NIB Big Game Species Richness: Southeast

This EnviroAtlas national map displays the Normalized Index of Biodiversity (NIB) for big game 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 big game species important?

The term big game refers to large animals that may be hunted for food or sport, including, in the Southeast, elk, white-tailed deer, bear, feral hog, and turkey. Individual state fish and wildlife agencies determine a species' designation as a game species. Elk, hunted to local extinction in the eastern U.S. in the 19th century, have been reintroduced in Great Smoky Mountains National Park and several southeastern states with suitable habitat.

Big game species richness estimates the number of big game 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.[1]

Within a food chain, big game animals function as primary and secondary consumers or as a food source for other wildlife. Grazers and browsers, such as elk and white-tailed deer, directly modify the species composition and condition of grassland and forest habitats. Top predators, by regulating herbivore numbers, indirectly influence habitat condition by reducing grazing pressure on plant production. A predator-prey balance, now lost in many ecosystems in the Southeast, helps to maintain plant and animal species diversity.[2] In the absence of large predatory species, such as red wolves, the harvesting of large and small game by humans becomes a substitute for natural predator control.

In addition to their roles in ecosystems, game species serve as an important food source, and they are appreciated for providing aesthetic value and recreation opportunities. The chance to see elk, deer, or bear attracts visitors to parks and other wildlife management areas. Big game hunting has a long tradition in the U.S. In 2011, approximately 85% of hunters pursued big game.[3] Beyond its recreational value,


Photo: Elk, S. Theodorski, NPS

hunting provides an economic vehicle for conservation, management, and restoration projects, the benefits of which extend beyond big game species. Revenue collected from a federal excise tax and from state hunting licenses must be spent to support wildlife and conservation programs.

How can I use this information?

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

These maps can 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. Connectivity planning and estimation of species' minimum area requirements are important considerations for mobile big game species with large territories.

After learning the big game 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).

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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 7 big game species that reside, breed, or use the habitat within 9 southeastern states for a significant portion of their life history. Big game species richness was calculated by combining predicted habitat for all GAP individual big game species by pixel across the 9 states. The number of big game 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 the data. These data, based on models and large national geospatial databases, are estimations of reality that may overestimate actual big game 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 big game 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 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

The data for Big Game Species Richness 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 big game 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 Jahre, EPA Student Services Contractor, and Sandra Bryce, Innovate!, Inc.

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. Miller, B., B. Dugelby, D. Foreman, C. Martinez del Rio, R. Noss, M. Phillips, R. Reading, M. E. Soulé, J. Terborgh, and L. Wilcox. 2001. The importance of large carnivores to healthy ecosystems. *Endangered Species Update* 18(5):202–210.

3. U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2013. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, FHW/11-NAT (RV), Washington, D.C.

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 Big Game Species Richness: Southwest

This EnviroAtlas national map displays the Normalized Index of Biodiversity (NIB), an index value for big game 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). Big game refers to large animals that are hunted; their designation as a game species is determined by state fish and wildlife agencies. 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 big game species important?

Big game usually refers to large animals, such as elk, deer, bear, moose, mountain sheep, and turkey. Big game species richness estimates how many different big game species may inhabit an area, based on potential habitat. Species richness 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. Therefore, many organizations consider managing areas for biodiversity a means to achieve an acceptable balance among competing demands for various ecosystem services. Big game species richness is one indicator of biodiversity within an area.

Each species, regardless of type or size, plays an important role within its ecosystem and the food web. Within the food chain, big game animals function as primary and secondary consumers and also as a food source for other wildlife. Some of these animals, such as wolves, may be top predators and even keystone species within their ecosystems. Grazing big game animals, such as bison, provide a critical function in managing native grasslands and foliage.

In addition to the roles that big game species play in ecosystems, they are also an important food source and are appreciated for the recreation opportunities and the aesthetic value they provide. Elk, deer, bison, and moose attract visitors to parks and wildlife areas. Big game hunting has a long tradition in the U.S. and is the most popular type of hunting; in 2011, approximately 85 percent of hunters went hunting for big game.[1]


Photo: Gary Zahm/USFWS

Beyond its recreational value, hunting provides a critical economic vehicle for conservation, management, and restoration projects, the benefits of which extend beyond big game species. Revenue is collected from a federal excise tax, as well as from state hunting licenses and permits. These funds are required to be used to support wildlife and conservation programs and have supported restoration projects for elk, deer, big-horn sheep, and non-game species such as bald eagles. The income generated by the presence of big game species helps protect lands, maintain wildlife populations, and conserve biodiversity.

How can I use this information?

The map, NIB Big Game Species Richness: Southwest, is one of three EnviroAtlas maps that illustrate indicators of big game species richness for the Southwest. Additional EnviroAtlas maps show the maximum and mean big game species richness for each 12-digit HUC. Used together or independently, these maps can help identify areas of potentially low or high big game species richness to help inform decisions about resource restoration, use, and conservation. Knowing the big game 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 and protection from further development for recreational or aesthetic reasons. This information can help identify areas that may be vulnerable to development.

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After finding out the big game 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 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 15 big game species that reside, breed, or use the habitat within the 5-state Southwest study area for a significant portion of their life history. Big game species richness was calculated by combining predicted habitat for all GAP individual big game species by pixel across the Southwestern United States. The number of big game 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 these data. These data are based on models and large national geospatial databases. Calculations based on these data are estimations of the truth founded on the best available science. Modeled data can be complementary but 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 game species and on biodiversity in general; a selection of these resources is listed below. Information on what is considered big game, and applicable management, rules, and regulations, can be found on each state's fish and wildlife department 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.

Acknowledgments

EnviroAtlas is a collaborative effort led by EPA. The data for Big Game Species Richness 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 Big Game Species Richness came from SWReGAP. The fact sheet was written by Kenneth Boykin, New Mexico State University, Anne Neale and William Kepner, EPA and Jessica Jahre, EPA Student Services Contractor.

Selected Publications

1. U.S. Department of the Interior, U.S. Fish and Wildlife Service, U.S. Department of Commerce, and U.S. Census Bureau. 2013. 2011 National survey of fishing, hunting, and wildlife-associated recreation, FHW/11-NAT (RV), Washington, D.C.

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. 2011. 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, Editors. 2007. Southwest Regional Gap Analysis Project Final Report. U.S. Geological Survey, Gap Analysis Program, Moscow, Idaho.