subsamples responded in approximately the same way to the potential of severe water restrictions despite the presence of other quite different attributes in the choice set.

Table 5-3. Coefficient Estimates for the Species Multiattribute Model.

Attribute/Variable	Model with Intercept		Model without Intercept		
	Coefficient	Standard Error	Coefficient	Standard Error	Marginal Willingness to Pay (WTP)
Intercept	0.0930	0.0715	-	-	-
Wetland Species	0.7736*	0.2239	0.5991*	0.1780	$9.26
Dryland Species	-1.3915*	0.6420	-1.1593*	0.6154	-$29.87
Estuarine Species	0.9589*	0.3594	1.0606*	0.3518	$27.34
Annual Cost	-0.0084*	0.0029	-0.0097*	0.0027	-
Water Restriction 1	-0.1289	0.1075	-0.0869	0.1027	-$8.95
Water Restriction 2	-0.3815*	0.0995	-0.3391*	0.0934	-$34.96
Farmland	-0.0001*	0.0001	-0.0001*	0.0001	-$9.27
Log Likelihood Function for the Model	-1078.12		-1078.96		
Unrestricted Log Likelihood Function	-1135.38		-1135.37		
Chi-squared (7 degrees of freedom)	114.39*		112.82*		

* Indicates significance at the 0.05 level

5.4 Statistical Results for Models with Socioeconomic Characteristics Interactions

The hydrological multiattribute and species multiattribute models were also estimated using interactive socioeconomic variables as described in Section 5.1 (Equation (8)). Tables 5.4 and 5.5 present results for the hydrological and species multiattribute models, respectively. These coefficient estimates are more difficult to interpret because of the large number of interactions. Moreover, WTP measures for individual attribute interactions with socioeconomic characteristics can be misleading if not considered along with other related interactions. Therefore, WTP values for the attributes are not presented in these tables.

The statistical results indicate several significant interaction effects but the effects differ in each model. In the hydrological multiattribute model, gender, region, income and ethnic variables had statistically significant effects. On the other hand, only income and ethnic status had significant effects in the species multiattribute model. While there were a number of insignificant interactions in both models, the overall statistical results (i.e. log likelihood functions) indicate that the multiattribute models with socioeconomic interactions provide important information to assess differences in respondent preferences.

The primary importance of these results is that they provide the basis for disaggregating overall scoring and ranking results for possible plans that can be constructed with alternative combinations of the attribute. This application of the results will be discussed in greater detail in Section 6.

Table 5-4. Coefficient Estimates for the Hydrological Multiattribute Model with Socioeconomic Characteristics Interactions.

Variable	Coefficient	Standard Error
Lake Okeechobee	-0.0222	1.5309
Water Conservation Areas	1.0656	1.0944
Everglades National Park	-3.6539*	1.1832
Annual Cost	-0.0130*	0.0030
Water Restriction 1	-0.3111	0.4345
Water Restriction 2	-1.2725*	0.3992
Farmland	-0.0001	0.0001
Political Party/Lake Okeechobee	0.1995	0.9244
Political Party/Water Conservation Areas	0.3207	0.6757
Political Party/Everglades National Park	0.5636	0.7257
Political Party/Water Restriction 1	-0.1225	0.2773
Political Party/Water Restriction 2	0.1598	0.2305
Political Party/Farmland	0.0001	0.0001
Region/Lake Okeechobee	0.4523	0.7936
Region/Water Conservation Areas	-0.3920	0.5723
Region/Everglades National Park	-1.9221*	0.6081
Region/Water Restriction 1	0.1474	0.2304
Region/Water Restriction 2	-0.0674	0.1997
Region/Farmland	-0.0001	0.0001
Donations/Lake Okeechobee	1.4508	0.7962
Donations/Water Conservation Areas	-0.1894	0.5829
Donations/Everglades National Park	-0.2004	0.6128
Donations/Water Restriction 1	0.2569	0.2298
Donations/Water Restriction 2	0.2534	0.2006
Donations/Farmland	0.0001	0.0001
Gender/Lake Okeechobee	-1.6513*	0.7763
Gender/Water Conservation Areas	-0.1156	0.5600
Gender/Everglades National Park	0.8863	0.6018
Gender/Water Restriction 1	0.4791*	0.2283
Gender/Water Restriction 2	0.5932*	0.1975
Gender/Farmland	0.0001	0.0001
Years in Florida/Lake Okeechobee	-0.0103	0.0285
Years in Florida/Water Conservation Areas	-0.0281	0.0201
Years in Florida/Everglades National Park	-0.0013	0.0218
Years in Florida/Water Restriction 1	-0.0144	0.0083
Years in Florida/Water Restriction 2	-0.0115	0.0073
Years in Florida/Farmland	0.0001	0.0001
Income/Lake Okeechobee	0.2408	0.1982
Income/Water Conservation Areas	0.1756	0.1440
Income/Everglades National Park	0.5424*	0.1540
Income/Water Restriction 1	0.0703	0.0578
Income/Water Restriction 2	0.0741	0.0502
Income/Farmland	-0.0001	0.0001
Ethnic1/Lake Okeechobee	0.7024	1.5441
Ethnic1/Water Conservation Areas	0.2611	1.1123
Ethnic1/Everglades National Park	0.9575	1.1794
Ethnic1/Water Restriction 1	-0.2855	0.4435
Ethnic1/Water Restriction 2	0.4555	0.3942
Ethnic1/Farmland	0.0001	0.0001
Ethnic2/Lake Okeechobee	0.0234	1.2438
Ethnic2/Water Conservation Areas	-0.2963	0.8771
Ethnic2/Everglades National Park	2.6056*	0.9424
Ethnic2/Water Restriction 1	-0.1129	0.3604
Ethnic2/Water Restriction 2	0.2937	0.3170
Ethnic2/Farmland	0.0001	0.0001
Log Likelihood Function for the Model	-951.91	
Unrestricted Log Likelihood Function	-1162.59	
Chi-squared (55 degrees of freedom)	421.36*	

* Indicates significance at the 0.05 level

Table 5-5. Coefficient Estimates for the Species Multiattribute Model with Socioeconomic Characteristics Interactions.

Variable	Coefficient	Standard Error
Wetland Species	-0.9084	0.6952
Dryland Species	-2.4959	2.0541
Estuarine Species	0.2779	1.3650
Annual Cost	-0.0100*	0.0028
Water Restriction 1	0.0614	0.3881
Water Restriction 2	-0.6717*	0.3484
Farmland	0.0000	0.0000
Political Party/Wetland Species	0.0813	0.4346
Political Party/Dryland Species	-0.4097	1.2692
Political Party/Estuarine Species	-0.5412	0.8297
Political Party/Water Restriction 1	0.1221	0.2490
Political Party/Water Restriction 2	-0.2261	0.2135
Political Party/Farmland	-0.0000	0.0000
Region/Wetland Species	0.5020	0.3825
Region/Dryland Species	1.2192	1.1279
Region/Estuarine Species	0.0371	0.7384
Region/Water Restriction 1	0.1276	0.2199
Region/Water Restriction 2	-0.0551	0.1872
Region/Farmland	0.0000	0.0000
Donations/Wetland Species	0.1908	0.3693
Donations/Dryland Species	0.3639	1.0930
Donations/Estuarine Species	-0.5563	0.7156
Donations/Water Restriction 1	0.1499	0.2120
Donations/Water Restriction 2	0.0693	0.1825
Donations/Farmland	0.0000	0.0000
Gender/Wetland Species	0.3046	0.3671
Gender/Dryland Species	-0.0713	1.0824
Gender/Estuarine Species	-0.7121	0.7079
Gender/Water Restriction 1	-0.2746	0.2106
Gender/Water Restriction 2	-0.2066	0.1805
Gender/Farmland	0.0000	0.0000
Years in Florida/Wetland Species	0.0075	0.0145
Years in Florida/Dryland Species	0.0360	0.0429
Years in Florida/Estuarine Species	-0.0123	0.0275
Years in Florida/Water Restriction 1	-0.0045	0.0084
Years in Florida/Water Restriction 2	-0.0005	0.0070
Years in Florida/Farmland	-0.0000	0.0000
Income/Wetland Species	0.2460*	0.0908
Income/Dryland Species	0.2445	0.2700
Income/Estuarine Species	0.3519*	0.1767
Income/Water Restriction 1	-0.0124	0.0523
Income/Water Restriction 2	0.0469	0.0447
Income/Farmland	-0.0000	0.0000
Ethnic1/Wetland Species	0.7429	0.8104
Ethnic1/Dryland Species	-4.8581*	2.2277
Ethnic1/Estuarine Species	-0.3573	1.4914
Ethnic1/Water Restriction 1	-0.2751	0.4444
Ethnic1/Water Restriction 2	-0.4575	0.4043
Ethnic1/Farmland	-0.0000	0.0000
Ethnic2/Wetland Species	-0.2601	0.5288
Ethnic2/Dryland Species	-0.5092	1.5440
Ethnic2/Estuarine Species	0.3932	1.0188
Ethnic2/Water Restriction 1	-0.0062	0.3003
Ethnic2/Water Restriction 2	0.4470	0.2608
Ethnic2/Farmland	-0.0000	0.0000
Log Likelihood Function for the Model	-1051.02	
Unrestricted Log Likelihood Function	-1135.37	
Chi-squared (55 degrees of freedom)	168.70*	

* Indicates significance at the 0.05 level

SECTION 6. EVALUATION OF ALTERNATIVE RESTORATION PLANS

6.1 Voting, Ranking and Net Willingness to Pay Measures from Multiattribute Models

The paired comparison, multiattribute utility approach is one method to derive quantitative measures of respondents' preferences for alternative levels of choice attributes based on statistically reliable procedures. The results reported in Section 5 provide multiattribute utility functions for both representative and socioeconomic-specific preferences using hydrological and species attributes of the Everglades/South Florida ecosystem. These utility functions can be used to evaluate how respondents would respond to hypothetical alternative combinations of the attributes based on the overall score assigned to an alternative (see Section 2.3). The scoring information can be summarized in three ways: 1) as *rankings* of alternatives based on overall scores, 2) as the *percent in favor* of an alternative relative to the status quo, and 3) as the *net willingness to pay* for an alternative. Because each summary measure aggregates the scoring results in a different way, the ordering of alternatives may vary with these measures.

A ranking evaluation of alternatives can be derived directly from the multiattribute utility function. Using the basic model described in Equations (5) and (6) in Section 5, the net score (S) for the jth alternative would be computed as:

$$S_j = (\beta_1 X_{1j} + \beta_2 X_{2j} + \beta_3 X_{3j} + \beta_4 X_{4j} + \beta_5 X_{5j} + \beta_6 X_{6j} + \beta_7 X_{7j})$$

where the β_i s are the estimated coefficients and X_{ij} is the level of the ith attribute in alternative j. This net score can be calculated for as many hypothetical alternatives as are feasible with the attribute combinations or are applicable to the overall problem setting. Once the net scores have been calculated for all alternatives, the alternatives can then be arrayed in order of the net score to provide a unique, ordinal ranking. The top ranked alternative would have the highest overall utility to respondents. This same computational approach could be used with the socioeconomic interactive variable models described in Equation (8) in Section 5 to provide rankings of alternatives according to respondents' location (e.g. South Florida vs Central Florida) or other socioeconomic characteristics.

The net scores for each alternative could also be used as measures of whether respondents would vote in favor of an alternative if it were presented as a referendum. If the status quo (i.e. a plan with no change from baseline attribute levels) has a net score defined as S_0 , then a voter would vote in favor of the jth alternative plan if $S_j \geq S_0$ or against the alternative if $S_j < S_0$. By adding up the votes of all respondents, the percent in favor of the alternative can be calculated. Note that this calculation only requires a comparison of two net scores for each individual. Therefore two alternatives with similar net scores may have the same percent in favor relative to the status quo.

The third way that the scoring information can be used is to calculate net willingness to pay (WTP) for each alternative. The net WTP is a measure of the economic benefits (value) each respondent would derive from all attributes included in the alternative. Following the basic approach to calculate the marginal WTP for each attribute described in Section 5.3, the net WTP can be defined as:

$$Net\ WTP_j = [((\$_1 X_{1j} - \$_1 X_{10})/\$_4) + ((\$_2 X_{2j} - \$_2 X_{20})/\$_4) + ((\$_3 X_{3j} - \$_3 X_{30})/\$_4) + ((\$_5 X_{5j} - \$_5 X_{50})/\$_4) + ((\$_6 X_{6j} - \$_6 X_{60})/\$_4) + ((\$_7 X_{7j} - \$_7 X_{70})/\$_4)) ! X_{4j}]$$

where the $\$_i$ s are the estimated coefficients, X_{ij} is the level of the ith attribute in alternative j, X_{i0} is the level of the ith attribute in the status quo (baseline) alternative, and $\$_4$ is the coefficient for the annual cost attribute. Dividing the net score for the jth alternative (relative to the baseline) by the annual cost coefficient converts the net score (measured in units of utility) into a money metric of individual benefits (Johnson and Desvousges 1997; Roe et al. 1996). In contrast to the other two evaluation measures, the net WTP measure provides some indication of the intensity of preferences. WTP measures can be used in benefit-cost analysis of alternative plans by aggregating across the sample and extrapolating the sample results to the population.

6.2 Overall Evaluation of Alternative Restoration Plans

6.2.1 Evaluation with the Hydrological Multiattribute Model

A set of alternative Everglades/South Florida ecosystem restoration plans were constructed with different levels of the attributes in the hydrological multiattribute model.[10] These plans were designed to represent a variety of possible scenarios: full and partial restoration with no direct costs to Floridians, full and partial restoration with varying levels of costs to Floridians, and the status quo. Each plan was then evaluated for the average survey respondent using the three measures described in the previous section. Not all of these plans are intended to be technically or administratively feasible. For example, any restoration plan conducted under the Water Resources Development Act of 1996 (see Section 1) would require 50/50 cost-sharing between federal and state government. While a restoration plan scenario involving no direct costs to Floridians is not likely, the no cost scenarios are useful as indicators of Floridians' preferences for Everglades/South Florida ecosystem restoration. The WTPs for the no cost scenarios can be interpreted as measures of the maximum benefits the average respondent would receive from restoration.

Descriptions of 13 alternative restoration plans, the attribute levels included in each plan, and results for the plan with the three evaluation measures are presented in Table 6-1. The baseline plan was represented as the status quo levels of the three hydrological attributes. Since no changes in water management attributes occur under the status quo, the annual cost, farmland and water restriction attributes would not change from their

[10] The reader should note that none of the plans were intended to fully represent the components being considered as part of the Everglades/South Florida Restudy. Also, the definition of the status quo (baseline) differs from that used in the Restudy. For a further discussion of the differences between this evaluation and the Restudy process, see Section 3.

baseline levels.[11] The baseline ranked 8th overall. Since the ‘percent in favor’ and net WTP measures are calculated relative to the baseline, there is no result for the baseline with these measures.

Table 6-1 Evaluation of Selected Restoration Plans with the Hydrological Multiattribute Model.

Plan Description		**Percent in Favor**	**Ranking**	**Net Willingness to Pay**
H1-Baseline (no change) Hydrology.				
Lake Okeechobee: 60%	Costs: 0	NA	8	NA
Water Conservation: 50%	Farmland Reduction: 0			
Everglades National Park: 50%	Water Restriction: 3 days/10%			
H2-Partial Everglades Park Restoration.				
Lake Okeechobee: 60%	Costs: 0	54.3	6	$7.01
Water Conservation: 50%	Farmland Reduction: 0			
Everglades National Park: 75%	Water Restriction: 3 days/10%			
H3-Full Everglades Park Restoration.				
Lake Okeechobee: 60%	Costs: 0	54.3	4	$11.21
Water Conservation: 50%	Farmland Reduction: 0			
Everglades National Park: 90%	Water Restriction: 3 days/10%			
H4-Partial Hydrologic Restoration without Costs.				
Lake Okeechobee: 75%	Costs: 0	71.7	2	$34.32
Water Conservation: 75%	Farmland Reduction: 0			
Everglades National Park: 75%	Water Restriction: 3 days/10%			
H5-Full Hydrologic Restoration without Costs.				
Lake Okeechobee: 90%	Costs: 0	71.7	1	$58.79
Water Conservation: 90%	Farmland Reduction: 0			
Everglades National Park: 90%	Water Restriction: 3 days/10%			
H6-Partial Everglades Park Restoration and Water Conservation Area with no costs, minimum restrictions.				
Lake Okeechobee: 60%	Costs: 0	54.3	7	$6.45
Water Conservation: 75%	Farmland Reduction: 100,000 acres			
Everglades National Park: 75%	Water Restriction: 2 days/25%			
H7-Partial Hydrologic Restoration with Minimized Taxes.				
Lake Okeechobee: 75%	Costs: $25	54.3	5	-$8.87
Water Conservation: 75%	Farmland Reduction: 100,000 acres			
Everglades National Park: 75%	Water Restriction: 2 days/25%			
H8-Partial Hydrologic Restoration, No Water Supply Restrictions.				
Lake Okeechobee: 75%	Costs: $25			
Water Conservation: 75%	Farmland Reduction: 100,000 acres	44.7	9	-$7.07
Everglades National Park: 75%	Water Restriction: 3 days/10%			

[11] The annual cost attribute would be $0 since no additional money would be paid by Floridians to finance restoration plans; the farmland attribute would be 0 since no farmland would be converted for water management purposes; and water use would be restricted to 3 days per week with 10 percent reductions in indoor use during dry years. These are essentially the 2010 conditions as described in the *Lower East Coast Water Supply Plan* (South Florida Water Management District 1997).

H9-Partial Hydrologic Restoration with MinimizedCosts Lake Okeechobee: 75% Costs: $25 Water Conservation: 75% Farmland Reduction: 100,000 acres Everglades National Park: 75% Water Restriction: 3 days/10%	44.3	10	$9.32
H10-Full Hydrologic Restoration with Minimized Costs. Lake Okeechobee: 90% Costs: $25 Water Conservation: 90% Farmland Reduction: 100,000 acres Everglades National Park: 90% Water Restriction: 2 days/25%	54.3	3	$15.60

Table 6-1 Continued.

Plan Description		Percent in Favor	Ranking	Net Willingness to Pay
H11-Full Everglades Park Restoration and Water Conservation Area				
Lake Okeechobee: 60%	Costs: $25	29.7	12	-$55.45
Water Conservation: 90%	Farmland Reduction: 200,000 acres			
Everglades National Park: 90%	Water Restriction: 1 day/40%			
H12-Full Hydrologic Restoration with Costs, No Water Supply Restrictions				
Lake Okeechobee: 90%	Costs: $50	41.6	11	-$23.99
Water Conservation: 90%	Farmland Reduction: 200,000 acres			
Everglades National Park: 90%	Water Restriction: 3 days/10%			
H13-Full Hydrologic Restoration with Full Costs				
Lake Okeechobee: 90%	Costs: $50	31.1	13	-$61.09
Water Conservation: 90%	Farmland Reduction: 200,000 acres			
Everglades National Park: 90%	Water Restriction: 1 day/40%			

NA=Not Applicable

Table 6-1 shows that the plan which ranked first overall was H1 - 'Full Hydrological Restoration Without Costs' with the highest level of restoration for each hydrological area (Lake Okeechobee, Water Conservation Areas, and Everglades National Park) and baseline levels for the other attributes. Nearly 3/4ths of the respondents would vote in favor of this plan and it had the highest WTP at $58.79 per respondent household. Because the annual cost attribute description encompasses a ten-year time period, the cumulative WTP per household for this plan would be $587.90.

By comparison, Table 6-1 shows that the lowest ranked alternative was H13 - 'Full Hydrologic Restoration with Full Costs' which would include the highest levels of restoration for the hydrological attributes and the highest levels of the annual cost, farmland, and water restriction attributes. Less than 1/3 of respondents would vote in favor of this plan and the net WTP for the plan is !$61.09. Because this plan is ranked lower than the baseline and the net WTP is negative, it would result in most respondents being worse off than the status quo.

The sensitivity of the average respondent to the cost components of a plan is clearly evident in the difference in the evaluation results between H10 and H12. Both plans include full hydrological restoration of the hydrological areas, but H12 has annual costs of $50, a reduction in farmland of 200,000 acres, and baseline water restrictions. H10 has annual costs of $25, a reduction in farmland of 100,000 acres, and water restrictions of 2 days outdoor use/25 percent indoor use reductions. Yet H10 is the 3rd ranked alternative with a majority in favor and a net WTP of $15.60 per household while H12 is the 11th ranked alternative with less than a majority and a net WTP of !$23.99. This result suggests that respondents would be willing to trade-off some reductions in water availability in lieu of higher direct annual costs and farmland reductions if full hydrological restoration were achieved.

The importance of the cost components of a plan is also demonstrated in other results in Table 6-1. For example, all of the full or partial restoration plans without costs (H2 - H5) are ranked higher than the baseline, have majorities in favor, and positive net WTPs. When direct costs are minimized such as in H6 and H7, even partial hydrological restoration plans are favored by a majority of respondents and have positive net WTPs.

In summary, these evaluations of alternative hydrological restoration plans with the multiattribute model results indicate that the average respondent has a strong desire for restoration of the Everglades/South Florida ecosystem. But, these preferences to restore the ecosystem are tempered by other preferences to minimize the direct costs of restoration to households and to avoid severe water use restrictions.

6.2.2 Evaluation with the Species Multiattribute Model

A comparable set of alternative Everglades/South Florida restoration plan scenarios were constructed for the attributes in the species multiattribute model. As with the hydrological model scenarios, these plans were designed to represent a variety of possible attribute combinations and were not intended to represent actual restoration plans or to be technically or administratively feasible. The variety of plan scenarios helps to illustrate the preferences of the average survey respondent who was interviewed using the species attribute pairwise choice process.

Descriptions of 11 alternative restoration plans, the attribute levels included in each plan, and results for the plan with the three evaluation measures are presented in Table 6-2. The baseline plan was again defined as the status quo levels of the three species attributes with all other attributes at their baseline levels. The baseline ranked 7th of the 11 plans considered indicating some plans were preferred to the baseline while others would leave respondents worse off.

The top ranked alternative in Table 6-2 was S3 ! 'Full Wetland Wildlife Restoration Without Costs." This plan had a very large majority in favor and a net WTP of $69.86 indicating significant potential economic benefits would accrue from this restoration scenario. The similarity in this net WTP value with the net WTP value for H1 ! 'Full Hydrological Restoration Without Costs' suggests that respondents were expressing a relatively consistent set of preferences regardless of the survey instrument used in the interview.

The effects of the large negative weighting given to dryland species restoration in the species multiattribute model (Table 5-3) are evident in the plan rankings in Table 6-2. Both partial and full dryland species restoration plans without costs (S4 and S5) were ranked below the baseline scenario and have negative net WTPs. Clearly the average respondent did not view restoring dryland species populations as a desirable outcome.

As in the hydrological restoration scenario evaluations, however, the cost components of a plan had a major impact on the overall evaluation. The full wetland wildlife restoration scenario S11 ! 'Full Wetland Wildlife Restoration With Full Costs' was the lowest ranked alternative and had a net WTP of !$33.64. Other full and partial wetland wildlife restoration plans illustrate the sensitivity of the average respondent to the cost components. But, the species model evaluations did not change as dramatically in response to costs as in the hydrological model evaluations. Plans S6 and S9 in Table 6-2 would yield either full or partial wetland wildlife species restoration with annual costs at $25, farmland reductions of 100,000 or less, and no severe water restrictions. These plans were ranked 3rd and 4th, respectively, had majorities in favor, and had positive net WTPs. Even plan S10 with full wetland wildlife species restoration and annual costs of $50 and farmland reductions of 200,000 acres had a majority in favor and a positive, yet small, positive net WTP. Only when partial wetland species restoration was coupled with annual costs of $25, farmland reductions of 100,000 acres, and water use restrictions of 2 days/25 percent as in plan S8 did the percent in favor fall below a majority and the net WTP become negative.

Table 6-2 Evaluation of Restoration Plans with the Species Multiattribute Model.

Plan Description		Percent in Favor	Ranking	Net Willingness to Pay
S-1 Baseline (no change) Wildlife.				
Wetland Species: 20%	Costs: 0	NA	7	NA
Dryland Species: 50%	Farmland Reduction: 0			
Estuarine Species: 60%	Water Restriction: 3 days/10%			
S-2 Partial Wetland Wildlife Restoration without Costs.				
Wetland Species: 50%	Costs: 0	92.7	2	$34.93
Dryland Species: 50%	Farmland Reduction: 0			
Estuarine Species: 75%	Water Restriction: 3 days/10%			
S-3 Full Wetland Wildlife Restoration without Costs.				
Wetland Species: 80%	Costs: 0	92.7	1	$69.86
Dryland Species: 50%	Farmland Reduction: 0			
Estuarine Species: 90%	Water Restriction: 3 days/10%			
S-4 Partial Dryland Wildlife Restoration without Costs.				
Wetland Species: 20%	Costs: 0	17.9	9	-11.95
Dryland Species: 60%	Farmland Reduction: 0			
Estuarine Species: 60%	Water Restriction: 3 days/10%			
S-5 Full Dryland Wildlife Restoration without Costs.				
Wetland Species: 20%	Costs: 0	17.9	10	-23.90
Dryland Species: 70%	Farmland Reduction: 0			
Estuarine Species: 60%	Water Restriction: 3 days/10%			
S-6 Partial Wetland Wildlife Restoration with Minimized Taxes.				
Wetland Species: 50%	Costs: $25	61.5	4	$9.93
Dryland Species: 50%	Farmland Reduction: 0			
Estuarine Species: 75%	Water Restriction: 3 days/10%			
S-7 Partial Wetland Wildlife Restoration, No Water Use Restrictions.				
Wetland Species: 50%	Costs: $25	52.1	6	$0.66
Dryland Species: 50%	Farmland Reduction:100,000 acres			
Estuarine Species: 75%	Water Restriction: 3 days/10%			
S-8 Partial Wetland Wildlife Restoration with Costs.				
Wetland Species: 50%	Costs: $25	42.7	8	-$8.3
Dryland Species: 50%	Farmland Reduction:100,000 acres			
Estuarine Species: 75%	Water Restriction: 2 days/25%			
S-9 Full Wetland Wildlife Restoration with Minimized Costs.				
Wetland Species: 80%	Costs: $25	67.9	3	$26.63
Dryland Species: 50%	Farmland Reduction:100,000 acres			
Estuarine Species: 90%	Water Restriction: 2 days/25%			
S-10 Full Wetland Wildlife Restoration with Costs and NoWater Use Restrictions.				
Wetland Species: 80%	Costs: $50	52.1	5	$1.32
Dryland Species: 50%	Farmland Reduction:200,000 acres			
Estuarine Species: 90%	Water Restriction: 3 days/10%			

S-11 Full Wetland Wildlife Restoration with Full Costs				
Wetland Species: 80%	Costs: $50	29.9	11	-33.64
Dryland Species: 50%	Farmland Reduction:200,000 acres			
Estuarine Species: 90%	Water Restriction: 1 day/40%			

In summary, the evaluations of alternative species restoration plans support the proposition that the average respondent had strong desires for restoration of the Everglades/South Florida ecosystem. Responses with the species multiattribute model were generally less sensitive to the cost components and resulted in favorable evaluations of several wetland wildlife species restoration plans. Respondents, however, showed no inclination to restore dryland species populations.

6.3 Effects of Socioeconomic Characteristics on Evaluations of Alternative Restoration Plans

6.3.1 Evaluations of Alternative Plans with the Hydrological Multiattribute Model by Respondents' Location and Environmental Donation Status

The same set of 13 alternative restoration plans constructed for the hydrological multiattribute model presented in Table 6-1 were evaluated using the socioeconomic characteristics interactive model coefficients reported previously in Table 5-4. This analysis was conducted using the same three evaluation measures. The interactive model allows the evaluation results to be disaggregated according to specific socioeconomic characteristics of the respondents.

Evaluation results for the 13 hydrological restoration plans for respondents in South Florida and Central Florida are reported in Table 6-3. The results reveal some rather striking differences in the preferences of South vs Central Floridians. While both rank H5 ! 'Full Hydrological Restoration Without Costs' as the most preferred alternative, a large majority (87.6 percent) of South Floridians would vote in favor of this plan while less than a majority (48.9 percent) of Central Floridians would vote in favor. Moreover, South Floridians' net WTP for H5 is $86.42 as compared to a net WTP of $8.24 for Central Floridians. In fact, only two plans (H4 and H5), which both include restoration with no costs to Floridians, are preferred by Central Floridians to the status quo and have positive net WTPs. All the other alternative plans evaluated for Central Florida respondents would be ranked lower than the baseline and have negative net WTPs. For some plans these negative values were quite large (e.g. ! $131.65 for H13) indicating a strong aversion to any restoration plan that would impose costs on Floridians.

On the other hand, the percent of South Floridians who would vote in favor of a number of restoration plans and the positive net WTPs for these plans indicates strong preferences for these alternatives. The only plans not preferred to the status quo and with negative net WTPs (i.e. H11 and H13) would impose high direct costs and severe water use restrictions. These results suggest that most South Floridians would be willing to incur significant personal costs and experience at least moderate water use restrictions to achieve hydrological restoration of the Everglades/South Florida ecosystem.

A similar evaluation of the 13 hydrological plans is reported by respondent's environmental donation status in Table 6-4. Prior research has shown that respondents who donated to environmental causes in the past generally express higher levels of concern about the environment and are more supportive of policies to protect and enhance the environment (Milon et al. 1998). It would be expected that respondents who donated to environmental causes would be more likely to have stronger preferences for environmental restoration plans. The results reported in Table 6-4 confirm these expectations. Respondents who donated ranked a significantly larger number of alternative plans as superior to the status quo and the percent voting in favor across all of the plans was consistently higher for the donations group. Moreover, the net WTPs for the donations group in Table 6-4 were negative for only two plans (H11 and H13). Compared with the average respondent's net WTPs for the same plans (Table 6-1), the donations group expressed consistently stronger preferences for Everglades/South Florida ecosystem restoration.

The differences in preferences between respondents who donated to environmental groups compared to those who did not are important given that approximately 50 percent of the sample respondents had donated (see Table 4-1). This is very similar to the percentage reporting environmental donations in other statewide surveys (e.g. Milon et al. 1998). The results suggest that Floridians who express high levels of concern about the environment are likely to strongly support Everglades/South Florida ecosystem restoration.

Table 6-3. Evaluation of Selected Restoration Plans with the Hydrological Multiattribute Model by Respondent Location.

Plan Description	Percent in Favor		Ranking		Net Willingness to Pay	
	South Florida	Central Florida	South Florida	Central Florida	South Florida	Central Florida
H-1 Baseline (no change) Hydrology. Lake Okeechobee: 60% Costs: 0 Water Conservation: 50% Farmland Reduction: 0 Everglades National Park: 50% Water Restriction: 3 days/10%	NA	NA	11	3	NA	NA
H-2 Partial Everglades Park Restoration. Lake Okeechobee: 60% Costs: 0 Water Conservation: 50% Farmland Reduction: 0 Everglades National Park: 75% Water Restriction: 3 days/10%	72.9	27.8	7	4	$21.55	-$18.10
H-3 Full Everglades Park Restoration. Lake Okeechobee: 60% Costs: 0 Water Conservation: 50% Farmland Reduction: 0 Everglades National Park: 90% Water Restriction: 3 days/10%	72.9	27.8	4	6	$34.47	-$28.96
H-4 Partial Hydrologic Restoration without Costs. Lake Okeechobee: 75% Costs: 0 Water Conservation: 75% Farmland Reduction: 0 Everglades National Park: 75% Water Restriction: 3 days/10%	87.6	48.9	2	2	$51.55	$2.37
H-5 Full Hydrologic Restoration without Costs. Lake Okeechobee: 90% Costs: 0 Water Conservation: 90% Farmland Reduction: 0 Everglades National Park: 90% Water Restriction: 3 days/10%	87.6	48.9	1	1	$86.42	$8.24
H-6 Partial Everglades Park Restoration and Water Conservation Area with no costs, minimum restrictions Lake Okeechobee: 60% Costs: 0 Water Conservation: 75% Farmland Reduction: 100,000 acres Everglades National Park: 75% Water Restriction: 2 days/25%	66.7	36.7	6	7	$21.61	-$31.37
H- 7 Partial Hydrologic Restoration with Minimized Taxes. Lake Okeechobee: 75% Costs: $25 Water Conservation: 75% Farmland Reduction: 100,000 acres Everglades National Park: 75% Water Restriction: 2 days/25%	72.9	27.8	5	5	$6.56	-$45.28

Table 6-3 Continued.

Plan Description	Percent in Favor		Ranking		Net Willingness to Pay	
	South Florida	Central Florida	South Florida	Central Florida	South Florida	Central Florida
H-8 Partial Hydrologic Restoration, No Water Supply Restrictions. Lake Okeechobee: 75% Costs: $25 Water Conservation: 75% Farmland Reduction: 100,000 acres Everglades National Park: 75% Water Restriction: 3 days/10%	64.3	16.7	8	9	$14.29	-$43.26
H-9 Partial Hydrologic Restoration with Minimized Costs. Lake Okeechobee: 75% Costs: $25 Water Conservation: 75% Farmland Reduction: 0 Everglades National Park: 75% Water Restriction:3 days/10%	58.1	24.4	10	10	$26.55	-$22.63
H-10 Full Hydrologic Restoration with Minimized Costs. Lake Okeechobee: 90% Costs: $25 Water Conservation: 90% Farmland Reduction: 100,000 acres Everglades National Park: 90% Water Restriction: 2 days/25%	69.0	33.3	3	8	$41.43	-$39.41
H-11 Full Everglades Park and Water Conservation Area Restoration Lake Okeechobee: 60% Costs: $25 Water Conservation: 90% Farmland Reduction: 200,000 acres Everglades National Park: 90% Water Restriction: 1 day/40%	45.7	6.7	12	12	-$16.97	-$128.83
H-12 Full Hydrologic Restoration with Costs, No Water SupplyRestrictions Lake Okeechobee: 90% Costs: $50 Water Conservation: 90% Farmland Reduction: 200,000 acres Everglades National Park: 90% Water Restriction: 3 days/10%	58.9	16.7	9	11	$11.90	-$83.01
H-13 Full HydrologicRestoration with Full Costs Lake Okeechobee: 90% Costs: $50 Water Conservation: 90% Farmland Reduction: 200,000 acres Everglades National Park: 90% Water Restriction: 1 day/40%	43.4	13.3	13	13	-$22.11	-$131.65

NA=Not Applicable

Table 6-4. Evaluation of Selected Restoration Plans with the Hydrological Multiattribute Model by Respondent Past Donations.

Plan Description	Percent in Favor		Ranking		Net Willingness to Pay	
	DONATIONS		DONATIONS		DONATIONS	
	NO	YES	NO	YES	NO	YES
H-1 Baseline (no change) Hydrology. Lake Okeechobee: 60% Costs: 0 Water Conservation: 50% Farmland Reduction: 0 Everglades National Park: 50% Water Restriction: 3 days/10%	NA	NA	3	11	NA	NA
H-2 Partial Everglades Park Restoration. Lake Okeechobee: 60% Costs: 0 Water Conservation: 50% Farmland Reduction: 0 Everglades National Park: 75% Water Restriction: 3 days/10%	48.4	62.6	4	8	-$2.18	$15.71
H-3 Full Everglades Park Restoration. Lake Okeechobee: 60% Costs: 0 Water Conservation: 50% Farmland Reduction: 0 Everglades National Park: 90% Water Restriction: 3 days/10%	48.4	62.6	5	6	-$3.49	$25.15
H-4 Partial Hydrologic Restoration without Costs. Lake Okeechobee: 75% Costs: 0 Water Conservation: 75% Farmland Reduction: 0 Everglades National Park: 75% Water Restriction: 3 days/10%	58.6	90.1	2	3	$16.29	$52.52
H-5 Full Hydrologic Restoration without Costs. Lake Okeechobee: 90% Costs: 0 Water Conservation: 90% Farmland Reduction: 0 Everglades National Park: 90% Water Restriction: 3 days/10%	58.6	90.1	1	1	$27.35	$92.26
H-6 Partial Everglades Park Restoration and Water Conservation Area with No Costs, Minimum Restrictions Lake Okeechobee: 60% Costs: 0 Water Conservation: 75% Farmland Reduction: 100,000 acres Everglades National Park: 75% Water Restriction: 2 days/25%	40.6	73.6	7	4	$20.22	$6.51
H-7 Partial Hydrologic Restoration with Minimized Taxes. Lake Okeechobee: 75% Costs: $25 Water Conservation: 75% Farmland Reduction:100,000 acres Everglades National Park: 75% Water Restriction: 2 days/25%	43.0	70.3	6	5	$41.99	$2.04

Table 6-4 Continued.

Plan Description	Percent in Favor		Ranking		Net Willingness to Pay	
	DONATIONS		DONATIONS		DONATIONS	
	NO	YES	NO	YES	NO	YES
H-8 Partial Hydrologic Restoration, No Water Supply Restrictions. Lake Okeechobee: 75% Costs: $25 Water Conservation: 75% Farmland Reduction: 100,000 acres Everglades National Park: 75% Water Restriction: 3 days/10%	32 .8	61.5	8	10	-$25.12	$12.82
H-9 Partial Hydrologic Restoration with Minimized Costs. Lake Okeechobee: 75% Costs: $25 Water Conservation: 75% Farmland Reduction: 0 Everglades National Park: 75% Water Restriction: 3 days/10%	27.3	68.1	10	7	-$8.71	$27.52
H-10 Full Hydrologic Restoration with Minimized Costs. Lake Okeechobee: 90% Costs: $25 Water Conservation: 90% Farmland Reduction: 100,000 acres Everglades National Park: 90% Water Restriction: 2 days/25%	39.1	75.8	9	2	-$30.93	$41.78
H-11 Full Everglades Park and Water Conservation Area Restoration. Lake Okeechobee: 60% Costs: $25 Water Conservation: 90% Farmland Reduction: 200,000 acres Everglades National Park: 90% Water Restriction: 1 day/40%	20.3	42.9	12	13	-$90.81	-$23.75
H-12 Full Hydrologic Restoration with Costs, No Water Supply Restrictions. Lake Okeechobee: 90% Costs: $50 Water Conservation: 90% Farmland Reduction: 200,000 acres Everglades National Park: 90% Water Restriction: 3 das/10%	28.1	60.4	11	9	-$55.47	$12.86
H-13 Full Hydrologic Restoration with Full Costs. Lake Okeechobee: 90% Costs: $50 Water Conservation: 90% Farmland: 200,000 acres Everglades National Park: 90% Water Restriction: 1 day/40%	15.6	52.7	13	12	-$109.35	-$7.68

NA=Not Applicable

6.3.2 Evaluations of Alternative Plans with the Species Multiattribute Model by Respondents' Location and Environmental Donation Status

The set of 11 alternative restoration plans constructed for the species multiattribute model presented in Table 6-2 was evaluated using the socioeconomic characteristics interactive model coefficients reported previously in Table 5-5. And, the same three evaluation measures were used as in the preceding analyses. The interactive model was used to disaggregate the species restoration plan evaluations into responses based on respondent location (South and Central Florida) and past donations to environmental groups.

Evaluation results for the 11 species restoration plans for respondents in South Florida and Central Florida are reported in Table 6-5. In contrast to the hydrological attributes evaluation, the results in Table 6-5 show relatively few differences in the preferences of South vs Central Floridians. Both rank S3 ! 'Full Wetland Wildlife Restoration Without Costs' as the most preferred alternative. And, a large majority of both South Floridians (88.7 percent) and Central Floridians (98.9 percent) would vote in favor of this plan. Both groups' net WTP for this plan are very similar ($68.82 and $72.42) and are also comparable to South Floridians' net WTP of $86.42 for their highest ranked hydrological restoration plan. Of the 11 species restoration plans, South Floridians prefer 4 of the plans to the status quo while Central Floridians prefer 7 of the plans to the status quo. Neither group favored the full or partial dryland species restoration plans (S4 and S5).

While the cost components clearly influenced the relative desirability of the plans, Central Floridians were generally less sensitive to the cost and water restriction attributes of the plans. Both S7 and S8, partial wetland wildlife species restoration plans with different cost attribute levels, were favored by a majority of Central Floridians but not by South Floridians. The net WTPs for both plans were positive for Central Floridians ($12.25 and $14.37, respectively) but negative for South Floridians (!$6.31 and !$22.39, respectively). Indeed, the only wetland wildlife restoration plan Central Floridians did not have a majority in favor or a positive net WTP was the full wetland wildlife restoration plan with full costs (S11).

A similar evaluation of the 11 species restoration plans is reported by respondent's environmental donation status in Table 6-6. As in the earlier evaluation of the hydrological restoration plans by environmental donation status (Table 6.4), respondents who donated to environmental causes in the past were more likely to favor the restoration plans. Seven of the plans were ranked higher than the status quo by those who donated compared with only 4 plans that were ranked higher by those who had not donated. But, in contrast to the hydrological restoration plan results, the overall differences between the donation status groups were not large. The overall percent in favor and net WTPs were relatively similar for partial wetland wildlife restoration with a $25 annual household cost (S6). The differences grew larger only when additional cost components were added such as in S8 and S9 which added 100,000 acre reductions in farmland and severe water use restrictions. The differences in net WTPs for S9 for those who donated ($39.81) versus those who did not ($15.00) suggest that the former were less averse to the prospect of severe water use restrictions as a tradeoff for full wetland wildlife restoration.

In general, the socioeconomic interaction evaluation results in Tables 6-5 and 6-6 indicate that the species multiattribute format tended to elicit fewer differences in preferences across socioeconomic groups than the hydrological multiattribute format (Tables 6-3 and 6-4). This result may have occurred because more respondents were able to understand the concept of restoring species population levels as compared to restoring historic water levels and timing. Respondents in Central Florida and those who had not contributed to environmental groups were the least likely to have strong preferences for hydrological restoration plans. These results suggest that building support for Everglades/South Florida ecosystem restoration on the basis of hydrological restoration endpoints may be difficult outside of South Florida.

Table 6-5. Evaluation of Selected Restoration Plans with the Species Mulitattribute Model by Respondent Location.

Plan Description		Percent in Favor		Ranking		Net Willingness to Pay	
		South Florida	Central Florida	South Florida	Central Florida	South Florida	Central Florida
S-1 Baseline (no change) Wildlife.							
Wetland Species: 20%	Costs: 0	NA	NA	5	8	NA	NA
Dryland Species: 50%	Farmland Reduction: 0						
Estuarine Species: 60%	Water Restriction: 3 days/10%						
S-2 Partial Wetland Wildlife Restoration without Costs.							
Wetland Species: 50%	Costs: 0	88.7	98.9	2	3	$34.41	$36.21
Dryland Species: 50%	Farmland Reduction: 0						
Estuarine Species: 75%	Water Restriction: 3 days/10%						
S-3 Full Wetland Wildlife Restoration without Costs.							
Wetland Species: 80%	Costs: 0	88.7	98.9	1	1	$68.82	$72.42
Dryland Species: 50%	Farmland Reduction: 0						
Estuarine Species: 90%	Water Restriction: 3 days/10%						
S-4 Partial Dryland Wildlife Restoration without Costs.							
Wetland Species: 20%	Costs: 0	7.0	34.8	8	9	-$17.62	-$3.87
Dryland Species: 60%	Farmland Reduction: 0						
Estuarine Species: 60%	Water Restriction: 3 days/10%						
S-5 Full Dryland Wildlife Restoration without Costs.							
Wetland Species: 20%	Costs: 0	7.0	34.8	10	10	-$35.23	-$7.74
Dryland Species: 70%	Farmland Reduction: 0						
Estuarine Species: 60%	Water Restriction: 3 days/10%						
S-6 Partial Wetland Wildlife Restoration with Minimized Taxes.							
Wetland Species: 50%	Costs: $25	59.9	64.1	4	7	$9.41	$11.21
Dryland Species: 50%	Farmland Reduction: 0						
Estuarine Species: 75%	Water Restriction: 3 days/10%						
S-7 Partial Wetland Wildlife Restoration, No Water Supply Restrictions.							
Wetland Species: 50%	Costs: $25	43.7	65.2	6	6	-$6.31	$12.25
Dryland Species: 50%	Farmland Reduction: 100,000 acres						
Estuarine Species: 75%	Water Restriction: 3 days/10%						

Table 6-5. Continued.

Plan Description	Percent in Favor		Ranking		Net Willingness to Pay	
	South Florida	Central Florida	South Florida	Central Florida	South Florida	Central Florida
S-8 Partial Wetland Wildlife Restoration with Minimized Costs.						
Wetland Species: 50% Costs: $25	21.8	75.0	9	5	-$22.39	$14.37
Dryland Species: 50% Farmland Reduction: 100,000 acres						
Estuarine Species: 75% Water Restriction: 2 days/25%						
S-9 Full Wetland Wildlife Restoration with Minimized Costs						
Wetland Species: 80% Costs: $25	54.9	88.0	3	2	$12.02	$50.58
Dryland Species: 50% Farmland Reduction: 100,000 acres						
Estuarine Species: 90% Water Restriction: 2 days/25%						
S-10 Full Wetland Wildlife Restoration with Costs, No Water Supply Restrictions						
Wetland Species: 80% Costs: $50	43.7	65.2	7	4	-$12.62	$24.50
Dryland Species: 50% Farmland Reduction: 200,000 acres						
Estuarine Species: 90% Water Restriction: 3 days/10%						
S-11 Full Wetland Wildlife Restoration with Full Costs						
Wetland Species: 80% Costs: $50	26.1	35.9	11	11	-$47.85	-$12.63
Dryland Species: 50% Farmland Reduction:200,000 acres						
Estuarine Species: 90% Water Restriction: 1 day/40%						

NA=Not Applicable

Table 6-6. Evaluation of Restoration Plans with the Species Multiattribute Model by Respondent Past Donations.

Plan Description	Percent in Favor		Ranking		Net Willingness to Pay	
	DONATIONS		DONATIONS		DONATIONS	
	NO	YES	NO	YES	NO	YES
S-1 Baseline (no change) Wildlife. Wetland Species: 20% Costs: 0 Dryland Species: 50% Farmland Reduction: 0 Estuarine Species: 60% Water Restriction: 3 days/10%	NA	NA	5	8	NA	NA
S-2 Partial Wetland Wildlife Restoration without Costs. Wetland Species: 50% Costs: 0 Dryland Species: 50% Farmland Reduction: 0 Estuarine Species: 75% Water Restriction: 3 days/10%	92.4	93.0	2	3	$33.61	$36.68
S-3 Full Wetland Wildlife Restoration without Costs. Wetland Species: 80% Costs: 0 Dryland Species: 50% Farmland Reduction: 0 Estuarine Species: 90% Water Restriction: 3 days/10%	92.4	93.0	1	1	$67.23	$73.37
S-4 Partial Dryland Wildlife Restoration without Costs. Wetland Species: 20% Costs: 0 Dryland Species: 60% Farmland Reduction: 0 Estuarine Species: 60% Water Restriction: 3 days/10%	10.1	26.1	8	9	-$15.65	-$8.65
S-5 Full Dryland Wildlife Restoration without Costs. Wetland Species: 20% Costs: 0 Dryland Species: 70% Farmland Reduction: 0 Estuarine Species: 60% Water Restriction: 3 days/10%	10.1	26.1	10	10	-$31.31	-$17.30
S-6 Partial Wetland Wildlife Restoration with Minimized Taxes. Wetland Species: 50% Costs: $25 Dryland Species: 50% Farmland Reduction: 0 Estuarine Species: 75% Water Restriction: 3 days/10%	63.0	60.0	4	4	$8.61	$11.68

Table 6-6 Continued.

Plan Description	Percent in Favor		Ranking		Net Willingness to Pay	
	DONATIONS		DONATIONS		DONATIONS	
	NO	YES	NO	YES	NO	YES
S-7 Partial Wetland Wildlife Restoration, No Water Supply Restrictions. Wetland Species: 50% Costs: $25 Dryland Species: 50% Farmland Reduction: 100,000 acres Estuarine Species: 75% Water Restriction: 3 days/10%	50.4	53.9	6	6	-$2.26	$4.35
S-8 Partial Wetland Wildlife Restoration with Costs. Wetland Species: 50% Costs: $25 Dryland Species: 50% Farmland Reduction: 100,000 acres Estuarine Species: 75% Water Restriction: 2 days/25%	27.7	58.3	9	7	-$18.62	$3.12
S-9 Full Wetland Wildlife Restoration with Minimized Costs. Wetland Species: 80% Costs: $25 Dryland Species: 50% Farmland Reduction: 100,000 acres Estuarine Species: 90% Water Restriction: 2 days/25%	59.7	76.5	3	2	$15.00	$39.81
S-10 Full Wetland Wildlife Restoration with Costs with No Water Supply Restrictions. Wetland Species: 80% Costs: $50 Dryland Species: 50% Farmland Reduction: 200,000 acres Estuarine Species: 90% Water Restriction: 3 days/10%	50.4	53.9	7	5	-$4.52	$8.71
S-11 Full Wetland Wildlife Restoration with Full Costs. Wetland Species: 80% Costs: $50 Dryland Species: 50% Farmland Reduction: 200,000 acres Estuarine Species: 90% Water Restriction: 1 day/40%	24.4	35.7	11	11	-$47.59	-$19.93

NA=Not Applicable

SECTION 7. SUMMARY AND EXTENSIONS

7.1 Study Objectives and Methods

Efforts to restore the Everglades/South Florida ecosystem represent one of the most difficult challenges in contemporary science and environmental decision-making. Numerous scientific questions exist over the current state of the ecosystem and how the components of the system will respond to management initiatives. Present and future scientific studies will help to address these uncertainties. Equally, if not more, difficult questions arise over the choice of objectives for restoration. These questions involve both scientific and public preference issues that require both natural and social science research. This report has attempted to answer some of these questions by presenting the results from a survey of Florida residents to identify their preferences and economic values for different levels of ecosystem restoration. These results provide baseline information about Floridians' preferences that can be used in contemporary assessments of alternative restoration plans and for comparisons with future social science studies of public preferences.

The survey was designed as an application of multiattribute utility (MAU) theory because the Everglades/South Florida ecosystem restoration problem requires the consideration of multiple dimensions as well as tradeoffs between natural and social system considerations. Given the geographic scale and ecological complexity of the region, a large number of attributes could possibly be considered. The range of possibilities was limited, however, by the need to develop a survey instrument that could be readily understood by the public and could be administered under normal field conditions. To represent ecological dimensions of the problem, functional endpoints were expressed as hydrological attributes that represented water levels and timing in three critical geographic areas: Lake Okeechobee, the Water Conservation Areas, and Everglades National Park. An alternative characterization of the ecological dimensions of the problem was expressed as species attributes that represented three broad species groupings: wetland species, dryland species, and estuarine species. These alternative attribute specifications were both measured in terms of 'percentages of historical levels' to describe how current and possible future conditions would change under alternative management plans. Other attributes used in the analysis captured the possible effects of restoration plans on water availability to municipal users, changes in farmland acreage in South Florida, and the annual cost to households.

Field interviews were conducted by an independent market research firm during the first half of 1998 based on a stratified, random sampling design of households in five Florida counties: Dade, Hillsborough, Lee, Orange and Palm Beach. Approximately 100 interviews were conducted in each county. The interviews were conducted in respondents' homes and consisted of five parts: 1) a general introduction, 2) questions to elicit respondents' attitudes about public expenditures and environmental issues, 3) an informational video about the Everglades/South Florida ecosystem, 4) description of the choice attributes and a pairwise choice task involving preselected attribute combinations, and 5) additional questions to elicit socioeconomic characteristics. Copies of all questions and supporting materials for the interviews are provided in the appendices to this report.

A pairwise choice response procedure was used in the interviews because pretesting indicated this was the simplest and most easily understood procedure for respondents to deal with the large number of attributes and attribute combinations. A split sample design was used so that the hydrological and species attribute specifications were divided evenly across respondents in each county. This design provided a basis to compare respondents' preferences for alternative restoration plans based on different representations of the ecological dimensions of the problem. While the interview procedure used in this study required more time and was more difficult than a typical public opinion survey, it was clear that respondents were able to understand the choices and express their preferences. Moreover, the survey framework provides detailed information about respondents' preferences that could be used to address specific components of proposed restoration plans.

7.2 Survey Results and Alternative Restoration Plan Evaluations

Responses from the pairwise choice tasks were used to estimate MAU functions for the hydrological and species attribute sets. The MAU functions were estimated using specifications that included only the basic attributes and with interactive variables to identify the effects of socioeconomic characteristics on respondent preferences. The results reported in Section 5 showed that both specifications resulted in strong statistical results indicating that respondents evaluated the attribute combination options and expressed their preferences for different levels of the attributes.

The MAU functions for the hydrological and species models can be compared through the use of normalized weights[12] for each attribute such as those presented in Figure 7-1. The figure shows that respondents gave a positive weight to all three hydrological attributes. The results indicate respondents preferred potential restoration plans that would lead to water levels and timing throughout the South Florida region that would be more similar to historical conditions. Other attributes in the model, however, revealed that higher levels of annual cost, water restrictions, or reductions in farmland acreage were negatively weighted. The negative weights assigned to these attributes would temper the positive weights given to higher levels of the hydrological attributes.

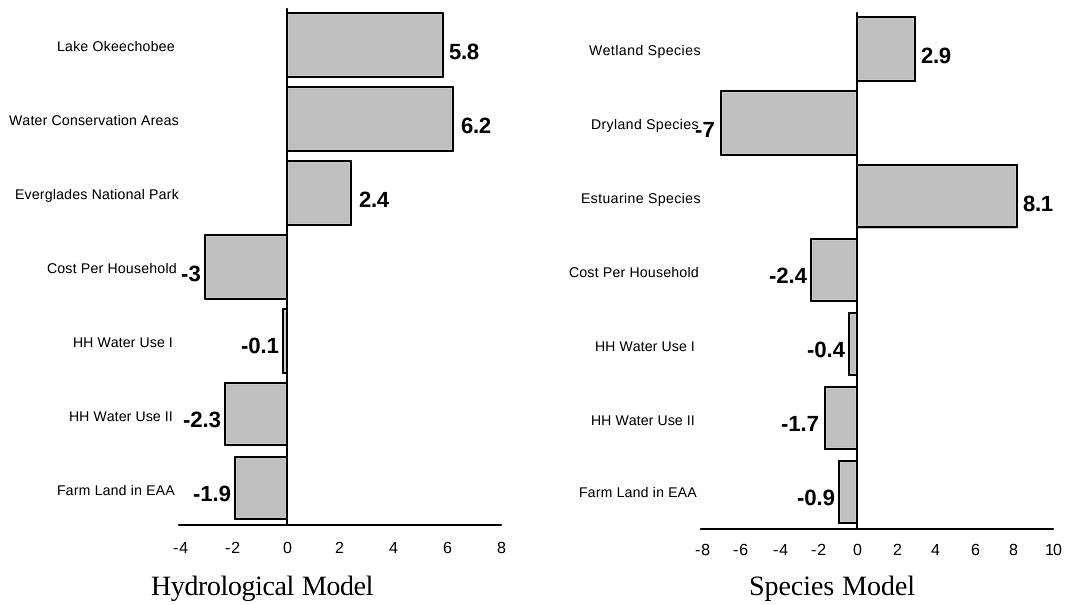
Weights for the species attributes from the species multiattribute model in Figure 7-1 show that respondents gave a positive weight to wetland and estuarine species attributes. But, they also gave a significantly negative weighting to the dryland species attribute indicating that restoring these species populations to be more comparable to historical levels was not preferred. The results for restoring wetland/estuarine species were also tempered by negative weights assigned to the annual cost, water restrictions, and farmland attributes. Figure 7-1 also shows that the weightings assigned to these three attributes in the hydrological and species multiattribute models were generally similar suggesting that respondents expressed consistent preferences in the two choice settings despite the presence of other attributes.

The statistically derived weights for the hydrological and species multiattribute models were used to evaluate alternative hypothetical restoration plans. The evaluation results reported in Section 6 indicated that Floridians expressed strong preferences for restoration plans that restore the hydrological conditions or wetland/estuarine species populations of South Florida. For example, Tables 6-1 and 6-2 showed that a large majority of respondents would be in favor of full restoration plans that imposed no or low costs on Floridians. In addition, the highest net willingness to pay (WTP) amounts for the full restoration plans were $58.79 annually with the

[12]The normalized weights were computed by multiplying each attribute coefficient times the mean level of the attribute and then multiplying the product times ten.

hydrological multiattribute model and $69.86 annually with the species multiattribute model. These economic values measure the maximum annual benefits the average resident would receive if full restoration were accomplished with no costs to Floridians.

Figure 7-1. Relative Weightings of Attributes in the Multiattribute Models



Costs imposed by a plan would reduce these maximum amounts and vary with the specifics of each plan. The tables in Section 6 showed how these amounts would change with different plans for the sample as a whole and for various socioeconomic groups.

There were differences in preferences for restoration between socioeconomic groups. Respondents in Central Florida and those who had not donated to environmental groups were much less supportive of restoration plans when these respondents expressed their preferences with the hydrological multiattribute choice set. The same results, however, did not occur in responses with the species multiattribute set. The differences for these groups may be that they did not relate the hydrological attributes to ecosystem restoration and therefore gave less weight to these attributes. These results suggest that it may be more difficult to explain and build support for an Everglades/South Florida restoration program if the emphasis is primarily hydrological management. The fact that higher levels of the wetland/estuarine species attributes were consistently preferred across the sample indicates that the general public would more readily identify with a restoration program that emphasizes species restoration.[13]

[13] It is interesting to note that the U.S. Fish and Wildlife Service recently announced a "South Florida Multi-Species Recovery Plan" that U.S. Department of the Interior Secretary Bruce Babbitt describes as "an integral component in meeting the Administration's restoration plan for South Florida" (1999, pp. I). This recovery plan is distinct from the Restudy yet many of the species identified in the plan "are dependent upon implementation of the Restudy for survival and recovery, and many others will benefit significantly as a result of this restoration effort" (1999, pp. ix). The perspective of the Plan's sponsors is

While the hypothetical restoration plan evaluation results indicated generally strong support for restoration, the results in Section 6 made it evident that respondents would not support a restoration plan that imposed high costs on Floridians. With either the hydrological or species multiattribute models, hypothetical restoration plans that included annual costs of $50 per household ($500 over 10 years) coupled with either farmland reductions of 100,000 or more acres or severe restrictions on municipal water use during dry years received poor rankings and less than majority support. Moreover, the net WTPs for these 'high cost' plans were negative suggesting a potential loss in economic welfare. Even socioeconomic groups such as those who had made environmental donations and typically revealed the strongest support for most plans had unfavorable evaluations of the high cost plans.

Overall the results of both the hydrological and species multiattribute models indicate that the likelihood of support for a restoration plan will depend on the balancing of restoration objectives with costs imposed on Floridians. The level of restoration will have to be considered in relation to the costs imposed. Some costs were clearly not viewed as too overbearing such as moderate restrictions on water use. But, it is clear that other costs associated with possible restoration plans such as severe water restrictions (outdoor uses restricted to 1 day per week and indoor uses reduced 40 percent) or annual costs greater than $25 per household would encounter significant opposition from the general public. Thus, the task of developing an actual plan for the Everglades/South Florida region that achieves meaningful ecosystem restoration, satisfies Floridians' obligation for cost sharing under the Water Resources Development Act of 1996, and is supported by the public may be a daunting endeavor.

7.3 Extending the Economic Valuation Results to the Florida Population

The results presented in Section 6 for the survey sample could also be extrapolated to the Florida population to estimate the aggregate benefits of alternative Everglades/South Florida restoration plans. Although the sampling design for this study was selected to represent the population of five counties (Dade, Hillsborough, Lee, Orange and Palm Beach), the comparison of the socioeconomic characteristics of the sample and the Florida resident population in Section 4 (Tables 4-1and 4-3) indicated a strong similarity between the sample and the population. This is not surprising since each county is located in the major population centers of the state and the five counties account for more than one-third of the total state population. The primary areas that were not represented in the sample are the urban and rural areas of North Florida. With these limitations of

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clearly revealed in the statement:

> "South Florida cannot be considered 'restored' if the song of the Cape Sable seaside sparrow has been silenced from the marl prairies of the Everglades, if clouds of wood storks no longer cover the skies of the mangrove forests of southernmost Florida, if the footprints of marsh rabbits no longer occur in the Lower Keys, or if there are no Florida scrub-jay families defending their territories on the Central Florida Ridge" (1999, pp. 1-2).

the sample data in mind, population estimates can be calculated for the 5.82 million households[14] in Florida in 1997 (Floyd et al., 1998).

Using the net WTP estimates reported in Section 6, aggregate measures of the economic benefits to Florida residents can be calculated by multiplying the average WTP for a specific plan by the number of households. For example, using the net WTP value of $58.79 per household per year for full hydrological restoration without costs (Plan H-5 in Table 6-1) from the hydrological multiattribute model would result in an aggregate annual WTP of $342.2 million for this plan. Over the ten-year period indicated in the cost attribute description (see Table 3-3), the aggregate WTP would be $3.42 billion in 1998 dollars.[15] Similarly, the WTP value of $69.86 per household for full wetland/estuarine species restoration without costs (Plan S-3 in Table 6-2) from the species multiattribute model would result in an annual WTP of $406.5 million for this plan or $4.07 billion over ten years.[16] These are aggregate measures of the maximum economic benefits Floridians would derive from a full restoration plan with no costs to Floridians.

A plan with direct costs to Floridians would obviously result in lower aggregate benefits for Floridians. For example, the restoration plan H10 developed from the hydrological multiattribute model would provide full hydrological restoration with annual costs of $25 per household, a 100,000 acre reduction in farmland, and moderate water restrictions. This plan yielded a net WTP of $15.60 for the sample (Table 6-1). Aggregating this economic benefit measure to the population would result in annual benefits of $90.8 million or $907.9 million over ten years. The same approach can be used to aggregate any of the net WTP results reported in Tables 6-1 and 6-2.

7.4 Limitations of the Study and Suggestions for Future Research

This research study was intended to provide an understanding of the preferences of Floridians for Everglades/South Florida ecosystem restoration. In any effort to identify public preferences, especially for complex issues such as ecosystem restoration, simplifying assumptions are always necessary. In the survey, it was necessary to limit the dimensions of the problem to make the multiattribute tradeoffs easily understood and consistent with the limited information that was available about different attributes of the ecosystem. While these constraints on the choices provided to respondents may have influenced the results, the extent and

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[14] Population estimates are presented for households rather than individuals because only respondents over 18 years of age who participated in household financial decisions were selected. Also, the cost attributes used in the multiattribute models were expressed in terms of annual household costs.

[15] Growth in the number of households in Florida or changes in preferences over the ten-year period are not considered in this calculation. Also, this calculation assumes that no additional benefits accrue beyond the ten-year period.

[16] An alternative approach to aggregating the benefits over time is to assume that the annual benefits would continue into perpetuity. Then the capitalized value of the benefits could be calculated by dividing the annual benefits by a capitalization (discount) rate. Assuming a real discount rate of 3 percent, the capitalized value of the economic benefits for full restoration without costs from the hydrological and species multiattribute models would be $11.4 and $13.5 billion, respectively.

direction of this influence cannot be known until a different survey is conducted using more extensive and complete information on the ecosystem and social attributes influenced by restoration decisions. Similarly, other multiattribute elicitation procedures such as direct rating and ranking of plan alternatives by respondents may influence the results. As with any social or natural science research, replication is necessary to validate results.

Also, the geographic coverage for this survey was constrained to large population centers of Florida due to the project budget. While the survey design resulted in a representative sample, certainly the preferences of rural Floridians and those who live in North Florida were not included. Whether the preferences of these Florida residents differ from the sample in this study cannot be known without further research.

Perhaps more importantly, this research provided no information about the preferences of people who live in other states or the millions of domestic and international visitors who come to Florida each year. Certainly the Everglades/South Florida region has a unique place among the U.S.'s national treasures (see Section 1), yet no information exists about the preferences of U.S. citizens for restoration of the region's ecosystem. This information is particularly important in light of the 50/50 state and federal cost sharing relationship established for Everglades/South Florida ecosystem restoration in the Water Resources Development Act of 1996.

Finally, it is important to recognize that social science research on public preferences is an integral part of an adaptive management approach to Everglades/South Florida ecosystem restoration (Milon et al. 1997). Uncertainty about the responses of natural systems to human intervention means that both scientists and the public will learn about the effects of restoration as a selected plan proceeds. As scientists update their information, so too will the public update their perceptions of the ecosystem and the restoration plan. Therefore, the results from this study should be viewed as a benchmark for future surveys to objectively evaluate how public perceptions and economic values may change over time. This integration of natural and social science research in an adaptive management framework offers the promise of continually improving the information available for both resource managers and the public.

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APPENDIX A

QUESTIONNAIRE AND INTERVIEWER GUIDE

QUESTIONNAIRE
AND
INTERVIEWER GUIDE

I. RESPONDENT SCREENING

S-1. READ: Are you 18 years of age or older? If NO, may I speak with someone in the household who is?

Age of respondent:

Yes	1
No	2
Refused	88

S-2. READ: Are you currently a resident of the State of Florida?

Yes	1
No	2
Refused	88

S-3. READ: Are you usually involved in the financial decision making for this household?

Yes	1
No	2
Refused	88

S-4. READ: This interview is being conducted as part of a research project by the University of Florida. You will not have to answer any questions you do not wish to answer and you may discontinue your participation at any time. The interview will take about 45 minutes and you will be paid $10 for your time.

In order to proceed with the interview, I need you to read this consent form and agree to participate in this interview. (IF RESPONDENT AGREES, CODE S-5 AND S-6)

S-5. CODE: Gender of Respondent

Male	1
Female	2

S-6. CODE: Type of Household Structure

Single-Family Detached Home	1
Townhouse, Row House	2
Attached Apartment or Condominium	3
Mobile Home	4

Duplex	5
Other (Specify)____________________	6

II. BASE SURVEY QUESTIONS

II-A. SPENDING PRIORITIES AND ENVIRONMENTAL ATTITUDES

II-B. VIDEO VIEWING

II-C. DESCRIPTION OF WATER/WILDLIFE MANAGEMENT PLAN ATTRIBUTES AND ATTRIBUTE LEVELS.

II-D. SELECTION OF EXAMPLE WATER/WILDLIFE MANAGEMENT PLANS

II-E. SELECTION OF SURVEY WATER MANAGEMENT PLANS.

II-F. SOCIO-DEMOGRAPHIC QUESTIONS

II-G. INTERVIEW EVALUATION

SECTION II-A.SPENDING PRIORITIES AND ENVIRONMENTAL ATTITUDES

READ: Thank you again for participating in this survey. I am going to start this survey by asking you some general questions about spending on programs by the State of Florida. Please bear in mind that eventually all government spending comes out of the taxes you and other Floridians pay. There are no right or wrong answers.

SHOW **CARD A** THAT LISTS STATE PROGRAMS.

READ: As I mention each program, tell me whether the amount now being spent should be increased a lot, increased somewhat, kept at the present level, decreased somewhat or decreased a lot.

SHOW **CARD B** THAT LISTS RESPONSES TO SPENDING ON STATE PROGRAMS.

CIRCLE ONE CODE FOR EACH QUESTION. RE-READ EACH QUESTION AS NECESSARY.

A-1. READ: Do you think that state spending should increase, be kept at the present level, or decrease for programs to combat crime?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-2. How about for public schools (K-12)?

Increase A Lot	1
Increase Somewhat	2

Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-3. To protect the environment?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-4. How about state spending for industrial development and to attract new industry?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-5. To acquire land to protect endangered species?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-6. For health care services?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-7. How about spending for colleges and universities?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-8. For state highways and road systems?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4

Decrease A Lot	5
Don't know	88

A-9. For low income families with children?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-10. How about state spending for the elderly?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-11. For state prisons and correctional facilities?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

A-12. How about state spending to promote tourism?

Increase A Lot	1
Increase Somewhat	2
Same	3
Decrease Somewhat	4
Decrease A Lot	5
Don't know	88

WITHDRAW **CARD B.**

A-13. Of those program areas which you feel should receive increased spending, which one would you give as your top priority for an increase?

REFER TO **CARD A** AGAIN : PRIORITY SPENDING PROGRAM

Programs to combat crime	1
Public schools (K-12)	2
Protect the environment	3
Industrial development and to attract new industry	4
Acquire land to protect endangered species	5
Health care service	6
State colleges and universities	7
State highways and road systems	8
Low income families with children	9
Elderly	10

Prisons and correctional facilities	11
Promote tourism	12
No increased spending on anything	13
Don't know	88

WITHDRAW **CARD A**.

READ: Now on want to ask you a few questions about your household water use.

A-14. Do you currently get your water for household uses such as drinking water and washing from a water utility or do you have a private well?

Water Utility	1
Private Well	2
Don't Know	88

A-15. How about water for watering the yard? Do you use water from a water utility or do you have a private well?

Water Utility	1
Private Well	2
Don't Know	88

A-16. Do you currently use water filters in your home?

Yes	1
No	2
Don't Know	88

A-17. Do you buy bottled drinking water from places such as the grocery store or a water company to use in your home?

Yes	1
No	2
Don't Know	88

IF RESPONDENT ANSWERS "YES" TO A-17, GO TO QUESTION A-17a. IF NOT, GO TO QUESTION A-18.

A-17a. IF YES, about what percentage of your total water uses for things like drinking, cooking, or making coffee and tea comes from bottled water? (ASSIGN RESPONSE TO CLOSEST CATEGORY)

100%	1
75%	2
50%	3
25% or less	4
Don't Know	88

A-18. Now I want to read you some statements and I'd like you to tell me whether you agree or disagree with each statement. Please indicate whether you Strongly Agree, Somewhat Agree, Somewhat Disagree or Strongly Disagree.

SHOW **CARD C**. AGREE/DISAGREE STATEMENTS

READ QUESTIONS AND CHOICES FIRST TIME, CIRCLE ONE RESPONSE FOR EACH; RE-READ QUESTIONS AS NECESSARY.

READ: The first statement is: In 10 years, there will not be enough water available for everyone who wants to move into my community. Do you ...

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3
Strongly Disagree	4
Don't Know	88

A-19. In 10 years, there will not be enough water available for everyone who wants to move into Florida.

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3
Strongly Disagree	4
Don't Know	88

A-20. Public officials should give first priority to the water supply needs of communities and economic development before they consider other water uses such as maintaining wetlands and protecting wildlife.

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3
Strongly Disagree	4
Don't Know	88

A-21. The environment is very delicate and easily upset.

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3
Strongly Disagree	4
Don't Know	88

A-22. When people interfere with the environment it often produces disastrous results.

IF NECESSARY, Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree?

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3
Strongly Disagree	4
Don't Know	88

A-23. Public officials have done all they can do to protect the people and buildings in my community from flooding caused by heavy rains and hurricanes.

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3

Strongly Disagree	4
Don't Know	88

A-24. People have the right to change the natural environment to suit their needs.

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3
Strongly Disagree	4
Don't Know	88

A-25. Everyone should use water conservation practices such as low-flow showers and toilets and landscaping their yards with plants that need little or no irrigation.

Strongly Agree	1
Somewhat Agree	2
Somewhat Disagree	3
Strongly Disagree	4
Don't Know	88

GO TO SECTION II-B.

SECTION II-B. VIDEO VIEWING

READ: In this part of the survey I am going to show you a video that will give you some information on the historical and present water management system in South Florida. Included in the video is a description of the various uses for water in South Florida and how those uses compete for water resources in South Florida. After the showing, I am going to ask you some questions about some of the issues raised in the video. The video will take about 10 minutes to show.

SHOW THE VIDEO.

AFTER THE VIDEO IS OVER GO TO SECTION II-C.

SECTION II-C. DESCRIPTION OF WATER MANAGEMENT/WILDLIFE MANAGEMENT PLAN ATTRIBUTES AND ATTRIBUTE LEVELS

INTERVIEWER NOTE:There are two types of attributes that describe the water management plans that the respondent will be asked to choose from. SET I Attributes are comprised of HYDROLOGICAL attributes and these are listed and described in Appendix III-B. SET II Attributes are comprised of WILDLIFE attributes and a listing and description of these attributes are given in Appendix III-C.

READ: As you heard in the video, several water management plans are now under consideration. Each possible water management plan has six attributes. In this part of the interview I am going to describe to you the various attributes of a water management plan. These attributes can be best described as representing the types of features one would compare between 2 automobile makes or models. For example, when buying a car, features to compare would include the price of the car, safety, horsepower or engine size, fuel economy, and seating capacity.

SHOW **CARD D**. ATTRIBUTES OF TWO CAR MODELS

READ: Each car has these same features or attributes, but the amount or level of each of these attributes will differ according to the make of car. For example, some cars will cost less than others, but may have fewer safety features as well. Or, one car may get great gas mileage, but has less seating capacity than another make. People choose the model of the car they want based on the amount or level of the attributes they value most. The choice process involves making tradeoffs.

I am now going to describe each attribute of a water management plan, and the corresponding attribute levels, to you in detail.

INTERVIEWER NOTE: If you are describing SET I HYDROLOGICAL attributes, see (Appendix III-B). If describing SET II WILDLIFE attributes, see Appendix III-C). The listing of the respective attributes, as well as a written and graphical description of the attributes and their levels are provided in NOTEBOOK form.

READ THE ATTRIBUTE LISTING AND EACH OF THE ATTRIBUTE DESCRIPTIONS WITH THE RESPONDENT, HOLDING THE NOTEBOOK SO THAT BOTH THE RESPONDENT AND YOU CAN EASILY SEE IT. EACH ATTRIBUTE DESCRIPTION CONSISTS OF TWO PARTS: A VERBAL DESCRIPTION AND A GRAPHIC DESCRIPTION IN THE FORM OF A BAR CHART. READ THE WRITTEN DESCRIPTION OF EACH ATTRIBUTE ALOUD, ALONG WITH THE CORRESPONDING ATTRIBUTE LEVELS GIVEN BELOW THE WRITTEN DESCRIPTION. NEXT, REFER TO THE BAR CHART THAT GIVES A GRAPHICAL REPRESENTATION OF THE LEVELS FOR THE ATTRIBUTE.

AFTER READING THE ATTRIBUTE DESCRIPTION AND SHOWING THE BAR CHART FOR EACH ATTRIBUTE, ASK THE RESPONDENT IF HE OR SHE HAS ANY QUESTIONS.

AFTER COMPLETING THE SET OF ATTRIBUTE DESCRIPTIONS, GIVE THE RESPONDENT COPIES OF THE BAR CHARTS (LAST PAGE OF NOTEBOOK) FOR EACH ATTRIBUTE TO REFER TO DURING THE REMAINDER OF WATER MANAGEMENT PLAN SELECTION EXERCISE.

GO TO SECTION II-D.

SECTION II-D. EXAMPLE WATER MANAGEMENT PLAN PAIRS

INTERVIEWER NOTE: THE EXAMPLE PAIRS OF WATER MANAGEMENT PLANS WHICH WILL BE USED FOR PRACTICE EXERCISES ARE DIVIDED INTO TWO SECTIONS. SECTION 1 HAS THE SET I HYDROLOGICAL ATTRIBUTES AND THREE PAIRS OF EXAMPLE PLANS TO CHOOSE FROM ARE SHOWN IN THE NOTEBOOK.

SECTION 2 INCLUDES SET II WILDLIFE ATTRIBUTES AND THREE PAIRS OF EXAMPLE PLANS TO CHOOSE FROM ARE SHOWN IN THE NOTEBOOK.

THE THREE PAIRS OF EXAMPLE PLANS TO CHOOSE FROM FOR SET I AND SET II ATTRIBUTES ARE PROVIDED IN THE NOTEBOOK.

WHETHER YOU ARE ADMINISTERING A QUESTIONNAIRE USING SET I HYDROLOGICAL ATTRIBUTES OR SET II WILDLIFE ATTRIBUTES, START WITH PRACTICE 1.

READ: We are now going to go through an example of a way of choosing between two alternative water management plans. Recall what I said earlier that, like automobiles, two management plans will differ according the effects each one will have on the levels of the attributes. Each management plans has six attributes, as earlier described.

SHOW PRACTICE 1: CHOOSE BETWEEN MANAGEMENT PLANS 1 AND 2.

READ: As you can see, Column 1 lists the six attributes for each of the two management plans.

READ THE LIST OF ATTRIBUTES TO THE RESPONDENT.

READ: Column 2 shows the attribute level achieved with Management Plan 1, and Column 3 shows the attribute level achieved with Water Management Plan 2.

POINT OUT TO THE RESPONDENT THE SIMILARITIES AND DIFFERENCES IN THE ATTRIBUTE LEVELS BETWEEN THE TWO MANAGEMENT PLANS. INDICATE WHICH ATTRIBUTES ARE AT THEIR "PRESENT LEVELS" AND REMIND THE RESPONDENT THAT HE/SHE CAN REFER TO THE BAR CHART GIVEN TO HIM/HER INDICATING THE POSSIBLE LEVELS THE SIX ATTRIBUTES.

ASK THE RESPONDENT IF HE/SHE HAS ANY QUESTIONS.

READ: Please read the levels of the attributes that Plan 1 and Plan 2 can achieve and select the Plan you most prefer. Take your time to make a selection. Tell me the number of the Plan you most prefer.

AFTER THE RESPONDENT HAS SELECTED ONE OF THE PLANS CIRCLE THE RESPONSE ON THE EXAMPLE PLAN ANSWER SHEET.

DEBRIEFING: ASK THE RESPONDENT WHY HE/SHE SELECTED A PARTICULAR PLAN? WHAT ATTRIBUTES WERE IMPORTANT? THE PURPOSE OF THE DEBRIEFING IS TO MAKE SURE THE RESPONDENT UNDERSTANDS WHAT THE DIFFERENT LEVELS OF THE PLAN ATTRIBUTES REALLY MEAN (e.g. that restrictions on water use become increasingly severe).

IF A RESPONDENT SELECTS A PLAN WHICH IMPLIES A HIGH LEVEL OF TAXATION, LOSS OF AGRICULTURAL LAND, OR SEVERE RESTRICTIONS ON INDOOR AND OUTDOOR WATER USE, ASK IF THIS IS THE CHOICE THE RESPONDENT REALLY WANTS.
READ: We are now going to do a second example exercise.

SHOW EXAMPLE PLAN'S 3 AND 4.

READ: The format for Management Plans 3 and 4 are the same as the previous example. However, there are now four attributes with different levels in Plans 3 and Plan 4.

INDICATE HOW THE ATTRIBUTES OF THE PLANS 3 AND 4 DIFFER. REMIND THE RESPONDENT THAT HE/SHE CAN REFER TO THE BAR CHART HANDOUTS DESCRIBING THE DIFFERENT POSSIBLE LEVELS OF ATTRIBUTES.

READ: Plans 3 and 4 are different from Plans 1 and 2. You are not to compare Plan 3 or Plan 4 with either Plan 1 or Plan 2. The only choice to make is between Plans 3 and 4. Please read the levels of the attributes of each plan carefully and select the one you most prefer. Tell me the number of the plan you most prefer. Please ask if you have any questions.

AFTER THE RESPONDENT HAS SELECTED ONE OF THE PLANS MARK THE CHOICE ON THE EXAMPLE PLAN ANSWER SHEET.

DEBRIEFING: ASK THE RESPONDENT WHY HE/SHE SELECTED A PARTICULAR PLAN? WHAT ATTRIBUTES WERE IMPORTANT? THE PURPOSE OF THE DEBRIEFING IS TO MAKE SURE THE RESPONDENT UNDERSTANDS WHAT THE DIFFERENT LEVELS OF THE PLAN ATTRIBUTES REALLY MEAN (e.g. that restrictions on water use become increasingly severe).

IF A RESPONDENT SELECTS A PLAN WHICH IMPLIES A HIGH LEVEL OF TAXATION, LOSS OF AGRICULTURAL LAND, OR SEVERE RESTRICTIONS ON INDOOR AND OUTDOOR WATER USE, ASK IF THIS IS THE CHOICE THE RESPONDENT REALLY WANTS.

STOP HERE AND PROCEED TO THE ACTUAL CHOICES (A thru N IF THE RESPONDENT SHOWS THAT HE/SHE UNDERSTANDS THE TASKS AND TRADEOFFS FOR CHOOSING A MANAGEMENT PLAN. IF NOT, CONTINUE ON AND DO THIRD EXAMPLE 3.

READ: We will now do a third example selection.

SHOW EXAMPLE PLANS 5 AND 6

READ: The format for the presented plans is the same as the previous two examples. Plan 5 and Plan 6 are different from one another because some of the levels for some attributes are different. Do not compare these plans with the previous example plans. Choose only between Plans 5 and 6. In this example, the levels of four attributes are different, but the differences are not the same as in the previous example.

INDICATE TO THE RESPONDENT HOW THE ATTRIBUTE LEVELS DIFFER BETWEEN THE TWO PLANS. REMIND THE READER THAT HE/SHE CAN REFER TO THE BAR CHART HANDOUTS IN MAKING A CHOICE.

READ: Please read the levels for each of the components of each Plan carefully and select the Plan you most prefer. Tell me the number of the Plan you most prefer. Please ask if you have any questions.

AFTER THE RESPONDENT HAS SELECTED ONE OF THE PLANS MARK THE ANSWER ON THE EXAMPLE ANSWER SHEET.

GO TO SECTION II-E.

SECTION II-E. SELECTION OF WATER/WILDLIFE MANAGEMENT PLANS

INTERVIEWER NOTE: THERE ARE TWO BASIC SETS OF WATER MANAGEMENT PLAN SELECTION EXERCISES, CORRESPONDING TO THE HYDROLOGICAL AND WILDLIFE ATTRIBUTES. EACH SET IS COMPOSED OF TWO FORMS, EACH FORM HAS SEVEN PAIRS OF MANAGEMENT PLANS. THE DIFFERENCE IN THE TWO FORMS FOR EACH SET IS THE ATTRIBUTE LEVELS. ONLY ONE FORM WILL BE ADMINISTERED FOR AN INDIVIDUAL RESPONDENT. THE FORM TO BE ADMINISTERED WILL BE DETERMINED PRIOR TO THE INTERVIEW. THE TWO SETS AND FOUR FORMS INCLUDE:

SET I: HYDROLOGICAL FORM 1 PLANS	SET II: WILDLIFE FORM 1 PLANS.
SET I: HYDROLOGICAL FORM 2 PLANS	SET II: WILDLIFE FORM 2 PLANS.

WITHIN EACH FORM THERE ARE SEVEN PAIRS OF WATER MANAGEMENT PLANS, STARTING WITH PAIR A-B AND GOING THROUGH M-N. AS IN THE PRACTICE EXERCISE, YOU ARE TO ASK RESPONDENTS TO CHOOSE ONE OF TWO PRESENTED PLANS.

READ: I am now going to ask you to choose between two alternative Management Plans. Each Plan is a unique combination of the levels for each of the six attributes described earlier. The first set is made up of Plans A and B.

SHOW PLANS A AND B.

READ: Please read the levels of each of the levels of the Plan A and B carefully, and tell me the letter of the Plan you most prefer. Take your time and refer to the bar charts as necessary. Please ask if you have any questions.

WAIT UNTIL RESPONDENT HAS SELECTED ONE OF THE PLANS AND CIRCLE THE PLAN INDICATED BY THE RESPONDENT ON THE PLAN ANSWER SHEET. INDICATE THE SET NUMBER ADMINISTERED AT THE TOP OF THE ANSWER SHEET.

READ: I am now going to give you the second set of management plans to consider. These are Plans C and D.

SHOW PLANS C AND D.

READ: These are plans C and D, and the levels for each of these plans also differ. Plans C and D are different from Plans A and B. You are choosing only between Plans C and D and are not to compare them to Plans A and B. Please consider each plan carefully and go at your own pace. Tell me the letter of the Plan you most prefer. If you have any questions, please ask.

WAIT UNTIL THE RESPONDENT HAS SELECTED ONE OF THE PLANS AND CIRCLE THE PLAN INDICATED BY THE RESPONDENT ON THE CODING ANSWER SHEET.

READ: I am now going to ask you to select a management Plan from a few more sets of Plans, starting with E and F. Remember, you are selecting only between these two Plans and are not to compare them with previous Plans. Once you have selected a Plan, tell me the letter of the Plan you most prefer. As you go along, please ask me any questions you may have.

SHOW PLANS E AND F. AFTER RESPONDENT HAS CHOSEN PLAN E OR F AND CIRCLE THE PLAN INDICATED BY THE RESPONDENT ON THE PLAN ANSWER SHEET. CONTINUE WITH ALL REMAINING PLANS THRU M AND N. CIRCLE THE PLAN INDICATED BY THE RESPONDENT ON THE PLAN ANSWER SHEET.

PROCEED TO SECTION II-F.

SECTION II-F. SOCIO-DEMOGRAPHICS

F-1. READ: I have a few final questions for you so that can analyze your answers along with the answers of others.

Have you voted in a state or local election within the past 3 years?

Yes	1
No	2

Don't know 88

F-2 What was the highest grade or year in school you completed?

0-8 years	1
Some high school	2
Completed high school	3
Some college	4
Completed college	5
Graduate or professional school	6
Don't Know	88

F-3 Were you born in Florida

Yes	1
No	2 ± Go to F-3a

F-3a How many years have you lived in Florida?

0-99
-88 Refused

F-4 What year were you born? (CODE LAST TWO YEARS ONLY e.g. 1950 is 50)

0-80
88 Refused

F-5 Including yourself, how many people live in your household?

1-20
88 Refused

F-6 How many children under age 18 do you have living with you?

0-10
88 Refused

SHOW RESPONDENT **CARD E**.

F-7 Please indicate how you would you describe your racial or ethnic background?

White (Non-Hispanic)	1
Black (Non-Hispanic)	2
White (Hispanic)	3
Black (Hispanic)	4
American Indian	5
Asian	6
Pacific Islander	7
Other	8
Refused	88

F-8 Generally speaking, do you usually think of yourself as a Republican, a Democrat, an Independent, or what?

Republican	1	± Go to F-9
Democrat	2	± Go to F-10
Independent	3	± Go to F-11
Other party	4	± Go to F-11
No preference	5	± Go to F-11

F-9 Would you consider yourself a strong, moderate or a not very strong Republican?

Strong	1
Moderate	2
Not very strong	3
Refused	88

F-10 Would you consider yourself a strong, moderate or a not very strong Democrat?

Strong	1
Moderate	2
Not very strong	3
Refused	88

F-11 Do you make donations to environmental groups?

Yes	1	± Go to F-12
No	2	± Go to F-13
Refused	88	± Go to F-13

F-12 On average how much do you donate annually?

Less than $100	1
Between $100 and $500	2
More than $500	3
Refused	88

F-13 Now consider your family's household income from all sources. Here is a card that lists various categories of income.

SHOW **CARD F**. CATEGORIES OF INCOME.

Please indicate the number of the category that best describes your total household income in 1996.

Less than $10,000	1
$10,000 to $20,000	2
$20,000 to $30,000	3
$30,000 to $40,000	4
$40,000 to $50,000	5
$50,000 to $60,000	6
$60,000 to $80,000	7
$80,000 to $100,000	8
over $100,000	9
Refused	88

THIS IS THE END OF THE SURVEY. THANK THE RESPONDENT FOR HIS/HER TIME AND COOPERATION.

SECTION II-G. INTERVIEW EVALUATION QUESTIONS

INTERVIEWER NOTE: PLEASE ANSWER QUESTIONS G-1 THROUGH G-4.

G-1. What was the reaction of the respondent as you read through the attribute descriptions (this includes the descriptive material, including the bar charts).

	EXTREMELY	VERY	SOMEWHAT	SLIGHTLY	NOT AT ALL	NOT SURE
a. How distracted was the respondent	1	2	3	4	5	8
b. How attentive was the respondent	1	2	3	4	5	8
c. How well did the respondent understand the material	1	2	3	4	5	8

G-2. Did the respondent say anything suggesting that he or she had any difficulty understanding either the attributes or the attribute levels?

1 YES (if YES, go to question G-2a).

2 NO

G-2a. Describe the difficulties.

____

____

____

____

G-3. Did the respondent have any difficulty understanding the process of choosing a water management or wildlife plan?

1 YES (if YES, go to question G-3a).

2 NO

G-3a. Describe the difficulties.

____

____

____

G-4. How serious was the consideration the respondent gave to the decision about what water management or wildlife plan to choose?

1 Extremely Serious
2 Very Serious
3 Somewhat Serious
4 Slightly Serious
5 Not At All Serious
6 Not Sure

UNIVERSITY OF FLORIDA

INTERVIEW CONSENT

I have received a copy of the interview consent form and I agree to participate in this interview.

NAME	DATE

CARD A

Programs to Combat Crime

Public Schools (K-12)

Protect the Environment

Industrial Development and Attract New Industry

Acquire land to Protect Endangered Species

Health Care Services

Spending for Colleges and Universities

Highways and Road Systems

Low Income Families with Children

State Spending for the Elderly

State Prisons and Correctional Facilities

State Spending to Promote Tourism

CARD B

Increase A Lot

Increase Somewhat

Same

Decrease Somewhat

Decrease A Lot

CARD C

Strongly Agree

Somewhat Agree

Somewhat Disagree

Strongly Disagree

CARD D

Attribute	Model A	Model B
Price (new)	$25,000	$15,000
Safety	Has air bags	No air bags
Horsepower	250	200
Fuel Economy	20 miles per gallon	25 miles per gallon
Seating Capacity	6 persons	4 persons

CARD E

White-Non-Hispanic

Black-Non-Hispanic

White-Hispanic

Black-Hispanic

American Indian

Asian

Pacific Islander

Other

CARD F

Less than $10,000	1
$10,000 to $20,000	2
$20,000 to $30,000	3
$30,000 to $40,000	4
$40,000 to $50,000	5
$50,000 to $60,000	6
$60,000 to $80,000	7
$80,000 to $100,000	8
over $100,000	9

MAIN ATTRIBUTES OF SOUTH FLORIDA WATER MANAGEMENT PLANS

- Water Levels and Timing in Lake Okeechobee

- Water Levels and Timing in Water Conservation Areas

- Water Levels and Timing in Everglades National Park and Florida Bay

- Annual Cost Per Household

- Restrictions on Outdoor and Indoor Household Water Use

- Acres of Farm Land in the Everglades Agricultural Area and Western Portions of Broward and Dade Counties

WATER LEVELS AND TIMING IN LAKE OKEECHOBEE

The water management system controls the water levels and fluctuations in Lake Okeechobee. Too much water in the Lake causes flooding of the shoreline and marsh areas. Too little water causes these areas to dry out. Part of a plan to change the South Florida water management system could include ways to control the levels of the Lake and the timing of fluctuatios to be similar to historic, predrainage conditions. The possible water level controls that could be included in the plan are:

- *60% of the Time Lake Levels and Timing are Similar to Historic, Predrainage Conditions.*
- 75% of the Time Lake Levels and Timing are Similar to Historic, Predrainage Conditions.
- 90% of the Time Lake Levels and Timing are Similar to Historic, Predrainage Conditions.

WATER LEVELS AND TIMING IN WATER CONSERVATION AREAS

The water management system controls the water levels and fluctuations in the Water Conservation Areas. Too much water in these Areas causes flooding of wetlands, upland areas, and tree islands. Too little water causes these areas to dry out. Part of a plan to change the South Florida water management system could include ways to control the water levels and fluctuations in the Water Conservation Areas to be similar to historic, predrainage conditions. The possible water level controls that could be included in the plan are:

- *50% of the Areas has Water Levels and Timing Similar to Historic, Predrainage Conditions.*
- 75% of the Areas has Water Levels and Timing Similar to Historic, Predrainage Conditions.
- 90% of the Areas has Water Levels and Timing Similar to Historic, Predrainage Conditions.

WATER LEVELS AND TIMING IN EVERGLADES NATIONAL PARK AND FLORIDA BAY

The water management system controls the water levels and fluctuations in Everglades national Park and the flow of fresh water to Florida Bay. Too much water causes flooding of wetlands, upland areas, and tree islands. Too little water causes these areas to dry out and increase salinity in Florida Bay. Part of a plan to change the South Florida water management system could include ways to control the water levels and fluctuations in the Park to be similar to historic, predrainage conditions. The possible water level controls that could be included in the plan are:

- *50% of the Park has Water Levels and Timing Similar to Historic, Predrainage Conditions.*
- 75% of the Park has Water Levels and Timing Similar to Historic, Predrainage Conditions.
- 90% of the Park has Water Levels and Timing Similar to Historic, Predrainage Conditions.

ANNUAL COST PER HOUSEHOLD

All Florida residents pay utility taxes as part of their water, electric, and telephone bills. Part of a plan to change the South Florida water management system could include additional taxes and all Floridians would pay for these changes over the next 10 years. Proceeds from these taxes would go into a special trust fund that would be used only to change the South Florida water management system. The possible tax payments that could be included in the plan are:

! *No Change in Utility Taxes*

! Utility Taxes Would Increase $25 per Year (Adding up to $250 over 10 years)

! Utility Taxes Would Increase $50 per Year (Adding up to $500 over 10 Years)

RESTRICTIONS ON OUTDOOR AND INDOOR HOUSEHOLD WATER USE

Changes in the water management system can affect the availability of water for households in South Florida. The primary effect would occur during years with low rainfall. These dry years occur, on average, in 1 out of every 5 years. The possible levels of restrictions on outdoor and indoor water use that could be included in the plan are:

! *In Dry Years, Outdoor Uses Restricted to 3 Days Per Week and Indoor Uses Reduced by 10%*

! In Dry Years, Outdoor Uses Restricted to 2 Days Per Week and Indoor Uses Reduced by 25%

! In Dry Years, Outdoor Uses Restricted to 1 Day Per Week and Indoor Uses Reduced by 40%

FARM LAND IN THE EVERGLADES AGRICULTURAL AREA AND WESTERN PORTIONS OF BROWARD AND DADE COUNTIES

Farm land acreage can be converted to water storage areas or wetlands to increase the flexibility of the water management system, increase the extent of natural areas, and reduce irrigation demand for water. Part of a plan to change the South Florida water management system could include reductions in existing farm land acreage in the Everglades Agricultural Area and in western portions of Broward and Dade counties that are adjacent to the Water Conservation Areas and Everglades National Park. The possible levels off farm land reductions that could be included in the plan are:

! *No Change in Farm Land Acreage*

! Reduce Farm Land Acreage by 100,000 Acres (15% of all Farm Acreage)

! Reduce Farm Land Acreage by 200,000 acres (30% of All Farm Acreage)

APPENDIX D

INFORMATIONAL VIDEO SCRIPT

Topic	Slide Num	Slide Description	Narrative Text
SECTION I INTRODUCTION AND HISTORIC EVERGLADES: ESTABLISHING AN ECOLOGICAL BASELINE			
Introduction		Satellite Video of South Florida	Viewed from high above, South Florida is rich in water resources. Water practically defines South Florida with its lakes, estuaries, and the Everglades. The purpose of this video is to provide you with information about the historic nature of the South Florida ecosystem and how that ecosystem has been changed to provide water-related services to the people of South Florida. After the video, we will ask you some questions to get your opinions about future changes in the water management system for the region.
Geographic Boundaries	1	Historic Everglades Basin: Uplands, Lowlands, Open Water.	Before the Twentieth Century, the defining feature of South Florida was the Everglades ecosystem. This system stretched from north of Lake Okeechobee to the Florida Keys in the south and covered an area 130 miles long and 50 miles wide. The system was made up of wetlands, upland areas, and open water.
Water Flow	2	Schematic map showing pre-drainage wet season high water surface flows through EG and to tide .	Surface water flow, which made the Everglades one of the largest freshwater marshes in the world, started at Lake Okeechobee and flowed like a river of grass to Florida Bay at the southern end of the state.
	3	Photo of saw grass marsh.	Flow from the Lake into the river of grass varied over the seasons and from year-to-year depending on rainfall.
Climatic Conditions	4	Schematic diagram of the hydrologic cycle.	This rainfall filled up surrounding marshes and recharged underground aquifers. Seasonal changes in rainfall affected the timing and flow of water and determined water levels in the Everglades.
	5	Chart showing annual rainfall, 1966-1990.	Rainfall in South Florida varies widely from less than 40 inches in dry years to more than 60 inches in wet years. Rainfall occurs during a wet season from May to October, and a dry season from November to April.
	6	Photo of hurricane winds and flooding.	During the wet season, hurricanes often produced heavy rains and flooding throughout South Florida.
	7	Photo of alligator hole habitat.	During the dry season alligator holes provided habitat for small fish and frogs and feeding areas for wading birds.
	8	Photo of Everglades fire.	When saw grass marshes dried out, fires caused by lightning were a natural part of the Everglade's ecosystem.

Topic	Slide Num	Slide Description	Narrative Text
Everglades Flora and Fauna	9	Photo of saw grass marsh	The variability in weather, and its effect on water flow, was the most important factor in creating a wide variety of natural habitats. Wetlands included saw grass marshes and tree islands which established themselves on higher ground within the marshes.
	10	Tree islands	There were also cypress swamps....
	11	Photo of cypress swamp.	tidal creeks and bays....
	12	Aerial photo of tidal creeks.	mangroves....
	13	Photo of mangroves with roosting birds and shallow marine coastal waters.	and sea grass beds in Florida Bay. The Everglades ecosystem also included dry land habitats such as hardwood hammocks....
	14	Photo of sea grass bed in Florida Bay	
	15	Photo of hardwood hammock	
	16	Photo of pine forest	pine forests....
	17	Photo of dry land prairie	and prairies.
	18	Photo of a spoonbill.	This blend of wetland and dry land habitat created one of the most diverse wildlife communities of any ecosystem in the world. Wetland areas supported more than 35 species of water birds and 50 reptile species.
	19	Photo of an egret	
	20	Photo of alligator.	Dry land areas supported more than 35 species of mammals and a wide variety of land birds.
	21	Photo of a deer	
	22	Photo of a scrub jay	
SECTION II PRESENT WATER MANAGEMENT SYSTEM and Infrastructure			
Geography	23	Slide with The Present Water Management System	In the past fifty years, the historic South Florida ecosystem has been changed to provide for a variety of water uses.
	24	Satellite photo of So. Fla./E.G. showing agriculture and urban development, with original area of E.G. outlined.	As shown by the dark line on the map, more than 50% of the historic Everglades has been drained to reclaim land for urban development and agricultural use. The white area to the right shows urban development along the Atlantic coast. The red area directly beneath Lake Okeechobee is farm land.
	25	Schematic map showing agriculture, storage wca's, and park lands.	The present water management system divides the historic Everglades into four separate regions: Lake Okeechobee, the Everglade's Agricultural Area, Water Conservation Areas, and Everglade's National Park. Water levels and flows in each region can be managed separately from the others.
	26	Map showing water flow in the present water management system	During the wet season, water levels in Lake Okeechobee and the Water Conservation Areas are controlled by releases to the Atlantic Ocean and Everglades National Park. During the dry season, releases are made to meet the agricultural, industrial, and household water needs of South Florida.

Topic	Slide Num	Slide Description	Narrative Text
Infrastructure	27	Aerial photo of Lake Okeechobee, dike and flood gates.	The present water management system consists of levees, canals, and water storage areas. Lake Okeechobee in the north is the beginning of the system.
	28	Aerial photo of canals and pumping station.	Water is pumped in a southward direction from the Lake through a managed system of six primary canals, an extensive network of secondary canals, and seven major pump stations.
	29	Aerial photo of levee and WCA	Water pumped from the Lake is stored in the Water Conservation Areas where it seeps into underground aquifers and well fields for urban and agricultural use.
Services Provided by Infrastructure			
Services Urban	30	Aerial photo of housing development adjacent to marsh.	Today's water management system provides services to urban, agricultural, and recreational users.
	31	Photo of flooded homes.	It serves to prevent seasonal flooding of residential areas although in very wet years some areas still experience problems.
	32	Slide of glass of water.	The Water Conservation Areas feed underground aquifers that are the primary water supply for South Florida's urban population of five million people and millions of tourists. By the year 2020, the population of South Florida is expected to increase by 40% to seven million people.
	33	Slide of lawn watering.	Also, water is supplied for outdoor uses such as watering lawns and washing cars.
Agricultural Services	34	Aerial photo showing ag. fields and adjacent canal.	The water management system provides services to agriculture in the form of drainage and irrigation, depending on the time of year. In the wet season, runoff from fields is pumped into large canals to prevent flooding. In the dry season, water is pumped from canals for crop irrigation.
	35	Photo of a sugarcane harvesting operation.	There are about a half million acres of crop land in the Everglades Agricultural Area just south of Lake Okeechobee, of which 85% is sugar cane.
	36	Photo of field and tractor.	Other crops produced in Palm Beach, Broward and Dade counties include sod for yards and golf courses, and vegetables such as radishes.....
	37	Photo of vegetable field	celery, corn, tomatoes and lettuce.
	38	Photo of fishing from a pier	The water management system also provides water for the environment so that residents and tourists can fish on freshwater lakes and rivers....
	39	Photo of men fishing in a boat	and on coastal bays.
	40	Aerial photo of boat in canal.	People can also enjoy boating ....
	41	Ranger with group tour	and observe wildlife.
B. Consequences of Controlling Water Flow in the Everglades			
	42	Map showing change in water flows direction.	Unfortunately, the present water management system has resulted in many unexpected consequences. Changes in water levels in Lake Okeechobee have damaged shore line habitat for fish and wildlife.

Topic	Slide Num	Slide Description	Narrative Text
	43	Schematic Map showing change in water flows	A significantly greater amount of water is now drained to the Atlantic Ocean rather than flowing through the Everglades to Florida Bay.
	44	Chart showing flows to tide and to ENP, pre- and post-drainage.	More than four times as much water flows to the Atlantic Ocean, causing damage to coastal estuaries. A 60% reduction in fresh water flows to Florida Bay has caused increased salinity in the Bay.
	45	Chart showing change in timing of flows.	The timing of water flows has also changed. Compared to historical flows, the current pattern of water flows are more uneven and move faster through the system.
	46	Map showing change in water levels in wet years	In these maps, wet areas are shown in green and blue, with dark blue indicating the highest water levels. In the historic system, water levels during the wet season were evenly distributed across the region and these areas were wet most of the year. In the present system, higher water levels are concentrated in a few areas. Some areas are much drier, even during the wet season.
	47	Map showing change in water levels in dry years	During the driest years, water levels in the historic system were lower than during the wet years, but were still evenly distributed across the region. In the present system, most of the region is dry in the driest years, including the Water Conservation Areas.
Wildlife	48	Slide of deer or other mammal in water	Changes in water depth, and the direction and timing of water flow, changed the pattern of wet and dry periods and adversely affected several Everglade's habitats. For example, storing water for long periods of time has resulted in unusually high water levels in some areas.
	49	Photo of heron in water	Wetland habitats for wading birds have been harmed by decreased water flows to the lower Everglades.
	50	Chart of wading bird population decline	As this chart shows, there has been about a 90% reduction in the number of wading birds in the lower Everglades in the last fifty years. Loss of habitat has resulted in the listing of 17 species of animals and birds as either endangered or threatened in South Florida.
	51	Aerial photo of Florida Bay.	Changes in the timing and flow of freshwater have also contributed to unusually high levels of salinity in Florida Bay.
	52	Photo of a damaged mangrove stand.	Once healthy mangroves along the coast have been damaged by high salinity levels and....
	53	Photo of a damaged sea grass bed.	during a recent dry period, about 100,000 acres of sea grass died back in Florida Bay.
	54	Shrimp boat in the bay.	These changes in the Bay have also harmed recreational fishing and the pink shrimp industry in the Florida Keys.
Groundwater/ Urban Consequence	55	Schematic of increasing salt water intrusion, 1904 and 1982.	The present water management system has also had consequences for drinking water supplies. Low water levels in wetlands, which replenish freshwater aquifers, have resulted in increased salt water intrusion into these aquifers. In the Miami area, for example, salt water intrusion has forced drinking water well fields to be located further inland.
	56	Aerial photo of suburban Coral Springs adjacent to Everglades	The growing population in South Florida requires more water for household uses. The increased demand puts pressure on groundwater supplies and may lead to future water shortages.
	57	Photo of water use restrictions placard.	Reduced rainfall and low levels of groundwater storage have sometimes led to restrictions on household water use.

Topic	Slide Num	Slide Description	Narrative Text
SECTION III : PLANNING FOR THE FUTURE			
	58	Slide with text: Planning For the Future	Public officials are now considering possible changes in the water management system in South Florida.
	59	Schematic map showing Alternative plans for restoration	A range of alternatives to change the mix of services provided by the present water management system are being considered. Many of these alternatives would take a decade or more to implement.
	60-65	Two-part slide of the Everglades and urban area (IFAS), and single slides of Everglades park, wildlife, sea grass bed, agriculture, and urban area.	The choice of which alternative to select will depend upon public opinion about the types of services to provide and the costs associated with a change in the water management system. Any decision will require tradeoffs between the various services described in this video and will have an impact on all Floridians.
	66	Four part video of various uses.	The purpose of the survey you are about to participate in is to ask your opinion about alternative water management plans for South Florida. Your opinion, along with those of other Florida citizens, is vital to this process and your participation is greatly appreciated.
	67	Slide with UF LOGO.	Thank you for your cooperation.

APPENDIX E

SUMMARY OF INTERVIWER EVALUATIONS OF RESPONDENTS

Respondent Distraction

Rating by Interviewer	Number of Respondents	Percentage of Respondents
Extremely distracted	12	2.5
Very distracted	11	2.3
Somewhat distracted	51	10.6
Slightly distracted	86	17.9
Not at all distracted	316	65.8
Not sure	4	0.8

Respondent Attentiveness

Rating by Interviewer	Number of Respondents	Percentage of Respondents
Extremely attentive	140	29.2
Very attentive	250	52.1
Somewhat attentive	75	15.6
Slightly attentive	10	2.1
Not at all attentive	5	1.0

Respondent Understanding of Material

Rating by Interviewer	Number of Respondents	Percentage of Respondents
Extremely well undestood	116	24.2
Very well understood	236	49.2
Somewhat understood	103	21.5
Slightly understood	17	3.5

Not at all understood	3	0.6
Not sure	5	1.0

Respondent Difficulty With Attributes

Rating by Interviewer	Number of Respondents	Percentage of Respondents
Yes (had difficulty)	36	7.5
No (had no difficulty)	444	92.5

Respondent Difficulty With Choosing Plans

Rating by Interviewer	Number of Respondents	Percentage of Respondents
Yes (had difficulty)	43	9.0
No (had no difficulty)	434	90.4

Respondent Seriousness

Rating by Interviewer	Number of Respondents	Percentage of Respondents
Extremely serious	153	31.9
Very serious	167	34.8
Somewhat serious	127	26.5
Slightly serious	16	3.3
Not at all serious	3	0.6
Missing	14	2.9