NIB Bird Species Richness: U.S.

This EnviroAtlas national map displays the Normalized Index of Biodiversity (NIB) for bird species richness based on potential habitat within each 12-digit hydrologic unit (HUC) in the conterminous United 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 bird species important?

Bird species richness estimates the number of different bird 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 or supports 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. Each species depends on others for some aspect of its survival to provide food, habitat, decomposition, pollination, or control of pest species. The removal of even one species from an ecosystem can create a trophic cascade that can affect the entire food chain.

Bird species are important to humans; they are the focal point of many non-profit organizations and citizen science data collection efforts such as the Breeding Bird Survey and Christmas Bird Count. Ecologically, birds participate in the food chain as predators, herbivores, and insect, nectar, and carrion feeders. Birds help to control insect populations. Birds also perform an important role in conservation biology because they have been shown to be sensitive indicators of landscape disturbance and habitat condition. Bird community indices record birds' response to disturbance gradients, from minimally-disturbed habitats (e.g., mature forest) to more highly disturbed human-influenced habitats. For example, researchers have found that in the southeastern U.S., forest canopy nesters and foragers, such as pine warbler, Acadian flycatcher, and red-eyed vireo, decline with forest fragmentation and conversion while generalist and non-native species increase with similar disturbance.[2]


Photo: Gray Catbird, T.G. Barnes, USFWS

Bird-watching is a popular pastime that can contribute to the economy as well as human physical and cultural well-being. A recent report estimated that 48 million birdwatchers in the U.S. contributed $36 billion to the economy as a result of bird-watching activities.[3] A diversity of birds in an area can bring tourist dollars to a community and enjoyment to local residents.

How can I use this information?

The map, NIB Bird Species Richness: U.S., is one of three EnviroAtlas maps that illustrate indicators of bird species richness for the conterminous United States. Other EnviroAtlas maps show maximum and mean bird species richness for each 12-digit HUC across the U.S.[4] Used together or independently, these maps can help identify areas of low or high potential bird 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 bird species richness values for a particular 12-digit HUC, users can investigate an area more intensively by using individual species models available

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from the U.S. Geological Survey Gap Analysis Project (GAP).

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.

GAP modeled habitat for bird species that reside, breed, or use the habitat within the U.S. for a significant portion of their life history. Bird species richness was calculated by combining predicted habitat for all GAP individual bird species by pixel across the country. The number of bird species in each pixel was summarized by 12-digit HUC and the mean species richness 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. The data, based on models and large national geospatial databases of predicted habitat, are estimations of reality that may overestimate actual bird species 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.

Where can I get more information?

A selection of resources related to biodiversity and birds is listed below. Information on the models and data used in the USGS GAP program is available on their website. 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. 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. Canterbury, G.E., T.E. Martin, D.R. Petit, L.J. Petit, and D.F. Bradford. 2000. Bird communities and habitat as ecological indicators of forest condition in regional monitoring. *Conservation Biology*14: 544–558.

3. Carver, E. 2009. Birding in the United Sates: A demographic and economic analysis. Addendum to the 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation. U.S. Fish and Wildlife Service, Arlington, Virginia.

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.