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Fact Sheet
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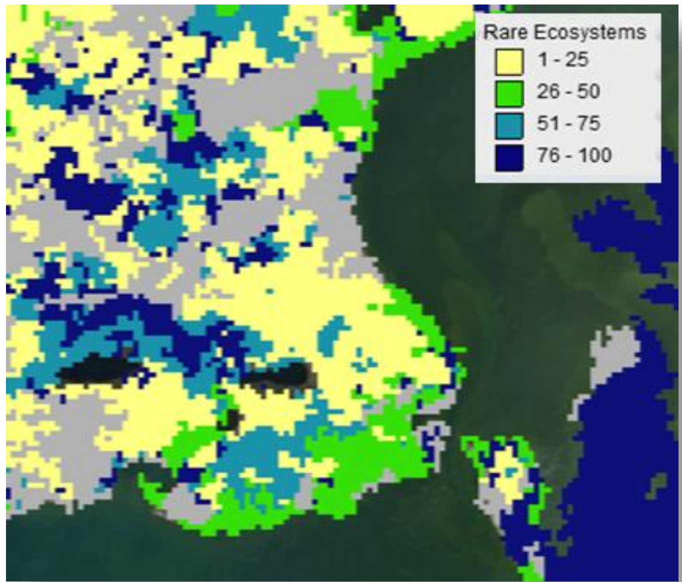
Rare Ecosystems in the Conterminous U.S.

This EnviroAtlas national map for rare ecosystems in the conterminous U.S. delineates the Ecoform Relative Rarity Index developed by the EPA. 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.



Why are rare ecosystems important?

The preservation of relatively rare ecosystems and the species they support is an important facet of biological conservation. Rare ecosystems often harbor endemic plant or animal species that are found nowhere else, as for example, various species found in Great Lakes alvars (limestone barrens), Oregon wet prairies[1], or California vernal pools. Rare ecosystems may support a unique assemblage of species that, once gone, eliminate other services or benefits associated with those ecosystems. An ecosystem may be rare because of an inherently limited supply or because of human conversion of a once widely-distributed ecosystem (e.g., wetlands, prairies, or old-growth forests). However, not all rare ecosystems are in imminent danger of conversion.[2] Some rare ecosystems are relics of a former climate regime (e.g., the last Pleistocene glaciation), or they occur in marginal habitats that are not easily developed (exposed rock, deep sand, or cliff faces).

The focus of EnviroAtlas is on the collective benefits and services that ecosystems provide. Ecosystem conservation offers a proactive and complementary alternative to a species-by-species response to declining biodiversity. Conservation of whole ecosystems, even those considered rare, can be a cost-effective approach to protect multiple species through habitat conservation.[2]

How can I use this information?

This dataset may be used to locate and determine the relative rarity of ecosystems in the conterminous U.S. Rare ecosystems data may be overlaid with protected areas or ecoregions and GAP Ecological Systems to assess the adequacy of reserves and remaining habitat core areas to conserve relatively rare ecosystems. This data may also be compared with connectivity maps to examine the connections among scattered rare ecosystem parcels. Using these data, planners may be able to identify the most vulnerable ecosystems to target for conservation or locate habitat areas that may be restored to increase connectivity within a network of relatively rare ecosystems. Connectivity studies will have even more importance in the context of progressing climate change to plan for adaptive movements of flora and fauna to alternate habitats.

Two other ecosystem rarity metrics are summarized by hydrologic unit (12-digit HUC): 1) the percentage of the terrestrial land area of each HUC covered by rare ecosystems and 2) the percent of land area within each HUC that is comprised of relatively rare ecosystem forms or ecoforms occurring on protected lands.

How were the data for this map created?

The rare ecosystems metric developed for EnviroAtlas ranks ecosystems based on current extent, spatial pattern type, and relative uniqueness. The U.S. Geological Survey (USGS) GAP Analysis Landcover Data (Version 2, 2011), specifically the GAP Ecological Systems data, were used as a base map of natural terrestrial ecosystems of the U.S. Ecological Systems refers to the vegetation classification developed by NatureServe to map the natural vegetation of the U.S. Open water and landcover types related to human use (e.g., urban or agriculture, shown in gray on the EnviroAtlas map layer) were removed from the landcover dataset to limit it to relatively natural landcover. The natural ecosystems were grouped into four spatial pattern categories: matrix-forming, linear, and small (1–50 ha) and large patch

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(50–2000 ha) systems. Linear spatial systems typically occur along riparian areas, coastal edges, or cliff escarpments and matrix-forming systems include forests, shrublands, and grasslands. The ecosystems within the spatial pattern categories were aggregated to create a new ecosystem type, here called ecoforms. The ecoforms were ranked by descending area. The ranks were divided by the total number of ecoforms in each spatial pattern set multiplied by 100 and rounded up to the nearest integer to create the Ecoform Relative Rarity Index, with scores ranging from 0 (common) to 100 (rarest). An ecoform with a score over 75 is considered rare.

This ecosystem rarity index and three other related measures are available for download as an ArcGIS Ecosystem Relative Rarity Toolbox. One of the other three metrics, the Ecosystem Relative Rarity metric, is a simple sorting and ranking of all the natural ecosystems. The two remaining metrics, the Macrogroup and Macroform Relative Rarity metrics, rely on aggregating similar ecosystems to reduce the number of ecosystems at the national scale. Before sorting and ranking the ecosystems, groups of diagnostic plant species with similar composition and growth forms were aggregated into larger groups (macrogroups) while retaining biogeographic differences among groups. The macrogroup is a category in the eight-level National Vegetation Classification (NVC) hierarchy composed of subcontinental or regional communities differing by mesoclimate, geology, substrate, hydrology, and disturbance regimes.[3]

What are the limitations of these data?

The GAP Ecological Ecosystems data are modeled from satellite imagery and additional digital data on soils, geology, topography, and aspect. As such, the data should be considered an interpretation of reality rather than a strict replication of actual ground cover.

The Ecological Systems and NVC macrogroup data are aggregations of landcover and vegetation classes. Rare ecosystems are often under-represented when vegetation classes are aggregated because some regional vegetation types may be omitted.[4] Because the dataset is based on vegetation cover, rare ecosystems in desert regions may be poorly represented. Also, the methodology doesn't allow us to distinguish between those systems that are rare because of inherent naturally limited extent and those that are rare because of human conversion. Ideally, one would have historic data for comparison, but such data does not exist in an electronic format or over national extent. Assessing rarity by spatial pattern types gives us a sense of the pre-European settlement coverage of a given ecosystem type. Because of the broad national scope of this dataset, it is suited to an overview or summary of relative ecosystem rarity.

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 rare ecosystems is listed below. To view maps created from other National Vegetation Classification classes (e.g., ecological system, class, formation), see the GAP Analysis Program Land Cover Data Viewer. For additional information on how the data were created, access the metadata for the data layer from the layer list drop down menu on the interactive map. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

Acknowledgments

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Selected Publications

1. Schultz, C.B., and K.M. Dlugosch. 1999. Nectar and host plant scarcity limit populations of an endangered Oregon butterfly. *Oecologia* 119:231–238.

2. Noss, R.F., E.T. LaRoe, and J.M. Scott. 1995. Endangered ecosystems of the United States: A preliminary assessment of loss and degradation. U.S. Department of the Interior, National Biological Service, Washington, DC.

3. Faber-Langendoen, D., D.L. Tart, and R.H. Crawford. 2009. Contours of the revised U.S. National Vegetation Classification Standard. *Bulletin of the Ecological Society of America* 90:87–93.

4. Thompson, S.D., and S.E. Gergel. 2008. Conservation implications of mapping rare habitats using high spatial resolution imagery: Recommendations for heterogeneous and fragmented landscapes. *Landscape Ecology* 23(9):1023–1037.

Nicholson, E., D.A. Keith, and D.S. Wilcove. 2009. Assessing the threat status of ecological communities. *Conservation Biology* 23:259–274.