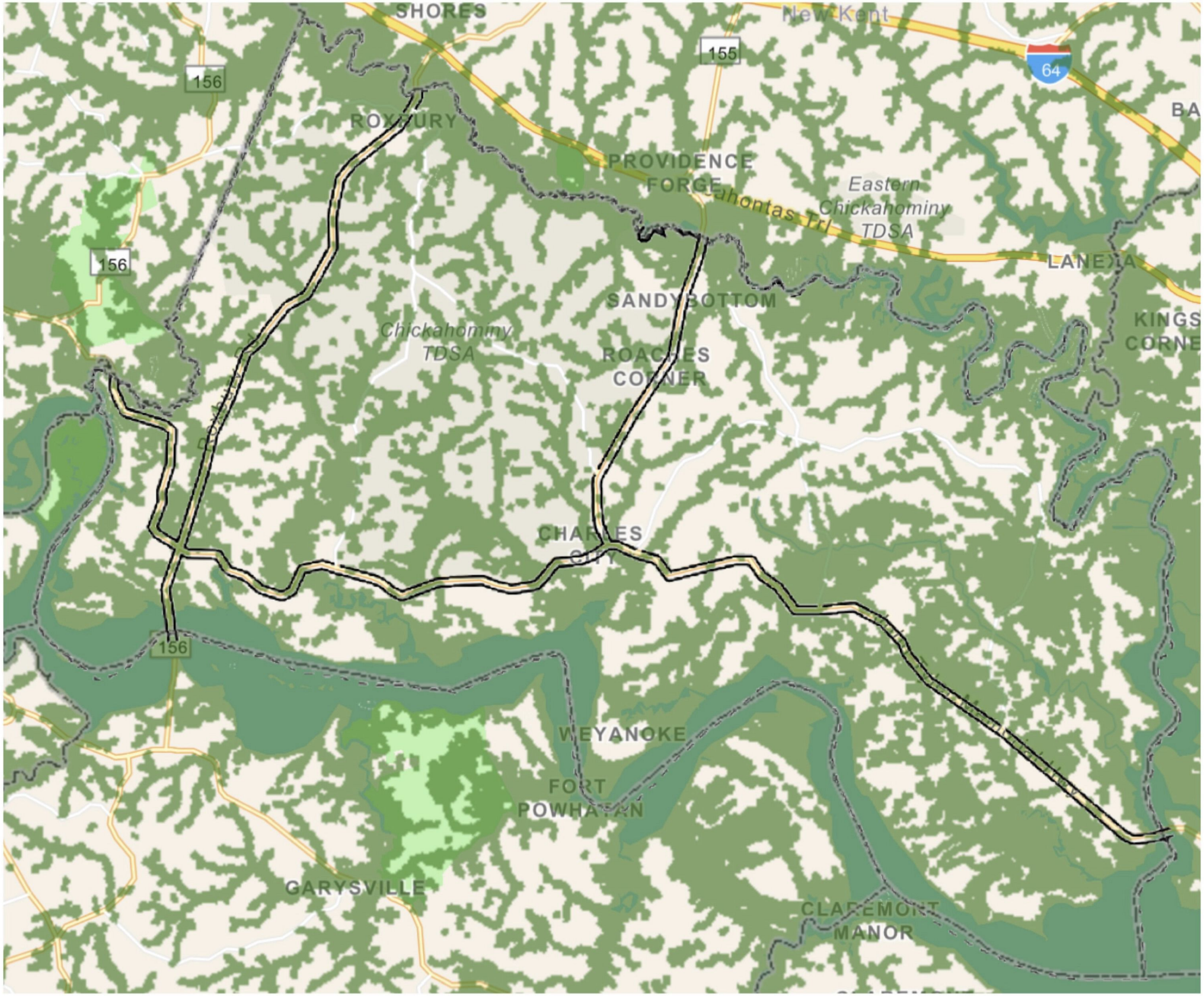
Environmental
Maps

Riparian Zones



United States Environmental Protection Agency. EnviroAtlas. Hydrologic Features. Waterscape. Riparian Zone. Retrieved: October 15, 2025 from enviroatlas.epa.gov/enviroatlas/interactivemap/

Waterscape: Riparian Zone

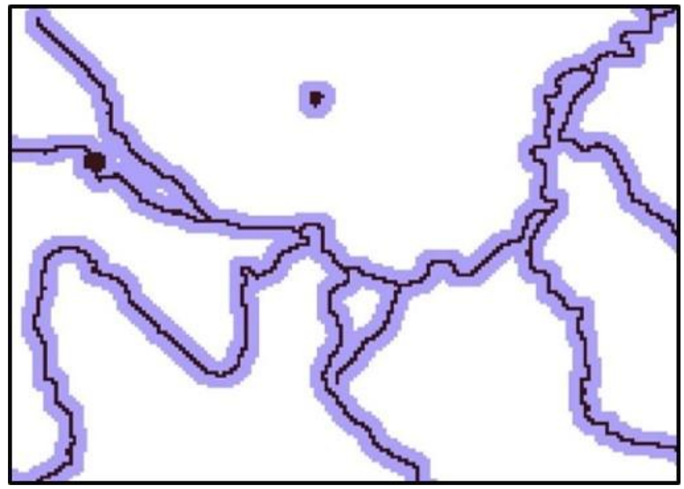
This EnviroAtlas national map depicts surface water in the U.S. with an approximate 100-meter riparian zone surrounding each surface water feature. These areas were determined using grid analysis of the buffer placed around the combined surface water features of the 2019 National Land Cover Database (NLCD) and the 1:100,000 scale National Hydrography Dataset (NHD, version 2.1). Surface water features included are oceans, estuaries, wetlands, rivers, streams, lakes and reservoirs.

Why is riparian data important?

Natural vegetation adjacent to streams and rivers, called the riparian area (or riparian buffer), helps protect terrestrial wildlife habitat, aquatic habitat, and water quality. Maintaining forest, shrub, and grassland cover in riparian buffers benefits water quality at the site as well as downstream. Land management in upstream areas directly affects water quality in downstream rivers and estuaries.

Natural vegetation growing in riparian buffers can slow and store floodwater and filter 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.[1] 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.[2]

Though the services provided by riparian buffers are clear, determining the optimum widths necessary for riparian buffers to deliver specific benefits and functions (e.g., flood storage, temperature moderation, nutrient filtering) is more difficult. Generally, streams with adjacent intense disturbances require wider buffers.[3] The ability of riparian vegetation to filter pollutants and store floodwater varies with local climate, buffer width, slope, channelization, and soil permeability. Narrow buffer widths of 5–15 meters (16–49 feet) maintain bank stability and provide some temperature moderation, but they are inadequate for sediment and nutrient reduction.[3] 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 m (100–300 fet).[3,4]



This riparian zone data layer was created for the Restoration and Protection Screening Tools (RPS) in collaboration with EnviroAtlas. The data layer is an important component in creating indicators of water quality. Knowing the location of water resources and their connectivity is prerequisite to learning how landscape attributes and human actions can impact water quality.

How can I use this information?

This riparian zone map identifies water features and a standard riparian buffer of approximately 100 meters surrounding them across the conterminous US. This map is a companion map to 2 other RPS maps covering surface water and hydrological connectivity among surface waters. These maps can be considered base maps for surface water features because the RPS data depict surface water features topographically. RPS maps may be used with other EnviroAtlas metrics such as protected lands (PADUS), land cover near water, on floodplains, or on hydric soils, and National Wetland Inventory (NWI) wetlands. They may be used in local conservation efforts by overlaying them on an EnviroAtlas aerial imagery base map and combining with specific national EnviroAtlas data layers such as Potential Wetland Area on Cropland.

Knowing the relationship between existing riparian buffers and potential runoff contributing areas can help target implementation of best management practices (BMPs) to improve water quality.[4] Wet areas maps may be compared with EnviroAtlas impaired waters data to assist in planning to maximize filtration capabilities when implementing Total

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Maximum Daily Loads (TMDLs) in streams. Wet areas restored alongside or upstream of impaired stream segments may help reduce sediment and nutrient loads to streams.

How were the data for this map created?

This dataset was developed using grid analysis to combine the surface water features of the 2019 National Land Cover Database (NLCD) and the 1:100,000 scale National Hydrography Dataset (NHD) Plus (version 2.1). First, the surface water features—Open Water (11), Woody Wetlands (90), and Emergent Herbaceous Wetlands (95)—were extracted from the NLCD. Then the flowline and waterbody features found in the catseed grid from the National Hydrography Dataset were added. The combination of these two datasets represents surface water for the U.S.; see the EnviroAtlas data fact sheet Waterscape: Surface Water for more information. Finally, distance from surface water features was calculated using the ArcMap Spatial Analyst Euclidean Distance tool to create the riparian buffer. All cells with a distance of 108 meters or less were included in the riparian zone.

What are the limitations of these data?

EnviroAtlas uses the best data available, but there are still limitations associated with these data. The data are based on models and large national geospatial databases. Calculations based on these data are estimations derived from the best available science. The landcover classes found in NLCD are created through the classification of satellite imagery. Human classification of different land cover types that have a similar spectral signature can result in classification errors.

A national-scale metric such as this gives an overview of the extent of riparian land within a fixed-distance buffer. However, at any point along a stream network, riparian vegetation 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.[5] They do not reflect upstream-downstream patterns of watershed land cover or differences between forested and unforested stream banks.[5] A full research effort that considered variable buffer widths would be required to get an accurate local estimate of riparian vegetation filtering capabilities within or among watersheds.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. NLCD and NHD data can be accessed through their respective websites.

Where can I get more information?

A selection of references relating to riparian buffers and ecosystem services is listed below. Additional information on Restoration and Protection Screening and indicators developed using the surface water layer can be found on the RPS website. For more information on data creation, access the metadata for the data layer from the dropdown menu on the interactive map. To ask specific questions about these data, please contact the EnviroAtlas Team.

Acknowledgments

EnviroAtlas is a collaborative effort led by the EPA. This riparian layer was developed by the EPA using data created by the U.S. Geological Survey. The data layer was generated by the EPA Office of Water Restoration and Protection Screening (RPS) team. The fact sheet was written by Elizabeth Smith and Doug Norton, EPA, and Sandra Bryce, Woolpert, Inc.

Selected Publications

1. Nowak, D.J., J. Wang, and T. Endreny. 2007. Chapter 4: Environmental and economic benefits of preserving forests within urban areas: Air and water quality. Pages 28–47 *in* de Brun, C.T.F. (ed.), The economic benefits of land conservation. The Trust for Public Land, San Francisco, California.

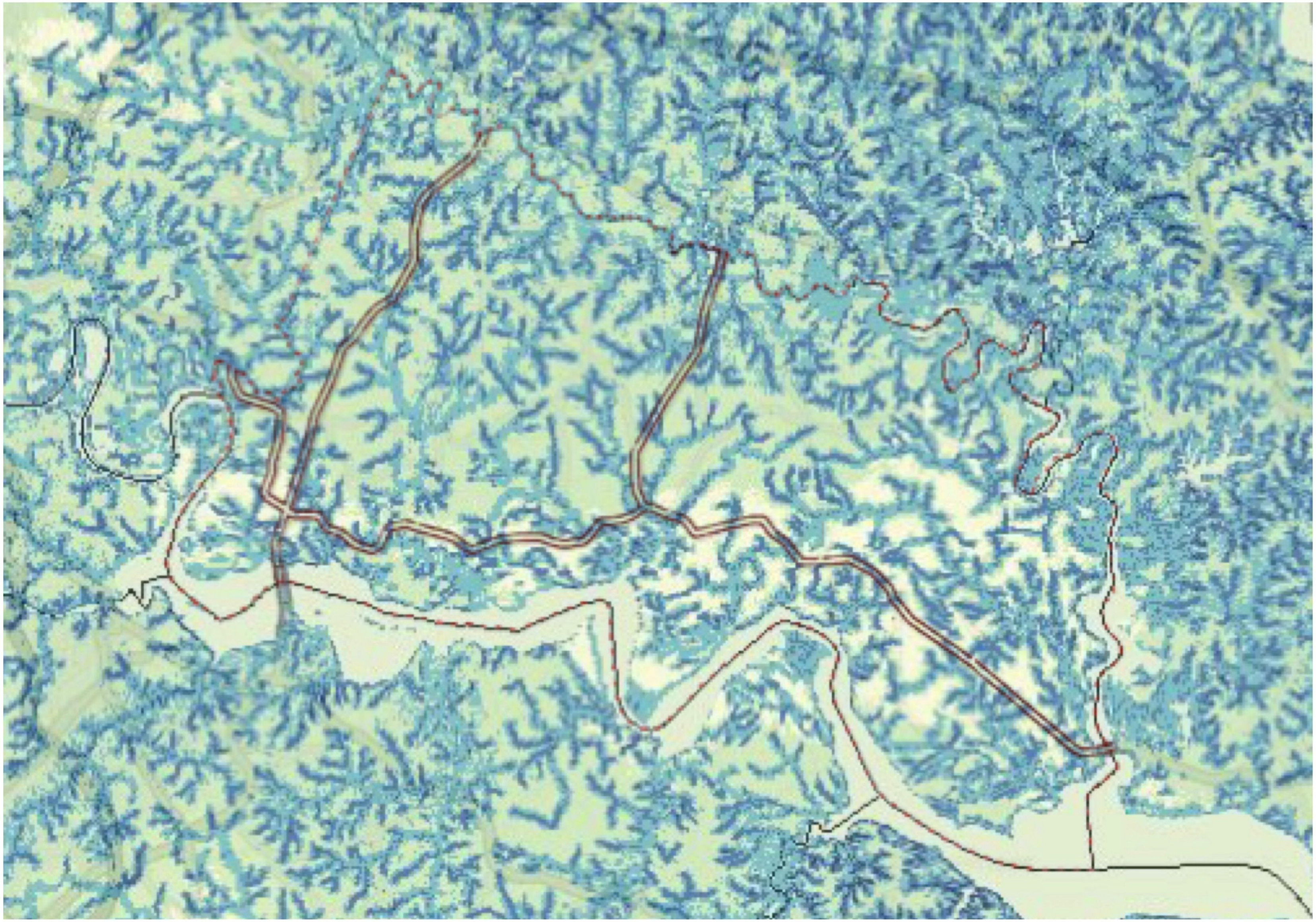
2. Mayer, P.M., S.K. Reynolds, M.D. McCutchen, and T.J. Canfield. 2006. Riparian buffer width, vegetative cover, and nitrogen removal effectiveness: A review of current science and regulations. EPA/600/R-05/118. U.S. Environmental Protection Agency, Cincinnati, Ohio.

3. Palone, R.S., and A.H. Todd (eds.). 1997. Chesapeake Bay riparian handbook: A guide for establishing and maintaining riparian forest buffers. NA-TP-02-97, U.S. Forest Service, Radnor, Pennsylvania.

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. Baker, M.E., Weller, D.E., Jordan, T.E. 2006. Improved methods for quantifying potential nutrient interception by riparian buffers. *Landscape Ecology*, 21 (8): 1327–1345.

DCR Watershed Impact Model



Watershed Impact Model

- 1 - 20 (Lowest Impact)
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100 (Highest Impact)

October 18, 2025

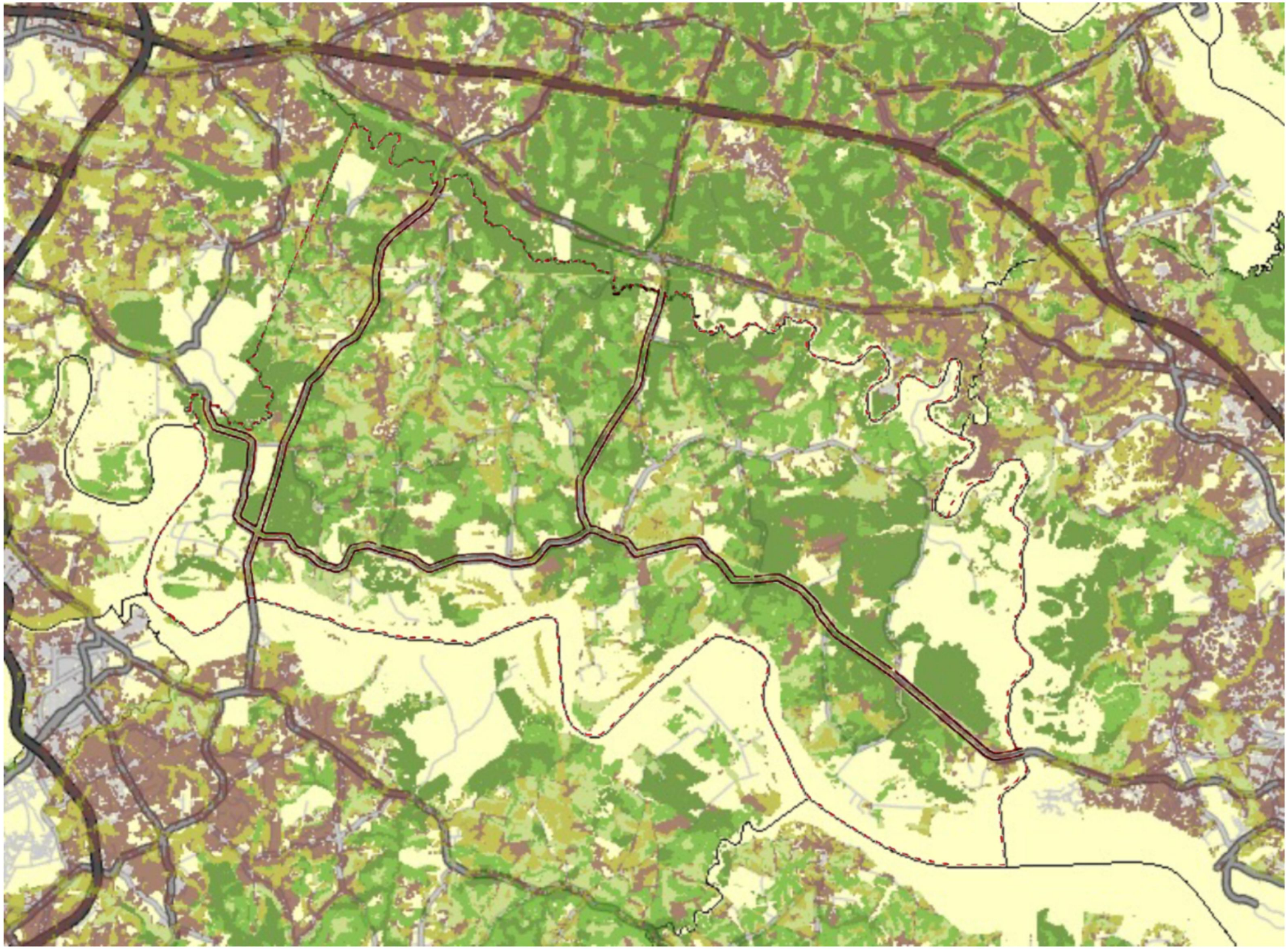
VGIN, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, VA DCR, Division of Natural Heritage, Esri, NASA, NGA,

DCR Watershed Impact Model Description

The purpose of the Virginia Conservation Vision Watershed Impact Model is to help establish geographic priorities for conservation, restoration, or implementation of best management practices, where the goal is to maintain or improve water quality and/or aquatic ecological integrity. It is intended as a geospatial screening tool for assessing where activities on the land are expected to have the greatest impact on water. The model relies on multiple data sources representing conditions that drive the terrestrial influence on aquatic systems, including precipitation, geology, soils, topography, and hydrology. Although land cover also exerts a key influence on hydrologic flow and pollutant loads reaching streams, it is not used to calculate potential impact in this model. Instead, potential impact is calculated under a "worst case scenario" assumption of barren land. By leaving land cover out of the equation, the calculation of potential impact is robust in the face of land cover changes that can happen over very short time scales. The model's primary output is a raster dataset representing potential impact, scored from 1 to 100.

For more information, go to https://www.dcr.virginia.gov/natural-heritage/vaconviswater

DCR Forest Conservation Values



Forest Conservation Values:

October 17, 2025

- 5: Outstanding
- 4: Very High
- 3: High
- 2: Moderate
- 1: Average

DCR Forest Conservation Values

The original FCV model was developed in 2013 by the VDOF. Since that time, a number of factors necessitated an update to the 2013 model. The agency has sharpened its focus and priorities through a strategic planning effort completed in 2017. In 2017, VDOF's Forestland Conservation Program implemented a new conservation ranking and prioritization system designed to identify the highest priority projects on a quarterly basis; the FCV is a key component of this ranking system.

The FCV is further intended to contribute to the Virginia ConservationVision, the suite of GIS models maintained by the Virginia Department of Conservation and Recreation (DCR) to inform a cohesive, statewide strategy for land conservation. As this multitude of needs were identified and as new data has become available, VDOF has taken the opportunity to create an up to date, improved FCV model to help inform both internal and statewide conservation efforts throughout the Commonwealth.

The 2018 model applied a completely new approach, with different criteria, methodology, and datasets selected for the analysis than were used in 2013. In 2020 the model was updated again with more recent data for Conserved Lands and SSURGO soils, and with multi-year data from the National Land Cover Dataset (NLCD). The multi-year NLCD allowed development of a more accurate forest cover dataset based on a pattern of productive forest landuse over time rather than the landcover class from a single year. The 2020 model replaces the 2018 version and direct comparison among versions is not recommended.

Model Components

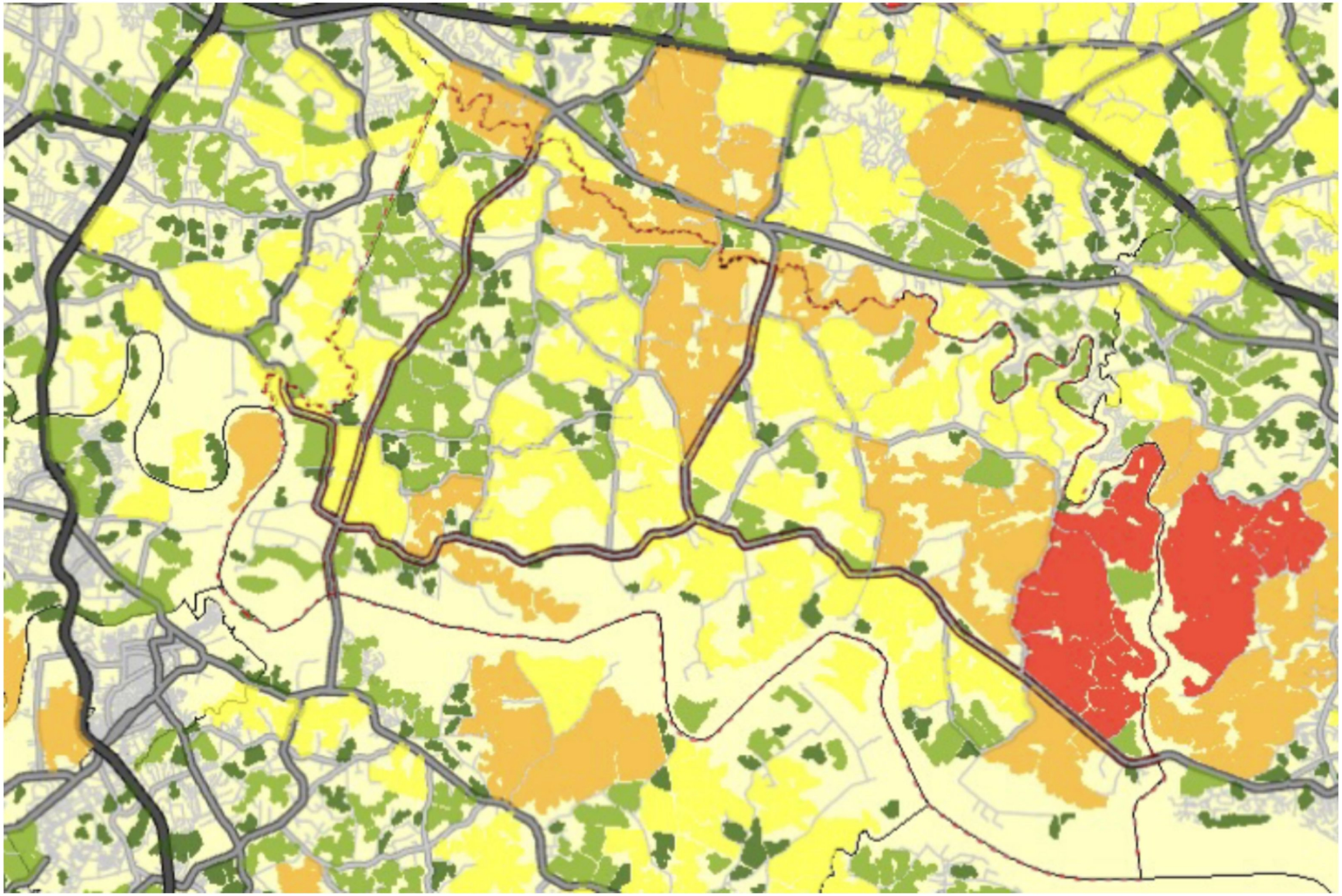
1. Forested Blocks
2. Forest Management Potential
3. Connectivity
4. Watershed Integrity
5. Threat of Conversion
6. Significant Forest Communities and Diminished Tree Species

Six data input layers were created based on these components and were ultimately combined to create the final FCV model. The 2020 FCV model evaluates these criteria to prioritize the highest value forestlands for conservation. The model ranks all forestland in Virginia from 1 (lowest) to 5 (highest) FCV. More complete detail on the background for selection, methodology, and limitations of each component is available with the **Data Download**.

Credits: Biasiolli, K., J. Pugh, and M. Santucci. 2020. Forest Conservation Value Model, 2020 Edition. Virginia Department of Forestry, Charlottesville, VA, USA.

For more information, go to: **https://dof.virginia.gov/forest-management-health/forestland-conservation/**

DCR Ecological Corridors Map



October 17, 2025

Ecological Cores:

C1: Outstanding
C2: Very High
C3: High
C4: Moderate
C5: General

DCR Ecological Corridors Map

Forests cover two-thirds of the Commonwealth. About 50% of that forested area is mapped and ranked as Ecological Cores and Habitat Fragments in the Virginia Natural Landscape Assessment. Ecological Cores are large patches of natural land with **at least 100 continuous acres of interior cover.** Habitat Fragments are smaller areas of continuous interior cover (i.e., 10 to 99 acres) that support Ecological Cores and provide functions and values that are especially important in localities with few remaining large intact areas of natural land. Interior cover begins 100 meters inward from edges caused by fragmenting features, such as roads. The combination of the 100-meter edge zones with the interior cover area, enable the mapping of each of the approximately 25,000 Ecological Cores and Habitat Fragments in Virginia.

Ecological Cores and Habitat Fragments are ranked by Ecological Integrity based on variables including rare species habitats, habitat diversity, resilience, and water quality, to reflect the wide range of important benefits and ecosystem services they provide. Brief descriptions of Ecological Integrity rankings are:

C1 - Outstanding: These cores tend to be large in area, of deepest interior, of greatest water quality protections, highest in habitat diversity and rich in rare species, including species listed as threatened or endangered. Of all Ecological Cores in the Commonwealth 1% are ranked as C1.

C2 - Very High: These cores have all or many of the same characteristics and values as C1 cores, though to a lesser extent. About 2.5% of all cores in the Commonwealth are ranked C2.

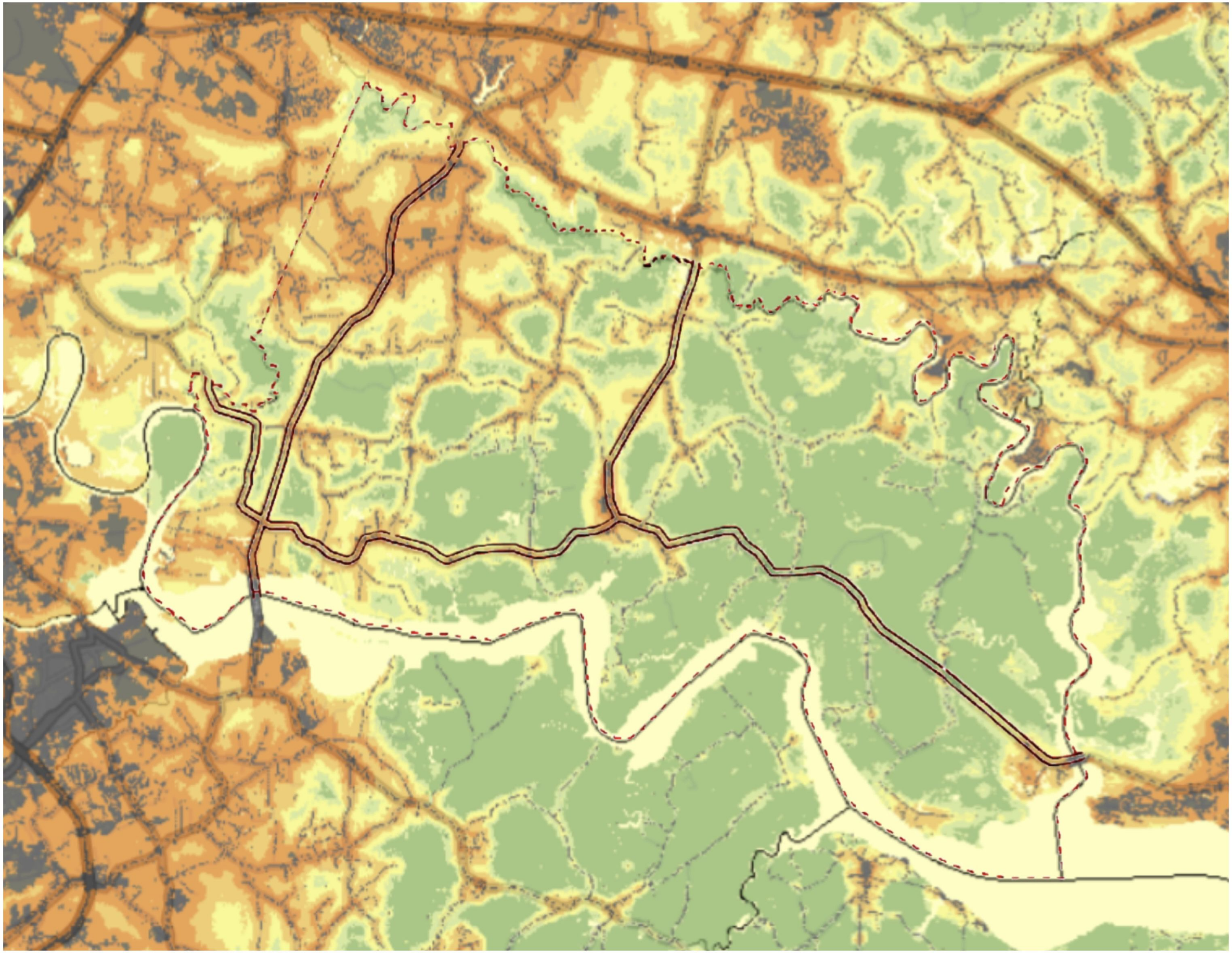
C3 - High, C4 - Moderate, and C5 - General: These cores, as well as Habitat Fragments, have some of the same quantifiable values and characteristics as higher-ranked cores, though much reduced due to their having substantially less interior area and smaller area overall.

Maintaining vital natural landscapes is essential for basic ecosystem services such as cleaning our air and filtering our water. Natural lands also harbor thousands of species of animals and plants and contain libraries of genetic information from which we derive new foods, materials, and medicinal compounds. These parts of the landscape also provide us with recreational opportunities and open space resources.

For more information, go to: http://www.dcr.virginia.gov/natural-heritage/vaconvisvnla.

Data Source: VA DCR, Division of Natural Heritage, 2017.

DCR Development Vunerability



Development Vulnerability:

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- Undevelopable (-1)
- Class I (0 - 5: Least Vulnerable)
- Class II (6 - 10)
- Class III (11 - 25)
- Class IV (26 - 50)
- Class V (51 - 100: Most Vulnerable)
- Already Developed (101)

DCR Development Vulnerability Map

The Virginia Conservation Vision Development Vulnerability Model quantifies the relative risk of conversion from natural, rural, or other open space lands to urbanized or other built-up land uses. Using land cover data from multiple time periods and a suite of predictor variables representing driving forces of development, a machine-learning approach was employed to estimate the relative risk of development in the future. The model output is a raster data set in which the relative vulnerability of lands ranges from 0 (least vulnerable) to 100 (most vulnerable). Conservation lands on which biodiversity preservation is believed to be the primary goal are considered undevelopable and are coded as -1, while areas in which development has already occurred are coded as 101. The model is based on ground conditions ca. 2019 and represents the relative likelihood of development by 2029.

For more information, go to http://www.dcr.virginia.gov/naturalheritage/vaconvisvulnerable

Data Source: VA DCR, Division of Natural Heritage, 2022