



## Percent Forest and Woody Wetlands

This EnviroAtlas national map estimates the percentage of land within each 12-digit hydrologic unit (HUC) that is covered by trees and forest or woody wetlands. This map uses the EnviroAtlas hybrid 2016 Cropland Data Layer (CDL) - 2016 National Land Cover Dataset (NLCD) to define forested land and woody wetlands for the conterminous U.S. 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 forest cover and woody wetlands important?

Forests and woody wetlands provide a host of ecosystem services including climate regulation, water quality protection, biodiversity conservation, erosion control, air quality maintenance, timber production, and recreational, cultural, and aesthetic values.<sup>1</sup> Woody wetlands are defined as areas where forest or shrubland vegetation accounts for >20% of vegetative cover and the soil is periodically saturated with or covered with water. In EnviroAtlas, woody wetlands include inland freshwater (palustrine) and tidal saltwater (estuarine) forested and shrub-covered wetlands.

Forests influence climate through the moderation of temperature, the absorption of carbon dioxide, and the release of water vapor and oxygen. Forests contribute to [climate change](#) mitigation by removing carbon dioxide from the atmosphere (during photosynthesis) and storing it as tree biomass ([carbon sequestration](#)). Woody wetlands also have the ability to store atmospheric carbon in standing vegetation, litter, and organic soil and sediments.

Forested areas provide communities with safe water supplies at reduced treatment costs.<sup>2</sup> Forests and woody wetlands slow runoff and filter precipitation, reducing flooding, removing pollutants, and increasing the quantity and quality of water that eventually reaches surface and groundwater drinking water sources.

A national map layer that combines both forest and woody wetlands depicts a broader range of ecosystem services than those provided by forests alone. Trees in woody wetlands are capable of filtering significant quantities of sediment, nutrients, and heavy metals. Toxic substances adhering to sediment particles may be modified by soil microorganisms



Photo: Cypress, G. Gardner, Everglades National Park

into less harmful forms and made available to plants. Trees also enable [denitrification](#), a process where bacteria in saturated soil transform dissolved nitrates into gaseous nitrogen compounds that escape to the atmosphere.<sup>3</sup>

One formerly widespread class of woody wetlands, bottomland hardwoods, has experienced some of the greatest losses of any wetland class in the conterminous U.S. over the last two centuries. The loss of bottomland hardwoods has reduced the floodwater storage capacity of the Mississippi River by 80%.<sup>3</sup> Between 2004 and 2009, more than 307,000 acres of forested wetlands were altered by logging across the U.S., which is more than twice the wetland acreage converted by urbanization.<sup>4</sup>

Forests and woody wetlands support [biodiversity](#) by providing habitat for plants and animals. A number of threatened and endangered species depend on forests and wetlands for their continued existence. The wetland backwaters of streams and rivers serve as nurseries for young fish. Migratory waterfowl use forested wet areas for resting, feeding, breeding, and nesting. The prominence of wildlife in forest and woody wetland areas attracts bird-watchers, photographers, and hunters. The opportunity to view wildlife is one of a number of recreational, cultural, and aesthetic values offered by intact forests and woody wetlands.

### How can I use this information?

This map is one of a series of EnviroAtlas data layers that depict national land cover. The map estimates the percent land area of 12-digit HUCs covered by forest and woody wetlands.

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 evaluate areas for conservation and to estimate risks related to natural hazards.<sup>5</sup>

For example, forest and woody wetlands land cover may be compared with data layers depicting natural areas, protected status (PADUS, GAP, or IUCN), or occurrence of threatened and endangered species to assess whether there are adequate numbers of protected areas to represent regional forest and woody wetland ecosystems. The land cover data may also be associated with major stressors such as national patterns of impervious area or atmospheric deposition or with particular ecosystem services such as carbon storage by tree biomass.

Forest and woody wetlands adjacent to streams and rivers, called the [riparian](#) area (or [riparian buffer](#)), help protect terrestrial and aquatic habitat and water quality in landscapes that have been cleared of forest for agriculture or urban development. For more information on riparian forest cover, see EnviroAtlas national and community data layers covering stream and lake buffers. Degraded or converted woody wetlands (e.g., farmed wetlands) are restorable to improve water quality; see the map and data fact sheet for Potentially Restorable Wetlands on Agricultural Land.

## How were these data created?

These data were generated by using land cover data 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. An EnviroAtlas hybrid 2016 [CDL-NLCD](#) was used for the conterminous U.S., and the 2016 [NLCD](#) was used for Alaska. C-CAP was used for Hawaii (2005–2011), Puerto Rico ([2010](#)), and the U.S. Virgin Islands ([2012](#)). NLCD classes 41 Deciduous, 42 Evergreen, 43 Mixed Forest, and 90 Woody Wetlands and C-CAP classes 9 Deciduous, 10 Evergreen, 11 Upland Forest, 13 Palustrine Forested Wetland, and 17 Estuarine Scrub/Shrub Wetland

## 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. Welsch, D.J., D.L. Smart, J.N. Boyer, P. Minkin, H.C. Smith, and T.L. McCandless. 1995. [Forested wetlands: Functions, benefits, and the use of best management practices](#). NA-PR-01-95, U.S. Forest Service, Natural Resources Conservation Service, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and U.S. Fish and Wildlife Service, Washington, D.C.
4. Dahl, T.E. 2011. [Status and trends of wetlands in the conterminous United States 2004 to 2009](#). U.S. Fish and Wildlife Service, Washington, D.C. 108 p.
5. 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.

were used to map Percent Forest and Woody Wetlands. The 12-digit HUC boundaries for all areas were taken from the [NHDPlusV2](#) Watershed Boundary Dataset (WBD Snapshot). The November 24, 2016 WBD was used for Alaska. For more information on the metric calculation, see the [ATtILA](#) User's Manual.

## What are the limitations of these data?

The landcover classes found in NLCD and C-CAP were 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 and C-CAP are a best estimate of actual landcover. Periodic updates to EnviroAtlas will reflect improvements to nationally available data. Each version of NLCD is released several years after the date of the satellite imagery, meaning that the land cover patterns are several years out of date when released.

## How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. The [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 and woody wetlands 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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