NIB Amphibian Species Richness: Southeast

This EnviroAtlas national map displays the Normalized Index of Biodiversity for amphibian species richness based on potential habitat within each 12-digit hydrologic unit (HUC) in 9 southeastern states. These data depend on habitat models rather than wildlife counts. Potential habitat may be specific to wintering, breeding, or year-round activities depending on the species.

Why are amphibian species important?

Amphibians are vertebrates in the class Amphibia that includes frogs, toads, salamanders, newts, and caecilians (wormlike amphibians). Amphibian species are considered important biological indicators of the health of an ecosystem because they live in both aquatic and terrestrial environments. They are sensitive to environmental changes and pollutants partly because they absorb water and oxygen directly through the skin.

Amphibian species richness estimates the number of amphibian species that may inhabit an area based on potential habitat. Species richness is frequently used as a surrogate for measuring biodiversity and as a measure of the relative conservation value of a particular area. Many scientists believe that biodiversity, because it represents all forms of life on earth, provides the core benefits that humans derive from their environment and helps sustain human culture worldwide. Many organizations consider managing for biodiversity as one way to achieve an acceptable balance among competing demands for various ecosystem services.[1]

Each species plays an important role within its ecosystem, and ecosystems are highly interconnected. The removal of even one species from an ecosystem can create a trophic cascade that can affect the entire food chain. Amphibians are secondary consumers in many food chains, acting as both predators and prey species. They eat large quantities of insects and help control pest populations that may damage plants and cultivated crops. Frog tadpoles feed on algae, which helps to keep waters clean. Amphibians play important roles in ecosystem nutrient cycling and energy flow. Amphibians also contribute to human health by providing new pharmaceuticals. Frog secretions have been developed into treatments for pain and hypertension. Maintaining the diversity and richness of these species allows for the possible future discovery of more valuable human health treatments.


Southern Toad, M.A. Musselman, USFWS

Many people enjoy viewing amphibian species and they seek them out in their natural habitats. Unfortunately, extreme declines in amphibian populations have been noted since the 1980s, with the extinction of at least 9 species.[2] The reasons for these declines vary and often are not well understood, though habitat loss, pollution, invasive species, and diseases are established causes. The Southeast is the center of amphibian biodiversity in the U.S.; there, 91 amphibians are listed as species of concern with 19 species considered critically imperiled. The southern Appalachian Mountains and the Florida Panhandle are two areas in the Southeast with high concentrations of endangered amphibian species.[3]

How can I use this information?

The map, NIB Amphibian Species Richness: Southeast, is one of three EnviroAtlas maps that illustrate amphibian species richness for the Southeast. Other EnviroAtlas maps show maximum and mean species richness for each 12-digit HUC.[4] Used together or independently, these maps can help identify areas of potentially low or high amphibian species richness to help inform decisions about resource restoration, use, and conservation. These maps can also be used in conjunction with other maps in EnviroAtlas such as protected areas (PADUS) or GAP ecological systems to help identify areas with high ecological or recreational value for inclusion in conservation, recreation, or restoration planning.

After learning the amphibian species richness values for a particular 12-digit HUC, users can investigate an area more intensively by using higher resolution individual species

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models available through the Southeast Regional Gap Analysis Project (SEGAP).

How were the data for this map created?

This data layer is based on data generated by the U.S. Geological Survey (USGS) National Gap Analysis Program (GAP). The GAP program maps the distribution of natural vegetation communities and potential habitat for individual terrestrial vertebrate species. These models utilize predictive environmental variables (e.g., GAP land cover, elevation, and distance to water) to derive deductive habitat models for each species.

Southeast GAP modeled habitat for 132 amphibian species that reside, breed, or use the habitat within 9 southeastern states for a significant portion of their life history. Amphibian species richness was calculated by combining predicted habitat for all GAP individual amphibian species by pixel across the 9 states. The number of amphibian species in each pixel was summarized by 12-digit HUC and the mean species richness value calculated for each HUC. The NIB was calculated by dividing the mean species richness value by the maximum value for each HUC.

What are the limitations of these data?

EnviroAtlas uses the best data available, but there are still limitations associated with these data. These data, based on models and large national geospatial databases, are estimations of reality that may overestimate actual amphibian presence. Modeled data are intended to complement rather than replace monitoring data. Habitat models do not predict the actual occurrence of species, but rather their potential occurrence based on their known associations with certain habitat types. Habitat is only one factor that determines the actual presence of a species. Other factors include habitat quality, predators, prey, competing species, and fine scale habitat features.

Other essential species information in addition to species richness includes the types of species and their functional groups, whether they are rare or common, native or non-native, tolerant or intolerant of disturbance. It is also important to consider that species numbers (at a landscape scale) tend to increase with moderate disturbance, meaning that moderately human-altered or disturbed habitats have higher numbers of species than either minimally disturbed or highly disturbed sites.[5]

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Metric values for individual pixels may be obtained from the New Mexico State University Center for Applied Spatial Ecology. Individual species data may be obtained from the SEGAP geo-data server.

Where can I get more information?

A selection of resources related to biodiversity and amphibians is listed below. Information on the models and data used in the USGS GAP and SEGAP projects is available on their respective websites. 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.

Acknowledgments

The Amphibian Species Richness data were created through a collaborative effort between the USGS GAP and EPA. Kenneth Boykin and graduate students from New Mexico State University generated the data. The data used to derive southeastern amphibian species richness came from SEGAP and the Biodiversity and Spatial Information Center (BaSIC) at North Carolina State University. The fact sheet was written by Kenneth Boykin, New Mexico State University, Anne Neale and William Kepner, EPA, Jessica Daniel, EPA Student Services Contractor, and Sandra Bryce, Innovate!, Inc.

Selected Publications

1. Boykin, K.G., W.G. Kepner, D.F. Bradford, R.K. Guy, D.A. Kopp, A. Leimer, E. Samson, F. East, A. Neale, and K. Gergely. 2013. A national approach for mapping and quantifying habitat-based biodiversity metrics across multiple spatial scales. *Ecological Indicators* 33:139–147.

2. Global Amphibian Assessment - NatureServe. 2004. Global Amphibian Assessment Fact Sheet. Accessed January 2014.

3. Wear, D.N., and J.G. Greis. 2002. Southern forest resource assessment: Summary of findings. *Journal of Forestry* 100(7):6–14.

4. Kepner, W.G., K.G. Boykin, D.F. Bradford, A.C. Neale, A.K. Leimer, and K.J. Gergely. 2013. Biodiversity Metrics Fact Sheet, EPA/600/F-11/006, U.S. Environmental Protection Agency, Washington, D.C.

5. Marzluff, J.M. 2008. Island biogeography for an urbanizing world: How extinction and colonization may determine biological diversity in human-dominated landscapes. *Urban Ecosystems* 8:155–177.