

## What are the Ecosystem Services of Forests?

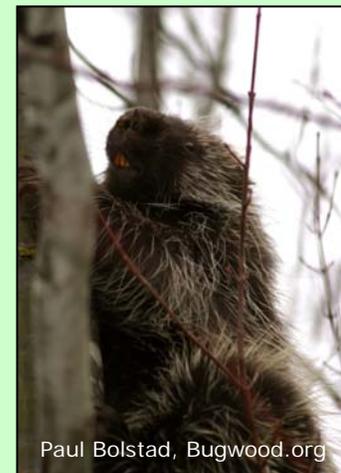
Forests are vital to our survival and well-being. The ecosystem services that forests provide make life on this planet possible. Ecosystem services as defined in [Nature's Services: Societal Dependence on Natural Ecosystems](#) are:

“The conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life.”

Examples of forest ecosystem services include the wood for our houses, the water we drink, the air we breathe, and our favorite mountain for hiking. As the human population increases so does the demand for ecosystem services. In many places on earth the sustainability of these services are threatened or are declining. As the demand for ecosystem services is rising, the amount of forest is declining, taking their ecosystem services with them, leaving the remaining forests and their services that they provide that more significant. In the last three centuries alone, forests globally have been reduced approximately 40%. Individual ecosystem services are also part of the interdependent web within a forest. Reducing one service can have dramatic effects on the other strands of the web. If a forest is managed for timber without forethought to its other ecosystem services, this may result for example in a decrease in its carbon sequestration capacity or its wildlife protection value. Ecosystem services of forests are essential for human life. Our understanding of these services is just beginning.

The [Millennium Ecosystem Assessment](#) (MA) was developed by the United Nations with the objective to assess the consequences of ecosystem change for human well-being and the scientific basis for actions needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being. One of the key messages from the board of the MA:

“Even today’s technology and knowledge can reduce considerably the human impact on ecosystems. They are unlikely to be deployed fully, however, until ecosystem services cease to be perceived as free and limitless, and their full value is taken into account. “



Paul Bolstad, Bugwood.org

- 44% of birds,
- 57% of amphibians,
- 87% of reptiles, and
- 75% of mammals are threatened by a decline in forest ecosystems.
- 8,000 or 9% of tree species are threatened.

The MA divided ecosystem services into 4 categories: provisioning, regulating, cultural, and supporting.

### **Provisioning**

Provisioning ecosystem services are products derived from ecosystems. Examples from forests are such things as timber, water, fuel, non-timber forest products, medicinal plants, and genetic resources. While wood is the most economically important forest product, forests provide the best protection of water supplies and aquatic ecosystems. Water originating from a forest plays a vital role locally and worldwide. More than 3/4<sup>th</sup> of the world's accessible fresh water comes from forested watersheds and 1/3 of the world's largest cities get their water supply from forested watersheds.

### **Regulating**

Regulating ecosystem services maintain a livable world. Forests play their critical part in many ways. One example is in forests influencing the hydrological cycle. Forests smooth out and extend stream flow, prevent erosion, diminish the impact from floods, and maintain water quality. Forests also help to mitigate climate change, purify air, sequester carbon, and shade streams for lower stream temperatures that help to support wildlife. These are just a few examples of the many services forest provide to help keep the world running as usual.

### **Cultural**

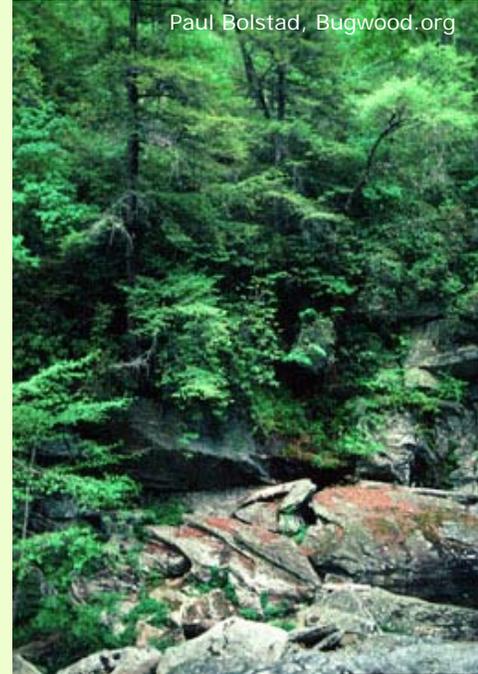
Cultural ecosystem services are the nonmaterial benefits people obtain from ecosystems. Examples include: aesthetic enjoyment, spiritual enrichment and fulfillment, recreational activities, and ecotourism opportunities. Forests, and trees in particular are symbolically and spiritually a part of the world's major religions.

### **Supporting**

Supporting ecosystem services are ones that are necessary in the production of the other provisioning, regulating and cultural ecosystem services. Their impact on people may not be as explicit as the other services, but are the foundation for the continued production of the other

The total biomass of forest ecosystems has 335 to 365 billion tons of carbon. This accounts for approximately 50% of the world's terrestrial organic carbon stocks.

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ecosystem services. Examples of supporting ecosystem services from a forest include soil formation, photosynthesis, nutrient cycling, erosion control, habitat for flora and fauna, and watershed protection. Hundreds of species are intertwined in a forest, each with their own role to play in the needed supporting processes we get from their interaction. The flora and fauna found in forest ecosystems are the most effective in soil development. Forests provide coarse woody debris and other inputs to streams that provide the base for the aquatic food chain. Forests provide a variety of functions to improve and sustain water quality. Forests can remove pollutants for overland flow by slowing down the flow and allowing infiltration to occur.

### **Watershed Protection & Forests**

In 1997, New York City made a decisive move to invest in the ecosystem services of forests to naturally purify and filter its drinking water. Not only was the city able to save billions of dollars in not building a water treatment facility, but brought to the forefront the importance of forests to the health and well-being of New York City residents.



Brian Lockhart, Bugwood.org

Ecosystem services are the fundamental link between nature and the well-being of humans. Without an understanding or appreciation of the values that ecosystem services have on our quality of life, humans are unlikely to take the steps necessary to protect them. To make conservation efforts relevant, the link between nature and the well-being of humans needs to be shown. Examples are safe drinking water, food, fuel, flood control, aesthetics, and cultural benefits. Biodiversity is also an essential part for the continued health and functioning of forest

ecosystems and the services they provide. Biodiversity and ecosystem services go hand in hand. Loss of forests results in the loss of its genetic, species, and habitat diversity.

Everyone is dependent on ecosystem services for their quality of life as well as their survival. As forests continue to disappear the value of their remaining services becomes even more significant. Understanding and awareness of not only the apparent ecosystem services forests provide but also their complex interactions is crucial to their management and understanding their link to water resources.

Calculating the economic value of ecosystem services is difficult. One such [study](#), as reported in [Nature](#), tackled this issue and determined the minimum global value of annual forest ecosystem services. In today's dollars the value would be \$6.7 trillion.



### **For Further Reading**

**Armsworth, P.R., K.M. A. Chan, G.C. Daily, P.R. Ehrlich, C. Kremen, T.H. Ricketts, and M.A. Sanjayan. 2007.** Ecosystem-Service Science and the Way Forward for Conservation. *Conservation Biology* 21(6):1383-1384.

**Brauman, K.A., G.C. Daily, T.K. Duarte, and H.A. Mooney. 2007.** The Nature and Value of Ecosystem Services: Highlighting Hydrologic Service. *Annual Review of Environment and Resources* 32:67-98.

**Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Sutton, and M. van den Belt. 1997.** The value of the world's ecosystem services and natural capital. *Nature* 387:253-260.

**Millennium Ecosystem Assessment. 2005.** Ecosystems and Human Well-being: Current State and Trends. Volume 1. Chapter 21 Forest and Woodland Systems. [www.millenniumassessment.org](http://www.millenniumassessment.org)

**Platt, R. H., P.K. Barten, and M.J. Pfeffer. 2000.** A Full Clean Glass? Managing New York City's Watersheds. *Environment* 42(5):8-20.

**Rodríguez, J.P., T.D. Beard Jr., E. M. Bennett, G.S. Cumming, S.J. Cork, J. Agard, A.P. Dobson, and G.D. Peterson. 2006.** Trade-offs across Space, Time, and Ecosystem Services. *Ecology and Society* 11(1):28.

## **Web Resources**

Millennium Ecosystem Assessment

<http://www.millenniumassessment.org/en/index.aspx>

USDA Forest Service: Valuing Ecosystem Services

<http://www.fs.fed.us/ecosystems-services/>

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