

Economic Value of Lake Ecosystem Services

Bill Jones

Anyone who lives on, plays in, or otherwise appreciates lakes values them. But what are they worth? And should that worth only be determined for the lake's value to humans? In today's society, there is an undeniable "paradox of lake values."

I fear that we take lakes for granted in much the same way that Garret Hardin wrote in his famous 1968 essay, "The Tragedy of the Commons." Hardin referred to the village green of Colonial America on which folks grazed their horses and livestock when they came into town. Over time, the overuse of this shared limited resource resulted in its degradation, even though it was clearly in no one's interest for this to happen. Public lakes, as we now use and manage them, are a modern-day tragedy of the commons.

The economic value of lakes is presumed to be high but is difficult to assess. What is the value of clean water? What would you be willing to pay to enjoy the peace and tranquility of a quiet lakeshore or to take your child fishing? The "willingness to pay" has long been used to place economic value on nature. But is this enough? If a polluter damages your lake, how much should the fine be? Courts follow the "law of economic waste" in which environmental damages are limited to the value of reduced property values. So what is the value of a lake?

Willingness to pay for lake water quality has been observed across the United States. In Itasca County, Minnesota, 56 percent of the county's 2003 tax base was provided by riparian residential properties, while lakes account for only about 9 percent of the total county area (Dziuk and Heiskary 2003). Also in Minnesota, declines in water clarity have lowered the price of lakefront property by up to \$500 per frontage foot. Similarly, in Maine, New Hampshire, and Vermont, a one-meter decrease in Secchi disk transparency was predicted to lower lakefront property prices between 0.9 to 8.5 percent (Boyle and Bouchard 2003).

A 2003 study conducted in Steuben County, Indiana, reported that assessed residential property value was 54 percent higher than that for four northern Indiana counties with similar size and characteristics but without as many lakes. The study concluded that the increase in property values, and thus tax revenue, was due to the lakes.

Clearly, lakes have value and clear lakes have more value than turbid lakes. But these values are all based on dollars and cents to humans. Are there not intrinsic values to lakes?

A recent article (<http://www.time.com/time/business/article/0,8599,1970173,00.html>) quoted Pavan Sukhdev, a senior banker with Deutsche Bank and Special Advisor to the United Nations Environment Programme's (UNEP) Green Economy Initiative as saying, "Biodiversity is the living capital of the planet." Currently, "the economic value attached to nature is zero. Our metrics are geared toward consumption and production of man-made goods and services, and we tend to gloss over nature." This, he says, has led to "bad accounting," which, in turn, has contributed to rapid biodiversity loss.

What kind of value are we talking about? According to the UNEP study, an annual investment of \$45 billion to biodiversity conservation worldwide could safeguard about \$5 trillion in ecosystem services – a benefit to cost ratio of 100 to 1. Just what are "ecosystem services"?

Ecosystem services are the benefits people obtain from ecosystems. These include *provisioning services* such as food, water, timber, and fiber; *regulating services* that affect climate, floods, disease, wastes, and water quality; *cultural services* that provide recreational, aesthetic, and spiritual benefits; and *supporting services* such as soil formation, photosynthesis, and nutrient cycling (MEA 2005).

In eutrophic Lake Winnipeg, Manitoba, the historic loss of ecosystem services (soil stability, nutrient sinks, sustainable shorelines, etc.) due to human development of the lake's watershed has been costly. Lake

Winnipeg's water quality has been degraded by a multitude of human activities influencing water and nutrient flows. Addressing the eutrophication of Lake Winnipeg could be realized by preserving and restoring environmental assets at the watershed scale. For example, if pre-settlement landscapes could be re-created, they would provide, on an annual basis, between \$500 million and \$3.1 billion of ecosystem services, and between \$80 million and \$1.4 billion worth of carbon offsets in the emissions market (Voora and Venema 2008). This is three times the current value of Lake Winnipeg's damaged ecosystem services.

Table 1 lists some of the more important ecosystem services provided by lakes. While some of these ecosystem services may seem esoteric, *Water Column* readers should find many that they can personally relate to.

As you can see, the value of our lakes can be measured by more than lakefront property values, tax bases, or fishing license revenue. Lakes provide value to all of us, whether we live on them or never even visit them.

Quantifying and valuing ecosystem service losses or gains provides an economic rationale for the preservation and restoration of environmental assets. By

Table 1. Lake Ecosystem Services

Contextual Relevance	Ecosystem Service	Description - Function
Water Quantity and Quality - Lake Eutrophication	Water Regulation	Regulation of water flows, which entrains pollutants and purifies water - Regulating.
	Water Supply	Filtering, retention, and storage of fresh water - Provisioning.
	Erosion control	Maintains arable land and prevents water silting by lowering soil losses by wind and sediment retention and runoff - Regulating.
	Waste Treatment	Removal, breakdown, or abatement of pollutants - Regulating.
Climate Change	Atmospheric Regulation	Regulation of atmospheric compositions by various processes such as carbon sequestration - Regulating.
	Climate Regulation	Influence of land covers on climate (temperature, precipitation, etc.) - Regulating.
Biodiversity	Biological Control	Control of populations, pests, and diseases through trophic-dynamic processes - Regulating.
	Habitat/Refugia	Suitable living space for species to evolve and breed - Supporting.
Material Benefits	Food Production	The conversion of solar energy into edible plants and animals suitable for human consumption - Provisioning.
	Raw Materials	Conversion of solar energy into materials suitable for construction - Provisioning.
	Genetic Resources	Genetic evolution in plants and animals - Provisioning.
Social Well-being	Disturbance Prevention	Dampening of environmental disturbances such as storm protection and flood prevention - Regulating.
	Recreation	Opportunities for recreation, relaxation, and refreshment - Cultural.
	Cultural	Spiritual, religious, historical, and symbolic values - Cultural.
Environmental Integrity	Soil Formation	Rock weathering and organic matter accumulation leading to the formation of productive soils - Supporting.
	Nutrient Cycling	Storage processing and acquisition of nutrients within the biosphere - Supporting.
	Pollination	Movement of plant genes for reproduction - Supporting.

Source: Voora and Venema (2008)

determining and understanding the economic value of Indiana's lake services to the natural ecosystem, we will be in a stronger position to campaign for local, state, and federal governments to commit money to their preservation and restoration.

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Indiana Lakes Management Conference

Sara Peel

The Indiana Lakes Management Conference was held March 25-27, 2010 at Merrillville's Radisson Star Plaza. More than 130 lake residents and enthusiasts joined the Indiana Lakes Management Society for the 22nd annual conference. Many thanks to our sponsors, including the Aquatic Control; Aquatic Weed Control; Baetis; D2 Land & Water, Incorporated; Christopher B. Burke Engineering Limited; Clarke Aquatic Services; Indiana Association of Soil and Water Conservation Districts; JF New; SePRO; the U.S. Geological Survey; and UPI.

This year's conference highlighted the differences between Indiana's inland lakes and our Great Lake, Lake Michigan, with a theme of *All Lakes Great and Small*. Karen Rodriguez of the USEPA's Great Lakes National Protection Office served as the keynote speaker. Karen highlighted the vast size and diversity of the Great Lakes habitat and detailed methods by which the Great Lakes can be improved through the Great Lakes Restoration Initiative and the Great Lakes Action Plan.

Attendees also attended sessions focused on building partnerships, water quality assessment and monitoring, watershed improvement opportunities, in-lake assessment and opportunities for near-shore and in-lake improvements, emerging issues in Indiana, and concerns relating to water control structure maintenance and water level concerns. Attendees highlighted a partnership presentation by three lake associations: Beaver Dam/Loon Lake Conservation Club, Diamond Lake Conservation Club, and Yellow Creek Lake Conservation Club, and a Saturday rain barrel workshop as their

favorite presentations. During the partnership presentation, the presenters detailed their growth as individual groups and how through their efforts together they've crafted a plan to improve water quality within all six lakes in their watershed. As part of the rain barrel workshop, Lake County Master Gardeners instructed participants on the construction of their own rain barrels. Participants constructed rain barrels that they carried home from the conference.

As part of the conference, ILMS conducted its annual meeting where ILMS members elected new board members Nate Bosch of Kosciusko Lakes & Stream and Grace College and Matt Kerkhof of Hoosier Aquatic Management, Inc. Additionally, Laura Esman of Purdue University and Carrie Pintar of V3 Companies Limited were elected secretary and treasurer of the society, respectfully. ILMS would like to thank out-going board members Gary Doxtater of the Indiana Wildlife Federation and Eileen Boekestein of Kosciusko Lakes and Stream for all of their efforts during their time on the board. Additionally, ILMS members voted to sign on to Indiana



Conference participants listen to Karen Rodriguez, the keynote speaker.

Wildlife Federation's Phosphorus-Free Resolution. The resolution is the first step in IWF's campaign to enact legislation banning the unnecessary use of phosphorus fertilizers statewide. IWF will be working with the Indiana Lakes Management Work Group, the Indiana Lakes Management Society, and groups throughout the state to enact a phosphorus fertilizer ban.

At its annual banquet, ILMS recognized the ILMS Student Scholarship recipients, Lake/Watershed Group of the Year, the Volunteer of the Year, and the Legislative Award winner. Scholarship recipients included Sarah Powers, Indiana University School of Public and Environmental Affairs; Janelle Heller, Indiana University; and Caleb Rennaker, Purdue University. Students received a \$500 scholarship and free conference attendance.

ILMS was pleased to recognize the Tippecanoe Watershed Foundation for its long-term efforts to improve water quality in Lake Tippecanoe and its 114-square-mile watershed. TWF began work in their watershed in 1997. Since that time, they've implemented over 50 projects totaling more than \$2 million, including streambank restoration, wetland restoration, sediment trap creation, filter strip installation, livestock restriction, storm drain improvement, shoreline restoration, and rain garden installation. More than 1,000 watershed residents attended TWF education events over the last 13 years. And TWF is not stopping anytime soon, as they have more than 100 projects on their to-do list.

ILMS also recognized Bill Jones from Indiana University SPEA for his volunteer efforts and service to lakes throughout the state. Although Bill is the first to point out that he isn't a volunteer, ILMS felt it was important to recognize all that Bill has done for ILMS since its inception in 1991 and all that he does for lake residents throughout

the state. Bill has given two three-hour educational workshops on limnology and stream ecology to ILMS conference attendees at the 2010 and the 2008 annual conferences. Bill offers sound, technical advice for individuals to manage their lakes during these workshops and via presentations made on a variety of topics at Indiana Lakes Management conferences over the past 24 years. Topics have included shoreline protection, toxic algae, in-lake management at Lake Shakamak, and many more. He also provides a source of education for many of Indiana's lake, watershed, and environmental professionals. His students at Indiana University lead efforts at IDEM, IDNR, and many other public and private entities throughout the state. Without Bill's commitment to environmental education and solid lake science, his dedication to students past, present, and retired lake volunteers, management of Indiana's lakes would not have reached the current level of quality.

The Indiana Lakes Management Society (ILMS) honored its first recipient of the Legislative Achievement Recognition Award, Senator Robert Meeks. Senator Robert Meeks served as the State Senator from Indiana's District 13 in northeast Indiana from 1988 through 2008. Throughout those 20 years, Senator Meeks authored, co-sponsored, and successfully steered a number of bills through the legislative process that have benefited Indiana lakes, lake residents, and lake users. His legislation, and the legislation he supported, will ensure for generations to come that our lakes will continue to provide a high-quality setting for natural resources management, outdoor recreation, and economic value.

Finally, as part of the conference, ILMS concluded its first annual photo contest and its third annual student poster contest. Photographs by George Hardie, Sara Peel, Toby Stone, Markie Edwards,



Former Senator Robert Meeks accepts his award.

and Carrie Sheets were the top vote-getters. Have photos you've taken of your lake? Submit them to the 2010 photo contest – details will be announced soon.

Diatom Blooms Cause Early Season Problems

Bill Jones

If the early growth of aquatic algae is any predictor, we could be in for a long, summer. We've already received several reports of early algal blooms in Indiana. On March 23, Joe Skelton, a volunteer lake monitor on Lake of the Woods in Marshall County, sent me photos and a sample of an algae bloom that formed a scum on the lake. The bloom was almost exclusively composed of a variety of different diatoms (Phylum: *Bacillariophyta*).

Diatoms are often the first algal group to begin growth in the spring when the water is still cool and silica, required for their cell walls, is available. Many types of diatoms are found attached to rocks, plants, and other surfaces, but there are others that are free-living within the waters of lakes and reservoirs. While not known as bloom formers, they sometimes grow in excess to form bloom conditions.



Diatom bloom at Lake of the Woods, Indiana during March 2010.



Thick strands of Gomphonema mat the bottom of Cascades Creek in February 2010.

In another diatom incident, a thick growth of attached diatoms covered the rocks of Cascades Creek in Bloomington during February of this year, where a SPEA stream ecology class was conducting an intensive stream study. Initially feared to be *Didymosphenia geminata*, a highly invasive diatom plaguing streams in northeastern

U.S., it was later confirmed as a species of *Gomphonema*, a diatom that can form long membranous stalks that help it perch above the stream bottom. Diatoms contain chlorophyll and carotene as primary pigments. This yields a yellow-brown color to the cells. The thick growth hadn't been observed previously in this creek.

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Zebra Mussel Found at Geist Means Trouble

While fishing recently, a marina worker at Geist Reservoir hooked a Chinese mystery snail – an exotic species already prominent in the reservoir – and on it was another undesirable species – an adult zebra mussel.

“That’s one invasive species colonizing on another,” said Doug Keller, aquatic invasive species coordinator with the DNR Division of Fish and Wildlife.

The find could signal trouble for Geist, much as the mussel’s presence has affected other waters.

Previously found in more than 65 bodies of water in 44 counties throughout Indiana, the discovery marks the first time that the mussel has been found in the Indianapolis area. Zebra mussels were also discovered last year in Summit Lake, the first population known to occur in Henry County.

Keller said the effect of zebra mussels can be devastating where the invasive species successfully colonizes. “Zebra mussels can rapidly multiply and are known for clogging drainage and filtration pipes,” Keller said. “Besides pipes, they can attach to virtually anything in the water column, including rocks, limbs, piers, or even boats.”



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Geist is one of three water supply reservoirs for the Indianapolis area. Keller said that as zebra mussel numbers increase in Geist and downstream in Fall Creek, there could be negative impacts to the water utility's withdrawal capacity.

Zebra mussels are originally from Europe and spread rapidly across North America in the 1990s. Aside from being a costly nuisance to humans, zebra mussels may also cause declines in fish populations. By filtering tiny plants called phytoplankton out of the water column, zebra mussels diminish the base of the food chain, potentially causing declines in all other aquatic life, including fish.

Keller said that few options for eradicating the mussel exist, short of eliminating every other living thing in the reservoir. The best means of control, he said, is by educating boaters about preventing further spread of the mussel.

Typically, zebra mussels are transported by human recreational activities such as boating or fishing. A few simple steps can prevent the spread of zebra mussels and other invasive species. Removing all aquatic vegetation and draining livewells, bilge, water lines, and boat trailers at access ramps will prevent transport of the mollusk to other waters. Drying equipment after each use also is important.

"Letting all equipment dry for five days after a boating trip will prevent the spread of both adults and larvae," Keller said. "However, if you plan to visit a body of water sooner, you can use a solution of 5 percent bleach and water to clean and disinfect all of your equipment."

For more information, visit <http://www.in.gov/dnr/fishwild/3123.htm>, or contact Keller at (317) 234-3883.

Perspectives

Editor's note: With the Virginia bluebells blooming now, I thought the following was appropriate.

The blue bell is the sweetest flower
That waves in summer air;
Its blossoms have the mightiest power
To soothe my spirit's care...

~ An excerpt from The Blue Bell, by Emily Jane Brontë (1818-1848)