

New Jersey Ecological Riparian Area Map—DRAFT

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Map description

This map represents ecological riparian areas in the state of New Jersey. The ecological riparian area is the highly connected region of freshwater and land where energy and materials flow back and forth. This map represents the estimated actual functioning riparian area throughout the state. The stream network and surface waterbodies are the central feature of the riparian area, and the map represents the area of associated land, including connected wetlands, floodplains, and hydric soils. In addition to intact natural areas, this delineation includes altered or urban land if it is still in a position that is highly connected to the freshwater network.

The functional ecological area is in contrast to riparian zones established by legislative acts or administrative rules. Some acts and rules, such as the NJ Flood Hazard Area Control Act, define a "riparian zone" where certain activities are restricted to protect the functional ecological riparian area and water quality. The legal definitions are based on a range of policy considerations and define the riparian zone in ways that are simple enough to be followed in practice. Therefore, the legal riparian zones are generally fixed-width zones that do not capture the full extent or complexity of riparian areas on the ground. This ecological function map does not represent legal riparian zones, which are mapped separately and can be used as an overlay.

The purpose of the ecological riparian layer for the State of New Jersey is to provide information on the spatial extent and distribution of the functional riparian area for use in watershed planning and the study of watershed process and change. The current riparian delineation updates a method previously developed at the Rutgers University Center for Remote Sensing and Spatial Analysis (CRSSA) by Lathrop et al. (2007, 2021). This update makes use of a more inclusive floodplain map (FEMA +3' and associated low-lying areas), and a simplified hydric soils definition. New Jersey authoritative datasets are incorporated in order to maintain consistency with other data sources, especially land cover, wetlands, and streams and waterbodies. We make an effort to define a variable-width riparian area corresponding to ground conditions; fixed-width buffers supplement in areas where the current data cannot precisely represent the real variability on the ground. Fixed-width buffers are only used as a proxy where ecological data, especially floodplain or flood height data, is lacking for a region or surface water type. Table 1 summarizes the datasets and criteria included in the ecological riparian area map. The following section provides a detailed explanation of the selection criteria for each data source.

Table 1. Summary of data and criteria used in ecological riparian area map.

Feature Type	Data Source/Dataset	Fields	Attributes	Additional Conditions	Source
Waterbodies	Land Use/Land Cover of New Jersey 2020	LU20	5100, 5200, 5400		Feature Service , updated November 28, 2023
Artificial Waterbodies	Land Use/Land Cover of New Jersey 2020	LU20	5300	Overlapping stream network	
Streams	National Hydrography Dataset (NHD) Streams 2015 for New Jersey	FTYPE	336, 460, 558		Feature Service , updated December 27, 2023
Floodplain	Inland Design Flood Elevation (FEMA 1% Chance Annual Flood Plus 3 Feet)				Feature Service , updated May 17, 2024
Floodplain	Inland Design Flood Elevation (FEMA 1% Chance Annual Flood Plus 3 Feet), Low-Lying Areas			Within 10 m of Floodplain or within 100m of streams or waterbodies	Feature Service , updated May 17, 2024
Wetlands	Land Use/Land Cover of New Jersey 2020	TYPE20	WETLAND S	Overlapping Floodplain or within 100m of streams or waterbodies	Feature Service , updated December 27, 2023
Hydric Soils	gSSURGO-Table Value1	Potential Wetland Soil Landscapes	>= 75%	Overlapping Floodplain or within 100m of streams or waterbodies	Website , July 2020 Refresh, Accessed June 16, 2021
Hydric Soils	gSSURGO-Table Components	Major Component; Component name	Yes; Udifluents, Fluvaquents	Overlapping Floodplain or within 100m of streams or waterbodies	Website , July 2020 Refresh, Accessed June 16, 2021
Watershed Management Areas	Watershed Management Areas in New Jersey	WMA		Excluded area in WMA 21	Feature Service , Updated December 27, 2023

Background

Riparian areas are transition areas between aquatic and upland ecosystems. They exist as “a natural gradient of hydrological, habitat and geomorphic change from land to channel” (Stutter et al. 2021). The main feature of riparian areas is connection to freshwater. The network of connected water, known as the *fluvial hydrosystem*, includes streams, rivers, floodplains, underlying alluvial aquifers, adjacent wetlands, and downstream waters such as lakes (Fritz et al. 2018). Fluvial hydrosystems are highly connected, both structurally and functionally, with fluxes of energy, materials, and biota moving among units of the network.

Riparian areas overlap the fluvial hydrosystem and are three-dimensional. They include surface water, groundwater, vegetation, floodplains, near-slopes that drain to the water, and parts of upland areas that have a strong linkage to the water (Ilhardt et al. 2000). In riparian areas, the water has a strong influence on the land, affecting many ecosystem functions, including soil formation, plant species composition, nutrient cycling processes, soil stability, and habitat formation. At the same time, the land has a strong influence on aquatic ecosystems; even high terraces and slopes that rarely flood contribute woody material, sediment, shade, and affect the underground water flows (Ilhardt et al. 2000). Riparian areas are important in the landscape because they provide a variety of important ecosystem functions and services including filtering of sediment and nutrients, water storage and release, habitat provision, and recreational and educational opportunities. Riparian areas support high biodiversity but are also highly susceptible to disturbance (Weissteiner et al. 2016).

Riparian area boundaries may be spatially variable along the length of a watercourse due to variation in ecology and landform such as stream shape, groundwater pathways, topography, soil type, vegetation cover, etc. *Riparian delineation* is the process of spatially representing the riparian area (Stutter et al. 2021). In general, similar criteria for riparian delineation could be used as in wetland delineation: saturated soils, hydrophytes, and presence of water table in rooting zone (Ilhardt et al. 2000).

Riparian area selection criteria

Surface water

The riparian areas of interest are freshwater streams, rivers, lakes, and other natural surface water. Saltwater and tidal areas were included under the same selection principles. Artificial ponds are more ambiguous but constitute a large component of the lakes and ponds in New Jersey. The landscape is highly altered, and there are many anthropogenic impoundments throughout the state. Artificial waterbodies with high connectivity to other watercourses should be included in the riparian network. Other impoundments are often made by damming or altering natural streams and wetlands and maintain a connection to the riparian area. Therefore, waterbodies that intersect the stream network are included (Figure 1). Small, isolated artificial waterbodies such as stormwater retention ponds, are not included.



Figure 1. Left: Artificial reservoir with stream flowlines. Reservoir is an artificial impoundment, but fully connected to the stream network as represented by the intersection with the stream flowlines. Right: small artificial ponds (dark blue) that are rain- or groundwater-fed are not as connected to the surface water system, as represented by a lack of intersection with stream flowlines.

Layer: *Land Use/Land Cover 2020*

Field: *LU15*: Numeric 4-digit code representing land use/land cover category (2020) using modified Anderson classification system.

Attributes:

5100, Streams and Canals: This category includes river, creeks, canals and other linear water bodies that have a minimum width of 30 feet. For watercourses interrupted by control structures, the impoundments are placed in other appropriate water categories (see below), and the impoundment structures are included in the Urban or Built-up category.

5200, Natural Lakes. Water bodies that are non-flowing and naturally enclosed, including regulated natural lakes but excluding reservoirs, are placed in this category. Islands that are below MMU are included in the water area.

5300, Artificial Lakes. All artificial impoundments of water. Water in this category typically includes water impounded for irrigation, flood control, municipal water supplies, recreation, landscaping and hydro-electric power or the result of an active extractive operation.** Included if intersected by stream network.

5400, Bays, Estuaries, and Other Tidal Waters. This category is comprised of salt-water inlets and arms of the sea that extend inland and fall within the landmass of New Jersey. The Atlantic Ocean (LU20 5430), is excluded as it is not freshwater.

Note: Tidal waters (all 5400 series) are included because these areas integrate with freshwater and change over time.

Fixed-width buffers on water features

To provide minimum riparian areas to surface water, fixed-width buffers were assigned. In most cases, wetlands, floodplains, and hydric soils will provide wider, variable-width riparian areas, so the fixed-width buffers are intended to cover areas where other datasets might not fully represent those conditions. In headwater streams in the northeast USA, riparian vegetation has been found to be distinct from upland vegetation to a distance of approximately 12 m (Jayasuriya et al. 2021). Other research has suggested 30m as the distance within which most riparian functions occur, based on tree canopy heights (McDade et al. 1990, Ilhardt et al. 2000). Freshwater and brackish categories in the LULC dataset (5100, 5200, 5400) and selected stream centerlines are all buffered at 30m. Artificial waterbodies from the LULC dataset (5300) are also buffered at 30m if they intersect the natural stream network (Weissteiner et al. 2016).

Layer: Stream Network 2015

The layer consists of routes that make up a linear surface water drainage network. (centerlines). NHDFlowline is the fundamental flow network consisting predominantly of stream/river and artificial path vector features.

Field: *Feature types (FType)*

Attributes:

Artificial path: A surrogate for general flow direction in NHDWaterbodies and NHDAreas (larger watercourses or waterbodies).

Canal/ditch: An artificial open waterway constructed to transport water, to irrigate or drain land, to connect two or more bodies of water, or to serve as a waterway for watercraft.

Stream/river: A body of flowing water.

Floodplains

Floodplains are flat areas bordering stream or river channels that are formed by sediment deposition from those channels during overbank flooding. Floodplains are inundated during moderate to high water events (Lane et al. 2018). The 100-year floodplain is the area with a 1% annual chance of being equaled or exceeded. The FIRM is based on historical flood data and does not take current conditions or near future potential increases in precipitation into account. Therefore, a model that incorporates three additional feet of flood height to the current FIRMs is included to more accurately represent current and near future conditions under climate change. This model is consistent with the design flood elevation established by the 2023 NJDEP Inland Flood Protection Rule.

Layers:

1. *Rutgers NJ Inland Design Flood Elevation (FEMA 1% Chance Annual Flood Plus 3 Feet)*

2. *Rutgers NJ Inland Design Flood Elevation (FEMA 1% Chance Annual Flood Plus 3 Feet), Low-Lying Areas*

These additional low-lying areas are included in the riparian area if they are connected to the stream network, as represented by overlapping the stream flowlines, or area likely extension of the Inland Design Flood Elevation, as represented by proximity of 10m or less to those polygons.

Wetlands

Riparian wetlands are distinguished from other types of wetlands by having some bidirectional, lateral hydrologic flows with the adjacent stream or river segment (Fritz et al. 2018). There can be great variability in the distance of connection between wetlands and streams in different ecoregions, and wetlands from as far as hundreds of meters to kilometers away can be hydrologically connected to the stream (Vanderhoof et al. 2017). Tracing the connections of the fluvial hydrosystem is a large and complex task, but proximity is one of the most straightforward and strongest predictors of connectivity between a wetland and the watercourse or waterbody (Fritz et al. 2018). Also, floodplain wetlands are considered to be hydrologically connected to the stream network by overbank and hyporheic flows during periodic flooding (Fritz et al. 2018). Therefore, for this delineation, all wetlands intersecting the 100-year floodplain are included in the riparian area.

Not all streams and lakes have a geomorphic or mapped floodplain in the FIRM, especially those in narrow valleys, yet they are still hydrologically connected to downstream waters (Lane et al. 2018). Furthermore, diking, or other alterations, can affect the mapped floodplain and exclude areas from the floodplain that remain hydrologically connected to each other (Figure 5). Due to these factors, wetlands within 100m of selected surface water were included.

Layer: *2020 LULC*

Field: *TYPE20*

Attribute: *WETLAND*

Hydric Soils

The 1994 NRCS definition of hydric soils is soils that: “that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (NRCS 2022b). Because of the relationship with water, hydric soils can indicate areas with a strong relationship to the fluvial hydrosystem. Hydric soils identified in the SSURGO map can also indicate locations of wetlands that have not yet been mapped as wetlands (Galbraith et al. 2003, Tang et al. 2015). Hydric soils also show areas that have been developed, thus are not defined as wetlands and are not in the FEMA floodplain, but have wet soils and ground water connections to the greater hydrosystem.

Previous riparian area delineation methods use different combinations of NRCS Soil Survey Geographic Database (SSURGO) attributes to define hydric soils (Weissteiner et al. 2016, Lathrop et al. 2021, Abood et al. 2022). To avoid bias in selecting more or else expansive definitions of hydric soils, we have used the NRCS’s own definition of hydric soils (NRCS 2002):

1. All Histels except Folistels, and all Histosols except Folists, or
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Aquisalids, Pachic subgroups, or Cumulic subgroups that are:
 - a. Somewhat poorly drained with a water table equal to 0.0 foot (ft) from the surface during the growing season, or
 - b. Poorly drained or very poorly drained and have either:
 - (1) water table equal to 0.0 ft during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches (in), or for other soils
 - (2) water table at less than or equal to 0.5 ft from the surface during the growing season if permeability is equal to or greater than 6.0 in/hour (h) in all layers within 20 in, or
 - (3) water table at less than or equal to 1.0 ft from the surface during the growing season if permeability is less than 6.0 in/h in any layer within 20 in, or
3. Soils that are frequently ponded for long duration or very long duration during the growing season, or
4. Soils that are frequently flooded for long duration or very long duration during the growing season.

The Potential Wetland Soil Landscapes (PWSL) category in the SSURGO also incorporates alternative ratings for map units that are unranked for hydric rating, so is more comprehensive than hydric rating alone (NRCS 2022a). Alluvial soils, soils composed of sediment deposits from flowing water such as rivers and streams, were also included; all soils taxonomically classified as fluvents, udifluvents, or fluvaquents (Lathrop et al. 2021). Isolated patches of hydric soils have been excluded using the same criteria as for isolated wetlands.

Natural Resources Conservation Service (NRCS) Gridded Soil Survey Geographic Database (gSSURGO)

Source: Soil Survey Staff. Gridded Soil Survey Geographic (gSSURGO) Database for New Jersey (July 2020 Refresh). 2020. United States Department of Agriculture, Natural Resources Conservation Service. Accessed June 16, 2021. gdg.sc.egov.usda.gov/, nracs.app.box.com/v/soils.

Table: *Value Added Lookup (Value1)*

Field: *Potential Wetland Soil Landscapes*. The percentage of the map unit that meets the PWSL criteria. Soil components with hydricrating = 'YES' are considered PWSL. Soil components with hydricrating = "NO" are not PWSL. Soil components with hydricrating = 'UNRANKED' are tested using other attributes, and will be considered PWSL if any of the following conditions are met: drainagecl = 'Poorly drained' or 'Very poorly drained' or the localphase or the otherph data fields contain any of the phrases "drained" or

"undrained" or "channeled" or "protected" or "ponded" or "flooded". If these criteria do not determine the PWSL for a component and hydricrating = 'UNRANKED', then the map unit will be classified as PWSL if the map unit name contains any of the phrases "drained" or "undrained" or "channeled" or "protected" or "ponded" or "flooded". NULL values are presented where data are incomplete or not available (NRCS 2022a).

Attribute: Greater than or equal to 75% PWSL component.

Table: *Component table*

Field: *Component name, [compname]*

Attributes: *Udifluents, Fluvaquents*

Field: Major component

Attributes: Yes

Riparian Layer Clean Up

All component layers were merged and dissolved. Some gaps and slivers come from combining datasets created at different scales (Figure 2). Other gaps come from land use/land cover definitions. Because changes in land use or land cover in relatively small areas do not disconnect the land from the surface water system, small gaps that are completely within the riparian area polygon are be merged with the riparian area.

Eliminating gaps within the riparian area polygons

Threshold: 4 acres

All polygons that are completely surrounded by the larger riparian area polygon that are less than or equal to four acres are merged using the Eliminate Polygon Part tool in ArcGIS Pro.



Figure 2. Areas of cut outs and gaps. Left: cutouts due to altered land use. Right: cutouts due to natural variation in topography and land cover.

Intersecting with Watershed Management Areas

To increase loading speeds and make the riparian area map more manageable in a GIS system, it was subdivided by Watershed Management Areas. The two layers were intersected. Any area of WMA 21 (Atlantic Ocean), was excluded from the final riparian area map.

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