

# Economic Benefits of Biodiversity

*Economic impact studies document the many and substantial economic benefits generated by biodiversity. This guide identifies major studies, summarizes key findings of each and provides hyperlinks to the studies.*

Last updated: November 14, 2011

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## Summary

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Economic impact studies identify a variety of economic benefits generated by biodiversity. The studies described in this guide each analyzed one or more of these benefits, including the following:

- Enabling the agricultural and forest industry through processes such as pollination, pest control, nutrient provision, genetic diversity, and disease prevention and control
- Provision of wild harvested food products such as fish, large and small animals, and maple syrup
- Provision of medicinal plants and raw materials for pharmaceuticals
- Enabling nature-based tourism and the hunting and fishing industry
- Natural degradation of chemicals released into the environment, a significant cost savings over physical, chemical and thermal bioremediation.
- Reduced healthcare costs through the prevention of the spread of disease.
- Reduction of worldwide poverty.
- Sustaining the natural ecosystems on which humans, and therefore human economic systems, depend.

## **Background**

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### **Each Species has a Role**

Biodiversity is “the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.” It is the foundation of life on Earth. - International Union for Conservation of Nature, (*About Biodiversity*, <http://iucn.org/what/tpas/biodiversity/about> at 11/14/2011)

Each species has a specific niche, a specific role and function in an ecosystem. These roles include capturing and storing energy, providing food, predation, decomposing organic matter, cycling water and nutrients, controlling erosion, controlling pests and climate regulation. Species support biological production and regulation throughout the food chain in a variety of ways, such as adding to soil fertility, pollination, plant growth, predation and waste decomposition. The more diverse an ecosystem is, the more stable it is, the more productive it tends to be, and the better it is able to withstand environmental stress. Biodiversity is essential for sustaining the natural ecosystems on which humans, and all life, depend.

Although concern about threats to species diversity tend to focus on large species, such as bald eagles or whooping cranes, threats to the biodiversity of small organisms such as arthropods and microbes are the same or greater. Small organisms are often more specialized and adapted to certain plant species and habitats than are the large animals, and therefore they are more susceptible than large animals to extinction.

## **Biodiversity Underpins Economic Activity**

Agriculture, forestry and fisheries products, stable natural hydrological cycles, fertile soils, a balanced climate and numerous other vital ecosystem services depend upon the conservation of biological diversity. Food production relies on biodiversity for a variety of food plants, pollination, pest control, nutrient provision, genetic diversity, and disease prevention and control. Both medicinal plants and manufactured pharmaceuticals rely on biodiversity. Decreased biodiversity can lead to increased transmission of diseases to humans and increased healthcare costs. The outdoor tourism industry relies on biodiversity to create and maintain that which tourists come to see, as does the multi-billion dollar fishing and hunting industry.

## **Related Benefits**

While this guide focuses on economic benefits, it is not meant to diminish the importance of the environmental and social benefits of biodiversity. Related guides at [ConservationTools.org](http://ConservationTools.org) include:

- Economic Benefits of Land Conservation
- Economic Benefits of Parks
- Economic Benefits of Trails
- Economic Benefits of Smart Growth and Costs of Sprawl
- Environmental Benefits of Conservation

## **Organization of This Guide**

This guide presents an inventory of studies. The heading of each section is the title of the study and is hyperlinked to the [ConservationTools.org](http://ConservationTools.org) library listing where the study can be viewed or downloaded. The organization responsible for the study is given, followed by a summary of the key economic findings of the study.

## **Economic Impact Studies**

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### **Economic and Environmental Benefits of Biodiversity**

*BioScience*

- Maintaining biodiversity is essential for organic waste disposal, soil formation, biological nitrogen fixation, crop and livestock genetics, biological pest control, plant pollination, and pharmaceuticals. Plants and microbes help to degrade chemical pollutants and organic wastes and cycle nutrients through the ecosystem. For example:
  - Pollinators, including bees and butterflies, provide significant environmental and economic benefits to agricultural and natural ecosystems, including adding diversity and productivity to food crops. As many as one-third of the world's food production relies directly or indirectly on insect pollination.

About 130 of the crops grown in the United States are insect pollinated. Habitat fragmentation and loss adversely affects pollinator food sources, nesting sites, and mating sites, causing precipitous declines in the populations of wild pollinators.

- There are 6 million tons of food products harvested annually from terrestrial wild biota in the United States including large and small animals, maple syrup, nuts, blueberries and algae. The 6 billion tons of food are valued at \$57 million and add \$3 billion to the country's economy (1995 calculations).
- Approximately 75% (by weight) of the 100,000 chemicals released into the environment can be degraded by biological organisms and are potential targets of both bioremediation and biotreatment. The savings gained by using bioremediation instead of the other available techniques; physical, chemical and thermal; to remediate chemical pollution worldwide give an annual benefit of \$135 billion (1997 calculation). Maintaining biodiversity in soils and water is imperative to the continued and improved effectiveness of bioremediation and biotreatment.
- Biodiversity is essential for the sustainable functioning of the agricultural, forest, and natural ecosystems on which humans depend, but human activities, especially the development of natural lands, are causing a species extinction rate of 1,000 to 10,000 times the natural rate.
- The authors estimate that in the United States, biodiversity provides a total of \$319 billion dollars in annual benefits and \$2,928 billion in annual benefits worldwide (1997 calculation)

## **Linking Biodiversity Conservation and Poverty Alleviation: A State of Knowledge Review**

### *Convention on Biological Diversity*

- Biodiversity conservation and poverty reduction are two global challenges that are inextricably linked. But biodiversity is generally a public good, so it is under-valued, or not valued at all, in national economies. This paper focuses on the question “which groups of the (differentiated) poor depend, in which types of ways, on different elements of biological diversity?” It focuses on biodiversity as a means of subsistence and income to the poor and biodiversity as insurance to prevent the poor from falling even deeper into poverty.
- Ten conservation mechanisms that can reduce poverty in the rural poor are identified: non-timber forest products, community timber enterprises, payments for environmental services, nature-based tourism, fish spillover, mangrove restoration, protected area jobs, agroforestry, grasslands management, and agrobiodiversity conservation.
- There are caveats to these links. The poor depend disproportionately on biodiversity for their subsistence needs and biodiversity conservation can be a route out of poverty under some circumstances. However, it is often the relatively low value or inferior goods that are most significant to the poor, and the more affluent's pursuit of the

higher commercial value often crowds out the poor. The scale of poverty reduction may be small; conservation interventions do not necessarily lend themselves to poverty interventions. A focus on the cash benefits of biodiversity conservation is too limited; it excludes the ability to meet basic human needs. And biomass may matter more in the short term, biodiversity (as the foundation for biomass) more in the long term.

## **Conserving Biological Diversity in Agricultural/Forestry Systems**

### *Bioscience*

- Both high agricultural productivity and human health depend on the activity of a diverse natural biota. Efforts to curb the loss of biodiversity have intensified in recent years, but they have not kept pace with the growing encroachment of human activities.
- An estimated \$20 billion year is spent worldwide on pesticides. Yet, parasites and predators existing in natural ecosystems provide an estimated 5-10 times this amount of the pest control. Without the existence of natural enemies, crop losses by pests in agriculture and forestry would be catastrophic and costs of chemical pest controls would escalate enormously.
- A diverse group of microbes fix nitrogen from the atmosphere for use by crops and forests. An estimated \$7 billion of nitrogen is supplied to US agriculture each year by nitrogen-fixing microbes and 90 million tons a year for use by agriculture worldwide with a value of almost \$50 billion.

## **Impacts of Biodiversity on the Emergence and Transmission of Infectious Diseases**

### *Nature*

- A loss of biodiversity leads to an increase in the spread of disease. Researchers speculate this is because some species are better at buffering disease transmission. An example of this is that species that have low rates of reproduction or invest heavily in immunity tend to be more strongly impacted by losses of biodiversity than those with high reproduction rates or those that invest less in immunity (and would consequently be more likely disease hosts).
- The study examines 12 diseases from different ecosystems worldwide, including Lyme disease. In eastern North America, the white-footed mouse is simultaneously the most abundant host species, the most competent host for the Lyme bacterium, and the highest-quality host for immature tick vectors. Virginia opossums are poor hosts for the pathogen and kill the vast majority of ticks that attempt to feed on them. Virginia Opossums however are absent from many low-diversity forest fragments and degraded forests, places where the mice are abundant. Along with a loss of biodiversity comes a loss of the species with the strongest disease buffering effect.
- Although the study does not discuss costs associated with an increased rate of disease transmission, it could be inferred that a decrease in biodiversity that leads to an

increase in disease transmission will lead to increased medical costs, increasing the urgency of the need of local, regional, and global efforts to preserve natural ecosystems and the biodiversity they contain.

## **Economic Reasons for Conserving Wild Nature**

*Science Magazine*

- Amidst continuing loss of natural habitat and biodiversity, it is necessary to examine the benefit:cost ratio of investments in habitat conservation. Evidence has been accumulating that shows habitat conservation generates more economic benefits than does habitat conversion. The authors estimate that the overall benefit:cost ratio of an effective global program for the conservation of remaining wild nature is at least 100:1.

## **Library**

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### **Related Library Categories at ConservationTools.org**

Economic Benefits of Biodiversity

### **Featured Library Items at ConservationTools.org**

[Featured library items are identical to those studies summarized in this guide.]

## **Related Guides**

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- Economic Benefits of Conservation
- Economic Benefits of Parks
- Economic Benefits of Trails
- Economic Benefits of Smart Growth and Costs of Sprawl
- Environmental Benefits of Conservation

## **Experts**

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Elana Richman

Richman performed the research for this guide.

## **Acknowledgements**

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This guide was researched and written by Elana Richman and edited by Andy Loza.

The Pennsylvania Land Trust Association prepared this guide with support from the Growing Greener Program of the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation.

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