Percent Forest Land in Stream Buffer

This EnviroAtlas national map portrays the percent of land within 45 meters of streams, rivers, and other hydrologically-connected waterbodies (e.g., lakes and ponds) covered by forest within each 12-digit hydrologic unit (HUC). The map layer uses the 2011 USDA Cropland Data Layer (CDL) combined with the 2011 National Land Cover Database (NLCD) to define forested land.

Why are forested stream buffers important?
Forest land adjacent to streams and rivers, sometimes called the riparian area (or riparian buffer), helps protect terrestrial wildlife habitat, aquatic habitat, and water quality. Maintaining forest cover in stream buffers benefits water quality at the site as well as downstream. Land management in upstream areas directly affects the water quality in downstream rivers, bays, and estuaries.

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. Studies have shown that sediment removal by trees ranges from 60–90% depending on buffer area, slope, and the volume and velocity of runoff. Toxic substances adhering to sediment particles may be modified by soil microorganisms into less harmful forms and made available to plants. A published review of 66 studies covering nutrient removal by buffer vegetation found that 75% and 90% of excess nitrogen was removed from mean buffer widths of 28 and 112 meters (92 and 367 feet), respectively. Though trees return a significant portion of the nitrogen they remove back to the soil as leaf litter, trees also enable denitrification, a process where bacteria in saturated soil transform dissolved nitrates into gaseous nitrogen compounds that escape to the atmosphere.

Some stakeholders involved in market-based strategies for maintaining water quality have found that it may be less expensive to establish buffers wide enough to accomplish needed functions, compensate land owners for withdrawing land from production, and replant gaps in riparian buffers along stream networks than it is to implement technological fixes for the degradation of water quality. To adequately provide these ecosystem services, it is important to continue to regionally characterize optimal buffer widths and to include science in the political and economic discussions surrounding how much riparian land to withdraw from agricultural production and urban development.

<table>
<thead>
<tr>
<th>BIODIVERSITY AQUATIC HABITAT</th>
<th>Minimum Riparian Corridor Widths: meters (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reptiles and Amphibians</td>
<td>30.5 (100)</td>
</tr>
<tr>
<td>Interior Bird Species</td>
<td>61 (200)</td>
</tr>
<tr>
<td>Edge Bird Species</td>
<td>30.5 (100)</td>
</tr>
<tr>
<td>Small mammals</td>
<td>55 (180)</td>
</tr>
<tr>
<td>Large mammals</td>
<td>100 (330)</td>
</tr>
<tr>
<td>Aquatic Species Diversity</td>
<td>24 (80)</td>
</tr>
<tr>
<td>Woody Debris Input</td>
<td>30.5 (100)</td>
</tr>
<tr>
<td>Water Temperature/Shading</td>
<td>6.1 (20)</td>
</tr>
</tbody>
</table>

Narrow buffer strips are also subject to flood and wind damage. Maintaining breeding habitat for songbirds and wildlife corridors for the movement of large mammals requires wider buffer widths of 30.5–91.4 meters (100-300 feet, see table below).
How can I use this information?
This map layer indicates which 12-digit HUCs may benefit from riparian buffer restoration projects to improve water quality. An area can be more thoroughly investigated by increasing the transparency on this map and adding data for streams and water bodies (NHDPlus under Boundary Layers) to an aerial imagery base map. Detailed examination shows land cover along streams and reveals where upstream areas may be contributing to problems in downstream communities. Many states have developed guidelines for riparian buffer best management practices (BMPs) and recommended buffer widths. For more information on riparian forest cover, see EnviroAtlas national and community data layers covering stream and lake buffers.

How were these data created?
These data were generated by using the combined 2011 Cropland Data Layer and 2011 National Land Cover Database (NLCD-CDL) with the medium resolution (1:100,000 or higher) NHDPlusV2 National Hydrography Dataset (stream lines and water bodies) in the landscape assessment tool, Analytical Tools Interface for Landscape Assessments (ATiLA). ATiLA is an Esri ArcGIS 10.0 extension created by EPA that calculates many commonly used landscape metrics, including land cover adjacent to streams. The 45-meter stream buffers were created by delineating a polygon 45 meters wide on either side of a stream network and around the perimeter of hydrologically-connected lakes or ponds. The percentage of NLCD-CDL forest cover within the buffer was recorded for each 12-digit HUC. Waterbodies not hydrologically connected within a drainage network were not included in the analysis. For more information, see the ATiLA User’s Manual.

What are the limitations of these data?
The landcover classes found in the NLCD and CDL 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. Also, because of their 30m pixel size, the NLCD and CDL may miss riparian buffers that are <30m wide.

A national-scale metric such as this gives an overview of the extent of forested land within a fixed-distance buffer summarized by 12-digit HUCs. However, at any point along a stream network, riparian forests may be narrower or wider than the fixed-distance buffer. Fixed-distance buffers cannot account for differences among buffer areas because of gaps in riparian vegetation, upslope sources of pollutants, or upslope forested areas.

These data were not recorded for every point along a stream. Fixed-distance buffers cannot account for differences among buffer areas because of gaps in riparian vegetation, upslope sources of pollutants, or upslope forested areas.

How can I access these data?
EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. The NLCD, CDL, and NHDPlusV2 data are accessible through their respective websites.

Where can I get more information?
A selection of resources related to riparian buffers 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.

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Selected Publications


EnviroAtlas: Led by the U.S. Environmental Protection Agency