NIB Threatened and Endangered Vertebrate Species: Southeast

This EnviroAtlas national map displays the Normalized Index of Biodiversity (NIB) for threatened and endangered vertebrate 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 threatened and endangered vertebrate species important?

Threatened species are vulnerable to multiple impacts from human development and they risk becoming endangered. Endangered species face extinction throughout all or much of their range. The Endangered Species Act (ESA) creates a mechanism to review petitions for classifying and federally listing species in these two categories. The act provides federal protections such as restrictions on taking or selling listed species, individual species recovery plans, and acquisition of habitat. Despite these protections, threatened and endangered vertebrate species continue to risk extinction from habitat loss, pollution, climate change, disease, and competition from invasive species. Some of the most endangered species in the Southeast include the red wolf, red-cockaded woodpecker, wood stork, and gopher tortoise.

The loss of these species may negatively affect the function of ecosystems and the benefits they provide. The removal of even one species from an ecosystem can create a trophic cascade that can affect the entire food chain. For example, grazers and browsers directly modify the species composition, diversity, and condition of grassland and forest habitats. Top predators, by regulating herbivore numbers, indirectly influence habitat condition and diversity by reducing grazing pressure on plant production.[1] The loss of a top predator like the red wolf removed population controls on white-tailed deer. Without predators, unchecked populations of deer degraded forest understories, affecting other species' habitat. Absence of the red wolf also allowed an increase in mid-sized predators like raccoon, fox, and coyote. Released from predation by red wolves, increased numbers of raccoons seasonally and opportunistically feed on eggs and nestlings, reducing the populations of songbirds, turkeys, quail, and the threatened gopher tortoise. Coyote is not native to the Southeast, but it has invaded in the last few decades to fill the void left by the extirpated red wolf. Today, one of the biggest obstacles to the reintroduction of the red wolf is the possible dilution of red wolf genes through hybridization with coyote.[2]


Photo: Red wolf, C. Carley

The red-cockaded woodpecker and the gopher tortoise are 2 of 29 federally-listed wildlife species of the longleaf pine ecosystem. The gopher tortoise has declined 80% in the last century as longleaf pine forests have been converted to pine plantations, agriculture, and housing. The tortoise is considered a keystone species in the longleaf pine ecosystem because its sand burrows provide shelter for over 300 other species (e.g., burrowing owl, indigo snake).[3]

In addition to their roles within ecosystems, threatened and endangered vertebrate species attract local tourism through their recreational, cultural, and aesthetic values.

How can I use this information?

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

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After learning the threatened and endangered species richness values for a particular 12-digit HUC, users can investigate an area more intensively 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 24 threatened and endangered vertebrate species that reside, breed, or use the habitat within 9 southeastern states for a significant portion of their life history. Species richness was calculated by combining predicted habitat for all GAP individual threatened and endangered vertebrate species by pixel across the 9 states. The number of threatened and endangered vertebrate species in each pixel was summarized by 12-digit HUC and the mean 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 threatened and endangered 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. 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 threatened and endangered species and biodiversity 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 the data creation process for EnviroAtlas, access the metadata found in the drop-down menu for each map layer. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

Acknowledgments

The data for Modeled Threatened and Endangered Vertebrate Species 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 threatened and endangered vertebrate 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. Ripple, W.J., and R.L. Beschta. 2005. Linking wolves and plants: Aldo Leopold on trophic cascades. *Bioscience* 55(7):613–621.

2. Phillips, M.K., V.G. Henry, and B.T. Kelly. 2003. Restoration of the red wolf. Paper 234, USDA National Wildlife Research Center, Lincoln, Nebraska.

3. Van Lear, D.H., W.D. Carroll, P.R. Kapeluck, and R. Johnson. History and restoration of the longleaf pine-grassland ecosystem: Implications for species at risk. *Forest Ecology and Management* 211:150–165.

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.

NIB Threatened and Endangered Vertebrate Species: Southwest

This EnviroAtlas national map displays the Normalized Index of Biodiversity (NIB), an index value for threatened and endangered vertebrate species richness with 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 threatened and endangered vertebrate species important?

Endangered species are those species that are in danger of extinction through all or much of their range; threatened species are likely to become endangered. The Endangered Species Act (ESA) provides protections for listed species that include protection from Federal activities, restrictions on taking or selling the species, plans to help them recover, and authority to acquire important habitat. Despite these protections, threatened and endangered vertebrate species remain at risk of extinction due to many factors such as habitat loss, competition from invasive species, pollution, climate change, and disease. The loss of these species may affect the function of some ecosystems and the many benefits they provide, including their added recreation, aesthetic and culutral value.

Each species 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. Each species depends on other species for some aspect of their survival, whether it is to provide habitat, serve as food source, decompose matter, pollinate plant species, or control pest species. Thus, the removal of even one species from an ecosystem could potentially have cascading effects throughout the system.

For instance, the endangered Gray Wolf is a keystone predator and an integral part of the ecosystems to which it belongs. It's re-introduction into Yellowstone National Park helped bring balance to both animal and plant communities, aiding in the recovery of this degraded ecoystem.[1]

In addition to their ecoystem roles, threatened and endangered vertebrate species are important to many people simply for their presence within environments. Many of these species provide recreational, cultural, or aesthetic value


Photo: Gary Kramer/ USFWS

and may contribute to an area's ability to attract tourism and tourism-related jobs. People who are interested in viewing wildlife, such as avid birdwatchers, may visit areas for the purpose of viewing species such as the endangered southwestern willow flycatcher or the recovered bald eagle.

How can I use this information?

The map, NIB Modeled Threatened and Endangered Vertebrate Species: Southwest, is one of three EnviroAtlas maps that illustrate indicators of threatened and endangered vertebrate species richness for the Southwest. Additional EnviroAtlas maps show the maximum and mean threatened and endangered vertebrate species richness for each 12-digit HUC. Used together or independently, these maps can help identify areas of potentially low or high threatened and endangered vertebrate species richness to help inform decisions about resource restoration, use, and conservation. Knowing threatened and endangered species richness provides one aspect necessary to conserve biodiversity.

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 or protection from further development for recreational or aesthetic reasons. This information can help identify areas that may be vulnerable to development.

After finding out the threatened and endangered species richness values for a particular 12-digit HUC, an area can be more intensively investigated by using individual species models at a higher resolution. Individual species models are

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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 21 threatened and endangered vertebrate species that reside, breed, or use the habitat within the 5-state Southwest study area for a significant portion of their life history. Species richness was calculated by combining predicted habitat for all GAP individual threatened and endangered vertebrate species by pixel across the southwestern United States. The number of threatened and endangered vertebrate species in each pixel was then summarized by 12-digit HUC and the mean value for each HUC 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 the information is 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 on the importance of threatened and endangered species; a selection of these is below. 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

EnviroAtlas is a collaborative effort led by EPA. The data for Threatened and Endangered Vertebrate Species were created through a collaborative effort between the USGS GAP and EPA. The data were generated by Kenneth Boykin and graduate students from New Mexico State University. The data used to derive Threatened and Endangered Vertebrate Richness came from SWReGAP. The fact sheet was written by Kenneth Boykin, New Mexico State University, Anne Neale and William Kepner, EPA, and Jessica Daniel, EPA Student Services Contractor.

Selected Publications

1. Beschta, R.L., and W.J. Ripple. 2009. Large predators and trophic cascades in terrestrial ecosystems of the western United States. *Biological Conservation* 142(11): 2401–2414.

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.

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