

DRIVERS OF ECONOMIC PERFORMANCE IN MICHIGAN

natural features, green infrastructure and social/cultural amenities

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A PARTNERSHIP BETWEEN THE LAND POLICY INSTITUTE AND THE MICHIGAN NATURAL FEATURES INVENTORY

summary report



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About Land Policy Research

Research and analysis is supported by the Land Policy Research (LPR) Team at LPI.

This report #LPR-2011-NE-04 of the LPI New Economy Report Series is the full report from a major research partnership between the Land Policy Institute (LPI); the Office of the John A. Hannah Distinguished Professor in Land Policy in the Department of Agricultural, Food and Resource Economics; and the Michigan Natural Features Inventory; all at Michigan State University. Its aim is to provide science-based information to local, regional, state and national policy decision makers and others involved in place-based strategies for sustainable development. This work was embarked on during the tenure of Professor Adesoji Adelaja, as Director of the Land Policy Institute.

Foreword

As our state economy transitions from one built on the platform of an old industrial model to one built on the principles of the next economy, it is important for state residents and their elected representatives to better understand the range of assets that are relevant in economic development in the New Economy. One of the newly emerging and exciting paradigms is a diversified and resilient economy based on the principles of sustainability. The transition from the industrial economy to the New Economy requires greater understanding of what drives sustainable development. Based on previous studies, it appears that green infrastructure, which encompasses critical natural features, is an important economic driver. Increasingly, these natural features are not being viewed as simply inputs to industrial economic development, but as drivers of economic activity, especially in the service and knowledge driven sectors of the economy, where significant growth has been occurring. It may well be that a basic premise of the New Economy is that economic activities can revolve around sustainable management of existing green assets, and that a state strategy that focuses on optimal management of such assets can drive prosperity. A fair amount of research has been done on the ecological benefits of natural amenities, but for those of us who participate in and inform public decision makers, we need more science and evidence about the green economy, its underpinnings, its interconnections, and how it translates into economic prosperity.

In the old industrial economy, economists were able to account for the impacts and marginal productivities of traditional industrial assets of places, especially labor, capital, technology, raw materials and management. One of the unique features of the New Economy is that assets previously viewed as “intangibles” may not only be tangible today, but may play a significant role in driving economic change. Earlier proponents of this idea drew the links between amenities and property values, and amenities and people’s preferences or satisfaction levels. This report gives the reader the necessary information to compare the roles of green infrastructure to other traditional economic development drivers. By showing how green infrastructure directly leads to changes in population, employment and income this report helps to illustrate how green infrastructure affects local economic growth.

We appreciate the support of the W.K. Kellogg Foundation, through the People and Land (PAL) initiative. Based on this work, we can now talk about such things as per capita income effect of wetlands per acre, the employment effects of trails, or the number of residents attracted to inland lakes. Similarly, we can now talk about the economic impacts of these natural amenities in comparison to adding one more strip mall to a community. The information provided in this report helps to set the stage for Michigan to move forward, by leveraging its place assets in sustainable ways and building future prosperity based on a green strategy.

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Preface

The Michigan Natural Features Inventory (MNFI) is a program of Michigan State University (MSU) Extension focused on providing end users with the best information available on Michigan's biological diversity. With more than 16,000 records in the natural heritage database, MNFI currently maintains the most comprehensive database available on Michigan's unique natural features. The MNFI aims for Michigan to be the leading state in providing decision makers involved in land- and water-based decisions and policies with the best information science can provide.

The Michigan State University Land Policy Institute (LPI) is a policy research institute involved in the utilization of data and informatics in policy modeling, simulation and analysis to inform policy decision makers and aid the policy development process. The Institute has implemented dozens of studies designed to discover game-changing policy ideas, especially in areas related to the green economy, the New Economy, renewable energy and asset-based economic development.

Despite several studies previously conducted by LPI on the impact of green infrastructure on key economic variables, questions continue to be raised about the nature of the green economy and the value of investments in green infrastructure. Of course, a meaningful place to focus efforts is on documenting just how natural features and green assets contribute to the economy. The partnership between LPI and MNFI in this study is a unique and exciting one, and holds great promise for Michigan. The initial result of this partnership is this report, which we deem to be the most comprehensive analysis of the economics of natural features conducted to date.

We expect that this report will provide greater understanding not only of the green economy, but also of the potential for a nature-based economic development strategy for Michigan. We also expect that this study will highlight the value and importance of the great work that the MNFI is engaged in to document the natural features of the state, and the important work of LPI in isolating the economic value of such infrastructure. After all, we know where all the bridges, roads, utilities and airports are and the roles that they play. If green infrastructure is relevant to Michigan's economic future, it is equally important that a comprehensive, accurate and up-to-date database on Michigan's natural features is in place to help local communities better understand the potential value of their natural amenities.

Michigan, with its wealth and diversity of natural resources, could benefit tremendously from an effort to complete a comprehensive natural features inventory. An accurate, up-to-date, systematic survey of Michigan's natural features would assist planners and decision makers in a large variety of land-based activities and decisions. Most importantly, because natural features are related to a wide range of economic activities, such as timber production, tourism, recreation and property transactions, they could play a significant role in Michigan's future economic recovery. One of the key elements of understanding this relationship is determining what effects, if any, various natural assets have on local economic performance in Michigan; this study provides a significant first step towards accomplishing that goal.

Green Infrastructure Drivers of Economic Performance in Michigan

AS THE NEW ECONOMY SLOWLY REPLACES TRADITIONAL ECONOMIC FRAMEWORKS AND BEGINS TO UNSEAT LONG HELD PARADIGMS, CLEAR PATHWAYS MUST BE EXPLORED ON HOW GREEN INFRASTRUCTURE AND AMENITIES IMPACT THE ECONOMY. DO NATURAL AMENITIES PROVIDE A COMPETITIVE ADVANTAGE TO COMMUNITIES IN MICHIGAN? WHICH COMPONENTS OF GREEN INFRASTRUCTURE DRIVE POPULATION, INCOME AND EMPLOYMENT GROWTH? WHAT ARE THE MEASURABLE IMPACTS OF SPECIFIC NATURAL AMENITIES TO LOCAL ECONOMIES, WHICH HAVE NEVER BEEN STUDIED AT SUCH A SCALE BEFORE? THIS REPORT SEEKS TO ANSWER THESE QUESTIONS.

Michigan's economy has struggled since the early 2000s, evidenced by periods of population and job loss combined with an increasing unemployment rate. The latest national recession made matters worse. At 9.8% (November 2011), unemployment was the tenth-highest of any state. The near collapse of the domestic automobile industry had politicians and other leaders scrambling to find solutions on how to diversify and correct Michigan's current economic predicament. It is evident that the state needs a diversified strategy, and many expect that this strategy will be tied to the long-term sustainability of its natural features.

There is no shortage of natural amenity and green infrastructure research, and some of the pieces of the puzzle are in place. Indeed, most studies have found positive relationships between the presence of natural amenities and such things as population change and economic growth. The literature is beginning to find that amenities are important for increasing employment and income growth as well. Historically, people chased jobs. But the New Economy has created a scenario where people move to places with high endowments of amenities, and jobs follow (Vias, 1999).

As the New Economy slowly replaces traditional economic frameworks and begins to unseat

long held paradigms, clear pathways must be explored on how green infrastructure and other amenities impact the economy. Do natural amenities provide a competitive advantage to communities in Michigan? Which components of green infrastructure drive population, income and employment growth? What are the measurable impacts of specific natural amenities to local economies, which have never been studied at such a scale before? This report seeks to answer these questions.

Bridging this gap in the literature, by specifically explaining the roles of a diverse set of green infrastructure assets on place performance, is the goal of this study. Specifically, this report expands the scope of natural amenities beyond those considered in previous studies, by including specific ecological variables measured at the local level. We examine a full range of amenities and natural features, and how they relate to the

GREEN INFRASTRUCTURE*
The physical environment within and between our cities, towns and villages. It is a network of multi-functional open spaces, including formal parks, gardens, woodlands, green corridors, waterways, wetlands, forest and open countryside. It comprises all environmental resources.

**Adapted from the "Green Infrastructure Planning Guide," by C Davies, R MacFarlane, C McGloin and M Roe.*



economic prosperity and performance of places. We also present a coherent economic modeling framework that allows the attribution of economic outcomes to specific green infrastructure elements.

To evaluate the influence of specific quality-of-life and amenity attributes on population, income and employment levels, a large and in-depth collection of data was necessary. Economic data are easily obtainable at the Minor Civil Division (MCD) level, which include cities, townships and villages. Data for this study is generated from various sources, including the U.S. Census Bureau, U.S. Bureau of Labor and Statistics, the Michigan Center for Geographic Information, the U.S. Geological Survey and others. When necessary, spatial data was processed from its original form, which covered Michigan or the country as a whole, and measured within Michigan communities. The data used in the study is a time series for the years 1990 and 2000, with the lion-share of the data relating to various factors within the community in 1990, and data representing shifting population, employment, and income trends from 1990 to 2000.

The categories of variables that have been theorized to impact growth include:

1. Initial Conditions and the Cost Associated with Structural Legacy;
2. Existing Gray Infrastructure Assets and Subsequent Investments;
3. Industrial Structure, including the Contributions of Key Industries;
4. Local Public Finance;
5. Local Governance and Political Structure;
6. Accumulation of Human Capital (including knowledge and creative capital, as well as knowledge infrastructure, such as universities);
7. Information Technology and Communications Technology Infrastructure (such as broadband);
8. Cultural Assets;
9. Social and Ethnic Diversity Related Assets;
10. Green Infrastructure (natural amenities); and
11. Others (such as demographic, housing market, socio-economic and educational factors).

Results

The primary focus of this study is understanding the roles of green infrastructure and natural features in economic growth. Table 1, a subset of the overall results, highlights the significant effects of green infrastructure on changes in population, income and employment. A more detailed explanation of the quantitative methods and a comprehensive table of regression results (Table 2) can be found in the full report.

The results of this study clearly demonstrate that natural assets can be important to the economic performance of local communities in Michigan. These results are not surprising given the findings from previous natural asset studies conducted across the United States.

Of the 27 natural asset variables included in the study, 19 (70%) had a positive impact on population, income and/or employment levels, with only one variable (state environmental areas) having a negative effect. The remaining seven variables had no significant effect.

Positive effects spanned all major categories of green infrastructure included in this study: 1) basic land assets, 2) ecological land assets, 3) basic water assets, 4) ecological water assets and 5) developed land or water assets. From a cumulative effects perspective, 14 of the 27 green infrastructure variables (52%) had at least one positive cumulative impact on resident population, income and/or employment levels. Additionally, nine of the 27 variables had zero cumulative effects (or a value of less than one), leaving only four variables that had a negative cumulative effect on population, income and/or employment levels.

Of particular interest, seven of the 27 green infrastructure variables (26%) had only positive cumulative effects on both population and employment levels. These include: 1) miles of Great Lakes shoreline, 2) presence of a trout stream, 3) miles of reference or no impact streams, 4) percentage of functional sub-watersheds, 5) number of state forest campgrounds, 6) presence of identified trails, and 7) number of boat launches.

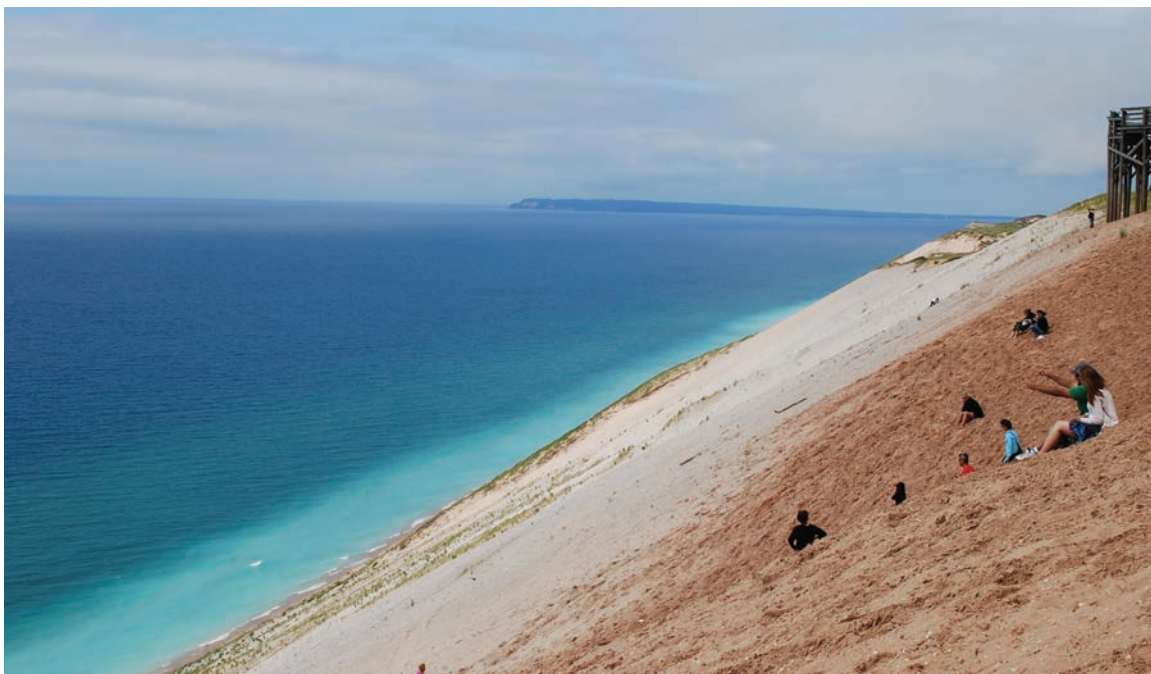


Table 1: Selected Green Infrastructure Findings

Green Infrastructure-Related Factor*	Effect On		
	Population	Per Capita Income	Employment
Each Additional 1% of Agriculture	6 fewer people	\$18.2 more in income	-
Each Additional 1% of Forested Land	5 fewer people	\$33.67 more in income	4 fewer employed people
Each Additional 1% of Sand, Rock and Clay	37 more people	-	29 fewer employed people
Presence of Important Bird Habitat	136 more people	-	89 fewer employed people
Each Additional 1% MCD Consisting of Natural Vegetation Core Area	3 more people	-	3 fewer employed people
Each Additional 10% MCD Consisting of Inland Lakes	-	\$4.80 more in income	1 fewer employed person
Each Additional Mile of Great Lakes Shoreline	2 more people	-	-
Each Additional Mile of Inland Lake Shoreline	0.51 more people	-	1 fewer employed person
Presence of State Environmental Area	51 fewer people	-	-
Each Additional 1% of Wetland	-	\$39.68 more in income	7 fewer employed people
Presence of a Trout Stream	35 fewer people	-	34 more employed people
Each Additional Mile of Reference/No Impact Stream	-	-	1 more employed person
Each Additional 10% of Functional Sub-Watershed	4 fewer people	-	8 more employed people
Each Additional State Forest Campground	45 fewer people	-	27 more employed people
Presence of Identified Trails	58 fewer people	-	34 more employed people
Each Additional Mile of Developed Inland Lake Frontage	2 more people	-	1 fewer employed person
Each Additional Boat Launch	9 more people	-	-
Each Additional Marina Business	103 fewer people	-	34 more employed people
Each Additional Mine	67 fewer people	\$127.68 less in income	47 more employed people
Each Additional National Pollutant Discharge Elimination System (NPDES) Site	31 more people	-	22 fewer employed people
Each Additional Part 201 Contaminated Site	83 fewer people	\$83.98 less in income	54 more employed people

Only statistically significant (at the $p < 0.1$ level) green infrastructure variables are shown. Other socio-economic, cultural, business and demographic variables have been omitted for simplicity.

The effect on population, employment and income change from 1990-2000 must be interpreted in the context of “all else being equal,” which includes those omitted variables.

* Measured at the Minor Civil Division (city, village, township) scale.

- Signifies that the variable is not significant in this model.

Recommendations

Much is being said nationally and internationally about green infrastructure and economic development. With its natural resources base, its alternative energy resource capacity, its huge and unique agricultural industry and the state's long-term history and prominence in preservation and conservation, Michigan may well be poised to be the leading green state in the nation. Therefore, based on these points and the results from this study, the following recommendations are offered.

Policy Recommendations

1. The results from this report do not encourage unbridled development of our natural lands or the 100% conservation of all open space. Rather, the findings point communities toward the long-term viability of their most important natural assets coupled with compatible, sustainable economic development.
2. Michigan should develop a green economy plan that incorporates ideas about how its natural resource base can be leveraged to help position its economy for long-term success, while improving the health of Michigan's natural assets and environment. The People and Land Initiative has identified Natural Resources for Recreation and Jobs as a "Pillar for Prosperity," but no definitive plan exists to reach such an objective. We recommend that the administration should direct its agencies to collaborate and deliver a plan for securing and improving Michigan's natural resources for place-based economic development, quality of life, recreation and talent attraction. If there is a prosperity pathway through "green," Michigan should be the state that's leading the nation.
3. One of the unique observations resulting from this study is that people are attracted to both employment centers and natural assets. However, employment centers in Michigan are typically highly urbanized. Urban and suburban communities have an excellent opportunity to increase their locational competitiveness by maintaining, restoring and enhancing their unique natural assets.
4. Obviously, Michigan's natural assets are diverse. This study begins to link various green asset categories to prosperity. We recommend that state agencies be tasked with developing and implementing strategies that recognize the estimated impact of various natural amenities, based on the findings of this report.





5. Planners and community and economic developers should explicitly consider the role of green infrastructure in all land use planning and economic growth activities, particularly master land use plans, and park and recreation plans.
6. In addition to green infrastructure's effect on economic growth, planners and community and economic developers should also explicitly consider the benefits that ecological services and green infrastructure provide (flood protection, pollution filtration, water storage, climate regulation, wildlife habitat, recreation opportunities, research and education, etc.), when making decisions about the future of Michigan's communities.
7. Since natural features and processes typically do not follow jurisdictional boundaries, regional or watershed planning efforts should be strongly encouraged or incentivized.
8. Jurisdictions that collaborate with their neighboring municipalities should be rewarded with grant funding to help complete planning, design or implementation efforts.
9. Similar to the Michigan Natural Resources Trust Fund (MNRTF) requiring an updated parks and recreation plan for communities to apply for funding, the state should require that all natural features be fully addressed in all land use planning activities, particularly land use master plans, in order to receive certain types of state financial assistance.
10. Since many landscape ecosystems and ecological processes, such as hydrology, occur over large scales, the state should take the lead in developing and promoting large-scale ecosystem management efforts. These efforts should be highly integrated and inclusive of economic, social, and ecological goals and objectives.

10. The old paradigm pitting conservation against economic development will not lead the state to the desired outcome of economic prosperity. In order to fully capitalize on the results of this study, a new form of economic growth will need to be created. This new paradigm will need to implement more of an integrated approach that takes into account the triple bottom line (economic prosperity, social equity and ecological health), and shift toward a model founded upon long-term sustainability.

Outreach Recommendations

1. One of the keys to facilitating the smart conservation/restoration of green infrastructure is to increase the accessibility of natural features information to local communities and decision makers. To do this, we will need: 1) a central hub to organize the information and serve as a gateway; 2) a



suite of decision support tools for different types of applications, such as utility planning, climate change adaptation and comprehensive land use plans; 3) a clearinghouse to store and share relevant data, information and knowledge; 4) technical support to assist end users and build capacity within communities; and 5) outreach and education to engage and inspire constituents across the state.

2. There should be support from the state to support additional outreach activities explaining the relationship between green infrastructure and economic growth to planners, economic development officials and other decision makers.

Funding Recommendations

1. In order to fully capitalize on a region's natural features, local communities need to know what they have, where it's located, how much they have, and what condition it is in. To accomplish this, there should be long-term financial support from the state to conduct a statewide systematic natural features inventory. This type of effort should be prioritized based on a set of logical criteria, such as the degree of threat to the resources, the amount of natural features, proximity to population centers, etc.
2. Pure Michigan ads have been successful in attracting tourists to Michigan, which translates into additional revenue for future management and consumer spending in our communities. We strongly recommend that the state maintain funding at current levels for the Pure Michigan Campaign to increase natural resource-based tourism activity.



3. Michigan is in desperate need of long-term stable funding to support natural features data management and delivery, smart conservation and restoration, applied research, technical support and outreach. A strategy needs to be deployed that engages a diverse coalition of groups who can build broad support for long-term funding and make it a reality. Successful revenue generation ideas in other states include: the percentage of sales tax, the percentage of real estate transfer tax, and bonds to provide important long-term support.

Research Recommendations

1. By conducting this analysis at the MCD scale, this study was able to uncover patterns occurring at a relatively small scale. As a follow up, a better understanding of the proximity effect of various quality-of-life and cultural assets and green infrastructure assets on community growth is needed. For example, someone may live and work in different places. Understanding the effects that nearby jurisdictions have on population, employment and income change is essential. These proximity effects could have a significant impact on the potential growth of a community.
2. Due to the fact that the vast majority of natural features are located in rural MCDs, we should conduct an analysis that distinguishes between rural and urban MCDs, or at least metropolitan and non-metropolitan MCDs. It would be very interesting to compare urban communities rich in natural features with urban communities poor in natural features. This distinction may also show significant differences in regard to quality-of-life and cultural assets.
3. From an ecological perspective, Michigan is a relatively diverse state, to which several different types of regional frameworks have been applied. Because of these regional differences, an econometric analysis of green infrastructure should be conducted based on ecological regions rather than the whole state. The addition of data from the 2010 Census would also determine, spatially, where the concentrations of wealth and growth occurred in the 2000s by MCD.
4. Zoning is decided at the local level. An inventory of zoning ordinances by MCD should be collected and the relationship between various types of zoning ordinances, natural features and economic performance should be explored.
5. Several efforts and trends are currently underway in Michigan—such as development of wind energy in agricultural areas and a new pheasant initiative focusing on private lands by the DNR. Specific studies should be conducted on a case-study basis to determine the effective synergy between different sectors of the economy—such as agricultural wind energy and biofuels-pheasant production—in order to identify new and innovative partnerships that can enhance local economies and promote natural resource use, conservation and alternative energy production.

Conclusion

Michigan finds itself at a crossroads. For more than a decade, Michigan has been suffering from an economic crisis from which it is still trying to recover. The impacts have been devastating to state and local governments, businesses, communities and families alike. To truly move the economy forward, a new paradigm is needed based on identifying, sustaining and enhancing its strengths and assets. Despite Michigan's dependence on the automobile sector and associated manufacturing industries over the last half of the 20th century, Michigan's underlying strengths have always been its wealth of natural resources. Bordering four of the five Great Lakes, Michigan is known proudly as the Great Lakes State. The two peninsulas encompass

more than 37 million acres of land, and at 19 million acres, the state contains the largest stock of forestland east of the Mississippi River. More than 38,000 miles of rivers and approximately 11,000 lakes can also be found within Michigan's borders. Its 3,200 miles of Great Lakes shoreline also boast the largest collection of freshwater dunes in the world. In moving forward, one of the biggest challenges Michigan faces is finding a way to balance desired economic growth with the long-term viability of its natural assets. Perhaps it is from the very challenge of defining, understanding and implementing long-term sustainability that new ideas and solutions will ultimately emerge for Michigan to become prosperous in the 21st century.



Michigan Natural Features Inventory

Michigan Natural Features Inventory (MNFI) is a program of Michigan State University Extension and serves as the natural heritage program for the State of Michigan. The MNFI is part of an international network of 74 other natural heritage programs and conservation data centers in the U.S., Canada, Latin America and the Caribbean dedicated to the collection of information on biological diversity within the Western Hemisphere. The Inventory's mission is to deliver the highest quality information that contributes to the conservation of biodiversity, especially rare and declining plants and animals and the diversity of ecosystems native to Michigan.

Since 1980, MNFI has been developing and maintaining the most comprehensive biological and conservation database on Michigan's rare plants and animals, exemplary natural communities, and other significant natural features. As a repository of knowledge and information about natural feature in Michigan, MNFI enhances the conservation and stewardship activities of public and private natural resource managers, and adds value to the work of others by forming and participating in effective collaborations and partnerships.

In addition to its role as steward of the state's most comprehensive natural features database, MNFI is involved in a variety of applied research such as life history analyses, population viability analyses, predictive modeling, threat analysis and biological surveys and monitoring. This information is then analyzed, synthesized and made available to federal, state and local agencies, universities, consultants, private organizations and private landowners through conservation planning efforts, outreach and educational activities, and information products. <http://mnfi.anr.msu.edu/>.

Land Policy Institute

The Land Policy Institute partners with the School of Planning, Design and Construction at Michigan State University to provide policy makers at the federal, state, local level and beyond with science-based tools and solutions that help build a better quality of life, strengthen the economy and protect the environment in ways that are fair to all. The LPI works to encourage collaboration among land use researchers, policy makers and community organizations. www.landpolicy.msu.edu.

John A. Hannah Professor in Land Policy

Housed in the Department of Agricultural, Food and Resource Economics (AFRE) at Michigan State University (MSU), the program of the Hannah Professor in Land Policy focuses on research-based innovation in land use, land policy, land security, place science, growth strategies, economic development and prosperity domestically and internationally. In Michigan, the Hannah Professor's work has been a cornerstone of economic development policy initiatives of the state, especially in areas related to renewable energy, the New Economy and the green economy. As Director and Founder of the Land Policy Institute, the Hannah Professor developed its research agenda and spearheaded several studies that relate to Michigan's growing economy. At the international level, the Hannah Professor's program focuses on resource availability, economic appetites of nations, global resource competition, land security and economic security. At the time of printing, Professor Adelaja is on leave from Michigan State University on a foreign assignment with the Office of the National Security Adviser at the Presidency of Nigeria, serving as Special Advisor on Economic Intelligence.

The Full Report

This full report is available for download online at
www.landpolicy.msu.edu/DriversofEconPerformanceinMIReport.

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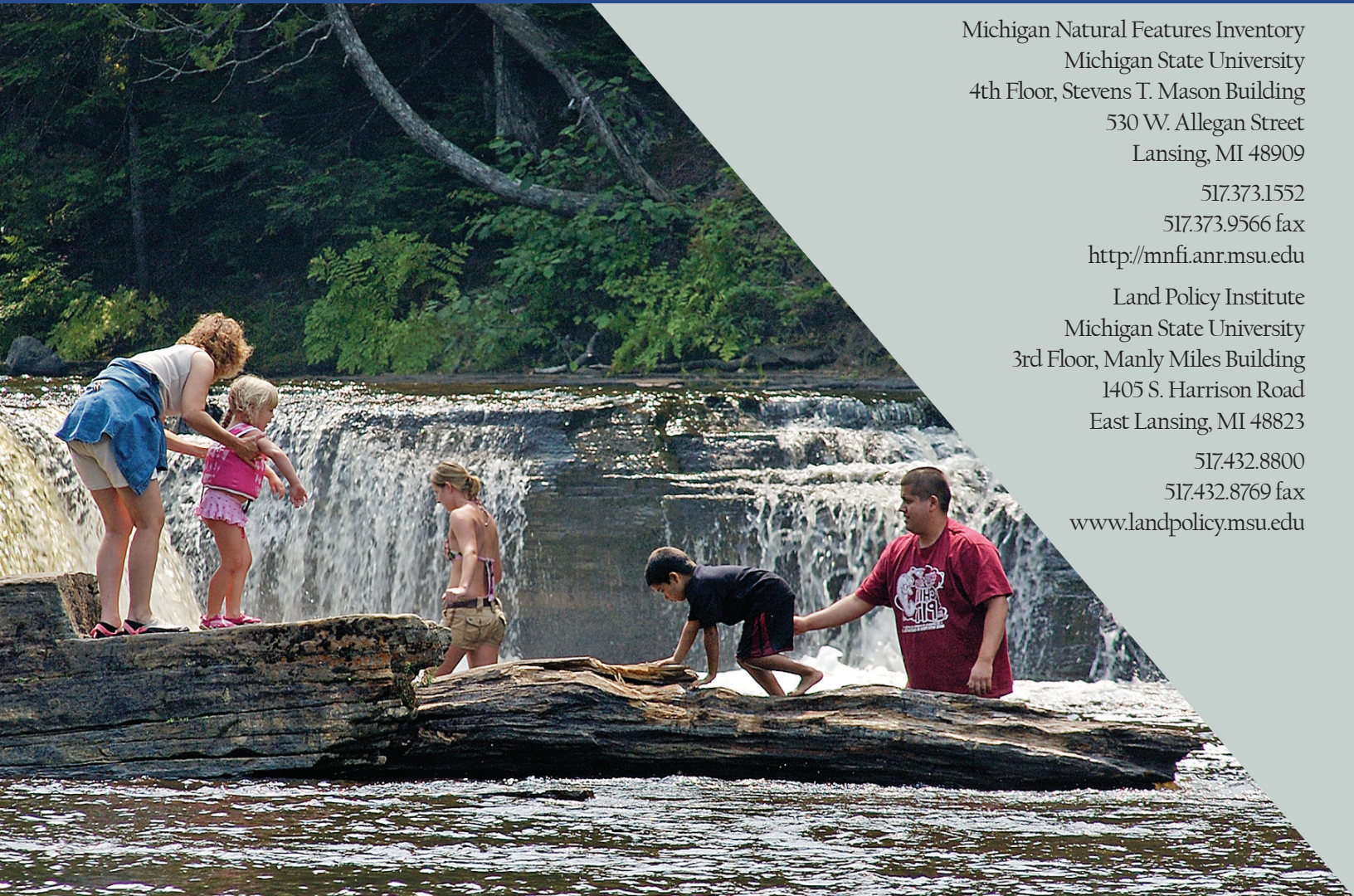
Photos by David Kenyon (Michigan DNR), pgs. 4, 8-9 and front (sailboat) and back covers; iStock, pg. front cover (trail); Justin Sparks, pg. 7; Michigan Dads, pg. 11; and Tyler Borowy, pg. 5.

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