

Minnesota Gap Analysis Project

Compiled from Final Project Report

Introduction

The Minnesota Gap Analysis Project (WI-GAP) began in 1994 as a part of the Upper Midwest Gap Analysis Project (UMGAP). The Upper Midwest GAP Project was originally initiated by the states of Michigan, Minnesota, and Wisconsin to provide Minnesota's Federal, state, and private land managers with resources that will help them maintain vertebrate species richness within the State.

The objectives were to: (1) map vegetation types; (2) map predicted distribution of terrestrial vertebrates; (3) document occurrence of inadequately represented vegetation types in special management areas; (4) document occurrence of inadequately represented terrestrial vertebrate species in special management areas; and (5) make all information available to resource managers and land stewards in a readily accessible format.

Land Cover

Minnesota has a total area of approximately 217,400 km², of which 8.4 percent is water and 91.6 percent is land. Minnesota is the twelfth largest state in the United States and ranks fourth in the nation for amount of water. Individuals and corporations own about three-fourths of the land surface. Governmental units own the remainder. The Federal government owns approximately 1.4 million hectares (7 percent) and the state/county governments own about 3.4 million hectares (17 percent). Federal land ownership is primarily concentrated in the Superior and Chippewa National Forests in northern Minnesota. The State, which owns a large amount of the area covered by water, is the largest landowner in Minnesota. State land ownership is more widely dispersed, but is also more concentrated in the central and northeast areas of the state where numerous State Forests exist (Minnesota DNR 2000).

The Minnesota GAP land cover layer was produced by the Minnesota Department of Natural Resources (MDNR), Division of Forestry, Forest Resource Assessment Unit stationed in Grand Rapids during 1995–2000. This raster dataset is a detailed (1-acre minimum), hierarchically organized vegetation cover map produced by computer classification of combined two-season pairs of early 1990s Landsat 4/5 Thematic Mapper (TM) satellite imagery. Landsat Thematic Mapper (TM) scene dates used to create a land cover layer for this project ranged from 1990–95, with the majority being 1991–92. Forty-nine land cover classes were mapped.

Accuracy Assessment

An accuracy assessment of the final statewide land cover layer determined it to be 91 percent accurate at Level 1, 78 percent at Level 2, 65 percent at Level 3, and 58 percent at Level 4. Due to the use of 27 processing units, statewide individual land cover type accuracy numbers were not compiled.

Terrestrial Vertebrate Distributions

Potential distribution maps were developed for 354 terrestrial vertebrate species comprising of 21 amphibians, 28 reptiles, 230 birds, and 75 mammals. This project chose an Ecological Classification System (ECS) to define its primary range extent because it is ecologically based and is part of a nationwide mapping initiative, the National Ecological Unit Hierarchy (Cleland et al. 1997). The Minnesota Department of Natural Resources and the U.S. Forest Service have developed an ECS for ecological mapping and landscape classification in Minnesota following the National Hierarchical Framework of Ecological Units (ECOMAP, written commun., 1993). Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. ECS mapping enables resource managers to consider ecological patterns for areas as large as North America or as small as a single timber stand and identify areas with similar management opportunities or constraints relative to that scale. There are eight levels of ECS units in the United States. Six of these levels occur in Minnesota and the first four have been mapped statewide: Province, Section, Subsection, and Land Type Associations.

To address MN-GAP wildlife species informational needs and document literature sources used in this report, information from the MNWRAP database (primarily state occurrence and range extent) was merged with existing framework (i.e. forms, queries, reports, etc.) and data from the Great Plains GAP effort. This Microsoft Access database (MN-GAP Wild) thereby became the data center for all wildlife species information (i.e. range extent, habitat relationships, literature sources, etc.) needed for this report.

ECS Subsection-based range extent maps were developed for all permanent residents that occupy Minnesota year-round, and regular residents were acceptable breeding, nesting, or

migrant records exist during at least eight years from 1989 to 1999. Casual/accidental species were also a part of this mapping effort if they had a state status of endangered, threatened, furbearer, or big game species. They were considered casual/accidental if an acceptable record existed during seven or less years from 1989 to 1999.

EMAP hexagon-based range extent maps were created using ECS Subsection-based range extent efforts described above. The conversion from ECS Subsection to the hexagon standard was accomplished by converting the EPA hexagon coverage projected in Lambert Azimuthal Equal Area, re-projecting to the DNR standard, UTM Zone 15N, NAD 83 meters, selecting hexagons that were within Minnesota and converting the new coverage to a new shapefile in ArcView. This shapefile was intersected with Minnesota's ECS Subsection coverage. Each hexagon was attributed to the ECS Subsection in which it fell. Hexagons that overlay two Subsections were attributed to the Subsection in which 50 percent or more of the hexagon's area was located. For a hexagon with three or more Subsections attributed to it, our best professional judgment was used, on an individual basis. Hexagons were assigned a value of "P" (Present) if the species met MN-GAP criteria to for inclusion in that hexagon or "a" (absent) if the species was absent in that hexagon.

Species Richness

Total vertebrate wildlife (n=354) species richness by ECS Subsection ranged from 160 to 250 with a mean of 215±21. The highest diversity of vertebrate wildlife (≥228) is located across east-central to central to northwest Minnesota; lowest (≤206) are located in the southeast, southwest, western and northeastern Minnesota.

Land Stewardship

The Minnesota GAP Stewardship layer was created in two steps. Initial development was handled by the MNDNR's Division of Forestry, Forest Resource Assessment Unit, and completed in 1998. With the start of wildlife species modeling efforts in 2004, it became apparent that the initial land stewardship layer/dataset were lacking in adequate stewardship detail for water areas and there were numerous errors/omissions in land stewardship classes. To adequately address these concerns, the MNDNR Division of Fish and Wildlife undertook an edit of this initial layer/dataset to correct these concerns.

Excluding Lake Superior, Minnesota's total surface area consists of 219,342 km². Of this total surface area, 71.3 percent is private, 26.8 percent is public (Federal, State, or

county), 1.7 percent is Tribal and 0.1 percent was not. Private lands are primarily concentrated in the agriculture/grassland dominated portions of the state (south and west) while public lands are primarily concentrated in the forested, northern one third of the state. Those public lands that do exist in the south and west areas of the State are scattered and consist primarily of State Wildlife Management Areas, Federal Waterfowl Production Areas, National Wildlife Refuges, County/Regional Parks, and other similar areas. Public lands in the northern areas of the State are in larger blocks and include State Forests, National Forests, County Forests, Boundary Waters Wilderness Canoe Area, Voyagers National Park, and other similar areas. Tribal lands are scattered within the various Indian Reservation and Ceded Territories within Minnesota, but are also primarily concentrated in the north.

Approximately 2.6 percent of Minnesota is within areas designated as management status 1. Most of these lands are public lands in northern Minnesota, with the Boundary Waters Wilderness Canoe Area (3,886 km²) and Voyageurs National Park (788 km²) being the two largest contributors to this management status category. Other land units and related land stewards include State Scientific and Natural Areas (Minnesota DNR) and preserves managed by private, non-profit organizations.

Approximately 5.1 percent of Minnesota is within areas designated as management status 2. Most of these lands are public lands such as Forest Service National Forests (8,223 km²), U.S. Fish and Wildlife Service National Wildlife Refuges and Waterfowl Production Areas (1,743 km²) and MDNR State Parks (947 km²). Other land stewards and related units include County and Regional Parks as well as reservoir lands managed by the U.S. Army Corp of Engineers.

Approximately 20.8 percent of Minnesota falls within areas designated as management status 3. Most of these lands are public lands administered by the MDNR (21,815 km² in State Forests, other Forestry administered lands, and State Wildlife Management Areas) or various Counties (12,274 km² in County Forest or county tax-forfeited). Another major, although temporary, contributor to this category were those private farmlands that were enrolled in Conservation Reserve Program practices (e.g. grassland or tree plantings) that qualified these lands to be included in this management status. Other lands stewards and related units include the Camp Ripley Military Reservation (213 km², Minnesota Department of Military Affairs) and various Tribal and related Bureau of Indian Affairs land (3,660 and 691 km², respectively).

Approximately 71.4 percent of Minnesota is within areas designated as management status 4. The vast majority of these lands are private lands, primarily farmland in the southern and western areas of the state and corporate forestlands in the north. Management status 4 is also the default code used when adequate information was not available to determine a 1, 2, or 3 management status.

GAP Analysis—Land Cover

A summary of percentage of habitat by wildlife species group and major land stewardship category is listed in [Table 1](#).

GAP Analysis—Vertebrates

Examples from [Table 2](#) include 9.4 percent of amphibian habitat on Federal land, and 62.7 percent is on Private land.

Table 1. Percentage of natural land cover types in management status 1 and 2 for Minnesota.

Land cover type	Percentage of land cover type				
	Less than 1 percent	1 to less than 10 percent	10 to less than 20 percent	20 to less than 50 percent	Greater than 50 percent
Non-Vegetated					
Mixed Developed		1.4			
High Intensity Urban		1.0			
Low Intensity Urban		1.4			
Transportation		1.4			
Barren		4.7			
Grassland					
Cropland	0.6				
Grassland		3.4			
Prairie				21.7	
Shrubland					
Upland Shrub			14.0		
Lowland Deciduous Shrub		9.9			
Lowland Evergreen Shrub			12.7		
Aquatic Environments					
Water (does not include Lake Superior)			14.0		
Floating Aquatic		7.8			
Sedge Meadow		8.3			
Broadleaf Sedge/Cattail			12.8		
Upland Conifer Forest					
Jack Pine				44.4	
Red/White Pine					55.7
Red Pine			25.2		
White Pine/mix			25.6		
Balsam Fir/mix			32.9		
White Spruce			14.4		
Upland Black Spruce					56.3
Upland Northern White-Cedar				24.6	
Red-cedar		3.4			
Upland Conifer			15.5		
Lowland Conifer Forest					
Lowland Black Spruce				19.0	
Stagnant Black Spruce					26.5
Tamarack			6.7		
Stagnant Tamarack			6.7		
Lowland Northern White-Cedar				11.1	
Stagnant Northern White-Cedar				16.5	
Stagnant Conifer				15.9	
Upland Deciduous Forest					
Aspen/White Birch mix					20.1
White/Red Oak		2.4			
Northern Pin Oak		3.8			
Red Oak		3.9			
Northern Pin Oak		5.5			
Maple/Basswood mix				11.4	
Upland Deciduous mix				15.0	
Lowland Deciduous Forest					
Black Ash		8.0			
Silver Maple					30.1
Cottonwood		4.6			
Lowland Deciduous					10.8
Mixed Forest					
Upland Conifer-Deciduous mix				13.8	
Jack Pine-Deciduous mix		9.0			
Red/White Pine-Deciduous mix					64.6
Spruce/Fir-Deciduous mix					70.1
Red-cedar-Deciduous mix		1.3			
Lowland Conifer-Deciduous mix					23.4

Table 2. Vertebrate wildlife habitat (percent) by major land stewardship category in Minnesota.

Taxonomic group	Federal	State	County	Other public	Tribal	Private conservancy	Private industrial	Private	Unknown
Amphibians	9.4	15.7	7.5	0.1	1.6	0.2	2.8	62.7	0.1
Reptiles	7.6	12.5	5.4	0.1	0.8	0.2	2.1	71.1	0.1
Birds – forest	13.6	18.9	11.3	0.1	1.8	0.1	4.2	49.9	0.1
Birds – open	2.6	10.8	2.2	0.1	0.5	0.2	0.9	82.6	0.0
Birds – water	7.7	12.8	4.9	0.1	2.4	0.2	1.8	70.1	0.1
Mammals	8.1	15.3	6.9	0.1	1.4	0.2	2.6	65.4	0.1

Data Availability

MN-GAP project data will be archived at the Wildlife GIS Program, Division of Fish and Wildlife, Minnesota Department of Natural Resources. We anticipate serving this data through the Minnesota Department of Natural Resources GIS Data Deli <<http://deli.dnr.state.mn.us/about.html>>, an internet-based spatial data acquisition site.

References Cited

- Cleland, D.T., P.E. Avers, W.H. McNab, M.E. Jensen, R.G. Bailey, T. King, and W.E. Russell. 1997. National Hierarchical Framework of Ecological Units: Published in Boyce, M.S., and A. Haney, eds. 1997. Ecosystem Management Applications for Sustainable Forest and Wildlife Resources. Yale University Press, New Haven, CT., p. 181-200.
- Minnesota Department of Natural Resources. 2000. Public land and mineral ownership in Minnesota: Minnesota Department of Natural Resources, Division of Lands and Minerals. 34 p.