Percent Forest

This EnviroAtlas national map portrays the percent of forest-covered land within each 12-digit hydrologic unit (HUC). For the conterminous U.S., the map layer uses the EnviroAtlas hybrid 2016 Cropland Data Layer (CDL) - 2016 National Land Cover Dataset (NLCD) to define forest land. Alaska is based on the 2016 NLCD; Hawaii is derived from the 2005–2011 National Oceanic and Atmospheric Administration's Coastal Change Analysis Program (C-CAP) data, Puerto Rico from 2010 C-CAP, and the U.S. Virgin Islands from 2012 C-CAP data.

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


Photo: Mt. Washington, New Hampshire

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 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]

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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 from an EnviroAtlas hybrid 2016 CDL-NLCD for the conterminous U.S. and the 2016 NLCD for Alaska. C-CAP data were used for Hawaii (2005–2011), Puerto Rico (2010), and the U.S. Virgin Islands (2012). The land cover data was used in the landscape assessment tool, Analytical Tools Interface for Landscape Assessments (ATtILA). ATtILA is an Esri ArcGIS extension created by EPA that calculates many commonly used landscape metrics. NLCD classes 41 Deciduous, 42 Evergreen, and 43 Mixed Forest and C-CAP classes 9 Deciduous, 10 Evergreen, and 11 Upland Forest were used to map Percent Forest. The 12-digit HUC boundaries were taken from the NHDPlusV2 Watershed Boundary Dataset (WBD Snapshot) for the conterminous U.S., Hawaii, Puerto Rico, and the U.S. Virgin Islands. The November 24, 2016 WBD was used for Alaska. For more information on this calculation, see the ATtILA User's Manual.

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 and C-CAP are created through the classification of 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, C-CAP, 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 from 2001 to 2016 at 2–3-year intervals.

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 layer list drop down menu on the interactive map. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

Acknowledgments

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Selected Publications

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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 2020.

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.