

Center
for
Biological
Diversity



Native Plant Conservation Campaign

Wildland Ecosystem Services: Sustaining our Economy and Quality of Life

Emily Roberson
March 1, 2003

Introduction	2
Wetlands	3
Recreation	4
Forests	4
Genetic Diversity – “The World’s Insurance Policy”	5
Ecosystem Services Are Taken for Granted	5
Conclusion	6
References	7



The mission of the Native Plant Conservation Campaign is to promote appreciation and conservation of native plant species and communities through collaboration, education, law, policy, land use and management.

The Native Plant Conservation Campaign is a project of the Center for Biological Diversity
www.biologicaldiversity.org * www.plantsocieties.org

Introduction

The Ecological Society of America defines ecosystem services as the processes by which the environment produces resources that we often take for granted such as clean water, timber, habitat for fisheries, and pollination of native and agricultural plants.

Ecosystem services include functions of healthy ecosystems such as

- water purification,
- oxygen production,
- maintenance of genetic diversity,
- soil formation,
- erosion control,
- sustainable commodity production,
- flood control,
- pollination,
- recreation and
- climate regulation.

The valuation of ecosystem services is

For every dollar generated by destroying wildlands for development or resource extraction, it is estimated that \$100 is lost in ecosystem services forgone.

still an inexact science (Daily, 1997; Pearce and Moran, 1995). However, in recent years, many researchers have

published estimates of the value of ecosystem services to local, regional

and global economies. Probably the most widely discussed study, published in the journal *Nature*, reported an average annual global economic value for ecosystem services of approximately \$33 trillion (Costanza, et al., 1997).

The estimated values of individual ecosystem services ranged from \$400 billion for pollination and \$1 trillion for flood control to \$17 trillion for soil formation. For the U.S. alone, pollination of agricultural crops by native pollinators has an estimated value of \$4.1 to \$6.7 billion per year (Nabham and Buchmann, 1997). Costs associated with losses of soil ecosystem services, primarily nutrient cycling and storage, have been estimated at \$27 billion per year for the United States alone (Pimentel et al., 1995).

The global value of wildland ecosystem services has been estimated at \$33 TRILLION per year.

A recent update to the Costanza study based on case studies in wildland ecosystems including Canadian wetlands, Thai Mangrove swamps, and tropical forests, reported that the average benefit:cost ratio of conservation of intact wildlands is at least 100:1 (Balmford et al., 2002).



Wetlands

Healthy functioning well distributed wetlands contribute significantly to local, state and national economies.

Numerous studies have calculated values for various wetland ecosystem services.

For example, one study found that the marshes of Louisiana produced over \$200 million in commercial fish and shellfish harvest (U.S. Environmental Protection Agency, 2003).

Purification of water by wetlands is also tremendously valuable. Wetlands remove excess nutrients, sediment, and other anthropogenic pollutants as waters pass through them. Many studies have examined the replacement value for wetlands in local communities and cities. The replacement value is the cost to a local government to construct a water purification plant to provide similar water purification services. One example, for the Congaree Bottomland Hardwood Swamp in South Carolina, found a minimum cost of \$5 million in initial capital investment would be required to replace the water purification services of the swamp. Annual maintenance of such a plant would require additional ongoing expenditures of tax dollars (U.S. Environmental Protection Agency, 2003).

Louisiana marshes produce over \$200 million annually in commercial fish and shellfish harvest

Wetlands control floods by capturing and storing high water flows and releasing them slowly into streams and rivers over time. As we fill or otherwise destroy wetlands, flood costs to society and taxpayers increase. The Environmental Protection Agency explains these costs (U.S. Environmental Protection Agency, 1995):

“Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation also slow the speed of flood waters and distribute them more slowly over the floodplain. This combined

water storage and braking action lowers flood heights and reduces erosion.

Wetlands within and downstream of urban areas are particularly

valuable, counteracting the greatly increased rate and volume of surface- water runoff from pavement and buildings. The bottomland hardwood- riparian wetlands along the Mississippi River once stored at least 60 days of floodwater. Now they store only 12 days because most have been filled or drained.”

In one small example, the Minnesota Department of Natural Resources has computed an average cost of \$300 to replace one acre-foot of wetland flood water storage. The cost to replace the 5,000 acres of wetlands lost annually in Minnesota would be \$1.5 million (in 1991 dollars) (U.S. Environmental Protection Agency, 2003). The U.S.

Army Corps of Engineers has found that loss of wetlands in the Charles River watershed in Massachusetts would result in \$17 million in annual flood damage (U.S. Army Corps of Engineers, 1971, 1976).

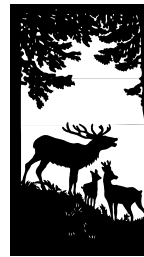


Recreation

Of all ecosystem services, probably the best studied in the United States is recreation. Every 5 years, the U.S. Fish and Wildlife Service publishes a survey of the use of wildlands for wildlife-associated recreation (fishing, hunting, viewing). The most recent survey available reports that 77 million people spent \$101 billion in 1996 on wildlife-associated recreation, including bird watching, wildflower viewing, hiking and other non-consumptive activities (U.S. Fish and Wildlife Service, 1996). These activities supported over 1 million full and part time jobs, nationwide. For California, total expenditures were \$7.5 billion.

The high economic values associated with non-consumptive uses of resources have important policy implications. The Klamath River in northern California is home to several endangered species and to fisheries important to local communities, including Indian tribes. These species

and fisheries have been adversely impacted by water diversions for agriculture. A recent U.S. Geological Survey analysis, using the travel cost method, found that a \$5 billion expenditure to reallocate water currently diverted for agriculture to restore the health of the river basin would produce approximately \$36 billion in economic benefits over 12 years, primarily associated with increased recreational use (Wall Street Journal 11/1/02; Douglas and Sleeper, 2002).



Forests

Ecosystem services provided by forests are also relatively well studied (Krieger, 2001). A review of tropical forest ecosystem services has suggested that an average acre of sustainably managed tropical forest is worth approximately \$220 per year. The \$220/acre includes: \$69 from non timber forest products (mushrooms, fibers), \$17 from recreation, \$10 from watershed functions including flood control, and \$110 from timber (Myers, 1997a).

"Forests ... supply such an exceptional array of goods and services that they should be reckoned among our most valuable natural resources. Only a few products are generally harvested, however, [and that harvest often damages] other potential outputs. Thus forests are overexploited and underutilized."

- Economist Norman Myers (1995)

Another study focusing on U.S. national forest roadless areas in the 48 contiguous states, reported a recreational value for these areas of \$600 million per year, nearly \$280 million in passive use values, and \$1 - \$1.5 billion per year in ecosystem services such as carbon storage and waste treatment (Loomis and Richardson, 2000).



Genetic Diversity – “The World’s Insurance Policy”

An often overlooked, but vital, service of wildland ecosystems is their function as genetic diversity reservoirs. Wild relatives of commercial timber, livestock and crop species are sources of genetic material which improve productivity, pest and disease resistance, and create ever more profitable plant and animal products (Myers, 1997). In Britain alone, there may be as many as 400 “microspecies” of blackberries (Crocker, 2002).

Corn is a well studied example. Hundreds of varieties of corn are found in its native habitat in Mexico and Guatemala. This genetic diversity has been called “the world’s [food] insurance policy” (Schapiro, 2002). Modern commercial crops are often grown as genetically identical monocultures of high yielding varieties. This can cause problems if disease, climate change, pests, or other environmental factors reduce or destroy a widely-used hybrid’s

yield. For example, in 1970, 15% of the U.S. corn crop was destroyed because a blight attacked a hybrid strain that covered 25% of the nation’s corn farms (Raven et al, 1981). This caused a substantial jump in food prices.

When such an event occurs, breeders look to wild and semi-wild strains for new traits to restore productivity. For wheat and maize only, estimates of the contribution of genetic diversity to the value of crop production in developed countries range from \$500 million/yr for the U.S. to \$2.7 billion per year for all OECD countries (United Kingdom, Europe, United States) (Mooney, 1993 cited in Pearce and Moran, 1995).

Ecosystem Services Are Taken for Granted

The tremendous economic value of ecosystem services is rarely factored into cost-benefit analysis for projects or policies that affect the environment.

Standard economic and cost-benefit analyses tend to ignore non - consumptive values of wildlands.

Analyses of economic impacts of environmental policies tend to be limited to the impacts of policies to the value of commodities (timber, minerals) that may be extracted or products (power, paper, cement) that may be produced. Degradation of the ability of impacted ecosystems to purify water, control floods, provide habitat for pollinators, offer recreational opportunities, create soil or to perform other economically

valuable services is rarely calculated or analyzed in project plans or economic analyses.

The U.S. Gross Domestic Product (GDP), for example, has been described as “recognizing environmental degradation as *an improvement in the economy*, sometimes counting it more than once – as the sales of products from a firm that pollutes, as the firms subsequent expenditures to clean up the pollution, and as sales of medical services to those harmed by the pollution” (Niemi and Whitelaw, 1997).

Some leaders are beginning to recognize the worth of ecosystem services. Water purification is a visible example. The city of New York has spend \$1.4 billion to purchase and restore forestland in the Catskill mountains watersheds which surround its largest water supply. Portland, Oregon and Portland, Maine each spend

A Presidential science commission calculated that it would cost \$6 – 8 billion to construct a water treatment plant to replace water purification services provided by wildlands.

almost \$1 million per year in land acquisition and management to maintain watershed integrity around their water supplies (Krieger, 2001). These cities have calculated that water purification delivered by intact native plant communities is less expensive and of higher quality than water purification provided by human-made facilities.

In fact President Clinton’s Committee on Science and Technology (1998) reported that it would cost \$6-8 billion for New York City to construct an artificial filtration plant to replace the ecosystem services provided by natural forests.

Conclusion

Through the diligence of researchers around the world, high quality data quantifying the economic impacts of environmental policies are accumulating. There is little evidence to support the fear that strong environmental protection policies will harm the economy or destroy jobs. Overwhelmingly, they show, as a consensus report of several dozen Pacific Northwest university economists put it:

“[We do not] have to choose between jobs and the environment. Quite the opposite: a healthy environment is a major stimulus for a healthy economy” (Power, et al., 1995).

In addition, The growing body of scientific research on the value of ecosystem services is making it steadily easier for project and policy analyses to quantify the economic effects of damage to ecosystems and the services that flow from them.

As the public and policymakers accept and act upon these increasingly well-documented concepts, the quality and sustainability of both our lives and economies will improve.

References

- Balmford, A. and others. 2002. Economic reasons for conserving wild nature. *Science* 297: 950-3
- Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.W. O'Neill, J. Paruelo, R.G. Raskin, and P. Sutton. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253-9.
- Crocker, M. 2002. Ancient Magic of the Blackberry. *The Guardian Weekly*, London. 10/10/02.
- Daily, G.C. (ed.) 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington DC.
- Douglas, A.J. and A. Sleeper. 2002. Estimating trip-related recreation benefits for the Klamath River Basin with TCM and contingent use data. U.S. Geological Survey, Washington, DC.
- Duffield, J.W., T.C. Brown, S.D. Stewart. 1994. Economic value of instream flow in Montana's Big Hold and Bitterroot Rivers. Res. Pap. RM-317. USDA Forest Service Rocky Mountain Forest and Range Experiment Station, Ft. Collins, CO
- Environmental Protection Agency. 1996. *Liquid Assets: a summertime perspective on the importance of clean water to the nation's economy*. 800-R-96-002. U.S. Environmental Protection Agency Office of Water, Washington, DC.
- Krieger, D.J. 2001. *Economic value of Forest Ecosystem Services: a review*. The Wilderness Society, Washington, DC.
- Loomis, J.B. and R. Richardson. 2000. *Economic values of protecting roadless areas in the United States*. The Wilderness Society and The Heritage Forests Campaign, Washington DC.
- Mooney, P.R.. 1993. Exploiting local knowledge: international policy implication. In: W. de Boef Amanor, K. Wellard and A. Bebbington Eds. *Cultivating Knowledge: Genetic diversity, farmer experimentation and crop research*. Intermediate Technology Publications, London UK
- Myers, N. 1997. Biodiversity's Genetic Library. In. Daily, G.C. (ed.) 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington DC.
- Myers, N. 1997a. The world's forests and their ecosystem services. In. Daily, G.C. (ed.) 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington DC.
- Myers, N. 1995. The world's forests: need for a policy appraisal. *Science* 268: 823.
- Nahbahm, G.P. and S.L. Buchmann. 1997. Services Provided by Pollinators. In. Daily, G.C. (ed.) *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington DC.

- Pearce, D. and D. Moran. 1995. *The Economic Value of Biodiversity*. IUCN-The World Conservation Union. Earthscan Publications, London.
- Pimentel, D., C. Harvey, P. Resosudarmo, K. Sinclair, D. Kurtz, M. McNair, S. Crist, L. Spritz, L. Fitton, R. Saffouri & R. Blair. 1995. *Environmental and Economic Costs of Soil Erosion and Conservation Benefits*. *Science* 267: 1117-1123
- Power, T.M. and others. 1995. *Economic Well-Being and Environmental Protection in the Pacific Northwest: a consensus report by Pacific Northwest economists*. Economics Department, University of Montana, Missoula MT.
- President's Committee of Advisors on Science and Technology. 1998. *Teaming with Life: Investing in Science to Understand and Use America's Living Capital*. March, 1998.
- Raven, P., R.F. Evert, H. Curtis. 1981. *Biology of Plants*. Worth Publishers, New York, NY.
- Schapiro, M. 2002. *Sowing Disaster? How genetically engineered American corn has altered the global landscape*. *The Nation*. 275 (14): 11.
- U.S. Army Corps of Engineers (ACOE). 1971. *Charles River Massachusetts, Main Report & Attachments*, New England Division.
- U.S. Army Corps of Engineers (ACOE). 1976. *Water Resources Development Plan, Charles River Watershed, Massachusetts*, New England Division.
- U.S. Environmental Protection Agency. 2003. *Economic Benefits of Wetlands. Website Fact Sheet* <http://www.epa.gov/owow/wetlands/facts/fact4.html>
- U.S. Environmental Protection Agency. 1995. *America's wetlands: Our vital link between land and water*. Office of Water, Office of Wetlands, Oceans and Watersheds. EPA843-K-95-001.
- U.S. Fish and Wildlife Service. 1996. *National Survey of Fishing Hunting and Wildlife-Associated Recreation*. U.S. Department of the Interior Fish and Wildlife Service, Washington DC.