

What is the Ohio Gap Analysis Program (GAP)?

The Gap Analysis Program (GAP) is a program for identifying the degree to which native species and natural communities are represented in present-day conservation lands. Those areas where unique biological communities and conservation lands do not overlap constitute gaps in our conservation effort.

GAP aids in the protection of biodiversity through a regional assessment of the conservation status of native species and natural land-cover types. This assessment provides a practical approach based on available data to identify potential conservation areas and strategies. GAP is a preliminary step to the more focused, local studies needed to establish boundaries for potential biodiversity management areas. GAP is conducted as state-level projects and is coordinated by

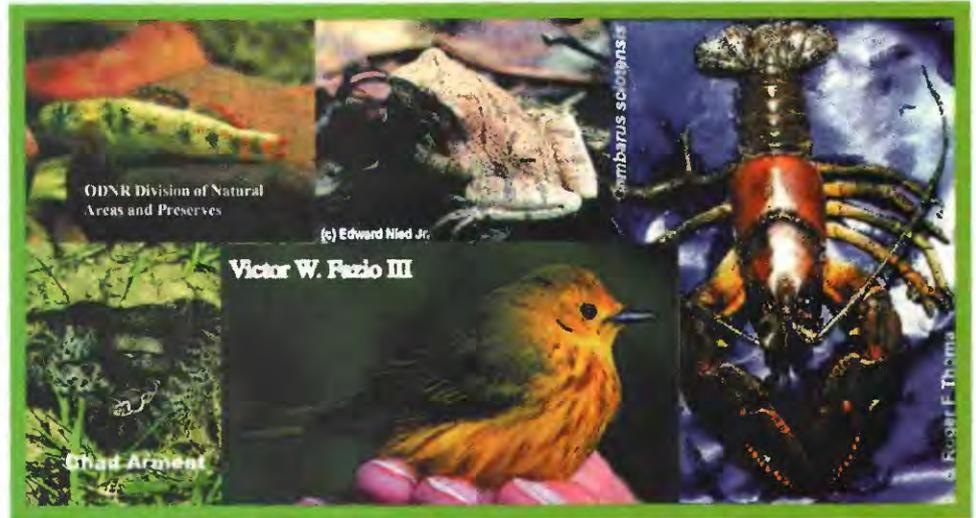


Figure 1. Numerous species can be found in Ohio. Some of these are, clockwise (starting at right): New River crayfish, *Cambarus sciotensis*, Yellow Warbler, *Dendroica petechia*, Racer, *Coluber constrictor*, Orangethroat darter, *Etheostoma spectabile*, Northern spring peeper, *Pseudacris crucifer*. (Photos reproduced with permission.)

Box 1

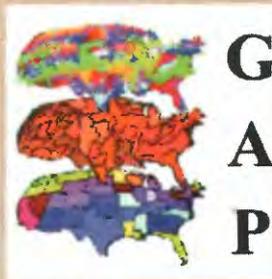
National GAP

The mission of the National Gap Analysis Program is to provide regional assessment of the conservation status of native vertebrate species and natural land-cover types and to facilitate the application of this information to land-management activities. This is accomplished through the following five objectives:

1. Map the land cover of the United States.
2. Map predicted distributions of vertebrate species for the United States.
3. Document the representation of vertebrate species and land-cover types in areas managed for the long-term maintenance of biodiversity.
4. Provide this information to the public and to those entities charged with land-use research, policy, planning, and management.
5. Build institutional cooperation in the application of this information to state and regional management activities.

These objectives can be used as a conservation tool to

- identify and map areas of species richness,
- determine and map the conservation status of lands comprising these areas, and
- identify the "gaps" between areas of high species richness and conservation lands.



<http://www.gap.uidaho.edu>

the U.S. Geological Survey (USGS) Biological Resources Discipline (BRD). It is a cooperative effort among regional, state, and Federal agencies and private groups.

Ohio GAP

In Ohio, the U.S. Geological Survey, The Ohio State University, and the Ohio Department of Natural Resources, Division of Wildlife, are cooperating on the GAP analysis. The Ohio GAP program, one of fifty, has terrestrial and aquatic components that include all terrestrial vertebrates, fish, crayfish, and a set of aquatic macroinvertebrates (fig. 1).

Additionally, through an Ohio Lake Erie Protection Fund grant, Ohio GAP is doing an analysis on wetlands within the Lake Erie Basin. This work allows the terrestrial and aquatic components

Box 2

Why is GAP important?

Loss of Biodiversity

Biological diversity, or biodiversity, refers to the variety of living things in an ecosystem. Biodiversity can be defined at three hierarchical levels: genetic, species, and ecosystem.

Why is the diversity of life important? Genetic diversity ensures the resilience and productivity of natural and agricultural ecosystems on which we depend for food, medicines, and raw materials. Species diversity ensures a supply of biological "workers" for ecological tasks: animals renew soil fertility, decompose wastes, and pollinate crops and natural vegetation, whereas plants are useful in erosion control, watershed protection (by countering droughts and floods), wastewater management, noise abatement, and air-pollution control (Murphy, 1988). Ecosystem diversity ensures that large-scale biotic systems interact to purify our air and water, control and stabilize the climate, and cycle nutrients.

Despite these and other benefits of biodiversity, species are disappearing at an alarming rate. The United States contains approximately 4 percent of the world's known reptile species, 5 percent of the amphibians, 7 to 8 percent of the freshwater fish, 9 percent of the mammals, and 8 percent of the birds (World Resources Institute, the United Nations Environment Programme, the United Nations Development Programme, and the World Bank, 1999). The Nature Conservancy estimates that about one-third of U.S. plant and animal species, about 6,500 species, are at risk of extinction (Stein and Flack, 1997). Animal species in Ohio are included in this potential risk of extinction (table 1).

Habitat Loss in Ohio

Habitat loss in Ohio is a major concern. The leading cause of loss of biodiversity is habitat destruction (Stein and Flack, 1997). Several kinds of human activities that most likely will lead to habitat loss include large-scale corporate farming, urban development, logging, grazing, mining, road building, water development, introduction of nonnative species, pollution, fire suppression, and recreation.

Among the 50 states, Ohio is ranked 7th in population with 11,256,654 people (U.S. Census Bureau, 2000) and 34th in land area with 41,330 mi² (Ohio Historical Society, 1999). Ohio has approximately 73,000 farms covering 15 million acres (Ohio Agricultural Statistics Service, 1998). The State produces an estimated 300 to 400 million board feet of timber each year (Ohio Agricultural Industry, 2001). There are 113,435 miles of highway in Ohio (Ohio Historical Society, 1999), which is, for its size, more than any other state (Key to the City, 2001).

of GAP to be integrated to produce an ecosystem-based conservation tool for wetlands, the unique areas between land and water. The Wetland GAP will be concurrent with the two other Ohio GAP projects.

Table 1. Federal or State endangered, threatened, special interest, and species of concern in Ohio

	Endangered		Threatened		Special interest	Species of concern
	State	Federal	State	Federal	State	Federal
Mammals	6	1	0	0	8	3
Birds	29	1	3	1	6	10
Reptiles	5	0	1	2	10	7
Amphibians	5	0	0	0	2	0
Fish	24	1	13	0	9	8
Mollusks	27	6	4	0	6	9
Dragonflies	9	0	0	0	0	2
Crayfish	0	0	1	0	2	0
Butterflies	7	2	1	0	3	3
Moths	14	0	4	0	3	3
Beetles	3	1	2	0	6	5

Sources: U.S. Fish and Wildlife Service, 2001; Ohio Department of Natural Resources, Division of Wildlife, written commun., 2001

Plateau, and (5) Western Allegheny Plateau. These divisions are used by many state and Federal agencies for land-use planning and management, as well as for biological assessments.

The Huron/Erie Lake Plain, a former lakebed in northwestern Ohio, consists of silty, poorly drained soils. Important remnant ecosystems found here include the Great Black Swamp, a large forested wetland that was converted to cropland at the turn of the last century, and the Oak Openings, a dune and swale ecosystem.

The Eastern Cornbelt Plain extends from central Ohio westward into Indiana. What once comprised beech-maple forests with scattered prairie openings is now prime agricultural land in Ohio.

The Interior Plateau in the southwestern corner of Ohio is a transitional area between the Western Allegheny Plateau and the Eastern Corn Belt Plain. Primarily agricultural in the west, the landscape becomes increasingly forested towards the east. Historically, forest openings contained prairie species and cedar barrens.

The Erie/Ontario Lake Plain, the home of most of Ohio's industry, occupies the northeast corner of the State. Many isolated wetlands (bogs, fens, and forested swamps) containing rare northern plant species are found in this part of the State.

Terrestrial Setting

Five natural ecoregions in Ohio have been defined by soil type, vegetation, and topography: (1) Huron/Erie Lake Plain, (2) Eastern Corn Belt Plain, (3) Erie/Ontario Lake Plain, (4) Interior

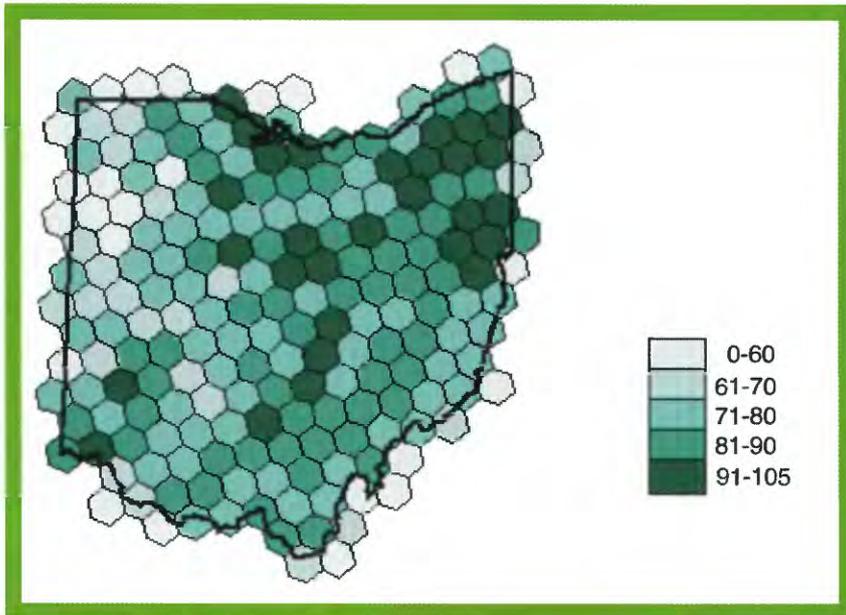


Figure 2. Breeding Bird Species Richness based upon location data from the Ohio Breeding Bird Atlas (Peterjohn and Rice, 1991).

The Western Allegheny Plateau, containing most of the public lands and forests in Ohio, occupies the southeastern part of the State. This unglaciated region is characterized by steep valleys, ridges, and many interesting geological formations. Coal mining and timber harvesting are the main land uses in this part of the State.

Historically, Ohio's landscape comprised a diverse array of ecosystems. Although 95 percent forested, the remainder of the State included 5 million acres of various wetland types (bogs, fens, and marshes). In addition, nearly 1,000 mi² (square miles) of prairies and grasslands occupied large forest openings at the time of settlement.

Today, few undisturbed prairies, wetlands, and forests remain. Since the late 1700s, Ohio has undergone drastic changes in land use, which have resulted in a mosaic landscape consisting mainly of agriculture, suburban/urban areas, and fragmented woodlands.

Aquatic Setting

Ohio is a water-rich state with more than 3,300 named streams and an even larger number of small, unnamed streams. Ohio has 44,000 miles of continuously flowing streams, 376 mi² of inland water, and 3,499 mi² of Lake Erie, providing Ohio with a diversity of freshwater species. Lake Erie is the 11th largest freshwater lake in the world and

has the most productive fishery in all the U.S. Great Lakes. The health of the Lake Erie fishery depends on the health of the streams flowing into the Lake. The Ohio River drainage basin, which contains more than 400 miles of waterways, is approximately 22,720 mi² within Ohio's borders. The Ohio River is the boundary for six states and is a major transportation corridor.

Ohio's aquatic resources are subject to many conflicting and competing uses, thus posing some of the State's most pressing ecological problems. Approximately 52 species of fish, 53 species of mussels, and 3 species of crayfish are

Box 3

Terrestrial Methods

Ohio Terrestrial GAP is generating range maps using a hexagon sampling grid created by the U.S. Environmental Protection Agency (USEPA) as part of standard GAP procedure (fig. 2). More detailed species distributions are being modeled within the hexagons where particular species are known to live. To conduct a GAP analysis, scientists create digital maps representing existing natural vegetation, predicted distributions of native vertebrate species, and current protected lands, using geographic information systems (GIS) and remote-sensing technology. These maps will be superimposed to analyze the elements (individual species, species-rich areas, and vegetation-cover types) that are underrepresented in areas designated for the management and protection of biodiversity.

listed on the State level as extinct, extirpated, of special interest, endangered, or threatened (Dave Risley, Ohio Department of Natural Resources, written commun., 2001). Problems facing Ohio's aquatic resources include the loss of 90 percent of Ohio's original wetlands to urban and agricultural use, the destruction of riverine habitat through the building of more than 60,000 dams, water withdrawal, land-use alteration (resulting in decreased water quality and alteration of flow), pollution, and the introduction of nonnative species. These problems will continue to put pressure on streams, rivers, and remaining natural wetland habitats in Ohio.

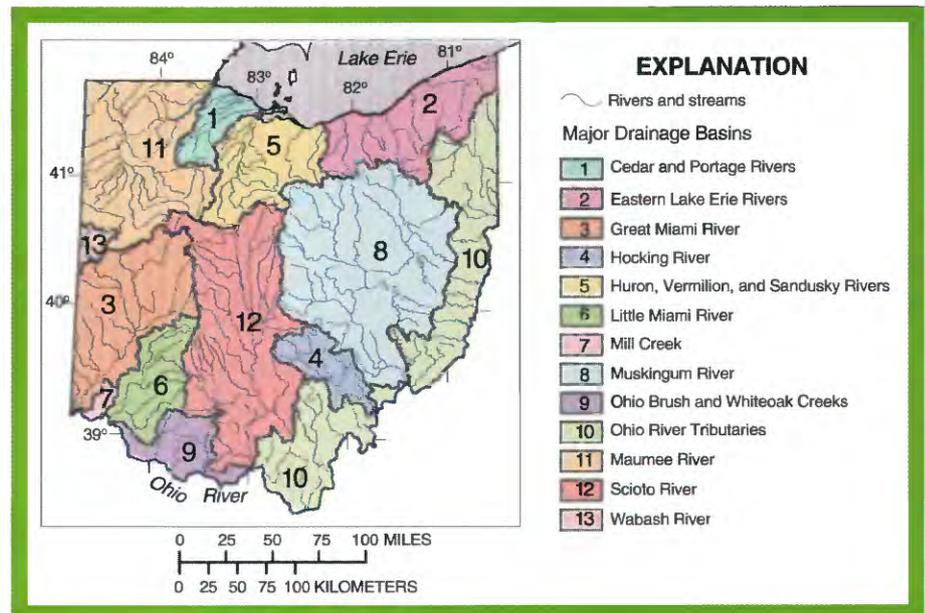


Figure 3. Ohio's major drainage basins.

Products

To aid in the protection, restoration, and conservation of terrestrial and aquatic habitats, GAP produces maps (Boxes 3 and 4) that identify ecologically valuable areas. Maps of vegetation, stream and wetlands classifications, biodiversity, and conservation status made available to state and local agencies charged with land-use, transportation, and development planning will help promote conservation prior to development. The GAP approach provides a useful planning tool to protect common species, while they are still common, as well as to protect rare species by identifying critical habitats.

The planned products of Ohio GAP can be used by State and Federal agencies, as well as local and regional planning authorities. Uses of GAP data include wildlife management, ecosystem restoration, county planning, land-use planning by private corporations, basic research, generation of options for conservation-area designations, and environmental assessments.

Box 4

Aquatic Methods

Ohio Aquatic GAP is generating a 1:100,000-scale digital map layer of riverine habitats for approximately 3,300 named streams in Ohio. To map riverine habitats, scientists are using landscape features that remain relatively constant through time, such as major drainage basins (fig. 3). By identifying stream types based on habitat and determining their rarity and conservation status, GAP researchers can develop conservation priorities for Ohio's rivers. Once conservation gaps based on habitat have been determined, the researchers will use distribution data for all known species of fish (fig. 4) and crayfish, as well as selected macro-invertebrates, to predict these species distributions in each riverine habitat.



Figure 4. Ohio distribution of pumpkinseed sunfish (blue dots) from Ohio GAP fish database. The red dots represent fish-collection sites where pumpkinseed sunfish were not observed.

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For more information, please contact:

Ohio GAP Coordinator
U.S. Geological Survey
6480 Doubletree Avenue
Columbus, OH 43229
Phone: (614) 430 - 7700
Internet: <http://oh.water.usgs.gov/ohgap/ohgap.html>

By: S. Alex. Covert, Melissa Haltuch, and Troy Wilson