Report as of FY2006 for 2006MI76B: "Economic Implications of Restoring Aquatic Ecosystems of the Muskegon River watershed"

Publications

Project 2006MI76B has resulted in no reported publications as of FY2006.

Report Follows

Project Number: 2006MI76B

Start: 03/01/06(actual)

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Title: Economic Implications of Restoring Aquatic Ecosystems of the Muskegon River watershed

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INTRODUCTION

The impact of human land use activities, such as groundwater withdrawal and agricultural nutrient runoff, often results in stream flow reduction and water quality degradation, subsequently impacting the beneficial uses of aquatic species. Many research studies have emphasized an examination of the effects of these anthropogenic activities on aquatic ecosystem degradation, especially at the watershed scale. Increasingly, scientific information is emerging to assist decision makers' understanding of natural ecosystems, and the problems, causes and consequences of human activity on ecosystem heath. This information proves useful to a resource manager attempting to identify management strategies to restore ecosystems. However, when faced with budget or resource constraints, it becomes necessary to bring economic information (e.g., costs, benefits, efficient restoration/conservation tradeoff options) into the decision making process.

This technical report provides information on the estimated value of ecosystem services in the Muskegon Watershed, Michigan, specifically those values related to supporting aquatic ecosystem functions. This information is helpful when making decisions related to the tradeoff between conservation implementation and restoration investment in the Muskegon River watershed.

RESEARCH PROGRAM

Project summary

Benefit transfer (BT) methodology was used for estimating the values of ecosystem services for wetlands, lakes and rivers. We reviewed non-market value studies from over 100 peer-reviewed papers related to these ecosystem services. The publications ranged from 1970-2006. Our criteria for selecting potential publications that were transferable to our study site (Muskegon River Watershed, Michigan) were based on several criteria related to relevance of geographical and population area, valuation method, unit of measurement, and statistical estimated values. Wetland and water (lakes and rivers) ecosystem services were our main focus. It was found that of the over 100 peer-reviewed

papers, only 20 percent could be used for BT in our study site. Due to insufficient value studies to transfer, we were able to transfer the values for 3 types of services (aesthetics/amenity, nutrient cycling and waste assimilation and recreation) for wetlands, and only "recreation values" for river and lakes. We compare the estimated values for wetland to the wetland metadata analysis compiled by Woodward and Wui (2001), and found that our BT wetland values are compatible and lie at the lower bound of the values in metadata studies. For water ecosystem services, we reported the individual consumer surplus per trip for our study site, which ranged from $53-$164. Rivers provide a significant value for fishing while lakes provide recreation value for boating and fishing activities. The values reported in this study are initial values. If we have more papers to incorporate into the database; it would help improve the value transfer to our site.

Problem and Research Objectives

It is important to quantify the values of ecosystem services, especially those not normally captured in market transaction activities. Many public policies on restoration and conservation are simply assigned a "zero" value for ecosystem services, while they may have values for human welfare greater than zero (e.g., existence value) (Dailey, 1997). This results in an under estimation of the benefit of their conservation or restoration policy and may lead to an inefficient public policy decision.

Rivers and wetlands are important to support the proper functioning of aquatic habitats and several recreation activities. They also provide many services to humans including water supply and purification, as well as flood and erosion reduction. In this paper we employ a resource valuation methodology called "Benefit Transfer (BT)" to estimate the value of ecosystem services to guide future ecosystem restoration efforts in the Muskegon River Watershed, Michigan. We focus on qualifying the benefits of rivers/lakes and wetlands services, as they are key for maintaining the health of aquatic ecosystems.

Methodology

Economists have developed a variety of non-market methods (e.g., travel cost method, contingent valuation method, hedonic property value method) that can be used to quantify the value of ecosystem services (note: the details of each method and others can be found in many publications). These methods involve conducting an original benefit estimate study at a detailed site-specific location and involve a large expense of both budget and time of public resources for collecting primary data.

In this paper we apply the BT estimation method, which is relatively less expensive and time consuming, to estimate values of ecosystem services at our study site (Muskegon River Watershed). BT is a method to transfer existing values estimated at one site (originally estimated by a variety of non-market methods) to another site (policy site) where agencies face budget and time constraints (Brouwer, 2000; Boyle and Bergstrom, 1992)). BT has been used by government agencies for many years for various natural resource policy contexts and it is rigorous enough for use in an informed resource manager's decision (Piper, 2001).

There are two approaches for benefit transfer; 1) value transfer and 2) function transfer (Rosenberger and Loomis (2001). Value transfer is the transfer of a single (point) benefit

estimate from a study site, or a measure of central tendency for several benefit estimates from a study site or sites (such as an average value). Function transfers encompass the transfer of a benefit or demand function from a study site, or a meta regression analysis function derived from several study sites. Function transfers then adapt the function to fit the specifics of the policy site such as socio-economic characteristics, extent of market and environmental characteristics.

This paper uses the BT methodology for estimating the non-market value of ecosystem services (use values) in the Muskegon Watershed of Michigan. We employed a value transfer approach including a single point estimate and/or average values of several studies where appropriate.

Principal Findings

Our initial search provided over 100 economic value studies for wetlands, rivers, and lakes in the U.S. These studies were primarily found through several online bibliographic databases, electronic journals, and online-search engines. Examples of these online databases are The Environmental Valuation Reference Inventory (EVRI) and the ENVALUE environmental valuation database, and search engines such as Google Scholar, and EconLit.

The EVRI is an international database of over 1500 non-market studies (http://www.evri.ca/). It allows users to choose the services valued and identifies studies with potential for BT (e.g., geography, environmental stressors, specific/general goods and services, and valuation techniques). The ENVALUE was developed by the Environmental Protection Agency in New South Wales, Australia (http://www.epa.nsw.gov.au/envalue/). It is a collection of more than 400 peer-reviewed studies containing data on environmental values (air, water, land, recreation, etc). The database can be searched by “environmental values”, “valuation method”, and “geographic location”.

We did an initial review of these articles and eliminated those not relevant to our study (e.g., not an empirical study, not a non-market value study, experimental study or preliminary study, not a peer-reviewed paper, unclear study timeframe, not a study site in the mainland U.S., etc). Table 1 summarizes the number of articles found though these search databases classified by land use (wetland and water (lakes and rivers)).

Table 1. Summary of articles found and those used for BT

Land use/ecosystem services	Number of articles found for initial review	Number of articles to be reviewed in detail	Number of article used for BT for the policy site	Ranges of publication period
Wetlands	49	26	9	1974-2007
River/Lakes	70	49	14	1980-2007
Total	119	75	23	1974-2007

Further review efforts were done only on those studies identified as most relevant with potential to be transferred to our study site. In this step we developed a review sheet for each article and developed a database containing information necessary to perform the BT. This information included valuation method, year of value given, geographic region, ranges and value estimates, units, statistical ranges and assumptions. All values were also adjusted by consumer price index to reflect the dollar value for 2006. The database allows us to compare value study information among articles.

The final step was to decide which values/studies could be transferred to our study site. The researcher made the final justification for those values using several criteria. Other than geographic relevance to the Midwest and/or the Great Lakes region, the major criteria were; 1) valuation methodology - we focused on the two measurements of welfare surplus (consumer and producer surplus). Therefore two methods, travel cost and contingent valuation approaches were our preferred methodologies; 2) unit measurement and reported value - we focused on individual consumer surplus per unit area, or in the case of recreation activities, reported the consumer surplus per trip, day and season. The estimated values were used in combination with local data, such as acres of wetlands in a watershed, number of trips and the population of recreational participants in a watershed; 3) Ecosystem services to be measured - to avoid double counting, we made certain the original study had an objective clearly stating what services were to be measured. Table 2 shows the values estimated for the Muskegon Watershed. The final column compares the values estimated to the wetland metadata analysis complied by Woodward and Wui (2001). Most of our estimated values are lower, or somewhat lower, than the wetland metadata study.

Table 2. Summary of estimated values using BT method for the Muskegon Watershed, Michigan[1]

Ecosystem Sever ices	Estimated value for rivers and lakes	Estimated value for wetlands	Wetland meta-data study[2]
Aesthetic/Amenity	Insufficient peer-review for BT	$16 per acre	$1.51-$21.59 per acre (Wetland)
Nutrient Cycling/Waste Assimilations	N/A (already measured their values through wetland values)	$1067-$2040 per acre	Not applicable to comparison
Recreation (sport fishing, hunting, wildlife watching)	$53-$164 per trip (Lake) and $82-$131 per trip (River)	$12-$83 per acre	$82-1,400 per acre (Wetland)

Note:
[1] all estimated values are year 2006
[2] Complied by Woodward and Wiu (2000) with values converted to 2006 dollars

Significance of Project

The values reported in Table 2 represent the values of ecosystem services for wetland and water recreation that can be used for the Muskegon Watershed. These values can be used for economic analysis of restoration or conservation policies implemented in the watershed. It should be noted that the values represent limited ranges of ecosystem services for wetlands, lakes and rivers. There are some important non-market services, such as erosion control, pollination, water regulation and water supply, which cannot be estimated for this study due to their limitation for data transfer or their inappropriateness for transfer. In addition, the values of ecosystem services reported here include only "use values", they do not include "non-use" or "passive" values (i.e., options, existence and bequest) where resources may have a significant value and importance to human welfare.

Publication citations associated with the research project

Boyle, K.J., and J.C. Bergstrom.1992. Benefit transfer studies: Myths, pragmatism, and idealism, Water Resources Research, 28. No. 3.

Brouwer, R. 2000. Environmental value transfer: State of the art and future prospects. Ecological Economics, 32, 137-152.

Dailey, G. 1997. Nature's services: societal dependence on natural ecosystems. Island Press, Washington, D.C.

Piper, S., and W. E. Martin. 2001. Evaluating the accuracy of the benefit transfer method: A rural water supply application in the USA. Journal of Environmental Management 63, 223-235.

Rosenberger, R.S.; Loomis, J.B. 2001. Benefit transfer of outdoor recreation use values: a technical document supporting the Forest Service Strategic Plan (2000 revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

Woodward, R., Y. S. Wiu. 2001. The economic value of wetland services: a meta-analysis. Journal of Ecological Economics 37(2001) 257-270.

NOTABLE AWARDS AND ACHIEVEMENTS.

n/a

PUBLICATIONS FROM PRIOR PROJECTS

n/a