North Dakota Gap Analysis Project

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Land Cover

A map of the land cover of North Dakota circa 1997 was prepared from the analysis of 42 Landsat-5 Thematic Mapper (TM) images acquired between August 1992 and May 1999 and digital National Wetlands Inventory data. The spatial resolution of the land cover map is the same as the TM imagery, 0.09 ha. The legend for the land cover map is hierarchical, with 8 general land cover categories at the upper level and 39 detailed land cover categories at the lower level. Approximately 118,760 km^2 (65 percent) of the surface area of North Dakota has been tilled at some time, with 30,543 km^2 of this land planted with perennial herbaceous vegetation at the time the map was made. Map estimates of the area of natural and seminatural prairie, wetlands, and shrublands are 35,681 km^2 (19 percent), 16,297 km^2 (9 percent), and 5,281 km^2 (3 percent), respectively. The area of woodland (natural and anthropogenic) is estimated at 4,284 km^2 (2.3 percent). The area of sparsely vegetated land cover including natural badlands was estimated at 1,897 km^2 (1 perent) and the area of developed land covers at 953 km^2 (0.5 percent).

A probability-based sampling design and design-based inference were used to assess the accuracy of the land cover map. The sample design was a stratified random single-stage cluster sample. Sixteen strata were defined by a combination of four physiographic regions and four anthropogenic land cover proportion classes. Observations of land cover from ground surveys and aerial photo interpretation were used to create an exhaustive land cover vector for 253 one mi^2 sample units. The land cover vectors were converted to 30 m grids for statistical analyses. From a preliminary analysis of data for 238 of the 253 sample units, the overall accuracy for the eight land cover categories at the upper level of the land cover map legend was 62 percent. Factors influencing the accuracy assessment include (1) temporal changes in land cover between 1992 and 1999 (when TM images were acquired) and 2002, when the data for the accuracy assessment were collected; (2) spatial registration of the map and the reference data; (3) differences in class generalizations, including definitions and inclusions arising from ground and satellite methods for observing land cover; and (4) the accuracy of the reference data. The accuracy assessment revealed that classification accuracy is spatially variable and a single number for an entire map is of limited value. One exciting outcome from our sampling design is the ability to produce maps of the spatial distribution of the accuracy parameters by applying the estimates to the strata maps. An accuracy assessment is in progress at multiple spatial scales intermediate to the pixel and sample unit scales (1 mi^2) for the 39 land cover categories at the lower level of the map legend.

Terrestrial Vertebrate Distributions

Potential distribution maps were developed for 281 terrestrial vertebrate species comprising 184 species of breeding birds, 71 species of mammals, 15 species of amphibians, and 11 species of reptiles. Range limits for each species were delineated on a grid of 635 km^2 hexagons using >200,000 locality records. Within the hexagons, species potential distributions were modeled based on species–land cover category affinities. The accuracy of the vertebrate potential distribution models was assessed by them with published species lists from six natural areas in North Dakota. Percent agreement averaged 94 percent (range 84–98 percent, n= 5), 89.6 percent (range 86–94 percent, n=3), to 92 percent (range 85–100 percent, n=3) for birds, mammals, and herptiles, respectively.

Land Stewardship

Approximately 6.4 percent of the land in North Dakota is managed by public agencies, with 4.3 percent under federal management and 2 percent under state jurisdiction. Approximately 4.2 percent of the land in North Dakota occurs within the boundaries of lands governed by five Native American tribal governments. Lands managed by nonprofit conservation organizations account for less than half of one percent of the land in North Dakota. Private landowners are responsible for managing approximately 89 percent of the land in North Dakota.

North Dakota does not have the equivalent of national parks, wilderness areas, and other management areas that meet the requirements for status 1 and 2 lands. State wildlife areas are managed for multiple uses and often include substantial proportions on nonnative vegetation. Status 1 and 2 lands occupy 383 km^2 and 1566 km^2, respectively, in North Dakota, which combined is slightly more than 1 percent of the state and 17 percent of the area in public and private conservation lands. Federal stewards are responsible for 97 percent of status 1 and 2 lands. Seventy-five percent of federal public lands were multiple-use and assigned a status of 3. Seventy-nine percent of lands managed by state government stewards were assigned a status of 4, and the remaining 21 percent of state public lands were assigned a status of 3.

Gap Analysis

All five of the general natural vegetation land cover categories (prairie, wetland, shrubland, woodland, and sparse vegetation) have their greatest abundance on private lands. Approximately 79 percent of the prairie land cover category occurs on private lands; the U.S. Forest Service (USFS), the North Dakota State Land Department (NDSL), and the U.S. Fish and Wildlife Service (USFWS) manage 5.9 percent, 5.1 percent, and 1.7 percent of prairie, respectively. Lands governed by the Native American Standing Rock Sioux and Three Affiliated Tribes (NATAT) account for 4.5 percent and 2.0 percent of the prairie land cover category. Nine individual stewards have less than 1 percent of the prairie land cover category on the lands they manage.

Private landowners are responsible for stewardship of approximately 77 percent of the wetland land cover category. The USFWS has responsibility for 5.9 percent of the wetland land cover category, with the Native American Spirit Lake Tribe and the NDSL responsible for 2 percent and 1 percent, respectively. Thirteen stewards individually have responsibility for less than 1 percent and together 3.5 percent of the wetland land cover category. Approximately 69 percent of shrublands occurred on private lands. The USFS, NATAT, and the NDSL manage approximately 13.4 percent, 6.5 percent, and 3.5 percent of shrublands, respectively. Stewardship responsibilities for shrublands may be distorted due to the difficulty of mapping shrublands. Seventy percent of the woodland land cover category occurs on private lands. This is probably an overestimate of the proportion of natural woodlands on private lands, as many woodlands in North Dakota are planted. Stewards, in decreasing order of responsibility for natural woodlands, include the USFS, NATAT, the Native American Turtle Mountain Chippewa, the North Dakota Game and Fish Department (NDGFD), USFWS, and the U.S. Army Corps of Engineers. Twenty-five percent of the terrestrial vertebrate species have 1 percent or less of their potential habitat distribution represented on status 1 or 2 lands. Ninety-five percent of the species have 5 percent or less of their potential habitat distribution represented in status 1 or 2 lands.

Applications of North Dakota Gap Analysis Project (ND-GAP) products

The ND-GAP land cover data is used by USFWS Private Land biologists to evaluate the land cover composition of watersheds for proposed wetland creations.

The ND-GAP land cover data was used by U.S. Geological Survey wildlife biologists in the design of a survey for Richardson's ground squirrels.

The ND-GAP land cover data is used by NDGFD biologists to evaluate land cover composition for a variety of planning purposes. ND-GAP data was used in the development of the NDGFD Comprehensive Conservation Strategy.

The ND-GAP vertebrate data was used by EPA region 7 and the Missouri Resource Assessment Partnership as one input to Cplan, a reserve design algorithm, as part of the EPA's Critical Ecosystems program.

The ND-GAP vertebrate data was used by University of Illinois researchers investigating deer ticks and Lyme disease for the Centers for Disease Control and Prevention.

The North Dakota Game and Fish Department envisions using the vertebrate data in the development of wildlife conservation and restoration efforts as part of the federally funded State Wildlife Grants program.

The ND-GAP stewardship data was used by South Dakota State University in the Upper Missouri River Aquatic Gap Analysis Project.

Data Availability

The final report is under review by the national GAP office and should be available for distribution soon. In addition, the data should also be available from a USGS ftp site at <ftpext.usgs.gov in the /pub/cr/nd/Jamestown/ndgap> subdirectory or the North Dakota GIS hub at <http://www.state.nd.us/gis>.