Percent Forest on Wet Areas

This EnviroAtlas national map uses a wetness index to estimate the percent of land within each subwatershed (12-digit HUC) that is frequently or periodically wet and is covered by trees and forests.

Why is forest on wet areas important?

Percent forest on wet areas is one of a series of EnviroAtlas data layers that uses a wetness index, or Composite Topographic Index (CTI), based on contributing area, slope, and overland flow. Wet areas are typically created by runoff from natural land cover when rain falls on saturated soil. Surface and rill (or small channel) runoff carries excess water to lowland depressions or wet areas. Runoff collects in wet areas until they fill and overflow downstream. In this way, stream networks can be extended into new areas that would not be hydrologically connected during drier times.[1] Wet area expansion and watershed hydrological connectivity differ between humid temperate and semi-arid and arid climates (where drought and soil crusts limit infiltration and produce flashier runoff).[1] Vegetation is a major influence on hydrological connectivity; it increases infiltration to limit runoff, and it directs and slows water flow during floods. Riparian vegetation also connects existing stream channels, either surficially or underground, with former channels (e.g., backwaters and oxbow lakes).[2]

The wet areas data layers cover potential runoff contributing areas that may or may not be defined as wetlands. The three main components used to define wetlands are the presence of wetland hydrology, hydric soils, and hydrophytic (water-adapted) vegetation. A depression that carries water during wet periods may be temporary and may not possess one or more of the required wetland components. Conversely, wet areas with high wetness index values may be true wetlands.

Forested wet areas have tree cover dominant with soil that is periodically saturated or flooded. If flooding lasts long enough to to deplete soil oxygen, tree species must have hydrophytic adaptations to withstand oxygen deficiencies created in saturated soils.[3] By trapping and processing pollutants, forest cover on wet areas can prevent sediment, nutrients, harmful bacteria, pesticides, and metals from entering other waterbodies. Tree cover also helps regulate the flow of flood water by slowing runoff, recharging ground water, and transpiring moisture back into the atmosphere through leaves and stems. By storing water and securing the floodplain with a network of roots, forest cover

on wet areas can reduce flood potential, help prevent erosion, and minimize downstream property damage. For example, a research study found that the conversion of bottomland hardwoods (southern floodplain forests) in the Mississippi River basin for agriculture and logging over the last century has reduced the floodwater storage capacity of the Mississippi River by 80%.[4]

In addition to the benefits provided for water quality and natural hazard mitigation, forested wet areas support biodiversity by providing habitat for fish, amphibians, reptiles, birds, and semi-aquatic mammals. The backwaters of streams and rivers serve as nurseries for young fish. Migratory waterfowl use forested wet areas for resting, feeding, breeding, and nesting.

Knowing the distribution of forest cover on wet areas is important for locating and prioritizing candidate areas for sediment capture, nutrient filtration, and groundwater recharge. Multiple functions may be ranked by local needs for water quality improvement, wildlife habitat, or flood protection. Once areas of forest cover on wet areas are identified, detailed site analysis may be planned for managing or restoring individual sites.

How can I use this information?

This national map estimates the percent land area of 12-digit HUCs covered by forest on wet areas. It is one of a series of national-scale maps displaying land cover (including agriculture and developed land) on wet areas using a CTI wetness index. For conservation efforts, this map may be

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overlaid with Supplemental data such as National Wetland Inventory (NWI) and Protected Areas (PADUS) or other national EnviroAtlas data layers such as Potentially Restorable Wetlands.

Knowing potential runoff contributing areas can help target implementation of best management practices (BMPs) to improve water quality.[4,5] The forested wet areas map may be overlaid with data on cropland or impervious cover to show possible contributing sources. Wet areas maps may be compared with EPA impaired waters data to optimize filtration planning when implementing Total Maximum Daily Loads in streams. Wet areas alongside or upstream of impaired stream segments may help reduce pollutant loads to streams.

How were the data for this map created?

This data layer of forest on wet areas for each 12-digit Hydrological Unit (HUC-12) is based on the 2006 National Land Cover Database (NLCD) and the USDA's 2010 Crop Data Layer (CDL). These combined sources provide NLCD land coverages and agricultural land uses. A wetness index or Composite Topographic Index (CTI) was developed to identify areas that collect water. The wetness index grid, calculated from National Elevation Data (NED), relates upstream contributing area and slope to overland flow. Results from previous studies suggested that CTI values > 550 captured the majority of wet areas. Percentages of forest land coverage on wet areas (CDL class 63 Forest, NLCD classes 141 Deciduous, 142 Evergreen, and 143 Mixed) within 12-digit HUCs were calculated by raster cell counts with a cell size of 30m x 30m and an area of 900 m^2 per raster cell. A list of metric creation steps is included in the metadata processing steps; 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.

What are the limitations of these data?

EnviroAtlas uses the best data available, but there are still limitations associated with these data. The landcover classes found in NLCD and CDL are created through the classification of satellite imagery. Human classification of different landcover types that have a similar spectral signature can result in classification errors.

The wetness index, CTI, tends to overestimate wet areas, in part because it does not consider precipitation and evaporation water balances. It will also overestimate wetness in areas with highly permeable soils that do not retain water. Finally, CTI indicates wet areas based entirely on topography and surface water flow and will miss wet areas created by other factors such as heavy precipitation or irrigation outflow.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Land cover, crop, and elevation data are available on their respective websites.

Where can I get more information?

A selection of references relating to forested wet areas and the ecosystem services they provide is listed below. Information about the base data layers can be found at the websites linked throughout the text. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

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Selected Publications

1. Bracken, L.J., and J. Croke. 2007. The concept of hydrological connectivity and its contribution to understanding runoff-dominated geomorphic systems. *Hydrological Processes* 21:1749–1763.

2. Tabacchi, E., L. Lambs, H. Guilloy, A-M. Planty-Tabacchi, E. Muller, and H. Decamps. 2000. Impacts of riparian vegetation on hydrological processes. *Hydrological Processes* 14:2959–2976.

3. Kozlowski, T.T. 1997. Responses of woody plants to flooding and salinity. Tree Physiology Monograph No. 1, Heron Publishing, Victoria, Canada. 29 p.

4. 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.

5. Jurasek, K. 1999. Estimation of potential runoff-contributing areas in Kansas using topographic and soil information. U.S. Geological Survey Water Resources Investigation Report 99-4242, U.S. Geological Survey, Washington, D.C.