NIB Bat Species Richness: Southeast

This EnviroAtlas national map displays the Normalized Index of Biodiversity (NIB) for bat species richness based on potential habitat within each 12-digit hydrologic unit (HUC) in 9 southeastern states. These data are based 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 bat species important?

Bat species richness estimates the number of bat 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.

Bats are nocturnal flying mammals. They are prevalent in both natural and human-influenced habitats. Some species that once used hollow trees for roosting freely use human-made structures. Bats worldwide have wide-ranging diets—from fruit, nectar, and flowers to small animals. Bats are important pollinators and seed dispersers for a variety of wild and cultivated plants worldwide, particularly in tropical forests.[1]

The great majority of bat species in the Southeast feed on insects. Besides the ubiquitous mosquito, bats ingest many destructive forest and agricultural pests, including cucumber beetles and cutworm, tent caterpillar, corn earworm, and gypsy moths. The quantities of insects consumed by bats vary seasonally and by species. Studies have shown that insectivorous bats consume 25%–100% of their body mass per night (higher percentages for nursing females); a single maternity colony of Brazilian free-tailed bats was estimated to consume up to 9 tons of insects in a single night.[1]

By consuming agricultural pests, bats reduce the need for the use of pesticides, some of which can have harmful effects on human health and the environment.[1] A recent study estimated that the cost-savings from insect-suppression by bats is worth $22.9 billion dollars annually to the U.S. agricultural industry.[2]

Of the 45 bat species that inhabit the United States, 7 are currently listed as endangered or threatened. Eighteen of the 20 bat species featured in EnviroAtlas are listed by various states as Species of Greatest Conservation Need. Populations of once-common bat species like the little brown bat are rapidly declining toward regional extinctions as a result of the emergence of white-nose syndrome, a fungal disease from Europe first detected in New York State in 2006. The disease spreads rapidly through hibernating populations, with regional site losses averaging 73%.[3] The disease was confirmed in Virginia and West Virginia by 2009–2010 and it spread into Tennessee and Kentucky in 2011–2012. In 2016, the disease skipped over the Great Plains and appeared in the western U.S. (Washington State) for the first time.


Photo: Virginia Big-Eared Bat, C. Stihler, USFWS

How can I use this information?

The map, NIB Bat Species Richness: Southeast, is one of three EnviroAtlas maps that illustrate indicators of bat species richness for the Southeast. Other EnviroAtlas maps show the maximum and mean bat species richness for each 12-digit HUC.[4] Used together or independently, these maps can help identify areas of potentially low or high bat species richness to help inform decisions about resource restoration, use, and conservation. Knowing bat species richness is one aspect useful to conserve biodiversity.

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

After learning the bat species richness values for a particular 12-digit HUC, users can investigate an area more intensively

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by using higher resolution individual species 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, distance to water) to derive deductive habitat models for each species.

Southeast GAP modeled habitat for 20 bat species that reside, breed, or use the habitat within 9 southeastern states for a significant portion of their life history. Bat species richness was calculated by combining predicted habitat for all GAP individual bat species by pixel across the 9 states. The number of bat species in each pixel was summarized by 12-digit HUC and the mean value calculated for each HUC. The mean species richness value was divided by the maximum value to calculate the Normalized Index of Biodiversity (NIB).

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 of predicted habitat, are estimations of reality that may overestimate actual bat 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 bats 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.

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Selected Publications

1. Kunz, T.H., E. Braun de Torrez, D. Bauer, T. Lobova, and T.H. Fleming. 2011. Ecosystem services provided by bats. *Annals of the New York Academy of Sciences* 1223(1):1– 38.

2. Boyles, J.G., P.M. Cryan, G.F. McCracken, and T.H. Kunz. 2011. Economic importance of bats in agriculture. *Science* 332:41–42.

3. Frick, W.F., J.F. Pollock, A.C. Hicks, K.E. Langwig, D.S. Reynolds, G.G. Turner, C.M. Butchkoski, and T.H. Kunz. 2010. An emerging disease causes regional population collapse of a common North American bat species. *Science* 329: 679–682.

4. Kepner, W.G., K.G. Boykin, D.F. Bradford, A.C. Neale, A.K. Leimer, and K.J. Gergely. 2011. 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.