This is to certify that the
dissertation entitled

PUBLIC PREFERENCES AND NONMARKET VALUES FOR THE MANAGEMENT OF FOREST ECOSYSTEM SERVICES

presented by

LAILA ANNA RACEVSKIS

has been accepted towards fulfillment
of the requirements for the

Doctoral degree in Agricultural Economics

Major Professor's Signature

12/15/2005

Date

PUBLIC PREFERENCES AND NONMARKET VALUES FOR THE MANAGEMENT OF FOREST ECOSYSTEM SERVICES

By

Laila Anna Racevskis

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

2005

ABSTRACT

PUBLIC PREFERENCES AND NONMARKET VALUES FOR
THE MANAGEMENT OF FOREST ECOSYSTEM SERVICES

By

Laila Anna Racevskis

This research uses a variety of techniques to investigate public preferences for and attitudes towards the management of forest ecosystem services among Michigan residents in order to provide information useful to natural resource managers and policy makers. The study focuses on a forested area in Michigan's Upper Peninsula to analyze public preferences for forest management in this region. The study forest is a timber dependent region with a history of intense timber harvesting. This area is also characterized by high winter deer densities that are potentially affecting tree regeneration and by the existence of important habitat for migratory forest songbirds. The interactions between deer populations and timber harvesting activities have adversely affected habitat for these songbirds. The presence of many complex interactions between humans, forests and wildlife in this area makes it an ideal setting in which to examine public preferences for tradeoffs between various forest ecosystem services.

The research is divided into four essays. Essay 1 is based on the results of focus groups that were conducted as part of the qualitative research design of the survey instrument. Analyses in essays 2, 3 and 4 are based on data collected from a mail survey of 2,000 Michigan residents, which collected data on forest management and environmental attitudes, demographic characteristics and stated preference contingent valuation data.

The first essay uses qualitative research techniques to analyze the results of a

series of focus group discussions held in and near the study forest. This research finds that residents of rural, timber-dependent communities do not hold purely anthropocentric forest management values and urban, non-timber dependent residents do not hold purely biocentric values.

The second essay uses factor analysis to identify an underlying structure to environmental and forest management attitude data and uses resulting factor scores in a regression analysis of factor scores on a set of demographic characteristics. This study concludes that environmental and forest management attitudes can be reduced into a set of 5 factors, which can, in turn, be interpreted according to an anthropocentric/biocentric value framework. Regression results show that area of residence, age, membership in an environmental organization and political views can explain factor scores that reflect particular value orientations.

The third and fourth essays utilize the attribute-based referenda (ABR) model, a variant of the contingent valuation method (CVM) to estimate nonmarket values for forest ecosystem attributes of the study area. An orthogonal main effects design was used to create choice sets presented to survey respondents. A dichotomous choice referendum question elicited stated preference data used to estimate a series of random effects probit models used to estimate willingness to pay (WTP) for a possible forest easement program. Essay 3 estimates the marginal effects and marginal dollar values of forest easement program attributes as well as the effects of a set of demographic characteristics on WTP. Essay 4 estimates the effects of distance, environmental attitudes and recreational use on WTP.

To my husband, Wolfgang, my parents, Maija and Karlis Racevskis,

my grandmother, Austra Līdacis, and in memory of my grandfather, Arvīds Līdacis

ACKNOWLEDGMENTS

Many people have helped me in the completion of this dissertation, and I would like to acknowledge and thank them here. I would like to thank Frank Lupi, my academic advisor, for being a wonderful mentor and for his constant support throughout this process. His expert guidance and generosity with his time and ideas have enriched my graduate school experience and have contributed greatly to my personal and professional development over the years. I feel very fortunate to have had an advisor whose help, kindness, patience and concern for my well being helped make my doctoral program an enjoyable and rewarding experience. I would also like to thank the members of my committee, Sandra Batie, Pat Norris and Karen Potter-Witter for the valuable contributions they have made to help improve this work and for the support and encouragement they have all given me along the way.

I would like to thank the Michigan Department of Natural Resources, USDA National Research Initiative of the USDA Cooperative State Research, Educational and Extension Service grant #MICL08292, Michigan State University Department of Agricultural Economics, the Michigan State University Environmental Science and Policy Program and the Michigan State University Graduate School for their financial support that contributed to the completion of this work.

I am very grateful to Jack Liu, Mike Walters, Haijin Shi, Ed Laurent, Joseph LeBouton and Kim Hall, the members of the Ecological Economics research team. Their dedication to our team project was instrumental to the completion of my work. I would especially like to thank Ed, Joseph and Kim for spending countless hours discussing forests, deer and birds and for taking the time to review and provide feedback on many

survey drafts. I greatly appreciate their time and efforts.

I would like to express my appreciation to the staff of the Department of Agricultural Economics for all of their help throughout my time here. I would especially like to thank Ann Robinson for her generosity in providing me with office space and resources to help with my survey mailings.

Many thanks go to fellow graduate students, past and present. In particular, I would like to thank Wei Zhang, David Mather, Tsitsi Makombe, Meera Manojkumar, Miguel Zamora and Kathryn Moeller, Brady Deaton, Meeta Punjabi, Kofi Nouve and Asfaw Negassa for their friendship, support and encouragement over the years. I would also like to thank Melissa Gibson and Oscar Arreola for taking the time to help me with the survey implementation process.

I thank my friends who are truly like family, Elaine Zamonski, Rebecca Watson, Andria Shaman and Ellen Sturm for believing in me, laughing with me and keeping me sane. I would also like to thank Zara Bennett, Michelle McGreevy, Mehnaz Safavian and Maria Pagura for their constant support and for inspiring me to reach this goal.

I am extremely grateful to my family for all of their love, support and encouragement. My parents deserve countless thanks for their unwavering and unending support, devotion and love, for all the trips to East Lansing, for providing a sympathetic and understanding ear at all hours of the day and night, and for being a constant source of inspiration to me. In remembrance of my grandfather, Arvīds Līdacis, I would like to thank him and my grandmother, Austra Līdacis, for their love, sacrifices, wisdom and kind words that continue to inspire me in everything I do. I thank my brothers, Andrew and Roland, my sisters-in-law, Megan and Lynnette, and my beautiful nieces, Sofia and Rosa, for all the crazy fun, joy and laughter they have brought to my life. My deepest

gratitude goes to my husband Wolfgang, for his belief in me, his eternal optimism and for being there for me through it all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

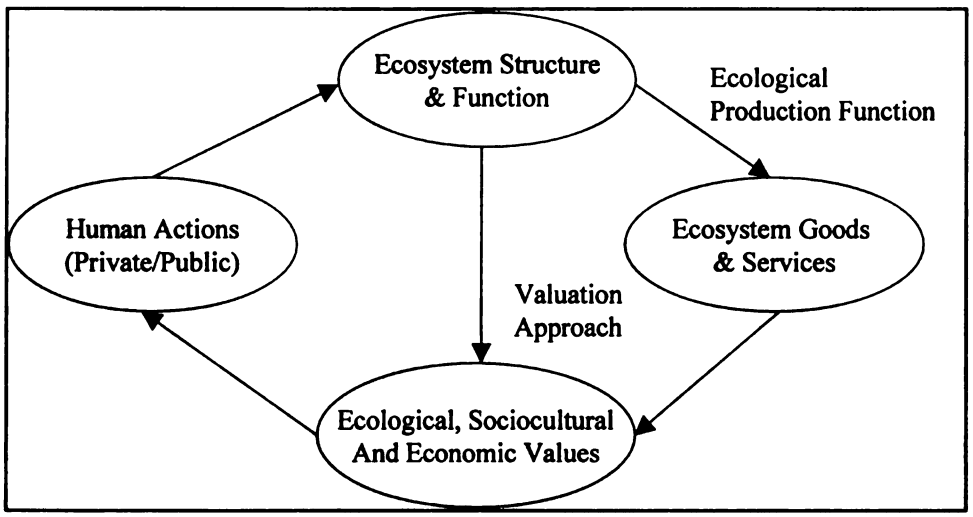
Ecosystems provide a wide variety of services that benefit human beings, including the production of food, fiber and water as well as other services, including recreation, cultural values, soil building and many others (Daily 1997, Heinz 2002, MA 2003). Achievement of the production of ecosystem services, such as food and fiber, often occurs at a cost to the provision of other services, such as wildlife habitat or water quality (MA 2003). Humans are dependent on the services provided by ecosystems (MA 2003), and many ecosystem services are currently being degraded or are being used in an unsustainable way (MA 2005). It is important to understand the benefits of ecosystem goods and services to society in order to effectively evaluate the tradeoffs that are made between the provision of different types of ecosystem goods and services (NRC 2005). Some ecosystem services, such as the production of food and fiber, can be quantified by placing a monetary value on them, but there are many other ecosystem goods and services that are very important to society, the benefits of which have not been quantified extensively (MA 2005).

Ecosystems are valued by people because they provide services that satisfy material and nonmaterial human needs (MA 2003). Many methods have been developed by numerous disciplines to conceptualize the values that ecosystems provide to humans (ibid). Ecosystem functions, when conceptualized in terms of the benefits they provide to humans, are referred to as ecosystem goods and services (de Groot et al. 2002). The values that these ecosystem goods and services provide to people can be placed into three categories:

1. Ecological values, which include criteria used to determine the capacity of ecosystems to provide these goods and services,
2. Sociocultural values, which include the social values and perceptions that determine the importance of ecosystems to people, and
3. Economic values, which include the market and nonmarket values of ecosystem services (de Groot et al. 2002).

Human actions affect the structure and function of ecosystems, which affect provision of ecosystem goods and services (NRC 2005). Humans have values for these goods and services, and these values, in turn, affect human behavior and action, which feeds back to affect ecosystem structure and function (ibid). This cyclical framework is illustrated in Figure I. Human well being is affected by the ways in which ecosystem goods and services are managed, and the ability to make informed management decisions relies on information on ecosystem patterns and conditions as well as economic, political, social and cultural consequences of management decisions (MA 2003). These relationships illustrate the importance of incorporating knowledge of ecology, economics and human values in natural resource allocation decisions.

Figure I. Ecosystem Valuation Framework



Adapted from NRC 2005

In order to assess the consequences of resource management decisions on ecosystem service provision, economic valuation methods are used as a means of comparing ecosystem services using a common metric (MA 2003). Economic valuation is based in the utilitarian paradigm, within which the concept of value is based on the idea that individuals derive utility from given ecosystem services (ibid). However, individuals may also hold sociocultural values for ecosystem services that are not easliy measured using the monetary metric of economic valuation methods (ibid). This research investigates both economic and non-economic (sociocultural) values that people hold for ecosystem goods and services.

Many different views exist across different disciplines on how to conceptualize the values derived from ecosystems (NRC 2005). Within the social forestry literature, the anthropocentric/biocentric continuum has been used to conceptualize the range of

values that people hold with respect to the management of forest ecosystem services. Anthropocentric values in this context refer to values that emphasize the instrumental and extractive uses of forest ecosystems for human benefit, whereas biocentric values emphasize the intrinsic value of forest ecosystems and the importance of their use for non-humans (Tarrant and Cordell 2002). This research implements this conceptualization of forest ecosystem value orientations and further bases the analysis in a cognitive hierarchy framework, in which values underlie attitudes and attitudes affect behavior (McFarlane and Boxall 2000).

Natural resource management and policy making utilize information on public preferences for resource management. Characterizing segments of the public that tend to hold particular resource management views can contribute to an increased understanding of individuals' motivations, behavior and acceptance of natural resource policies. This work is presented as a suite of analyses that explore Michigan residents' views, attitudes and preferences related to the management of forest ecosystem services in an area of Michigan's Upper Peninsula. The analyses contribute to understanding the characteristics of individuals that can assist in predicting acceptability of certain policy initiatives among different segments of the population. This information can be a useful input to educational efforts aimed at disseminating information on natural resource management efforts as well as to natural resource policy design. This work contributes to the literature on the integration of ecological and economic analyses in order to better understand the connections between human actions, ecological consequences and the values generated by ecosystem goods and services.

This research focuses on an area of Michigan in which forests are increasingly being managed for multiple uses. Multiple use forest management decisions involve

many different stakeholders who frequently have conflicting interests. For example, resource allocation decisions require making trade-offs between managing for timber production versus managing for improving wildlife habitat. Forests provide services that are bought and sold in the market (e.g. timber), and they also generate benefits that are not traded in the market and therefore do not have market values associated with them (e.g. wildlife habitat). A principal motivation of this research was to estimate the nonmarket values generated by forest ecosystem services in this area of Michigan and to gain an understanding of public views of and preferences for the tradeoffs involved in multiple use forest management. In addition, a goal of the research was to investigate public attitudes towards forest management in this region and to establish connections between attitudes, demographic characteristics and nonmarket values.

To assess public preferences for multiple use forest management in an area of Michigan's Upper Peninsula, this study uses results from a mail survey of 2,000 Michigan residents to analyze the relationships between demographic characteristics, environmental and resource management attitudes, and nonmarket values of forest ecosystem attributes. The research was guided by the following objectives:

1. To gain a better understanding of public views and perceptions of forest-human-wildlife interactions in Michigan's western Upper Peninsula;
2. To understand how demographic characteristics and environmental and forest management attitudes are related;
3. To estimate non-market values of forest ecosystem characteristics in Michigan's western Upper Peninsula; and

4. To determine how distance, attitudes and recreational use affect the results of nonmarket valuation analysis of forest ecosystem attributes in Michigan's western Upper Peninsula.

The study area consists of about 500,000 ha of forested land in Michigan's western Upper Peninsula and includes parts of Baraga, Dickinson, Iron, Marquette, and Menominee counties (See Figure 1.1 in Essay 1 for a map of the study area). This research forms part of a larger project conducted by ecologists and foresters within the same defined study area. The development of the survey used to collect socioeconomic and non-market value data was aided by the work of ecologists done in the same location. These researchers have collected data on tree sapling regeneration, deer densities, and bird species diversity and have estimated the effects of forest management on these variables as well as the effect of deer populations on tree regeneration and bird diversity. The ability to integrate ecological and economic information in the same study area makes this project a unique opportunity to explore the economic and ecological effects of different forest management practices.

This region was chosen for its diverse ecological landscape, for its variety of industrial and recreational uses of its forests, and for the presence of various forest management methods. There are several issues of concern in this area relating to forest and wildlife management. For example, there are concerns that timber harvesting may be affecting wildlife habitat by removing cover in some areas through practices such as clearcutting. There are also concerns that high deer densities are affecting regeneration of commercially valuable tree species. The deer population, by reducing tree regeneration, may be adversely affecting the habitat for other wildlife, such as certain types of

songbirds. The effects of deer on forest regeneration may decrease future timber availability for the forest products industry as well as change the structure and composition of forested areas used for recreation, which could impact local economies.

The effects of forest management practices on forest structure and on deer populations, as well as the effects of deer on forest structure and wildlife, illustrate a few of the many complex interactions within a managed forest ecosystem. Forests provide timber, wildlife habitat, recreation, aesthetics, clean air, water filtration, and other ecosystem functions. Forest management decisions result in different levels of these market and non-market outputs, and trade-offs must be made between competing needs of different stakeholders. Understanding the preferences and attitudes of the public toward management of forest resources is an important component of forest policy making. The study area used in this project provides an appropriate setting in which to examine public preferences for multiple use forest management.

The research is presented in the form of four separate essays, which together have a common focus in that they investigate individuals' preferences for the management of forest resources. Research methods used in the essays include qualitative and quantitative ones and include several different analytical methods. The first essay employs content analysis of focus group data, the second uses factor and regression analysis and the third and fourth essays implement contingent valuation methodology. The essays together contribute to understanding the ways in which individuals' characteristics influence preferences for natural resource management.

The first essay, which is in press at the journal *Society and Natural Resources*, reports the results of a series of focus groups held in and near the study area. This paper focuses on the differences in perceptions of and familiarity with the management of

forest ecosystems in the study area between urban and rural demographic groups. The study examines how urban and rural residents' views fall along an anthropocentric/biocentric continuum. This work contributes to understanding the ways in which rural, timber dependent and urban, non-timber dependent community residents view natural resource management.

The second essay provides a deeper exploration of the range of anthropocentric to biocentric values that underlie individuals' environmental and forest management attitudes. This study uses attitudinal data collected from the mail survey to conduct factor and regression analysis. Factor analysis is used to identify the underlying structure of the attitudinal data and to identify whether the attitudinal data can be conceptualized using the anthropocentric/biocentric continuum framework. The results of the factor analysis are used as inputs to OLS regression of respondent demographic characteristics on factor scores that reflect a range of anthropocentric to biocentric attitudes towards the environment and forest management. The analysis in this essay contributes to understanding the environmental and forest management attitudes of different demographic groups and has implications for the types of values (anthropocentric versus biocentric) held by different segments of the population.

The third essay presents a nonmarket valuation analysis of major forest ecosystem services in the study area. The analysis uses an attribute-based referenda framework based in random utility theory. The objective of this study is to estimate nonmarket values for the forest ecosystem attributes of possible forest easement programs in the study area. The attribute-based framework allows estimation of the tradeoffs individuals are willing to make between different forest ecosystem attributes. The analysis also investigates the demographic characteristics that have an effect on willingness to pay.

The fourth essay also employs nonmarket valuation of forest ecosystem attributes, utilizing the same theoretical framework established in Essay 3. This essay explores the effects of distance, attitudes and recreational use on willingness to pay. This research contributes to the literature on defining the extent of the market for environmental goods and services in nonmarket valuation literature, as well as the literature on incorporating attitudinal data in nonmarket valuation studies.

REFERENCES

Daily, G.C. 1997. Introduction: What are ecosystem services? In *Nature's Services: Societal Dependence on Natural Ecosystems*, edited by G. C. Daily. Washington, D.C.: Island Press.

de Groot, R.S., M.A. Wilson, and R.M.J. Boumans. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics* 41:393-408.

Heinz (The H. John Heinz III Center for Science, Economics and the Environment). 2002. *The State of the Nation's Ecosystems: Measuring the Lands, Waters, and Living Resources of the United States*. Cambridge, UK: Cambridge University Press.

MA (Millenium Ecosystem Assessment). 2003. *Ecosystems and Human Well Being: A Framework for Assessment*. Washington, D.C.: Island Press.

———. 2005. *Ecosystems and Human Well Being: Synthesis*. Washington, D.C.: Island Press.

McFarlane, B.L. and P.C. Boxall. 2000. Factors Influencing Forest Values and Attitudes of Two Stakeholder Groups: The Case of the Foothills Model Forest, Alberta, Canada. *Society and Natural Resources* 13:649-661.

NRC (National Research Council). 2005. *Valuing Ecosystem Services: Toward Better Environmental Decision Making*. Washington, D.C.: The National Academies Press.

Tarrant, M., and H. Cordell. 2002. Amenity values of public and private forests: Examining the value-attitude relationship. *Environmental Management* 30 (5):692-703.

Essay 1:
Comparing Urban and Rural Perceptions of and Familiarity with the Management of Forest Ecosystems[1]

1.1 Introduction & Rationale for Research

The focus of forest management on public and private lands has changed considerably over the past decade due to increased public concern for wildlife, recreation and aesthetics (Steel et al. 1994, Tarrant and Cordell 2002). As a result, management of forests for multiple uses has emerged as an important goal for forest land managers. Multiple use forest management involves trade-offs between frequently conflicting forest management goals. For example, the resources provided by forest ecosystems generate both market (e.g. timber) and non-market (e.g. wildlife) values to individuals. This research uses the results of six focus group discussions to understand how the public perceives these tradeoffs and to examine differences between urban and rural groups in an area of Michigan's Central Upper Peninsula[2].

Information on public preferences for forest management is critical for effective resource management decision making (Bingham et al. 1995, Boxall and Macnab 2000, Dennis 1998, Jacobson and Marynowski 1997, McFarlane and Boxall 2000, Stein et al. 1999, Tarrant and Cordell 2002, Zinkhan et al. 1997). Social acceptability is important to the forest policy-making process (Kearney 2001), and clear communication of management options to the public can help increase public acceptability of forest policies (Shindler et al. 2002). This communication process begins by understanding public preferences for and knowledge of different forest management alternatives, and this

[1] This essay is currently in press at *Society and Natural Resources*
[2] This area is referred to in this essay as the "study area," while in Essays 2, 3 and 4 it is referred to as the "study forest."

process is a key to connecting management regimes with publicly acceptable ecosystem outcomes.

Public preferences for forest ecosystem management may vary by demographic characteristics (Bourke and Luloff 1994, Dietz et al. 1998, Jacobson and Marynowski 1997, McFarlane and Boxall 2000, Reading et al. 1994, Steel et al. 1994, Tahvanainen et al. 2001) or by the level and type of interaction with the resource (Gobster 2001). Numerous studies have examined the influence of socioeconomic factors on forest values and attitudes (Bourke and Luloff 1994, Dietz et al. 1998, McFarlane and Boxall 2000, Reading et al. 1994, Solecki 1998, Steel et al. 1994). Attitudes towards and preferences for natural resource management may differ between rural and urban groups (Brunson et al. 1997, Ribe and Matteson 2002, Tremblay and Dunlap 1978). In addition to the urban-rural distinction, it is also possible to differentiate communities based on whether or not they are dependent on timber for economic stability. The "jobs versus owls" controversy in the northwest U.S. is often portrayed as an urban/rural issue but may be better described by timber-dependent versus non-timber-dependent households (Brunson et al. 1997). There may be differences in forest management preferences between timber-dependent rural and non-timber-dependent rural populations (Xu et al. 2003). Other studies have examined the effects of geographic location on resource management preferences in the context of community-based ecosystem management (Bandara and Tisdell 2003, Cordell and Tarrant 2002, Noss and Cuellar 2001, Obiri and Lawes 2002, Stein et al. 1999).

Many studies in the social forestry literature have concluded that residents of timber-dependent (often rural) communities tend to be more in favor of resource extraction, and residents of communities not dependent on timber (often urban) tend to

favor resource protection (Brunson et al. 1997, McFarlane and Boxall 2000, Steel et al. 1994, Tarrant and Cordell 2002, Tremblay and Dunlap 1978). This theme in the social forestry literature is sometimes referred to as the "anthropocentric/biocentric continuum," in which timber-dependent communities fall at the anthropocentric end and non-timber-dependent communities fall at the biocentric end (Tarrant and Cordell 2002). In other words, residents of communities that are dependent on forest resources for economic stability are more likely to support forest management that promotes resource extraction and emphasizes instrumental values of forests and are less likely to be concerned about the intrinsic value of forests for their own sake or their ecological and life support values, and vice versa (Steel et al. 1994, Tarrant and Cordell 2002). Drawing upon this literature, the guiding hypothesis of this study is that rural, timber-dependent community residents will hold strong anthropocentric views of forest management and urban, non-timber-dependent community residents will hold strong biocentric views of forest management. This hypothesis is examined for a managed forest ecosystem in Michigan's Upper Peninsula. The forest ecosystem includes rural, timber dependent communities and draws recreational users from a nearby urban area.

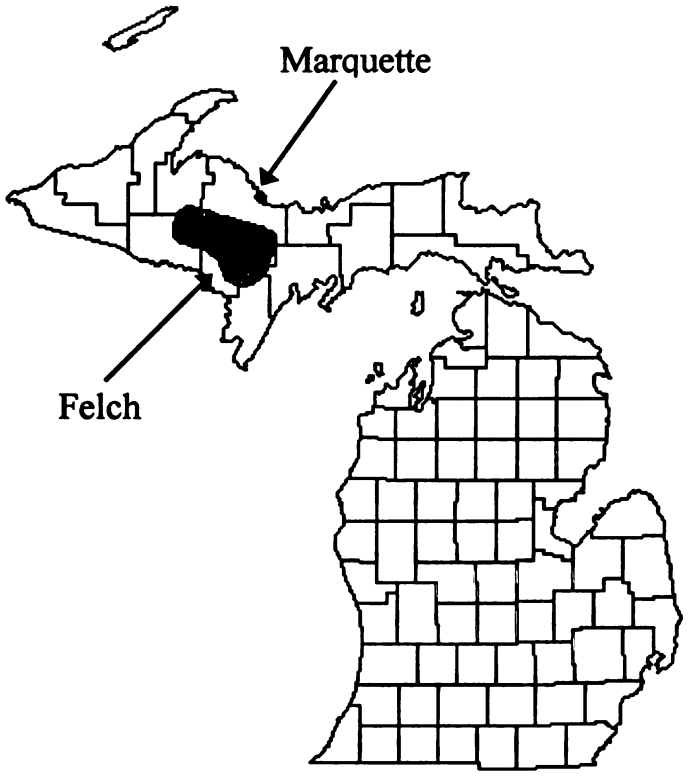
Forest ecosystems provide timber, wildlife habitat, recreation, aesthetics, clean air, water filtration and other ecological functions. Forest management decisions result in different levels of these market and non-market outputs, and trade-offs must be made between competing needs of different stakeholders. In the study area, prior forest management decisions have had ecological effects on forest structure, deer populations and forest migratory songbird habitat. Forest management also affects the local timber-dependent economy in this area, resulting in numerous complex interactions among humans, forests and wildlife.

This study was undertaken to provide policy makers and resource managers with information on public preferences for and familiarity with forests and forest management in this area of Michigan. The following research objectives were identified: 1) Identify forest ecosystem services recognized by the public; 2) Explore public familiarity with and perceptions of forest management, forest land ownership and forest/human/wildlife interactions in an area of Michigan's Upper Peninsula; and 3) Determine whether urban-rural differences exist with respect to the topics explored in Objectives 1 and 2.

1.2. Study Area

The study focuses on an area of about 500,000 ha of forested land in Michigan's Central Upper Peninsula and includes parts of Baraga, Dickinson, Iron, Marquette, and Menominee counties (See Figure 1). This region was chosen for its diverse ecological landscape, variety of industrial and recreational uses of its forests, and for the presence of various forest management methods. In order to achieve research objective 3 and to test the hypothesis that timber-dependent community residents will hold anthropocentric views of forest management and non-timber-dependent community residents will hold biocentric views, the study area is defined as a rural, timber-dependent area and the views of its residents are compared to Marquette, a nearby urban area that is not timber dependent.

Figure 1.1 Map of Michigan with Study Area Highlighted



1.2.1. Ecological characteristics of the Study Area

The study area consists of forest ecosystems in which complex interactions exist between forest management practices, forest structure and composition, deer populations, and forest migratory songbirds. The study area provides unique and important breeding habitat for many species of neo-tropical migratory forest songbirds (Howe et al. 1995). Winter deer density in this area is higher in locations with high intensity timber harvests (unpublished data, Michigan Department of Natural Resources). Decreases in regeneration rates of some trees, such as northern white cedar and sugar maple, may be related to these high winter deer densities (Miller 1997, Miller et al. 1990, DeCalesta

2000, LeBouton et al. 2003). Changes in tree regeneration may, in turn, be adversely affecting habitat for neo-tropical migratory forest songbirds in the area (Laurent et al. 2003). In addition, these changes may affect the local economy by decreasing future timber availability as well as changing the structure and composition of forested areas used for recreation. The existence of these and many other complex interactions between people, forests and wildlife within this managed forest ecosystem, make it an appropriate setting in which to examine public preferences for multiple use forest management.

1.2.2. Economic and demographic characteristics of the study area and Marquette

The study area is also characterized by economic dependence on timber resources. Dominated by public and private forest lands, it is a sparsely populated region made up of natural resource-dependent communities that rely on timber, tourism and recreation for income, employment and economic sustainability, making it similar to many other areas of the Upper Peninsula (McDonough et al. 1999, Potter-Witter 1995). Two common indicators of resource dependence are employment levels in a particular sector and the percent of land devoted to a particular industry (Bailey 2004, Machlis and Force 1988). Direct forest-based employment (logging, sawmills and wood product manufacturing) accounts for 12 to 28 percent of total employment in the study area (U.S. Census Bureau 2004c). Two large industrial landholders and several small mills in this area produce valuable forest products such as dimensional lumber, poles, posts, veneer, and pulp. This area is 90 percent forested, and the land is owned primarily by forest industry (43%) and the state (42%) (Pugh et al. 2001).

The nearby city of Marquette and its surrounding area are not timber-dependent. In the Marquette zip code area, 4% of the land is owned by the forest industry, and 17 %

is state-owned (Pugh et al. 2001). Direct forest-based employment in the Marquette area is less than one percent of total employment (U.S. Census Bureau 2004c). In the zip code area of Negaunee, adjacent to the Marquette zip code area, employment in forest-based jobs accounts for 1 to 3% of total employment in that area. Moving further west to the zip code area of Ishpeming, adjacent to Negaunee, employment in forest industry accounts for 4 to 9% of total employment (U.S. Census Bureau 2004c). Employment in forest products industry increases as distance from the city of Marquette increases. Although Marquette County produces large amounts of timber, Marquette city is not timber-dependent and is substantially different in this respect from our study area.

Marquette and the study area also differ in population and population density. Populations of communities within the study area range from 350 to 2,064 (U.S. Census 2004d), and are defined as rural according to the U.S. Census definition (less than 2,500 residents)(U.S. Census Bureau 2004a). The city of Marquette is an urban area with a population of 19,598 and is the largest city in the Upper Peninsula (U.S. Census 2004b). The population density of the city of Marquette is 120 to 1,999 people per square mile, and Marquette Township has a population density of 60 to 119 people per square mile (MTA 2004). By contrast, almost all of the townships that fall within our study area have population densities of less than 20 people per square mile, with one township having 20 to 59 people per square mile (MTA 2004).

Although Marquette is not a typical large urban center, the intent of this study was not to compare views of residents in the study area with those of a large urban area such as Detroit. Rather, the study sought to compare urban and rural residents' views of a natural resource with which both groups have some familiarity. There are substantial differences in population, population density and economic dependency between

Marquette and our study area, which, along with the existing literature, suggest that the views of their residents may also be different.

1.3. Methods

Focus groups are a research method that collects data using group discussions based on a topic defined by the researcher (Morgan 1997, p.6). The goal of this study is to understand differences in perceptions and the range of understanding that rural, timber-dependent and urban, non-timber-dependent community residents have of forests and forest/human/wildlife interactions. Focus groups are a well-accepted method of eliciting information from participants through open-ended questions, allowing participants to respond in a manner of their own choosing (Kreuger and Casey 2000, p.5; Morgan 1997, p.5). By obtaining information on familiarity and perceptions of forest management in an open-ended discussion format, results of focus groups allow us to gain an understanding of public views of forest resources.

The goals of focus groups are to listen to people, encourage them to share their points of view in a permissive environment, and to gather information about people's perceptions by listening to their discussion (Kreuger and Casey 2000, p.4). This method allows respondents' discussions to reveal their familiarity with a subject as well as their preferences, beliefs and opinions. Numerous studies have used focus groups to assess public preferences for and perceptions of natural resources and their attributes (Kaplowitz and Hoehn 2001, Minnis et al. 1997, Pomeroy and Beck 1999, Smith and McDonough 2001, Winter and Fried 2000). They have also been used in studies to evaluate forest recreation preferences (Mitra 1994) and to understand why people value forests (Hull et al. 2001).

To accomplish the outlined research objectives, six focus groups were conducted in Michigan's Central Upper Peninsula. Planning the study is an integral part of conducting focus group research (Kreuger and Casey 2000, p.21). The structure of the focus group discussions was carefully developed based on input from ecologists and foresters collaborating on this project. The discussions were structured around the following topics: perceptions of forest services and uses of forests; goals of forest management; forest land ownership; effects of management on forests, deer and other wildlife; and effects of deer on forests and wildlife.

The ideal size of a focus group is between 6 and 8 participants (Kreuger and Casey 2000, p.73). It is typical to over-recruit for a focus group because of the risk of no-shows (Morgan 1997, p.42). Therefore, fifteen individuals were recruited for each group to ensure that 8 people would arrive and participate. Focus group recruitment was conducted by systematic random sampling of individual names from area telephone directories for the city of Marquette and Felch Township to form the urban and rural groups, respectively. Potential participants were told that the discussion would be about issues concerning Michigan's Upper Peninsula but were given no further details on the topic of the discussion groups.

All individuals who showed up for a focus group were paid a $40 honorarium, and eight people were kept to participate in the discussions. Following standard practice, when more than eight individuals arrived, some individuals were dismissed and sent home with their honorarium (Goldman and McDonald 1987, p.34). All urban participants resided in the city of Marquette, and all rural participants lived in small towns in the study area (Felch, 8; Foster City, 7; Hardwood, 4; Vulcan, 1; Ralph, 3), with

the exception of one participant from Kingsford (population 5,666), which shares a telephone exchange with Felch.

Discussions were structured around the previously mentioned topics and lasted about two hours. Each discussion was tape recorded, and a systematic analysis was conducted of the focus group data (Kreuger and Casey 2000, p.128). Discussion questions were designed to allow participants to become familiar with topics before launching into key questions. Information from notes taken by the assistant moderator was incorporated in the results, and the transcribed discussions were analyzed for content. Transcripts were coded by attaching labels to each theme every time it appeared (ibid, p.130). Transcripts were reviewed carefully in order to ensure that participant comments were correctly interpreted. This is a method of verifying the intent of participant comments after the focus groups have been conducted (ibid, p.128). Debriefing occurred between the moderator and assistant moderator following the discussions in order to exchange impressions and main points that emerged from the groups. Comments made by participants were organized into theme groups to illustrate similarities and differences between the urban and rural discussions.

The use of numbers in reporting focus group results is controversial (Kaplowitz 2000). Caution should be used when reporting numbers, and some researchers recommend not using numbers in focus group reporting at all (Kreuger and Casey 2000, p.141). However, others assert that frequency counts of coded comments, or "descriptive counting," are especially useful in studies that seek to compare different types of groups to reveal how often different topics were mentioned in each group (Morgan 1997, p.61, Shively 1992). Descriptive statistics on participants are reported in Table 1, and frequencies and extensiveness of comments are reported in Table 2. It is important to

emphasize that these numbers should not be used to generalize to the population because the sample size is too small. Importance of comments should be determined by the specificity, detail, emotion and intensity of comments as well as extensiveness, or how many people made each type of comment (Kreuger and Casey 2000, p.136). Therefore, Table 2 reports comment frequencies and extensiveness as supplements to the detailed presentation of the discussion content in order to illustrate the differences between the urban and rural groups.

1.4. Results and Discussion

1.4.1 Focus Group Participant Characteristics

The socioeconomic characteristics of focus group participants are reported in Table 1. The rural participants had, on average, lived in the U.P. and Michigan longer than the urban participants, though these differences are not statistically significant at the ten percent level. Most urban participants owned zero acres of property in the study area, while most rural participants owned ten or more acres in the study area, and this difference is statistically significant[3]. Urban participant ages are more concentrated in lower age groups while rural participant ages tend toward higher age groups. The number of urban participants holding a college degree or higher is larger than in the rural groups. Urban-rural differences in age and education levels are statistically significant[4]. Information about participant occupations was also collected. In the urban groups, 3 participants were employed in medicine or higher education, and no participants in the rural groups had jobs in these fields. No participants in the urban groups had forest-

[3] The Mann Whitney U test was used to test statistical significance.
[4] The Pearson Chi Square test was used to test statistical significance.

related jobs, while in the rural groups, two participants had jobs in logging, suggesting that occupation types differed slightly between the rural and urban groups.

Table 1.1 Socioeconomic Characteristics of Urban and Rural Focus Group Participants

Socioeconomic Characteristic	Urban *(n=24)*	Rural *(n=24)*
Average years lived in the U.P.	31	35
Average years lived in Michigan	39	46
Property ownership in Study Area**		
Median acres owned in study area	0	43
# of people owning 0 acres in study area	22	0
# of people owning 1-50 acres in study area	0	13
# of people owning 50-500 acres in study area	1	10
# of people owning >500 acres in study area	1	1
Age*		
Median age group	40-49	50-59
# of people <50 years old	16	7
# of people >50 years old	8	16
Household income		
Median household income level	$26-50K	$26-50K
# of people with <$50,000 in annual household income	13	12
# of people with >$50,000 in annual household income	10	9
Education**		
Median education level	Associate's degree	Some college
# of people with Associate's Degree or lower	16	20
# of people with College degree or higher	8	4

* = $p < 0.10$; ** = $p < 0.05$

1.4.2. Focus Group Participant Comments

Content analysis of discussion group transcripts revealed that most rural participants were able to speak with a high degree of specificity about forest/wildlife/human interactions in the study area, and most urban participants spoke of these interactions in less detail and exhibited a lower level of familiarity with forest

management than the rural participants. Rural participants exhibited a closer connection with the forest resources and discussed with emotion a broad range of non-market services provided by forests. Urban participants did not display as close a connection to the resource and expressed emotion over a smaller range of non-market services of forests, with an emphasis on recreational uses. These results are consistent with the findings of Stein et al. (1999) who concluded that rural community residents have a closer connection to the resource and receive more non-market benefits of forest resources than urban residents and, in fact, may be more likely to value these forest services than urban residents. However, a few urban participants who had interacted more closely with the resource (e.g. hunters or land owners in the study area) were able to speak with greater specificity and detail about forest management and wildlife interactions. This suggests that differences in perceptions, attitudes, and familiarity with forest ecosystems are also related to experiences with the resource.

The following sections describe major themes that emerged from the discussions and highlight corresponding similarities or differences between the groups. Comments are organized around the following themes: 1) forest services, 2) forest management, 3) land ownership and 4) forest/human/wildlife interactions. Table 2 presents frequencies and extensiveness for comments within these themes. In the following discussion, rural group participant comments are numbered *R1* through *R24*, and urban group participant comments are numbered *U1* through *U24*.

Table 1.2. Theme and Sub-Theme Frequencies and Comment Extensiveness of Urban and Rural Focus Groups

Theme	Urban *(n=24)*		Rural *(n=24)*	
	Frequency	Extensiveness*	Frequency	Extensiveness*
Theme 1: Forest Services				
Beauty/emotional connection	7	5	22	13
Economic values	17	14	66	21
Recreation	53	20	43	18
Theme 2: Forest management	47	19	87	24
Theme 3: Land ownership	46	18	73	23
Theme 4: Forest/Human/Wildlife Interactions				
Effects of forest management on wildlife	54	17	53	21
Deer browse	24	12	51	20
Effects of deer on other wildlife	16	9	28	16

* *Extensiveness = The number of unique individuals who made each comment*

1.4.2.1 Forest Services

One research objective was to identify forest ecosystem services recognized by the public. Members of both urban and rural groups discussed the importance of forests, but their discussions of why forests are important differed. In each discussion, participants identified similar services they associated with forests, such as recreation, water filtration, erosion control, hunting, lumber, jobs, tourism and beauty. Both groups expressed the importance of preserving forests for future generations, and many urban and rural participants discussed the importance of forests to wildlife. Although the services mentioned were similar across the groups, the discussions that followed were

not. Forest beauty and emotional connection emerged as a strong sub-theme in the rural discussions. Several rural participants expressed emotion and intensity when describing the forests in the area with words like "wonderful," "absolutely gorgeous," "breathtaking" and "unbelievable." Some rural participants said the forests are a principle reason they enjoy living there, and some discussed their emotional attachment to the forests.

"I wouldn't live anywhere else," "[We live here] because we love it" (R18 and R22- Similar comments from 5 other people)

"I am much more emotionally involved with where I live here...you never feel an emotional attachment to bricks, but you do to trees" (R1)

Although a few urban participants expressed emotion over the beauty of forests in the area, the frequency and extensiveness of comments within this sub-theme were lower in the urban than in the rural groups (See Table 2).

"I came here because I want to be here, because it made an impression when I was that young" (U8)

"They should preserve some forest for recreational beauty" (U13 – Similar comment from 1 person)

Concerns for local economic sustainability and the community were expressed repeatedly and with strong emotion by most rural participants. They spoke with specificity about the important role of forests in providing employment in recreation and tourism as well as the forest products industry and the ways in which this affects their community.

"When I think of the forest, I think of recreation, a lot of jobs in this area, very important around here" (R4 – 4 other people made similar comments)

"[Forestry] is the only industry we have left here" (R17 – Similar comments made by 5 other people)

Rural groups independently identified the concept of balance, which did not emerge from the urban discussions. Rural participants discussed difficulties of balancing conflicting goals of forest management such as managing to provide jobs while maintaining wildlife habitat and aesthetics. The strong emotion and specificity of these comments were tied to stated concerns the rural participants had for community stability and the importance to them of the multiple roles that forests play in their lives.

"It just isn't one thing, it's everything together, the timber has to provide for that and the people survive off the deer hunting and the timber and the recreation is a big thing up here." (R14 – Three other people made similar comments)

The economic importance of forests was discussed to a lesser extent in the urban groups, which can be seen by comparing the frequency and extensiveness of comments in this sub-theme in Table 2. A few participants referred to the importance of the forest products industry to the region, though comments were not specific and did not express strong emotion about the economic importance of forests to the local economy.

"It's important to cut down [timber] for jobs, for industry, because we need to have pulp" (U13 – Similar comments were made by 4 other people)

Urban participants referred to economic issues by mentioning recreation, specifically the importance of snowmobile and ATV trails as tourism draws.

"...snowmobiling and 4-wheelers are getting more popular, there should be trails for those also, it's a strong economic asset" (U1 – Similar comment from 1 other person)

Concern for maintaining recreational opportunities in forests was mentioned by most urban participants in the context of resource use for individual benefits. Urban participants discussed the importance of forests for a variety of recreational uses.

"...you're not going to picnic in a clearcut, you know, there's really nothing after it's clearcut, there's not much you can do there, until like they say, 40 years from now, there are some bird hunting opportunities after a few years..." (U10 – Five other people made similar comments)

Urban comments reflect an anthropocentric view of forest management, not for favoring resource extraction, but for favoring management that enhances individual recreational opportunities. Rural comments, by contrast, reflected the importance of forests for many purposes, including instrumental as well as intrinsic values, indicating that perhaps the rural participants' views lie not at the anthropocentric end of the continuum but somewhere in the middle.

Among rural participants, concern was expressed for maintaining forest recreational services to support the local economy through tourism revenues. A few people mentioned the importance of forest aesthetics in attracting tourists.

"I know lots and lots of people make a special trip just to come and see the [fall] colors here" (R1 – Three other people made similar comments)

Some rural participants also discussed the importance of forest recreation through hunting, with a strong emphasis on deer hunting and associated tourism revenues.

"...hunting is for recreation, but it's also economy up here, because [hunters] spend a lot of money, generate a lot of money" (R18 – Similar comments made by 6 other people)

Overall, reasons for concern about forest recreational opportunities differed between the urban and rural groups. Both urban and rural participants' views of recreation can be interpreted as anthropocentric, but rural participants expressed a stronger concern for community well-being than for their own personal interests in recreational opportunities.

1.4.2.2 Forest Management

One objective established for the study was to explore public familiarity with and opinions of forest management and harvesting practices. All of the rural group participants were able to contribute something to this discussion, and most of them were able to discuss different types of forest management practices in detail. The discussion of forest management in the rural groups included many specific references to management practices (See Table 2). Many rural participants exhibited familiarity with and an understanding of different types of harvesting practices such as select cutting and clearcutting and discussed post-harvest activities such as replanting. A few people discussed the benefits of selective cutting.

> *"...the advantages of select cutting are tremendous...you take trees out of a certain area that are mature, it allows the sunlight to get in, ground vegetation to start, smaller trees to mature, it's just fantastic for the whole area" (R4- Five other people made similar comments)*

A few rural participants recognized the inability of loggers to practice lower impact harvesting because of economic factors.

"The market won't allow [select cutting], you've got to get volume, because prices I don't think have gone up that much, you just have to do it in volume" (R11 – Six other people made similar comments)

The urban participants had a less detailed discussion of forest management practices that focused on clearcutting, which some participants viewed negatively. Most of the urban participants were not able to speak about any other harvesting practices such as select cutting.

"Clearcutting looks like a scar" (U4 – Similar comments made by four other people)

Some urban participants discussed increasing logging intensity in the area over the years.

"It seems that we're cutting 10 times as much out of the woods as we used to, with the equipment we have now." (U11 – Three other people made similar comments)

Some urban participants made detailed comments about management, but these were not as extensive as those in the rural groups. Urban group discussions of the effects of intense timber harvesting on forest services was not detailed, and participants did not mention possible negative effects of harvesting on other forest services. Many rural participants discussed with specificity the economic need for timber extraction, however, many of them also discussed with great emotion negative feelings towards the intensity of extraction they see in their community. Most rural participants discussed negative effects of intense harvesting on provision of other non-market forest services and expressed strong concern for maintaining these other services.

1.4.2.3 Land Ownership

Participants were asked about land ownership and its implications for forest management. Perceptions of land ownership and its effects differed between the groups. Many of the rural participants view non-industrial private landowners as protectors of the area's forests whereas they view private industrial and public landowners as threats to forest resource sustainability.

> *"...the individuals who manage their land, or cut their land, they do a lot better job managing their land than the state....a person lives here knows what's going to happen if he cuts all those trees." (R12 – Similar comments were made by 6 other people)*

Most urban participants held an opposite view of the role of landowners. They expressed that private owners practice uninformed management that depletes forest resources while corporate or public land management is beneficial to forest resource sustainability.

> *"...a private owner probably won't replant because they're getting rid of [the trees] because they want a yard, or because they want access to something, or they want the firewood" (U3 – Similar comments were made by 3 other people)*

Although urban and rural groups recognized that landowner type affects the way forests are managed, perceptions of the roles of different landowners differed between the groups.

1.4.2.4 Forest Management and Wildlife Interactions

An objective of the research was to learn about familiarity with and perceptions of forest, wildlife and human interactions. Discussions that explored this theme are divided into three sub-themes: 1) effects of forest management on deer and other wildlife, 2) effects of deer on forests, and 3) effects of deer on other wildlife. Many rural participants

were able to discuss with specificity and detail the effects of forest management and harvesting practices on wildlife in the area, and most participants expressed emotion when discussing the effects of harvesting on wildlife habitat.

"We have to selective cut... if you get an area that has too much tree cover then you don't get the undergrowth so you don't have the animals" (R3 – Similar comments were made by 11 other people)

Urban participants discussed in less detail the effects of forest management on wildlife. Most were able to discuss clearcutting, and some mentioned its effects on wildlife. Many were not able to speak about specific ways in which forest management can affect wildlife.

"Certainly, anytime they change something in the forest, it alters all the habitat, I haven't been out in the woods doing much with wildlife, but I realize how it affects one and another" (U18 – Similar comments were made by 6 other people)

A few urban participants did not accurately understand how timber harvesting affects wildlife.

"There's not as much wildlife in the places where they cut" (U7 – Similar comment made by two other people)

Perceptions of forest management and its effects on wildlife differed between urban and rural groups. While many urban participants were not aware of the ways in which clearcutting can affect wildlife, most rural participants were able to speak in detail about these effects. Most rural participants spoke accurately and in detail about effects of forest management on wildlife. A few urban participants were able to speak in detail about these interactions, and these individuals have had more frequent contact with these forests through recreational activities. Rural participants were more strongly aware of

forest/human/wildlife interactions, as evidenced by comment frequencies and extensiveness in Table 2, and they displayed concern for the instrumental values of forests as well as ecological values.

In the second section of human/forest/wildlife interactions, participants were probed on their familiarity with the effects of deer on the forest. Most rural group participants engaged in a detailed discussion of the effects of deer browse on the forest, and a few participants had already mentioned this topic before it was initiated by the moderator.

> *"Definitely, [deer affect the forest], in a stand of hardwoods, when there's too many deer. You get all this scrub brush that's never going to be worth anything, you'll never be able to afford the taxes on the land because deer eat the sugar maple" (R7 – Similar comments were made by 11 other people)*

In contrast, urban participants did not initiate the deer browse discussion on their own, and this discussion followed the predetermined script. Many were familiar with deer browse and were able to have a general discussion about it. Of the urban participants who discussed browse, most did not mention its specific effects on the forest and some did not see it as a problem.

> *"I think the deer would have to be really overpopulated for quite some time in order to have a big noticeable impact on forests" (U2 – Similar comments were made by 4 other people*
>
> *"Yeah, you can tell when there's large numbers and there isn't a lot of food, everything from like 6 feet down will be stripped" (U17 – Six other people made similar comments)*

Comments by rural participants about deer browse were very detailed and extensive, while comments from urban participants expressed some familiarity with deer browse but were general and not extensive (See Table 2).

In the third section on human/forest/wildlife interactions, participants were asked about possible effects of deer on other wildlife. Members of both urban and rural groups found it difficult to understand how deer could impact other wildlife. Neither urban nor rural participants initiated this topic independently. Many rural group participants made an attempt to think of ways deer could affect other wildlife while only some urban participants contributed ideas on this topic (See Table 2). Neither group spoke on this topic with much specificity or emotion.

1.5. Conclusions

This study was undertaken in order to better understand the preferences and viewpoints of urban and rural groups with respect to the complex interactions between people, forests and wildlife in Michigan's Central Upper Peninsula. Much of the literature suggests that rural, timber-dependent community residents would hold strong preferences for managing forests for human uses, and urban, non-timber-dependent communities would hold strong preferences for managing forests for ecological and biological uses. The guiding hypothesis of this study was that rural, timber-dependent community residents will hold strong anthropocentric views of forest management and urban, non-timber-dependent community residents will hold strong biocentric views of forest management.

The results indicate that urban/rural differences in perceptions of forests and forest/human/wildlife interactions do not fit smoothly with the two typologies defined in

the literature. In contrast to some studies, the rural participants did not fall neatly on the anthropocentric end of the anthropocentric-biocentric continuum because they do not place importance simply on extractive, utilitarian uses of the forests. Similarly, the findings do not place the urban participants neatly at the biocentric end of the continuum because they did not express strong preferences for forest conservation, but they did express strong concerns about anthropocentric forest uses such as their own recreation.

Given the limitations of qualitative research, the quantitative data in this study should not be used to generalize the results to other populations. However, the qualitative findings are evidence that viewpoints of rural timber-dependent and urban non-timber-dependent community residents may not fall at expected ends of the anthropocentric-biocentric continuum. In crafting natural resource policy, management, and communication strategies, our findings suggest that decision makers and other researchers should be cautious in utilizing a simple anthropocentric/biocentric continuum or similar results of previous studies since our research suggests that relationships are more complex.

Two unique features of this study may be fruitful avenues of research aimed at better understanding this evidence. First, even though the urban area in this study is the largest in the Upper Peninsula of Michigan, it is not a major metropolitan area. Second, the urban area was close enough to the study resource to serve recreational purposes, and the findings revealed that recreational concerns were more commonly mentioned by the urban groups than biocentric concerns. Studies aimed at identifying the effect of these features might improve the robustness of the anthropocentric/biocentric continuum.

The differences in resource and forest management familiarity and opinions identified above can be useful to policy makers and resource managers interested in

designing management strategies to more effectively satisfy public preferences. The information can also be used in designing communication and educational efforts to articulate the goals and purpose of forest management. For example, although the rural participants demonstrated a strong understanding of forest management techniques and were clear about the need to balance the competing goals of forest management, the urban participants did not express such understanding and might be better reached by messages targeting their recreational and personal use of forests. Messages to rural residents should be cognizant of the importance of balancing resource extraction and resource protection. For example, emphasizing the degree to which voluntary forest landowner incentive programs can help balance timber production with resource protection could encourage forest landowners in rural areas to implement conservation practices on their land.

REFERENCES

Bailey, C. 2004. Resource Dependency and Rural Development in Alabama [cited November 10, 2004]. Available from http://www.ag.auburn.edu/~cbailey/dependency.htm.

Bandara, R., and C. Tisdell. 2003. Comparison of rural and urban attitudes to the conservation of Asian elephants in Sri Lanka: empirical evidence. *Biological Conservation* 110:327-342.

Bingham, G., R. Bishop, M. Brody, D. Bromley, E. Clark, W. Cooper, R. Costanza, T. Hale, G. Hayden, S. Kellert, R. Norgaard, B. Norton, J. Payne, C. Russell, and G. Suter. 1995. Issues in ecosystem valuation: improving information for decision making. *Ecological Economics* 14:73-90.

Bourke, L., and A.E. Luloff. 1994. Attitudes toward the management of nonindustrial private forest land. *Society and Natural Resources* 7:445-457.

Boxall, P.C., and B. Macnab. 2000. Exploring the preferences of wildlife recreationists for features of boreal forest management: a choice experiment approach. *Canadian Journal of Forest Research* 30:1931-1941.

Brunson, M.W., B. Shindler, and B.S. Steel. 1997. Consensus and dissention among rural and urban publics concerning forest management in the Pacific Northwest. In *Public Lands Management in the West: Citizens, Interest Groups, and Values*, edited by B. Steel, pp. 83-94. Westport, CT: Praeger.

Cordell, H., and M. Tarrant. 2002. Changing demographics, values, and attitudes. *Journal of Forestry* 100 (7):28-33.

DeCalesta, D.S. 2000. *Deer, ecosystem damage, and sustaining forest resources* 1997 [cited October 31 2000]. Available from http://www.arec.umd.edu/policy/Deer-Management-in-Maryland/decalesta.htm.

Dennis, D.F. 1998. Analyzing Public Inputs to Multiple Objective Decisions on National Forests Using Conjoint Analysis. *Forest Science* 44 (3):421-429.

Dietz, T., P.C. Stern, and G.A. Guagnano. 1998. Social structural and social psychological bases of environmental concern. *Environment and Behavior* 30:450-471.

Gobster, P.H. 2001. Human dimensions of early successional landscapes in the eastern United States. *Wildlife Society Bulletin* 29 (2):474-482.

Goldman, A.E. and S.S. McDonald. 1987. *The Group Depth Interview: Principles and Practice*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Howe, R.W., Niemi, G., and J.R. Probst. 1995. Management of Western Great Lakes Forests for the Conservation of Neotropical Migratory Birds. In *Management of Midwestern Landscapes for the Conservation of Neotropical Migratory Birds*, edited by F.R. Thompson III, pp. 144-167. Detroit, MI: USDA Forest Service North Central Forest Experiment Station.

Hull, B.P., D. Robertson, and A. Kendra. 2001. Public understandings of nature: a case study of local knowledge about 'natural' forest conditions. *Society and Natural Resources* 14:325-340.

Jacobson, S.K., and S.B. Marynowski. 1997. Public attitudes and knowledge about ecosystem management on Department of Defense land in Florida. *Conservation Biology* 11(3):770-81.

Kaplowitz, M.D. 2000. Statistical analysis of sensitive topics in group and individual interviews. *Quality and Quantity* 34:419-431.

Kaplowitz, M.D., and J.P. Hoehn. 2001. Do focus groups and individual interviews reveal the same information for natural resource valuation? *Ecological Economics* 36:237-247.

Kearney, A.R. 2001. Effects of an informational intervention on public reactions to clear-cutting. *Society and Natural Resources* 14:777-790.

Kreuger, R.A. and M.A. Casey. 2000. *Focus Groups: A Practical Guide for Applied Research, 3rd edition.* Thousand Oaks: Sage Publications.

Laurent, E.J., J.P. LeBouton, D. Gatzioli, M.B. Walters and J. Liu. 2003. Evaluating the effects of land cover classification indices used to investigate wildlife-habitat relationships. Presentation. Ecological Society of America, Savannah, GA, August 3, 2003.

LeBouton, J.P., E.J. Laurent, M.B. Walters, and J. Liu. 2003. Regional vs local effects of white-tailed deer herbivory on vegetation structure and composition in northern hardwood forests. Ecological Society of America 88th annual meeting, Savannah, Georgia. August 3-8, 2003.

Machlis, G.E. and J.E. Force. 1988. Community Stability and Timber-Dependent Communities. *Rural Sociology* 53:220-234.

McDonough, M., J. Fried, K. Potter-Witter, J. Stevens, and D. Stynes. 1999. The Role of Natural Resources in Community and Regional Economic Stability in the Eastern Upper Peninsula. East Lansing, MI: Michigan Agricultural Experiment Station, Michigan State University, Research Report 568.

McFarlane, B.L., and P.C. Boxall. 2000. Factors Influencing Forest Values and Attitudes of Two Stakeholder Groups: The Case of the Foothills Model Forest, Alberta, Canada. *Society and Natural Resources* 13:649-661.

Miller, R. 1997. Northern White-Cedar Regeneration: Promise and Problems. Escanaba, MI: Upper Peninsula Tree Improvement Center, Michigan State University.

Miller, R.O., D. Elsing, M. Lanasa, and M. Zuidema. 1990. Northern White-Cedar: Stand Assessment and Management Options. Presented at Northern White-Cedar in Michigan Workshop, Sault Sainte Marie, February 21-22, 1990.

Minnis, D.L., R.H. Holsman, L. Grice, and R.B. Payton. 1997. Focus groups as a human dimensions research tool: three illustrations of their use. *Human Dimensions of Wildlife* 2 (4):40-49.

Mitra, A. 1994. Use of focus groups in the design of recreation needs assessment questionnaires. *Evaluation and Program Planning* 17 (2):133-140.

Morgan, D.L. 1997. *Focus Groups as Qualitative Research, 2nd edition.* Vol. 16, *Qualitative Research Methods Series.* Thousand Oaks, CA: Sage Publications.

MTA, Michigan Township Association. 2004. *Michigan Township Maps* 2004 [cited October 27 2004]. Available from http://www.liaa.cc/mta/maps.

Noss, A., and R. Cuellar. 2001. Community attitudes towards wildlife management in the Bolivian Chaco. *Oryx* 35 (4):292-300.

Obiri, J., and M. Lawes. 2002. Attitudes of coastal-forest users in Eastern Cape Province to management options arising from new South African forest policies. *Environmental Conservation* 29 (4):519-529.

Pomeroy, C., and J. Beck. 1999. An experiment in fishery comanagement: evidence from Big Creek. *Society and Natural Resources* 12:719-739.

Potter-Witter, K. 1995. Timber and Timberland Resources. East Lansing, MI: Michigan Agricultural Experiment Station, Michigan State University, Special Report 71.

Pugh, S.A., Reed, D.D., Pregitzer, K.S. 2001. FIAMODEL User's Guide Version 3.0. Houghton, MI and St. Paul, MN: School of Forestry and Wood Products, Michigan Technical University and USDA Forest Service North Central Research Station.

Reading, R.P., T.W. Clark, and S.R. Kellert. 1994. Attitiudes and knowledge of people living in the Greater Yellowstone Ecosystem. *Society and Natural Resources* 7 (4):349-365.

Ribe, R., and M. Matteson. 2002. Views of Old Forestry and New Among Reference Groups in the Pacific Northwest. *Western Journal of Applied Forestry* 17 (4):173-182.

Shindler, B.A., M. Brunson, and G.H. Stankey. 2002. Social Acceptability of Forest Conditions and Management Practices: A Problem Analysis. USDA Forest Service Pacific Northwest Research Station General Technical Report PNW-GTR-537.

Shively, J. 1992. Cowboys and Indians: Perceptions of Western Films Among American Indians and Anglos. *American Sociological Review* 57:724.

Smith, P.D., and M.H. McDonough. 2001. Beyond public participation: fariness in natural resource decision making. *Society and Natural Resources* 14 (3):239-249.

Solecki, W.D. 1998. Local attitudes on regional ecosystem management: A study of New Jersey Pinelands residents. *Society and Natural Resources* 11 (5):441-463.

Steel, B., P. List, and B. Shindler. 1994. Conflicting values about federal forests: A comparison of national and Oregon publics. *Society and Natural Resources* 7:137-153.

Stein, T.V., D.H. Anderson, and T. Kelly. 1999. Using stakeholders' values to apply ecosystem management in an upper midwest landscape. *Environmental Management* 24(3):399-413.

Tahvanainen, L., L. Tyrvainen, M. Ihalainen, N. Vuorela, and O. Kolehmainen. 2001. Forest management and public perceptions - visual versus verbal information. *Landscape and Urban Planning* 53:53-70.

Tarrant, M., and H. Cordell. 2002. Amenity values of public and private forests: Examining the value-attitude relationship. *Environmental Management* 30 (5):692-703.

Tremblay, K.R., and R. Dunlap. 1978. Rural-urban residence and concern with environmental quality. *Rural Sociology* 43:474-491.

U.S. Census Bureau. 2004a. *Urban and Rural Definitions* 1995 [cited October 7 2004]. Available from http://www.census.gov/population/censusdata.urdef.txt.

———. 2004b. *Census 2000 Urban and Rural Population for Michigan, Counties and County Subdivisions* 2000 [cited June 25 2004]. Available from http://www.census.gov/geo/www/ua/ua_2k.html.

———. 2004c. *Zip Code Business Patterns (NAICS) 2001* 2001 [cited September 14 2004]. Available from http://censtats.census.gov/cgi-bin/zbpnaic/zbpsect.pl.

———. 2004d. *American Fact Finder* 2004 [cited October 20 2004]. Available from http://factfinder.census.gov.

Winter, G., and J.S. Fried. 2000. Homeowner perspectives on fire hazard, responsibility, and management strategies at the wildland-urban interface. *Society and Natural Resources* 13:33-49.

Xu, W., B.R. Lippke, and J. Perez-Garcia. 2003. Valuing biodiversity, aesthetics, and job losses associated with ecosystem management using stated preferences. *Forest Sci.* 49(2):247-257.

Zinkhan, F.C, T.P. Holmes and D.E. Mercer. 1997. Conjoint analysis: A preference-based approach for the accounting of multiple benefits in southern forest management. *Southern Journal of Applied Forestry* 21 (4):180-186.

Essay 2:
Forest and Environmental Values and Attitudes: Differences Between Demographic Groups in Michigan

2.1 Introduction

Ecosystems are valued by people because they provide services that satisfy material and nonmaterial human needs (MA 2003). The goods and services provided by ecosystems can have ecological, economic and sociocultural values (de Groot et al. 2002), and a wide variety of methods have been developed across different disciplines for estimating and understanding these values (MA 2003). Information on environmental values and attitudes is an important component of natural resource management and policy because it can help natural resource managers and policy makers understand which aspects of natural resource management are important to different segments of the public (Bengston et al. 2001, Jacobson and Marynowski 1997, Weiler and O'Leary 1997, Tarrant and Cordell 2002, McFarlane and Boxall 2000, Potter and Norville 1981, Reading et al. 1994, Solecki et al. 1998). An important step in incorporating ecosystem values into decision making is understanding values and attitudes towards the management of ecosystem services and the factors that influence those values and attitudes (McFarlane and Boxall 2000). For example, values for and attitudes towards forest ecosystem management and the environment may be influenced by socioeconomic characteristics. This study examines the relationship between socioeconomic characteristics and environmental and forest ecosystem management values and attitudes among Michigan residents.

The influence of socioeconomic and social influence factors on attitudes and values toward resource management has been the subject of many studies (Honnold

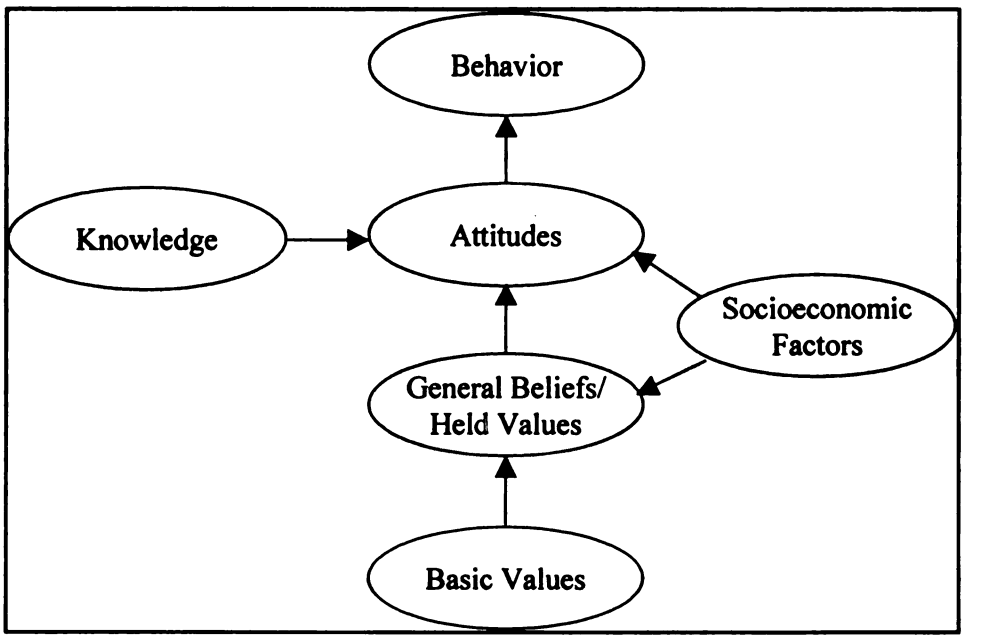
1981, McFarlane and Boxall 2000, Dietz et al. 1998, Steel et al. 1994, Tarrant and Cordell 2002). Resource dependence, urban versus rural residence location, age and education are considered the strongest predictors of environmental attitudes (Dietz et al. 1998, McFarlane and Boxall 2000). Others have found that gender (Dietz et al 2002), political orientation (Steel et al 1994, Jones et al 1999) and ethnicity (Tarrant and Cordell 2002) have an important influence on environmental attitudes. Influences of other socioeconomic variables such as income, occupation and industrial sector and religion on environmental values have been found to be relatively weak (Dietz et al. 1998).

Understanding how different demographic groups view forest management and its effects can facilitate a better understanding of the economic and ecological trade-offs involved in forest management (Xu et al. 2003). In order to analyze environmental values and attitudes, it is important to define them and put them within a structural context. A value is defined as "an enduring conception of the good" (Rokeach 1973), and an attitude is defined as "a learned disposition toward some object as either favorable or unfavorable" (Fishbein and Ajzen 1975). Studies of environmental and ecosystem service values have used a social psychological approach in order to provide a theoretical framework for understanding the relationship between values and attitudes (McFarlane and Boxall 2000, Stern et al. 1995, Tarrant and Cordell 2002).

The social psychological approach used to understand environmental and forest ecosystem management values and attitudes is based within the cognitive hierarchy framework (Rokeach 1973). Within this framework, basic values, representing fundamental social and biological needs, influence general beliefs and held values, which in turn affect attitudes, which ultimately influence behavior (ibid.) This framework is illustrated in Figure 2.1. Based on this framework, general beliefs or held forest values

influence environmental and resource management attitudes or preferences, and these preferences ultimately affect behavior and specific actions (Stern et al. 1995). In this framework, an individual's economic value is derived from behavior, either observed or stated. For example, a willingness to pay for a good or service reveals an economic value through behavior. Thus, attitudes and other values are antecedents to economic values.

Figure 2.1 Cognitive Hierarchy Framework



Adapted from McFarlane and Boxall 2000

Numerous approaches exist for conceptualizing a range for held forest values, including distinctions between instrumental and noninstrumental or intrinsic values (Xu and Bengston 1997) and between anthropocentric and biocentric values (McFarlane and Boxall 2000, Steel et al. 1994, Tarrant and Cordell 2002). Instrumental or anthropocentric values emphasize the extractive uses of forest ecosystems for human benefit (McFarlane and Boxall 2000). This value orientation presumes that humans have

a central role in the natural world and nonhumans are valued only in terms of the benefits they provide to people (Steel et al. 1994). A biocentric value orientation, on the other hand, is based on a "nature centered" approach in which the natural world is valued in its own right, not only for the benefits it provides to humans, and it recognizes the place of humans within a larger ecological context (ibid).

Studies have concluded that individuals with particular demographic characteristics should fall in predictable ways along a continuum of anthropocentric to biocentric values (Tarrant and Cordell 2002). However, Essay 1 concluded that residents of rural, timber dependent and urban, non-timber dependent communities do not have value orientations that fall neatly along this continuum. The qualitative data used in the analysis in Essay 1 was taken from a very small sample, making it difficult to extrapolate to the larger population. However, the results of Essay 1 suggest the need for a deeper investigation of the relationship between demographic characteristics and environmental attitudes. This essay builds on Essay 1 by using a much larger data set taken from the results of a mail survey of Michigan residents that collects data on demographic characteristics, general environment attitudes, and attitudes towards forest management in a particular area of Michigan's Upper Peninsula.

This research uses the anthropocentric/biocentric continuum approach to forest value orientations and further bases the analysis in the cognitive hierarchy framework, in which values underlie attitudes. Environmental attitude data are used to provide information on the underlying held forest values of individuals. There are two guiding hypotheses of this study. The first is that there is an underlying structure to the way in which individuals respond to forest management and environmental attitude questions that reveals information about held forest and environmental values. The second

hypothesis is that these values can be explained by a set of socioeconomic characteristics. Exploratory factor analysis is used to determine whether there is an underlying structure to responses to attitudinal questions. Multivariate regression analysis is used to explain the resulting environmental value factors using a set of socioeconomic variables.

2.2 Methods

2.2.1 Survey Design and Implementation

A mail survey of Michigan residents was designed using results from focus groups, individual interviews and interviews with forestry and agency professionals (See Essay 1 for details of the qualitative research procedures and analysis and Essay 3 for details of survey design). The survey focuses on an area of Michigan's Upper Peninsula, referred to in this essay as the study forest (See Essay 1 for a description and map of the study forest). A 5-point likert scale was used to elicit responses to attitudinal statements ranging from 'strongly agree' to 'strongly disagree.' Summaries of response frequencies to all attitude questions in the survey are presented in Appendix 6.

The sample was stratified into four geographic regions of Michigan: the study forest, the rest of the Upper Peninsula, the northern Lower Peninsula, and the southern Lower Peninsula. Details of the sample design are provided in Appendix 1. An equal number of households was chosen from each strata in order to ensure that a sufficient number of responses would be attained to represent the study forest, a small, sparsely populated area, as well as the remainder of the UP, which is also sparsely populated relative to the rest of the state. The survey was mailed on April 15, 2005 to a stratified sample of 2,000 Michigan residents using a modified version of Dillman's tailored design method (Dillman 2000). A total of 954 usable surveys were returned, yielding an overall

response rate of 50% (See Essay 3 and Appendix 5 for details of survey implementation).

The survey contains a set of attitudinal statements related to forest management goals that were designed to elicit attitudes relating to trade-offs between economic and ecological outcomes of forest management. Other attitude statements were designed to elicit respondent opinions on community forest management participation, forest management programs, the quality of forest management by different types of landowners, and attitudes towards environmentally certified wood products. Nine environmental attitude statements were included in the survey. These are based on the New Environmental Paradigm (NEP), a popular and widely used environmental attitude scale originally developed by Dunlap and VanLiere (1978). The original scale consisted of 12 environmental attitude statements, which are reduced to nine statements in this study based on Tarrant and Cordell's adaptation of the NEP (2002). Other survey questions elicited information about recreational use of the study area as well socioeconomic characteristics such as age, education, income, etc. A summary of respondent socioeconomic characteristics is reported in Appendix 6.

2.2.2 Factor Analysis and Factor Score Regression

Factor analysis is a multivariate statistical technique used to reduce a large number of variables into a smaller, usable group of factors which can then be subjected to further analysis (Hair et al. 1998, Churchill 1991). This method is commonly used to reduce data into a smaller set of factors that can be used to linearly reconstruct the original variables (STATA 2003). One principal purpose of factor analysis is to identify an underlying structure to the data (Aaker and Day 1986). Factor analysis is represented by the following equation:

$$y_{ij} = z_{i1}b_{1j} + z_{i2}b_{2j} + \ldots + z_{iq}b_{qj} + e_{ij} \quad (1)$$

where y_{ij} is the value of the ith observation of variable j, z_{ik} is the value of observation i on factor k, b_{kj} are linear coefficients referred to as factor loadings, and the e_{ij} are unique factors of variable j, similar to residuals (STATA 13.0). A factor loading is the correlation between the factor and the original variable (Hair et al 1998). The b_{kj}, or factor loadings, can be estimated using principal components factor analysis. The estimated factor loadings provide a basis for creating a new set of variables, or factors, that represent the original variables (ibid.). A factor can be interpreted as a construct or unobservable variable that is inferred from the set of variables used as inputs to the analysis and is interpreted based on factor loadings (Aaker and Day 1986).

Factor analysis can lead to infinite factor solutions, and the decision of the number of factors to use is at the researcher's discretion. There are a number of guidelines that can be used to determine a limit to the number of factors to be extracted. One criterion is the latent root (eigenvalue) criterion, which states that only factors that have eigenvalues greater than 1 are considered significant and should be retained (Churchill 1991, Hair et al. 1998). An eigenvalue, which is the sum of squared loadings for a factor, represents the amount of variance explained by each factor (Hair et al. 1998). Another criterion is the scree test, which plots the latent roots against the number of factors extracted. A common rule of thumb is to cut off the factors at the point where the eignenvalue plot in the scree graph becomes flat (Churchill 1991).

When the desired number of factors to be extracted is determined, the initial factor matrix is generated. This matrix contains the factor loadings of each variable on each factor. Each factor is orthogonal to other factors, meaning there is no correlation of

factor axes to each other (Hair et al 1998). This relationship is achieved by deriving each factor from the variance that remains after the previous factor has been extracted. This process achieves data reduction, but in most cases, it does not provide the best interpretation of the variables being investigated (ibid). It is important to rotate the factor solution in order to improve the interpretation of the variables' contributions to the factors. In factor rotation, the reference axes of the factors are rotated to a new position, which redistributes the variance among the factors, resulting in a simpler and more meaningful result (ibid.). The VARIMAX rotation, which is an orthogonal rotation, is the most commonly used method. In this type of rotation, the axes are maintained at 90 degrees.

Once the factor matrix has been rotated, it is necessary to identify the highest factor loading for each variable. When these loadings are identified, the variables that load highly onto the same factors are placed into groups, and these groups are interpreted by the researcher and labeled according to the similarity of the variables within them.

Factor loadings, once calculated, can be used to compute new variables called factor scores. The rotated factor loading matrix is used to compute factor coefficients, which are, in turn, used to compute factor scores for each individual in the sample. These scores can be viewed as composite measures that indicate the degree to which a person scores highly on a particular factor based on their responses to the variables included in that factor (Hair et al. 1998). The new variables created by factor scores can then be used in subsequent analyses.

Survey data on environmental and forest values can be reduced to form smaller sets of factors, which can then be converted to factor scores and analyzed using multivariate regression techniques. This method of analysis can be used to analyze the

effect of demographic variables on factor scores derived from environmental attitude data (Dietz et al. 1998, McFarlane and Boxall 2000). These regression analyses of each factor score on a set of explanatory socioeconomic variables can provide information on the demographic characteristics of respondents based on their factor scores.

The following equation will be estimated using OLS regression:

$$F_i = \beta z + \varepsilon \tag{2}$$

In this equation, F_i represents the factor score value of factor *i*, which is estimated based on the results of the factor analysis, β is a vector of coefficients, and *z* is a vector of socioeconomic variables. Explanatory variables will be presented in Table 2.5. Stepwise regression is used to estimate the parameters of this model for all factors that result from the factor analysis. Results of the estimation are reported in section 2.4.

2.3 Factor Analysis Results

Factor analysis was conducted on responses to the attitude statements listed in Table 2.1. These statements were used in the survey to elicit attitudes about the goals of forest management with respect to human and wildlife needs as well as general environmental attitudes. The hypothesis is that there is an underlying structure to the way in which individuals respond to these attitude statements. Factor analysis using principal components is conducted using the attitude statement variables listed in Table 2.1 as inputs. The latent roots criterion, percentage of variance, and the scree test are used to determine the number of factors to retain in the analysis.

Table 2.1. Survey Attitude Statements and Associated Variables Used in Factor Analysis (N = 608)

Variable	Survey Statement
HUMNEED	In my opinion, the Western U.P. Study Forest should be managed to meet the needs of people.
WLFNEED	In my opinion, the Western U.P. Study Forest should be managed to meet the needs of wildlife.
COMMNEED	In my opinion, the Western U.P. Study Forest should be managed to meet the needs of communities that are economically dependent on forests, no matter what effect this has on the environment.
BALNEED	In my opinion, the Western U.P. Study Forest should be managed to balance environmental needs with the needs of communities that are economically dependent on forests.
FUTGENNEED	In my opinion, the Western U.P. Study Forest should be managed to meet the needs of future generations.
MTNINDJOB	In my opinion, the Western U.P. Study Forest should be managed to maintain forest industry jobs.
MTNRECJOB	In my opinion, the Western U.P. Study Forest should be managed to maintain forest-based recreation jobs.
PROTRES	In my opinion, the Western U.P. Study Forest should be managed to protect forest and wildlife resources.
BALJOBRES	In my opinion, the Western U.P. Study Forest should be managed to achieve a balance between maintaining forest-related jobs and protecting forest and wildlife resources.
INCRDIV	In my opinion, the Western U.P. Study Forest should be managed to increase migratory forest songbird diversity even if there are economic losses to forest-based industries.
BALINDDIV	In my opinion, the Western U.P. Study Forest should be managed to achieve a balance between sustaining forest-based industries and migratory forest songbird diversity.
PROTHAB	In my opinion, the Western U.P. Study Forest should be managed to protect habitat for migratory forest songbird species of conservation concern even if it results in economic losses to forest-based industries.
BALINDHAB	In my opinion, the Western U.P. Study Forest should be managed to achieve a balance between sustaining forest-based industries and protecting habitat for migratory forest songbird species of conservation concern.
HUMABUSE	Humans are severely abusing the environment.

Table 2.1 (continued)

Variable	Survey Statement
HUMRIGHT	Humans have the right to modify the natural environment to suit their needs.
HUMRULE	Humans were meant to rule over nature.
HUMLEARN	Humans will eventually learn enough about how nature works to be able to control it.
BALNATURE	The balance of nature is delicate and easily upset.
LIMIT	We are approaching the limit to the number of people this earth can support.
CONSEQ	When humans interfere with nature, it often produces disastrous consequences.

After forming the initial factor matrix, eigenvalues for each factor and the percentage of variance with each successive factor were examined (See Table 2.2). Eigenvalues are greater than one for factors one through six and become less than one starting at factor seven. According to the latent roots criterion, factors should be retained up to the point where eigenvalues become less than one. According to this criterion, six factors should be retained for the analysis.

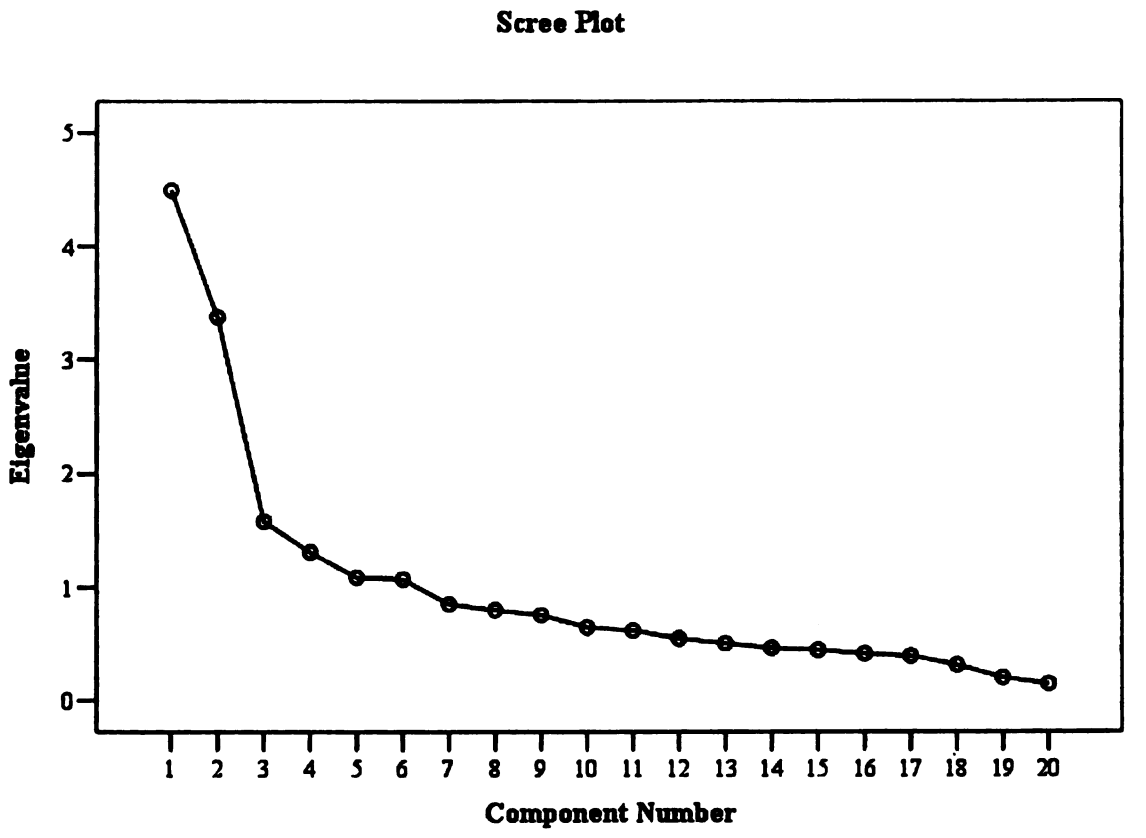
The percentage of variance extracted by successive factors is another criterion used to determine the number of factors to retain in the analysis. This is a summary measure that indicates the amount of total variance of all input variables explained by each factor (Aaker and Day 1986). It is common in the social sciences to retain factor solutions that account for at least 60 percent of total variance (Hair et al.1998).

Table 2.2. Total Variance Explained

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	4.494	22.468	22.468
2	3.376	16.882	39.350
3	1.580	7.902	47.252
4	1.309	6.547	53.799
5	1.086	5.432	59.231
6	1.070	5.349	64.581

Another criterion for factor retention requires an examination of the scree diagram, which plots eigenvalues against factors in the order they are extracted (Hair et al. 1998). In component factor analysis, the proportion of common variance to unique variance changes as more factors are extracted, and the scree test provides a way to identify the point where unique variance begins to outweigh common variance (ibid.). The point at which this curve becomes a flat line is considered the cut-off point for the number of factors to extract (Churchill 1991). In Figure 2.1, this cut-off point can be seen between factors (or components, as indicated in the diagram) 5 and 6 where the line becomes visibly flat. According to the scree test criterion, a total of 5 factors should be retained in the solution.

Figure 2.2. Scree Plot of Eigenvalues and Factors



The latent root criterion suggests retaining 6 factors. The percentage of variance criterion suggests retaining 6 factors as well, however, almost 60 percent of variance is extracted by 5 factors (59.23%), and retaining a 5-factor solution would closely meet this criterion. The scree test suggests retaining 5 factors, and therefore, 5 factors were retained in the solution. After deciding on the number of factors to retain in the solution, a VARIMAX orthogonal rotation was applied to the first 5 factors. The following table reports factor loadings from the rotated factor matrix.

Table 2.3. Rotated Factor Matrix

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
HUMNEED	-0.012	-0.056	0.616	-0.172	0.295
WLFNEED	0.061	0.352	0.298	0.477	-0.041
COMMNEED	-0.273	-0.268	0.383	-0.036	0.308
BALNEED	0.533	0.114	0.415	-0.261	0.110
FUTGENNEED	0.224	0.402	0.483	-0.031	0.167
MTNINDJOB	0.178	-0.292	0.723	-0.176	0.070
MTNRECJOB	0.207	-0.158	0.708	0.138	-0.122
PROTRES	0.134	0.366	0.308	0.525	-0.184
BALJOBRES	0.701	0.081	0.272	-0.075	0.021
INCRDIV	-0.065	0.152	-0.237	0.843	-0.057
BALINDDIV	0.900	0.067	0.019	0.103	0.000
PROTHAB	-0.007	0.206	-0.214	0.837	-0.078
BALINDHAB	0.891	0.034	0.005	0.088	-0.045
HUMABUSE	0.113	0.681	-0.084	0.257	-0.162
HUMRIGHT	-0.095	-0.275	0.119	-0.086	0.699
HUMRULE	-0.080	-0.216	0.091	-0.179	0.711
HUMLEARN	0.194	-0.044	0.020	0.030	0.698
BALNATURE	0.119	0.720	8.75e-005	0.133	-0.195
LIMIT	-0.039	0.590	-0.206	0.119	-0.061
CONSEQ	0.035	0.682	-0.104	0.158	-0.235

A factor loading of 0.35 or greater indicates a significant loading value; therefore factors are determined by variables with loading values of 0.35 or greater (Dietz et al. 1998). These variables are indicated by the highlighted cells in Table 2.3. Four variables, *WLFNEED, BALNEED, FUTGENNEED* and *PROTRES* all load highly onto more than one factor. It is common in factor analysis for variables to have moderate

loadings on more than one factor, and this result presents a challenge to the researcher in that the interpretation of the resulting factors becomes more complex when single variables are associated with multiple factors (Hair et al. 1998). However, in this study, a logical interpretation can be applied to all of the factors that include variables that load highly more than once.

When interpreting factor loadings, positive signs indicate that variables are positively related and negative signs indicate a negative relationship between variables, but this relationship only applies to variables within the same factor because orthogonal factor solutions are independent (Hair et al 1998). For example, the variable *HUMNEED* under Factor 1 has a negative sign. This sign indicates that responses to the *HUMNEED* statement move in the opposite direction of responses to the other variables with positive signs. In other words, a person who agrees strongly with *BALNATURE, LIMIT, CONSEQ* and *HUMABUSE* will tend to disagree with *HUMNEED,* and vice versa. This interpretation makes intuitive sense based on the definitions of the attitude statements (See Table 2.1).

Five factors have been extracted from the factor analysis and each factor contains several variables with high factor loadings. Each factor needs to be described based on these variables and given a descriptive name. The factor description is based on what is meant by a high score response to the statements (variables) included in that factor. High score responses are those that have scores of 4 or 5, meaning *disagree* or *strongly disagree,* respectively. The following paragraphs describe the interpretation of each factor.

Variables that load highly onto Factor 1 relate to achieving a balance between economic and ecological goals, *BALNEED, BALJOBRES, BALINDDIV* and

BALINDHAB. Factor 1 is labeled the "Balance" factor. All of the variables that load highly onto this factor have positive signs, indicating that responses for these variables move in the same direction. High scores (indicating disagreement) for these variables indicate that the respondent does not believe it is important to achieve balance between ecological and economic needs of forested communities, and low scores (indicating agreement) indicate that the respondent feels that balancing ecological and economic goals of forest management is important. It is ambiguous whether high scores on this factor reveal anthropocentric or biocentric values. However, low scores on this factor reflect a combination of anthropocentric and biocentric values.

The variables with high loading values on Factor 2 relate to forest management that benefits wildlife and future generations (*WLFNEED, FUTGENNEED, PROTRES*) and to how humans affect the environment (*HUMABUSE, BALNATURE, LIMIT* and *CONSEQ*). Factor 2 is labeled the "Environment" factor. High scores (indicating disagreement) for responses to all of these attitude statements indicate that the respondent feels that wildlife resources should not be protected under forest management, forests should not be protected for future generations, and that environmental problems are not serious. High scores on this factor reveal an anthropocentric value orientation, and low scores reveal a biocentric value orientation.

Factor 3 variables relate to forest-related jobs and resource dependent communities, *HUMNEED, COMMNEED, BALNEED, FUTGENNEED, MTNINDJOB,* and *MTNRECJOB,* and all variables have positive signs. This factor is labeled the "Management" factor. High scores (indicating disagreement) on this factor indicate disagreement with forest management goals for humans, resource dependent communities, for balancing economic and ecological goals, for future generations and for

forest-based jobs. This factor seems to reflect attitudes of individuals who believe that forests should not be managed for human needs at all. High scores on this factor reflect a strongly biocentric value orientation.

All of the variables that load highly onto Factor 4 are related to wildlife and wildlife habitat: *WLFNEED, PROTRES, INCRDIV* and *PROTHAB.* As with Factor 2, all highly loading variables have positive signs, indicating that responses move together. This factor is labeled the "Wildlife" factor. High scores on these variables indicate that the respondent feels that forests should not be managed to meet the needs of wildlife or to protect forest and wildlife resources, and that ecological goals such as increasing songbird diversity or protecting songbird habitat should not be met if it imposes costs on forest industries. High scores on this factor reflect an anthropocentric value orientation and low scores reflect a biocentric orientation.

The variables that load highly onto Factor 5 concern human needs and the role of humans with respect to the natural environment: *HUMRIGHT, HUMRULE* and *HUMLEARN.* This factor is labeled the "Human Role" factor. These variables move in the same direction because they all have positive signs. High scores on this factor indicate disagreement with statements that humans have the right to modify the natural environment to suit their needs, that humans were meant to rule over nature and that humans will learn enough about nature to be able to control it. High scores on this factor reflect a biocentric environmental value orientation.

The following table summarizes the 5 factors that have been identified to show which variables fall under each factor description.

Table 2.4. Factors, Associated Variables and Factor Score Meanings

Factor	Variables Included in Factor	Meaning of Low Factor Scores *(Opposite meaning is applicable for high factor scores)*
Balance	*BALNEED* *BALJOBRES* *BALINDDIV* *BALINDHAB*	Achieving balance between ecological and economic needs of forested communities is important *(Ambiguous whether anthropocentric or biocentric)*
Environment	*WLFNEED* *FUTGENNEED* *PROTRES* *HUMABUSE* *BALNATURE* *LIMIT* *CONSEQ*	Forest management should benefit wildlife and future generations; Humans are abusing the environment and this has potentially harmful consequences *(Biocentric)*
Management	*HUMNEED* *COMMNEED* *BALNEED* *FUTGENNEED* *MTNINDJOB* *MTNRECJOB*	Forests should be managed to meet the needs of humans, the needs of resource dependent communities, to balance economic and ecological goals, for future generations and for forest-based jobs *(Anthropocentric)*
Wildlife	*WLFNEED* *PROTRES* *INCRDIV* *PROTHAB*	Forests should be managed to meet the needs of wildlife, to protect wildlife resources, and should improve bird habitat even at an economic cost *(Biocentric)*
Human Role	*HUMRIGHT* *HUMRULE* *HUMLEARN*	Humans have the right to modify the environment, humans were meant to rule over nature, and humans will learn enough about nature to be able to control it *(Anthropocentric)*

The factors extracted from the data from this analysis summarize forest and environmental attitudes of survey respondents and succeed in reducing the amount of data required for subsequent analysis. The results indicate that there is an underlying structure to the way in which people respond to these attitude statements. The variables

that load highly on each factor form logical groupings, which allows logical descriptions to be assigned to all resulting factors. The factors also reflect forest and environmental value orientations.

2.4 Factor Score Regression Results

Factor loadings that resulted from the analysis in section 2.3 were converted into factor scores for each respondent using SPSS software (SPSS 13.0). These factor scores are used as dependent variables in a set of models estimated using stepwise OLS regression. Factor scores for each of the 5 factors extracted from the data (See Table 4) are regressed onto a set of socioeconomic variables collected from the surveys, which are listed in Table 2.5.

Table 2.5. Definitions of Variables Used in Factor Score Regression Models

Variable	Definition
SA	Dummy variable equal to 1 if respondent lives in the study area, 0 otherwise
FORORG	Dummy variable equal to 1 if respondent is member of a forestry organization, 0 otherwise
ENVORG	Dummy variable equal to 1 if respondent is member of an environmental organization, 0 otherwise
AGE	Variable indicating respondent's age
GENDER	Dummy variable equal to 1 if respondent is male, 0 otherwise
POLVIEW	Dummy variable equal to 1 if reported political view is conservative, 0 otherwise

The stepwise regression included all socioeconomic variables collected from survey data, but results only report those variables that were significant in the regression

analysis. Other variables that were included but were not significant include the following: property ownership in study forest, membership in hunting club, education, income, employment in resource based industry, urban/rural residence, ethnic background and religion. The results of 5 linear multivariate stepwise regression models estimated with the remaining socioeconomic variables are discussed below and reported in Table 2.6. The original data set of 954 responses was reduced to a total of 563 observations in the factor score regressions. This number, 563, reflects the number of survey respodents for whom observations were complete for all variables included in the factor analysis and the socioeconomic variables included in the regressions.

Table 2.6. Factor Score OLS Stepwise Regression Results

	Model 1 ***Balance***	**Model 2** ***Envirmt***	**Model 3** ***Mgmt***	**Model 4** ***Wildlife***	**Model 5** ***HumanRole***
SA			-0.188**	0.252***	
FORORG			-0.582***	0.544***	
ENVORG				-0.397**	
AGE				0.300***	
GENDER	0.405***				
POLVIEW		0.308***	-0.250***		-0.177**
Intercept	-0.324***	-0.114**			
N	563	563	563	563	563
adj. R^2	0.024	0.021	0.03	0.045	0.006
F value	14.891***	12.889***	6.888***	7.657***	4.149**

*$p<0.10$; **$p<0.05$; ***$p<0.01$

In Model 1, *GENDER* is statistically significant with a positive sign, indicating that men are more likely to disagree with forest management goals that emphasize

achieving a balance between economic and ecological goals than women.

In Model 2, *POLVIEW* is statistically significant with a positive sign. This suggests that politically conservative individuals are more likely to disagree with attitude statements within the "Environment" factor. Individuals who are politically conservative are more likely to disagree with forest management for wildlife needs, future generation needs, and protection of forest and wildlife resources. They are likely to disagree that humans are severely abusing the environment, that the balance of nature is easily upset, that there is a limit to the number of people the earth can support, and that human interference with nature often produces disastrous consequences.

Three socioeconomic variables are statistically significant in Model 3: *SA*, *FORORG* and *POLVIEW*. All three variables have negative signs, indicating that individuals with these characteristics are more likely to agree with the attitude statements within the "Management" factor. Residents of the Study Area, members of forestry organizations and politically conservative individuals are more likely to agree that forests should be managed to meet human needs, the needs of communities dependent on forests, to balance environmental needs with the needs of resource-dependent communities, to meet the needs of future generations and to maintain forest industry and forest-based recreation and tourism jobs.

In Model 4, *SA, FORORG*, and *AGE* are statistically significant with positive signs, and *ENVORG* is significant with a negative sign. This suggests that residents of the Study Area, members of forestry organizations and individuals over the age of 60 tend to disagree with forest management that meets wildlife needs, protects forest and wildlife resources, increases forest migratory songbird diversity and protects habitat for songbirds of conservation concern. Members of environmental organizations, by

contrast, tend to agree with these forest management goals.

The only statistically significant variable in Model 5 is *POLVIEW*, which has a negative sign. Politically conservative individuals tend to agree that humans have the right to modify the environment to suit their needs, humans were meant to rule over nature, and that humans will learn enough about nature to be able to control it.

Although an F-test rejects the hypothesis that all coefficients are jointly equal to zero for all models, each model has fairly low explanatory power. Models 3 and 4 had slightly better explanatory power than models 1, 2 and 5 as judged by the slightly higher R^2 values, which represent the percent of variation explained by the regression.

2.5 Discussion

Model results suggest that residents of the study area and members of forestry organizations are more likely to disagree with forest management solely for the benefit of wildlife and are likely to agree with forest management that meets human needs. This result suggests that study area residents hold anthropocentric views of forest management and the environment, which contradicts results of the qualitative analysis in Essay 1. This result may be the case because the participants in focus group discussions had the opportunity to provide richer details of their thoughts and opinions. Survey respondents from the study area, when faced with a more impersonal mail questionnaire format, may have been more likely than focus group participants to express strong anthropocentric views because of their economic dependence on the timber industry.

Members of environmental organizations tend to favor forest management that benefits forest and wildlife resources. This response suggests a biocentric value orientation for members of environmental organizations. Older individuals do not favor

forest management that benefits forest and wildlife resources, and this result may reflect a more anthropocentric value orientation of this demographic group. Men are more likely than women to reject forest management that tries to achieve balance between economic and ecological goals. This result reflects neither an anthropocentric nor a biocentric value orientation clearly. Politically conservative individuals do not favor forest management for protection of forest and wildlife resources and feel that humans are not adversely affecting the environment. This demographic group also tends to agree with forest management that meets human needs and feels that humans have the right to use the environment for their own purposes and to rule over nature. These results reflect a strong anthropocentric value orientation for this demographic group.

2.6 Conclusions

This research analyzes attitudinal data from a mail survey of Michigan residents in order to determine whether attitudes reveal underlying forest and environmental values and whether or not demographic characteristics can be used to describe individuals who hold certain value orientations. There were two original research hypotheses: 1) there is an underlying structure to the way in which individuals respond to forest management and environmental attitude questions that reveals information about individuals' environmental values, and 2) these environmental values can be explained by a set of socioeconomic characteristics.

The first hypothesis was tested by conducting exploratory factor analysis on a set of variables that measure attitudes towards forest management in a particular area of Michigan's Upper Peninsula as well as general environmental attitudes. The results of factor analysis confirm the hypothesis that there is an underlying structure to the

responses to these attitude statements. The five factors resulting from the exploratory factor analysis are labeled Balance, Environment, Management, Wildlife and Human Role. Each factor, with the exception of Balance, can be interpreted within the anthropocentric/biocentric value framework according to the level of agreement or disagreement with attitude statements associated with that factor.

The second hypothesis was tested by converting results of factor analysis into factor scores for each individual in the sample and running a multivariate regression of factor scores for each factor against a set of socioeconomic characteristics. A set of socioeconomic characteristics was used as explanatory variables in a stepwise regression, which reduced the number of explanatory socioeconomic variables. Each factor model had at least one significant socioeconomic explanatory variable, which supports the hypothesis that environmental value orientations can be explained in part by socioeconomic characteristics. Regression analysis of computed factor scores for each factor indicate that certain demographic groups tend to hold anthropocentric views of forests and the environment while others tend to hold more biocentric views. Results suggest that residents of the Study Area, members of forestry organizations, older individuals, politically conservative individuals tend to hold anthropocentric views while members of environmental organizations tend to hold biocentric views of forests and the environment. The value orientation of men's views is ambiguous.

Information on forest management and environmental attitudes and the underlying values and characteristics of people that express these attitudes comprise an important additional input to be considered in natural resource program and policy evaluation. This research has established connections between certain socioeconomic characteristics and held environmental and forest values and as such provides a means of

predicting attitudes and the consumer and voter behavior of different segments of the public. Results of the regression analysis of factor scores on demographic characteristics, however, did not demonstrate great explanatory power. This result suggests that demographic factors may not be sufficient to fully explain which segments of the public hold particular forest and environmental value orientations. Future research should investigate additional factors that may differentiate groups that hold different forest and environmental value orientations. For example, connections may exist between attitudes, values, and pro-environmental consumer behavior or knowledge of environmental issues.

The research results do provide some guidance, nevertheless, that can inform natural resource management and policy design. For example, when conducting a comparison of forest easement programs to be implemented in the study area, this research suggests that members of forestry organizations will be more likely to favor programs that enhance opportunities for humans whereas environmentalists will tend to prefer programs that protect wildlife and forest resources. Designing a program that combines the preferences of both demographic groups can lead to higher public acceptance and therefore higher success of the program. Results also suggest that proposed programs within the study area would need to emphasize the human or instrumental benefits of the program in order to in order to achieve broad public acceptability in the region. Voluntary forest landowner incentive programs, such as FLEP (Forest Land Enhancement Program), present a means of generating ecological as well as economic benefits from forestry. Results suggest that efforts to disseminate information in the study region to gain membership in this program would need to focus heavily on sustaining long term economic benefits to landowners as well as achieving ecological goals.

REFERENCES

Aaker, D.A., and G.S. Day. 1986. *Marketing Research 3rd Edition.* New York: John Wiley & Sons.

Bengston, D., G. Xu, and D. Fan. 2001. Attitudes toward ecosystem management in the United States, 1992-1998. *Society and Natural Resources* 14:471-487.

Churchill, G.A. Jr. 1991. *Marketing Research: Methodological Foundations 5th Edition.* Chicago: The Dryden Press Harcourt Brace College Publishers.

de Groot, R.S., M.A. Wilson, and R.M.J. Boumans. 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics* 41:393-408.

Dietz, T., L. Kalof, and P.C. Stern. 2002. Gender, Values, and Environmentalism. *Social Science Quarterly* 83 (1):353-364.

Dietz, T., P.C. Stern, and G.A. Guagnano. 1998. Social structural and social psychological bases of environmental concern. *Environment and Behavior* 30:450-471.

Dillman, D.A. 2000. *Mail and Internet Surveys: The Tailored Design Method, 2nd edition.* 2nd ed. New York: John Wiley and Sons, Inc.

Dunlap, R.E., and K.D. VanLiere. 1978. New Environmental Paradigm. *Journal of Environmental Education.* 9(4): 10-19.

Fishbein, M., and I. Ajzen. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research.* Reading, MA: Addison-Wesley.

Hair, J.F. Jr., R.E. Anderson, R.L. Tatham, and W.C. Black. 1998. *Multivariate Data Analysis 5th Edition.* Upper Saddle River, NJ: Prentice Hall.

Honnold, J.A. 1981. Predictors of public environmental concern in the 1970s. In *Environmental Policy Formation: The Impact of Values, Ideology, and Standards,* edited by D. E. Mann. Lexington, MA: Lexington Books, D.C. Heath and Company.

Jacobson, S.K., and S.B. Marynowski. 1997. Public attitudes and knowledge about ecosystem management on Department of Defense land in Florida. *Conservation Biology* 11 (3):770-781.

Jones, R.E., J.M. Fly, and H.K. Cordell. 1999. How green is my valley? Tracking rural and urban environmentalism in the southern Appalachian Ecoregion. *Rural Sociology* 64 (3):482-499.

MA (Millenium Ecosystem Assessment). 2003. *Ecosystems and Human Well Being: A Framework for Assessment*. Washington, D.C.: Island Press.

McFarlane, B.L. and P.C. Boxall. 2000. Factors Influencing Forest Values and Attitudes of Two Stakeholder Groups: The Case of the Foothills Model Forest, Alberta, Canada. *Society and Natural Resources* 13:649-661.

Potter, H.R., and H.J. Norville. 1981. Social values inherent in policy statements: An evaluation of an energy technology assessment. In *Environmental Policy Formation: The Impact of Values, Ideology, and Standards*, edited by D. E. Mann. Lexington, MA: Lexington Books, D.C. Heath and Company.

Reading, R.P., T.W. Clark, and S.R. Kellert. 1994. Attitiudes and knowledge of people living in the Greater Yellowstone Ecosystem. *Society and Natural Resources* 7 (4):349-365.

Rokeach, M. 1973. *The Nature of Human Values*. New York: Free Press.

Solecki, W.D. 1998. Local attitudes on regional ecosystem management: A study of New Jersey Pinelands residents. *Society and Natural Resources* 11 (5):441-463.

SPSS 13.0. Chicago, IL.

STATA Corporation. 2003. *STATA Base Reference Manual A-F Release 8*. Vol. 1. College Station, TX: STATA Press.

Steel, B., P. List, and B. Shindler. 1994. Conflicting values about federal forests: A comparison of national and Oregon publics. *Society and Natural Resources* 7:137-153.

Stern, P.C., T. Dietz, and G.A. Guagnano. 1995. The New Ecological Paradigm in social-psychological context. *Environment and Behavior* 27 (6):723-743.

Tarrant, M., and H. Cordell. 2002. Amenity values of public and private forests: Examining the value-attitude relationship. *Environmental Management* 30 (5):692-703.

Weiler, K.S., and J.T. O'Leary. 1997. Demographic trends and forest resource implications for the Lake States. In *Lake States Regional Forest Resources Assessment: Technical Papers*, edited by J. M. V. a. H. H. Webster. St. Paul, MN: USDA Forest Service North Central Forest Experiment Station General Technical Report NC-189.

Xu, W., B.R. Lippke, and J. Perez-Garcia. 2003. Valuing biodiversity, aesthetics, and lob losses associated with ecosystem management using stated preferences. *Forest Science* 49 (2):247-257.

Xu, W., and D.N. Bengston. 1997. Trends in national forest values among forestry professionals, environmentalists, and the news media, 1982-1993. *Society and Natural Resources* 10(1):43-59.

Essay 3:
Valuing Forest Ecosystem Characteristics:
An Attribute-Based Contingent Valuation Approach

3.1 Introduction

Forest ecosystem services, such as wildlife habitat and biodiversity, are public goods that are not traded in a market, making it difficult to place a value on them. Public goods are goods for which property rights are not defined and thus are available to all individuals for consumption (Mitchell and Carson 1989). Even though no market values exist for these goods, members of the public may hold values for them. Estimates of these values, as well as pubic preferences for these services, can be useful to policy makers and resource managers in evaluating the tradeoffs involved in natural resource allocation decisions. This study estimates public preferences and values for forest ecosystem services and the tradeoffs between them in an area of Michigan's Upper Peninsula (UP), referred to in this essay as the study forest (See Essay 1 for a map and description of the study forest).

The communities in this region are economically dependent on the forests in the area for timber, recreation and tourism industries (See Essay 1 for details). There are numerous complex interactions between humans, wildlife and forests in the study forest, and these interactions are, in turn, connected with ecological and economic trade-offs in the region. For example, studies by other researchers have shown that increases in intensive timber harvesting can increase deer density from the creation of excess browse, which, in turn, causes deer to overbrowse tree saplings, reducing future tree regeneration and reducing habitat for certain forest birds in this region (Laurent et al. in prep, Shi et al. 2005). An evaluation of public preferences for these trade-offs can provide useful

information for natural resource policy makers.

At the time this study was undertaken, the study forest, which is a heavily forested area, was owned primarily by the state (42%) and private forest industry (43%). However, over the past few years, hundreds of thousands of acres of land in this area have been converted to other non-industrial private land uses (Potter-Witter 2005). These recent changes in forest land ownership in the area have implications for the way the forests are managed, which, in turn, affects the types of ecosystem services provided by these forests. For example, lands transferred to non-industrial private ownership may no longer be managed for timber, which may affect local forest industry jobs. The conversion of previous large forest land holdings to small parcels of forest land also has implications for wildlife habitat. For example, industrial forest lands that are sold and no longer managed to grow a particular tree species may reduce habitat for certain types of forest songbirds. Information on public values for ecosystem services in the study forest is needed to understand the potential benefits and costs of the changing forest landownership and management patterns in this region.

A variety of economic techniques exist that provide ways of estimating values for public goods by asking individuals to state their preferences for the provision of an environmental good (Carson 2000). Contingent Valuation (CV) is a stated preference method that uses survey questions to elicit an individual's willingness to pay (WTP) to achieve an environmental improvement or to avoid an environmental injury (Mitchell and Carson 1989, Bennett and Adamowicz 2001). The CV method presents respondents with a hypothetical, or constructed, market that provides information about the environmental good to be valued, how it will be provided, how it will be paid for, and asks the respondent to make a decision about the provision of that good (Mitchell 2002).

CV has been used extensively to estimate benefits of environmental improvements and to assess natural resource damages (Carson 2000). CV studies have been used to estimate the benefits of forest ecosystem services on non-industrial private forest lands (Stevens et al. 2000). Studies have estimated the value of protecting forest land (vanRensburg et al. 2002, Loomis et al. 1994) and the non-market values of forest attributes (Hanley and Ruffell 1993). This study uses ecological information to develop a stated preference survey to estimate the economic value of forest ecosystem attributes that are not valued in the market. The survey results yield values for the estimated marginal utilities of forest ecosystem attributes, and these values are interpreted to analyze the relative benefits of a set of forest ecosystem services.

3.2 Attribute-Based Referenda Model

Research on non-market values of managed forest ecosystems naturally lends itself to a multiattribute approach because of the numerous characteristics of forests managed for multiple uses. Attribute-based methods (ABMs) are growing in popularity as an alternative to the traditional CVM, which has been the most commonly used method for measuring passive use values (Adamowic and Boxall 2001, Holmes and Adamowicz 2003, Holmes and Boyle 2005). Like the CVM, ABMs are based in random utility theory, but they focus on sets of environmental policy-relevant attributes, along with cost, as opposed to one total value, which is the focus of traditional CV studies (Hanley et al. 1998, Bennett and Blamey 2001, Holmes and Boyle 2005).

Numerous studies have compared traditional CVM with ABMs and have concluded that there are several advantages of using ABMs to estimate values of environmental goods with multiple attributes (Boxall et al. 1996, Hanley et al. 1998). A

commonly used ABM is the choice experiment (CE), which is a non-market valuation method that is well suited for the estimation of marginal values of environmental attributes (Boxall et al. 1996, Hanley et al. 1998, Lupi et al. 2002, Stevens et al. 2000).

Another type of ABM is the attribute-based referenda model (ABR), which is a hybrid of contingent valuation and attribute-based method stated preference questions (Holmes and Boyle 2005). This method uses an attribute-based description of an environmental good or service and a referendum-style choice between the status quo and a policy alternative to the status quo.

The ABR model used in this study is based on a contingent market for an environmental good that is described in terms of multiple attributes. The contingent market used in this survey is a political market that presents respondents with a decision to vote 'yes' or 'no' to a forest and wildlife protection program for the Study Forest. This is referred to as a referendum format, or "Take-It-or-Leave-It" approach, and it shows the program and its costs and elicits the respondent's vote (Mitchell and Carson 1989). It is chosen because of the nature of the environmental valuation question, which involves the protection of forest ecosystem resources in a particular geographic area. This approach is desirable because it mimics voting choices that consumers make in the real world, and therefore is more realistic to respondents and is not as susceptible to strategic behavior on the part of respondents as other elicitation methods (ibid). Other reasons for favoring this approach include that people are generally familiar with voting procedures, voting decisions present realistic economic consequences to consumers' households, a ballot is easy to convey through a mail survey, and public goods are paid for collectively (ibid).

The theoretical basis for the ABR method, like CVM and other ABMs, comes

from random utility theory (Adamowicz and Boxall 2001, McFadden 1974). According to random utility theory (RUT), utility consists of an observable and an unobservable component. It is possible to explain a large part of the essentially unobservable consumer utility if a valid procedure for preference elicitation is used (Louviere 2001). However, there will always be a random portion of utility that remains unexplained.

Indirect utility, u, is the maximum amount of utility that a household can derive from income, y, given prices of goods, a vector of environmental quality variables, x, other socioeconomic factors, z, and a component of individual preferences, ε, known to the individual but not to the researcher.

$$u = u(y, x, z, \varepsilon) \tag{1}$$

In an ABR model, respondents are asked if they are willing to pay a certain amount to achieve an environmental quality improvement. In this model, the quality improvement is described by changes in the levels of attributes of a forested ecosystem that will be provided by a program at a cost to the respondent. The indirect utility when an amount p is paid is:

$$u_1 = u(x_1, z, y - p, \varepsilon_1). \tag{2}$$

In this equation, u_1 represents the indirect utility function for an individual who pays the cost of the program, and x_1 is a vector of forest ecosystem attributes under the forest protection program. If the cost, p, of the program is not paid, the indirect utility function is:

$$u_0 = u(x_0, z, y, \varepsilon_0). \tag{3}$$

In this equation, u_0 represents indirect utility under the status quo, and x_0 is the vector of forest attribute levels without the program. An individual will be willing to pay for the proposed program if:

$$u_1(x_1, z, y - p, \varepsilon_1) \geq u_0(x_0, z, y, \varepsilon_0). \tag{4}$$

The probability that a respondent is willing to pay p for the forest protection program (probability of saying yes) is given by the probability that the utility received from the forest protection program is greater than the utility received under the status quo:

$$\begin{aligned} \Pr(yes) &= \Pr[u_1(x_1, z, y - p, \varepsilon_1) > u_0(x_0, z, y, \varepsilon_0)] \\ &= \Pr[\Delta u > 0]. \end{aligned} \tag{5}$$

The indirect utility function has an unobservable, random component. Let indirect utility of individual i from alternative j be expressed by the sum of its explainable and unexplainable components:

$$u_{ij} = v_{ij} + \varepsilon_{ij}, \tag{6}$$

where v_{ij} is the explainable component of utility to individual i from alternative j, and ε is the unexplainable, random component of utility for individual i from alternative j.

The deterministic component of indirect utility can be written as:

$$v_{ij} = \alpha x_j + \gamma_j z_i + \beta(y_i - p_j) \quad , \quad \gamma_j = \gamma_m \; \forall \; j, m \neq 0, \tag{7}$$

where x_j is a vector of k attributes associated with alternative j, α is a vector of estimable parameters, β is an estimable parameter, y_i is income of respondent i, p_j is the price paid

for alternative j, z_i is a vector of socioeconomic characteristics of respondent i and γ_j is a vector of estimable parameters for alternative j for the effect of respondent socioeconomic attributes. Using (6), equation (5) can be rewritten as

$$\Pr(yes) = \Pr[v_{ij} + \varepsilon_{ij} > v_{i0} + \varepsilon_{i0}]. \tag{8}$$

Substituting (7) for the deterministic component of indirect utility in (8) yields the following result:

$$\begin{aligned} \Pr(yes) &= \Pr\left[\alpha x_j + \gamma_j z_i + \beta(y_i - p_j) + \varepsilon_{ij} > \alpha x_0 + \gamma_0 z_i + \beta y_i + \varepsilon_{i0}\right] \\ &= \Pr\left[\alpha x_j - \alpha x_0 + \gamma_j z_i - \gamma_0 z_i - \beta p_j > \varepsilon_{i0} - \varepsilon_{ij}\right] \\ &= \Pr\left[\alpha(\Delta x_j) + \gamma z_i - \beta p_j > \varepsilon_{i0} - \varepsilon_{ij}\right]. \end{aligned} \tag{9}$$

It is typically assumed that the marginal utility of income does not change between the two states, and this assumption allows the βy_i terms to be dropped from the second part of (9). The last equation in (9) can be estimated by making certain assumptions about the error terms. A common assumption is that the errors follow a standard normal distribution. When this assumption is made, the probability of an individual choosing alternative j over the status quo is given by the standard probit model:

$$\Pr\left[\alpha(\Delta x_j) + \gamma z_i - \beta p_j > \varepsilon_{i0} - \varepsilon_{ij}\right] = \Phi\left[\alpha(\Delta x_j) + \gamma z_i - \beta p_j\right], \tag{10}$$

where Φ is the cumulative distribution function (cdf) of the standard normal distribution, assuming that $\sigma = 1$. Equation (10) can be estimated using the maximum likelihood estimation procedure for a probit model. Because of the discrete nature of the choices, σ cannot be identified in a probit, but it is customary to normalize the coefficients so that

$\sigma = 1$. The probability of discrete choice c_i ($c_i = 1$ for a *yes* response and $c_i = 0$ for a *no* response) given attributes x_i is denoted as:

$$\Pr(c_i|x,z,y,p) = \left\{ \begin{array}{l} \Phi\left(\alpha\left(\Delta x_j\right) + \gamma\, z_i - \beta p_j\right)^{c_i} \\ * \left[1 - \Phi\left(\alpha\left(\Delta x_j\right) + \gamma\, z_i - \beta p_j\right)\right]^{(1-c_i)} \end{array} \right\}. \quad (11)$$

where Φ, again, is the cdf of the standard normal distribution. The log-likelihood function for the probit model is written as:

$$L(\alpha,\beta|x,z,y,p) = \sum_{i=1}^{n} \left\{ \begin{array}{l} c_i \log\left[\Phi\left(\alpha\left(\Delta x_j\right) + \gamma\, z_i - \beta p_j\right)\right] \\ + (1-c_i)\log\left[1 - \Phi\left(\alpha\left(\Delta x_j\right) + \gamma\, z_i - \beta p_j\right)\right] \end{array} \right\}. \quad (12)$$

An assumption of the standard probit model is that the error component is independent and identically distributed among individuals and across observations for each individual. However, when an individual responds to more than one stated preference question, it is likely that there are unobservable characteristics specific to that individual that induce correlation across her responses. If this suspected to be the case, it is appropriate to estimate a random effects probit model (Wooldridge 2002). In a random effects model, the error term is treated as separable into two components: one that is unobservable and specific to each individual and another that is unobservable and due to random response shocks across all individuals and all responses (Boxall et al. 2003). The random effects utility difference model can be written as:

$$\Delta u_{ij} = \alpha\left(\Delta x_j\right) + \gamma\, z_i - \beta p_j + \mu_i + \varepsilon_{ij}, \quad (13)$$

where μ_i is the individual-specific error term, and ε_{ij} is the random disturbance term

across all individuals and observations. The random effects probit likelihood function can be written as follows (adapted from Boxall et al. 2003):

$$L=\prod_{i=1}^{N}\int_{-\infty}^{\infty}\prod_{t=1}^{T}\Phi\left[\left\{\left(\frac{\alpha(\Delta x_{it})+\gamma\, z_i-\beta p_{it}}{\sigma_\varepsilon}\right)+\mu_i\left(\frac{\rho}{1-\rho}\right)^{1/2}\right\}(2c_{it}-1)\right]f\left(\frac{\mu_i}{\sigma_\mu}\right)d\left(\frac{\mu_i}{\sigma_\mu}\right). \tag{14}$$

In this equation, Φ is the cdf of the standard normal distribution, and t indexes the choice made by each individual *i*. The correlation coefficient between the responses of individual *i* is defined as:

$$\rho=\frac{\sigma_\mu^2}{\sigma_\varepsilon^2+\sigma_\mu^2}=\frac{\sigma_\mu^2}{\sigma^2}\,. \tag{15}$$

If there is no correlation among the disturbance terms within individuals, ρ will not be significantly different from zero and the standard probit model in which the data is pooled is appropriate. If, however, ρ is significantly different from zero, the standard probit model yields biased standard errors of the estimated coefficients, making it necessary to use the random effects probit model (Boxall et al. 2003). Results of the random effects probit models are reported in section 3.6.

3.2.1 Model Specification

Equations (9) and (13) can be estimated using data collected from a stated preference survey. If we assume that an individual has a linear conditional indirect utility

function, that he gains utility from the forest ecosystem in the study forest, and that his utility can be decomposed into different ecosystem attributes, we can specify the following utility difference function (See Table 3.1 for variable definitions):

$$\begin{aligned}\Delta u_{ij} &= \alpha(\Delta x_j) - \beta p_j \\ &= \alpha_0 + \alpha_1 \Delta indjobs_j + \alpha_2 \Delta rtjobs_j + \alpha_3 \Delta birddiv_j \\ &\quad + \alpha_4 \Delta birdcons_j + \alpha_5 \Delta deer_j + \beta_1 cost_j \ .\end{aligned} \tag{16}$$

(*Note:* $\beta_1 = -\beta$)

where α_k and β represent estimable parameters. Stated preference data collected from a mail survey of Michigan residents are used to estimate the model parameters using random effects probit estimation. Individuals are asked to state in the survey whether or not they would vote for a program that provides specific levels of ecosystem services in the study forest. The data from individuals' yes/no responses along with associated attribute levels with or without the program are inputted to estimate equation (16). Estimation results are presented in section 3.6.

Equation (16) only includes the attributes of the forest easement program that are used to describe the program scenarios. It is also possible to include socioeconomic characteristics, z_i, of survey respondents in order to determine whether certain characteristics are important in predicting a yes response to the easement program. To account for the possible effects of socioeconomic attributes, the following model will also be estimated:

$$\begin{aligned}\Delta u_{ij} &= \alpha(\Delta x_j) + \gamma z_i - \beta p_j \\ &= \alpha_0 + \alpha_1 \Delta indjobs_j + \alpha_2 \Delta rtjobs_j + \alpha_3 \Delta birddiv_j \\ &\quad + \alpha_4 \Delta birdcons_j + \alpha_5 \Delta deer_j + \gamma_1 age_i + \gamma_2 huntclub_i \\ &\quad + \gamma_3 envorg_i + \gamma_4 educ_i + \gamma_5 polview_i + \gamma_6 urban_i + \gamma_7 rec_i + \beta_1 \, cost_j \ .\end{aligned} \tag{17}$$

Table 3.1. Variable Definitions

Variable	Definition
indjobs	Number of forest industry jobs in the study forest
rtjobs	Number of forest-based recreation and tourism jobs in the study forest
birddiv	Percent of study forest with high migratory forest songbird species diversity
birdcons	Number of migratory forest songbird species of conservation concern that are at or above their target population level (out of 19 possible species)
deer	Percent of area with deer browse high enough to affect tree regeneration
cost	Cost to household in increased annual taxes
age	Dummy variable that equals 1 if respondent is over age 60, 0 otherwise
huntclub	Dummy variable equal to 1 if respondent is a member of a hunting club, 0 otherwise
envorg	Dummy variable that equals 1 if respondent is member of an environmental organization, 0 otherwise
educ	Education dummy variable that equals 1 if respondent has college education or above, 0 otherwise
polview	Dummy variable that equals 1 if respondent self-reports to be politically conservative, 0 otherwise
urban	Dummy variable that equals 1 if respondent lives in urban area, 0 otherwise
rec	Dummy variable that equals 1 if respondent has participated in recreational activities in or near the study area, 0 otherwise

It is hypothesized that certain socioeconomic characteristics of respondents affect the probability of voting 'yes' for the forest easement program. The characteristics included in the final model include those reported in Table 3.1. Other socioeconomic characteristics that were examined in the model but were not statistically significant were

then dropped from the model. These included income, religious preference, ethnicity, resource dependence and gender. The estimated coefficients from the random effects probit models will be used to calculate welfare estimates for the forest ecosystem attributes and the overall forest easement program. The following section describes the welfare estimates to be calculated.

3.3 Welfare Estimates

The results of the model estimation will provide values with which welfare measures can be calculated. It is commonly accepted in the non-market valuation literature to use the concepts of compensating surplus and willingness to pay to calculate and discuss welfare estimates (Haab and McConnell 2002). The amount of money that makes an individual indifferent between the status quo and a state with an environmental quality improvement is the individual's willingness to pay for the improvement (Haab and McConnell 2002). This is equivalent to an estimate of compensating surplus (CS), which is an estimate of welfare change that gives the change in income for which an individual would be indifferent between two states when he has an implied right to the status quo (Morrison et al. 1999). This value of WTP is found at the point of equality between indirect utility with and without the program, given by (18).

$$u_0(x_0, z, y, \varepsilon_0) = u_1(x_1, z, y - WTP, \varepsilon_1). \tag{18}$$

Substituting the deterministic components of indirect utility for the status quo and the state with the program, which are represented by the equations in (7), yields the following result:

$$\alpha x_{i0} + \beta y_i = \alpha x_{ij} + \gamma z_i + \beta(y_i - WTP). \tag{19}$$

Solving (19) for WTP yields:

$$WTP = -\left(\frac{\alpha\left(x_{i0} - x_{ij}\right) - \gamma\, z_i}{\beta}\right). \tag{20}$$

or:

$$WTP = -\left(\frac{v_0 - v_1}{\beta}\right). \tag{21}$$

If the resulting change in the attributes is desirable, an individual's income needs to be reduced by the amount of WTP in order to maintain the utility level v_0, implying a positive WTP value (Morrison et al. 1999).

The ratio of each attribute coefficient, α_k or γ_h, to the cost parameter estimate, β, yields marginal dollar estimates for each individual attribute (Hanemann 1994). These values are referred to as implicit prices (IPs) of the attributes and represent the marginal rate of substitution between an attribute and the cost attribute (Morrison et al. 1999). The marginal value of a particular attribute can be calculated as follows:

$$IP_k = -\left(\frac{\alpha_k}{\beta}\right) \text{ for } x_k \quad \text{or} \quad -\left(\frac{\gamma}{\beta}\right) \text{ for } z_i \ , \tag{22}$$

where k indexes each attribute used in the choice design, α is the estimated coefficient of any model attribute and β is the coefficient on the cost variable. The marginal rate of substitution can be calculated in the same way between any two model attributes to determine how much respondents are willing to give up of one attribute to have an additional unit of another, without changing utility.

3.4 Survey Design

The presentation of information in a questionnaire can affect the responses gained, and misinterpretation of survey information can cause serious problems in the data gathered from the responses. The validity and usefulness of results from a CV study rely in large part on carefully defining the environmental good being valued and placing it within the appropriate policy context (Bishop and Heberlein 1992). Careful design of stated preference surveys with multiple attributes is necessary to ensure that choice tasks are realistic and understandable to respondents (Kaplowitz et al. 2004).

Designing the survey instrument involves a qualitative research phase in which focus groups and individual interviews are both integral parts of the survey design process (Kaplowitz and Hoehn 2001). Questionnaire development has been guided by the results of six focus groups, 21 individual pre-test interviews, and interviews with ecologists, foresters and state agency employees (See Essay 1 for details on some of the focus group research related to questionnaire development). The questionnaire contains sections on the economy of the study forest, wildlife in the study forest (focusing on migratory forest songbirds and deer) and a proposed forest management program. The attributes were chosen based on qualitative research findings and also to ensure that the results of this research will be suitable for integration with results from the ecological component of this project. The survey presents respondents with information treatments for each attribute. The questions that follow each attribute's information treatment help to ensure that the respondent connects with the information provided for that attribute.

The questionnaire uses a forest easement program as the policy context for the contingent market. This type of program was chosen for several reasons. Forest easements are a form of conservation easement whose primary purpose is to ensure the

protection of conservation values (Ward and Ervin 2005). A conservation easement is defined as a legal agreement in which a landowner voluntarily limits the use of her land for the purposes of protecting specific conservation values (Lind 2001a). Working forest easements provide a way of conserving the ecological resources of a forest while at the same time ensuring the continued economic and social benefits generated by forests (Lind 2001b). It is realistic to propose a forest easement as a referendum ballot issue because similar programs have been implemented in several other states as a result of successful voting referenda (New Hampshire, Maine, Vermont) (Newsom 2002). Forest easements are also flexible programs that allow landowners to have input into the process of designing a management plan (Ward and Ervin 2005). The voluntary nature of easement programs is a characteristic that is potentially appealing to the general public. This type of program has not been implemented in Michigan and is therefore not a redundancy in this region.

The forest easement program is described in the survey using a set of attributes. These attributes, listed in Table 3.2, are allowed to take on varying levels and form the basis of the choice sets presented to respondents in the survey. These choice sets are established using an experimental design procedure, which is a method of manipulating attributes and their associated levels in such a way as to permit testing specific hypotheses (Louviere et al. 2000). Factorial designs combine each level of each attribute with all levels of all other attributes and have the property that all attribute interactions are independent (ibid). However, full factorial designs can generate extremely large numbers of choice sets. Therefore, fractional factorial designs are employed because of their ability to reduce the number of possible choice sets into a practical amount while retaining the statistical properties of full factorial designs (ibid.). Each of the six forest

easement program attributes listed in Table 3.2 is allowed to take on three levels. The experimental design of the 6 attributes is based on a 3^6 main effects design plan, which produces 18 choice sets (Addelman and Kempthorne 1961).

Table 3.2. Survey Attributes and Levels

Variable Name	Attribute Name	Status Quo Level	Attribute Levels
indjobs	Number of forest industry jobs in the area	675	600, 675, 710
rtjobs	Forest-based recreation and tourism jobs in the area	190	170, 190, 250
birddiv	Percent of area with high migratory forest songbird species diversity	35%	38%, 55%, 75%
birdcons	Number of migratory songbird species of conservation concern that are *at or above their target population* (out of 19 possible species)	6	7, 12, 17
deer	Percent of area with deer browse high enough to affect tree regeneration	69%	67%, 58%, 49%
cost	Cost to your household in increased annual taxes	$0	$20, $90, $400

A description of how the forest easement program works is provided, and the respondent is asked to vote 'yes' or 'no' to a series of proposed forest easement programs. The choices are presented as tables in which one column lists program attributes and the remaining two columns list the levels that each attribute takes with and without the program (See Appendix 3 for a copy of the survey instrument). Several follow-up questions collect additional information about respondent behavior. Following

the choice tables, a debriefing page asks respondents to indicate the level of importance each attribute had in their decision-making and provides a space for the respondent to list reasons for her choices. The debriefing information is important for use in determining whether the respondent was interpreting the tasks correctly and whether or not they understood the tasks, as well as verifying the consistency of their responses (Hanemann 1994).

3.4.1. Economic Attributes

Results of focus group discussions indicated that the public was concerned about timber harvest methods and their effects on the economy, wildlife and recreation in the region. The importance of the forest products industry as well as forests for personal recreational use and generation of tourism revenues to support the local economy came across strongly in the focus group discussions. Focus group results suggested that job impacts would be an important consideration for individuals' preferences. Based on this feedback, we have included a variable for forest industry jobs in the region as well as forest-based recreation jobs.

The use of jobs as an attribute may not intuitively seem like an appropriate attribute for which to estimate a non-market value, because jobs have market values. However, in the context of a resource-dependent community such as the one in our study area, the value of a job related to forests has an importance to community well-being and community health overall. Several studies use jobs as attributes in non-market valuation studies based on the rationale that jobs have a social value (Morrison et al. 1999, Lockwood et al. 1994, Xu et al. 2003, Adamowicz et al. 1998, Morrison et al. 2002, Portney 1994, Blamey et al. 2000).

Two variables were created to account for forest-related jobs. The first variable is defined as Number of Forest Industry Jobs in the Area and the second is Forest-based Recreation and Tourism Jobs in the Area. A question is included in the survey that asks the respondent whether he thinks that a change in the number of forest-related jobs in the study forest will affect his own income. Data from these responses is used as a proxy to ensure that respondent income is measured correctly. A majority of respondents (62%) feel that a change in the number of forest-related jobs would not affect their own income.

Respondents are presented with information about forest industry and forest-based recreation and tourism jobs in the survey. The information treatments are designed to help the survey respondent understand and respond to the choice tables later in the survey in which the forest job variables are listed as choice attributes. The baseline number of forest industry jobs in the area was estimated using data from the U.S. Census for study area zip codes and townships. Employment data for all logging and wood product manufacturing sectors was tabulated for the zip codes that fall within the study area boundaries. See Appendix 2 for details of these calculations.

Forest-based recreation and tourism employment encompasses many subsectors, including retail trade, food and accommodation services. However, not all of these services are directly related to forest-based recreation and tourism. The proportion of the total number of arts, entertainment, recreation, accommodation and food service jobs in the study forest that are directly attributable to forest-based recreation is calculated by estimating the number of jobs attributable to the two most popular forest-based recreation activities in the study forest: snowmobiling and deer hunting. The baseline number of forest-based recreation and tourism jobs in the study forest was estimated using U.S. Census employment data for retail, food, entertainment and accomodation service

sectors. Economic multipliers are used to estimate the number of jobs attributable to each of the two important recreation-based industries in the area. See Appendix 2 for details of these calculations.

3.4.2. Birds

The study forest serves as important habitat to migratory forest songbirds, and this region has one of the highest levels of migratory forest songbird diversity in North America because of the overlap that occurs in this part of the UP between northern and southern migratory habitats (Howe et al. 1995). One of the variables chosen to represent migratory forest songbirds is "percent of area with high migratory forest songbird diversity." This variable was defined in such a way as to allow us to connect the economic variable later with the ecological variable in a larger integrated model. Another variable relating to migratory forest songbirds is "number of species of conservation concern at or above their target population level." Because the wildlife ecologist researchers will not have data on all of the individual species of conservation concern in the study forest to be used in the integrated model, we chose to define the variable in a more general way that will allow us to later connect this variable with the ecological data in the larger integrated model.

The information treatment on migratory forest songbirds was developed with the collaboration of the ecologists working on the project. The Partners in Flight (PIF) classification of "priority breeding species for conservation" for Region 12 (a region that most closely approximates the study forest) was used to identify the migratory forest songbirds in the study forest that are also birds of conservation concern (PIF 2005) (See Appendix 2 for more details). The criteria used by PIF to determine priority for conservation is based on numerous variables, including the following: global relative

abundance, global scores for breeding distribution and winter distribution, global score for threats in the nonbreeding season, threats to successful breeding, importance of Region 12 for breeding, population trend, priority tier, percent of species' breeding population in Region 12, and watch list status (PIF 2005).

The data from the PIF source was used to determine the number of migratory songbirds of conservation concern currently in the study forest that are at or above their target population level. This is the status quo level for the variable *birdcons*. The current level of migratory forest songbird species diversity in the study area was taken from an estimate provided by the wildlife ecologists collaborating on this project. This is the status quo level for the variable *birddiv*.

3.4.3 Deer

There is evidence that deer browse is affecting the regeneration of certain species of trees in the study forest and that this in turn is adversely affecting habitat for migratory forest songbirds (Laurent et al. in prep, Shi et al. 2005). The concept of deer browse was familiar to most focus group participants. The variable chosen to represent deer browse is "percent of area with deer browse high enough to affect tree regeneration." Deer browse and its effect on tree regeneration is an important component of this research project because of its complex ecological effects. We discovered through the focus group discussions that the relationships between deer browse, forest structure and composition, forest songbird habitat and timber harvesting activities were too complicated to attempt to convey in this survey.

In order to maintain simplicity and to convey the issue of deer browse, only its effect on tree regeneration was discussed in the survey. The status quo level of "deer browse in the study area high enough to affect tree regeneration" is based on estimates

provided by forest ecologists collecting deer browse data in the study forest. The choice table in the survey also showed respondents an attribute representing deer numbers. This was intended to ensure that respondents did not confuse deer browse with deer numbers in the area. The level of the deer number attribute did not vary across choices.

3.5 Survey Implementation

The survey was sent to a stratified random sample of Michigan households using a modified version of Dillman's tailored design method (Dillman 2000). The sample was purchased from Survey Sampling International and was designed to represent four geographic strata of Michigan households. Strata were divided to represent: 1) households within the study area (defined by U.S. Census 2000 block groups), 2) households within the Upper Peninsula but outside the study area (defined by U.S. Census 2000 block groups and Michigan counties), 3) households within the counties of the Northern Lower Peninsula and 4) households within the counties of the Southern Lower Peninsula (See Appendix 1 for details on sample design).

Surveys were mailed to a sample of 2,000 Michigan households (See Appendix 5 for details on survey implementation). The survey was sent using four contacts: a hand-signed, personalized prenotice letter, a first mailing of the questionnaire, a hand-signed personalized reminder post card, and a second mailing of the questionnaire (See Appendices 3 and 4 for copies of survey correspondence and the survey instrument). Each questionnaire mailing included a hand-signed, personalized cover letter, a survey booklet and a postage-paid business reply envelope. Three first class stamps were included in the first questionnaire mailing of each group as a respondent incentive. The use of three first class stamps as an incentive in the first wave mailing was assumed to

increase the response rate by as much as a third wave mailing would, and the costs of an additional third wave mailing were not feasible within the project budget when using the stamp incentive. Previous surveys have shown that using an incentive of three first-class stamps can increase response rates by approximately 5% (Lupi 2005). Of the 2,000 surveys mailed, 1,899 were delivered to respondents. A total of 954 usable surveys were returned, yielding an overall response rate of 50% (AAPOR 2004).

Summary statistics of the socioeconomic characteristics of respondents are reported in full in Appendix 6. Most respondents (82%) do not own property in the study area. Those that do (18%) own an average of 39 acres. A small percentage of respondents (3%) are members of forestry organizations, while a slightly larger percentage are members of an environmental organization (7%) and even more are members of a hunting club (20%). Respondents on average were predominantly male (77%), with a median age of 55. A minority (39%) have an associate's degree or higher. A majority of respondents reported living in a rural area (71%). The respondent pool is not very ethnically or religiously diverse with 95% white respondents and 75% protestant or catholic respondents. Many respondents (74%) have participated in recreational activities in or near the study area at some point in their life. This may indicate that those who were already familiar with the study area were more likely to respond to the survey.

After the series of choice questions in the survey, each respondent was presented with a table in which she could rank the importance of each forest easement program attribute in her decision to vote yes or no for the programs. The frequency of responses for attribute importance rankings is reported in Table 3.3. Industry jobs, recreation and tourism jobs, deer browse and deer numbers are ranked 'important' to 'very important' by a majority of respondents. Cost is considered to be important to very important by

about 78% of respondents. Forty-four to 45% of respondents ranked bird diversity and protecting bird species of conservation concern as 'important' to 'very important,' respectively. Few respondents ranked the industry jobs, recreation and tourism jobs and cost variables as unimportant (12%, 14% and 9%, respectively), while slightly more respondents ranked the bird diversity and bird conservation variables as unimportant in their decisions (24% and 25%, respectively). While all variables seem to rank highly for respondents in influencing their choices, the economic variables (jobs and cost) rank the highest in importance, followed by the deer browse and deer number attributes. The bird diversity and bird conservation attributes rank lowest in importance overall.

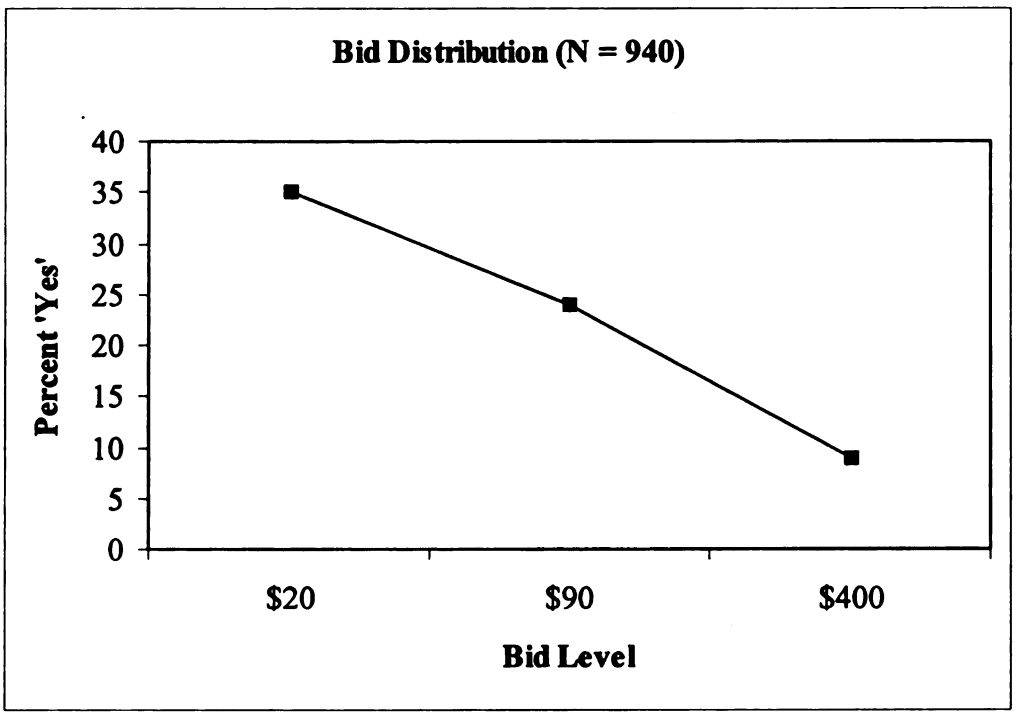
Table 3.3. Response Frequencies for Respondent Evaluation of Attribute Importance to Choice

Easement Program Attribute	Percent Response					N
	VI*	I	SI	NVI	NI	
Number of forest industry jobs in the area	22.9	38.2	27	8.2	3.7	899
Number of forest-based recreation and tourism jobs in the area	18.5	38.5	28.8	10.8	3.4	890
Percent of area with high migratory forest songbird species diversity	11.1	34.2	30.6	18.4	5.6	889
Number of migratory forest songbird species of conservation concern *at or above their target population* (out of 19 possible species)	11.7	32.3	31.1	18.5	6.4	896
Percent of area with deer browse high enough to affect tree regeneration	12.3	39.6	33.8	11.1	3.1	893
Number of deer in the area (more, same, less)	15.1	37.3	30.3	13.5	3.8	895
Cost to your household in increased annual taxes	50.6	27.8	12.8	5.2	3.6	897

** VI = Very Important; I = Important; SI = Somewhat Important; NVI = Not Very Important; NI = Not Important At All*

The response pattern to the different bid amounts offered in the dichotomous choice questions can be seen in a graph of the bid distribution. The percent of individuals who respond yes to each bid is presented in graphical form in Figure 3.1. Responses in this graph are averaged over all responses to bid levels with the same bid amount. The distribution of 'yes' responses to the three bids ($20, $90 and $400) presented to survey respondents follows the expected pattern of a downward sloping curve, which means that the percent of 'yes' responses decreases as the bid increases.

Figure 3.1. Graph of Bid Distribution



3.6 Model Estimation Results

The standard probit and the random effects probit models were estimated using the forest easement program attributes as explanatory variables in order to test for the presence of random effects. Rho, the correlation coefficient between the overall model variance and the variance within an individual's responses, is significantly different from zero at the 99% level or higher, therefore it can be concluded that the standard probit model results in biased standard errors of the estimated coefficients, and that it is necessary to use the random effects model (Boxall et al. 2003). The model results reported in Table 3.4 are therefore based on random effects probit model estimation.

Two models are estimated and results are reported in Table 3.4. Model 1 includes

only the forest easement program attributes as explanatory variables, and Model 2 includes easement program attributes as well as a set of socioeconomic characteristics of the respondents. Many socioeconomic characteristics were originally included in the model, but several were dropped due to a lack of explanatory power. Regardless of different combinations of socioeconomic variables in the model, program attribute coefficients and standard errors remained consistent. The variables that were dropped include income, resource dependence (measured by employment of any family member in a natural resource based industry), ethnicity, religion and gender. Income was not found to have a significant effect on WTP in the analysis reported here[1]. While income is typically expected to have a positive and statistically significant relationship with WTP, income elasticity of WTP is often found to be less than one in contingent valuation studies (Carson et al. 2001, Hanemann 1994).

Expected signs of the estimated coefficients are as follows. An additional forest industry job or forest-based recreation and tourism job should increase the probability of an individual voting for the program. Therefore the signs on *indjobs* and *rtjobs* are expected to be positive. The signs on *birddiv* and *birdcons* are also expected to be positive, as an increase in bird diversity or an increase in the number of songbird species of conservation concern should increase the probability of a 'yes' response because increases in these variable represent environmental improvements. The coefficient on *deer* is expected to be negative because an increase in the percent of area with high deer browse is an effect that should decrease an individual's probability of voting 'yes' for the

[1] In this study, 11 individuals in the sample reported an annual household income of $200,000 or greater, and income was significant in versions of the model where these individuals were dropped from the analysis.

program because an increase in this variable represents a negative environmental effect. Similarly, the coefficient on *cost* is expected to be negative, because as the price of the program increases, the probability of a 'yes' response should decrease.

It is expected that recreational use, *rec,* will have a positive effect on willingness to pay. Studies of environmental attitudes conclude that attitudes can be predictors of behavior (McFarlane and Boxall 2000). Several studies that identify the effects of socioeconomic characteristics on environmental attitudes conclude that higher levels of education, urban residence and membership in environmental organizations are connected to pro-environmental attitudes (Dietz et al. 1998). Studies in the environmental attitude literature have also shown that individuals in older age groups and politically conservative individuals tend to have attitudes that do not favor the environment (Dietz et al. 1998). Based on these studies and based on the assumption that attitudes can be predictors of behavior, it is hypothesized that education, *educ*, urban place of residence, *urban*, and environmental organization membership, *envorg,* will have a positive effect on the probability of voting 'yes' for environmental improvements and are therefore expected to have positive signs. Age, *age*, and conservative political views, *polview*, are expected to decrease the probability that a respondent will vote 'yes' for a conservation program and therefore are expected to take on negative signs.

The estimated coefficients in both models all have the expected signs, and all variables are significant at the 95% level or higher. All easement program attributes are highly significant (99%) in both models with the exception of *birdcons,* which decreased slightly in significance in Model 2, but is still significant at the 95% level in Model 2. Of the socioeconomic variables, *polview* and *urban* are significant at the 95% level, and the remaining variables, *age, huntclub, envorg, educ* and *rec* are all significant at the 99%

level.

Estimation results indicate that an increase in the number of forest industry jobs, the number of forest-based recreation and tourism jobs, bird diversity and habitat for songbirds of conservation concern increases the probability of an individual voting 'yes' for the easement program. An increase in the area affected by deer browse reduces the probability of voting 'yes' for the program, as does an increase in the cost of the program to a household. Older individuals, members of hunting clubs, and politically conservative individuals have lower probabilities of voting 'yes' for the forest easement program, while members of environmental organizations, individuals with higher levels of education, people who live in an urban area, and people who have used the study area for recreational purposes have a higher probability of voting 'yes' for the program.

Table 3.4. Estimation Results from Random Effects Models

Variable	Model 1	Model 2
Intercept	-0.9389***	-0.2438
	(0.1281)	(0.3556)
indjobs	0.0076***	0.0081***
	(0.0008)	(0.0009)
rtjobs	0.0069***	0.0071***
	(0.0012)	(0.0012)
birddiv	0.0119***	0.0130***
	(0.0026)	(0.0027)
birdcons	0.0240***	0.0235**
	(0.0095)	(0.0098)
deer	-0.0151***	-0.0177***
	(0.0054)	(0.0056)
cost	-0.0075***	-0.0072***
	(0.0005)	(0.0005)
age		-0.0211***
		(0.0051)
huntclub		-0.5032***
		(0.1899)
envorg		0.9750***
		(0.2829)
educ		0.5226***
		(0.1696)
polview		-0.3553**
		(0.1590)
urban		0.5322**
		(0.2418)
rec		0.4868***
		(0.1980)
Rho	0.7902***	0.7572***
	(0.0204)	(0.0235)
Number of obs	3646	3264
Number of groups	940	841
Log Likelihood	-1433.15	-1272.48
Prob > chi-square	<0.0000	<0.0000

*Standard errors in parentheses; ***Significant at the 99% level; ** Significant at the 95% level*

The chi square test of the hypothesis that all estimated model parameters are jointly equal to zero can be rejected at the 99% level for both models. Another indicator of the overall performance of a model is the likelihood value at convergence. Higher values of log likelihood at convergence indicate improved performance of a model, and likelihood ratio tests compare two different models to see if they are statistically different (Boxall and Macnab 2000). Because likelihood tests need to be conducted on models that use the same number of observations, another version of Model 1, Model 1a, was estimated excluding all missing observations from the socioeconomic variables. The hypothesis that the parameters on the socioeconomic variables in Model 2 are equal to zero is tested using the likelihood ratio statistic. The likelihood value of Model 1a (the restricted model) estimated using the N=841 data set is -1303.31 and the value for Model 2 (the unrestricted model) using the same number of observations is -1272.48. The larger likelihood value of Model 2 indicates a better performance of that model. The likelihood ratio statistic is calculated as follows:

$$\lambda = 2(L_{UR} - L_R) \sim \chi^2$$

This statistic follows the chi square distribution with the degrees of freedom given by the number of restrictions imposed. The test statistic for comparing Models 1a and 2 is:

$$2(-1272.48 - (-1303.31)) = 61.66$$

The p-value of obtaining a chi square value higher than 61.66 with 7 degrees of freedom is less than 0.005. Therefore, the null hypothesis that the coefficients on the 7 socioeconomic variables are equal to zero can be rejected, and the variables can be retained in the model.

Overall, both models perform very well. Results of tests of significance of

parameter estimates and a likelihood ratio test indicate that Model 2 performs better than Model 1a overall. All of the socioeconomic variables included in Model 2 are significant and indicate that, in addition to program characteristics, demographic factors also have an important influence on respondent choices.

3.7 Welfare Analysis and Discussion

The estimation results from the previous section can be used to estimate willingness to pay for program attributes. These WTP values are referred to as implicit prices and are calculated using equation 22, specified in Section 3.3. Their calculation is based on the ceteris paribus assumption that all other variables are held constant (Bennett et al. 2001). Implicit prices can provide useful information to policy makers on the benefits of small changes in individual aspects of environmental quality (Morrison et al. 2002). The implicit prices of each attribute of the easement program from both models are reported in Table 3.5. Implicit prices for each attribute are similar across both models, but the values are slightly higher for all attributes in Model 2, which was determined to be a better performing model in the previous section.

All attributes have a positive implicit price with the exception of *deer*, which has a negative value for marginal WTP. This means that individuals need to be compensated for an additional unit of deer browse damage. The amount of compensation for deer browse damage is greater in Model 2 than Model 1. The marginal implicit prices are slightly higher in Model 2 for *indjobs, rtjobs, birddiv* and *birdcons*. The value of an additional forest industry job is slightly higher than that of a forest-based recreation or tourism job in both models. People are willing to pay more for an additional songbird species of conservation concern at or above its target population than for they are willing

to pay for an additional percent of bird diversity or for an additional forest industry or forest-based recreation and tourism job. These results provide an indication of the relative values individuals place on the different forest ecosystem attributes specified in the forest easement program.

Table 3.5. Implicit Prices of Attributes

Variable	Model 1	Model 2
indjobs	$1.01	$1.13
rtjobs	$0.92	$0.99
birddiv	$1.59	$1.81
birdcons	$3.20	$3.26
deer	-$2.01	-$2.46

Implicit prices are marginal rates of substitution between a nonmonetary attribute and a monetary attribute. Other marginal rates of substitution can also be calculated between nonmonetary attributes. The marginal rate of substitution of one attribute for another can be calculated and used to examine the trade-offs that individuals are willing to make among program attributes, or the relative importance they place on attributes. Because Model 2 was shown to be a better performing model than Model 1, coefficients from Model 2 are used to calculate the trade-offs between other easement program attributes in Table 3.6.

Table 3.6. Marginal Rates of Substitution Between Nonmonetary Program Attributes

	For a 1 unit increase in:				
	indjobs	*rtjobs*	*birddiv*	*birdcons*	*deer*
Willing to give up:					
indjobs		0.87	1.6	2.9	-2.18
rtjobs	1.14		1.83	3.31	-2.49
birddiv	0.62	0.55		1.81	-1.36
birdcons	0.34	0.30	0.55		-0.75
deer	-0.46	-0.40	-0.73	-1.33	

Individuals are willing to trade slightly more recreation and tourism jobs for an increase in forest industry jobs than they are willing to trade the converse. Individuals are willing to give up approximately 1 recreation and tourism job for an additional forest industry job but will give up less than one industry job for an additional recreation and tourism job. This suggests that forest industry jobs rank higher in importance than recreation and tourism jobs. For additional units of bird diversity and bird species of conservation concern, individuals are willing to give up more recreation and tourism jobs than industry jobs. Increases in species of conservation concern are worth relatively more in jobs than are increases in bird diversity. The largest trade-offs in nonmonetary attributes are made for increases in migratory forest songbird species of conservation concern that are at or above their target population.

The trade-offs made between the deer variable and other attributes require a slightly different interpretation because an increase in the deer attribute represents a negative effect of increased browse levels that affect tree regeneration. For increases in

industry jobs, recreation and tourism jobs and bird diversity, individuals are willing to give up a less than one percent reduction in area that is heavily browsed. For an increase in bird species of conservation concern at or above the target habitat level, individuals are willing to give up slightly more than a one percent reduction in heavily browsed areas. If the area heavily browsed by deer increases by one percent, people are willing to accept an increase of about 2 industry jobs, 2 1/2 recreation and tourism jobs, slightly more than 1 percent increase in bird diversity, and an increase of less than one songbird species of conservation concern.

3.8 Conclusions

This research uses data collected from a mail survey of 2,000 Michigan residents to estimate the nonmarket values of forest ecosystem attributes of an area of Michigan's Upper Peninsula. The analysis employs the contingent valuation method, based on random utility theory, within an attribute-based referendum format. Attributes for which nonmarket values are estimated in this study reflect the ecological and social importance of the study forest.

The study forest is a region that is economically dependent on forests and where forests form a dominant part of the ecological landscape. Forests in the study area are extremely important to the economic sustainability of the region. In addition, forest management practices in this region have had adverse effects on wildlife habitat and forest regeneration. This study estimates nonmarket values for forest industry jobs, forest-based recreation and tourism jobs, forest migratory songbird species diversity, number of forest migratory songbird species of conservation concern and the effects of deer browse on tree regeneration. The results of this research show that ecological and

social attributes of forests are valued by individuals in Michigan.

Results of this research can be useful in policy and resource management decisions that require a comparison of the relative benefits of specific environmental attributes of the study forest. These results indicate that support for protection of ecological and social resources in this area of the Upper Peninsula exists in Michigan. Results also suggest that the development of programs aimed at forest and wildlife conservation in the area need to include options for sustaining the social value of forest jobs in the area.

REFERENCES

AAPOR. 2004. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*. Edited by American Association for Public Opinion Research. 3rd ed. Lenexa, KS.

Adamowicz, V., and P. Boxall. 2001. Future directions of stated choice methods for environment valuation. Paper read at Choice Experiments: A New Approach to Environmental Valuation, April 10, 2001, at London, England.

Adamowicz, W.L., P. Boxall, M. Williams and J. Louviere. 1998. Stated Preference approaches to measuring passive use values: choice experiments versus contingent valuation. *American Journal of Agricultural Economics* 80 (1):64-75.

Addelman, S., and O. Kempthorne. 1961. Orthogonal Main-Effect Plans. Ames, IA: Iowa State University, Aeronautical Research Laboratory, Office of Aerospace Research, United States Air Force.

Bennett, J., and R. Blamey. 2001. Introduction. In *The Choice Modelling Approach to Environmental Valuation*, edited by J. Bennett and R. Blamey. Cheltenham, UK: Edward Elgar.

Bennett, J., and V. Adamowicz. 2001. Some Fundamental of Environmental Choice Modelling. In *The Choice Modelling Approach to Environmental Valuation*, edited by J. Bennett and R. Blamey. Cheltenham, UK: Edward Elgar.

Bennett, J., J. Rolfe, and M. Morrison. 2001. Remnant vegetation and wetlands protection: Non-market valuation. In *The Choice Modelling Approach to Environmental Valuation*, edited by J. Bennett and R. Blamey. Cheltenham, UK: Edward Elgar.

Bishop, R., and T. Heberlein. 1992. The Contingent Valuation Method. In *Natural Resource Damages: Law and Economics*, edited by K. W. a. J. Duffield: John Wiley and Sons.

Blamey, R., J. Rolfe, J. Bennett, and M. Morrison. 2000. Valuing remnant vegetation in Central Queensland using choice modelling. *The Australian Journal of Agricultural and Resource Economics* 44 (3):439-456.

Boxall, P., K. Rollins, and J. Englin. 2003. Heterogeneous preferences for congestion during a wilderness experience. *Resource and Energy Economics* 25:177-195.

Boxall, P.C., and B. Macnab. 2000. Exploring the preferences of wildlife recreationists for features of boreal forest management: a choice experiment approach. *Canadian Journal of Forest Research* 30:1931-1941.

Boxall, P.C., W.L. Adamowicz, J. Swait, M. Williams and J. Louviere. 1996. A comparison of stated preference methods for environmental valuation. *Ecological Economics* 18:243-253.

Carson, R.T., N.E. Flores and N.F. Meade. 2001. Contingent valuation: Controversies and Evidence. Environmental and Resource Economics 19:173-210.

Carson, R.T. 2000. Contingent Valuation: A User's Guide. *Environmental Science and Technology* 34:1413-1418.

Dietz, T., P.C. Stern, and G.A. Guagnano. 1998. Social structural and social psychological bases of environmental concern. *Environment and Behavior* 30:450-471.

Dillman, D.A. 2000. *Mail and Internet Surveys: The Tailored Design Method, 2nd edition.* 2nd ed. New York: John Wiley and Sons, Inc.

Haab, T.C., and K.E. McConnell. 2002. *Valuing Environmental and Natural Resources.* Cheltenham, UK: Edward Elgar.

Hanemann, W.M. 1994. Valuing the environment through contingent valuation. *The Journal of Economic Perspectives* 8 (4):19-43.

Hanley, N. and Ruffel, R.J. 1993. The contingent valuation of forest characteristics: two experiments. *Journal of Agricultural Economics* 44 (2):218-229.

Hanley, N., R.E. Wright & V. Adamowicz. 1998. Using choice experiments to value the environment. *Environmental and Resource Economics* 11 (3-4):413-428.

Holmes, T.P., and K.J. Boyle. 2005. Dynamic learning and context-dependence in sequential, attribute-based, stated-preference valuation questions. *Land Economics* 81 (1):114-126.

Holmes, T.P., and W.L. Adamowicz. 2003. Attribute-based methods. In *A Primer on Nonmarket Valuation*, edited by P.A. Champ K.J. Boyle and T.C. Brown. Dordrecht: Kluwer Academic Publishers.

Howe, R.W., Niemi, G., and J.R. Probst. 1995. Management of Western Great Lakes Forests for the Conservation of Neotropical Migratory Birds. In *Management of Midwestern Landscapes for the Conservation of Neotropical Migratory Birds*, edited by I. F.R. Thompson. Detroit: USDA Forest Service North Central Forest Experiment Station.

Kaplowitz, M.D., and J.P. Hoehn. 2001. Do focus groups and individual interviews reveal the same information for natural resource valuation? *Ecological Economics* 36:237-247.

Kaplowitz, M.D., F. Lupi, and J.P. Hoehn. 2004. Multiple-Methods for Developing and Evaluating A Stated Choice Survey for Valuing Wetland Ecosystems. In *Questionnaire Development, Evaluation, and Testing Methods*, edited by S. Presser et al. New York: John Wiley & Sons, Inc.

Laurent, E. J., J.B. LeBouton, H. Shi, M. Walters and J. Liu. In prep. Independent effects of managed northern hardwood stand characteristics on bird species' occurrences in Michigan's Upper Peninsula.

Lind, B. 2001a. Trends in working forest conservation easements - A report from the April 2001 meeting of the Land Trust Alliance Working Forest Conservation Easements Advisory Panel. Washington, D.C.: Land Trust Alliance.

———. 2001b. Using conservation easements to protect working forests. *Exchange* Spring 2001:10-13.

Lockwood, M., J. Loomis, and T. De Lacy. 1994. The relative unimportance of a nonmarket willingness to pay for timber harvesting. *Ecological Economics* 9:145-152.

Loomis, J., M. Lockwood, and T. DeLacy. 1993. Some Empirical Evidence on Embedding Effects in Contingent Valuation of Forest Protection. *Journal of Environmental Economics and Management* 24:45-55.

Louviere, J.J. 2001. Choice experiments: An overview of concepts and issues. In *The Choice Modelling Approach to Environmental Valuation*, edited by J. B. a. R. Blamey. Cheltenham, UK: Edward Elgar.

Louviere, J.J., D.A. Hensher, and J.D. Swait. 2000. *Stated Choice Methods: Analysis and Application*. Cambridge: Cambridge University Press.

Lupi, F. 2005. Personal Communication.

Lupi, F., M.D. Kaplowitz, and J.P. Hoehn. 2002. The Economic Equivalency of Drained and Restored Wetlands in Michigan. *American Journal of Agricultural Economics* 84 (5):1355-1361.

McFadden, D. 1974. Conditional logit analysis of qualitative choice behavior. In *Frontiers in Econometrics*, edited by P. Zarembka. New York: Academic Press.

McFarlane, B.L., and P.C. Boxall. 2000. Factors Influencing Forest Values and Attitudes of Two Stakeholder Groups: The Case of the Foothills Model Forest, Alberta, Canada. *Society and Natural Resources* 13:649-661.

Mitchell, R.C. 2002. On designing constructed markets in valuation surveys. *Environmental and Resource Economics* 22:297-321.

Mitchell, R.C., and R.T. Carson. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method.* Washington, D.C.: Resources for the Future.

Morrison, M., J. Bennett, and R. Blamey. 1999. Valuing improved wetland quality using choice modeling. *Water Resources Research* 35 (9):2805-2814.

Morrison, M., J. Bennett, R. Blamey, and J. Louviere. 2002. Choice modeling and tests of benefit transfer. *American Journal of Agricultural Economics* 84 (1):161-170.

Newsom, D. 2002. Forest certification and working forest conservation easements: Common elements and first thoughts on a combined system: Rainforest Alliance Sustainable Forestry Division.

Partners in Flight (PIF). 2005. *Partners in Flight Bird Conservation Plan for the Boreal Hardwood Transition (Physiographic area 20), Draft*: American Bird Conservancy.

Portney, P.R. 1994. The contingent valuation debate: Why economists should care. *The Journal of Economic Perspectives* 8 (4):3-17.

Potter-Witter, K. 2005. Personal Communication.

Shi, H., E.J. Laurent, J. LeBouton, L. Racevskis, K.R. Hall, M. Donovan, R.V. Doepker, M.B. Walters, F. Lupi and J. Liu. 2005. Local spatial modeling of white-tailed deer distribution. *Ecological Modeling.*

Stevens, T.H., R. Belkner, D. Dennis, D. Kittredge, and C. Willis. 2000. Comparison of contingent valuation and conjoint analysis in ecosystem management. *Ecological Economics* 32:63-74.

vanRensburg, T.M., G.A. Mill, M. Common, and J. Lovett. 2002. Preferences and multiple use forest management. *Ecological Economics* 43:231-244.

Ward, J., and J. Ervin. 2005. *Land trusts and certification: Complementary tools for forest conservation* 2005 [cited September 17 2005]. Available from http://www.greendesign.net/understory/sum99/LandTrusts.html.

Wooldridge, J.M. 2002. *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press.

Xu, W., B.R. Lippke, and J. Perez-Garcia. 2003. Valuing biodiversity, aesthetics, and job losses associated with ecosystem management using stated preferences. *Forest Science* 49 (2):247-257.

Essay 4:
Effects of Distance, Attitudes and Recreational Use on Willingness to Pay for Forest Ecosystem Services

4.1 Introduction

Environmental value estimates that result from non-market valuation studies are key inputs to cost-benefit analysis in support of policy decisions (Hanley et al. 2003). In order to improve the usefulness of estimates for cost-benefit analysis and policy making, it is important to determine whose values should be included in the analysis. Determining the extent of the market for environmental goods and services can be accomplished by estimating effects of distance, resource management attitudes and recreational use on willingness to pay for the provision of an environmental good or service. This study investigates the effects of these factors on willingness to pay (WTP) for a forest easement program in an area of Michigan's Upper Peninsula (UP).

Information on the relationship between distance and WTP can provide a conceptualization of who benefits from environmental improvements (Hanley et al 2003). Several studies have analyzed the effect of distance on non-market values of natural resources and have found a negative relationship between distance and WTP (Johnson et al. 2001, Loomis 1996, Bateman and Langford 1997, Pate and Loomis 1997, Sutherland and Walsh 1985), also referred to as the distance decay effect (Hanley et al. 2003). This study estimates the effect of distance on WTP for a forest easement program in a study forest in Michigan's UP.

Attitudes towards resource management may also play an important role in predicting the probability that individuals will support an environmental improvement. The connections between environmental values, attitudes and behavior have been well

established in the environmental behavior literature (Dietz et al. 1998, Nordlund and Garvill 2002, Johnson et al. 2004, Tarrant and Cordell 1997, Stern et al. 1995, Poortinga et al. 2004). However, relatively few studies in the nonmarket valuation literature have examined the effects of attitudes on the nonmarket values of environmental goods and services. Contingent valuation (CV) studies that have included attitudes in the analysis of WTP values report a positive relationship between pro-environmental attitudes and WTP (Bandara and Tisdell 2003, Streever et al. 1998, Stevens et al. 1991). Attitudinal variables can improve the performance of CV models, and information on the effects of attitudes on WTP forms an important component of nonmarket valuation that can help understand the motivations that underlie individuals' choices (McLelland 2001).

In this study, attitudinal data collected from a mail survey of Michigan residents is included in a CV model to test the hypothesis that resource management attitudes can be used to explain WTP. It is assumed that there are certain types of environmental values that underlie individuals' attitudes towards resource management. The conceptualization of environmental values and attitudes in this paper is based on the hierarchical framework established by Stern et al. (1995), in which values underlie attitudes and attitudes predict behavior.

Consideration of use and non-use values also contributes to determining the extent of the market for an environmental good. When the total value an individual holds for a resource is greater than that individual's use value, the remaining value is referred to as non-use value (Freeman 2003). Benefit estimates taken only at the site of the resource may result in exclusion of use and non-use values of individuals who do not live near the resource, and if the region from which values are elicited is too broad, estimates may be inflated (Pate and Loomis 1997, Sutherland and Walsh 1985). Results from

Essay 3 showed that recreational use has a significant positive effect on WTP. This study uses data on specific types of recreational uses of survey respondents to determine how the effects of recreational use on WTP change as distance from the resource increases.

4.2 Methods

4.2.1 Survey design and implementation

The survey instrument was designed based on results from six focus groups, 21 individual pre-test interviews and interviews with professional ecologists, forests and state agency employees. The survey collected stated preference data using a dichotomous choice referendum format and also collected data on attitudes towards forest management in the study area. The questionnaire utilizes a forest easement program as the policy context for the contingent market. The easement program is described using a set of six program attributes that take on any of these levels (See Table 4.1). The combinations of attributes and their levels are established according to an orthogonal main-effects experimental design. The experimental design of the six attributes is based on a main effects design plan for a 3^6 design, which produced 18 choice sets (Addelman and Kempthorne 1961).

Table 4.1. Survey Attributes and Levels

Variable Name	Attribute Name	Status Quo Level	Attribute Levels
indjobs	Number of forest industry jobs in the area	675	600, 675, 710
rtjobs	Forest-based recreation and tourism jobs in the area	190	170, 190, 250
birddiv	Percent of area with high migratory forest songbird species diversity	35%	38%, 55%, 75%
birdcons	Number of migratory songbird species of conservation concern that are *at or above their target population* (out of 19 possible species)	6	7, 12, 17
deer	Percent of area with deer browse high enough to affect tree regeneration	69%	67%, 58%, 49%
cost	Cost to your household in increased annual taxes	$0	$20, $90, $400

The survey was mailed to a stratified random sample of 2,000 Michigan households using a modified version of Dillman's tailored design method (Dillman 2000). Of the 2,000 surveys mailed, 954 usable surveys were returned, yielding an overall response rate of 50% (AAPOR 2004). Details of survey design and implementation are reported in Essay 3 and Appendices 2 and 5.

4.2.2 Theoretical model

The analysis in this essay utilizes an attribute-based referenda model (ABR), which is a nonmarket valuation method that is a hybrid of contingent valuation and attribute-based stated preference nonmarket valuation methods (Holmes and Boyle 2005). The analysis in this study tests the hypothesis that distance from the resource has a

negative effect on WTP for forest ecosystem services in an area of Michigan's Upper Peninsula (UP). The analysis uses data collected from a stated preference mail survey of Michigan residents. The study forest, which forms the focus of the survey, was chosen for the importance of its forests to deer habitat, forest migratory songbird habitat as well as to the sustainability of the local economy.

ABR models, like contingent valuation and attribute-based methods, are based in random utility theory (Holmes and Boyle 2005, McFadden 1974). Within the random utility theoretical framework, utility is assumed to be composed of a deterministic component and a random component. Indirect utility, u, is the maximum amount of utility that a household can derive from income, y, given prices of goods, a vector of environmental quality variables, x, other respondent characteristics, z, and a component of individual preferences, ε, known to the individual but not to the researcher,

$$u = u(\mathrm{y}, x, z, \varepsilon), \tag{1}$$

In an ABR model, respondents are asked if they are willing to pay a certain amount to achieve an environmental quality improvement. In this model, the quality improvement is described by changes in the levels of attributes of a forested ecosystem that will be provided by a program at a cost to the respondent. Utility to the individual when an amount p is paid is:

$$u_1 = u(x_1, z, y - p, \varepsilon_1). \tag{2}$$

In this equation, u_1 represents the indirect utility function for an individual who pays the cost of the program; x_1 is a vector of forest ecosystem attributes under the forest protection program. If the cost, p, of the program is not paid, the indirect utility function is written as follows:

$$u_0 = u(x_0, z, y, \varepsilon_0)\,. \tag{3}$$

In this equation, u_0 represents indirect utility under the status quo, and x_0 is the vector of forest attribute levels without the program. An individual will be willing to pay for the proposed program if:

$$u_1(x_1, z, y - p, \varepsilon_1) \geq u_0(x_0, z, y, \varepsilon_0)\,. \tag{4}$$

The probability that a respondent is willing to pay for the forest protection program (probability of saying yes) is given by the probability that the utility received from the forest protection program is greater than the utility received under the status quo:

$$\begin{aligned} \Pr(yes) &= \Pr\left[u_1(x_1, z, y - p, \varepsilon_1) > u_0(x_0, z, y, \varepsilon_0)\right] \\ &= \Pr\left[\Delta u > 0\right]. \end{aligned} \tag{5}$$

The indirect utility function has an unobservable, random component. Indirect utility of individual *i* from alternative *j*, therefore, can be expressed as the sum of its explainable and unexplainable components:

$$u_{ij} = v_{ij} + \varepsilon_{ij}\,, \tag{6}$$

where v_{ij} is the explainable component of utility to individual *i* from alternative *j*, and ε is the unexplainable, random component of utility for individual *i* from alternative *j*.

The deterministic component of utility is defined as:

$$v_{ij} = \alpha x_j + \gamma_j z_i + \beta(y_i - p_j) \quad , \quad \gamma_j = \gamma_m \;\forall\, j, m \neq 0\,, \tag{7}$$

where *i* indexes individuals, *j* indexes alternatives, *v* is indirect utility, x_j is a set of program attributes, z_i is a set of respondent characteristics, *y* is income, *p* is the cost of

the program and α, γ and β are estimable parameters. An individual will vote 'yes' to the program if utility with the program exceeds utility without the program. Because utility is composed of a deterministic and a random component, the following expression represents the probability that an individual will vote for the program:

$$\Pr(yes) = \Pr[v_{ij} + \varepsilon_{ij} > v_{i0} + \varepsilon_{i0}], \tag{8}$$

which, when substituting (7) for indirect utility, yields

$$\Pr(yes) = \Pr[\alpha(\Delta x_j) + \gamma z_i - \beta p_j > \varepsilon_{i0} - \varepsilon_{ij}]. \tag{9}$$

Assuming that the error terms follow a standard normal distribution, the probit model can be used to estimate equation 9.

An assumption of the standard probit model is that the error component is independent and identically distributed among individuals and across observations for each individual. However, when an individual responds to more than one stated preference question, it is likely that there are unobservable characteristics specific to that individual that induce correlation across her responses. If this is suspected to be the case, it is appropriate to estimate a random effects probit model (Wooldridge 2002). In a random effects model, the error term is treated as separable into two components: one that is unobservable and specific to each individual and another that is unobservable and due to random response shocks across all individuals and all responses (Boxall et al. 2003).

The utility difference function is specified using a random effects utility model and is written as follows:

$$\Delta u_{ij} = \alpha(\Delta x_j) + \gamma z_i - \beta p_j + \mu_i + \varepsilon_{ij}, \tag{10}$$

where μ_i is the individual-specific error term, and ε_{ij} is the random disturbance term across all individuals and observations.

4.2.3 Model Specification

To estimate the effects of distance, attitudes and recreational use on WTP, Equations 9 and 10 are estimated using a series of random effects probit models. Distance from the resource, attitudes and recreational use variables are included in the model as respondent characteristics, z_i. Results of these models are presented in Section 4.3. The utility difference function is specified as follows:

$$\begin{aligned}\Delta u_{ij} &= \alpha(\Delta x_j) + \gamma z_i - \beta p_j \\ &= \alpha_0 + \alpha_1 \Delta indjobs_j + \alpha_2 \Delta rtjobs_j + \alpha_3 \Delta birddiv_j \\ &\quad + \alpha_4 \Delta birdcons_j + \alpha_5 \Delta deer_j + \gamma z_i + \beta_1 cost_j ,\end{aligned} \tag{11}$$

(*Note*: $\beta_1 = -\beta$)

where α is a vector of estimable parameters for each of the k program attributes, x, of alternative j, γ is a vector of estimable parameters for the effect of respondent characteristics, z_i, and β is an estimable parameter for the program cost.

4.3 Model estimation

4.3.1 Distance model

The hypothesis that distance has a negative effect on the probability that an individual will be willing to pay for the forest easement program is tested by estimating a random effects probit model using binary choice data of voting 'yes' or 'no' to a forest

easement program as the dependent variable and program attributes and distance as explanatory variables. The variables used in the distance model include program atttributes, defined in Table 4.1, and the variable *distance*, which represents the distance in miles from the respondent's zip code to the zip code of the center of the study area. Results of this model are reported in Table 4.2.

Table 4.2. Distance Model Estimation Results

Variable	Model 1
Constant	-1.1674*** (0.1614)
indjobs	0.0076*** (0.0009)
rtjobs	0.0069*** (0.0012)
birddiv	0.0120*** (0.0026)
birdcons	0.0242** (0.0095)
deer	-0.0158*** (0.0054)
cost	-0.0074*** (0.0005)
distance	0.0010** (0.0004)
Rho	0.7919*** (0.0210)
N	3618
# of groups	933
Log likelihood	-1422.38
Prob>chi^2	<0.000

The program attributes in this model all significantly affect WTP. An increase in both forest industry jobs and forest-based recreation and tourism jobs increases the probability of voting for the program. Likewise, increases in bird diversity and the number of birds of conservation concern at or above their target population increase the probability of voting for the program. As expected, an increase in the cost of the program decreases the probability that an individual would vote for the easement program. An increase in the level of deer browse high enough to affect tree regeneration also decreases WTP. Results reported in Table 4.2 show that distance has a positive and significant effect on the probability of voting 'yes' for the easement program. This unexpected result leads to the rejection of the distance-decay hypothesis. However, there may be other factors that explain this positive distance effect, and additional hypotheses are tested to examine why distance has a positive effect in this model.

4.3.2 Distance and attitudes model

In addition to the referendum choice data, the survey instrument also collected data on respondent attitudes towards forest management in the study area. Individuals were presented with descriptions of the importance of the study area for migratory forest songbird habitat as well as its importance for the provision of forest industry and forest-based recreation and tourism jobs. Respondents were asked to respond to a series of statements that reflect attitudes about the goals of forest management in the study area. Analysis of these attitude statements in Essay 2 concluded that respondent attitudes can be conceptualized using an anthropocentric/biocentric value scale. The anthropocentric-biocentric continuum conceptualizes different types of values individuals hold that relate to natural resources and the environment. Anthropocentric values reflect support of the

instrumental value of natural resources and the environment for the benefit of humans, whereas biocentric values reflect support of the intrinsic value and ecological and life support roles of natural resources (Steel et al. 1994, Tarrant and Cordell 2002). This essay tests the hypothesis that differences between individuals with anthropocentric versus biocentric forest management attitudes explain the probability of voting 'yes' for the easement program.

This hypothesis is first examined by using descriptive statistics to examine how attitudes differ between recreational users at various distances from the study area. Survey respondents are divided into 4 different distance zone groups based on the number of miles from the study area within each distance quartile. The following table defines the different distance zones.

Table 4.3. Definition of Distance Zones

Distance Zone	Miles from study area
1	0 to 37
2	38 to 117
3	118 to 368
4	369 to 503

Seventy-eight percent of survey respondents reported some type of participation in recreational activities in or near the study area. The survey collected data on whether the respondent had ever participated in any recreational activities in or near the study area but did not collect data on the frequency of recreational use. Typically it is assumed that recreational use is inversely related to distance (Sutherland and Walsh 1985).

Although Table 4.4 supports this assumption, users drop from 91% in the first quartile of distance from the study area to 62% in the furthest quartile of distance. However, there is still a relatively high proportion of respondents who are recreational users of the study area living relatively far away from the study area.

Table 4.4. Proportions of Recreational Users and Non-Users Within Different Distance Zones

Respondent Type	Zone 1 (0 to 37 miles)		Zone 2 (38 to 117 miles)		Zone 3 (118 to 368 miles)		Zone 4 (369 to 503 miles)		All zones	
	N	%	N	%	N	%	N	%	N	%
Users	216	91	200	84	173	74	146	62	735	78
Non-users	22	9	38	16	60	26	90	38	210	22
Total	238	100	238	100	233	100	236	100	945	100

A comparison of attitudes between recreational users in the different distance zones reveals that there are significant differences in biocentric/anthropocentric attitudes between them, and that there tend to be more recreational users with biocentric attitudes who live farther from the resource. To simplify the reporting of results, distance zones were condensed from 4 zones into 2 zones in order to investigate how recreational users' attitudes differ at different distances from the resource. Table 4.5 shows cross-tabulation results of forest management attitudes for which significant differences exist between Zone 1 and 2 users below the median distance and Zone 3 and 4 users above the median distance.

Table 4.5. Summary of Recreational Users' Forest Management Attitudes Compared Between Distance Zones

Attitudes	Zones 1&2 or Zones 3&4 recreational users
Tend to agree that study area forests should be managed to meet human needs	Zones 1&2**
Tend to agree that forests should be managed to meet the needs of communities economically dependent on forests regardless of environmental consequences	Zones 1&2*
Tend to agree that study area forests should be managed to protect forest industry jobs	Zones 1&2***
Tend to be aware of the importance of the study area for songbird habitat	Zones 1&2**
Tend to be concerned about forest songbird diversity in the study area	Zones 3&4*
Tend to agree that forest management in the study area should increase songbird diversity even if it means losses to forest-based industries	Zones 3&4**
Tend to feel that it is important to protect habitat for forest songbirds of conservation concern in the study area	Zones 3&4***
Tend to agree that forest management in the study area should protect habitat for songbirds of conservation concern even if it means economic losses to forest-based industries	Zones 3&4***

Pearson chi squared statistic * = $p < 0.10$; ** = $p < 0.05$; *** = $p < 0.001$*

The results reported in Table 4.5 show that users farther from the resource tend to hold more biocentric views of forest management, while users in closer proximity to the resource tend to hold more anthropocentric views. Users closer to the resource tend to be more aware of the importance of the study area for migratory forest songbirds; however, users farther away tend to express higher levels of concern for protection of songbird habitat in the study area. These results suggest that forest management attitudes may

play an important role in explaining the probability that an individual will support the forest easement program.

In order to test the hypothesis that forest management attitudes affect WTP, a variable was created that incorporates several attitude variables from the survey, each of which reflects a range of anthropocentric to biocentric attitudes towards forest management in the study area. An index of several attitude statements is preferred to using a set of individual attitude statements because of the potential colinearity among the separate attitude indicators (McClelland 2001). Attitude statements in the following table are therefore summed to form an attitude index variable, *biocentric*, for which high scores reflect biocentric attitudes and low scores reflect anthropocentric ones. The sample average for each individual attitude statement was used to impute values for attitude variables with missing values. The index variable, *biocentric*, was calculated by summing values for the attitude variables listed in Table 4.6.

Table 4.6. Attitude Variables Included in the Calculation of *biocentric*

Variable	Attitude statements/questions and scale
imptcons	How important is it to you to protect habitat for migratory forest songbird species of conservation concern in the Western U.P. Study Forest? 1 (*Not at all important*) ↔ 4 (*Very important*)
prothab	In my opinion, the Western U.P. Study Forest should be managed to protect habitat for migratory forest songbird species of conservation concern even if it results in economic losses to forest-based industries. 1 (*Strongly disagree*) ↔ 5 (*Strongly agree*)
incrdiv	In my opinion, the Western U.P. Study Forest should be managed to increase migratory forest songbird diversity even if there are economic losses to forest-based industries. 1 (*Strongly disagree*) ↔ 5 (*Strongly agree*)
concernhab	How concerned are you about migratory forest songbird diversity in the Western U.P. Study Forest? 1 (*Not at all concerned*) ↔ 4 (*Very concerned*)
humneed	In my opinion, the Western U.P. Study Forest should be managed to meet the needs of people. 1 (*Strongly agree*) ↔ 5 (*Strongly disagree*)
commneed	In my opinion, the Western U.P. Study Forest should be managed to meet the needs of communities that are economically dependent on forests, no matter what effect this has on the environment. 1 (*Strongly agree*) ↔ 5 (*Strongly disagree*)
mtnindjob	In my opinion, the Western U.P. Study Forest should be managed to maintain forest industry jobs. 1 (*Strongly agree*) ↔ 5 (*Strongly disagree*)
biocentric	Attitude index created by summing responses to all attitude statements listed above 7 (*Anthropocentric attitudes*) ↔ 33 (*Biocentric attitudes*)

The hypothesis that forest management attitudes affect WTP is tested by estimating a random effects probit model using program attributes, cost and the attitude index variable *biocentric* as explanatory variables. Model 2 results, reported in Table 4.7, show that *biocentric* has a positive and highly significant effect on WTP. This indicates that individuals who hold biocentric attitudes towards forest management in the study area are more likely to vote for the forest easement program than individuals who

hold anthropocentric attitudes. However, this result applies to individuals holding these attitudes regardless of where they live in relation to the resource. To investigate how attitudes and distance together affect WTP, a random effects probit model is estimated again using program attributes, *cost, distance* and *biocentric* as explanatory variables. The results of this model, Model 3 in Table 4.7, show that *biocentric* again has a highly significant and positive effect on WTP and that the effect of *distance* on WTP is no longer significant. This suggests that the *biocentric* variable is explaining part of the positive distance effect that was found in Model 1.

Model 4 reports results of estimation of a random effects probit model using program attributes, *cost*, *distance*, *biocentric*, as well as the interaction of *biocentric* with *distance*. These results show that *biocent*dist* has a positive and significant effect, while *distance* now has a negative and significant effect. This suggests that individuals who hold biocentric attitudes and live farther away from the resource are more likely to be WTP than individuals who hold biocentric attitudes and live closer to the resource. *Biocentric* is again highly significant and positive, indicating the individuals, regardless of location, with biocentric attitudes are more likely to be WTP than individuals with anthropocentric views. When these attitude effects are controlled for, the effect of distance is negative.

It can be seen from the model results reported in Table 4.7 that *distance*, while it was shown to have a positive and significant effect when included alone as an explanatory variable, no longer has the same effect when *biocentric* and *biocent*dist* are included as explanatory variables. The biocentric attitude index has strong explanatory power and has a highly significant positive effect on the probability that an individual will vote 'yes' for the program. In general, individuals with biocentric attitudes are more

likely to support the program than individuals with anthropocentric attitudes. This effect also holds as distance from the resource increases. This suggests that individuals with biocentric attitudes that live farther away from the resource have a higher willingness to pay for the program than individuals with biocentric attitudes who live closer to the resource. The inclusion of the variable that indexes attitudes changes the effect of distance, and when the interaction of attitudes and distance is included, the distance decay hypothesis is supported by the results. Likelihood values indicate that Model 4 performs better than the other models, which suggests that *distance*, *biocentric* and *biocent*dist* should be retained in the model.

In the models discussed above, the program attribute variable coefficients are almost identical to those estimated in Model 1, and changes in the estimated coefficients for the program attributes estimated between Models 2, 3 and 4 are almost negligible. Results for program attribute variables, therefore, are very stable across the models.

Table 4.7. Random Effects Probit Estimation Results of Distance and Attitudes Models

Variable	Model 2	Model 3	Model 4
Constant	–4.0770*** (0.3850)	-4.0940*** (0.3848)	-3.4340*** (0.5230)
indjobs	0.0075*** (.0008)	0.0075*** (0.0008)	0.0075*** (0.0008)
rtjobs	0.0069*** (0.0012)	0.0069*** (0.0012)	0.0069*** (0.0012)
birddiv	0.0125*** (0.0026)	0.0126*** (0.0026)	0.0127*** (0.0026)
birdcons	0.0229** (0.0094)	0.0228** (0.0094)	0.0228** (0.0094)
deer	-0.0170*** (0.0054)	-0.0170*** (0.0054)	-0.0170*** (0.0054)
cost	-0.0070*** (0.0005)	-0.0070*** (0.0005)	-0.0071*** (0.0005)
distance		0.0002 (0.0004)	-0.0032* (0.0020)
biocentric	0.1625*** (0.0181)	0.1609*** (0.0182)	0.1265*** (0.0260)
*biocent*dist*			0.0002* (0.0001)
Rho	0.7429*** (0.0224)	0.7415*** (0.0225)	0.7412*** (0.0224)
N	3618	3618	3618
# of groups	933	933	933
Log likelihood	-1377.88	-1377.713	-1376.09
Prob>chi^2	0.000	0.000	0.000

** = $p < 0.10$; ** = $p < 0.05$; *** = $p < 0.01$*

4.3.3 Distance, recreational use and attitude models

The previous section showed that forest management attitudes can be used to explain why WTP for the easement program increases as distance from the resource increases. However, an examination of recreational use of the resource may provide additional information about the factors that explain this positive distance effect. Variables used in the following analyses are defined in Table 4.8.

Table 4.8. Variable Definitions for Recreational Use Models

Variable	Definition
user	Dummy variable equal to one if respondent is a recreational user of the study area
*user*dist*	Interaction of *user* and *distance*
nonuser	Dummy variable equal to one if respondent is not a recreational user of the study area
*nonuser*dist*	Interaction of *nonuser* with *distance*
hs	Dummy variable equal to one if respondent has participated in only hunting and/or snowmobiling in the study area
*hs*dist*	Interaction of *hs* with *distance*
other	Dummy variable equal to one if respondent has participated in any other recreational activities in the study area and has not participated in hunting or snowmobiling
*other*dist*	Interaction of *other* with *distance*
allrec	Dummy variable equal to one if respondent has participated in hunting and/or snowmobiling in the study area *and* has participated in other recreational activities in the study area
*allrec*dist*	Interaction of *allrec* with distance

This section tests the hypothesis that recreational users who live farther away from the resource are more likely to support the program than recreational users who live

closer to the resource. To test this hypothesis, a dummy variable for recreational users is interacted with distance and included as an explanatory variable in the model, along with distance. Model 5 in Table 4.9 shows the estimation results. In this model, *distance* is not significant and *user*dist* is positive and highly significant, indicating the users who live farther from the resource are willing to pay more than users who live closer to the resource.

It is generally expected that, all else equal, use values decline with distance, and it is therefore surprising that users who live farther from the resource would be WTP more than users who live closer to the resource. A deeper look at the causes of this is warranted, and one way to do this is to look at different types of recreational uses. Recreational activities are often categorized as consumptive, e.g. hunting or firewood gathering, versus non-consumptive uses, e.g. birdwatching or hiking (Li et al. 2003, Wilson and Tisdell 2001, Benson 2001). Studies have shown that non-consumptive recreational users tend to have stronger conservationist attitudes than consumptive recreational users (Porter and Bright 2003). This provides the rationale for the hypotheses that certain types of recreational users will have higher WTP than other types of users and that WTP for certain types of recreational users will increase as distance from the resource increases.

In order to determine what type of recreational use distinctions were appropriate for this research, survey data on 22 different recreational uses was investigated for correlations between activities. High correlation (>0.50) was found among deer hunters, bird hunters, other hunters and snowmobilers. High correlation was also found among recreational users who participate in all other recreational activities, such as berry picking, birdwatching, boating, firewood gathering, fishing and hiking. Because these

correlations do not distinguish themselves based on consumptive versus non-consumptive uses, this study distinguishes between people who participate in only hunting and snowmobilig (*hs*), those who participate in other recreational uses but not in hunting or snowmobiling (*other*), and those who participate in hunting, snowmobiling and at least one other recreational activity (*allrec*).

The recreational use dummy variables, *other* and *allrec* are included in the model as well as a dummy variable that represents those who are not recreational users of the study area, *nonuser*. Parameter estimates of these dummy variables measure the effect of each dummy variable relative to recreational users who participated in hunting and or snowmobiling in the study area (*hs*). Interactions of these dummy variables with distance are included to capture the effect of distance on the probability of voting 'yes' by non-users and users. All of the distance/recreational use interaction terms together account for the distance effect.

Model results are reported in Table 4.9. The effect of *nonuser* and *other* on WTP is positive but not significant, and the effect of *allrec* is positive but not significant. These results weakly support the hypothesis that there are certain types of recreational users who are WTP more than other types of users. The interaction of recreational use variables with distance is only significant for *allrec*dist*, supporting the hypothesis that there are certain types of recreational users whose WTP increases with increasing distance from the resource. Individuals who participate in a combination of hunting, snowmobiling and other activities and live farther from the resource have higher WTP than those types of users living closer to the resource. *Nonuser*dist* has a negative effect on WTP but is not significant. The effects of *other* and *allrec* users compared to *hs* users are positive but not significant, which weakly supports the hypothesis that certain types

of recreational users are willing to pay more than other types of users.

In order to examine what happens when attitude variables are included with recreational use variables to estimate the combined effects of distance, attitudes and recreational use on WTP, Model 7 is estimated including all of these variables. The interaction of *nonuser* and *distance* has a significant and negative effect, indicating that nonusers living farther from the resource have lower WTP than those living closer to the resource, which suggests that the distance decay effect holds for non-users. Results are again not significant for the interaction of recreational use variables with distance. However, *nonuser*, *other* and *allrec* have positive and significant effects on WTP, which indicates that these groups have a higher WTP than *hs* users, supporting the hypothesis that certain types of recreational users have higher WTP than other users of the resource. The effect of *biocentric* is again highly significant and positive, and its interaction with distance again shows that individuals with biocentric views who live farther away are more likely to vote 'yes' than those who hold biocentric views and live closer to the resource.

As was the case in the distance and attitudes models, program attribute coefficients in the models discussed above display stability across all models. Likelihood ratio tests of the three models show that the inclusion of the attitude variables in Model 7 significantly improved performance of the model. These results demonstrate that WTP differs for different types of recreational users, and the attitudes of respondents remain an important explanatory factor in estimating WTP.

Table 4.9. Results of Recreational Use and Attitudes Models

Variable	Model 5	Model 6	Model 7
Constant	-1.1666***	-1.2188***	-4.4853***
	(0.1574)	(0.3679)	(0.5364)
indjobs	0.0077***	0.0076***	0.0074***
	(0.0009)	(0.0008)	(0.0008)
rtjobs	0.0070***	0.0070***	0.0069***
	(0.0012)	(0.0012)	(0.0012)
birddiv	0.0121***	0.0122***	0.0128***
	(0.0026)	(0.0026)	(0.0026)
birdcons	0.0238**	0.0238**	0.0222**
	(0.0095)	(0.0095)	(0.0093)
deer	-0.0161***	-0.0162***	-0.0171***
	(0.0054)	(0.0054)	(0.0053)
cost	-0.0073***	-0.0073***	-0.0070***
	(0.0005)	(0.0005)	(0.0005)
distance	-0.0007		
	(0.0007)		
*user*dist*	0.0023***		
	(0.0007)		
*nonuser*dist*		-0.0008	-0.0038**
		(0.0023)	(0.0017)
*hs*dist*		0.0001	-0.0011
		(0.0023)	(0.0022)
*other*dist*		0.0010	-0.0026
		(0.0001)	(0.0017)
*allrec*dist*		0.0017**	-0.0015
		(0.0007)	(0.4036)
nonuser		0.0905	1.0923*
		(0.4821)	(0.6219)
other		0.3507	1.2748**
		(0.4368)	(0.6060)
allrec		-0.0034	0.9383*
		(0.3773)	(0.5577)
biocentric			0.1277***
			(0.0222)

Table 4.9 (continued)

Variable	Model 5	Model 6	Model 7
*biocentric*dist*			0.0001** (0.0001)
Rho	0.7858*** (0.0210)	0.7789*** (0.0218)	0.7327*** (0.0226)
N	3618	3618	3618
# of groups	933	933	933
Log likelihood	-1416.94	-1415.46	-1369.47
Prob>chi^2	0.000	0.000	0.000

* = $p < 0.10$; ** = $p < 0.05$; *** = $p < 0.01$

Implicit prices of attributes can be calculated by dividing parameter estimates by the estimated coefficient on the cost variable, as shown in the following equation:

$$IP_k = -\left(\frac{\hat{\alpha}_k}{\hat{\beta}}\right).$$

The following table shows implicit prices calculated based on results from Model 7.

Table 4.10. Implicit Prices of Model Attributes

Attribute	Implicit Price
indjobs	$1.06
rtjobs	$0.99
birddiv	$1.83
birdcons	$3.14
deer	-$2.44

Willingness to pay for an additional forest industry job is slightly higher than a forest-based recreation and tourism job. Individuals are WTP more for an additional unit of bird diversity than for an additional job, either forest industry or recreation and tourism-based. WTP is higher still for an additional songbird species of conservation concern at or above its target population level. Individuals need to be compensated for an additional unit of deer browse high enough to affect tree regeneration.

Because of the interactions present in some of the variables, implicit prices calculated from the recreational use and attitude variables are more difficult to interpret without reference to the levels of the variables being interacted. To address this, the implicit prices for the variables *nonuser, other* and *allrec,* were calculated as if distance was zero, and these values were then used to calculate relative WTP for *hs, other*, and *allrec* users and non-users at different distances from the resource and at different levels of biocentrism. Establishing *hs* users (the base case for the *other, allrec* and *nonuser* dummy variables) who live closest to the resource and have low levels of biocentrism as a baseline, WTP values relative to this baseline were calculated to investigate relative WTP values. Table 4.11 reports these relative WTP values.

Table 4.11. Relative WTP of *hs*, *other* and *allrec* Users and Non-Users at Different Distances from the Resource and Different Levels of Biocentrism[1]

Distance (miles)[2]	Level of Biocentrism[3]	*hs* Users	*other* Users	*allrec* Users	Non-Users
38	Low	$0	$175	$132	$141
38	Medium	$122	$297	$255	$263
38	High	$244	$419	$377	$386
118	Low	$2	$160	$131	$112
118	Medium	$131	$290	$260	$242
118	High	$261	$419	$390	$371
369	Low	$7	$115	$125	$21
369	Medium	$160	$268	$278	$174
369	High	$313	$421	$431	$326

[1] The table presents the relative difference in WTP, holding all else equal, across gradients of distance, biocentrism, and user type relative to the WTP for hs users that have low biocentrism and live 38 miles from the study area.

[2] The distances represent the first quartile, median and third quartile for distances in the sample.

[3] The levels of biocentrism represent the first quartile, median and third quartile in the sample for the biocentrism index that ranges from 1 to 33.

Table 4.11 shows the relative WTP of *hs*, *other* and *allrec* users and non-users at different distances from the resource and at different levels of biocentrism. A low level of biocentrism corresponds to anthropocentric attitudes. The values in the table illustrate relative differences in WTP amounts between different types of recreational users and non-users and how these differences are affected by distance from the resource and environmental attitudes. At 38 and 118 miles from the resource, *other* users have higher relative WTP at each level of biocentrism than *hs*, *allrec* and non-users. At 369 miles from the resource, *allrec* users have the highest relative WTP. Relative WTP of *other*,

allrec users and non-users is much higher than that of *hs* users at distances of 38 and 118 miles from the resource, but at 369 miles from the resource, the relative WTP of *hs* users and non-users is similar.

The relative WTP of strongly biocentric *other* and *allrec* users who live farther from the resource is slightly higher than for those types of users who are strongly biocentric and live close to the resource. Relative WTP is much higher for strongly biocentric *other* and *allrec* users than those types of users living close to the resource who have low to medium biocentrism. The relative WTP of anthropocentric and biocentric non-users decreases as distance increases, supporting the distance decay hypothesis.

These results suggest that environmental attitudes have a strong effect on WTP. Individuals with biocentric values and attitudes have a higher WTP relative to individuals with anthropocentric values. This relative effect exists even as distance from the resource increases. Recreational users who participate in activities other than hunting and snowmobiling and those who participate in hunting, snowmobiling and other recreational activities have higher WTP at all distance gradients and biocentrism levels than people who only hunt or snowmobile. The results demonstrate that although types of recreational use and non-use affect WTP values, the predominant factor affecting WTP in this analysis is the presence of biocentric attitudes.

4.4 Conclusions

This study sought to understand the effects of various factors on WTP in order to determine the extent of the market for the provision of a forest easement program in an area of Michigan's Upper Peninsula. The analysis used stated preference and attitudinal

data collected from a mail survey of Michigan residents to estimate an attribute-based referenda model. A series of random effects probit models were estimated to identify the effects of distance, forest management attitudes and recreational use on predicting WTP.

Model results revealed a positive distance effect when distance was included without attitudinal or recreational use variables. This results in the rejection of the distance decay hypothesis, which is contrary to the results found throughout the nonmarket valuation literature on distance effects. The distance effect, however, changed when attitudinal and recreational use variables were included in the model.

The inclusion of an attitudinal index variable that reflects a range of anthropocentric to biocentric attitudes towards resource management eliminated the positive distance effect apart from its positive interaction with biocentric attitudes. The strong explanatory power of the attitude variable shows that attitudes are significant predictors of WTP. Results of recreational use models showed that use values increase as distance from the resource increases, which was a counterintuitive result. However, the inclusion of the attitude variable in this model once again changed the positive effect of use interacted with distance.

Recreational users who participate in activities other than hunting and snowmobiling, users who participate in a combination of all activities and nonusers are WTP substantially more than users who participate in only hunting and snowmobiling. Results show that a significant negative distance effect exists for individuals who are not users of the resource when attitude variables are included in the model. Attitudes have a strong influence on WTP values, and individuals with biocentric attitudes have a higher WTP than individuals with anthropocentric attitudes. The WTP of individuals with biocentric attitudes increases as distance from the resource increases.

The results of this research show that the market for the implementation of a forest easement program in Michigan's UP extends into areas of the state that are a large distance away from the resource. The results confirm the hypothesis that attitudes are predictors of WTP and support the results of other studies that have shown that it is appropriate to include attitudes in nonmarket valuation analyses. Results also indicate that individuals who live far away from the resource and who value it can be identified by their environmental attitudes or by their recreational use of the area. Results show that non-use values decline with distance but values of recreational users increase with distance. This may be due to increasing use values with distance that offset the distance decay effect found for non-users. However, this also may be due to increasing non-use values with distance among users. Further research on the effects of distance and use on WTP is warranted.

This study showed that biocentric and anthropocentric values that underlie environmental attitudes play an important role in estimating nonmarket values of environmental goods and services. Results provide insight into the factors that influence individuals' choices and behavior, which can be a useful input to the policy making process. Results show that there are strong interactions between distance, attitudes and types of recreational use/non-use that influence WTP. Information on the types of beliefs and values that motivate individuals to support certain policy actions can help predict which members of the public will be more willing to support particular conservation initiatives.

REFERENCES

AAPOR. 2004. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*. Edited by American Association for Public Opinion Research. 3rd ed. Lenexa, KS.

Addelman, S., and O. Kempthorne. 1961. Orthogonal Main-Effect Plans. Ames, IA: Iowa State University, Aeronautical Research Laboratory, Office of Aerospace Research, United States Air Force.

Bandara, R. and C. Tisdell. 2003. Comparison of rural and urban attitudes to the conservation of Asian elephants in Sri Lanka: empirical evidence. *Biological Conservation* 110:327-342.

Bateman, I.J., and I.H. Langford. 1997. Non-users' willingness to pay for a national park: An application and critique of the contingent valuation method. *Regional Studies* 31 (6):571-582.

Benson, D.E. 2001. Wildlife and recreation management on private lands in the United States. *Wildlife Society Bulletin* 29 (1):359-371.

Boxall, P., K. Rollins, and J. Englin. 2003. Heterogeneous preferences for congestion during a wilderness experience. *Resource and Energy Economics* 25:177-195.

Dietz, T., P.C. Stern, and G.A. Guagnano. 1998. Social structural and social psychological bases of environmental concern. *Environment and Behavior* 30:450-471.

Dillman, D.A. 2000. *Mail and Internet Surveys: The Tailored Design Method, 2nd edition*. 2nd ed. New York: John Wiley and Sons, Inc.

Freeman, A.M.III. 2003. *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington, D.C.: Resources for the Future.

Hanley, N., F. Schlapfer, and J. Spurgeon. 2003. Aggregating the benefits of environmental improvements: distance-decay functions for use and non-use values. *Journal of Environmental Management* 68:297-304.

Holmes, T.P., and K.J. Boyle. 2005. Dynamic learning and context-dependence in sequential, attribute-based, stated-preference valuation questions. *Land Economics* 81 (1):114-126.

Johnson, C.Y., J.M. Bowker, and H.K. Cordell. 2004. Ethnic variation in environmental belief and behavior: An examination of the New Ecological Paradigm in a social psychological context. *Environment and Behavior* 36 (2):157-186.

Johnson, F., R. Dunford, W. Desvouges, and M. Banzhaf. 2001. Role of knowledge in assessing nonuse values for natural resource damages. *Growth and Change* 32:43-68.

Li, C.L., H.C. Zinn, and S.C. Barro. 2003. A cross-regional comparison of recreation patterns of older hunters. *Leisure Sciences* 25 (1):1-16.

Loomis, J. 1996. How large is the extent of the market for public goods: evidence from a nationwide contingent valuation survey. *Applied Economics* 28:779-782.

McClelland, E. 2001. Measurement issues and validity tests for using attitude indicators in contingent valuation research, Working Paper #01-01. Washington, D.C.: U.S. Environmental Protection Agency National Center for Environmental Economics.

McFadden, D. 1974. Conditional logit analysis of qualitative choice behavior. In *Frontiers in Econometrics*, edited by P. Zarembka. New York: Academic Press.

Nordlund, A.M., and J. Garvill. 2002. Value structures behind proenvironmental behavior. *Environment and Behavior* 34 (6):740-756.

Pate, J., and J. Loomis. 1997. The effect of distance on willingness to pay values: a case study of wetlands and salmon in California. *Ecological Economics* 20:199-207.

Poortinga, W., L. Steg, and C. Vlek. 2004. Values, environmental concern, and environmental behavior: A study into household energy use. *Environment and Behavior* 36 (1):70-93.

Porter, R., and A.D. Bright. 2003. Non-Consumptive Outdoor Recreation, Activity, Meaning and Environmental Concern. In *Proceedings of the 2003 Northeastern Recreation Research Symposium*, edited by J. Murdy. USDA Forest Service Northeastern Research Station, General Technical Report NE-317. Newtown Square, PA.

Steel, B., P. List, and B. Shindler. 1994. Conflicting values about federal forests: A comparison of national and Oregon publics. *Society and Natural Resources* 7:137-153.

Stern, P.C., T. Dietz, and G.A. Guagnano. 1995. The new ecological paradigm in social-psychological context. *Environment and Behavior* 27 (6):723-743.

Stevens, T.H., J. Echeverria, R.J. Glass, T. Hager, and T.A. More. 1991. Measuring the existence value of wildlife: What do CVM estimates really show? *Land Economics* 67 (4):390-400.

Streever, W.J., M. Callaghan-Perry, A. Searles, T. Stevens, and P. Svoboda. 1998. Public attitudes and values for wetland conservation in New South Wales, Australia. *Jounral of Environmental Management* 54:1-14.

Sutherland, R.J., and R.G. Walsh. 1985. Effect of distance on the preservation value of water quality. *Land Economics* 61 (3):281-291.

Tarrant, M., and H. Cordell. 2002. Amenity values of public and private forests: Examining the value-attitude relationship. *Environmental Management* 30 (5):692-703.

Wilson, C., and C. Tisdell. 2001. Sea turtles as a non-consumptive tourism resource especially in Australia. *Tourism Management* 22 (3):279-288.

Wooldridge, J.M. 2002. *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press.

Conclusions

This research contributes to the understanding of sociocultural and economic values of ecosystem services in a forested area of Michigan's Upper Peninsula. The first essay is based on results of focus group discussions that were also used to develop a mail survey instrument. Essays 2, 3 and 4 are based on results of the mail survey of 2,000 Michigan residents.

The work establishes links between environmental attitudes, underlying environmental value orientations, socioeconomic characteristics, and economic values. The results contribute to a broader understanding of the factors that influence individuals' behavior with respect to environmental conservation issues. The connections established in this research follow the cognitive hierarchy framework presented in Essay 2, Figure 2.1, in which economic values can be linked to behavior, which can in turn be predicted by attitudes, which can be linked to underlying environmental value orientations.

The first research objective was to gain a better understanding of public views and perceptions of forest-human-wildlife interactions in an area of Michigan's Upper Peninsula. Essay 1 reports results from a series of focus group discussions held in and near the study forest. Content analysis of focus group data reveals that the value orientation of rural, timber-dependent individuals and urban, non-timber dependent individuals does not lie as expected along an anthropocentric/biocentric continuum. The rural participants did not express purely extractive, utilitarian views of forest management, as would be expected according to much of the literature on value orientations of resource dependent community residents. Findings with respect to urban participants also contradict much of the literature that suggests that urban, non-timber

dependent residents hold strong biocentric views of resource management. The urban participants in this study did not express strong opinions in favor of ecological forest values but did express strong concerns for anthropocentric forest uses such as their own recreation.

The second objective of this research was to understand how demographic characteristics and environmental and forest management attitudes are related. This was accomplished in Essay 2 by examining survey respondent attitudes towards the environment and towards forest management in the study area. Factor analysis was used to reduce a set of attitude variables into a set of 5 factors that reflect a range of anthropocentric to biocentric value orientations. The five factors extracted from the analysis are labeled Balance, Environment, Management, Wildlife and Human Role. Factor scores were created from the factors for each respondent in the sample and a series of stepwise regressions regressed factor scores for each of the 5 factors onto a set of demographic characteristics.

Results of Essay 2 show that area of residence, age, membership in an environmental organization and political views had significant effects in explaining factor scores. The factors extracted from the analysis reflected anthropocentric and biocentric value orientations. Results suggest that residents of the study area, members of forestry organizations, older individuals and politically conservative individuals tend to hold anthropocentric views of the environment and forest management in the study area while members of environmental organizations were found to hold biocentric views. The results of this research demonstrate that there is a connection between demographic characteristics and environmental and forest management attitudes and value orientations. The low explanatory power of the regression models, however, suggests

that demographic characteristics do not provide sufficient information to adequately explain variation in attitudes and values towards forest ecosystem management and the environment.

The third objective of the research was to estimate non-market values of forest ecosystem characteristics in Michigan's western Upper Peninsula. An attribute-based referenda (ABR) model was used to estimate willingness to pay for a forest easement program. The forest easement program was described in the survey using sets of attributes that were created based on an orthogonal main-effects experimental design. The binomial choice stated preference data, attribute levels and demographic characteristics were used as inputs to a random effects probit model. Results report the estimated effects of these variables on public support for the forest easement program and show that individuals hold values for the nonmarketed attributes of forest ecosystems in the study area.

The attributes for which nonmarket values were estimated reflect the social and ecological importance of forests in the study area. Attributes in the analysis include forest industry jobs, forest-based recreation and tourism jobs, forest migratory songbird species diversity, number of forest migratory songbird species of conservation concern and the effects of deer browse on tree regeneration. Results show that people value both the economic (job related) and ecological attributes of a possible forest easement program in the study area. Resource management and policy decisions affecting the study area that cause reductions in forest-based employment will be less acceptable to the public. Programs that improve bird habitat, reduce deer browse and reduce forest-based employment will be less acceptable than programs that improve ecological attributes while also improving or maintaining forest-based employment opportunities.

Results also indicate that older individuals, members of a hunting club and politically conservative individuals are less likely to vote for and have lower willingness to pay for the forest easement program while members of environmental organizations, individuals with higher levels of education, residents of urban areas and individuals who have participated in recreational activities in the study area are more likely to vote 'yes' for the easement program and have higher willingness to pay.

The fourth objective of the research was to determine how distance, attitudes and recreational use affect the results of nonmarket valuation analysis of forest ecosystem attributes in Michigan's western Upper Peninsula. Essay 4 reports model results from maximum likelihood estimation of random effects probit models using the stated preference data collected from the survey. Models included various combinations of distance, attitude and recreational use variables. Results show that while distance is found to have a positive effect on WTP, which is a counterintuitive result, this effect is mitigated by the inclusion of attitudinal and recreational use variables. Attitudes that reflect anthropocentric/biocentric value orientations significantly affect WTP, and a significant effect was also found for the interaction of distance with attitudes. Particular types of recreational users (those who have participated in a variety of recreational activities in the study forest) are more likely to vote 'yes' for the program than recreational users that only participate in hunting and/or snowmobiling.

Information gained from the analyses in Essay 4 provides an indication of the extent of the market for a forest easement program in the study area. Results indicate that there are subpopulations of individuals who live further from the resource who are more likely to support the forest easement program than individuals living closer to the resource. In addition, the positive effect of distance on WTP is explained by the value

orientation of individuals. Those individuals holding biocentric attitudes towards resource management have higher WTP relative to individuals who hold anthropocentric views. While recreational use and non-use were found to affect relative WTP values, changes in relative WTP between different types of recreational users and non-users at different distances from the resource was predominantly affected by biocentric attitudes. The results indicate that including environmental attitudes in nonmarket valuation studies can substantially improve one's ability to explain preferences and WTP.

The work as a whole illustrates the connections that exist between and sociocultural and economic ecosystem service values, socioeconomic variables and attitudes. The essays informed each other in the investigation of these links. Results of Essay 1 reported urban-rural differences in perceptions of forest management but were limited to a small sample of individuals living in close proximity to the resource. These results, however, pointed towards the need for a deeper investigation of the effects of demographic characteristics on environmental attitudes. Essay 2 built upon these results by analyzing the underlying structure of environmental attitude data and connecting it to sociocultural ecosystem service values within an anthropocentric/biocentric framework. Environmental attitudes were further connected to demographic characteristics to describe segments of the public who tend to hold particular sociocultural value orientations. The explanatory power of the demographic characteristics, however, was not strong, suggesting that other characteristics should be explored in future research to explain environmental attitudes. For example, connections could be investigated between attitudes and pro-environmental consumer behavior or knowledge of environmental issues. Essay 2 results, nevertheless, suggested a deeper investigation of

the environmental value/attitude connection and how this is linked to behavior, which was undertaken in Essay 4.

The third essay sought to estimate preferences for forest ecosystem services and to connect socioeconomic characteristics to economic ecosystem service values. Results showed that certain demographic characteristics were significant in explaining these values, connecting individuals' socioeconomic characteristics to their stated preferences and their behavior. Essay 4 continued to explore the effects of respondent characteristics on economic values by including distance, environmental attitudes and types of recreational use in the analysis. Results showed that economic values are influenced not only by demographic characteristics but also by environmental attitudes and that in fact, attitudes have stronger explanatory power in nonmarket valuation than socioeconomic characteristics alone. Essay 4 results connect attitudes and underlying environmental value orientations to economic values, thereby establishing a connection between sociocultural and economic ecosystem service values.

The research has several limitations. The sample used in the survey research was stratified into four regions of Michigan. A limitation of the sample design is that the division of Michigan into four geographic strata may not have been the best way to capture regional differences across the state. Perhaps the division of the sample into more regional strata would capture differences between regions within Michigan more successfully. For example, strong regional differences may exist within the Upper Peninsula, and dividing the UP sample into more than 2 regions may have better captured these differences.

Response rates differed by sample strata, but there is not enough information available to determine whether there was a non-response bias based on regions.

Responses were relatively higher from the study area and the rest of the Upper Peninsula than for the Lower Peninsula strata.

The nonmarket valuation component of the research resulted in a large number of 'no' responses. Therefore, when mean WTP is computed over the unrestricted interval $(-\infty, \infty)$, i.e. when negative WTP is allowed, the results yield negative aggregate WTP values for some forest easement program scenarios. We can identify respondents who are indifferent to the choice based on survey questions that asked whether the individual would ever vote for the program regardless of the price. This problem of a large number of 'no' responses could be investigated further by estimating a spike model to account for the effect of indifferent respondents.

It was expected that distance from the study site would be positively correlated with income, however, the correlation between distance and income was not significant. Distance and biocentric were found to be significantly positively correlated, but the correlation is very low. Distance was positively related to WTP in some of the models, and although negative distance effects are typically found in the nonmarket valuation literature, this positive distance effect may not be counterintuitive. According to studies in the social forestry literature, urban residents tend to have strong biocentric attitudes. There is a much higher concentration of urban areas in the southern portion of Michigan, and individuals from the southern LP strata are more likely to live in or near a major urban center than residents of the northern LP or the UP. This may explain the positive distance effect and the positive relationship between distance and biocentric attitudes.

Descriptive analysis of regional differences in environmental attitudes (reported in Appendix 7) reveals that individuals across all regions tended to agree with statements about the importance of managing forests to benefit wildlife and the importance of

achieving balance between ecological and economic goals of forest management. These results suggest that some of the individuals identified as anthropocentric in this research may be better characterized as having a mixture of anthropocentric and biocentric attitudes. The regional comparison of attitude statements indicates that UP residents tended to disagree with forest management that improves ecological attributes at a cost to the local economy. Individuals living closer to the resource will bear more of the costs of economic losses to forest-based industries in the area than people living farther away. Therefore, it is logical that people in the UP would express attitudes that favor forest management to meet human needs. However, the UP respondents' attitudes towards the importance of achieving balance is not significantly different than those of LP respondents. This warrants a deeper investigation of attitudes towards balance of ecological and economic forest management goals. Individuals living close to or in the study area may have biocentric views of resources in other parts of Michigan, where changes in forest ecosystems may not directly affect the economic well being of their communities.

The finding of significant preferences for economic as well as ecological forest ecosystem services demonstrates public support for multiple use forest management. Due in part to increasing public concern for the sustainable use of forest resources, forest management for multiple uses has been increasing in its application throughout the US over the past few decades. Information on preferences for multiple use forest management as well as the types of people who hold those preferences can contribute to connecting forest management activities with publicly acceptable outcomes.

The work provides information useful to policy makers and resource managers on the characteristics of individuals who hold particular environmental attitudes and

examines how these characteristics influence individuals' economic ecosystem service values, which, in turn, can assist in predicting the behavior of different segments of the public and can help predict acceptability of conservation initiatives. For example, essay 4 showed that values of individuals who hold biocentric attitudes increase with increasing distance from the resource, indicating that public support for conservation initiatives in the study area exists in areas of Michigan at great distances from the study forest.

Results of this research demonstrate public support for forest management that provides multiple uses. For example, the public cares not only about forest industry jobs but also about forest recreation and tourism jobs in the study area. The management of forests for multiple uses contributes to the sustainable management of forest resources, and information on public preferences for this type of management can help ensure its continued implementation.

The results also indicate that the public values the ecosystem services provided by forests, such as songbird species diversity. A manager could use these results to inform legislators of public concern for these ecosystem services and of the values people hold for them in order to provide support for conservation initiatives to protect the provision of these services. Results also show that there is public support for a particular type of conservation initiative, the forest easement, although the support is not overwhelmingly strong.

The essays as a whole explain different aspects of individuals' motivations and behavior with respect to natural resource management. The research contributes to understanding the characteristics of people that influence their acceptance of particular types of natural resource policies. The results of this research provide information on the sociocultural and economic values that people hold for ecosystem goods and services.

These values are further linked to characteristics and attitudes, which establishes connections that can be used to help understand and predict human actions that feed back to affect the provision of ecosystem goods and services.

APPENDIX 1:

SURVEY SAMPLE DESIGN

The survey sample was designed as a stratified sample of 1,750 households from each of four regions of Michigan for a total sample size of 7,000. The research aims to understand public perceptions of and values for forest resources within a particular area of Michigan's Upper Peninsula (referred to in this appendix as the study area). It was therefore important to obtain a representative sample of residents of the study area, as well as residents of the Upper Peninsula, in addition to residents of Michigan's Lower Peninsula. Therefore, the sample was stratified to represent four regions: the Study Area (SA), the Rest of Upper Peninsula (RUP), the Northern Lower Peninsula (NLP) and the Southern Lower Peninsula (SLP). From the initial stratified sample of 7,000 Michigan residents, 500 households were randomly chosen from each strata for form a total sample size of 2,000 for the survey mailing.

The survey sample was purchased from Survey Sampling International and was formed by randomly choosing households from U.S. Census 2000 Block Groups and Michigan counties. The first stratum, SA, was selected from the Census Block Groups that fall most closely within the ecologically defined study area boundaries (See Table A.1.1). The RUP stratum was randomly selected from the remaining Census Block Groups that fall within study area counties but are not in the study area, as well as all remaining Upper Peninsula counties (See Table A.1.2). The NLP stratum was randomly selected from all counties in the Northern Lower Peninsula (See Table A.1.3). The SLP stratum was randomly selected from all counties in the Southern Lower Peninsula but was adjusted to ensure that large urban areas would not be over-represented in the sample (See Table A.1.4).

The Southern LP includes three very populous counties: Wayne, Macomb and Oakland. Each of these counties contains 24, 9 and 14 percent, respectively, of the entire

population of the Southern LP (US Census 2005). The total number of households in the SLP in 2002 was 2,838,765, and 39.6 percent of these households were located in Wayne, Macomb and Oakland counties (US Census 2005). In order to avoid over-representing these very populous counties in the sample, the number of households sampled from these three counties was designed to be proportionate to the three counties' share of Southern LP households. Therefore, 693 households were sampled from Wayne, Macomb and Oakland counties (the proportion of SLP households in the most populous counties, 39.6%, multiplied by the total SLP sample size, 1,750), and 1,057 households were sampled from the remaining counties in the SLP (the proportion of SLP households in the remaining counties, 60.4%, multiplied by the total SLP sample size, 1,750).

Table A.1.1. Sample Frame for Stratum 1: *Study Area*

County	Census Tract	Census Block Group
Dickinson	9501	1
Dickinson	9502	All
Iron	9801	1
Marquette	0022	1
Marquette	0023	1
Marquette	0026	All
Menominee	9601	1

Table A.1.2. Sample Frame for Stratum 2: *Rest of U.P.*

County	Census Tract	Census Block Group
Alger	All	All
Chippewa	All	All
Delta	All	All
Dickinson	9503	All
	9504	All
	9505	All
	9506	All
	9507	All
Gogebic	All	All
Houghton	All	All
Iron	9801	2, 3 & 4
	9802	All
	9803	All
	9804	All
	9805	All

County	Census Tract	Census Block Group
Keewenaw	All	All
Luce	All	All
Mackinac	All	All
Marquette	0001	All
	0002	All
	0003	All
	0004	All
	0005	All
	0006	All
	0007	All
	0008	All
	0009	All
	0010	All
	0011	All
	0012	All
	0013	All
	0014	All
	0015	All
	0016	All
	0017	All
	0018	All
	0019	All
	0020	All
	0021	All
	0022	2 & 3
	0023	2 & 3
	0024	All

County	Census Tract	Census Block Group
	0025	All
Menominee	9601	2
	9602	All
	9603	All
	9604	All
	9605	All
Ontanagon	All	All
Schoolcraft	All	All

Table A.1.3. Sample Frame for Stratum 3: *Northern Lower Peninsula (NLP)*

Counties		
Alcona	Iosco	Ogemaw
Alpena	Isabella	Osceola
Antrim	Kalkaska	Oscoda
Arenac	Lake	Otsego
Bay	Leelanau	Presque Isle
Benzie	Manistee	Roscommon
Charlevoix	Mason	Wexford
Cheboygan	Mecosta	
Clare	Midland	
Crawford	Missaukee	
Emmet	Montmorency	
Gladwin	Newaygo	
Grand Traverse	Oceana	

Table A.1.4. Sample Frame for Stratum 4: *Southern Lower Peninsula (SLP)*

Counties		
Allegan	Ingham	Ottawa
Barry	Ionia	Saginaw
Berrien	Jackson	Sanilac
Branch	Kalamazoo	Shiawassee
Calhoun	Kent	St. Clair
Cass	Lapeer	St. Joseph
Clinton	Lenawee	Tuscola
Eaton	Livingston	Van Buren
Gennessee	Macomb	Washtenaw
Gratiot	Monroe	Wayne
Hillsdale	Montcalm	
Huron	Oakland	

APPENDIX 2:

SURVEY DESIGN

This appendix describes the design of the survey instrument. The hypothetical forest easement program presented in the survey consisted of a set of attributes. A baseline level was calculated for each attribute, and the following sections describe how these baselines levels were estimated. The attributes and their varying levels were grouped into choice sets according to an experimental design plan. The last section of this appendix describes the experimental design.

Forest-based recreation and tourism jobs

One of the two economic attributes included in the survey is forest-based recreation and tourism jobs in the study area. This section describes how the baseline number of jobs in forest-based recreation and tourism in the study area was calculated. The calculation was based on estimates of tourism spending for the most popular recreational activities in the study area, snowmobiling and deer hunting.

Snowmobiling is an important recreational activity throughout Michigan, and it draws many recreational users in the UP (Stynes et al. 1998). According to a study of the economic impact of snowmobiling in Michigan, 11% of all tourism spending in the western Upper Peninsula (UP) is attributable to snowmobiling (Stynes et al. 1998). Our study area lies almost entirely within the western UP, and drawing upon the Stynes et al. (1998) study, it was assumed that 11% of all tourism spending within the study area is also attributable to snowmobiling.

To calculate how many forest-based recreation and tourism jobs are due to snowmobiling activity in the study area, it is necessary to first estimate the total amount of spending on tourism in the study area. US Census data for the study area can be most closely approximated by township-level data. Table A2.1 lists the townships that make

up the study area along with the counties within which they are located.

Table A2.1. Study Area Counties and Townships

County	Townships
Baraga	Spurr
Dickinson	Breen
	Felch
	Norway
	Sagola
	Waucedah
	West Branch
Iron	Crystal Falls
	Mansfield
Marquette	Ely
	Ewing
	Forsyth
	Humboldt
	Republic
	Tilden
	Turin
	Wells
Menominee	Harris
	Meyer
	Spalding

Tourism spending estimates are not available at the township level from US Census data. Therefore, spending on tourism in study area townships is extrapolated from county-level tourism spending data. Employment attributable to tourism spending is approximated by data on employment in the arts, entertainment, recreation, accomodation and food service sector, and Table A2.2 presents data on employment in the study area townships in this sector as a percent of total county employment.

Table A2.2. Study Area Township Service Sector Employment and Estimated Tourism Spending in 2000

County	Study area Service Sector Employment as Percent of Total County Employment	Tourism Spending (millions of $)	Estimated Study Area Township Tourism Spending
Baraga	1%	14.1	$141,000
Dickinson	1%	26.6	$266,000
Iron	1.6%	24.1	$385,600
Marquette	1.7%	82.7	$1,405,900
Menominee	3.5%	23.5	$822,500

Sources: US Census 2005a, US Census 2005b, Stynes 2005

Summing study area township tourism spending estimates in Table A2.2. yields a total study area tourism spending estimate of $3,021,000. If we assume that 11% of all tourism spending in the study area is attributable to snowmobiling, then $3,021,000*11% = $332,310 is spent on snowmobiling in the study area annually. According to the Stynes et al. economic impact of snowmobiling study, in the Western UP, the multiplier for number of jobs per $1 million in sales from snowmobiling is 57. This implies that one tourism job is attributable to $17,543 in annual snowmobiling spending in the study

area (Stynes et al. 1998). Based on the estimated spending on snowmobiling in the study area calculated above, the total number of jobs created from snowmobiling in the study area in 2000 was 19 jobs (332,310/17,543 = 19).

The number of jobs created from deer hunting in the study area was calculated by estimating the number of deer hunters that hunted in the study area in 2003. Based on the Michigan Deer Harvest Survey Report, approximately 12,000 deer hunters visited the Deer Management Units (DMUs) that fall within the study area in 2003 (Frawley 2004). This number was then multiplied by $768, the average per trip spending by Michigan hunters (US Dept of Interior et al. 2001). Total estimated spending atttributable to deer hunting in the study area is $9,216,000 (12,000* $768). Estimated expenditures in Michigan due to deer hunting in 2001 equaled $281,774,267, and the number of jobs attributable to these retail sales in 2001 was 5,386 (IAFWA 2002). The estimated ratio of deer hunting expenditures to jobs is $52,300 (281,774,267/5,386). Using this number, the total number of jobs due to deer hunting in the study area can be calculated by dividing total deer hunting expenditures in the study area, $9,216,000, by $52,300 to yield a total of 176 jobs attirubtable to deer hunting in the study area.

The baseline number of forest-based recreation and tourism jobs used in the survey is 190, and the attribute was allowed to take on levels of 170, 190 and 250.

Forest Industry Jobs

The finest level of forest industry employment data available from US Census data is at the zip code level. Therefore, the zip codes that fall within the study area boundaries were identified. Table A2.3 lists the study area zip codes used in the following calculation of forest industry jobs in the study area.

Table A2.3. Study Area Zip Codes

Zip Code Name	Zip Code
Crystal Falls	49920
Michigamme	49861
Republic	49879
Champion	49814
Ishpeming	49849
Gwinn	49841
Little Lake	49833
Perronville	49873
Spalding	49866
Powers	49874
Hermansville	49847
Foster City	49834
Vulcan	49892
Channing	49815
Sagola	49881

Source: MIC 1994

Industry codes as defined by the North American Industry Classification System (NAICS) used to calculate forest industry jobs in the study area include sector 11, the forestry, fishing, hunting and agriculture sector, and sector 31, the manufacturing sector. Forest industry employment was calculated by collecting employment data from subsectors of Sector 11 and Sector 31, and these are listed in Table A2.4.

Table A2.4. Forest Industry Employment Subsectors Used in Calculation of Forest Industry Jobs in the Study Area

Sector 11 subsectors	Sector 31 subsectors
Logging	Sawmills
	Other millwork
	Reconstituted wood product manufacturing
	Cut stock, resawing lumber and planing
	Wood window and door manufacturing
	Other misc wood product manufacturing
	Prefab wood building manufacturing

Employment in study area zip codes is reported in Table A2.5. Two of the study area zip codes included in forest industry employment data include townships that do not fall within study area boundaries. Because employment data at the township level is not disaggregated into subsectors, it was not possible to use township data to calculate forest industry jobs. However, the number of Sector 11 jobs in the townships that are included in study area zip code boundaries but that clearly do not lie in the study area are subtracted from the employment data collected at the zip code level. After making this adjustment, the total number of jobs attributable to forest-based industries in the study area is 677.

Table A2.5. Forest Industry Employment in 2001 in Study Area Zip Codes

Zip Code	Total Empl.	Total Empl. in Logging	Total Empl. in forest-based mfg.	Emplmt. not in study area	Adjusted Total Forest-based Employment[1]
Michigamme	61	0	0		0
Crystal Falls	764	17-36	21-53	46	17
Republic	74	26-51	1-4		26.5
Champion	124	0	0		0
Ishpeming	3449	8-21	100-249	189	0
Gwinn	1392	1-4	100-249		177
Channing	55	20-38	1-4		31.5
Foster City	19	8-21	0		14.5
Sagola	273	60-118	121-302		300.5
Vulcan	107	0	20-49		34.5
Little Lake	25	0	0		0
Perronville	0-19	0	0		0
Hermansville	324	1-4	5-9		9.5
Powers	194	0	21-53		37
Spalding	148	10-19	10-19		29
TOTAL					677

Source: US Census 2005c

[1]Total employment calculated using median values for ranges reported in each category

The basline number of forest industry jobs was set at 675 and this attribute was allowed to take on levels of 600, 675 or 710.

Birds

The attribute levels chosen for the bird attributes were developed with the collaboration of ecologists working on this project. Of the migratory forest songbird species present in the study area, a subset was identified that are considered to be of conservation concern. Our study area falls within the Boreal Hardwood Transition (physiographic region 20), as defined by the organization Partners in Flight. At a finer scale, the study area falls within Region 12 of the Boreal Hardwood Transition. Scores defined by Partners in Flight for Region 12 were used to identify which songbird species in our study area are considered "priority breeding species for conservation." The criteria used by PIF to determine priority for conservation is based on numerous variables, including the following: global relative abundance, global scores for breeding distribution and winter distribution, global score for threats in the nonbreeding season, threats to successful breeding, importance of Region 12 for breeding, population trend, priority tier, percent of species' breeding population in Region 12, and watch list status (PIF 2005). Table A2.6. lists the migratory forest songbird species of conservation concern identified in the study area.

Table A2.6. Migratory Forest Songbird Species of Conservation Conern in the Study Area

Species of Conservation Concern		
Black and White Warbler*	Eastern Wood Pewee	Rose-breasted Grosbeak
Black-billed Cuckoo	Hermit Thrush*	Scarlet Tanager
Blackburnian Warbler	Least Flycatcher	Veery
Black-throated Blue Warbler	Magnolia Warbler	White-throated Sparrow
Black-throated Green Warbler	Mourning Warbler	Winter Wren*
Blue-headed Vireo	Nashville Warbler*	
Chestnut-sided Warbler*	Ovenbird*	

* = *Species that are at or above target population level*

Of the species of conservation concern listed in Table X, 6 species were identified whose populations are currently at or above their target level based on an evaluation of PIF criteria (personal communication, Kim Hall). The total number of birds of conservation concern that could be at their target habitat level is 19. Therefore, the baseline level for the birds of conservation concern attribute was set at 6 and was allowed to take on levels of 7, 12 and 17.

The second bird attribute was chosen to represent the biodiversity of songbirds in the study area. The levels of this attribute were suggested by the ecologists working on the project based on their estimation of current percent of the study area with high migratory forest songbird species diversity and the maximum level they believe it could reach with certain changes in forest management practices (personal communication, Ed Laurent and Kim Hall). The baseline level for this attribute was defined to be 35% and was allowed to take on the following levels: 38%, 55% and 75%.

Deer

Current levels of deer browse have been estimated by foresters collaborating on this project. Data from their research shows that approximately 69% of the study area currently has deer browse levels that are high enough to affect tree regeneration. These researchers estimate that this level could be reduced to approximately 49% of the study area if the appropriate forest management practices are implemented (personal communication, Joseph LeBouton). Therefore, the baseline value for the deer attribute was set a 69% and was allowed to take levels of 67%, 58% and 49%.

Experimental Design

The experimental design of the choice sets included in the survey resulted in five choice sets presented to each respondent. A 3^6 orthogonal design generated 18 choice sets (Addelman and Kempthorne 1961). From these 18 sets, eleven versions of the survey instrument were designed in which each respondent is presented with five choice sets. Each survey respondent was presented with an introductory 'easy' choice that was not part of the experimental main effects design. This choice was constructed to have no change in the job variables and very small improvements in the ecological variables. The remaining four choice sets in each version were chosen based on the main effects design.

Six of the eleven survey versions include choice sets where the respondent sees the same cost across all choices and the remaining five versions include choice sets in which the respondent sees different costs across the choices. Versions with the same cost were created by assigning random numbers to each of the 18 possible choice sets that had the same cost. Because the cost took on three levels, there were six choice sets for each cost level. For example, all six choice sets in which the cost is $20 were assigned

random numbers and then placed in sequence. The first four sets were then assigned to version 1, the last four to version 2. This was done for the remaining two price levels creating four choice sets with the same price for six of the survey versions. Adding these four choice sets to the introductory choice generated five choice sets for each of these six versions.

The remaining five survey versions present respondents with varying prices. These were created by taking all choice sets with the same price level, randomizing and then sequencing them and then assigning one choice set from each price level group to each of versions 7 through 11. This assigned three choice sets to each of versions 7 through 11. After randomizing and assigning the choice sets to these 5 versions, 3 choice sets (one for each price level) remained. These three were randomized, sequenced and assigned as the fifth choice to versions 7, 8 and 9. To assign a fifth choice to versions 10 and 11, all choice sets (excluding the previous three that were left over and assigned to 7,8 and 9) were randomized and sequenced, and the first two sets were assigned respectively to versions 10 and 11. Along with the easy introductory choice, this created five total choice sets for each version.

REFERENCES

Addelman, S., and O. Kempthorne. 1961. Orthogonal Main-Effect Plans. Ames, IA: Iowa State University, Aeronautical Research Laboratory, Office of Aerospace Research, United States Air Force.

Frawley, B.J. 2004. Michigan deer harvest survey report - 2003 seasons, Wildlife Report No. 3418: Michigan Department of Natural Resources.

International Association of Fish and Wildlife Agencies (IAFWA). 2002. Economic Importance of Hunting in America. Washington, D.C.: International Association of Fish and Wildlife Agencies.

Michigan Information Center (MIC). 1994. Zip codes of Michigan: A geographic directory: Michigan Information Center Department of Management and Budget.

Partners in Flight (PIF). 2005. *Partners in Flight Bird Conservation Plan for the Boreal Hardwood Transition (Physiographic area 20), Draft*: American Bird Conservancy.

Stynes, D. 2005. *Michigan Tourism Spending by County, 2000 - Update* 2000 [cited July 14 2005]. Available from http://www.prr.msu.edu/miteim/michtsm00.htm.

Stynes, D.J., C.M. Nelson, and J.A. Lynch. 1998. State and regional economic impacts of snowmobiling in Michigan. East Lansing, MI: Michigan State Univeristy, Department of Park, Recreation and Tourism Resources.

US Census. 2005c. *Zip Code Business Patterns (NAICS)*. US Census Bureau 2001 [cited July 14 2005c]. Available from http://censtats.census.gov.

———. 2005b. *2000 County Business Patterns (NAICS)*. US Census Bureau 2005 [cited July 14 2005b]. Available from http://censtats.gov.

———. 2005a. *General Demographic Characteristics, 2000 Census Demographic Profile*. Northwest Michigan Council of Governments 2005 [cited July 14 2005a]. Available from www.nwmcog.org.

US. Dept of the Interior, Fish and Wildlife Service and U.S. Dept of Commerce, U.S. Census Bureau. 2001. 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation - Michigan.

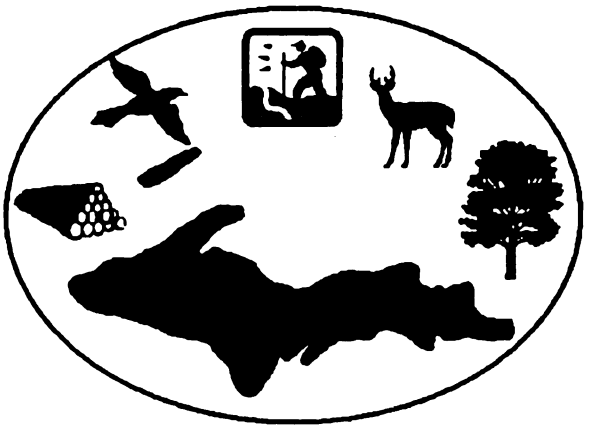
APPENDIX 3:

SURVEY INSTRUMENT

Survey printed on 8 1/2 x 11 paper

Forests, Wildlife and People in Michigan's Upper Peninsula

A Survey of Your Opinions



Forests provide many benefits to people, including wood products, wildlife habitat, recreation, water filtration, clean air, beauty, and erosion control. All of these things are affected by forest management decisions.

Your opinions matter!

By completing this survey, you are helping forest land managers get the information they need in order to design forest policies that better reflect the views and concerns of all Michigan citizens.

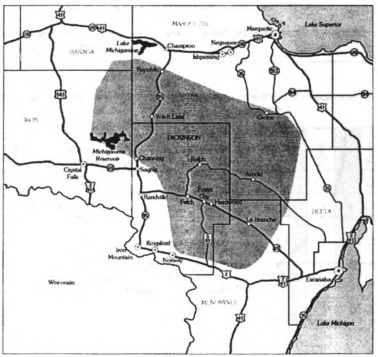
MICHIGAN STATE
UNIVERSITY

The Western Upper Peninsula Study Forest

This survey asks ***your opinions*** about forests and wildlife in an area of Michigan's Upper Peninsula that we will refer to as the ***Western U.P. Study Forest***. This area is represented by the shaded part of the map found on this page *and* on the back cover of this survey. Please refer to this map when answering questions throughout the survey.

1. Have you ever visited the Western U.P. Study Forest? ***Please refer to the shaded area of the map found on this page or on the back cover of this survey.***

- ❑ Yes
- ❑ No
- ❑ Not sure



Your Opinions on the Western U.P. Study Forest

- This is a **heavily forested area** where forest policies have significant effects.
- State forest policy makers need to know ***your opinions and concerns*** in order to design forest policies for this area.
- The Western U.P. Study Forest is **economically** important, and forest management can affect forest industry jobs as **well as** forest-based recreation and tourism jobs.
- The Western U.P. Study Forest is also important for **wildlife habitat**, and forest management can affect habitat for songbirds and deer in the area.
- High impact timber harvesting has been practiced in this area for many years, affecting timber production, recreation, tourism and wildlife habitat.
- The information in this survey is backed by **scientific research** being done in the Western U.P. Study Forest.

2. Please provide **your opinion** by indicating your agreement or disagreement with the following statements. Mark one response for each statement.

	In my opinion, the Western U.P. Study Forest should be managed to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a.	Meet the needs of people.	☐	☐	☐	☐	☐
b.	Meet the needs of wildlife.	☐	☐	☐	☐	☐
c.	Meet the needs of communities that are economically dependent on forests, no matter what effect this has on the environment.	☐	☐	☐	☐	☐
d.	Balance environmental needs with the needs of communities that are economically dependent on forests.	☐	☐	☐	☐	☐
e.	Meet the needs of future generations.	☐	☐	☐	☐	☐

The Economy

Forest Products

- The Western U.P. Study Forest is an important source of wood products.
- Jobs in forestry, logging, and wood product and paper manufacturing are an important source of employment in this area.
- In 2001 there were about 675 forest industry jobs in the Western U.P. Study Forest.

Recreation and tourism

- Many people visit the Western U.P. Study Forest to participate in deer hunting, snowmobiling and fall color tours.
- Recreational activities in the Western U.P. Study Forest attract visitors who spend money in the area and support the local economy.
- In 2001 there were about 190 forest-based recreation and tourism jobs in the Western U.P. Study Forest.

3. Please provide **your opinion** by indicating your agreement or disagreement with the following statements. Mark one response for each statement.

	In my opinion, the Western U.P. Study Forest should be managed to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a.	Maintain forest industry jobs.	☐	☐	☐	☐	☐
b.	Maintain forest-based recreation jobs.	☐	☐	☐	☐	☐
c.	Protect forest and wildlife resources.	☐	☐	☐	☐	☐
d.	Achieve a balance between maintaining forest-related jobs *and* protecting forest and wildlife resources.	☐	☐	☐	☐	☐

4. Do you think that a change in the number of forest-based jobs in the Western U.P. Study Forest could affect ***your own income***?

☐ Yes
☐ No
☐ Not sure

Wildlife in the Western U.P. Study Forest

Migratory Forest Songbirds

- **Migratory forest songbirds** breed and nest in the northern U.S. and Canada and have winter homes in southern areas.
- Scientific research has shown that the **Western U.P. Study Forest** provides **important habitat** for these types of birds.
- One way to measure **bird diversity** is by counting the number of different birds a person can hear by standing anywhere in the forest.
- For the Western U.P. Study Forest, **"high" migratory forest songbird diversity** means being able to hear 10 or more birds while standing anywhere in the forest.
- Currently, **35%** of the Western U.P. Study Forest has **high migratory forest songbird diversity**.
- With changes in forest management, up to **90%** of the Western U.P. Study Forest *could* have high migratory forest songbird diversity.

5. Were you aware of the importance of the Western U.P. Study Forest for migratory forest songbird habitat?

❑ Yes ❑ No

6. How concerned are you about migratory forest songbird diversity in the Western U.P. Study Forest?

❑ Very concerned
❑ Concerned
❑ Somewhat concerned
❑ Not at all concerned

7. Please provide **your opinion** by indicating your agreement or disagreement with the following statements. Mark one response for each statement.

	In my opinion, the Western U.P. Study Forest should be managed to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a.	Increase migratory forest songbird diversity *even if* there are economic losses to forest-based industries.	❑	❑	❑	❑	❑
b.	Achieve a balance between sustaining forest-based industries *and* migratory forest songbird diversity.	❑	❑	❑	❑	❑

Migratory Forest Songbirds of Conservation Concern

- Of the 65 migratory forest songbird species in the Western U.P. Study Forest, scientists have identified **19** as **species of conservation concern** due to factors like the importance of habitat, threats to breeding success and evidence of population declines.
- The number of birds necessary for each species to thrive is currently **above** the scientifically defined **target level** for **6** of these **19** species of conservation concern.
- Scientists think that the reasons why some of these forest songbird species are **below** the **target population level** are related to **forest management practices** in the Western U.P. Study Forest
- Forest management practices can be changed to **improve habitat** for migratory forest songbirds that are **species of conservation concern.**

8. Were you aware of the importance of the Western U.P. Study Forest for migratory forest songbird species of conservation concern?

❑ Yes ❑ No

9. How important is it to you to protect habitat for migratory forest songbird species of conservation concern in the Western U.P. Study Forest?

❑ Very important
❑ Important
❑ Somewhat important
❑ Not at all important

10. Please provide **your opinion** by indicating your agreement or disagreement with the following statements. Mark one response for each statement.

	In my opinion, the Western U.P. Study Forest should be managed to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a.	Protect habitat for migratory forest songbird species of conservation concern, *even if* it results in economic losses to forest-based industries.	❑	❑	❑	❑	❑
b.	Achieve a balance between sustaining forest-based industries *and* protecting habitat for migratory forest songbird species of conservation concern.	❑	❑	❑	❑	❑

Deer

- Deer feed on twigs and small branches of trees in the winter. This activity is called **deer browse**.
- Scientific studies have shown that **high deer browse** may be slowing, or in some areas nearly eliminating, the regeneration of certain types of young trees in the Western U.P. Study Forest.
- Currently, 69% of the Western U.P. Study Forest has deer browse levels that are high enough to affect tree regeneration.

Low Deer Browse

High Deer Browse

- **Forest management** practices can be changed to **reduce** the effects of **deer browse** on the forest.
- By **changing** the timing, frequency and location of timber harvests, it is possible to move deer around the landscape, ***reducing deer browse*** while ***maintaining the same number of deer*** in the area.

11. Please indicate your agreement or disagreement with the following statements. Mark one response for each statement.

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a.	I was aware of deer browse before reading this.	☐	☐	☐	☐	☐
b.	I have seen the effects of high deer browse on forests.	☐	☐	☐	☐	☐
c.	I am concerned about the effects of deer browse on the appearance of the Western U.P. Study Forest.	☐	☐	☐	☐	☐
d.	Forest management should reduce deer browse *even if* it means *fewer deer* in the area.	☐	☐	☐	☐	☐
e.	Forest management should move deer around the landscape to reduce deer browse and *keep the same number* of deer in the area.	☐	☐	☐	☐	☐

Forest Management Programs

- Management decisions of **private forest landowners** can affect forest services that provide benefits to the landowner and others, and **government programs** can encourage forest management practices that provide certain benefits.
- Sometimes, **laws and regulations** can be used to *require* private forest landowners to implement specific forest management practices.
- In other cases, **voluntary programs** can encourage private forest landowners to meet certain forest management goals; Landowners are *not required* to participate.
- A type of **voluntary program** is the ***forest easement***, which provides financial incentives for private forest landowners to manage their forests to meet certain goals.

Voluntary forest easements....

- Have been used in other states such as Maine and New Hampshire.
- Ensure sustained timber harvests and permanent protection of forested areas.
- Can ensure the achievement of particular forest management goals, such as improving habitat for migratory forest songbirds of conservation concern or reducing the effects of deer browse on tree regeneration.

12. Please indicate your agreement or disagreement with the following statements. Mark one response for each statement.

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a.	I was already familiar with voluntary forest easements.	❑	❑	❑	❑	❑
b.	I am familiar with laws or regulations for private forest landowners.	❑	❑	❑	❑	❑
c.	I am familiar with other voluntary forest management programs for private forest landowners.	❑	❑	❑	❑	❑
d.	*Some* forest management decisions made by private forest landowners should be regulated by laws.	❑	❑	❑	❑	❑
e.	All private forest landowners should make their own management decisions without government programs.	❑	❑	❑	❑	❑
f.	All private forest landowners should be able to enroll in voluntary forest management assistance programs.	❑	❑	❑	❑	❑

A Proposed Voluntary Forest Easement Program

- A **voluntary forest easement** program is currently being developed for **private** forest landowners in the **Western U.P. Study Forest**.
- Private forest landowners in the Western U.P. Study Forest that ***voluntarily enroll*** receive **financial incentives** to develop and follow a new forest management plan.
- The forest management plans differ for each landowner that enrolls, but they all contribute to the program's objectives and meet the needs of individual landowners.

Program Implementation

- The proposed program would be implemented if it is approved by Michigan voters in a special referendum.
- The program would not be implemented if it is not approved by Michigan voters.

Program Cost

- The voluntary forest easement program **costs money** to implement.
- The money to fund the program would be used to: pay foresters to develop plans (10% of costs), pay administrative costs (5% of costs), and pay landowners to enroll in the program (85% of costs).
- State and local taxes will be used to fund the forest easement program.

Choosing among Forest Easement Programs

- Because there are many different forest easement programs that could be adopted in the Western U.P. Study Forest, forest managers and policy makers need to know which aspects of forests and wildlife in this area of Michigan are **important to you.**
- In the following pages, you will be presented with a series of **possible programs** that show what would change in the Western U.P. Study Forest if that voluntary forest easement program is implemented.
- The estimated cost to your household will depend on the program features.
- You will be asked to vote 'yes' or 'no' for each scenario.

This table shows a possible voluntary forest easement program for the Western U.P. Study Forest (the area on the back cover). The table shows what would change in that area if the program is implemented. Please use the table to answer the questions below.

Things in the Western U.P. Study Forest that would be affected by the voluntary forest easement program	Current Level, *without* easement program	Level *with* Forest Easement Program A
Economy		
• Number of forest industry jobs in the area	675	675
• Forest-based recreation and tourism jobs in the area	190	190
Migratory Forest Songbirds		
• Percent of area with high migratory forest songbird species diversity	35%	38%
• Number of migratory forest songbird species of conservation concern that are *at or above their target population* (out of 19 possible species)	6	7
Deer		
• Percent of area with deer browse high enough to affect tree regeneration	69%	67%
• Number of deer in the area (more, same, less)	n/a	Same
Program cost per year		
• Cost to your household in increased annual taxes	$0	$20

13a. For an increase of $20 per year in your household's taxes, would you vote for this program?

❑ Yes ❑ No

13b. How sure are you about your response to question 13a?

❑ Very sure ❑ Sure ❑ Somewhat sure ❑ Somewhat unsure ❑ Very unsure

13c. If you answered 'yes' to 13a, please go to the next page.
If you answered 'no' to 13a, which one of the following best describes your answer?

❑ I would vote 'yes' if the cost was much lower.
❑ I might vote 'yes' if the cost was much lower.
❑ I would never vote for this program, no matter what the cost is.

This table shows a possible voluntary forest easement program for the Western U.P. Study Forest (the area on the back cover). The table shows what would change in that area if the program is implemented. Please use the table to answer the questions below.

Things in the Western U.P. Study Forest that would be affected by the voluntary forest easement program	Current Level, *without* easement program	Level *with* Forest Easement Program B
Economy		
• Number of forest industry jobs in the area	675	710
• Forest-based recreation and tourism jobs in the area	190	250
Migratory Forest Songbirds		
• Percent of area with high migratory forest songbird species diversity	35%	38%
• Number of migratory forest songbird species of conservation concern that are *at or above their target population* (out of 19 possible species)	6	12
Deer		
• Percent of area with deer browse high enough to affect tree regeneration	69%	58%
• Number of deer in the area (more, same, less)	n/a	Same
Program cost per year		
• Cost to your household in increased annual taxes	$0	$20

14a. For an increase of $20 per year in your household's taxes, would you vote for this program?

❑ Yes ❑ No

14b. How sure are you about your response to question 14a?

❑ Very sure ❑ Sure ❑ Somewhat sure ❑ Somewhat unsure ❑ Very unsure

14c. If you answered 'yes' to 14a, please go to the next page.
If you answered 'no' to 14a, which one of the following best describes your answer?

❑ I would vote 'yes' if the cost was much lower.
❑ I might vote 'yes' if the cost was much lower.
❑ I would never vote for this program, no matter what the cost is.

This table shows a possible voluntary forest easement program for the Western U.P. Study Forest (the area on the back cover). The table shows what would change in that area if the program is implemented. Please use the table to answer the questions below.

Things in the Western U.P. Study Forest that would be affected by the voluntary forest easement program	Current Level, *without* easement program	Level *with* Forest Easement Program C
Economy		
• Number of forest industry jobs in the area	675	675
• Forest-based recreation and tourism jobs in the area	190	190
Migratory Forest Songbirds		
• Percent of area with high migratory forest songbird species diversity	35%	55%
• Number of migratory forest songbird species of *conservation concern* that are *at or above their target population* (out of 19 possible species)	6	12
Deer		
• Percent of area with deer browse high enough to affect tree regeneration	69%	67%
• Number of deer in the area (more, same, less)	n/a	Same
Program cost per year		
• Cost to your household in increased annual taxes	$0	$20

15a. For an increase of $20 per year in your household's taxes, would you vote for this program?

❑ Yes ❑ No

15b. How sure are you about your response to question 15a?

❑ Very sure ❑ Sure ❑ Somewhat sure ❑ Somewhat unsure ❑ Very unsure

15c. If you answered 'yes' to 15a, please go to the next page.
If you answered 'no' to 15a, which one of the following best describes your answer?

❑ I would vote 'yes' if the cost was much lower.
❑ I might vote 'yes' if the cost was much lower.
❑ I would never vote for this program, no matter what the cost is.

This table shows a possible voluntary forest easement program for the Western U.P. Study Forest (the area on the back cover). The table shows what would change in that area if the program is implemented. Please use the table to answer the questions below.

Things in the Western U.P. Study Forest that would be affected by the voluntary forest easement program	Current Level, *without* easement program	Level *with* Forest Easement Program D
Economy		
• Number of forest industry jobs in the area	675	600
• Forest-based recreation and tourism jobs in the area	190	170
Migratory Forest Songbirds		
• Percent of area with high migratory forest songbird species diversity	35%	38%
• Number of migratory forest songbird species of conservation concern that are *at or above their target population* (out of 19 possible species)	6	7
Deer		
• Percent of area with deer browse high enough to affect tree regeneration	69%	67%
• Number of deer in the area (more, same, less)	n/a	Same
Program cost per year		
• Cost to your household in increased annual taxes	$0	$20

16a. For an increase of $20 per year in your household's taxes, would you vote for this program?

❑ Yes ❑ No

16b. How sure are you about your response to question 16a?

❑ Very sure ❑ Sure ❑ Somewhat sure ❑ Somewhat unsure ❑ Very unsure

16c. If you answered 'yes' to 16a, please go to the next page.
If you answered 'no' to 16a, which one of the following best describes your answer?

❑ I would vote 'yes' if the cost was much lower.
❑ I might vote 'yes' if the cost was much lower.
❑ I would never vote for this program, no matter what the cost is.

This table shows a possible voluntary forest easement program for the Western U.P. Study Forest (the area on the back cover). The table shows what would change in that area if the program is implemented. Please use the table to answer the questions below.

Things in the Western U.P. Study Forest that would be affected by the voluntary forest easement program	Current Level, *without* easement program	Level *with* Forest Easement Program E
Economy		
• Number of forest industry jobs in the area	675	710
• Forest-based recreation and tourism jobs in the area	190	170
Migratory Forest Songbirds		
• Percent of area with high migratory forest songbird species diversity	35%	75%
• Number of migratory forest songbird species of conservation concern that are *at or above their target population* (out of 19 possible species)	6	17
Deer		
• Percent of area with deer browse high enough to affect tree regeneration	69%	58%
• Number of deer in the area (more, same, less)	n/a	Same
Program cost per year		
• Cost to your household in increased annual taxes	$0	$20

17a. For an increase of $20 per year in your household's taxes, would you vote for this program?

❑ Yes ❑ No

17b. How sure are you about your response to question 17a?

❑ Very sure ❑ Sure ❑ Somewhat sure ❑ Somewhat unsure ❑ Very unsure

17c. If you answered 'yes' to 17a, please go to the next page.
If you answered 'no' to 17a, which one of the following best describes your answer?

❑ I would vote 'yes' if the cost was much lower.
❑ I might vote 'yes' if the cost was much lower.
❑ I would never vote for this program, no matter what the cost is.

18. When you made your choices of whether or not to vote for the forest easement programs in Questions 13 through 17, how important were the following attributes in your decisions?

		Very important	Important	Somewhat important	Not very important	Not at all important
a.	Number of forest industry jobs in the area	☐	☐	☐	☐	☐
b.	Number of forest-based recreation and tourism jobs in the area	☐	☐	☐	☐	☐
c.	Percent of area with high migratory forest songbird species diversity	☐	☐	☐	☐	☐
d.	Number of migratory forest songbird species of conservation concern *at or above their target population* (out of 19 possible species)	☐	☐	☐	☐	☐
e.	Percent of area with deer browse high enough to affect tree regeneration	☐	☐	☐	☐	☐
f.	Number of deer in the area (more, same, less)	☐	☐	☐	☐	☐
g.	Cost to your household in increased annual taxes	☐	☐	☐	☐	☐

19. Please use the space below to list a few reasons for your decisions to vote either 'yes' or 'no' for the forest easement programs in Questions 13 through 17.

How you use the Western U.P. Study Forest

Please refer to the map on the back of this survey when answering the following questions.

20. **Please indicate if you have ever participated in any of the following recreational activities in the following locations.**

	I have participated in:	*In* the Western U.P. Study Forest	*Near* the Western U.P. Study Forest	In other parts of Michigan	Never in Michigan
a.	Berry picking	❑	❑	❑	❑
b.	Birdwatching	❑	❑	❑	❑
c.	Boating	❑	❑	❑	❑
d.	Camping	❑	❑	❑	❑
e.	Cross-country skiing	❑	❑	❑	❑
f.	Firewood gathering	❑	❑	❑	❑
g.	Fishing	❑	❑	❑	❑
h.	Hiking	❑	❑	❑	❑
i.	Hunting (Deer)	❑	❑	❑	❑
j.	Hunting (Game birds)	❑	❑	❑	❑
k.	Hunting (*Other, please specify* _____)	❑	❑	❑	❑
l.	Mushroom gathering	❑	❑	❑	❑
m.	Other wildlife viewing	❑	❑	❑	❑
n.	Sightseeing/Touring	❑	❑	❑	❑
o.	Snowmobiling	❑	❑	❑	❑
p.	Snowshoeing	❑	❑	❑	❑
q.	Trail horseback riding	❑	❑	❑	❑
r.	Other activities (*Please specify* _____)	❑	❑	❑	❑

Your Opinions

21. We would like to know how you feel about forests and the environment. Please mark one response for each item.

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a.	Whether or not I visit the Western U.P. Study Forest, just knowing that the forest is there is important to me.	❑	❑	❑	❑	❑
b.	I have participated in community forest management.	❑	❑	❑	❑	❑
c.	I would like to participate in community forest management.	❑	❑	❑	❑	❑
d.	I think the state communicates its forest management goals clearly to local communities.	❑	❑	❑	❑	❑
e.	I think my input matters to the decisions of state forest managers.	❑	❑	❑	❑	❑
f.	I think that state forest land is well managed.	❑	❑	❑	❑	❑
g.	I think industrial private forest land is well managed.	❑	❑	❑	❑	❑
h.	I think non-industrial private forest land is well managed.	❑	❑	❑	❑	❑
i.	I have purchased environmentally certified wood products.	❑	❑	❑	❑	❑
j.	I would like to be able to purchase environmentally certified wood products.	❑	❑	❑	❑	❑
k.	Human skill and resources will ensure that we do not make the earth unlivable.	❑	❑	❑	❑	❑
l.	Humans are severely abusing the environment.	❑	❑	❑	❑	❑
m.	Humans have the right to modify the natural environment to suit their needs.	❑	❑	❑	❑	❑
n.	Humans were meant to rule over nature.	❑	❑	❑	❑	❑
o.	Humans will eventually learn enough about how nature works to be able to control it.	❑	❑	❑	❑	❑
p.	The balance of nature is delicate and easily upset.	❑	❑	❑	❑	❑
q.	The so-called "environmental crisis" has been greatly exaggerated.	❑	❑	❑	❑	❑
r.	We are approaching the limit to the number of people this earth can support.	❑	❑	❑	❑	❑
s.	When humans interfere with nature, it often produces disastrous consequences.	❑	❑	❑	❑	❑

Questions About You

Your answers below help us ensure that our information represents Michigan's general population. Please remember that all answers you provide will be held strictly confidential.

22. Do you own property **within the shaded area of the map** on the back page?

- ❑ Yes
- ❑ No ⟹ *Please go to question 25.*

23. How many acres do you own? _____

24. What are the primary uses of your property? *Please check all that apply.*

- ❑ Primary residence
- ❑ Second home or cabin
- ❑ Forest products
- ❑ Agriculture
- ❑ Recreational use
- ❑ Hunting for yourself or family
- ❑ Hunting for others
- ❑ Other_____

25. Are you a member of any forestry organizations? ❑ Yes ❑ No

26. Are you a member of any hunting clubs or organizations? ❑ Yes ❑ No

27. Are you a member of any environmental organizations? ❑ Yes ❑ No

28. What is the highest level of education that you have completed? *Please check one.*

- ❑ Some high school
- ❑ High school graduate or equivalent
- ❑ Trade or vocational school
- ❑ Some college
- ❑ Associates degree (2 year)
- ❑ College graduate (4 year degree)
- ❑ Graduate or professional degree

29. In what year were you born? 19_____

30. What is your gender? ❑ Male ❑ Female

31. What was your gross household income in 2004? _____ dollars

32. Is anyone in your household employed directly in any of the following industries? *Please check all that apply.*

- ❑ Forestry
- ❑ Logging
- ❑ Wood product manufacturing
- ❑ Tourism
- ❑ Hotels or other accommodation services
- ❑ Outdoor recreation
- ❑ Natural resource management agency
- ❑ None of the above

33. How many years have you lived in Michigan? _____ years

34. How would you describe the area in which you live?

❑ Urban ❑ Suburban ❑ Rural

35. From what countries or parts of the world did your ancestors come?

_____

36. What is your ethnic background?

❑ Hispanic, Latino or Spanish origin
❑ White
❑ African American or Black
❑ Native American or Alaska native
❑ Hawaiian or Pacific Islander
❑ Asian
❑ Other_____

37. What is your religious preference?

❑ Protestant
❑ Catholic
❑ Jewish
❑ Muslim
❑ None
❑ Other_____

38. How would you describe your political views?

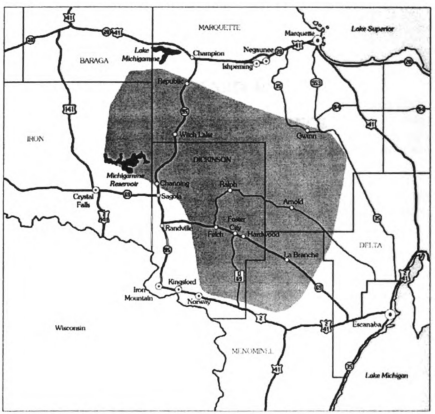
❑ Extremely liberal
❑ Somewhat liberal
❑ Moderate, middle of the road
❑ Somewhat conservative
❑ Extremely conservative

Thank You! **This completes the questionnaire.**

We appreciate your help and feedback.

If you would like to share your ideas or opinions with us, please use the remainder of this page, or feel free to attach additional sheets to this survey.

Map of Michigan's Western Upper Peninsula Study Forest



Please place your completed questionnaire in the enclosed envelope and return it to:

UP Forest & Wildlife Project, Attention: Laila A Racevskis, Department of Agricultural Economics, Michigan State University, East Lansing, MI 48824-1039

APPENDIX 4:

SURVEY CORRESPONDENCE

1) Prenotice Letter - Printed on 8 1/2 x 11 watermark paper and hand signed

MICHIGAN STATE
UNIVERSITY

Name Surname
Address
City, State Zip

Dear Name Surname:

You have been selected to participate in a study of forests and wildlife in Michigan's Upper Peninsula. The study is part of research at Michigan State University. The project will provide needed information to local, regional, and state agencies about residents' opinions and concerns about forests and wildlife in the Upper Peninsula.

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

Thank you very much.

Sincerely,

DEPARTMENT OF
AGRICULTURAL
ECONOMICS

Michigan State University
East Lansing, MI
48824-1039
517/353-7888
FAX: 517/432-1800
e-mail: racevsk1@msu.edu

Laila Racevskis
Project Coordinator

2) Wave 1 Cover Letter - Printed on 8 1/2 x 11 watermark paper and hand signed

MICHIGAN STATE
UNIVERSITY

Name Surname
Address
City, State Zip

Dear Name Surname:

You have been selected to participate in a study about forest and wildlife resources in Michigan's Upper Peninsula. You may recall receiving a letter about this study about a week ago. The study is part of an effort by Michigan State University to learn about citizens' opinions and concerns regarding the management of forests and wildlife in an area of Michigan's Upper Peninsula.

Your input is important because managing Michigan's forest and wildlife resources involves trade-offs that affect you. Results of the questionnaire will provide needed guidance to local, regional, and state agencies about residents' opinions and concerns about forested areas of Michigan's Upper Peninsula.

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

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

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

If you have any questions or comments about this study feel free to call me by phone at: (517) 353-7898, fax at: (517) 432-1800, or e-mail at: racevsk1@msu.edu. If you have questions concerning your rights as a survey participant, please contact Dr. Peter Vasilenko, Chair of the MSU Committee on Research Involving Human Subjects, by phone at (517) 355-2180, fax at: (517) 432-4503, or e-mail at: ucrihs@msu.edu.

Thanks for participating in this study.

Sincerely,

Laila Racevskis
Project Coordinator

DEPARTMENT OF
AGRICULTURAL
ECONOMICS

Michigan State University
125 Cook Hall
East Lansing, MI
48824-1039
517/353-7898
FAX: 517/432-1800
e-mail: racevsk1@msu.edu

3) Reminder Post Card - Printed on 3 1/2 x 5 white card stock and hand signed

Dear Sir or Madam:

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

Sincerely,

Laila Racevskis
Project Coordinator
Michigan State University
(517) 353-7898

MICHIGAN STATE
UNIVERSITY

4) Wave 2 Cover Letter, Printed on 8 1/2 x 11 watermark paper and hand signed

MICHIGAN STATE
UNIVERSITY

Name Surname
Address
City, State Zip

Dear Name Surname:

We recently sent you a survey about forest and wildlife resources in Michigan's Upper Peninsula. Although we have received completed surveys from many Michigan residents, to date we have not heard from you.

I am writing to you again because your input is vital! You are part of a small sample of citizens that was selected to represent Michigan. **We need you to participate in this study even if you do not reside in or are not familiar with the Upper Peninsula, because we need to represent the views of all Michigan citizens.**

Your input is important because managing Michigan's forest and wildlife resources involves trade-offs that affect you. Results of the questionnaire will provide needed guidance to local, regional, and state agencies about residents' opinions and concerns about forested areas of Michigan's Upper Peninsula.

Please take a few minutes to share your viewpoint by filling out this survey. By completing and returning this survey, you indicate your voluntary consent to participate in this study and have your answers included in the project data set. We remind you that we will keep your individual views entirely confidential. Rest assured, your privacy will be protected to the maximum extent allowable by law.

If you have any questions or comments about this study feel free to call me by phone at: (517) 353-7898, fax at: (517) 432-1800, or e-mail at: racevsk1@msu.edu. If you have questions concerning your rights as a survey participant, please contact Dr. Peter Vasilenko, Chair of the MSU Committee on Research Involving Human Subjects, by phone at (517) 355-2180, fax at: (517) 432-4503, or e-mail at: ucrihs@msu.edu.

Thanks for participating in this study.

Sincerely,

Laila Racevskis
Project Coordinator

DEPARTMENT OF
AGRICULTURAL
ECONOMICS

Michigan State University
125 Cook Hall
East Lansing, MI
48824-1039
517/353-7898
FAX: 517/432-1800
e-mail: racevsk1@msu.edu

APPENDIX 5:

SURVEY IMPLEMENTATION

This appendix describes the details of survey implementation. All survey correspondence as well as the survey instrument can be found in Appendices 3 and 4 .

The first contact, the prenotice letter, was mailed to 2,000 Michigan households via first class mail on Friday, April 8, 2005. The letter was printed on white watermark paper with MSU letterhead, personalized for each respondent, hand signed and mailed in #10 white watermark envelopes.

The second contact, the first survey mailing, was sent on Friday, April 15, 2005. It was mailed in a white 10x13 envelope and included a personalized, hand signed cover letter printed on white watermark paper with MSU letterhead with three first class stamps affixed with a paper clip, a postage-paid white 9x10 business reply envelope and the questionnaire.

Due to an error in the mailing process, a private company to whom the mass mailing was contracted by the university's mail processing system mailed the survey using Pre-sort Standard mail rather than First Class mail, as had been requested. This meant that the survey took longer to reach some areas of Michigan than it would have had it been sent via First Class mail, and packages mailed to bad addresses were not returned to sender.

The third contact, a personalized, hand signed reminder post card, was mailed via first class mail on Friday, April 22, 2005. The fourth contact, a second wave mailing of the survey, was sent to 1,057 Michigan households on Friday, June 3rd, 2005. This mailing occurred 7 weeks after the initial prenotice mailing, which is longer than the time interval between first and second mailings recommended by Dillman (2000). However, because of the timing delay in the first mailing, returned surveys continued to come in for several weeks, and therefore the second mailing was delayed until first wave returns

decreased substantially.

The second mailing consisted of a personalized, hand signed, region-specific cover letter, a postage-paid business reply envelope, and the questionnaire. After the first survey mailing, several people indicated that they did not believe they were qualified to complete the survey because of a lack of familiarity with the region under study. Therefore, the cover letters of the second mailing were revised to encourage those who are not residents of the study area to respond to the survey. The letters were tailored to residents of the Upper Peninsula who do not reside in the study area and those who are not Upper Peninsula residents.

Codes from the American Association for Public Opinion Research (AAPOR) are used to classify survey responses and to calculate survey response rates (AAPOR 2004). These codes are provided in detail for all waves and regions in Table 3D.3. The first mailing resulted in 90 bad addresses, 54 non-respondents, and 824 returned, usable surveys, for a total first wave response rate of 43% (ibid). The second mailing resulted in 11 bad addresses, 15 non-respondents, and 130 returned, usable surveys, for a total second wave response rate of 12% (ibid). In the first and second mailings, there were a total of 101 bad addresses, 69 non-respondents, and 954 returned, usable surveys, for an overall response rate of 50% for the entire survey (ibid).

Each of the eleven versions of the survey were randomly assigned to survey recipients in each region. Versions 1 through 6 were each sent to 46 households in each region, and versions 7 through 11 were each sent to 45 households in each region.

Table A5.1. Disposition of Survey Mailings

Contact	Number Mailed	Completed Returned Surveys[1]	Non-responses[2]	Non-deliverables[3]	Response Rate[4]	Cumulative Response[5]
First mailing	2,000	824	54	90	43%	NA
Second mailing	1,057	130	15	11	12%	50%
Total	3,057	954	69	101	NA	50%

[1]*AAPOR Disposition Code 1: Returned Questionnaire*
[2]*AAPOR Disposition Code 2: Eligible "Non-Interview"; Includes individuals who indicate that they are physically unable to complete the survey, individuals who have died and returned surveys that are blank or too incomplete to process*
[3]*AAPOR Disposition Code 3: Unknown eligibility, "Non-interview"; Includes incorrect addresses, individuals who are no longer at the address*
[4] *Response Rate = Completed returned surveys/(N - Non-deliverables)*
[5]*Cumulative response = Completed returned surveys/(2000 - Non-deliverables)*

Table A5.2. Regional Response Rates

Study Area (SA)	Rest of Upper Peninsula (RUP)	Northern Lower Peninsula (NLP)	Southern Lower Peninsula (SLP)
62%	51.9%	45.6%	39.6%

Table A5.3. Detailed AAPOR Disposition Codes for Each Survey Mailing

AAPOR Code	Code Definition	First Mailing	Second Mailing
1.1	Returned questionnaire - complete	824	130
2.1	Refusal and break-off	4	3
2.11	Refusal	15	4
2.12	Break-off questionnaire too incomplete to process	3	0
2.26	Other notification that respondent was unavailable during field period	1	0
2.31	Death	17	4
2.32	Physically or mentally unable/incompetent	14	4
3.23	Refused by addressee	0	2
3.2520	Insufficient address	5	2
3.253	No mail receptacle	0	1
3.31	Cannot be delivered as addressed	14	3
3.311	Attempted - Addressee not known	14	3
3.3131	No such number	1	0
3.3134	Vacant	1	1
3.314	Not delivered as addressed	6	0
3.3141	Unable to forward	38	0
3.32	Moved, left no address	10	1
3.9	Other	1	0

REFERENCES

AAPOR. 2004. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*. Edited by American Association for Public Opinion Research. 3rd ed. Lenexa, KS.

Dillman, D.A. 2000. *Mail and Internet Surveys: The Tailored Design Method, 2nd edition*. 2nd ed. New York: John Wiley and Sons, Inc.

APPENDIX 6:

SURVEY RESULTS - DESCRIPTIVE STATISTICS

Table A6.1. Socioeconomic Characteristics of Survey Respondents

Characteristic	Survey	Michigan
N	953	9,938,444 [a]
Own property in study area	18%	
Average # of acres owned	39	
Primary property uses of property owned in the study area:		
Primary residence	79%	
Second home or cabin	9%	
Forest products	1%	
Agriculture	0	
Recreational use	0	
Hunting for yourself or family	8%	
Hunting for others	0	
Other	3%	
Member of forestry organization	3%	
Member of hunting club	20%	
Member of environmental organization	7%	
Gender		
% Male	77%	49% [a]
% Female	23%	51% [a]
Median Age	55	35.5 [a]
Education		
% Some high school	5%	11.9% [a]
% High school or equiv	26%	31.3% [a]
% Trade or vocational school	9%	N/A
% Some college	21%	23.3% [a]
% Associate's degree	10%	7% [a]

Characteristic	Survey	Michigan
% College graduate	17%	13.7% [a]
% Graduate or professional degree	12%	8.1% [a]
Median household reported income	$50,000	$44,667 [a]
% employed in resource-based industry	13%	
Average # years lived in Michigan	47	
% residing in:		
Urban area	9%	75% [b]
Suburban area	20%	N/A
Rural area	71%	25% [b]
Ethnic background:		
% Hispanic, Latino or Spanish origin	0.7%	3.3% [a]
% White	94.5%	80.2% [a]
% African American or Black	1%	14.2% [a]
% Native American or Alaska native	1.9%	0.6% [a]
% Hawaiian or Pacific Islander	0.2%	<1% [a]
% Asian	0.4%	1.8% [a]
% Other	1.3%	1.3% [a]
Religious preference:		
% Protestant	39%	53.7% [c]
% Catholic	36.1%	29.5% [c]
% Jewish	0.8%	0.9% [c]
% Muslim	0.2%	0.4% [c]
% None	11.3%	11.1% [c]
% Other	12.6%	4.4% [c]
Political views:		
% Extremely liberal	2%	12.6% [c]
% Somewhat liberal	15%	12.6% [c]

Characteristic	Survey	Michigan
% Moderate	45%	40% [c]
% Somewhat conservative	32%	30.9% [c]
% Extremely conservative	6%	2.6% [c]

[a] http://quickfacts.census.gov/qfd/, *Profile of Demographic and Social Characteristics 2000*; Accessed 6/27/05

[b] http://www.michigan.gov/documents/urban_rural_42109_7.pdf, *Census 2000 Urban and Rural Population for Michigan, Counties and County Subdivisions*; Accessed 9/02/05

[c] http://www.cpanda.org/codebookDB/sdalite.jsp?id=a00079, General Social Survey 2002, Quick Analysis for Survey Results, Accessed 9/02/05; Reported statistics represent East North Central Region (WI, IL, IN, MI, OH)

Table A6.2. Response Frequencies for Forest Management Environmental Attitude Statements

Survey Statement *(Question number)*	Percent Response					N
In my opinion, the Western U.P. Study Forest should be managed to:	**SA**	**A**	**N**	**D**	**SD**	
Meet the needs of people. *(2a)*	19.5	49.9	19.5	9	2.2	915
Meet the needs of wildlife. *(2b)*	38.5	49	9.5	2.5	0.5	920
Meet the needs of communities that are economically dependent on forests, no matter what effects this has on the environment. *(2c)*	4.8	13.4	15.8	41.2	24.8	916
Balance environmental needs with the needs of communities that are economically dependent on forests. *(2d)*	31.5	50.1	13.3	4.4	0.8	931
Meet the needs of future generations. *(2e)*	40.1	47.1	9.8	2.5	0.5	923
Maintain forest industry jobs. *(3a)*	18	52.1	20.8	7	2	884
Maintain forest-based recreation jobs. *(3b)*	13.2	58.5	21.2	5.9	1.2	887
Protect forest and wildlife resources. *(3c)*	39.7	51.1	7.1	1.3	0.8	891
Achieve a balance between maintaining forest-related jobs *and* protecting forest and wildlife resources. *(3d)*	46	43.9	8.4	1.1	0.6	906
Increase migratory forest songbird diversity *even if* there are economic losses to forest-based industries. *(7a)*	6.8	15.4	30.3	35.5	11.9	881
Achieve a balance between sustaining forest-based industries *and* migratory forest songbird diversity. *(7b)*	26.5	48.8	15.7	6.3	2.7	905
Protect habitat for migratory forest songbird species of conservation concern, *even if* it results in economic losses to forest-based industries. *(10a)*	7.7	20.1	25.6	34.7	11.9	896
Achieve a balance between sustaining forest-based industries *and* protecting habitat for migratory forest songbird species of conservation concern. *(10b)*	28.1	49.2	14	6.7	2	908

Survey Statement *(Question number)*	Percent Response					N
I was aware of deer browse before reading this. *(11a)*	22.5	48.6	9.9	13.4	5.5	901
I have seen the effects of high deer browse on forests. *(11b)*	17	42	18.6	17.1	5.3	902
I am concerned about the effects of deer browse on the appearance of the Western U.P. Study Forest. *(11c)*	11.5	42.2	30.5	12.9	3	899
Forest management should reduce deer browse *even if* it means *fewer deer* in the area. *(11d)*	9.5	24.4	19.6	33.8	12.7	907
Forest management should move deer around the landscape to reduce deer browse and *keep the same number* of deer in the area. *(11e)*	20	41.6	22	12.1	4.3	909
I was already familiar with voluntary forest easements. *(12a)*	3.8	20.4	31.2	35.4	9.1	886
I am familiar with laws or regulations for private forest landowners. *(12b)*	3.1	18.6	32.4	35.7	10.2	885
I am familiar with other voluntary forest management programs for private forest landowners. *(12c)*	2.8	21.7	30.5	35.6	9.4	883
Some forest management decisions made by private forest landowners should be regulated by laws. *(12d)*	8	34.4	21.3	24	12.4	889
All private forest landowners should make their own management decisions without government programs. *(12e)*	14.1	24.4	22.8	32.7	5.9	893
All private forest landowners should be able to enroll in voluntary forest management assistance programs. *(12f)*	27	57.1	12.3	3	0.6	896
Whether or not I visit the Western U.P. Study Forest, just knowing that the forest is there is important to me. *(21a)*	38	39.1	13.8	6.2	2.9	894
I have participated in community forest management. *(21b)*	5.4	13.9	39.7	26.7	14.3	875

Survey Statement *(Question number)*	Percent Response					N
I would like to participate in community forest management. *(21c)*	6.5	16.7	49.8	19.2	7.8	872
I think the state communicates its forest management goals clearly to local communities. *(21d)*	2.9	17.5	42.2	27.7	9.7	893
I think my input matters to the decisions of state forest managers. *(21e)*	6	30.8	38.1	17.4	7.6	895
I think that state forest land is well managed. *(21f)*	1.7	26.6	51.8	15.1	4.8	898
I think industrial private forest land is well managed. *(21g)*	1.8	21.4	55	17.2	4.6	889
I think non-industrial private forest land is well managed. *(21h)*	1.8	19.8	56.9	17.2	4.3	888
I have purchased environmentally certified wood products. *(21i)*	4.1	21.8	45.5	18.7	9.9	861
I would like to be able to purchase environmentally certified wood products. *(21j)*	9.3	34.6	41.9	9.1	5.2	872
Human skill and resources will ensure that we do not make the earth unlivable. *(21k)*	20.7	46.1	17.3	11.2	4.6	889
Humans are severely abusing the environment. *(21l)*	19	35.2	21.6	17.1	7.1	893
Humans have the right to modify the natural environment to suit their needs. *(21m)*	3.4	16	25.5	36.4	18.8	894
Humans were meant to rule over nature. *(21n)*	4.3	15.2	21.8	35.3	23.4	894
Humans will eventually learn enough about how nature works to be able to control it. *(21o)*	7.7	26.7	26.2	27.4	12	888
The balance of nature is delicate and easily upset. *(21p)*	26.9	42.1	15.9	10.9	4.3	893
The so-called "environmental crisis" has been greatly exaggerated. *(21q)*	7.4	20	31.4	27	14.2	886
We are approaching the limit to the number of people this earth can support. *(21r)*	13.6	29.4	31.2	21.2	4.6	888
When humans interfere with nature, it often produces disastrous consequences. *(21s)*	23.5	44	19.9	10.7	1.9	732

Table A6.3. Response Frequencies for Recreational Activities

Recreational Activity *(Question number)*	Percent Response			N
	In or near the Western U.P. Study Forest	In other parts of Michigan	Never in Michigan	
Berry picking *(20a)*	44.5	44.5	11	836
Birdwatching *(20b)*	42.1	37.9	20	805
Boating *(20c)*	49.9	42.9	7.2	853
Camping *(20d)*	50.7	36.5	12.8	814
Cross-country skiing *(20e)*	29.7	32.8	37.5	738
Firewood gathering *(20f)*	46.9	38.2	14.8	803
Fishing *(20g)*	55.5	36.9	7.6	841
Hiking *(20h)*	50.2	32	17.8	799
Hunting (Deer) *(20i)*	43.9	29.7	26.5	789
Hunting (Game birds) *(20j)*	36.8	27.8	35.4	709
Hunting (*Other, please specify* _____) *(20k)*	26.4	24.8	48.8	564
Mushroom gathering *(20l)*	31	34.8	34.2	761
Other wildlife viewing *(20m)*	55	32.4	12.6	793
Sightseeing/Touring *(20n)*	60.5	28.9	10.5	798
Snowmobiling *(20o)*	36.1	28.9	35	726
Snowshoeing *(20p)*	27.5	18.9	53.6	692
Trail horseback riding *(20q)*	12.9	23.4	63.7	564
Other activities (*Please specify* _____) *(20r)*	63.2	18.8	18	345

Table A6.4. Other Response Frequencies

Survey Question *(Question number)*	Percent Response		N
	Yes	No	
Have you ever visited the Western U.P. Study Forest? *(1)*	72.2	27.8	694
Were you aware of the importance of the Western U.P. Study Forest for migratory forest songbird habitat? *(5)*	30.2	69.8	908
Were you aware of the importance of the Western U.P. Study Forest for migratory forest songbird species of conservation concern? *(8)*	16.5	83.5	904

APPENDIX 7:

DESCRIPTIVE STATISTICS BY REGION

Table A7.1 Regional Response Frequencies for Forest Management Environmental Attitude Statements (Pearson Chi-Square < 0.10 = *; < 0.05 = **; < 0.001 = ***)

Survey Statement *(Question number)*	Percent Response Within Region					N
In my opinion, the Western U.P. Study Forest should be managed to:	**SA**	**A**	**N**	**D**	**SD**	**N**
Meet the needs of people. *(2a)*						907
Study Forest	23	50.5	15.8	9.3	1.4	291
Rest of UP	22.6	49.8	19.2	6.3	2.1	239
Northern LP	16.6	48.2	22.6	10.1	2.5	199
Southern LP	13.5	50	23	10.1	3.4	178
Meet the needs of wildlife. *(2b)*						912
Study Forest	40.7	49	7.2	2.4	0.7	290
Rest of UP	34.3	52.7	10.9	1.7	0.4	239
Northern LP	42.4	45.3	8.4	3.4	0.5	203
Southern LP	36.1	48.3	12.2	2.8	0.6	180
Meet the needs of communities that are economically dependent on forests, no matter what effects this has on the environment. *(2c)* ***						908
Study Forest	5.9	12.1	11.4	43.3	27.3	289
Rest of UP	6.3	19.7	17.6	35.7	20.6	238
Northern LP	5.4	6.9	19.8	43.6	24.3	202
Southern LP	0.6	12.8	16.2	43.6	26.8	179
Balance environmental needs with the needs of communities that are economically dependent on forests. *(2d)*						923
Study Forest	31.1	50.9	10.9	7.2	0	293
Rest of UP	33.1	49	15.1	1.7	1.3	239
Northern LP	30.3	50	14.9	3.8	1	208
Southern LP	32.8	48.6	13.1	4.4	1.1	183

Survey Statement *(Question number)*	Percent Response Within Region					N
Meet the needs of future generations. *(2e)*						915
Study Forest	40.3	47.1	9.2	2.7	0.7	293
Rest of UP	41.3	48.3	6.3	3.3	0.8	240
Northern LP	38.6	47.5	11.9	1.5	0.5	202
Southern LP	41.7	43.3	12.8	2.2	0	180
Maintain forest industry jobs. *(3a)***						877
Study Forest	21.3	51.8	18.8	7.4	0.7	282
Rest of UP	21.5	52.8	16.7	6.9	2.1	233
Northern LP	17.6	48.2	23.3	7.8	3.1	193
Southern LP	8.9	54.4	27.8	5.9	3	169
Maintain forest-based recreation jobs. *(3b)*						880
Study Forest	12.7	56.2	24.4	5.7	1.1	283
Rest of UP	12.9	61.6	16.4	7.3	1.7	232
Northern LP	18.5	50.8	23.6	6.2	1	195
Southern LP	8.8	65.9	20	4.1	1.2	170
Protect forest and wildlife resources. *(3c)*						884
Study Forest	36.6	53.9	6	2.5	1.1	284
Rest of UP	39.5	51.1	7.7	0.9	0.9	233
Northern LP	45.9	45.4	7.1	1	0.5	196
Southern LP	39.2	52	7.6	0.6	0.6	171
Achieve a balance between maintaining forest-related jobs *and* protecting forest and wildlife resources. *(3d)*						899
Study Forest	44.3	46.7	8	0.7	0.3	287
Rest of UP	45	45	8.8	0.8	0.4	238
Northern LP	47.5	41.4	8.6	2.5	0	198
Southern LP	46.3	43.6	8.5	1.1	1.7	176

Survey Statement *(Question number)*	Percent Response Within Region					N
Increase migratory forest songbird diversity *even if* there are economic losses to forest-based industries. *(7a)***						874
Study Forest	6.7	10.6	24	42.8	15.9	283
Rest of UP	7	17.2	30	32.6	13.2	227
Northern LP	7.7	16	35.1	34.5	6.7	194
Southern LP	5.3	20	36.5	28.2	10	170
Achieve a balance between sustaining forest-based industries *and* migratory forest songbird diversity. *(7b)*						898
Study Forest	26.3	47.4	16.6	6.9	2.8	289
Rest of UP	24.9	50.6	16.9	5.5	2.1	237
Northern LP	26.9	49.2	14.7	6.1	3	197
Southern LP	29.1	47.4	13.7	6.9	2.9	175
Protect habitat for migratory forest songbird species of conservation concern, *even if* it results in economic losses to forest-based industries. *(10a)***						888
Study Forest	6.7	14.4	22.1	40	16.8	285
Rest of UP	7.5	21.2	27	30.5	13.7	226
Northern LP	8.1	22.8	28.4	33	7.6	197
Southern LP	8.9	24.4	26.1	33.3	7.2	180
Achieve a balance between sustaining forest-based industries *and* protecting habitat for migratory forest songbird species of conservation concern. *(10b)*						900
Study Forest	26	50.3	14.2	6.9	2.4	288
Rest of UP	27.8	48.7	15	6	2.6	234
Northern LP	31.7	47.7	11.1	8	1.5	199
Southern LP	28.5	49.7	14.5	6.1	1.1	179

Survey Statement *(Question number)*	Percent Response Within Region					N
I was aware of deer browse before reading this. *(11a)***						893
Study Forest	31.6	54.4	5.6	7	1.4	285
Rest of UP	25.8	49.8	9	12.9	2.6	233
Northern LP	17.2	50	12.6	13.1	7.1	198
Southern LP	9	36.7	14.7	24.9	14.7	177
I have seen the effects of high deer browse on forests. *(11b)****						894
Study Forest	22.8	51.6	13	10.5	2.1	285
Rest of UP	19.7	42.5	18	16.7	3	233
Northern LP	16.7	40.4	19.2	19.2	4.5	198
Southern LP	4.5	27.5	28.1	25.3	14.6	178
I am concerned about the effects of deer browse on the appearance of the Western U.P. Study Forest. *(11c)***						891
Study Forest	15.1	38	28.9	14.1	3.9	284
Rest of UP	12.6	40.9	27.4	16.5	2.6	230
Northern LP	7.1	44.4	33.8	12.1	2.5	198
Southern LP	9.5	48.6	32.4	7.3	2.2	179
Forest management should reduce deer browse *even if* it means *fewer deer* in the area. *(11d)**						899
Study Forest	10.5	23	16.4	36.6	13.6	287
Rest of UP	13.3	21	17.6	34.3	13.7	233
Northern LP	5.1	25.8	25.8	30.8	12.6	198
Southern LP	8.3	27.6	21	32.6	10.5	181

Survey Statement *(Question number)*	Percent Response Within Region					N
Forest management should move deer around the landscape to reduce deer browse and *keep the same number* of deer in the area. *(11e)***						902
Study Forest	19.7	40.5	21.5	12.8	5.5	289
Rest of UP	18	45.9	16.3	14.2	5.6	233
Northern LP	17.1	39.2	26.6	13.6	3.5	199
Southern LP	27.1	40.3	24.9	6.1	1.7	181
I was already familiar with voluntary forest easements. *(12a)****						878
Study Forest	3.9	21.1	33	35.1	6.8	279
Rest of UP	5.3	25	29.8	31.6	8.3	228
Northern LP	4.1	20.9	30.6	36.7	7.7	196
Southern LP	1.7	12	30.9	39.4	16	175
I am familiar with laws or regulations for private forest landowners. *(12b)****						877
Study Forest	2.9	19.7	31.5	37.3	8.6	279
Rest of UP	3.9	23.6	34.5	30.1	7.9	229
Northern LP	3.6	19	32.3	35.4	9.7	195
Southern LP	1.7	9.8	31	40.8	16.7	174
I am familiar with other voluntary forest management programs for private forest landowners. *(12c)***						875
Study Forest	3.2	23.5	27.4	37.5	8.3	277
Rest of UP	2.6	22.3	34.9	32.8	7.4	229
Northern LP	4.1	24.6	31.3	32.3	7.7	195
Southern LP	1.1	13.8	29.3	39.7	16.1	174

Survey Statement *(Question number)*	Percent Response Within Region					N
Some forest management decisions made by private forest landowners should be regulated by laws. *(12d)***						881
Study Forest	5.7	28.7	18.3	26.9	20.4	279
Rest of UP	8.7	29.9	21.2	29.9	10.4	231
Northern LP	8.7	32.8	26.7	22.1	9.7	195
Southern LP	9.1	52.3	19.9	14.2	4.5	176
All private forest landowners should make their own management decisions without government programs. *(12e)****						885
Study Forest	19.6	29.2	19.2	26.7	5.3	281
Rest of UP	13.9	26	24.2	30.7	5.2	231
Northern LP	11.2	23.9	25.4	35	4.6	197
Southern LP	8	15.3	23.9	43.2	9.7	176
All private forest landowners should be able to enroll in voluntary forest management assistance programs. *(12f)*						888
Study Forest	24.5	57.4	13.1	3.9	1.1	282
Rest of UP	27.7	60.2	10.4	1.7	0	231
Northern LP	31.6	54.6	10.2	3.1	0.5	196
Southern LP	25.7	55.9	14.5	3.4	0.6	179
Whether or not I visit the Western U.P. Study Forest, just knowing that the forest is there is important to me. *(21a)*						887
Study Forest	38.9	40	12.5	6.8	1.8	280
Rest of UP	36.5	41	13.1	6.8	2.7	222
Northern LP	39.7	37.7	14.7	4.4	3.4	204
Southern LP	37.6	38.7	14.4	6.1	3.3	181

Survey Statement *(Question number)*	Percent Response Within Region					N
I have participated in community forest management. *(21b)***						868
Study Forest	5	13.3	42.4	28.4	10.8	278
Rest of UP	4.6	15.1	44.3	25.6	10.5	219
Northern LP	8	16.1	40.7	21.1	14.1	199
Southern LP	4.1	10.5	28.5	32	25	172
I would like to participate in community forest management. *(21c)*						865
Study Forest	5.8	20.3	48.6	19.2	6.2	276
Rest of UP	6.4	15.1	51.1	21	6.4	219
Northern LP	8.7	15.3	54.6	13.8	7.7	196
Southern LP	5.7	14.9	44.8	22.4	12.1	174
I think the state communicates its forest management goals clearly to local communities. *(21d)****						886
Study Forest	1.8	14.2	36.3	34.5	13.2	281
Rest of UP	3.6	19.6	43.3	24.6	8.9	224
Northern LP	4.9	16.7	46.8	24.6	6.9	203
Southern LP	1.7	21.3	45.5	23	8.4	178
I think my input matters to the decisions of state forest managers. *(21e)* ***						888
Study Forest	4.3	26.3	32.7	25.6	11	281
Rest of UP	4	37.5	37.9	13.8	6.7	224
Northern LP	8.8	28.9	40.7	14.2	7.4	204
Southern LP	8.4	32.4	43	12.8	3.4	179

Survey Statement *(Question number)*	Percent Response Within Region					N
I think that state forest land is well managed. *(21f)****						891
Study Forest	0.7	19.8	52.3	19.8	7.4	283
Rest of UP	2.2	27.8	51.1	16.3	2.6	227
Northern LP	2.5	33.5	48.3	9.9	5.9	203
Southern LP	1.7	28.7	55.6	11.8	2.2	178
I think industrial private forest land is well managed. *(21g)*						882
Study Forest	2.8	23.8	49.5	18.9	5	281
Rest of UP	2.2	24.2	55.2	14.8	3.6	223
Northern LP	1	21.6	57.3	15.1	5	199
Southern LP	0.6	14	59.8	20.7	5	179
I think non-industrial private forest land is well managed. *(21h)*						881
Study Forest	1.4	19.2	54.4	19.6	5.3	281
Rest of UP	1.8	22.3	56.8	15.5	3.6	220
Northern LP	2	20.2	60.1	13.8	3.9	203
Southern LP	2.3	18.1	57.1	19.2	3.4	177
I have purchased environmentally certified wood products. *(21i)*						854
Study Forest	2.9	21.1	48	17.8	10.2	275
Rest of UP	4.7	24.5	40.6	22.2	8	212
Northern LP	4.1	21.6	45.9	17	11.3	194
Southern LP	5.2	20.8	47.4	17.3	9.2	173

Survey Statement *(Question number)*	Percent Response Within Region					N
I would like to be able to purchase environmentally certified wood products. *(21j)*						865
Study Forest	8.3	31.8	43.7	9.4	6.9	277
Rest of UP	9.6	37.9	39.7	9.1	3.7	219
Northern LP	11.8	29.2	45.6	8.2	5.1	195
Southern LP	8	42.5	37.9	8	3.4	174
Human skill and resources will ensure that we do not make the earth unlivable. *(21k)*						882
Study Forest	19.6	42.5	21.8	11.1	5	280
Rest of UP	18.8	50.4	15.2	12.1	3.6	224
Northern LP	21.5	47	18	9.5	4	200
Southern LP	24.7	46.1	12.4	12.4	4.5	178
Humans are severely abusing the environment. *(21l)****						886
Study Forest	17.9	34.3	19.6	19.6	8.6	280
Rest of UP	17.9	29	26.8	22.3	4	224
Northern LP	20.7	37.4	19.2	13.3	9.4	203
Southern LP	20.7	41.9	21.2	11.2	5	179
Humans have the right to modify the natural environment to suit their needs. *(21m)***						887
Study Forest	2.8	20.2	23.8	31.6	21.6	282
Rest of UP	4.9	14.3	26.9	41.7	12.1	223
Northern LP	1.5	15.8	25.2	34.2	23.3	202
Southern LP	3.3	12.2	26.1	40.6	17.8	180

Survey Statement *(Question number)*	Percent Response Within Region					N
Humans were meant to rule over nature. *(21n)*						887
Study Forest	3.9	16	20.9	33	26.2	282
Rest of UP	4.9	14.8	21.5	39.5	19.3	223
Northern LP	4	16.8	22.8	33.2	23.3	202
Southern LP	4.4	13.3	21.7	36.7	23.9	180
Humans will eventually learn enough about how nature works to be able to control it. *(21o)*						881
Study Forest	8.2	22.8	26.7	28.8	13.5	281
Rest of UP	6.8	32	26.1	25.2	9.9	222
Northern LP	9.5	26.9	23.9	28.4	11.4	201
Southern LP	6.2	26.6	28.2	26	13	177
The balance of nature is delicate and easily upset. *(21p)*						886
Study Forest	26.9	43.1	11.7	12	6.4	283
Rest of UP	26	39.9	20.2	10.8	3.1	223
Northern LP	28.4	42.3	13.4	12.4	3.5	201
Southern LP	26.3	42.5	20.7	7.3	3.4	179
The so-called "environmental crisis" has been greatly exaggerated. *(21q)*						879
Study Forest	8.7	23.1	31	23.8	13.4	277
Rest of UP	6.3	20.8	29	28.1	15.8	221
Northern LP	9.9	18.3	32.7	27.7	11.4	202
Southern LP	4.5	15.6	33.5	30.7	15.6	179

Survey Statement *(Question number)*	Percent Response Within Region					N
We are approaching the limit to the number of people this earth can support. *(21r)*						881
Study Forest	15.4	30.1	31.9	17.2	5.4	279
Rest of UP	12.9	29	29.9	25	3.1	224
Northern LP	13.5	27.5	29	26	4	200
Southern LP	11.2	31.5	34.3	17.4	5.6	178
When humans interfere with nature, it often produces disastrous consequences. *(21s)***						728
Study Forest	21.1	43.1	16.8	15.5	3.4	232
Rest of UP	19.8	44.8	25	9.9	0.6	172
Northern LP	26.2	45.9	18.6	7.6	1.7	172
Southern LP	28.3	42.8	20.4	7.2	1.3	152

Individuals from all regions tended to agree with statements about forest management to protect wildlife. The statements for which UP respondents tend to differ from LP respondents involve trade-offs between economic and ecological goals of forest management. UP respondents tend to disagree with statements that support forest management for ecological benefits that may come at a cost to forest based industries. This result is sensible because the residents of the study forest and other areas of the UP bear the costs of changes in jobs in the forest-based industries in the UP, whereas people from the LP may not feel that they bear these costs and therefore express attitudes in favor of forest management that protects forest ecosystem services even in the face of economic losses to the region. Respondents from all regions, however, tended to agree that forest management should attempt to achieve balance between economic and ecological goals.

Table A7.2. Socioeconomic Characteristics of Survey Respondents by Region

Characteristic	Region							
	SA		RUP		NLP		SLP	
		N		N		N		
% that own property in study area[1]* **	**51%**	**142**	**9%**	**22**	**2%**	**3**	**1%**	**2**
Average # of acres owned[2]	40	132	40	17	32	3	65	1
% member of forestry organization[1]	4%	12	4%	9	4%	8	2%	3
% member of hunting club[1]* **	**29%**	**85**	**16%**	**38**	**21%**	**43**	**12%**	**23**
% member of environmental organization[1]	6%	17	5%	13	10%	20	9%	16
Education[1] **								
% some high school	5%	15	4%	10	5%	11	5%	10
% high school or equiv	28%	81	28%	69	25%	50	20%	37
% trade or vocation school	12%	35	6%	15	8%	16	7%	13
% some college	21%	60	21%	51	20%	40	25%	46
% associate's degree	9%	25	10%	24	10%	20	14%	25
% college graduate	18%	53	18%	43	22%	44	11%	21
% graduate or professional degree	8%	23	12%	30	11%	23	18%	33
Average age[2]	55	292	56	241	55	205	55	185
Gender[1]								
% male	82%	239	75%	182	77%	157	74%	138
% female	18%	53	25%	61	23%	48	26%	48
Mean household income[2]	$60K	204	$56K	168	$60K	140	$67K	147

[1]Pearson chi square test of independence; * = $p < 0.10$, ** = $p < 0.05$, *** = $p < 0.001$

[2]ANOVA test used to compare means

Characteristic	Region							
	SA		RUP		NLP		SLP	
% employed in resource dependent industry[3]* **	**19%**	**48**	**16%**	**33**	**7%**	**12**	**7%**	**11**
Average # of years lived in Michigan[4]	45	292	47	240	50	204	48	185
Urban/Rural/Suburb.[3]* **								
% living in urban area	2%	5	16%	38	8%	17	14%	25
% living in suburban area	7%	19	15%	35	18%	36	50%	87
% living in rural area	91%	261	69%	164	74%	148	36%	63
Ethnic background[3]* **								
% Hispanic, Latino or Spanish origin	0%	0	<1%	1	<1%	1	2%	3
% White	96%	273	94%	221	98%	195	90%	162
% African American or Black	0%	0	0%	0	0%	0	5%	9
% Native American or Alaska native	<1%	2	5%	11	1%	2	1%	2
% Hawaiian or Pacific Islander	<1%	1	0%	0	<1%	1	0%	0
% Asian	<1%	1	<1%	2	0%	0	<1%	1
% Other ethnicity	2.5%	7	<1%	1	<1%	1	2%	3
Religious Preference[3]*								
% Protestant	36%	102	38%	86	39%	76	46%	83
% Catholic	39%	109	42%	96	32%	63	29%	52
% Jewish	<1%	2	0%	0	1%	2	1%	2
% Muslim	0%	0	0%	0	0%	0	1%	2
% None	12%	33	10%	23	12%	23	12%	22
% Other religion	12%	37	10%	24	17%	33	11%	19

[3]Pearson chi square test of independence; * = $p < 0.10$, ** = $p < 0.05$, *** = $p < 0.001$

[4]ANOVA test used to compare means

Characteristic	Region							
	SA		RUP		NLP		SLP	
Political Views[5]								
% Extremely liberal	1%	3	2%	5	2	4	4%	7
% Somewhat liberal	10%	29	16%	37	16	30	19%	35
% Moderate	47%	131	48%	109	42	79	42%	76
% Somewhat conservative	33%	92	29%	67	34	64	29%	53
% Extremely conservative	8%	23	4%	10	7	13	5%	9

[5]Pearson chi square test of independence; * = $p < 0.10$, ** = $p < 0.05$, *** = $p < 0.001$