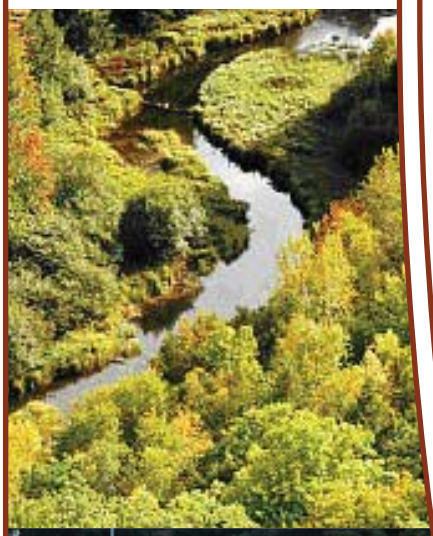

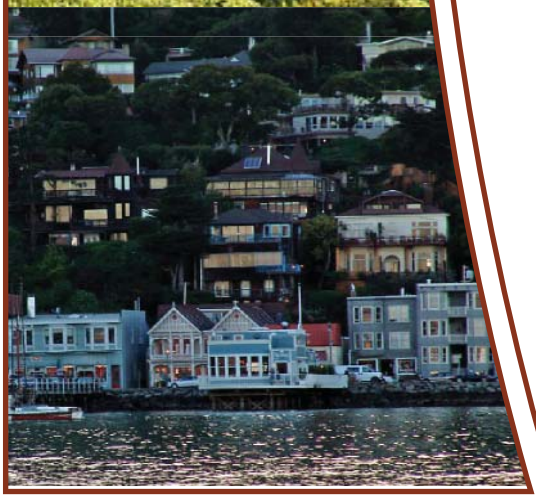

Comprehensive Study on Economic Valuation, Economic Impact Assessment, and State Conservation Funding of Green Infrastructure Assets in Michigan

Report # CS-2008-01

LAND POLICY
INSTITUTE

Shaping the Future from the Ground Up

COMPREHENSIVE STUDY ON ECONOMIC VALUATION, ECONOMIC IMPACT ASSESSMENT AND STATE CONSERVATION FUNDING OF GREEN INFRASTRUCTURE ASSETS IN MICHIGAN

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In partnership with:
Heart of the Lakes Center for Land Conservation Policy

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Executive Summary

This report consists of three studies related to natural resource valuation, natural resource impact analysis and natural resource conservation funding. Though undertaken as separate studies, the three studies are part and parcel of a broader framework that is aimed at understanding the relationship between green infrastructure assets and economic impacts. These studies aim at addressing several key issues: the economic impact of natural resources; valuation of green infrastructure; identifying natural resource conservation funding benchmarks; and relevant policy discussions. This comprehensive report is aimed at closing the existing gap in the understanding of the above issues in Michigan.

Impact of Green Infrastructure on Property Values

The first study focused on valuation of *green infrastructure* in Michigan. Green infrastructure provides numerous services to the public, including quality of life benefits, increasing the attractiveness of locations for growth, and influencing the value of properties and hence local tax collections. To understand the value of green infrastructure in Michigan, two case study counties were selected—Hillsdale and Oakland Counties. In Hillsdale County, the value of water amenities was considered; and in Oakland County, the amenity values of waterways, water-body, recreational lands and walkability and bikeability—including green infrastructure such as trails, sidewalks, bike lanes, and park paths–were considered.

The objective of this study was to estimate a part of the value of the green infrastructure in Hillsdale and Oakland counties, namely the value to surrounding landowners. To this end, property sales transactions data from both counties were collected. Additional spatial data on the location of green infrastructure were also collected and analyzed. By developing a hedonic pricing model, which measures the contributions of property characteristics on property values, the influence of each green infrastructure characteristic on property values was isolated and estimated.

Results indicate that, consistently, across the two counties and across green infrastructure, these assets are found to contribute positively and significantly to property values. In the case of water amenities in Hillsdale County, results indicate that, on average, properties located within 15 meters, 15 to 75 meters and 75 to 150 meters from identified water amenities have 81.8 percent, 38.5 percent and 22.9 percent more value, respectively, compared to similar properties located at distances more than 150 meters from water amenities.

In the case of water amenities in Oakland County, the results suggest that properties within 15 meters of waterbodies have a substantial capitalization, or positive impact, of these amenities to property values, compared to properties located at more than 150 meters. The average “green-capitalization” attributable to waterbodies within 15 meters is $55,082. In the case of recreational lands in Oakland County, results suggest that they

have significant impact on property values, ranging in impact from 3.1 percent capitalization for properties within 15 meters, 3.2 percent gain for properties within 15 to 75 meters, 2.2 percent gain for properties within 75 to 150 meters and a 2.6 percent capitalization for properties within 150 to 300 meters, compared to properties located at more than 450 meters. In the case of walkable and bikeable green infrastructure in Oakland County, results indicate that the effects of these amenities on property values were significant. Existence of these composite green assets within 100 to 500 meters appreciates property values by 4.6 percent or $11,785, within 500 to 1,000 meters results in "green-capitalization" of 2.3 percent, and within 1,000 to 1,500 meters results in a gain of 6.3 percent or $16,140, compared to properties located at more than 1,500 meters away from these outdoor opportunities.

Obviously, based on the analysis of green infrastructure valuation in Hillsdale and Oakland counties, people are "voting with their feet" and "voting with their wallet," meaning that people are willing to pay a higher premium for locations with high quality green infrastructure. This is vital information for local officials, as they pursue green infrastructure strategies that are sustainable and add to the bottom-line. Local officials are somewhat supportive of green assets, but this study suggests that they should be more supportive for an economic reason, as it enhances taxable property values.

Impact of Green Infrastructure on Local and Regional Economies

The second study examined the impact of parks on the local economy in Michigan. This particular study focused on the economic impact of the Rifle River Recreational Area (RRRA) in Ogemaw County, Michigan, as additional evidence of the economic importance of green assets. RRRA is a wilderness area located in the AuSable State Forest, which provides recreational opportunities to an average of 38,900 day-time users and generates 15,273 "camper group nights" per year. The camp is operated with an annual payroll of $263,243 and maintenance expenses of $71,591.

Economic impact can be defined as the total income, jobs, tax and value-added[1] impacts to local and regional economies as a result of changes in investment or spending patterns in the local, regional or economic area. Economic impact studies can provide relevant information of interest to local communities, regional institutions, and development planners. The total annual economic impact of RRRA is estimated at $1,788,095. Moreover, we estimate that RRRA creates 37 jobs and an additional $933,003 in total value-added impacts per year. Considering the fact that the park is only 4,450 acres in size, the estimated annual economic impacts are quite significant. This result provides additional evidence that local green assets could be sources of significant local comparative advantage, and if properly leveraged, could potentially stimulate local economic growth.

[1] Value-added can be literally defined as "the difference between the overall cost of a manufacturing or marketing process and the final value of the goods." Source: http://www.allwords.com/word-added%20value.html. Value-added in general can mean the additional economic value (in terms of additional after cost value) created as a result of a given economic activity.

As Michigan and many regional organizations and local governments strive to restructure the economy and facilitate prosperity, the role of green assets and other local assets will be significant. As much as keeping the balance between green infrastructure utilization and conservation is important, so is the ability to sustainably generate economic value from local green assets. This report aims to bridge the information gap on the green infrastructure and economic impact linkages and encourages broader discussion on identifying key local resources to help Michigan grow in a sustainable and smart way.

Conservation Spending Across the United States

The third study focused on conservation spending patterns across the U.S. and compared them with Michigan. Natural and environmental resources provide a wide array of market and non-market benefits to society, ranging from recreational and scenic qualities, to extractive uses. Natural resources are "green assets" that can attract knowledge based workers who can further employment and income opportunities. However, the interactions between natural resources and the economy have not always been well understood by the public and policy decision makers. Resource degradation and development of sensitive lands for alternative uses are signs of the consequences of this information and knowledge gap. Residents in many states are increasingly concerned about this issue and have voiced their opinions through state, county and municipal conservation ballot initiatives. A number of states have also responded to the call by expanding their conservation policies and by committing additional resources to conservation funding.

This study focuses on understanding the determinants of conservation spending in the U.S. Significant differences in per capita conservation spending across the U.S. call for a methodical understanding of the drivers of, or influences on, conservation policy. Conservation spending is defined to include all state budget items related to natural resource conservation and environmental protection, excluding agricultural land protection and conservation. This report develops an econometric model and applies it to data from 48 contiguous states in estimating the conservation funding gaps for each state. Each state's socioeconomic characteristics, demographic characteristics, natural resources and political structure were identified as the key drivers of conservation spending across states. Data were collected from each state's budget office.

Results from the analysis indicate: (1) Conservation spending in the U.S. is not driven by natural resource endowment (or base); (2) Economic conditions of states do matter (i.e., while a growing state gross domestic product (GDP) and ability to tax increase conservation spending, higher level of poverty and public debt put a downward pressure on state conservation spending); and (3) Political environment is important (i.e., states with a competitive state senate (balanced legislative power) tend to have more conservation spending per capita than states with a one party dominated legislature). These results collectively underscore the point that even though one expects conservation spending to be driven by the amount of resources to protect, in the U.S. it is primarily driven by socioeconomic and political structures of states.

These findings raise critical questions and policy implications: (1) What are the long-term implications of pegging conservation funding to parameters that are not related to the resource base? (2) What is the long-term impact of not considering the quality or quantity of natural resources in determining conservation spending levels? (3) If conservation spending is influenced by other social programs and priorities, what will the gap between actual and expected conservation spending be, and how will this be resolved as we try to balance growth and conservation? (4) Can one design a conservation policy framework that is in tune with resource base and quality while capturing socioeconomic parameter changes? All of these are interesting conservation policy questions.

Wyoming tops the nation in per capita state spending on conservation and exhibits the largest positive funding gap (i.e., spends on conservation more than what is expected given its natural resource, socioeconomic and political characteristics), followed by Nevada, Idaho, Arizona and West Virginia. Surprisingly, the Great Lakes States are at the bottom of the list in per capita conservation spending and top the under-funding list, with the exception of Illinois and Wisconsin, which are in the positive funding gap category. Michigan stands out nationally. On one hand, it is at the top of the list in terms of the size of its resource base. On the other hand, it ranks 47th in per capita conservation spending and dead last in the conservation funding gap. The fact that the Great Lakes States, with high resource endowment, are not adequately funding conservation is cause for concern.

As states like Michigan strive to restructure their economies and bring about prosperity, the place for conservation investment in such initiatives becomes critical. Environmental programs are often the ones that face budgetary cuts in times of economic slowdown. A mechanism within a budgetary process that will keep balance between growth priorities and ability to sustain such growth in the future through effective resource protection is probably desirable, but it has numerous challenges. This report aims to bridge the information gap and encourages broader debate for a comprehensive conservation agenda in the U.S.

Green infrastructure investment also has broader implications. In the *New Economy*, talent and innovation are sources of new local and regional economic growth. Talent tends to migrate to places with significant green infrastructure. Jobs tend to follow people, who tend to follow green infrastructure quality. If this is true, then the findings of this study suggest that green assets enhancement meets sustainability goals and enhances the economy simultaneously.

The second study focused on the impact of parks on the local economy in Michigan. Despite strong evidence of links between green infrastructure and quality of life, the connection to economic activity and prosperity is not often well understood. Many questions still arise with regard to the value and role of green assets and the ability of local communities to leverage their green infrastructure for economic prosperity. Understanding the link between green assets and economic activity will be crucial to local communities and regional organizations in defining sustainable future sources of economic growth and prosperity.

In increasingly competitive global, regional and local economies, stiff economic competition has encouraged many to pursue new economic strategies for local comparative advantage. Green infrastructure development and the attraction of knowledge-based workers are among the emerging sources of new comparative advantage and competitiveness in the New Economy. Understanding the crucial links between green infrastructure and its contribution to the local economy is a first step in understanding the value of local green assets and in leveraging them to bring economic growth.

Comprehensively, the three studies inform citizens and decision makers on the critical linkages between green infrastructure and economic activity and value. The fact that green assets add substantial value to properties and stimulate the local economy means that in the New Economy, they constitute part of a strategic resource that can be leveraged sustainably to induce new growth and prosperity.

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General Introduction

The State of Michigan is endowed with a wide variety of natural resources, some of which are among the best in the United States. Michigan has the largest water boundary responsibility in the nation, some of the best wetlands, inland waters and attractive eco-tourism sites. With the transition of the U.S. economy from that of extractive resources to service-based industry, and the recent shift toward green infrastructure-based growth, natural resources play a critical role in fostering an alternative source of economic growth in the "New Economy." This requires a better understanding of the intricate relationships between growth and natural resources base.

Understanding the role and impact of natural resources in Michigan's economy and the quality of life of its citizens is an important first step in designing and implementing policies that facilitate the transition to the New Economy. This study is focused on addressing specific themes within this general framework. To address the specific themes, a partnership has formed between Michigan State University's Land Policy Institute and the Heart of the Lakes Center for Land Conservation Policy. The major goals of this partnership are to:

(1) Conduct extensive review of Michigan natural resource valuation studies;
(2) Analyze the effects of natural resources on property values;
(3) Conduct an economic impact analysis of natural resources;
(4) Analyze natural resource protection funding nationwide and its comparison with Michigan; and
(5) Identify future conservation research strategies.

This report provides results from three separate studies that are focused on addressing the above stated objectives. The first study focused on the impact of natural resources on property values. This section provides an understanding of the linkages between natural resource and environmental services and local property values that enables effective measurement of the value of natural amenities to residents. For this analysis, Hillsdale County and Oakland County were selected as case studies to provide wider evidence of the role of green infrastructure on local economies and quality of life.

The second study focused on the economic impact of parks as a first step in understanding the economic value of natural and environmental services to local and regional economies. This report provides an economic impact analysis of parks in terms of employment, income and tax impacts. Economic impact assessment provides a framework to understand the extent of the relationship between green infrastructure assets and local and regional economic vitality. This linkage is a precursor in designing economic development policies and programs that are tied to green asset bases.

The third study focused on conservation spending in Michigan vis-à-vis the national trend. This study aimed at understanding whether natural resources conservation funding is in synch with the inherent spending expectations of Michigan given its natural resources endowment, socioeconomic characteristics and political structure. This study

provides a natural resource conservation investment gap analysis for the nation and compares results with Michigan.

This comprehensive study addresses different aspects of the green infrastructure, economic impact and conservation funding policy. The main motivation in these studies is to provide empirical evidence on the importance of the linkage between green assets and economic prosperity. As such, it focused on assessing the share of economic activity in Michigan attributable to green infrastructure assets. This study will serve as a base for evaluating the contribution of green infrastructure assets to new economic growth opportunities and policy. Subsequent studies from the Land Policy Institute will target the specific policy question of relevance in the context of today's economic reality in Michigan.

1.0 Economic Valuation of Natural Resource Amenities:
A Hedonic Analysis of Hillsdale and Oakland Counties

1.1 Introduction

"Green infrastructure"[2] is increasingly becoming an important location attribute, providing numerous quality of life and economic benefits to society. Green infrastructure services from public lands, water bodies, forested lands, wetlands, and other forms of open space were important drivers of recent trends in population density and wealth creation across regions of the U.S. (Mieszowski and Mills, 1993; Burchell and Shad, 1998; Heimlich and Anderson, 2001). Increasingly, the location preference of new businesses and residents has partly been tied to location amenity endowments and natural and environmental services. The economic effects of high quality natural and environmental amenities (green infrastructure services) have encouraged many to suggest intensified green infrastructure as a potent economic growth strategy.

High quality natural and environmental amenities have also attracted increased housing density change and commercial development, which have resulted in the conversion of natural amenities and land resources to development uses (Klein and Reganold, 1997; Daniels, 1991). As a result, a number of states have initiated some form of natural resource and land conservation initiatives to manage the increasing pressure on natural and environmental resources (Nickerson and Hellerstein, 2003). These initiatives illustrate the importance of utilizing natural and environmental services and proper conservation and protection policies.

Michigan is endowed with a multitude of natural resources, some of which are among the most distinct and abundant in the nation. These resources add to the quality of life and economic vitality of many of the counties in the state. Michigan has 3,288 miles of Great Lakes shoreline, 38,000 square miles of Great Lakes water, 11,000 inland lakes, 36,000 miles of rivers and streams, 75,000 acres of sand dunes, and 5.5 million acres of wetlands (Nelson and Stynes, 2003). Michigan also has a total of 19.3 million acres in forested lands of which 38 percent are publicly owned (Hansen and Brand 2006). These resources are significant sources of amenities benefits and economic impacts. However, there is limited information about the economic value of these resources in general and their impact on local economies through such channels as property values and appreciation.[3]

The economic valuation of green infrastructure services from public lands, wetlands, forested lands, agricultural lands, and other forms of open space can provide the information upon which timely natural resource utilization, management and

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[2] Green infrastructure is defined as "the physical environment within and between cities, towns and villages. It is a network of multi-functional open spaces, including parks, gardens, woodlands, green corridors, waterways, street trees and open countryside." (http://www.greeninfrastructure.eu/?section=006.002&page=39).

[3] To the extent to which high quality natural areas, such as water fronts and trails, increase property values, they also increase property tax revenues, which affect local public services.

conservation can be adapted. To bridge the information gap on the economic value of natural resource amenities in Michigan, the Hannah Professor Research Program of the Land Policy Institute undertook this study. This report focuses on measuring the value of natural resource amenities in Hillsdale and Oakland counties as case studies, to inform citizens and decision makers on the value of green infrastructure in Michigan.

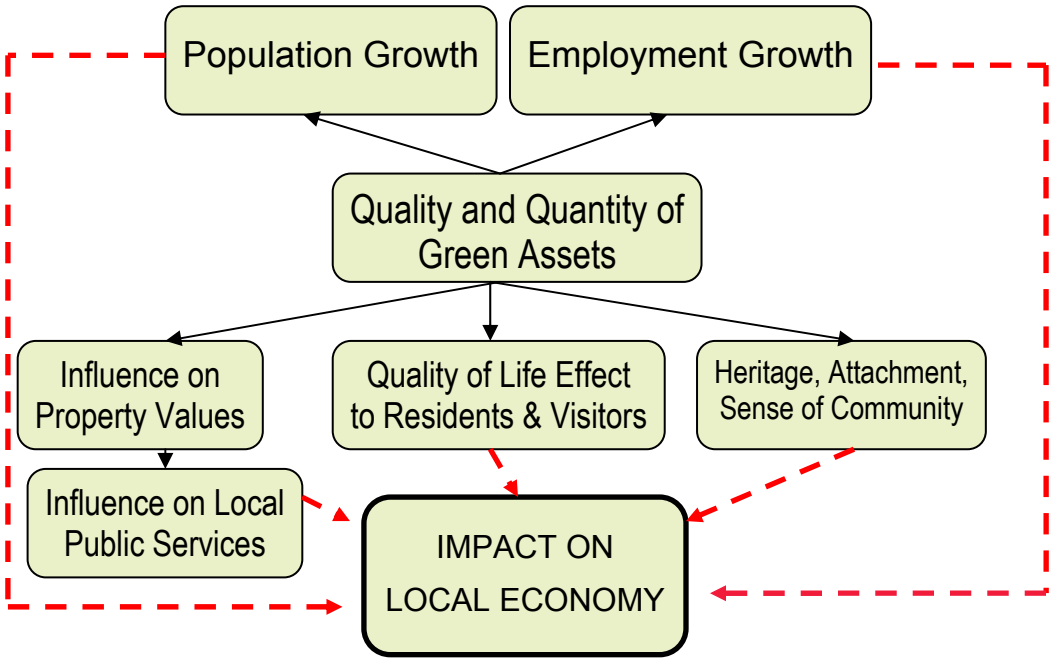
This study aims to provide:

(1) Estimation of the value of selected natural resource amenities;
(2) Analysis of the links between these natural resource services and such variables as property values and local economic performance;
(3) Analysis of the benefits that households receive from being located near different natural resources through direct amenity benefits and indirect benefits–through property value appreciation; and
(4) Policy discussion on the relevance of understanding the value of natural resource services.

1.2 Framework for Valuation of Natural Resource Amenities

Understanding the economic value of local green infrastructure has a multitude of benefits, including information support for: (1) local development planning based on local resources; (2) local Smart Growth based land use planning; (3) the value of resources to prioritize for conservation; and (4) property value, and hence, property tax impacts of local green infrastructure and its connection to local economic vitality. In general, green infrastructure has broader impacts on local economies. High quality locations attract population and employment growth as these locations become desirable. High amenity areas also support the quality of life of local residents and foster community attachment and heritage. Studies show that high quality areas have substantial impacts on local property values that determine ability to finance local public services. All these aspects of green infrastructure services impact the vitality of local economies. Figure 1.1 summarizes these interconnections between green assets and the local economy.

Figure 1.1 The Links between Green Infrastructure and Local Economic Vitality



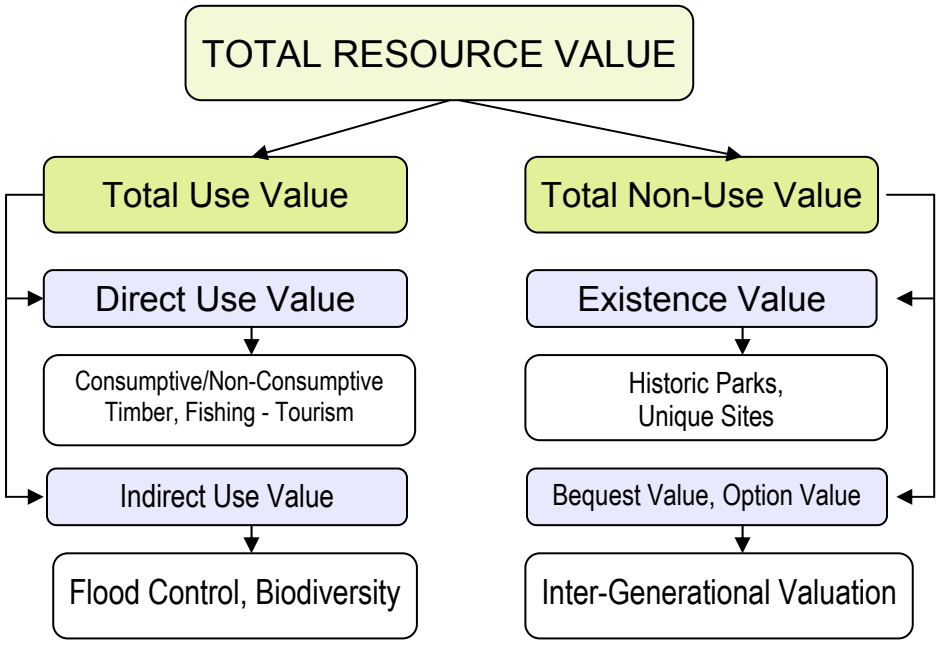
Communities are increasingly aware of the links between local green infrastructure and economic performance. However, the value of natural resources has not been widely estimated and properly understood for local decision making purposes. Valuation of green infrastructure requires, first, clear understanding of what one means by *value*. For instance, Figure 1.2 demonstrates different types of natural resource amenities, ranging from waterfront properties to farmlands. Each area depicted in these images provides

amenity benefits, but each resource has different uses. Therefore, when one *values* these resources, what particular aspect of the resource measured is important to consider? Farmland has productive use in agriculture, but is also a source of open space amenities; forested land provides forest products, but also provides recreational opportunities, such as hiking. Therefore, the elements of the resource characteristics being measured are an important consideration in the valuation process.

Figure 1.2 Different Natural Resource Amenities

In general, there are different components of green infrastructure (natural resource) values. Natural resources have *use value*, that is economic value related to direct extraction or use: farming, logging, fishing, etc. In this case, the use value is *direct* in that the resource has direct extractive or productive use values. The value of natural resources can also be *indirect,* as they are useful in supporting the consumption of secondary benefits, such as the flood control benefit of forest resources. Natural resources can also have *non-use value,* in the sense that they can be valuable even if one may not be able to directly utilize their services. This includes *existence value*, resources commanding value for the reason that they exist (such as historic parks and other unique sites) and *bequest value,* resources valued because they also have relevance for the next generation. Figure 1.3 summarizes the different aspects of green infrastructure values.

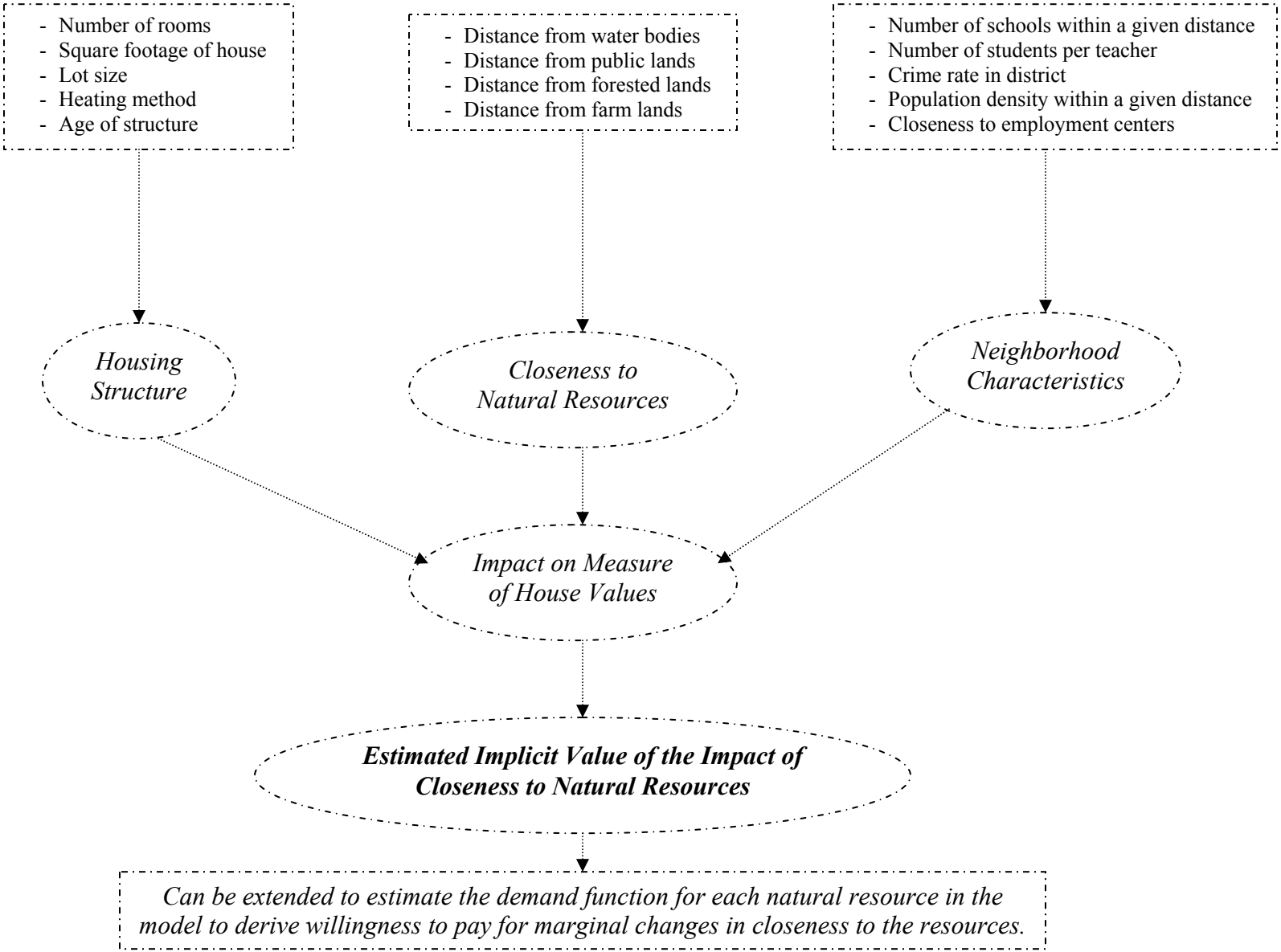
Figure 1.3 Sources of Natural Resource Values



This study aims to estimate the value of selected green infrastructure in Hillsdale and Oakland counties. The value estimation is focused on the *use value* of natural amenities, and will not include value estimation for potential *non-use values*. Estimation of *non-use values* often involves extensive survey on the value people attach to non-use characteristics of natural resources. *Use values* can be readily estimated from already existing secondary data, even though the data requirement is often large. Since most resource values are tied to *use values*, focus on this aspect of total value will provide reliable measurements of natural resource values.

There are different methods to estimate the value of green infrastructure. One sound method, based on observed market data, is the *hedonic valuation* model. Figure 1.4 provides a thematic framework of a hedonic valuation methodology.

Figure 1.4 Hedonic Valuation of Green Infrastructure Services



The *hedonic valuation* method enables one to estimate the value of green infrastructure through observation of property value differences. The value of a typical house (property) is determined by different factors, but particularly by housing structure and closeness to natural amenities. Figure 1.4 summarizes the hedonic valuation framework and how natural resource values can be estimated (segmented out) from property values.

Structural factors that affect property values include the number of rooms, lot size, property square footage, floor space, garage square footage, etc. Closeness to high amenity areas could include parks, trails, waterways, recreational lands, open space, etc. Neighborhood characteristics could also have an impact on property values. Figure 1.4 summarizes a variety of factors that impact property values. A hedonic valuation method allows for isolation of the impact of closeness to natural resource amenities on property values. This estimated value is an indirect measure of the value of closeness to natural resource services.

A hedonic valuation method is widely used to segment the part of housing values that is attributable to the influence of natural amenities. Recent applications in decomposing the share of environmental services in property values have proven effective (Epp and Al-Ani, 1979; Pendleton and Mendelsohn, 1998; Faux and Perry, 1999; Wilson and Carpenter, 1999; Mohan, Polaski and Adams, 2000; Taylor and Smith, 2000; Laggett and Bockstael, 2000). The integration of additional spatial data with housing characteristics, such as buffered measures of natural features from each property, has also proven helpful in accurately estimating natural resource values (Lake, et al. 2000).

Focusing on particular resources, hedonic valuation methodology has been applied to measure the amenity value of water (Michael, et al., 2000; Leggett and Bockstael, 2000), the amenity value of wetlands (Mohan, et al., 2000), the environmental value of national parks (Kluvankova, 1998), the value of scenic view (Benson, et al., 1998), and the economic value of freshwater ecosystems (Wilson and Carpenter, 1999). In many of these studies, natural amenities have a significant effect on property values. For instance, Benson, et al. show that scenic quality appreciates housing values by as much as 60 percent.

1.3 The Study Areas: Hillsdale and Oakland Counties

Two hedonic valuation case studies were conducted in Hillsdale and Oakland counties. The Hillsdale County study focused on the valuation of waterbodies (lakes, wetlands, etc.). This analysis involved the estimation of the impact of distance from waterbodies on the value of properties. The Oakland County study focused on the valuation of waterbodies, water ways, recreational lands, and a specially constructed variable designed to capture access to walkable and bikable infrastructure, such as trails, bike lanes, safety paths, and sidewalks.

Hillsdale County is a rural, agrarian county with US Census (2005) estimated population of 49,000. The county covers a land area of 599 square miles. Per capita income in the county is estimated at $20,361, with an unemployment rate of 3.8 percent. Increasingly, the county attracts residential development and second home development for residents of nearby Toledo, Ohio. There are 18 townships and three cities in Hillsdale County. The county's high quality lakefront and public lands provide environmental services and attract development near these resources.

Oakland County is located in southeast Michigan. The county has a total area of 908 square miles, of which 3.91 percent is water. The Census Bureau (2005) estimated that the population of the county was 1,214,361, which is roughly one-tenth of the population of Michigan. Oakland County is part of the Detroit metropolitan area and constitutes 62 cities, villages and townships. General Motors, Ford and Chrysler have significant investment in the county, though the economy of Oakland County is relatively diverse. According to Census figures, the median household income for 2000 stood at $61,907, which compares favorably to the U.S. median household income of $41,994 for the same period.

1.4 Hedonic Valuation Model

The analysis of both Hillsdale and Oakland Counties used a hedonic valuation model, the only difference being the implementation of the model: a focus on water-related amenities in Hillsdale; and a focus on a broader set of green infrastructure features in Oakland (waterways, waterbodies, recreational lands and infrastructure that allows walkability and bikeability, i.e., trails, sidewalks, safety paths and park walk-paths). Given the rural character of Hillsdale, it lacked data on some of the amenities accounted for in Oakland County.

Figure 1.4 (page 9) provides a thematic presentation of the hedonic valuation approach. In practice, a hedonic model is an econometric approach that allows analysis to separately estimate the values of green infrastructure. Hedonic models have different functional specifications, ranging from linear to non-linear models. A more general hedonic functional form, with flexible choices, involves the specification of a Box-Cox function that can be modeled to provide both linear and non-linear functional forms. One general specification of a hedonic model is one that transforms the dependent variable (housing unit price) using a Box-Cox transformation, while keeping independent variables (housing characteristics and closeness to natural amenities) linear. This model is specified as:

$$Y^{(\lambda)} = f(X) \qquad (1)$$

$$\text{where } \left\{ \begin{array}{ll} Y^{(\lambda)} = (Y^{(\lambda)} - 1)/\lambda & if\ (\lambda) \neq 0 \\ Y^{(\lambda)} = \log(Y) & if\ (\lambda) = 0. \end{array} \right\}$$

Y refers to the dependent variable (housing unit price) and X refers to all independent variables in the model that determine housing unit value, including housing characteristics and proximity to natural amenities. This model transforms the dependent variable using a Box-Cox transformation while the explanatory variables are all linear.

For the purpose of this study, a more general specification is used that transforms both the dependent and independent variables using a Box-Cox transformation. Model testing is conducted to identify particular models that fit the data well. The advantage of Box-Cox specification is that it does not impose any theoretically restrictive parameters. It allows for both linear and non-linear specification alternatives as special cases, but selects other parameter values that will generate best estimation results. The generalized Box-Cox specification can be given as:

$$y_i^{(\lambda)} = \beta_0 + \sum_i \beta_i x_i^{(\phi)} + \sum_j \kappa_j Z_j + \varepsilon_i \qquad i \in (1,...,n)\ and\ j \in (1,...,n)$$

where $$\left\{\begin{array}{ll} y^{(\lambda)}=(y^{(\lambda)}-1)/\lambda & if\ (\lambda)\neq 0 \\ y^{(\lambda)}=\log(y) & if\ (\lambda)=0 \\ x_i^{(\phi)}=(x_i^{(\phi)}-1)/\phi & if\ (\phi)\neq 0 \\ x_i^{(\phi)}=\log(x_i) & if\ (\phi)=0. \end{array}\right\} \quad (2)$$

The dependent variable (y_i) is the price of houses, which is transformed using the Box-Cox parameter (λ); (x_i) refers to all explanatory variables in the model, excluding dummy variables, which are transformed using a Box-Cox parameter (ψ); and all dummy variables are given by (Z_j). Even though it is customary to assign the Box-Cox parameters a value of either 0 or 1, a maximum-likelihood function can be specified, and the Box-Cox parameters will be determined through an optimization process. Equation (2) is estimated through different alternative models using Box-Cox transformations. The hedonic model indicated in equation (2) allows for estimation of green infrastructure values from property sales transactions data.

1.5 Data Description and Characteristics

To estimate the value of selected green infrastructure in Hillsdale and Oakland Counties through the use of the hedonic model specified in equation (2), extensive data was collected from the Assessor's Office in each county. To make sure data used in the analysis is based on market transactions of properties and full property structural information, extensive data editing is undertaken to exclude transactions that are not valid or are not based on free market transactions. Table 1.1 provides the description of the data used in the analysis.

Table 1.1 Description of Data Used for Hedonic Analysis – Hillsdale County

Variable	Description
BSMTDUMY	1 if there is a basement, 0 otherwise.
GRNDSQFT	Square footage of ground floor.
NUMBATHR	Number of bathrooms.
QLTYRATE	Quality rating of house by assessor (out of 100).
GRGESQFT	Garage square footage.
FLRSQFT1	Square footage of floor.
AGE11	Age of house.
LOTACR12	Lot size in acres.
SOLD2001	1 if house is sold in 2001, 0 otherwise.
SOLD2002	1 if house is sold in 2002, 0 otherwise.
SOLD2003	1 if house is sold in 2003, 0 otherwise.
SOLD2004	1 if house is sold in 2004, 0 otherwise.
SOLD2005	1 if house is sold in 2005, 0 otherwise.
H2OW0-15	1 if house is located within 15 meters of water, 0 otherwise.
H2O15-75	1 if house is located within 15 to 75 meters of water, 0 otherwise.
H2075-150	1 if house is located within 75 to 150 meters of water, 0 otherwise.

Now, let's examine the data needed to conduct the hedonic analysis in Hillsdale County. Housing sales data for the years 2000 to 2005 were collected, which was obtained from the Assessor's Office of Hillsdale County. The data was thoroughly checked for consistency, was appropriately corrected or excluded, and was limited to "arms-length" transactions (buyers and sellers are matched according only to the details of a transaction). Only arms-length transactions were included because they reflect market transactions. The housing sales transaction data includes information on sale price of properties as well as housing characteristics.

Spatial data on the distance of sold properties from identified water amenities was generated by the Hannah Professor Research Program of the Land Policy Institute and

was matched with the county property sales data to determine the impact of proximity to water amenities on property values. The sample size (number of property sales transactions) used in the final analysis was 2,504. Table 1.1 provides both structural information of sold properties between the years 2000 to 2005 and spatial information on the distance of the sold properties from identified water features. Appropriate data transformation was also undertaken to test alternative hedonic model specifications.

In the case of Oakland County, data comprised two categories – housing structural (and value) and spatial data on the closeness of properties to selected green infrastructure. Descriptions of these data are provided in Table 1.2.

Table 1.2 Description of Data Used for Analysis – Oakland County

Variable	Description
GRND_FL	Square footage of ground floor.
TOTSQFT	Square footage of lot size.
BSMENT	1 if there is a basement, 0 otherwise.
GARAGE	Garage square footage.
BEDRMS	Number of bedrooms.
FULL-BATH	Full bath.
STYLBILE	Structural style is Bi-Level.
STYLBUNG	Structural style is Bungalow.
STYLCAPC	Structural style is Cape Cod.
STYLCOLO	Structural style is Colonial.
STYLCNTM	Structural style is Contemporary.
STYLMOBI	Structural style is Mobile.
STYLOTHR	Structural style is Other.
STYLRNCH	Structural style is Ranch.
STYLTRIL	Structural style is Tri-Level.
STYLTUDR	Structural style is Tudor.
STYLTWNH	Structural style is Townhouse/Duplex.
STYLSNGL	Structural style is Single Family.
YARD_IMPV	Yard improvement value.
Sold2000	Property sold in 2000.
Sold2001	Property sold in 2001.
Sold2002	Property sold in 2002.
Sold2003	Property sold in 2003.

Table 1.2 Description of Data Used for Analysis (Continued)

Variable	Description
Sold2004	Property sold in 2004.
Sold2005	Property sold in 2005.
Sold2006	Property sold in 2006.
H20_1DMY	Property located within 15 meters of water body.
H20_2DMY	Property located between 15 and 75 meters of water body.
H2O_3DMY	Property located between 75 and 150 meters of water body.
H20_4DMY	Property located at greater than 150 meters from water body.
REC_1DMY	Property located within 15 meters of recreational land.
REC_2DMY	Property located between 15 and 75 meters of recreational land.
REC_3DMY	Property located between 75 and 150 meters of recreational land.
REC_4DMY	Property located between 150 and 300 meters of recreational land.
REC_5DMY	Property located between 300 and 450 meters of recreational land.
REC_6DMY	Property located at greater than 450 meters from recreational land.
OUTD_1DMY	Property located within 100 meters of outdoor activity allowing green assets.
OUTD_2DMY	Property located between 100 and 500 meters of outdoor activity allowing green assets.
OUTD_3DMY	Property located between 500 and 1000 meters of outdoor activity allowing green assets.
OUTD_4DMY	Property located between 1000 and 1500 meters of outdoor activity allowing green assets.
OUTD_5DMY	Property located at greater than 1500 meters from outdoor activity allowing green assets.
WTRW_1DM	Property located within 15 meters of waterways.
WTRW_2DM	Property located between 15 and 75 meters of waterways.
WTRW_3DM	Property located between 75 and 150 meters of waterways.
WTRW_4DM	Property located at greater than 150 meters from waterways.
AGE	Age of house.
SOLD2001	1 if house is sold in 2001, 0 otherwise.
SOLD2002	1 if house is sold in 2002, 0 otherwise.
SOLD2003	1 if house is sold in 2003, 0 otherwise.
SOLD2004	1 if house is sold in 2004, 0 otherwise.
SOLD2005	1 if house is sold in 2005, 0 otherwise.
H2OW0-15	1 if house is located within 15 meters of water, 0 otherwise.
H2O15-75	1 if house is located within 15 to 75 meters of water, 0 otherwise.
H2075-150	1 if house is located within 75 to 150 meters of water, 0 otherwise.

First, housing sales value (price) and structural attributes data for the years 2000 to 2006 were provided by the Oakland County Tax Assessor's Office. The data was thoroughly checked for consistency, type of transaction and duplication. Out of the original 121,073 data points collected, only 45,424 were used in the final hedonic valuation analysis. This is due to data cleaning, refinements, utilization of only transactions with complete information, avoidance of duplications, and limitation of data sample to "valid-sales" transactions. The analysis benefits from having a relatively large sample size. Data transformation was undertaken as needed to refine the quality of output from the model and to test alternative models.

Second, spatial data was generated from Geographic Information System (GIS) layer files provided by the Oakland County GIS Unit. Distance of sold properties from identified natural amenities was measured from the GIS layers and reclassified into either four or six categories of distance buffers. An index closer to 1 indicates the natural amenity is closer to any given sold property, while an index of 4 or 6 indicates the sold property is located farther from the natural amenity property. This helps measure the impact of natural amenity closeness or distance on property values, and hence natural amenity implicit values.

1.6 Results: Valuation of Green Infrastructure

The valuation of green infrastructure in each county is provided below. In Hillsdale County, the value of water amenities is estimated. In Oakland County, a number of different natural amenities are valued, as previously mentioned in Section 1.5.

1.6.1 Valuation of Water Amenities – Hillsdale County

In estimating the hedonic model for Hillsdale County, three sets of factors that determine property values were considered. First, physical characteristics of sold properties, such as total square footage, existence of basement, number of bedrooms, etc., are included. Second, trend variables are included to capture the tendency of property values to appreciate over time (captured by including information on when the property is sold). Third, to measure the value of water amenities in Hillsdale County, distance of sold properties from identified waterbodies are measured. The analysis conducted a comparison of property values for properties located within 15 meters, between 15 to 75 meters, and between 75 to 150 meters against those properties that are located at greater than 150 meters from waterbodies. The data used in the analysis is reported in Table 1.1.

Three separate models were also analyzed to provide the best estimates for the value of water amenities in Hillsdale County. A double-log model (Model 3) performs better in explaining patterns in the data, and is used in the final analysis. Table 1.3 summarizes the estimated results by category, i.e., physical characteristics of property, market trends and environmental factors.

First, the impact of physical characteristics of property on property values in Hillsdale County is considered. The results indicate that the existence of a basement, a one percent increase in ground square footage, a one percent increase in quality rating, a one percent increase in garage square footage, and a one percent increase in floor square footage are expected to increase average property values by 0.23 percent, 0.03 percent, 1.2 percent, 0.03 percent and 0.45 percent, respectively. As expected, the results suggest that structural factors of properties do have influence on the property value.

Second, consider the impact of market trends on property values in Hillsdale County. The results indicate that, on average, properties sold in 2001, 2002, 2003, 2004 and 2005 had higher market values by a 4.9 percent, 10.4 percent, 15.5 percent, 17 percent and 20.9 percent, respectively, compared to average values in 2000. This shows a significant appreciation in average property values due to market conditions.

Table 1.3 Estimated Values of Water Amenities – Hillsdale County

Variables	Linear Model (Model 1)			Semi-log Model (Model 2)			Double-log Model (Model 3)		
	Coef.	Prob. Value	Elasticity	Coef.	Prob. Value	Elasticity	Coef.	Prob. Value	Elasticity
Physical Characteristics of Property									
BSMTDUMY	20,854	0.000	0.150	18,545	0.000	0.110	0 .231	0.001	0.165
GRNDSQFT	2.757	0.567	0.032	-17,077	0.323	-0.142	0.162	0.033	0.162
NUMBATHR	16,281.4	0.000	0.241	50,253	0.000	0.418	0.056	0.238	0.056
QLTYRATE	581.522	0.054	0.428	8,675.55	0.165	0.072	1.209	0.000	1.209
GRGESQFT	25.290	0.162	0.091	3,241.89	0.001	0.027	0.026	0.000	0.027
FLRSQFT1	22.115	0.232	0.312	13,898.1	0.336	0.116	0 .447	0.000	0.447
AGE11	25.494	0.624	0.013	633.08	0.683	0.005	0.305	0.000	0.305
LOTACR12	100.897	0.116	0.026	5,969.72	0.012	0.049	0.003	0.801	0.003
Market Trends									
SOLD2001	1,808.8	0.632	0.003	539.468	0.889	0.001	0.049	0.335	0.008
SOLD2002	5,176.77	0.169	0.010	4,230.66	0.251	0.007	0.104	0.046	0.020
SOLD2003	9,448.65	0.024	0.020	8,157.52	0.024	0.014	0.155	0.006	0.033
SOLD2004	12,226.6	0.007	0.027	9,941.35	0.006	0.018	0.170	0.004	0.038
SOLD2005	20,156.4	0.004	0.012	19,367.4	0.000	0.009	0.209	0.009	0.012
Environmental Factors									
H2OW0-15	20,854.4	0.000	0.177	93,055.8	0.000	0.149	0.819	0.000	0.158
H2O15-75	91,273.5	0.000	0.032	34,464.9	0.000	0.028	0.385	0.000	0.034
H2075-150	35,418.5	0.000	0.016	18,281.9	0.000	0.014	0.229	0.001	0.021
Sigma-sq.	2711936	0.041	-	2880531	0.000	-	0.463	0.009	-
Θ	-			1			0		
Λ	-			0			0		
-Log-lik.	30,735			30,810.826			31,540		

Third, the impact of proximity to water amenities on property values is considered. The results indicate that on average, properties located within 15 meters, 15 to 75 meters, and 75 to 150 meters from identified water amenities have 81.8 percent, 38.5 percent and 22.9 percent more value, respectively, compared to similar properties located at distances more than 150 meters from water amenities. Table 1.4 summarizes the estimated property value appreciation as a result of closeness to water amenities.

In dollars, this would mean that, on average, properties located within 75 to 150 meters from water sources have $22,760.05 more value compared to similar houses located at more than 150 meters from water amenities. Similarly, houses located at 15 to 75 meters from water amenities have $38,264.72 more value than similar houses located at more than a 150 meter distance. Finally, houses located adjacent to water amenities within a 15-meter distance have $81,399.50 more premium value compared to similar houses located at the 150 meter distance from these water amenities. Since these estimated values are independent of the structural and market trend effects on property values, they are indirect measures of the value of water amenities in Hillsdale County.

Table 1.4 The Effect of Water Amenities on Property Values – Hillsdale County

Location of House from Water Amenities	Percentage Gain in Property Value	Amount Gained in Property Value
Within 15 meters	+ 81.9%	+ $81,399.50
15 to 75 meters	+ 38.5%	+ $38,264.72
75 to 150 meters	+ 22.9%	+ 22,760.05
Base Comparison: > 150 meters	*Base*	*Base*

The predictable decline in value as one moves away from water amenities indicates that these amenities clearly have a significant impact on property values, and hence local tax income. The estimated values of housing premiums due to amenities are for an average house. Adding these benefits (property value gain from closeness to water amenities) across many houses in Hillsdale can give a clear image of the magnitude of social benefits derived from water amenities.

The results have further implications: the appreciation of housing values due to closeness to natural amenities indicates the value that people attach to the environmental benefits of natural resources. To the extent that the environmental services of water amenities influence property values, they will have indirect effects on local tax revenues through the effect on property values.

1.6.2 Valuation of Natural Amenities – Oakland County

In estimating the hedonic model for Oakland County, similarly, three sets of factors that determine property values were considered. First, physical characteristics of sold properties, capturing such factors as total square footage, existence of basement, number of bedrooms, style of property, etc., are included. Second, trend variables are included to capture property values appreciation (or depreciation) over time by including property "year sold" data. Third, selected green infrastructure, such as waterways, waterbodies, recreational lands, and neighborhood walkability and bikeability access attributes (captured by trails, park walk path, safety path and sidewalks) are included. The analysis conducted a comparison of property value differences on the basis of distance from (closeness to) the identified green infrastructure. The data used in the analysis and the distance categories from each selected green infrastructure are reported in Table 1.2 and the estimated results are provided in Table 1.5.

Table 1.5 Estimated Values of Green Infrastructure – Oakland County

Variables	Linear Model (Model 1)		Double-Log Model (Model 2)	
	Coef.	t-statistic	Coef.	t-statistic
Physical Characteristics of Property				
GRND_FL	19.352	5.417	0.093	6.839
TOTSQFT	154.665	55.855	0.665	46.715
BSMENT	22335.5	10.565	0.021	26.962
GARAGE	12791.6	5.777	0.032	33.125
BEDRMS	-5808.84	-6.071	0.009	3.449
FULL-BATH	30507.59	21.101	0.086	23.929
YARD_IMPV	3.265	27.286	10^{-5}x4	13.614
STYLBILE	-25996.43	-3.696	-0.065	-3.561
STYLBUNG	31477.20	12.291	0.058	8.364
STYLCAPC	20101.80	2.564	0.083	4.105
STYLCOLO	-28529.67	-11.167	-0.006	-0.913
STYLCNTM	3551.13	0.742	0.101	8.189
STYLMOBI	-62368.42	-2.646	-0.523	-8.585
STYLOTHR	-12033.04	-3.047	0.003	0.301
STYLRNCH	26327.84	9.935	0.061	8.480
STYLTRIL	-22119.78	-4.675	-0.052	-4.275
STYLTUDR	79642.97	7.639	0.184	6.853
STYLTWNH	-38613.92	-2.001	-0.194	-3.885
Market Trends				
Sold2001	35999.46	5.769	0.061	3.796
Sold2002	20276.21	4.240	0.057	4.650
Sold2003	29839.62	6.272	0.098	7.990
Sold2004	4697.95	8.500	0.129	10.700
Sold2005	50059.58	10.638	0.152	12.507
Sold2006	43752.14	9.199	0.111	9.032
Environmental Factors				
Water Amenities				
H20_1DMY	67690.33	23.872	0.215	29.356
H2O_2DMY	-6733.81	-2.533	-0.007	0.298
H2O_3DMY	-13518.17	-6.199	-0.023	-4.143
Recreational Land Amenities				
REC_1DMY	11014.84	2.887	0.031	3.126
REC_2DMY	21091.97	8.181	0.031	4.706
REC_3DMY	16283.03	6.723	0.022	3.558
REC_4DMY	17720.45	8.632	0.026	4.993
REC_5DMY	11020.15	4.933	0.006	1.023
Walkability and Bikeability Amenities				
TRL_1DMY	5494.85	1.709	-0.006	-0.745
TRL_2DMY	20523.39	6.545	0.046	5.680
TRL_3DMY	21780.71	6.285	0.023	2.548
TRL_4DMY	29102.75	7.181	0.063	6.055
Waterways Amenities				
WTRW_1DM	1000.14	0.800	0.019	1.883
WTRW_2DM	-1407.72	0.672	0.013	1.481
WTRW_3DM	-3515.77	0.185	0.022	3.198
Intercept	-150458.3	-24.070	6.051	111.28
Θ	-		0	
Λ	-		0	
-Log-lik.	-624,693.17		-21,317.04	
R^2	0.56		0.57	

In the case of Oakland County, several specifications were estimated, and the appropriate model specification was selected based on results from the log-likelihood test, Akaike Criterion and significance levels. The double-log specification (Model 2) was chosen over the linear specification. Table 1.5 summarizes the estimated results by category, i.e., physical characteristics of property, market trends and environmental factors.

First, consider the impact of property physical attributes on property values in Oakland County. As expected, the results suggest that a one percent increase in ground floor square footage (*GRND_FL*), total square footage (*TOTSQFT*), basement square footage (*BSMENT*), and garage square footage (*GARAGE*) increase property values by 0.09 percent, 0.66 percent, 0.02 percent and 0.03 percent, respectively. Similarly, additional bedrooms (*BEDRMS*) fetch a 0.9 percent gain in property values, full bath (*FULL_BATH*) brings 8.6 percent gain, and yard improvement (*YARD_IMPV*) adds a slight increase in property value. The style of building also matters. Holding single family home style as a base comparison, *BiLevel*, *BUNG, CAPC, COLO, CNTM, MOBI, OTHR, RNCH, TRIL, TUDR* and *TWNH* styles differ in comparative value by -6.5 percent, 5.8 percent, 8.3 percent, -0.06 percent, 10.1 percent, -52.3 percent, 0.03 percent, 6.1 percent, -5.2 percent, 18.4 percent and -19.4 percent, respectively.

Second, consider the effect of market trends on property values in Oakland County. The results suggest that holding average property values in the year 2000 as a base comparison, average property values appreciated by 6.1 percent in 2001, 5.7 percent in 2002, 9.8 percent in 2003, 12.9 percent in 2004, 15.2 percent in 2005 and 11.1 percent in 2006. These indicate the market trend effect on property values.

Third, consider the property value impacts of the four identified natural resource amenities in Oakland County—waterbodies, recreational lands, neighborhood walkability and bikeability green infrastructure and waterways. Let's consider each green infrastructure separately.

Waterbodies: Table 1.6 summarizes the effect of the presence of or proximity to waterbodies on property values by distance and by degree of effect in Oakland County. Properties were classified by their distance from waterbodies within 15 meters, 15 to 75 meters, 75 to 150 meters, and beyond 150 meters. The results suggest that properties that lie within 15 meters of waterbodies have a substantial capitalization of property values, compared to properties located at more than 150 meters. The average "green-capitalization" attributable to waterbodies within 15 meters is $55,082. This substantial gain in property value signals the implicit value of water amenities to Oakland County residents. Beyond the 15 meter buffer, however, water-body amenities have a rapidly diminishing impact on property values. This could be perhaps due to the scenic value associated with these amenities, which diminishes as the scenic quality declines. The results suggest that water amenities have substantial value that can be capitalized into property values, but they have a high sensitivity to distance and scenic quality.

Table 1.6 The Effect of Water Amenities on Property Values – Oakland County

Location of House from Water Amenities	Percentage Gain in Property Value	Amount Gained in Property Value
Within 15 meters	+ 21.5%	+$55,081.71
15 to 75 meters	-	-
75 to 150 meters	-2.3%	-$5,892.46
Base Comparison: > 150 meters	*Base*	*Base*

Recreational Lands: Table 1.7 summarizes the effect of proximity to recreational lands on property values by distance and by degree of effect in Oakland County. Properties were classified based on distance from identified recreational lands following the distance categories of 15 meters, 15 to 75 meters, 75 to 150 meters, 150 to 300 meters, 300 to 450 meters and beyond 450 meters. The results suggest that recreational areas have significant impact on property values, ranging in impact from 3.1 percent capitalization for properties within 15 meters, to 3.2 percent gain for properties within 15 to 75 meters, 2.2 percent gain for properties within 75 to 150 meters, and a 2.6 percent capitalization for properties within 150 to 300 meters, compared to properties located at more than 450 meters. The results soundly conclude that recreational lands have significant value, more so the closer one gets to these resources. Recreational areas are part of quality of life, and their significant positive value per house measures their implicit market value to Oakland County residents.

Table 1.7 The Effect of Recreational Amenities on Property Values – Oakland County

Location of House from Recreational Land	Percentage Gain in Property Value	Amount Gained in Property Value
Within 15 meters	+3.1%	+$7,942.01
15 to 75 meters	+3.2%	+$8,198.21
75 to 150 meters	+2.2%	+$5,636.27
150 to 300 meters	+2.6%	+$6,661.04
300 to 450 meters	-	-
Base Comparison: > 450 meters	*Base*	*Base*

Walkability and Bikeability Allowing Green Infrastructure: Table 1.8 summarizes the effect of walkable and bikeable green infrastructure on property values in Oakland County. Green assets in this category are sidewalks, bike lanes, trails, park paths and safety paths. Properties were classified by their distance from green infrastructure within 100 meters, 100 to 500 meters, 500 to 1,000 meters, 1,000 to 1,500 meters and beyond

1,500 meters. Results indicate that the effect of these green infrastructure on property values were significant, but not within 100 meters. Existence of these composite green assets within 100 to 500 meters appreciates property values by 4.6 percent, or $11,785, within 500 to 1,000 meters results in "green-capitalization" of 2.3 percent, and within 1,000 to 1,500 meters results in a gain of 6.3 percent or $16,140, compared to properties located at more than 1,500 meters away from these outdoor opportunities. The insignificant result for much closer proximity could be perhaps due to the congestion and disutility of having people walk and exercise at closer proximity to one's property. However, once these green assets are close enough to bring amenity value, yet far enough to reduce the impact of congestion, they command substantial value.

Table 1.8 The Effect of Composite Outdoor Activity Allowing Green Assets on Property Values – Oakland County

Location of House from Composite Green Assets	Percentage Gain in Property Value	Amount Gained in Property Value
Within 100 meters	-	-
100 to 500 meters	+4.6%	+$11,784.92
500 to 1000 meters	+2.3%	+$5,892.46
1000 to 1500 meters	+6.3%	+$16,140.22
Base Comparison: > 1500 meters	*Base*	*Base*

Waterways: Table 1.9 summarizes the effect of proximity to waterways on property values in Oakland County. Properties were classified based on their distance from waterways at 15 meters, 15 to 75 meters, 75 to 150 meters and beyond 150 meters. Results suggest that waterways tend to have a marginal positive impact on property value, estimated at a "green-capitalization" of 1.9 percent for properties within 15 meters and 2.2 percent for houses within 75 to 150 meters, compared to properties located at more than 150 meters. The estimated implicit value for waterways is smaller, yet positive. Waterways do have non-market value, and residents put a premium on such locations.

Table 1.9 The Effect of Waterways on Property Values – Oakland County

Location of House from Waterway Amenities	Percentage Gain in Property Value	Amount Gained in Property Value
Within 15 meters	+1.9%	+$4,867.69
15 to 75 meters	-	-
75 to 150 meters	+2.2%	+$5,636.27
Base Comparison: > 150 meters	*Base*	*Base*

In summary, the results clearly indicate that green infrastructure commands significant value, as estimated in the case of Hillsdale and Oakland Counties. Natural resources also have significant impacts on local economies through property values and quality of life. The appreciation of housing value due to closeness to natural amenities indicates the value people attach to the environmental benefits of natural resources, and their willingness to "vote through their feet" and to "vote through their wallets." The results also suggest that, to the extent that the environmental services of natural resources influence property values, they will have indirect effects on local tax revenues through their effects on property values.

1.7 Conclusion and Implications

This report presents the findings of a study designed to document the impacts of natural resources (green infrastructure) on property values and therefore on local tax revenues. Applications of the hedonic valuation technique to Oakland and Hillsdale Counties suggest that green infrastructure, or natural resources, have significant amenity values that translate into higher property values. Our approach isolates the value of green infrastructure attributes such that the impact of green infrastructure in enhancing property value is estimated. With every attribute measured, the results support the positive economic value and impact of green infrastructure.

In the case of water amenities in Hillsdale County, it was found that properties located within 15 meters reflected an 81.9 percent gain property value (or $81,399.50), properties located within 15 to 75 meters gained 38.5 percent in property values (or $38,264.72), and properties located within 75 to 150 meters gained 22.9 percent in value (or $22,760.05). The enhancements in property values are quite significant, given that average property values from property sales transaction data are around $100,000. The difference in property value at different distance from water amenities shows people are "voting with their foot" and with their "wallet" in support of green infrastructure.

This study also conducted valuation analysis of waterbodies, recreational lands, and walkability and bikeability allowing green infrastructure, and waterways in Oakland County. In the case of waterways, it was found that properties located within 15 meters of waterways gained 1.9 percent in property values (or $4,867.69) and properties located within 75 to 150 meters gained 2.2 percent in value (or $5,636.27), compared to properties located beyond 150 meters of waterways. In the case of recreational lands, properties within 15 meters gained 3.1 percent in property value (or $7,942.01), properties within 15 to 75 meters gained 3.2 percent in value (or $8,198.21), properties within 75 to 150 meters gained 2.2 percent in value (or $5,636.27), and properties within 150 to 300 meters gained 2.6 percent in value (or $6,661.04). In the case of walkability and bikeability allowing green infrastructure (such as trails, bike lanes, sidewalks, and park path), properties located within 100 to 500 meters gained 4.6 percent in property value (or $11,784.92), properties located within 500 to 1000 meters gained 2.3 percent in value (or $5,892.46), and properties located 1000 to 1500 meters gained 6.3 percent (or $16,140.22) compared to properties located beyond 1500 meters. Finally, in the case of water amenities, it was found that properties located within 15 meters gained 21.5 percent in value (or $55,081.71) compared to properties located beyond 150 meters from water amenities. Given the average property value from property sales transaction data of $275,000, the gains in property values as a result of proximity to green infrastructure are significant in economic value and impact.

The results from both Hillsdale and Oakland Counties consistently show that, when it comes to green infrastructure, people are "voting with their feet" and "voting with their wallet." The positive findings for green infrastructure should be good news for local officials, since their revenue from property taxes increases with amenities. Local officials

are somewhat supportive of green assets; however, this study suggests that they should be more supportive for an economic reason, as it enhances taxable value.

The study results have numerous implications:

(1) Natural amenities do matter, have significant value, and have a bearing on local property values. Therefore, efforts to protect such resources are sensible responses to protecting value.
(2) Natural amenities have a substantial effect on local property values, from which some local public services are provided. To the extent that property taxes are relevant to local government units, understanding the important links provided in this study between local economies and natural resources is crucial.
(3) Natural amenities are different in value as implicitly measured in the market place; as such, estimated green infrastructure values can provide the guide as to which resources are highly valued by local residents for conservation purposes, especially in the face of limited conservation funding.
(4) Given the fact that green infrastructure affects property tax value, local decision makers can enhance the long-term financial viability of their communities through green infrastructure based strategies.

Green infrastructure investment also has broader implications. In the New Economy, talent and innovation are sources of new local and regional economic growth. Talent tends to migrate to places with significant green infrastructure; jobs tend to follow people, who follow green infrastructure quality. If this is the case, then the findings of this study suggest that green asset enhancement meets sustainability goals and also enhances the economy, simultaneously. As part of a long-term strategy, green infrastructure (shown to have significant economic value) can be leveraged to enhance local economic viability and sustainability at the same time.

2.0 Economic Impact of Michigan's State Parks

A Case Study of Ogemaw County

2.1 Introduction

As components of green infrastructure, natural and environmental resources provide a wide array of amenity services benefits to society (Kline and Wichelns, 1996; Platinga and Miller, 2001; Irwin and Bockstael, 2002). They also determine population and income growth (Deller, et al., 2001; Duffy-Deno, 1998) and generate direct and indirect economic impacts through visitor spending in the local economy (Stynes, et al., 2000; Nelson and Stynes, 2003). Despite the existence of substantial evidence on the quality of life importance of green infrastructure, the connection between natural and environmental resources and economic activity is often not well understood. Many questions arise in this regard from different corners:

(1) Does the protection of natural resources translate into economic opportunities?
(2) How can natural resources be included in the mix of strategies to bring about local economic prosperity?
(3) What does local green infrastructure add to quality of life?
(4) In the face of economic challenges in Michigan, how can we leverage our local green assets to foster sustainable economic growth?

The answers to these questions are critical and relevant in defining future economic growth strategies for Michigan communities.

Green infrastructure assets, such as parks, wetlands, sand dunes, forests, water bodies, trails, and other natural areas, have been shown to have substantial economic value. With changing global and regional economic structures, and with increasing specialization in service-based industries, the economic vitality and role of green assets in creating new economic opportunities has become relevant. To many, the question has increasingly become how can one leverage local green resources, assets and services to gain a comparative advantage? Identifying crucial local green assets and investigating their contribution to the local economy is a key first step in addressing this question.

The main goal of this particular study is to provide some evidence on the economic impact of green infrastructure, particularly a state park, on county economic activity. The study aims to estimate the economic impact of the Rifle River Recreational Area (RRRA) on the Ogemaw County economy.

Economic impact is broadly defined as the total income, job creation, tax revenue and value-added impacts to local or regional economies as a result of changes in investment or spending in the same local or regional economy. Economic impact analysis, therefore, focuses on "the assessment of the change in the overall economic activity as a result of some change in one or several economic activities" (IMPLAN Pro V.2.0 2004). In the context of the RRRA, economic impact is defined as the total job creation, income and value added impacts of annual RRRA visitors' spending in Ogemaw County.

To the extent that green infrastructure affects tax collections, income and job creation, and value-added growth; it is relevant to local citizens, local governments and policy makers. Information on such interactions can support sound policies to leverage green assets for economic opportunities.

This study can add value in many ways:

(1) It can inform on links between green assets and economic activities in a measurable way.
(2) It can potentially inform decision makers about the level of contribution of green infrastructure to local economies.
(3) It can highlight the importance of bringing green assets into the mix of strategies to gain local comparative advantage as the overall national and regional economies become more competitive and strategic.

2.2 Economic Impact of Green infrastructure in Michigan

Previous studies that focused on measuring the economic impact of natural resources in Michigan provided evidence on linkages between green infrastructure and economic outcomes. Michigan is well-endowed with natural and environmental resources and has significant natural resource-based economic activities. Michigan has 3,288 miles of Great Lakes shoreline, 38,000 square miles of Great Lakes water, 11,000 inland lakes, 36,000 miles of rivers and streams, 75,000 acres of sand dunes and 5.5 million acres of wetlands (Nelson and Stynes, 2003). Michigan also has a total of 19.3 million acres in forested lands of which 38 percent are publicly owned (Hansen and Brand, 2006).

Michigan ranks 3rd in the nation in licensed hunters (over 750,000), with a $1.3 billion annual contribution to the economy. The state also ranks 8th in number of anglers, with a $2 billion economic contribution. The state ranks 1st in the number of registered boats and snowmobiles, with an estimated $2 billion economic contribution (MDNR, 2007-b).

In 2000, Michigan had 89 million "travel party nights" with $8.8 billion in tourism spending, creating 209,000 jobs; $4.3 billion in personal income; and $6.9 billion in value-added. This represented two percent of the state economy and four percent of total jobs (Stynes, 2000). In 2000-2001, skiers and snowboarders spent $146 million on trips to ski areas through 2.2 million skier visits, generating $63.7 million in ski revenue; $41.3 million in visit expenditures; and $41.4 million in tourism related spending. This created $54 million in direct personal income and 3,900 jobs (Stynes and Sun, 2001).

At the local level, the economic impact of green infrastructure-based activities was also substantial. For instance, in 2002, total tourism spending in Washtenaw County was estimated at $352 million. The direct economic impact of this spending was $111 million in wages and about 5,700 jobs (Stynes, 2003). Similarly, Pictured Rocks National Lakeshore hosted 421,000 recreational visits in 2001, spending $14.8 million. The total estimated economic impact of visitor spending was $12 million in sales, $4.6 million in personal income, $7.4 million in direct value-added and 426 jobs (Stynes and Sun, 2003).

These studies have investigated the economic value of the services from different types of green assets. The estimated income, employment and value-added impacts are quite substantial and clearly inform on the link in Michigan between green infrastructure and economic impacts. At the local or regional level, these studies provide information on the value of green infrastructure in offering local economic opportunities. This becomes particularly relevant to communities and regions in transition from "old" to "new" economies.

2.3 Profile of Ogemaw County and Rifle River Recreation Area

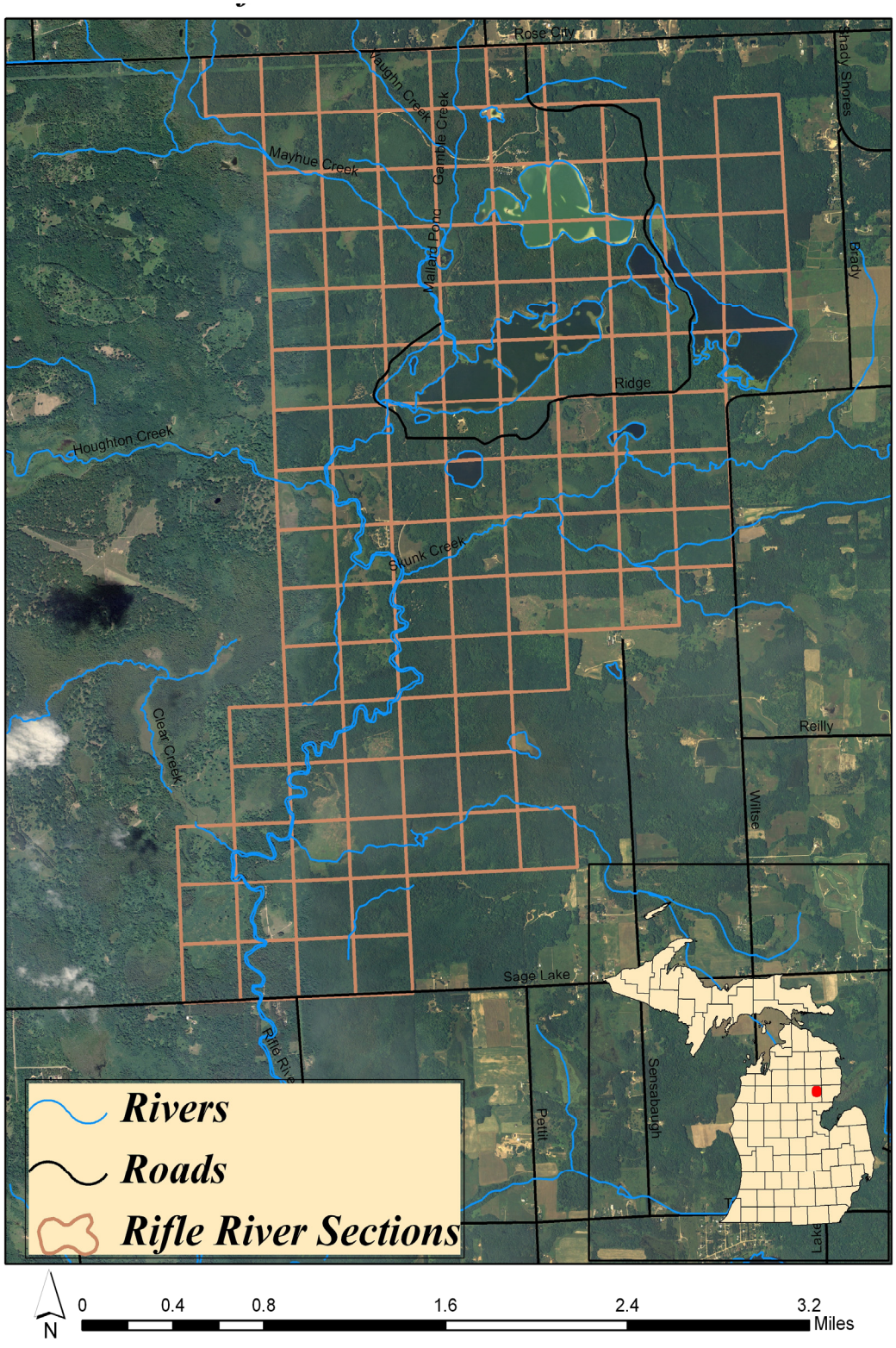
The Rifle River Recreation Area (RRRA) is a wilderness area located within the AuSable State Forest, which provides recreational opportunities to visitors. Before 1945, RRRA was a private hunting and fishing retreat owned by the late H.M. Jewett, a pioneer auto manufacturer (MDNR, 2007). In 1945, it was purchased by the Department of Conservation and was renamed Rifle River Area. In 1963, the Parks Division acquired the area, now named Rifle River Recreation Area (MDNR, 2007-a).

RRRA is located in the northeastern part of the Lower Peninsula of Michigan in Ogemaw County. It has an approximate area of 4,450 acres. In terms of visitors, it accommodates 15,273 camper party group nights (camper nights), for an estimated 72,000 campers per year. The camp also accommodates an estimated 10,824 user group party days (day visits) per year. There are an estimated 38,900 day users of the camp. The annual employee payroll for the camp is estimated at $263,243 and the annual maintenance expenses are $71,591. Figure 2.1 shows the location of RRRA in Michigan.

Ogemaw County has a population of 21,645 and a population density per square mile of 38.36 (2000 Census of Population). The median household income of the County, based on 2000 Census estimates, is $30,474. This falls short of the national average for the same period, estimated at $41,994. The economic profile of the County by sectoral activity is summarized in Table 2.1.

In terms of the major sources of employment opportunities in the County by the industrial sector, manufacturing, retail trade, and healthcare and social assistance industries provides the largest share of employment opportunities for 1,040, 1,287 and 1,101 workers, respectively. The accommodation and food services industry, which is closely linked with tourism activities, also provides a significant employment opportunity in the County, employing 684 workers. Table 2.1 summarizes additional information by sector for jobs, payroll and trade.

Figure 2.1 Rifle River Recreation Area



Source: Prepared by the Hannah Professor Research Program of the Land Policy Institute.

Table 2.1 Economic Profile of Ogemaw County

Industry	Number of Establishments	Number of Employees	Annual Payroll ($1,000)	Shipments/Sales/ Receipts
Manufacturing	34	1,040	$31,182	$101,540
Wholesale Trade	14	224	$7,193	$74,957
Retail Trade	135	1,287	$23,702	$316,402
Information	7	73	$2,176	Not Reported
Real Estate and Rental and Leasing	25	91	$1,891	$9,797
Professional, Scientific and Technical Services	29	119	$2,973	$7,108
Administrative Support, Waste Management and Remediation Service	16	72	$2,306	$4,415
Health Care and Social Assistance	62	1,101	$28,678	$71,919
Arts, Entertainment and Recreation	12	51	$975	$3,482
Accommodation and Food Services	62	684	$7,331	$30,188
Other Services (Except Public Administration)	42	156	$2,707	$9,777

Source: Ogemaw County, Michigan Business Data; available at http://www.city-data.com/ business2/econ-Ogemaw_County-MI.html.

2.4 Methodology and Data

To estimate the economic impact of RRRA on the economy of Ogemaw County, park visitor spending data was collected and the economic impact of such spending on the local economy was estimated. The regional economic impacts of RRRA were determined using the Stynes (1998) estimated visitor spending profiles, created using the 1996/1997 Michigan State Park (MSP) visitor survey, 2005/2006 RRRA user and operations budget data, as well as income spending profiles and a regional economic model of Ogemaw County estimated using IMPLAN Pro 2.0 software. Stynes (1998) calculated spending profiles for several user types throughout the four major regions of Michigan (Upper Peninsula, Northern Lower Peninsula (NLP), and the Eastern/Western Lower Peninsula). These spending profiles were estimated on a *party day basis* (all spending for a user group per day) and then multiplied by the number of RRRA camper party nights and day use party visits to estimate total visitor spending. Total visitor spending was then applied in an IMPLAN generated input-output model of the Ogemaw County economy to estimate secondary effects and to estimate the amount of income and jobs associated with visitor spending. Because the Stynes (1998) study used dollar values from 1997, all visitor spending profiles were adjusted to reflect 2006 values using the Bureau of Labor and Statistics Consumer Price Index calculator.[4]

Local purchases for RRRA operations, as well as employees spending of their incomes locally, must be accounted for in order to derive the total regional economic impacts of RRRA. The amount spent within RRRA by park visitors is subtracted from their spending profiles, as these dollars are the same dollars spent by employees via income or on RRRA operations. To separate visitor impacts from park operations impacts, all visitors staying overnight in the park (campers) have their lodging expense set to zero. RRRA employee income is then categorized using annual income spending profiles derived from IMPLAN, and those on the payroll are assumed to spend their income in the local area. The impact of employees spending their income locally and the impact of locally spent dollars on park maintenance are then calculated as separate *events* using IMPLAN. Visitor impacts and operations impacts are then aggregated to arrive at the total regional economic impacts of RRRA on Ogemaw County, Michigan.

The reported number of 'camps' (15,273 nights) at the park are used to estimate camping activity. A camp is a single group occupying a single site for a single night. Day use figures (~38,966) are divided by an average day use party size (3.6), derived by the Michigan Department of Natural Resources and the RRRA park supervisor. Reported park operations expenditures (payroll and maintenance expenses) are assumed to provide an accurate estimate of the annual cost to sustain the RRRA.

The spending profiles for park users require some assumptions. State park visitors are divided into three groups: (1) state park campers, (2) day users on day trips, and (3) day users on overnight trips. Day users reported spending for their entire group for the day and campers reported spending for everybody at the campsite. A detailed explanation of

[4] Bureau of Labor and Statistics Consumer Price Index calculator is available at: http://www.bls.gov/cpi.

the assumptions made by Stynes (1998) is available in that study, including how the following were managed: zeros and missing data, outliers, campers in the day use sample and double counting.

Data on number of camper nights, number of day users, number of park employees, wages and hours worked, and maintenance expenses were based on information provided by park staff. Spending profile data, i.e., average spending per visitor, is based on the Stynes (1998) study. Regional economic multipliers were calculated in IMPLAN Pro 2.0 economic impact analysis software.

The impact analysis was thus estimated based on three user groups (campers, users on day trips, and users on overnight trips) and data on six spending categories (vehicle-related, groceries, restaurants, sporting goods, lodging, and other expenses). Using this information, the total economic impact of visitor spending on local income, jobs and value-added was estimated.

The estimated economic impacts are reported at three levels: (1) *direct economic impacts* (the total economic activity facilitation effect of RRRA visitors' spending in industries directly related to visitors, such as lounge and hotels, restaurants, sport goods stores, groceries, gas stations, etc.) and *indirect economic impacts* (the secondary impacts in "backward" and "forward" linked industries as a result of RRRA visitors' spending impact in primary sectors); (2) total (direct and indirect) job creation impacts; and (3) total value-added impacts (value in goods and services added across industries as a result of spending by RRRA visitors after accounting for costs).[5]

[5] The estimation of economic impacts from visitor spending involves direct and indirect economic impacts. Economic activities are inter-related. As a result, there are "backward" and "forward" linkages in the economy where changes in one economic activity will often have a chain effect on related activities. Suppliers of parts and services to mainline economic activity are "backward linked" to the main activity, and economic activities that are dependent on the mainline activity as inputs are "forward linked." In the case of RRRA, its impact on the economy of Ogemaw County is determined similarly following the *backward* and *forward* linkages of the park services with other activities in the rest of the County economy.

2.5 Estimated Economic Impacts of RRRA in Ogemaw County

In general, there are an estimated 15,273 camper party group nights (camper nights), 72,000 campers, 10,824 day visits and 38,900 day users annually. The annual employee payroll is $263,243 and maintenance expenses are $71,591. The total economic impacts associated with these visitors and their spending in Ogemaw County were estimated and results are provided in Table 2.2.

Based on the RRRA visitors' spending data, the total annual estimated direct economic impact of visitor spending on Ogemaw County economy is $1,368,280, and the induced (indirect) economic impacts are estimated at $419,815. The total direct and indirect economic impacts are, therefore, $1,788,095. For a park of 4,450 acres, the annual economic impacts are significant.

Table 2.2 Direct and Indirect (Induced) Economic Impacts of Rifle River Recreational Area Visitor Spending

Type of Economic Impact	Economic Impact Estimates
Total Economic Impacts	$1,788,095
Direct Economic Impacts	*$1,368,280*
Indirect (Induced) Economic Impacts	*$419,815*
Total Jobs Created	37 jobs
Direct Jobs Creation	*32 jobs*
Indirect (Induced) Job Creation	*5 jobs*
Total Value-Added Impacts	$933,003
Direct Value-Added Impacts	*$684,574*
Indirect (Induced) Value-Added Impacts	*$248,429*

In terms of job creation impact, the total employment impact of the park is estimated at 32 jobs in direct job creation and five jobs in indirect (induced) job creation impacts. The induced job impacts are the jobs created in other sectors that are related to RRRA park activities, due to visitor spending in RRRA related activities. The total job impacts associated with the park, direct and indirect, is therefore 37 jobs.

In terms of value-added impacts, the direct value added impact of RRRA on Ogemaw County is estimated at $684,574 and the indirect (or induced) value-added impacts in other sectors are estimated at $248,429. The total value-added impact is, therefore, estimated at $933,003.

2.6 Conclusion and Implications

This particular study is focused on understanding the economic impacts of green infrastructure, specifically the Rifle River Recreational Area. As Michigan experiences economic growth challenges, key questions arise as to whether green infrastructure can provide an economic growth opportunity at the local level. This case study of the Rifle River Recreational Area in Ogemaw County can contribute to an increased understanding of the economic contributions of green infrastructure.

Using visitor spending data on RRRA related visits and activities, and utilizing the Stynes (1998) visitor spending profile, the annual economic impact of RRRA visitor spending on the economy of Ogemaw County was estimated using IMPLAN. Results suggest significant economic impact. The total estimated direct and indirect economic impacts of RRRA visitor spending is $1,788,095. Given the park size of 4,450 acres, the economic impact is significant. RRRA visitor spending is also estimated to induce a total of 32 jobs in direct job creation and 5 jobs in induced (indirect) job creation. The total job impact of RRRA visitor spending is estimated at 37 jobs. The total value-added impact of RRRA visitor spending is estimated at $684,574 in direct value-added impact and $248,429 in indirect value-added impact. The total estimated value added impact in Ogemaw County is $933,033.

The findings from this study clearly indicate the importance of green infrastructure to local economic activities and the overall impact of "green assets" on local economic performance. These results can suggest three policy implications: (1) to the extent that the services of "green assets" are related to economic impacts, sustainable and viable utilization of these resources can translate into economic outcomes; (2) to the extent that "green-assets" are tied to creating or enhancing local economic opportunities, they can be used as strategic assets for local comparative advantage; and (3) conservation of natural resources and economic growth need not be antagonistic, and in fact can be synthesized in win-win sustainable use of "green assets" to foster economic prosperity.

As Michigan strives to foster economic prosperity, green infrastructure can play a crucial role in providing local economies with needed support. As the translation from "green assets" to economic performance becomes better known, the strategic role of green infrastructure in revitalizing and enhancing local economies will become more apparent.

3.0 State Conservation Spending in the U.S.:
A Political Economy Analysis

3.1 Introduction

Natural resource and environmental services provide a flow of benefits to society that enhance the quality of life of a state's residents and support economic activities in different sectors. With the gradual transformation of the U.S. from a production-based to a service-based economy, the demand for location specific amenity services from "green infrastructure" has increased (Kline and Wichelns, 1996; Platinga and Miller, 2001; Irwin and Bockstael, 2001). These resources provide recreational opportunities, scenic quality and other non-market benefits that attract new development (Irwin and Bockstael, 2001; Dissart and Deller, 2000). Natural and environmental services can also attract population and income growth and facilitate rural economic growth (Deller, et al., 2001; Duffy-Deno, 1998).

Unmanaged and unsustainable use of natural and environmental resources has, on the other hand, resulted in resource degradation. Air pollution, water quality deterioration, forest clearing, urban development encroachment on sensitive lands and ground water contamination are a few examples of the potential impacts of the mismanagement of natural and environmental services. With broader citizen understanding of the value of conserving natural and environmental resources on the one hand, and with increasing pressure on such resources from their unsustainable use on the other, a debate arises as to what responsibility states have in natural resource conservation and conservation fund commitment. From 1997 to 2004, for instance, there have been more than 1,100 referenda for conservation in state, county and municipal ballots across the U.S. In these referenda, over 75 percent have passed with large margins (Banzhaf, et al., 2006). This nationwide trend in voter preference for conservation of natural resources is one key indicator of citizens' preference for conservation funding. Some states have responded by introducing policies to limit the environmental impact of development (Nickerson and Helerstein, 2003; Agthe, et al., 1996), and by committing conservation funding to mitigate and protect from the negative impacts of growth and development on "green assets."

In this study, we define conservation spending as the portion of a state's spending (or budget item) related to natural resource conservation and environmental protection, including the budgets of such agencies as departments of environmental quality, departments of environmental protection, and departments of forestry, fish and wildlife, and related agencies, but excluding agricultural and farmland preservation spending. Detailed information for each state on state agencies, major natural resource concerns, and funding sources are provided in Appendix B.

Observation of such conservation spending data in the U.S. reveals significant differences across states, ranging from $552 per capita in Wyoming (which has had two referenda) to

$17 per capita in Georgia (which had 20 referenda). In Michigan (which has had 32 referenda), conservation spending stands at $25 per capita.
These observations pose a number of critical questions about conservation spending and policy:

(1) What drives the level of states' conservation spending?
(2) What explains differences in conservation spending across states?
(3) Can one determine a benchmark for state conservation spending?
(4) Is conservation spending sensitive to states' socioeconomic and political structures?

The main goal of this study is to understand the determinants of conservation spending in the U.S. and to explain differences across states in conservation funding commitment. The study also aims to establish a benchmark for each state's conservation funding and compare current spending patterns against the established benchmark. In conducting such analysis, the study develops the concept of a "funding gap" for each state. This gap is estimated as the difference between each state's spending, given its unique reality, resource quality and size, socioeconomic differences and variations in political structures, and each state's expected spending, as determined from our analysis of all states. Cross-state comparison of conservation spending is useful in ranking states according to their conservation funding commitment and would indicate the amount of funding needed to make each state "conservation-competitive."

Determining and understanding the drivers of state conservation funding have significant policy relevance, particularly in states where budgetary deficits have a major impact on natural resource and environmental public programs. First, the ability to link state conservation spending, through modeling, with the natural resource base, and the socioeconomic and political conditions of each state, will allow for the determination of the level of conservation spending needed in each state. Since each state is different in the mentioned factors, accounting for such differences will help generate funding benchmarks. Public debate about conservation funding and policy will thus be better informed if such information becomes readily available. Second, estimating the conservation spending gap in each state on the basis of socioeconomic, natural resource base, and political factors, and analysis of how different scenarios may increase or decrease conservation spending in the future, is useful for long-term conservation policy and strategy. And finally, this study's results can hopefully better equip legislators to make informed decisions regarding conservation funding.

3.2 Determinants of Conservation Spending

The literature on determinants of public spending is quite extensive and well established, as the issue has been well investigated. However, when it comes to the unique segment of public spending, i.e., conservation spending, very little work has been done. For instance, Pergams, et al. (2004) argued that the level of conservation activity is tied to trends in the U.S. economy. Others have also argued that the level of state spending on environmental programs is tied to the state's ability to tax, voter perception of the importance of environmental problems in the state, and characteristics of the legislature (Agthe, et al., 1996). Aside from these few studies that focus on environmental program funding, the bulk of the literature focuses on drivers of general public spending.

A number of studies suggest that public spending is significantly determined by demographic, socioeconomic and political factors. Demographic factors, such as population density, urban-rural distribution of population and age distribution are important drivers of public spending (Ohls and Wales, 1972; Benson and Engen, 1988; Case, et al., 1993). Population density may capture the need for concentrated demand for public services; urban-rural population distribution may capture relative political stake and degree of political participation to demand public services; and age distribution determines public services that are tied to age groups, such as education and health care. Therefore, demographic factors can play a significant role in shaping public spending behavior. However, whether or not demographic factors can determine non-agricultural conservation spending remains an empirical issue.

Socioeconomic factors that can potentially determine public spending patterns include per capita income, property tax rates, owner-occupied housing, marginal tax rates, and inter-governmental competition (Ohls and Wales, 1972; Blackley and Deboer, 1987; Benson and Engen, 1988; Knapp and Graves, 1989; Agthe, et al., 1996; Brueckner, 2000). The tax base and the structure and source of taxation can determine the resources available for public spending. State per capita income could be a proxy for state residents' wealth. The higher the income, the greater the demand could be for numerous public services. Inter-governmental competition can also determine the level and composition of public spending to attract and increase tax bases or to maintain population and tax base.

Political factors also play a key role in determining the composition and level of spending on public programs. Voters assess state politicians on the basis of their preferences and cross-jurisdictional (or "yard-stick") competition. The fact that voters have a degree of control on political choices through their voting preference means that public programs that reflect the wishes of the median voter are more likely to be pursued (Besley and Case, 1995; Bloch and Zanginobuz, 2006; Banzhaf, et al, 2005; Gucio and Mazza, 2006). The composition of the state legislature and its competitiveness could also be an important determinant of public spending (Agthe, et al., 1996).

Even though socioeconomic and political factors generally determine the level of public spending, the extent to which such factors also determine conservation spending is an open empirical question. The literature is generally silent on whether the quantity and quality of natural resources could determine spending on environmental programs. For instance, Agthe, et al. (1996) argued that the quality of environmental programs can determine state spending on such programs. However, the role of the size of the natural resource base in state conservation spending behavior is not considered in prior studies.

This study, therefore, hypothesizes that demographic, socioeconomic, and political characteristics of each state will determine the level of state commitment to conservation spending. An additional hypothesis that the level of natural resource endowment can potentially influence the level of state conservation spending is posed.

3.3 Econometric Model, Data and Estimation

The study's focus is on conservation funding gap analysis. This is to determine whether current levels of conservation spending are consistent with the level of funding expected based on natural resource endowment, socioeconomic characteristics of the state, and existing political environment, especially as it relates to the power base and role of the conservation community. The latter factors define the characteristics of the state and its ability to fund conservation. In general, states with large amounts of natural resources are expected to spend more on conservation, as are states with large tax base, lower levels of social problems like poverty, conducive political environment, and lower public debts. The reason being the existence of social problems, public debts and less conducive political environments can shift the priorities of the state away from conservation funding to other social programs. The reality of a fixed budget pie on a year-to-year basis highlights the fact that allocation to any social program will have a direct effect on other programs, including conservation of resources. As a result, this study focuses on state characteristics, resource endowment, budgetary constraints and political environments to determine whether there is a gap in conservation spending for Michigan and other states.

The study uses a political economy framework. In many cases, funding for public programs has a political and economic component, and a political economy framework provides the ideal approach to study determinants of public spending on a specific program (Besley and Case, 1995; Bloch and Zenginobuz, 2006). The framework for estimating the drivers of conservation spending in the U.S. is such that conservation spending is a function of each state's socioeconomic, political, natural resource base and other relevant factors as discussed in the general literature. Following these arguments, the econometric model to decompose the determinants of public spending on non-agricultural conservation spending can be given as:

$$CS_m = \beta_0 + \sum_{i=1}^{I} \beta_i NR_{im} + \sum_{j}^{J} \beta_j SE_{jm} + \sum_{k}^{K} \beta_k POL_{km} + \sum_{l}^{L} \beta_l SSp_{lm} + e_m$$

where CS_m is non-agricultural and non-federal state government allocated conservation spending in each state, i.e. state m; NR_{im} is the natural resource base that encompasses endowment of all the major natural resources in each state (rangelands, wetlands, forest, park acres, river miles, ocean coast, Great Lakes coast, inland lakes and total coastal water management responsibility areas); SE_{jm} is the socioeconomic factors such as public debt, state GDP, per capita taxes and poverty rate; POL_{km} refers to political factors such as lower and upper house competitiveness, dominance of the legislature by a particular party and other political factors; SSp_{lm} refers to state specific variables such as the percent of urban population and homeownership rates; and e_m refers to model errors.[6] Table 3.1 summarizes the list of variables used in the analysis.

[6]The model is tested for heteroskedasticity using White's test and for alternative specifications. A linear model and a double-log model were specified and tested. As is consistent in the public spending literature,

Table 3.1 Definition of Variables Used in the Analysis

Variable	Definition
Conservation Spending	
LCONSPPC	Log of conservation spending per capita.
Natural Resource Base	
LH2O	Log of water acres.
LRANGE	Log of rangeland acres.
LWETLND	Log of wetland acres.
LFOREST	Log of forestland acres.
LPARKS	Log of park acres.
LRIVER	Log of river miles.
LOCEAN	Log of ocean miles.
GRTLKS	Great Lakes coast miles.
LINLDLKS	Log of inland lakes acres.
TWBRESP	Total area of water boundary responsibility.
Socioeconomic and Demographic Characteristics	
LPOV	Log of poverty rate.
LOWNOCC	Log of percent of owner occupied houses.
LPCGDP	Log of per capita GDP.
LPUBDEBT	Log of public debt.
LPCTAX	Log of per capita taxes.
LURBAN	Log of percent urban population.
Political Characteristics	
LHCOMP	Lower house competitiveness.
UHCOMP	Upper house competitiveness.

Conservation spending data was critical for this study. Since there was no central report to get such information, conservation spending data for each state was collected from each state's budget office website. Data was available for a few years, and data reporting years were not similar in some cases. Some states provide such information annually, while others (North Dakota, Oregon, Texas, Washington, and Wyoming) have a biannual conservation spending data collection process. Adjustments were made to account for reporting differences across states. Spending data reflect appropriations from state general funds, special funds, capital funds and other sources (see Appendix B). States use these sources to fund agency and department operating budgets as well as to support specific conservation programs. These spending items are aggregated to determine each state's conservation spending levels. The data was transformed into log and other forms for estimation purposes, and the appropriateness of such transformation was tested in the process of model estimation.

Data on each of the categories of causal factors identified above are collected from different sources. For the natural resource base, spatial data on water acres, rangelands,

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a double-log model performed better. Hence, the estimates and other analyses are based on the double-log specification.

wetland, forestland, parks, rivers, ocean coasts, inland lakes and coastal water administration responsibility area were generated by spatial analysts with the Hannah Professor Research Program of the Land Policy Institute at Michigan State University. For socioeconomic characteristics category, data on state GDP, public debt, poverty and per capita taxes were collected from the U.S. Census Bureau reports and State and Local Government Finance report of U.S. Census Bureau. Data on other state specific characteristics, such as percent of urban population and percent of owner occupied houses were also collected from U.S. Census Bureau reports.

The state political environment category essentially captures the dynamics of state politics. Data on the legislative competitiveness, such as number of lower (Representatives) and upper (Senate) house seats occupied by Democrats and Republicans, which were collected from the Census of Government (U.S. Census Bureau). The variables used in estimating the model are described in Table 3.1.

3.4 Empirical Results

The empirical model explains 70 percent of the total variation in conservation spending in the U.S. The results are reported in Table 3.2. Focusing first on whether natural resource base factors determine the pattern of public spending on conservation, Table 3.2 reveals that despite expectations, conservation spending in the U.S. is not primarily driven by the size of the resource base. Results indicate that the size of rangelands, wetlands, forested lands, parks, river miles, ocean coasts and coastal water boundary responsibility area do not have a systematic relationship with per capita conservation spending.

The only natural resource factor that varies systematically with spending is water acres, in which case states that are endowed with large portions of water bodies tend to spend less on conservation. This leads to the general observation that conservation spending at the state level in the U.S. is not driven by the extent of states' resource base. This finding is surprising, as one may expect a degree of systematic variation in conservation spending to be roughly proportional to the extent of the resource base.

State socioeconomic and demographic characteristics have a significant impact on per capita conservation spending. For instance, the level of poverty has a negative impact on conservation spending. It is estimated that a one percent increase in state poverty level results in a 0.86 percent decline in allocated conservation funding. The strong 1 to 0.86 percent proportionate impact of poverty on conservation commitment suggests that conservation activities are not undertaken independent of the level of socioeconomic parameters. It also suggests that there is a substantial trade-off among different public goals and public programs.

The level of state GDP has a positive and significant impact on states' conservation spending. The estimated relationship suggests that for every one percent increase in state GDP, conservation funding is expected to expand by 1.55 percent. Conversely, a one percent decline in state GDP will have a 1.55 percent expected cut in conservation funding. The result suggests not only that the level of state conservation funding commitment is directly tied to the health of the state's economy, but also that such spending may be a superior good which receives great attention at times of economic boom but gets less attention at times of economic slowdown. The result may suggest that states with economic hardship will have difficulty in allocating needed conservation funding and natural and environmental resource protection.

Table 3.2 Econometric Results of Drivers of Conservation Spending in the U.S.

Variable	Coefficient	p-value
Natural Resource Base		
LH20	-0.546**	0.026
LRANGE	0.002	0.921
LWETLND	-0.073	0.454
LFOREST	0.146	0.269
LPARKS	0.019	0.878
LRIVER	0.195	0.279
LOCEAN	0.024	0.594
GRTLKS	-0.0003	0.183
LINLDLKS	0.124	0.409
TWBRESP	$4.4x10^{-7}$	0.155
Socioeconomic and Demographic Characteristics		
LPOV	-0.863*	0.078
LOWNOCC	-0.396	0.823
LPCGDP	1.551***	0.0014
LPUBDEBT	-0.351**	0.019
LPCTAX	0.801*	0.067
LURBAN	-0.066	0.918
Political Characteristics		
LHCOMP	-0.504	0.562
UHCOMP	-2.359***	0.0003
INTERCEPT	8.710	0.108
R^2	0.699	
N	48	

Total outstanding public debt is a measure of the state's commitment to meet its loans for past borrowed spending. As expected, public debt has a negative impact on conservation spending. A one percent increase in state public debt decreases expected conservation funding by 0.35 percent. This suggests that long-term financial viability and state fiscal resiliency are critical in determining the level of state conservation funding commitment. In other words, states, on average, do not prefer to borrow money to pay for conservation, but prefer to pay for it from general revenue funds. In the context of the New Economy, where conservation is increasingly being looked at as a strategy for enhancing green infrastructure, the study team questions the decision of funding green infrastructure differently from other infrastructure that bond funds help support.

Related to public debt is the issue of the ability to tax. Increasing taxes has generally become a political challenge, and raising taxes to expand critical public investments, such as conservation, has become an even tougher political challenge in many states. The result indicates that states with better ability to tax are in a better position to fund conservation. The estimated relationship suggests that for every one percent additional ability to tax, conservation spending increases by 0.8 percent, which is quite a significant

proportion. The corollary to this finding is states that have a lower ability to tax to meet conservation funding have a lower per capita spending on conservation. The results of public debt and taxing ability together suggest that state fiscal policy and fiscal flexibility are crucial to meeting long-term conservation spending and investment targets.

To capture the role of state politics on conservation spending, two variables (factors) are considered: state lower house and state senate competitiveness. A competitive legislature is defined as one that has a 50 percent-50 percent representation of both parties or very close to balanced legislature, and a less competitive legislature is one that is dominated by one party. The most competitive house has a 50 percent-50 percent representation and the least competitive house has a 0 percent-100 percent representation. Competitive legislatures can force each party to develop aggressive programs median voters might approve, including conservation.

In an attempt to gain dominance, social programs, such as conservation, can be accelerated. This hypothesis is tested by constructing a legislative competitiveness index and measuring its impact on conservation funding. The result suggests that while state lower house competitiveness doesn't seem to significantly alter the pattern of conservation funding, state senate competitiveness has a significant and positive impact on conservation funding. For every one percent movement towards competitive state senates, conservation spending increases by 2.36 percent. Therefore, a one-sided senate is not necessarily beneficial to the conservation agenda. The measured impact is quite substantial and underscores the crucial role of politics in determining the pattern of state conservation spending.

Fundamentally, the results suggest that state conservation spending is not driven by the extent of a state's natural resource endowment, but rather by socioeconomic conditions and political characteristics. This finding uncovers a major constraint in the way conservation funding is channeled. An optimal conservation investment mechanism may put more emphasis on the quality and size of the resource to protect in determining fund allocation. The design of the current budgetary process that puts more emphasis on economic conditions, fiscal health and political atmosphere in allocating conservation funding pegs long-term natural and environmental resource protection and sustainability to factors that may not ensure sufficient resources for "green assets." As the future strength of service-based economies relies on the quality of "green assets," the current funding mechanism that doesn't explicitly account for resource base in funding in the U.S. poses serious conservation funding and conservation policy challenges, particularly in times of economic downturns and fiscal imbalance.

3.5 The Extent of Under-Spending on Conservation by State

The previous section provided information on the determinants of conservation spending in the U.S. This section discusses the gap between current actual conservation spending and what each state is expected to spend given its socioeconomic, demographic, natural resource base and political characteristics. Actual spending on conservation by state is already reported, but *expected* conservation spending by a state is determined by using the econometric model. The model provides expected spending for specific state characteristics. Figures A.1 to A.14 in Appendix A provide the state distribution of conservation spending per capita and other natural resource endowments for the states. This information is utilized in generating expected spending estimates for each state.

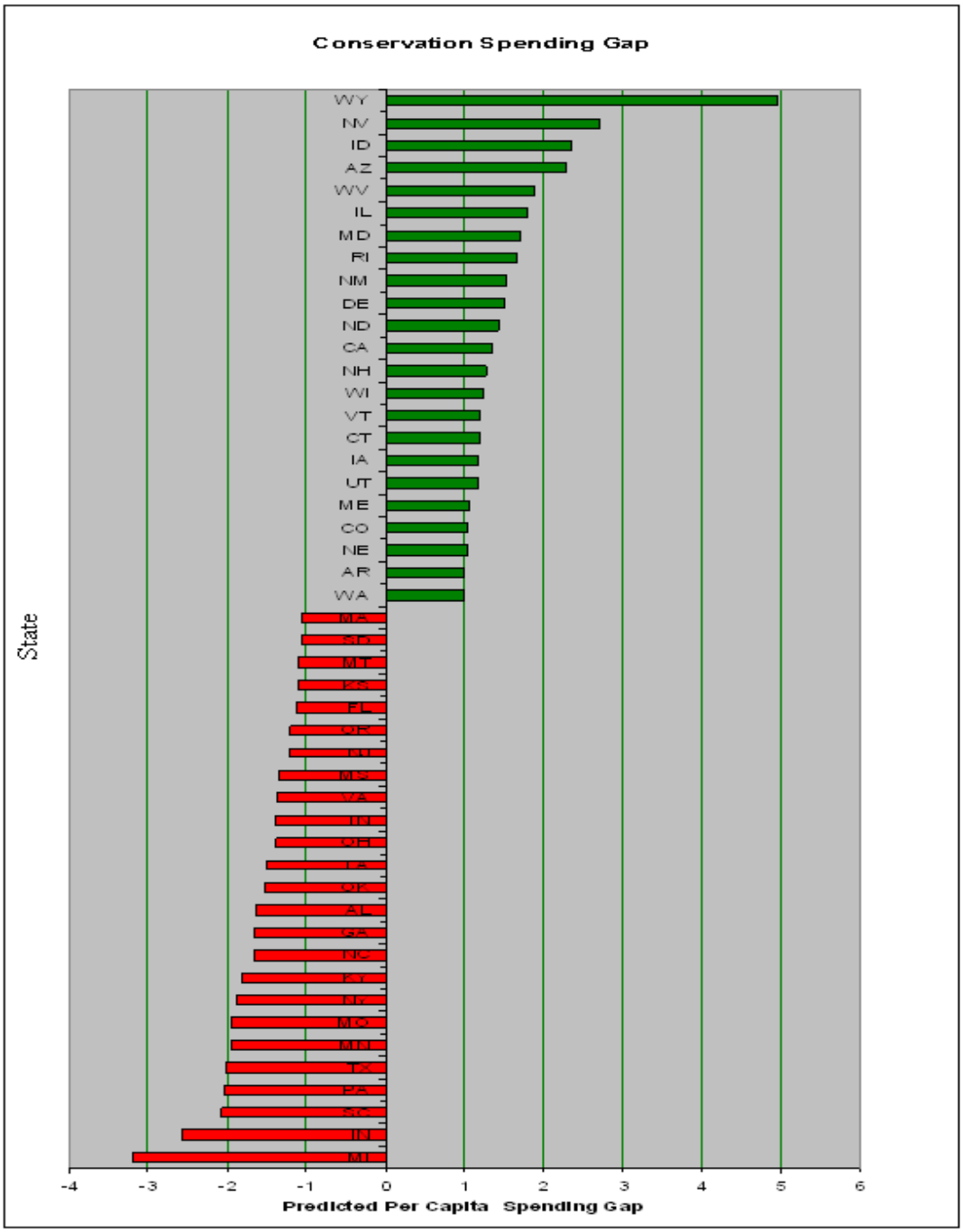
To determine the gap between current conservation spending and expected spending given state characteristics, the difference between the actual and the model projection is estimated. The difference in per capita conservation spending for all states is then ranked from the highest to the lowest. Results are demonstrated in Fig. 3.1. States indicated with green bars are the ones that are currently committing conservation spending above what is expected given their characteristics. In a sense, these states are "investing" in conservation. States with red bars are essentially "under-spending" on conservation given their characteristics.

While states such as Wyoming, Nevada, Idaho, Arizona, West Virginia, Illinois, Maryland, Rhode Island, New Mexico and Delaware comprise the top 10 states in the nation in terms of per capita non-agricultural land conservation resource commitment, states such as Michigan, Indiana, South Carolina, Pennsylvania, Texas, Minnesota, Missouri, New York, Kentucky and North Carolina are states with significant under-spending on conservation. Generally, Great Lakes States are over-represented in the bottom. Michigan has the nation's largest under-spending on conservation, estimated at -$3.2 per capita, or given the state's population estimate of 2006, about $32 million annually. The study considered 48 states in the analysis; hence the fact that 25 states are significantly under-spending on conservation nationwide underscores the need to push forward strategic conservation policies to place conservation goals at the center of future sustainable state growth strategies.

In the "New Economy," where green infrastructure provides a unique comparative advantage, the continued emphasis in public spending following "old economy" lines in many states is partially evident from this result. With global changes, the composition of states' output and economic structure is likely to transform in the coming decades. With continued emphasis on environmental quality, resource use, sustainability, demand for high amenity locations and new opportunities flowing to high quality locations and states, the need for protecting "green assets" becomes evident. The fact that 25 states still under-spend on conservation activities signals the need for broader initiatives and increasing awareness of the importance of conservation investment, not only as a tool of preserving

resources, but also as an economic prosperity strategy to capture a significant share of future "green-growth" and "green-development."[7]

Figure 3.1 Per Capita Conservation Spending Gap by State



[7] A quick look at recent economic performance of states suggests that many of the best performing states in income growth are within the top ten of the positive conservation spending gap. Idaho, the fastest growing state in 2006, is ranked in the top three in terms of positive spending gap. In fact, many of the leading states in economic growth appear in our top ten states.

3.6 Focus on Michigan

To investigate what needs to be done to close the current significant under-spending on conservation in the 25 states, a closer evaluation of each state and its characteristics is useful. This section focuses on a state that has the largest conservation spending gap per capita – Michigan, as a case in point. Even though Michigan has the largest under-spending on conservation per capita in the nation, the state is rich in natural resource endowment. Table 3.3 summarizes the ranking of Michigan in critical asset endowments.

Michigan is well endowed in water resources, such as the Great Lakes area, total coastal miles, and wetlands. The state also ranks 12th in water resources in general, 10th in state park acres, and 12th in inland lake area. However, despite the significant resource endowment, the state continues to commit fewer financial resources to conservation.

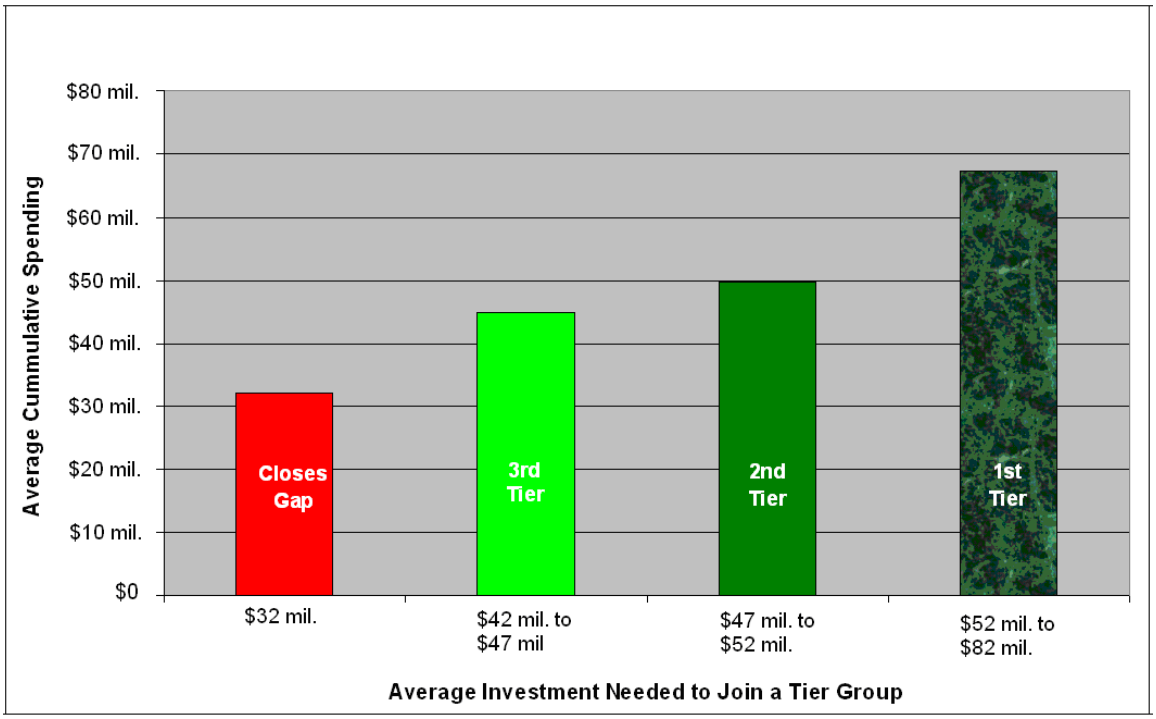
Table 3.3 Michigan's Natural Resource Endowment National Ranking

Natural Resources Features	Quantity	National Rank
Water (Acres)	1,022,080	12
Wetlands (Acres)	6,332,800	4
Rangeland (Acres)	782,720	21
Forest (Acres)	15,267,840	20
State Parks (Acres)	285,000	10
Rivers (Miles)	53,881	33
Ocean Coast (Miles)	0	22
Great Lakes Coast (Miles)	3,189	1
Total Coast (Miles)	3,189	3
Inland Lake Area (Sq Miles)	1,233	12
Inland Lake Perimeter (Miles)	13,605	8
Ocean Management (Sq Miles)	0	22
Great Lakes Management (Sq Miles)	24,733,827	1
Total Coastal Management (Sq Miles)	24,733,827	1

For Michigan to transform itself from its rank as the current lowest conservation investing state, and to join top investing states, the increase in funding needed is estimated and presented in Figure 3.3. Given Michigan's population, to close the conservation under-spending gap, Michigan will need an additional $32 million per year in conservation funding. To place Michigan with the third best category states, the State will need to commit an estimated $42 million to $47 million (or on average $44.5 million) in additional annual conservation spending. To place Michigan among the

second best conservation spending states, the State will need to commit an estimated $47 million to $52 million (or on average $49.5 million) in additional annual conservation spending. For Michigan to join the top conservation investing states in the nation, an estimated $52 million to $82 million (or on average $67 million) in additional annual spending on conservation will be needed. After closing the current spending gap, Michigan can choose to spend to join a higher category nationwide, but continual under-spending on conservation can compromise the future quality and quantity of resource available for sustainable growth and inter-generational resource transfer.

Figure 3.2 Michigan's Conservation Spending Gap by Tier Group



It is important to note that these estimated figures are based on current socioeconomic and political environment data. If Michigan's economic conditions improve, for instance if public debt levels drop, poverty levels are reduced, taxing potential increases, or the state's GDP increases, then the conservation spending numbers are expected to increase as well. The above indicated figures are the amount needed given the current economic realities of Michigan, and are expected to change if the underlying conditions in the state change.

3.7 Sensitivity Analysis of Socioeconomic and Political Changes and their Impact on Conservation Spending

As discussed previously, the estimated conservation spending gap for each state in this study is based on socioeconomic and political data in the study period. However, over time, socioeconomic and political factors are likely to change. To understand the impact of changes in these factors on conservation spending, we continue to focus on Michigan as a case in point, and conduct a sensitivity analysis. The sensitivity analysis is conducted for an improvement of two percent and five percent in socioeconomic and political environment and for a deterioration in socioeconomic and political climate within a two percent and five percent range. Since most of these variables are likely to change within this range over a short time period, the analysis can reflect likely outcomes in short-term changes of the discussed factors. Table 3.4 summarizes the sensitivity analysis results.

Table 3.4 Sensitivity Analysis of Conservation Spending Gap to Socioeconomic and Political Environment Changes in Michigan

Changing Variable (Factor)		Variable (Factor) Changes by:			
		-5%	-2%	+2%	+5%
GDP	Per Capita Spending Gap	$4.097	$3.519	$2.874	$2.469
	Total Dollar Amount of Gap	-$41,358,150.55	-$35,530,787.62	-$29,017,709.91	-$24,929,114.930
Public Debt	Per Capita Spending Gap	$3.003	$3.108	$3.254	$3.368
	Total Dollar Amount of Gap	-$30,321,931.32	-$31,382,181.85	-$32,853,741.43	-$34,002,520.39
Ability to Tax	Per Capita Spending Gap	$3.625	$3.351	$3.018	$2.791
	Total Dollar Amount of Gap	-$36,593,576.68	-$33,833,142.25	-$30,473,731.36	-$28,174,947.13
Poverty	Per Capita Spending Gap	$2.763	$3.006	$3.365	$3.661
	Total Dollar Amount of Gap	-$27,891,306.60	-$30,350,645.68	-$33,970,351.04	-$36,965,714.91
Political Competitiveness	Per Capita Spending Gap	$4.674	$3.710	$2.727	$2.164
	Total Dollar Amount of Gap	-$47,187,623.95	-$37,455,158.11	-$27,526,838.49	-$21,849,417.32

The current estimated under-spending on conservation in Michigan is $3.18 per capita or about $32 million. First, consider the impact of GDP changes. A five percent decline in state GDP is expected to cause a further deterioration in conservation funding, and the total gap is expected to increase to about $41.4 million. This amount will keep Michigan not only at the bottom of conservation spending in the nation, but also as the one with the most substantial gap from the national average. A two percent decline in state GDP is expected to cause a decline in conservation spending as well, with an estimated per capita gap of $3.519 or a State total gap of $35 million. If Michigan succeeds in improving the economy, and if GDP increases by two percent, the conservation spending gap is expected to decline to $29 million, and with a five percent increase in GDP, the gap is expected to decline further to $24.9 million. Obviously, moderate changes in the state economy will have significant impact on Michigan's ability to spend on "green assets" conservation.

Next consider total short- and long-term outstanding state debt. A decline in state debt is expected to increase ability to fund public programs. A five percent decline in State debt is expected to help lower the conservation spending gap to $3.003 per capita, or $30.3

million total. Similarly, a two percent decrease in State debt is expected to lower the conservation spending gap to $31.4 million. However, further indebtedness of the State, say by two percent, is expected to lead to a lower ability to spend on conservation, to result in a higher spending gap of $32.8 million. A five percent increase in public debt will further increase the gap to $34 million. The nature of state indebtedness is an important determinant of ability to invest in "green assets." Even though the impact of changes in state debt on spending are not as strong as the impact from GDP changes, their influence on spending, however, can not be minimized.

Now consider the ability to tax. Tax policy has been very intricate nationwide due to the politics of tax that overshadowed the economics of tax. Analysis of state spending patterns nationwide on numerous public programs has revealed that the ability to raise tax is a significant determinant of the level of spending. The sensitivity analysis result indicates that a five percent decline in the ability to raise taxes increases the conservation spending gap further to $3.625 per person, or to a State total of $36.6 million annually. A two percent decline in ability to tax will also increase the gap to $33.8 million. Since the current spending in Michigan per capita is the lowest in the nation, further decline in the ability to tax is expected to result in further decline in "green assets" conservation spending. On the contrary, an improvement in the State's ability to tax will help reduce the current gap in conservation spending. A two percent and a five percent increase in the ability to tax are expected to result in a decline to the current conservation spending gap to $30.5 million and $28.2 million, respectively. This result shows the importance of State fiscal policy and health in the sustained ability to direct resources to critical areas, such as "green assets" protection.

Poverty and other social problems have direct and indirect effects on the state's ability to direct resources to critical areas. The sensitivity analysis on poverty indicates that a two percent decline in poverty is expected to relieve resources that will lower the spending gap on conservation to $30.4 million. A five percent decline in poverty will help raise resources to reduce the current spending gap to $27.9 million. On the contrary, deterioration in poverty in Michigan will worsen the ability to spend on conservation. A two percent and five percent increase in poverty in Michigan are expected to increase the current conservation spending gap to $34 million and $37 million, respectively. As a result, public spending priorities, such as investment in "green assets" can not be seen in isolation of other social goals that demand resources from the same pool. An overall improvement in major social indicators in Michigan will help raise more resources for conservation in the future.

Now consider the political environment. This study tried to gauge the political system through its competitiveness. A competitive legislature is one that is well represented with lower level of dominance by one party. The result of this study already indicated that a competitive legislature nationwide is more conducive to conservation spending, and dominance leads to reduction in conservation spending. The sensitivity analysis shows that if the State Senate is further dominated by any party by two or five seats, the conservation spending gap is expected to increase to $37.4 million and $47.2 million, respectively. Of all the indicators considered, this is the largest estimated impact on the

conservation spending gap. Deterioration in a competitive state politics and movement towards dominance in State Senate will shift the priorities and result in substantial increase in spending gap. On the other hand, an improvement in the competitiveness of the State Senate will significantly help reduce the current spending gap. A two or five seats increase towards a balanced and competitive Senate, or a reduction in dominance, will help lower the current conservation spending gap to $27.5 million or $21.8 million, respectively. This is, by far, the largest drop in existing spending constraints as a result of changes considered within two percent to five percent in the existing environment. As such, politics plays a substantial role in determining the composition of public spending and, more particularly, the level of conservation spending.

In general, the current estimated gap of $32 million annually is based on currently available information and is likely to change due to changes in the socioeconomic and political environment. Conservation policy should, therefore, be keen to understand the links between future expected changes in the economy and implications to conservation funding and investment.

3.8 Conclusion and Policy Implications

This study delved into the issue of what determines conservation spending in the U.S. At a time where strategic regional economic strength emanates from the protection and enhancement of "green infrastructure" as a source of new comparative advantage, the way natural and environmental resources are managed will directly determine the nature of future growth in a service economy. Studies have extensively documented the non-market value of "green assets" on the vitality of "green assets" to attract population, employment, and income growth to a region, and on the quality of life contribution of such resources. As such, citizens have voted in ballots across the country demanding more conservation. However, the political and resource allocation response has its own dynamics. This study demonstrates that conservation spending in the U.S. is not directed by the underlying natural resource endowment, but rather by socioeconomic, demographic and political characteristics of states.

This finding raises critical questions and policy implications: (1) What are the long-term implications of pegging conservation funding to parameters that are not related to the resource base? (2) What is the long-term impact of not considering the quality or quantity of resources in determining conservation spending levels? (3) If conservation spending is influenced by other social programs and priorities, what will be the gap between actual and expected conservation spending, and how will this be resolved as we try to balance between growth and conservation? and (4) Can we design a conservation policy that is in tune with resource base and quality while capturing socioeconomic parameter changes? All of these are interesting conservation policy questions. The study demonstrates that what happens in the rest of the economy (fiscal balance, outstanding debt, taxing ability, GDP trends, etc.) and in the political arena have a substantial impact on conservation spending.

As states like Michigan strive to restructure their economy and enhance prosperity, the place for conservation investment in such initiatives becomes a concern. Environmental programs are often the ones that face budgetary cuts when an economic slowdown occurs. A mechanism within a budgetary process that will keep balance between growth priorities and the ability to sustain such growth in the future through effective resource protection will be a potential optimal strategy, but it has numerous challenges. The budgetary process itself is one with stiff political competition and haggling with outcomes that may not balance conservation against other defined social priorities. In an environment where current unemployment, budget deficit, poverty and other social challenges cloud the ability to think forward to create more opportunities using "green-growth" strategies to overcome such problems in the long-run can be overlooked, with substantial costs to future economic vitality and competitiveness in a changing global environment.

A comprehensive development strategy that encompasses natural resource protection as a central theme increases sustainability. Towards this end, a broader partnership between community leaders, legislators, conservation organizations, and the State will be crucial in prioritizing natural resource and environmental conservation investments and in protecting resources for future economic resiliency. This report, thus, aims to bridge the information gap and encourages broader debate for a comprehensive conservation agenda in the U.S.

General Conclusion

Michigan is endowed with a wide variety of natural resources, some of which are among the best in the nation. Michigan has the largest water boundary responsibility in the nation, some of the best wetlands, inland waters and attractive eco-tourism sites. These natural resources can play a critical role in supporting "New Economy" growth in Michigan.

In leveraging natural resources for New Economy growth, it is important to understand the role and impact of natural resources in Michigan's economy and the quality of life of its citizens. Information on the relationship between green infrastructure assets and economic impacts and performance is crucial for designing and implementing natural resource policies that facilitate the transition to the New Economy.

This report provides results from three studies that are focused on informing the links between green infrastructure assets and the economy. The first study focused on the impact of natural resources on property values and on valuation of green infrastructure assets, the second study focused on the economic impact of state parks and the third study focused on conservation spending in Michigan vis-à-vis the national trend. Combined, these three studies provide a framework to comprehensively assess the economic value of green infrastructure, the economic impact of green infrastructure assets and state conservation funding.

First, based on the green infrastructure valuation study in Hillsdale and Oakland Counties, results consistently show that green infrastructure assets have significant positive value. The major policy conclusions are:

(1) Natural amenities do matter, have significant value, and have a bearing on local property values. Therefore, efforts to protect such resources are sensible responses to protecting value.

(2) Natural amenities have substantial effect on local property values, from which some local public services are provided. To the extent that property taxes are relevant to local government units, understanding the important links provided in this study between local economies and natural resources is crucial.

(3) Natural amenities are different in value as implicitly measured in the market place; as such, estimated green infrastructure values can provide the guide as to which resources are highly valued by local residents for conservation purposes, especially in the face of limited conservation funding.

(4) Given the fact that green infrastructure affects taxable property values, local decision makers can enhance long-term financial viability of their communities through green infrastructure-based strategies.

Second, based on the economic impact results of the Rifle River Recreational Area (RRRA) study, state parks can have significant economic impacts. Findings indicate that RRRA annual visitor spending impacts to the local economy include 32 jobs in direct job creation and 5 jobs in induced job creation, and $933,033 in total value added impacts. The major policy conclusions are:

(1) To the extent that the services of green assets are related to economic impact, sustainable and viable utilization of these resources can translate into economic outcomes.

(2) To the extent that green-assets are tied to creating or enhancing local economic opportunities, they can be used as strategic assets for local comparative advantage.

(3) Conservation of natural resources and economic growth need not be antagonistic, and in fact can be synthesized in win-win sustainable use of green assets to foster economic prosperity.

Third, based on results from the state conservation spending study, state conservation funding is not driven by a natural resource base, but primarily by state socioeconomic and political characteristics. Results also indicate that Michigan ranks the lowest in conservation spending per capita in the nation, after adjusting for its natural resource base, socioeconomic and political characteristics. This is crucial to note as the previously mentioned two studies established the significant economic value of protecting and leveraging natural resource assets. The major policy conclusions are:

(1) Conservation spending in the U.S. is not significantly driven by the natural resource base of states but by state socioeconomic and political factors. Thus, the long-term implications of pegging conservation spending to other factors than the natural resource base need to be carefully considered.

(2) Michigan ranks last in adjusted per capita conservation spending. As states like Michigan strive to restructure their economy and enhance prosperity, the place for conservation investment in such initiatives becomes a concern.

(3) Natural resource and environmental programs are often the ones that face budgetary cuts when an economic slowdown occurs. A mechanism within a budgetary process, that will keep balance between growth priorities and the ability to sustain such growth in the future through effective resource protection, may need to be considered.

(4) In an environment where current unemployment, budget deficit, poverty and other social challenges cloud the ability to think forward to create more opportunities using “green-growth” strategies, long-run green asset-based opportunities can be overlooked, with substantial costs to future economic vitality and competitiveness in a changing global environment.

In conclusion, as Michigan strives to foster economic prosperity, green infrastructure can play a crucial role in providing local economies with needed support. As the transition from green assets to economic performance becomes better known, the strategic role of green infrastructure in revitalizing and enhancing local economies will become more apparent.

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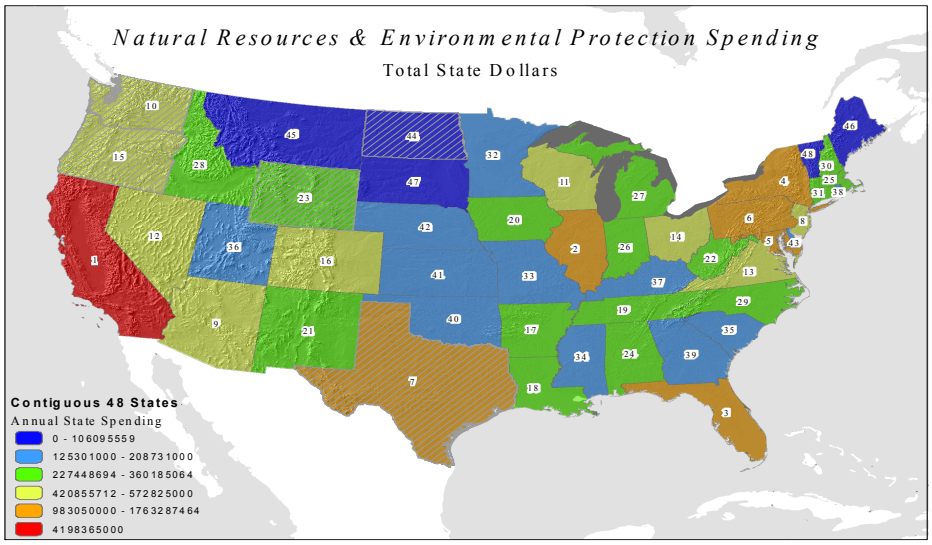
Appendix A

Figure A.1



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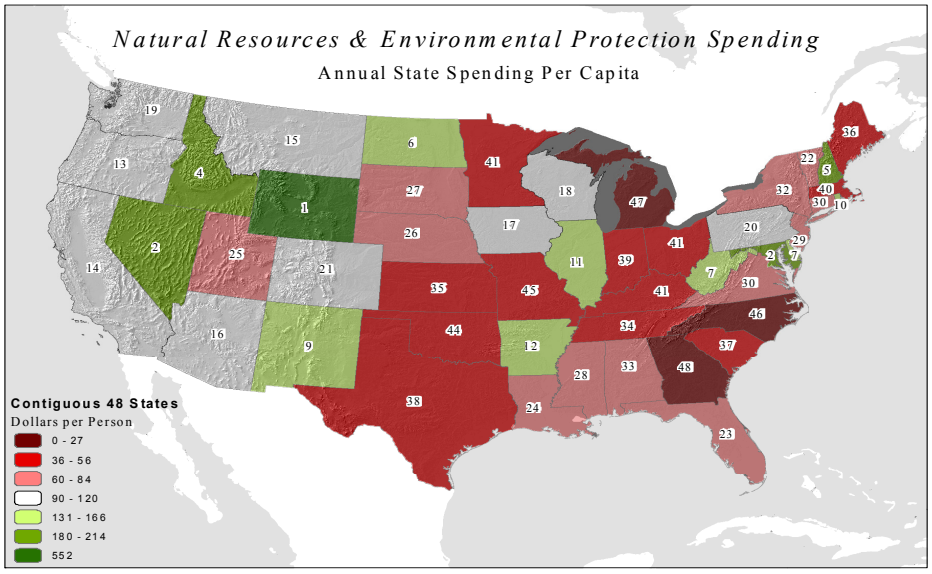

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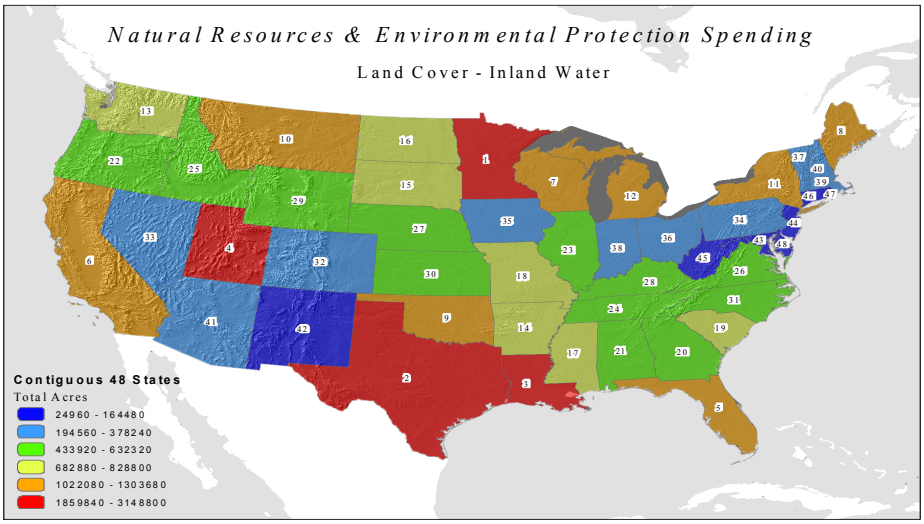

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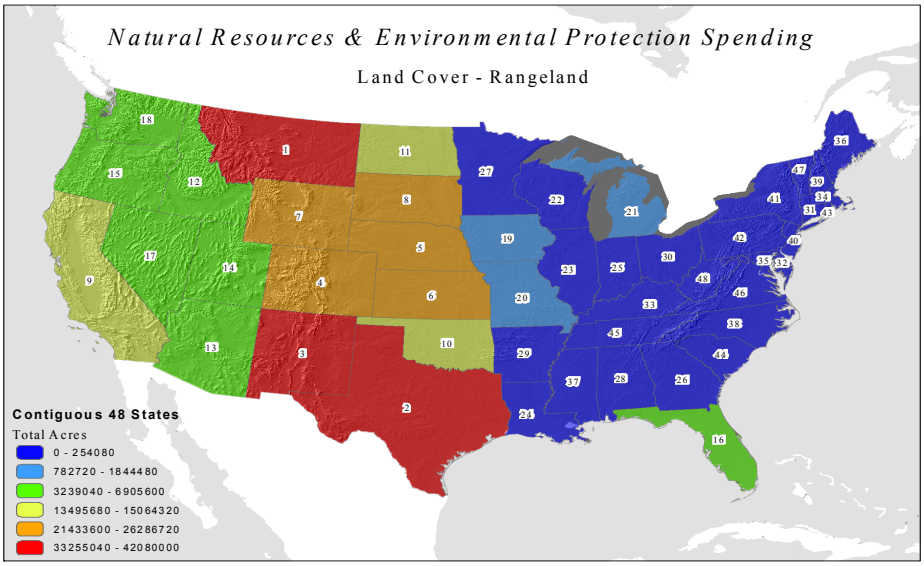

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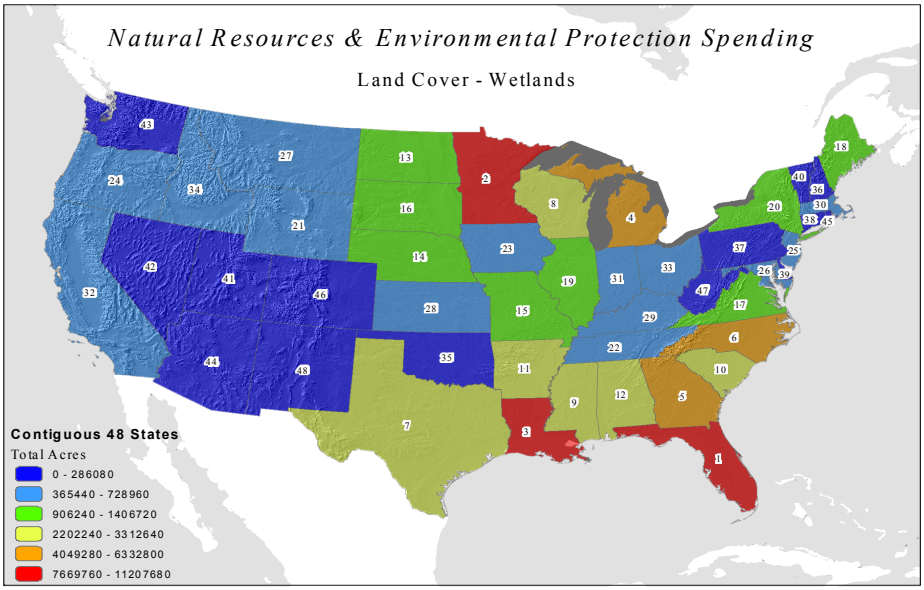

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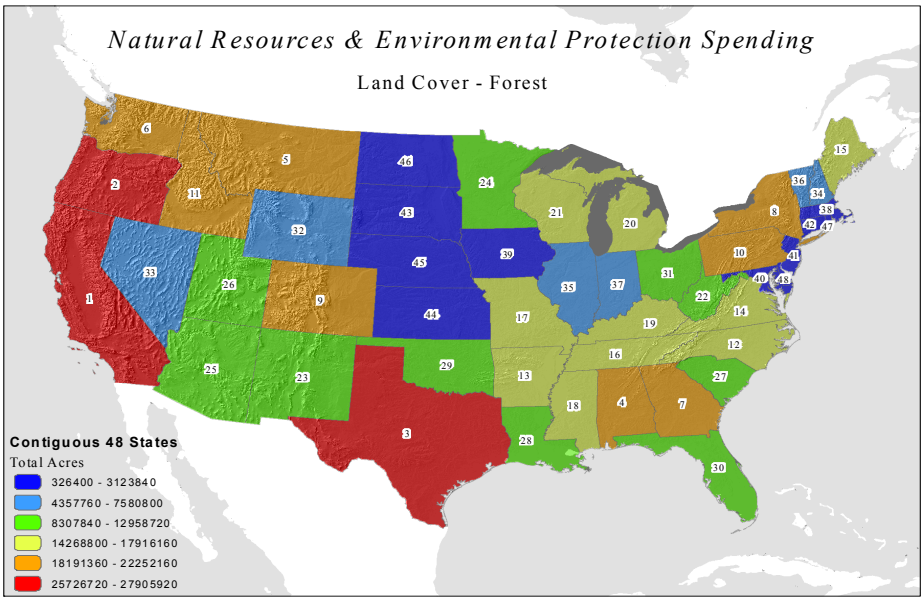

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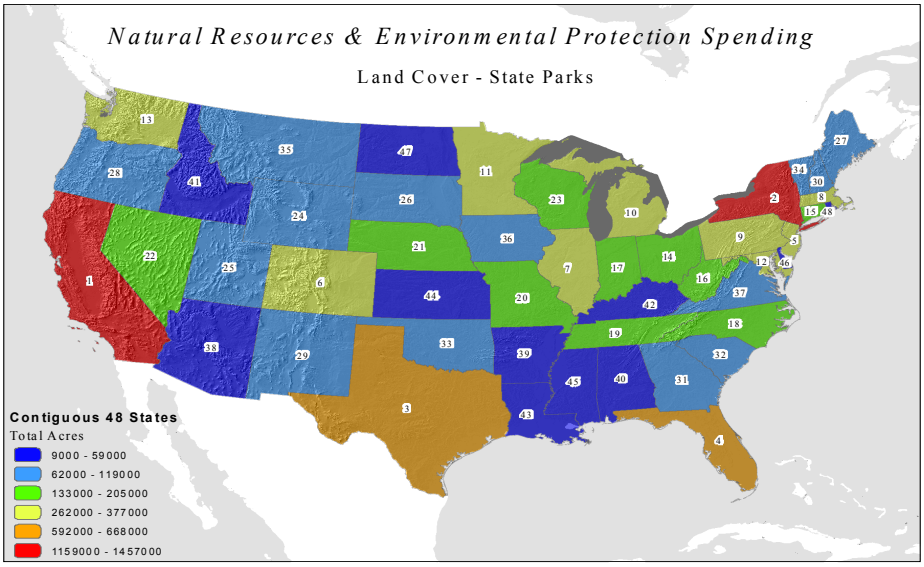

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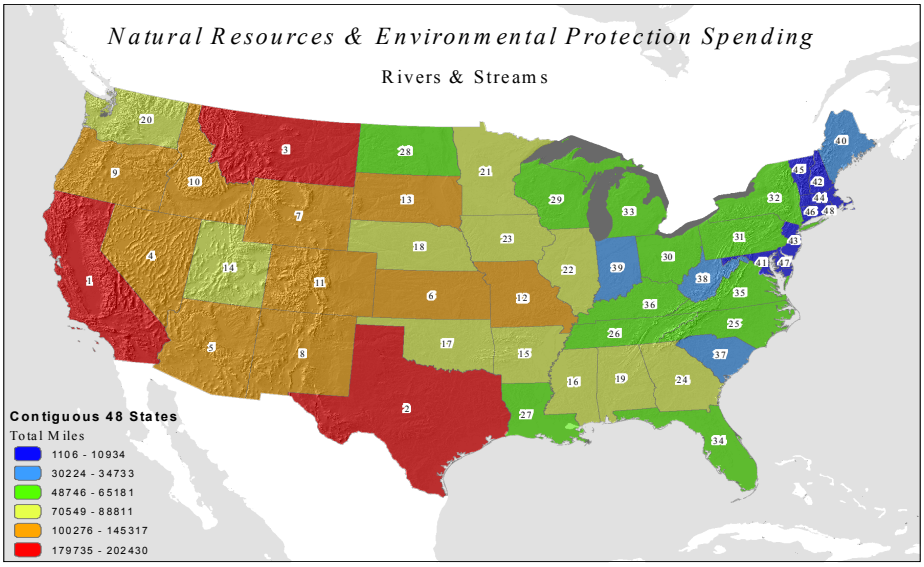

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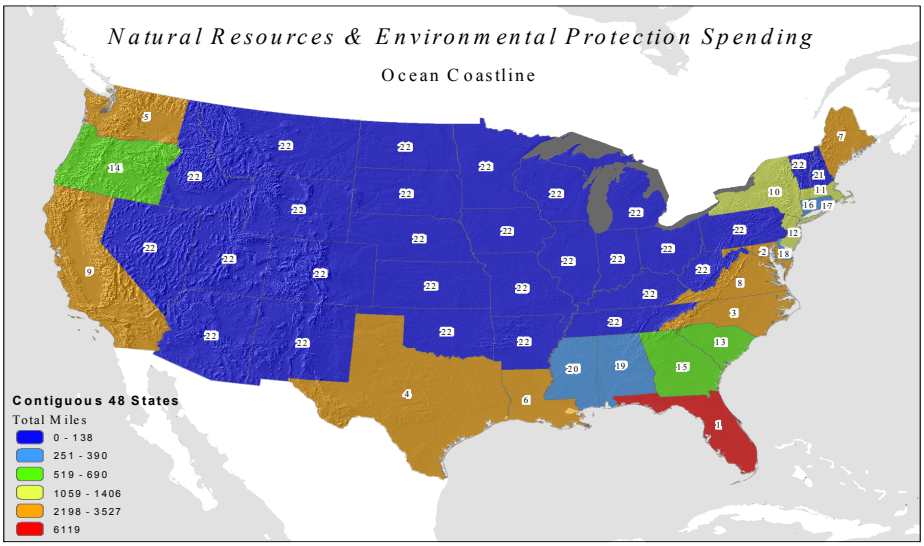

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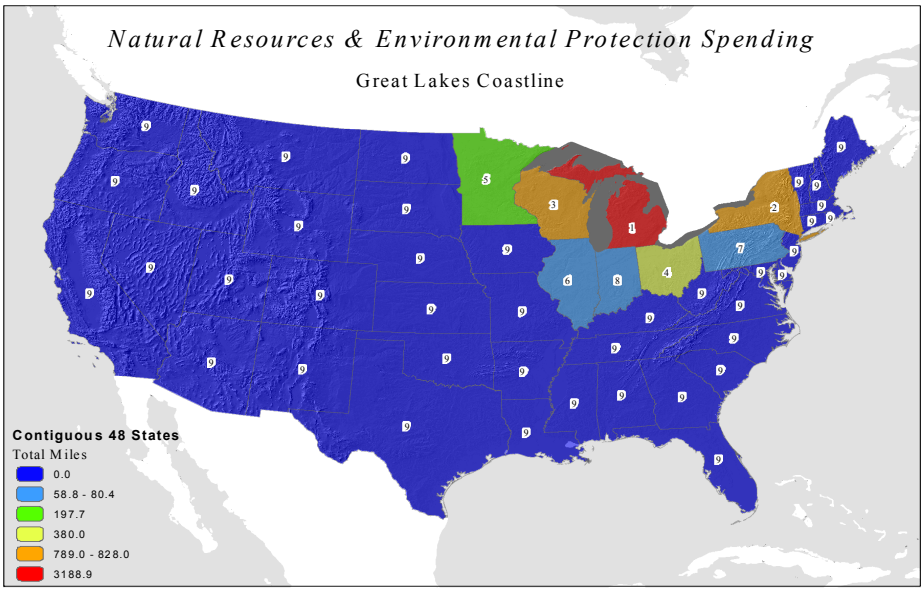

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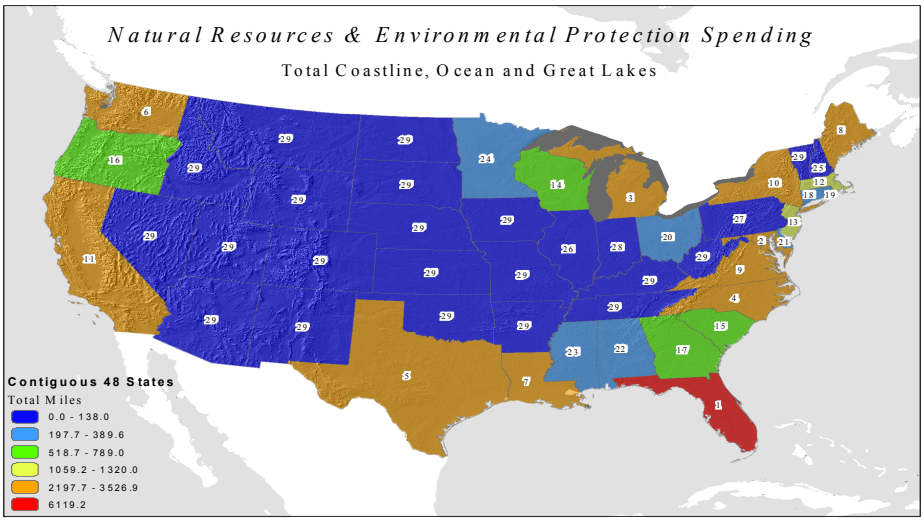

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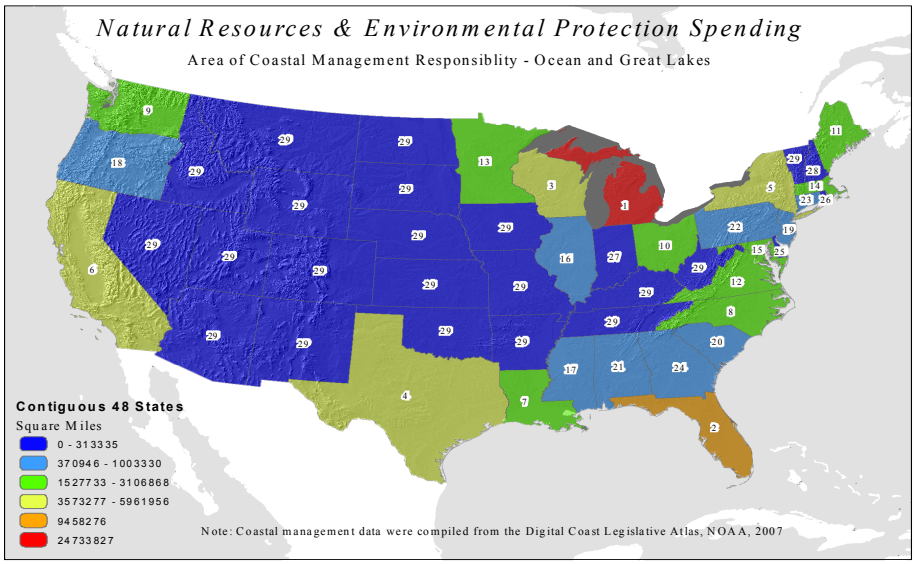

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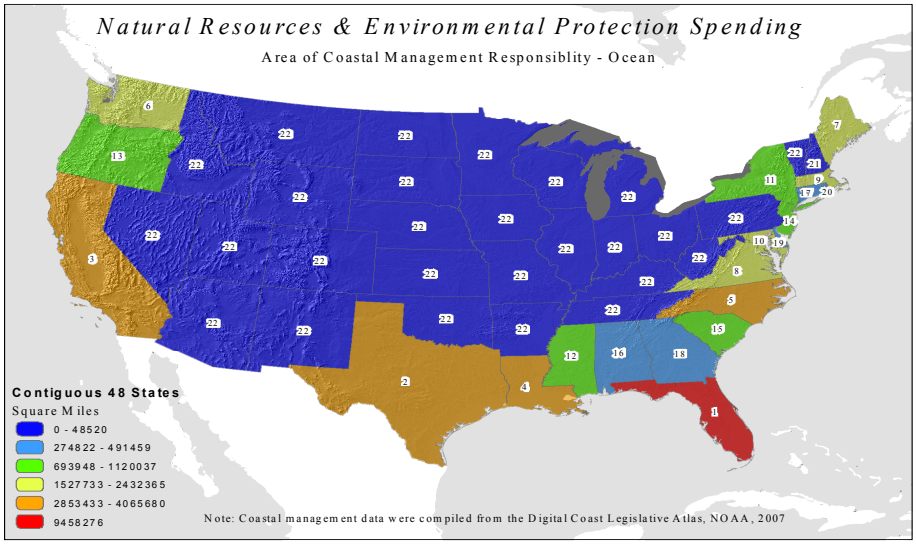

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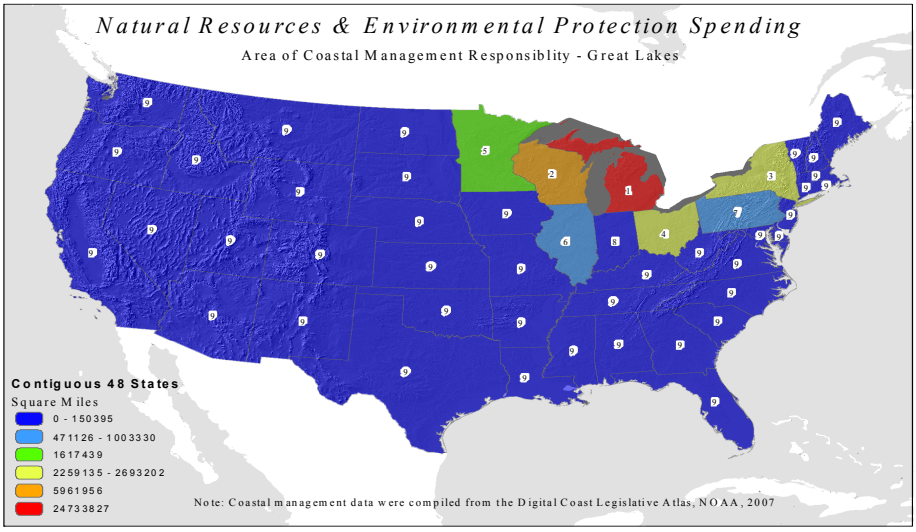

Appendix B

State Agencies, Major Conservation Issues and Source of Funding by State

Alabama –

- Agencies: Department of Conservation and Natural Resources, Department of Environmental Management, Forestry Commission, Board for Registry of Foresters, Forever Wild Trust Fund, Forever Wild Trust Stewardship Board, Soil and Water Conservation Commission, and Various River/Creek/Watershed Commissions and Management Authorities.
- Basic Characteristics: The Department of Conservation and Natural Resources houses the divisions dealing with State Parks, Public Lands, Research and Management, Coastal Activities, and Education, and promotion of outdoor activity. The Department of Environmental Management has divisions for the protection of Air, Land and Water, as well as divisions dedicated to Field Operations, Permits and Services, and the administration of the Department. The other commissions and boards generally fall under the executive branch of the state government.
- Major Resources/Issues: Fish and Game, "Watchable Wildlife", Coastal Ecosystem, Water, Boating and Education.
- Type of Budget: General Fund Appropriations.

Arizona –

- Agencies: Department of Environmental Quality, Game and Fish Department, State Land Department, State Parks Board and Department of Water Resources.
- Basic Characteristics: These agencies and departments exist independently, except for the Fish and Game Department, which is under the Game and Fish Commission.
- Major Resources/Issues: Fish and Game, Pollution Standards and Enforcement, Fire Management, Colorado River and Grand Canyon.
- Type of Budget: General Funds, Appropriated Funds and Non-Appropriated Funds.

Arkansas –

- Agencies: Department of Environmental Quality, Game and Fish Commission, State Land Commissioner, Board of Registration for Foresters, Forestry Commission, Department of Arkansas Heritage, Natural and Cultural Resources Council, Natural Resources Commission, and Department of Parks and Tourism.
- Basic Characteristics: The Game and Fish Commission and the State Land Commission are Constitutional offices. The Board of Registration for Foresters is considered a regulatory board. The others are state agencies.
- Major Resources/Issues: Rivers and Streams (Extraordinary Resource Waters), mining, Conservation District Beaver Control Program, Wetlands, Recreational Fishing, Commercial Catfish Operations, Captive Wildlife and Nuisance Wildlife.

- Type of Budget: General Revenue, Special Revenue, Cash Funds, Trust Funds and Other/Revolving Funds.

California –

- Agencies: Department of Conservation, California Environmental Protection Agency, Department of Water Resources, Department of Fish and Game, Air Resources Board, Department of Forestry and Fire Protection, Tahoe Conservancy, California Conservation Corps, Energy Resource Conservation/Development Commission, Renewable Resources Investment Program, Colorado River Board of California, State Lands Commission, Wildlife Conservation Board, Department of Boating and Waterways, Coastal Commission, State Coastal Conservancy, Native American Heritage Commission, Santa Monica Mountains Conservancy, San Francisco Bay Conservation and Development Commission, San Gabriel/Lower Los Angeles River/Mountains Conservancy, San Joaquin Mountains Conservancy, Baldwin Hills Conservancy, Delta Protection Commission, San Diego River Conservancy, Coachella Valley Mountains Conservancy, Sierra Nevada Conservancy and Bay-Delta Authority.
- Basic Characteristics: Entities can be described as agencies, commissions, boards and conservancies.
- Major Resources/Issues: Biodiversity, Open Space and Agricultural Land Preservation, Energy (oil and gas, renewables), Mining, Water Resources, Trees and Forests, Wildlife and Wildlife Habitat, Ocean Coast, Air Quality, State Parks, Historic Landscapes and Native American Resources.
- Type of Budget: General Fund, Special Funds and Bond Funds.

Colorado –

- Agencies: Department of Natural Resources (DNR) and Department of Public Health and Environment. The Colorado DNR has the following major divisions: Division of Wildlife, State Parks, Oil and Gas Conservation Commission, Division of Water Resources, Water Conservation Board, Geological Survey, Board of Land Commissioners, Division of Reclamation Mining and Safety, and Division of Forestry.
- Basic Characteristics: All activity falls under the two departments, each with multiple divisions.
- Major Resources/Issues: Water Resources, Inventoried Roadless Area Task Force, Wildlife Habitat Protection Program, Water and Air Quality Control, Hazardous Materials, Waste Management, Colorado River, Grassland Conservation plan and Wetlands Partnership.
- Type of Budget: General Fund, Cash Funds and Cash Funds Exempt.

Connecticut –

- Agencies: Department of Environmental Protection (DEP).
- Basic Characteristics: Connecticut DEP has many bureaus, offices, and programs to manage natural resources and environmental protection. The DEP is part of the executive branch of the state government.

- Major Resources/Issues: Coastal Management, Stream Habitat Restoration, Hazardous Waste, Pollution, Environmental Justice, Recreational Hunting and Fishing, Forestry, Wildlife, State Parks, Lakes and Ponds, Endangered Species, Long Island Sound Restoration, Nitrogen Reduction, and Greenhouse Gas Emission Reduction.
- Type of Budget: General Funds and Capital Funds.

Delaware –

- Agencies: Department of Natural Resources and Environmental Control.
- Basic Characteristics: Under the single department, we find the Division of Air and Waste Management, Division of Water Resources, Division of Fish and Wildlife, Division of Soil and Water, Division of Parks and Recreation, Delaware Energy Office and Division of Boiler Safety.
- Major Resources/Issues: Natural Heritage and Endangered Species Program, Delaware Shorebird Project, Operation Game Theft, Northern Delaware Wetlands Rehabilitation Program, Mosquito Control, Education, and Shoreline and Waterway Management.
- Type of Budget: General Fund.

Florida –

- Agencies: Department of Environmental Protection (DEP), and Fish and Wildlife Conservation (FWC) Commission.
- Basic Characteristics: DEP is divided into three areas: Regulatory Programs, Land and Recreation, Planning and Management. The FWC was created by Constitutional Amendment 5 in 1999, by combining the former Florida Game and Fresh Water Fish Commission, Florida Marine Fisheries Commission, and parts of the Department of Environmental Protection.
- Major Resources/Issues: Everglades Conservation and Restoration, Coastal Habitats, Red Tide, Commercial and Recreational Fishing, Air and Water Quality, Recreational Activities, State Parks, Land Conservation and Imperiled Species.
- Type of Budget: General Fund.

Georgia –

- Agencies: Georgia Forestry Commission and Department of Natural Resources (DNR).
- Basic Characteristics: All programs/activities fall under the above two entities, one a state agency and the other a commission established by the Georgia Legislature. The DNR has the following divisions: Coastal Resources, Environmental Protection, Historic Preservation, Parks Recreation and Historic Sites, Pollution Prevention Assistance, Program Support, and Wildlife Resources.
- Major Resources/Issues: Coastal Management, Commercial Fishing, Education, Saltwater Recreational Fishing, Water and Air Quality, Water Use, State Parks, Hunting and Freshwater Fishing, Forest Resources and Aquatic Nuisance Species.
- Type of Budget: General Funds, Capital Funds and Other Funds.

Idaho –

- Agencies: Department of Environmental Quality, Department of Fish and Game, Department of Lands, Department of Parks and Recreation, Department of Water Resources, Governor's Office of Species Conservation, Soil Conservation Commission, Forest Products Commission and Lava Hot Springs Foundation.
- Basic Characteristics: The Soil Conservation Commission is under the Department of Agriculture, but is included in the budget total. The Office of Species Conservation reports to the Governor. The Lava Hot Springs Foundation reports to the Department of Parks and Recreation. The Forest Products Commission was created by the legislature and its five members are appointed by the Governor. The other entities are state agencies.
- Major Resources/Issues: Big Game Hunting, Recreational Fishing, Air and Water Quality, Waste Management, Water Use, Threatened and Endangered Species, and Forest Management and Forest Products.
- Type of Budget: General Fund, Dedicated Funds and Other Funds. The Forest Products Commission budget is not included in the state total because it is entirely financed by mandatory assessments from the forest industry.

Illinois –

- Agencies: Environmental Protection Agency (EPA), Department of Natural Resources (DNR) and Drycleaner Environmental Response Trust Fund Council (DERTFC).
- Basic Characteristics: Entities are either agencies (EPA, DNR) or an executive branch council (DERTFC).
- Major Resources/Issues: Environmental Justice, Pollution Control, Mining, Threatened and Endangered Species, Recreational Fishing and Hunting, Chronic Wasting Disease in wildlife, Water Resources and Education.
- Type of Budget: General Funds, Other State Funds and Capital Funds.

Indiana –

- Agencies: Department of Natural Resources and Department of Environmental Management.
- Basic Characteristics: Entities are state agencies.
- Major Resources/Issues: Resource Management, Hunting and Fishing, Nuisance Wildlife, Endangered Wildlife, Mine Reclamation, State Parks, Soil Air and Water Quality and Hazardous Waste.
- Type of Budget: General Funds, Property Tax Replacement Funds and Dedicated Funds.

Iowa –

- Agencies: Department of Natural Resources (DNR), Iowa Environmental Protection Commission, and Department of Agriculture and Land Stewardship Division of Soil Conservation.
- Basic Characteristics: The DNR is a state agency. The Environmental Protection Commission is a nine-member citizen panel. The Division of Soil Conservation is

a part of a different state agency, the Department of Agriculture and Land Stewardship.

- Major Resources/Issues: Missouri River, Avian Influenza, Flood Control, Water Quality, Air Quality, Water Resources, Mineral Resources, Education, Hunting and Fishing, State Parks, Threatened and Endangered Species, Wildlife Management, Asbestos, Forestry, Underground Storage Tanks, Concentrated Animal Feeding Operations and Soil Conservation.
- Type of Budget: General Fund, Other Funds, Agriculture and Land Stewardship Fund and Natural Resources Capital.

Kansas –

- Agencies: State Conservation Commission, Department of Wildlife and Parks, Department of Health and Environment Division of Environment, and Kansas Water Office. The Kansas Forest Service is administered by Kansas State University; however budget figures are unavailable and not included in the state total.
- Basic Characteristics: The State Conservation Commission is a nine-member board consisting of five geographically-distributed elected members, two academic and university extension representatives, and two agency (Kansas Department of Agriculture and U.S. Department of Agriculture Natural Resources Conservation Service) employees. The Division of Environment is part of the Department of Health and Environment. The Department of Wildlife and Parks and the Kansas Water Office are state agencies.
- Major Resources/Issues: Water Resources, Lake Restoration, Wetlands Conservation and Restoration, Air and Water Pollution, State Parks, Hunting and Fishing, Education, Operation Game Thief, Exotic Nuisance Species, and Threatened and Endangered Species.
- Type of Budget: State General Fund, Water Plan Fund, Special Revenue Funds, Economic Development Initiatives Fund and Other Funds.

Kentucky –

- Agencies: Department of Environmental Protection, Department of Natural Resources, Kentucky State Nature Preserves Commission, Environmental and Public Protection Cabinet, Division of Conservation, Division of Forestry, Environmental Quality Commission, and Mine Safety Review Commission.
- Basic Characteristics: Entities are state agencies, divisions of agencies or independent commissions.
- Major Resources/Issues: Soil and Water Conservation, Water Resources, Wetlands, Coal Mining, Air and Water Quality, Management of Natural Areas, Biological Biodiversity, and Threatened and Endangered Species.
- Type of Budget: General Fund, Restricted Funds, Road Fund, Tobacco Settlement-Phase I and Capital Investment Income.

Louisiana –

- Agencies: Department of Environmental Quality, Department of Natural Resources, and Department of Wildlife and Fisheries.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Coastal Restoration, Hurricane Katrina Clean-Up and Recovery, Water Resources, Mineral Resources, Flood Protection, Hunting and Fishing, Threatened and Endangered Species, Nutria Control, Boating and Education.
- Type of Budget: State General Fund, Fees and Self-Generated, Statutory Dedications and Interim Emergency Board Funds.

Maine –

- Agencies: Bureau of Parks and Lands, Department of Conservation, Department of Environmental Protection, Department of Marine Resources, Department of Inland Fisheries and Wildlife, Atlantic Salmon Commission, Atlantic States Marine Fisheries Commission, Saco River Corridor Commission, St. Croix International Waterway Commission and New England Interstate Water Pollution Control Commission.
- Basic Characteristics: Entities range from state agencies to regional and interstate commissions, with focus generally split between marine issues and inland issues.
- Major Resources/Issues: Coastal Restoration, Water Resources, Marine and Commercial Fishing, Mineral Resources, Threatened and Endangered Species, Parks and Public Lands, Land Use, Forestry, Hunting and Recreational Fishing, Water and Air Pollution, Invasive Aquatic Species and Chronic Wasting Disease.
- Type of Budget: General Fund and Highway Fund.

Maryland –

- Agencies: Department of Natural Resources and Department of the Environment.
- Basic Characteristics: Both entities are state agencies.
- Major Resources/Issues: Chesapeake Bay, Water Pollution, Wetlands, Hunting and Recreational Fishing, Boating, Marine Resources, Parks and Forests, Invasive Species, Maryland Artificial Reef Plan, Land Conservation, Environmental Justice, Air Quality, Hazardous Waste, Noise Pollution and Lead Poisoning Prevention.
- Type of Budget: General Fund, Special Funds and GO Bonds.

Massachusetts –

- Agencies: Department of Recreation and Conservation, Department of Environmental Protection, Department of Fish and Game, Office of the Secretary of Environmental Affairs, State Reclamation Board and Department of Agricultural Resources.
- Basic Characteristics: All the entities above are state agencies under the Executive Office of Environmental Affairs.
- Major Resources/Issues: Habitat Restoration, Smart Growth Land Use, Water Resources, Climate Protection Plan, World Class Parks, Smart Conservation

Strategy (land, ocean, water), Brownfield Redevelopment, Commercial and Recreational Fishing, Boating, Hunting, Outdoor Education and Riverways.
- Type of Budget: General Fund and Capital Funds.

Michigan –
- Agencies: Department of Environmental Quality and Department of Natural Resources.
- Basic Characteristics: Both entities are state agencies.
- Major Resources/Issues: The Great Lakes, the Upper Peninsula, Forestry, Hunting and Fishing, Water Resources, Water and Air Quality, Waste Management, Dioxin Contamination, Emerald Ash Borer, TB in White-Tailed Deer, Invasive Species, State Parks and State Recreation Areas, Inland Lakes, Boating and Education.
- Type of Budget: General Fund, Bottle Deposits Fund, Forest Development Fund, Game and Fish Protection Fund, Game and Fish Protection Trust Fund, Marine Safety Fund, Michigan Natural Resources Trust Fund, Michigan Non-Game Fish and Wildlife Fund, Michigan State Parks Endowment Fund, Michigan State Waterways Fund, Michigan Transportation Fund and Park Improvement Fund.

Minnesota –
- Agencies: Department of Natural Resources, Water and Soil Resources Board, Pollution Control Agency, Minnesota Conservation Corps and Metropolitan Council Parks.
- Basic Characteristics: The Metropolitan Council is a regional planning agency that serves the greater Minneapolis-St. Paul area. The Department of Natural Resources is a state agency and includes the other entities under its umbrella.
- Major Resources/Issues: Water Resources, Soil Resources, Education, Hunting and Recreational Fishing, State Parks, Forests, Invasive Species, Threatened and Endangered Species, Nuisance Species, Mineral Resources, Native Plant Communities, Boating, Wetlands, and Air and Water Pollution.
- Type of Budget: General Fund, Environment and Natural Resources Fund, General Obligation Bonding and User Financed Bonding.

Mississippi –
- Agencies: Department of Environmental Quality, Forestry Commission, Department of Marine Resources, Mississippi River Parkway Commission, Soil and Water Conservation Commission, Tennessee-Tombigbee Waterway Development Authority (TTWDA) and Department of Wildlife Fisheries and Parks.
- Basic Characteristics: Most entities can be described as either state agencies or state commissions. The TTWDA is a federal interstate compact but its funding includes state contributions.
- Major Resources/Issues: Beaver Control, Tidelands Projects, Hurricane Katrina Recovery, Water Resources, Water and Air Quality, Brownfield Remediation, Marine Debris, Hazardous Waste, Mining, Forestry, Marine Resources,

Commercial Fishing and Shrimp and Oyster Harvesting, Marine Debris Project and Waterfowl.
- Type of Budget: General Fund, Budget Contingency Fund and Education Enhancement Fund.

Missouri –
- Agencies: Department of Conservation and Department of Natural Resources.
- Basic Characteristics: Both entities are state agencies.
- Major Resources/Issues: Missouri River, Mississippi River, Lake of the Ozarks, Forestry, Mark Twain National Forest, Water and Air Quality, Flood Management, Hazardous Waste, Methamphetamine Lab Cleanup, State Parks, Mineral Resources, Lead Contamination, Rivers and Streams, Caves, Urban Sprawl, Threatened and Endangered Species, Hunting and Recreational Fishing and Invasive Species.
- Type of Budget: Conservation Commission Fund, General Fund, Other Funds and Capital Spending.

Montana –
- Agencies: Department of Fish Wildlife and Parks, Department of Environmental Quality and Department of Natural Resources and Conservation.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Air and Water Quality, Water Resources, Methamphetamine Cleanup Program, State Parks, Hunting and Fishing, Poaching, Avian Influenza, Threatened and Endangered Species, Mineral Resources, Public Lands, Forestry and Ranching.
- Type of Budget: General Fund and Other State and Special Funds.

Nebraska –
- Agencies: Department of Environmental Quality, Game and Parks Commission, Department of Natural Resources, and Nebraska Oil and Gas Conservation Commission.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Water Quality, Air and Water Pollution, Wildcat Hills, Sand Hills, Chronic Wasting Disease, Hunting and Fishing, Big Game, State Parks, Education, Wetlands, Threatened and Endangered Species and Mineral Resources.
- Type of Budget: General Fund, Cash Fund, Capital Construction and Capital Building Renewal.

Nevada –
- Agencies: Department of Conservation and Natural Resources, Department of Wildlife and Colorado River Commission.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Colorado River, Lake Tahoe, Lake Mead, Pyramid Lake, Hoover Dam, Water Resources, Air and Water Quality, Hazardous Waste,

Mojave Desert, Proposed High-Level Nuclear Waste Repository at Yucca Mountain, Hunting and Fishing, Boating, Education, Wildlife Disease, State Parks, Wild Horses, Land Use and Invasive Species.

- Type of Budget: General Fund, Non-General Fund, Supplemental Appropriations and One-Shot Appropriations.

New Hampshire –

- Agencies: Fish and Game Department, Resources and Economic Development Department and Department of Environmental Services.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Forestry, State Lands, State Parks, Air and Water Quality, Hazardous Waste, Hunting, Fishing, Education, Non-Game and Endangered Wildlife, Water Resources, West Nile Virus, Lyme Disease and Avian Flu.
- Type of Budget: General Fund, Capital Funds Fish and Game Fund.

New Jersey –

- Agencies: Department of Environmental Protection (DEP).
- Basic Characteristics: The DEP, a single state agency, coordinates all activity related to natural resources and environmental protection.
- Major Resources/Issues: Pine Barrens, Marine Coastline, Artificial Reef Program, Chronic Wasting Disease, Air and Water Quality, Mercury Emissions, Regional Greenhouse Gas Initiative, Wetlands Management, Solid and Hazardous Waste, Brownfield Redevelopment, State Parks, Forest Management, Education, Land Use, Green Acres Program, Hunting and Fishing, Commercial Fishing, Endangered and Non-Game Species, and White-Tailed Deer Management.
- Type of Budget: General Funds, Revolving Funds and Property Tax Relief Fund.

New Mexico –

- Agencies: Department of Game and Fish, Energy Minerals and Natural Resources Department, Youth Conservation Corps, Commissioner of Public Lands, State Engineer, Department of Environment and Office of the Natural Resources Trustee.
- Basic Characteristics: The Youth Conservation Corps is a program to educate and employ youths 14-25 years of age on natural resources projects. The Commissioner of Public Lands, the State Engineer, and the Office of Natural Resources Trustee are offices with an oversight or advisory capacity relative to the state agencies. The Department of Fish and Game, the Department of Environment, and the Energy Minerals and Natural Resources Department are state agencies.
- Major Resources/Issues: Natural Resource Assessment and Restoration Program, Wildlife Depredation and Nuisance Abatement, Hunting and Recreational Fishing, Water Resources, Renewable Energy and Energy Efficiency, Healthy Forests, State Parks, Mine Reclamation, Oil and Gas Conservation, Hazardous Waste and Pollution, Air and Water Quality, Threatened and Endangered Species, Land Use, Avian Flu, Chronic Wasting Disease, Poaching and Climate Change.

- Type of Budget: General Fund Transfers, Other Transfers, Other Program Revenues, Enterprise Program Revenues, General Revenues, Extraordinary and Special Revenues, Fund Balance, Special Supplemental and Deficiency Appropriations and Information Technology Appropriations.

New York –

- Agencies: Department of Environmental Conservation, State Office of Parks Recreation and Historic Preservation, and Adirondack Park Agency.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Mercury Management, Regional Greenhouse Gas Initiative, Air and Water Quality, Mosquito Control, Brownfield Redevelopment, Chronic Wasting Disease, Hudson River and Estuary, Hazardous Waste, Open Space, Recycling, Medical Waste, Hunting and Recreational Fishing, Commercial Fishing, Oil Gas and Solution Salt Mining, Coastal Habitat Management, Green Building Initiative, Waste Tires, Concentrated Animal Feeding Operations, Environmental Justice, Pollution Prevention, Adirondack Trail, Earth Day, Wildlife Diversity, Threatened and Endangered Species, State Parks and Pine Barrens.
- Type of Budget: General Fund, Capital Spending, Environmental Protection Fund, Superfund, Waste Tire Management and Recycling Program, and State Park Infrastructure Fund.

North Carolina –

- Agencies: Department of Environment and Natural Resources and Wildlife Resources Commission.
- Basic Characteristics: Both entities are state agencies.
- Major Resources/Issues: Coastal Management, Outer Banks, Hunting and Fishing, Education, Forest Resources, Air and Water Quality, State Parks, Water Resources, Soil and Water Conservation, Waste Management, Wetlands, Brownfield Redevelopment, Commercial Fishing, Albemarle-Pamlico National Estuary Program, and Threatened and Endangered Species.
- Type of Budget: General Fund, Special Funds, Air Quality-Fuel Tax, Dry Cleaning Solvent Tax, Forest Development Fund, Clean Water Management Trust Fund and Natural Heritage Trust Fund.

North Dakota –

- Agencies: Game and Fish Department, Parks and Recreation Department, Water Commission and Department of Health (DOH) Environmental Health Section.
- Basic Characteristics: The Environmental Health Section, part of the DOH (a state agency), addresses such issues as air and water quality, and pollution, analysis of environmental samples, waste management, and municipal facilities. The other entities are state agencies.
- Major Resources/Issues: Water Rights, Air and Water Quality, Waste Management, Flood Control, State Parks, Hunting and Recreational Fishing, Threatened and Endangered Species Management, Aquatic Habitat Restoration,

Mineral Resources, Boating, Forestry, Outdoor Education, Devils Lake, and Missouri and Red Rivers.

- Type of Budget: General Fund, Special Funds and Capital Funds. Note: The budget figures are for two years.

Ohio –

- Agencies: Department of Natural Resources, Air Quality Development Authority, Environmental Protection Agency and Environmental Review Appeals Commission.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Hunting and Recreational Fishing, Boating, Education, Forestry, State Parks, Water Resources, Air and Water Quality, Mineral Resources, Lake Erie Coastal Management, Ohio River, Soil and Water Conservation, Threatened and Endangered Species, Mercury Pollution, Hazardous Waste, Industrial Waste and Nuisance Wildlife.
- Type of Budget: General Revenue Fund, General Services Fund, State Special Revenue Fund, Waterways Safety Fund, Accrued Leave Liability Fund, Wildlife Fund, Holding Account Redistribution Fund, Agency Fund, Coal Research/Development Fund and Clean Ohio Revitalization Fund.

Oklahoma –

- Agencies: Department of Environmental Quality, Oklahoma Conservation Commission, Water Resources Board, Water Resources Rural Economic Action Plan (REAP), Pollution Control Board, Oklahoma Scenic Rivers Commission, Oklahoma Tourism and Recreation Department (State Parks, State Resorts and Golf Program only.), Wildlife Conservation Commission, and Department of Agriculture, Food, and Forestry (Forestry and Wildlife Programs only.).
- Basic Characteristics: The Oklahoma Conservation Commission is under the Department of Agriculture, Food and Forestry; a state agency. The other entities are state agencies.
- Major Resources/Issues: Abandoned Mine Reclamation, Flood Control, Education, Water Quality, Wetlands Management, Water Resources, Forestry, Hunting and Recreational Fishing, Threatened and Endangered Species, Superfund Remediation, Hazardous Waste, Solid Waste, and State Parks and Resorts.
- Type of Budget: General Revenue, Conservation Commission Fund, Various Revolving Funds (too many to list), REAP Water Projects Fund, Tar Creek Mine Reclamation Fund, Hazardous Waste Fund, Certification Fund, Drillers and Installers Fund, Well Drillers and Pump Installers Fund, Interagency Reimbursement Fund, Drinking Water Treatment Loan Fund, Wastewater Facility Construction, WRF-Construction Revolving Loan, Wildlife Conservation Fund, Wildlife Diversity Fund, Scenic River Commission Fund, Tourism and Recreation Fund, State Park System Improvement Revolving, Land and Water Conservation Fund, Special Cash Fund, Conservation Cost-Share Fund, and Capital Outlay and Special Projects.

Oregon –

- Agencies: Columbia River Gorge Commission, Department of Environmental Quality, Department of Fish and Wildlife, Forestry Department, Department of Land Conservation and Development, Land Use Board of Appeals, Department of State Land, Marine Board, Department of Parks and Recreation, Water Resources Department and Watershed Enhancement Board.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Watershed Restoration, Confined Animal Feeding Operations, Water Quality, Smoke Management, Coastal Management, Columbia River, Salmon Management, Forestry, Mineral Resources, Land Use, State Parks and State Lands, Threatened and Endangered Species, Hazardous Waste and Recycling.
- Type of Budget: General Fund, Other Funds and Lottery Funds.

Pennsylvania –

- Agencies: Department of Conservation and Natural Resources, Department of Environmental Protection (DEP), Pennsylvania Fish and Boat Commission, Environmental Hearing Board and Pennsylvania Game Commission.
- Basic Characteristics: The Environmental Hearing Board is under the DEP (in terms of budget); a state agency. The other entities are state agencies.
- Major Resources/Issues: State Parks, Forestry, Mineral Resources and Mining, Land Use, Water and Air Quality, Hunting and Recreational Fishing, Carbon Sequestration, Susquehanna River, Allegheny National Forest, Lake Erie, Scenic Rivers, Boating, Mercury Reduction, Governor's Green Government Council, Abandoned Mines, Black Fly Suppression, Brownfield Redevelopment, Confined Animal Feeding Operations, Recycling, Erosion, Environmental Justice, Smart Growth, Green Growth, Hazardous Waste, Superfund Cleanup, Nuclear Waste, Water Conservation, Wind Energy, Threatened and Endangered Species, Wildlife Diseases and Nuisance Wildlife.
- Type of Budget: General Fund, Special Funds (too many to list), Augmentations, Restricted Funds, Other Funds and Capitol Funds.

Rhode Island –

- Agencies: Water Resources Board, Coastal Resources Management Council, Department of Environmental Management, Clean Water Finance Agency (CWFA), Department of Health (DOH) Division of Environmental Health and Narragansett Bay Commission.
- Basic Characteristics: The Water Resources Board, Coastal Resources Management Council and the Department of Environmental Management are state agencies. The Narragansett Bay Commission is a quasi-public agency, and the Division of Environmental Health is under the DOH, another state agency. The CWFA is an independent, public corporation with a distinct legal separation from the state.
- Major Resources/Issues: Brownfield Redevelopment, Coastal Management, Wetlands Conservation and Restoration, Water and Air Pollution, State Parks,

Hunting and Recreational Fishing, Commercial Fishing, Boating, Forest Management, Fish and Wildlife Management, Narragansett Bay, Waste Management, Water Resources, Greenhouse Gas Project, Hazardous Waste, Recycling, Education, Mercury Reduction Program, Narragansett Bay Estuary, Underground Storage Tank Removal and Cleanup, Chronic Wasting Disease and avian Influenza.

- Type of Budget: General Revenues, Restricted Receipts, Other Funds and Capital Spending.

South Carolina –

- Agencies: Forestry Commission, Department of Natural Resources, Sea Grant Consortium, Department of Parks Recreation and Tourism, South Carolina Conservation Bank and Department of Health and Environmental Control (some programs).
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Coastal Management, Artificial Reef Program, Education, Forestry, Water Quality, Hunting and Fishing, Wildlife Management, Land and Water Stewardship Program, Flood Mitigation, Scenic Rivers, Aquatic Plant Management, Boating, State Parks, Farmland Preservation and State Parks.
- Type of Budget: General Funds (recurring and non-recurring), Other Funds, Provision 73.14 Supplemental Funds and Capital Reserve Funds.

South Dakota –

- Agencies: Game Fish and Parks and Environment and Natural Resources.
- Basic Characteristics: Both entities are state agencies.
- Major Resources/Issues: Air and Water Quality, Water Rights, Concentrated Animal Feeding Operations, Waste Management, Mineral Resources, Methamphetamine Lab Cleanup, State Parks, Hunting and Fishing, Education, Boating, Threatened and Endangered Species, Wetlands Conservation, Lewis and Clark Trail, Lake Oahe, Mississippi River and Black Hills.
- Type of Budget: General Funds and Other Funds.

Tennessee –

- Agencies: Tennessee Wildlife Resources Agency and Department of Environment and Conservation.
- Basic Characteristics: The Department of Environment and Conservation is a state agency. The Tennessee Wildlife Resources Agency is listed under boards and commissions, according to the state website.
- Major Resources/Issues: Hunting and Fishing, State Parks, Boating, Threatened and Endangered Species, Air Pollution, Radiological Health, Education, Underground Storage Tanks, Hazardous Waste, Solid Waste, Brownfield Remediation, Methamphetamine Lab Cleanup, Water Pollution, Water Resources, Waste Tire Program, Agricultural Pesticide Waste Collection Program, Great Smoky Mountains and Mississippi River.
- Type of Budget: State Funds, Other Funds, Bonds and Dedicated Revenues.

Texas –

- Agencies: Texas Commission on Environmental Quality, Department of Agriculture (DOA), Animal Health Commission, General Land Office and Vet's Land Board, General Land Office Trusted Programs, Parks and Wildlife Department, Railroad Commission of Texas, River Compact Commissions, Soil and Water Conservation Board, Water Development Board and Texas Forest Service.
- Basic Characteristics: The Department of Agriculture and the Parks and Wildlife Department are state agencies. The Texas Forest Service is under Texas A&M University. The other entities are either boards or commissions.
- Major Resources/Issues: Water Quality, Water Resources, Hazardous Waste, Air and Water Pollution, State Parks, Forestry, Hunting and Fishing, Boating, Education, Mineral Resources, Threatened and Endangered Species, Hurricanes Katrina and Rita Recovery, Rio Grande, Gulf of Mexico, Historical and Cultural Sites, Underground Petroleum Storage Tanks, Recycling, Nuisance Wildlife, Nature Tourism and Wildlife Diseases.
- Type of Budget: General Revenue, General Revenue Dedicated and Other Funds.

Utah –

- Agencies: Department of Environmental Quality, Department of Natural Resources, Department of Agriculture and Food, State and Institutional Trust Lands Administration, Utah State Fair Corporation and Public Lands Policy Coordinating Office.
- Basic Characteristics: The Public Lands Policy Coordinating Office is under the office of the governor. The other entities are state agencies.
- Major Resources/Issues: Wildlife Resources, State Parks, Forestry, Mineral Resources, Water Resources, Air and Water Quality, Soil Conservation, Environmental Response, Solid and Hazardous Waste, Radiological Waste, Threatened and Endangered Species, Aquatic Nuisance Species, Invasive Species, Hunting and Fishing, Boating, Education, Great Salt Lake, Colorado River and Wildlife Diseases.
- Type of Budget: General Fund, Dedicated Credits, Restricted Funds, Other Funds, Mineral Lease, Restricted and Trust Funds and Capital Funds.

Vermont –

- Agencies: Agency of Natural Resources and Natural Resources Board. The Agency of Natural Resources contains the Department of Environmental Conservation, the Department of Fish and Wildlife, and Department of Forests, Parks and Recreation.
- Basic Characteristics: The Agency of Natural Resources is a state agency. The other entity is an advisory board, and replaces the Water Resource Board and Environmental Board (as of 2/1/2005).
- Major Resources/Issues: Recycling, Waste Management, Mercury Pollution, Climate Change, Brownfield Remediation, Air and Water Quality, Water Resources, Hazardous Waste, Hunting, Trapping and Fishing, Wildlife Habitat

Management, Education, Forest Resources, State Parks, State Lands, Lake Champlain, Aquatic Nuisance Species, Invasive Species, Threatened and Endangered Species, Flood Hazard Management, Gold Sluicing, Mineral Resources, Underground Storage Tanks, Waste Tire Management and Concentrated Animal Feed Operations.

- Type of Budget: General Fund, Transportation Fund, Special Funds and Tobacco Settlement Fund.

Virginia –

- Agencies: Department of Natural Resources, Department of Environmental Quality, Department of Agriculture and Forestry, Department of Conservation and Recreation, Department of Game and Inland Fisheries, Virginia Marine Resources Commission, Chippokes Plantation Farm Foundation, Virginia Museum of Natural History and Chesapeake Bay Commission.
- Basic Characteristics: All entities are state agencies under the Secretariat of Natural Resources, except the Chesapeake Bay Commission, which is a legislative agency.
- Major Resources/Issues: Chesapeake Bay, Coastal Management, Air and Water Quality, Mercury Pollution, Avian Influenza, Brownfield Renewal, Education, Superfund Sites, Wetlands Management, Waste Tires, Water Resource Management, Forest Resources, Urban Forestry, Hunting and Fishing, Boating, Wildlife Habitat Management, Threatened and Endangered Species, Wildlife Diseases, Nuisance Wildlife, Zebra Mussel Eradication, Commercial Fishing, State Parks, Soil and Water Conservation, Dam Safety, Floodplain Management and Land Conservation.
- Type of Budget: General Fund, Non-General Fund and Capital Projects.

Washington –

- Agencies: Department of Natural Resources, Department of Fish and Wildlife, State Conservation Commission, Interagency Committee for Outdoor Recreation, State Parks and Recreation Commission, Department of Ecology, Columbia River Gorge Commission, Environmental Hearings Office, Governor's Salmon Recovery Office and Salmon Recovery Funding Board.
- Basic Characteristics: The Salmon Recovery Funding Board and the Governor's Salmon Recovery Office are under the Interagency Committee for Outdoor Recreation; a state agency. The Environmental Hearings Office is an independent state agency that houses the Pollution Control Hearings Board, Shorelines Hearings Board, Forest Practices Hearings Board, Hydraulic Appeals Board, and Environmental and Land Use Hearings Board. The other departments, commissions and offices are state agencies.
- Major Resources/Issues: Puget Sound, Columbia River, Salmon Habitat, Coastal Management, Air and Water Quality, Water Resources, Climate Change, Nuclear Waste, Solid Waste, Hazardous Waste, PCB and Mercury Pollution Reduction, Electronics Recycling, Rayonier Port Angeles Mill Cleanup, Flood Management, Forest Resources, Mineral Resources, Hunting and Fishing, Commercial Fishing,

Boating, Education, Wildlife Habitat Management, Threatened and Endangered Species, Avian Influenza and Wildlife Diseases.
- Type of Budget: Operating Budget and Capital Budget.

West Virginia –
- Agencies: Department of Environmental Protection (DEP), Air Quality Board, Environmental Quality Board, Oil and Gas Conservation Commission, Solid Waste Management Board, Department of Commerce (DOC) Division of Forestry, Department of Commerce Division of Natural Resources and Department of Agriculture (DOA) Conservation Agency.
- Basic Characteristics: Two entities are divisions within the DOC (Forestry and Natural Resources) and one is an agency within the DOA (Conservation Agency). Of the remaining entities, one is a state agency (DEP) and the others are either commissions or boards.
- Major Resources/Issues: Hazardous Waste, Air and Water Quality, Abandoned Mines Reclamation, Environmental Remediation, Litter Control, Recycling, Dam Management, Mineral Resources, Education, Forestry, Urban Forestry, Boating, Hunting and Fishing, State Parks, Wildlife Resources, Threatened and Endangered Species, Wildlife Diseases, Nuisance Species, Exotic/Invasive Species, Ohio River and Potomac River Basin.
- Type of Budget: General Fund, Appropriated Special Fund and Non-Appropriated Special Fund.

Wisconsin –
- Agencies: Department of Natural Resources, Board of Commissioners of Public Lands, Environmental Improvement Program and Fox River Navigational System Authority.
- Basic Characteristics: All entities are state agencies.
- Major Resources/Issues: Great Lakes, Lake Winnebago, Mississippi River, Lower Fox River, Air and Water Quality, Waste Management, Hazardous Waste, Brownfield Remediation, Environmental Cleanup, Underground Storage Tanks, Superfund Sites, Invasive Species, Boating, Mercury Pollution, Persistent Bioaccumulative Toxic Substances, Mining, Recycling, Ecological Landscapes, Hunting and Fishing, Forestry, Natural Heritage Inventory, Threatened and Endangered Species, Wetlands, State Parks and Outdoor Recreation.
- Type of Budget: General Purpose Revenue, Program Revenue-Service, Program Revenue-Other and Segregated Revenue-Other.

Wyoming –
- Agencies: Department of Environmental Quality, State Parks and Cultural Resources, Water Development Office, Wildlife/Natural Resources Trust, Game and Fish Commission, Office of State Lands and Investments and Department of Agriculture Natural Resources Division.
- Basic Characteristics: All entities are state agencies, except one that is the division of another state agency.

- Major Resources/Issues: Yellowstone National Park, Colorado River, Snake River, Abandoned Mines, Air Quality, Water Quality, Industrial Siting, Land Quality, Solid and Hazardous Waste, Hunting and Fishing, Boating, Education, Avian Influenza, Wildlife Diseases, Urban and Nuisance Wildlife, Threatened and Endangered Species, Mineral Resources, Forest Resources, State Parks, Aquatic Habitats, Water Resources and Land Use.
- Type of Budget: General Fund, Other Funds, Special Revenue and Enterprise Fund.

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