Bird Species Richness

Three EnviroAtlas national maps display the number of bird species with 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?

The metric, Bird Species Richness, estimates the number of bird species that may inhabit an area based on potential habitat. Species richness is one measure of biodiversity that can represent 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 to sustain human society, economy, health, and well-being. Managing for biodiversity is one way to balance competing demands for 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 focus of many non-profit organizations and citizen science 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 and they also perform other important roles as pollinators and seed dispersers. In conservation biology, they serve as sensitive indicators of landscape disturbance and habitat condition. Bird community indices record birds' responses 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 disturbances. [2]

Bird-watching contributes to human physical, cultural, and economic well-being. It is estimated that 48 million birdwatchers in the U.S. contributed $36 billion to the


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

economy from birdwatching activities in 2006.[3] The total economic benefit of wildlife watching in 2015 was $166 billion. Bird diversity can bring tourist dollars to a community and enjoyment to residents.

How can I use this information?

Three EnviroAtlas maps, Mean, Maximum, and Normalized Index of Biodiversity (NIB), illustrate bird species richness for each 12-digit HUC in the conterminous United States. Used together or independently, these maps can help identify areas of low or high potential bird species richness to inform decisions about resource restoration, use, and conservation. Mean richness is a commonly used and understood value for comparison. NIB provides an index to compare a metric with other metrics across multiple project scales simultaneously. Maximum richness identifies habitats that are species rich but may not occupy large areas (e.g. linear riparian areas).

These maps can be used in conjunction with other maps in EnviroAtlas such as ecoregions, the U.S. Geological Survey (USGS) protected areas database (PAD-US), or the USGS Gap Analysis Project (GAP) ecological systems to identify areas with high ecological or recreational value for 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 from the GAP project.

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How were the data for this map created?

The USGS GAP project maps the distribution of natural vegetation communities and potential habitat for individual terrestrial vertebrate species. These models use environmental variables (e.g., land cover, elevation, and distance to water) to predict habitat for each species. GAP modeled habitat for bird species that reside, breed, or use the habitat within the conterminous U.S. for a significant portion of their life history. These maps are based on 621 GAP bird species.

Predicted habitat for the 621 bird species was combined to calculate bird species richness by pixel. The mean and maximum numbers of bird species in each 30-meter pixel were calculated for each 12-digit HUC. The mean species richness value by HUC was divided by the maximum mean value within all HUCs to calculate the 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.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Individual 30-meter pixel data may be downloaded from the New Mexico State University Center for Applied Spatial Ecology.

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 Core Science Analytics, Synthesis & Library's 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 layer list drop down menu. 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.

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. (Fact sheet for the original regional habitat models for southeastern and southwestern U.S.)

Pearce, D., and D. Moran. 1994. *The economic value of biodiversity*. International Union for Conservation of Nature, Taylor and Francis, New York, New York. 104 p.