



## Socioeconomic evaluation of the impact of natural resource stressors on human-use services in the Great Lakes environment: A Lake Michigan case study

William S. Breffle<sup>a,b,1</sup>, Daya Muralidharan<sup>a,b,\*,2</sup>, Richard P. Donovan<sup>a,c,3</sup>, Fangming Liu<sup>a,d</sup>, Amlan Mukherjee<sup>a,e,4</sup>, Yongliang Jin<sup>a,f</sup>

<sup>a</sup> Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931, USA

<sup>b</sup> School of Business and Economics, 127 Academic Office Building, 1400 Townsend Drive, Houghton, MI 49931, USA

<sup>c</sup> Sustainable Futures Institute, 840 DOW, 1400 Townsend Drive, Houghton, MI 49931, USA

<sup>d</sup> Environmental Policy, Department of Social Sciences, 1400 Townsend Drive, Houghton, MI 49931, USA

<sup>e</sup> Department of Civil and Environmental Engineering, Service Systems Engineering Program, 201J Dillman Hall, 1400 Townsend Drive, Houghton, MI 49931, USA

<sup>f</sup> Department of Civil and Environmental Engineering, 1400 Townsend Drive, Houghton, MI 49931, USA

### ARTICLE INFO

#### Article history:

Received 12 July 2012

Received in revised form

12 October 2012

Accepted 16 October 2012

Available online 20 November 2012

#### Keywords:

The Great Lakes

Environmental stressors

Focus group

Public preferences

### ABSTRACT

The Great Lakes watershed is home to over 40 million people (Canadian and U.S.) who depend on a healthy Great Lakes ecosystem for economic, societal, and personal vitality. The challenge to policy-makers and the public is to balance economic benefits with the need to conserve and replenish regional natural resources in a manner that ensures long term prosperity. Nine critical broad-spectrum stressors of ecological services are identified, which include pollution and contamination, agricultural erosion, non-native species, degraded recreational resources, loss of wetlands habitat, climate change, risk of clean water shortage, vanishing sand dunes, and population overcrowding. Many of these stressors overlap. For example, mining activities alone can create stress in at least five of these categories. The focus groups were conducted to examine the public's awareness of, concern with, and willingness to expend resources on these stressors. This helped generate a grouping of stressors that the public is especially concerned about, those they care little about, and everything else in between. Stressors that the respondents have direct contact with tend to be the most important to them. This approach of using focus groups is a critical first step in helping natural resource managers such as Trustees and NGOs understand what subsequent steps to take and develop policy measures that are of most interest and value to the public. Skipping or glossing over this key first task could lead to difficulties with respect to survey design and model development in a non-market valuation study. The focus group results show that concern related to pollution and contamination is much higher than for any of the others. It is thus clear that outreach programs may be necessary to educate the public about the severity of some low-ranked stressors including climate change.

© 2012 Elsevier Ltd. All rights reserved.

## Introduction

### Background

The Great Lakes are the biggest body of freshwater lakes in the world. They contain about 23,000 km<sup>3</sup> (5500 mi<sup>3</sup>) of water; cover a total area of 244,000 km<sup>2</sup> (94,000 mi<sup>2</sup>), and account for 90% of the United States' surface fresh water (20% of the world's fresh surface water). The Great Lakes watershed drains almost 200,000 mi<sup>2</sup>, has a nearly 10,000 mi long shoreline, and includes 35,000 islands. It is home to over 40 million people (Fig. 1). Over 25 million people in the U.S. rely on the Great Lakes for their drinking water (U.S. Environmental Protection Agency, 2009).

At \$3.7 trillion, the non-farm economy represents 30% of the value of the GDP in the U.S. and Canada combined while

\* Corresponding author at: Michigan Technological University, School of Business and Economics, Assistant Professor of Economics, 1400 Townsend Drive, 127 Academic Office Building, Houghton, Michigan 49931, USA.  
Tel.: +1 906 487 2786; fax: +1 906 487 2944.

E-mail addresses: [wsbreffl@mtu.edu](mailto:wsbreffl@mtu.edu) (W.S. Breffle), [dmuralid@mtu.edu](mailto:dmuralid@mtu.edu) (D. Muralidharan), [rpdonova@mtu.edu](mailto:rpdonova@mtu.edu) (R.P. Donovan), [fliu2@mtu.edu](mailto:fliu2@mtu.edu) (F. Liu), [amlan@mtu.edu](mailto:amlan@mtu.edu) (A. Mukherjee), [yjin@mtu.edu](mailto:yjin@mtu.edu) (Y. Jin).

<sup>1</sup> Tel.: +1 906 487 1959; fax: +1 906 487 2944.

<sup>2</sup> Tel.: +1 906 487 2786; fax: +1 906 487 2944.

<sup>3</sup> Tel.: +1 906 487 3612; fax: +1 906 487 3612.

<sup>4</sup> Tel.: +1 906 487 1952; fax: +1 906 487 2943.

employing 43.4 million people. Agriculture alone contributes \$53.4 billion in Canada and the U.S. (Krantzberg, deBoer (2006)). Forestry remains a locally important industry throughout much of the watershed. For example, in Wisconsin in 2000, pulp, paper, wood products manufacturing, and other forest products industries employed 74,000 workers and generated more than \$18 billion in shipments (Union of Concerned Scientists and the Ecological Society of America, 2003). Like forestry, shipping is a relatively small percentage of the overall economy but critically important to virtually every aspect of the Great Lakes economy. Grain, soybean, coal, iron ore, and other goods and commodities worth billions of dollars from the Midwest and Canada are shipped to markets worldwide. The watershed contains 20% of all U.S. timberland and 20% of all U.S. manufacturing (58% of cars made in the U.S. and Canada are made in the basin). In addition, the Great Lakes support a \$1-billion-plus recreational fishing industry (Krantzberg, deBoer, 2006).

Though the Great Lakes are one of America's most important natural features, and they are important to the economy of both U.S. and Canada, environmental issues related to them are often overlooked. However, the healthy functioning of ecosystems in the Great Lakes region and the services they provide are important. Unfortunately the complexity of the interactions between the environmental services provided by the ecosystem and the societal demands upon that ecosystem tend to obscure the importance of tending to the significant impact that over 40 million people are having on this ecosystem. Human activities, such as urban sprawl, land use change, discharge of pollutants into air and water, mining, and shipping that introduced zebra

mussels and other damaging non-native, invasive species into the Great Lakes have put increasing pressure on the ecosystem. Also, mining of sand for construction and development is one of the activities that results not only in the depletion of the nonrenewable resource, but also contributes to pollution and presence of invasive species in the area.

Further, in current economic times, it is easier for companies to stress the benefits from activities such as mining, and downplay the negative impacts on the environment. According to the National Wildlife Federation website, mining and exploration companies are finding deposits of minerals including copper, nickel, gold and other metals in the area surrounding Lake Superior. General mining activities have the potential to affect the quality and services of aquifers, wetlands, recreation, heavy metal and other releases into the environment, and problems may be correlated with population density. Likewise, oil extraction could be included in studies of regions where that activity is relevant. In face of the strong lobbying by mining companies, public perceptions about natural resource usage and environmental stressors take on an added importance, especially when it comes to public policy.

Policymakers and the public face the challenge of balancing economic benefits with the need to conserve and/or replenish regional natural resources to ensure long term prosperity. This challenge is significant and complicated by: (1) perceptions that natural resources are publicly owned and therefore available for everyone to exploit that leads to the well-known "tragedy of the commons" (e.g., non-point source runoff from mines or farms); (2) perceptions that environmental regulation and promotion of economic growth are conflicting objectives requiring significant



Fig. 1. Source: NOAA Great Lakes Environmental Research Laboratory ([http://www.flickr.com/photos/noaa\\_glerl/4036834381/sizes/l/in/set-72157622521835043/](http://www.flickr.com/photos/noaa_glerl/4036834381/sizes/l/in/set-72157622521835043/)).

Download English Version:

<https://daneshyari.com/en/article/985701>

Download Persian Version:

<https://daneshyari.com/article/985701>

[Daneshyari.com](https://daneshyari.com)