

Paying for ecosystem services

I. What is the issue?

If you had known, decades ago, that Hurricane Katrina was going to kill more than 1,300 people and cause billions of dollars in property damage, would you have thought it prudent and economically advantageous to prevent the development of coastal wetlands that could have served as natural buffers when the storm hit?

If you had never visited Prince William Sound in Alaska and never planned to visit it, would you still have felt a loss – a loss you could put a dollar value on – because of the environmental damage caused to the sound and its birds, fish and animals by the Exxon Valdez oil spill?

If you wanted people to once again find it attractive to fish and swim in the Minnesota River, would you have hit on the idea of paying farmers to leave untilled buffer strips along the river and its tributaries? Would you have been willing to pay to clean up the river?

Now, lots of people, including the comptroller general of the United States, are suggesting that knowing the value of those Gulf Coast wetlands might have caused politicians to make different decisions on development, decisions that would have lessened Katrina's damage.¹

During litigation over the Exxon Valdez spill in the 1990s, economists employed by the state of Alaska and the federal government questioned people around the country about how much they personally would be willing to pay if they could avert the ecosystem damage caused by the oil tanker's spill. The number the economists got averaged \$31 per household. They then applied that average to every household in the country and estimated the loss – to people who received no direct benefit from the Prince William Sound and probably never would – at \$2.8 billion. Not surprisingly, the \$2.8 billion estimate was hotly disputed by a rival team of economists working for Exxon. The Exxon team put the value at only "several million dollars."²

And former Minnesota Gov. Arne Carlson and lawmakers in 1998 began an ambitious plan to piggy-back on a federal farm program and pay farmers to stop silt, fertilizers and pesticides from washing into the Minnesota River. Since then, the state has spent \$105 million and the federal government \$200 million to buy permanent easements on about 110,000 acres of erosion-prone crop land and plant it with grass and trees.

The concept of paying landowners to practice conservation is not new, but over about the last two decades, ecologists, economists, policy-makers and a few entrepreneurs have participated in an explosion of activity aimed at putting monetary values on the services ecosystems provide to human beings.³

The results have been as diverse as:

- Flood plain land in northern Illinois was valued, for all purposes other than mitigating flooding, at \$8,177 an acre. Adding in the service the land provided by temporarily storing water after heavy rains boosted its value to \$60,517 an acre.⁴
- In 1997, in article in *Nature*, Robert Costanza, an ecological economist, and a group of colleagues reviewed the relevant scientific literature and estimated the average value of all the world's ecosystem services – including food production, climate regulation and cultural and recreational activities – was \$33 billion a year.⁵
- In 2003, financier Richard Sandor opened the Chicago Climate Exchange, a private, voluntary market in which members – including businesses like Ford Motors, Kodak and IBM, and institutions, like the University of Minnesota – individually pledge to reduce their output of greenhouse gases. If they exceed their goals, they can use the exchange to sell pollution rights to others. If they fail to meet their goals, they can buy carbon emission rights from others.⁶

II. Why would anyone want to value ecosystem services?

When considering whether to attach a monetary value to ecosystem services, it's not enough to say as Democratic campaign strategist James Carville famously did in 1992: "It's the economy, stupid." It's also our planet and its ability to continue sustaining human life. In an understated introduction to his 1997 *Nature* article attempting to put a value on all the world's ecosystems, Costanza wrote:

"Because ecosystem services are not fully 'captured' in commercial markets or adequately quantified in terms comparable with economic services and manufactured capital, they are often given too little weight in policy decisions. This neglect may ultimately compromise the sustainability of humans in the biosphere."⁷

In other words, putting a dollar value on something makes us take it seriously, and we need to take seriously the air we breathe, the water we drink and other benefits that we receive from the natural systems around us.

Putting a value on nature also establishes a milieu in which we can begin to pay for current and future ecosystem benefits, and can compensate landowners, even landowners across the globe, for undertaking conservation efforts – such as preserving rain forests – that maintain biodiversity and soak up greenhouse gases.

"...(T)he record clearly shows that conservation can't succeed by charity alone," wrote Gretchen C. Daily, one of the pioneers of the effort to attach a dollar sign to nature. "It has a fighting chance, however, with well-designed appeals to self-interest. The challenge now is to change the rules of the game so as to produce new incentives for environmental protection, geared to both society's long-term well-being and individual's self-interest."⁸

In 2005, the National Research Council, in the latest of a string of studies examining the valuation of natural systems, made the case for valuation this way:

“Despite growing recognition of the importance of ecosystem functions and services, they are often taken for granted and overlooked in environmental decision-making. Thus, choices between the conservation and restoration of some ecosystems and the continuation and expansion of human activities in others have to be made with an enhanced recognition of this potential for conflict and of the value of ecosystem services. In making these choices, the economic values of the ecosystem goods and services must be known so that they can be compared with the economic values that may compromise them and so that improvements to one ecosystem can be compared to those in another.”⁹

III. How do you put a value on a mangrove swamp or a peat bog?

In deciding what to value, many of the ecologists and economists working on ecosystem valuations acknowledge that nature may have an intrinsic worth totally separate from any benefits it yields for human beings. But the emerging science of valuing ecosystems generally separates ecosystem functions from human use of those functions. And the discipline attaches its dollar signs to the services, however broadly they may be defined, that benefit humans.

Gretchen C. Daily defined ecosystem services as “the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life.”¹⁰

Costanza, in the 1997 *Nature* article, noted that some people object to attaching a monetary value to nature because it is impossible to value such intangibles as human life, environmental aesthetics or long-term ecological benefits. He responded that we do that every day, for example, when we weigh costs against safety considerations in highway construction.

Costanza also wrote:

“Another frequent argument is that we should protect ecosystems for purely moral or aesthetic reasons...But there are equally compelling moral arguments that may be in direct conflict with the moral argument to protect ecosystems; for example, the moral argument that no one should go hungry.”

One of the first principles in valuing nature’s services is to consider broadly all the services an ecosystem provides and to attempt to put a value on each. To ignore a service or to decide it is too difficult to monetize is, in essence, to assign it a value of zero.

Costanza, in the 1997 *Nature* article, used 17 categories of ecosystem services. They included regulation of gases, climate, disturbances and water; water supply, erosion control, soil formation, nutrient cycling, waste treatment, pollination, biological control, habitat, food production, raw materials, genetic resources, recreation and cultural benefits.

Other scientists have proposed other lists. *Valuing Ecosystem Services* cites several attempts to categorize nature’s services. One, a 33-item list adapted from a 2002 publication by R.S. De Groot, includes “enjoyment of scenery,” “ecotourism,” and “inspiration for creative activities.”¹¹

Despite the fervent interest by ecologists and economists in inventorying and valuing ecosystem services, the task is daunting because no market exists for many of the services. Economists have developed a number of techniques – for example, determining how far people travel and how much they spend on gear to avail themselves of free outdoor recreational opportunities, and surveying people about how much they would pay to maintain natural features – but the results are imprecise.

Valuing Ecosystem Services cites one study that estimated that destroying one square kilometer of mangrove swamp in Mexico reduced the value of a shrimp harvest by \$150,000 a year. But another study of “normal-quality” wetlands estimated the impact of development on shrimp fishing at only \$277 per square kilometer.

And, in the Exxon Valdez litigation, one group of economists estimated the oil spill would cause the value of recreational fishing trips to drop by \$2.6 to \$3.2 million a year, and another set of economists estimated losses as high as \$50 million.

IV. The New York public water system’s Catskills experience

The decision by New York officials in 1997 to pay to regulate and protect a watershed in the Catskills Mountains that is a major source of much of the city’s drinking water is a touchstone of some of the literature about paying for ecosystem services.

The watershed protection plan, which so far has allowed New York to avoid building a multi-billion-dollar filtration system, has been repeatedly cited as an example of humans saving money by doing what’s right for the environment.

Beginning in 1989, the federal Environmental Protection Agency began requiring each public water system to mechanically filter surface water in addition to disinfecting it, primarily through the addition of chlorine – “unless its source water meets specific water quality criteria and it establishes a watershed management program.”¹²

New York officials built a filtration plant to purify a small part of its water supply. But they calculated that it would cost \$6 billion to \$8 billion to construct and operate a plant big enough to filter water coming from the Catskills. The city, instead, won EPA approval to spend \$1 billion to \$1.5 billion to protect surface waters in the Catskills.¹³

The city promised to spend its money to buy land and conservation easements from willing sellers; pay farmers to reduce or eliminate runoff from their fields, dairies and feedlots; and help cities pay for improved sewage treatment operations.

New York won waivers from the EPA’s filtration requirement in 1997, 2002 and again in 2007. Along the way, the city, at the insistence of the EPA, also built a huge plant to offer a second form of water treatment, exposure to ultraviolet light.

Some writers have cited the New York watershed improvement as a signal demonstration of the economic savings available through valuing and paying for ecosystem services. Gretchen C. Daily and Katherine Ellison described the New York tradeoff this way:

“With billions of dollars and the drinking water of nearly 10 million people at stake, planners weighed the costs and benefits of two alternative solutions to their water problem – constructing a filtration plant or repairing the largely natural filtration system that had been purifying the city’s water all along. Nature won. And in a turn of events that would have global implications, it won on economic grounds.”¹⁴

Shortly after the New York deal was agreed to, the New York City comptroller asked the National Research Council to review and evaluate the trade-off. In a 1999 report titled *Watershed Management for Potable Water Supply: Assessing the New York City Strategy*, the council generally supported the cost-saving approach, but it urged New York officials to remain open to the possibility they might need to resort to filtration at some time in the future.

In another report in 2005, the National Research Council discussed the New York watershed protection plan as a case study in valuing ecosystem services and noted two ways in which it differed from the methodology ecologists and economists have advocated:

- No monetary value was attached to any services, other than protecting drinking water, that the Catskills ecosystem offered to human beings.
- Nor did New York officials attempt to put a dollar value on contributions the Catskills environment made to protecting water purity. Instead, they merely calculated that it was cheaper to protect the water at its source than to filter it.

“If this answer had been different – if, for example, the cost of restoration had exceeded the cost of a new water filtration system – it might still have been appropriate to restore the watershed. However, in that case, a complete economic justification of such a decision would have required the valuation of a sufficient number of services of the Catskills watershed to show that the total economic value exceeded the costs of restoration, and offered New York City an attractive return on its investment. Such a valuation exercise would have been an order of magnitude more complex.”¹⁵

V. What has happened in Minnesota?

Minnesota has been a national leader since the mid-1980s in paying for ecosystem services through its Re-Invest in Minnesota, or RIM, program. The state’s money, often paired with federal Conservation Reserve Program money, has bought easements on farmland along rivers and streams, on wetlands and on land surrounding wells used by public water systems.¹⁶

But, like New York City’s efforts in the Catskills, the Minnesota conservation effort was largely accomplished without any formal attempt to put a dollar value on the ecosystem services rendered by the easements.

Minnesota's RIM program has three major goals:

- Reduce erosion.
- Improve water quality.
- Enhance fish and wildlife habitat.

The state began the program in 1986 in the midst of a farm crisis marked by declining land values and farm bankruptcies and at about the same time the federal government began its Conservation Reserve Program that paid farmers to set aside cropland and plant it in grass and trees. Initially, Minnesota relied on the Environmental Trust Fund, financed by the state lottery to buy 10-year easements on environmentally sensitive farm land.

Then, in February 1998, Minnesota was the second state -- Maryland was first, by a few hours -- to win approval from federal officials to combine state money with federal payments for conservation easements. Former Gov. Carlson, in his last year in office, began the ambitious plan to use the easements to fight water pollution in the Minnesota River.

Prior to 1998, Minnesota spent roughly \$75 million to buy easements on 80,000 acres. Since 1998, the state has spent about \$105 million and the federal government about \$200 million to persuade farmers to protect land near surface waters, and, in a few cases, near wellheads for community water systems.

Typically the federal government paid farmers to take land out of production for 15 years, and the state would boost the total federal payment by 40 percent to make the easements perpetual. Farmers retained control over their land; the easements did not buy public access to the property.

Overall, the state had bought about 5,000 easements covering 190,000 acres. A few of the leases are for 20 years, but an estimated 95 percent are perpetual. The state spent about \$180 million on buying the leases, administering the program and restoring cropland to grass and trees. About \$150 million went directly to farmers for the easements.

Between June 2005 and late 2007, the state and the federal government tried to replicate the Minnesota River Valley program in other parts of the state, but with much less success. The state bought easements covering about 8,000 acres, mostly in southeastern and southwestern Minnesota.

In a related program, the state cooperated with the federal Natural Resources Conservation Service in buying easements on about 16,000 more acres of wetlands.

As a result of legislation passed in 2007, the state Board of Water and Soil Resources is in the final stages of outlining a new program aimed at combining conservation with the production of bio-fuels. Called RIM Reserve Clean Energy, the program will pay farmers to use their land to produce grasses or other so-called "cellulosic" plants to be processed into liquid fuel. The program, which will encourage alternatives to the production of corn-based ethanol, will base its payments on a number of criteria. The

criteria are: water quality, soil health, reduction of carbon use, soil carbon storage, biodiversity and wildlife habitat.¹⁷

In different program, aimed at assuring public access to northern forests, Minnesota in October 2007 entered into a \$12 million deal to protect 80 square miles of forest in Itasca and Koochiching counties. The Nature Conservancy, the Blandin Foundation, the Trust for Public Land and other groups joined the state in buying a conservation easement from the land's owner, Forest Capital Partners. The easement allows the owner to continue logging the property, but precludes development of the land. The easement also guarantees continued public access to the land for hunting, fishing and other outdoor recreation.

And, in still another state initiative, the MN Terrestrial Carbon Sequestration Program, a project sponsored by the University of Minnesota, is scheduled to report soon on another ecosystem service: the carbon that is stored by Minnesota's forests, marshes and peat bogs.

The report is scheduled to be presented to the Legislature by Feb. 1.

Cheryl Miller, the project coordinator, said in an interview that the report will say that some 6 billion tons of carbon are stored in Minnesota's forests and wet lands, with the vast majority of it in peat bogs. If global warming or fire were to dry out those bogs, much of that carbon could escape into the atmosphere, further contributing to global warming.

She said the program's report will suggest three steps state policy-makers should take to promote carbon sequestration and fight climate change:

- Protect existing forests and peat bogs.
- Take carbon that is kept out of the atmosphere into consideration in valuing existing conservation and biofuels programs.
- Invest in research and development aimed at more precisely valuing different types of carbon storage so that credits for carbon sequestration eventually can be bought and sold.

But Miller said the report would not recommend any immediate effort to monetize and trade carbon credits from land use practices. More study is needed before that type of carbon market is justified, she said.

¹ David M. Walker, the comptroller general of the United States, cited Katrina and the linkage between lost wetlands and the storm's toll in the introduction to an October 2007 report on a scientific and economic conference on measuring and valuing natural resources. The conference was sponsored by the General Accounting Office and the National Academy of Sciences.

² National Research Council. 2005. *Valuing Ecosystem Services*. Washington, D.C.: The National Academies Press.

³ The movement toward valuing nature is part of a broader movement to assess and keep track of all the benefits we receive from ecosystems. The conference sponsored by the General Accounting Office and National Academy of Sciences focused, in large part, on the importance of gathering data, but participants agreed it was “important to include monetary values for the natural resources and environmental assets that are included in our nation’s environmental accounts.”

⁴ National Research Council. *Valuing Ecosystem Services*.

⁵ Costanza Robert, et al. 1997. “The value of the world’s ecosystem services and natural capital.” *Nature* 387:253-260.

⁶ www.chicagoclimateex.com

⁷ Costanza et al.

⁸ Daily, Gretchen C. and Ellison, Katherine. 2002. *The New Economy of Nature*. Washington, D.C.: Island Press.

⁹ National Research Council. *Valuing Ecosystem Services*.

¹⁰ Daily, Gretchen C. 1997. *Nature’s Services: Societal Dependence on Natural Ecosystems*. Washington D.C.: Island Press. Cited by the National Research Council in *Valuing Ecosystem Services*.

¹¹ National Research Council. *Valuing Ecosystem Services*.

¹² National Research Council. 1999. *Watershed Management for Potable Water Supply: Assessing the New York City Strategy*. Washington, D.C.: The National Academies Press.

¹³ National Research Council. *Valuing Ecosystem Services*.

¹⁴ Daily, Gretchen C. and Ellison, Katherine. *The New Economy of Nature*.

¹⁵ National Research Council. *Valuing Ecosystem Services*.

¹⁶ Information on Minnesota’s RIM program comes from an interview with Kevin Lines, conservation easement section manager for the Minnesota Board of Water & Soil Resources.

¹⁷ The legislation is Minnesota Statutes 103F.518. Information on the program comes from the Board of Water and Soil Resources Web site: www.bwsr.state.mn.us.