NIB Amphibian Species Richness: Southwest

This EnviroAtlas national map displays the Normalized Index of Biodiversity (NIB), an index value for amphibian species richness based on potential habitat within each 12-digit hydrologic unit (HUC) in the southwestern United States (Arizona, Colorado, Nevada, New Mexico, and Utah). These data are based on habitat models, not 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 a class of vertebrates including frogs, toads, salamanders, newts, and caecilians. Amphibian species are thought to be important biological indicators, or indicators of the health of an ecosystem. Because they live in both aquatic and terrestrial environments and breathe through their skin, amphibians are highly sensitive to environmental changes and pollutants.

Amphibian species richness estimates how many different amphibian species may inhabit an area, based on potential habitat. Species richness, or diversity, is frequently used as a measure of the relative conservation value of a particular area. It has been used as a surrogate for measuring biodiversity. Many scientists believe biodiversity, as it represents all forms of life on earth, provides or supports the core benefits that humans derive from their environment and helps sustain human culture throughout the world. Amphibian species richness is one indicator of biodiversity within an area.

Each species, regardless of size or function, plays an important role within its ecosystem. Ecosystems are highly interconnected, with numerous food chains that form a food web, where all species have a vital function. The removal of even one species from an ecosystem could potentially have cascading effects throughout the system. Amphibians are secondary consumers in many food chains, acting as both predators and prey species. They eat large amounts of insects and help control pest populations that may damage plants and cultivated crops. Frog tadpoles feed on algae, which helps keep waters clean. Amphibians also play important roles in ecosystem nutrient cycling and energy flow.

In addition to playing important roles in their ecosystems, these species can also be important to human health and the development of pharmaceuticals. For instance, some frogs secrete substances that have been used as painkillers and to treat hypertension. Diversity and richness in these species allows for the discovery of these important treatments.


Photo: Gary M. Stolz/USFWS

Many people enjoy viewing amphibian species and seek them out in their natural habitats. Unfortunately, extreme declines in amphibian populations have been noted since the 1980s, with at least 9 species reported to have gone extinct.[1] The Global Amphibian Assessment found that 43 percent of all amphibian species are in decline, and an additional 113 species have not been seen recently and are thought to be extinct.[1] The reasons for these declines vary and often are not well understood, though habitat loss, pollution, invasive species, and diseases such as Chytridiomycosis are established causes.

How can I use this information?

The map, NIB Amphibian Species Richness: Southwest, is one of three EnviroAtlas maps that illustrate indicators of amphibian species richness for the Southwest. Additional EnviroAtlas maps show the maximum and mean amphibian species richness for each 12-digit HUC. 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 to help identify areas with high ecological or recreational value for inclusion in conservation or restoration planning, protection from further development, or highlighted for recreational or aesthetic reasons. This

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information can help identify areas that may be vulnerable to development.

After finding out the values of amphibian species richness for a particular 12-digit HUC, an area can be more intensively investigated by using individual species models at a higher resolution. The individual species models are available through the Southwest Regional Gap Analysis Project (SWReGAP).

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, distance to water) to derive deductive habitat models for each species.

A component of GAP, SWReGAP modeled habitat for 37 amphibian species that reside, breed, or use the habitat within the 5-state Southwest study area for a significant portion of their life history. Amphibian species richness was calculated by combining predicted habitat for GAP individual amphibian species by pixel across the southwestern United States. The number of amphibian species in each pixel was then summarized by 12-digit HUC and the mean value for each HUC was calculated. The NIB was calculated by dividing the mean 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 the data. These data are based on models and large national geospatial databases. Calculations based on the data are estimations of the truth founded on the best available science. Modeled data can be complementary but they are not meant to replace monitoring data. Habitat models do not predict the actual occurrence of species, but rather their predicted 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 such as woody debris.

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. SWReGAP and GAP data and accuracy information can be accessed through their respective websites.

Where can I get more information?

There are numerous resources about the importance of amphibians and on biodiversity in general; a selection of these resources is listed below. Additional information on the models and data used in the USGS GAP and SWReGAP projects are 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

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Selected Publications

1. Conservation International, World Conservation Union (IUCN), and Natureserve. 2004. Global Amphibian Assessment Fact Sheet. Accessed April, 2013.

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.

Boykin, K.G., B.C. Thompson and S. Propeck-Gray. 2010. Accuracy of gap analysis habitat models in predicting physical features for wildlife-habitat associations in the southwest U.S. *Ecological Modelling* 221:2769–2775.

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.

Prior-Magee, J.S., K.G. Boykin, D.F. Bradford, W.G. Kepner, J.H. Lowry, D.L. Schrupp, K.A. Thomas, and B.C. Thompson, (Eds.). 2007. Southwest Regional Gap Analysis Project Final Report. U.S. Geological Survey, Gap Analysis Program, Moscow, ID.