FINAL REPORT SUMMARIES

Michigan Gap Analysis Project

Michael Donovan
Wildlife Division, Michigan Department of Natural Resources, Lansing

Introduction

The Michigan Gap Analysis Project (MI-GAP) began in 1994 as part of the Upper Midwest Gap Analysis Project (UMGAP). UMGAP includes Minnesota, Wisconsin, Illinois, and Michigan, and was coordinated through the U.S. Geological Survey's (USGS) Upper Midwest Environmental Sciences Center (UMESC). In Michigan, the project was coordinated by the Michigan Department of Natural Resources (DNR). Major cooperators are the Michigan State University Department of Fisheries and Wildlife and the Michigan Natural Features Inventory (MNFI), Michigan State University Extension.

Michigan contains some of the most biologically diverse and valuable habitat for many threatened, endangered, and candidate species in the Upper Midwest. Significant habitat diversity exists here, including oak savanna, jack pine and oak barren, boreal forest, northern hardwood forests, and dune ecosystems. Michigan has six federally threatened and endangered terrestrial vertebrate species and one candidate species for federal threatened and endangered status. There are 21 globally imperiled and rare animal species in Michigan (MNFI 1999).

Information produced by MI-GAP provides an overview of the distribution and management status of Michigan's terrestrial vertebrates and land cover biodiversity. Gap analysis seeks to identify vegetation types and wildlife species that are not adequately represented in the current network of conservation areas. These are the "gaps" in the present-day overall mix of conservation lands and activities. Decision makers can use this information for land management planning so that fewer species become endangered and fewer conflicts occur in natural resource management.

Land Cover

The MI-GAP land cover layer was derived from the classification of Landsat satellite imagery. It required 19 scenes to cover all of Michigan. Three dates of imagery (spring, summer, and fall) were acquired for each scene. Image dates ranged from 1999 through 2001. Both supervised and unsupervised classification techniques were used in conjunction with multiple ancillary data sources to produce 32 categories of land cover (Table 1). An accuracy assessment of the final land cover layer determined it to be 87 percent accurate at level 2 in the hierarchical classification scheme. At the finest level of classification detail (level 3), class accuracies range from 36 percent to 87 percent.

Land Stewardship

The MI-GAP stewardship layer classified conservation lands in Michigan based on the existence of an identified management direction for the protection of biodiversity. This layer was derived through acquisition and analysis of federal, state, and some land conservancies' ownership and management records. This data layer classified land by ownership (federal, state, conservancy, and private) and by biodiversity protection status (Table 2). Approximately 1.5 perent of Michigan's land area is classified as a stewardship level 1 or 2 (highest biodiversity protection status). Michigan has 19.4 percent classified as stewardship level 3 (some biodiversity protection) and 79.1 percent classified as level 4 (no plan for the protection of biodiversity, or unknown).

Terrestrial Vertebrate Distributions

The MI-GAP vertebrate species modeling effort produced predicted range and predicted habitat maps for 22 amphibians, 30 reptiles, 61 mammals, and 214 birds. Range maps were produced by summarizing the existing literature on the range for each species to produce a draft range map. The draft range maps were reviewed by experts who had the opportunity to update the range map based on the most recent occurrence data and their expert knowledge. Habitat maps were produced by developing a wildlife habitat relationship model for each species. Each model relates the life requisites of the species to GAP land cover classes and other ancillary data sets. The predicted habitat map for each species was clipped by the predicted range to produce a spatially explicit model of the location of habitat for a species within its range.

Species richness, measured by the number of species present, varied geographically for each of the four major taxonomic groups. Amphibian species richness was highest in the southwest Lower Peninsula. Reptile species richness was highest in the entire southern Lower Peninsula and the lowest in the Upper Peninsula. Mammal species richness was highest in the western Upper Peninsula and portions of the northern Lower Peninsula. Bird species richness was highest in the eastern Upper Peninsula. For birds and mammals, the areas of highest species richness in the state also had relatively large amounts of public land in stewardship categories 1–3. The species-rich areas of the state for reptiles and amphibians contained very little land in stewardship categories 1, 2, or 3.

Table 1. Total area (km^2) and percent of each land cover type mapped by MI-GAP. Water type does not include the Great Lakes.

Land Cover Type	Area (km^2)	Percent (%)
Urban Types (Total)	7,857	5.22
Low Intensity Urban	2,184	1.45
High Intensity Urban	1,405	0.93
Airports	37	0.02
Roads/Parking Lots	4,232	2.81
Agricultural Types (Total)	38,420	25.52
Non-Vegetated Farmland	237	0.16
Row Crops	16,125	10.71
Forage Crops	21,322	14.16
Orchards/Vineyards/Nursery	736	0.49
Open Land Types (Total)	15,277	10.15
Herbaceous Open Land	11,033	7.33
Upland Shrub and Low Density Trees	3,928	2.61
Parks and Golf Courses	315	0.21
Upland Forest (Total)	56,798	37.73
Northern Hardwood	17,287	11.48
Oaks Types	6,270	4.17
Aspen Types	10,274	6.83
Other Upland Deciduous	163	0.11
Mixed Upland Deciduous	4,318	2.87
Pine Types	8,363	5.56
Other Upland Conifer	1,491	0.99
Mixed Upland Conifer	817	0.54
Upland Mixed Forest	7,814	5.19
Water	3,512	2.33
Lowland Forest (Total)	17,139	11.38
Lowland Deciduous Forest	7,314	4.86
Lowland Coniferous Forest	9,301	6.18
Lowland Mixed Forest	523	0.35
Non-Forested Wetlands (Total)	10,908	7.25
Floating Aquatic Wetland	445	0.30
Shrub Wetland	6,269	4.16
Emergent Wetland	1,084	0.72
Mixed Non-Forest Wetland	3,110	2.07
Non-Vegetated Types (Total)	630	0.42
Sand/Soil	420	0.28
Exposed Rock	22	0.01
Mud Flats	0	0.00
Other Bare/Sparsely Vegetated	188	0.12
Total	150,540	100.00

Table 2. Total area (km^2) and percent within each ownership category for each GAP management status level.

Owner	Status 1	Status 2	Status 3	Status 4	Total
U.S. Forest Service	0	0	11483.6 7.6%	0	11483.6 7.6%
U.S. National Park Service	570.6 0.4%	374.6 0.2%	153.1 0.1%	0	1098.3 0.7%
U.S. Fish and Wildlife Service	380.8 0.3%	0	38.1 0.0%	0	418.9 0.3%
Michigan DNR	314.6 0.2%	513.7 0.3%	17226.6 11.4%	17	18071.9 12.0%
State of Michigan	0	0	303.0 0.2%	1322.9 0.9%	1625.9 1.1%
The Nature Conservancy	61.7 0.0%	0	0	0	61.7 0.0%
Other	0	0	0	117790 78.2%	117790 78.2%
Total	1327.7 0.9%	888.3 0.6%	29204.4 19.4%	119129.9 79.1%	150550.3 100.0%

Gap Analysis

Geographic Information System (GIS) analysis of stewardship status for terrestrial vertebrates showed 60 of 214 (28 percent) birds, 19 of 61 (31 percent) mammals, 21 of 30 (70 percent) reptiles, and 7 of 22 (32 percent) amphibians have less than 1 percent of their predicted distribution in status 1 or 2 lands. One hundred forty-seven of 214 (69 percent) birds, 42 of 61 (69 percent) mammals, 9 of 30 (30 percent) reptiles, and 15 of 22 (68 percent) amphibians have between 1 and 10 percent of their predicted distribution in status 1 or 2 lands.

Only 7 of 214 (3 percent) birds, 0 mammals, 0 reptiles, and 0 amphibians have over 10 percent of their predicted distribution in status 1 or 2 lands. These 7 species all have limited predicted distributions and are associated with wetlands or Great Lakes coastal environments. Status 1 National Wildlife Refuges in Michigan are principally wetland-dominated environments, while status 1 and 2 national lakeshores protect coastal environments.

Conclusions

It is very clear from the analysis of stewardship status for terrestrial vertebrates that status 1 and 2 lands (1.5 percent of Michigan's landscape) do not afford adequate protection for the complete range of biodiversity elements in Michigan. Status 3 lands (19.4 percent of Michigan's landscape) offer the best opportunity for protecting biodiversity on public land. The Michigan DNR manages two-thirds of Michigan's status 3 lands and the U.S. Forest Service manages almost all of the remaining. If status 3 lands are considered to offer an equivalent measure of biodiversity protection to status 1 and 2 lands, the outlook for the conservation of biodiversity in Michigan improves dramatically. Hence, the challenge for the Michigan DNR and the U.S. Forest Service in Michigan is to manage their extensive status 3 land base for the protection of the full range of biodiversity elements.

Products from MI-GAP are used across the state in a variety of research projects at universities. The Michigan DNR is using GAP products in multiple initiatives, including the development of their Comprehensive State Wildlife Conservation Strategy, the development of a biodiversity atlas, and sustainable forestry certification of their state forest lands. GAP products are also incorporated into the DNR's Integrated Forest Monitoring and Prescription (IFMAP) project. The IFMAP GIS-based decision-support system will bring GAP products to the desktop of DNR land managers throughout Michigan. MI-GAP data can be downloaded from the Michigan Geographic Data Library at <http://www.michigan.gov/cgi>.

Literature Cited

Michigan Natural Features Inventory (MNFI). 1999. Michigan's special animals. List produced by the Endangered Species Program of the Michigan DNR and the Michigan Natural Features Inventory, Lansing.