



Percent Forest

This EnviroAtlas national map portrays the percent of forest-covered land within each 12-digit hydrologic unit ([HUC](#)). This map layer represents the percentage of land area that is classified as forest land in the EnviroAtlas hybrid 2011 Cropland Data Layer (CDL) - 2011 National Land Cover Dataset (NLCD).

Why are forests important?

Forest lands provide a host of ecosystem services including climate regulation, water quality protection, air quality maintenance, biodiversity conservation, erosion control, timber production, and recreational, cultural, and aesthetic values.¹ Forest trees moderate temperature through shading and evapotranspiration. They contribute to [climate change](#) mitigation by removing carbon dioxide from the atmosphere (during photosynthesis) and storing it as tree biomass ([carbon sequestration](#)). The U.S. Forest Service estimates that trees in U.S. National Forests sequester \$3.4 billion worth of carbon (at \$65/ton) every year.¹

Forested areas provide communities safe water supplies with reduced treatment costs.² Eight million people in the city of New York depend on forested watersheds for their [water supply](#). In a forested watershed, most of the precipitation infiltrates the ground and only about 10 percent flows over the land surface as runoff.² In a developed watershed with a high proportion of [impervious surfaces](#), surface runoff does not seep into the ground but flows directly into nearby lakes and streams, collecting pollutants as it goes. Forest land slows and filters precipitation and runoff, reducing flooding, removing pollutants, and increasing the quantity and quality of water that eventually reaches surface and groundwater drinking water sources.

Forest trees are capable of removing atmospheric pollutants such as nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, and particulate matter, contributing to air and water quality, climate stabilization, and public health. Gaseous pollutants are taken in through pores in leaves and stems and absorbed or converted to other compounds. The removal of air pollutants is particularly valuable in urban environments, where strategic planting of open space and street trees can improve human health by reducing air pollution levels and some human health risks.³

Forest land adjacent to streams and rivers, called the [riparian area](#) (or [riparian buffer](#)), helps protect aquatic habitat and



Photo: Mt. Washington, New Hampshire

water quality in forest land and in more developed rural or urban landscapes. Trees in riparian buffers are capable of slowing and storing floodwater and filtering significant quantities of sediment, nutrients, and heavy metals from agricultural fields and urban stormwater runoff.⁴

Forested areas also support biodiversity by serving as habitat for plants and animals that provide critical benefits like pollination, natural pest control, and food. A number of threatened and endangered species depend on forests for their continued existence. The opportunity to view wildlife is one of a number of recreational, cultural, and aesthetic values offered by intact forests.

Because forests provide so many benefits and services, stakeholders compete to partition the limited resource. Public and private land managers need to prioritize resource uses and justify spending. Government agencies have the added tasks of maximizing environmental benefits and considering public values, including the more intangible cultural and aesthetic values.⁵ Though valuation techniques have been used for decades, they are becoming more sophisticated as the need for ecosystem services valuation grows. It is difficult, but necessary, to attach a monetary value to an intangible service if aesthetic values are to compete with more tangible economic values when prioritizing resources.⁵

How can I use this information?

This national map, Percent Forest, estimates the percent land area of 12-digit HUCs covered by forest. Percent forest is

one of a series of EnviroAtlas data layers that depict national land cover. Continuous nationwide land cover data allows the assessment of national and regional environmental issues. Land cover, together with other EnviroAtlas biophysical and demographic data, can be used to estimate risks related to natural hazards and to prioritize areas for conservation.⁶ For example, forest land cover may be compared with data layers depicting natural areas, protected status (PADUS and GAP), or occurrence of threatened species to assess whether there are adequate numbers of protected areas to represent regional forest ecosystems.

Forest land cover may also be associated with particular ecosystem services such as carbon storage by tree biomass or with major stressors such as national patterns of impervious area or atmospheric deposition. A group of EnviroAtlas community maps estimates the amount of various pollutants removed annually by trees and the health and economic benefits of pollutants removed by urban tree cover. For more information on riparian forest cover, see EnviroAtlas national and community data layers on waterbody buffers.

How were these data created?

These data were generated by using an EnviroAtlas hybrid 2011 Cropland Data Layer (CDL) - 2011 National Land Cover Dataset (NLCD) in the landscape assessment tool, Analytical Tools Interface for Landscape Assessments (ATtILA). [ATtILA](#) is an Esri ArcView extension created by EPA that calculates many commonly-used landscape metrics. NLCD classes 41 Deciduous, 42 Evergreen, and 43 Mixed Forest were used to map Percent Forest. The landcover data were summarized by 12-digit HUC boundaries taken from the [NHDPlusV2](#) Watershed Boundary Dataset (WBD Snapshot). For more information on this calculation, see the [ATtILA](#) User's Manual. For details on the update to WBD Snapshot, see the metadata.

Selected Publications

1. Krieger, D.J. 2001. [The economic value of forest ecosystem services: A review](#). The Wilderness Society, Washington, D.C. 31 p.
2. Ernst, C. 2004. [Protecting the source: Land conservation and the future of America's drinking water](#). The Trust for Public Land and the American Water Works Association, San Francisco, California. 56 p.
3. Nowak D.J., D.E. Crane, and J.C. Stevens. 2006. [Air pollution removal by urban trees and shrubs in the United States](#). *Urban Forestry and Urban Greening* 4: 115–123.
4. Bentrup, G. 2008. [Conservation buffers: Design guidelines for buffers, corridors, and greenways](#). General Technical Report SRS-109. U.S. Forest Service, Southern Research Station, Asheville, North Carolina. 110 p.
5. King, D.M., and M. Mazzotta. 2000. [Ecosystem valuation](#). Accessed May 2014.
6. K.B. Jones. 2006. [Importance of land cover and biophysical data in landscape-based environmental assessments](#). Pages 215–249 in North American Land Cover Summit, September 20-22, 2006, Association of American Geographers, Washington, D.C.

What are the limitations of these data?

Though EnviroAtlas uses the best data available, there are limitations associated with the data. The landcover classes found in NLCD are created through the classification of 30 meter resolution satellite imagery. Human classification of landcover types that have a similar spectral signature can result in classification errors. As a result, NLCD is a best estimate of actual landcover. A national-scale metric such as this gives a broad scale overview of forested land summarized by 12-digit HUC. It is not meant to convey forest density or fragmentation. Periodic updates to EnviroAtlas will reflect improvements to nationally available data.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. [NLCD](#), [CDL](#), and [WBD](#) data are accessible through their respective websites. NLCD data are updated every 5 years to enable change detection research; a land cover change data layer is also available that contains only the pixels identified as changed during the ten year interval from 2001 to 2011.

Where can I get more information?

A selection of resources related to forest cover and ecosystem services is listed below. For additional information on how the data were created, access the metadata for the data layer from the drop down menu on the interactive map table of contents and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about this data layer, please contact the [EnviroAtlas Team](#).

Acknowledgments

EnviroAtlas is a collaborative effort led by EPA. This EnviroAtlas map was developed by Donald Ebert, EPA. Sandra Bryce, Innovate!, Inc., wrote the data fact sheet.