Percent Rare Ecosystem Forms Protected

This EnviroAtlas national map illustrates the percent of land area within each 12-digit hydrologic unit (HUC) that is comprised of relatively rare ecosystem forms or ecoforms occurring on protected lands. In EnviroAtlas, ecosystem rarity is evaluated based on four ecosystem spatial pattern categories: small patch, large patch, linear, and matrix-forming. Ecoforms (and corresponding ecosystems) with values of the relative rarity index greater than 75 (on a scale of 0 to 100) are considered rare. Protected status is derived from the Protected Area Database of the US (PAD-US 1.3).

Why are protected rare ecosystems important?

Ecosystems are interconnected networks that include living organisms interacting with the non-living (abiotic) environment (e.g., climate and soil). The natural processes that occur within ecosystems produce benefits or ecosystem services (e.g. clean air, clean water, and food) that human communities and other ecological communities depend on to be most productive. These services may be unique to processes occurring within individual ecosystems. For example, wetlands, forests, and grasslands provide different functions and benefits. Protecting rare ecosystems may also preserve the services they provide.

There is growing recognition that ecosystem-based conservation is an effective approach to maintaining and protecting biodiversity. Protecting an entire ecosystem ensures the protection of both the living and non-living elements that comprise the system. By mapping and evaluating the existence of rare ecosystems, conservation efforts can effectively target and protect multiple species that comprise and/or depend on those ecosystems. For example, the rare South Florida Pine Rockland ecosystem provides crucial habitat for the endangered Florida panther; it is only one of the rare ecosystems that exist within the boundaries of the Everglades national park (see photo).

In addition to the benefits to biodiversity conservation, rare ecosystems may also provide aesthetic, recreational, and cultural value to neighboring communities. For example, the Cascade Mountains in the Pacific Northwest include matrix-forming and large patch ecosystems. In addition to valuable wildlife habitats, these ecosystems provide recreational opportunities for residents and tourists.

Photo: National Park Service, Pine Rocklands, Everglades

One challenge in an ecosystem-based conservation approach is defining "rare ecosystem." Rare ecosystems are often defined as ecosystems that occupy less than 30 percent of their original or pre-industrial range.[1] However, this definition is difficult to apply due to a lack of historical data.[2]

To address this gap in data, EPA has developed an index of ecosystem rarity that can distinguish between ecosystems which are naturally small in extent (i.e. riparian or bog systems) from those that have limited area due to land conversion and development. Understanding relative ecosystem rarity within the scope of current protected lands provides insight into the distribution of ecosystem types that may need further protection.

How can I use this information?

This map, Percent Rare Ecosystem Forms Protected, and its underlying data can be used to estimate the relative percentage of land area within 12-digit hydrologic units (HUCs) in the conterminous U.S. that may contain protected rare ecosystems with an Ecoform Relative Rarity Index value greater than 75. Identifying the presence of protected rare ecosystems may help inform future conservation efforts and land use planning.

This map can be viewed in conjunction with both the Rare Ecosystems supplemental biophysical-raster map and the Land Protection Status (PADUS) layers (also found in the Supplemental Data area of the EnviroAtlas interactive map). Together, these layers can show HUCs with a high

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percentage of rare ecosystems and locations within HUCs where rare ecosystems may exist in relation to protected areas. This map can also be used with population data to provide insight into the overlap of human populations and rare ecosystems.

How were the data for this map created?

These data are based on U.S. Geological Survey (USGS) National Gap Analysis Program (GAP) landcover data. Open water and human use (e.g., urban or agriculture) landcover types were removed to concentrate on more natural ecosystems. The systems were grouped into four spatial pattern types (i.e. matrix forming, linear, small patch and large patch), as defined by NatureServe. Ecosystems within each spatial pattern type were aggregated to the scale of the macrogroup in the National Vegetation Classification (NVC) system. These aggregated ecosystem types, or ecoforms, are used in the calculation of the ecosystem rarity index.

A relative rarity index ranging from 0 to 100 was calculated for each ecoform based on spatial pattern type, area, and relative uniqueness and summarized by 12-digit hydrologic unit. Ecoforms with index values greater than 75 were considered rare. The Protected Area Database of the United States (PAD-US 1.3) was used to identify protected lands. The database was limited to GAP protection status levels 1 and 2, which specify areas under permanent protection with minimal extractive uses allowed. That is, in protection levels 1 and 2, logging, mining, and other activities that drastically diminish the natural state of the area are precluded. The percent of the rare area protected within a HUC was calculated by dividing the total protected rare acres by the total rare acres.

What are the limitations of these data?

The USGS GAP Version 2 Landcover data represents a hybrid dataset. It was created by compiling regional GAP landcover datasets, classified by aerial imagery at 30-meter resolution, with data from the LANDFIRE project (USDA Forest Service and U.S. Department of Interior, 2012) as well as data from non-governmental organizations, state and federal agencies. The GAP landcover data maps individual ecological systems across the entire United States. These ecological systems are based upon the NatureServe Ecological Systems classification[3], yet they are not identical. The GAP labeling of the NatureServe ecosystems includes modifiers to the base NatureServe ecosystem labels.

All national data layers such as GAP landcover and the GAP PAD_US 1.3 are, by their nature, inherently imperfect; they are an estimation of the truth based on the best available science. Calculations based on these data are therefore also estimations. Accuracy information for the source data sets can be found on their respective web sites.

How can I access these data?

EnviroAtlas data can be viewed in the Interactive Map, accessed through web services, or downloaded. USGS GAP, NatureServe, and NVC data are available on their respective websites. The EnviroAtlas Ecosystem Rarity Toolbox provides downloadable tools for four different ecosystem rarity metrics.

Where can I get more information?

There are numerous resources on the classification of ecosystems, their value, and conservation; a selection of these resources is listed below. Organizations such as USGS, NatureServe, and the International Union for the Conservation of Nature are groups that work on the conservation and classification of ecosystems. 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 these data, please contact the EnviroAtlas Team.

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Selected Publications

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