

## ECOSYSTEM SERVICES

Have you ever considered that the cereal you eat is brought to you each morning by the wind, or that the glass of clear, cold, clean water drawn from you faucet may have been purified for you by a wetland or perhaps the root system of an entire forest? Trees in your front yard work to trap dust, dirt, and harmful gases from the air you breathe. The bright fire of oak logs you light to keep warm on cold nights and the medicine you take to ease the pain of an ailment come to you from Nature's warehouse of services. Natural ecosystems perform fundamental life-support services upon which human civilization depends. Unless human activities are carefully planned and managed, valuable ecosystems will continue to be impaired or destroyed.



The Ecological Society of America

### WHAT ARE ECOSYSTEM SERVICES?

Ecosystem Services are the processes by which the environment produces resources that we often take for granted such as clean water, timber, and habitat for fisheries, and pollination of native and agricultural plants. Whether we find ourselves in the city or a rural area, the ecosystems in which humans live provide goods and services that are very familiar to us.



*Courtesy of David Inouye*



Ecosystems provide “services” that:

- moderate weather extremes and their impacts
- disperse seeds
- mitigate drought and floods
- protect people from the sun's harmful ultraviolet rays
- cycle and move nutrients
- protect stream and river channels and coastal shores from erosion
- detoxify and decompose wastes
- control agricultural pests
- maintain biodiversity
- generate and preserve soils and renew their fertility
- contribute to climate stability
- purify the air and water
- regulate disease carrying organisms
- pollinate crops and natural vegetation

### WHAT IS AN ECOSYSTEM?

An ecosystem is a community of animals and plants interacting with one another and with their physical environment. Ecosystems include physical and chemical components, such as soils, water, and nutrients that support the organisms living within them. These organisms may range from large animals and plants to microscopic bacteria. Ecosystems include the interactions among all organisms in a given habitat. People are part of ecosystems. The health and well-being of human populations depends upon the services provided by ecosystems and their components - organisms, soil, water, and nutrients.

### WHAT ARE ECOSYSTEM SERVICES WORTH?

Natural ecosystems and the plants and animals within them provide humans with services that would be very difficult to duplicate. While it is often impossible to place an accurate monetary amount on ecosystem services, we can calculate some of the financial values. Many of these services are performed seemingly for “free”, yet are worth many trillions of dollars, for example:

- Much of the Mississippi River Valley's natural flood protection services were destroyed when adjacent wetlands were drained and channels altered. As a result, the 1993 floods resulted in property damages estimated at twelve billion dollars partially from the inability of the Valley to lessen the impacts of the high volumes of water.
- Eighty percent of the world's population relies upon natural medicinal products. Of the top 150 prescription drugs used in the U.S., 118 originate from natural sources: 74 percent from plants, 18 percent from fungi, 5 percent from bacteria, and 3 percent from one vertebrate (snake species). Nine of the top 10 drugs originate from natural plant products.
- Over 100,000 different animal species - including bats, bees, flies, moths, beetles, birds, and butterflies - provide free pollination services. One third of human food comes from plants pollinated by wild pollinators. The value of pollination services from wild pollinators in the U.S. alone is estimated at four to six billion dollars per year.

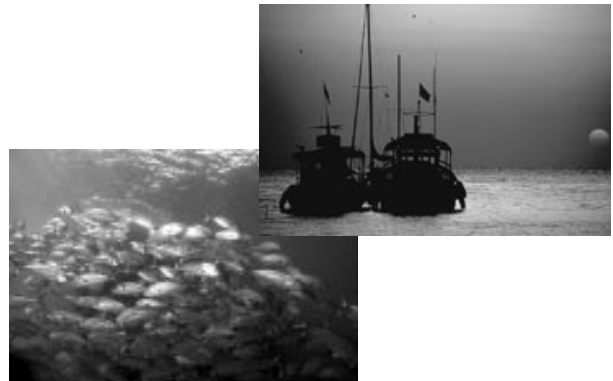
*Before it became overwhelmed by agricultural and sewage runoff, the watershed of the Catskill Mountains provided New York City with water ranked among the best in the Nation by Consumer Reports. When the water fell below quality standards, the City investigated what it would cost to install an artificial filtration plant. The estimated price tag for this new facility was six to eight billion dollars, plus annual operating costs of 300 million dollars - a high price to pay for what once was free. New York City decided instead to invest a fraction of that cost (\$660M) in restoring the natural capital it had in the Catskill's watershed. In 1997, the City raised an Environmental Bond Issue and is currently using the funds to purchase land and halt development in the watershed, to compensate property owners for development restrictions on their land, and to subsidize the improvement of septic systems.*

## HOW ARE ECOSYSTEM SERVICES "CUT OFF" ?

Ecosystem services are so fundamental to life that they are easy to take for granted and so large in scale that it is hard to imagine that human activities could destroy them. Nevertheless, ecosystem services are severely threatened through (1) growth in the scale of human enterprise (population size, per-capita consumption, and effects of technologies to produce goods for consumption) and (2) a mismatch between short-term needs and long-term societal well-being.

Many human activities disrupt, impair, or reengineer ecosystems every day including:

- runoff of pesticides, fertilizers, and animal wastes
- pollution of land, water, and air resources
- introduction of non-native species
- overharvesting fisheries
- destruction of wetlands
- erosion of soils
- deforestation
- urban sprawl



## ECOLOGY AND ECOSYSTEM SERVICES

Ecologists work to help us understand the interconnection and interdependence of the many plant and animal communities within ecosystems. Although substantial understanding of many ecosystem services and the scientific principles underlying them already exists, there is still much to learn. The tradeoffs among different services within an ecosystem, the role of biodiversity in maintaining services, and the effects of long and short-term perturbations are just some of the questions that need to be further explored. The answers to such questions will provide information critical to the development of management strategies that will protect ecosystems and help maintain the provisions of the services upon which we depend.

**The choices we make today in how we use land and water resources will have enormous consequences on the future sustainability of earth's ecosystems and the services they provide.**

## FOR MORE INFORMATION

*Issues in Ecology*, "Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems, No. 2, Spring, 1997, Ecological Society of America. Available on ESA's web site at <http://esa.sdsc.edu/issues.htm>

*Nature's Services, Societal Dependence on Natural Ecosystems*, Gretchen C. Daily, Editor, Island Press, 1997.

*Teaming with Life: Investing in Science to Understand and Use America's Living Capital*, President's Committee of Advisors on Science and Technology, March 5, 1998. Available through the Internet at [http://www.whitehouse.gov/WH/EOP/OSTP/html/OSTP\\_Home.html](http://www.whitehouse.gov/WH/EOP/OSTP/html/OSTP_Home.html).