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# Natural History Survey

## Development and Expansion of the Natural Resource Data and Information Systems in Support of the Illinois Comprehensive Wildlife Conservation Plan

(Project: T-02-P-001-Final)

**Project Completion Report 2006**

Jeff Walk, Chris Phillips, Leon Hinz, Tari Tweddale, Diane Szafoni, Liane Cordle, Ann Holtrop, Leslie Bol, Pat Brown, Ed Heske, David Thomas, and John Epifanio

Submitted to

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Illinois Natural History Survey Technical Report 06/05

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Final Project Completion Report 2006
Project: T-02-P-001

1 February 2003 to 30 September 2006

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November 2006

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INHS Tech. Report 06/05

# Development & Expansion of the Natural Resource Data & Information Systems in Support of the Illinois Comprehensive Wildlife Conservation Plan

(Project: T-02-P-001-Final)

## Project Report Contents

## Development and Expansion of the Natural Resource Data and Information Systems in Support of the Illinois Comprehensive Wildlife Conservation Plan (Project: T - 02 – P – 001 – Final)

The Illinois landscape has changed dramatically since the time of European settlement with natural lands being manipulated and developed. Illinois has lost over 90% of its original wetlands, 99.9% of its original prairie, and currently has 424 state and 24 federally listed threatened and endangered species within it's boundaries. The mission of the Illinois Department of Natural Resources (IDNR), Office of Resource Conservation, is to protect, conserve and manage these natural resources. Protection, conservation and management is on-going, but implementation has been traditionally multi-focused. The purpose of this proposal is to develop a comprehensive wildlife conservation plan for Illinois.

Illinois has been involved with several large-scale landscape management efforts (e.g., Conservation 2000 Ecosystem Program (Interagency Pilot Watershed Program), the Conservation Reserve Enhancement Program (CREP), and the Illinois Rivers Restoration Effort) as well as more geographically focused efforts to document and describe our resources (e.g., Illinois Natural Areas Inventory, Resource Rich Areas, Important Bird Areas). With the diversity of conservation goals and programs being implemented by the Office of Resource Conservation, it has become increasingly more difficult for field staff to distinguish IDNR priorities, efficiently direct funding and manpower to address priorities, and effectively evaluate the success of their efforts.

The creation of a Comprehensive Wildlife Conservation Plan will establish a single plan for the IDNR to use in the selection of projects and distribution of services. Such a plan will foster better communication throughout the Department, especially within the Office of Resource Conservation, which is responsible for working with the native flora and fauna of Illinois. The Comprehensive Wildlife Conservation Plan will address all species of wildlife, with a special focus on species with the greatest conservation need. It will include management and stewardship activities that will promote the preservation of wildlife species throughout all Department activities.

To complete the development of the Illinois comprehensive plan, the IDNR initially approached the challenge from two directions. This proposal encompasses activities directly related to producing the plan and all aspects of data development, information systems, and other activities that support the development of the plan. Without this critical compilation of information, development of information management tools, GIS analysis, and transfer of programmatic knowledge (e.g. terrestrial GAP), the plan will be a weaker and less complete product. Elements of this proposal build upon the previous proposal T-03-P-001 and continue the development of these support mechanisms for the conservation plan through the following primary activities:

1. Continued updating of Biotics 4: This is the information system containing all locational data and descriptive information on state and federally listed threatened and endangered species, natural areas, nature preserves and other high quality features. This data set will be a fundamental base layer of information supporting the development of the state wildlife plan.

2. Critical GIS data development: Four important data sources (Green Infrastructure, Natural Divisions, terrestrial GAP, and state Owned, Managed, and Leased Properties [OMLP]) will be either further developed, completed, or transferred to support the development of the state wildlife plan.

3. Continuation of the stream classification project: The state recognizes that the aquatic components and data infrastructure of the state wildlife plan is not as well supported or developed as the terrestrial side. Thus, these jobs will further develop the stream classification work and position the resulting information as a sound base layer and planning tool for the aquatic component of the state wildlife plan.

4. Analysis of technological requirements for plan/strategy implementation and evaluation:

OBJECTIVES:

The Illinois Department of Natural Resources will create a Comprehensive Wildlife Conservation Plan for the identification, protection, and management of wildlife habitat throughout Illinois as required by Congress. The objectives of this plan/strategy are to fulfill the required elements of such a plan/strategy:

1. information on the distribution and abundance of species of wildlife (any species of wild, free-ranging fauna including fish, and also fauna in captive breeding programs the object of which is to reintroduce individuals of a depleted indigenous species in a previously occupied range), including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife;
2. descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1);
3. descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;
4. descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions;

5. proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions;
6. descriptions of procedures to review the State Comprehensive Wildlife Conservation Plan at intervals not to exceed ten years;
7. plans for coordinating the development, implementation, review, and revision of the State comprehensive wildlife conservation plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats; and,
8. provide broad public participation with the development and implementation of the plan.

# Project Report Contents

## Project 1 – Identification and Selection of Conservation Elements

**Job 1 Identification and Selection of Conservation Elements**

**Status:** Job completed.
**INHS Project Leads**: Jeff Walk, Liane Cordle, David Thomas, John Epifanio
**Electronic File Name**: *T-2-P1 Job 1.doc (Word format)*

## Project 2 - Distribution and Abundance of Conservation Elements

**Job 2.1 Distribution and abundance of priority wildlife species**
**Job 2.2 Distribution of Priority Game Species**

**Status:** Job completed.
**INHS Project Leads**: Jeff Walk, Liane Cordle, Ed Heske, John Epifanio
**Electronic File Name**: *T-2-P1 Job 2.1 & 2.2.doc*

**Job 2.3 Location and Condition of Terrestrial and Wetland Habitats**

**Status:** Job completed.
**INHS Project Leads**: Liane Cordle, Diane Szafoni, John Epifanio
**Electronic File Name**: *T-2-P1 Job 2.3.doc*

**Job 2.4 Location and Condition of Stream Habitats**

**Status:** Job completed.
**INHS Project Leads**: Leon Hinz, Ann Holtrop, Leslie Bol, John Epifanio
**Electronic File Name**: *T-2-P1 Job 2.4.doc*

**Job 2.5 Update of Species Occurrence and Habitat Condition Data.**

**Status:** Job completed.
**INHS Project Leads**: Chris Phillips
**Electronic File Name**: *T-2-P1 Job 2.5.doc*

**Job 2.6 Biotics 4 Updating**

**Status:** Job Completed.
**INHS Project Leads**: Tara Kinnenger, Chris Phillips
**Electronic File Name**: *T-2-P1 Job 2.6.doc*

## Project 3 - Identification of Detrimental Factors

### Job 3.3 Identification of Detrimental Factors

**Status:** Job Completed.
**INHS Project Leads:** Jeff Walk, Liane Cordle, David Thomas, John Epifanio
**Electronic File Name:** *T-2-P1 Job 3.doc*

## Project 4 - Development of Conservation Opportunity Areas and Landscapes

### Job 4.1 Selecting Opportunity Areas and Landscapes

**Status:** Job Completed.
**INHS Project Leads:** Jeff Walk, Diane Szafoni, Liane Cordle, John Epifanio
**Electronic File Name:** *T-2-P1 Job 4.1.doc*

### Job 4.2 Mapping of Illinois' Natural Divisions

**Status:** Job Completed.
**INHS Project Leads:** Tari Tweddale, Liane Cordle, John Epifanio
**Electronic File Name:** *T-2-P1 Job 4.2.doc*

### Job 4.3 Mapping of IDNR's Owned, Managed, and Leased property (OMLP project)

**Status:** Job Completed.
**INHS Project Leads:** Tari Tweddale, Liane Cordle, John Epifanio
**Electronic File Name:** *T-2-P1 Job 4.3.doc*

### Job 4.4 Ecological Classification of Rivers for Environmental Assessment and Management: Model Development and Risk Assessment

**Status:** Job Completed.
**INHS Project Leads:** Ann Holtrop, Leon Hinz
**Electronic File Name:** *T-2-P1 Job 4.4.doc*

## Project 5 - Involvement of Conservation Partners, Agencies and the Public in Developing, Implementing, and Evaluating the Comprehensive Wildlife Conservation Plan

**Job 5.1** Consultation for Partner Coordination and Public Involvement

**Status:** Job Completed.

**INHS Project Leads**: Jeff Walk, Liane Cordle, John Epifanio
**Electronic File Name**: *T-2-P1 Job 5.1.doc*

**Job 5.2** Developing an Illinois CWCPS Website
**Status:** Job Completed.
**INHS Project Leads**: Jeff Walk, John Epifanio

**Project 6 - Implementation, Evaluation and Review Strategy**

**Job 6.1 Developing an Implementation, Evaluation and Review Strategy**

**Status:** Job Completed.
**INHS Project Leads**: Jeff Walk, Liane Cordle, John Epifanio
**Electronic File Name**: *T-2-P1 Job 6.1.doc*

**Job 6.2 Information Coordinator for Development of the Comprehensive State Wildlife Conservation Plan.**

**Status:** Job Completed.
**INHS Project Leads**: Jeff Walk, John Epifanio

**Project 7 - Report Development**

**Status:** Job Completed.
**INHS Project Leads**: Jeff Walk, Liane Cordle, David Thomas, John Epifanio
**Electronic File Name**: *T-2-P1 Job 7.doc*

**Appended Materials**
I Budget Summary
II Outdoor Illinois Article
III Illinois Steward Article
IV Illinois Wildlife Action Plan brochure

**STATE WILDLIFE GRANT PROGRAM**

**State of Illinois**

**Final Performance Report**

**Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems**

**Project 1 - Identification and Selection of Conservation Elements**

Objectives:

To identify the key wildlife species or species groups that will be considered conservation elements for the plan, the State of Illinois will:

1. Develop criteria for selecting priority species
2. Solicit input on criteria and proposed priority species from Illinois Department of Natural Resources staff, conservation partners and the public
3. Compile species list and identify functional guilds, based on taxonomy, natural history or ecology
4. Submit priority species and functional groups to scientific peer-review

Project Description:

Criteria for selecting priority wildlife species were to be developed based upon the guidelines required by the Wildlife Conservation & Restoration Program and State Wildlife Grants Program, documents provided by the International Association of Fish & Wildlife Agencies, and criteria employed by other conservation organizations. The federal and Illinois lists of threatened and endangered animals, global conservation ranks (available through NatureServe), conservation plans, literature, and conservation lists were to be reviewed and considered for the draft priority species lists. Potential criteria and conservation elements were to be reviewed and modified by Illinois Department of Natural Resources staff, conservation partners, and the public. Criteria and lists were scientifically critiqued by endangered species technical advisory committees and other experts. The Comprehensive Wildlife Conservation Plan steering committee was to approve the final criteria and species lists.

As appropriate, wildlife species were to be grouped into functional groups, based upon habitat associations, taxonomic relatedness, natural history, or ecology. Species may be included in more than one functional group. By grouping species into functional groups, comprehensive, ecosystem-based conservation actions can be directed at fewer priorities (opposed to a single species approach), and one functional group. By grouping species into functional groups, comprehensive, ecosystem-based conservation actions can be directed at fewer priorities (opposed to a single species approach), and maximize the efficiency of conservation planning and delivery. Functional groups of wildlife species were to be evaluated by scientific experts for their validity. Within functional groups, biologists may identify potential umbrella species (species with broader conservation needs that encompass the needs of many other species), flagship species (species that attract broad conservation interests), and proxy species (species that are easily monitored and can indicate the effectiveness of conservation actions for entire functional groups).

Approach:

In determining Illinois' Species in Greatest Need of Conservation, the state considered the description provided by Congress in required element 1, "...including low and declining populations..." and "...indicative of the diversity and health of the state's wildlife." From this, eight criteria were developed for selecting the Species in Greatest Need of Conservation. These criteria reflect the concepts of abundance (rarity), population trend, vulnerability, responsibility, usefulness as indicators, and lack of information. The criteria were adopted following review by the Endangered Species Technical Advisory Committees, scientists with other agencies and institutions, and Illinois Department of Natural Resources staff (Table 1).

The plan coordinator developed initial lists of Species in Greatest Need of Conservation for all taxonomic groups based upon unambiguous criteria (1, 2; Illinois Endangered Species Protection Board [Herkert 1999, Nyboer et al. 2004]; NatureServe 2004) and conservation priority species identified in other plans or publications [U.S. Forest Service Regional Forester's Sensitive Animals (2000, 2002); Williamson (2003); Phillips et al. (1999); The North American Waterbird Conservation Plan, *Upper Mississippi-Great Lakes regional draft*; Partners in Flight Physiographic Areas 16, 31 and 32; US Fish & Wildlife Service's Birds of Conservation Concern (2002); Upper Mississippi Valley/Great Lakes Regional Shorebird Conservation Plan (de Szalay et al. 2000); North American Waterfowl Management Plan (2003); National Audubon Society Watch List (2002)].

These species lists were then reviewed and augmented by Department of Natural Resources biologists and Endangered Species Technical Advisory Committees (committees of the Illinois Endangered Species Protection Board) and linked to the appropriate criteria. When determining the Species in Greatest Need of Conservation, scientists considered whether these eight criteria applied to a species at any life stage or in any portion of its range (e.g., many migratory birds are affected by habitat loss or degradation on wintering or breeding grounds outside of Illinois, but still considered Species in Greatest Need of Conservation). Most species in greatest need of conservation were associated with one or more major habitat types.

The revised criteria and lists of Species in Greatest Need of Conservation were made available for comment from Illinois Department of Natural Resources staff, other agencies, institutions, organizations, and the public during the two public review periods from January-March 2005 and May-June 2005.

Results:

Information and expertise was generally adequate to apply the criteria to all species of vertebrates. With the possible exception of freshwater mussels, these criteria were incompletely applied to all groups of invertebrates due to lack of available information and/or expertise. Organizing available knowledge and completing additional surveys to better determine the statewide status of invertebrates will be important for updates to the Illinois Plan/Strategy. Many participants in the planning process identified the exclusion of native plant species from the Species in Greatest Need of Conservation as a knowledge gap to be addressed and incorporated into the Plan/Strategy. All information generated from this project is compiled and presented as "Appendix I - Species in Greatest Need of Conservation for Illinois as identified by eight criteria," of the Illinois Comprehensive Wildlife Conservation Plan/Strategy (Table 2, this report).

*Mussels* - Twenty-nine species of Illinois' 61 extant freshwater mussels were identified as Species in Greatest Need of Conservation (48%)--an additional 19 species are extinct or extirpated. Twenty-four of the Species in Greatest Need of Conservation are listed as threatened or endangered in Illinois.

*Fishes* - Scientists selected 80 fish species as Species in Greatest Need of Conservation, representing about 38% of Illinois' fish diversity. Thirty-one species are threatened or endangered in Illinois.

*Amphibians* - Fourteen of Illinois' 41 amphibians (34%) were selected as Species in Greatest Need of Conservation, and eight are threatened or endangered in Illinois.

*Reptiles* - Twenty-three of Illinois' 60 reptiles (37%) were selected as Species in Greatest Need of Conservation, and 16 are threatened or endangered in Illinois. The eastern massasauga is a candidate for federal protection under the Endangered Species Act.

*Birds* - Eighty-three bird species, about 28% of the state's avian diversity, met criteria as Species in Greatest Need of Conservation, 32 of which are threatened or endangered in Illinois.

*Mammals* - Twenty of Illinois' 59 mammals (34%) were identified as Species in Greatest Need of Conservation. Nine of these species are threatened or endangered in Illinois.

Conclusions:

Completion of Project 1 defined the species of wildlife, including low and declining populations, that are indicative of the diversity and health of the State's wildlife (required element 1). This Project began the prioritization of conservation by identifying functional groups of species (element 4), and research and survey efforts needed (element 3). This process also incorporated priority species of other land management agencies and organizations (element 7) and provided for public involvement (element 8). This process will be modified, if necessary, and employed in future iterations of the CWCP (element 6).

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**Table 1**. Criteria for Selecting Illinois' Species in Greatest need of Conservation.

1. All species listed as threatened or endangered in Illinois, including federally listed species that occur within the State.

2. Species with a global conservation rank indicator of G1, G2, or G3.

3. Species is rare (small or low population size, density or range) or has significantly declined in abundance or distribution from historical levels.

4. Species is dependent upon a rare or vulnerable habitat for one or more life history needs (breeding, migration, wintering).

5. Species is endemic to Illinois, or the Illinois population is disjunct from the rest of the species' range.

6. Illinois' population of a species represents a significant proportion of the species' global population.

7. Species is representative of broad array of other species found in a particular habitat.

8. Species' status is poorly known, but available evidence suggests conservation concern.

**Table 2.** Species in Greatest Need of Conservation for Illinois as identified by eight criteria. Abbreviations used: **FE** - Federally Endangered; **FT** - Federally Threatened; **FC** - Federal candidate for listing under the Endangered Species Act; **XN** - experimental, nonessential population of a federally-listed species; **SE** - State Endangered; **ST** - State Threatened; **RR** - recent recovery/delisted within 10 years; **G1, G2, G3** - Global Conservation Ranks as indicated by NatureServe Explorer (http://www.natureserve.org/explorer/ Accessed March 2004).

| **INVERTEBRATES** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| MOLLUSKS | | | | | | | | | |
| Acella haldemani (spindle lymnaea) | | | G3 | 1 | | | | | |
| Alasmidonta viridis (slippershell mussel) | Streams | ST | | 1 | | | | | |
| Arcidens confragosus (rock pocketbook) | Streams, large rivers | | | 1 | | | | | |
| Cincinnatia integra (midland slitsnail) | | | G3 | 1 | | | | | |
| Cyclonaias tuberculata (purple wartyback) | Streams, large rivers | ST | | 1 | | | | | |
| Cyprogenia stegaria (fanshell mussel) | Large rivers | FE SE | G1 | 1 | | | | | |
| Cumberlandia monodonta (spectacle case mussel) | Large rivers | FC SE | G2 | 1 | | | | | |
| Discus macclintocki (Iowa Pleistocene snail) | Algific slopes | FE SE | G1 | 1 | | | | | |
| Ellipsaria lineolata (butterfly) | Large rivers | ST | | 1 | | | | | |
| Elliptio crassidens (elephant-ear mussel) | Large rivers | ST | | 1 | | | | | |
| Elliptio dilatata (spike) | Streams | ST | | 1 | | | | | |
| Epioblasma triquetra (snuffbox mussel) | Streams | SE | G3 | 1 | | | | | |
| Euchemotrema (= Stenotrema) hubrichti (carinate pillsnail) | | | G1 | 1 | | | | | |
| Fontigens aldrichi (Hoosier amnicola) | | | G3 | 1 | | | | | |
| Fontigens antroecetes (Hydrobiid cavesnail) | | | G2 | 1 | | | | | |
| Fusconaia ebena (ebonyshell) | Large rivers | ST | | 1 | | | | | |
| Gastrocopta rogersensis (a snaggletooth snail) | | | G2 | 1 | | | | | |
| Lampsilis abrupta (pink mucket) | Large rivers | FE SE | G2 | 1 | | | | | |
| Lampsilis fasciola (wavy-rayed lampmussel) | Streams | SE | | 1 | | | | | |
| Lampsilis higginsii (Higgins eye) | Large rivers | FE SE | G1 | 1 | | | | | |
| Lasmigona compressa (creek heelspliter) | Streams | | | 1 | | | | | |
| Lasmigona costata (fluted shell) | Streams | | | 1 | | | | | |
| Ligumia recta (black sandshell) | Streams, Large rivers | ST | | 1 | | | | | |
| Lithasia armigera (armored rocksnail) | | | G3 | 1 | | | | | |
| Lithasia obovata (Shawnee rocksnail) | | | G3 | 1 | | | | | |
| Lithasia verrucosa (varicose rocksnail) | | | G3 | 1 | | | | | |
| Megapallifera ragsdalei (Ozark mantleslug) | | | G2 | 1 | | | | | |
| Micromenetus sampsoni | | | G2 | 1 | | | | | |
| Oxyloma salleanum (Louisiana ambersnail) | | | G3 | 1 | | | | | |
| Paravitrea significans (domed supercoil) | | | G3 | 1 | | | | | |
| Plethobasus cooperianus (orange-foot pimpleback) | Large rivers | FE SE | G1 | 1 | | | | | |
| Plethobasus cyphyus (sheepnose mussel) | Streams, Large rivers | FC SE | G3 | 1 | | | | | |
| Pleurobema clava (clubshell) | Streams | FE SE | G2 | 1 | | | | | |
| Pleurobema cordatum (Ohio pigtoe) | Large rivers | SE | G3 | 1 | | | | | |
| Pleurocera alveare (rugged hornsnail) | | | G3 | 1 | | | | | |
| Potamilus capax (fat pocketbook pearly mussel) | Large river | FE SE | G1 | 1 | | | | | |
| Ptychobranchus fasciolaris (kidneyshell mussel) | Streams, Large rivers | SE | | 1 | | | | | |

| **INVERTEBRATES (Mollusks), continued** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Pyrgulopsis scalariformis (moss pyrg) | | | G1 | 1 | | | | | |
| Quadrula cylindrica (rabbitsfoot mussel) | Streams, Large rivers | SE | G3 | 1 | | | | | |
| Quadrula metanerva (monkeyface) | Streams, Large rivers | | | 1 | | | | | |
| Simpsonaias ambigua (salamander mussel) | Streams | SE | G3 | 1 | | | | | |
| Somatogyrus depressus (sandbar pebblesnail) | | | G2 | 1 | | | | | |
| Stagnicola woodruffi (coldwater pondsnail) | | | G3 | 1 | | | | | |
| Strobilops affinis (eightfold pinecone) | | | G3 | 1 | | | | | |
| Succinea forsheyi (spotted ambersmail) | | | G3 | 1 | | | | | |
| Triodopsis discoidea (rivercliff threetooth) | | | G3 | 1 | | | | | |
| Triodopsis fradulenta (baffled three-tooth) | | | G3 | 1 | | | | | |
| Toxolasma lividus (purple lilliput mussel) | Streams | SE | G2 | 1 | | | | | |
| Valvata perdepressa (purplecap valvata) | | | G3 | 1 | | | | | |
| Vallonia gracilicosa (multirib vallonia) | | | G3 | 1 | | | | | |
| Venustaconcha ellipsiformis (ellipse) | Streams | | G3 | 1 | | | | | |
| Villosa iris (rainbow mussel) | Streams | SE | | 1 | | | | | |
| Villosa lienosa (little spectacle case mussel) | Streams | ST | | 1 | | | | | |
| Viviparus intertextus (rotund mysterysnail) | | | G2 | 1 | | | | | |
| Viviparus subpurpureus (olive mysterysnail) | | | G2 | 1 | | | | | |
| Xolotrema obstrictum (sharp wedge) | | | G3 | 1 | | | | | |
| Zonitoides limatulus (dull gloss) | | | G3 | 1 | | | | | |
| | | | | | | | | | |
| CRUSTACEANS | | | | | | | | | |
| Bactrurus brachycaudus | | | G3 | 1 | | | | | |
| Cambarus laevis (crayfish) | | | G3 | 1 | | | | | |
| Caecidotea beattyi (a cave obligate isopod) | Caves Caves | | G3 | 1 | | | | | |
| Caecidotea bicrenata (a cave obligate isopod) | | | G3 | 1 | | | | | |
| Caecidotea lesliei (isopod) | Groundwater | SE | | 1 | | | | | |
| Caecidotea packardi (a cave obligate isopod) | Caves | | G3 | 1 | | | | | |
| Caecidotea spatulata (a cave obligate isopod) | Caves | SE | G3 | 1 | | | | | |
| Caecidotea tridentata | | | G3 | 1 | | | | | |
| Crangonyx anomalus (anomolous spring amphipod) | Seeps, springs, caves | SE | | 1 | | | | | |
| Crangonyx packardi (amphipod) | Caves | SE | G3 | 1 | | | | | |
| Diacyclops clandestinus (a cave obligate copepod) | Caves | | G3 | 1 | | | | | |
| Gammarus acherondytes (Illinois cave amphipod) | Caves | FE SE | G1 | 1 | | | | | |
| Gammarus bousfieldi (Bousfield's amphipod) | Gravel shoals of Ohio River | | G1 | 1 | | | | | |
| Orconectes illinoisensis (Illinois crayfish) | | | G3 | 1 | | | | | |
| Orconectes indianensis (Indiana crayfish) | rocky streams | SE | G3 | 1 | | | | | |
| Orconectes kentuckiensis (Kentucky crayfish) | rocky streams | SE | G2 | 1 | | | | | |
| Orconectes lancifer (shrimp crayfish) | deep water at Horseshoe Lake | SE | | 1 | | | | | |
| Orconectes placidus (bigclaw crayfish) | gravel, rocky streams & rivers | SE | | 1 | | | | | |
| Orconectes stannardi (crayfish) | | | G2 | 1 | | | | | |
| Stygobromus iowae (Iowa amphipod) | Algific slopes | SE | G3 | 1 | | | | | |
| Stygobromus subtilis (subtle cave amphipod) | Caves | | G3 | 1 | | | | | |
| Order Anostraca | ephemeral wetlands | | | | 1 | | | | 1 |
| | | | | | | | | | |
| INSECTS | | | | | | | | | |
| Abagrotis orbis | sand prairie | | | 1 | | | | | |
| Acanthametropus pecatonica (Pecatonica River mayfly) | | | G2 | 1 | | | | | |
| Acontia lactipennis | sand prairie | | | 1 | | | | | |
| Acrolepiopsis leucoscia | sedge meadow | | | 1 | | | | | |
| Acronicta tritona | | | | 1 | | | | | |
| Aeshna mutata (spatterdock darner) | | | G3 | 1 | | | | | |
| Aflexia rubranura (redveined prairie leafhopper) | xeric/mesic prairie | ST | G1 | 1 | | | | | |

| INVERTEBRATES (Insects), continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Agonopterix hyperella | wet prairie | | | 1 | | | | | |
| Agonopterix lythrella | wet prairie | | | 1 | | | | | |
| Agrotis stigmosa | sand savanna | | | 1 | | | | | |
| Allocapnia illinoensis (a stonefly) | | | G3 | 1 | | | | | |
| Ambesa laetella | sand | | | 1 | | | | | |
| Amblyscirtes aesculapius (lace-winged roadside-skipper) | | | G3 | 1 | | | | | |
| Amblyscirtes carolina (Carolina roadside skipper) | | | G3 | 1 | | | | | |
| Amblyscirtes linda (Linda's roadside-skipper) | | | G2 | 1 | | | | | |
| Amblyscirtes reversa (revered roadside-skipper) | | | G2 | 1 | | | | | |
| Ancylis semiovana | sand savanna | | | 1 | | | | | |
| Apainea lutosa | prairie | | | 1 | 1 | | | | |
| Apamea (Agroperina) lutosa | prairie | | | 1 | | | | | |
| Apamea (Crymodes) relicina | prairie | | | 1 | | | | | |
| Apamea alia | prairie | | | 1 | | | | | |
| Apamea impulsa | prairie | | | 1 | | | | | |
| Apamea indocilis | prairie | | | 1 | | | | | |
| Apamea lignicolora | prairie | | | 1 | | | | | |
| Apamea plutonia | prairie | | | 1 | 1 | | | | |
| Apodrepanulatrix liberaria | sand savanna | | | 1 | | | | | |
| Archanara laeta | sedge meadow | | | 1 | | | | | |
| Archanara subflava | prairie | | | 1 | | | | | |
| Aristotelia elegantella | prairie | | | 1 | | | | | |
| Arphia pseudonietana | gravel prairie | | | 1 | | | | | |
| Atascosa glareosella | dunes | | | 1 | | | | | |
| Aterpia approximana | wet prairie | | | 1 | | | | | |
| Atrytone arogos (arogos skipper) | prairie | SE | G3 | 1 | | | | | |
| Atrytonopsis hianna | sand prairie | | | 1 | | | | | |
| Attenuipyga vanduzeei | xeric prairie | | | 1 | | | | | |
| Auridius helvus | | | | 1 | | | | | |
| Bagisara gulnare | | | | 1 | | | | | |
| Boloria selene myrina | wet prairie | | | 1 | | | | | |
| Bombus fraternus | | | | 1 | | | | | |
| Bruchomorpha extensa | mesic prairie | | | 1 | | | | | |
| Bruchomorpha occulata | prairie | | | 1 | 1 | | | | |
| Calephelis borealis (northern metalmark) | | | G3 | 1 | | | | | |
| Calephelis muticum (swamp metalmark) | fen | SE | G3 | 1 | | | | | |
| Callophrys irus (frosted elfin) | sand savanna | | G2 | 1 | | | | | |
| Callophrys polios | sand prairie | | | 1 | | | | | |
| Calyptra canadensis | wet prairie | | | 1 | | | | | |
| Camelobaetidius waltzi (a mayfly) | | | G3 | 1 | | | | | |
| Capis curvata | prairie | | | 1 | | | | | |
| Carectocultus perstrialis | | | | 1 | | | | | |
| Carmenta anthrasipennis | mesic/wet prairie | | | 1 | | | | | |
| Catocala abbreviatella | xeric prairie/savanna | | | 1 | | | | | |
| Catocala amestris | sand savanna | | | 1 | | | | | |
| Catocala antinympha | sand savanna | | | 1 | | | | | |
| Catocala atocala (an underwing moth) | | | G3 | 1 | | | | | |
| Catocala dulciola (quiet or sweet underwing) | | | G3 | 1 | | | | | |
| Catocala gracilis | sand savanna | | | 1 | | | | | |
| Catocala marmorata (marbled underwing) | | | G3 | 1 | | | | | |
| Catocala praeclara | prairie | | | 1 | | | | | |
| Catocala relicta | sand savanna | | | 1 | | | | | |
| Catocala similis | sand savanna | | | 1 | | | | | |

| INVERTEBRATES (Insects), continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Name | Habitat Association | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Catocala sordida | sand savanna | | | 1 | | | | | |
| Catocala whitneyi (Whitney's underwing) | hill prairie | | G3 | 1 | | | | | |
| Centroptilum walshi (a mayfly) | | | G2 | 1 | | | | | |
| Chlorotettix dentatus | wet prairie/woods | | | 1 | | | | | |
| Chlorotettix fumidus | silt loam savanna | | | 1 | | | | | |
| Chlorotettix limosus | wet prairie | | | 1 | | | | | |
| Chlosyne gorgone carlota | xeric prairie | | | 1 | | | | | |
| Chlosyne harrisii | Fens | | | 1 | | | | | |
| Chortodes (Hypocoena) defecta | wet prairie | | | 1 | | | | | |
| Chortodes (Hypocoena) enervata | wet prairie | | | 1 | | | | | |
| Chortodes (Hypocoena) inquinata | sedge meadow | | | 1 | | | | | |
| Cicaudula cyperacea | prairie | | | 1 | 1 | | | | |
| Cicaudula straminea | prairie | | | 1 | 1 | | | | |
| Cicindela ancocisconensis (a tiger beetle) | | | G3 | 1 | | | | | |
| Cloeon cognatum (a mayfly) | | | G3 | 1 | | | | | |
| Commellus colon | sand prairie | | | 1 | | | | | |
| Cosmotettix beirni | wet savanna/flat woods | | | 1 | | | | | |
| Cosmotettix bilineatus | wet prairie | | | 1 | | | | | |
| Cosmotettix delector | wet prairie | | | 1 | | | | | |
| Cosmotettix luteocephalus | wet prairie | | | 1 | | | | | |
| Crambus girardellus | sand prairie | | | 1 | | | | | |
| Crambus murellus | xeric prairie | | | 1 | | | | | |
| Crambus watsonellus | calcareous prairie | | | 1 | | | | | |
| Cryptocala acadiensis | sand prairie | | | 1 | | | | | |
| Cyclophora pendulinaria | savanna | | | 1 | | | | | |
| Deltocephalus gnarus | sedge meadow | | | 1 | | | | | |
| Derrima stellata | sand prairie | | | 1 | | | | | |
| Destria fumida | wet prairie | | | 1 | | | | | |
| Diapheromera velii | xeric prairie | | | 1 | | | | | |
| Diceroprocta vitripennis | sand savanna | | | 1 | | | | | |
| Dicranopselaphus (variegated false water penny beetle) | | | G1 | 1 | | | | | |
| Digrammia ordinata | prairie | | | 1 | | | | | |
| Elaphria chalcedonia | wet prairie | | | 1 | | | | | |
| Enodia creola (creole pearly-eye) | | | G3 | 1 | | | | | |
| Epipaschiinae | | | | 1 | | | | | |
| Erastria coloraria | sand savanna | | | 1 | | | | | |
| Eremobina jocasta | sand prairie | | | 1 | | | | | |
| Eritettix simplex | sand prairie | | | 1 | | | | | |
| Erynnis icelus | prairie/sand savanna | | | 1 | | | | | |
| Erynnis lucilius | sand savanna | | | 1 | | | | | |
| Erynnis martialis (mottled duskywing) | prairie/savanna | | G3 | 1 | | | | | |
| Erynnis persius | sand savanna | | | 1 | | | | | |
| Euchlaena milnei (a geometrid moth) | | | G2 | 1 | | | | | |
| Euchloe olympia | sand savanna | | | 1 | | | | | |
| Eucoptocnemis fimbriaris | sand prairie | | | 1 | | | | | |
| Eucosma bipunctella | mesic prairie | | | 1 | | | | | |
| Eucosma fulminana | mesic prairie | | | 1 | | | | | |
| Eucosma n.s. | mesic/wet prairie | | | 1 | | | | | |
| Eucosma palabundana | sand prairie | | | 1 | | | | | |
| Eucosma pandana | prairie | | | 1 | | | | | |
| Eucosma rusticana | mesic prairie | | | 1 | | | | | |
| Eucosma sombreana | sedge meadow | | | 1 | | | | | |
| Euphyes bimacula | mesic/wet prairie | | | 1 | | | | | |

| INVERTEBRATES (Insects), continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Name | Habitat Association | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Euphyes dion | prairie | | | 1 | 1 | | | | |
| Euphyes dukesi (Duke's skipper) | | | G3 | 1 | | | | | |
| Euphyes niveilinea | prairie | | | 1 | 1 | | | | |
| Euscelis sahlbergi | wet prairie | | | 1 | | | | | |
| Euxoa albipennis | prairie | | | 1 | | | | | |
| Euxoa aurulenta | dunes | | | 1 | | | | | |
| Euxoa immixta | sand prairie | | | 1 | | | | | |
| Euxoa manitobana | sand prairie | | | 1 | | | | | |
| Euxoa scandens | sand prairie | | | 1 | | | | | |
| Evora hemidesma | prairie | | | 1 | | | | | |
| Fagitana littera | wet prairie | | | 1 | | | | | |
| Fitchiella robertsoni | hill prairie | | | 1 | | | | | |
| Flexamia abbreviata | dry prairie | | | 1 | | | | | |
| Flexamia albida | hill prairie | | | 1 | | | | | |
| Flexamia areolata | prairie | | | 1 | 1 | | | | |
| Flexamia atlantica | wet prairie | | | 1 | | | | | |
| Flexamia grammica | sand prairie | | | 1 | | | | | |
| Flexamia pyrops | xeric prairie | | | 1 | | | | | |
| Gabara subnivosella | wet sand savanna | | | 1 | | | | | |
| Glaucopsyche lygdamus | savanna | | | 1 | | | | | |
| Gomphus ventricosus (skillet clubtail) | | | G3 | 1 | | | | | |
| Graminella oquaka | prairie | | | 1 | 1 | | | | |
| Grapholita tristrigana | prairie | | | 1 | | | | | |
| Gryllotalpa major (prairie mole cricket) | | | G3 | 1 | | | | | |
| Hadena capsularis | sand savanna | | | 1 | | | | | |
| Hadena ectypa | sand savanna | | | 1 | | | | | |
| Hebecephalus signatifrons | | | | 1 | | | | | |
| Hemaris gracilis | sand savanna | | | 1 | | | | | |
| Hemileuca maia | sand savanna | | | 1 | | | | | |
| Hemileuca nevadensis | sand savanna | | | 1 | | | | | |
| Heptagenia patoka (a mayfly) | | | G2 | 1 | | | | | |
| Heptagrotis phyllophora | | | | 1 | | | | | |
| Hesperia attalus (dotted skipper) | | | G3 | 1 | | | | | |
| Hesperia dacotae (Dakota skipper) | xeric prairie | FC | G2 | 1 | | | | | |
| Hesperia leonardus | xeric prairie | | | 1 | | | | | |
| Hesperia metea (cobweb skipper) | sand prairie | ST | | 1 | | | | | |
| Hesperia ottoe (ottoe skipper) | xeric prairie | ST | G3 | 1 | | | | | |
| Hesperia sassacus | sand savanna | | | 1 | | | | | |
| Homoeoneuria ammophila (a sand-filtering mayfly) | | | G3 | 1 | | | | | |
| Homorthodes furfurata | sand prairie | | | 1 | | | | | |
| Hydraecia (Hydroecia) immanis | prairie | | | 1 | | | | | |
| Hydraecia stramentosa | mesic prairie | | | 1 | | | | | |
| Hyparpax aurora | sand savanna | | | 1 | | | | | |
| Hydroperla fugitans (a spring stonefly) | | | G3 | 1 | | | | | |
| Incisalia polios (hoary elfin) | | SE | | 1 | | | | | |
| Iodopepla u-album | sand prairie | | | 1 | | | | | |
| Isogenoides varians (a stonefly) | | | G3 | 1 | | | | | |
| Itame amboflava | mesic/wet prairie | | | 1 | | | | | |
| Kansendria kansiensis | sand prairie | | | 1 | | | | | |
| Laevicephalus minimus | xeric prairie | | | 1 | | | | | |
| Laevicephalus peronatus | savanna | | | 1 | | | | | |
| Lemmeria digitalis | wet prairie | | | 1 | | | | | |
| Lethe appalachia | | | | 1 | | | | | |

| INVERTEBRATES (Insects), continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Name | Habitat Association | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Leucania extincta | sand prairie | | | 1 | | | | | |
| Limotettix elegans | wet prairie | | | 1 | | | | | |
| Limotettix nigrax | wet prairie/savanna | | | 1 | | | | | |
| Limotettix parallelus | wet prairie | | | 1 | | | | | |
| Limotettix pseudospagneticus | wet prairie | | | 1 | | | | | |
| Limotettix truncatus | wet prairie | | | 1 | | | | | |
| Lonatura catalina | xeric prairie | | | 1 | | | | | |
| Loxagrotis grotei | xeric prairie | | | 1 | | | | | |
| Loxocrambus awemensis | dunes | | | 1 | | | | | |
| Lycaeides melissa samuelis (Karner blue butterfly) | sand savanna | FE SE | | 1 | | | | | |
| Lycaena helloides | wet prairie | | | 1 | | | | | |
| Lycaena xanthoides | wet prairie | | | 1 | | | | | |
| Macrochilo (Hormisa) bivittata | prairie | | | 1 | | | | | |
| Macrochilo (Hormisa) litophora | prairie | | | 1 | | | | | |
| Macrochilo (Hormisa) louisiana | prairie | | | 1 | | | | | |
| Macrosteles pottoria | sedge meadows | | | 1 | | | | | |
| Melanchra assimilis | prairie fens | | | 1 | | | | | |
| Melanomma auricinctaria | savanna | | | 1 | | | | | |
| Melanoplus dawsoni | sand prairie | | | 1 | | | | | |
| Memnonia panzeri | | | | 1 | | | | | |
| Meropleon diversicolor | sedge meadow | | | 1 | | | | | |
| Mesamia straminea | mesic prairie | | | 1 | | | | | |
| Nannothemis bella (elfin skimmer) | fen/seep | ST | | 1 | | | | | |
| Neoconocephalus lyristes | sedge meadow/fen | | | 1 | | | | | |
| Nephopterix dammersi | xeric prairie | | | 1 | | | | | |
| Nicrophorus americanus (American burying beetle) | | | G2 | 1 | | | | | |
| Nomotettix parvus (low-ridged pygmy grasshopper) | | | G3 | 1 | | | | | |
| Oarisma powesheik (Powesheik skipperling) | wet prairie | | G2 | 1 | | | | | |
| Okanagana balli | silt loam prairie | | | 1 | | | | | |
| Olethreutes comandrana | prairie | | | 1 | | | | | |
| Olethreutes osmundana | sand prairie/savanna | | | 1 | | | | | |
| Oligia obtusa | sand savanna | | | 1 | | | | | |
| Oncocnemis riparia | sand prairie | | | 1 | | | | | |
| Oncocnemis saundersiana | prairie | | | 1 | | | | | |
| Oncocnemis viriditincta | sand savanna | | | 1 | | | | | |
| Oncopodura iowae (a cave isopod springtail) | | | G3 | 1 | | | | | |
| Pachypolia atricornis (three-horned moth) | | | G3 | 1 | | | | | |
| Paecetes abrostolella | sand prairie | | | 1 | | | | | |
| Palus bilineatus | prairie | | | 1 | 1 | | | | |
| Palus delector | prairie | | | 1 | 1 | | | | |
| Palus luteocephalus | prairie | | | 1 | 1 | | | | |
| Pangrapta decoralis | sand prairie | | | 1 | | | | | |
| Paraleptophlebia sticta (a mayfly) | | | G1 | 1 | | | | | |
| Paraphlepsius lupalus (leafhopper) | | SE | | 1 | | | | | |
| Papaipema aerata | unknown | | | 1 | | | | | |
| Papaipema araliae (Aralia shoot borer moth) | | | G3 | 1 | | | | | |
| Papaipema beeriana (blazing star stem borer) | prairie/fen | | G3 | 1 | | | | | |
| Papaipema birdi | wet prairie/fen | | | 1 | | | | | |
| Papaipema cerina | savanna | | | 1 | | | | | |
| Papaipema cerrusata | wet prairie/fen | | | 1 | | | | | |
| Papaipema eryngii (rattlesnake-master borer moth) | wet/mesic prairie | SE | G1 | 1 | | | | | |
| Papaipema eupatorii | wet prairie | | | 1 | | | | | |
| Papaipema harrissi | fen | | | 1 | | | | | |

| INVERTEBRATES (Insects), continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Papaipema inquaesita | wet prairie | | | 1 | | | | | |
| Papaipema leucostigma | sand savanna | | | 1 | | | | | |
| Papaipema limpida | mesic/wet prairie | | | 1 | | | | | |
| Papaipema lysimachiae | sedge meadow | | | 1 | | | | | |
| Papaipema maritima | prairie/fen | | | 1 | | | | | |
| Papaipema necopina | savanna | | | 1 | | | | | |
| Papaipema nelita | fen/savanna | | | 1 | | | | | |
| Papaipema nepheleptena | wet prairie/fen | | | 1 | | | | | |
| Papaipema pterisii | sand savanna | | | 1 | | | | | |
| Papaipema rigida | mesic prairie | | | 1 | | | | | |
| Papaipema rutila | savanna | | | 1 | | | | | |
| Papaipema sciata (cluvers root borer) | prairie/fen | | G3 | 1 | | | | | |
| Papaipema silphii (Silphium borer moth) | prairie | | G3 | 1 | | | | | |
| Papaipema sp. 10 (Grundy County papaipema) | mesic/wet prairie | | G1 | 1 | | | | | |
| Papaipema speciosissima | sand prairie | | | 1 | | | | | |
| Papaipema unimoda | prairie/fen | | | 1 | | | | | |
| Paraphilaenus parallelus | wet prairie | | | 1 | | | | | |
| Paraphlepsius altus | sand prairie | | | 1 | | | | | |
| Paraphlepsius carolinus | sand prairie | | | 1 | | | | | |
| Paraphlepsius electus | prairie | | | 1 | | | | | |
| Paraphlepsius humidus | wet prairie | | | 1 | | | | | |
| Paraphlepsius incisus | savanna? | | | 1 | | | | | |
| Paraphlepsius lascivius | savanna | | | 1 | | | | | |
| Paraphlepsius lupalus | sand prairie | SE | | 1 | | | | | |
| Paraphlepsius maculosus | sand prairie | | | 1 | | | | | |
| Paraphlepsius nebulosus | prairie | | | 1 | | | | | |
| Paraphlepsius rossi | savanna | | | 1 | | | | | |
| Paraphlepsius solidaginis | prairie | | | 1 | | | | | |
| Paraphlepsius texanus | hill prairie | | | 1 | | | | | |
| Paraphlepsius umbellatus | prairie | | | 1 | | | | | |
| Paraphlepsius umbrosus | wet prairie | | | 1 | | | | | |
| Parapoynx maculalis | marsh | | | 1 | | | | | |
| Pediasia abnaki | fens | | | 1 | | | | | |
| Peltonotellus histrionicus | wet prairie | | | 1 | | | | | |
| Perlesta golconda (a stonefly) | | | G2 | 1 | | | | | |
| Petrophora subaequaria | savanna | | | 1 | | | | | |
| Phalaenostola hanhami | prairie | | | 1 | | | | | |
| Phytometra ernestinana | prairie | | | 1 | | | | | |
| Pieris virginiensis (West Virginia white) | | | G3 | 1 | | | | | |
| Plagiomimicus (Stibadium) spumosum | prairie | | | 1 | | | | | |
| Plagiomimicus heitzmani | prairie | | | 1 | | | | | |
| Platyperigea (Caradrina) meralis | sand savanna | | | 1 | | | | | |
| Platytes vobisne | wet prairie | | | 1 | | | | | |
| Plauditus veteris (a mayfly) | | | G2 | 1 | | | | | |
| Plusia venusta | wet prairie | | | 1 | | | | | |
| Poanes viator | sedge meadow | | | 1 | | | | | |
| Polyamia compacta | prairie | | | 1 | 1 | | | | |
| Polyamia dilata | hill prairie | | | 1 | | | | | |
| Polyamia herbida | sand savanna | | | 1 | | | | | |
| Polyamia interrupta | sand savanna | | | 1 | | | | | |
| Polyamia obtecta | xeric prairie | | | 1 | | | | | |
| Polyamia rossi | sand prairie | | | 1 | | | | | |
| Polyamia similaris | xeric prairie | | | 1 | | | | | |

| INVERTEBRATES (Insects), continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Prairiana cinerea | prairie/savanna | | | 1 | | | | | |
| Prionapteryx achatina | sand prairie | | | 1 | | | | | |
| Prionapteryx nebulifera | dunes | | | 1 | | | | | |
| Problema byssus (Byssus skipper) | mesic/wet prairie | | G3 | 1 | | | | | |
| Procloeon irrubrum (a mayfly) | | | G2 | 1 | | | | | |
| Procloeon mendax (a mayfly) | | | G2 | 1 | | | | | |
| Procloeon quaesitum (a mayfly) | | | G2 | 1 | | | | | |
| Procloeon simplex (a mayfly) | | | G2 | 1 | | | | | |
| Proserpinus guarae | mesic prairie | | | 1 | | | | | |
| Protorthodes incincta | sand prairie | | | 1 | | | | | |
| Psectraglaea carnosa | sand savanna | | | 1 | | | | | |
| Pseudanophthalmus illinoisensis (Illinois cave beetle) | | | G1 | 1 | | | | | |
| Pseudeva purpurigera | wet prairie | | | 1 | | | | | |
| Pseudexentera vaccinii | sand prairie | | | 1 | | | | | |
| Pygarctia spraguei (Sprague's pygarctic) | sand savanna | | G3 | 1 | | | | | |
| Pyla arenaeola | dunes | | | 1 | | | | | |
| Pyrausta laticlavia | prairie | | | 1 | | | | | |
| Pyrausta orphisalis | prairie | | | 1 | | | | | |
| Rhodoecia aurantiago | mesic prairie | | | 1 | | | | | |
| Richia n. sp. | sand prairie | | | 1 | | | | | |
| Rimulincola divalis | | | G1 | 1 | | | | | |
| Rosenus cruciatus | sand prairie/savanna | | | 1 | | | | | |
| Satyrium edwardsii | savanna | | | 1 | | | | | |
| Scaphytopius abbreviatus | sand prairie/savanna | | | 1 | | | | | |
| Scaphytopius cinereus | prairie | | | 1 | | | | | |
| Scaphytopius dorsalis | xeric prairie | | | 1 | | | | | |
| Scaphytopius rubellus | prairie | | | 1 | 1 | | | | |
| Scaphytopius vaccinium | xeric prairie | | | 1 | | | | | |
| Schinia gloriosa | sand & hill prairie | | | 1 | | | | | |
| Schinia gracilenta (bifascia) | wet prairie | | | 1 | | | | | |
| Schinia guarae | mesic prairie | | | 1 | | | | | |
| Schinia indiana | sand savanna | | | 1 | | | | | |
| Schinia jaguarina | mesic-xeric prairie | | | 1 | | | | | |
| Schinia lucens | prairie | | | 1 | | | | | |
| Schinia nundina | sand savanna | | | 1 | | | | | |
| Schinia oleagina | xeric prairie | | | 1 | | | | | |
| Schinia saturata | sand prairie | | | 1 | | | | | |
| Schinia septentrionalis | mesic-xeric prairie | | | 1 | | | | | |
| Schizura apicalis (plain schizura) | | | G2 | 1 | | | | | |
| Scudderia pistillata | wet/mesic prairie | | | 1 | | | | | |
| Semiothisa eremiata | sand prairie/savanna | | | 1 | | | | | |
| Serratella frisoni (Frison's serratellan mayfly) | | | G3 | 1 | | | | | |
| Siphlonurus marshalli (a mayfly) | | | G3 | 1 | | | | | |
| Sitochroa dasconalis | | | | 1 | | | | | |
| Somatochlora hineana (Hine's emerald dragonfly) | fen/seep | FE SE | G2 | 1 | | | | | |
| Spartiniphaga includens | wet prairie | | | 1 | | | | | |
| Spartiniphaga inops | wet prairie | | | 1 | | | | | |
| Spartiniphaga panatela | wet prairie | | | 1 | | | | | |
| Speyeria aphrodite | mesic prairie | | | 1 | | | | | |
| Speyeria diana (Diana fritillary) | | | G3 | 1 | | | | | |
| Speyeria idalia (regal fritillary) | xeric/mesic prairie | FC ST | G3 | 1 | | | | | |
| Sphinx eremitus | mesic/wet prairie | | | 1 | | | | | |
| Sphinx luscitiosa | prairie | | | 1 | | | | | |

| **INVERTEBRATES (Insects), continued** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Stegasta bosquella | prairie | | | 1 | | | | | |
| Stethophyma lineatum | sedge meadow | | | 1 | | | | | |
| Stroggylocephala mixtus | wet prairie | | | 1 | | | | | |
| Stylurus notatus (elusive clubtail) | | | G3 | 1 | | | | | |
| Suleima helianthana | prairie | | | 1 | | | | | |
| Tarachidia binocula | xeric/wet prairie | | | 1 | | | | | |
| Tebenna silphiella | prairie | | | 1 | | | | | |
| Tetralopha baptisiella | prairie | | | 1 | | | | | |
| Texananus cumulatus | sand prairie | | | 1 | | | | | |
| Texananus decorus | prairie | | | 1 | | | | | |
| Thaumatopsis pectinifer | sand | | | 1 | | | | | |
| Tricholita notata | mesic prairie | | | 1 | | | | | |
| Trichosilia manifesta | sand savanna | | | 1 | | | | | |
| Triclonella determinatella | prairie | | | 1 | | | | | |
| Trimerotropis maritima | dunes | | | 1 | | | | | |
| Trimerotropis saxatilis (a grasshopper) | | | G3 | 1 | | | | | |
| Ulolonche modesta | sand savanna | | | 1 | | | | | |
| Vaxi auratella | wet prairie | | | 1 | | | | | |
| Vaxi critica | wet prairie | | | 1 | | | | | |
| Xerophloea major | prairie | | | 1 | 1 | | | | |
| Xerophloea peltata | sand prairie | | | 1 | | | | | |
| Zomaria interuptolineana | sand prairie/savanna | | | 1 | | | | | |
| | | | | | | | | | |
| FLATWORMS | | | | | | | | | |
| Sphalloplana hubrichti (a cave obligate planarian) | caves | | G3 | 1 | | | | | |
| | | | | | | | | | |
| MILLIPEDES | | | | | | | | | |
| Semionellus placidus (a millipede) | | | G3 | 1 | | | | | |
| Tingupa pallida (a cave obligate millipede) | caves | | G3 | 1 | | | | | |
| Zosteractis interminata (a millipede) | | | G3 | 1 | | | | | |
| | | | | | | | | | |
| ARACHNIDS | | | | | | | | | |
| Centruroides vittatus (striped scorpion) | Talus slopes, glades | | | 1 | | | | | |
| Mundochthonius cavernicola (a troglobitic pseudoscorpion) | caves | | G3 | 1 | | | | | |

| **FISHES** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Acipenser fulvescens (lake sturgeon) | large lakes, rivers | SE | G3 | 1 | 1 | 0 | 0 | 1 | 1 |
| Anguilla rostrata (American eel) | large lakes, rivers | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Ameiurus nebulosis (brown bullhead) | vegetated lakes, low-gradient streams | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| Ammocrypta clara (western sand darter) | medium-large rivers over sand | SE | G3 | 1 | 1 | 0 | 1 | 1 | 0 |
| Ammocrypta pellucida (eastern sand darter) | rivers w/ sand substrate | ST | G3 | 1 | 1 | 0 | 0 | 1 | 1 |
| Campostoma oligolepis (largescale stoneroller) | streams, rivers over gravel, rock | 0 | 0 | 1 | | | | | 1 |
| Carpoides velifer (highfin carpsucker) | pools, backwaters of streams, rivers | 0 | 0 | 1 | | | | | 1 |
| Catostomus catostomus (longnose sucker) | cold lakes, rivers | ST | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Centrarchus macropterus (flier) | swamps, backwaters over mud | 0 | 0 | 1 | | | | | 1 |
| Coregonus artedi (cisco or lake herring) | Lake Michigan | ST | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Coregonus clupeaformis (lake whitefish) | Lake Michigan | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Cottus bairdi (mottled sculpin) | Lake Michigan | 0 | 0 | 1 | | | | | |
| Cottus carolinae (banded sculpin) | Lake Michigan | 0 | 0 | 1 | | | | | |

| **FISHES, continued** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Couesius plumbeus (lake chub) | gravel bottoms, rocky shorelines | 0 | 0 | 1 | | | | | |
| Crystallaria asprella (crystal darter) | sand, gravel runs of rivers | 0 | 0 | 1 | | | | | 1 |
| Culaea inconstans (brook stickleback) | vegetation in cool streams | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Cycleptus elongatus (blue sucker) | rivers w/ rocky substrate | 0 | G3 | 1 | 1 | 0 | 0 | 1 | 1 |
| Cyprinella venusta (blacktail shiner) | sandy pools, runs of rivers | 0 | 0 | 1 | | | | | |
| Elassoma zonatum (banded pygmy sunfish) | swamps | 0 | 0 | 1 | | | | | |
| Erimystax x-punctatus (gravel chub) | rivers w/ gravel substrate | ST | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Erimyzon sucetta (lake chubsucker) | vegetation in lakes, backwaters | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| Esox lucius (northern pike - native stocks) | clear, vegetated lakes, backwaters | 0 | 0 | | | | | 1 | |
| Esox masquinongy (muskellunge-native stocks) | cool-water streams, lakes | 0 | 0 | | | | | 1 | |
| Etheostoma camurum (bluebreast darter) | rivers w/ rocky substrate | SE | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Etheostoma chlorosomum (bluntnose darter) | swamps, backwaters, low-gradient streams | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Etheostoma crossopterum (fringed darter) | rocky pools, riffles of steams | 0 | 0 | 1 | | | | | 1 |
| Etheostoma exile (Iowa darter) | vegetation in ponds, lakes | ST | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Etheostoma histrio (Harlequin darter) | high-gradient rivers over gravel woody debris | SE | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| Etheostoma proelaire (cypress darter) | slow water, vegetation over mud | 0 | 0 | 1 | | | | | 1 |
| Etheostoma squamiceps (spottail darter) | rocky pools, riffles of steams | 0 | 0 | 1 | | | | | |
| Forbesichthys agassizi (spring cavefish) | springs, caves | 0 | 0 | 1 | | | | | |
| Fundulus diaphanus (banded killifish) | vegetated lakes, low-gradient streams over sand/gravel | ST | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Fundulus dispar (starhead topminnow) | vegetated lakes, ponds, low-gradient streams | ST | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| Hybognathus hayi (cypress minnow) | swamps, backwaters, low-gradient streams | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Hybopsis amblops (bigeye chub) | vegetated stream over sand, gravel | SE | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Hybopsis amnis (pallid shiner) | rivers over sand | SE | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| Ichthyomyzon fossor (northern brook lamprey) | streams and rivers | SE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Ichthyomyzon unicuspis (silver lamprey) | streams and rivers over gravel | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Lampetra aepyptera (least brook lamprey) | streams and rivers over sand, gravel | ST | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| Lampetra appendix (American brook lamprey) | streams and rivers over gravel | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| Lepomis miniatus (redspotted sunfish) | vegetated backwaters, low-gradient streams | ST | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| Lepomis symmetricus (bantam sunfish) | vegetated swamps, backwaters | ST | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Lythrurus fumeus (ribbon shiner) | vegetated low-gradient streams over sand, silt | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Macrhybopsis gelida (sturgeon chub) | rivers over sand, gravel | SE | G3 | 1 | 1 | 0 | 1 | 1 | 1 |
| Macrhybopsis meeki (sicklefin chub) | rivers over sand, gravel | 0 | G3 | 1 | 1 | 0 | 1 | 1 | 1 |
| Micropterus dolomieu (smallmouth bass) | cool streams, rivers over gravel, rock | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Micropterus punctulatus (spotted bass) | streams, rivers over gravel, rock | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Moxostoma carinatum (river redhorse) | high-gradient rivers over rocky | ST | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| Moxostoma duquesnei (black redhorse) | streams over sand, rock | 0 | 0 | 1 | | | | | |
| Mxostoma valenciennesi (greater redhorse) | rivers over gravel, rock | SE | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| Myoxocephalus quadricornis (fourhorn sculpin) | | 0 | 0 | | | | | | |
| Nocomis micropogon (river chub) | streams, rivers over gravel, rock | SE | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Notropis anogenus (pugnose shiner) | vegetated glacial lakes, streams | SE | G3 | 1 | 1 | 0 | 0 | 1 | 0 |
| Notropis boops (bigeye shiner) | streams over sand, gravel | SE | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Notropis buchanani (ghost shiner) | large turbid rivers | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |

| FISHES, continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Notropis chalybaeus (ironcolor shiner) | vegetated low-gradient streams over sand | ST | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| Notropis heterodon (blackchin shiner) | vegetated low-gradient streams over sand | ST | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Notropis heterolepis (blacknose shiner) | vegetated cool streams, lakes over sand | SE | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Notropis maculatus (taillight shiner) | vegetated backwaters, swamps, lakes | SE | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| Notropis nubilus (Ozark minnow) | pools, streams, over grave | 0 | 0 | 1 | | | | | |
| Notropis rubellus (rosyface shiner) | rocky runs of small-medium rivers | 0 | 0 | 1 | | | | | |
| Notropis shumardi (silverband shiner) | turbid rivers over sand, gravel | 0 | 0 | 1 | | | | | |
| Notropis texanus (weed shiner) | vegetated streams over sand | SE | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Noturus eleutherus (mountain madtom) | high-gradient streams, rivers over gravel, rock | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| Noturus exilis (slender madtom) | high-gradient streams, rivers over gravel, rock | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Noturus stigmosus (northern madtom) | streams, rivers over sand, woody debris | SE | G3 | 1 | 1 | 0 | 0 | 0 | 1 |
| Opsopoeodus emilae (pugnose minnow) | vegetated lakes, low-gradient streams | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| Perca flavescens (yellow perch) | Lake Michigan | 0 | 0 | 1 | | | | | |
| Percopisis omiscomaycus (trout-perch) | lakes, pools over sand | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Phoxinus erythrogaster (southern redbelly dace) | cool streams over sand, gravel | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Polyodon spathula (North American paddlefish) | large silty rivers rich w/ zooplankton | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Rhyinichthys atratulus (blacknose dace) | cool streams over sand, gravel | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Rhyinichthys cataractae (longnose dace) | coolwater streams | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Salvelinus fontinalis | coolwater streams | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Salvelinus namaycush (lake trout) | Lake Michigan | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Scaphirhynchus albus (pallid sturgeon) | large turbid rivers over sand | FE SE | G1 | 1 | 1 | 0 | 0 | 1 | 1 |
| Scaphirhynchus platorhynchus (shovelnose sturgeon) | large turbid rivers | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Stizostedion canadense (sauger) | large rivers | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Stizostedion vitreum (walleye) | streams, rivers, lakes | 0 | 0 | | | | | 1 | |
| Umbra limi (central mudminnow) | vegetation in still water, over mud | 0 | 0 | 1 | | | | | |

| AMPHIBIANS | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Ambystoma jeffersonianum (Jefferson salamander) | forest, ephemeral pools | ST | 0 | 1 | 1 | 0 | 0 | | 0 |
| Ambystoma laterale (blue-spotted salamander) | forest, ephemeral pools | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |
| Ambystoma platineum (silvery salamander) | forest, ephemeral pools | SE | 0 | 1 | 1 | 0 | 0 | | 0 |
| Ambystoma talpoideum (mole salamander) | swamp | 0 | 0 | 1 | 1 | 0 | 0 | | 0 |
| Cryptobranchus alleganiensis (hellbender) | swift rivers, streams | SE | G3 | 1 | 1 | 0 | 0 | | 1 |
| Desmognathus conanti (spotted dusky salamander) | cool headwaters, forest | SE | 0 | 1 | 1 | 0 | 0 | | 0 |
| Gastrophryne carolinensis (eastern narrowmouth toad) | open floodplains, emphemeral pools | ST | 0 | 1 | 0 | 0 | 0 | | 0 |
| Hemidactylium scutatum (four-toed salamander) | pools, streams, forest | ST | 0 | 1 | 1 | 0 | 0 | | 0 |
| Hyla avivoca (bird-voiced treefrog) | swamp | ST | 0 | 1 | 1 | 0 | 0 | | 0 |
| Necturus maculosus (mudpuppy) | gravel-bottom streams, lakes | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |
| Pseudacris streckeri illinoensis (Illinois chorus frog) | sand prairie, ephemeral pools | ST | 0 | 1 | 1 | 1 | 1 | | 0 |
| Rana areolata (crayfish frog) | wet grasslands, ephemeral pools | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |

| **AMPHIBIANS, continued** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Rana palustris (pickerel frog) | cool, rocky headwaters, cave entrances | 0 | 0 | 1 | 1 | 0 | | | 1 |
| Rana sylvatica (wood frog) | forest, ephemeral pools | 0 | 0 | 1 | 0 | 0 | 0 | | 1 |

| **REPTILES** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Apalone mutica (smooth softshell turtle) | sand-bottom streams | 0 | 0 | 0 | 1 | 0 | 0 | | 1 |
| Clemmys guttata (spotted turtle) | marsh | SE | 0 | 1 | 1 | 0 | 0 | | 0 |
| Clonophis kirtlandii (Kirtland's snake) | wet grassland, marsh | ST | 0 | 1 | 1 | 0 | 1 | | 1 |
| Crotalus horridus (timber rattlesnake) | forest, rocky slopes | ST | 0 | 1 | 1 | 0 | 0 | | 0 |
| Elaphe emoryi (great plains rat snake) | rocky grassland/savanna slopes | SE | 0 | 1 | 1 | 0 | 0 | | 0 |
| Emydoidea blandingii (Blanding's turtle) | marsh | ST | 0 | 1 | 1 | 0 | 0 | | 0 |
| Farancia abacura (mud snake) | swamp | 0 | 0 | 1 | 1 | 0 | 0 | | 0 |
| Heterodon nasicus (western hognose snake) | sand prairie, sand savanna | ST | 0 | 1 | 1 | 1 | 0 | | 0 |
| Kinosternon flavescens (Illinois mud turtle) | wetlands in sand prairie | SE | 0 | 1 | 1 | 1 | 1 | | 0 |
| Kinosternon subrubrum (eastern mud turtle) | swamp | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |
| Macrochelys temminckii (alligator snapping turtle) | rivers, swamp | SE | G3 | 1 | 1 | 0 | 0 | | 1 |
| Masticophis flagellum (coachwhip) | rocky grassland/savanna slopes | SE | 0 | 1 | 1 | 0 | 0 | | 0 |
| Nerodia cyclopion (Mississippi green water snake) | swamp | ST | 0 | 1 | 1 | 0 | 0 | | 0 |
| Nerodia erythrogaster neglecta (n. copperbelly watersnake) | swamp, bottomland forest | *** | 0 | 1 | 1 | 0 | 1 | | 0 |
| Nerodia fasciata (broad-banded water snake) | swamp | SE | 0 | 1 | 1 | 0 | 0 | | 0 |
| Liochlorophis vernalis (smooth green snake) | grassland, savanna, marsh, successional | 0 | 0 | 1 | 0 | 0 | 0 | | 1 |
| Ophisaurus attenuatus (slender glass lizard) | grassland, savanna | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |
| Pseudemys concinna (river cooter) | rivers, swamp | SE | 0 | 1 | 1 | 0 | 0 | | 0 |
| Sistrurus catenatus catenatus (eastern massasauga) | marsh, bottomland forest, grassland | FC SE | 0 | 1 | 1 | 0 | 1 | | 0 |
| Tantilla gracilis (flathead snake) | rocky, wooded slopes | ST | 0 | 1 | 1 | 0 | 0 | | 1 |
| Terrapene ornata (ornate box turtle) | grassland | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |
| Thamnophis sauritus (eastern ribbon snake) | bottomland forest, swamp | ST | 0 | 1 | 1 | 0 | 0 | | 0 |
| Tropidoclonion lineatum (lined snake) | grassland | ST | 0 | 1 | 1 | 0 | 0 | | 0 |

*** *N. E. neglecta* is protected by Illinois Administrative Rule, part 880.70, in 14 southeastern Illinois counties

| **BIRDS** | | **Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Ammodramus henslowii (Henslow's sparrow) | Grassland | ST | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ammodramus leconteii (LeConte's sparrow)[1] | Grassland, marsh | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ammodramus nelsoni (Nelson's sharp-tailed sparrow)[1] | Grassland, marsh | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ammodramus savannarum (grasshopper sparrow) | Grassland | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Anas rubripes (American black duck)[1] | Forested streams, lakes | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Ardea alba (great egret) | Forested streams, lakes | 0 | 0 | RR | 1 | 0 | 0 | 0 | 0 |
| Asio flammeus (short-eared owl) | Grassland | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Aythya affinis (lesser scaup) | Rivers, lakes | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |

| BIRDS, continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Name | Habitat Association | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Aythya valisineria (canvasback) | Rivers, lakes | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Bartramia longicauda (upland sandpiper) | Grassland | SE | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Bonasa umbellus (ruffed grouse) | Forest, successional forest | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Botaurus lentiginosus (American bittern) | Marsh | SE | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Buteo lineatus (red-shouldered hawk) | Bottomalnd forest, forest | 0 | 0 | RR | 0 | 0 | 0 | 1 | 0 |
| Buteo platypterus (broad-winged hawk) | Forest | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Buteo swainsoni (Swainson's hawk) | Savanna, grassland, agriculture | SE | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| Calcarius pictus (Smith's longspur)[1] | Agricultural, grassland | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| Calidris himantopus (stilt sandpiper)[1] | Vernal pool, mudflat, marsh | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Caprimulgus carolinensis (chuck-will's-widow) | Forest | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Caprimulgus vociferus (whip-poor-will) | Forest, successional | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Certhia americana (brown creeper) | Bottomland forest, forest | 0 | 0 | RR | 0 | 0 | 0 | 0 | 0 |
| Chaetura pelagica (chimney swift) | swamp, urban | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Charadrius melodus (piping plover) | Beach | FE SE | G3 | 1 | 1 | 0 | 0 | 0 | 0 |
| Chlidonias niger (black tern) | Marsh | SE | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Chordeiles minor (common nighthawk) | urban, barren, grassland | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Circus cyaneus (northern harrier) | Grassland, marsh | SE | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Cistothorus palustris (marsh wren) | Marsh | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Cistothorus platensis (sedge wren) | grassland, marsh | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Coccyzus americanus (yellow-billed cuckoo) | Forest, savanna | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Coccyzus erythropthalmus (black-billed cuckoo) | forest | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Colaptes auratus (northern flicker) | savanna, grassland | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Colinus virginianus (northern bobwhite) | Successional field, grassland | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| Coturnicops noveboracensis (yellow rail)[1] | Marsh | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Cygnus buccinator (trumpeter swan)[1] | Marsh, lakes | XN | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Dendroica cerulea (cerulean warbler) | Bottomland forest | ST | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Dendroica discolor (prairie warbler) | successional | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Dolichonyx oryzivorus (bobolink) | Grassland | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Egretta caerulea (little blue heron) | Forested streams, lakes | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Egretta thula (snowy egret) | Forested streams, lakes | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Empidonax traillii (willow flycatcher) | marsh, successional | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Empidonax virescens (Acadian flycatcher) | forest | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Euphagus carolinus (rusty blackbird)[1] | Swamp, bottomland forest | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| Falco peregrinus (peregrine falcon) | Urban, cliffs | FE ST | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gallinula chloropus (common moorhen) | Marsh | ST | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gallinago delicatata (Wilson's snipe) | Marsh, vernal pool | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| Grus americana (whooping crane)[1] | Marsh | XN | G1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Grus canadensis (sandhill crane) | Marsh | ST | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Haliaeetus leucocephalus (bald eagle) | Forested streams, lakes | FT ST | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Helmitheros vermiforma (worm-eating warbler) | forest | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Hylocichla mustelina (wood thrush) | forest | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Icteria virens (yellow-breasted chat) | Successional fields, edges | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Ictinia mississippiensis (Mississippi kite) | Forested streams, lakes | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ixobrychus exilis (least bittern) | Marsh | ST | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Lanius ludovicianus (loggerhead shrike) | Grassland | ST | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Laterallus jamaicensis (black rail) | Marsh | SE | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| Limnodromus griseus (short-billed dowitcher)[1] | Marsh, vernal pool, mudfalt | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| Limnothlypis swainsonii (Swainson's warbler) | Bottomland forest | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Lophodytes cucullatus (hooded merganser) | Forested streams, lakes | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Melanerpes erythrocephalus (red-headed woodpecker) | Savanna | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| Nyctanassa violacea (yellow-crowned night-heron) | Swamp | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

| BIRDS, continued | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Nycticorax nycticorax (black-crowned night-heron) | Swamp | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Oporornis agilis (Connecticut Warbler)[1] | Forest | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Oporornis formosus (Kentucky warbler) | Forest | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Pandion haliaetus (osprey) | Forested streams, lakes | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Passerculus sandwichensis (savannah sparrow) | Grassland, agricultural | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Phalaropus tricolor (Wilson's phalarope) | Marsh, vernal pool | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Pluvialis dominica (American golden-plover)[1] | Agricultural, mudflat, grassland | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| Podilymbus podiceps (pied-billed grebe) | Marsh, lakes | 0 | 0 | RR | 1 | 0 | 0 | 0 | 0 |
| Protonotaria citrea (prothonotary warbler) | bottomland forest | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Rallus elegans (king rail) | Marsh, grassland | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Scolopax minor (American woodcock) | Successional fields, ecotones | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Seiurus aurocapillus (ovenbird) | Forest | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Spiza americana (dickcissel) | Grassland | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Spizella pusilla (field sparrow) | successional | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Sterna antillarum (least tern) | Rivers, shoreline | FE SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Sterna forsteri (Forster's tern) | Marsh | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Sterna hirundo (common tern) | Beach | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Thryomanes bewickii (Bewick's wren) | Successional areas, forest | SE | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| Toxostoma rufum (brown thrasher) | succssional | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Tringa melanoleuca (greater yellowlegs)[1] | Vernal pool, mudflat, marsh | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| Tryngites subruficollis (buff-breasted sandpiper)[1] | Vernal pool, mudflat, marsh | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| Tympanuchus cupido (greater prairie-chicken) | Grassland | SE | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| Tyto alba (barn-owl) | Savanna, grassland, agriculture | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Vermiforma pinus (blue-winged warbler) | successional, forest | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vireo belli (Bell's vireo) | Successional fields, grassland | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Xanthocephalus xanthocephalus (yellow-headed blackbird) | Marsh | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

[1] - Does not typically breed in Illinois

| MAMMALS | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Canis lupus (gray wolf )[1] | Forest | FT ST | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Corynorhinus rafinesquii (eastern big-eared bat) | Forest, caves, mines, buildings | SE | G3 | 1 | 1 | 0 | 0 | 1 | 0 |
| Lontra canadensis (river otter) | Streams, impoundments | 0 | 0 | RR | 0 | 0 | 0 | 0 | 0 |
| Lynx rufus (bobcat) | Forest, ecotones | 0 | 0 | RR | 0 | 0 | 0 | 1 | 0 |
| Sorex hoyi (pygmy shrew) | Forests, successional areas, bogs | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Microtus pinetorum (woodland vole) | Deciduous forest, successional forest | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Mustela nivalis (least weasel) | Grassland, successional, ecotones | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Myotis austroriparius (southeastern bat) | Forests, caves, mines | SE | G3 | 1 | 1 | 0 | 0 | 0 | 0 |
| Myotis grisescens (gray bat) | Caves, mines | FE SE | G3 | 1 | 1 | 0 | 0 | 1 | 0 |
| Myotis sodalis (Indiana bat) | Forests, riparian areas, caves, mines | FE SE | G2 | 1 | 1 | 0 | 0 | 1 | 0 |
| Neotoma floridana (eastern woodrat) | Rocky cliffs, caves | SE | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ochrotomys nuttalli (golden mouse) | Ecotones, successional fields | ST | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Ondatra zibethicus (muskrat) | Marshes, streams, ponds | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Oryzomys palustris (marsh rice rat) | Marsh, wetland ecotones | ST | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Peromyscus gossypinus (cotton mouse) | Forest, swamp | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |

| MAMMALS | | Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Name** | **Habitat Association** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Spermophilus franklinii (Franklin's ground squirrel ) | grassland, early successional areas | ST | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Sylvilagus aquaticus (swamp rabbit ) | bottomland forest | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Tamiasciurus hudsonicus (red squirrel) | Forest, coniferous forest | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Taxidea taxus (American badger) | Grassland, agricultural | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Urocyon cinereoargenteus (gray fox) | Forest, successional areas | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

[1] Occurs as a vagrant only in Illinois

**STATE WILDLIFE GRANT PROGRAM**

**State of Illinois**

**Final Performance Report**

**Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems**

**Project 2 - Distribution and Abundance of Conservation Elements**

**Job 2.1: Distribution & Abundance of Priority Wildlife Species**

**Job 2.2: Distribution & Abundance of Game Species**

Objectives:

1. Describe the distribution and abundance of conservation elements in an information system
2. Describe the distribution and abundance of game species in an information system

Project Description:

*Job 2.1: Distribution & abundance of priority wildlife species*

For describing the distribution and abundance of priority species, threatened and endangered species will be mapped with geographic locations reported in the Biotics database. For non-listed vertebrate species, GAP Analysis creates projected distribution maps. GAP methodology involves the mapping of 1) existing natural vegetation to the level of dominant or co-dominant plant species from classification of satellite imagery; 2) predicted distribution of native vertebrate species based on known locations and habitat preferences; and 3) public land ownership and private conservation lands. The information on terrestrial vertebrate biodiversity, species distributions, habitat preferences, and potential locations will provide valuable input to the development, implementation, and assessment of the State Comprehensive Wildlife Conservation Plan. GAP analysis for Illinois will be incorporated into the comprehensive wildlife conservation plan, producing a spatial database (GIS coverage) of GAP information pertinent to the state conservation plan. For invertebrate and other aquatic species, collections at universities and museums, published accounts, and other sources will be searched for distribution records and mapped. Abundance will be qualified or quantified using survey results, published accounts and other sources.

*Job 2.2: Distribution and abundance of game species*

Distributions and abundances of game species will be mapped using habitat-abundance models, survey and harvest results, and other sources. By including these models, the State of Illinois is including an important species group into the comprehensive planning effort, making both nongame and game interests stakeholders in the planning and implementation processes, and demonstrating opportunity areas for diverse conservation interests to work cooperatively.

<u>Approach:</u>

*Job 2.1: Distribution & abundance of priority wildlife species*

Where available, distribution and abundance of priority wildlife species were referenced to printed, online, and Department of Natural Resources publications (all terrestrial vertebrates - Illinois GAP Analysis; mammals - Hoffmeister 1989; breeding birds - Sauer et al. 2004, Kleen et al. 2004; amphibians and reptiles - Phillips et al. 1999; fishes - Department of Natural Resources basin surveys and fisheries database; mussels - Illinois Natural History Survey mussel database; all threatened and endangered species - Department of Natural Resources Biotics 4 database).

A comprehensive source of current information on the distribution and habitat preferences of terrestrial vertebrate species was the Illinois Gap Analysis Project (IL-GAP), conducted from 1998-2004 as part of the national USGS GAP program. Spatial database layers (i.e. GIS coverages) that were created as part of IL-GAP are 1) land cover layer showing existing natural vegetation to the level of dominant or co-dominant plant species from classification of satellite imagery; 2) predicted distributions of native terrestrial vertebrate species based on known locations and habitat preferences; and 3) public land ownership and private conservation lands. IL-GAP provides information on terrestrial vertebrate species distributions, habitat preferences, and potential locations for priority species.

To summarize all available information across taxonomic groups into a uniform format, state experts completed a table of abundance, population trend, and official status (e.g., threatened, endangered). Where possible, abundance was quantified (i.e., population estimates or number of extant populations/locations), a population trend was estimated (quickly increasing, increasing, stable, declining, quickly declining), and official status (threatened/endangered) recorded. Persons completing these tasks confidence-ranked (medium to high confidence, low confidence, and very low confidence/no available information) each datum to indicate the strength of available scientific information and/or degree of expertise. Matrices of abundance, population trend and official status (and confidence qualifiers) were posted on the Plan/Strategy website and open to internal and external peer review.

*Job 2.2: Distribution and abundance of game species*

Abundance of game species or groups of species (e.g., "sunfishes" and "migratory ducks") were indexed to Department of Natural Resources harvest reports, and population trends were qualified (quickly increasing, increasing, stable, declining, quickly declining) by teams of experts. Persons completing these tasks confidence-ranked (medium to high confidence, low confidence, and very low confidence/no available information) each datum to indicate the strength of available scientific information and/or degree of expertise. Distributions of key native game species were mapped, based upon presence and proper interspersion of habitat components (e.g., white-tailed deer, northern bobwhite) and probability of encounter (e.g., wild turkey).

Results:

*Job 2.1 Distribution and abundance of priority wildlife species.*

Information on the distribution and abundance of all threatened and endangered species, largely derived from the Illinois Department of Natural Resources' Biotics 4 database, are available in Nyboer et al. (2004) (see Figure 1 for an example, the red-veined leafhopper, *Aflexa rubranura*). Information on all mussels in greatest need of conservation was obtained from the Illinois Natural History Survey's mussel database (see Figure 2 for an example, the ellipse, *Venustaconcha ellipsiformis*). Information on all fishes in greatest need of conservation was obtained from the Illinois Natural History Survey's fish collections database (see Figure 3 for an example, the central mudminnow, *Umbria limi*). Information on all amphibians and reptiles in greatest need of conservation is available in Phillips et al. (1999) (see Figure 4 for an example, the crayfish frog, *Rana areolata*). The Illinois Breeding Bird Atlas (Kleen et al. 2004) documents the distribution and abundance of all bird species nesting in Illinois, and contains recent data from the North American Breeding Bird Survey (Sauer et al. 2004) (see Figure 5 for an example, the bobolink). The Illinois GAP Analysis Project created expected distribution maps for all terrestrial vertebrates (see Figure 6 for a mammalian example, the least weasel).

Accounts for all of Illinois' species in greatest need of conservation from the above sources were provided as a "Supplement to the Illinois Comprehensive Wildlife Conservation Plan/Strategy - Information on the Distribution and Abundance of Illinois' Species in Greatest Need of Conservation." (See accompanying disc of the same title, with this report.)

A uniform table of abundance, population trend, and official status was developed for all Species in Greatest Need of Conservation and game species, and was presented within the Illinois Comprehensive Wildlife Conservation Plan/Strategy in "Appendix II - Status, objectives, and Stresses to Illinois' Wildlife & Habitats." (Table 1, this report). A brief overview of each taxonomic group was provided in the Illinois Comprehensive Wildlife Conservation Plan/Strategy in "Section III - Statewide Overview, Part B - Current Status of Wildlife & Habitat Resources."

*Mussels* - Twenty-four of the 29 mussel Species in Greatest Need of Conservation are listed as threatened or endangered. (An additional 19 species are extinct or extirpated.) Roughly equal proportions of these species are found in large rivers and smaller streams, and none are primarily found in lakes or impoundments. Some large river species are now known from only stream locations, and some stream species currently occur only in large rivers.

*Fishes* - Thirty-one of the 80 priority fish species are threatened or endangered. Some of the priority fishes are species occurring in Illinois on the periphery of their natural range, where conservation beyond protecting existing populations and habitat may not be appropriate. These species are found in habitats ranging from Lake Michigan to vegetated backwaters, and large, turbid rivers to high-gradient cool-water streams.

*Amphibians* - Eight of the 14 amphibian Species in Greatest Need of Conservation are threatened or endangered. The distribution, abundance and population trend of several species is poorly understood. Many of these species are forest/wetland species in eastern and southern Illinois. The Illinois chorus frog is endemic to sand areas of the state.

*Reptiles* - Sixteen of the 23 reptile Species in Greatest Need of Conservation are threatened or endangered. Like the fishes and amphibians, the reptilian Species in Greatest Need of Conservation list includes edge-of-range and poorly-known species. Diversity of reptiles is highest in southern Illinois. Species in Greatest Need of Conservation include prairie, savanna, marsh, swamp, and bluff species. The eastern massasauga is a candidate for federal protection under the Endangered Species Act.

*Birds* - Thirty-two of the 83 priority bird species are threatened or endangered in Illinois. Relative to other groups, bird populations are the best-monitored. Many of the birds in greatest need of conservation are wetland, grassland, and long-distance migratory species, including king rails, greater prairie-chickens, American golden plovers, and cerulean warblers.

*Mammals* - Nine of the 20 mammal species in greatest need of conservation are threatened or endangered in Illinois. More information is needed on the status of some nocturnal or cryptic species. Bobcats and river otter are increasing and no longer listed as threatened species in Illinois. Reports of cougars, wolves and armadillos have also become more frequent. Black bears occur in southern Indiana, eastern Kentucky and central Wisconsin, and may be reported from Illinois.

*Job 2.2 Distribution and abundance of game species*

Abundance/harvest levels and population trend for game species was included in the parallel process for determining abundance, population trend, and official status of Species in Greatest Need of Conservation (Table 1).

*Mussels* - Commercial mussel harvest was an important economic endeavor in the late nineteenth and early twentieth centuries. Degradation of rivers led to a collapse in mussel populations and this industry. At present, harvest is restricted to ten species, in limited waters of Illinois, with regulations on individual size, quantities and methods of harvesting mussels.

*Trout & salmon* - In Lake Michigan, several species of trout and salmon are stocked by Illinois and other states to maintain fishable populations. Demand far exceeds supply of fish available. Brook trout have been extirpated from coolwater streams in northern Illinois, and few self-sustaining populations of brown trout occur. Catchable rainbow trout are also stocked in inland streams and lakes during spring and fall.

*Northern pike, muskellunge* - Pike and muskie are stocked in 66 lakes statewide. Demand continues to be high for these fish, which are capable of reaching large size and are highly valued by sport anglers.

*Walleye, sauger, and perch* - These fish are highly valued for their sporting and eating qualities. Some natural reproduction occurs in streams (walleye, sauger) and Lake Michigan (perch). Walleye and sauger fisheries in impoundments are maintained by stocking, and demand far exceeds current supplies for all three species.

*Black bass* - Largemouth, smallmouth, and spotted bass occur in Illinois waters. Largemouth bass are intensively managed to provide recreation and as a predator for forage and panfish populations. Natural reproduction of largemouth bass occurs in both streams and impoundments, however supplemental stockings are required to maintain quality fisheries in some impoundments. Smallmouth bass are largely restricted to better-quality streams in the northern half of the state. Bass are generally managed with restrictive size and creel limits. Demand far exceeds bass supply.

*Panfish* - Panfish are a group of highly sought-after, small sport fish, including bluegill and crappies. Panfish are managed via predator introduction (bass) and by angler harvest and creel limits. Current supply and demand are nearly equal, though demand exceeds supply in high-quality public fisheries.

*White Bass, Striped Bass & Hybrids* - These popular sportfish are available in many impoundments and streams. Demand exceeds supply.

*Catfish* - Channel, flathead, and blue catfish make up the majority of Illinois catfish. Natural reproduction is common in larger lakes and streams. Channel catfish do not reproduce well in smaller lakes, thus they are commonly stocked to produce quality fisheries. Current supply and demand are nearly equal.

*Commercial fish* - Commercial fish include buffaloes, carp, carpsuckers, and freshwater drum (and catfish as well). Asian carp have become a commercial resource, a tool that may aid in control of these invasive species. Supply far exceeds the demand for these fish generally found in abundance in Illinois' largest streams. Commercial harvest values for these fish in 2002 was estimated at nearly $1.7 million.

*Amphibians & Reptiles* - Bullfrogs and common snapping turtles are the species most commonly harvested. Both species are common statewide in streams, impoundments, lakes, and ponds, and populations apparently are stable (Phillips et al. 1999).

*Waterfowl* - The Canada goose harvest is comprised primarily of birds from Illinois' giant Canada goose population and the migratory Mississippi Valley Population. Changing weather patterns and land uses are implicated in changing wintering distribution for geese in Illinois. Resident Canada geese are a local nuisance. Snow goose populations are at higher than desired levels and these birds have become common migrants in Illinois. Mallard, wood duck, gadwall, and green-winged teal are the species most commonly harvested in Illinois, and are near or above population objectives established in the North American Waterfowl Management Plan.

*Coots, rails & shorebirds* - The coot harvest is small, decreasing, and largely incidental to harvest of other waterfowl. Few Illinois hunters pursue rails (sora, Virginia rail) or Wilson's snipe. While the status of rails and snipe are poorly understood, marsh, sedge meadow and wet prairie habitats used by them are scarce and in poor condition. Harvest of woodcock in Illinois has decreased as the regional population has declined dramatically in recent years.

*Wild turkey* - Following successful reintroduction to Illinois in the late 20th century, turkeys now occur in almost all counties in Illinois. As these birds continue to pioneer unoccupied habitat, the population (and harvest) is increasing (Figure 7).

*Upland gamebirds* - Populations and harvests of bobwhites, pheasants and gray (Hungarian) partridge have decreased by more than 75% since 1970. Changing agricultural practices, development, and invasive species have reduced the quality (plant diversity, structure and disturbance patterns) and amount of available habitat, especially grassland and shrubs. Ring-necked pheasants are most common in the Grand Prairie, Northeastern Moraine, Rock River Hill Country and Illinois River Sand Areas natural divisions. The highest-quality habitat for northern bobwhites occurs in west-central and south-central Illinois (Figure 8).

*Doves & crow* - The harvest of mourning doves in Illinois exceeds the harvest of all other gamebirds combined. Populations and harvest of mourning doves are stable to slightly decreasing. Eurasian collared-doves are beginning to appear in the bags of dove hunters as populations exponentially increase. American crows are abundant in Illinois and a local nuisance. West Nile Virus reduced crow abundance in some areas in recent years, with indications populations are rebounding.

*White-tailed deer* - White-tailed deer, the most popular game mammal in Illinois, are abundant statewide (Figure 9), and the harvest is increasing. The herd is estimated at 750,000 to 800,000, with recent hunter harvests of about 180,000 animals. Efforts are on-going to contain and eradicate Chronic Wasting Disease in northern Illinois. Deer-vehicle collisions, crop/property damage and adverse effects of heavy browsing on natural areas are persistent issues, and herd size somewhat exceeds desired levels.

*Rabbits & squirrels* - Although cottontail and squirrel populations have been stable in recent years in Illinois, the harvest is shrinking as fewer hunters pursue them. Swamp rabbits are localized and uncommon in floodplain forests in southern Illinois (Figure 10).

*Furbearers* - Many furbearers are common to abundant in Illinois and harvest is limited by trapper/hunter effort rather than population size. Badgers are widespread. Abundance of red foxes may have decreased in recent decades due to interactions with coyotes and limited availability of grassland habitat. Declines in the gray fox population are suspected with unknown causes. While not legal to harvest at present, conservation efforts have recovered the bobcat and river otter in Illinois. Reports of otter damage to fisheries (particularly in small impoundments) are increasing.

Conclusions:

Completion of Jobs 2.1 and 2.2 provides information on the distribution and abundance of priority species (required element 1) and the distribution and abundance of game species. Data from Jobs 2.1 and 2.2 will form a baseline for monitoring priority species, and the effectiveness of conservation actions. The information compiled in Jobs 2.1 and 2.2 (e.g., Table 1, this report) will be updated as new information becomes available (required element 5), and thus will be employed in future iterations of the Illinois Comprehensive Wildlife Conservation Plan/Strategy (required element 6).

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**Table 1. Status of Illinois' Wildlife Resources.** Status is described as a population estimate (*N*) if available, a population trend (*Trend*) scored from -2 (strongly decreasing) to +2 (strongly increasing), and *Listing*, if a species is listed as threatened or endangered at the state or federal level. Color-coded cells reflect the quantity/quality of information considered for this exercise and the expertise level of the scientist(s) completing the exercise (green: moderate to high confidence; yellow: low confidence; red: very low confidence/no information); **FE** - Federally Endangered; **FT** - Federally Threatened; **FC** - Federal candidate for listing under the Endangered Species Act; **XN** - experimental non-essential population of a federally-listed species; **SE** - State Endangered; **ST** - State Threatened

| **MUSSELS** | | | |
|---|---|---|---|
| Resource - Species | Status | | |
| | N | Trend | Listing |
| Alasmidonta viridis (slippershell mussel) | | -1 | ST |
| Arcidens confragosus (rock pocketbook) | | 0 | |
| Cyclonaias tuberculata (purple wartyback) | | -1 | ST |
| Cyprogenia stegaria (fanshell mussel) | | -2 | FE SE |
| Cumberlandia monodonta (spectacle case mussel) | | -2 | SE |
| Ellipsaria lineolata (butterfly) | | -1 | ST |
| Elliptio crassidens (elephant-ear mussel) | | -1 | ST |
| Elliptio dilatata (spike) | | -2 | ST |
| Epioblasma triquetra (snuffbox mussel) | | -2 | SE |
| Fusconaia ebena (ebonyshell) | | -1 | ST |
| Lampsilis abrupta (pink mucket) | | -2 | FE SE |
| Lampsilis fasciola (wavy-rayed lampmussel) | | -1 | SE |
| Lampsilis higginsii (Higgins eye) | | -2 | FE SE |
| Lasmigona compressa (creek heelspliter) | | -1 | |
| Lasmigona costata (fluted shell) | | -1 | |
| Ligumia recta (black sandshell) | | -1 | ST |
| Plethobasus cooperianus (orange-foot pimpleback) | | -2 | FE SE |
| Plethobasus cyphyus (sheepnose mussel) | | -2 | SE |
| Pleurobema clava (clubshell) | | -2 | FE SE |
| Pleurobema cordatum (Ohio pigtoe) | | -1 | SE |
| Potamilus capax (fat pocketbook pearly mussel) | | -2 | FE SE |
| Ptychobranchus fasciolaris (kidneyshell mussel) | | -2 | SE |
| Quadrula cylindrica (rabbitsfoot mussel) | | -2 | SE |
| Quadrula metanerva (monkeyface) | | -1 | |
| Simpsonaias ambigua (salamander mussel) | | -2 | SE |
| Toxolasma lividus (purple lilliput mussel) | | -1 | SE |
| Venustaconcha ellipsiformis (ellipse) | | -1 | |
| Villosa iris (rainbow mussel) | | -2 | SE |
| Villosa lienosa (little spectacle case mussel) | | -1 | ST |

Completed by Kevin Cummings and Robert Szafoni, with Dave Day - 6 August 2004

| FISHES | | | |
|---|---|---|---|
| Resource - Species | Status | | |
| | N | Trend | Listing |
| *Species in Greatest Need of Conservation* | | | |
| Acipenser fulvescens (lake sturgeon) | | 0 | SE |
| Anguilla rostrata (American eel) | | -2 | |
| Ameiurus nebulosis (brown bullhead) | | -1 | |
| Ammocrypta clara (western sand darter) | | -1 | SE |
| Ammocrypta pellucida (eastern sand darter) | | 1 | ST |
| Campostoma oligolepis (largescale stoneroller) | | 0 | |
| Carpoides velifer (highfin carpsucker) | | -1 | |
| Catostomus catostomus (longnose sucker) | 0? | 0? | ST |
| Centrarchus macropterus (flier) | | 0 | |
| Coregonus artedi (cisco or lake herring) | | | ST |
| Coregonus clupeaformis (lake whitefish) | | | |
| Cottus bairdi (mottled sculpin) | | 0 | |
| Cottus carolinae (banded sculpin) | | 0 | |
| Couesius plumbeus (lake chub) | | | |
| Crystallaria asprella (crystal darter) | 0? | 0 | |
| Culaea inconstans (brook stickleback) | | 0 | |
| Cycleptus elongatus (blue sucker) | | 1 | |
| Cyprinella venusta (blacktail shiner) | | 0 | |
| Elassoma zonatum (banded pygmy sunfish) | | -1 | |
| Erimystax x-punctatus (gravel chub) | | -1 | ST |
| Erimyzon sucetta (lake chubsucker) | | 0 | |
| Esox lucius (northern pike - native stocks) | | -1 | |
| Esox masquinongy (muskellunge - native stocks) | 0 | | |
| Etheostoma camurum (bluebreast darter) | | 0 | SE |
| Etheostoma chlorosomum (bluntnose darter) | | 0 | |
| Etheostoma crossopterum (fringed darter) | | | |
| Etheostoma exile (Iowa darter) | | 1 | ST |
| Etheostoma histrio (Harlequin darter) | | 2 | SE |
| Etheostoma proelaire (cypress darter) | | 0 | |
| Etheostoma squamiceps (spottail darter) | | 0 | |
| Forbesichthys agassizi (spring cavefish) | <1000 | 0 | |
| Fundulus diaphanus (banded killifish) | | -1 | ST |
| Fundulus dispar (starhead topminnow) | | -1 | ST |
| Hybognathus hayi (cypress minnow) | near 0 | 0? | SE |
| Hybopsis amblops (bigeye chub) | | 0 | SE |
| Hybopsis amnis (pallid shiner) | 1 location | 0? | SE |
| Ichthyomyzon fossor (northern brook lamprey) | | 0 | SE |
| Ichthyomyzon unicuspis (silver lamprey) | | 0 | |
| Lampetra aepyptera (least brook lamprey) | | 0 | ST |
| Lampetra appendix (American brook lamprey) | | 0 | |
| Lepomis miniatus (redspotted sunfish) | | -2 | ST |
| Lepomis symmetricus (bantam sunfish) | | | ST |
| Lythrurus fumeus (ribbon shiner) | | -1 | |
| Macrhybopsis gelida (sturgeon chub) | | 0 | SE |
| Macrhybopsis meeki (sicklefin chub) | | 0 | |
| Micropterus dolomieu (smallmouth bass) | | 1 | |
| Micropterus punctulatus (spotted bass) | | 1 | |
| Moxostoma carinatum (river redhorse) | | 1 | ST |
| Moxostoma duquesnei (black redhorse) | | 1 | |
| Moxostoma valenciennesi (greater redhorse) | | 1 | SE |
| Myoxocephalus quadricornis (fourhorn sculpin) | | 0 | |
| Nocomis micropogon (river chub) | | -1 | SE |
| Notropis anogenus (pugnose shiner) | | -2 | SE |

| **FISHES, continued** | | | |
|---|---|---|---|
| Resource - Species | Status | | |
| | N | Trend | Listing |
| Notropis boops (bigeye shiner) | | -2 | SE |
| Notropis buchanani (ghost shiner) | | -1 | |
| Notropis chalybaeus (ironcolor shiner) | | 0 | ST |
| Notropis heterodon (blackchin shiner) | | 0 | ST |
| Notropis heterolepis (blacknose shiner) | | -1 | SE |
| Notropis maculatus (taillight shiner) | 1 location | 0 | SE |
| Notropis nubilus (Ozark minnow) | | 0 | |
| Notropis rubellus (rosyface shiner) | | -1 | |
| Notropis shumardi (silverband shiner) | | 0 | |
| Notropis texanus (weed shiner) | | 0 | SE |
| Noturus eleutherus (mountain madtom) | | -1 | |
| Noturus exilis (slender madtom) | | -1 | |
| Noturus stigmosus (northern madtom) | | -1 | SE |
| Opsopoeodus emilae (pugnose minnow) | | -1 | |
| Perca flavescens (yellow perch) | | 1 | |
| Percopisis omiscomaycus (trout-perch) | | 0 | |
| Phoxinus erythrogaster (southern redbelly dace) | | 0 | |
| Polyodon spathula (North American paddlefish) | | -1 | |
| Rhyinichthys atratulus (blacknose dace) | | 0 | |
| Rhyinichthys cataractae (longnose dace) | | 0 | |
| Salvelinus fontinalis (brook trout) | 0 | 0 | |
| Salvelinus namaycush (lake trout) | | | |
| Scaphirhynchus albus (pallid sturgeon) | | -1 | FE SE |
| Scaphirhynchus platorhynchus (shovelnose sturgeon) | | -1 | |
| Stizostedion canadense (sauger - native stock) | | 1 | |
| Stizostedion vitreum (walleye - native stock) | | 1 | |
| Umbra limi (central mudminnow) | | 0 | |
| | | | |
| *Game Species* | (angler days[1]) | | |
| Trout - Lake Michigan | [illegible] | 1 | |
| Trout - inland | [illegible] | 0 | |
| Salmon - Lake Michigan | [illegible] | 1 | |
| Smelt | [illegible] | -2 | |
| Northern pike, muskie | 1062166 | 0 | |
| Walleye, sauger | [illegible] | 1 | |
| Yellow perch | 457143 | -2 | |
| Largemouth bass | 9442328 | 0 | |
| Smallmouth bass, spotted bass | 1493274 | 0 | |
| White bass, yellow bass | 1028328 | 0 | |
| Striped bass & hybrids | 514616 | 0 | |
| Catfish | 6543927 | 1 | |
| Bullhead | 595278 | 0 | |
| Sunfish | 4303262 | 1 | |
| Crappie | 5868962 | 0 | |
| Carp | [illegible] | -1 | |
| Other fish | 161897 | 0 | |

[1] Illinois Department of Natural Resources. 2000. 1998 Illinois Sport Fishing Survey. Special Fisheries Report No. 57.

Matrix completed by Trent Thomas, Ann Holtrop, Dave Day, with Jeff Walk; 5 August 2004

| **AMPHIBIANS & REPTILES** | | | |
|---|---|---|---|
| Resource - Species | Status | | |
| | N | Trend | Listing |
| *Species in Greatest Need of Conservation* | | since 1985 | |
| AMPHIBIANS | | | |
| Ambystoma jeffersonianum (Jefferson salamander) | [illegible] counties | | ST |
| Ambystoma laterale (blue-spotted salamander) | 6 counties | 0 | |
| Ambystoma platineum (silvery salamander) | 1 county | | SE |
| Ambystoma talpoideum (mole salamander) | | 0 | |
| Cryptobranchus alleganiensis (hellbender) | no records since 1990 | -2 | SE |
| Desmognathus conanti (spotted dusky salamander) | 2 counties | 0 | SE |
| Gastrophryne carolinensis (eastern narrowmouth toad) | | -1 | ST |
| Hemidactylium scutatum (four-toed salamander) | | -1 | ST |
| Hyla avivoca (bird-voiced treefrog) | 6 counties | -1 | ST |
| Necturus maculosus (mudpuppy) | | -1 | |
| Pseudacris streckeri illinoensis (Illinois chorus frog) | 7 counties | 0 | ST |
| Rana areolata (crayfish frog) | | -1 | |
| Rana palustris (pickerel frog) | | 0 | |
| Rana sylvatica (wood frog) | | 0 | |
| | | | |
| REPTILES | | | |
| Apalone mutica (smooth softshell turtle) | | 0 | |
| Clemmys guttata (spotted turtle) | 1 location | -2 | SE |
| Clonophis kirtlandii (Kirtland's snake) | | -1 | ST |
| Crotalus horridus (timber rattlesnake) | | 0 | ST |
| Elaphe emoryi (great plains rat snake) | 2 counties | -1 | SE |
| Emydoidea blandingii (Blanding's turtle) | | -1 | ST |
| Farancia abacura (mud snake) | | 0 | |
| Heterodon nasicus (western hognose snake) | | 0 | ST |
| Kinosternon flavescens (Illinois mud turtle) | | -1 | SE |
| Kinosternon subrubrum (eastern mud turtle) | | 0 | |
| Macrochelys temminckii (alligator snapping turtle) | no records since 1978 | -1 | SE |
| Masticophis flagellum (coachwhip) | no records since 1974 | -2 | SE |
| Nerodia cyclopion (Mississippi green water snake) | 1 location | 0 | ST |
| Nerodia erythrogaster neglecta (n. copperbelly watersnake) | | 0 | Admin Rule [1] |
| Nerodia fasciata (broad-banded water snake) | no records since 1954 | -2 | SE |
| Liochlorophis vernalis (smooth green snake) | | -1 | |
| Ophisaurus attenuatus (slender glass lizard) | | -1 | |
| Pseudemys concinna (river cooter) | | 0 | SE |
| Sistrurus catenatus catenatus (eastern massasauga) | | -2 | SE |
| Tantilla gracilis (flathead snake) | 2 counties | -1 | ST |
| Terrapene ornata (ornate box turtle) | | 0 | |
| Thamnophis sauritus (eastern ribbon snake) | | 0 | ST |
| Tropidoclonion lineatum (lined snake) | | -1 | ST |
| | | | |
| *Game Species* | (harvest) | | |
| Bullfrog | | 1 | |

[1] *N. E. neglecta* is protected by Illinois Administrative Rule, part 880.70, in 14 southeastern Illinois counties

Matrix completed 23 August 2004 by Scott Ballard, Mike Redmer, with Jeff Walk

| BIRDS | | | |
|---|---|---|---|
| Resource - Species | Status | | |
| | N | Trend | Listing |
| *Species in Greatest Need of Conservation* | | since 1985 | |
| Ammodramus henslowii (Henslow's sparrow) | 1,500 | [redacted] | [redacted] |
| Ammodramus leconteii (LeConte's sparrow)[1] | | -1 | [redacted] |
| Ammodramus nelsoni (Nelson's sharp-tailed sparrow)[1] | | -1 | [redacted] |
| Ammodramus savannarum (grasshopper sparrow) | 240,000 | [redacted] | [redacted] |
| Anas rubripes (American black duck)[1] | | [redacted] | [redacted] |
| Ardea alba (great egret) | | [redacted] | [redacted] |
| Asio flammeus (short-eared owl) | <50 | 0 | [redacted] |
| Aythya affinis (lesser scaup) | | [redacted] | [redacted] |
| Aythya valisineria (canvasback) | | [redacted] | [redacted] |
| Bartramia longicauda (upland sandpiper) | <500 | [redacted] | [redacted] |
| Bonasa umbellus (ruffed grouse) | | -1 | [redacted] |
| Botaurus lentiginosus (American bittern) | <100 | -1 | [redacted] |
| Buteo lineatus (red-shouldered hawk) | | [redacted] | [redacted] |
| Buteo platypterus (broad-winged hawk) | | [redacted] | [redacted] |
| Buteo swainsoni (Swainson's hawk) | <20 | -1 | [redacted] |
| Calcarius pictus (Smith's longspur)[1] | | [redacted] | [redacted] |
| Calidris himantopus (stilt sandpiper)[1] | | -2 | [redacted] |
| Caprimulgus carolinensis (chuck-will's-widow) | | [redacted] | [redacted] |
| Caprimulgus vociferus (whip-poor-will) | 36,000 | [redacted] | [redacted] |
| Certhia americana (brown creeper) | | [redacted] | [redacted] |
| Chaetura pelagica (chimney swift) | 800,000 | [redacted] | [redacted] |
| Charadrius melodus (piping plover) | [redacted] | [redacted] | [redacted] |
| Chordeiles minor (common nighthawk) | | [redacted] | [redacted] |
| Chlidonias niger (black tern) | <100 | -1 | [redacted] |
| Circus cyaneus (northern harrier) | <100 | 0 | [redacted] |
| Cistothorus palustris (marsh wren) | | -2 | [redacted] |
| Cistothorus platensis (sedge wren) | 17,000 | -1 | [redacted] |
| Coccyzus americanus (yellow-billed cuckoo) | 210,000 | [redacted] | [redacted] |
| Coccyzus erythropthalmus (black-billed cuckoo) | 6,600 | -1 | [redacted] |
| Colaptes auratus (northern flicker) | 150,000 | [redacted] | [redacted] |
| Colinus virginianus (northern bobwhite) | 320,000 | [redacted] | [redacted] |
| Coturnicops noveboracensis (yellow rail)[1] | | [redacted] | [redacted] |
| Cygnus buccinator (trumpeter swan)[1] | | 1 | [redacted] |
| Dendroica cerulea (cerulean warbler) | 400 | -2 | [redacted] |
| Dendroica discolor (prairie warbler) | 8,300 | -1 | [redacted] |
| Dolichonyx oryzivorus (bobolink) | | [redacted] | [redacted] |
| Egretta caerulea (little blue heron) | <5 colonies | -1 | [redacted] |
| Egretta thula (snowy egret) | <5 colonies | -1 | [redacted] |
| Empidonax traillii (willow flycatcher) | 31,000 | [redacted] | [redacted] |
| Empidonax virescens (Acadian flycatcher) | 62,000 | [redacted] | [redacted] |
| Euphagus carolinus (rusty blackbird)[1] | | -2 | [redacted] |
| Falco peregrinus (peregrine falcon) | <20 | [redacted] | [redacted] |
| Gallinula chloropus (common moorhen) | <200 | -1 | [redacted] |
| Gallinago delicatata (Wilson's snipe) | | 0 | [redacted] |
| Grus americana (whooping crane)[1] | | 1 | [redacted] |
| Grus canadensis (sandhill crane) | 100-200 | [redacted] | [redacted] |
| Haliaeetus leucocephalus (bald eagle) | [redacted] | [redacted] | [redacted] |
| Helmitheros vermiforma (worm-eating warbler) | 4,600 | -1 | [redacted] |
| Hylocichla mustelina (wood thrush) | 97,000 | [redacted] | [redacted] |
| Icteria virens (yellow-breasted chat) | 110,000 | [redacted] | [redacted] |
| Ictinia mississippiensis (Mississippi kite) | <500 | 0 | [redacted] |
| Ixobrychus exilis (least bittern) | [redacted] | 1 | [redacted] |
| Lanius ludovicianus (loggerhead shrike) | 16,000 | [redacted] | [redacted] |

| **BIRDS, continued** | | | |
|---|---|---|---|
| Resource - Species | Status | | |
| | N | Trend | Listing |
| Laterallus jamaicensis (black rail) | [redacted] | [redacted] | [redacted] |
| Limnodromus griseus (short-billed dowitcher)[1] | | -2 | [redacted] |
| Limnothlypis swainsonii (Swainson's warbler) | <50 | 0 | [redacted] |
| Lophodytes cucullatus (hooded merganser) | | 0 | [redacted] |
| Melanerpes erythrocephalus (red-headed woodpecker) | 180,000 | [redacted] | [redacted] |
| Nyctanassa violacea (yellow-crowned night-heron) | <100 | 0 | [redacted] |
| Nycticorax nycticorax (black-crowned night-heron) | <500 | 0 | [redacted] |
| Oporornis agilis (Connecticut Warbler)[1] | | [redacted] | [redacted] |
| Oporornis formosus (Kentucky warbler) | 18,000 | [redacted] | [redacted] |
| Pandion haliaetus (osprey) | <20 | 0 | [redacted] |
| Passerculus sandwichensis (savannah sparrow) | | [redacted] | [redacted] |
| Phalaropus tricolor (Wilson's phalarope) | <100 | 0 | [redacted] |
| Pluvialis dominica (American golden-plover)[1] | | -2 | [redacted] |
| Podilymbus podiceps (pied-billed grebe) | | 1 | [redacted] |
| Rallus elegans (king rail) | [redacted] | -2 | [redacted] |
| Scolopax minor (American woodcock) | | [redacted] | [redacted] |
| Seiurus aurocapillus (ovenbird) | | [redacted] | [redacted] |
| Spiza americana (dickcissel) | | [redacted] | [redacted] |
| Spizella pusilla (field sparrow) | 270,000 | [redacted] | [redacted] |
| Sterna antillarum (least tern) | [redacted] | -1 | [redacted] |
| Sterna forsteri (Forster's tern) | [redacted] | 0 | [redacted] |
| Sterna hirundo (common tern) | [redacted] | 0 | [redacted] |
| Thryomanes bewickii (Bewick's wren) | <100 | -2 | [redacted] |
| Tringa melanoleuca (greater yellowlegs)[1] | | -2 | [redacted] |
| Tryngites subruficollis (buff-breasted sandpiper)[1] | | -2 | [redacted] |
| Tympanuchus cupido (greater prairie-chicken) | [redacted] | [redacted] | [redacted] |
| Tyto alba (barn-owl) | | -2 | [redacted] |
| Vermiforma pinus (blue-winged warbler) | 1,700 | -1 | [redacted] |
| Vireo belli (Bell's vireo) | 4,000 | -1 | [redacted] |
| Xanthocephalus xanthocephalus (yellow-headed blackbird) | [redacted] | 0 | [redacted] |
| | | | |
| *Game Species* | (harvest) | | |
| Migratory geese (Anserinae) | [redacted] | [redacted] | [redacted] |
| Migratory ducks (Anatinae) | [redacted] | [redacted] | [redacted] |
| Resident Canada geese | [redacted] | [redacted] | [redacted] |
| Nesting ducks (Anatinae) | [redacted] | [redacted] | [redacted] |
| American coots | [redacted] | [redacted] | [redacted] |
| rails (sora, Virginia) | [redacted] | [redacted] | [redacted] |
| Wilson's snipe | [redacted] | [redacted] | [redacted] |
| American woodcock | [redacted] | [redacted] | [redacted] |
| Wild turkey | [redacted] | [redacted] | [redacted] |
| Northern bobwhite | [redacted] | [redacted] | [redacted] |
| Ring-necked pheasant | [redacted] | [redacted] | [redacted] |
| Gray partridge | [redacted] | [redacted] | [redacted] |
| Mourning dove | [redacted] | [redacted] | [redacted] |
| American crow | [redacted] | [redacted] | [redacted] |

[1] Does not breed in Illinois

Matrix completed by J. Walk, July 2004, with M. Ward and S. Bailey

| MAMMALS | | | |
|---|---|---|---|
| Resource - Species | Status | | |
| | N | Trend | Listing |
| *Species in Greatest Need of Conservation* | | since 1985 | |
| Canis lupus (gray wolf)[1] | 0 | 0 | FT ST |
| Corynorhinus rafinesquii (eastern big-eared bat) | 3 summer colonies | 0 | SE |
| Lontra canadensis (river otter) | | 2 | |
| Lynx rufus (bobcat) | | 1 | |
| Microsorex hoyi (pygmy shrew) | | | |
| Microtus pinetorum (woodland vole) | | | |
| Mustela nivalis (least weasel) | | | |
| Myotis austroriparius (southeastern bat) | 4 summer colonies | 0 | SE |
| Myotis grisescens (gray bat) | <4 summer colonies | 0 | FE SE |
| Myotis sodalis (Indiana bat) | | 1 | FE SE |
| Neotoma floridana (eastern woodrat)[2] | 4 colonies [illegible] reintroductions | 1 | SE |
| Ochrotomys nuttalli (golden mouse) | | >0 | ST |
| Ondatra zibethicus (muskrat) | | 0 | |
| Oryzomys palustris (marsh rice rat) | | 0 | ST |
| Peromyscus gossypinus (cotton mouse)[3] | | 0 | |
| Spermophilus franklinii (Franklin's ground squirrel) | | -1 | ST |
| Sylvilagus aquaticus (swamp rabbit) | | 0 | |
| Tamiasciurus hudsonicus (red squirrel) | | 0 | |
| Taxidea taxus (American badger) | | 0 | |
| Urocyon cinereoargenteus (gray fox) | | -1 | |
| | | | |
| *Game Species* | (harvest) | | |
| White-tailed Deer | 182,78 | 1 | |
| Rabbit (Cottontail & Swamp) | 348,614 | -2 | |
| Gray Squirrel | 461,213 | 1 | |
| Fox Squirrel | 444,719 | -2 | |
| Muskrat | 50,895 | | |
| Beaver | 9,388 | | |
| Woodchuck | 8,057 | | |
| Opossum | 35,621 | 0 | |
| Striped Skunk | 3,281 | -1 | |
| Mink | 5,189 | | |
| American Badger | 89 | | |
| Weasel (Least & Long-tailed) | 61 | | |
| Raccoon | 330,084 | -1 | |
| Coyote | 64,141 | 0 | |
| Gray Fox | 1,312 | -1 | |
| Red Fox | 5,438 | -2 | |

[1] Occurs as vagrant only in Illinois

[2] Reintroduction efforts on-going, may obscure population trend

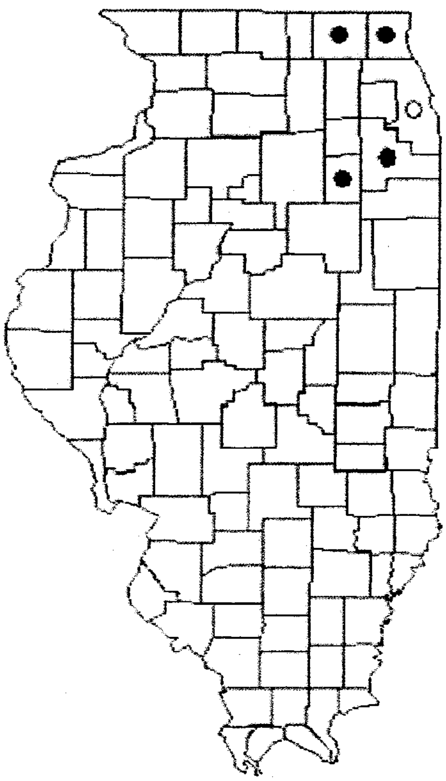
[3] Identification is problematic; may intergrade broadly with other *Peromyscus*

[4] Annual harvest of 140,000 deer results in a stable population. In the short-term, harvest exceeding current levels will be necessary to reduce the herd to a point where a 140,000-animal harvest maintains a stable population.

Matrix completed by Joyce Hofmann, Ed Heske, 16 August 2004, with Jeff Walk

## *Aflexia rubranura* (DeLong)

**REDVEINED PRAIRIE LEAFHOPPER** **CICADELLIDAE Status:** Threatened in Illinois



**Present Distribution:** The redveined prairie leafhopper is found in scattered localities in the Great Lakes region. Specimens have been collected from extreme eastern South Dakota, Wisconsin, northeastern Illinois, northern Michigan, and Manitoulin Island, Ontario, Canada.

**Former Illinois Distribution:** This species is known in Illinois only from Cook, Grundy, Lake, McHenry, and Will counties, but was probably very common when prairies were more prevalent in the state.

**Habitat:** The redveined prairie leafhopper occurs in tall grass prairie sites, and one time was probably a major faunal component where prairie dropseed (*Sporobolus heterolepis*) was a common prairie species (Hamilton 1999). It has recently been found at four sites in Illinois, all on state-owned property.

**Reason For Status:** This leafhopper has apparently become less common in recent years, and is now known from only 28 tall grass prairie sites from throughout its range (Hamilton 1994, 1999). This wingless leafhopper is adversely affected by fire management regimens, as well as the loss of habitat. Many of the sites thought to have the greatest potential for this species have been searched, but only a few redveined prairie leafhopper populations have been found.

**Figure 1.** The information on distribution, abundance, habitat association, and status available for the red-veined prairie leafhopper in Nyboer et al. (2004). Similar accounts in this source are available for all of Illinois' Threatened and Endangered Species. The Illinois Department of Natural Resources' Biotics 4 database is the primary source for current distribution information in the state. All of these accounts are on the accompanying "Information on the Distribution and Abundance of Illinois' Species in Greatest Need of Conservation" disk.

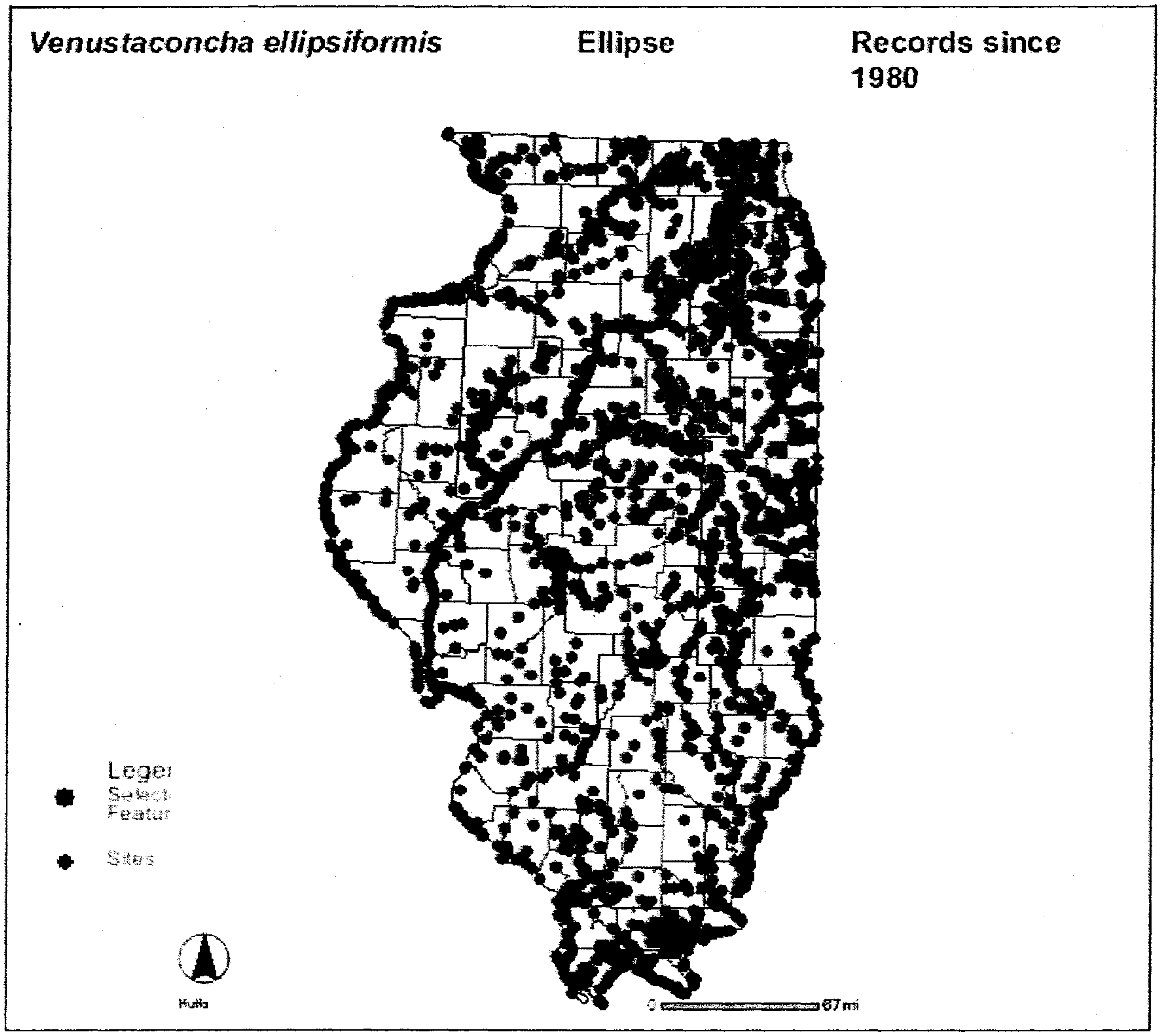



**Figure 2.** The information on distribution and abundance available for the ellipse, a freshwater mussel, in the Illinois Natural History Survey's mussel database. Red dots indicate points where the species has been recorded since 1980, brown dots indicate all sample locations since 1980. The database includes location data, survey dates and personnel, and the number and size classes of all live, dead and relict individuals of all species on each survey date. Similar accounts in this source are available for all of Illinois' Mussels in Greatest Need of Conservation. Similar maps for all of these species are on the accompanying "Information on the Distribution and Abundance of Illinois' Species in Greatest Need of Conservation" disk.

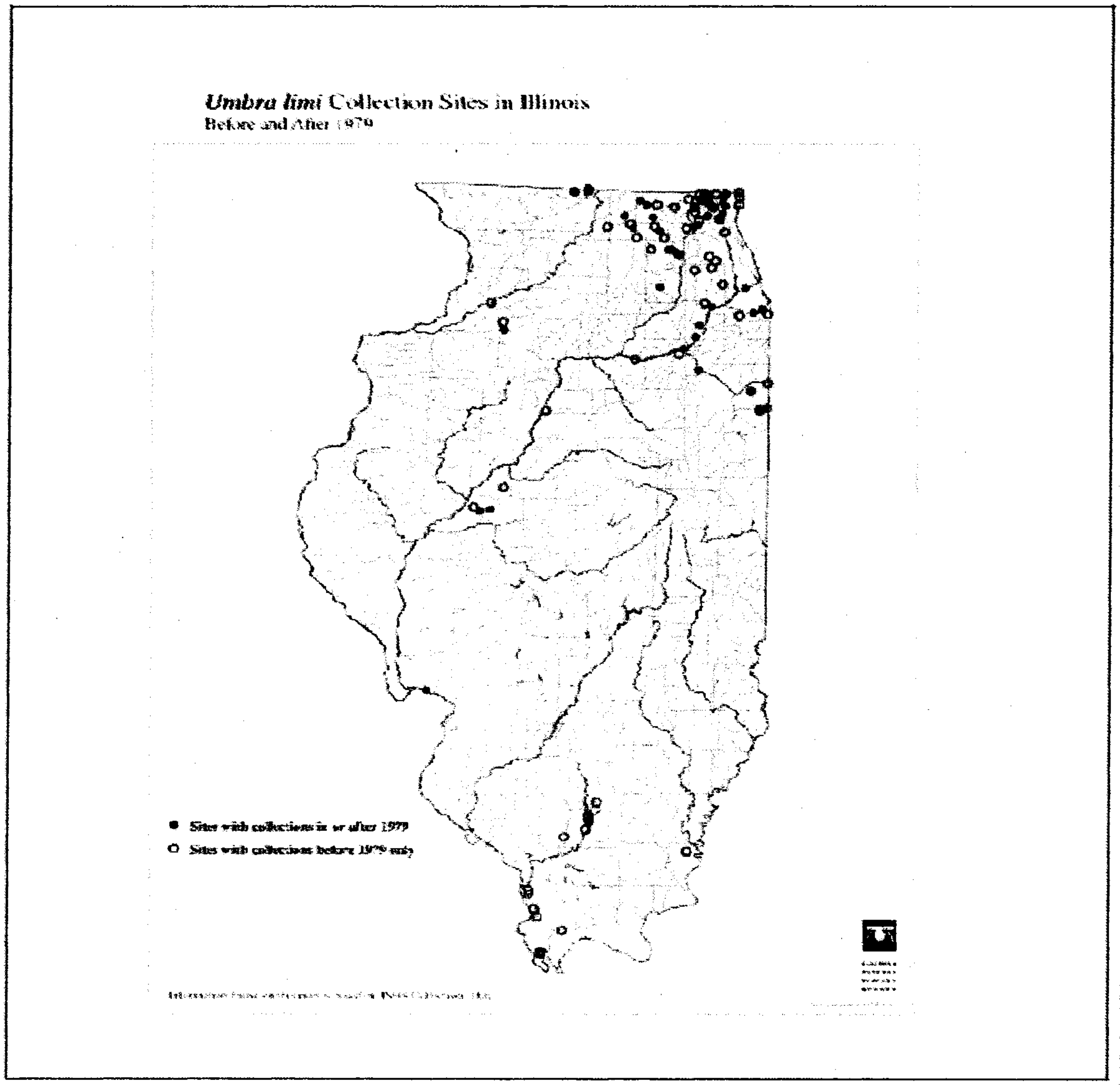
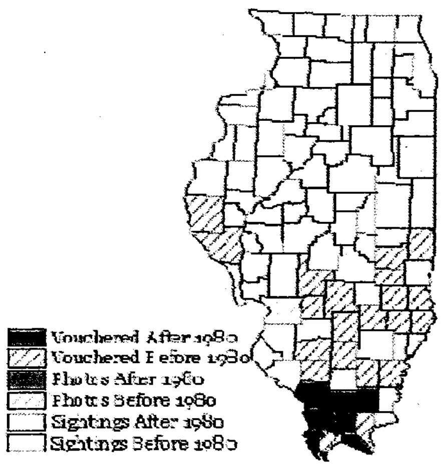



**Figure 3.** The information on distribution and abundance available for the central mudminnow, *Umbra limi*, in the Illinois Natural History Survey's fish collections database. Closed dots indicate points where the species has been recorded since 1980, open dots indicate collections in 1979 or earlier. The database includes location data, survey dates and personnel, and the number and size classes of individuals of all species on each survey date. Similar accounts in this source are available for all of Illinois' Fishes in Greatest Need of Conservation. Similar maps for all of these species are on the accompanying "Information on the Distribution and Abundance of Illinois' Species in Greatest Need of Conservation" disk.




***Rana areolata***

**Crayfish Frog**

Purple shade indicates vouchered specimens. Light blue (cyan) shade indicates photographic records. Yellow shade indicates verified sighting.
Slanted hatch indicates pre-1980 records only

NOTE: Not all specimens upon which these maps are based have been verified.

**Key Characters:** Large head; mottled upper jaws; distinctively humped lower back when at rest; dark spots on back crowded together and encircled by light borders.

**Similar Species:** Northern leopard frog, pickerel frog, plains leopard frog, southern leopard frog.

**Subspecies:** Northern crawfish frog, *R. a. circulosa*.

**Description:** Large (6.6-11 cm SVL) spotted frog with dorsolateral fold along each side of body. Entire belly unspotted white. Snout cone-shaped. Male has paired vocal pouches, at corners of jaw, and enlarged thumbs used for holding onto female during amplexus.

**Habitat:** Prairies, woodlands, and brushy fields in hardpan clay soils in low, wet areas. Common breeding sites include flooded fields, fish-free farm ponds, and small lakes in pastures or on golf courses.

**Natural History:** Lives underground most of year in mammal burrows, storm drains, and abandoned crayfish burrows. Known to eat crayfish and small amphibians and reptiles, mostly at burrow entrances. Adults breed in pools during March-April, sometimes in large numbers. Breeding call is a loud, deep snore. Female lays 3,000-7,000 eggs. Tadpoles transform in midsummer.

**Status:** Formerly widespread in southern half of state. Uncommon and declining in some areas where breeding habitats have been drained or stocked with predatory fishes (see distribution map, above).

**Figure 4.** The information on distribution, abundance, habitat association, natural history and status available for the crayfish frog in Phillips et al. (1999). Similar accounts in this source are available for all of Illinois' Amphibians and Reptiles in Greatest Need of Conservation. All of these accounts are on the accompanying "Information on the Distribution and Abundance of Illinois' Species in Greatest Need of Conservation" disk.

**Figure 5** (*following two pages*). The information on distribution, abundance, habitat association, and status available for the bobolink in Kleen et al. (2004). Similar accounts in this source are available for all of Illinois' Birds in Greatest Need of Conservation that nest within Illinois. Accounts for all of these species are on the accompanying "Information on the Distribution and Abundance of Illinois' Species in Greatest Need of Conservation" disk.

# Bobolink *Dolichonyx oryzivorus*

Chicago Academy of Sciences

**Code: BOBO**
**Range and Distribution: southern Canada, south to central South America.**

**ILLINOIS**
**Abundance: common migrant and fairly common summer resident in north, decreasing southward.**
**Endangered/Threatened Status: none**
**Breeding Habitat: prairie, tall grasslands, wet meadows, and cultivated croplands.**
**Nest: a cup of coarse grass and forbs lined with finer grasses, in dense cover on the ground.**
**Eggs: 5–6, gray to pale reddish brown, marked with browns or purples.**
**Incubation: 10–13 days.**
**Fledging: from 10 to 14 days.**

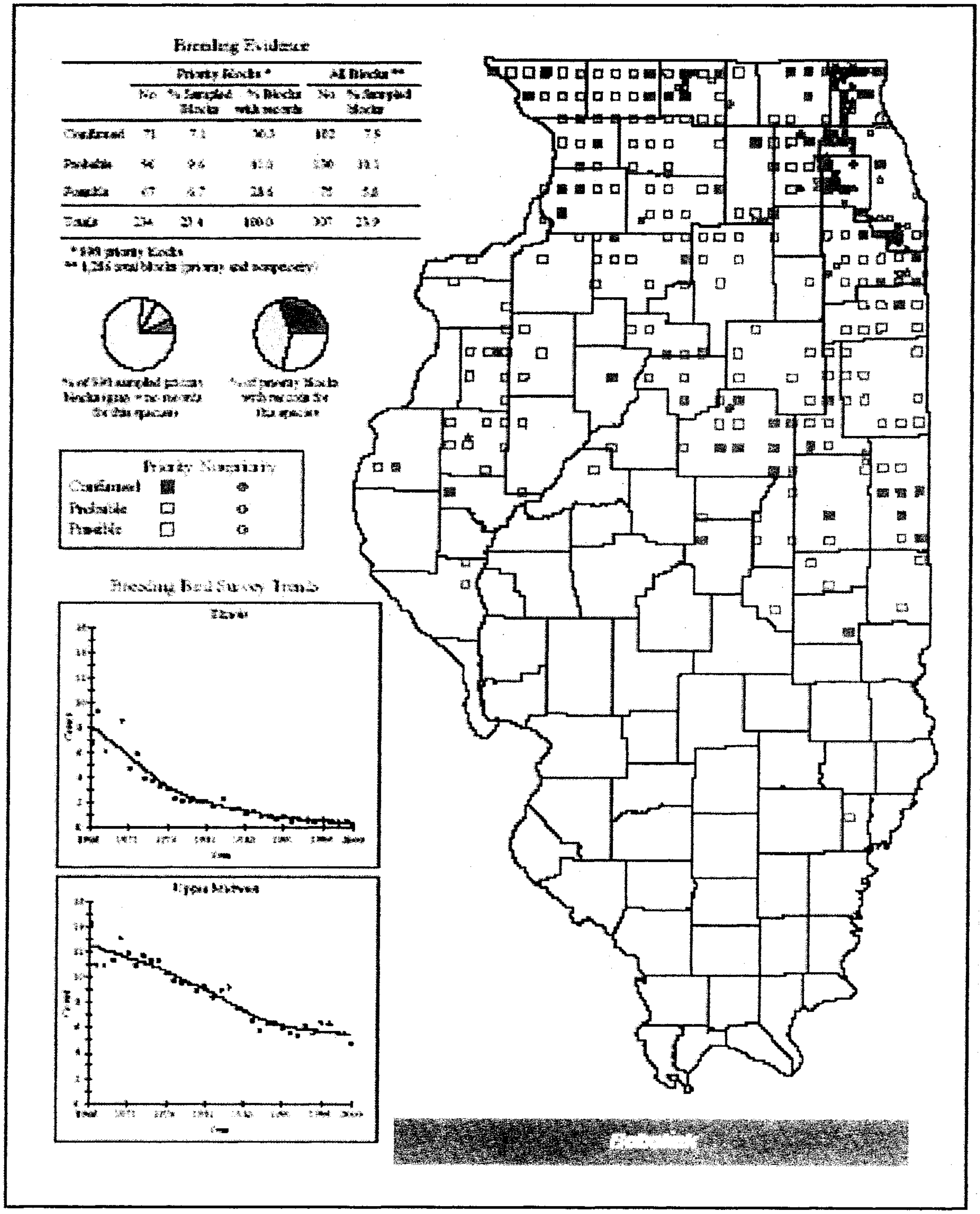
The plumage of the breeding male Bobolink is unique among North American songbirds in that it is white above and black below. Originally a prairie grassland species, the Bobolink now inhabits open fields, hayfields, pastures, and wet meadows and may prefer larger fields with a mixture of grasses and broad-leaved forbs (Martin and Gavin 1995, Fitzgerald and Pashley 2000). Males sing a bubbling song from elevated perches or while flying and circling over their territories. Bobolinks are polygynous; a male frequently pairs with multiple females and the female may lay a clutch of eggs sired by more than one male (Martin 1971, Bollinger and Gavin 1991, Martin and Gavin 1995). Nests are built with grasses and sedges in depressions on the ground where taller vegetation provides shade. Bobolinks breed in southern Canada and the northern half of the U.S. Although populations fluctuate from year to year and place to place, the population has been steadily declining in recent years because of land use changes (e.g. loss of hayfields), changes in the vegetative composition of hayfields, and mowing practices (Martin and Gavin 1995).

### Illinois History
During the late 1800s, Ridgway (1889) reported that the Bobolink bred only in the northern part of Illinois, where it was an abundant summer resident. Cory (1909) likewise indicated that it was "a common summer resident in northern Illinois". Graber and Graber (1963) reported a slight increase in the Bobolink population between 1909 and 1957. From the early 1900s to the 1950s most of the Bobolink population was in the northern part of the state but their numbers had increased substantially in central Illinois by the 1950s (Graber and Graber 1963).

### Breeding Bird Survey Trends
Like many other grassland dependent species, Bobolink populations are in serious decline. BBS data indicate decreases in the population of –[illegible]% per year in Illinois (significant, P < 0.01) and –2.[illegible]% per year in the upper Midwest (significant, P < 0.01) for 1966–2000 (Credibility Index: IL = [illegible] and 124 = [illegible]).

### Distribution
During the atlas project, the Bobolink was limited to the northern half of the state, where they were found in [illegible] and Confirmed as breeding in [illegible] counties. The record in [illegible] County may have been migrants.

### Frequency
The Bobolink was reported from [illegible] ([illegible]%) priority blocks and [illegible] nonpriority blocks. Breeding was Confirmed in 71 ([illegible]%) of the priority blocks; adults feeding young and fledged young were the most frequently used breeding evidence criteria for these 71 Confirmed records ([illegible] FY and [illegible] FL records, respectively). It is likely that Bobolinks nested in most blocks in which they were reported.



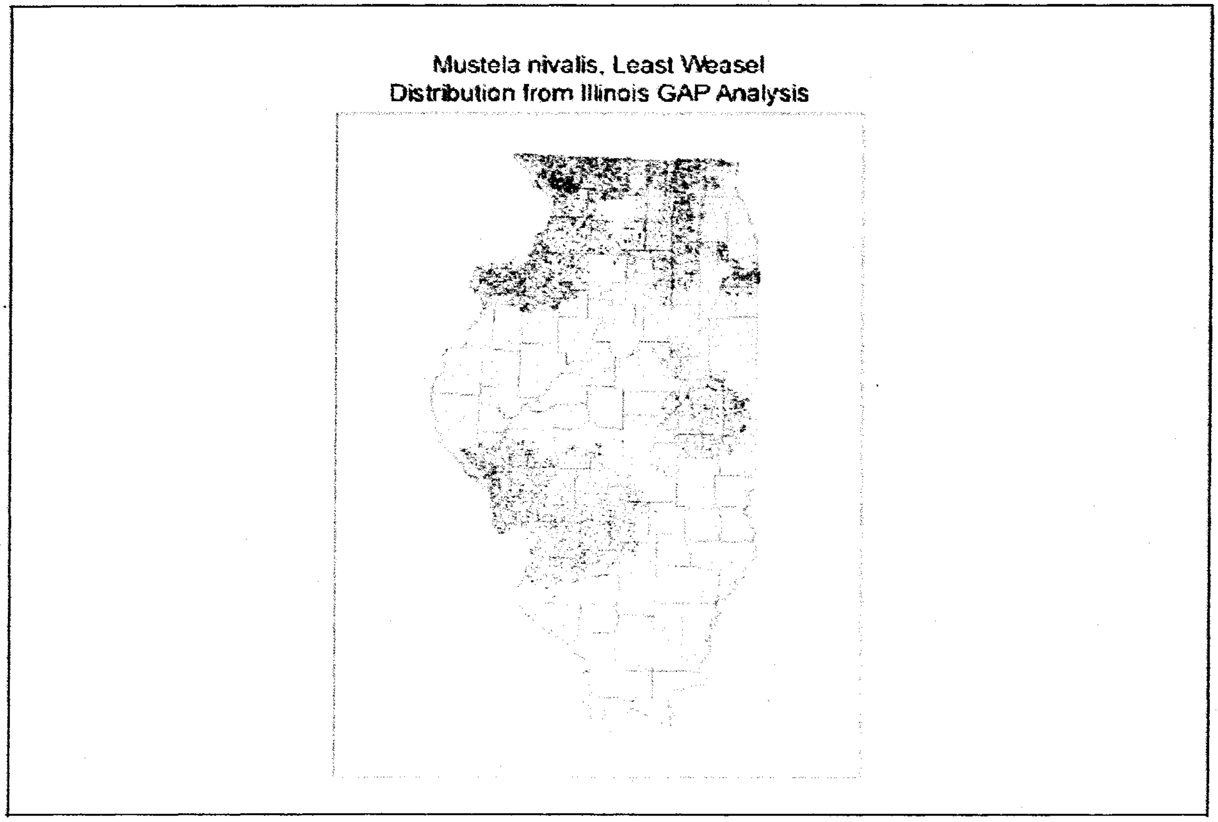



**Figure 6.** The information on distribution of the least weasel from the Illinois GAP Analysis Project (http://www.inhs.uiuc.edu/cwe/gap/). Similar maps from this project are available for all of Illinois' Amphibians, Reptiles, Birds and Mammals in Greatest Need of Conservation. All of these maps for amphibians, reptiles, migrant-only birds, and mammals are on the accompanying "Information on the Distribution and Abundance of Illinois' Species in Greatest Need of Conservation" disk.

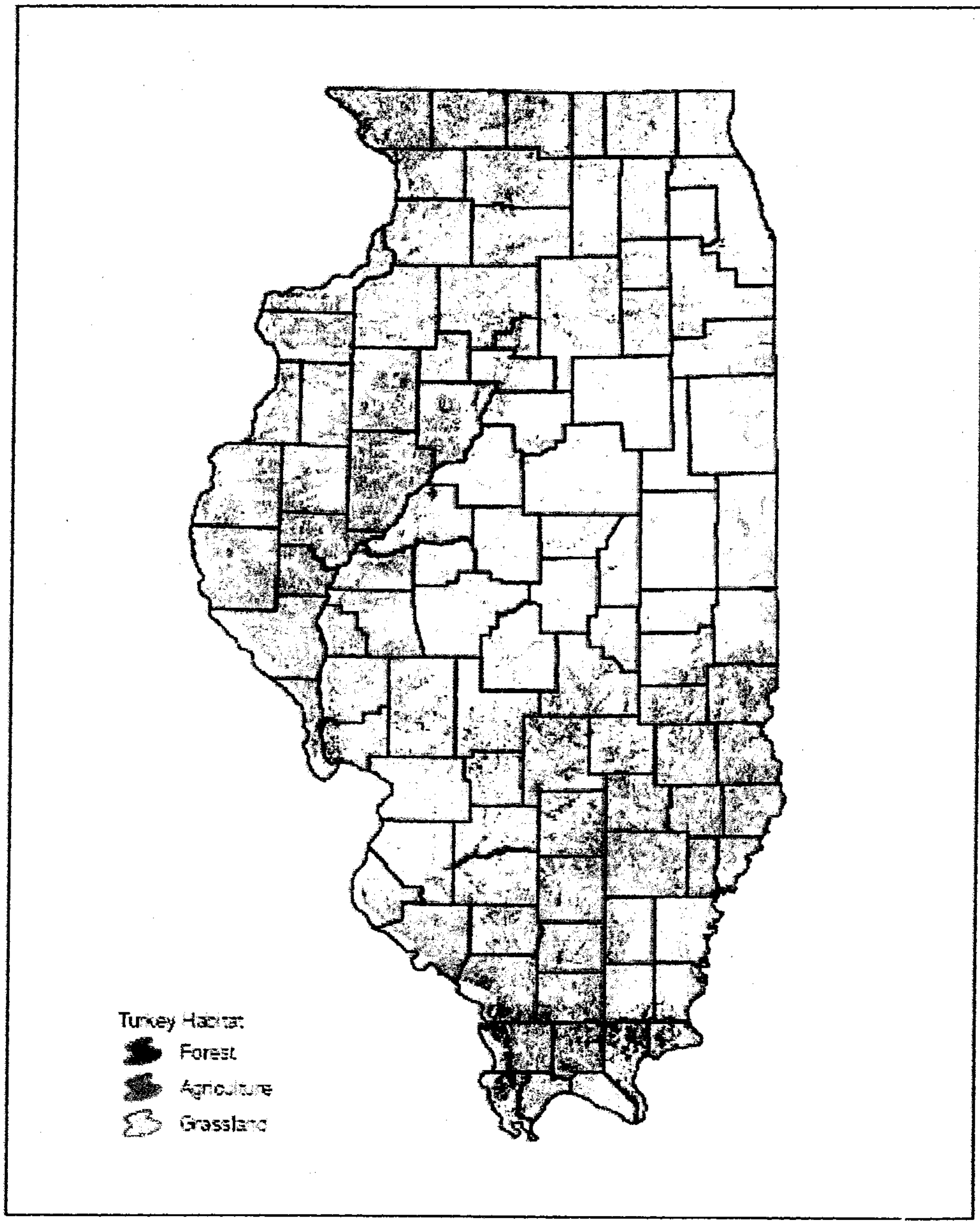



**Figure 7.** Modeled distribution of wild turkey habitat in Illinois. Habitat includes all forest types, and grassland and agricultural lands within approximately 275 m of forested areas, and excludes all areas within approximately 275 m of developed areas (A. Hulin, Illinois Dept. Natural Resources, Div, Wildlife Resources, pers. comm).

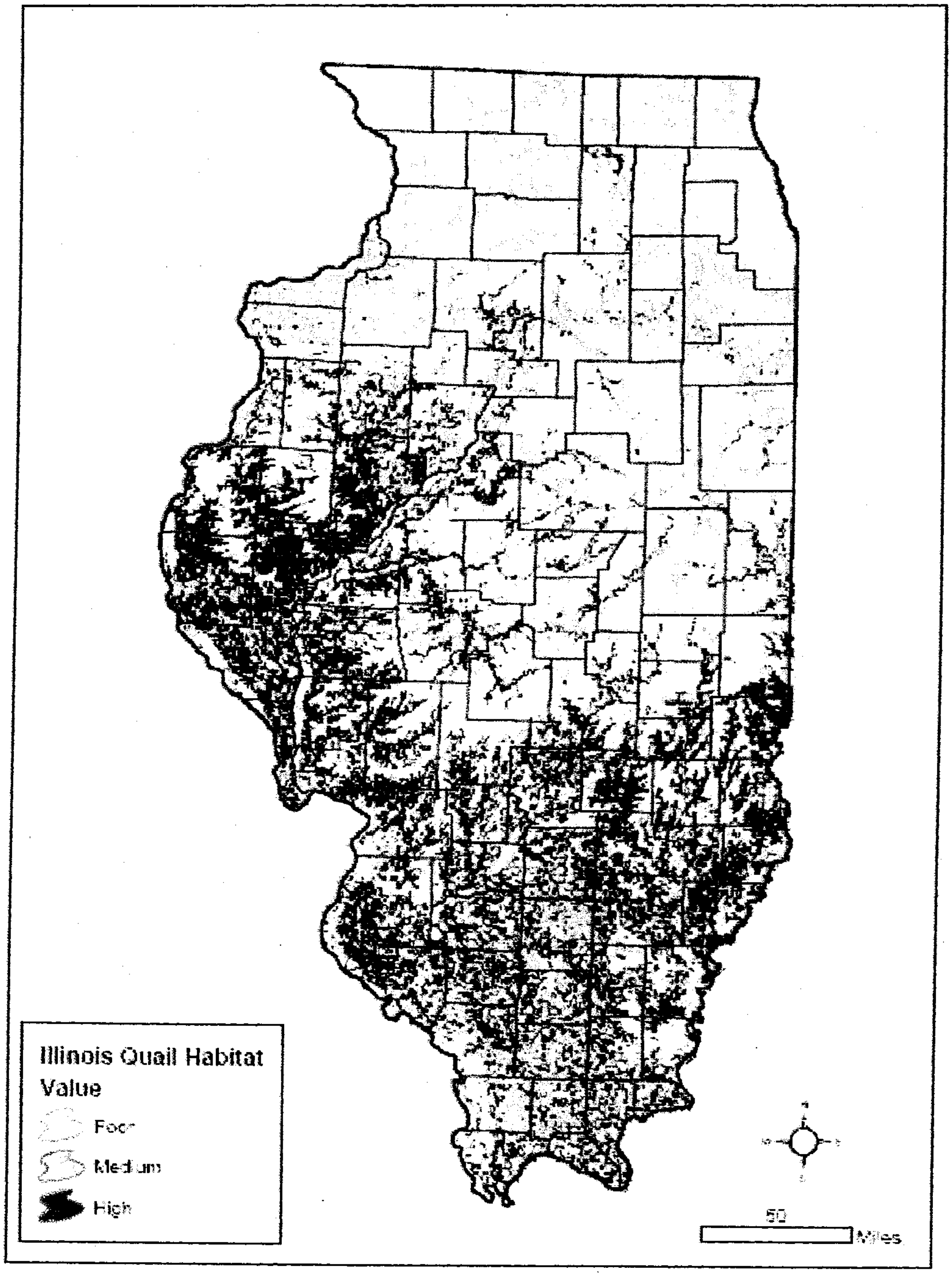



**Figure 8.** Habitat suitability of the northern bobwhite (quail) throughout Illinois. Areas are ranked on the presence and interspersion of cropland, grassland, and wooded land covers (derived from Roseberry and Sudkamp 1998).

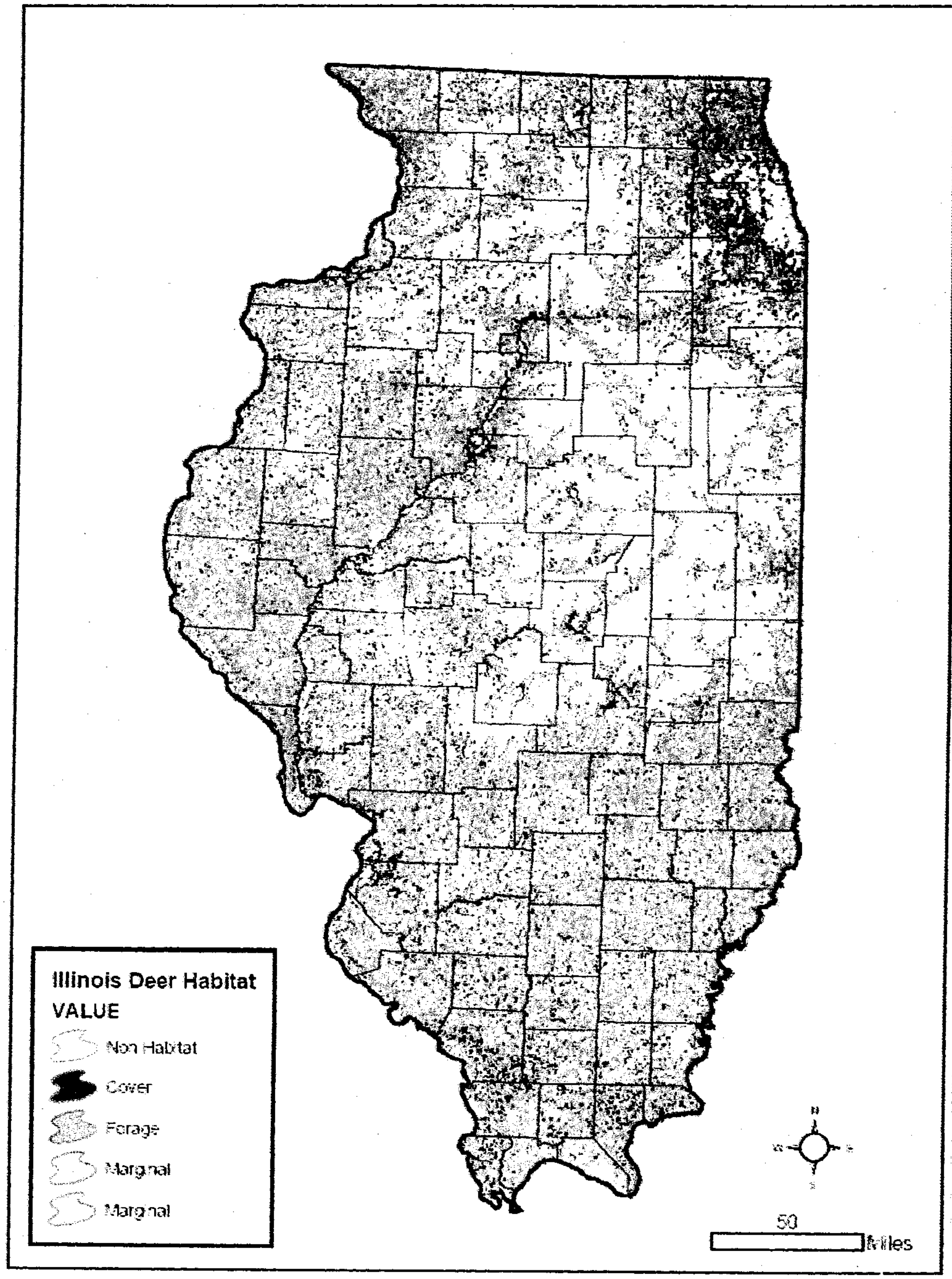



**Figure 9.** White-tailed deer habitat in Illinois, derived from Woolf et al. (1997). Grassland and cropland are "forage" habitats, and open and closed, deciduous and coniferous forest are "cover" habitats. "Marginal" forage was 300-750 m from cover; "marginal" cover was 500-1000 m from forage.

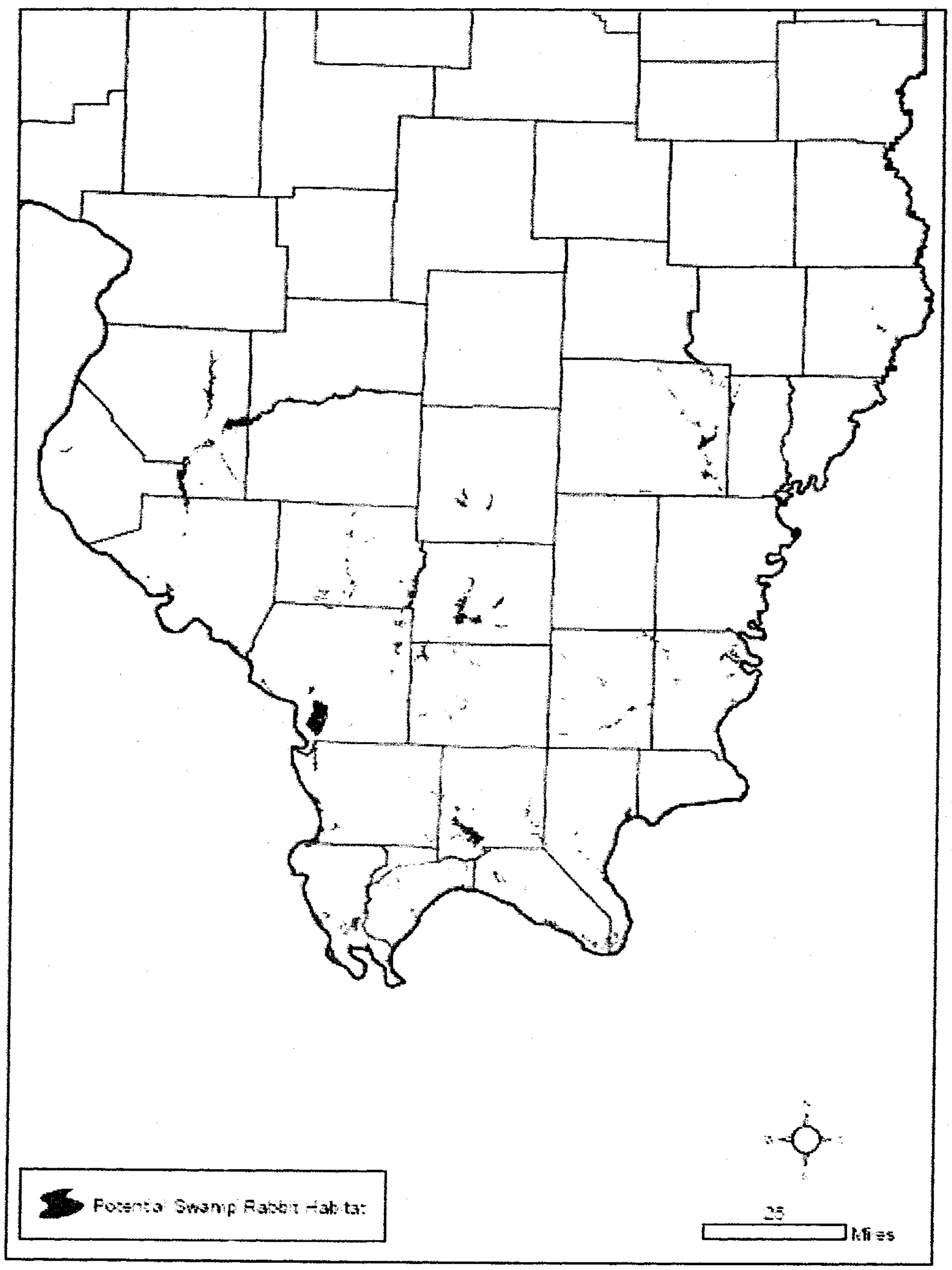



**Figure 10.** Locations of potential swamp rabbit habitat in Illinois. Derived from Woolf and Barbour (2002), based on sightings and floodplain forest land cover.

# STATE WILDLIFE GRANT PROGRAM
# State of Illinois
# Final Performance Report

## Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems

## Project 2 – Identification and Selection of Conservation Elements

### Job 2.3 Location and condition of terrestrial and wetland habitats

Job 2.3 consisted of two related parts: (Part 1) GIS support for the Illinois Wildlife Action Plan (IWAP) and (Part 2) Identification and characterization the remaining key wildlife habitats or "green infrastructure".

### Part 1. GIS support for the Illinois Wildlife Action Plan (IWAP)

The GIS support for the Illinois Wildlife Action Plan was completed in October, 2005 when the final plan was submitted to the National Acceptance Advisory Team. In this first part, GIS technology was used to built on work we conducted under a previous contract with the Illinois Department of Natural Resources (IDNR), to identify key wildlife habitats for species in greatest need of conservation. This study made use of the most current GAP land cover data (1999-2000) to identify and characterize the remaining tracts (hubs) of land of a critical size and the connecting links (corridors) between them. Hubs were based on forests and grasslands identified in the GAP Land Cover of Illinois 1999-2000 database and wetlands from the National Wetlands Inventory (NWI). Corridors were delineated by linear features, which in Illinois are mainly streams and abandoned rail road right-of-ways. The Illinois Streams Information System (ISIS) database and a statewide database of abandoned railroads was the basis for corridors in this study. The final hubs and corridor dataset was characterized for IWAP based on statewide data sets such as the Illinois GAP analysis ecotone and vertebrate models for terrestrial vertebrates, Threatened and Endangered species locations, Illinois Natural Areas Inventory sites, The Nature Conservancy Ecoregions of Illinois, Bird Conservation Regions of Illinois, and the Natural Division of Illinois. Maps were created to facilitate the identification of proposed conservation opportunity areas in state and regional meetings with partner agencies and conservation groups. The deliverables for this section are the final figures that were included in the CWCP final plan (ICWCPS, 2005) and the final areas identified by partner agencies, state biologist, and conservation group (Figure 1)

## Part 2. Identification and characterization the remaining key wildlife habitats or "green infrastructure"

A systematic landscape analysis was performed to identify ecologically significant and critical landscape patches and linkages for potential protection. This is intended to be a system that can be replicated and enhanced as new and improved data become available. This project represents a first step in the identification of critical habitats for protection with the new statewide Illinois Wildlife Action Plan.

### Introduction

### Background

The landscape of Illinois has changed greatly in the past 200 years. Before European settlement, Illinois was 41% forest, 55% prairie and the rest open water and wetlands (Cordle, Szafoni and Greer, 2002). By 2000, Illinois' forest had decreased to 14.6%, prairie had disappeared almost entirely (< 0.001%), replaced by cool season grassland (11.5%) agriculture (65%) and urban areas (6.4%) (INHS, 1999-2000). Much of the conversion of Illinois' land to agriculture was largely complete by the early 1900s. Today, most of the land conversion in Illinois is due to increasing urban areas. In the last 30 years, urban land had increased from 4.7% of the state to (USGS LUDA) to 6.4% (INHS, 1999-2000). Much of this new growth has occurred on the edges of existing urban areas, spreading into agricultural land, forests and wetlands. In Illinois, this growth has been concentrated around major metropolitan areas, especially in the northeastern corner of the state. McGrath (2005) calculated the total urban land area for major cities in the United States and found that Chicago increased in size from 708 sq. miles in 1950, to 960 sq. miles by 1960, 1277 sq. miles by 1970, 1498 sq. miles by 1980 and to 1585 sq. miles by 1990. This more than doubled the urban area (an increase of 877 sq. miles) in 40 years. This development has come primarily at the urban fringes. A number of communities with forested areas nearby have shown an expansion of large, multi-acre lots into these areas. This pattern of urban development consumes large amounts of land and increases fragmentation of the landscape.

Illinois' population grew from 55,211 in 1820 (just after statehood in 1818) to 12,419,293 in 2000 (U.S. Census Bureau). The ten year period from 1990 – 2000 saw 8.6% increase in Illinois' population. Population is projected to increase an additional 8.2% between 2000 and 2030 (U.S. Census Bureau). Land development has increased even faster than population. The Sierra Club (US Census Bureau data) did a study of urban sprawl and found that Chicago's population increased by one percent from 1970 to 1990, while its urbanized area grew by 24 percent.

The scattered pattern of modern development not only consumes an excessive amount of land, it fragments the landscape. Numerous studies have shown the negative ecological effects of forest fragmentation in the landscape (Wilcox and Murphy, 1985, Robertson et al, 1995). As forest areas are divided and isolated by roads and development, interior habitat decreased. This coupled with increased human disturbance and the spreading of opportunistic edge species results in the populations of many animals become too small to persist.

Besides the negative effect on animal populations through the loss of wildlife habitat and migration corridors, normal ecosystem functions such as absorption of nutrients, recharging of water supplies and replenishment of soil are disturbed or destroyed (Saunders et al., 1991). Water quality has been degraded in many rivers and streams and many of Illinois' remaining wetlands have been altered by filling, drainage, impoundment, livestock grazing, logging, direct discharges of industrial wastes and municipal sewage, and indirect pollution from urban and agricultural runoff.

Today, with urban land continuing to sprawl into the surrounding landscape, there is an even more urgent need to accurately identify and protect the most important unprotected natural lands in the state before they are lost. The Department of Natural Resources (IDNR) has many programs for land acquisition, and easements and other forms of protection. Timely knowledge of where key lands and corridors are situated would facilitate these processes.

**What is Green Infrastructure?**

In 1999, the Conservation Fund and the USDA Forest Service formed the Green Infrastructure Work Group (http://www.greeninfrastructure.net). This group developed the following definition for green infrastructure: "Green infrastructure is our nation's natural life support system – an interconnected network of waterways, wetlands, woodlands, wildlife habitats and other natural areas; greenways, parks and other conservation land; working farms, ranches, and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for America's communities and people" (Benedict & McMahon, 2006). A shorter version of the definition for Green Infrastructure was provided by Benedict and McMahon in 2002 as: "an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations".

Two recently completed studies of Green Infrastructure were used as a model for this work. In 2000, Hoctor et al. published the results of their work on an ecological network for Florida. This was extended in 2002 (Carr et al.), for the entire southeastern United States (Florida, Georgia, South Carolina, North Carolina, Alabama, Mississippi, Tennessee and Kentucky). In 2003, Maryland's Green Infrastructure Assessment (Weber, 2002) was finalized.

**Past Illinois Studies - Resource Rich Areas.**

The IDNR has long recognized the value of a landscape level approach to identify natural resources. The use of Geographic Information System (GIS) software and landscape ecology has been proven a real aid to locating remaining wildlife habitats.

Past research, such as the Inventory of Resource Rich Areas (RRA) (Suloway et al., 1996), has evaluated ecological resources in Illinois. The Resource Rich Areas report identified and characterized areas rich in biological resources by Illinois Environmental Protection Agency (IEPA) watersheds. A list of ecological characteristics and functions for large ecological reserves, and criteria to identify and evaluate these areas was developed. Eight hundred sixteen watersheds were evaluated using existing data available for GIS analysis. These datasets included percent of forest and wetlands from the 1995 Critical Trends Assessment Project Land cover, total area of Illinois Natural Areas Inventory (INAI) and total length of Biologically Significant Streams (BSS), as well as supplemental data about Natural Heritage communities, state and federally owned land, Illinois Nature Preserves and natural divisions. The four variables of percent forest and wetland, total area of INAI and total length of BSS were given equal weight. Each watershed was ranked against all other watersheds for each variable. Watersheds were placed into 10% quantiles for each variable and given a score of 10 points for the top quantile, 9 for 81-90% quantile, 8 for 71-80% quantile, etc. Watersheds in which variables did not occur were given a 0 score for that variable. The scores for each variable in each watershed were summed. The maximum possible cumulative score was 40. Watersheds were considered to be rich in resources if their cumulative score ranked in the top 10%. This study, with its watershed level scale is fine as a first attempt to identify important wildlife habitats. However, this process could be improved by a finer scale analysis of potential sites and additional landscape ecology analyses.

**Present Study – Green Infrastructure**

Whereas Resource Rich Areas looked as entire watersheds, Green Infrastructure looked at all possible blocks of land individually. The components of Green Infrastructure consist of core reserves - large patches of natural vegetation, and corridors connecting the core reserves. The corridors are wide swashes of vegetation that provide corridors for wildlife movement, and connections for the core reserves. Together, the core reserves and corridors represent the most ecologically important large size patches remaining in Illinois.

The core reserves or *hub*s are blocks of land that provide living space and areas of origins and destinations for plants and animals. *Links* are the connecting corridors that tie the hubs. These linear remnants of natural land allow plants and animals to move from one hub to another, helping to ensure long-term survival and continued diversity. The hubs and links can range in size, function and ownership, but in order to be successful, they need to provide long-term protection.

**Methods**
**Hub Identification**

For this study, hubs or core areas were defined as contiguous areas at least 20 acres in size, with one or more habitat area of major ecological importance. These habitat areas were delineated by combining forest, grasslands and wetland complexes. In an effort to assess the entire landscape of Illinois, we used the Illinois GAP land cover data to identified forests and grasslands. This statewide land cover data was the result of computer classification of Landsat 5 TM and Landsat 7 ETM+ satellite imagery acquired for three dates (spring, summer, and fall seasons) of 1999 and 2000. Ten TM Path/Row scene areas were required to cover Illinois, and imagery for the same year was acquired for each scene to ensure seasonal consistency for the computer classification. The satellite imagery for four of the TM scene areas was acquired in 1999, and the remaining six scene areas were acquired in 2000.

The forests categories selected from the Illinois GAP land cover were upland deciduous, coniferous, and bottomland forest categories. After removing roads from the GAP land cover, the grassland category was selected from the rural grassland, and other small grains and hay categories. Wetlands were selected from the National Wetlands Inventory (NWI) data. Wetland complexes were created by first identifying forested and emergent wetlands in NWI. The forested wetlands were buffered by 165 meters and emergent wetlands were buffered by 98 meters (as per Brown et al, 1990). Forested and emergent wetlands and their buffers were combined to create wetland complexes. Size thresholds of 150 acres for forest and interior forests (forests with a 120 meter transition zone); 40 acres for grassland and 250 acres for wetlands were used. These size threshold values were based on a visual inspection of the 3 land cover categories at different sizes. Once all 3 land cover categories were combined, developed areas and major roads were removed. An arbitrary size limit was imposed, removing all hubs with areas less than 100 acres. This removed mainly small, isolated areas. Adjacent wetlands and forests were added to the remaining areas, and interior gaps or holes identified. Any undeveloped land, such as wetlands, open water (impoundments, ponds and backwaters), forests and grasslands that occurred in the gaps were identified and added to the hubs. Finally, hubs less than 100 acres in size were again removed (Figure 2). Appendix A has the detailed methods for all steps of this GIS analysis.

**Hub Ranking**

Hubs identified in the proceeding process were next characterized based on the relative importance as potential habitat for wildlife. The ecological parameters used includes measures of size such as the area of critical habitat types within the hub, presence of natural communities or of unique natural resources, amount of protected areas, and spatial relationships. Threat parameters include development pressures, remoteness from roads, and road density within the hubs. This analysis was based on a total of 26 parameters which tried to take in account the ecological importance of the hub areas, and potential risk of loss of wildlife due to development (Table 1). Measures of size and presence for ecological and threat parameters uses exiting databases such as the Illinois Natural Areas Inventory, Illinois Nature Preserve, and public land (e.g. IDNR Owned, Managed and Leased, Properties - OMLP, Illinois Recreational Facilities Inventory - IRFI, IL-GAP project stewardship layer), significant aquatic features (Biological Streams Characterization, and Biological Significant Streams), IL-GAP land cover, pre-settlement land cover (Land Cover of Illinois in the Early 1800s), railroad prairies remnants and floodplain locations. Spatial relationships were calculated using V-Late software and include area, location, type, shape, spatial arrangement relative to other green space, and landscape context (surrounding land cover types). Weighting factors were applied to the final results and a final rank for each hub was derived (Table 2). The ranked hubs were divided into 3 natural breaks and the top third was used in the corridor analysis (Figure 3). Appendix A has the detailed methods for all steps of this GIS analysis.

**Corridor Identification**

Potential corridor ecotypes in Illinois are aquatic and terrestrial areas, wetlands along streams and abandoned rail road right of ways. The Illinois Streams Information System (ISIS) provided the source for the terrestrial habitat corridors. There are two types of bank side vegetation in the ISIS data base, area and bank side. The area vegetation lists the dominant vegetation type from the stream shoreline out to 300 meters, the bank side vegetation has three width categories, 0 – 25 meters, 0 – 75 meters and 0 - > 75 meters. A minimum width of 300 meters was needed, so the area vegetation was chosen as the terrestrial corridor source. The forest land cover type used for the corridors selected the ISIS codes 1 – forest (> 45% canopy cover) and 2 – mixed (< 45% canopy cover and > 55% mixed grass and woody vegetation). The grass land cover type used for the corridors selected the ISIS code 3 – grass (Figure 4). Vegetation types were combined and as long as that land cover was present on one bank, the stream segment was included in the corridor data set.

Linear emergent and forested wetlands from the NWI data were used for the wetland ecotype. Aquatic ecotype data was extracted from Biologically Significant streams and Biological Streams Characterization (level A rating). The streams from these two data sets were combined. Both the wetland and aquatic potential corridors were buffered a minimum of 168 meters, or extended to the Federal Emergency Management Agency (FEMA) flood zones (up to a maximum distance of 305 meters). The final corridor source was the abandoned rail road right of ways from the Illinois statewide railroad database. This was buffered out to the common railroad right of way distance of 15.25 meters for this analysis (Figure 5).

All four potential corridor types were combined and used for the creation of forest and wetland impedance layers. These impedance layers were based on land cover, stream presence, presence or absence or roads and urban areas, slope, and land management. A GIS technique called lease-cost path analysis was used to determine the best paths between the top third hubs. In this analysis, the 'cost' is a measure of the difficulty for wildlife to travel along the corridors. The best corridor is the pathway between two hubs with the fewest obstacles (roads, bridges, and urban areas), and the most favorable habitat (forest, grassland, wetlands), was the least-cost path. Figure 6 shows the final top third hubs and the connecting corridors. Appendix A has the detailed methods for all steps of this GIS analysis.

## Results, Benefits, and Deliverables

The goal of this component was the creation a statewide, GIS database of habitat 'hubs' and connecting 'corridors' that can be used to help identify the important wildlife habitat remaining in Illinois. This data is intended to be used along with the 'on the ground' knowledge of the statewide areas by resource experts (IDNR resource biologist, INHS research scientist, partner agency biologist, etc.) to help guide conservation, management, land acquisition, and restoration efforts. Figure 7 shows how the ranked Hubs compare with the areas selected by these experts in part 1 of this job. This GIS data layer will provide one of the base layers to help develop, support, and enhance conservation efforts of the CWCP. A compact disk of the final data sets, parameters used to rank the hubs, figures and the detailed GIS methodology.

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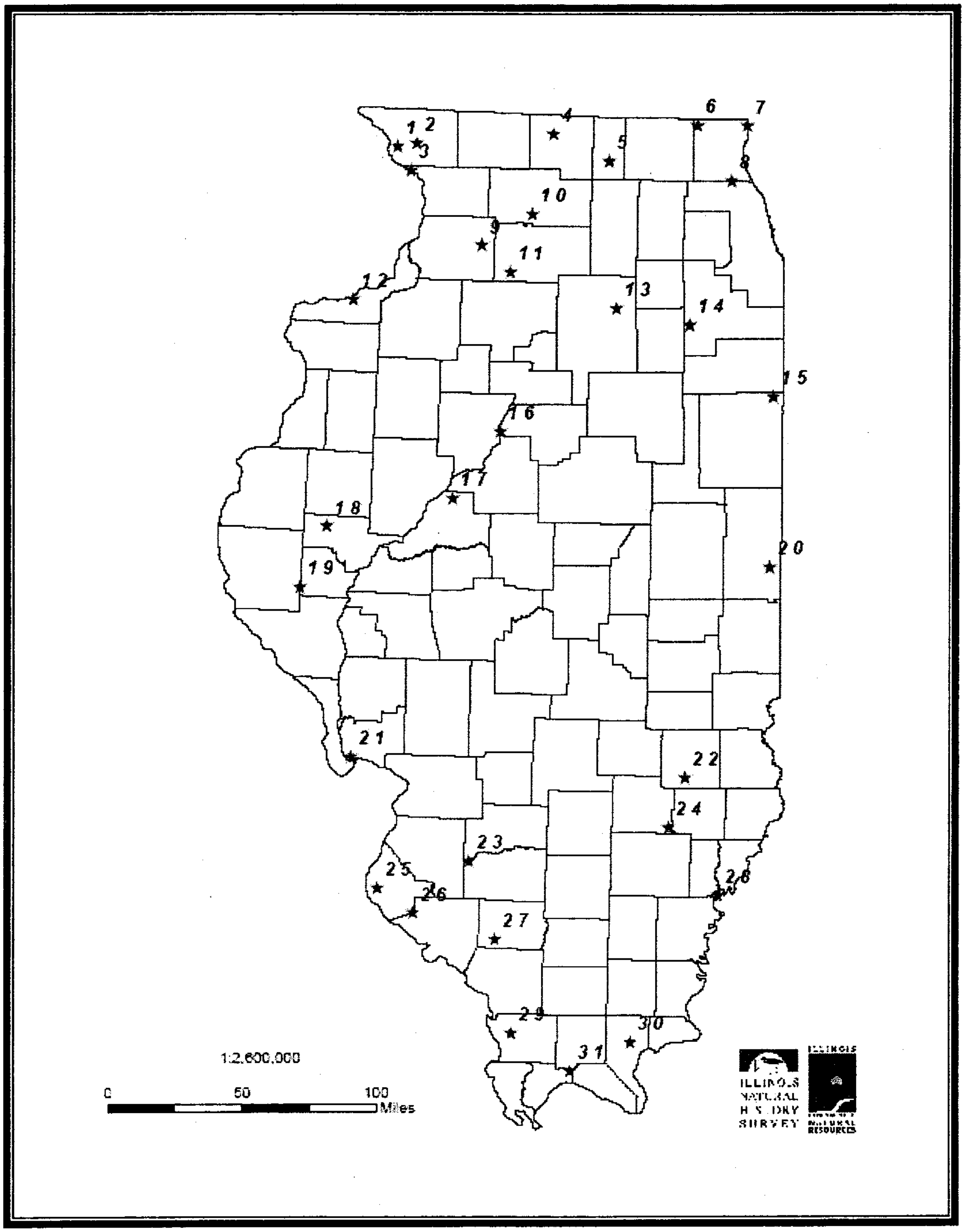


Figure 1. Areas identified by partner agencies and conservation groups during statewide meetings for the Illinois Wildlife Action Plan.

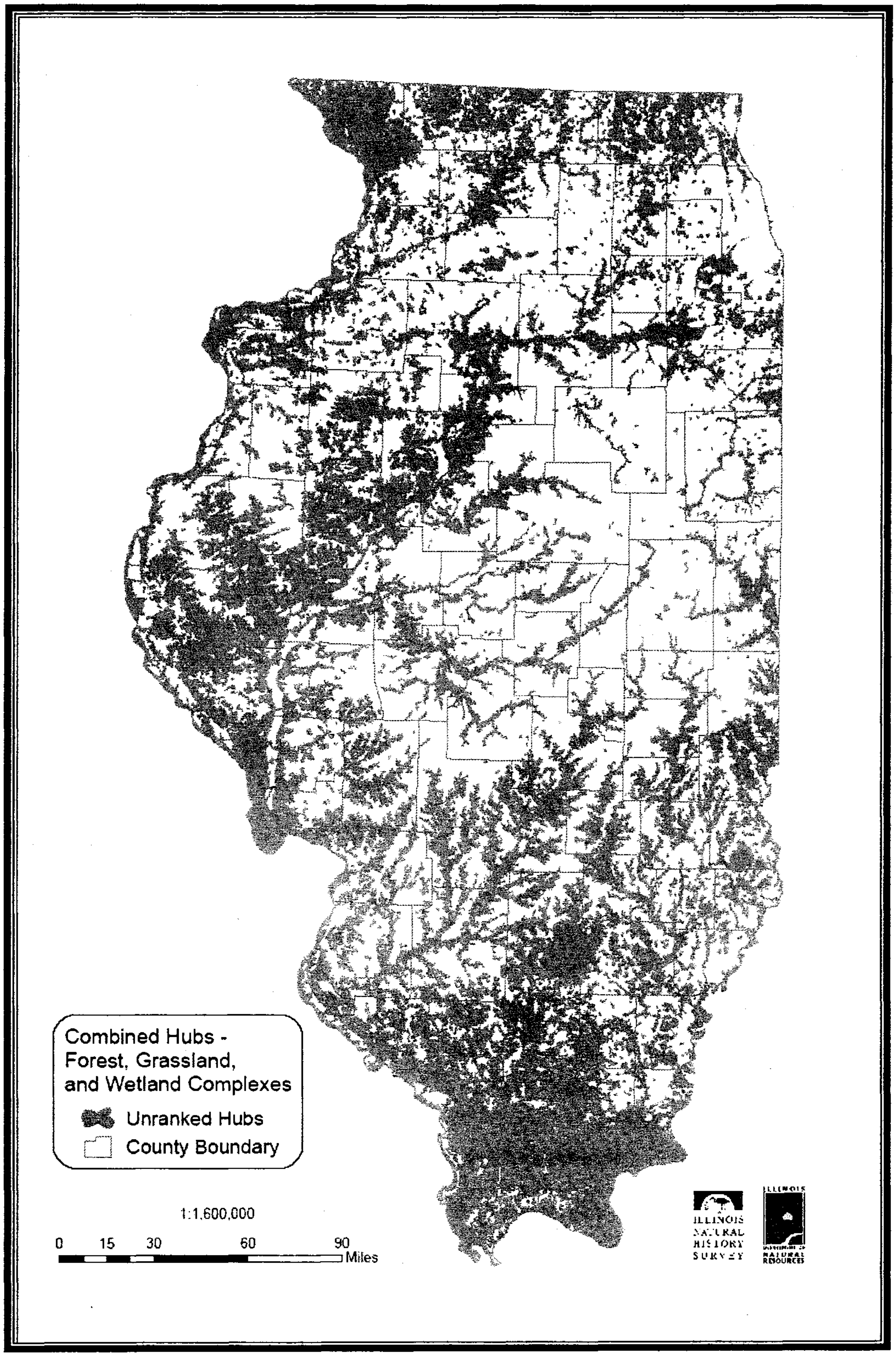


Figure 2. The forest, grassland, and wetland complexes were combined into hubs of 100 acres or more in size.

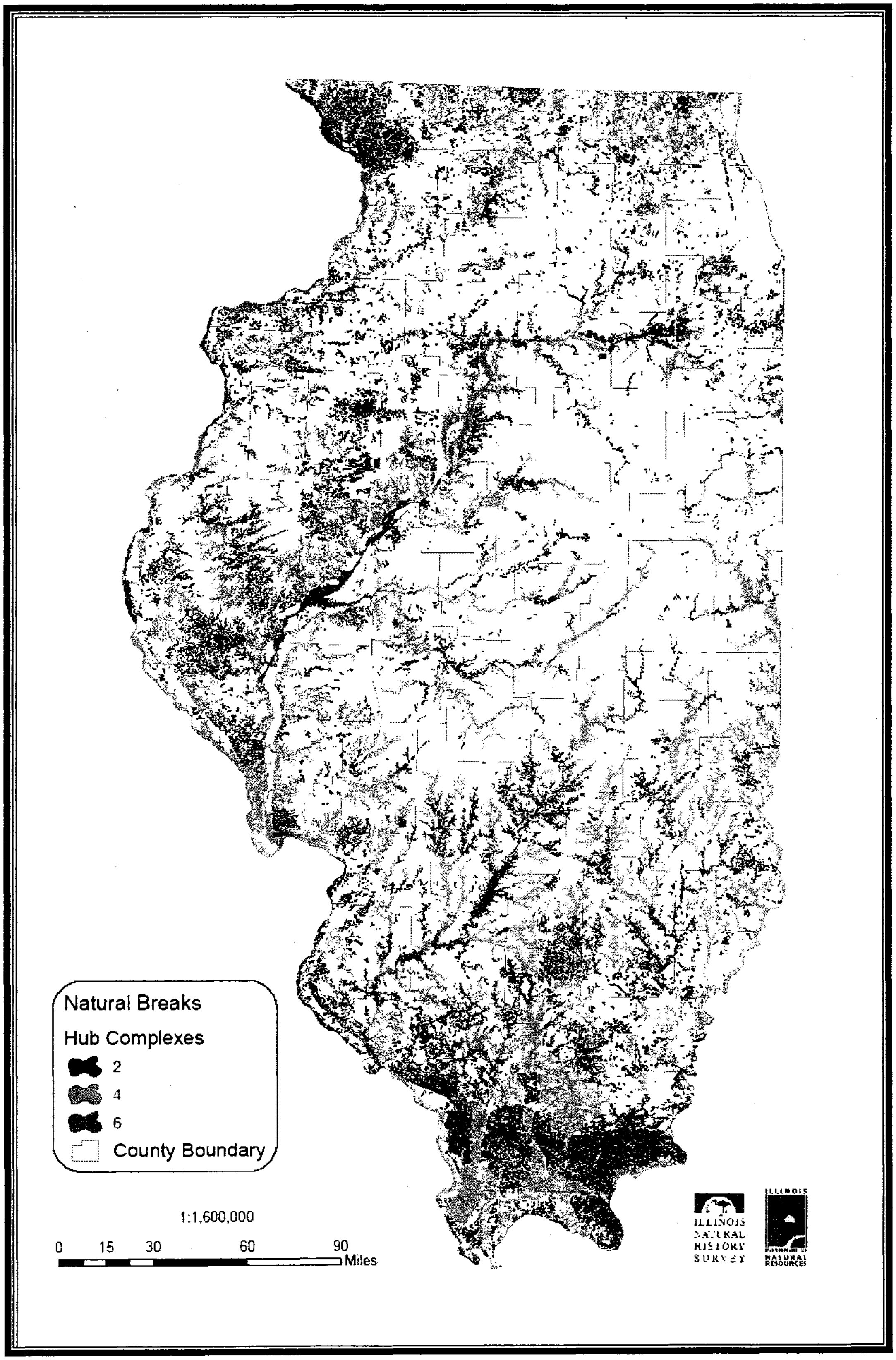


Figure 3. Ranked Hubs.

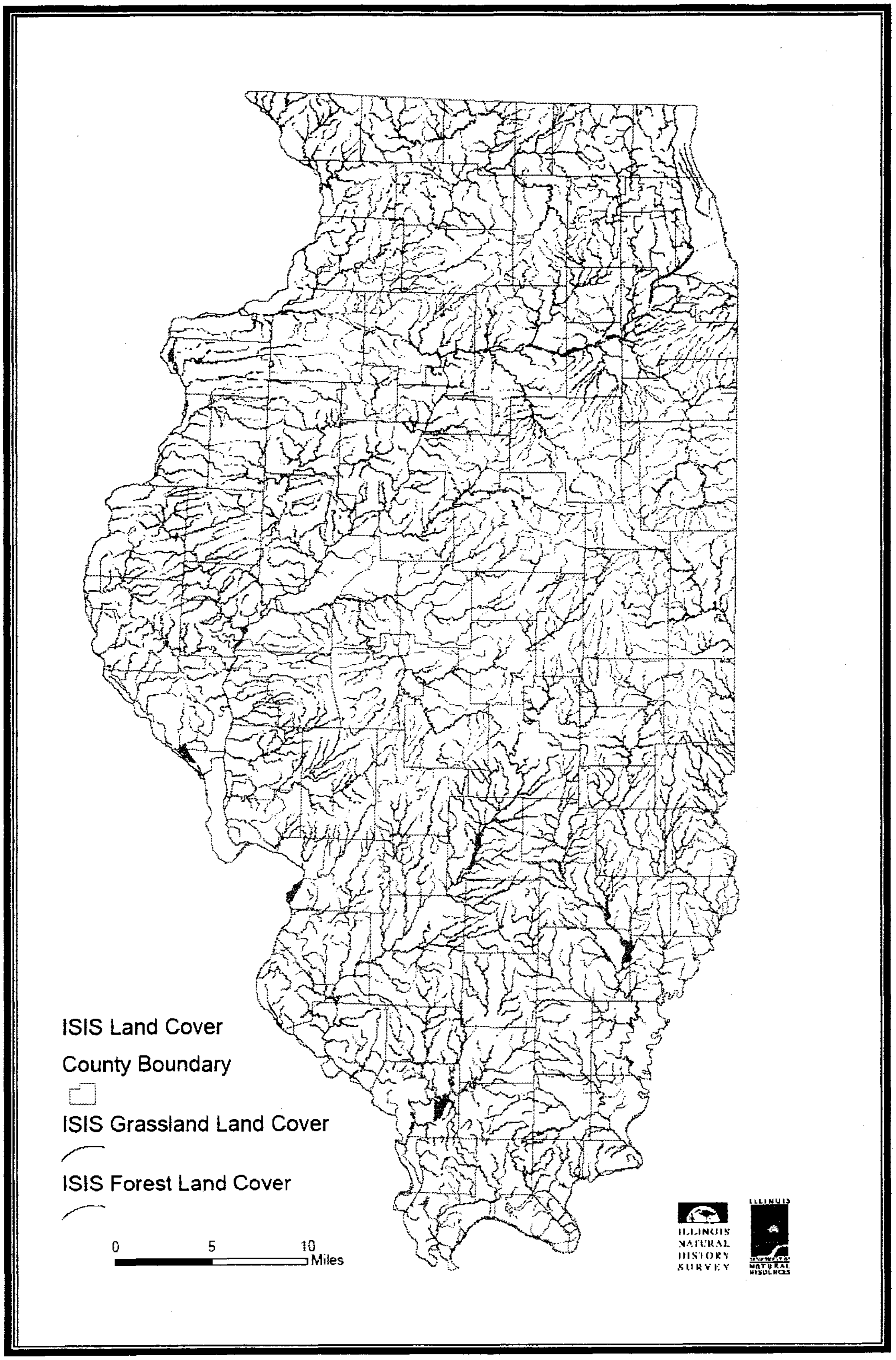


Figure 4. Forest and grassland land cover from the Illinois Streams Information System (ISIS) database.

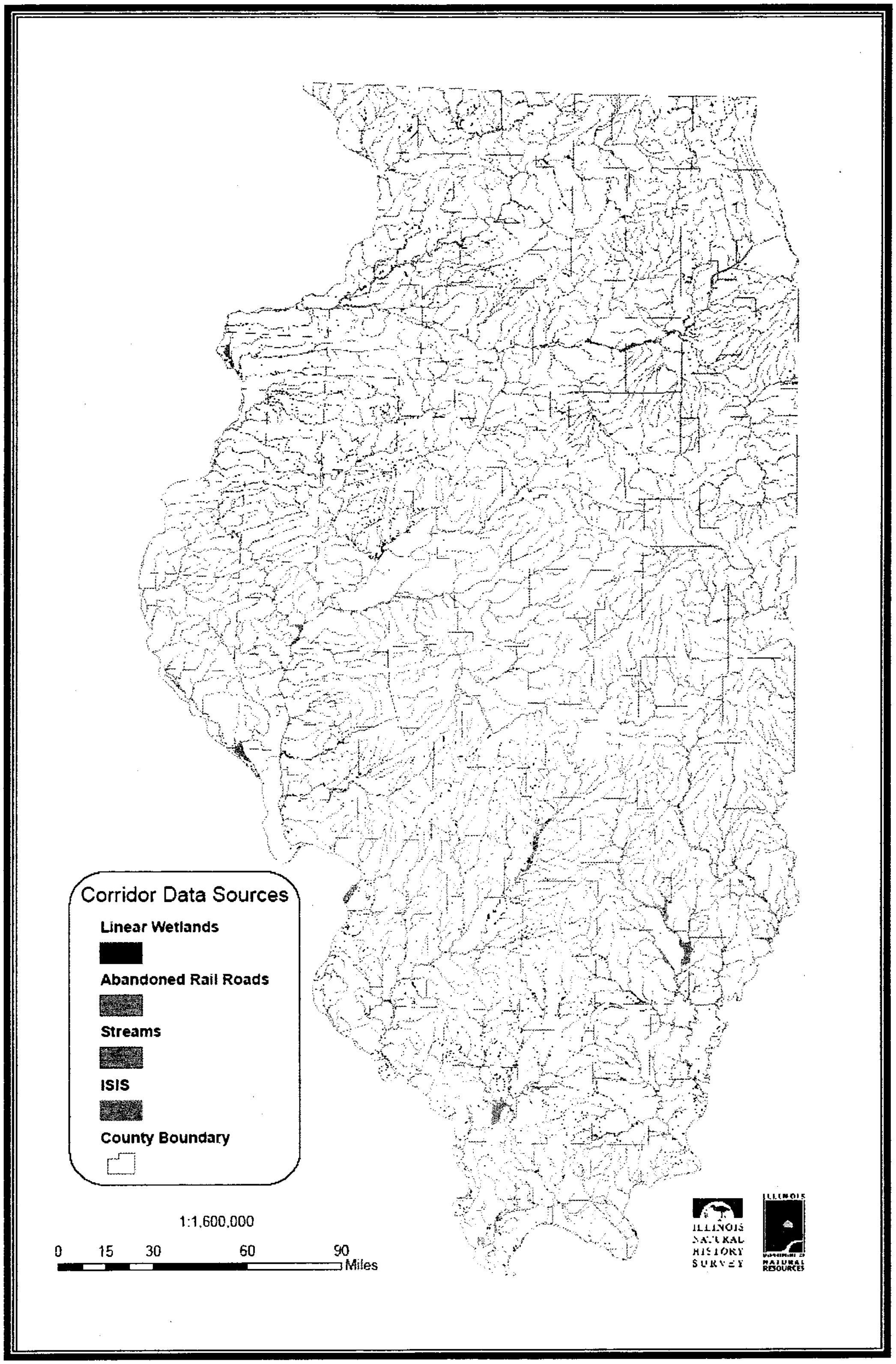


Figure 5. All potential corridors used in corridor analysis.

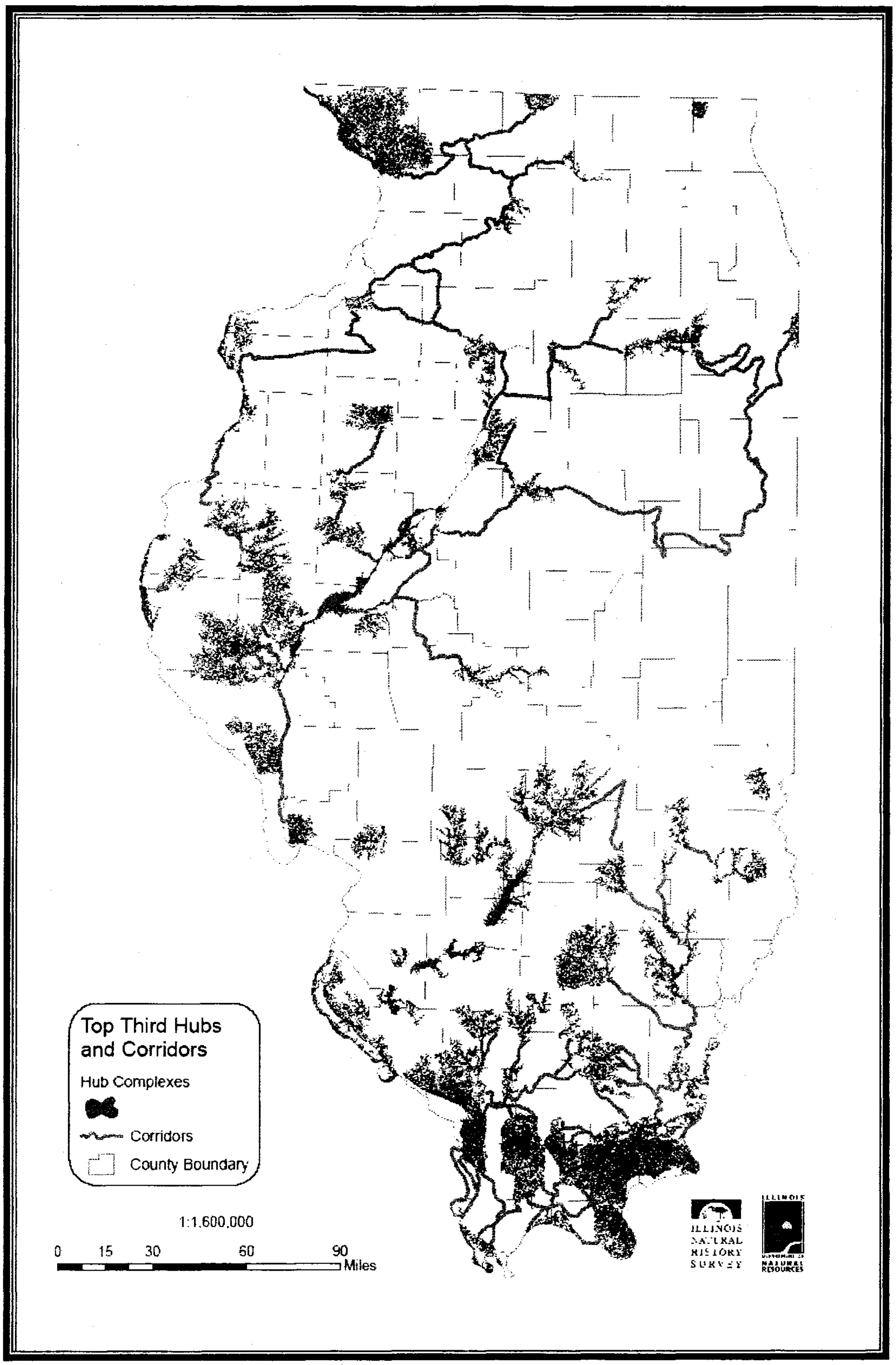


Figure 6. Top third of ranked hubs and connection corridors.

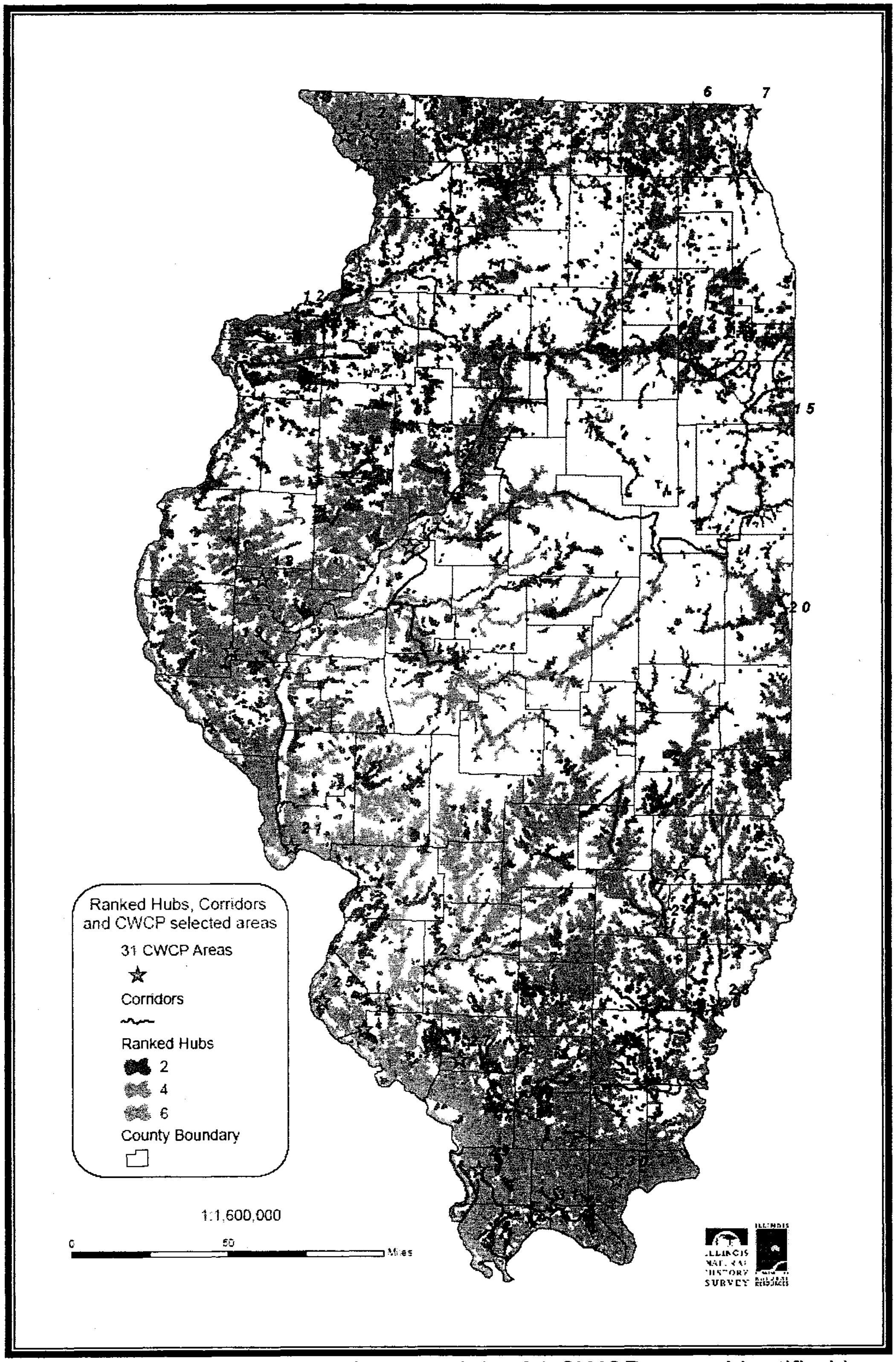


Figure 7. Ranked hubs, corridors and the 31 CWCP areas identified by partner agencies and conservation groups during statewide meetings for the Illinois Wildlife Action Plan (Part 1 of this Job).

Table 1. Ecological and threat parameters used to rank hubs. The weight indicates the added importance given to the parameter.

| Parameters | Weight |
|---|---|
| Area of proximity zone outside hub | 2 |
| Proportion of interior gap area in hub | 4 |
| Area of INAI sites | 5 |
| Area of forest | 4 |
| Area of grasslands | 1 |
| Area of emergent wetlands | 3 |
| Area of forest wetlands | 4 |
| Area of all wetlands | 1 |
| Area of interior forest | 4 |
| Area of unmodified NWI wetlands | 2 |
| Area of Threatened & Endangered Species | 2 |
| Area of Public land | 1 |
| Area of Nature Preserves | 1 |
| Area of floodzone | 1 |
| Area of railroad prairie remnant | 4 |
| Area of Forest Presettlement Vegetation still forest | 2 |
| Number of streams sources and junctions | 2 |
| Number of wetland types | 1 |
| Number of soil types | 1 |
| Number of Natural Divisions | 1 |
| Length of headwater streams within interior forest | 4 |
| Length of BSC or BSS streams | 1 |
| Remoteness from roads | 3 |
| Road density | 3 |
| Patch Shape | 1 |
| Topographic relief | 1 |

Table 2. Top third Hubs and the final ranks. See Excel spreadsheet on CD for individual parameters and ranks of all hubs.

| Hub ID | Total Hub Rank |
|---|---|
| 2364 | 136.41 |
| 3231 | 134.15 |
| 3203 | 130.01 |
| 1147 | 128.63 |
| 3272 | 128.40 |
| 9 | 127.75 |
| 1969 | 127.53 |
| 2883 | 126.54 |
| 1769 | 126.40 |
| 1753 | 125.76 |
| 1488 | 125.38 |
| 10 | 125.30 |
| 1993 | 125.09 |
| 3093 | 124.61 |
| 2771 | 123.88 |
| 2549 | 123.31 |
| 1966 | 123.31 |
| 2355 | 122.85 |
| 163 | 122.60 |
| 1222 | 121.75 |
| 3236 | 121.34 |
| 1479 | 121.12 |
| 3140 | 120.63 |
| 2532 | 120.37 |
| 3289 | 120.32 |
| 2501 | 119.98 |
| 3077 | 119.94 |
| 3216 | 119.92 |
| 3262 | 119.53 |
| 1894 | 119.43 |
| 3229 | 118.90 |
| 1119 | 118.36 |
| 3176 | 117.49 |
| 3121 | 117.20 |
| 2387 | 117.18 |
| 2070 | 116.98 |
| 1715 | 116.91 |
| 3166 | 116.34 |
| 29 | 116.27 |
| 2374 | 116.03 |
| 2945 | 115.97 |

| | |
|---|---|
| 1802 | 115.69 |
| 1117 | 115.54 |
| 1646 | 115.38 |
| 2860 | 115.25 |
| 2974 | 114.89 |
| 946 | 114.87 |
| 2880 | 114.69 |
| 3242 | 114.68 |
| 3235 | 114.59 |
| 1710 | 114.32 |
| 2928 | 114.16 |
| 1183 | 114.01 |
| 3015 | 113.99 |
| 2119 | 113.95 |
| 3246 | 113.70 |
| 328 | 113.61 |
| 3086 | 113.58 |
| 2789 | 113.10 |
| 2839 | 112.94 |
| 2543 | 112.91 |
| 2441 | 112.32 |
| 2258 | 112.16 |
| 2109 | 112.01 |
| 1636 | 111.98 |
| 2492 | 111.90 |
| 595 | 111.90 |
| 3254 | 111.83 |
| 3100 | 111.79 |
| 1246 | 111.78 |
| 3005 | 111.69 |
| 2565 | 111.65 |
| 74 | 111.65 |
| 2479 | 111.56 |
| 3296 | 111.52 |
| 3021 | 111.31 |
| 1325 | 111.19 |
| 1787 | 111.16 |

## Appendix A

## Illinois' Green Infrastructure Assessment: Detailed GIS Methods

### 1. Define Study Area

1.1. Define the study area for Green Infrastructure: All of Illinois, up to the state boundary.

1.2. All data was given a common projection:

CORRIDINATE SYSTEM DESCRIPTION

Projected coordinate system name: NAD 1983 UTM Zone 16N
Geographic coordinate system name: GCS North American 1983
Datum: NAD83
Spheroid: GRS1980
Units: Meters

BOUNDING COORDINATES
In Decimal degrees
West: -91.675105
East: -87.482225
North: 42.564635
South: 36.935103
In projected or local coordinates
Left: 115645.328125
Right: 457100.5000000
Top: 4712602.500000
Bottom: 4096379.5000000

### 2. Create data sets to be used in analysis

### 2.1. Threatened and Endangered Species Locations

2.1.1. Converted shape file to coverage (in arctoolbox)
*e&t_040616 to e_t_emall*

2.1.2. Reprojected coverage to UTM, zone16 (in arctoolbox)
*Project cover e&t_040616 etsmutm*
*Build etsmutm poly*

### 2.2. Protected Lands

2.2.1. Obtained Stewardship coverage from GAP program. This is a combination of the Owned, Managed and Leased land from IDNR and the Public land data set from the GAP project.

2.2.1.1. *pub_man*

**2.3. Prairies**

2.3.1. Extracted prairies from the Illinois Natural Areas Inventory data set obtained from IDNR.

2.3.1.1. Obtained list of prairie sites from IDNR.

2.3.1.2. Related INAI from Dec. 16, 2003 to list by NAINUM item in each table.

2.3.1.3. Selected sites with value in related SITENAME field. Saved to new file *inai_prairie*

**2.4. INAI site**

2.4.1. Selected sites with size greater than or equal to 100 acres.

*Inai = con (isnull (inai-grid), 0, inai-grid)*
*Et = con (isnull (etsm-grid), 0, etsm-grid)*
*Streams = con (isnull (bscabssbf-g), 0, bscabssbf-g)*
*Pub = con (isnull (pub-man-grid), 0, pub-man-grid*

**3. Identify Hubs**

**3.1. Forest**

3.1.1. Obtained Illinois GAP land cover raster data set.

3.1.2. Create forest grid from Illinois GAP land cover raster data.

3.1.2.1. Select land cover classes 22, 23, 24, 25, 26 (dry upland, dry mesic upland, mesic upland, partial canopy/savannah upland, and coniferous forested land), and 45, 46, 47, 48, (mesic floodplain, wet-mesic floodplain, wet floodplain forests and swamp).

3.1.2.2. Save to new file with the reclass command in ArcMap Spatial Analyst, above values used for inside, NoData = outside.

3.1.2.3. Save grid as *gap-for-all*

3.1.3. Bisect forest grid with interstate, state, and county roads.

3.1.3.1. Used Illinois Dept. of Transportation roads (obtained from IDNR Springfield office) idot_lam27

3.1.3.2. Reprojected coverage to UTM, Zone 16

3.1.3.3. Buffered road center lines by widths of roads to create a polygon coverage
*buffer idot_rds_utm idot_rdbf_nm # BUFFER_WTH # 1 Line Round Full*
BUFFER_WTH
Interstates = 30 meters
US Highways = 16 meters
County roads = 12 meters

3.1.3.4. Removed roadways from forest grid.
*Gap-fwg-nrd = gap-forwetgr * ( ^ idot-rds )*

3.1.4. Convert forest grid to polygon coverage
*Forallnrds = gridpoly (for-all-nords, 1)*

3.1.5. Added item (flag) to forallnrds.pat file, calculated 'flag' item for all forest polygons to 1
*additem forallnrds.pat forallnrds.pat flag 1 1 i*
*info*
*ARC*
*SEL FORALLNRDS.PAT*
*RESEL GRID-CODE > 0*
*CALC FLAG = 1*
*Q STOP*

3.1.6. Dissolved forest polygons on flag
*dissolve forallnrds forall_dis flag poly*

3.1.7. Select forest greater than or equal to 150 acres
*resel forall_dis for area GE 150 acres. Save to forall_150*

3.1.8. Converted forest to grid *forall_150g.*

3.1.9. Bisect forests with interstate, state, and county roads (*idot* created above)
*For150-nrd = forall_150g * (^ idot)*

## 3.2. Large blocks of contiguous interior forest

3.2.1. Determine grid of interior forest. I used 3 pixels, or 120 meters from forest edge. First, determined the distance from each forest cell to the nearest non-forest cell. Convert distance grid to integer values to save space.
*dist3 = int(eucdistance(con(for-boo == 0, 1)))*
*dist_wedge3 = con(for-boo >= 0, dist3)*

*intfor120m = con(dist_wedge3 >= 120, 1, 0)*

3.2.2. Converted interior forest grid to polygon coverage

```
intforall = gridpoly(intfor120m, 0)
build intforall poly
```

3.2.3. Added item to .pat file, calculated all forest polygons to 1

```
additem intforall.pat intforall.pat flag 1 1 i
info
    ARC
    SEL INTFORALL.PAT
    RESEL GRID-CODE > 0
    CALC FLAG = 1
    Q STOP
```

3.2.4. Dissolved forest polygons on flag

```
dissolve intforall intforall_dis  flag poly
```

3.2.5. Selected forest blocks with at least 150 acres of contiguous interior forest, based on the 120 meter edge width.

```
additem intforall_dis.pat intforall_dis.pat acres 4 12 f 3
info
    ARC
    SEL INTFORALL_DIS.PAT
    RESEL FLAG = 1
    CALC ACRES = AREA * 0.0002471044
    Q STOP
arcedit
ec intforall_dis
ef poly
sel all
resel acres ge 150
put intfor150
q
build intfor150 poly
```

## 3.3. Grasslands

3.3.1. Created from Illinois GAP land cover raster data *ilgapvegclp.*

3.3.1.1. Select land cover classes 14 and 17 (other small grains and hay, rural grassland).

3.3.1.2. Use reclassify command in ArcMap Spatial Analyst, above values used for inside, NoData = outside.

3.3.1.3. Save grid as *grass-2cts*

3.3.1.4. Convert nodata to zero
Grass-2ct-0 = con(isnull(grass-2cts), 0, grass-2cts)

3.3.2. Bisect grassland with interstate, state, and county roads (*idot* created above)
*Grass2ct-nrds = grass-2cts * (^ idot)*

3.3.3. Convert grassland grid to polygon coverage
*Gr2canrds = gridpoly (gr-2c-nords, 1)*

3.3.4. Added item -flag to gr2canrds.pat file, calculated 'flag' item for all grassland polygons to 1
*additem gr2canrds.pat gr2canrds..pat flag 1 1 i*
*info*
*ARC*
*SEL GR2CANRDS.PAT*
*RESEL GRID-CODE > 0*
*CALC FLAG = 1*
*Q STOP*

3.3.5. Dissolved forest polygons on flag
*dissolve gr2canrds gr2c_dis flag poly*
*build gr2c_dis poly*

3.3.6. Select grassland greater than or equal to 40 acres
*resel gr2c_dis for area GE 40 acres.. Save to* ***gr2c-40ac***

3.3.7. Converted grassland to grid. Call *grass-40*

3.3.8. Bisect grassland with interstate, state, and county roads (*idot* created above)
*Grass40-nrd =grass-40 * (^ idot)*

## 3.4. Wetlands - Forested and Emergent Wetlands

3.4.1. Created Forested wetland coverage from National Wetland Inventory (NWI) statewide data set.
Reselected from j:\statewide_datasets\wetstpy-utm to create wetnwi_for
illcode > 1100 and illcode <= 1122
illcode > 2100 and illcode <= 2122

3.4.2. Created emergent wetlands coverage from NWI dataset
Reselected from j:\statewide_datasets\wetstpy-utm to create wetnwi_emg
illcode > 1130 and illcode <= 1230
illcode > 2130 and illcode <= 2230

3.4.3. Combined wetlands to create wetland complexes.

3.4.3.1. Added item to .pat file, calculated all wetland forest polygons to 1

```
additem wetfor-p.pat wetfor-p.pat flag 1 1 i
info
    ARC
    SEL WETFOR-P.PAT
    RESEL GRID-CODE > 0
    CALC FLAG = 1
    Q STOP
```

3.4.3.2. Added item to .pat file, calculated all wetland emergent polygons to 1

```
additem wetemg-p.pat wetemg-p.pat flag 1 1 i
info
    ARC
    SEL WETEMG-P.PAT
    RESEL GRID-CODE > 0
    CALC FLAG = 1
    Q STOP
```

3.4.4. Dissolved wetland polygons on flag

```
dissolve wetfor-p wetfor-d  flag poly
build wetfor-d poly
dissolve wetemg-p wetemg-d flag poly
build wetemg-d poly
```

3.4.5. Buffered forested wetlands by 165 meters and emergent wetlands by 98 meters.

```
buffer wetfor-d wford100-165m # # 165 1
buffer wetemg-d wemgd-98m # # 98 1
```

3.4.6. Combined forested and emergent wetland coverages.

```
union wford-165m wemgd-98m wcmpx 1 join
```

3.4.6.1. Dissolved wetland complex on flag.

```
dissolve wcmpx wcmpxd flag poly
build wcmpxd poly
```

3.4.7. Selected wetland complexes with at least 250 acres.

```
additem wcmpxd.pat wcmpxd.pat acres 4 12 f 3
info
    ARC
    SEL WCMPXD.PAT
    RESEL FLAG = 1
    CALC ACRES = AREA * 0.0002471044
    Q STOP
arcedit
```

*ec wcmpxd*
*ef poly*
*sel all*
*resel acres ge 250*
*put wetcmpxd-250ac*
*q*
*build wetcmpxd250ac poly*

3.4.8. Converted wetlands to grid. Call *wetcmpx250.*

3.4.9. Bisect wetlands with interstate, state, and county roads (*idot* created above)
*Wetcmp250-nrd = wetcmpx250 * (^ idot)*

### 3.5. Combined layers from 2.2 to 2.5

3.5.1. Converted NODATA values in grids to 0
*Grass40-0 = con(isnull(grass-40), 0, grass-40)*
*For150-0 = con(isnull(for150-nrd), 0, for150-nrd)*
*Wetcmp250-0 = con(isnull(wetcmp250-nrd), 0, wetcmp250-nrd)*

3.5.2. Combined grids together to make hubs grid.
*Hubs = combine(grass40-0, for150-0, wetcmp250-0))*
*Additem hubs-blk.vat hubs-blk.vat tot 4 16 b*
*Calc tot = GRASS40-0 +FOR150-0i +WETCMP250-0*

3.5.3. Convert all items of 'tot' to one

3.5.4. Convert NODATA values to 0
*Hubs-0 = con (isnull(hubs), 0, hubs)*

### 3.6. Remove developed areas and major roads.

3.6.1. Converted NODATA values in municipal and road grids to 0.

3.6.1.1. *idot = con (isnull (idotrds-gr), 0, idotrds-gr)*

3.6.1.2. Created urban grid from land cover data
*gap-urban* = used gap-urban data to create urban mask, using only:
High density = 31
Low density = 34
Low/medium density = 32
Medium density = 33
Urban open space = 35

3.6.1.3. Converted all values greater than 1 to 1
*In arcmap, reclassified urban areas to 1, nodata to 0. Saved as gap-urban1*

3.6.1.4. Converted NODATA values to 0
*Urban-0 = con(isnull(gap-urban1), 0, gap-urban1)*

3.6.2. Removed developed areas.
*Hubs2 = hubs-0 * (^ urban-0)*

**3.7. Removed all hubs with areas < 100 acres**

3.7.1. *Hubs-100 = con (zonalarea (regiongroup(con(hubs2 == 1, 1), #, four)) >= 404687.9, 1)*

3.7.2. Convert NODATA values to 0
*Hubs100-0 = con (isnull (hubs-100), 0, hubs-100)*

**3.8. Add adjacent wetlands, and forests.**

3.8.1. Converted NODATA values in wetland complexes and all forest/wetland and NWI wetlands grids to 0.
*Wetcmp83-0 = con (isnull (wetcmpall-83), 0, wetcmpall-83)*
*Grass2cnrd-0 = con (isnul(grasscnrd-1), 0,grasscnrd-1)*
*Forall-0 = con (isnull (fowetnrd-1), 0, forwetnrd-1)*

3.8.2. Combine forest and wetlands. Remove roads and towns.
*forwetgr0-nr = (wetcmp83-0 or forall-0 or grass2cnrd-0) and (not(idot)) and (not(urban-0))*

3.8.3. Select wetlands and forests adjacent to hubs, to a maximum of 304.8 meters (1000 feet).
nearhub = con(isnull(forwetgr0-nr), 0, forwetgr0-nr) * con(eucdistance(hub100-0) <= 304.8, 1, 0)

3.8.4. Select groupings that overlap hubs
Overlay zonalmax(regionroup(con(nearbub == 1,1), #, four), con(isnull(hubs100), 0, 1), DATA)

3.8.5. Add forest and wetlands that area adjacent to hubs to hub coverage
*hubs3 = con(isnull(hubs-100), 0, 1) or con(isnull(overlay), 0, overlay)*
*(Had to build vat table to see grid properly)*

**3.9. Identify gaps (holes) within hubs.**

3.9.1. Calculate the area of non-hub cell aggregations in acres, and discount areas outside hubs (> 10,000 Ac).
*Hubgaps = con((zonalarea(regiongroup(con(hubs3 == 0, 1), #, four)) / 4046.879) < 10000, 1)*

3.9.2. Selected from GAP land cover, undeveloped land - wetlands and open water
In Arcmap, reclassified land cover (14, 17, 22, 23, 24, 25, 26, 41, 42, 43, 45, 46, 47, 48, 49, 51), deleted all other land cover. Call *gapfrwtgrwa.*

In ArcMap, set value = 1, rest = nodata. Called *gapfrwtgrwa-1.*

3.9.3. Set water, wetlands (emergent and forested), and grassland/smallgrains and hay to 1, elsewhere = NODATA
*Hubsgap-lc = con((hubgaps * gapfrwtgrwa-1) == 1, 1)*

3.9.4. Add to hubs
*Hubs4 = hubs3 or con(isnull(hubsgap-lc), 0, 1)*

**3.10.Add undeveloped land cover to hubs, if connected.**

3.10.1. Identify open water from gap data
In arcmap, reclassify all delete all but open water, rest = NODATA. Save as *gap-openwater.*

3.10.2. Converted NODATA values in openwater to 0
*Gapwater-0 = con (isnull(gap-openwater), 0, gap-openwater)*

3.10.3. Select openwater overlapping with hubs
*Gapwat-ovlp4 = zonalmax (regiongroup(con(gapwater-0 == 1, 1), #, four), con (isnull(hubs4), 0, 1), DATA)*

Convert NODATA to 0
*Gapwatovlp4-0 = con(isnull(gapwat-ovlp4), 0, gapwat-ovlp4)*

3.10.4. Add openwater (minus roads) that overlap hubs to hub data
*Hubs5 = hubs4 or con(isnull(gapwatovlp4-0), 0, gapwatovlp4-0)*

**3.11.Delete roads**
*Hubs6 = hubs5 * ( ^ idot) * (^ urban-0)*

3.11.1. **Eliminate Hubs less than 100 acres.**
*Hubs8 = con(hubs6ac >= 100, 1)*

**3.12.Clip to county boundary**
*Gridclip hubs7 hubs7co cover j:\greenways\anc_data\counties_new*
*Gridclip hubs8 hubs8co cover j:\greenways\anc_data\counties_new*
*Grifclip hubs8 hubs8-clnd cover j:\greenways\anc_data\natdiv705-nam*

**3.13.Give hubs separate IDs.**
*Hubs9 = regiongroup(con(hubs8co == 1, 1), #, eight)*

**3.14. Converted to polygon coverage and calculated acres.**

*Gridpoly hubs9 hubs9-py 1*
*Additem hubs9-py.pat hubs9-py.pat acres 4 12 f 3*
*In info,*
*Calc acres = area * 0.0002471044*

## 4. Hub Ranking

4.1. Area of proximity zone outside hub hubs = 2

4.1.1. Used Thiessen polygons to create crude measure of proximity to other hubs.

Copy hubs9-py hubs9py-cent
Centroidlabels hubs9py-cent outside
In Arcedit, selected labels of hubs9py-cent, reselect id > 0, put in hubs9cen-id
Thiessen hubs9cen-id hubs9-thies
Clip hubs9-thies statebnd hubs9-thes-cl poly 1
Recalculated acres
Summarized area of thiessen polygon on ID in **sum**-hub9-thies.dbf

5 natural breaks
1317.7745 = 5
4383.3852 = 4
10819.262695 = 3
25424.138672 = 2
66507.226563 = 1

In Arcmap table, added item 'rank-thes', sorted on acres and used above values to calculate ranks. Exported table. In excel, created subtotals of IDs with average ranks. Removed 'average' title (find and replace).

In excel, calculated proximity area by subtracting hub9-py areas from thiessen polygon areas. Saved as sum-hub9-proximity.xls and to sum-hub9-proximity.dbf
Related sum-hub9-proximity.dbf file to hubs9-py. Displayed with 5 natural breaks

14449.335
31874.4744
53709.2231
83376.0428
132948.5280

In excel, combined thiessen polygon acres, acres of hubs minus thiessen polygons and average ranks in **sum-hub9-thes.xls** in new directory of sum-ranks.

4.2. Proportion of internal gap area = 4

5 Natural Breaks of hubs9py
3533.1729

13428.5918
30949.0117
63062.4727
126879.0859

Not-hubs-ac = int(zonalarea(regiongroup(con(isnull(hubs3 = = 0, 1), #, four)) / 4046.879)
Hubgaps = con(not-hubs-ac < 10000, 1)
Gridpoly hubsgaps hubgaps-py 1
Combined hubs9py and hubgaps-py into hubdis-pylb
Calculated acres of hubdis-pylb and hubs9py.
Subtracted acres of hubs9-py from **hubdis-pylb** to get acres of hubsgaps
5 hubs were inside the interior gap of larger hubs.
2872 (176.3584) inside 2789 (168.8)
2894 (120.9823) inside 2789 (114.76)
3095 (138.9962) inside 2883 (135.22)
3186 (126.7646) inside 3171 (112.98)
3348 (443.2312) inside 3289 (442.56)
Created coverage of just these 5 hubs called hubs9-mgap
Coded ID and grid-code, dissolved on grid-code to hubs9-mgapd
Summarized data to sum-hubs9-mgap-acres.xls
Summarized all hub data in sum-hub9-total-gaps.xls
Deleted acreage of 5 hubs listed above in exterior hubs in another sheet of **sum-hub9-total-gaps.xls**
5 Natural Breaks of hubdis-pylb
5178.8882 = 5
18321.4824 = 4
44148.0898 = 3
88065.1172 = 2
182538.0625 = 1
Saved in sum-hub9-intgap.dbf.

4.3. Area of INAI = 5
Identity inai_12_16_03 hubs9py **hubs9-inai**
Defined Selection as INAI-RANK = 5 and ID > 0
Summarized acres in **sum-hub9-inaiacres.dbf**
5 Natural Breaks of hubs9-inai
211.2517 = 1
917.9268 = 2
2734.0208 = 3
6374.9224 = 4
13327.3584 = 5
There was more than one value per ID, so averaged rank on ID. Saved to sum-hub9-inai

4.4. Area of wetlands all, emergent, or forested (NWI) = 1, 3 or 4

a. Identity wetemg-d hubs9py **hubs9wemg**
Defined selection as flag = 1 and ID > 0
Summarized acres in **sum-hub9-wemgarea.dbf**
5 Natural Breaks
147.7811 = 1
1033.5406 = 2
2680.0811 = 3
5608.5347 = 4
13427.3447 = 5
Added item –rank-wemg. Calculated as above. Summarized average rank-wemg for each hub ID into sum-hub9-wemg.dbf

b. Identity wetfor-d hubs9py **hubs9wfor**
Defined selection as flag = 1 and ID > 0
Summarized acres in **sum-hub9-wforacres.dbf**
5 Natural Breaks
80.5003 = 1
341.0427 = 2
955.1495 = 3
2229.9473 = 4
5024.3809 = 5
Added item –rank-wfor. Calculated as above. Summarized average rank-wfor for each hub ID into sum-hub9-wfor.dbf
c. Identity wet-all-83 hubs9py **hubs9-wetall**
Define selection as ID > 0 and ILLCODE > 0
Summarized acres in sum-hub9-wetall.dbf
5 Natural Breaks
94.28 = 1
494.84 = 2
1540.5 = 3
3714.59 = 4
13107.16 = 5
Added item –rank-wall. Calculated as above. Summarized average rank-wall for each hub ID into sum-hub9-wall.dbf

4.5. Area of forest = 4
Identity forall_150 hubs9py **hubs9-for** poly 1
Defined selection as grid-code = 1 and ID > 0
Summarized acres in **sum-hub9-foracres.dbf**
5 Natural Breaks:
467.0273 = 1
2315.7883 = 2
7683.0439 = 3
20881.2344 = 4
74753.2813 = 5

Added item –rank-for. Calculated as above. Summarized average rank-for for each hub ID into sum-hub9-for.dbf

4.6. Area or grassland = 1
Gridpoly grass40-nrd grass40nrd-py
Identity grass40nrd-py hubs9py **hubs9-grass** poly 1 join
Defined selection as flag = 1 and ID > 0
Summarized acres in **sum-hub9-grass-acres.dbf**
5 Natural Breaks
281.9955 = 1
992.7667 = 2
2571.0967 = 3
6594.4258 = 4
22823.1797 = 5
Added item –rank-grass. Calculated as above. Summarized average rank-grass for each hub ID into sum-hub9-grass.dbf

4.7. Area of upland interior forest (upland and wetland forest) = 4
Identity intforall_dis hubs9py **hubs9-intfor** poly 1 join
Defined selection as intfor-weight = 3 and ID > 0
Summarized acres in **sum-hub9-inforacres.xls**
5 Natural Breaks
148.3368 = 1
1124.2014 = 2
3575.8726 = 3
10093.7949 = 4
28058.5566 = 5
Added item –rank-intfor. Calculated as above. Summarized average rank-intfor for each hub ID into sum-hub9-intfor.dbf

4.8. Area of unmodified wetlands = 2
Identity wet-allforemg hubs9py **hubs9-wetall** poly 1 join
Defined selection as ILLCODE >= 1000 and < 2000 and ID > 0
Summarized acres in **sum-hub9-wetall-unmodac.dbf**
5 Natural Breaks:
41.29 = 1
194.00 = 2
607.57 = 3
1589.16 = 4
3427.96 = 5
Added item –rank-unmod. Calculated as above. Summarized average rank-unmod for each hub ID into sum-hub9-unwet.dbf

4.9. Area of Threatened and Endangered Species = 2
Identity etsmutm hubs9py **hubs9-etsm** poly 1 join
Define selection as GRID-CODE = 1 and ID > 0

Summarized acres in **sum-hub9-etsm-acres.dbf**
5 Natural Breaks
5.9672 = 1
104.0623 = 2
426.4832 = 3
1054.1210 = 4
2785.3345 = 5
Added item –rank-t-e. Calculated as above. Summarized average rank-e-t for each hub ID into sum-hub9-etsm.dbf

4.10. Number of wetland types = 1
Identity wet-allforemg hubs9py **hubs9-wetall** poly 1 join
Defined selection as ILLCODE > 0 and ID > 0
Summarized number of wetland types in sum-hub9-wet-type.xls
Calculated total number of wetland types for each hub in excel (subtotal function). Saved as info file (sum-hub9-wet-types. Joined to hubs9-wetall.pat on ID. Added item in hubs9-wetall.pat called wet-num. Calculated 5 Natural Breaks
4 = 1
7 = 2
10 = 3
13 = 4
18 = 5
Calculated ranks in rank_wetyp item. Summarized in sum-hub9-wall-types-rank.dbf

4.11. Number of soil types = 1
Identity h:\h\statewide_datasets\soilassoc hubs9py hubs-soils poly 1 join
Defined selection as ID > 0 and s > 0
Summarized number of soil types in sum-hub9-soils-num.xls. Saved as sum-hub9-soils-num.dbf
Additem sum-hub9-soils-num id 4 12 f 3
Joinitem hubs-soils.pat sum-hub9-soils-num hubs-soils.pat id
5 Natural breaks
3 = 1
5 = 2
7 = 3
9 = 4
12 = 5
Additem hubs-soils.pat rank-soil-num. Calc as above. Summarize rank-soil-num (Maximun), save as sum-hub9-soilnum.dbf

4.12. Number of Natural Divisions = 1
Identity natdiv_0705 hubs9py **hub9-natdiv** poly 1 join
Defined selection as Name > “ and gridcode > 0
Additem id, calc = grid-code (the ID number from hubs9py)
Additem natdiv, calc = code for each
Coastal Plain = 1

Grand Prairie = 2
Illinois & Mississippi Rivers Sand Areas = 3
Lower Mississippi River Bottomlands = 4
Major Water Bodies = 5
Middle Mississippi River Border = 6
Northeastern Morainal = 7
Ozarks = 8
Rock River Hill Country = 9
Shawnee Hills = 10
Southern Till Plan = 11
Upper Mississippi and Illinois River Bottomlands = 12
Wabash River Border = 13
Western Forest-Prairie = 14
Wisconsin Driftless = 15

Summarized number of natural areas in **sum-hub9-natdiv-num.xls**
Added number field to sort on, added count = 1
Subtotal first on grid-code, then on name
Saved as sum-hub9-natdiv-num-short.dbf (deleted extra sheets)
Dbaseinfo sum-hub9-natdiv-num-short.dbf sum-hub9-natdivnum
Joinitem hub9-natdiv.pat sum-hub9-natdivnum hub9-natdiv.pat id
Calculated 5 natural breaks for Number_Nat
1 = 1
2 = 2
3 = 3
4 = 4
5 = 5

Additem hub9-natdiv.pat rank-natdiv. Calculated as above. Summarized as sum-hub9-natdiv using maximum number of rank-natdiv.

Summarized acres in natural division in **sum-hub9-natdiv-acres.xls**

4.13. Number of Stream sources and confluences = 2
nodepoint streams-cler streams-point
build anc_data\streams-point point
identity streams-point hubs9py **hubs9-strm2** point 1 join
Defined selection as ID > 0
Summarized number of nodes in **sum-hub9-strmnodes.dbf**
Copied hubs9py to hubs9-stnode
Converted to info file called sum-hub9-strnodes
Joinitem hubs9-stnode.pat sum-hub9-strnodes hubs9-stnode.pat id
Created 5 natural breaks of Node_Num
17 =1
53 = 2
103 = 3
180 = 4
304 = 5

Additem rank-stnodes, calculated as above. Summarized (maximum) and saved to sum-hub9-strnode.dbf

4.14. Length of Streams in Interior Forest = 4

Intfor_90m = con(j:\greenways\grid-clips\dist_wedge3 >= 90, 1)
Gridpoly intfor_90m intfor90m-py
Build intfor90m-py poly
Clip j:\greenways\streams\newstrms2 intfor90m-py intfor90m-str line
Identity intfor90m-str j:\greenways\final-2\hubs9py **ifstrm90-hub** line .001 join
Defined selection as ID > 0
Summarized length of streams in interior forest in **sum-hub9-strmlength.dbf**
Copied hubs9py to hubs9-strlgt. Converted sum-hub9-strmlength.dbf to info file sum-hub9-strlgt. Joinitem hubs9-strlgt.pat sum-hub9-strlgt hubs9-strlgt.pat id
Created 5 natural breaks from sum_length

846.8852 = 1
3003.8302 = 2
6821.5047 = 3
19439.0016 = 4
48210.2788 = 5

additem rank-strlgt and calculated as above. Summarized (maximum) and saved in sum-hub9-strlgt.dbf

4.15. Topographic relief = 1

In ArcMap,
ZonalStatisticsAsTable hubs9 Value ildem_nad83 **sum-hub9-elev.dbf** DATA
Saved as sum-hub9-elev-sd.dbf with only value (ID and standard devation)
Joined to hubs9-topo. Created 5 Natural Breaks from SD

20.57 = 1
38.580002 = 2
58.0 = 3
87.93 = 4
127.089996 = 5

Additem rank-topo. Calculated as above. Summarized (maximum) as sum-hub9-topo.dbf.

4.16. Remoteness from Major Roads = 3

Grid: roads = con(j:\greenways\grid-clips\idot-rds, 1)
Grid: dist_roads2 = int (eucdistance(roads))
Grid: hubs9-dist2 = int(zonalmean(j:\greenways\final-2\hub-id\hubs9, dist_roads2, DATA))
In ArcMap, at the command line:
ZonalStatisticsAsTable hubs9 Value hubs9-dist2 j:\greenways\final-2\hub-rank\remoteness2.dbf DATA
Deleted extra columns, saved at remoteness2b.xml

Note – this method resulted in large distances to nearest road for hubs near state boundary. Need to add roads in surrounding states. Used ESRI USA major roads layer.
Buffered Illinois boundary by 17500 (largest distance from road for just Illinois roads), then clipped ESRI major roads layer with this.
Converted to coverage, than converted routes to arcs.
Added item – buffer- to .aat file. Edited 'pretype' item, moving some items to 'type' item. Calculated new item to equal buffer distance.
Created buffer lookup table (j:\greenways\anc_data\buffer) with 2 items, buffer and dist (required item name).
Buffer esri-mjrd3 esri-mdrd3bf buffer buffer # 1 line round full
Defined projection to UTM83.
Erased center with state boundary (erase esri-mjrd3bf statebnd esri-mjrd-out poly 1
Combined IDOT roads with ESRI roads (union idot_rdbf_nm esri-mjrd-out **idot-esri-bf** 1 join
Converted to grid (polygrid idot-esri-bf idotesribf road (cell size 30)
Recalculated remoteness:
Grid: roads-st = con(j:\greenways\anc_data\idotesribf, 1)
Grid: dist-roads-st = int(eucdistance(roads))
Grid: hubs9-dist-st = int(zonalmean(j:\greenways\final-2\hub-id\hubs9, dist-roads-st, DATA))
In ArcMap, at the command line:
zonalStatisticsAsTable hubs9 Value hubs9-dist-st j:\greenways\final-2\hub-rank\remoteness-st DATA
Saved remoteness-st.dbf to **sum-hub9-remoteness-st.xls**
Created coverage – hubs9-dis-st. joinitem to sum-hub9-dist-st-tab. Created 5 Natual Breaks on distance (meters) – item name is DIST
759 = 1
2106 = 2
3237 = 3
4765 = 4
12914 = 5
additem rank-rdist to hubs9-dis-st.pat Calculated equal to above ranks.
Summarized data (average rank) in sum-hub9-rdist.dbf

4.17. Road Density = 3
Identity h:\h\statewide_datasets\roads hubs9py **hub9-rd-den** line .001 join
In ArcMap, reselect gridcode > 0.
Sum length on ID in **sum-hub9-road-density-all.dbf**
Copied to info: dbaseinfo sum-hub9-road-density-all.dbf sum-hub9-rdensity
Adjusted item (added, calc, droped) to equal ID in hubs9-rdens.pat
Joinitem hubs9-rdens.pat sum-hub9-rdensity hubs9-rdens.pat id
Created 5 natural Breaks
18698.2482 = 5
156093.796 = 4

309456.6801 = 3
472098.5348 = 2
679849.81 = 1

Additem rank-rdens, calculated as above. Summarized as sum-hubs9-rdensity using maximum value (all road lengths were the same number for all hub IDs.) Saved as sum-hub9-rdens.dbf

4.18. Patch Shape = 1
Ran V-LATE 1.1 on hubs9py. Used grid-code for class. Saved results as hubdis-class_form_analysis.xls. Copied to hubdis-class_form_analysis.dbf. Converted to info file (hubdis-shape).
*Joinitem hubs9-phshape.pat hubdis-shape hubs9-phshape.pat id*
Created Natural Breaks for mean_shape and calculated rank-shape
1 = 5
4 = 4
6 = 3
10 = 2
16 = 1
Saved as sum-hub9-shape.dbf

4.19. Area of Public land = 1
Identity j:\greenways\base-polys\pub-dnr hubs9py hubs9-pubdnr poly 1 join
Defined selection as ID > 0 and Rank-DNR-PUB > 0
Sum area in **sum-hub-pub-acres.dbf**
5 Natural Breaks
773.3374 = 1
2980.9631 = 2
7196.1548 = 3
15133.6133 = 4
37527.0547 = 5
Added item –rank-public. Calculated as above. Summarized average rank-public each hub ID into sum-hub9-public.dbf

4.20. Area of Nature Preserves = 1
Identity inpc_0205_feu hubs9py hubs9-inpc poly 1 join
Defined selection as ID > 0 and INPC_0205_FEU# > 1
Sum area in **sum-hub9-inpc-acres.dbf**
5 Natural Breaks
89.7030 = 1
315.3129 = 2
916.7225 = 3
2423.9187 = 4
4236.4463 = 5
Added item –rank-inpc. Calculated as above. Summarized average rank-inpc for each hub ID into sum-hub9-inpc.dbf

4.21. Area in floodzones = 1
Identity floods-utm hubs9py **hubs9-flzn** poly 1 join
Defined selection as ID > 0 and flood >= 100
Summarized acres in **sum-hub9-flzn-acres.dbf**
5 Natural Breaks
1206.7160 = 1
5527.2041 = 2
13568.4258 = 3
31808.0566 = 4
61460.4960 = 5
Added item –rank-flood. Calculated as above. Summarized average rank-flood each hub ID into sum-hub9-flood.dbf

4.22. Length of BSC or Significant Streams in hub = 1
Deleted redefined items in j:\greenways\anc_data\bsc (id, enr1, enr2)
Identity bsc hubs9py hubs9-bsc line 1 join
Defined selection as ID > 0 and grid-code > 0 and bsc = A
Summarized length in sum-hub9-bsc-length.dbf
Dbaseinfo sum-hubs9-bsc-length.dbf sum-hubs9-bsc-lng
Joinitem hubs9-bsc.aat sum-hubs9-bsc-lng hubs9-bsd.aat id
Created 5 Natural Breaks for sum-length
4265.9015 = 1
9344.6962 = 2
16528.6974 = 3
28521.9401 = 4
50483.6253 = 5
Additem rank-bsc. Calculate as above. Summarized average rank-bsc for each hub ID into sum-hub9-bsc.dbf.

4.23. Area of presettlement forest vegetation in forest hubs = 2
Identity H:\G\glo\final_glo_v6\glo_py6 glo_py6 hubs9py **hubs9-glo** poly 1 join
Defined selection as ID > 0 and (map = barrens or map = bottomland or map = forest or map = swamp) and flag = 1
Summarized acres in **sum-hub9-glo-forest-acres.dbf**
5 Natural Breaks for GLO forest land cover
151.7513 = 1
769.8430 = 2
2779.9800 = 3
12113.8193 = 4
30337.0879 = 5
Added item rank-glo. Calculated as above. Summarized average rank-glo for each hub ID into sum-hub9-glo.dbf

4.24. Area of Railroad prairies in hub = 4

Identity h:\h\statewide_datasets\pr_remnants hubs9py **hubs9-prs-rem** poly 1 join
Defined selection as ID > 0 and Flag = 1
Summarized acres in **sum-hub9-premn-acres.dbf**
5 Natural Breaks
10.0314 = 1
31.9952 = 2
65.3114 = 3
134.7932 = 4
285.9608 = 5
Added item –rank-pr-rem. Calculated as above. Summarized average rank-pr-rem each hub ID into sum-hub9-pr-rem.dbf

4.25. In Access, joined all tables. Added weights. Converted to dbase file, then into info (group-all) Adjusted items (ID) to match.
*Joinitem hubs9py-rank.pat group-all hubs9py-rank.pat id*
created 3 natural breaks, calculated natbrk-3 ranks.
54 - 91 = 2
92 - 110 = 4
111 - 136 = 6

## 5. Identify potential corridors

### 5.1. Identified healthy aquatic corridors.

5.1.1. Combined BSC-A ranked streams and Significant streams coverages.

```
Arcedit
ec bsc
ef arc
sel bsc = 'A'
put bscabss
ec sigstrms
ef arc
sel all
put bscabss
ec bscabss
```

5.1.2. Removed overlapping arcs, fixed node dangles.

5.1.3. Created aquatic minimum width area

5.1.4. Buffered streams by about 550 feet(167.6 - 168 meters) and 1000 feet (304.8 meters)
*buffer bscabss bscabssb1 # # 167.6 1 line flat full*
*buffer bscabss bscabssb2 # # 304.8 1 line flat full*

5.1.5. Clipped floodzone coverage with buffered streams. This retained only the floodzones within the significant stream areas.

*clip floodzns_100y bscabssb2 bscabssfz poly 1*

5.1.6. Combined healthy aquatic corridors buffered streams with clipped floodzones.

*union bscabssfz bscabssb1 bscabssbf 1 join*

5.1.7. Added item to .pat file, calculated all polygons to 1.

*additem cor-fz-mx.pat cor-fz-mx.pat flag-aq 1 1 i*
*info*

*ARC*
*SEL COR-FZ-MX.PAT*
*RESEL COR-FZ-MX# > 1*
*CALC FLAG-AQ = 1*
*Q STOP*

Looked at coverage in arcmap. Found polygon in-holding and calculated flag to 0. (One in southern Illinois where streams joined together and enclosed a polygon)

5.1.8. Dissolved polygons on flag

*dissolve cor-fz-mx* ***cor-fz-mxd*** *flag-aq poly*

## 5.2. Identified healthy terrestrial corridors ISIS area vegetation

5.2.1. Extracted ISIS forest and grassland bankside vegetation (*forkball, grbkall*)

5.2.2. Combined into one coverage (*isisbk-cov*)

5.2.3. Created aquatic minimum width area

5.2.4. Buffered streams by about 550 feet(167.6, or 168 meters) and 1000 feet (304.8 meters)

*buffer isisbk-cov isisbk-bf1 # # 167.6 1 line flat full*
*buffer isisbk-cov isisbk-bf2 # # 304.8 1 line flat full*

5.2.5. Clipped floodzone coverage with buffered streams. This retained only the floodzones within the significant stream areas.

*clip floodzns_100y isisbk-bf2 fz-bf2 poly 1*

5.2.6. Combined healthy terrestrial corridors buffered streams with clipped floodzones.

*union isisbk-bf1 fz-bf2 isisbk-fzbf2 1 join*

5.2.7. Added item to .pat file, calculated all polygons to 1.

*additem isisbk-fzbf2.pat isisbk-fzbf2.pat flag 1 1 i*
*info*

*ARC*

*SEL ISISBK-FZBF2.PAT*
*RESEL ISISBK-FZBF2# > 1*
*CALC FLAG = 1*
*Q STOP*

Looked at coverage in arcmap. Found 3 areas of polygon in-holding and calculated flag to 0.

5.2.8. Dissolved polygons on flag
*dissolve isisbk-fzbf2* ***isisbk-fz-ds*** *flag poly*

## 5.3. Identified linear wetlands.

5.3.1. Created Forested and emergent wetland coverage from National Wetland Inventory (NWI) statewide data set.
Reselected from j:\greenways\corridors\wetstateln to create wetstateln-ef
illcode > 1100 and illcode <= 1122
illcode > 2100 and illcode <= 2122
illcode > 1130 and illcode <= 1230
illcode > 2130 and illcode <= 2230

5.3.2. Buffered streams by about 550 feet(167.6 - 168 meters) and 1000 feet (304.8 meters)
*buffer wetstateln-ef wetlnef-1 # # 167.6 1 line flat full*
*buffer wetstateln-ef wetlnef-2 # # 304.8 1 line flat full*

5.3.3. Clipped floodzone coverage with buffered streams. This retained only the floodzones within the significant stream areas.
*clip floodzns_100y wetlnef-2 fz-wetlnef2 poly 1*

5.3.4. Combined healthy wetland corridors buffered streams with clipped floodzones.
*union wetlnef-1 fz-wetlnef2 wetlnef-fzwet 1 join*
*build wetlnef-fzwet poly*

5.3.5. Added item to .pat file, calculated all wetland forest polygons to 1
*additem wetlnef-fzwet.pat wetlnef-fzwet.pat flag 1 1 i*
*info*
*ARC*
*SEL WETLNEF-FZWET.PAT*
*RESEL WETLNEF-FZWET# > 0*
*CALC FLAG = 1*
*Q STOP*

5.3.6. Dissolved wetland polygons on flag
*dissolve wetlnef-fzwet wetlnefz-d flag poly*
*build* ***wetlnefz-d*** *poly*

**5.4. Create railroads coverage**

5.4.1. clip railroads with state boundary
*clip rails100 county_new rails-clip line 1*

5.4.2. Select abandoned railroads.

5.4.3. buffer by typical width of 50 feet (common railroad right of way) (15.25 m)
*buffer rails-clip rails-buf # # 15.25 1 line flat full*
*build rails-buf poly*

**5.5. Convert final corridor covers to rasters**
Wetlnefz-d to wetlnefzd-gd on FLAG = wetland corridors
Isisbk-fz-ds to isisbkfzd-gd2 on FLAG = terrestrial corridors
Cor-fz-mxd to corfzmxd-gd on FLAG = streams corridors
Rails-buf to railsbuf-gd on FLAG-RR

**5.6. Merge all corridors together**
***All-corridors*** *= merge (wetlnefzd-gd, isisbkfzd-gd2, corfzmxd-gd, railsbuf-gd)*

**6. Corridor Ranking**

6.1. Forest Impedance - Created upland forest core areas

6.1.1. *upland-for1 = con(j:\greenways\anc_data\ilgapvegbuf >= 22, con(j:\greenways\anc_data\ilgapvegbuf <= 26, 1))*

6.1.2. *upland-for2 = con(j:\greenways\anc_data\ilgapvegbuf >= 45, con(j:\greenways\anc_data\ilgapvegbuf <= 48, 1))*

6.1.3. *uplandfor = merge (upland-for1, upland-for2)*

6.1.4. *uplandtr1 = uplandfor * con(j:\greenways\final-2\hub-rank\hubs-1tier = = 6, 1)*

6.2. Create Land Cover impedance (starting grid)

6.2.1. Used ilgapvegbuf grid, reclassified il-gap to impedance values. Save as LC-imped.
Did a second version with urban and riparian values entered. Save as **lc-imped2**

6.3. Created riparian forest.

6.3.1. Used corfzmxd-gd, reclassified value (1) to 25 = value to subtract from

6.3.2. Used ISISfor_bkall grid, reclassified value (1 or 2) to 25 = value to subtract from impedance of forest cells adjacent to water. Save as **isisbk-impeds.**

6.4. Created interior forest impedance

6.4.1. Used intforall, created grid and reclassified value to 13 = value to subtract from impedance of interior forest cells adjacent to water. Saved as **intfor-imped.**

6.5. Created proximity to urban development impedance

6.5.1. Used ilgapvegbuf to create high density urban development grid
*Hidev = con(h:\h\landcov\il-gap\grid\ilgapvegbuf ge 30, con(h:\h\landcov\il-gap\grid\ilgapvegbuf le 31, 1))*
*Dist-hidev = int(eucdistance(hidev))*
*Gridclip dist-hidev dist-hidevcl statebnd*
*Displayed with 6 natural breaks and exclusion of 0 and >90.*

6.5.2. Converted distance from high-intensity to impedance value
For high density urban, used

| Distance (m) | Disturbance Intensity | Add to Impedance |
|---|---|---|
| 0 | 2000 | NoData |
| 30 | 1000 | 950 |
| 42 | 683 | 633 |
| 60 | 524 | 474 |
| 67 | 366 | 316 |
| 84 | 208 | 158 |
| 90 | 50 | 0 |

6.5.3. Used ilgapvegbuf to create low/medium urban development grid
*lomdev = con(h:\h\landcov\il-gap\grid\ilgapvegbuf ge 32, con(h:\h\landcov\il-gap\grid\ilgapvegbuf le 34, 1))*
*Dist-lomdev = int(eucdistance(lomdev))*
*Gridclip dist-lomdev lomdevcl statebnd*
*Displayed with 6 natural breaks and exclusion of 0 and >90*

6.5.3.1. Converted distance from low/medium density to impedance value. For low/medium intensity used:

| Distance (m) | Disturbance Intensity | Add to Impedance |
|---|---|---|
| 0 | 2000 | NoData |
| 30 | 500 | 450 |
| 42 | 350 | 300 |
| 60 | 275 | 225 |
| 67 | 200 | 150 |

| | | |
|---|---|---|
| 84 | 125 | 75 |
| 90 | 50 | 0 |

6.5.4. Reclassified NoData to 0 in low/med and high urban intensity grids so that two grids would merge properly. Saved as higint-imped0 and lomdint-imped respectively.

6.5.5. Combined impedances by selecting maximum value.
*__Urbprox-imped__ = max(higint-imped0, lomint-imped0)*

6.6. Created road impedance layer

6.6.1. Created idot-interstate grid from idot_int_bf and saved as idot-intst. Created impedance layer by assigning interstate roads impedance value of 5000. Assigned inside of 1 to nodata.

6.6.2. Created idot-state grid from idot_st_bf and saved as idot-state. Created impedance layer by assigning state roads impedance value of 1000. Assigned inside of 1 to nodata. Save as idotst-imp

6.6.3. Created idot-us grid from idot_us_bf and saved as idot-us. Created impedance layer by assigning county roads impedance value of 1000. Assigned inside of 1 to nodata. Save as idotus-imp.

6.6.4. Created 'county highways' coverage from ESRI roads, selecting FCC = A30 and highway_name contains county highway. Saved as county_hwys. Created impedance layer by assigning county highways inpediance value of 500. Saved as cohy-imp

6.6.5. Merged the 4 impedance layers
*Rd-imp1 = merge(idotst-imped idot-in-imped, idotus-imped, cohwy-imp)*

6.6.6. Created bridges coverage – used idot_bridges point cover. Converted to coverage, reprojected and buffered by 150 ft (45.7 meters). Convert to grid (idot-brdg) Saved as idot-brd-45bf Create impedance layer by assigning bridges impedance value of 300. Save as *idotbd-imped.*

6.6.7. Create 'other roads' coverage from statewide roads2 coverage. Used 12 m buffer. Saved as roads2buf. Calculated score by road type, 0 for urban, 1 for interstate, etc. and 5 for rural roads. Saved as roads2-score. Reclassified 5 as 400, rest as nodata, saves as rd2-score2

6.6.8. merged roads and bridges together
*__rd-impall__ = merge(idotbd-imped, rd-imp1, rd2-score2)*

6.7. Slope impedance

6.7.1. Created slope by using the spatial analysis tool, leaving the z value as the default '1'. Adjusted classification to 4 natural breaks, 4, 14, 30 and 88(max).

6.7.2. Reclassified using

0 – 4 = 0
4.1 – 14 = 2
14.1 – 30 = 5
30.1 – 88 = 10

Saved as slope-imped. Reproject to utm-83. Saved as **slope-imped2**

6.8. Protected land impedance

6.8.1. Created grid of public (stewardship layer) land using classification column.

6.8.2. Reclassified value to 5. Saved as **public-imped**.

6.9. Created hub impedance

6.9.1. Converted hubs9py-rank with 3 natural breaks into grid hubs9-py-rk3, reclassified so only top tier remains, called **hubs-1tier**

6.10. Merge impedances to create overall landscape impedance.

6.10.1. grid: setwindow j:\greenways\final-2\hub-id\hubs9

6.10.2. setcell j:\greenways\final-2\hub-id\hubs9

6.10.3. Give bridges impedance calculated earlier, other developed cells value of 0, elsewhere overlay road impedance over forested wetland impedance and landcover impedance.

*Roadlcimp-0 = merge(idotbdimp-0, (merge(rdimp-0, lcimp2-0) + con(urbproimp-0 >= 0, 0)))*

6.10.4. Converted all NoData to 0. Merge road impedance with other impedance.

*Uplandimp-0 = roadlcimp-0 – isisbdimp-0 – intforimp-0 + urbproimp-0 + sloimp-0 – pubimp-0 – hubs9-rk3-0 (also called j:\greenways\corridors\final\upland-impall)*

6.10.5. Extract by mask upland-imp-0 with all-corridors to create j:\greenways\corridors\final\leastcost2\allcorr-imped

6.10.6. Reclassified allcorr-imp to **all-imp-noneg** by converting all negative values to 1.

6.11. Least-cost path

6.11.1. Convert upland-core (uplandtr1) to polygon coverage. Save as j:\greenways\forests\uplandtr1-py

6.11.2. Add items 'flag'. Select grid-code >= 0. Calc flag = 1

6.11.3. Dissolve uplandtr1-py on flag. Save as upcoredis-py

6.11.4. Move labels to center of polygon
*Centroidlabels upcordis-py inside*

6.11.5. Select large core areas, those with areas > 100 acres. Saved as upcordis-100
6.11.6. Created label coverage from upcordis-100. Saved as upcod100pt

6.11.7. Selected one label per polygon. Saved as upwetpts-id Added labels from hubdis-ids Converted to raster and saved as upwetptsid-gd

6.12. Ran cost distance from arctoolbar. Used upwetptid-gd for sources, and all-imp-noneg for impedance. Saved output as j:\greenways\corridors\final\leastcost2\upwet-cstdist and upwet-cstbklk

6.13. Created cost distance grid
Ran (in ArcToolBox) cost distance command. Used upwetptid-gd and all-imp-noneg to create upwet-cstdist, upwet-cstbklk

6.14. Created cost path grid
Ran (in ArcToolBox) cost path command. Used upwetptid-gd and upwet-cstdist and upwet-cstbklk to create **upwet-cpath**. Calcuated for each cell.
6.15. Convert upwet-cpath to arc coverage
*Gridline upwet-cstpath up-patharc2 positive thin # round grid-code 500 # #*

**6.16. Corridor Ranking - Wetland Impedance**

6.16.1. Created wetland core areas

6.16.2. Selected wetlands > 100 acres from wets-emg, saved to wetemg-100ac. Converted to grid on ilcode – saved as wetsemg-100ac. (Note this contains emergent and forested wetlands)

6.16.3. wetland-core = con(j:\greenways\final-2\hub-rank\hubs-1tier == 6, 1) * wetlsemg-100ac

6.17. Created land cover impedance using table values. Saved as lcwetimp.

| Land Cover Name | Land Cover Class | Impedance Value |
|---|---|---|
| Open Water | 48, 51 | 150 |
| Urban (low, med, high) | 30 - 34 | NoData |
| Quaries-barren | 52 | 650 |

| | | |
|---|---|---|
| Forest (Deciduous/Coniferous) | 20-26 | 225 |
| Hay, Pasture | 14, 17 | 250 |
| Row Crops/ Urban grass | 10-13, 15-17 | 325 |
| Wetlands forested-emergent | 40-48 | 50 |
| NoData | | NoData |

6.17.1. Reclassified NoData as 0. Saved as lcwetimp-0

6.18. Created wetland impedance
reclassified nwi-emerg to ..corridors\wetemg-imped. Code all ILCODE as 50, rest as NoData . Reprojected to utm-83 and saved as wetemg-imped2

6.19. Created riparian impedance

6.19.1. Reclassified ilgapvegclp for surface water only = 1, rest = NoData. Saved as wet-openwater in streams directory.

6.19.2. Reclassified ilgapvegclp for non forest-wetland areas. Forest, wetlands, water = NoData, rest = 1. Saved as j:\greenways\corridors\wet-nonfor

6.19.3. Calculated distance of each forest, wetlands, and water cell to the nearest non-forest, wetlands, or water cell.
*Dist_in_cover = int(eucdistance(wet-nonfor))*

6.19.4. Calculate riparian impediance

| Riparian Distance (meters) | Riparian impedance |
|---|---|
| <67 | 150 |
| 67 | 100 |
| 161 | 96 |
| 318 | 87 |
| 582 | 84 |
| 1075 | 81 |
| 1938 | 75 |

6.20. Interior forest impedance – same as forest

6.21. Road impedance – same as forest

6.22. Proximity to urban development impedance – same as forest

6.23. Slope impedance – same as forest

6.24. Protected land impedance – same as forest

6.25. Hub impedance – same as forest

6.26. Merge bridge impedance calculated earlier, other developed cells NoDAta, elsewhere overlay road impedance over wetland, riparian, and land cover impedance

***wroad-lc-imp*** *= merge(idotbd-imped, (merge(rd-impall, lcwet-imp) + con(urbprox-imped >= 0, 0)))*

6.26.1. Converted all NoData to 0. Reran merge

***Wroadlc-imp0*** *= merge(idotbdimp-0, (merge(rdimp-0, lcwetimp-0) + con(urbproimp-0) >= 0, 0)))*

6.26.2. Merge impedances to create overall landscape impedance
***wetland-imped*** *= wroad-lc-imp – intfor-imped + urbprox-imped + sloimpclipl – public-imped – hubs9py-rk3*

6.26.3. Converted all NoData to 0. reran merged impedances

*Wetfinimp = wroadlc-imp0 – intforimp-0 + urbproimp-0 + sloimp-0 – pubimp-0 – hubs9-rk3-0*

6.27. Created impedance of 0 for wetland core areas.

*Grid: wetland-imp2 = con(isnull(wetland-core), wetfinimp, 0)*

6.27.1. Extract by mask wetland-imp2 with all-corridors to create j:\greenways\corridors\final\leastcost2\wetcorr-imped

6.27.2. Reclassified wetcorr-imp to **wet-imp-noneg1** by converting all negative values to 1.

6.28. Least-cost path

6.28.1. Convert wetland-core to polygon coverage. Save as wetcor-py

6.28.2. Add items 'flag'. Select grid-code >= 0. Calc flag = 1

6.28.3. Dissolve wetcor-py on flag. Save as wetcordis-py

6.28.4. Move labels to center of polygon

*Centroidlabels wetcordis-py inside*

6.28.5. Select large core areas, those with areas > 100 acres. Saved as wetcordis-100

6.28.6. Created label coverage from wetcordis-100. Saved as wetcod100pt

6.28.7. Create raster file of wetcod100pt. Save as wetcod100ptgd

6.28.8. Deleted all but 1 label for each hub. Moved labels to center, saved as wetpyidnew2.

6.29. Created cost distance grid

Ran (in ArcToolBox) cost distance command. Used wetpyidnew2 and wet-imp-noneg1 to create wet-cosstdis, wet-cosstbkl

6.30. Created cost path grid

Ran (in ArcToolBox) cost path command. Used wetpyidnew2 and wet-costdis and wet-cstbkl to create **wet-cospath**. Calcuated for each cell.
Note – this did not produce meaningful results. I re-ran with upwetptid-gd as point file. Got wetup-cstpath.

6.31. Convert wet-cpath to arc coverage

*Gridline wetup-cstpath wetup-patharc positive thin # round value 600 # #*

**6.32. Combine corridors**

6.32.1. Erased hubs from corridor path files

*Erase up-patharc with upwetpts-id2 (polygon coverage) to create up_path_nohub*

*Erase wetup-patharc with upwetpts-id2 to create wet_path_nohub*

6.32.2. Added flag to files

*Additem up_flag to up_path_nohub. Calculated = 1*

*Additem wet_flag to wet_path_nohub. Calculated = 1*

6.32.3. Merged upland and wetland corridor files.

Merge up_path_nohub and wet_path_nohub to create up_wet_merge.shp

6.32.4. Deleted dangeling corridors in up_wet_merge.shp Cleaned up small arcs in stray places. Saved as **corridor-all.**

# STATE WILDLIFE GRANT PROGRAM
## State of Illinois
## Final Performance Report

## Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems

## Project 2 – Identification and Selection of Conservation Elements

### Job 2.4 Ecological Classification of Rivers for Environmental Assessment and Management: Model Development and Risk Assessment

**Background**

Hawkins et al. (1993) describe several purposes that a general classification of stream habitats should serve, including facilitating communication between researchers and managers. Although the scale of their classification (channel units) may differ from what we propose (stream reaches), their suggestions on the functionality of a classification are very relevant. Unlike our terrestrial colleagues who have described habitat types at various spatial scales with much clarity, stream ecologists lack standardized names for systems that are widely accepted. Until aquatic systems are uniformly described and named, it is difficult for researchers and managers to agree on the status of and preferred management options for various stream types. Hawkins et al. (1993) further suggest that the attributes used in the classification are at the appropriate spatial scale to the biota of interest and the defined stream types are ecologically meaningful to both researchers and managers. We recognize that aquatic biota are influenced by local features within the channel, but are also influenced by the surrounding landscape and the water moving through the channel from the upstream watershed. Therefore, we have developed a database of attributes at several spatial scales that includes the local channel, local riparian zone, and local catchment, as well as the entire upstream riparian zone and watershed for each stream reach. A description of the GIS-derived attributes can be found in Holtrop et al. (2005).

Various methods for classifying rivers exist and range from purely physical or biological classifications to combinations of both. Geomorphic classifications such as that proposed by Rosgen (1994) and the channel evolution model (Schumm et al. 1984) are widely used across the United States. The premise of these classifications is that channels develop in a set pattern and can be classified as to their current state. Although these developmental channel stages can be shown to be important, purely geomorphic classifications do not capture variations in key ecological factors such as chemistry, hydrology, and temperature that also strongly shape the aquatic biota. Further, purely biological classifications, such as the Biological Stream Characterization (BSC; Bertrand et al. 1996) developed for Illinois waters, do not take into account physiochemical habitat when rating streams. BSC ratings are assigned to a stream reach primarily based on the fish community sampled at the site. Given the limitations of each of these approaches Illinois resource managers need a tool that will integrate ecological, biological, and geomorphic factors in a way that allows aquatic systems to be described in a standardized fashion.

To build on these existing approaches, we proposed the development of a statewide database system consisting of physically and biologically attributed stream reaches that can be used for description and classification of Illinois streams. The objectives for this project are to: 1) build models to predict habitat and biota from mapped landscape and local variables, and 2) assess risk of Illinois streams to future land use change. These objectives correspond to jobs 2.4 and 4.4 respectively in T-2-P1.

**Location and condition of stream habitats.**

The purpose of this job is to build statistical models for predicting riverine site habitats and biota from mapped landscape and local variables. Specifically, we created a series of models for flow, instream temperature, macroinvertebrates, and fish. The models described below are based on landscape-scale environmental variables that were derived from GIS data layers under Job 2.1 in T-3-P1 (see Holtrop et al. 2005 for more details). The models were then used to predict biological and habitat conditions for all river segments, including sampled and unsampled reaches.

<u>Flow</u>

Discharge was characterized using data from 70 U.S. Geological Survey stream gages scattered across Illinois. These gages were selected to minimize the influence of direct alteration by major diversions or seasonal regulation at dams. We summarized data from 1981-2000 to match the most recent land cover available and to be long enough to characterize natural inter-annual variation in discharge. Additional information associated with these catchments was derived from GIS data layers and used for model development and application (Figure 2.4a).

Multiple linear regression models were developed for a range of annual exceedence discharges (5%, 10%, 25%, 50%, 75%, 90%, and 95%). Potential predictors were proportions of surficial geology, landcover, and summary characteristics of the stream network (e.g., drainage area, link number, precipitation, slope) based on the catchment associated with the USGS gage data. Some variables were combinations of attributes such as the percentage of lakes and percent emergent wetlands combined into one 'open and wet' variable. Summarized discharge data and all potential predictors were checked for normality assumptions and transformed if necessary (generally natural logarithm or exponential).

Model development essentially followed an addition ($p<0.05$)/removal ($p<0.10$) stepwise regression procedure with initial development focused on the median flow. After each addition or removal, the predictive equation derived for the median flow model was reparameterized with high flow ($Q_{10}$) and with low flow ($Q_{90}$) data. If the most recent change did not result in a major decrease in the fit (adjusted $R^2$ and standard error) of these models, then the change was kept and development continued. When additional changes did not improve the fit of the models, then this combination of predictors was used to create a family of models for the additional exceedence flows (i.e., $Q_5$, $Q_{10}$, $Q_{25}$, $Q_{75}$, $Q_{90}$, $Q_{95}$). All models predict the natural log of the exceedence discharge in cubic meters per second and all predictors were retained in these models (values were converted to cubic feet per second for this report). Overall these models had good fits with high flows consistently predicted better than low flows (Table 2.4a).

Summaries from our georeferenced database system were applied to these hydrologic models for stream segments throughout the state. Modeled flows were added to the database system by attributing stream segments with the model output, thus allowing for a state-wide view of expected annual flows (Figures 2.4b-d). Less than two percent of all segments within Illinois were not able to be assessed with this method because the models did a poor job predicting discharge in small catchments with uniform surficial geology and/or landcover and in very large rivers.

### Temperature

Records from 75 temperature loggers collected between 1999 and 2005 demonstrate a broad range of thermal conditions existing in Illinois streams (Figure 2.4e). These temperature summaries were used with landscape based GIS catchment summaries to develop multiple regression models that estimate water temperatures. Since thermal records were seldom longer than a single year at any of the sites, we focused on summer water temperatures. We used landcover and geology summary data from several scales as potential predictors. Summaries were acquired for each logger location and each stream reach throughout the state for the local watershed, total upstream watershed, local riparian buffer, and total upstream riparian buffer. Summarized temperature data and all potential predictors were checked for normality assumptions and transformed if necessary (e.g., arcsine, square root, natural logarithm, or exponential). Model development followed an addition/removal stepwise regression procedure similar to that used for modeling discharge (see above). Mean daily maximum and mean daily minimum water temperatures for the month of July were modeled separately from these data (Table 2.4b).

The developed models were applied within our statewide georeferenced database system as a preliminary assessment of the thermal conditions within Illinois streams. Mean daily July temperatures were then derived as the average of the daily maximum and minimum temperatures from these models (Figure 2.4f). Stream segments were given a thermal code based on the Minimum and Maximum July water temperatures from the model output. The vast majority (79%) of segments had characteristics of warmwater streams but cold-/cool-water segments comprised approximately 16% of the total number of coded segments statewide (Figure 2.4f). Roughly four percent of all segments within Illinois were not able to be assessed with this method because these models did a poor job predicting water temperatures in very large rivers and small and/or relatively uniform catchments.

Macroinvertebrates

Summaries of macroinvertebrate sample collections from 636 stations were obtained from the Illinois Environmental Protection Agency (IEPA) that cover a broad range of conditions occurring in wadeable streams throughout the state. These collections were made between 1982 and 1998 by IEPA biologists and approximate the time associated with the recent landcover in our database system. With the assistance of our collaborators in Michigan, multiple linear regression models were developed that relate summaries of the invertebrate assemblage to human-induced stressors (e.g., landcover) and natural causes/covariates (e.g., drainage area, geology, etc). Total catchment and riparian zone summaries were obtained for each station from our existing database and used to develop models for several invertebrate assemblage summaries (i.e., number of Ephemeroptera Taxa, number of Ephemeroptera + Plecoptera + Trichoptera (EPT) Taxa, and the Macroinvertebrate Biotic Index (MBI)).

Where necessary, independent variables were transformed to meet assumptions of normality. Predictors that had the highest correlations with the invertebrate metrics were added into the models first; subsequent variables were added only if they were significant ($p<0.05$) and they improved the model fit ($r^2$). Overall these models explained slightly more than one quarter of the statewide variation in these invertebrate assemblage summaries (Table 2.4c) and demonstrate the potential for using our statewide database system for analysis with macroinvertebrate collections. While the model fits are not spectacular, they are in the range of similar models developed in other parts of the Midwest (M. J. Wiley, University of Michigan, personnel communication).

IEPA modified its sampling protocol during the course of this study and developed a macroinvertebrate Index of Biotic Integrity to better meet their assessment needs and water-quality objectives (Tetra Tech, Inc. 2005). These changes increase the sensitivity of the MBI but also make our model results difficult to compare with current assessment practices since the sampling protocol differs. Therefore we did not apply the macroinvertebrate models developed in this study throughout the state. However, we expect to undertake the development of similar models once adequate samples collected with the revised methods are available, and will subsequently apply these results within our statewide system.

Fish

We obtained fish community data for this study from the Fisheries Analysis System (FAS) database, which contains hundreds of samples collected by IDNR - Office of Resource Conservation biologists. Some sites have been sampled multiple times throughout IDNR=s monitoring program, thus a sample comprises the fish community sampled at a site on a given day. A subset of samples within FAS have corresponding water quality and instream habitat data collected by the Illinois Environmental Protection Agency as part of a cooperative agreement between the two agencies. All samples used in this modeling effort were wadeable or semi-wadeable sites, and were sampled as part of basin surveys. Abundance data for fishes were obtained from single pass electrofishing surveys conducted during summers from 1990 - 2000 at 442 sites.

Initially, our dataset comprised 146 fish species, including 9 hybrids. Each site had 3 - 41 species. Similar to Zorn et al. (2002), we used cluster analysis to group fishes that shared similar abundance patterns. Prior to analysis, hybrid species, individuals that were identified to genus, and rare species (i.e., those that occurred at less than 2% of sites) were removed. Sites were grouped into fish assemblage categories based on flexible beta hierarchical clustering (beta = -0.25) of a Relative Sorensen distance matrix, carried out in PC-ORD (PC-ORD 1999). Cluster analysis was performed on abundance data, which was defined as catch per unit effort (CPUE). For this job, CPUE was defined as the natural log (catch of each species per 1000 ft of stream length sampled +1). Initial analysis suggested that two ubiquitous species, Bluntnose minnow (present at 89% sites) and Green sunfish (present at 83% of sites) influenced the assemblage clusters. Therefore, these two species were removed prior to final clustering.

We used classification and regression tree (CART) analysis (Salford Systems 2002) to predict the occurrence of fish assemblages (defined by cluster analysis) and six individual species in Illinois streams based on landscape-scale variables. Thirty-two landscape-scale environmental variables, which were derived from GIS data layers, were used as predictors (Table 2.4d). Presence/absence data were used to model six individual species. Hornyhead chub (*Nocomis biguttatus*), Smallmouth bass (*Micropterus dolomieu*), Striped shiner (*Luxilus chrysocephalus*), Creek chubsucker (*Erimyzon oblongus*), Longear sunfish (*Lepomis megalotis*), and Fantail darter (*Etheostoma flabellare*) were chosen because they represented four families, three fish assemblages defined through our cluster analysis, as well as different ranges and habitat preferences. Smallmouth bass is identified as a species in greatest need of conservation in Illinois' Wildlife Action Plan.

To assess the accuracy of CART models, we assessed the classification rate, which is the group membership predicted by the model compared to the actual group membership. For the individual species models we further described the level of misclassification into errors of commission, where the model predicted presence but absence is observed in the data, and omission, where absence is predicted but presence is observed.

Using the remaining 86 species, we identified seven clusters of fishes for continued analysis (Table 2.4f). A dendrogram from the cluster analysis is shown in Figure 2.4g. Group 1 includes a few generalist warm-water fish species, and many species that are affiliated with clear water and minimal human impacts. The species included in group 2 tend to be restricted to the Wabash/Ohio drainage, and half of the species are in family Percidae. Group 3 is the largest group and comprises 26 species that are relatively common in larger streams and rivers. Many species in the group prefer sand or gravel substrates. Species comprising group 4 either persist only in southern Illinois, or are most abundant in backwaters, low gradient, and well-vegetated streams. Group 5 comprises species that tend to prefer slower moving water, quiet pools, and larger creeks or rivers. We combined groups 6 and 7 into one group based on the species= affinities to clear, cool, faster-flowing water. The final group comprises two shiner species, which prefer large to very large rivers. Presumably this group would comprise more species if our analysis included non-wadeable streams, which would include other large river species.

We used CART analysis to predict the occurrence of fish assemblages that we defined by cluster analysis. Four of the original seven clusters lacked sufficient representation in the dataset for further analysis; thus only three assemblages (Group 1, 2, 5 in Table 2.4g) were modeled using CART (Table 2.4f). The resulting model was then used to predict one of the three fish assemblages for every stream arc in Illinois (Figure 2.4h). Overall, these predicted fish assemblages matched our expectations. As our dataset grows to include more examples of the rare assemblage types (i.e., the four we could not model due to inadequate sample size), we will revisit the development of an assemblage-level model for fish. We expect the output from a more refined assemblage model will be very valuable for guiding restoration and protection efforts of Illinois' fish species in greatest need of conservation.

In addition to modeling fish assemblages, we modeled the presence/absence of six individual fish species (Tables 2.4g – 2.4l). Models included three to eight variables, and all included latitude and at least one landcover predictor (Table 2.4m). At least half of the models also included geology (bedrock or surficial), size, and flow. The range of total misclassification for each model was acceptable and ranged from 17% - 27% (Table 2.4m). Errors of commission accounted for 75% of the misclassification errors for all species models. Each model was then applied to all stream arcs, and the results of the models are shown in Figures 2.4i – 2.4n.

In general, the individual species models predict similar trends to known presence and absence of the selected species. In some cases (e.g., Striped shiner [Figure 2.4i] and Longear sunfish [Figure 2.4j]), latitude and longitude were such strong predictors that models appear to be driven almost exclusively by those factors. Other models (e.g., Creek chubsucker [Figure 2.4l] and Fantail darter [Figure 2.4n]) clearly have a latitudinal component, but other variables weigh in to predict occurrence of species outside of the latitude/longitude boundaries. Overall, the model for Smallmouth bass appears to have the most overlap between known presence and absence and the model predictions (Figure 2.4k). In Illinois, Smallmouth have a limited distribution and have a strong preference for streams with rocky substrate, continuous flow, and cooler water; these habitats are not uniformly represented throughout the state. The individual species models suggest that our approach is useful for predicting species presence/absence, especially for species that have specific habitat requirements.

**DISCUSSION**

This project marks an important step toward developing a tool that simplifies the natural variability in stream systems. The flow, temperature, and fish models developed in this project have been applied and attributed to streams segments statewide. By providing expectations for stream habitat and fish communities in sampled and unsampled reaches throughout the state, the resulting database system will be a valuable tool for implementing Illinois' Wildlife Action Plan. For example, one of the actions identified in the stream's campaign of Illinois' Plan is to restore populations of imperilled and extirpated aquatic animals (State of Illinois 2005). To meet this objective, resource managers need to identify where suitable habitat persists, which may include groundwater fed streams, as well as those with cool summer water temperatures. Prior to the completion of this project, summer water temperatures and groundwater influence were unknown for most streams in Illinois. Additionally, many of the GIS attributes developed in Holtrop et al. (2005) and used in the models in this project provide the basis for identifying system-wide limiting factors such as connectivity.

Hydrologic modeling provides a tool for developing expectations for stream flow where data are lacking or for assessing potential alterations in flow associated with local changes in model parameters (e.g., land cover). Application of the models developed in this project suggests the existence of a wide range of annual flow conditions within the streams of Illinois. When applied to the Kaskaskia River basin and compared with the 2025 LTM, these models provide a spatial analysis of potential alterations in flow associated with changes in land cover. While many of the stream reaches show little change in flow character, certain areas appear to be vulnerable to large alterations in flow conditions if current development trends continue. These results may help develop guidance for flow standards and will provide insight into the contribution of land alteration to the modification of flow regimes especially as additional basins are assessed.

Our assessment of thermal conditions in Illinois streams provides a geospatial picture of the locations where summer temperatures may limit the distribution or success of many aquatic species, particularly those considered coolwater or those that require high dissolved oxygen concentrations. However, our temperature models are based only on summer water temperatures from a single year at each site and thus provide no information about interannual variability or nonsummer conditions. Longer thermal records that would allow the modeling of mean conditions that take into account annual variability should improve the fit of our temperature models and provide more accurate estimates of the thermal character of modeled streams. Long periods of cold temperature are another potential period of stress for stream organisms that are not addressed with these models but may have a strong influence on the distribution of aquatic species in Illinois streams. These limitations could easily be addressed by continuing to annually monitor water temperature at fixed stations and in a variety of different streams throughout the state. Redevelopment and improvement of temperature models as additional data become available would improve and expand the reliability of our assessment of Illinois stream temperatures.

Although the fish assemblage model presented in this report is simplistic, it presents a useful approach to classifying biotic communities in rivers. As more data become available, the models may be refined to identify locations of rarer community types, including coolwater and headwater fish assemblages. The individual species models, which are based on presence/absence data, provide one approach for identifying areas that can be conserved to sustain population of listed species, as well as identifying suitable habitats for species reintroductions.

The outputs for the models developed in this project along with the GIS attributes developed in Holtrop et al. (2005) provide the necessary data for developing a stream classification for Illinois. We intend to develop an approach for grouping stream arcs into larger stream reaches and then classify these reaches into stream types. An ecological classification of rivers as we propose will help Illinois resource managers identify high-quality examples of all river and stream communities, thereby helping to set restoration and management priorities. In this project, we attempted to document changes in flow, temperature, biota associated with altered land use. In general, our models did not detect numerous changes between current conditions and those of 2025. However the changes that were identified suggest areas that may be at risk by future land use change. As our models are refined, we should have increased ability to detect potential risks to biota in the future.

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**Table 2.4a.** Summary of hydrologic model family fit statistics. Landcover and surficial geology Variables are transformed proportions of the total upstream watershed. **Bold** are statistically significant ($p<0.05$).

| Model | Q05 | Q10 | Q25 | Q50 | Q75 | Q90 | Q95 |
|---|---|---|---|---|---|---|---|
| R squared | 98.6% | 98.4% | 98.0% | 96.9% | 93.9% | 81.9% | 75.6% |
| R squared (adjusted) | 98.4% | 98.2% | 97.7% | 96.6% | 93.2% | 79.8% | 72.7% |
| Standard Error | 0.197 | 0.2175 | 0.2551 | 0.3372 | 0.537 | 1.37 | 1.888 |
| Degrees of Freedom | 67 | 67 | 67 | 67 | 67 | 67 | 67 |

| Variable | prob | prob | prob | prob | prob | prob | prob |
|---|---|---|---|---|---|---|---|
| Constant | **< 0.0001** | **< 0.0001** | 0.0924 | 0.7583 | 0.6245 | 0.2167 | 0.8084 |
| (Ln) Drainage Area | **< 0.0001** | **< 0.0001** | **< 0.0001** | **< 0.0001** | **< 0.0001** | **< 0.0001** | **< 0.0001** |
| (exp) Forested Wetland | **< 0.0001** | **0.0741** | **0.0006** | **< 0.0001** | **< 0.0001** | **0.0003** | **0.012** |
| (exp) Open and Wet | 0.4399 | 0.157 | **< 0.0001** | **< 0.0001** | **< 0.0001** | **0.0019** | **0.0045** |
| (exp) Fine Moraine | **0.0002** | 0.5422 | **0.0002** | **< 0.0001** | **< 0.0001** | **< 0.0001** | **< 0.0001** |
| (exp) Urban | 0.7493 | **0.0139** | **< 0.0001** | **< 0.0001** | **< 0.0001** | **< 0.0001** | **< 0.0001** |
| (exp) Coarse Moraine | 0.34 | **0.0769** | **0.0022** | **0.0044** | **0.0044** | **0.0343** | **0.0525** |
| (exp) Bedrock | **< 0.0001** | **0.019** | 0.7737 | **0.0082** | **< 0.0001** | **0.0055** | **0.0203** |
| (exp) Medium Moraine | **0.0032** | **0.0662** | 0.5843 | **0.026** | **< 0.0001** | **< 0.0001** | **< 0.0001** |

**Table 2.4b.** Summary of temperature fit statistics and model predictor variables. Landcover and geology variables are transformed proportions of the total upstream watershed (WT_), local riparian (R_), total upstream riparian (RT_). **Bold** are statistically significant ($p<0.05$).

| July mean daily Minimum | Fit | July mean daily Maximum | Fit |
|---|---|---|---|
| R squared | 68.6% | R squared | 55.5% |
| R squared (adjusted) | 63.4% | R squared (adjusted) | 48.2% |
| Standard Error | 1.418 | Standard Error | 1.724 |
| Degrees of Freedom | 61 | Degrees of Freedom | 61 |
| **Variable** | **prob** | **Variable** | **prob** |
| Constant | **< 0.0001** | Constant | **< 0.0001** |
| WT_Darcy | **< 0.0001** | WT_Darcy | **< 0.0001** |
| (asin) R_Shale | **0.0199** | (asin) R_Shale | **0.0009** |
| (asin) R_BD0 50 | **0.0036** | (asin) R_BD0 50 | **0.0027** |
| (asin) RT_Moraine | **< 0.0001** | (asin) RT_Moraine | **0.0004** |
| (sqrt) WT_Moraine | **0.0019** | (sqrt) WT_Moraine | **0.0207** |
| (ln) WT_Slope | **0.0012** | (ln) WT_Slope | **0.0001** |
| (ln) Link | **0.0012** | (ln) R_Soil_Permeability | **0.0068** |
| RT_Carbonate | 0.0523 | (ln) RT_Slope | **0.0006** |
| (asin) RT_Fine | **0.0475** | (ln) Link | **0.0152** |
| (sqrt) R_Slope | 0.0896 | (exp) R_Forest Total | **0.0092** |

**Table 2.4c.** Multiple linear regression models developed for macroinvertebrate assemblages in Illinois streams. Models are in the general form Y = constant + $B_1 Ln(X_1+0.0001) + B_2 Ln(X_2+0.0001) + \ldots + B_n Ln(X_n+0.0001)$. All independent variables are catchment scale attributes, land use and geology are in percentages, drainage area in $km^2$, Air temp in °C, ecoregion code 1 = interior river valleys and hills, ecoregion code 2 = driftless area. [a]No transformation used on variable, [b]Square root transformation used on variable.

| Dependent Variable | Independent variable | Coefficient | Coefficient standard error | Coefficient P-value | Model $R^2$ | Model P-value |
|---|---|---|---|---|---|---|
| No. of E taxa (E count) | Constant | 0.466 | 0.407 | 0.253 | 29.7 | <0.001 |
| | Drainage area | 0.842 | 0.072 | <0.001 | | |
| | Urban | -0.213 | 0.046 | <0.001 | | |
| | Wetland | -0.795 | 0.102 | <0.001 | | |
| | Forest | 0.205 | 0.077 | 0.008 | | |
| | Q90/Q10 [b] | -3.844 | 1.335 | 0.004 | | |
| No. of EPT taxa (EPT count) | Constant | 15.600 | 4.671 | <0.001 | 27.4 | <0.001 |
| | Drainage Area | 1.095 | 0.098 | <0.001 | | |
| | Urban | -0.439 | 0.069 | <0.001 | | |
| | Wetland | -0.650 | 0.132 | <0.001 | | |
| | JL Air Temp Max[a] | -0.458 | 0.152 | 0.003 | | |
| Macroinvertebrate Biotic Index (MBI) | Constant | 6.029 | 0.114 | <0.001 | 26.3 | <0.001 |
| | Drainage area | -0.183 | 0.021 | <0.001 | | |
| | Urban | 0.094 | 0.013 | <0.001 | | |
| | Forest | -0.113 | 0.022 | <0.001 | | |
| | Q90/Q10 [b] | 1.142 | 0.418 | 0.007 | | |
| | Ecoregion code 1[a] | 0.675 | 0.071 | <0.001 | | |
| | Ecoregion code 2[a] | 0.657 | 0.211 | 0.002 | | |

Table 2.4d. Landscape-scale environmental variables used in CART analysis. All variables are taken, calculated, or predicted from GIS data layers.

| Variable Name | Definition |
|---|---|
| *Connectivity* | |
| DAM | Categorical variable which identifies the presence of a dam (1) versus not (0) |
| BIGRIVER | Categorical variable which identifies if the stream reach is connected to a large river, defined as |
| DLINK | Shreve stream order of downstream arc |
| *Water Temperature* | |
| MEANJULY | Maximum daily mean water temperature, based on model |
| RANGEJULY | Greatest daily range in water temperature between June through August, based on model predictions |
| MEANCODE | Categorical variable for predicted mean July temperature |
| RANGECODE | Categorical variable for range July temperature |
| *Channel Form* | |
| SLOPE | Mean slope |
| SINUOSITY | Sinuosity of stream reach, the actual channel length/straight |
| GRADIENT | Channel gradient, the change in elevation /channel length from start to finish |
| *Flow* | |
| Q_MAGNITUDE | 50% exceedence flow, the median flow; as 50% of flows are 50% of flows are lower |
| Q_VARIATION | 10% exceedence flow divided by the 90% exceedence flow |
| Q50YIELD | 50% exceedence flow/drainage area |
| *Location* | |
| LATITUDE | Latitude (decimal degrees, N) |
| LONGITUDE | Longitude (decimal degrees, W) |
| ECOREGION | Omernik's Level III ecoregions |
| *Potential Groundwater* | |
| R_DARCY | Average Darcy value, an index of potential groundwater movement with lower values indicating more groundwater potential, for an area 150 m wide, centered on channel |
| *Land Use/Land Cover* | |
| R_URBAN | % of riparian zone with urban land uses such as roads, |
| R_AGR | % of riparian zone with agricultural land uses such as row crops, pasture, orchards, farm buildings, and feedlots |
| R_FOREST | % of riparian zone with forest land cover, excluding forested wetlands |
| WT_URBAN | % of entire watershed with urban land uses |

| | |
|---|---|
| WT_AGR | % of entire watershed with agricultural land uses |
| WT_FOREST | % of entire watershed with forest land cover |
| *Bedrock and Surficial* | |
| W_BD0_50 | % of watershed with bedrock at a depth of 50 ft or less |
| W_SHALE | % of watershed with shale bedrock |
| W_FINE | % of watershed with fine texture surficial geology |
| W_MEDIUM | % of watershed with medium texture surficial geology |
| W_COARSE | % of watershed with coarse texture surficial geology |
| *Size* | |
| LINK | Shreve stream order |
| ORDER | Strahler stream order |
| DA_KM2 | Drainage area of entire watershed, calculated in square |

Table 2.4e. Fish species assemblages as defined by cluster analysis. Table is sorted by common name within each group.

| | SPECIES CODE | COMMON NAME | SCIENTIFIC NAME | FAMILY |
|---|---|---|---|---|
| Group 1 | | | | |
| | BMS | Bigmouth shiner | Notropis dorsalis | Cyprinidae |
| | BLD | Blackside darter | Percina maculata | Percidae |
| | COS | Central stoneroller | Campostoma anomalum | Cyprinidae |
| | CRC | Creek chub | Semotilus atromaculatus | Cyprinidae |
| | GOR | Golden redhorse | Moxostoma erythrurum | Catostomidae |
| | HOC | Hornyhead chub | Nocomis biguttatus | Cyprinidae |
| | JOD | Johnny darter | Etheostoma nigrum | Percidae |
| | NHS | Northern hog sucker | Hypentelium nigricans | Catostomidae |
| | ORD | Orangethroat darter | Etheostoma spectabile | Percidae |
| | RES | Red shiner | Cyprinella lutrensis | Cyprinidae |
| | ROB | Rock bass | Ambloplites rupestris | Centrarchidae |
| | RYS | Rosyface shiner | Notropis rubellus | Cyprinidae |
| | SAS | Sand shiner | Notropis ludibundus | Cyprinidae |
| | SHR | Shorthead redhorse | Moxostoma macrolepidotum | Catostomidae |
| | SVR | Silver redhorse | Moxostoma anisurum | Catostomidae |
| | SMB | Smallmouth bass | Micropterus dolomieu | Centrarchidae |
| | STC | Stonecat | Noturus flavus | Ictaluridae |
| | STS | Striped shiner | Luxilus chrysocephalus | Cyprinidae |
| | SUM | Suckermouth minnow | Phenacobius mirabilis | Cyprinidae |
| | WHS | White sucker | Catostomus commersoni | Catostomidae |
| Group 2 | | | | |
| | BAD | Banded darter | Etheostoma zonale | Percidae |
| | BLR | Black redhorse | Moxostoma duquesnei | Catostomidae |
| | BRM | Brindled madtom | Noturus miurus | Ictaluridae |
| | DUD | Dusky darter | Percina sciera | Percidae |
| | ESD | Eastern sand darter | Etheostoma pellucidum | Percidae |
| | LOP | Logperch | Percina caprodes | Percidae |
| | RAD | Rainbow darter | Etheostoma caeruleum | Percidae |
| | SFS | Spotfin shiner | Cyprinella spiloptera | Cyprinidae |
| | SPB | Spotted bass | Micropterus punctulatus | Centrarchidae |
| | SDS | Spotted sucker | Minytrema melanops | Catostomidae |
| Group 3 | | | | |
| | BHC | Bighead carp | Aristichthys nobilis | Cyprinidae |
| | BLB | Black bullhead | Ameiurus melas | Ictaluridae |
| | BNS | Blacknose shiner | Notropis heterolepis | Cyprinidae |
| | CAP | Carp | Cyprinus carpio | Cyprinidae |
| | CCF | Channel catfish | Ictalurus punctatus | Ictaluridae |
| | CYM | Cypress minnow | Hybognathus hayi | Cyprinidae |
| | EMS | Emerald shiner | Notropis atherinoides | Cyprinidae |
| | FHM | Fathead minnow | Pimephales promelas | Cyprinidae |
| | FCF | Flathead catfish | Pylodictis olivaris | Ictaluridae |

| | | | | |
|---|---|---|---|---|
| | FRD | Freshwater drum | Aplodinotus grunniens | Sciaenidae |
| | GZS | Gizzard shad | Dorosoma cepedianum | Clupeidae |
| | GOL | Goldeye | Hiodon alosoides | Hiodontidae |
| | GRC | Grass carp | Ctenopharyngodon idella | Cyprinidae |
| | HFC | Highfin carpsucker | Carpiodes velifer | Catostomidae |
| | LOG | Longnose gar | Lepisosteus osseus | Lepisosteidae |
| | NOP | Northern pike | Esox lucius | Esocidae |
| | ORS | Orangespotted sunfish | Lepomis humilis | Centrarchidae |
| | ULL | Quillback | Carpiodes cyprinus | Catostomidae |
| | RSF | Redear sunfish | Lepomis microlophus | Centrarchidae |
| | RVC | River carpsucker | Carpiodes carpio | Catostomidae |
| | SHD | Slenderhead darter | Percina phoxocephala | Percidae |
| | SAB | Smallmouth buffalo | Ictiobus bubalus | Catostomidae |
| | WAE | Walleye | Stizostedion vitreum | Percidae |
| | WES | Weed shiner | Notropis texanus | Cyprinidae |
| | WHB | White bass | Morone chrysops | Moronidae |
| | WHC | White crappie | Pomoxis annularis | Centrarchidae |
| Group 4 | | | | |
| | BAS | Banded sculpin | Cottus carolinae | Cottidae |
| | BKB | Black buffalo | Ictiobus niger | Catostomidae |
| | BLC | Black crappie | Pomoxis nigromaculatus | Centrarchidae |
| | BOW | Bowfin | Amia calva | Amiidae |
| | FLR | Flier | Centrarchus macropterus | Centrarchidae |
| | RBS | Ribbon shiner | Lythrurus fumeus | Cyprinidae |
| | STD | Stripetail darter | Etheostoma kennicotti | Percidae |
| | TPM | Tadpole madtom | Noturus gyrinus | Ictaluridae |
| Group 5 | | | | |
| | BST | Blackspotted topminnow | Fundulus olivaceus | Cypriodontidae |
| | BLT | Blackstripe topminnow | Fundulus notatus | Cypriodontidae |
| | BLG | Bluegill | Lepomis macrochirus | Centrarchidae |
| | BRS | Brook silverside | Labidesthes sicculus | Atherinidae |
| | CCS | Creek chubsucker | Erimyzon oblongus | Catostomidae |
| | GRP | Grass pickerel | Esox americanus | Esocidae |
| | LMB | Largemouth bass | Micropterus salmoides | Centrarchidae |
| | LOS | Longear sunfish | Lepomis megalotis | Centrarchidae |
| | MOF | Mosquitofish | Gambusia affinis | Poeciliidae |
| | PRP | Pirate perch | Aphredoderus sayanus | Percopsidae |
| | RDS | Redfin shiner | Lythrurus umbratilus | Cyprinidae |
| | SJM | Silverjaw minnow | Notropis buccatus | Cyprinidae |
| | SES | Steelcolor shiner | Cyprinella whipplei | Cyprinidae |
| | YEB | Yellow bullhead | Ameiurus natalis | Ictaluridae |
| Group 6 | | | | |
| | BKD | Blacknose dace | Rhinichthys atratulus | Cyprinidae |
| | CMS | Common shiner | Luxilius cornutus | Cyprinidae |
| | FAD | Fantail darter | Etheostoma flabellare | Percidae |
| | LSS | Largescale stoneroller | Campostoma oligolepis | Cyprinidae |

| | | | | |
|---|---|---|---|---|
| Group 7 | | | | |
| | OZM | Ozark minnow | Notropis nubilus | Cyprinidae |
| | SRD | Southern redbelly dace | Phoxinus erythrogaster | Cyprinidae |
| Group 8 | | | | |
| | MMS | Mimic shiner | Notropis volucellus | Cyprinidae |
| | RVS | River shiner | Notropis blennius | Cyprinidae |

Table 2.4f. Results of CART analysis of the fish assemblage cluster dataset. Four of the original seven clusters lacked sufficient representation in the dataset for CART analysis; thus only three assemblages were modeled using CART. The CART model is portrayed as a dichotomous key. For each leaf in the model, N indicates the number of sites within that leaf. Parentheses are used to identify the number of sites with each assemblage type in that leaf. The total misclassification rate for the model is 25%.

---

1a. ECOREGION ≤ 63.000 **Go to 2.**

- 2a. GRADIENT ≤ 0.001 **Go to 3.**
  - 3a. QVARIATION ≤ 192.859 **Go to 4.**
    - 4a. WT_URBAN ≤ 1.495; N=37 (1=19, 2=1, 5=17)
    - 4b. WT_URBAN > 1.495; N=21 (1=17, 2=3, 5=1)
  - 3b. QVARIATION > 192.859; N=43 (1=38, 2=3, 5=2)
- 2b. GRADIENT > 0.001; N=146 (1=139, 2=3, 5=4)

1b. ECOREGION > 63.000 **Go to 5.**

- 5a. QANN50_CMS ≤ 0.287; N=111 (1=29, 2=78, 5=4)
- 5b. QANN50_CMS > 0.287 **Go to 6.**
  - 6a. W_SHALE ≤ 87.555; N=30 (1=18, 2=2, 5=10)
  - 6b. W_SHALE > 87.555 **Go to 7.**
    - 7a. R_FOREST ≤ 20.460; N=7 (1=4, 2=1, 5=2)
    - 7b. R_FOREST > 20.460; N=35 (1=16, 2=18, 5=1)

Table 2.4g. Results of CART analysis of Striped shiner presence/absence dataset. The CART model is portrayed as a dichotomous key. For each leaf in the model, N indicates the number of sites within that leaf. Parentheses are used to identify the number of sites where the species is present or absence in that leaf. The total misclassification rate for the model is 19%.

---

1a. WT_FOREST ≤ 6.500 **Go to 2.**

  2a. LATITUDE ≤ 41.500 **Go to 3.**

    3a. LONGITUDE ≤ -90.500; N=11 (0=9, 1=2)

    3b. LONGITUDE > -90.500; N=152 (0=24, 1=128)

  2b. LATITUDE > 41.500 **Go to 4.**

    4a. WT_AGR ≤ 76.000; N=17 (0=17, 1=0)

    4b. WT_AGR > 76.000; N=18 (0=8, 1=10)

1b. WT_FOREST >6.500; N=243 (0=212, 1=31)

Table 2.4h. Results of CART analysis of Longear sunfish presence/absence dataset. The CART model is portrayed as a dichotomous key. For each leaf in the model, N indicates the number of sites within that leaf. Parentheses are used to identify the number of sites where the species is present or absence in that leaf. The total misclassification rate for the model is 17%.

---

1a. LONGITUDE ≤ -89.500; N=152 (0=136, 1=16)

1b. LONGITUDE > -89.500 **Go to 2.**

2a. LATITUDE ≤ 41.500 **Go to 3.**

3a. W_BDO_50 ≤ 1.500 **Go to 4.**

4a. R_FOREST ≤ 67.000 **Go to 5.**

5a. QANN50_YLD ≤ 0.003; N=37 (0=6, 1=31)

5b. QANN50_YLD > 0.003 **Go to 6.**

6a. LINK ≤ 40.500; N=29 (0=9, 1=20)

6b. LINK > 40.500; N=11 (0=10, 1=1)

4b. R_FOREST > 67.000; N=13 (0=10, 1=3)

3b. W_BDO_50 > 1.500; N=162 (0=18, 1=144)

2b. LATITUDE > 41.500; N=37 (0=37, 1=0)

Table 2.4i. Results of CART analysis of Smallmouth bass presence/absence dataset. The CART model is portrayed as a dichotomous key. For each leaf in the model, N indicates the number of sites within that leaf. Parentheses are used to identify the number of sites where the species is present or absence in that leaf. The total misclassification rate for the model is 26%.

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1a. LATITUDE ≤ 39.500; N=166 (0=164, 1=2)

1b. LATITUDE > 39.500 **Go to 2.**

2a. DA_KM2 ≤ 73.000; N=44 (0=34, 1=10)

2b. DA_KM2 > 73.000 **Go to 3.**

3a. LATITUDE ≤ 40.500 **Go to 4.**

4a. QANN50_YLD ≤ 0.002; N=12 (0=11, 1=1)

4b. QANN50_YLD > 0.002 **Go to 5.**

5a. W_FINE ≤ 58.500 **Go to 6.**

6a. QANN50_YLD ≤ 0.003; N=12 (0=11, 1=1)

6b. QANN50_YLD > 0.003 **Go to 7.**

7a. WT_URBAN ≤ 7.000 **Go to 8.**

8a. WT_AGR ≤ 85.000; N=18 (0=4, 1=14)

8b. WT_AGR > 85.000; N=13 (0=11, 1=2)

7b. WT_URBAN > 7.000; N=6 (0=6, 1=0)

5b. W_FINE > 58.500; N=18 (0=5, 1=13)

3b. LATITUDE > 40.500; N=152 (0=48, 1=104)

Table 2.4j. Results of CART analysis of Creek chubsucker presence/absence dataset. The CART model is portrayed as a dichotomous key. For each leaf in the model, N indicates the number of sites within that leaf. Parentheses are used to identify the number of sites where the species is present or absence in that leaf. The total misclassification rate for the model is 20%.

1a. LATITUDE ≤ 39.500 **Go to 2.**

2a. LONGITUDE ≤ -89.500 **Go to 3.**

3a. WT_URBAN ≤ 0.500; N=6 (0=3, 1=3)

3b. WT_URBAN > 0.500; N=29 (0=29, 1=0)

2b. LONGITUDE > -89.500; N=131 (0=65, 1=66)

1b. LATITUDE > 39.500 **Go to 4.**

4a. W_FINE ≤ 99.500 **Go to 5.**

5a. QVARIATION ≤ 7020.190; N=257 (0=253, 1=4)

5b. QVARIATION > 7020.190; N=7 (0=3, 1=4)

4b. W_FINE > 99.500; N=11 (0=6, 1=5)

Table 2.4k. Results of CART analysis of Hornyhead chub presence/absence dataset. The CART model is portrayed as a dichotomous key. For each leaf in the model, N indicates the number of sites within that leaf. Parentheses are used to identify the number of sites where the species is present or absence in that leaf. The total misclassification rate for the model is 21%.

---

1a. LATITUDE ≤ 39.500; N=166 (0=164, 1=2)

1b. LATITUDE > 39.500 **Go to 2.**

  2a. DA_KM2 ≤ 284.500; N=275 (0=90, 1=185)

  2b. DA_KM2 > 284.500 **Go to 3.**

    3a. R_AGR ≤ 5.500; N=15 (0=13, 1=2)

    3b. R_ARG > 5.500; N=61 (0=30, 1=31)

Table 2.41. Results of CART analysis of Fantail darter presence/absence dataset. The CART model is portrayed as a dichotomous key. For each leaf in the model, N indicates the number of sites within that leaf. Parentheses are used to identify the number of sites where the species is present or absence in that leaf. The total misclassification rate for the model is 29%.

---

1a. LATITUDE $\leq$ 39.500 **Go to 2.**

- 2a. SLOPE $\leq$ 5.500; N=159 (0=157, 1=2)
- 2b. SLOPE > 5.500; N=7 (0=4, 1=3)

1b. LATITUDE > 39.500 **Go to 3.**

- 3a. QANN50_CMS $\leq$ 1.007 **Go to 4.**
  - 4a. R_AGR $\leq$ 39.000 **Go to 5.**
    - 5a. W_SHALE $\leq$ 84.000; N=58 (0=26, 1=32)
    - 5b. W_SHALE > 84.000 **Go to 6.**
      - 6a. LONGITUDE $\leq$ -89.500; N=39 (0=37, 1=2)
      - 6b. LONGITUDE > -89.500; N=60 (0=36, 1=24)
  - 4b. R_AGR > 39.000 **Go to 7.**
    - 7a. R_FOREST $\leq$ 0.500; N=10 (0=6, 1=4)
    - 7b. R_FOREST > 0.500; N=47 (0=45, 1=2)
- 3b. QANN50_CMS > 1.007 **Go to 8.**
  - 8a. WT_FOREST $\leq$ 11.500; N=56 (0=55, 1=1)
  - 8b. WT_FOREST > 11.500; N=5 (0=2, 1=3)

Table 2.4m. Comparison of CART results for individual fish species based on presence/absence data. A misclassification of commission (COM) indicates that the model predicted the species to be present but it was actually absent, whereas omission (OM) indicates the models predicted the species to be absent but it was actually present. The predictor variables are listed in order of entry into the model; variables separated by a backslash entered at the same level but at different branches in the tree.

| Species | Sites Present | % Misclassification Total | COM | OM | Predictor Variables |
|---|---|---|---|---|---|
| Striped shiner | 171 | 19 | 10 | 9 | WT_FOREST, LATITUDE, LONGITUDE/WT_AGR |
| Longear sunfish | 215 | 17 | 13 | 4 | LONGITUDE, LATITUDE, W_BDO_50, R_FOREST, QANN50_YLD, LINK |
| Smallmouth bass | 147 | 26 | 21 | 5 | LATITUDE, DA_KM2, LATITUDE, QANN50_YLD, W_FINE, QANN50_YLD, WT_URBAN, WT_AGR |
| Creek Chubsucker | 82 | 20 | 17 | 3 | LATITUDE, LONGITUDE/W_FINE, WT_URBAN/QVARIATION |
| Hornyhead chub | 187 | 21 | 15.6 | 5.7 | LATITUDE, DA_KM2, R_AGR |
| Fantail darter | 73 | 27 | 21 | 6 | LATITUDE, SLOPE/ QANN50_CMS, R_AGR/ WT_FOREST, W_SHALE/ R_FOREST, LONGITUDE |

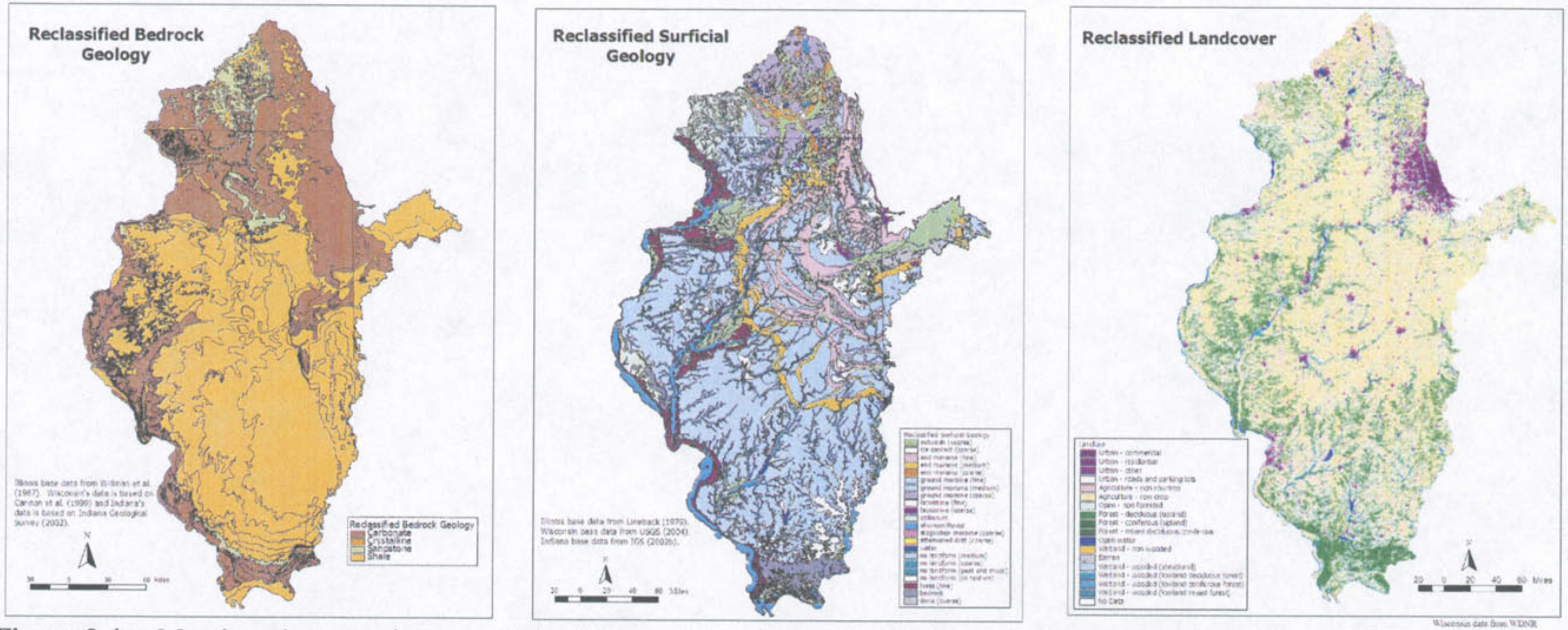


**Figure 2.4a.** Map-based summaries were derived from existing data and used to populate stream reaches using a GIS system. Summaries of bedrock geology, surficial geology, landcover, digital elevation, and meteorological data (e.g., air temperature, growing degree days, precipitation) were incorporated by attributing these data to individual stream reaches.

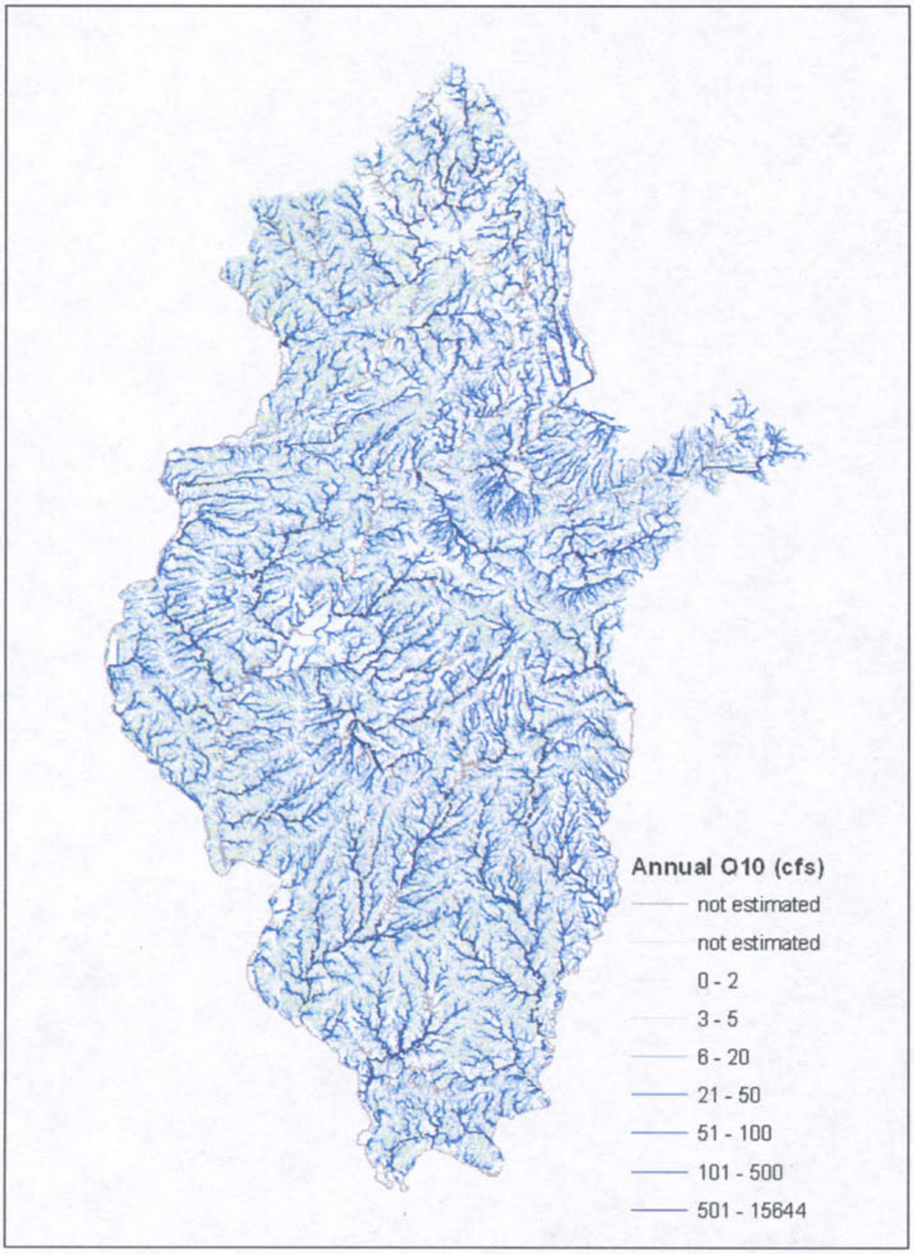


**Figure 2.4b.** Annual High Flow Discharge based on model output.

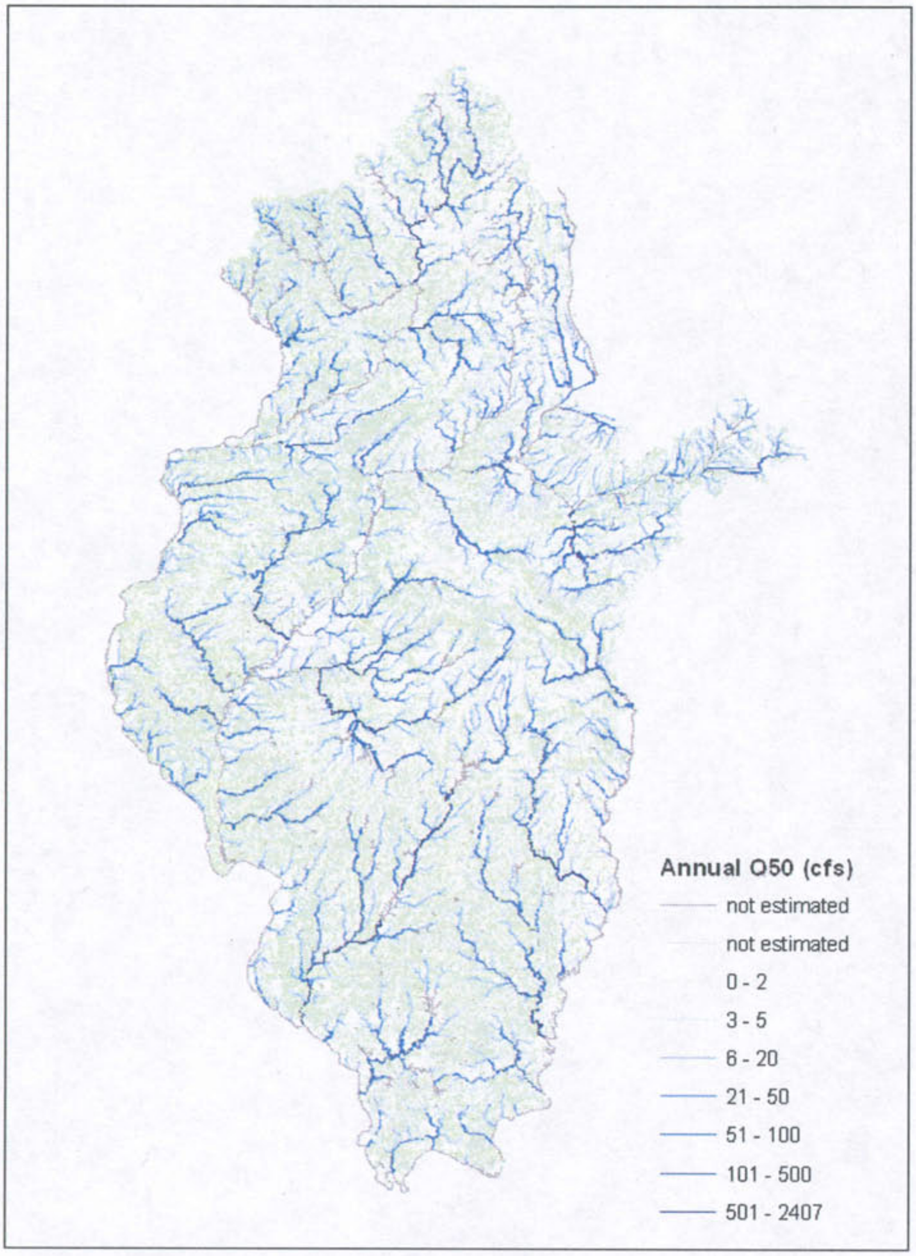


**Figure 2.4c.** Median Annual Discharge based on model output.

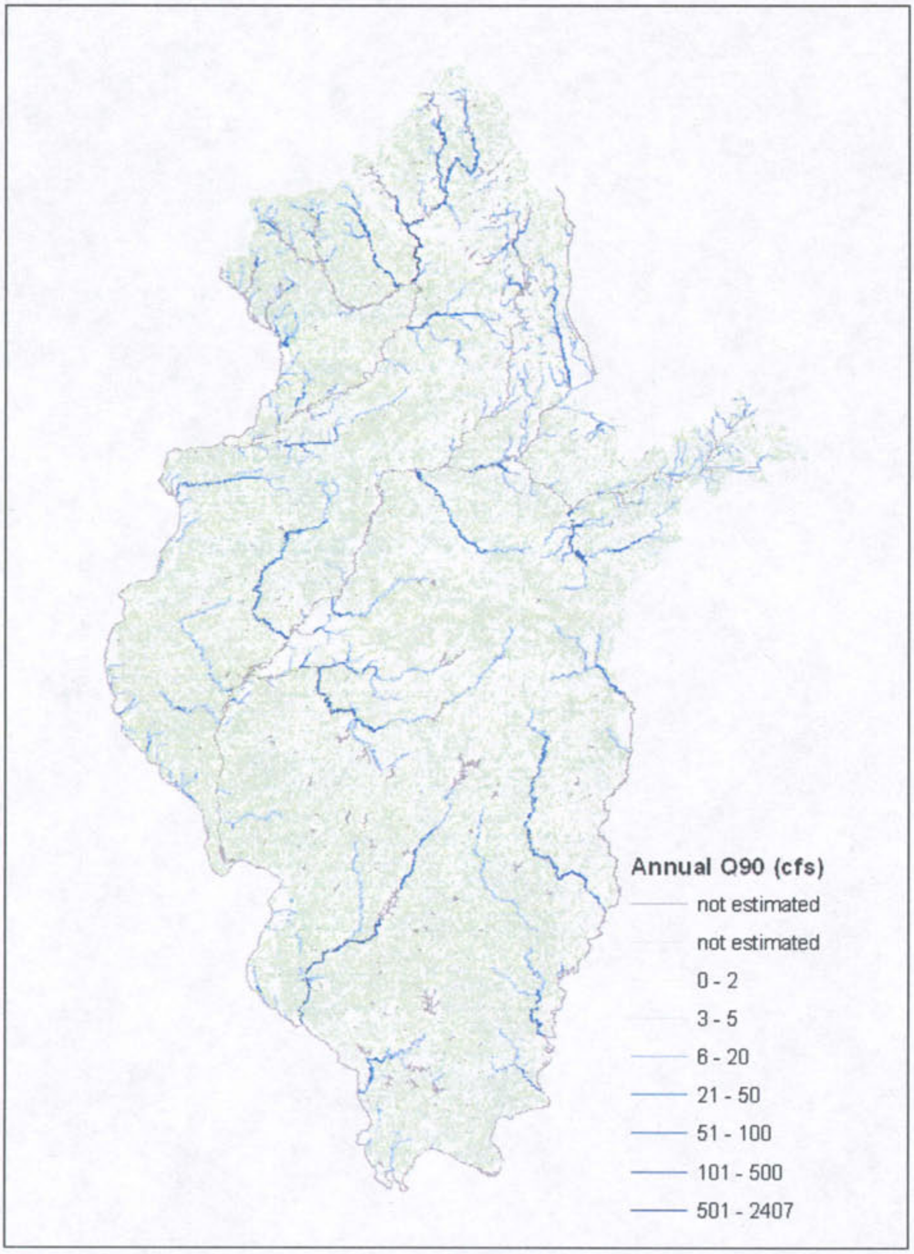


**Figure 2.4d.** Annual Low Flow Discharge based on model output.

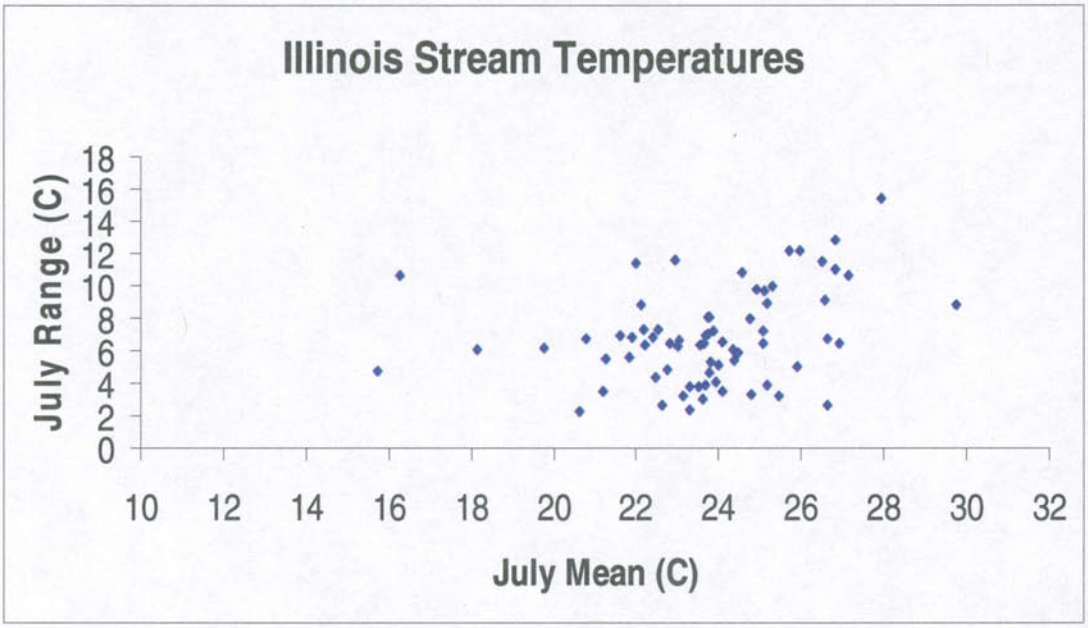


**Figure 2.4e.** Summer stream temperatures from loggers records collected 1999 – 2005 throughout Illinois. Each point provides a summary of an individual site that collectively illustrate the wide range of thermal conditions that exist within the wadeable streams of Illinois.

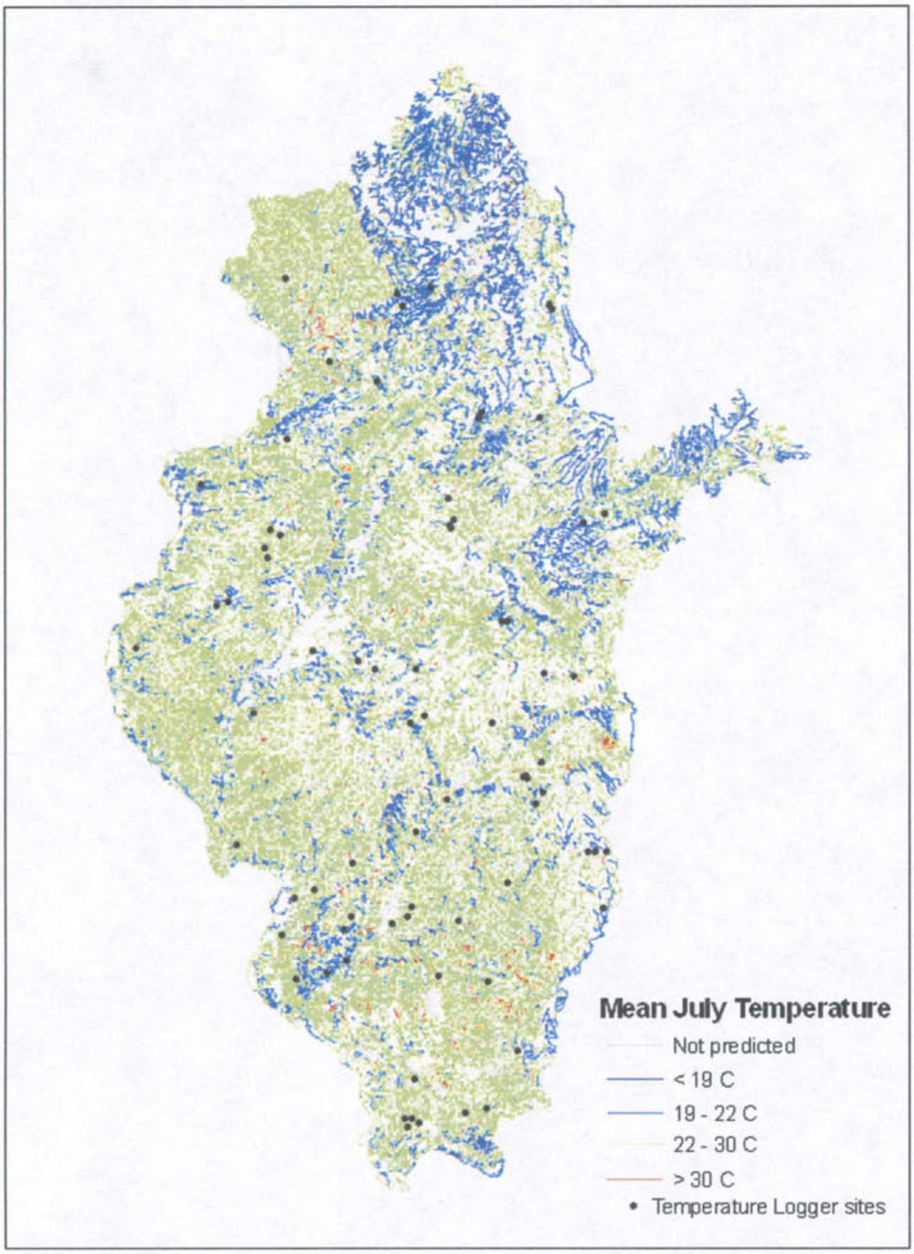


**Figure 2.4f.** Summer Stream Temperatures based on model output.

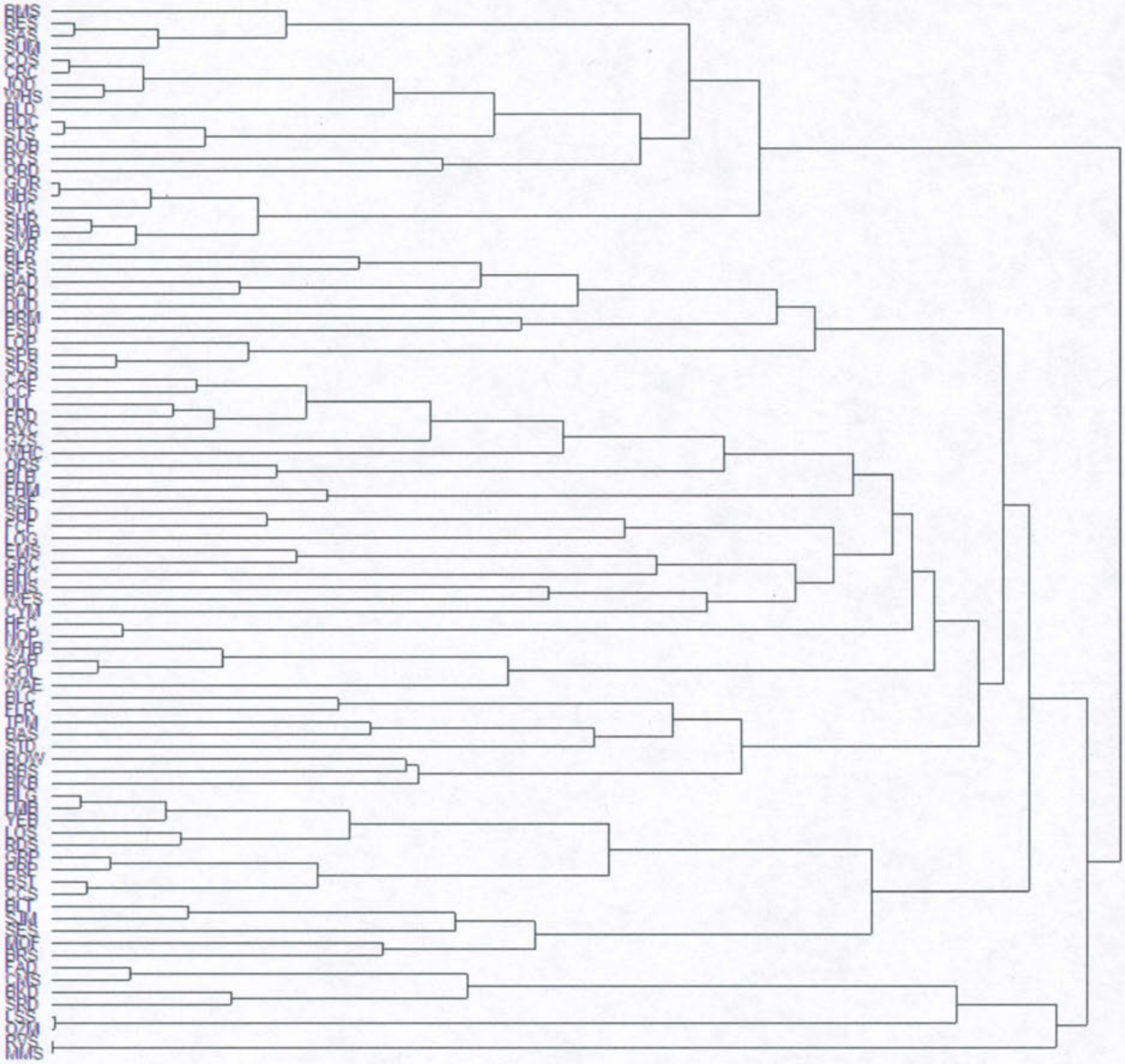

Figure 2.4g. Dendrogram resulting from cluster analysis carried out in PC-ORD.

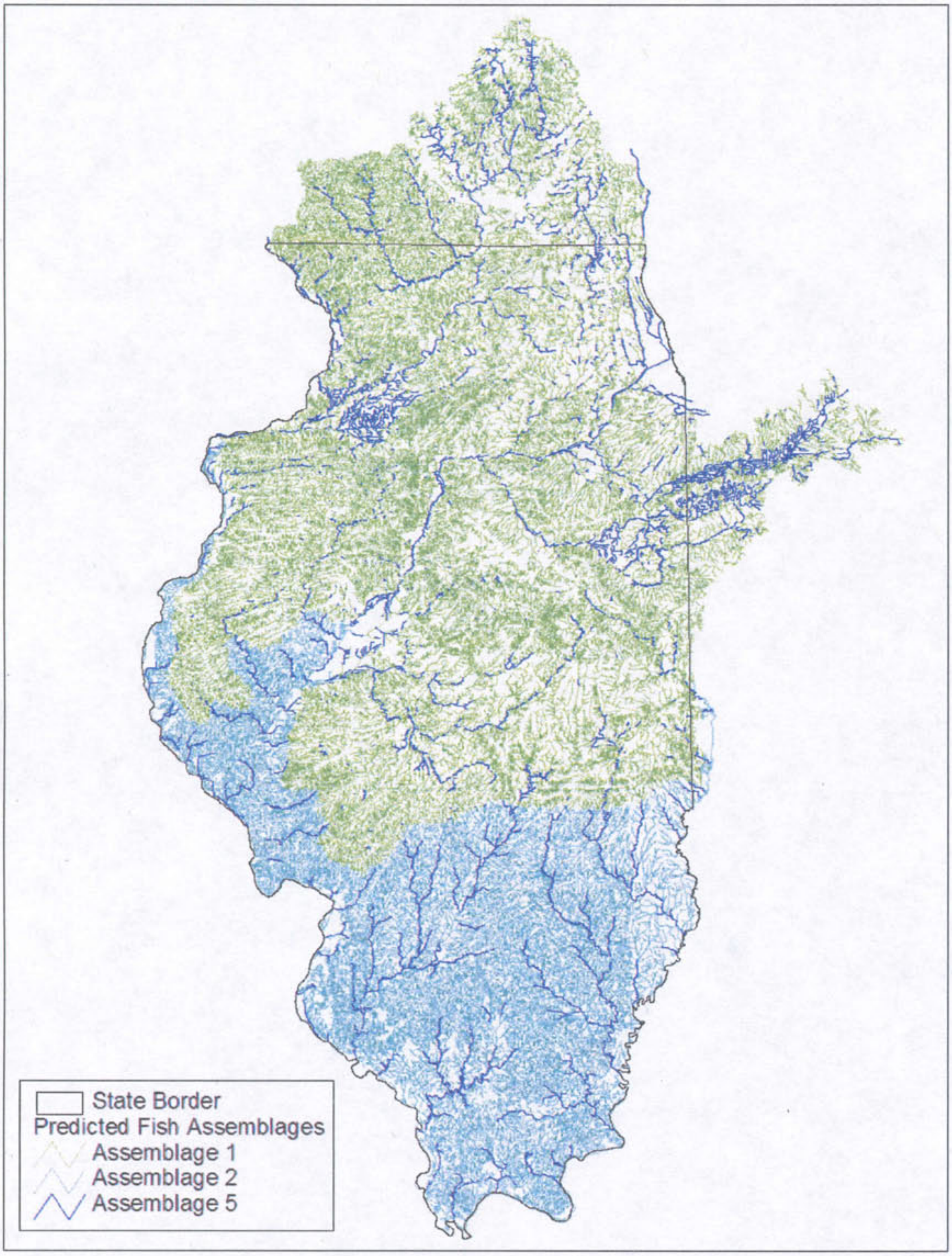


Figure 2.4h. Fish assemblages based on CART-derived model output. Only three assemblages, which are described in Table 2.4e, contained sufficient members for modeling.

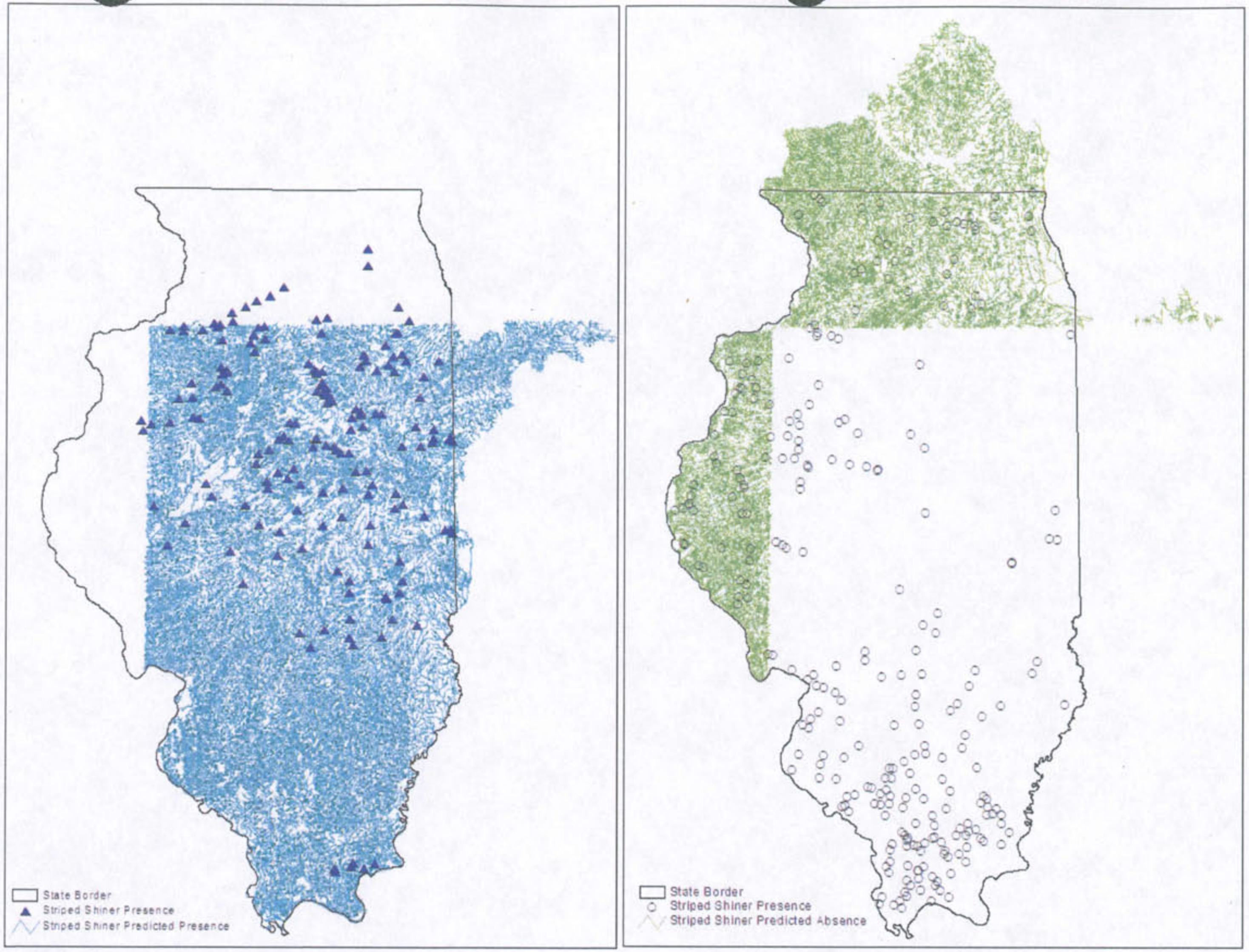


Figure 2.4i. Known presence and absence of Striped shiner compared to predicted presence and absence of the species.

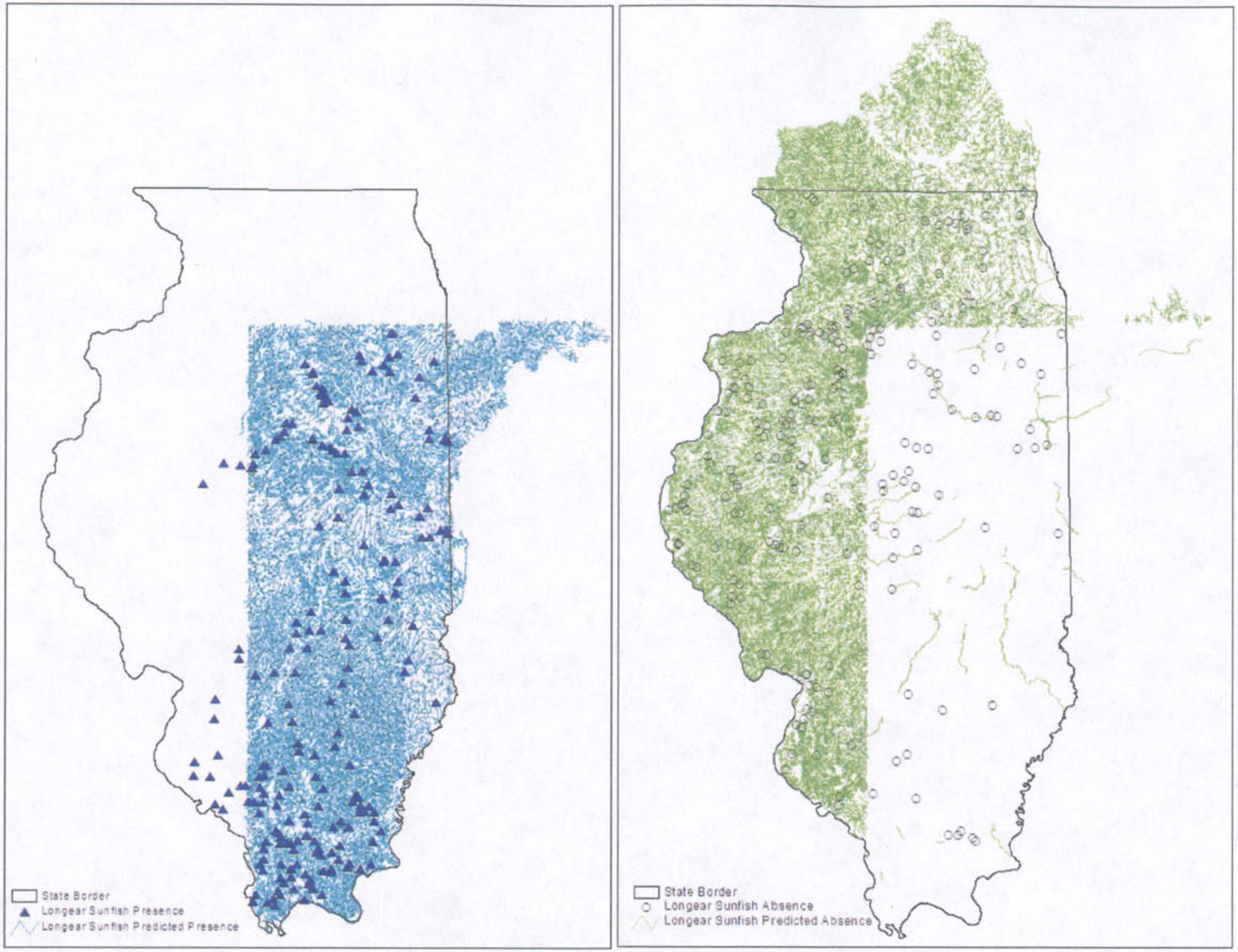


Figure 2.4j. Known presence and absence of Longear sunfish compared to predicted presence and absence of the species.

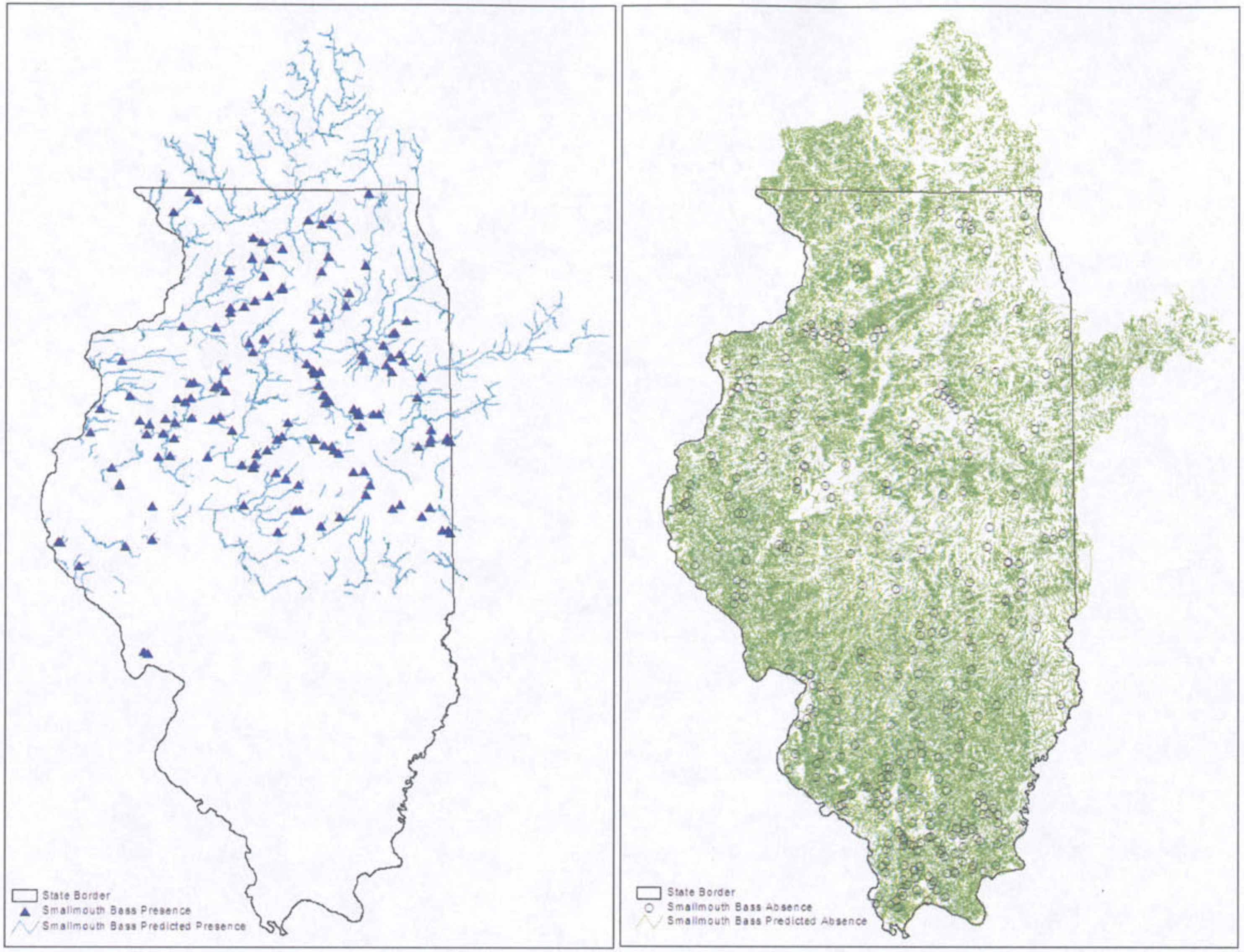


Figure 2.4k. Known presence and absence of Smallmouth bass compared to predicted presence and absence of the species.

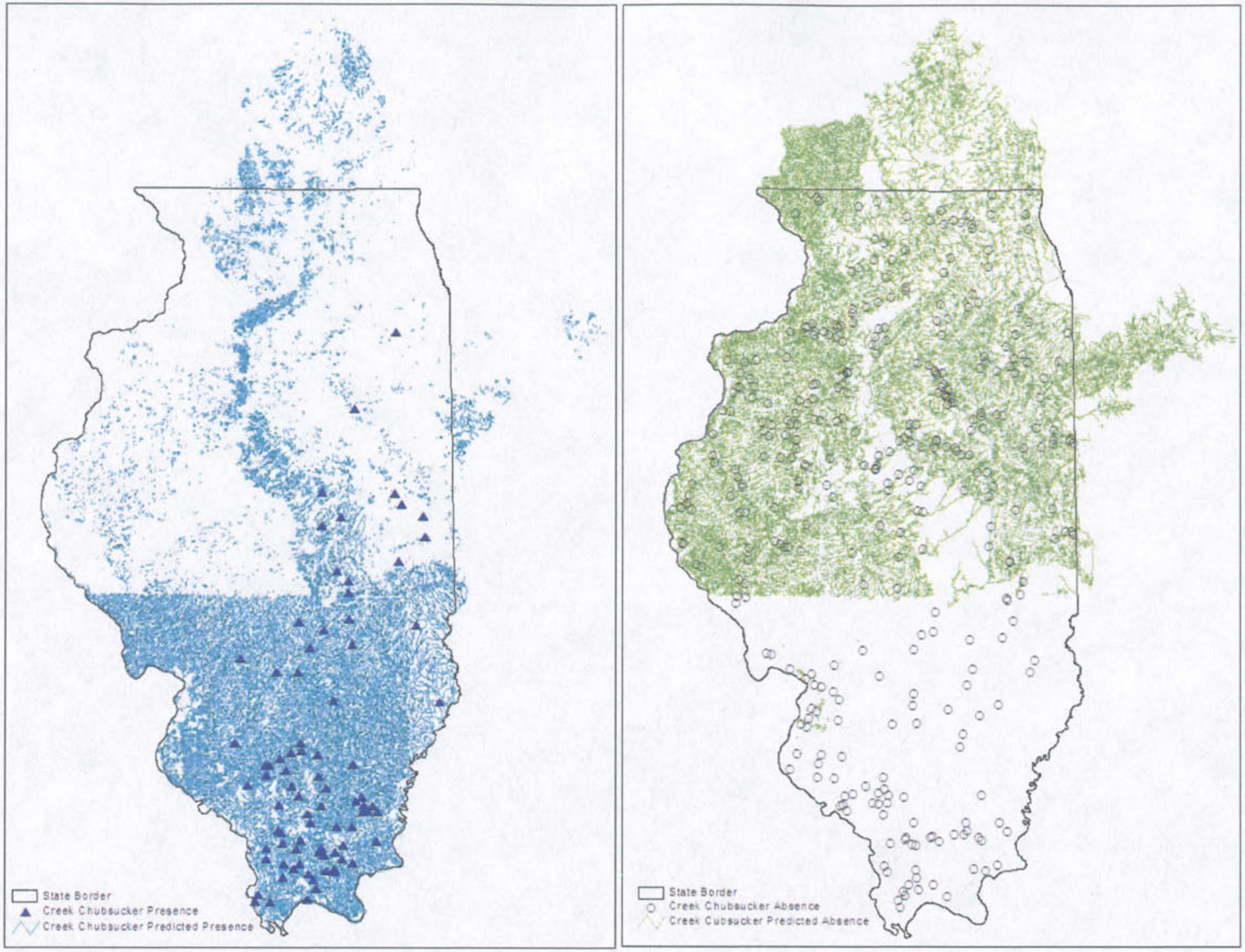


Figure 2.4l. Known presence and absence of Creek chubsucker compared to predicted presence and absence of the species.

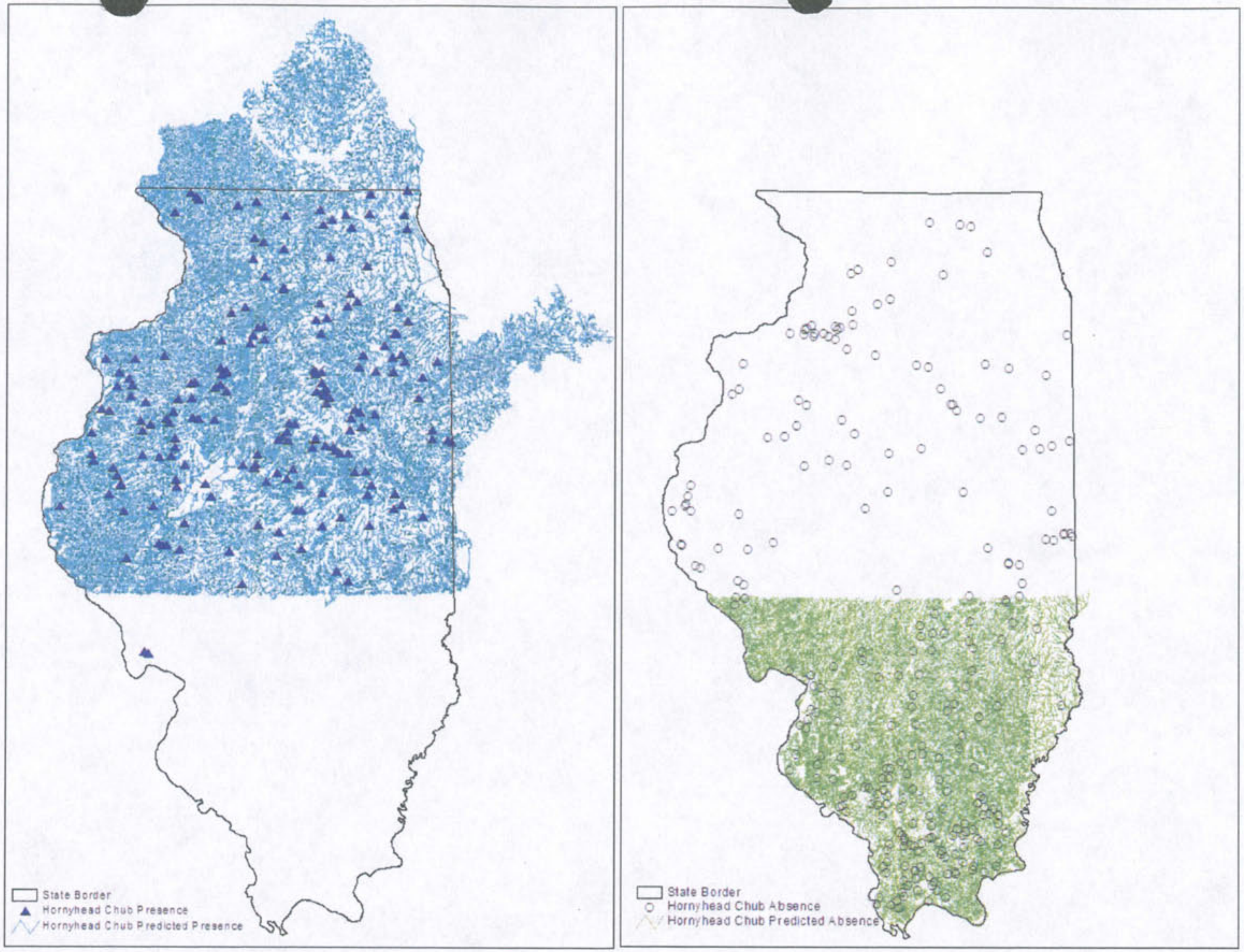


Figure 2.4m. Known presence and absence of Hornyhead chub compared to predicted presence and absence of the species.

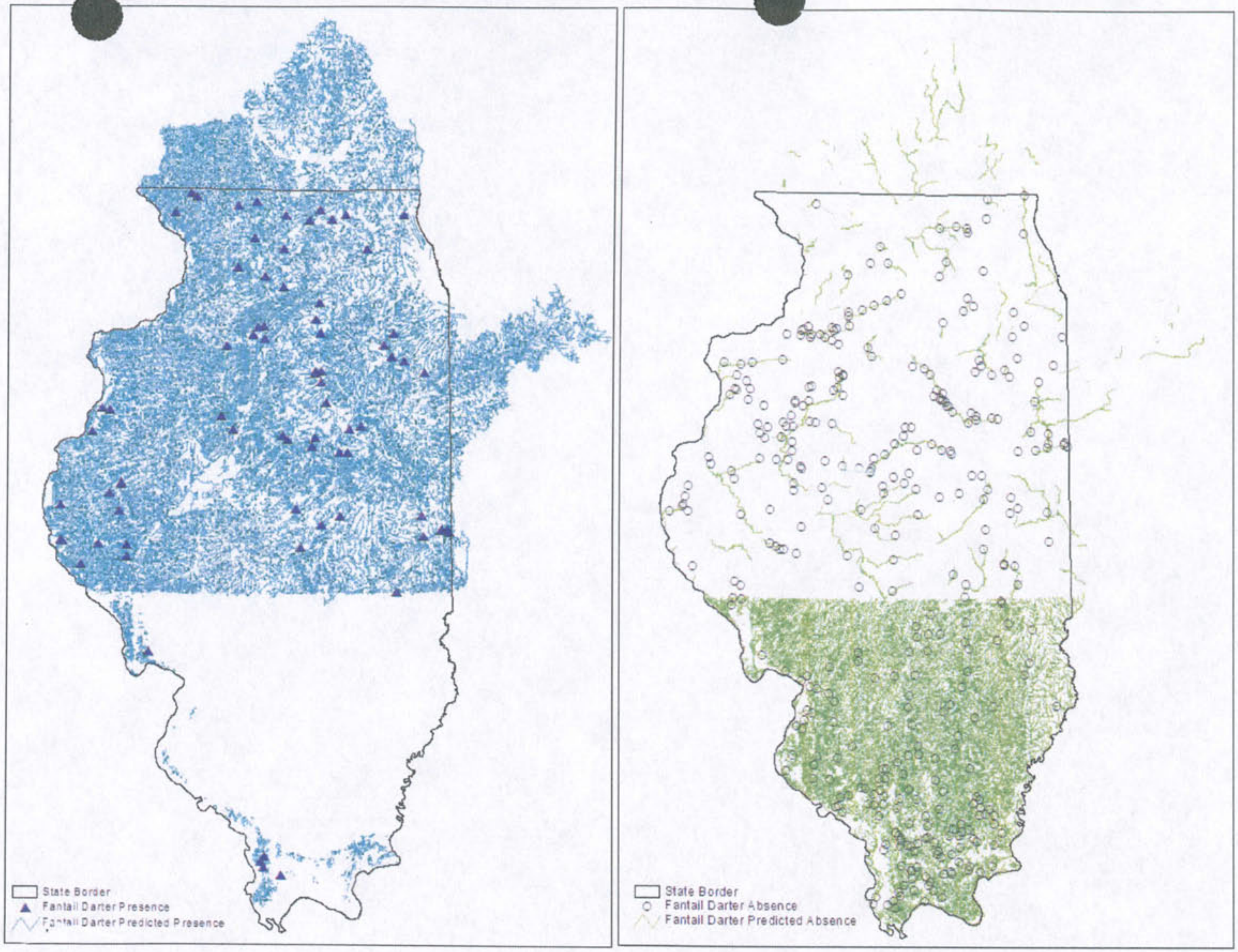


Figure 2.4n. Known presence and absence of Fantail darter compare to predicted presence and absence of the species.

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## Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems

## Project 2 – Identification and Selection of Conservation Elements

### Job 2.5. Update of species occurrence and habitat condition data.

Field surveys were conducted to determine the presence/ absence and relative abundance of cryptic species identified as priority species due to poorly known status. This work was undertaken in small regions of the state and in specific habitat types to determine presence/absence and relative abundance of priority species. Last year we identified several species of amphibians and reptiles with poorly known distributions and that require specialized survey methods: Blanding's Turtle (*Emydoidea blandingii*), Spotted Turtle (*Clemmys guttata*), Illinois Mud Turtle (*Kinosternon flavescens*), River Cooter (*Pseudemys concinna*), Four-toed salamander (*Hemidactylium scutatum*), and several pond-breeding salamanders (genus *Ambystoma*). Landover and aerial photography were examined to locate potential areas for field surveys for each species.

**Blanding's Turtle**
We chose the population cluster in the Green River Basin of Lee County for field surveys because this area has received little attention over the past 10 years, but may hold the largest populations outside of the Chicago region. Hoop traps baited with sardines were set at 18 sites over three consecutive days from June to August of 2006 (Table 1). Trapping effort ranged from nine trap-nights to 27 trap-nights (Table 1). Only one Blanding's Turtle was captured, which may be attributable to lower than average rainfall during the trapping period.

Table 1. Trapping effort for the Blanding's Turtle in Lee County, Illinois June to August 2006. Cpict = Painted Turtle; Cserp = Snapping Turtle.

| Site (EOID) | First Night Trapped | Trap Effort (trap-nights) | No. Blanding's Turtles Captured | Other Turtles Captured |
|---|---|---|---|---|
| 256 | 7/22/06 | 9 | 0 | |
| 555 | 7/22/06 | 27 | 1 | Cserp, Cpict |
| 1652 | 7/22/06 | 9 | 0 | |
| 3203 | 7/25/06 | 12 | 0 | Cserp, Cpict |
| New Site | 7/17/06 | 9 | 0 | |
| New Site | 7/17/06 | 9 | 0 | Cpict |
| New Site | 6/28/06 | 12 | 0 | |
| New Site | 7/17/06 | 9 | 0 | |

| | | | | |
|---|---|---|---|---|
| New Site | 6/22/06 | 9 | 0 | Cpict |
| New Site | 6/27/06 | 12 | 0 | |
| New Site | 6/28/06 | 12 | 0 | Cserp |
| New Site | 6/11/06 | 12 | 0 | |
| New Site | 7/30/06 | 9 | 0 | |
| New Site | 7/30/06 | 9 | 0 | |
| New Site | 7/30/06 | 12 | 0 | Cpict |
| New Site | 8/2/06 | 12 | 0 | |
| New Site | 8/2/06 | 12 | 0 | |
| New Site | 8/2/06 | 9 | 0 | |

**Spotted Turtle**
The spotted turtle is known only from Will County in Illinois. In cooperation with the Forest preserve District of Will County, we surveyed Lockport Prairie Nature Preserve, near Lockport, Illinois, from 5/1/06-5/29/06. Using hoop traps (approximately 450 trap-nights) and visual searching (approximately 300 search-hours) we made 364 spotted turtle captures of 110 individuals. This represents the largest effort expended and number of spotted turtles encountered at Lockport Prairie to date.

**Illinois Mud Turtle**
We chose the cluster of populations in Mason and Tazewell counties for field surveys because there has been recent trapping effort at these sites. Hoop traps baited with sardines were set at three sites over three consecutive days from June 13 to 16, 2006 (Table 2). Trapping effort ranged from 12 to 15 trap-nights (Table 2). Only one Illinois Mud Turtle was captured, which may be attributable to lower than average rainfall during the trapping period. This individual, 2,8L;11R was a male that was originally marked in 1993.

Table 2. Trapping effort for the Illinois Mud Turtle in Mason and Tazewell counties, Illinois June 13 to 16, 2006. Cpict = Painted Turtle; Cserp = Snapping Turtle.

| Site (EOID) | Trap Effort (trap-nights) | No. Illinois Mud Turtles Captured | Other Turtles Captured |
|---|---|---|---|
| 009 | 15 | 0 | Cserp |
| 010 | 12 | 1 | |
| 005 | 15 | 0 | Cpict |
| Totals | 42 | 1 | |

**River Cooter**
The river cooter is known primarily from floodplain lakes along the Wabash and Ohio rivers in southeastern Illinois. We trapped 14 of these lakes from June to August, 2006 with hoop traps baited with sardines (Table 3). Trapping effort ranged from 6 to 42

trap-nights (Table 3). Only one River Cooter was captured, but this represents a new site in Illinois.

Table 3. Trapping effort for the River Cooter in southeastern Illinois June to August 2006. Aspin = Spiny Softshell, Cpict = Painted Turtle; Cserp = Snapping Turtle; Gouach = Ouachita Map Turtle, Opseud = False Map Turtle, Sodor = Stinkpot; Tscript = Slider turtle.

| Site (EOID) | Trapping Dates | Trap Effort (trap-nights) | No. River Cooters Captured | Other Turtles Captured |
|---|---|---|---|---|
| 936 | 8/2/06-8/8/06 | 17 | 0 | Cserp, Cpict, Sodor, Tscript |
| 3789 | 8/16/06-8/25/06 | 42 | 0 | Cserp, Cpict, Gouach, Sodor, Tscript |
| New Site | 8/16/05-8/18/06 | 6 | 1 | Aspin, Cpict, Sodor, Tscript |
| New Site | 7/29/06-8/6/06 | 16 | 0 | Cserp, Tscript |
| New Site | 7/26/06-8/1/06 | 18 | 0 | Cserp, Sodor, Tscript |
| New Site | 7/26/06-8/1/06 | 19 | 0 | Cserp, Cpict, Sodor, Tscript |
| New Site | 7/29/06-8/7/06 | 15 | 0 | Cserp, Tscript |
| New Site | 7/31/06-8/5/06 | 11 | 0 | Cserp, Tscript |
| New Site | 6/17/06-6/22/06 | 8 | 0 | Aspin, Cserp, Tscript |
| New Site | 6/27/06-6/24/06 | 21 | 0 | Cserp, Gpseud, Tscript |
| New Site | 6/17/06-6/24/06 | 28 | 0 | Sodor, Tscript |
| New Site | 6/17/06-6/24/06 | 33 | 0 | Cserp, Gpseud, Sodor, Tscript |
| New Site | 6/17/06-6/24/06 | 14 | 0 | Gpseud, Tscript |
| New Site | 6/26/06-6/30/06 | 14 | 0 | Tscript |

**Four-toed Salamander**

In Illinois, since 2000, individuals or populations have been found or re-verified from seven counties including: Jo Davies, Knox, La Salle, Lawrence, Ogle, Rock Island, and Vermilion. Vouchered specimens exist (all but one were pre-1980 records) from five additional counties: Cook, Jersey, Lake, McDonough, and Will. We surveyed the Vermilion County population because it is the largest Illinois population and has been surveyed in recent years. Timed visual encounter surveys were conducted between 9 April and 16 May 2006. Leaf litter and logs were checked for salamanders, as were grass tussocks within the ponds where female salamanders are known to nest. The total number of salamanders by species was recorded. We determined the sex of four-toed salamanders only by visually examining the abdomen to determine if it was swollen with eggs. All four-toed salamanders were toe clipped to indicate previous encounter and a GPS location was taken.

A total of 510 search minutes (8.5 hours) yielded 26 salamanders: 1 *Ambystoma texanum*, 2 *Eurycea cirrigera*, 13, *H. scutatum* (individuals or nests), and 10 *Plethodon cinereus*. Of the *H. scutatum* found 3 were males, 4 were females on nests, 2 were juveniles, and 4 were unguarded nests (no female) (Table 4). Nests were found no earlier than April 29$^{th}$ (Table 4). It took an average of 40 minutes to find one *H. scutatum* individual/nest.

Table 4. Four-toed Salamanders captured in Vermilion County, Illinois in April and May of 2006.

| Date | Sex | Notes |
|---|---|---|
| 4/9/06 | Male | Under wood |
| 4/9/06 | Juvenile | Under wood |
| 4/11/06 | Male | Under log |
| 4/23/06 | Juveniles | Under log |
| 4/23/06 | Male | Under log |
| 4/29/06 | Female | Nest with female and eggs |
| 4/29/06 | Eggs | Nest with older eggs, no female present |
| 5/7/06 | Eggs | Nest with older eggs, no female present |
| 5/16/06 | Female | Nest with female, eggs well-developed |
| 5/16/06 | Female | Nest with female, eggs well-developed |
| 5/16/06 | Female | Nest with female, eggs well-developed |
| 5/16/06 | Eggs | Nest w/o female, eggs less than 1 week old |
| 5/16/06 | Eggs | Nest w/o female, eggs less than 1 week old |

**Pond-breeding Salamanders**

Pond-breeding amphibians are particularly vulnerable to the isolation effects of habitat fragmentation because of their low vagility and strict physiological requirements. As suitable matrix habitat surrounding breeding ponds is reduced, limited dispersal among populations can produce low levels of within-population genetic variation and have negative fitness effects. We surveyed 25 ponds, 8 in a grassland matrix and 17 in a forest matrix, in Lee County, Illinois for the presence of three pond-breeding amphibians; Northern Leopard Frog (*Rana pipiens*), Cope's Gray Treefrog (*Hyla chrysoscelis*), and Tiger Salamander (*Ambystoma tigrinum*). These three have markedly different upland habitat associations that may affect dispersal patterns and spatial structure: *R. pipiens* forages in open grasslands and overwinters in permanent water bodies, *H. chrysoscelis* inhabits a closed canopy throughout its lifecycle, and *A. tigrinum* uses both forest and grasslands.

During the 2006 field season, we collected data on the distribution and abundance and body size of 988 individuals of the three species. We are interested in the relationship between density (abundance/ surface area of pond) and body condition (residuals of regression of body mass and size – higher values indicate better overall health) to pond characteristics for each of the species. We predict that density and body condition will be lower for species from ponds in the "wrong" habitat matrix (e.g. treefrogs from ponds surrounded by grassland) and that body condition will be negatively correlated with distance to the nearest neighboring pond.

To date we have analyzed the treefrog body condition data as they represented 60% of all captures. Analysis of variance indicated that average body condition differs among ponds. Since landscape structure varies significantly between the two sites (forest and grassland), we also tested for a difference in body condition between sites. A t-test indicates that treefrogs from the forest ponds have a significantly higher body condition than those from grassland frogs, as predicted.

These initial findings show the importance of landscape-level variables to the conservation of pond-breeding amphibians and suggests that simply constructing or maintaining suitable breeding ponds will not ensure success of it's inhabitants. This can have ramifications for choosing the locations of mitigated wetlands as well as managing existing ones.

**Summary**

While the number of individuals encountered for the Spotted Turtle and Four-toed Salamander were relatively high compared to the search effort, the results of the remaining turtle surveys are more typical of the difficulty with most amphibian and reptile surveys, especially those of species in need of conservation. This is an often-overlooked component of cryptic species surveys and should be taken into account when planning future projects of this nature.

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## Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems

## Project 2 – Identification and Selection of Conservation Elements

### Job 2.6 Biotics 4 Updating

Data managers were hired to log, enter, and map faunal data received by the Illinois Natural Heritage Database Program as part of a multi-year effort to update information in Biotics 4 for use within the Illinois Wildlife Action Plan. During this project, the number of Data Specialists on staff for this project varied from one to three. The data managers were responsible for entering faunal data collected under previous year's funding and additional data received by the program, as well as for remapping existing occurrences under the new Heritage data methodology. In addition, the data managers updated Biotics 4 with changes resulting from the 2004 revised list of endangered and threatened species of Illinois.

During this project, the Data Specialists processed 2,520+ faunal records of both new T&E faunal populations and updates to existing faunal T&E populations. An additional 540+ records of high quality natural communities, colonial bird colonies, and geological features were added or updated in Biotics 4. All records were screened for accuracy under an established quality control process.

Work on remapping existing faunal occurrences under the new Heritage data methodology began in August 2005. In 2002, all original T&E point locations were brought into the new Biotics 4 software via buffering. The size of the buffer was based on the accuracy of the locational data provided. In an effort to establishing more meaningful polygonal locations for existing records, every faunal T&E location is being remapped following a thorough review of all existing data and documentation. To date, nearly 400 faunal records have been remapped in 13 of 102 counties in Illinois. Completed counties include:

| | | |
|---|---|---|
| Carroll | Lake | St. Clair |
| Cook | Madison | Whiteside |
| DuPage | McHenry | Will |
| Jo Daviess | Monroe | |
| Kane | Randolph | |

Five Geographic Information System (GIS) workstations were purchased to replace the outdated computer systems used by the Illinois Natural Heritage Database program for work on Biotics 4. Additional purchases include the Biotics 4 software upgrade from

*NatureServe* and a perpetual term, five-user Oracle license required for the extra database staff.

Database staff traveled to attend several NatureServe Biotics training courses including Core Heritage Methodology and Advanced Biotics training. Core Heritage Methodology training provided data staff with beginning to moderate skills in Biotics 4 and mapping of T&E populations while Advanced Biotics training provided data staff with advanced skills in querying and administration of Biotics 4. Additional database training was achieved via online conference calls with NatureServe.

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**Project 3 - Identification of Detrimental Factors**

Objectives:

1. Describe factors that adversely affect conservation elements
2. Describe factors that adversely affect key habitats and communities
3. Identify information gaps

Project Description:

The Critical Trends Assessment Project provides detailed data on factors that are affecting the health and integrity of key habitats on a statewide and landscape basis. A large body of literature exists on factors that are shown and/or suspected of adversely affecting populations of priority species, habitats and natural communities in Illinois and the Midwest. Additionally, Illinois Department of Natural Resources biologists, Illinois Natural History Survey scientists, and scientists within other agencies, organizations and institutions were to be polled for factors adversely affecting priority species and habitats in each region of the State. These results were compiled to form a comprehensive description of the factors that adversely affect conservation elements, key habitats and communities necessary for conserving the species in greatest need of conservation. Through this process, the State solicit feedback on situations where information is lacking to identify the true status of a priority species, the habitats or communities required by a priority species, or the factors that are adversely affecting a priority species or its habitat.

Approach:

Based on published literature and discussions with biologists, twenty (20) potential stresses to the Species in Greatest Need of Conservation were defined (Table 1). Stresses were categorized as habitat-related, population-related (e.g., genetics), community-related (e.g., predation), and directly human-related (e.g., killing). Teams of state-wide experts in freshwater mussels, fishes, amphibians and reptiles, birds and mammals were assembled to complete rapid assessments of the stresses to the Species in Greatest Need of Conservation, based upon their knowledge of available scientific literature and field experience in Illinois. With the exception of freshwater mussels, these stresses were not scored for other groups of invertebrates due to lack of available information and/or expertise. Assessing the stresses to the other invertebrate Species in Greatest Need of Conservation will be important for updates to the Illinois Plan/Strategy.

For each of the Species in Greatest Need of Conservation, each potential stress was scored on a 3-point scale: the stress has had, is having, or is likely to have little or no effect on population viability or abundance (1); the stress has had, is having, or is likely to have a moderate effect on population viability or abundance (2); and the stress has had, is having, or is likely to have a severe effect on population viability or abundance (3). Stresses were considered regardless of their point of origin (i.e., even if outside of the State of Illinois). Each stress score was also given a confidence-ranking (medium to high confidence, low confidence, and very low confidence/no available information) to indicate the strength of available scientific information and/or degree of expertise. Completion of this exercise took 2 to 5 hours for each of the taxonomic groups.

Habitat stresses were similarly ranked and qualified for each of the major habitat classes. The Critical Trends Assessment Project provided detailed data on factors that are affecting the health and integrity of key habitats on a statewide and landscape basis. A large body of literature was consulted for factors that are shown and/or suspected of adversely affecting populations of priority species, habitats and natural communities in Illinois and the Midwest.

Additionally, Illinois Department of Natural Resources biologists, Illinois Natural History Survey scientists, and scientists within other agencies, organizations and institutions were polled for factors adversely affecting priority species and habitats in each region of the State. These results are provided for each of the 15 natural divisions in Section IV (Natural Division Assessments) of the Illinois Comprehensive Wildlife Conservation Plan/Strategy. Matrices of stress scores to the Species in Greatest Need of Conservation and their habitats (and confidence qualifiers) were posted on the Plan/Strategy website and open to internal and external peer review.

## Results:

Stresses were considered as factors directly affecting wildlife and habitat (Table 2), and not the sources of those stresses. For example, loss of habitat is a stress, whereas an agriculture practice or development may be the source of that stress. In many cases, the sources of stresses are apparent or well-known. Others are not well-understood, and require investigation. Sources of stress (including lack of knowledge) are primarily described in the "Issues" segments, and immediately addressed with specific conservation actions, in the seven campaigns of Sect. III, E (Priority Actions for Conserving Illinois Wildlife & Habitats) of the Illinois Comprehensive Wildlife Conservation Plan & Strategy.

Many of the Species in Greatest Need of Conservation, sport fishes, and game animals are limited by similar factors. Stresses relating to habitat quality and condition, such as composition and disturbance patterns, are as problematic as the total amount, or extent of habitat. Please refer to Table 2 for stress assessments of individual species and habitat types.

Species in Greatest Need of Conservation

*Mussels* - Water quality and sedimentation were identified as the primary threat to these species. Recruitment, availability of host species, and changes in hydrology are also challenges. Fragmentation of streams by dams is impeding the movements mussel hosts (fishes). Most aspects of mussel ecology are poorly understood.

*Other Invertebrates* - Data are lacking for most of the invertebrate species, making it difficult to determine Species in Greatest Need of Conservation, and to evaluate stresses that may be affecting those species. Biologists presume similar stresses are affecting invertebrates as the other Species in Greatest Need of Conservation, but perhaps more intensely. For example, many insects are dependent on specific host plants or animals, and likely are more adversely affected by degrading natural communities. Aquatic invertebrates, often with smaller body size, shorter lifespans, and lesser abilities to seek out new, better habitats, may be more affected by periods of poor water quality.

*Fishes* - Water quality and sedimentation, which also affect the composition and structure of aquatic habitats, are stressing fishes in greatest need of conservation. Quality of many aquatic habitats, defined by vegetation, water temperature, flow, substrate and other factors, are limiting most species. Fragmentation of remaining aquatic habitats, by other unsuitable aquatic habitats, dams and levees, stresses small, isolated populations. Competition of invasive species is increasing.

*Amphibians* - The extent of habitat, disturbance regimes and altered hydrology, structure and composition of habitat, and habitat fragmentation are the primary challenges to the amphibian Species in Greatest Need of Conservation. Recruitment is also thought to be problematic, but not well understood.

Given amphibians' sensitivity to environmental factors, it will be increasingly important to minimize local stressors such as habitat loss and pollutants in order to reduce the effects of climate change (Inkley et al. 2004).

*Reptiles* - Recruitment (specifically relating to high predation rates on eggs and juveniles), while not well understood, is thought to be a serious threat to the reptiles in greatest need of conservation. Mortality due to roadways, habitat extent, composition and structure, disturbance regimes and fragmentation, and genetics are also challenges to these populations.

*Birds* - All habitat issues (extent, composition and structure, fragmentation, disturbance regimes, and invasive plants) are and likely will continue to challenge the avian Species in Greatest Need of Conservation. Recruitment (relating to high predation rates of eggs and juveniles), mortality, and human structures and infrastructures (windows and wind turbines) are also of high concern for many of these species. Matthews et al. (2004) modeled the effects of climate change on 150 species of birds in eastern United States. Generally, ranges are predicted to shift northward, with many species expected to become restricted in or extirpated from Illinois (e.g., red-headed woodpecker, bobolink) . Other species are likely to expand their range or pioneer into Illinois (e.g., little blue heron, Bachman's sparrow).

*Mammals* - The severity of challenges vary considerably among the mammal species in greatest need of conservation, though habitat extent and fragmentation are the most important for the group as a whole. High bat mortality at wind turbines has been reported in other states, and wind energy is a rapidly growing industry in Illinois. Disturbance of hibernacula is a serious potential stress to wintering bats.

<u>Harvested Wildlife Resources</u>

*Sportfishes* - Recruitment is an on-going challenge for many native sport fish, which in many lakes and rivers are maintained by stocking (black bass, channel catfish, lake trout, sauger). Other stocked fishes (e.g., brook trout, muskellunge) seldom reproduce naturally in Illinois, but may when high-quality habitat and conditions (e.g., coolwater streams) are restored. Water quality and sedimentation, which also affect the composition and structure of aquatic habitats, are stressing some sport fisheries. Smallmouth bass are negatively affected by stream channelization and lack of riparian habitat. Invasive species, such as Asian carp, are a growing challenge.

*Birds* - The major challenges to the game birds are habitat-associated, especially with wetlands, grasslands, and shrub/successional habitat. The related factors of composition and structure, disturbance patterns, invasive plants, and fragmentation are greater challenges than the current extent of habitat. Changing forest composition may affect wild turkey abundance in the future. Nearly all climate change models predict reduced soil moisture (strongly correlated with the abundance of small wetlands) for the Prairie Pothole region of the northern United States and southern Canada (Inkley et al. 2004), where most ducks harvested in Illinois are produced.

*Mammals* - Relative to other groups, the furbearers and game mammals are perceived as secure in Illinois. While habitat quantity and quality are important, most of these species have proven adaptable to a wide range of habitat conditions. Chronic Wasting Disease, currently restricted to a few counties in northern Illinois, is a threat to the white-tailed deer herd.

<u>Habitats</u>

The following key statewide findings are from a report of the Critical Trends Assessment Program (2001), and highlight a number of the most significant challenges to the streams, wetlands, grasslands, and forests of Illinois:

• *habitat fragmentation is a widespread problem that limits attempts to maintain and enhance biodiversity,*

• *habitat degradation is a widespread problem that could be slowed or minimized by simply removing the degradation factors, such as improper grazing,*

• *if degradation is severe, restoration to predisturbance condition will likely require intensive vegetation management,*

• *restoring native vegetation along streams would shade the streams, stabilize banks, and filter sediment and chemicals from runoff before they reached the streams, resulting in less siltation and desiccation and lower water temperatures, and*

• *setting prescribed fires in terrestrial ecosystems, such as prairies, marshes, savannas and oak-*

*dominated forests, that need regular burning would maintain and enhance their characteristics and diversity.*

Based on a assessment process similar to that used for the Species in Greatest Need of Conservation (only habitat-related stresses; see Table 2), the stresses affecting eight major important habitat classes in Illinois are summarized in the following section.

*Forest* - Maintaining and improving the quality of Illinois' forest will be considerably more challenging than maintaining or increasing the amount of forest acreage, which has been steadily increasing since the 1920s. Composition and structure, disturbance regimes, and invasive species all received the highest stress scores. Fire exclusion, poor timber harvest practices (namely high-grading and single tree selection methods), grazing/over-grazing, increasing sugar maple and mesophytic tree species, invasive exotic plants and insects, and diseases are changing Illinois' forests. Illinois' forests are highly fragmented, a trend accelerating due to exurban development.

*Open Woodland/Savanna/Barren* - Composition and structure, disturbance regimes and invasive species are priority concerns, as is the extent of savanna habitat. Savanna-like habitats apparently continue to decline due to destruction, improper grazing, and succession into closed forest in the absence of fire, timber harvest and other disturbances. Oak savannas, especially mesic savannas, are vulnerable to rapid invasion by shade tolerant species in the absence of fire. When undesirable trees are too large to be affected by prescribed fire, they must be physically removed for restoration.

*Grassland* - Once the dominant land cover in Illinois, native prairie has been eliminated from The Prairie State. The remaining "postage stamps" of prairie are threatened by succession, fire suppression, invasive species, and conversion to other land uses. In spite of an increase of more than 780,000 acres of idle grassland through the Conservation Reserve Program since 1985, Illinois has experienced a net loss of more than half of its grassland habitat over 50 years as grasslands, including hay and pasture, have been converted to rowcrops and developed lands. Stresses to habitat quality (fragmentation, composition and structure, disturbance regimes such as poorly-timed and unnecessary mowing, invasive species), severely limit the ability of existing grasslands to function as a natural community that provides suitable habitat for wildlife. Most remaining grasslands are too small to attract area-sensitive species, and the juxtaposition of grassland, relative to wetlands, savannas, shrub/successional habitat, and cropland are very important to many farmland species.

Climate change over the next century may make grassland habitat, and tallgrass prairie in particular, more difficult to maintain in Illinois. Simulated vegetation responses by 2100 to climate change models predict a shift from a savanna/woodland climate of present to a temperate deciduous forest and southeastern mixed forest climate. Atmospheric $CO_2$ enrichment further favors plants with $C_3$ photosynthesis (e.g., trees, shrubs and cool-season grasses) over the many tallgrass prairie species with $C_4$ photosynthesis physiology (see discussion in Inkley et al. 2004).

*Shrub/successional* - Though reliable knowledge is not available, anecdotal reports and population trends of certain species suggest concern for the extent and condition of shrubland and early successional habitats. Loss of pastures, old fields, idle areas and fence rows in agricultural areas and reduction of timber harvest and burning in woodlands have contributed to a decrease of this habitat type. Invasive shrub species are replacing native shrubs and increasing in forest understories, with unknown effects on shrubland wildlife.

*Wetland* - The quantity and quality (fragmentation, composition and structure, disturbance regimes, invasive species, pollution and sedimentation) of wetlands in Illinois are problematic. While conservation actions have led to localized increases in wetland acres and improvement in condition, the statewide trend is towards wetland loss and deterioration. Many restored wetlands are isolated, poorly managed after construction, and could be greatly improved for wildlife benefits (Phillips and Brown 2004).

*Lake & pond* - Volume loss to sedimentation is the primary stress for lake and pond habitat in Illinois. Invasive species, sedimentation, shoreline development, and boat traffic have reduced submersed and emergent vegetation, harming composition and structure. Nutrient loading has lead to eutrophication in many bodies of water as well.

*Streams* - Substrate composition and structure of streams is negatively affected by sedimentation, dredging and channelization. Dams and levees fragment stream reaches and adjacent habitats in many watersheds, and rapid run-off from agricultural and urban areas combined with water releases from dams, result in extreme flow regimes. Invasive fishes and invertebrates are significant problems in the larger rivers.

*Cave* - Water quality and availability and human disturbance or damage are the primary issues for the conservation of cave habitats and the sensitive species they support. Groundwater protection and pollution prevention are critical in karst regions. Abandoned mines can provide additional habitat for hibernating bats if entrances are properly protected for human safety and to prevent disturbance.

Conclusions:

The results of Project 3 describe the problems affecting priority species and their habitats, and identify survey and research efforts that are necessary to understand the problems affecting these species and habitats (element 3). This process will be modified, if necessary, and used in future iterations of the Illinois Comprehensive Wildlife Conservation Plan/Strategy (element 6). Descriptions of factors adversely affecting priority species and their habitats, and information needs, at this point in time will be compared to this repeated process in the future, and provide an indication of the effectiveness of surveys, research and conservation actions to alleviate the adverse effects of certain factors (element 5).

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**Table 1.** Stresses considered as potentially having adverse effects on Illinois' Species in Greatest Need of Conservation. Experts ranked each stress as had, having, or likely to have little or no effect on population viability or abundance (1); had, having, or likely to have a moderate effect on population viability or abundance (2); and had, having, or likely to have a severe effect on population viability or abundance (3), and qualified available information for making these determinations as medium/high confidence, low confidence, and very low confidence/no available information.

Habitat Stresses (6):

*Extent*, the gross amount of habitat

*Fragmentation*, includes the effects of isolation (the physical separation of habitat patches), juxtaposition (the relative position of habitat types), patch size (the size of individual habitat patches) and edge effects (phenomena of ecotones and patch edges, such as increased mortality)

*Composition-Structure*, the biological and physical attributes of habitat within a patch

*Disturbance/Hydrology*, disturbance regimes are the frequency, timing and intensity of disturbances such as fire, and hydrology relates to patterns in water level and availability

*Invasives/Exotics*, novel species that are changing a habitat (overlaps other habitat stress categories)

*Pollution - Sediment*, abnormal inputs of chemical or physical materials or heat

Community Stresses (7):

*Competitors*

*Predators*

*Parasites-Disease*

*Prey-Food*

*Hosts*

*Invasives/Exotics* (overlaps one or more community stress category)

*Other Symbionts*

***Table 1, continued***

Population Stresses (4):

*Genetics*, genetic problems such as inbreeding, outbreeding depression

*Dispersal*, movement of individuals among habitat patches and/or subpopulations

*Recruitment*, addition of individuals to breeding populations (birth rates and survival from birth to maturity)

*Mortality*

Direct Anthropogenic Stresses (3):

*Killing*, direct killing/removal by humans

*Disturbance*, direct harassment by humans

*Structures-Infrastructure*, killing or harassment by structures (dams, towers, etc.) or infrastructure (roads, utility lines, etc.)

**Table 2. Stresses to Illinois' Wildlife & Habitat Resources.** All stresses are scored on a 3-point scale: had, is having, or is likely to have little or no effect on population viability or abundance = 1; had, is having, or is likely to have a moderate effect on population viability or abundance = 2; and had, is having, or is likely to have a severe effect on population viability or abundance. Color-coded cells reflect the quantity/quality of information considered for this exercise and the expertise level of the scientist(s) completing the exercise (green: moderate to high confidence; yellow: low confidence; red: very low confidence/no information).

| MUSSELS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| Alasmidonta viridis (slippershell mussel) | 1 | 1 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 1 |
| Arcidens confragosus (rock pocketbook) | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| Cyclonaias tuberculata (purple wartyback) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| Cyprogenia stegaria (fanshell mussel) | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 1 |
| Cumberlandia monodonta (spectacle case mussel) | 1 | 2 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 1 |
| Ellipsaria lineolata (butterfly) | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| Elliptio crassidens (elephant-ear mussel) | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 1 |
| Elliptio dilatata (spike) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 |
| Epioblasma triquetra (snuffbox mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 2 | 3 | 2 | 1 | 2 | 1 |
| Fusconaia ebena (ebonyshell) | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| Lampsilis abrupta (pink mucket) | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 1 |
| Lampsilis fasciola (wavy-rayed lampmussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| Lampsilis higginsii (Higgins eye) | 1 | 2 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 |
| Lasmigona compressa (creek heelspliter) | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 1 |
| Lasmigona costata (fluted shell) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| Ligumia recta (black sandshell) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 1 |
| Plethobasus cooperianus (orange-foot pimpleback) | 1 | 2 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 | 3 | 2 | 2 | 3 | 1 |

| **MUSSELS, continued** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| Plethobasus cyphyus (sheepnose mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 1 |
| Pleurobema clava (clubshell) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 1 |
| Pleurobema cordatum (Ohio pigtoe) | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| Potamilus capax (fat pocketbook pearly mussel) | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 1 |
| Ptychobranchus fasciolaris (kidneyshell mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 1 | 2 | 1 |
| Quadrula cylindrica (rabbitsfoot mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 1 |
| Quadrula metanerva (monkeyface) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 |
| Simpsonaias ambigua (salamander mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | 2 | 2 | 3 | 2 | 1 | 2 | 1 |
| Toxolasma lividus (purple lilliput mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| Venustaconcha ellipsiformis (ellipse) | 2 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 |
| Villosa iris (rainbow mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| Villosa lienosa (little spectacle case mussel) | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |

Completed by Kevin Cummings and Robert Szafoni, with Dave Day - 6 August 2004

| FISHES | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structure/Infrastructure |
| *Species in Greatest Need of Conservation* | | | | | | | | | | | | | | | | | | | | |
| Acipenser fulvescens (lake sturgeon) | 3 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 3 |
| Anguilla rostrata (American eel) | 2 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 2 | 1 | 1 | 3 |
| Ameiurus nebulosis (brown bullhead) | 3 | 3 | 3 | 1 | 2 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Ammocrypta clara (western sand darter) | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ammocrypta pellucida (eastern sand darter) | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Campostoma oligolepis (largescale stoneroller) | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Carpoides velifer (highfin carpsucker) | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 |
| Catostomus catostomus (longnose sucker) | | | | | | | | | | | | | | | | | | | | |
| Centrarchus macropterus (flier) | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Coregonus artedi (cisco or lake herring) | | | | | | | | | | | | | | | | | | | | |
| Coregonus clupeaformis (lake whitefish) | | | | | | | | | | | | | | | | | | | | |
| Cottus bairdi (mottled sculpin) | 2 | 2 | 1 | 3 | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 |
| Cottus carolinae (banded sculpin) | 2 | 1 | 1 | 3 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Couesius plumbeus (lake chub) | | | | | | | | | | | | | | | | | | | | |
| Crystallaria asprella (crystal darter) | | | | | | | | | | | | | | | | | | | | |
| Culaea inconstans (brook stickleback) | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cycleptus elongatus (blue sucker) | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 3 |
| Cyprinella venusta (blacktail shiner) | 3 | 2 | 1 | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 3 | 1 | 1 | 1 | 1 |
| Elassoma zonatum (banded pygmy sunfish) | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Erimystax x-punctatus (gravel chub) | 2 | 2 | 3 | 3 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Erimyzon sucetta (lake chubsucker) | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 |
| Esox lucius (northern pike - native stocks) | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| Esox masquinongy (muskellunge - native stocks) | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| Etheostoma camurum (bluebreast darter) | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |

| **FISHES, continued** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structure/Infrastructure |
| Etheostoma chlorosomum (bluntnose darter) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Etheostoma crossopterum (fringed darter) | | | | | | | | | | | | | | | | | | | | |
| Etheostoma exile (Iowa darter) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Etheostoma histrio (Harlequin darter) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 2 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Etheostoma proelaire (cypress darter) | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Etheostoma squamiceps (spottail darter) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Forbesichthys agassizi (spring cavefish) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 2 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Fundulus diaphanus (banded killifish) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Fundulus dispar (starhead topminnow) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Hybognathus hayi (cypress minnow) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Hybopsis amblops (bigeye chub) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Hybopsis amnis (pallid shiner) | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | [redacted] | 2 | 2 | 1 | 1 | 1 | 1 |
| Ichthyomyzon fossor (northern brook lamprey) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Ichthyomyzon unicuspis (silver lamprey) | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | [redacted] | 1 | 1 | [redacted] | 1 | 2 | 1 | 1 | 1 | 1 |
| Lampetra aepyptera (least brook lamprey) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Lampetra appendix (American brook lamprey) | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | [redacted] | 1 | 2 | 1 | 1 | 1 | 1 |
| Lepomis miniatus (redspotted sunfish) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Lepomis symmetricus (bantam sunfish) | | | | | | | | | | | | | | | | | | | | |
| Lythrurus fumeus (ribbon shiner) | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| Macrhybopsis gelida (sturgeon chub) | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Macrhybopsis meeki (sicklefin chub) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Micropterus dolomieu (smallmouth bass) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 2 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

| FISHES, continued | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structure/Infrastructure |
| Micropterus punctulatus (spotted bass) | 1 | 2 | 2 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 |
| Moxostoma carinatum (river redhorse) | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Moxostoma duquesnei (black redhorse) | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Moxostoma valenciennesi (greater redhorse) | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Myoxocephalus quadricornis (fourhorn sculpin) | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Nocomis micropogon (river chub) | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Notropis anogenus (pugnose shiner) | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 |
| Notropis boops (bigeye shiner) | 3 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Notropis buchanani (ghost shiner) | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Notropis chalybaeus (ironcolor shiner) | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Notropis heterodon (blackchin shiner) | 3 | 3 | 3 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Notropis heterolepis (blacknose shiner) | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Notropis maculatus (taillight shiner) | | | | | | | | | | | | | | | | | | | | |
| Notropis nubilus (Ozark minnow) | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Notropis rubellus (rosyface shiner) | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Notropis shumardi (silverband shiner) | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Notropis texanus (weed shiner) | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Noturus eleutherus (mountain madtom) | 2 | 1 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 |
| Noturus exilis (slender madtom) | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Noturus stigmosus (northern madtom) | 3 | 1 | 3 | 2 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Opsopoeodus emilae (pugnose minnow) | 2 | 2 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Perca flavescens (yellow perch) | 1 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 1 | 2 | 2 | 3 | 3 | 2 | 1 | 1 |
| Percopisis omiscomaycus (trout-perch) | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Phoxinus erythrogaster (southern redbelly dace) | 2 | 3 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Polyodon spathula (North American paddlefish) | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 3 |

| FISHES, continued | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structure/Infrastructure |
| Rhyinichthys atratulus (blacknose dace) | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Rhyinichthys cataractae (longnose dace) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Salvelinus fontinalis (brook trout) | 3 | 2 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 1 | 2 |
| Salvelinus namaycush (lake trout) | | | | | | | | | | | | | | | | | 3 | | | |
| Scaphirhynchus albus (pallid sturgeon) | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 2 | 1 | 1 | 2 | 3 |
| Scaphirhynchus platorhynchus (shovelnose sturgeon) | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 3 |
| Stizostedion canadense (sauger - native stock) | 2 | 2 | 3 | 1 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 1 | 2 |
| Stizostedion vitreum (walleye - native stock) | 2 | 2 | 3 | 2 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 1 | 2 |
| Umbra limi (central mudminnow) | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | | | | | | | | | | | | | | | | | |
| *Game Species* | | | | | | | | | | | | | | | | | | | | |
| Trout - Lake Michigan | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 1 | 2 | 1 | 3 | 2 | 1 | 1 | 1 |
| Trout - inland | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 2 |
| Salmon - Lake Michigan | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 1 | 2 | 2 | 3 | 2 | 1 | 1 | 1 |
| Smelt | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Northern pike, muskie | 1 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 1 |
| Walleye, sauger | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 1 | 2 |
| Yellow perch | 1 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 1 | 2 | 2 | 3 | 3 | 2 | 1 | 1 |
| Largemouth bass | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Smallmouth bass, spotted bass | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 |
| White bass, yellow bass | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| Striped bass & hybrids | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 1 | 1 | 1 |
| Catfish | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 1 | 1 | 1 |
| Bullhead | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| Sunfish | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 |
| Crappie | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 |
| Carp | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

[1] Illinois Department of Natural Resources. 2000. 1998 Illinois Sport Fishing Survey. Special Fisheries Report No. 57.

Matrix completed by Trent Thomas, Ann Holtrop, Dave Day, with Jeff Walk; 5 August 2004

| **AMPHIBIANS & REPTILES** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| *Species in Greatest Need of Conservation* | | | | | | | | | | | | | | | | | | | | |
| AMPHIBIANS | | | | | | | | | | | | | | | | | | | | |
| Ambystoma jeffersonianum (Jefferson salamander) | 3 | 2 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 |
| Ambystoma laterale (blue-spotted salamander) | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ambystoma platineum (silvery salamander) | 3 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 |
| Ambystoma talpoideum (mole salamander) | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cryptobranchus alleganiensis (hellbender) | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 |
| Desmognathus conanti (spotted dusky salamander) | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 |
| Gastrophryne carolinensis (eastern narrowmouth toad) | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 |
| Hemidactylium scutatum (four-toed salamander) | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | 1 | 1 | 1 |
| Hyla avivoca (bird-voiced treefrog) | 2 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| Necturus maculosus (mudpuppy) | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 1 |
| Pseudacris streckeri illinoensis (Illinois chorus frog) | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rana areolata (crayfish frog) | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 2 |
| Rana palustris (pickerel frog) | 2 | 2 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| Rana sylvatica (wood frog) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | | | | | | | | | | | | | | | | | | | | |
| REPTILES | | | | | | | | | | | | | | | | | | | | |
| Apalone mutica (smooth softshell turtle) | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 1 |
| Clemmys guttata (spotted turtle) | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 1 |
| Clonophis kirtlandii (Kirtland's snake) | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 |
| Crotalus horridus (timber rattlesnake) | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| Elaphe emoryi (great plains rat snake) | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 3 | 1 | 2 | 3 |
| Emydoidea blandingii (Blanding's turtle) | 2 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 2 |
| Farancia abacura (mud snake) | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 |
| Heterodon nasicus (western hognose snake) | 2 | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 2 |

| AMPHIBIANS & REPTILES, continued | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| Kinosternon flavescens (Illinois mud turtle) | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 2 | 1 | 1 | 1 |
| Kinosternon subrubrum (eastern mud turtle) | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Macrochelys temminckii (alligator snapping turtle) | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 2 | 1 | 1 | 1 |
| Masticophis flagellum (coachwhip) | 2 | 1 | 2 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 3 | 1 | 2 | 3 |
| Nerodia cyclopion (Mississippi green water snake) | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 |
| Nerodia erythrogaster neglecta (n. copperbelly watersnake) | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Nerodia fasciata (broad-banded water snake) | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 2 | 1 | 2 | 2 |
| Liochlorophis vernalis (smooth green snake) | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |
| Ophisaurus attenuatus (slender glass lizard) | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 2 |
| Pseudemys concinna (river cooter) | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 |
| Sistrurus catenatus catenatus (eastern massasauga) | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 2 | 2 | 3 |
| Tantilla gracilis (flathead snake) | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | 2 | 1 | 2 | 2 |
| Terrapene ornata (ornate box turtle) | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| Thamnophis sauritus (eastern ribbon snake) | 2 | 2 | 2 | 2 | [illegible] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 |
| Tropidoclonion lineatum (lined snake) | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| | | | | | | | | | | | | | | | | | | | | |
| *Game Species* | | | | | | | | | | | | | | | | | | | | |
| Bullfrog | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

[1] *N. E. neglecta* is protected by Illinois Administrative Rule, part 880.70, in 14 southeastern Illinois counties

Matrix completed 23 August 2004 by Scott Ballard, Mike Redmer, with Jeff Walk

| BIRDS | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| *Species in Greatest Need of Conservation* | | | | | | | | | | | | | | | | | | | | |
| Ammodramus henslowii (Henslow's sparrow) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Ammodramus leconteii (LeConte's sparrow)[1] | [redacted] | 2 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Ammodramus nelsoni (Nelson's sharp-tailed sparrow)[1] | [redacted] | 2 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Ammodramus savannarum (grasshopper sparrow) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Anas rubripes (American black duck)[1] | | | | | | | | | | | | | | | | | | | | |
| Ardea alba (great egret) | | | | | | | | | | | | | | | | | | | | |
| Asio flammeus (short-eared owl) | | | | | | | | | | | | | | | | | | | | |
| Aythya affinis (lesser scaup) | | | | | | | | | | | | | | | | | | | | |
| Aythya valisineria (canvasback) | | | | | | | | | | | | | | | | | | | | |
| Bartramia longicauda (upland sandpiper) | | | | | | | | | | | | | | | | | | | | |
| Bonasa umbellus (ruffed grouse) | 2 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 2 |
| Botaurus lentiginosus (American bittern) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Buteo lineatus (red-shouldered hawk) | | | | | | | | | | | | | | | | | | | | |
| Buteo platypterus (broad-winged hawk) | | | | | | | | | | | | | | | | | | | | |
| Buteo swainsoni (Swainson's hawk) | | | | | | | | | | | | | | | | | | | | |
| Calcarius pictus (Smith's longspur)[1] | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 |
| Calidris himantopus (stilt sandpiper)[1] | [redacted] | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| Caprimulgus carolinensis (chuck-will's-widow) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Caprimulgus vociferus (whip-poor-will) | | | | | | | | | | | | | | | | | | | | |
| Certhia americana (brown creeper) | | | | | | | | | | | | | | | | | | | | |
| Chaetura pelagica (chimney swift) | | | | | | | | | | | | | | | | | | | | |
| Charadrius melodus (piping plover) | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 1 | 3 | 3 |
| Chordeiles minor (common nighthawk) | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 |
| Chlidonias niger (black tern) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Circus cyaneus (northern harrier) | | | | | | | | | | | | | | | | | | | | |
| Cistothorus palustris (marsh wren) | | | | | | | | | | | | | | | | | | | | |
| Cistothorus platensis (sedge wren) | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |

| **BIRDS, continued** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| Coccyzus americanus (yellow-billed cuckoo) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Coccyzus erythropthalmus (black-billed cuckoo) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Colaptes auratus (northern flicker) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Colinus virginianus (northern bobwhite) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Coturnicops noveboracensis (yellow rail)[1] | [redacted] | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 3 |
| Cygnus buccinator (trumpeter swan)[1] | [redacted] | | | | | | | | | | | | | | | | | | | |
| Dendroica cerulea (cerulean warbler) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Dendroica discolor (prairie warbler) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Dolichonyx oryzivorus (bobolink) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Egretta caerulea (little blue heron) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Egretta thula (snowy egret) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Empidonax trailli (willow flycatcher) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Empidonax virescens (Acadian flycatcher) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Euphagus carolinus (rusty blackbird)[1] | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Falco peregrinus (peregrine falcon) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Gallinula chloropus (common moorhen) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Gallinago delicatata (Wilson's snipe) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Grus americana (whooping crane)[1] | [redacted] | | | | | | | | | | | | | | | | | | | |
| Grus canadensis (sandhill crane) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Haliaeetus leucocephalus (bald eagle) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Helmitheros vermiforma (worm-eating warbler) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Hylocichla mustelina (wood thrush) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Icteria virens (yellow-breasted chat) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Ictinia mississippiensis (Mississippi kite) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Ixobrychus exilis (least bittern) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Lanius ludovicianus (loggerhead shrike) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Lateralius jamaicensis (black rail) | [redacted] | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 1 | 1 | 2 |

| BIRDS, continued | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| Limnodromus griseus (short-billed dowitcher)[1] | [redacted] | 2 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| Limnothlypis swainsonii (Swainson's warbler) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Lophodytes cucullatus (hooded merganser) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Melanerpes erythrocephalus (red-headed woodpecker) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Nyctanassa violacea (yellow-crowned night-heron) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Nycticorax nycticorax (black-crowned night-heron) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Oporornis agilis (Connecticut Warbler)[1] | 2 | 2 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Oporornis formosus (Kentucky warbler) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Pandion haliaetus (osprey) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Passerculus sandwichensis (savannah sparrow) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Phalaropus tricolor (Wilson's phalarope) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Pluvialis dominica (American golden-plover)[1] | 1 | 2 | 2 | 3 | 1 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | 2 |
| Podilymbus podiceps (pied-billed grebe) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Rallus elegans (king rail) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Scolopax minor (American woodcock) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Seiurus aurocapillus (ovenbird) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Spiza americana (dickcissel) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Spizella pusilla (field sparrow) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Sterna antillarum (least tern) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Sterna forsteri (Forster's tern) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Sterna hirundo (common tern) | [redacted] | | | | | | | | | | | | | | | | | | | |
| Thryomanes bewickii (Bewick's wren) | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 1 | 2 | 2 |
| Tringa melanoleuca (greater yellowlegs)[1] | [redacted] | 2 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| | | | | | | | | | | | | | | | | | | | | |

| BIRDS, continued | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| Tryngites subruficollis (buff-breasted sandpiper)[1] | [redacted] | 2 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 |
| Tympanuchus cupido (greater prairie-chicken) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Tyto alba (barn-owl) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Vermiforma pinus (blue-winged warbler) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Vireo belli (Bell's vireo) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Xanthocephalus xanthocephalus (yellow-headed blackbird) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| | | | | | | | | | | | | | | | | | | | | |
| *Game Species* | | | | | | | | | | | | | | | | | | | | |
| Migratory geese (Anserinae) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Migratory ducks (Anatinae) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Resident Canada geese | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Nesting ducks (Anatinae) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| American coots | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| rails (sora, Virginia) | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Wilson's snipe | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| American woodcock | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Wild turkey | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Northern bobwhite | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Ring-necked pheasant | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Gray partridge | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Mourning dove | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| American crow | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

[1] Does not breed in Illinois

Matrix completed by J. Walk, July 2004, with M. Ward and S. Bailey

| **MAMMALS** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| *Species in Greatest Need of Conservation* | | | | | | | | | | | | | | | | | | | | |
| Canis lupus (gray wolf)[1] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 1 |
| Corynorhinus rafinesquii (eastern big-eared bat) | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 1 |
| Lontra canadensis (river otter) | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Lynx rufus (bobcat) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Microsorex hoyi (pygmy shrew) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Microtus pinetorum (woodland vole) | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mustela nivalis (least weasel) | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Myotis austroriparius (southeastern bat) | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
| Myotis grisescens (gray bat) | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 |
| Myotis sodalis (Indiana bat) | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 |
| Neotoma floridana (eastern woodrat)[2] | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 |
| Ochrotomys nuttalli (golden mouse) | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ondatra zibethicus (muskrat) | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Oryzomys palustris (marsh rice rat) | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Peromyscus gossypinus (cotton mouse)[3] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| Spermophilus franklinii (Franklin's ground squirrel) | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 |
| Sylvilagus aquaticus (swamp rabbit) | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Tamiasciurus hudsonicus (red squirrel) | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Taxidea taxus (American badger) | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Urocyon cinereoargenteus (gray fox) | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| *Game Species* | | | | | | | | | | | | | | | | | | | | |
| White-tailed Deer | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rabbit (Cottontail & Swamp) | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Squirrel | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Fox Squirrel | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Muskrat | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Beaver | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Woodchuck | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |

| **MAMMALS, continued** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resource - Species | Habitat Stresses | | | | | | Community Stresses | | | | | | | Population Stresses | | | | Direct Human Stresses | | |
| | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment | Competitors | Predators | Parasites - Disease | Prey - Food | Hosts | Invasives/Exotics | Other Symbionts | Genetics | Dispersal | Recruitment | Mortality | Killing | Disturbance | Structures - Infrastructure |
| Opossum | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Striped Skunk | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mink | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| American Badger | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Weasel (Least & Long-tailed) | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Raccoon | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Coyote | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Fox | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 |
| Red Fox | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

[1] Occurs as vagrant only in Illinois

[2] Reintroduction efforts on-going, may obscure population trend

[3] Identification is problematic; may intergrade broadly with other *Peromyscus*

[4] Annual harvest of 140,000 deer results in a stable population. In the short-term, harvest exceeding current levels will be necessary to reduce the herd to a point where a 140,000-animal harvest maintains a stable population.

Matrix completed by Joyce Hofmann, Ed Heske, 16 August 2004, with Jeff Walk

| **HABITATS** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Resource | | Stresses | | | | | |
| | | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment |
| Forest | Upland Forest | 1 | 2 | 3 | 3 | 3 | 1 |
| | Sand Forest | 1 | 2 | 3 | 3 | 3 | 1 |
| | Floodplain | 2 | 2 | 3 | 3 | 3 | 3 |
| | Flatwoods | 2 | 2 | 3 | 3 | 3 | 1 |
| | Successional | 2 | 2 | 3 | 3 | 3 | 1 |
| | Coniferous Plantation | 1 | 1 | 2 | 2 | 2 | 1 |

| **HABITATS**, ***continued*** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Resource | | Stresses | | | | | |
| | | Extent | Fragmentation | Composition-Structure | Disturbance/Hydrology | Invasives/Exotics | Pollutants - Sediment |
| Open Woodland, Savanna & Barrens | Savanna | 3 | 2 | 3 | 3 | 3 | 1 |
| | Sand Savanna | 3 | 2 | 3 | 3 | 3 | 1 |
| | Barren | 3 | 2 | 3 | 3 | 3 | 1 |
| Grassland | Prairie | 3 | 3 | 3 | 3 | 3 | 1 |
| | Sand Prairie | 3 | 3 | 3 | 3 | 3 | 1 |
| | Gravel Prairie | 3 | 3 | 3 | 3 | 3 | 1 |
| | Dolomite Prairie | 3 | 3 | 3 | 3 | 3 | 1 |
| | Hill Prairie | 3 | 2 | 3 | 3 | 3 | 1 |
| | Shrub Prairie | 3 | 2 | 3 | 3 | 3 | 1 |
| | Pasture | 2 | 2 | 3 | 3 | 3 | 1 |
| | Idle-introduced | 2 | 2 | 3 | 3 | 3 | 1 |
| | Early successional | 2 | 2 | 2 | 3 | 2 | 1 |
| | Hay | 2 | 2 | 2 | 3 | 2 | 1 |
| Wetland | Marsh | 3 | 3 | 3 | 3 | 3 | 3 |
| | Swamp | 3 | 3 | 2 | 3 | 3 | 3 |
| | Bog | 3 | 3 | 2 | 3 | 3 | 2 |
| | Fen | 3 | 3 | 3 | 3 | 3 | 3 |
| | Sedge Meadow | 3 | 3 | 3 | 3 | 3 | 3 |
| | Panne | 3 | 3 | 3 | 3 | 3 | 3 |
| | Seep & Spring | 2 | 3 | 3 | 3 | 3 | 3 |
| | Vernal Pool or Flat | 3 | 3 | 2 | 3 | 2 | 3 |
| Lake & Pond | Pond | 1 | 2 | 3 | 3 | 3 | 3 |
| | Lake | 1 | 2 | 3 | 3 | 3 | 3 |
| | Lake Michigan | 1 | 1 | 3 | 3 | 3 | 2 |
| | Impoundment | 1 | 1 | 3 | 3 | 2 | 3 |
| Stream | Creek | 1 | 2 | 3 | 3 | 2 | 3 |
| | River | 1 | 3 | 3 | 3 | 3 | 3 |
| | Major River | 1 | 3 | 3 | 3 | 3 | 3 |
| Primary | Glade | 3 | 2 | 3 | 3 | 3 | 1 |
| | Cliff | 3 | 3 | 2 | 2 | 2 | 3 |
| | Lake Shore | 3 | 3 | 3 | 3 | 3 | 3 |
| Cave | Aquatic | 3 | 1 | 3 | 3 | 1 | 3 |
| | Terrestrial | 3 | 1 | 3 | 3 | 1 | 3 |
| Cultural | Cropland | 1 | 1 | 3 | 3 | 3 | 3 |
| | Developed | 1 | 1 | 3 | 3 | 3 | 3 |

[1] Land Cover of Illinois Statistical Summary 1999-2000. http://www.agr.state.il.us/gis/stats/landcover/mainpages/stats_statewide.htm. Accessed 7 July 2004.

[2] Illinois Natural Areas Inventory, fide R. Collins, Natural Areas Tracking System, July 04

[3] Combined forest types, excluding floodplain forest, coniferous plantation and open woodland/savanna/partial canopy, from Land Cover 1999-2000

[4] Open woodland/savanna/partial canopy category from Land Cover 1999-2000 likely includes successional areas

[5] Rural grassland category from Land Cover 1999-2000; an estimated 781,465 acres are enrolled in the Conservation Reserve Program (from grassland conservation practices; http://www.fs.usda.gov. Accessed 12 August 2004.).

[6] Marsh and swamp categories likely include other scarce wetland types

[7] Open water category from Land Cover 1999-2000 includes ponds, lakes, impoundments and some rivers, but excludes Lake Michigan

NA - not available, not appropriate

**STATE WILDLIFE GRANT PROGRAM**

**State of Illinois**

**Final Performance Report**

**Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems**

**Project 4 -Development of Conservation Opportunity Areas and Landscapes**

**Job 4.1: Selecting Opportunity Areas and Landscapes**

Objectives:

1. Layer ecosystem boundary, land ownership/protection, and on-going conservation action and interagency and partnership opportunity information with conservation element location information onto maps.
2. Select opportunity areas and landscapes, establish objectives and determine priority conservation actions.

Project Description:

Using GIS products of the T-2-P-1 grant as well as GIS layers provided by partner organizations (e.g., Important Bird Areas, The Nature Conservancy Portfolio Sites, C2000 strategic sub-watersheds), Illinois Department of Natural Resources staff and the Illinois Comprehensive Wildlife Conservation Plan/Strategy steering committee located sites and landscapes providing outstanding conservation opportunity. Through regional meetings with Illinois Department of Natural Resources staff, and regional meetings with conservation partners, these opportunity areas and landscapes were refined. At these regional meetings, participants developed management guidelines, established conservation objectives, and described priority conservation actions that are appropriate for each conservation opportunity area. The resulting conservation opportunity areas, proposed management priorities, objectives, and actions were made available for public comment.

Approach:

Conservation Opportunity Areas are described as locations with significant existing or potential wildlife and habitat resources, where partners are willing to plan, implement and evaluate conservation actions, where financial and human resources are available, and where conservation is motivated by an actions, where financial and human resources are available, and where conservation is motivated by an agreed-upon conservation philosophy and set of objectives. In developing the Plan/Strategy, selection of Conservation Opportunity Areas was approached from a natural resources and human dimensions perspective.

To identify the most important locations for the Species in Greatest Need of Conservation, habitats were ranked in the categories of upland forest, grassland, wooded wetlands (swamp and floodplain forest), emergent/shallow water wetlands, and streams. For each of these habitat types except streams, a Geographic Information System was used to rank the entire state on the basis of habitat patch size (larger patches ranked higher), designation as Illinois Natural Areas Inventory sites (from Biotics 4 database), known presence of one or more threatened or endangered wildlife species (since 1995; Biotics 4 database), and diversity of vertebrate Species in Greatest Need of Conservation associated with each habitat type, based upon modeled distribution maps (Illinois GAP Analysis Project). As the Critical Trends Assessment Program indicated, land cover representation of grassland does not reflect grassland functioning as wildlife habitat, so patch size was excluded as a ranking factor for grassland. Streams were ranked by their designation as Illinois Natural Areas Inventory sites (from Biotics 4 database), known presence of one or more threatened or endangered wildlife species (since 1995; Biotics 4 database), and diversity of fish and freshwater mussel Species in Greatest Need of Conservation known to occur in the stream, based upon Department of Natural Resources Fisheries basin surveys, ongoing mussel surveys, and the Illinois Natural History Survey mussel database.

Participants in planning workshops helped identify Conservation Opportunity Areas by placing five markers per participant on maps of the State of Illinois. To assist in their decision-making, the habitat maps described above and maps of previously identified priority areas were made available. Further, participants were challenged to place at least one marker on a location where current conditions were not exceptional or conservation is not on-going, to identify restoration opportunities. For each location indicated, workshop participants described the site, the priority resources, and active partnerships.

Conservation actions were derived from existing plans, proposed by Office of Resource Conservation program managers as goals were being developed, and solicited from Department of Natural Resources biologists and partner agencies and organizations through the workshops and meetings described above. At planning workshops, participants were asked to identify the most effective conservation actions and the most feasible conservation actions. The planning coordinator compiled these proposed actions, considered their support (consensus, frequency of suggestion), perceived effectiveness and perceived feasibility, and arranged them into the overlapping, complimentary campaigns in the Illinois Comprehensive Wildlife Conservation Plan/Strategy.

Results:

Through an analysis of distributions of Species in Greatest Need of Conservation, presence of threatened/endangered species, locations of Illinois Natural Areas Inventory sites, and patch size, each parcel of habitat in Illinois received a relative importance ranking for Species in Greatest Need of Conservation. Because the ranking process was highly selective, a very small proportion of the state scored highly for upland forest, grasslands/prairies, wooded wetlands, emergent/shallow-water wetlands, and streams. The results of this analysis are discussed in the Illinois Comprehensive Wildlife Conservation Plan at "Section III - Statewide Overview, Part E - Priority Conservation Actions," and graphically featured in Figures 12 through 16 of that document.

*Upland Forest* - By far, the largest and most significant upland forest areas for Species in Greatest Need of Conservation were in southern Illinois and associated with the Shawnee National Forest (Figure 1). Other areas highlighted were forests of the Wisconsin Driftless area in northwestern Illinois, the Siloam Springs State Park area, lower LaMoine River area, and Pere Marquette State Park area, each in west-central Illinois.

*Grassland* - Given the poor condition of remnant prairie and poor status of many grassland species, it was not surprising that very little high priority grassland habitat exists in Illinois (Figure 2). Prairie Ridge State Natural Area, while comprised of scattered, relatively small parcels of grassland, is significant, as is the large remnant sand prairie area at Lost Mound National Wildlife Refuge. Other small, but relatively high-ranking locations include Goose Lake Prairie, DesPlaines Conservation Area, Nachusa Grassland, Glacial Park, Iroquois County Conservation Area, and Sand Prairie-Scrub Oak Nature Preserve. Improving the status of Illinois' grassland Species in Greatest Need of Conservation will be highly dependent upon augmentation of existing sites and large-scale restoration, such as is underway at Midewin National Tallgrass Prairie.

*Wooded Wetlands* - Highest-ranking wooded wetland areas (a combination of floodplain forest and swamp land cover categories) in Illinois are associated with large rivers, primarily in southern Illinois (Figure 3). The Cache River watershed and Oakwood Bottoms - LaRue Swamp areas are especially important for Species in Greatest Need of Conservation. The lower Kaskaskia River, middle Little Wabash River (Wayne County), Wabash-Ohio River confluence, Mark Twain National Wildlife Refuge, and Sanganois State Fish & Wildlife Area are also significant.

*Emergent & Shallow Water Wetlands* - As with prairies, losses and degradation to marsh-like wetlands has been severe and species dependent on this habitat have poor status. Though small and threatened by urban expansion, northeastern Illinois, especially along the Fox River in Lake and McHenry counties and Illinois Beach State Park, hosts the most significant concentrations of emergent/shallow water wetland habitats for Species in Greatest Need of Conservation in Illinois (Figure 4). Larger, but modestly-ranking, areas of emergent wetland habitat are located along the middle Illinois River floodplain, and immediately above Carlyle and Rend lakes. As with grasslands, successful conservation will be dependent on effective restoration, as is underway at Hennepin & Hopper Lakes and the Emiquon area.

*Streams* - Illinois hosts several stream segments of high value to Species in Greatest Need of Conservation (Figure 5). Fewer streams have high value along most or all of their length. Among these significant resources are the Wabash River, the Rock River, the Vermilion River and its major tributaries in Vermilion County, the Kankakee River, and the upper Mississippi River (particularly above Keokuk, Iowa).

In addition to Figures 1-5 of this report, participants in planning meetings were also provided with maps of high-priority locations in Illinois for conservation identified by previous planning and analyses (Figure 6) to help inform their decisions in selecting Conservation Opportunity Areas. The information mapped included threatened/endangered species locations, Illinois Natural Areas Inventory sites, public-trust conservation lands (including county forest preserves, state fish and wildlife areas, national forests, national fish and wildlife refuges, and long-term Conservation Reserve Enhancement Program contracts), High Quality Streams (Biologically Significant Streams - Page et al. 1992; Biological Stream Characterization - Hite and Bertrand 1989), Resource Rich Areas (Suloway et al. 1996) , The Nature Conservancy's Portfolio Sites, and Illinois's Important Bird Areas.

Given our current analyses (Figures 1-5, this report) and the previously-identified conservation-priority locations (Figure 6, this report), participants selected priority areas for conservation action based on current conditions and restoration potential (Figure 7). Each of these three approaches showed a high degree of agreement. Highly-ranked habitats for Species in Greatest Need of Conservation correlated strongly with previously identified priority areas, public conservation lands, and areas indicated by planning participants. There are a number of likely reasons for this, including:

1. a highly altered Illinois landscape with little high-quality habitat
2. on-going conservation efforts that have placed many of the highest priority resources under long-term protection and/or public ownership

3. reliance on the same primary sources of information, such as Illinois Natural Areas Inventory sites, threatened and endangered species locations, and land cover (i.e., it is not appropriate to consider these approaches as independent)

4. many of the areas with greatest restoration potential are well-known among Illinois' conservation partners.

Based on these results, an initial set of 32 Conservation Opportunity Areas were included in the Illinois Comprehensive Wildlife Conservation Plan/Strategy as priority areas for conserving Illinois' species in greatest need of conservation, listed in Table 8 of that document, and described in narratives within "Section IV - Natural Division Assessments" (see also Appendix I, this report). Conservation Opportunity Areas have special importance in conserving Illinois' Species in Greatest Need of Conservation, but not all of these species occur within this set of locations, and restricting conservation actions to these areas will not necessarily maintain viable populations or meet the objectives outlined in the Plan/Strategy.

Conclusions:

Job 4.1 describes and prioritizes conservation actions for conserving species and their habitats within opportunity areas for all regions of the State (required element 4). With other land and water management agencies and conservation organizations playing a key role in determining geographic priorities, conservation objectives, and proposed actions, these groups were invested in the Illinois Comprehensive Wildlife Conservation Plan/Strategy development and implementation (required element 7). By updating the information systems created in Job 4.1, modifying, if necessary, and repeating this process, priorities will be periodically re-evaluated for future iterations of the Illinois Comprehensive Wildlife Conservation Plan/Strategy (required element 6). This Job further provides for coordination with conservation partners (required element 7) and public participation (required element 8).

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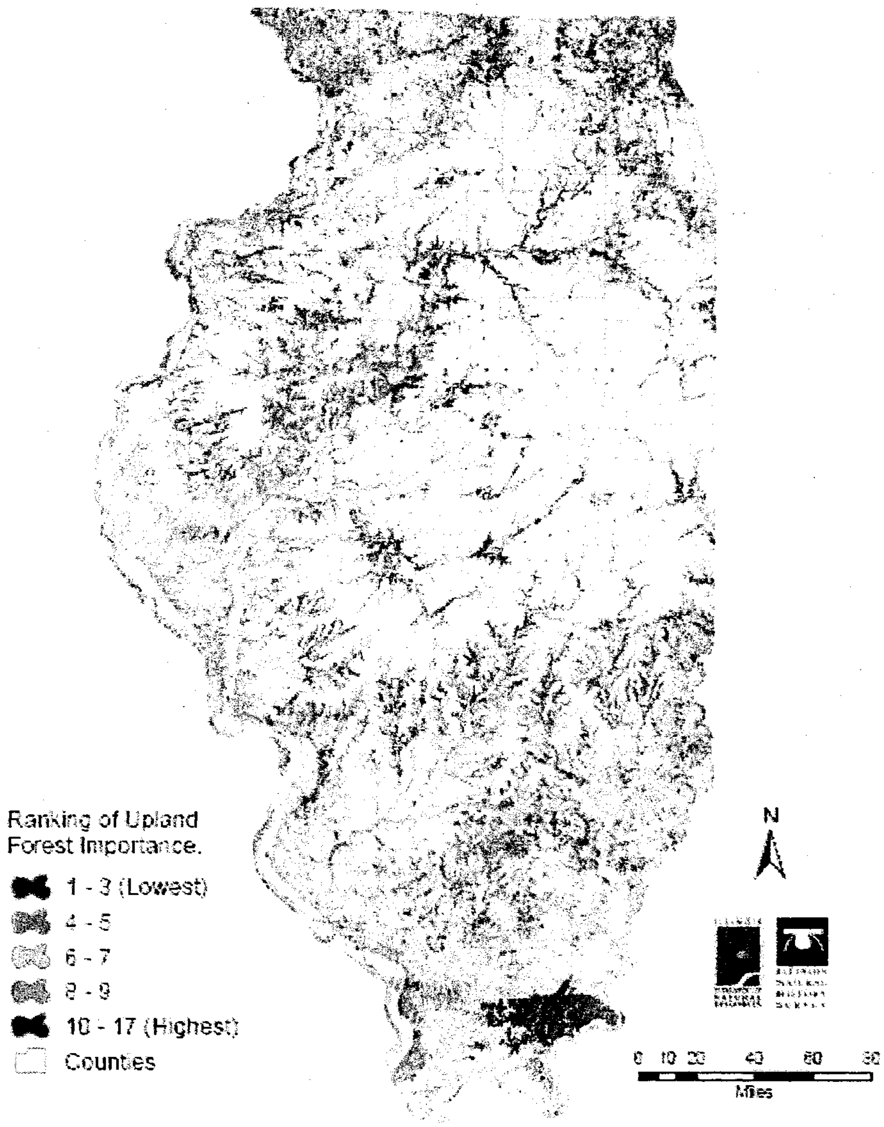



**Figure 1.** Ranking of upland forest habitat for Illinois' Species in Greatest Need of Conservation, based on forest size, diversity of Species in Greatest Need of Conservation predicted from GAP Analysis, known locations of endangered species, and Illinois Natural Areas Inventory forest communities.

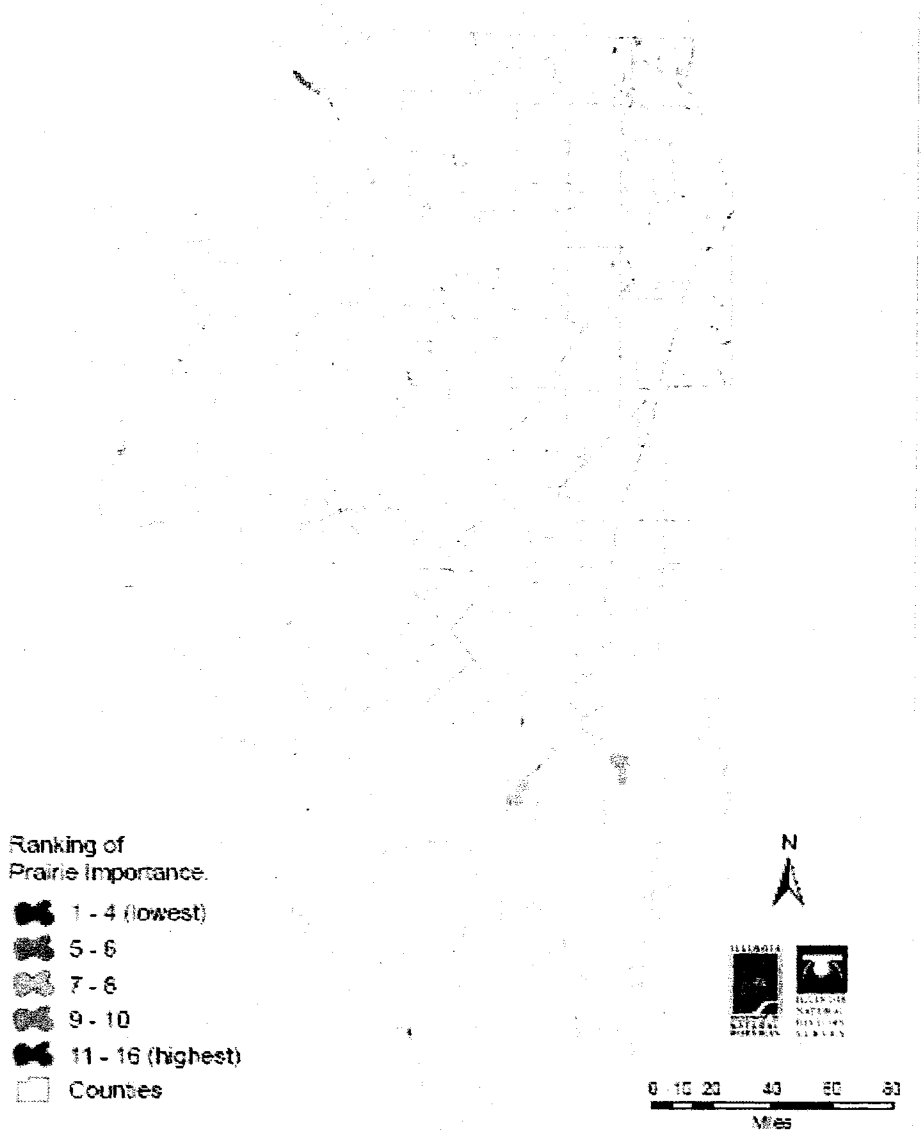



**Figure 2.** Ranking of grassland habitat for Illinois' Species in Greatest Need of Conservation, based on diversity of Species in Greatest Need of Conservation predicted from GAP Analysis, known locations of endangered species, railroad prairie remnants and Illinois Natural Areas Inventory forest communities.

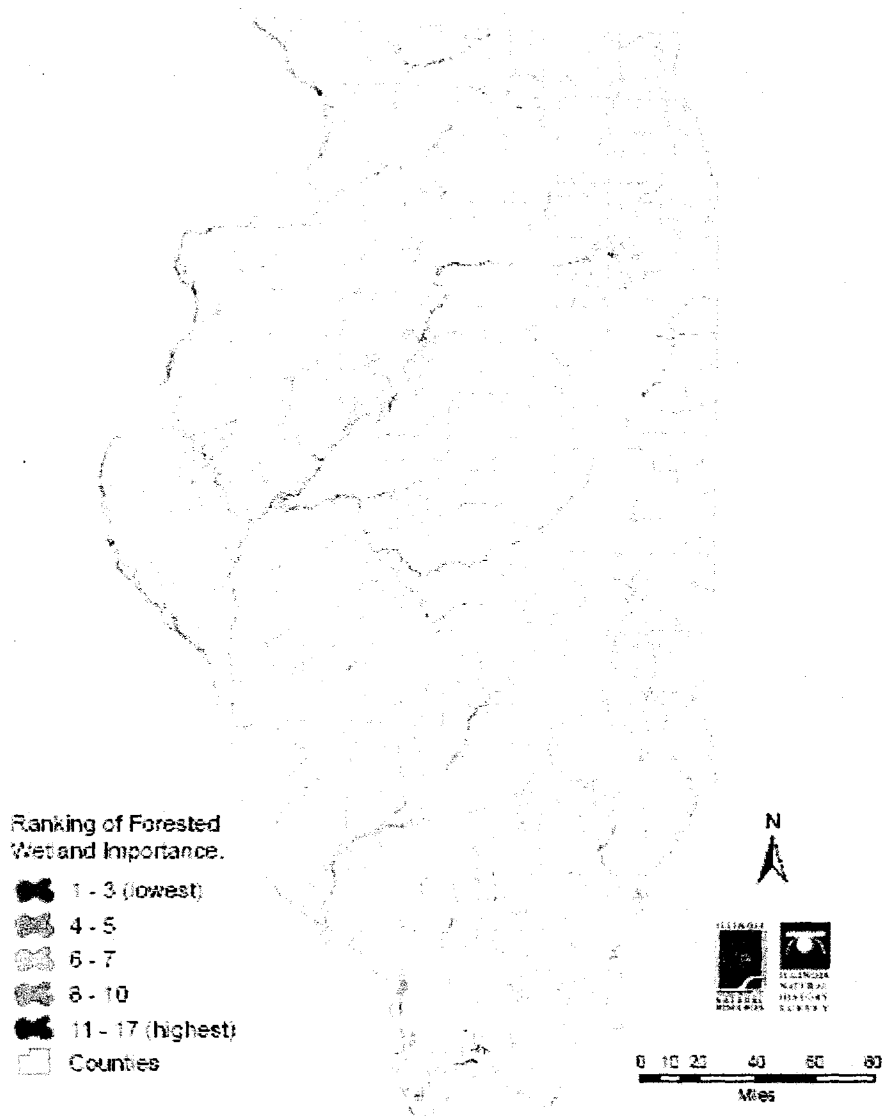



**Figure 3.** Ranking of forested wetland habitat (floodplain forest and swamp) for Illinois' Species in Greatest Need of Conservation, based on wetland size, diversity of Species in Greatest Need of Conservation predicted from GAP Analysis, known locations of endangered species, and Illinois Natural Areas Inventory forested wetland communities.

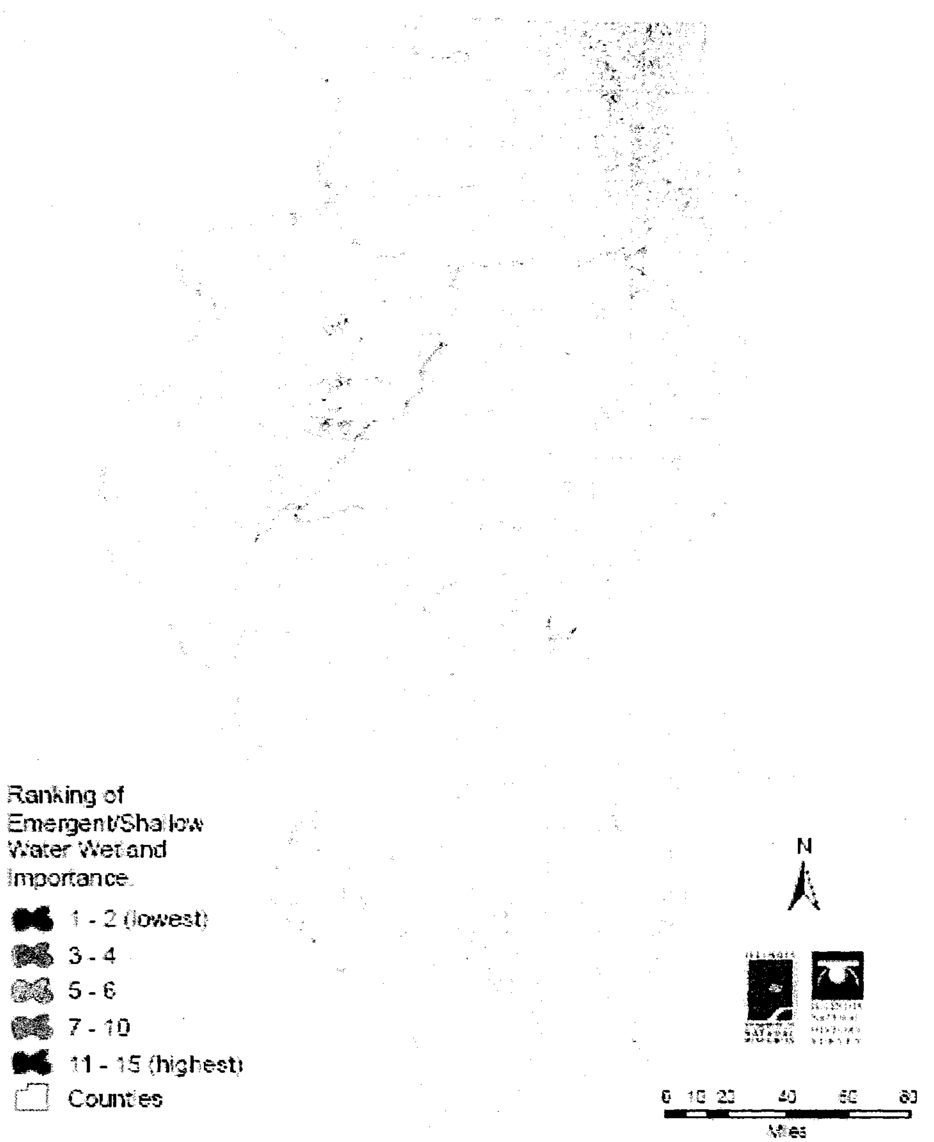



**Figure 4.** Ranking of emergent wetland habitat for Illinois' Species in Greatest Need of Conservation, based on wetland size, diversity of Species in Greatest Need of Conservation predicted from GAP Analysis, known locations of endangered species, and Illinois Natural Areas Inventory emergent wetland communities.

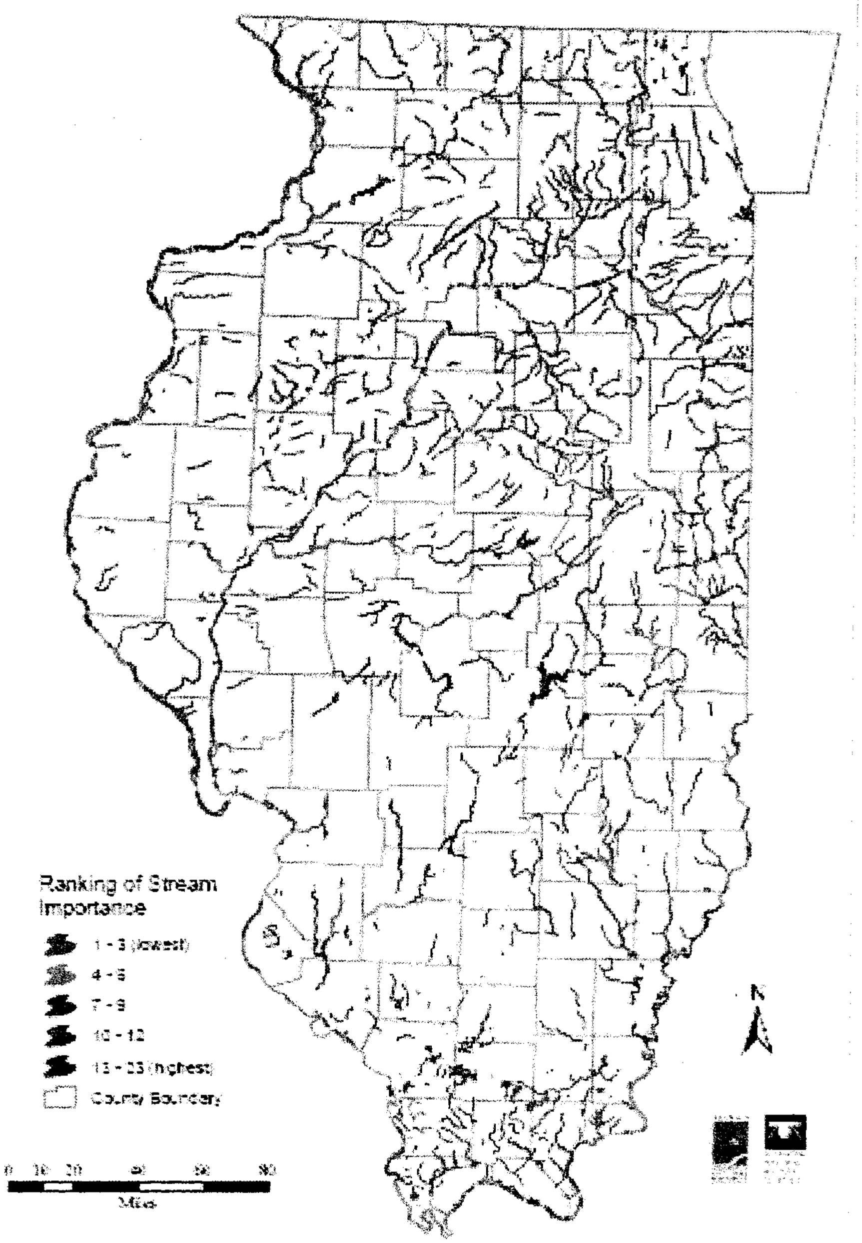



**Figure 5.** Ranking of stream habitat for Illinois' Species in Greatest Need of Conservation, based on diversity of fish and mussel Species in Greatest Need of Conservation, known locations of endangered species, and Illinois Natural Areas Inventory stream communities.

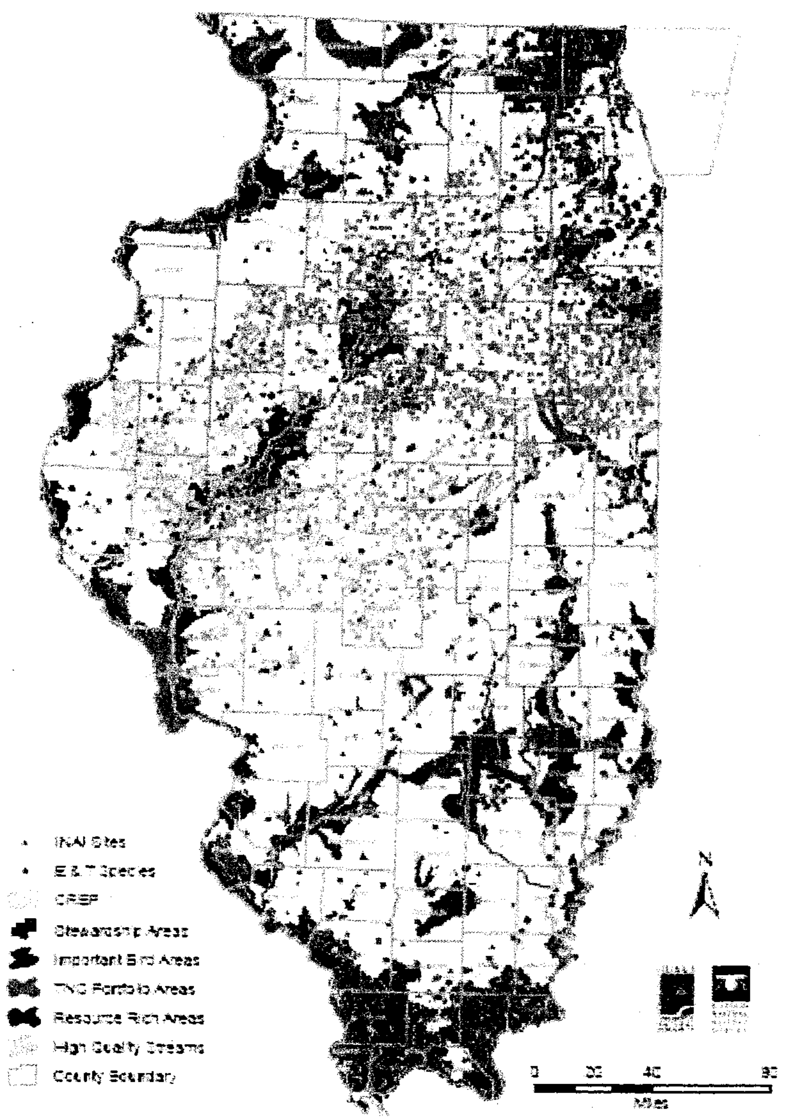


**Figure 6.** Priority conservation areas identified by other conservation plans and other known resource locations. Information on this map includes Illinois Natural Areas Inventory (INAI) sites, locations of Endangered and Threatened wildlife since 1995 (E&T Species), sections with Conservation Reserve Enhancement Program (CREP) contracts, conservation lands of federal, state and county agencies (Stewardship Areas), Important Bird Areas, The Nature Conservancy (TNC) Portfolio Areas, Resource Rich Areas (Suloway et al. 1996), and Biologically Significant Streams and 'A'-quality streams of the Biological Stream Characterization (High Quality streams).

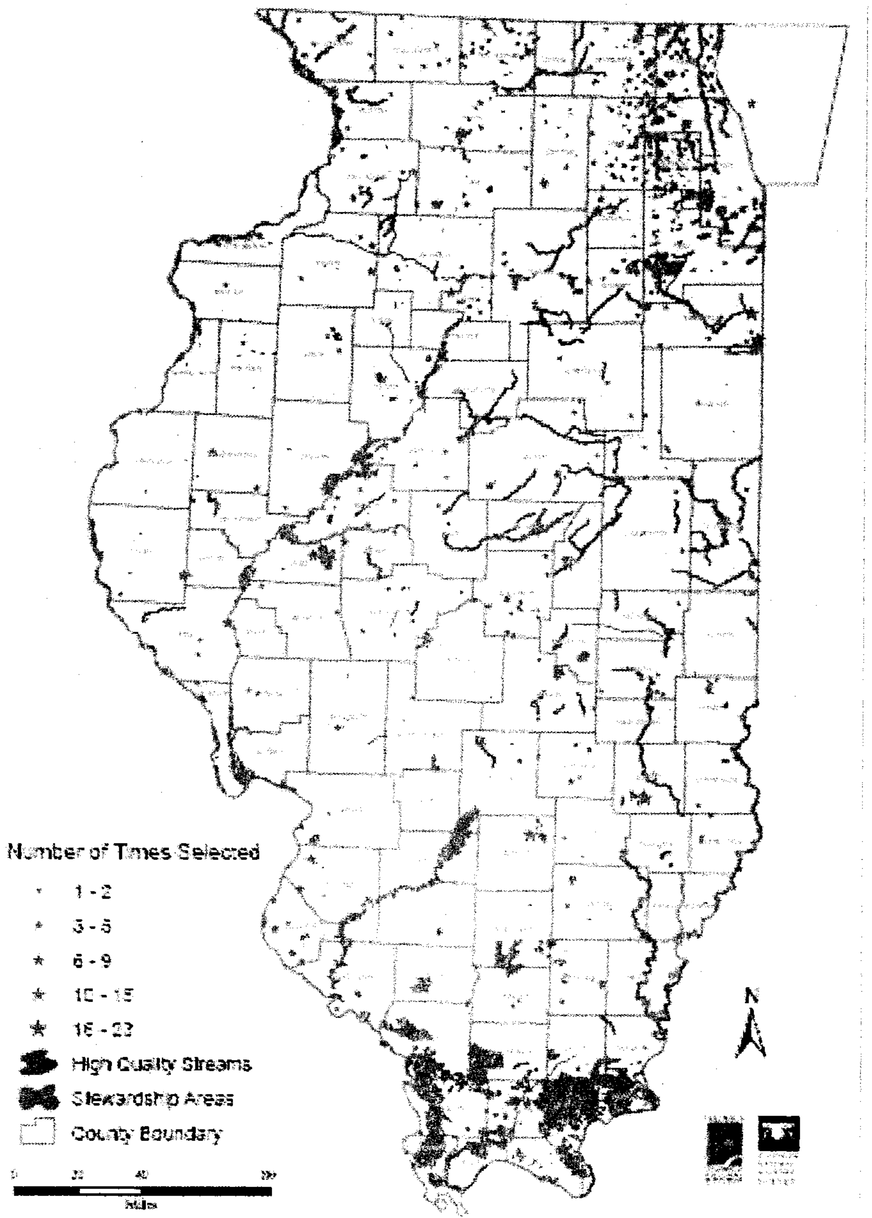



**Figure 7.** Partner-selected priority areas for conserving Illinois' Species in Greatest Need of Conservation, indicated by participants in planning workshops in 2004. High Quality Streams and Stewardship Areas (federal, state and county conservation lands) are shown for reference.

**Appendix I.** Descriptions of Illinois's Conservation Opportunity Areas, by natural division.

## Coastal Plain Natural Division

Cache River Joint Venture Partnership Project

*Protected Lands* - Cache River State Natural Area, Cypress Creek National Wildlife Refuge, Grassy Slough Preserve, Cypress Pond State Natural Area, Heron Pond-Little Black Slough Natural Area

*Priority Resources* - Bottomland Hardwood forest, swamp forest, migratory waterfowl and shorebirds, Neotropical migratory songbirds

*Conservation Philosophy* - Restoration, preservation, and management of bottomland hardwood forests, swamp forests, and riparian aquatic habitat. Resource management will be guided by conditions that were present prior to human disturbance, and emphasis will be placed on restoration of ecological processes that will provide sustainability of all natural communities within the river continuum.

*Wildlife Habitat Objectives* - By 2020 increase land in public ownership within the project area to 60,000 acres; achieve partial reconnection of the Upper and Lower Segments of the Cache River by 2010; reduce peak flows in Big Creek by 25%

*Key Actions* - Land acquisition, partial reconnection of the Upper and Lower Segments of the Cache River, reforestation and wetland restoration

*Partners* - Illinois Department of Natural Resources, U.S. Fish & Wildlife Service, The Nature Conservancy, Ducks Unlimited, U.S. Department of Agriculture-Natural Resources Conservation Service and local Soil and Water Conservation Districts

*Implementation Resources* - C2000, State Wildlife Grants, Wildlife Habitat Incentives Program, Wetland Reserve Program, Natural Areas Acquisition Fund

***Appendix I, continued.***

*Research, Monitoring and Evaluation* - Southern Illinois University at Carbondale, Illinois Natural History Survey, Illinois State Water Survey, Little River Research, Inc.

**Grand Prairie Natural Division**

Prairie & Grassland Restoration Areas (locations to be determined)

*Protected lands* - Establishment of 3 grassland Bird Conservation Areas (>3,000 acres of 'ecologically-patterned' grassland; see Fitzgerald et al. 2000) in the Grand Prairie Division will require restoration in areas where little habitat currently exists. Management of areas of this size will need to accommodate the conservation of grassland Species in Greatest Need of Conservation and provide recreational opportunities, including ring-necked pheasant hunting. Pheasant Habitat Areas, patches of 80-640 acres (typically <120 acres) managed by the Illinois Department of Natural Resources for public hunting, are sometimes the only significant habitat patch on the landscape. These locations may be a starting point for influencing grassland habitat on a landscape scale. Additional incentives for landowners adjacent to Pheasant Habitat Areas's may promote larger contiguous grassland habitat on private lands, particularly in areas with concentrations of highly-erodible soils.

*Goal* - Establish and manage grassland landscapes, as described above, for the benefit of grassland Species in Greatest Need of Conservation and offering compatible, high-quality, wildlife-recreation opportunities

*Key actions* - identify locations with highest restoration potential; modify existing programs to encourage restoration of grassland on private lands

*Partners* - Illinois Department of Natural Resources, Pheasants Forever, U.S. Department of Agriculture (Natural Resources Conservation Service, Farm Service Agency), Grand Prairie Friends, C2000 Ecosystem Partnerships

***Appendix I, continued.***

Midewin - Des Plaines - Goose Lake Prairie Macrosite

*Protected lands* - Located in Will county, Midewin is the first tallgrass prairie to be established under federal control. Encompassing over 19,000 acres, it is the largest tallgrass prairie complex in the state, and is second only to Prairie Ridge State Natural Area in the number of nesting area-sensitive grassland bird species. Goose Lake Prairie is the largest native tallgrass prairie remnant in Illinois. Des Plaines Conservation Area provides 2,000 acres of additional grassland habitat.

*Key Actions* - Restoration and management of tallgrass prairie vegetation are on-going; unnecessary legacy infrastructure (Midewin) and invasive woody vegetation are being removed. The surrounding landscape is vulnerable to exurban and suburban development because of its proximity to Chicago. Preserving open space would help ease the impact of land lost to development and increase an already ecologically important grassland ecosystem.

*Partners* - U.S. Forest Service, Illinois Department of Natural Resources, The Nature Conservancy

Kankakee Sands - Pembroke Savannas - Kankakee River - Momence Wetlands Area

*Protected Lands* - Iroquois County State Fish & Wildlife Area, The Nature Conservancy properties

*Objectives* - Restore and manage an additional 10,000 acres of black oak sand savanna, sand prairie and sand flatwoods within the Kankakee Sands Section; restore and manage 2,000 acres in the Momence Wetlands; restore in-stream habitat and natural process in the Kankakee River in Illinois and Indiana, especially issues of sand bed and sediment load

Key Actions - work across state boundaries to restore channelized streams, stabilize stream banks, manage drainage practices to moderate water flows, and develop minimum flow standards; protect and restore remnant savanna, sand prairie and wetland habitat

*Partners* - Illinois Department of Natural Resources, State of Indiana, The Nature Conservancy, Illinois Nature Preserves Commission, Northern Illinois Anglers Association

***Appendix I, continued.***

Green River (*No information contributed.*)

Lower Fox River (*No information contributed.*)

**Illinois River and Mississippi River Sand Areas Natural Division**

Mason County Sand Areas

*Protected lands* - 4,000 acres among Henry Allan Gleason State Natural Area, Sparks Pond State Natural Area, Rollo Prairie State Natural Area, Sand Prairie Scrub Oak State Natural Area, Long Branch Sand Prairie State Natural Area, Revis Springs Hill Prairie State Natural Area, Matanzas Prairie State Natural Area, Barton Summer Timbers State Natural Area, and Clear Lake's open water

*Priority Resources* - sand prairie, sand savanna, ephemeral wetlands, sand-restricted wildlife, grassland and savanna Species in Greatest Need of Conservation

Lost Mound - Hanover Bluff - Mississippi Palisades

*Protected Lands*: Upper Mississippi River National Fish & Wildlife Refuge - Lost Mound unit, Hanover Bluff Nature Preserve, Falling Down Prairie Nature Preserve, Mississippi Palisades State Park

*Conservation Philosophy:* Restoration of the continuum of riverine (Mississippi River bottomlands), prairie (Lost Mound), and upland forest (Hanover Bluff, Mississippi Palisades) as an ecosystem landscape. At Lost Mound (within the Sands natural division), the objective is restoration of a sand prairie/sand savanna ecosystem capable of maintaining viable populations of grassland species, including both permanent residents and migratory species, with emphasis on declining grassland bird species and threatened and endangered species while allowing compatible recreational activities.

*Partners:* U.S. Fish & Wildlife Service, Illinois Department of Natural Resources, The Friends of the Depot, The Prairie Enthusiasts, The Nature Conservancy, Jo Daviess Natural Areas

***Appendix I, continued.***

Guardians, Driftless Area Partnership, Natural Land Institute, Jo Daviess Conservation Foundation, Blufflands Alliance, National Wild Turkey Federation

* See also *Upper Mississippi River and Illinois River Bottomlands* and *Wisconsin Driftless* natural divisions

**Lower Mississippi River Bottomlands Natural Division**

<u>LaRue - Pine Hills - Western Shawnee - Trail of Tears</u>

*Protected lands* - Pine Hills Ecological Area, LaRue Ecological Area, Ozark Hills Nature Preserve, Shawnee National Forest (including Oakwood Bottoms), Trail of Tears State Forest

*Conservation philosophy* - Maintain connectivity among Ozark, Shawnee Hills and Lower Mississippi River Bottomlands Natural Divisions with riverine, swamp, bottomland forest, bluff, and upland forest, glade and barrens communities. Protect and proactively manage for the unique flora and fauna native to these ecosystems. Use sound management decisions, with historical conditions as a guide.

*Priority resources (LaRue Swamp)* - swamp, sloughs of the Big Muddy River, high diversity of reptiles and amphibians

*Objectives* - enroll unprotected critical habitats for endangered/threatened species into long term protection plans; generate funding to increase biologist positions to help with personnel needed to proactively manage these communities.

*Priority actions* - use prescribed fire to manage fire climax communities of glades, barrens, and upland forests; permanent protection of land parcels with high quality community types; reforestation to create larger patches

*Partners* - U.S. Forest Service, Illinois Department of Natural Resources, The Nature Conservancy

***Appendix I, continued.***

*Research, monitoring & evaluation* - research and monitoring can be conducted by Illinois Department of Natural Resources, Southern Illinois University (Carbondale and Edwardsville campuses), Southwest Illinois College, and the Illinois Natural History Survey

* See also *Ozark* and *Shawnee Hills* natural divisions

**Middle Mississippi River Border Natural Division**

Pere Marquette State Park

*Protected Lands* - 8,000-acre Pere Marquette State Park

*Priority Resources* - large forested area, hill prairies, major rivers, bald eagles

*Key Actions* - develop a plan to deal with the numerous exotic plant species

**Northeastern Morainal Natural Division**

Crow's Foot Marsh - Coon Creek - Kishwaukee River

In 2002, The Boone County and the McHenry County Conservation Districts formed a partnership with the Illinois Department of Natural Resources to develop a conservation initiative aimed at preserving and enhancing habitat along the high quality Kishwaukee River and its' tributary, Coon Creek. Initial effort is focused on conservation of open space – farms, wildlife habitat, and water resources – through easements, incentive based programs or acquisition with willing participants or sellers. The feasibility study looked at a total area of about 16,500 acres. The study area includes portions of both the Kishwaukee River watershed and the Coon Creek watershed. The Kishwaukee River watershed has been identified as a "Unique Aquatic Resource" or class "A" stream. This area includes habitat for at least four state threatened species of birds and six endangered species of birds.

*Funding:* Illinois Clean Energy Community Foundation, Open Land Trust, Boone and McHenry County Conservation District, Natural Resources Conservation Service

***Appendix I, continued.***

Illinois Beach - Chiwaukee Prairie

The Chiwaukee Prairie Preservation Fund established a 40-year partnership to preserve and restore Chiwaukee Prairie in southeast Wisconsin. Partners include the Village of Pleasant Prairie, University of Wisconsin-Parkside, The Nature Conservancy - Wisconsin and the Wisconsin Department of Natural Resources. Potential exists for a larger agreement to manage critical beach, dune, swale habitat across state lines with Illinois Department of Natural Resources at Illinois Beach State Park and Lake County Forest Preserve District at Spring Bluff and Lyons Woods Nature Preserves. The District Restoration Ecologist has initiated contact with the Wisconsin partners. Reintroductions of rare insects and management of federally endangered species exist.

Lake-McHenry County Wetland Complex

*Protected lands* - Redwing Slough, Black Crown-Marsh, Chain O' Lakes, Moraine Hills, Volo Bog, Marl Flat, Sun Lake, Nippersink, Grant Woods, Gavin Bog & Prairie, Wauconda Bog Nature Preserve, Broberg Marsh, Airstrip Marsh, Schreiber Lake Bog, Bangs Lake, Fairfield Road South Marsh, Fourth Lake Nature Preserve, Rollins Savanna and McDonald Woods Marsh

*Priority resources* - several rare wetland types including fens and bogs, rare wetland and grassland species–some not found elsewhere in Illinois; several hundred recently-protected acres are slated for wetland, prairie and savanna restoration

*Partners* - Illinois Department of Natural Resources, Forest Preserve District of Lake County, McHenry County Conservation District

Upper Des Plaines River Corridor

*Protected lands:* Van Patten Woods, Wadsworth Savanna Nature Preserve, Wetlands Demonstration Site, Gurnee Woods

*Priority resources* - Des Plaines River, wetland, sedge meadow, and savanna habitat; several threatened/endangered species, migratory birds

***Appendix I, continued.***

*Conservation opportunities* - Large areas are available for wetland, savanna, sedge meadow and floodplain forest restoration occur within this complex.

**Ozark Natural Division**

Hill Prairie Corridor

*Protected lands* - Fults Hill Prairie Nature Preserve, Pine Hills Annex Hill Prairie, Piney Creek Ravine Nature Preserve, several privately-owned land & water reserves, nature preserves, and natural heritage landmarks

*Priority resources* - hill prairies and associated species

*Conservation philosophy* - restore, maintain and protect the fragmented hill prairies that exist on these areas to prevent their closing in by woody encroachment; protect and proactively manage for the unique flora and fauna native to these blufftop ecosystems; use sound management decisions guided by historical conditions

*Objectives* - expand boundaries of hill prairies to historical extent; enroll unprotected hill prairies and critical habitats for endangered/threatened species into long term protection plans; generate funding for biologist positions to provide personnel needed to proactively manage these blufftop communities

*Priority actions* - use prescribed burning to manage the fire climax communities of hill prairies, glades, barrens, and upland forests; permanent protection of available parcels of high quality community types; create connection of the hill prairies system along the Mississippi River bluffs from Dupo to Prairie du Rocher

*Partners* - Illinois Department of Natural Resources, blufftop protection groups

*Conservation resources* - C2000 grants, Wildlife Preservation Fund, Wildlife Habitat Incentives Program, Natural Areas Acquisition Fund

***Appendix I, continued.***

*Research, monitoring & evaluation* - research and management can be conducted by Illinois Department of Natural Resources, Southern Illinois University (Carbondale and Edwardsville campuses), Southwest Illinois College, and the Illinois Natural History Survey

<u>Sinkhole Plain</u>

*Protected lands* - Fogelpole Cave Nature Preserve, Illinois Caverns State Natural Area

*Priority resources* - sinkhole ponds, caves

*Conservation philosophy* - maintain and protect in perpetuity the karst topography and underlying subterranean ecosystems; protect and proactively manage for the unique flora and fauna native to these cave ecosystems; use sound management decisions guided by historical conditions

*Objectives* - enroll unprotected cave systems and critical habitats for endangered/threatened species into long term protection plans; generate funding for biologist positions to provide personnel needed to proactively manage these communities

*Priority actions* - establish buffers around sinkholes and critical groundwater recharge areas to protected water quality; increase education and technical assistance for protection of sinkhole and cave habitat

*Partners* - Sinkhole Plain Ecosystem Partnership (defunct), karst working groups, Naturall Resources Conservation Service

*Conservation resources* - C2000 grants, Wildlife Preservation Fund, Wildlife Habitat Incentives Program, Natural Areas Acquisition Fund

*Research, monitoring & evaluation* - research and management can be conducted by Illinois Department of Natural Resources, Southern Illinois University (Carbondale and Edwardsville campuses), Southwest Illinois College, and the Illinois Natural History Survey

***Appendix I, continued.***

LaRue - Pine Hills - Western Shawnee - Trail of Tears

*Protected lands* - Pine Hills Ecological Area/Research Natural Area, LaRue Ecological Area/Research Natural Area, Ozark Hills Nature Preserve

*Conservation philosophy* - Maintain connectivity among Ozark, Shawnee Hills and Lower Mississippi River Bottomlands Natural Divisions with riverine, swamp, bottomland forest, bluff, and upland forest, glade and barrens communities; protect and proactively manage for the unique flora and fauna native to these ecosystems; use sound management decisions guided by historical conditions

*Priority Resources (Pine Hills, Shawnee)* - glades, barrens, large forest tracts, Neotropical migratory birds

*Objectives* - restoration and management of a forest >50,000 acres; enroll unprotected critical habitats for endangered/threatened species into long term protection plans; proactively manage natural communities

*Priority actions* - use prescribed fire to manage fire climax communities of glades, barrens, and upland forests; permanent protection of high quality community types; reforestation to create larger patches

*Partners* - Illinois Department of Natural Resources, U.S. Forest Service, The Nature Conservancy

*Research, monitoring & evaluation* - research and management can be conducted by Illinois Department of Natural Resources, Southern Illinois University (Carbondale and Edwardsville campuses), Southwest Illinois College, and the Illinois Natural History Survey

* See also *Lower Mississippi River Bottomlands* and *Shawnee Hills* natural divisions

***Appendix I, continued.***

**Rock River Hill Country Natural Division**

Sugar-Pecatonica River

*Protected lands* - Winnebago County forest preserves, Rock Cut State Park

*Priority resources* - high quality stream, wetlands

*Partners* - Winnebago County Forest Preserve District, Sugar-Pecatonica Ecosystem Partnership, The Natural Land Institute, Illinois Department of Natural Resources

Nachusa-Franklin Creek-Castle Rock-Lowden Miller

*Protected lands* - Nachusa Grassland, Franklin Creek Natural Area, Castle Rock State Park, Lowden-Miller State Forest, White Pines Forest

*Priority resources* - Nachusa Grasslands, over 2,500 acres of prairie remnants and restorations, is one of the largest remaining prairie landscapes in Illinois. The forested area along the Rock River at Castle Rock and Lowden Miller is the largest forest in the region, and hosts a highly diverse nesting community of Neotropical migratory birds.

Partners - The Nature Conservancy, Illinois Department of Natural Resources

Rock River

*Priority resources* - high quality stream

**Shawnee Hills Natural Division**

LaRue - Pine Hills - Western Shawnee - Trail of Tears

*Protected lands* - Pine Hills Ecological Area/Research Natural Area, LaRue Ecological Area/Research Natural Area, Ozark Hills Nature Preserve

***Appendix I, continued.***

*Conservation philosophy* - Maintain connectivity among Ozark, Shawnee Hills and Lower Mississippi River Bottomlands Natural Divisions with riverine, swamp, bottomland forest, bluff, and upland forest, glade and barrens communities; protect and proactively manage for the unique flora and fauna native to these ecosystems; use sound management decisions guided by historical conditions

*Priority Resources (Shawnee)* - high-quality streams, glades, barrens, large oak-hickory forest tracts, Neotropical migratory birds

*Objectives* - restoration and management of a forest >50,000 acres; proactively manage natural communities

*Priority actions* - use prescribed fire to manage fire climax communities of glades, barrens, and upland forests; permanent protection of land parcels with high quality community types; reforestation to create larger patches.

*Partners* - Illinois Department of Natural Resources, U.S. Forest Service, The Nature Conservancy

*Research, monitoring & evaluation* - research and management can be conducted by the Illinois Department of Natural Resources, Southern Illinois University (Carbondale and Edwardsville campuses), Southwest Illinois College, and the Illinois Natural History Survey

* See also *Ozark* and *Lower Mississippi River Bottomlands* natural divisions

<u>Eastern Shawnee</u>

*Protected lands* - Shawnee National Forest

*Priority resources* - high-quality streams, glades, barrens, large oak-hickory forest tracts, Neotropical migratory birds

***Appendix I, continued.***

*Objectives* - restoration and management of a forest >50,000 acres; proactively manage natural communities

*Priority actions* - use prescribed fire to manage fire climax communities of glades, barrens, and upland forests; permanent protection of land parcels with high quality community types; reforestation to create larger patches

*Partners* - U.S. Forest Service, Illinois Department of Natural Resources, Illinois Nature Preserves Commission

*Research, monitoring & evaluation* - research and management can be conducted by the Illinois Department of Natural Resources, Southern Illinois University-Carbondale, and the Illinois Natural History Survey

**Southern Till Plain Natural Division**

<u>Prairie Ridge Landscape</u>

*Protected lands* - Prairie Ridge State Natural Area (nature preserve, land & water reserve and Illinois Natural Areas Inventory parcels), Twelve-Mile Prairie (conservation easement)

*Priority resources* - rare and declining grassland wildlife (especially threatened and endangered birds) and grassland-wetland wildlife, remnant prairie communities

*Conservation philosophy* - The primary goal is development of a grassland ecosystem capable of maintaining viable populations of grassland species, including both permanent residents and migratory species, with emphasis on threatened and endangered species. A secondary goal is the development of a prairie preserve characteristic of the presettlement flora of the Southern Till Plain natural division of Illinois (from Simpson & Esker 1997).

*10-Year Goals* - add 500 grassland acres per year until target acreages (5,000 acres in each unit) are obtained; improve private land synergies (open space, foraging areas, brood habitat) on 500

***Appendix I, continued.***

acres near each unit within 3 years; establish three 500-acre satellite locations from year 4 to 7 of implementation (see Simpson and Esker 1997, Walk 2004)

*Key Actions* - Establishing additional habitat at core locations and satellites. Promoting compatible agricultural practices on adjacent private lands (managed grazing, small grains, legumes, idle/fallow areas, and field borders) with incentives and farm programs. Continually addressing grassland management/succession and invasive species (especially fescue) with methods including grazing, prescribed fire, mowing and mechanical and chemical control. Addressing management, restoration and outreach staffing/equipment/facility needs.

*Partners* - Illinois Department of Natural Resources, Illinois Audubon Society, U.S. Department of Agriculture - Natural Resources Conservation Service & Farm Service Agency, Ameren-CIPS, The Nature Conservancy, Illinois Central Gulf Railroad, Eastern Illinois University, University of Illinois, Illinois Natural History Survey, Endangered Species Protection Board, Illinois Nature Preserves Commission

*Research, Monitoring & Evaluation* - ongoing and periodic efforts include site breeding bird census, Christmas Bird Count (Jasper County), Spring Bird Count, prairie-chicken lek surveys, prairie-chicken genetic evaluations, threatened/endangered species surveys, herpetological surveys, insect surveys, vegetation cover mapping, research on grassland birds, mesopredators, reptiles, and prairie restorations (Illinois Department of Natural Resources, Illinois Natural History Survey, Eastern Illinois University, University of Illinois)

<u>Pyramid Landscape</u>

*Protected lands* - Pyramid State Park

*Priority resources* - grassland, shrubland and wetland wildlife; Henslow's sparrow, northern harrier, short-eared owl, Bell's vireo, loggerhead shrike, northern bobwhite, migratory waterfowl, least bittern; potential landscape for greater prairie-chicken re-introduction

*Conservation philosophy* - Maintain shrub, marsh and lake habitats in an open grassland matrix to

***Appendix I, continued.***

manage priority wildlife resources, while providing high-quality resource-compatible recreation opportunities.

*Key Actions* - Continually addressing grassland and shrubland management/succession and invasive species with methods including grazing, prescribed fire, mowing and mechanical and chemical control). Develop site management plan that balances natural resource conservation with recreational demands; may require re-designation of "Arkland" portion from State Park to State Fish & Wildlife Area.

<u>Lower Kaskaskia River Bottomlands</u>

*Priority Resources* - High concentration and large tracts of bottomland hardwood forest (including Illinois' largest forest); area includes one-half of all high quality flatwoods in Illinois. Near-natural floodplain-river ecosystem, wood duck, cerulean warbler, red-shouldered hawk, brown creeper, prothonotary warbler

*Partners* - U.S. Army Corps of Engineers, Kaskaskia Watershed Association, Illinois Department of Natural Resources, U.S. Department of Agriculture

**Upper Mississippi River and Illinois River Bottomlands Natural Division**

<u>Middle Illinois River</u>

*Protected lands* - Woodford State Fish & Wildlife Area, Marshall State Fish & Wildlife Area, Illinois River National Wildlife Refuges, Donnelly State Fish & Wildlife Area, and DePue State Fish & Wildlife Area, Hennepin-Hopper Lakes, Sanganois State Fish & Wildlife Area, Anderson Lake State Fish & Wildlife Area, Rice Lake State Fish & Wildlife Area, Spring Lake State Fish & Wildlife Area, Banner Marsh State Fish & Wildlife Area, Pekin Lake State Fish & Wildlife Area, numerous Conservation Reserve Enhancement Program, Conservation Reserve Program, and Wetland Reserve Program enrollments

*Priority Resources* - emergent/moist soil/submergent wetlands, bottomland forest, deep-water habitat, backwater lakes, fish and mussel communities, migratory birds

***Appendix I, continued.***

*Conservation philosophy* - Promote wetland habitat in backwaters that support viable fish populations and migrating and wintering waterfowl and shorebirds; promote bottomland hardwood forests that support viable populations of wildlife including rare and declining species.

*Wildlife and habitat objectives* - establish aquatic plants in 20% of the backwater lake surface area; establish deep water fish habitat in 50% of the backwater lakes in the pool

*Key actions* - aquatic plant and bottomland forest establishment

*Partners* - Illinois Department of Natural Resources, The Wetlands Initiative, The Nature Conservancy, U.S. Department of Agriculture, Soil & Water Conservation Districts, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers

*Implementation resources* - Current and future Farm Bill conservation programs, U.S. Army Corps of Engineers programs, Migratory Waterfowl Stamp funds, North American Wetland Conservation Act

*Monitoring and evaluation mechanisms*- Indicator species need to be designated and monitored. Annual aerial photos taken in October and digitized could be used to measure plant coverage in the backwaters.

Upper Mississippi River

*Priority resources* - mussel and fish communities, migratory birds

Lost Mound - Hanover Bluff - Mississippi Palisades

*Protected Lands*: Upper Mississippi River National Fish & Wildlife Refuge - Lost Mound unit, Hanover Bluff Nature Preserve, Mississippi Palisades State Park

*Conservation Philosophy:* Restoration of the continuum of riverine (Mississippi River bottomlands), prairie (Lost Mound), and upland forest (Hanover Bluff, Mississippi Palisades) as an ecosystem landscape.

***Appendix I, continued.***

*Partners:* U.S. Fish & Wildlife Service, Illinois Department of Natural Resources, The Friends of the Depot, The Prairie Enthusiasts, The Nature Conservancy, Jo Daviess Natural Areas Guardians, Driftless Area Partnership, Natural Land Institute, Jo Daviess Conservation Foundation, Blufflands Alliance, National Wild Turkey Federation

* See also *Illinois River and Mississippi River Sand Areas* and *Wisconsin Driftless* natural divisions

**Wabash Border Natural Division**

<u>Vermilion River (Middle Fork, North Fork and Salt Fork) & Little Vermilion River</u>

*Protected Lands* - Kickapoo State Recreation Area, Middle Fork State Fish & Wildlife Area, Kennekuk Cove County Park, Woodyard State Natural Area, Fleirman's River Nature Preserve

*Priority Resources* - streams (National Wild & Scenic River), fishes, mussels, geographically restricted amphibians

*Conservation Philosophy* - Maintain and enhance Scenic River Corridor and buffer areas, utilize historic vegetation conditions as a guide for a mosaic of prairie, shrubland, savanna, and open woodland on sandy terraces and flat uplands, dry-mesic and mesic forest in ravines, emphasizing forest establishment and enhancement.

*Objectives* - assess streambank erosion and stabilization needs; protect and restore terrace wetlands and all seeps, maintain 3-5 forested tracts >200 acres; develop channel evolution model for river to help identify future management needs; enhance oak recruitment in existing wooded tracts; decrease amount of 'hard' habitat edges through burning, invasive species control, and planting.

*Priority Actions* - hydrologic analysis and plan (especially vis-a-vis streambanks and channel stability); restoration of degraded habitats using historical vegetation conditions as a guide; landowner contact for all rare resources in database; establish amphibian breeding habitat

***Appendix I, continued.***

adjacent to existing woodlands, forests, and woodland/forest restorations; control/remove exotic species; reduce hard habitat edges; increase prescribed burning, especially in oak woodlands and forests; perform biotic inventories and establish monitoring protocols

*Partners* - Illinois Nature Preserves Commission, National Park Service, Dynegy Midwest Generation; U.S. Department of Agriculture Natural Resource Conservation Service, Vermilion County Conservation District; Vermilion County Soil & Water Conservation District, Prairie Rivers Network, Volunteer Stewardship Network, canoe outfitters, Illinois Department of Natural Resources

*Conservation Resources* - Illinois Nature Preserves Commission Landowner Contact, U.S. Fish & Wildlife Service W-76-D; State Wildlife Grants, C2000, National Park Service

*Research, Monitoring, and Evaluation* - Illinois Natural History Survey, University of Illinois, Eastern Illinois University, Illinois State Water Survey, Illinois State Geological Survey, Critical Trends Assessment Program, Prairie Rivers Network

Wabash River, Floodplain & Backwater Ponds

*Priority Resources* - free-flowing river, bottomland forest, backwater ponds, baldcypress communities, cane restoration, successional areas, shallow-water wetlands, mussels, fishes, river cooter, alligator snapping turtle, copperbelly watersnake, migratory waterfowl, shorebirds, interior least tern, cerulean warbler, red-shouldered hawk, brown creeper, prothonotary warbler

*Key Actions* - No coordinated conservation effort is underway at present in Illinois or with Indiana. A natural resources inventory of the area, including compilation of available data and field surveys, is essential.

Middle Little Wabash River

*Priority Resources* - Bottomland forest, wetlands, migratory waterfowl, cerulean warbler, red-shouldered hawk, copperbelly watersnake, brown creeper, prothonotary warbler

***Appendix I, continued.***

*Key Actions* - No coordinated conservation effort is underway at present. A natural resources inventory of the area, including compilation of available data and field surveys, is essential.

**Western Forest-Prairie Natural Division**

Lower LaMoine River

*Protected areas* - Conservation Reserve Enhancement Program contracts

*Priority resources* - extensive upland oak-hickory forest, open woodland/savanna, and bottomland forest

*Partners* - Lamoine River Watershed Partnership, Illinois Department of Natural Resources, Natural Resources Conservation Service, Quail Unlimited, National Wild Turkey Federation

*Implementation resources* - Conservation Reserve Program, Conservation Reserve Enhancement Program, Forestry Incentive Program, Supplemental Incentive Program, Forestry Development Act, Private Land Incentive Program, Acres for Wildlife Program

Siloam Springs Complex

*Protected areas* - Siloam Springs State Park and Buckhorn Unit, Weinberg-King State Park including Cecil White and Scripps units

*Priority resources* - extensive upland oak-hickory forest, open woodland/savanna, and prairie remnants

*Key Actions* - Determine appropriate extent of grassland, open woodland and forest; restore open woodlands and savannas

*Partners* - Illinois Department of Natural Resources, Natural Resources Conservation Service, Quail Unlimited, National Wild Turkey Federation

***Appendix I, continued.***

*Implementation resources* - Conservation Reserve Program, Conservation Reserve Enhancement Program, Forestry Incentive Program, Supplemental Incentive Program, Forestry Development Act, Private Land Incentive Program, Acres for Wildlife Program

**Wisconsin Driftless Natural Division**

Lost Mound - Hanover Bluff - Mississippi Palisades

*Protected Lands*: Upper Mississippi River National Fish & Wildlife Refuge - Lost Mound unit, Hanover Bluff Nature Preserve, Mississippi Palisades State Park

*Conservation Philosophy:* Restoration of the continuum of riverine (Mississippi River bottomlands), prairie (Lost Mound), and upland forest (Hanover Bluff, Mississippi Palisades) as an ecosystem landscape. Protect, manage, and restore the natural communities of the sites.

*Partners:* U.S. Fish & Wildlife Service, Illinois Department of Natural Resources, The Friends of the Depot, The Prairie Enthusiasts, The Nature Conservancy, Jo Daviess Natural Areas Guardians, Driftless Area Partnership, Natural Land Institute, Jo Daviess Conservation Foundation, Blufflands Alliance, National Wild Turkey Federation, Illinois Nature Preserves Commission

* See also *Upper Mississippi River and Illinois River Bottomlands* and *Illinois River and Mississippi River Sand Areas* natural divisions.

Wisconsin Driftless Forest

*Protected Lands*: Witkowsky State Wildlife Area, Winston Tunnel, Tapley Woods

*Priority resources:* extensive oak-hickory forests, open woodland/savanna, and primary communities

*Conservation Philosophy*: Protect, manage, and restore the natural communities of the site and provide for compatible recreational activities.

***Appendix I, continued.***

*Partners:* Illinois Department of Natural Resources, National Wild Turkey Federation, Jo Daviess Natural Areas Guardians, The Prairie Enthusiasts, Jo Daviess Natural Areas Guardians, Driftless Area Partnership, Natural Land Institute, Jo Daviess Conservation Foundation, Blufflands Alliance, The Nature Conservancy

Apple River

*Protected Lands:* Apple River Canyon State Park, McKeague Nature Preserve, Thompson Prairie Nature Preserve, Salem Unit, and protected lands of the Lost Mound-Hanover Bluff-Mississippi Palisades Conservation Opportunity Area (see above) along the lower Apple River

*Priority Resources:* coolwater streams and fishes, freshwater mussels, primary habitats; Trout Unlimited's nascent Driftless Area Restoration Initiative recognizes the need for restoration of hydrologic function, condition, and aquatic populations to coolwater streams, and the opportunity of broad scale interest in brook trout stream restoration within the Driftless area.

*Conservation Philosophy:* Protect, manage and restore the natural communities of the area and provide for compatible recreational activities. Restore the continuum of the Upper Apple River Illinois Natural Areas Inventory site (coolwater stream with significant primary communities) to the Lower Apple River Illinois Natural Areas Inventory site (mussel beds, bottomland habitat) and the Lost Mound-Hanover Bluff-Mississippi Palisades Conservation Opportunity Area.

*Partners:* The Prairie Enthusiasts, Jo Daviess Conservation Foundation, Trout Unlimited, The Nature Conservancy, Jo Daviess Natural Areas Guardians, Driftless Area Partnership, Natural Lands Institute, Blufflands Alliance, National Wild Turkey Federation, Illinois Department of Natural Resources, U.S. Fish & Wildlife Service

# STATE WILDLIFE GRANT PROGRAM
# State of Illinois
# Final Performance Report

## Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems

## Project 4 – Development of Conservation Opportunity Areas and Landscapes

### Job 4.2 Mapping of Illinois' Natural Divisions

### Background

The Natural Divisions of Illinois is a classification of natural features in the state based on flora, fauna, and physiographic features, derived from such factors as topography, soils, bedrock, glacial history, and the distribution of plants and animals. Fourteen natural regions are delineated in the state. The Natural Divisions designations, originally designed to guide the development of the Illinois Nature Preserves System, is currently widely accepted and used in many natural resource applications. The use of natural divisions will also be a fundamental organizing layer for the development of the state wildlife plan as it will provide a key classification scheme for management of species, communities, and habitats.

The scale of the current GIS coverage of Natural Divisions, which was digitized by ESRI in the mid-1980s, is 1:1,000,000 and is not adequate for many mapping and analyses applications (Figure 1). For example, some Natural Areas from the Illinois Natural Areas Inventory appear in the incorrect Natural Division due to the difference in resolution between the two coverages.

This component of the project will update the current Natural Divisions coverage, creating a new coverage with higher resolution based on input from IDNR-Springfield staff and other available GIS data such as plant and animal distributions, land cover, soils, glacial boundaries, digital topographic maps, and digital aerial photography.

### Procedures and Results

The objective of this project is to create a GIS coverage of the Natural Divisions of Illinois at a resolution appropriate for use in developing the state comprehensive wildlife conservation plan. Based upon bedrock geology, glaciations, soils, climate, and plant and animal distributions, Illinois can be divided into 14 natural regions (Figure 2) and 33 distinct sections (Figure 3).

The Natural Divisions designations are currently widely accepted and used in many natural resource applications. The natural divisions serve as the basis for identifying natural features to be included in the nature preserves system. The original natural divisions classified by John E. Schegman in 1969 were updated using 1:500,000 scale soil associations, 1:500,000 moraines, 1:500,000 glacial boundaries, 1998 1 meter digital ortho quarter quadrangles (DOQQ's), and 1:24,000 digital raster graphics (DRG's), as well as input from IDNR-Springfield staff. By defining the major ecosystem borders within Illinois, the Natural Divisions of Illinois will provide a key classification scheme for management of species, communities, and habitats (Elements 1, 2, and 4) in the state. The Natural Divisions GIS layer required enhancements to improve its resolution so it can be effectively used in the GIS environment (e.g. spatial information such as species distributions and habitat locations are correctly assigned to a natural division when conducting spatially based analyses).

The updated Natural Divisions coverage showing the 14 divisions and 33 sections, as well as FGDC compliant metadata have been copied to compact disc (CD) and provided to IDNR and USFWS.

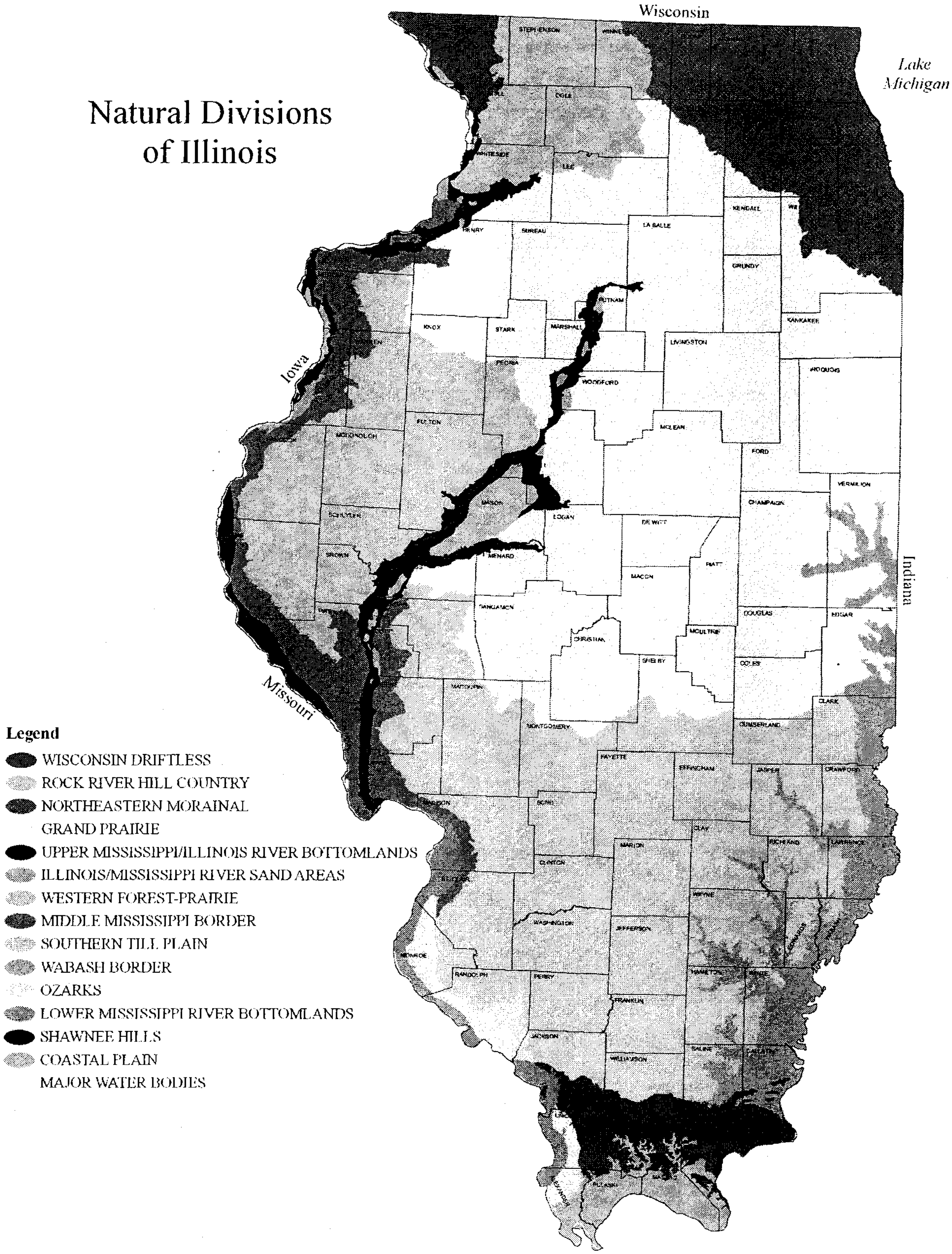

Natural Divisions
of Illinois
Wisconsin
Lake
Michigan
Iowa
Indiana
Missouri
Legend
WISCONSIN DRIFTLESS
ROCK RIVER HILL COUNTRY
NORTHEASTERN MORAINAL
GRAND PRAIRIE
UPPER MISSISSIPPI/ILLINOIS RIVER BOTTOMLANDS
ILLINOIS/MISSISSIPPI RIVER SAND AREAS
WESTERN FOREST-PRAIRIE
MIDDLE MISSISSIPPI BORDER
SOUTHERN TILL PLAIN
WABASH BORDER
OZARKS
LOWER MISSISSIPPI RIVER BOTTOMLANDS
SHAWNEE HILLS
COASTAL PLAIN
MAJOR WATER BODIES

**Figure 1.** Current 1:1,000,000 scale Natural Divisions of Illinois map showing 14 natural regions

# Natural Divisions of Illinois

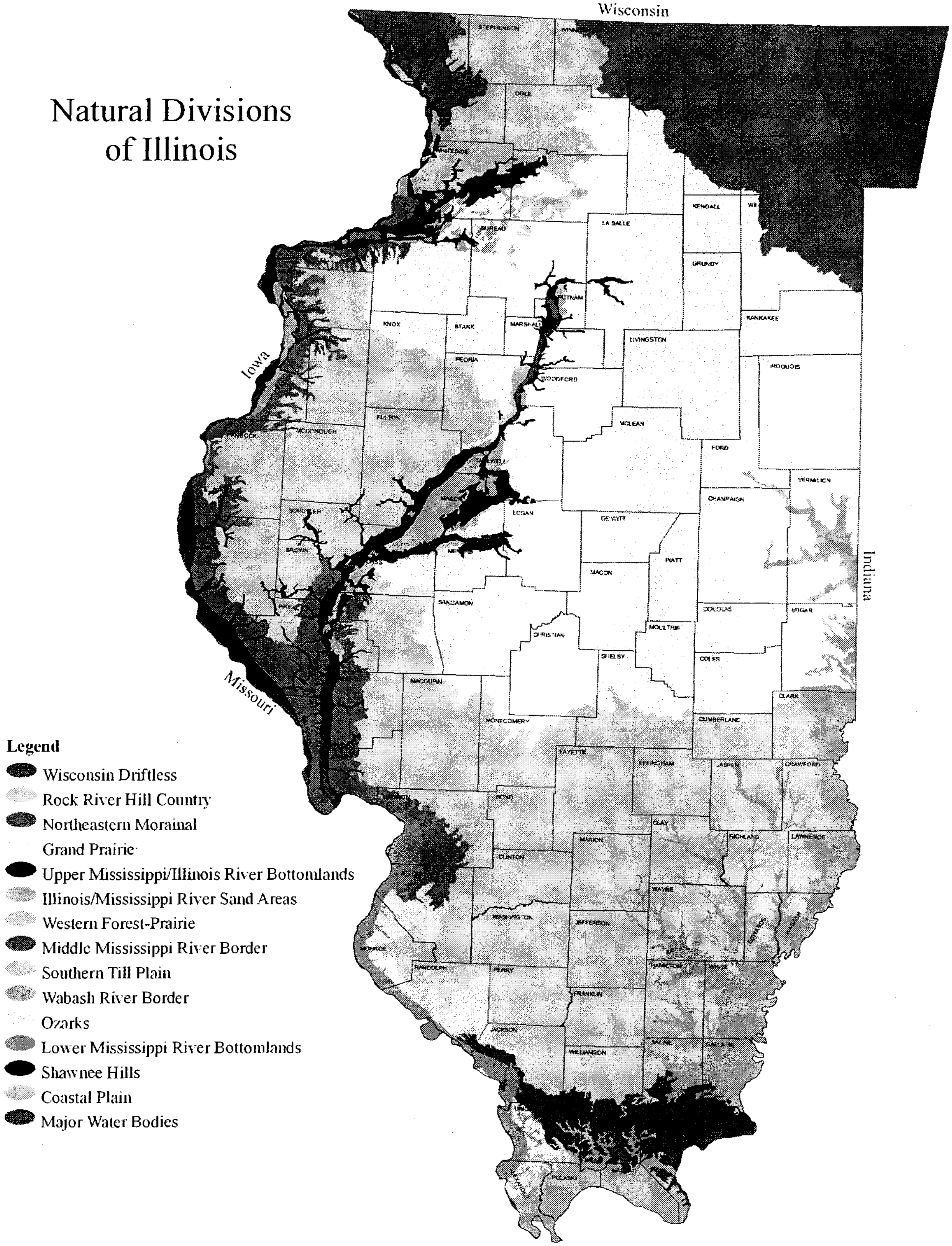


**Figure 2.** Updated 1:500,000 scale Natural Divisions of Illinois showing 14 natural regions

Figure 3

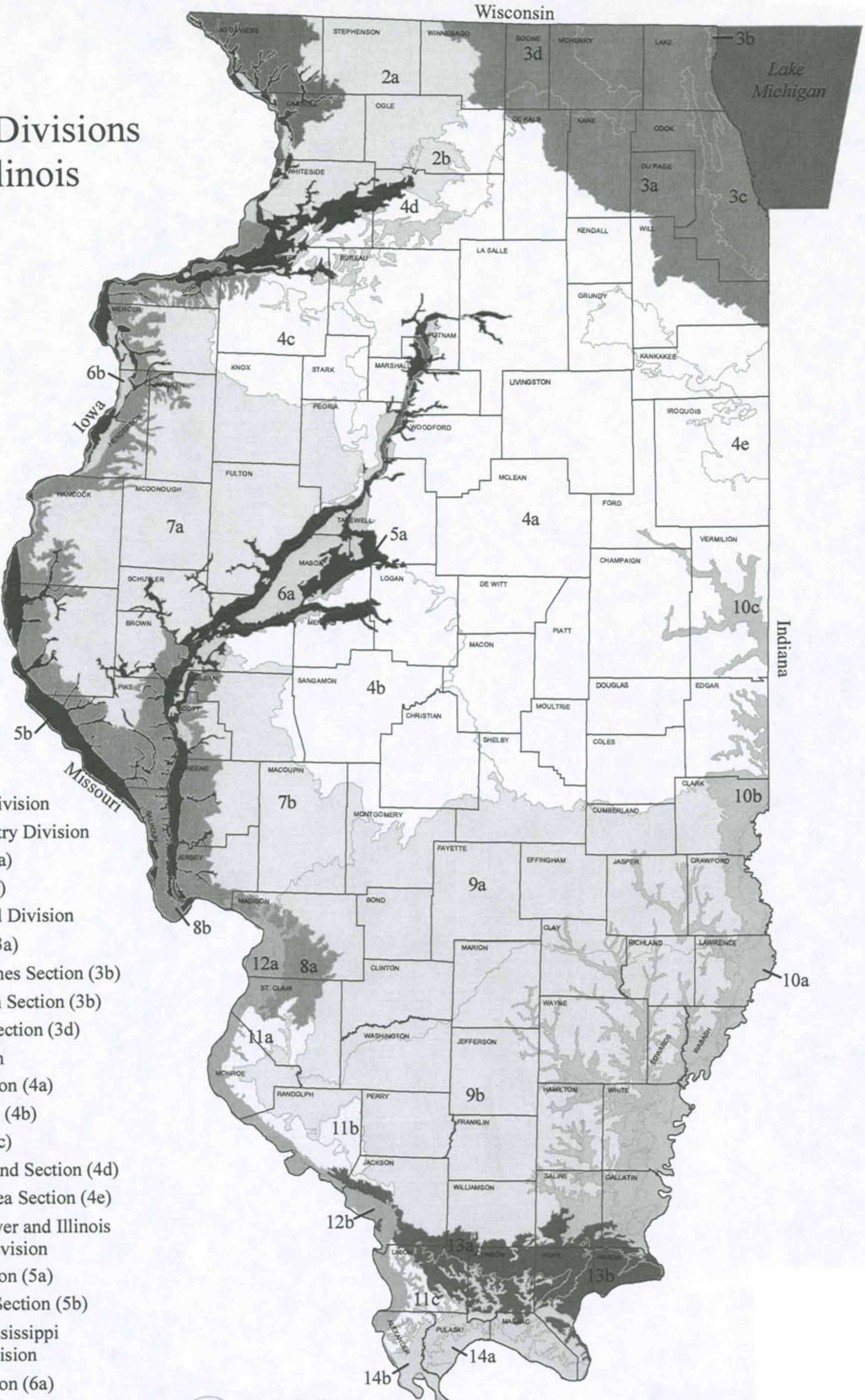
[illegible]

Not Drawn

map

**Figure 3. Updated** 1:500,000 scale Natural Divisions of Illinois showing 33 sections.

# Natural Divisions of Illinois




**Legend**

- Wisconsin Driftless Division
- Rock River Hill Country Division
  - Freeport Section (2a)
  - Oregon Section (2b)
- Northeastern Morainal Division
  - Morainal Section (3a)
  - Lake Michigan Dunes Section (3b)
  - Chicago Lake Plain Section (3b)
  - Winnebago Drift Section (3d)
- Grand Prairie Division
  - Grand Prairie Section (4a)
  - Springfield Section (4b)
  - Western Section (4c)
  - Green River Lowland Section (4d)
  - Kankakee Sand Area Section (4e)
- Upper Mississippi River and Illinois River Bottomlands Division
  - Illinois River Section (5a)
  - Mississippi River Section (5b)
- Illinois River and Mississippi River Sand Areas Division
  - Illinois River Section (6a)
  - Mississippi River Section (6b)
- Western Forest-Prairie Division
  - Galesburg Section (7a)
  - Carlinville Section (7b)
- Middle Mississippi River Border Division
  - Glaciated Section (8a)
  - Driftless Section (8b)
- Southern Till Plain Division
  - Effingham Plain Section (9a)
  - Mt. Vernon Hill Country Section (9b)
- Wabash River Border Division
  - Bottomlands Section (10a)
  - Southern Uplands Section (10b)
  - Vermilion River Section (10c)
- Ozarks Division
  - Northern Section (11a)
  - Central Section (11b)
  - Southern Section (11c)
- Lower Mississippi River Bottomlands Division
  - Northern Section (12a)
  - Southern Section (12b)
  - Mississippi River Section (12c)
- Shawnee Hills Division
  - Greater Shawnee Hills Section (13a)
  - Lesser Shawnee Hills Section (13b)
- Coastal Plain Division
  - Cretaceous Hills Section (14a)
  - Bottomlands Section (14b)
- Major Water Bodies
  - Lake Michigan Section
  - Illinois River Section
  - Mississippi River Section
  - Ohio River Section
  - Wabash River Section

# STATE WILDLIFE GRANT PROGRAM
## State of Illinois
## Final Performance Report

## Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems

## Project 4 – Development of Conservation Opportunity Areas

## Job 4.3 Mapping of IDNR's owned, managed, and leased property (OMLP project)

### Background

As was first related in T-03-P-001, a statewide GIS geodatabase describing state land holdings is critical for conservation planning efforts. The first phase of the OMLP project, initiated under T-03-P-001, focused on the mapping of those properties purchased with federal and dedicated funds. This early focus was needed as no way existed that would guide the planning of conservation practices allowable on those properties. Once those special funds' properties were completed, mapping work continued on the larger and key state properties. Early in T-03-P-001, a geodatabase was created the form of a parcel-based mapping system. Facilities for mapping outer extent property boundaries as well as corner monument markers, interior parcel lines, right-of-way and easement extents, and historical boundary change information have been built into the OMLP GIS data management system. A large portion of the mapping project has involved the thorough researching of existing paper and database records for each property. Extensive paper records have been collected over the years, and each file had to be reviewed for relevant and critical historical information concerning appropriate uses and limitations on conservation practices inherent in each property. Tasks and expenditures for this work in T-03-P-001 will be completed prior to initiating tasks identified in this job (4.3).

Under this proposal, the GIS mapping of the IDNR, OMLP data will continue as work progresses on recording of all remaining properties into the standardized and accurate geodatabase structure that was developed during the first Phase of the mapping project. Properties that were prioritized lower in the immediate needs schedule will be mapped during this second Phase. Since a thorough and complete GIS database is critical for the proper implementation of the statewide conservation plan, the mapping of all IDNR owned, managed, and leased properties must be completed as a part of this project to reach Objective 1. Selection of conservation opportunity areas and landscapes (Objective 3) is incumbent upon being able to describe lands and waters already under the protection of IDNR.

Furthermore, as a part of this project, a methodology and associated protocols will be developed which will institutionalize the maintenance of the OMLP databases and the inputting of new property acquisitions into the newly created GIS and relational (tabular) DBMS? This will ensure that the OMLP information will be kept current and accurate, as existing staff will have their workloads adjusted to accommodate OMLP database day-to-day housekeeping tasks. This institutionalization is critical to maintaining up-to-date property boundaries for the accurate tracking of conservation management practices on all IDNR owned and leased properties.

**Procedures and Results**

An OMLP GIS database with property boundaries and associated management information was created using ArcGIS software. The geodatabase is a parcel-based mapping system with legal boundary descriptions obtained mainly from paper records housed and maintained in the Office of Realty and Environmental Planning at the IDNR office in Springfield. While many properties have fully documented boundary descriptions, some property acquisitions (generally those prior to the mid 1960s) were difficult to fully document and were therefore digitized using best available information or legal description. The OMLP geodatabase is housed on an IDNR computer in Springfield and managed by Charlie Foor. The geodatabase with the properties completed in Phase 2 has been copied to a CD and provided to IDNR and USFWS. During subsequent phases of the project, additional properties are being digitized into the geodatabase.

Each property required thoroughly researching existing paper and database records for relevant and critical historical information at the offices of IDNR in Springfield. Personnel had to become familiar with the organization and format of the property documents. A data source checklist for researching realty paper files for each site is given in Appendix A.

A procedure for accurately and consistently digitizing aspects of each property has been developed and implemented. Facilities for mapping outer extent property boundaries as well as corner monument markers, interior parcel lines, right-of-way and easement extents, and historical boundary change information have been built into the OMLP GIS data management system. An outline for the input methodology is given in Appendix B and details for creating boundaries using the Public Land Survey System are listed in Appendix C. The methodology and procedure process is continuously changing as new properties are completed and new data sources are made available. These changes and updates will be incorporated in the additional phases of the OMLP Project.

Federal Geographic Data Committee (FGDC) compliant metadata has been created for the GIS data layers and will be updated as necessary as additional phases of the OMLP project are completed in the future. Metadata is included on the CD provided to IDNR and USFWS. Some of the metadata provided on the CD will be modified as needed as work continues in the next phase of the project. An initial quality assurance, quality control (QA/QC) methodology was developed to insure the data created meets the accuracy standards defined in the OMLP project data input methodology. Changes and updates to the QA/QC methodology will be incorporated in the additional phases of the OMLP Project.

The remaining OMLP properties purchased with federal or special funds, which were not completed under T-03-P-001, were the focus of Task 1. These sites were assigned first priority for inclusion in the database. There are 69 federal and special interest sites (Appendix D). Of the 16 remaining federal interest sites not completed under T-03-P-001 (Appendix E), four have been completely researched and digitally mapped (Appendix F) under this phase of the project. Of the sites not yet digitally mapped most currently have incomplete paper records, one site has been dropped, one site is still pending acquisition by IDNR, and three are being mapped in the next contract (T-17-P-001). The majority of the remaining sites contain a portion of land that is leased from a either a private company or other agency (i.e. Army Corps of Engineers, Central Illinois Public Service, Illinois Power Company) and managed by IDNR. The legal descriptions for these sites (which can be difficult to obtain for some of the older sites) need to be obtained from the leasing agency in order to complete the paper records and digitize the site. A lot of research time and effort has been put forward during this phase of the project to try and obtain the legal description information from the Army Corps of Engineers for the four reservoir sites that IDNR manages. Progress has been slow; however work on these sites is being continued in the next phase of the project.

The database has been designed to accommodate the inclusion of additional IDNR owned, managed, and leased properties that were not included in Task 1, with the goal of creating a complete GIS database of state owned, managed or leased conservation-related properties (Task 2). Changes and updates to the GIS database will be incorporated in the additional phases of the OMLP project. Under this phase of the project, 12 non-federal interest sites have been completely researched and digitally mapped (Appendix F). These sites were included because they were either directly adjacent to a federal interest site, is a “satellite” site of a federal interest site, or is a heavily used and managed site.

The OMLP project is an on-going effort and is continuing beyond the Phase 2 work reported in this document. In Phase 3 additional properties are being researched and mapped. Digitizing methodology and procedures, QA/QC methodology and procedures, metadata, database fields, forms, and tables are being further refined and developed as necessary as the work continues. One thing to note is that there was a one year overlap period (September 2005 – September 2006) between this contract (T-02-P-001) and the next ongoing contract (T-17-P-001). The following sites have various problems or issues that are ongoing and research time has been spent on both contracts to try and obtain all the necessary documentation in order to properly digitize the site (Appendix G). These problems and issues are continuing to be worked on in the next phase of the project.

**Appendix A: Data Source Checklist for Researching Realty Paper Files for Each Site**

- ☐ Lands Acquisition Database – Print land card report for each site. NOTE: Check report to determine if parcels acquired prior to 6-30-65 are lumped together. If so, then extra effort will be required to determine if all conveyances are found.
- ☐ Check list of DOQ sites produced by Bob Sandidge in OREP to see if georeferenced CAD files based on DOQQ's have been created.
- ☐ Checking list of sites produced by Don Mole in OREP to see if georeferenced or survey grade GPS CAD files have been created.
- ☐ Check list of sites which have completed or partially completed Project Land Maps.
- ☐ Realty Central File Index - All correspondence and documents for each parcel reflecting entire acquisition process (list is in a binder in Kevin's office, files on individual parcels are in central copier area - moving shelves)
- ☐ Realty Central Files – Deed file. Check Central File Index to determine what has been microfilmed. (in central copier area – moving shelves)
- ☐ Microfilm of Acquisition Files – NOTE: Only need to look on microfilm if no paper copy is located. (microfilm machine is located in Kevin's office)
- ☐ Site files – NOTE: May contain more deeds than the deed file in central files. (by windows, on either side of the copier).
- ☐ Acquisition Plats – NOTE: If prepared by B.L. Sandidge in 1997, or after, or by Don Moles, there should be a CAD file. If reference to land survey then plat of survey should be in the file. (by windows in labeled cabinet)
- ☐ Boundary Maps – NOTE: Scale is an indication of accuracy. Compare date of map to acquisition date to determine if it is up to date. (by windows, next to acquisition plats)
- ☐ Plats of Survey Index and File – Any large maps or surveys that were conducted for a site. (in cabinets and tubes in drafting room)
- ☐ Technical Reference Materials – Check index content and determine if file contains helpful information. (in drafting room)
- ☐ ORC Paper or Microfiche files for Federal Funds Acquisition Records - NOTE: only need to look on microfiche if no paper copy is located. (3rd floor central copier area and SE corner)
- ☐ Nature Preserve and Land and Water Reserve Dedications - Only need to get documents and legal descriptions if a site contains a Nature Preserve and Later and Water Reserve. (in central copier area – moving shelves)
- ☐ Land and Water Report – Compare total acreage on in report to Access database report (land card). NOTE: If they do not match it raises a red flag.
- ☐ State Archives – NOTE: May need to go to the archives if no deed information was located in Realty files.
- ☐ County Recorders Office - NOTE: May need to go to the county recorders office if no deed information was located in Realty files or the State Archives.

## Appendix B: OMLP Input Methodology Outline

1. All property data will be created from UTM NAD83 DOQQs or from CADD data developed from survey grade GPS or existing survey work.
2. Property data will be constructed from 1.) PLSS TRS data adjusted to the DOQQs by sight when corners are clearly visible on the DOQQ, 2.) measured from distances acquired from original GLO plats, or 3.) extrapolated from corners on the DRGs as a last resort.
3. All relevant OREP and Fed Aid documents will be reviewed as a part of the pre-input procedure for each site or property. Copies of deeds and other relevant documents will be made by the site technician.
4. A site technician will be assigned to each site or property to carry out all research and data input tasks for that site from beginning to completion.
5. All ownership parcels will be researched and digitized within each property boundary for all Fed Aid associated properties.
6. The complete exterior boundaries of all ownership parcels for a property will be topologically coincident and be used to construct the finished site or property boundary.
7. A scale of 1:3,000 will be used for all heads-up digitizing on DOQQ-based work. This is especially important for the placement of PLSS-TRS section corners and the creation of boundaries created by tracing road centerlines or stream centerlines.
8. The OMLP Geo-databases are constructed in the UTM meter projection, using the NAD83 datum, with one database in UTM Zone 16 and another based in UTM Zone 15. This was done to maximize accuracy and transferability into more accurate coordinate systems in the future.
9. Please refer to the itemized list of research documents for a detailed account of the research trail pursued for each site.
10. The first priority for the OMLP project will be to digitize all ownership parcels, property boundaries, use parcels, and federally defined project boundaries for all sites where federal funds were used to purchase parcels.
11. The second priority will involve digitizing sites where "special funds" were used to purchase parcels.
12. The third priority will be to digitize all sites with federal interest but not federal purchased.
13. A forth priority will be to digitize any sites that DNR manages but does not own and that has federal interests.
14. Backups of personal Geo-databases (both Champaign and Springfield) must done daily. One backup copy should go to a designated location on the DNR network hard drives and one backup should go to CD for storage off site.
15. Proposed changes to one of the personal Geo-databases must be relayed to SDE / Data Manager ASAP so that the changes can be oked and then applied to the other database, maintaining 100% capability between to two.
16. Both personal Geo-databases will be reconciled to 100% coincidence on a weekly basis by the SDE / Data Manager.

(Created February 3, 2004 by Charlie Foor)

## Appendix C. Procedure to Create PLSS Sections, Quarter Sections, and Quarter-Quarter Sections

Task: Create New Feature
Target: Section corners
Label the section corners by clicking on the sketch tool and place points in the appropriate location

Task: Create 2-point line feature
Target: Section lines
Click on the sketch tool and click on one corner, then double-click on a second corner to make one section line. Repeat this for all four section lines. Be sure that the snapping is set to Section corners.
***If the section is adjacent to one that has already been digitized, use the existing section line instead of making a new one on top of the old.

Task: Create New Feature
Target: Section Poly
Use the edit tool to select all four section lines. Click on the construct features button on the topology toolbar. Be sure to **UNCHECK** the box for "Consider existing features of the target layer in the current extent". And click OK

Task: Create New Feature
Target: Quarter Lines
If any of the section lines are shared with an area that has already been digitized, **UNSELECT** those lines, (you will use the existing lines in order to avoid duplicates). With the section lines still selected, choose copy and paste from the edit menu to paste them into the Quarter Line layer. Select one line and click on the "split" tool under the editor toolbar. Split the line by 50 percent. Repeat for the remaining lines. With the snapping set to quarter line end, draw in the cross lines to divide the section into four quarters. After these lines are drawn, split them both by 50%.

*If you wish, the Township, Range, and Section fields can be filled in on the section and quarter poly attribute tables now.*

Task: Create New Feature
Target: Quarter Poly
Use the edit tool to select all quarter lines. Click on the construct features button on the topology toolbar.

Task: Create New Feature
Target: Quarter-quarter Lines
If any of the quarter lines are shared with an area that has already been digitized, UNSELECT those lines. With the quarter lines still selected, choose copy and paste from the edit menu to paste them into the Quarter-Quarter Line layer. Select one line and click on the "split" tool under the editor toolbar. Split the line by 50 percent. Repeat for each of the remaining lines. With the snapping set to quarter-quarter line end, draw in the cross lines to divide each quarter into quarter-quarters. After these lines are drawn, split them each by 50%.

Task: Create New Feature
Target: Quarter-quarter Poly
Use the edit tool to select all quarter-quarter lines. Click on the construct features button on the topology toolbar.

## Appendix D: IDNR Owned, Managed, and Leased Sites with Federal Interest

1 Anderson Lake Conservation Area (a.k.a West Point Wildlife Refuge) [1 4 7 8]
2 Baldwin Lake State Fish and Wildlife Area (a.k.a Kaskaskia River Area) [1 8]
3 Banner Marsh State Fish and Wildlife Area [8 9]
4 Beaver Dam State Park [1]
5 Big Bend Fish and Wildlife Area [2 4]
6 Bradford Pheasant Habitat Area/ Hennepin Canal [3]
7 Burris Habitat Area (a.k.a. Hurricane Creek NA) [2]
8 Cache River [4 7]
9 Campbell Lake (a.k.a. Little Muddy River Project Area) [1 4]
10 Carlyle State Fish and Wildlife Area [4 8]
11 Chain-O-Lakes State Park [1 9]
12 Clifton Pheasant Habitat Area [3]
13 Clinton Lake Recreation Area [7 9]
14 Coffeen Lake Fish and Wildlife Area [8 9]
15 Des Plaines Game Propagation Center [8]
16 Donnelly Fish and Wildlife Area [8]
17 Dublin Highlands Habitat Area (a.k.a. Elroy Pheasant Habitat Area) [3]
18 Eastern Prairie Fringed Orchid Land Acquisition [6]
19 Double "T" State Fish and Wildlife Area (a.k.a. Fulton County Goose Management Area) [7]
20 Emiquon National Wildlife Refuge [4]
21 Friends Creek Regional Park / Ankrom Addition [2]
22 Green River State Wildlife Area (a.k.a. Lee County Conservation Area) [1 8]
23 Hallsville Pheasant Habitat Area at Clinton Lake [3]
24 Hegewisch Marsh (a.k.a.Calumet Open Space Reserve) [6]
25 Helfrich Game Propagation Center [8]
26 Hennepin-Hopper Lake [6 7]
27 Herschel Workman Habitat Area [3]
27 Herschel Workman Habitat Area - Addition [3]
28 Hindsboro Habitat Area [2 3]
29 Horseshoe Lake Conservation Area [1 8 9]
30 Iroquois County Conservation Area [8]
31 Kaecker Sand Hill Habitat Area [3]
32 Lake DePue/Donnelly FWA [4]
33 Mackinaw Fish and Wildlife Area [8]
34 Manito Pheasant Habitat Area [3]
35 Marshall State Fish and Wildlife Area (a.k.a. Marshall County Refuge and Recreation) [1 7 8]
36 Marshall State Fish and Wildlife Area (Sparland Unit) [7]
37 Marshall State Fish and Wildlife Area (a.k.a. Spring Branch Refuge) [1 8]
38 Marshall State Fish and Wildlife Area (Duck Ranch Unit) [7]

39 Maytown Pheasant Habitat Area [3]
40 Mazonia-Braidwood Fish and Wildlife Area [8]
41 Mermet Lake Conservation Area [1 8]
42 Milroad Marsh Fish & Wildlife Area [4]
43 Mississippi Fish and Wildlife Area [2 4 5 7 8]
44 Mt. Vernon Game Propagation Center [8]
45 Newton Lake Fish and Wildlife Area [8 9]
46 Peabody / River King Fish and Wildlife Area [8]
47 Perdueville Pheasant Habitat Area @ Morraine View [3]
48 Ray Norbut State Fish & Wildlife Area [2 8]
49 Rend Lake State Fish and Wildlife Area [8 9]
50 Rice Lake Conservation Area [1 8]
51 Sam Dale Lake Conservation Area (a.k.a. Wayne County Conservation Lake) [1]
52 Sangamon County State Fish and Wildlife Area [2]
53 Sanganois Fish and Wildlife Area [1 7 8]
54 Sangchris Lake State Park [2 3 4 9]
55 Saybrook Habitat Area [3]
56 Shabonna Lake [1 9]
57 Shelbyville State Fish and Wildlife Area [8]
58 Snakeden Hollow Fish and Wildlife Area [8]
59 Spring Lake State Fish and Wildlife Area [7 8 9]
60 Stephen A. Forbes State Park (a.k.a. Marion County Lake) [1 9]
61 Steward Pheasant Habitat Area (a.k.a. Shabbona Lake PHA) [3]
62 Ten Mile Creek Fish and Wildlife Area [8]
63 Turkey Bluffs (a.k.a. Mary's River Area Land Acquisition) [1]
64 Union County Conservation Area [1 8]
65 Victoria Pheasant Habitat Area [3]
66 Whitefield Habitat Area [3]
67 Wildcat Hollow State Forest [2]
68 Willow Creek Habitat Area [2]
69 Woodford County Conservation Area [8]

**Priority Ranking of Sites**

[1] IDNR Lands with Federal Interest (PR/DJ)
[2] Illinois Habitat Fund
[3] State Pheasant Fund
[4] State Migratory Waterfowl Stamp Fund
[5] State Furbearer Fund
[6] Non-DNR owned Lands with Federal Interest (Land Rights)
[7] IDNR Lands with Federal Interest - (NAWCA)
[8] 100% Wildlife and Fish Eligible Sites
[9] Lake Development and Major Construction Project (Boat Access) with Federal Participation (DJ only)

**Appendix E: Remaining Federal Interest Sites NOT Completed under T-03-P-001**

1. Baldwin Lake State Fish and Wildlife Area (a.k.a Kaskaskia River Area) [1 8]
2. Big Bend Fish and Wildlife Area [2 4]
3. Carlyle State Fish and Wildlife Area [4 8]
4. Chain-O-Lakes State Park [1 9]
5. Clinton Lake Recreation Area [7 9]
6. Coffeen Lake Fish and Wildlife Area [8 9]
7. ~~Eastern Prairie Fringed Orchid Land Acquisition~~ [6] (Grant terminated 5-17-06)
8. Friends Creek Regional Park / Ankrom Addition [2]
9. Hegewisch Marsh (a.k.a.Calumet Open Space Reserve) [6] (Site still pending as of 5-17-06)
10. Hennepin-Hopper Lake [6 7]
11. Mississippi Fish and Wildlife Area [2 4 5 7 8]
12. Newton Lake Fish and Wildlife Area [8 9]
13. Rend Lake State Fish and Wildlife Area [8 9]
14. Sangchris Lake State Park [2 3 4 9]
15. Shelbyville State Fish and Wildlife Area [8]
16. Spring Lake State Fish and Wildlife Area [7 8 9]

**Priority Ranking of Sites**

[1] IDNR Lands with Federal Interest (PR/DJ)
[2] Illinois Habitat Fund
[3] State Pheasant Fund
[4] State Migratory Waterfowl Stamp Fund
[5] State Furbearer Fund
[6] Non-DNR owned Lands with Federal Interest (Land Rights)
[7] IDNR Lands with Federal Interest - (NAWCA)
[8] 100% Wildlife and Fish Eligible Sites
[9] Lake Development and Major Construction Project (Boat Access) with Federal Participation (DJ only)

**Appendix F: Federal and Non-Federal Interest Sites Completed as of June 30, 2006.**

1 Baldwin Lake State Fish and Wildlife Area (a.k.a Kaskaskia River Area) [1 8]
2 Big Bend Fish and Wildlife Area [2 4]
3 Chain-O-Lakes State Park [1 9]
4 Cypress Pond SNA
(One parcel in same deed as a Cache River parcel, so included site)
5 Deer Pond SNA
(One parcel in same deed as a Cache River parcel, so included site)
6 Des Plaines Conservation Area
(Game Propagation Center is located within this area, so included site)
7 Dixon Mounds Museum
(Located directly adjacent to Emiquon, so included site)
8 Edward R. Madigan State Park
(Located directly adjacent to Helfrich Game Farm, so included site)
9 Friends Creek Regional Park / Ankrom Addition [2]
10 Hooper Branch Savanna
(Located directly adjacent to Iroquois County CA, so included site)
11 Hennepin-Hopper Lake [6 7]
12 Kankakee River Dam
(Site directly adjacent to Kankakee River State Park, so included site)
13 Kankakee River State Park [9]
14 Manito Prairie
15 Matthiessen State Park
(Located directly adjacent to Starved Rock State Park, so included site)
16 Sangchris Lake State Park [2 3 4 9]
17 Spring Lake State Fish and Wildlife Area [7 8 9]
18 Starved Rock State Park [9]
19 Tunnel Hill State Trail

NOTE: Non-Federal Interest Sites are indicated in BLUE. Sites which have been researched under this contract but will be digitized during the next contract phase are indicated in PINK.

**Priority Ranking of Sites**
[1] IDNR Lands with Federal Interest (PR/DJ)
[2] Illinois Habitat Fund
[3] State Pheasant Fund
[4] State Migratory Waterfowl Stamp Fund
[5] State Furbearer Fund
[6] Non-DNR owned Lands with Federal Interest (Land Rights)
[7] IDNR Lands with Federal Interest - (NAWCA)
[8] 100% Wildlife and Fish Eligible Sites
[9] Lake Development and Major Construction Project (Boat Access) with Federal Participation (DJ only)

**Appendix G: Remaining Federal Interest Sites with Problems/Issues that Overlap Under Contract T-02-P-001 and T-17-P-001**

| Site Name | Status | Problem/Issues |
| --- | --- | --- |
| Baldwin Lake State Fish and Wildlife Area (a.k.a Kaskaskia River Area) [1 8] | In progress. | Site is very large and will take months to complete. |
| Carlyle State Fish and Wildlife Area [4 8] | In progress. Owned parcels researched and digitized. | Majority of this site is leased from the US Army Corp of Engineers. **CAN'T COMPLETE SITE UNTIL DETAILED LEASE INFO IS OBTAINED FROM USACE.** |
| Clinton Lake Recreation Area [7 9] | In progress. | Majority of this site is leased from current power company (Ameren IP). |
| Coffeen Lake Fish and Wildlife Area [8 9] | Researched owned parcels. | Majority of this site is leased from current power company (Ameren IP). **CAN'T COMPLETE SITE UNTIL DETAILED LEASE INFO IS OBTAINED FROM POWER COMPANY.** |
| Friends Creek Regional Park / Ankrom Addition [2] | In progress now that we have received information from Macon County Conservation District on 5-23-06. | |
| Hegewisch Marsh (a.k.a.Calumet Open Space Reserve) [6] | Not started. | DNR has conservation easement at this site, which is owned by the City of Chicago. Warranty deed information is pending. CAN'T COMPLETE SITE UNTIL DEED INFORMATION IS OBTAINED. |
| Hennepin-Hopper Lake [6 7] | In progress now that we have received legal description information from the County Recorder's office. | |

| | | |
|---|---|---|
| Mississippi Fish and Wildlife Area [2 4 5 7 8] | Not started. | Majority of this site is leased from the US Army Corp of Engineers. CAN'T COMPLETE SITE UNTIL DETAILED LEASE INFO IS OBTAINED FROM USACE. |
| Newton Lake Fish and Wildlife Area [8 9] | Research completed. | Majority of this site is leased from current power company (Ameren IP). |
| Rend Lake State Fish and Wildlife Area [8 9] | Owned parcels researched by not started. | Majority of this site is leased from the US Army Corp of Engineers. CAN'T COMPLETE SITE UNTIL DETAILED LEASE INFO IS OBTAINED FROM USACE. |
| Shelbyville State Fish and Wildlife Area [8] | In progress. Owned parcels researched and digitized. | Majority of this site is leased from the US Army Corp of Engineers. CAN'T COMPLETE SITE UNTIL DETAILED LEASE INFO IS OBTAINED FROM USACE. |

# STATE WILDLIFE GRANT PROGRAM
# State of Illinois
# Final Performance Report

## Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems

### Project 4 – Development of Conservation Opportunity Areas

### Job 4.4. Future risk assessment for Illinois streams.

## INTRODUCTION

Hawkins et al. (1993) describe several purposes that a general classification of stream habitats should serve, including facilitating communication between researchers and managers. Although the scale of their classification (channel units) may differ from what we propose (stream reaches), their suggestions on the functionality of a classification are very relevant. Unlike our terrestrial colleagues who have described habitat types at various spatial scales with much clarity, stream ecologists lack standardized names for systems that are widely accepted. Until aquatic systems are uniformly described and named, it is difficult for researchers and managers to agree on the status of and preferred management options for various stream types. Hawkins et al. (1993) further suggest that the attributes used in the classification are at the appropriate spatial scale to the biota of interest and the defined stream types are ecologically meaningful to both researchers and managers. We recognize that aquatic biota are influenced by local features within the channel, but are also influenced by the surrounding landscape and the water moving through the channel from the upstream watershed. Therefore, we have developed a database of attributes at several spatial scales that includes the local channel, local riparian zone, and local catchment, as well as the entire upstream riparian zone and watershed for each stream reach. A description of the GIS-derived attributes can be found in Holtrop et al. (2005).

Various methods for classifying rivers exist and range from purely physical or biological classifications to combinations of both. Geomorphic classifications such as that proposed by Rosgen (1994) and the channel evolution model (Schumm et al. 1984) are widely used across the United States. The premise of these classifications is that channels develop in a set pattern and can be classified as to their current state. Although these developmental channel stages can be shown to be important, purely geomorphic classifications do not capture variations in key ecological factors such as chemistry, hydrology, and temperature that also strongly shape the aquatic biota. Further, purely biological classifications, such as the Biological Stream Characterization (BSC; Bertrand et al. 1996) developed for Illinois waters, do not take into account physiochemical habitat when rating streams. BSC ratings are assigned to a stream reach primarily based on the fish community sampled at the site. Given the limitations of each of these approaches Illinois resource managers need a tool that will integrate ecological, biological, and geomorphic factors in a way that allows aquatic systems to be described in a standardized fashion.

To build on these existing approaches, we proposed the development of a statewide database system consisting of physically and biologically attributed stream reaches that can be used for description and classification of Illinois streams. The objectives for this project are to: 1) build models to predict habitat and biota from mapped landscape and local variables, and 2) assess risk of Illinois streams to future land use change. These objectives correspond to jobs 2.4 and 4.4 respectively in T-2-P1.

The purpose of this job is to develop a series of predictions for ecological attributes of river segments reflecting various scenarios of human disturbance. To do this, we linked output from a land transformation model to some of the models developed in Job 2.4. This linkage allows forecasting of riverine conditions as they relate to land use changes in specific river reaches. The future scenarios will help identify stream segments at risk for future impacts loss due to land use changes including urban development.

Land Transformation Model

Bryan Pijanowski, Ph.D., and his colleagues at Purdue University developed a Land Transformation Model (LTM) for Illinois that uses neural net logic to build a map of predicted land cover changes over time. A key component to building a land transformation model is having at least two landcover datasets for a given area that are consistently developed. Because Illinois' two recent landcover datasets (IDNR 1996 and USDA NASS et al. 2002) were developed with different methods, Dr. Pijanowski lacked the necessary land use change data to build the basic land transformation model. Therefore, he relied on other sources of data to create the base model. In the northern quarter of Illinois, he used change data collected by the Northeastern Illinois Planning Commission (NIPC). For the southern three quarters of Illinois, Dr. Pijanowski relied on central Indiana data. The NIPC and central Indiana data were used to determine the urban rates of growth in small towns and to identify what other landcover is being added or lost. Once these rates and factors were identified, they were applied to Illinois landcover data (IDNR 1996). The resulting LTM was applied statewide, and a series of maps reflecting potential future development scenarios was created (Figure 4.4a).

Risk Assessment

The risk assessment portion of this project proved more difficult than anticipated. Each time series modeled (i.e., 2005, 2010, 2015, 2020, 2025, and 2030) resulted in a new land cover map (Figure 4.4a). In order to rerun the models described in Job 2.4, proportions of each land cover type for each time series had to be attributed to each arc. Further, landcover had to be summarized at four spatial scales (i.e., local riparian zone, entire riparian zone, local watershed, and entire watershed). Given that there are approximately 55,000 stream arcs in Illinois, attributing six different time series of landcover at four spatial scales proved to be beyond our computer capability. Therefore we selected the Kaskaskia River basin as a pilot for the risk assessment portion of this project. Further, we limited our analysis to current landcover and model outputs from 2025, which corresponds to the timeframe of Illinois' Wildlife Action Plan.

Output from the LTM representing the 2025 development scenario was assigned to each arc, and then summarized into variables used in models described in Job 2.4.

Flow

Annual median discharge was attributed to more than 92% of the available arcs in the Kaskaskia River basin using the flow models developed in this project. Certain reaches with extremely small catchments and areas associated with reservoirs (i.e., Carlyle Lake and Lake Shelbyville) were not modeled successfully (Figure 4.4b). Discharge was also estimated by applying summaries from the 2025 LTM and attributed to the appropriate arc (Figure 4.4c). Comparisons between these modeled flows suggest that most stream reaches would experience only small changes in annual median flow characteristics under the conditions described with the 2025 LTM. The majority of segments (62.6%) had projected median discharges within 10% of those from the recent land cover with over forty percent (43.8%) of all modeled segments expected to have changes less than 5% under the 2025 projected land cover. However, a small fraction of stream segments show large percentage change in this analysis. These stream segments are primarily those with extremely low discharge where small changes in magnitude are described as large percentage change (Table 4.4a). This highlights a weakness in this form of analysis but also of flow models that were developed based on a regional dataset that under-represent catchments with small drainage areas and those with very low discharge. Our flow models have a tendency to overestimate low flows and underestimate high flows due to these factors and in part from the linear modeling techniques used in their development. Additional discharge data from small streams and the development of separate models for headwaters would greatly improve our statewide assessment of these important areas.

Temperature

Mean daily temperature for July was attributed to more than 95% of the available arcs in the Kaskaskia River basin using the temperature models developed in this project. Certain reaches with extremely small catchment areas and/or with relatively uniform surficial geology or land cover were unable to be modeled successfully. Similarly, areas associated with reservoirs (i.e., Carlyle Lake and Lake Shelbyville) were not modeled (Figure 4.4d). July stream temperatures were estimated by applying summaries from the 2025 LTM and attributed to the appropriate arc (Figure 4.4e). These results suggest that the Kaskaskia River contains a wide range of summer temperatures but that warmer waters flow through the majority of the basin. Modeled temperatures were similar between those derived from the recent land cover and the 2025 LTM with over half of the stream arcs (58.3%) differing within the resolution (< 0.1 C) of our temperature recorders (Table 4.4a). This analysis suggests that the majority of the Kaskaskia River basin will maintain similar summer water temperatures under conditions as described in the 2025 LTM. It must be kept in mind that altering temperatures even small amounts may impact stream biota if they are living near their thermal limits. This could be particularly important for coolwater species or those that live in the very warmest of streams. However, little is currently known about the distribution of streams with extreme summer thermal conditions within Illinois, especially coolwater areas, where these types of impacts may occur.

Fish

The fish assemblage model was rerun based on output from the land transformation model and the results were applied statewide (Figure 4.4e). Ninety-five percent of the stream arcs had the same fish assemblage predicted for current conditions as well as potential conditions in 2025. Approximately half of the arcs that showed a change between current conditions and those suggested in 2025 are associated with reservoirs (i.e., Carlyle Lake and Lake Shelbyville) where this model is not applicable. The majority of the remaining arcs (i.e., 96%) differing between current and 2025 conditions were predicted to change from group 5, which comprises species preferring slower moving water and quiet pools, to group 2, which comprises species of the Wabash/Ohio drainage or species in the family Percidae. Although only a small proportion of arcs showed a change in fish assemblages, the arcs that did change suggest the potential for alteration in land cover to effect local fish distribution.

Because our model for predicting fish assemblages is rather simplistic, we selected Longear sunfish as a test to see if individual species models might be more sensitive to future land use change. When the Longear sunfish model was run based on LTM output for 2025, no additional locations were predicted for species presence. However, if we ignore the stream arcs comprising Carlyle Lake and Lake Shelbyville, there are still a few stream reaches where Longear sunfish were predicted to occur in present conditions, but were predicted absent using the 2025 land cover scenario (Figure 4.4f). This analysis suggests that the land cover change associated with the 2025 LTM would lead to a loss of stream reaches with suitable conditions for Longear sunfish.

## DISCUSSION

This project marks an important step toward developing a tool that simplifies the natural variability in stream systems. The flow, temperature, and fish models developed in this project have been applied and attributed to streams segments statewide. By providing expectations for stream habitat and fish communities in sampled and unsampled reaches throughout the state, the resulting database system will be a valuable tool for implementing Illinois' Wildlife Action Plan. For example, one of the actions identified in the stream's campaign of Illinois' Plan is to restore populations of imperilled and extirpated aquatic animals (State of Illinois 2005). To meet this objective, resource managers need to identify where suitable habitat persists, which may include groundwater fed streams, as well as those with cool summer water temperatures. Prior to the completion of this project, summer water temperatures and groundwater influence were unknown for most streams in Illinois. Additionally, many of the GIS attributes developed in Holtrop et al. (2005) and used in the models in this project provide the basis for identifying system-wide limiting factors such as connectivity.

Hydrologic modeling provides a tool for developing expectations for stream flow where data are lacking or for assessing potential alterations in flow associated with local changes in model parameters (e.g., land cover). Application of the models developed in this project suggests the existence of a wide range of annual flow conditions within the streams of Illinois. When applied to the Kaskaskia River basin and compared with the 2025 LTM, these models provide a spatial analysis of potential alterations in flow associated with changes in land cover. While many of the stream reaches show little change in flow character, certain areas appear to be vulnerable to large alterations in flow conditions if current development trends continue. These results may help develop guidance for flow standards and will provide insight into the contribution of land alteration to the modification of flow regimes especially as additional basins are assessed.

Our assessment of thermal conditions in Illinois streams provides a geospatial picture of the locations where summer temperatures may limit the distribution or success of many aquatic species, particularly those considered coolwater or those that require high dissolved oxygen concentrations. However, our temperature models are based only on summer water temperatures from a single year at each site and thus provide no information about interannual variability or nonsummer conditions. Longer thermal records that would allow the modeling of mean conditions that take into account annual variability should improve the fit of our temperature models and provide more accurate estimates of the thermal character of modeled streams. Long periods of cold temperature are another potential period of stress for stream organisms that are not addressed with these models but may have a strong influence on the distribution of aquatic species in Illinois streams. These limitations could easily be addressed by continuing to annually monitor water temperature at fixed stations and in a variety of different streams throughout the state. Redevelopment and improvement of temperature models as additional data become available would improve and expand the reliability of our assessment of Illinois stream temperatures.

Although the fish assemblage model presented in this report is simplistic, it presents a useful approach to classifying biotic communities in rivers. As more data become available, the models may be refined to identify locations of rarer community types, including coolwater and headwater fish assemblages. The individual species models, which are based on presence/absence data, provide one approach for identifying areas that can be conserved to sustain population of listed species, as well as identifying suitable habitats for species reintroductions.

The outputs for the models developed in this project along with the GIS attributes developed in Holtrop et al. (2005) provide the necessary data for developing a stream classification for Illinois. We intend to develop an approach for grouping stream arcs into larger stream reaches and then classify these reaches into stream types. An ecological classification of rivers as we propose will help Illinois resource managers identify high-quality examples of all river and stream communities, thereby helping to set restoration and management priorities. In this project, we attempted to document changes in flow, temperature, biota associated with altered land use. In general, our models did not detect numerous changes between current conditions and those of 2025. However the changes that were identified suggest areas that may be at risk by future land use change. As our models are refined, we should have increased ability to detect potential risks to biota in the future.

**Table 4.4a.** Potential change in annual median discharge and mean July temperature based on model output from the LTM 2025 for the Kaskaskia River basin.

| | **Percent change between models.** | | | | | |
|---|---|---|---|---|---|---|
| **Model Assessed Median Discharge** | **< 1 %** | **< 5 %** | **< 10 %** | **< 25 %** | **< 50 %** | **> 50 %** |
| % of stream segments | 21.0 | 43.8 | 62.6 | 89.6 | 95.9 | 4.1 |

| | **Magnitude of change between models.** | | | | |
|---|---|---|---|---|---|
| **July Mean Daily (C)** | **< 0.1** | **< 0.5** | **< 1** | **< 1.5** | **> 1.5** |
| % of stream segments | 58.3 | 97.7 | 99.8 | 100.0 | 0.0 |

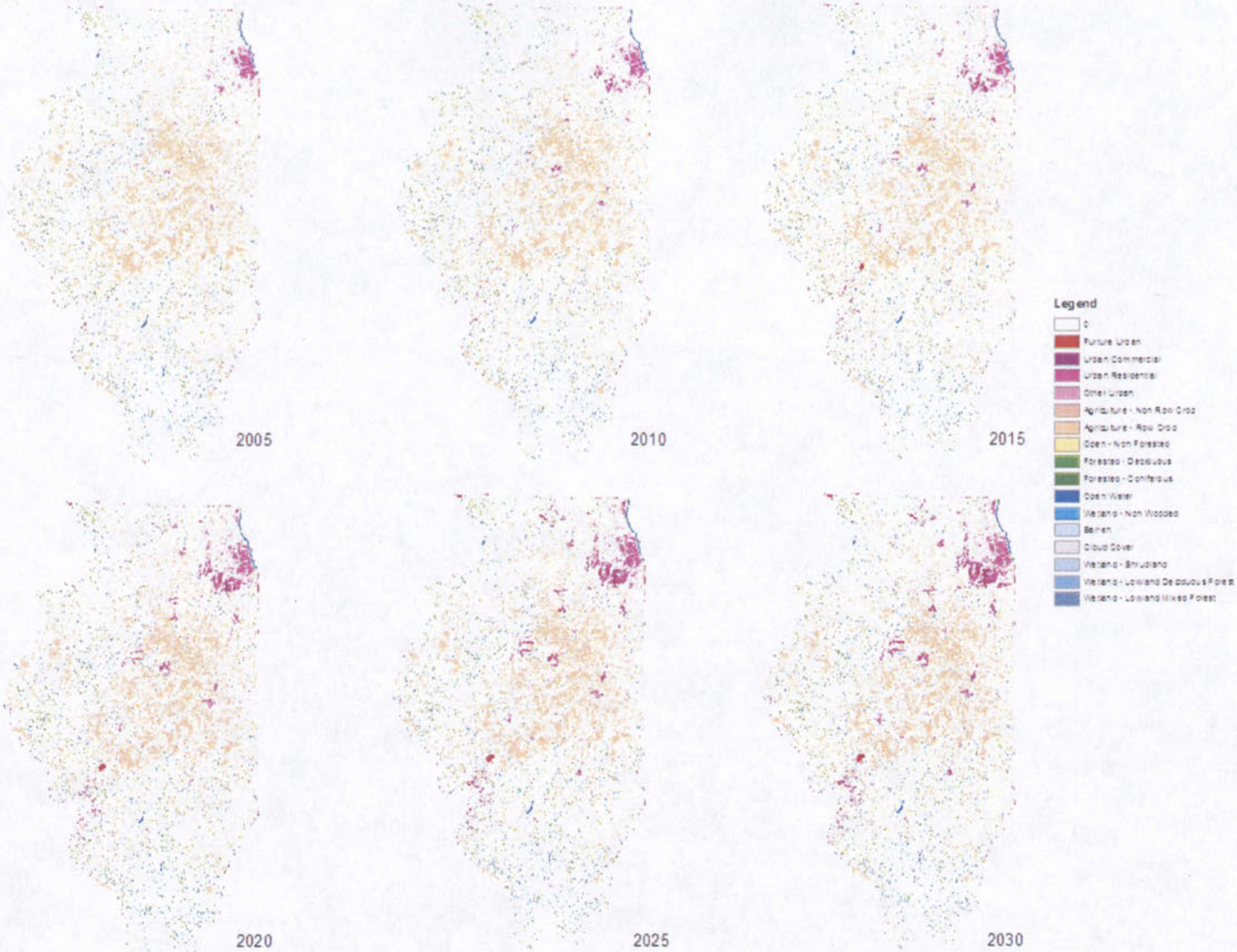



Figure 4.4a. Potential future scenarios based on a land transformation model developed by Bryan Pijanowski, Ph.D.

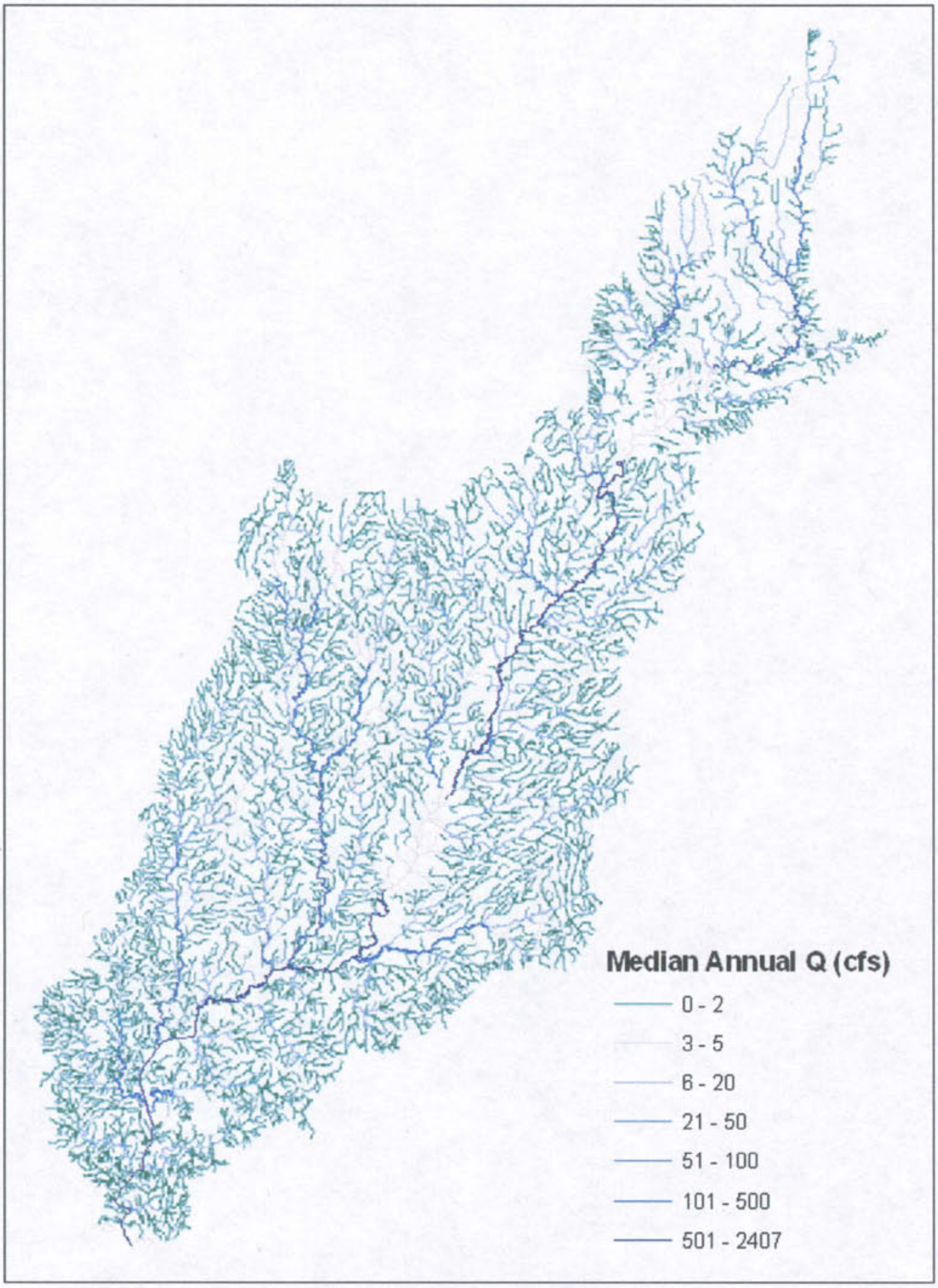



**Figure 4.4b.** Kaskaskia River median annual discharge estimates based on MLR output for recent landcover.

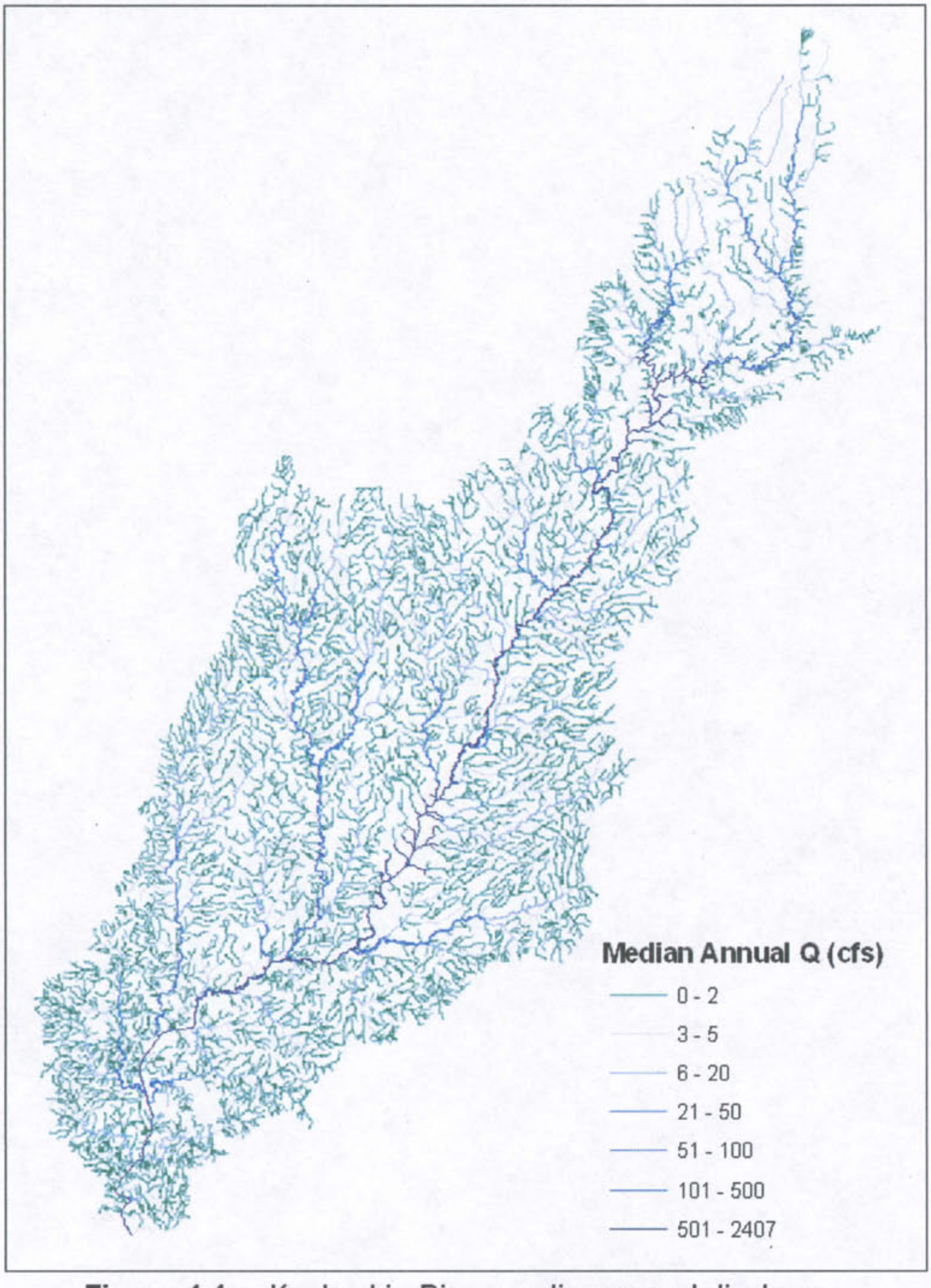



**Figure 4.4c.** Kaskaskia River median annual discharge estimates based on LTM output for 2025 Scenario.

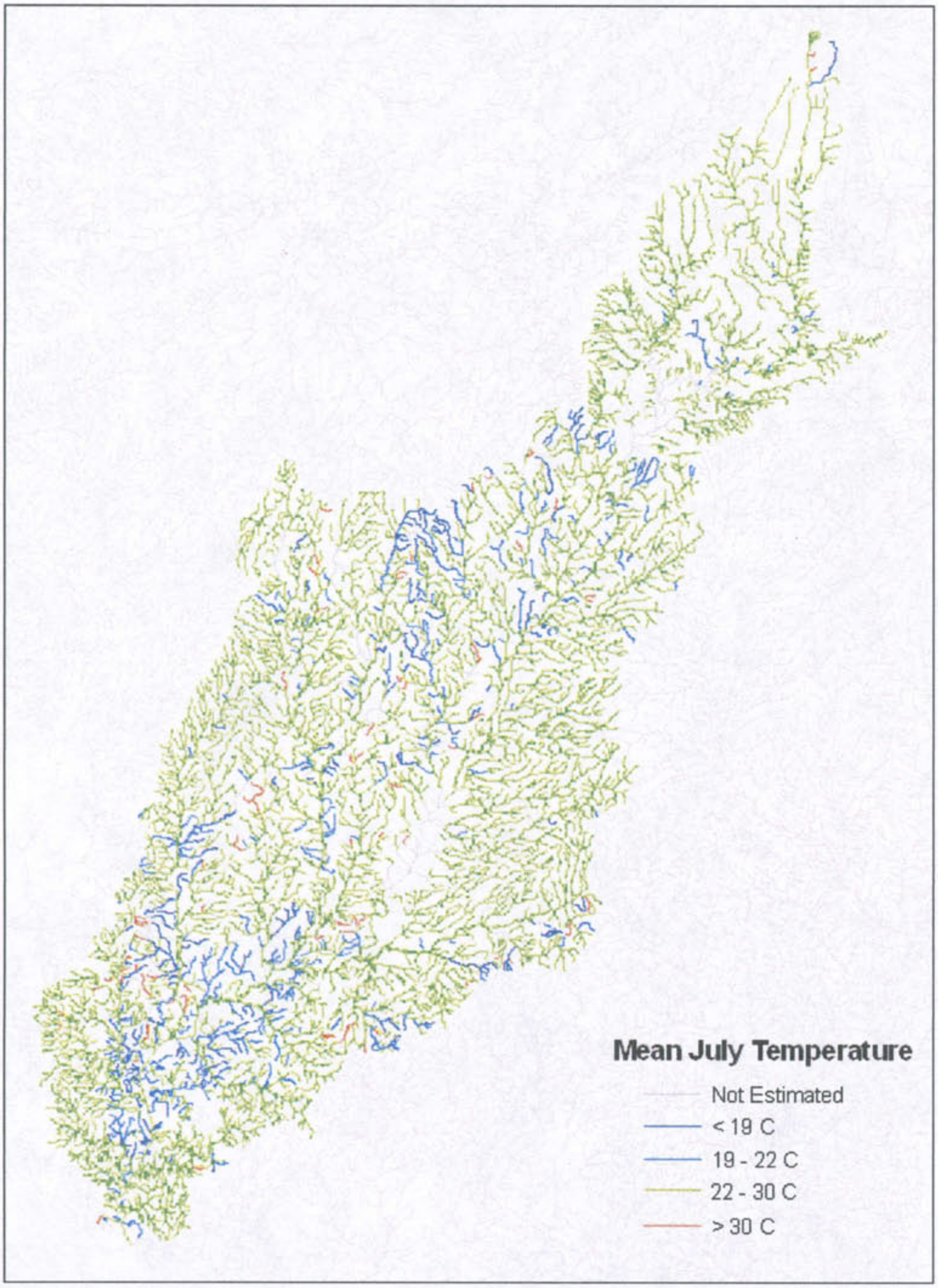



**Figure 4.4d.** Kaskaskia River summer stream temperature estimates based on MLR model output for recent landcover.

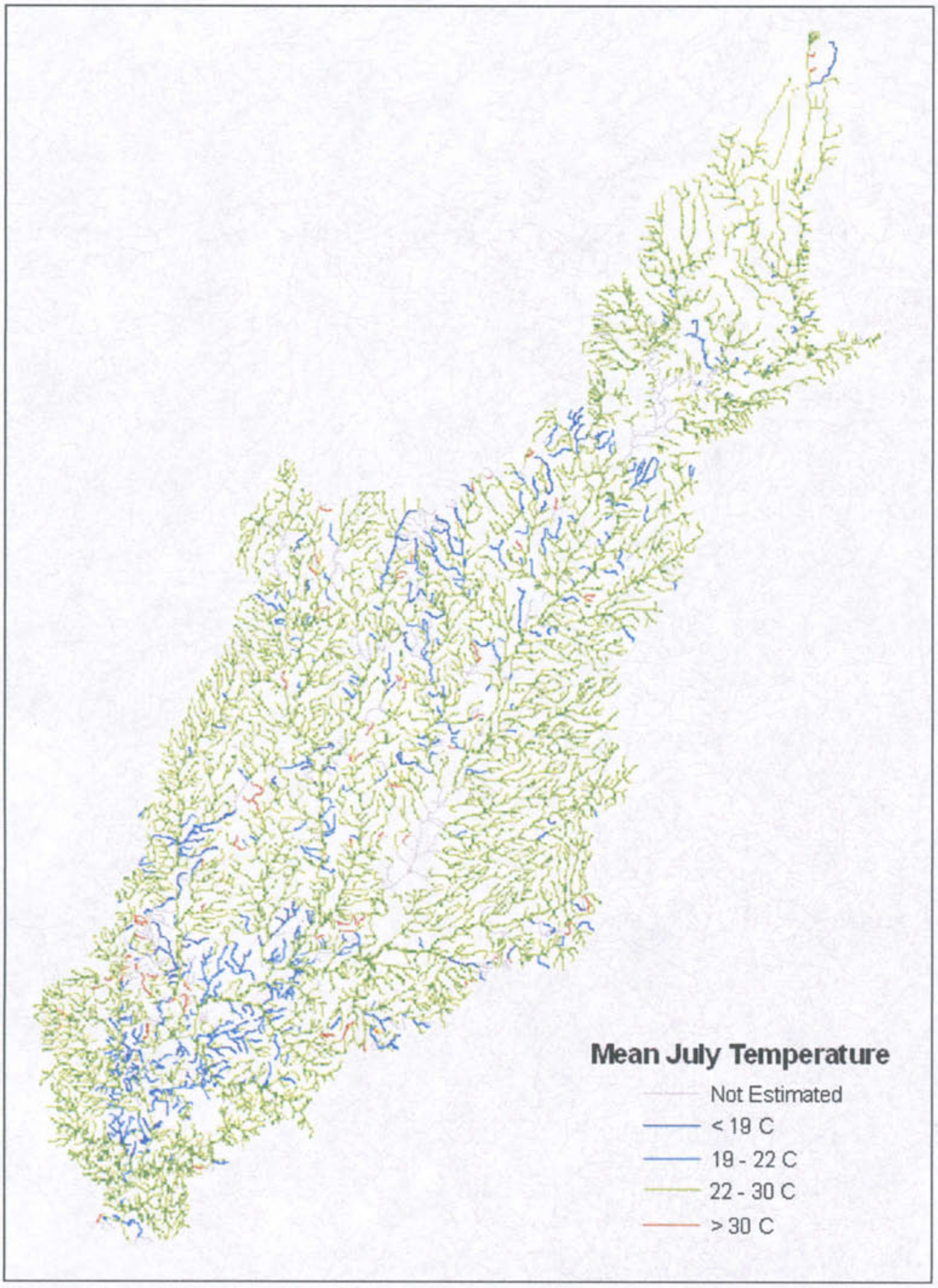



**Figure 4.4e.** Kaskaskia River summer stream temperature estimates based on LTM output for 2025 Scenario.

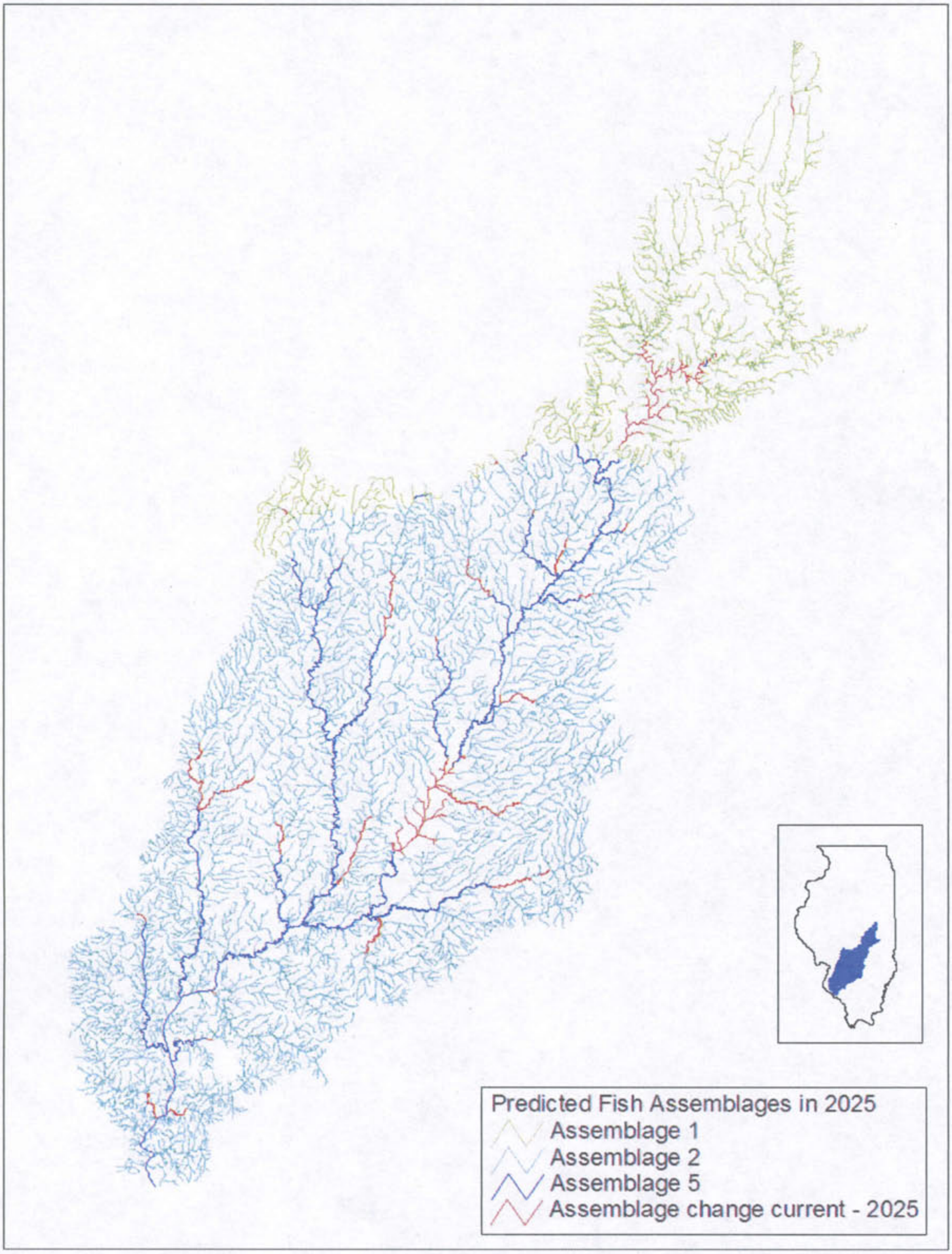



Figure 4.4f. Kaskaskia River fish assemblages based on LTM output.

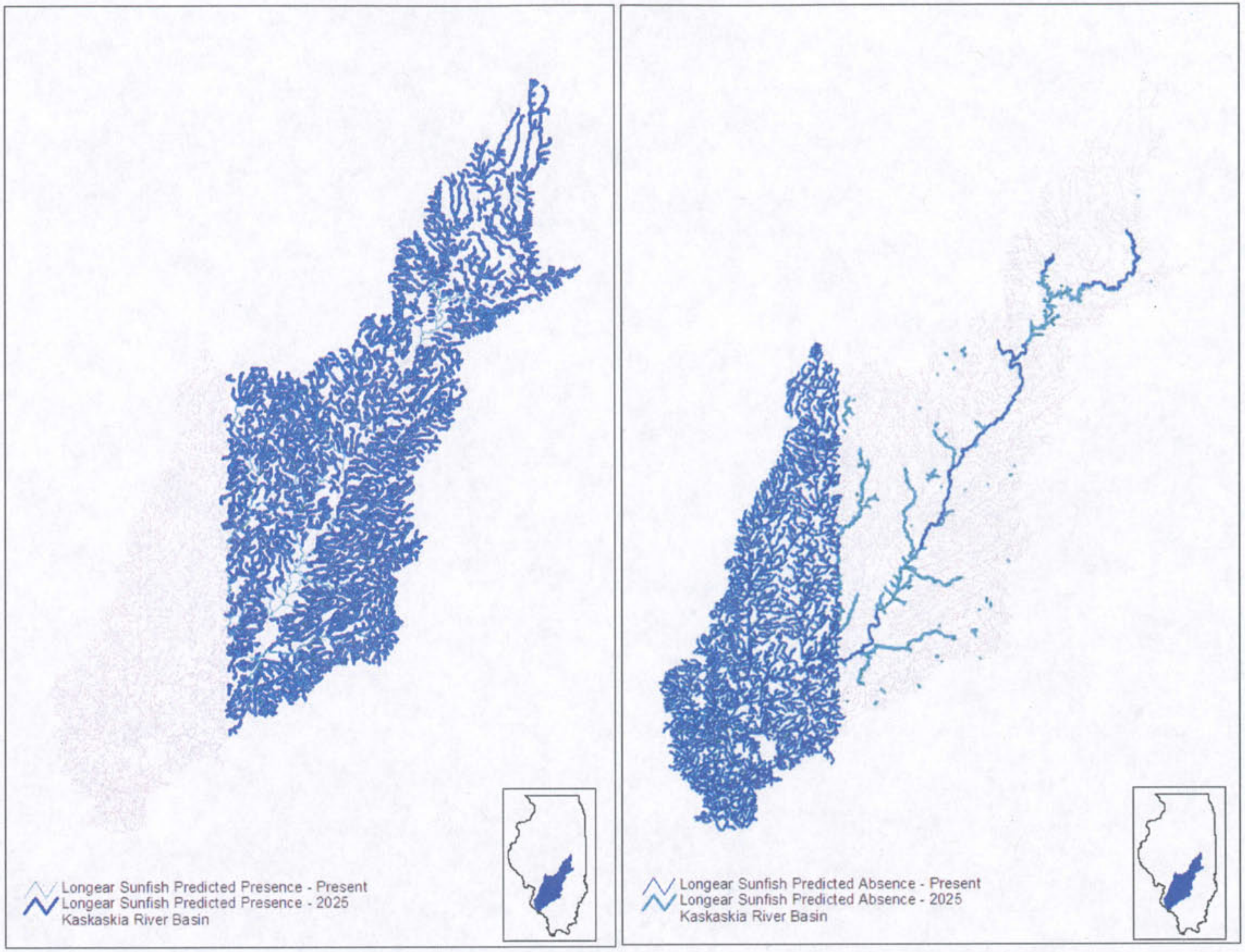



Figure 4.4g. Predicted occurrence of Longear sunfish based on LTM output.

## ACKNOWLEDGMENTS

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**STATE WILDLIFE GRANT PROGRAM**

**State of Illinois**

**Final Performance Report**

**Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems**

**Project 5 - Involvement of Conservation Partners, Agencies and the Public in Developing, Implementing, and Evaluating the Comprehensive Wildlife Conservation Plan**

Objectives:

1. Coordinate development, implementation, review and incorporation of critques of the Comprehensive Wildlife Conservation Plan/Strategy with state federal and local agencies and private organizations managing significant land and water resources in Illinois or administer programs significantly affecting conservation elements
2. Provide for broad public input in development, implementation and review of the Comprehensive Wildlife Conservation Plan/Strategy

Project Description:

*Job 5.1: Consultation for partner coordination and public involvement*

Coordination of the Comprehensive Wildlife Conservation Plan/Strategy with other agencies and partners and public involvement were integrated into multiple jobs of this proposal (Project 1, Project 3, Job 4.1, Project 6). However, given the diverse perspectives and priorities of the agencies and partner organizations involved, professional consulting assistance was necessary for developing a communications framework and ensuring communications remain productive towards completing the Comprehensive Wildlife Conservation Plan/Strategy. Specifically, assistance was needed in collecting contact information, creating opportunities for communication (i.e., printed, electronic and web-based, and in-person meetings), and facilitating regional meetings of agency staff and conservation partners. Similarly, Illinois has a large and diverse public. Ensuring citizens had ample opportunity to learn about the Comprehensive Wildlife Conservation Plan/Strategy process and contribute constructively to the document were paramount, as was handling large amounts of feedback and responding appropriately. Consultation aided in establishing an efficient public involvement system.

*Job 5.2: Developing an Illinois Comprehensive Wildlife Conservation Plan/Strategy website*

The internet provides an excellent opportunity for sharing data, reviewing documents, viewing maps, and receiving feedback from agency staff, conservation partners, and the public. The Illinois Department of Natural Resources developed a website that integrated other planning efforts and conservation partner's priorities, contained digital documents supporting the Comprehensive Wildlife Conservation Plan/Strategy, drafts and the final version of the Comprehensive Wildlife Conservation Plan/Strategy, and allowed for electronic public input.

Approach:

*Job 5.1: Consultation for partner coordination and public involvement*

A concerted effort was made to inform and involve the public throughout the planning process. D.J. Cases & Associates, with the Plan Coordinator, developed a strategy for public participation that outlined the expected audiences, public involvement objectives for each audience, and strategies for reaching those objectives (DJ Case & Assoc. 2004).

A steering committee, composed of Illinois Department of Natural Resources staff and external representatives was farmed to assist broadly in all aspects of developing, reviewing, implementing, and updating the Plan/Strategy for Illinois. To develop familiarity with the planning process, present information on the status of wildlife and habitat resources, and gather input on priority conservation strategies and local priorities, workshops were organized for Department of Natural Resources staff, partner agencies and organizations, and facilitated with professional assistance from D.J. Case & Associates, U. S. Department of Agriculture Natural Resources Conservation Service, and Southern Illinois University. Additionally, efforts were made to solicit participation from partners and the public via print media, direct mailings, and presentations at meetings and conferences.

*Job 5.2: Developing an Illinois Comprehensive Wildlife Conservation Plan/Strategy website*

As the planning process advanced, the Plan/Strategy website was developed and expanded. The website's content was designed to (1) provide information on the plan and planning process to partners and the public, (2) provide periodic updates to those involved in the planning process and describe additional opportunities to participate (e.g., upcoming meetings, public comment periods on draft material), and (3) distribute and accept peer review and public comments of data and draft materials developed through the planning process.

Results:

*Job 5.1: Consultation for partner coordination and public involvement*

Consultation with DJ Case & Associates produced a framework for coordinating with partner agencies and organizations, and providing for public input (Appendix I, this report). In carrying out this plan, high-quality information was received from and shared among conservation partners, content of the Illinois Comprehensive Wildlife Conservation Plan/Strategy was thoroughly reviewed by scientists, and thousands of persons were informed of the process and invited to contribute.

*Steering Committee* - A steering committee was formed, chaired by the Planning Coordinator, composed of Department of Natural Resources staff from the Offices of Resource Conservation, Realty and Environmental Planning, and Land Management and Education, and representatives from four external not-for-profit partner organizations (Ducks Unlimited, Illinois Audubon Society, National Wild Turkey Federation, and The Nature Conservancy; see Table 1, this report). These groups were invited to serve on the steering committee, based upon several factors, including: (1) a statewide presence of the groups, (2) a habitat-conservation mission, (3) a balance of traditionally sporting and environmental organizations, (4) staffing levels within the organization that would allow steering committee representatives to devote significant time to the planning process, and (5) representatives that would be able to communicate with diverse constituents on the planning process. Specifically, the committee guided the identification of conservation priority areas; information-sharing on the distribution, abundance, and threats to conservation elements within Illinois; development of conservation objectives and prioritization of conservation opportunity areas for management intervention; and the proposal, design and implementation of conservation actions and monitoring/evaluation protocols. Committee members assisted the Plan Coordinator in communicating with partner agencies and organizations, and facilitated public participation in the planning process through outreach to their constituents and broader audiences. The steering committee met on six (6) occasions between February 2003 and May 2005.

*Planning workshops* - Workshops for Department of Natural Resources field staff were held in each of the five Department of Natural Resources administrative regions from 15-24 September 2004, and facilitated with assistance from the U. S. Department of Agriculture Natural Resources Conservation Service and Southern Illinois University. These workshops reached 177 agency staff. Workshops for partner agencies and organizations were held October 4-6 in Bartlett (northern Illinois), Springfield (central Illinois), and Whittington (southern Illinois), facilitated by D.J. Case & Associates. These workshops were attended by about 75 attendees.

*Print media* - An article announcing the planning process appeared in the First Quarter 2004 issue of the newsletter "DNR Update," and provided contact information for the Planning Coordinator and a link to the Plan/Strategy website (Appendix II, this report). The Spring/Summer issue of "The Conservation Communicator" (a Department of Natural Resources newsletter for the C2000 Ecosystems Program, EcoWatch Network, Critical Trends Assessment Program, and Illinois Natural Resources Information Network), discussed the planning process, introduced the steering committee, presented the eight 'required elements,' and provided a link to the Plan/Strategy website (Appendix III, this report). In the November 2004 issue of *Outdoor Illinois* (the Department of Natural Resources' primary publication), the opening article from Director Joel Brunsvold discussed the need for the Plan/Strategy, and encouraged readers to get involved by commenting on the Plan/Strategy and supporting organizations that develop and implement conservation activities (Appendix IV, this report). The article also included a link to the Plan/Strategy website, and direct contact information for the Planning Coordinator. An announcement of the final review of the draft Plan/Strategy was published in the March 2005 *Outdoor Illinois*, and a press release announcing the acceptance of the Illinois Comprehensive Wildlife Conservation Plan/Strategy was issued in October 2005 (Appendix V, this report). Subsequent to approval of the Plan/Strategy, articles on the "Wildlife Action Plan" were written and printed in the *Outdoor Illinois* and *Illinois Steward* magazines (Walk 2006a, b; see also Appendices VI, VII, this report).

*Direct mailings* - In July 2004, a letter introducing the planning process, and invitation to participate, and contact information for the Plan/Strategy coordinator was sent to about 350 agencies, organizations, and institutions (Appendix VIII, this report). This contact list encompassed the Illinois Department of Natural Resources' Conservation Congress database, constituent lists maintained by the Divisions of Fisheries, Wildlife Resources, and Habitat Resources, C2000 Ecosystem partnerships, universities, museums, zoos and aquaria. Also included were land use planning commissions and development and agricultural groups. From these letters and individual contacts, periodic updates were sent to more than 400 addresses (well over 95% preferred receiving email updates).

*Presentations* - Upon request, the Planning Coordinator gave presentations on the planning process, progress, and results at various meetings and conferences of partner agencies and organizations. From December 2004 through May 2005, the planning coordinator made 31 presentations, consisting of a 20-40 minute slide show (see Appendix IX, this report, as an example), question-and-answer sessions, and assorted handouts. This process reached an estimated 600 persons.

*Job 5.2: Developing an Illinois Comprehensive Wildlife Conservation Plan/Strategy website*

A website for the Plan/Strategy was developed and posted at: (http://dnr.state.il.us/orc/wildliferesources/theplan/home.htm).
The website featured information on the need and justification for the Plan/Strategy; the eight required elements; the criteria used to identify the Species in Greatest Need of Conservation and an explanation of why the list was necessary and how it was to be used; taxonomic lists of the Species in Greatest Need of Conservation, their habitat associations and criteria by which they were selected; the expected benefits of the Plan/Strategy for Illinois; an explanation of the responsibility of Department of Natural Resources to coordinate and deliver the Plan/Strategy to the National Acceptance Advisory Team by 1 October 2005, and the composition of the steering committee; a "Get Involved!" link where upcoming presentations, workshops, grant applications, and documents for review were posted; a periodically-updated status segment, including a timeline for developing and delivering the Plan/Strategy; a gallery of conservation maps; copies of slide-show presentations on the Plan/Strategy given at various workshops; and an outline of the Plan/Strategy. Most importantly, the partial and complete drafts of the Plan/Strategy were posted on the website, with roughly 50-day comment periods each, and contact information for sending feedback to the Planning Coordinator (materials from the website are compiled in Appendix X of this report).

Conclusions:

Although addressed in other projects of T-2-P-1, Project 5 coordinated the development, implementation, review and revision of the plan/strategy with other agencies and conservation organizations (required element 7) through advanced planning, effective communication, productive regional meetings, and web-based access to draft components of the plan. Project 5 provided for public involvement in developing, implementing and reviewing the Plan/Strategy (required element 8) through advanced planning, effective communications, and web-based access to information.

Sources:

D.J. Case & Associates. 2004. CWCP Public Participation Plan. Developed for Illinois Department of Natural Resources, August 2004.

Illinois Department of Natural Resources. Illinois Comprehensive Wildlife Conservation Plan. http://dnr.state.il.us/orc/wildliferesources/theplan/

Walk, J. 2006a. The Illinois Wildlife Action Plan. Outdoor Illinois 14:7-9.

Walk, J. 2006b. The Illinois Wildlife Action Plan: keeping common species common. Illinois Steward 15:8-18.

**Table 1.** Composition of the Illinois Comprehensive Wildlife Conservation Plan/Strategy Steering Committee.

- Partner Organizations
  - Ducks Unlimited - *Eric Schenck*
  - Illinois Audubon Society - *Marilyn Campbell*
  - National Wild Turkey Federation - *John Burk*
  - The Nature Conservancy - *Carl Becker*
- Illinois Department of Natural Resources
  - Illinois Natural History Survey - *John Epifanio, Liane Cordle*
  - Office of Land Management & Education - *Terry Musser*
  - Office of Realty & Environmental Planning - *David Baker, Lisa Dowson, Wayne Hartel, Brian Reilly, Tammy Watson*
  - Office of Resource Conservation
    - Division of Fisheries - *Steve Pallo, Scott Stuewe*
    - Division of Habitat Resources - *Glen Kruse*
    - Watershed Protection Section - *Joel Cross, Steve Sobaski*
    - Division of Wildlife Resources - *John Buhnerkempe*
- Planning Coordinator (committee chair) - *Jeff Walk*

**Appendix I.** Public Participation Plan developed by D.J. Case & Associates, August 2004.

# CWCP PUBLIC PARTICIPATION PLAN

***Draft for Internal Staff***

**Illinois Department of Natural Resources**

**August 19, 2004**

## Project description

What is the purpose of the plan?

The CWCP identifies habitat areas that demonstrate the greatest conservation need and potential, and establishes specific goals for the conservation, enhancement and protection of these areas. The plan identifies actions to achieve specific and broad conservation goals. Monitoring wildlife responses through protocols described in the CWCP will ensure conservation actions are contributing to natural resource goals. Through adaptive management and a dynamic CWCP, new challenges and opportunities that arise will be addressed quickly.

What are the internal IDNR coordination needs created by the plan?

The Illinois Department of Natural Resources (IDNR) is charged with protecting, conserving and managing the State's natural resources. Protection, conservation and management are ongoing, but implementation has been traditionally multi-focused.

Illinois has been involved with several large-scale landscape management efforts (e.g., Conservation 2000 Ecosystem Program, Interagency Pilot Watershed Program, the Conservation Reserve Enhancement Program (CREP), and the Illinois Rivers Restoration Effort) as well as more geographically focused efforts to document and describe our resources (e.g., Illinois Natural Areas Inventory, Resource Rich Areas, Important Bird Areas).

***Appendix I, continued.***

With the diversity of conservation goals and programs being implemented by the IDNR Office of Resource Conservation, it has become increasingly difficult for field staff to distinguish IDNR priorities, efficiently direct funding and staffing to address multiple program priorities, and effectively evaluate the success of efforts.

The CWCP establishes a single plan for the IDNR to use in the selection of projects and distribution of services. The plan is fostering better communication throughout the Department, especially within the Office of Resource Conservation. Besides fulfilling the legal requirements for receiving federal aid funding under WCRP and SWG, the CWCP will support future grants, direct habitat programs, guide the management of IDNR sites and land acquisitions, and facilitate external partnerships.

How will IDNR staff be involved?

The plan will be introduced to professional biologists across the state with updates on progress presented in the following venues:

Division administrators meeting (e.g., wildlife, natural heritage)

Illinois Chapter of The Wildlife Society

Opportunities to review the priority species list also have been provided regularly through email communications with all department professional staff.

**Where:** Formal interaction with the plan coordinator will occur at 5 regional meetings with the first meeting held in Springfield.

**Who:** Supervisors will be asked to send at least a few representatives from each major work unit among regional and land management units, including site superintendents and law enforcement.

***Appendix I, continued.***

The **purpose** of the regional IDNR workshops will be to:

Familiarize staff with the planning process.

Present charts on habitat, population targets and threats, so that the staff understand the rationale behind the data.

Identify any key components or information that was inadvertently omitted.

Explain the role of the CWCP process to determine and convey priorities for projects and partnerships that will emerge from IDNR administration.

Discuss how CWCP could function as an umbrella to tie division strategic plans together and elevate the collective profile of the agency.

Develop a sense of enthusiasm for long-term engagement in implementation.

**Facilitation:** External facilitators and recorders will be requested from NRCS or Cooperative Extension. Facilitators will be provided with background on the process and the purpose of the meetings and an agenda. The CWCP coordinator will make the PowerPoint presentation and be available to answer questions about the process.

**Timeline:** The first meeting will be conducted with administrative staff in the Springfield office on August 26. The other four regional meetings will be scheduled through September and October.

*Why* will the public be involved?

The IDNR is mandated to protect Illinois' wildlife resources, and is ultimately responsible for delivering and implementing the CWCP by the October 1, 2005, deadline. However, the wildlife of Illinois is a public resource and it is important for other agencies, organizations and citizens to assist in

***Appendix I, continued.***

developing the plan. Even more importantly, the plan will be broad and comprehensive, and will require collaboration among a host of partners to be implemented most effectively.

The CWCP will facilitate partner projects with federal, local and not-for-profit conservation organizations and private landowners. This plan should be used as a tool by the Conservation 2000 watershed partnerships and the Conservation Congress.

*How* will traditional conservation partners be involved?

A steering committee composed of staff from several divisions of the IDNR and representatives from The Nature Conservancy, Illinois Audubon Society, Ducks Unlimited and The National Wild Turkey Federation are guiding development of the plan. The steering committee began meeting in February 2004 and members have been encouraged to talk about the plan with their peers, including coworkers, friends and constituents. In addition, regional workshops will be held to involve many more partners such as land management agencies and conservation organizations.

**Where:** Currently, the IL DNR intends to host one meeting in each of five regions of the state.

**Who:** Invitations will be sent by group email and bulk mailing to approximately 200 organizations on the Conservation Congress list provided by Constituency Services. It is hoped that meetings will draw 20-40 people representing about 20 groups in each region.

The **purpose** of the regional public workshops will be to:

Inform the public about the process.

Present charts and discuss trends on habitat descriptions, use of harvest goals and population

***Appendix I, continued.***

targets, and identification of key threats through workstations that have maps and displays, so that the public understands the rationale behind the data and significance to their region.

Identify information gaps or additional sources of data.

Present conservation actions, as developed by the steering committee, for public understanding and to demonstrate how IDNR intends to manage stressors that are threatening species of concern and their supporting habitats.

Determine resources and conservation priorities represented by the groups in attendance.

Identify and recruit new constituencies that are aligned with IDNR priorities.

Energize supporters and focus their energies on high priority conservation projects, perhaps in anticipation of forming regional implementation subcommittees and volunteerism to conduct projects for which IDNR does not have adequate resources.

Discuss the long-term goal of direct involvement by local stakeholders in identifying places, setting priorities, establishing goals and developing conservation philosophies for sites.

Participants will be asked to address three questions, specifically regarding their region:

What are the key conservation issues?

What should the conservation projects achieve?

How could you contribute to these projects?

The agenda for the meetings will be consistent throughout the five locations to avoid any perception of inconsistency in agency messages from region to region.

**Facilitation:** D.J. Case & Associates will facilitate and record the first meeting, and possibly additional

***Appendix I, continued.***

meetings, dependent upon scheduling, availability and budget. Meetings will be used as a training opportunity for IDNR facilitators who will manage any meetings that DJCA cannot attend. Raw notes will be summarized as bullet statements (notes will not be verbatim transcripts) and made available to the IDNR for additional processing and consideration in plan development.

**Timeline:** Meetings will be scheduled following completion of IDNR regional meetings, most likely held in early November. Meetings likely will be distributed over several weeks to allow processing of information and preparation between meetings.

How will potentially concerned interests be involved?

The IDNR coordinator will meet with any interest groups that may react negatively to the conservation plan. Involving them early in the process and meeting with them to hear their concerns in a nonconfrontational environment will help participants find common ground and produce understanding of their mutual needs and expectations.

**Who:** The coordinator will contact organizations known to have a strong interest in land use and water management, such as the Farm Bureau, housing development organizations, and others.

**Purpose:** The goal for the meetings will be to develop informed consent among these interests to avoid confrontations at a later point and possibly generate new constituents for implementation phases of the plan.

**Timeline:** Meetings are in process and will continue as needed throughout plan development.

***Appendix I, continued.***

What mechanisms will be available for announcements and document review?

Press releases introduced the CWCP process in December 2003. IDNR will provide additional updates through regular channels throughout the next two years.

A link on IDNR website will provide an introduction, questions & answers, review of criteria and species selection, comments on sites, actions, and public review of the draft plan.

Periodic updates on the planning process and a draft of the CWCP will be posted to the website with comments sent to project coordinator Jeff Walk at jwalk@dnrmail.state.il.us.

A draft of the plan will be made available for public comment, probably early in 2005. The plan will be posted on the IDNR website and announced through print media. For individuals without internet capability, the plan will be available for review on CD-ROM or in hard copy upon request.

Preparation for regional meetings

The IDNR coordinator will provide a PowerPoint presentation that introduces the groups to the planning process and the level and type of involvement requested from the group. DJCA will assist the coordinator with development of the following:

Agendas for the two types of meetings, designed to be an effective use of the time available for input.

A PowerPoint presentation for each of the two types of meetings with attention to the structure of the presentation, level of detail in explanation, strategy for wording and presenting the information, management of audience participation and expectations, and preparation to handle questions that are likely to arise.

Facilitation of at least one public meeting with additional meetings depending upon budget and scheduling availability.

***Appendix I, continued.***

Training of facilitators for meetings where DJCA cannot be present. The IDNR facilitators will attend the meeting(s) facilitated by DJCA to observe how the input is handled. DJCA will meet with IDNR facilitators to debrief after each session to discussion strategy and group dynamics.

Due to restrictions in the project budget and inevitable needs that may not be anticipated, DJCA believes that it is in the best interest of both parties to bill on an hourly basis for involvement in the project. DJCA will focus first on assisting with development of the meeting agendas and review of the PowerPoint presentations to maximize preparation before the meetings. DJCA will facilitate and record the first meeting with IDNR facilitators present for training purposes. Depending on the remaining budget and timing of additional public meetings, DJCA will facilitate as many of those meetings as feasible, depending on IDNR needs and DJCA scheduling availability. IDNR will be responsible for all meeting logistics and invitations.

**Personnel**

Gwen White will serve as the lead contact on the project and will coordinate activities of other staff. Phil Seng or Gwen White will serve as lead facilitator with assistance from Gwen White or Tim Longwell and staff of the INHS and IDNR. Gwen White, Phil Seng, Dave Case, and Tim Longwell will work on review and development of presentation materials. Marci Greenroyd will provide administrative assistance to the project staff.

**Appendix II.** Introduction to the development of the Plan/Strategy in the First Quarter 2004 issue of the *DNR Update* newsletter.

DNR Update

Grants

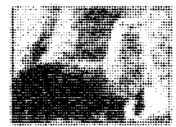
# Illinois' Comprehensive Wildlife Conservation Plan

## Small Project Program Grants Available

Illinois Department of Natural Resources

**Appendix III.** Article on development of the Plan/Strategy from the Spring/Summer 2004 *Conservation Communicator* newsletter of the C2000 project, distributed to watershed conservation groups.

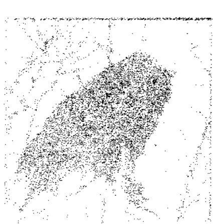
Feature



## Illinois Comprehensive Wildlife Conservation Plan

### Eight Elements Required by Congress for Comprehensive Wildlife Conservation Plans

- Distribution and abundance of declining wildlife species
- Locations and relative condition of key habitats and community types
- Problems which may adversely affect identified species or their habitats
- Conservation actions proposed to conserve species and habitats
- Plans for monitoring species and their habitats
- Procedures to review the State Comprehensive Wildlife Conservation Plan
- Coordination of the development, implementation, and revision of the plan
- Provisions to ensure public participation in the development and implementation of the plan



**Appendix IV.** Editorial by Joel Brunsvold, Director of the Department of Natural Resources, soliciting participation in the development of the Plan/Strategy in his November 2004 editorial in the Outdoor Illinois magazine.

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**Appendix V.** Press release on the acceptance of the Illinois Comprehensive Wildlife Conservation Plan/Strategy.

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**Illinois Department of**
**Natural Resources**
One Natural Resources Way
Springfield, Illinois 62702-1271
http://dnr.state.il.us

Rod R. Blagojevich, Governor
Joel Brunsvold, Director

**FOR IMMEDIATE RELEASE**
October 31, 2005

**CONTACTS: Melaney Arnold**
Communications Manager
(217) 588-0500 (office)
(217) 836-6438 (cell)

**ILLINOIS PLAN TO CONSERVE WILDLIFE, NATURAL AREAS ACCEPTED**

SPRINGFIELD, ILL. - The Illinois Wildlife Action Plan, the product of a two-year effort by scientists, sportsmen, conservationists and other members of the community to conserve and enhance the state's wildlife, has been accepted by the U. S. Fish and Wildlife Service, Illinois Department of Natural Resources (IDNR) Director Joel Brunsvold announced today.

All states and territories agreed to develop a Wildlife Action Plan and submit it to the U.S. Fish and Wildlife Service by October 1, 2005, as a condition of accepting State Wildlife Grant Program funding for non-game conservation. Thanks to more than 150 agencies and organizations that assisted in developing the document, the Illinois Wildlife Action Plan is among the first ten to be accepted nationwide.

"Illinois has tremendously valuable land and water," said Brunsvold. "As we use these resources for housing, agricultural production and economic development, it is important to consider how we are going to conserve our wildlife and natural areas for future generations to enjoy. A pro-active plan will be more cost-effective than waiting until wildlife becomes more rare and more difficult to protect."

The Illinois Wildlife Action Plan identifies goals for fish and wildlife conservation, and priority actions to address problems affecting wildlife. A committee of Illinois Department of Natural Resources staff and representatives from The Nature Conservancy, Illinois Audubon Society, the National Wild Turkey Federation and Ducks Unlimited provided oversight of the planning process. The Department of Natural Resources has welcomed public participation through workshops and other opportunities to review the draft action plan.

"The Illinois plan considers the unique natural resources, historic trends a nd public interests of the state," said Robyn Thorson, U.S. Fish and Wildlife Service Midwest Regional Director. "The Service was pleased to participate in the development of the Illinois plan by identifying key, natural resources at our national wildlife refuges, as well as trust responsibilities, such as migratory birds. We now look forward to continued partnership with Illinois, to help address priority actions identified in its plan."

***Appendix V, continued.***

"The cooperation of many agencies, the agricultural community and conservation organizations in putting together the action plan has been encouraging," said Jeff Walk, a research scientist with the Illinois Natural History Survey, who coordinated the development of the Illinois Wildlife Action Plan for the IDNR. "We all recognize that healthy wildlife populations, functioning natural systems and clean water go hand-in-hand with our own health and quality of life. It's worth the investment."

Wildlife-associated recreation generates nearly $4 billion in economic activity in Illinois each year. Fishing and hunting provide about 40 million days of recreation, with a value of more than $2.5 billion. Non-consumptive activities, such as bird watching and photography, generate about $1.3 billion in economic activity and support more than 13,000 jobs.

Details on the Illinois Wildlife Action Plan are available on the IDNR web site at the following link: http://dnr.state.il.us/orc/Wildliferesources/theplan/

IDNR is offering 20 minutes blocks of time on Wednesday morning, November 2, 2005, from 9:00 a.m. to 11:30 a.m. to interview Illinois Natural History Survey research scientist Jeff Walk about the Wildlife Action Plan. Call Melaney Arnold at (217) 558-0500 to reserve a time.

###

**Appendix VI.** Article on the final Plan/Strategy (or "Wildlife Action Plan") from the January 2006 issue of the magazine, *Outdoor Illinois*.

By investing in the Illinois Wildlife Action Plan, we're conserving wildlife and natural areas for future generations.

# The Illinois Wildlife Action Plan

Story By [illegible]
Photos By [illegible]

Ask people about their favorite wildlife memory and often the answer centers on a place that's very special to them.

When I was a kid, there was a stream behind our subdivision where we built rock dams and caught crayfish and minnows.

[illegible]

[illegible]

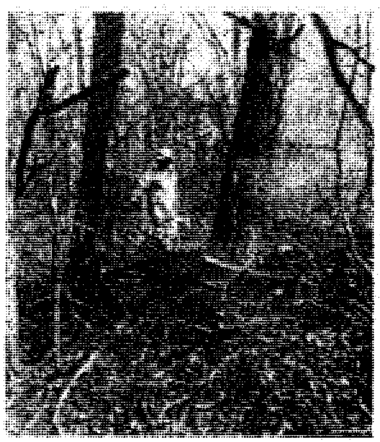
[illegible]

**Scientists flagged about one in three of the state's mussels, fishes, amphibians, reptiles, birds and mammals as species in need of conservation. Illinois is at the core of the range of the red-headed woodpecker, which is still common but has declined sharply over the past 30 years.**

[illegible]

[illegible]

***Appendix VI, continued.***



[illegible] Program, we have [illegible] half as much grassland as in 19[illegible]. And constantly, a dizzying barrage of new plants, animals and diseases find their way into Illinois, crowding out the native flora and fauna that make Illinois unique [illegible]

[illegible] In the fall of 2005, Illinois and every other state completed a Wildlife Action Plan to consider the wildlife and places that need extra help and to decide the most important conservation actions to take. More than 150 agencies, conservation groups and agricultural and development interests worked together to build the innovative Illinois Wildlife Action Plan.

**Destruction of habitat is an obvious problem, but with proper planning, development can minimize impacts and incorporate "green areas."**

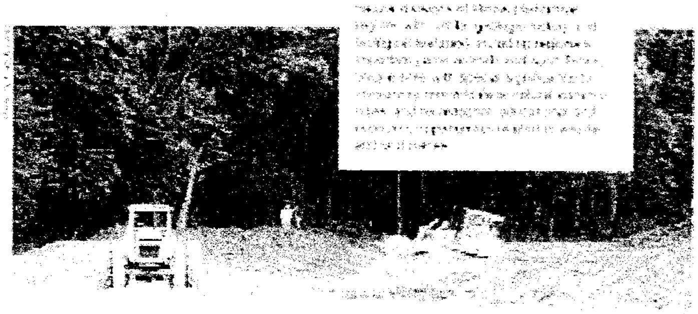
**The Illinois Wildlife Action Plan outlines objectives for both nongame and game species and how to improve the quality of existing habitat through a variety of techniques, including prescribed burns and removal of exotic species such as purple loosestrife (above).**

By [illegible] populations or special needs, conservation will be more effective—and less [illegible] [illegible] Making the Illinois Wildlife Action Plan successful is going to take many people and groups working together, just as they did to develop the plan. [illegible] this is worth the investment. [illegible] helping wildlife benefits people, too.

The lands and waters of Illinois are [illegible] important natural resources for the 12 million citizens of Illinois. Everyone needs land and water for so many things: places to live, food and drinking water, economic development, recreation and agricultural production. Hopefully there's room for wildlife in these places.

## What's in the Illinois Wildlife Action Plan?

[illegible]



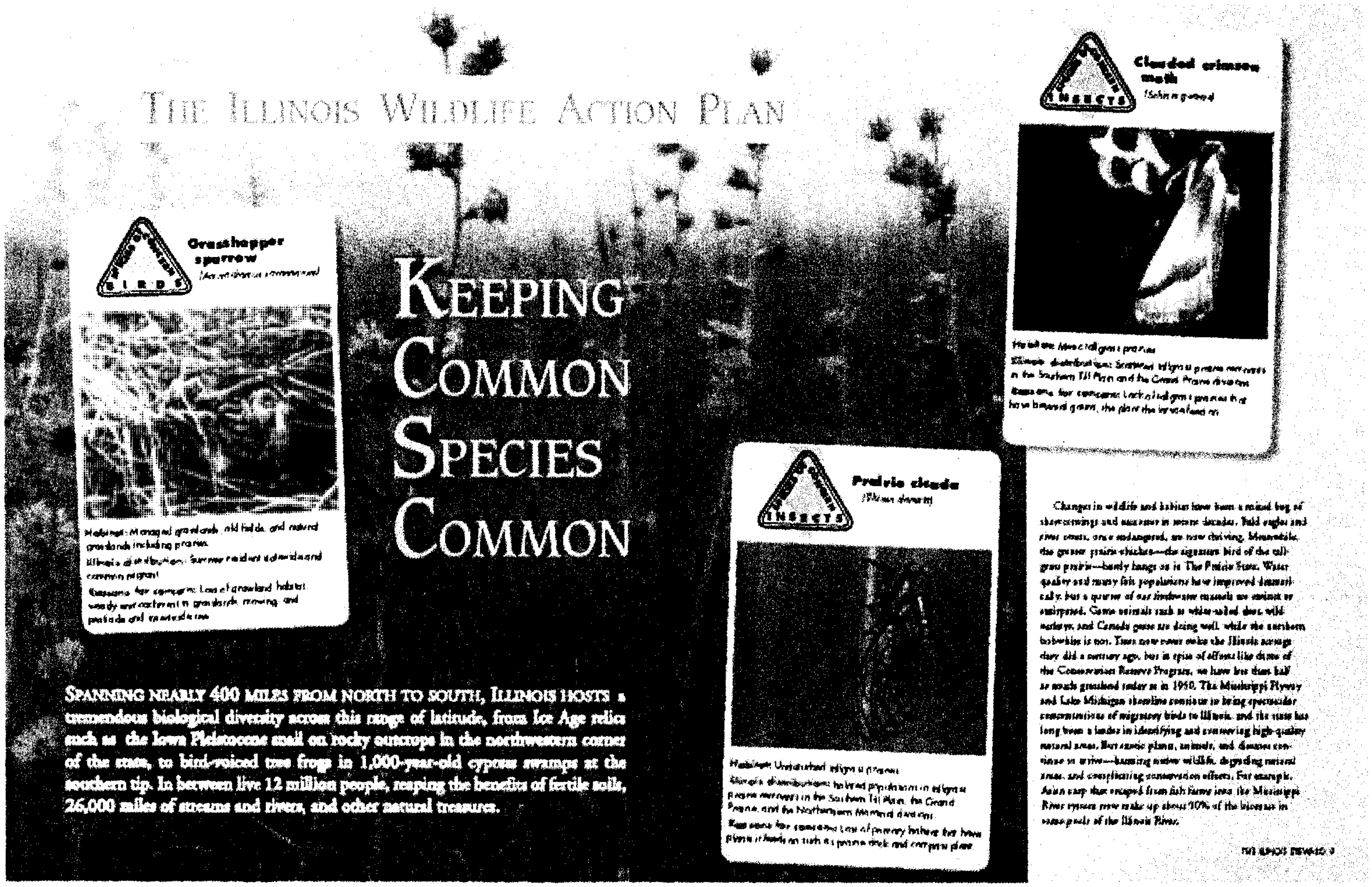
*Appendix VI, continued.*

## Learn more about the plan

**The Illinois Wildlife Action Plan is a long-term strategy for conserving natural areas for future generations.**

**Illinois' new action plan recognizes the importance of wildlife and wild places as family traditions.**

**Appendix VII.** Article on the final Plan/Strategy (or "Wildlife Action Plan") from the Summer 2006 issue of the magazine, *The Illinois Steward.*



THE ILLINOIS WILDLIFE ACTION PLAN

# KEEPING COMMON SPECIES COMMON

Grasshopper sparrow

Prairie cicada

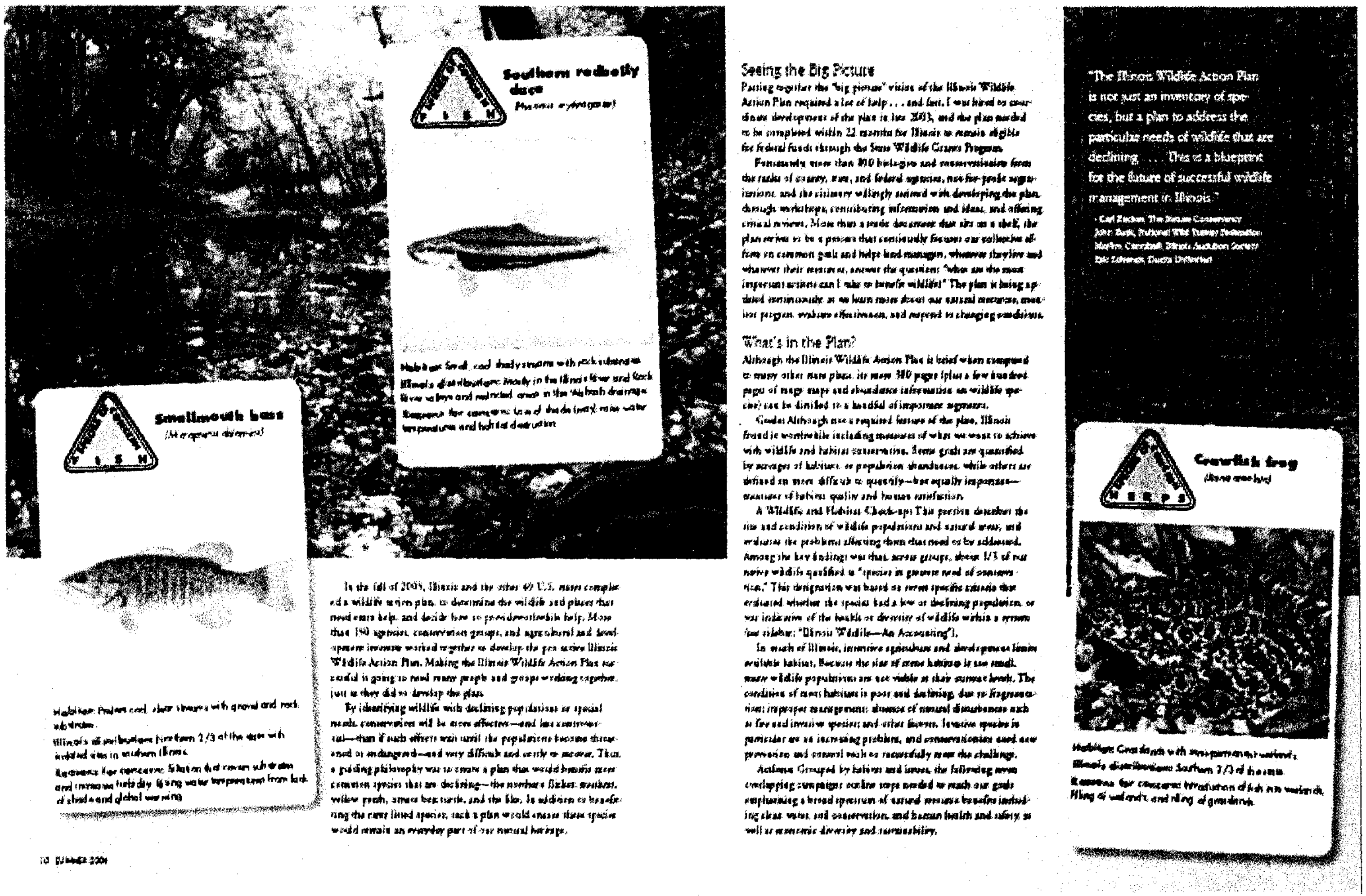
Clouded crimson moth

SPANNING NEARLY 400 MILES FROM NORTH TO SOUTH, ILLINOIS HOSTS a tremendous biological diversity across this range of latitude, from Ice Age relics such as the Iowa Pleistocene snail on rocky outcrops in the northwestern corner of the state, to bird-voiced tree frogs in 1,000-year-old cypress swamps at the southern tip. In between live 12 million people, reaping the benefits of fertile soils, 26,000 miles of streams and rivers, and other natural treasures.

Changes in wildlife and habitat have been a mixed bag of shortcomings and successes in recent decades. Bald eagles and river otters, once endangered, are now thriving. Meanwhile, the greater prairie-chicken—the signature bird of the tallgrass prairie—barely hangs on in The Prairie State. Water quality and many fish populations have improved dramatically, but a quarter of our freshwater mussels are extinct or extirpated. Game animals such as white-tailed deer, wild turkeys, and Canada geese are doing well, while the northern bobwhite is not. Trees now cover twice the Illinois acreage they did a century ago, but in spite of efforts like those of the Conservation Reserve Program, we have less than half as much grassland today as in 1950. The Mississippi Flyway and Lake Michigan shoreline continue to bring spectacular concentrations of migratory birds to Illinois, and the state has long been a leader in identifying and protecting high-quality natural areas. But exotic plants, animals, and diseases continue to arrive—harming native wildlife, degrading natural areas, and complicating conservation efforts. For example, Asian carp that escaped from fish farms into the Mississippi River system now make up about 10% of the biomass in some pools of the Illinois River.

THE ILLINOIS STEWARD 9

*Appendix VII, continued.*




In the fall of 2005, Illinois and the other 49 U.S. states completed a wildlife action plan, to determine the wildlife and places that need extra help, and decide how to provide worthwhile help. More than 150 agencies, conservation groups, and agricultural and development interests worked together to develop the pro-active Illinois Wildlife Action Plan. Making the Illinois Wildlife Action Plan successful is going to need many people and groups working together, just as they did to develop the plan.

By identifying wildlife with declining populations or special needs, conservation will be more effective—and less controversial—than if such efforts wait until the populations become threatened or endangered—and very difficult and costly to recover. Thus, a guiding philosophy was to create a plan that would benefit more common species that are declining—the northern flicker, meadowlark, willow prairie, ornate box turtle, and the like. In addition to benefiting the rarer listed species, such a plan would ensure these species would remain an everyday part of our natural heritage.

## Seeing the Big Picture

Putting together the "big picture" vision of the Illinois Wildlife Action Plan required a lot of help . . . and fast. I was hired to coordinate development of the plan in late 2003, and the plan needed to be completed within 22 months for Illinois to remain eligible for federal funds through the State Wildlife Grants Program.

Fortunately more than 300 biologists and conservationists from the ranks of county, state, and federal agencies, not-for-profit organizations, and the citizenry willingly assisted with developing the plan, through workshops, contributing information and ideas, and offering critical reviews. More than a static document that sits on a shelf, the plan strives to be a process that continually focuses our collective efforts on common goals and helps land managers, wherever they live and whatever their resources, answer the question: "what are the most important actions can I take to benefit wildlife?" The plan is being updated continuously as we learn more about our natural resources, monitor progress, evaluate effectiveness, and respond to changing conditions.

## What's in the Plan?

Although the Illinois Wildlife Action Plan is brief when compared to many other state plans, its mere 340 pages (plus a few hundred pages of maps and abundance information on wildlife species) can be distilled to a handful of important segments.

Goals: Although not a required feature of the plan, Illinois found it worthwhile including measures of what we want to achieve with wildlife and habitat conservation. Some goals are quantified by acreages of habitats or population abundances, while others are defined in more difficult to quantify—but equally important—measures of habitat quality and human satisfaction.

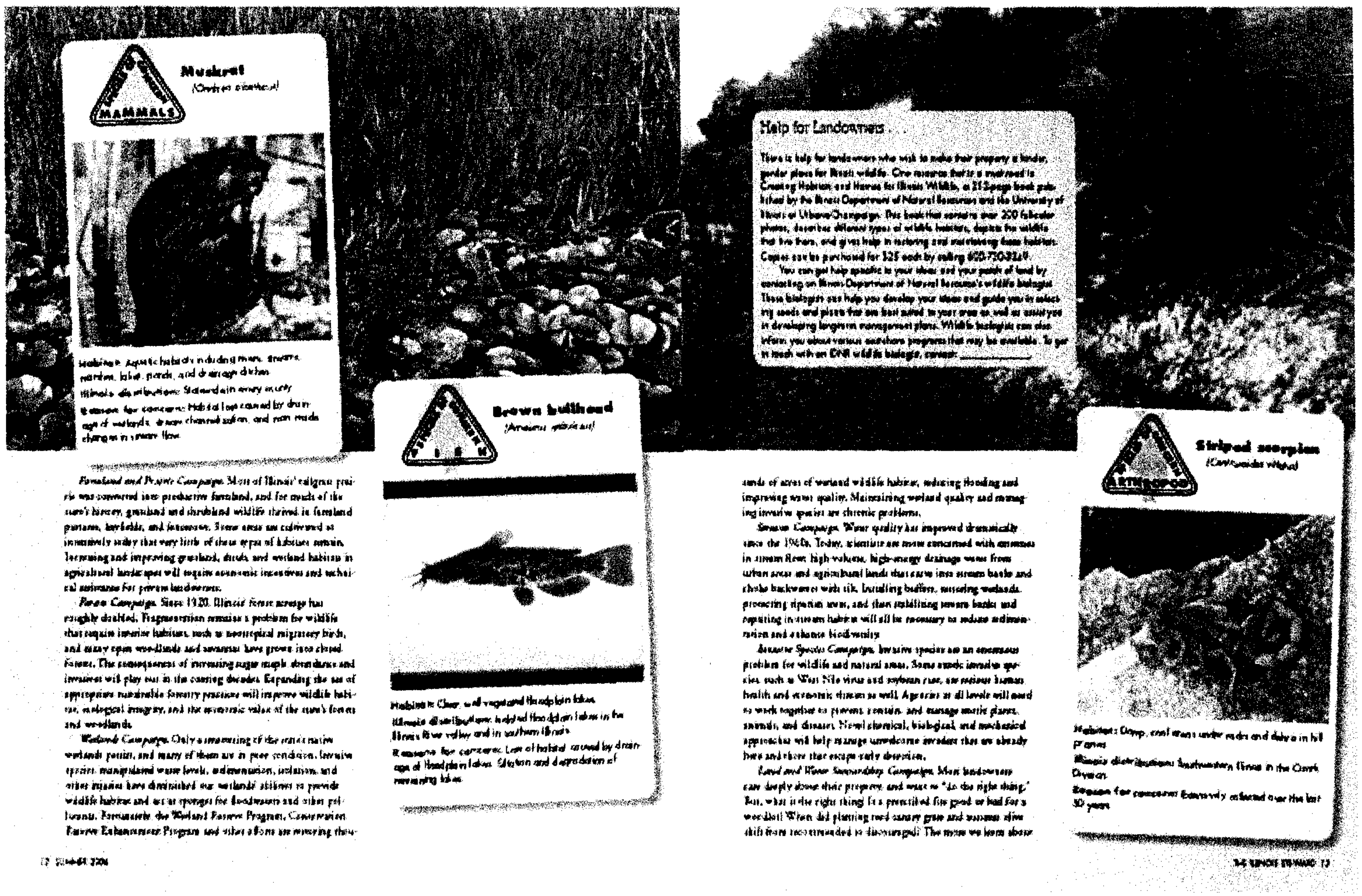
A Wildlife and Habitat Check-up: This portion describes the size and condition of wildlife populations and natural areas, and evaluates the problems affecting them that need to be addressed. Among the key findings was that, across groups, about 1/3 of our native wildlife qualified as "species in greatest need of conservation." This designation was based on seven specific criteria that evaluated whether the species had a low or declining population, or was indicative of the health or diversity of wildlife within a system (see sidebar, "Illinois Wildlife—An Accounting").

In much of Illinois, intensive agriculture and development limits available habitat. Because the size of some habitats is too small, many wildlife populations are not viable at their current levels. The condition of most habitats is poor and declining, due to fragmentation; improper management; absence of natural disturbances such as fire and invasive species; and other factors. Invasive species in particular are an increasing problem, and conservationists need new prevention and control tools to successfully meet this challenge.

Actions: Grouped by habitat and issues, the following seven overlapping campaigns outline steps needed to reach our goals emphasizing a broad spectrum of natural resource benefits including clean water, soil conservation, and human health and safety, as well as economic diversity and sustainability.

"The Illinois Wildlife Action Plan is not just an inventory of species, but a plan to address the particular needs of wildlife that are declining . . . This is a blueprint for the future of successful wildlife management in Illinois."

*Appendix VII, continued.*



**Muskrat**
*(Ondatra zibethicus)*

MAMMALS

**Habitat:** Aquatic habitats including rivers, streams, marshes, lakes, ponds, and drainage ditches.
**Illinois distribution:** Statewide in every county.
**Reason for concern:** Habitat loss caused by drainage of wetlands, stream channelization, and man-made changes in stream flow.

*Farmland and Prairie Campaign.* Most of Illinois' tallgrass prairie was converted into productive farmland, and for much of the state's history, grassland and shrubland wildlife thrived in farmland pastures, hayfields, and fencerows. These areas are cultivated so intensively today that very little of these types of habitat remain. Increasing and improving grassland, shrub, and wetland habitat in agricultural landscapes will require economic incentives and technical assistance for private landowners.

*Forest Campaign.* Since 1920, Illinois' forest acreage has roughly doubled. Fragmentation remains a problem for wildlife that require interior habitats, such as neotropical migratory birds, and many open woodlands and savannas have grown into closed forests. The consequences of increasing sugar maple abundance and invasives will play out in the coming decades. Expanding the use of appropriate sustainable forestry practices will improve wildlife habitat, ecological integrity, and the economic value of the state's forests and woodlands.

*Wetlands Campaign.* Only a smattering of the state's native wetlands persist, and many of them are in poor condition. Invasive species, manipulated water levels, sedimentation, isolation, and other injuries have diminished our wetlands' abilities to provide wildlife habitat and act as sponges for floodwaters and other pollutants. Fortunately, the Wetland Reserve Program, Conservation Reserve Enhancement Program and other efforts are restoring thousands of acres of wetland wildlife habitat, reducing flooding and improving water quality. Maintaining wetland quality and managing invasive species are chronic problems.

**Brown bullhead**
*(Ameiurus nebulosus)*

**Habitat:** Clear, well vegetated floodplain lakes.
**Illinois distribution:** Isolated floodplain lakes in the Illinois River valley and in southern Illinois.
**Reason for concern:** Loss of habitat caused by drainage of floodplain lakes. Siltation and degradation of remaining lakes.

*Streams Campaign.* Water quality has improved dramatically since the 1960s. Today, scientists are more concerned with extremes in stream flow: high-volume, high-energy drainage water from urban areas and agricultural lands that carve into stream banks and choke backwaters with silt. Installing buffers, restoring wetlands, protecting riparian areas, and then stabilizing stream banks and repairing in-stream habitat will all be necessary to reduce sedimentation and enhance biodiversity.

*Invasive Species Campaign.* Invasive species are an enormous problem for wildlife and natural areas. Some exotic invasive species, such as West Nile virus and soybean rust, are serious human health and economic threats as well. Agencies at all levels will need to work together to prevent, contain, and manage exotic plants, animals, and diseases. Novel chemical, biological, and mechanical approaches will help manage unwelcome invaders that are already here and those that escape early detection.

*Land and Water Stewardship Campaign.* Most landowners care deeply about their property and want to "do the right thing." But, what is the right thing? Is a prescribed fire good or bad for a woodlot? When did planting reed canary grass and autumn olive shift from recommended to discouraged? The more we learn about

Help for Landowners . . .

There is help for landowners who wish to make their property a kinder, gentler place for Illinois wildlife. One resource that is a must-read is Creating Habitats and Homes for Illinois Wildlife, a 213-page book published by the Illinois Department of Natural Resources and the University of Illinois at Urbana-Champaign. This book that contains over 250 full-color photos, describes different types of wildlife habitats, depicts the wildlife that live there, and gives help in restoring and maintaining these habitats. Copies can be purchased for $25 each by calling 800-720-2249.

You can get help specific to your ideas and your parcel of land by contacting an Illinois Department of Natural Resources's wildlife biologist. These biologists can help you develop your ideas and guide you in selecting seeds and plants that are best suited to your area as well as assist you in developing long-term management plans. Wildlife biologists can also inform you about various cost-share programs that may be available. To get in touch with an DNR wildlife biologist, contact: ______________

**Striped scorpion**
*(Centruroides vittatus)*

ARTHROPOD

**Habitat:** Dry, cool areas under rocks and debris in hill prairies.
**Illinois distribution:** Southwestern Illinois in the Ozark Division.
**Reason for concern:** Extensively collected over the last 30 years.

12 ILLINOIS ... 2006 ... THE ILLINOIS STEWARD 13

## Appendix VII, continued.

## Appendix VII, continued.

Illinois Wildlife—An Accounting*

| Wildlife | Total number | Species in greatest need of conservation* | Threatened/ endangered |
|---|---|---|---|
| Mussels | 81** | 35 | 24 |
| Snails | 170 | 25 | 2 |
| Insects | About 17,000 | 247 | 12 |
| Crustaceans | 307 | 33 | 10 |
| Fish | 187 | 80 | 31 |
| Amphibians | 41 | 14 | 8 |
| Reptiles | 60 | 27 | 16 |
| Birds | 300*** | 83 | 33 |
| Mammals | 55 | 20 | 9 |
| Totals | About 18,000 | 638 | 148 |

* Based on seven criteria, including low or declining populations, dependence on a rare or vulnerable habitat, and usefulness as an indicator of the health of a community or habitat.
** An additional 17 species are extinct, or have been extirpated from Illinois.
*** Approximate number of regularly occurring species. Including vagrants and accidentals, 432 species have been documented.

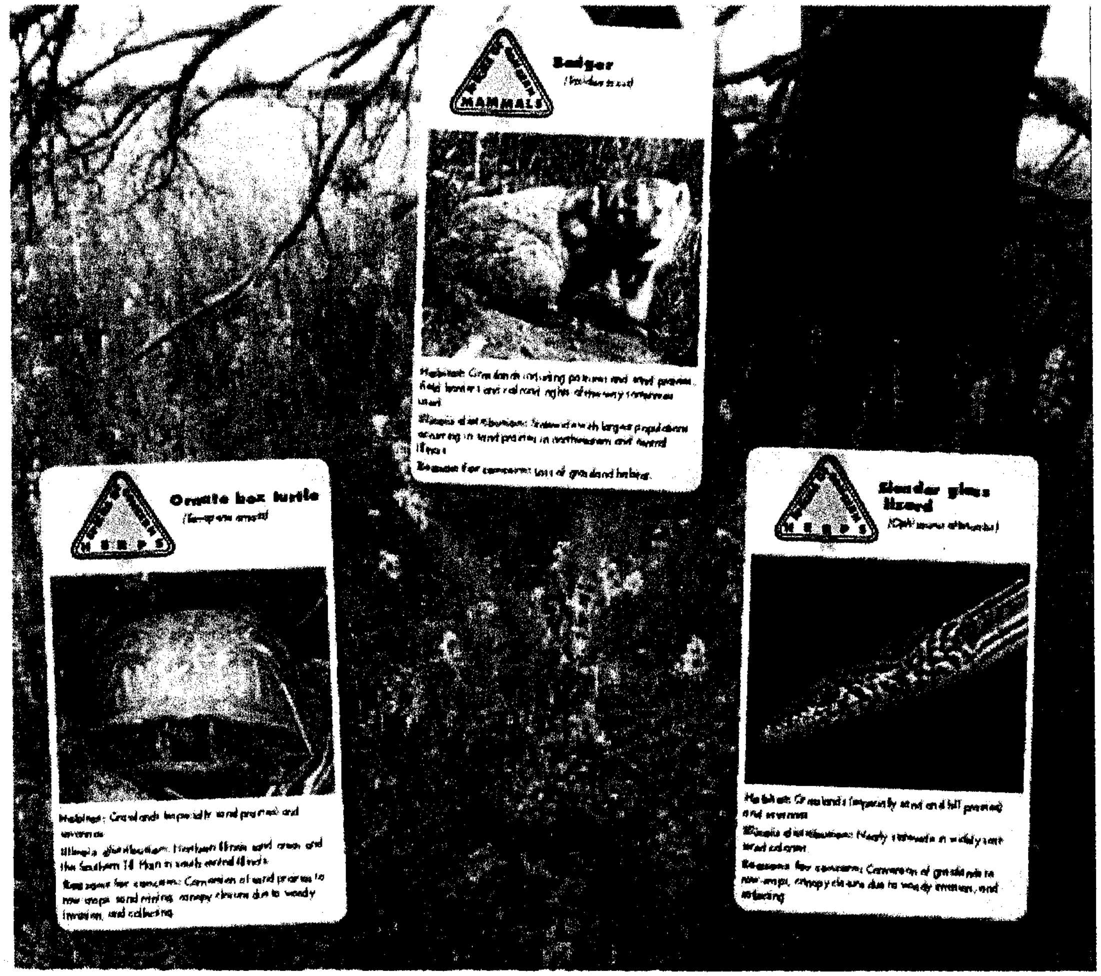
### Now, the Real Work Begins

Soon after the plan was completed, a colleague said to me, "congratulations, we've reached the starting line." And that is so true: implementation of the plan will be the real challenge, and the ultimate measure of whether the effort is a success. The Illinois Department of Natural Resources will be leading the on-the-ground efforts called for in the plan, and is expanding the committee that guided development of the plan to include a broad spectrum of conservation agencies and not-for-profit groups to coordinate actions and foster collaborative efforts.

All landowners in Illinois can do their part, too, to help make the vision of the Illinois Wildlife Action Plan a reality. The first step is to consider what needs to be done in your area by learning what the most important habitats are within your natural division, and whether there is a site of special importance nearby. The second step is to consider what you can do, based on surrounding land uses and other limitations. For example, if you wanted to reforest an area that is only a few acres and not adjacent to other woodlands, the result probably wouldn't attract and sustain the forest species that most need help—typically those that require large forested areas of hundreds of acres. On the other hand, an isolated woodlot, managed as a savanna or open woodland, may indeed attract species of concern such as red-headed woodpeckers and great crested flycatchers that appear to be able to thrive in smaller habitats.

Conserving wildlife makes Illinois a better place to live for all of us. Open space and natural areas enhance property values because people place a premium on green space and the natural beauty of rivers, grasses, savannas, and lakes. Communities surrounded by

14 Summer 2006



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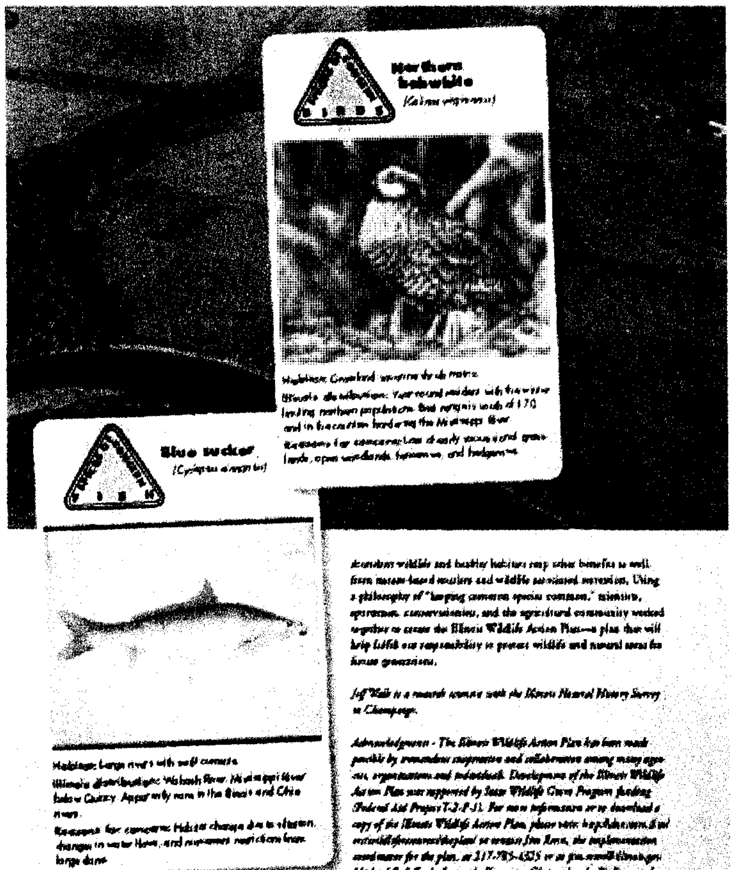



Abundant wildlife and healthy habitats reap other benefits as well, from nature-based tourism and wildlife-associated recreation. Using a philosophy of "keeping common species common," scientists, sportsmen, conservationists, and the agricultural community worked together to create the Illinois Wildlife Action Plan—a plan that will help fulfill our responsibility to protect wildlife and natural areas for future generations.

*Jeff Walk is a research scientist with the Illinois Natural History Survey in Champaign.*

*Acknowledgments - The Illinois Wildlife Action Plan has been made possible by tremendous cooperation and collaboration among many agencies, organizations and individuals. Development of the Illinois Wildlife Action Plan was supported by State Wildlife Grant Program funding (Federal Aid Project T-2-P-1). For more information or to download a copy of the Illinois Wildlife Action Plan, please visit: [illegible] or contact Jim Herkert, the implementation coordinator for the plan, at 217-785-4325 or at [illegible]. Michael R. Jeffords, Laura A. Kammin, Christopher A. Phillips, and Michael E. Retzer provided specific information on the species of concern.*

**Appendix VIII.** Letter sent in July 2004 to roughly 350 agencies, organizations and institutions, soliciting participation in development of the Plan/Strategy.

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Illinois Department of
**Natural Resources**

One Natural Resources Way • Springfield, Illinois 62702-1271
http://dnr.state.il.us

Rod R. Blagojevich, Governor
Joel Brunsvold, Director

Dear Conservation Partner, 25 June 2004

On behalf of the Illinois Department of Natural Resources (IDNR), I would like to invite you and your organization to cooperate in the development of Illinois' Comprehensive Wildlife Conservation Plan (CWCP). The IDNR has committed to developing a CWCP by October 1, 2005, as a condition of receiving federal Wildlife Conservation and Restoration Program and State Wildlife Grants Program funding. In FY04, Illinois received more than $2 million in additional federal funding for conservation work through the State Wildlife Grants Program. Congress has affirmed that the plan should be coordinated with agencies and organizations that control significant land and water resources, or administer programs that significantly affect wildlife and wildlife habitat.

The IDNR is using this non-regulatory planning process to identify fish and wildlife priorities and to create opportunities for working with other organizations to deliver effective, efficient conservation for the people of Illinois. The cooperation of all interested conservation organizations is important for developing strategies in the CWCP that achieve our mutual interests.

For more information on the Comprehensive Wildlife Conservation Plan, please visit the IDNR's homepage at: http://dnr.state.il.us/ORC/new.htm or contact me. If you would like to be on a mailing list for future updates in the CWCP process and opportunities to provide input, or to review the draft CWCP, please respond to me by 27 July 2004, and indicate if you would prefer to receive information electronically (email) or printed. Time commitments for participating in this process will be entirely at the discretion of your organization. With your cooperation, I am confident the CWCP will be a benefit to the people and natural resources of Illinois.

Sincerely,

Jeffery W. Walk, Ph.D.
Comprehensive Wildlife Conservation Plan Coordinator

Telephone (217) 782-6384
Email jwalk@dnrmail.state.il.us

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**Appendix IX.** Sample slide show of presentations given to agencies and organizations, explaining development of the Plan/Strategy, and inviting their participation and review. An estimated 600 people saw the 31 presentations made from December 2004 through May 2005.

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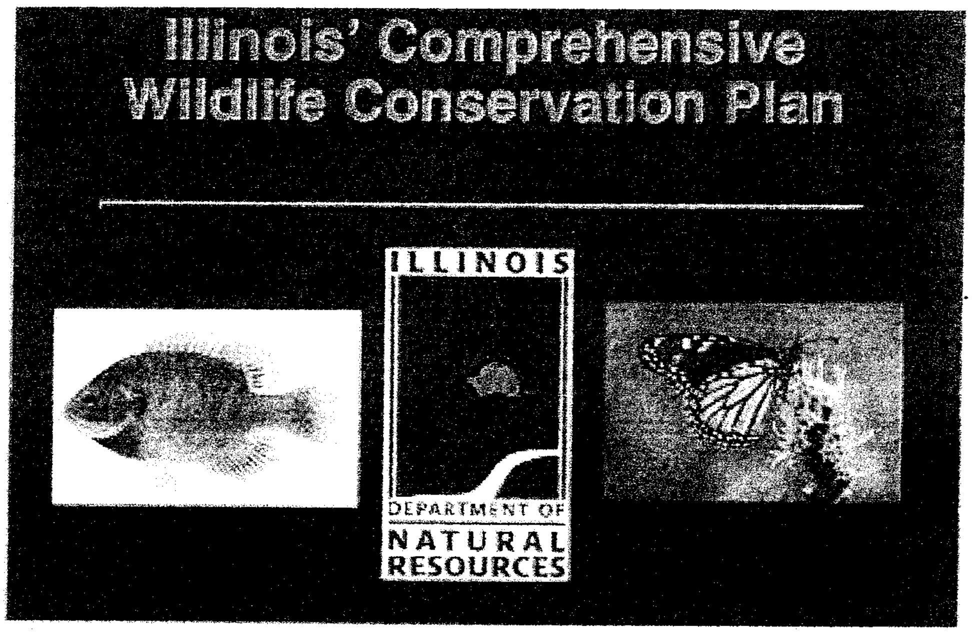


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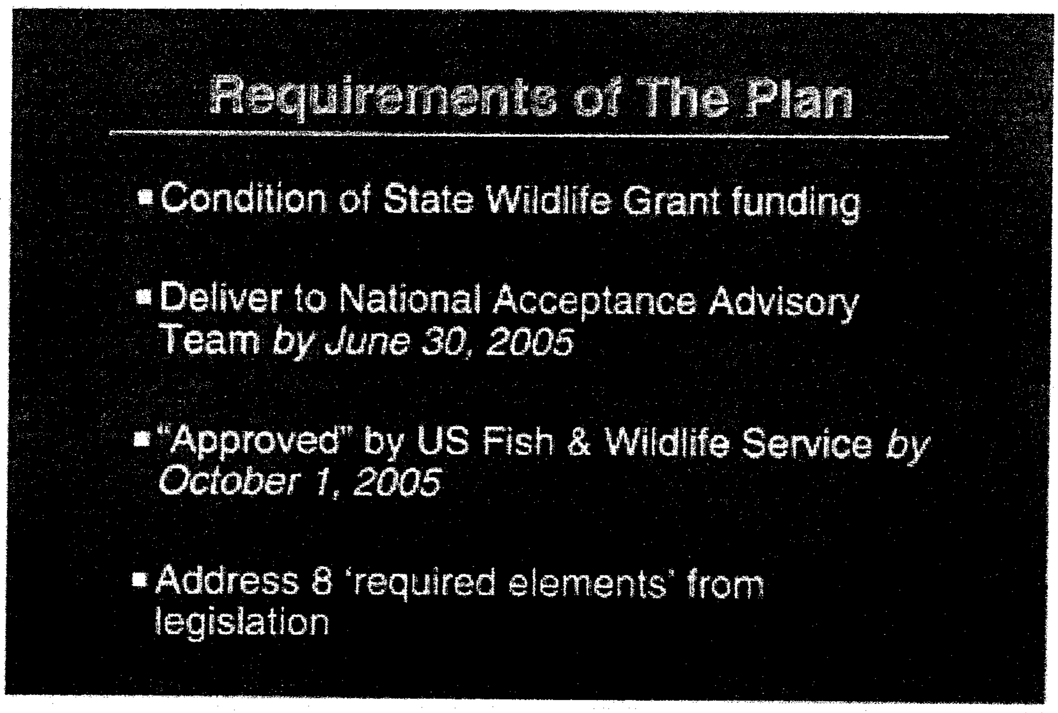


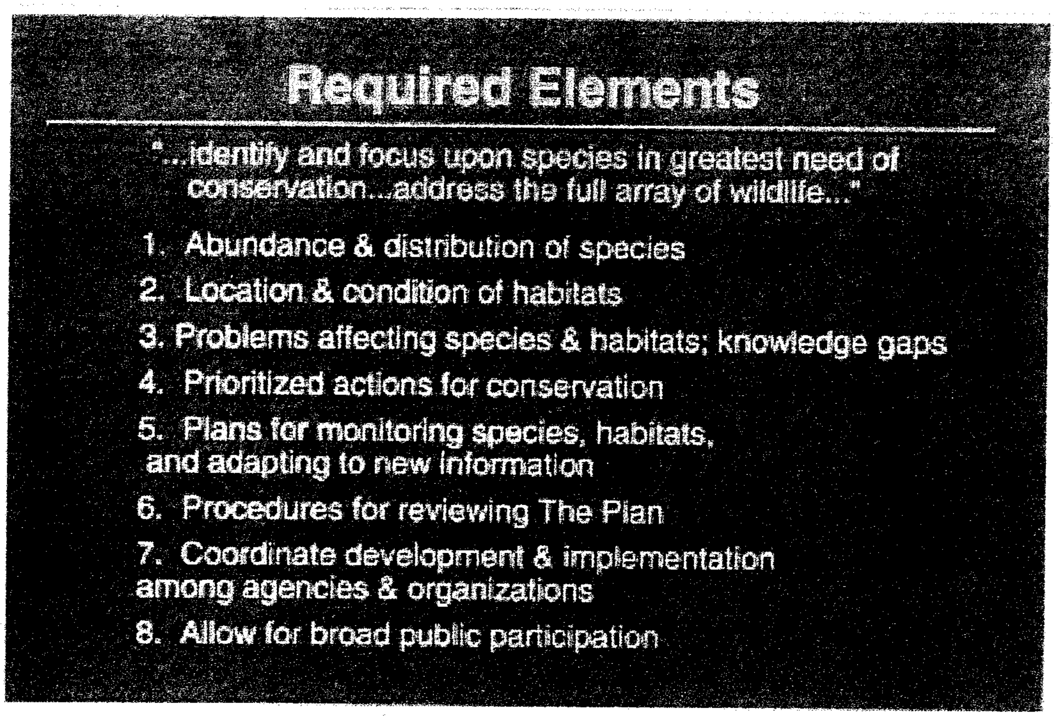

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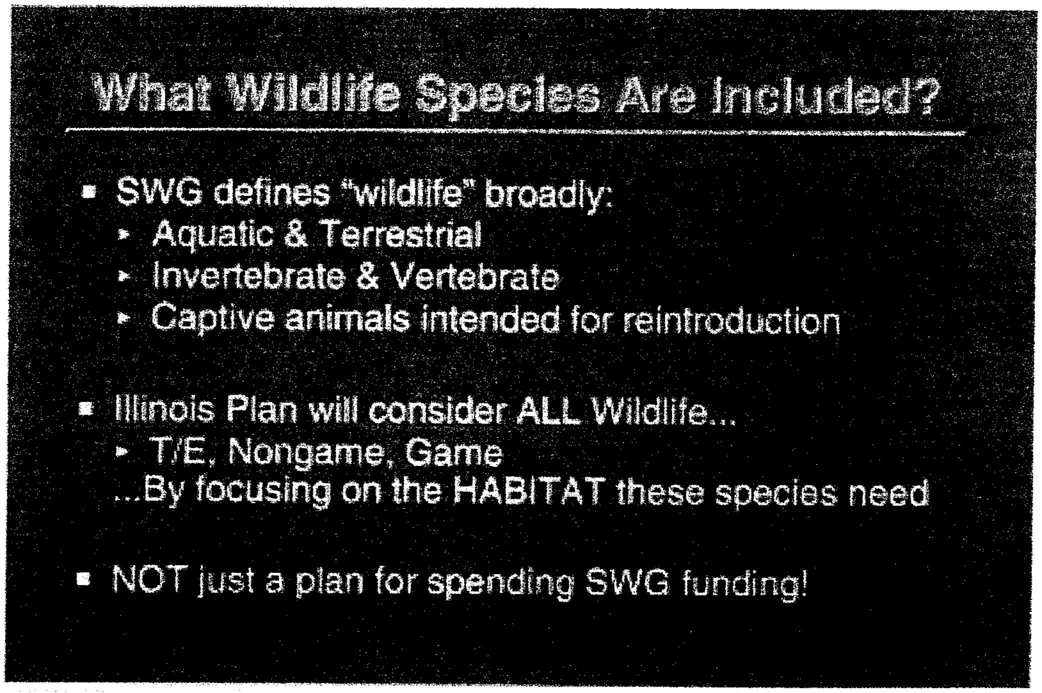


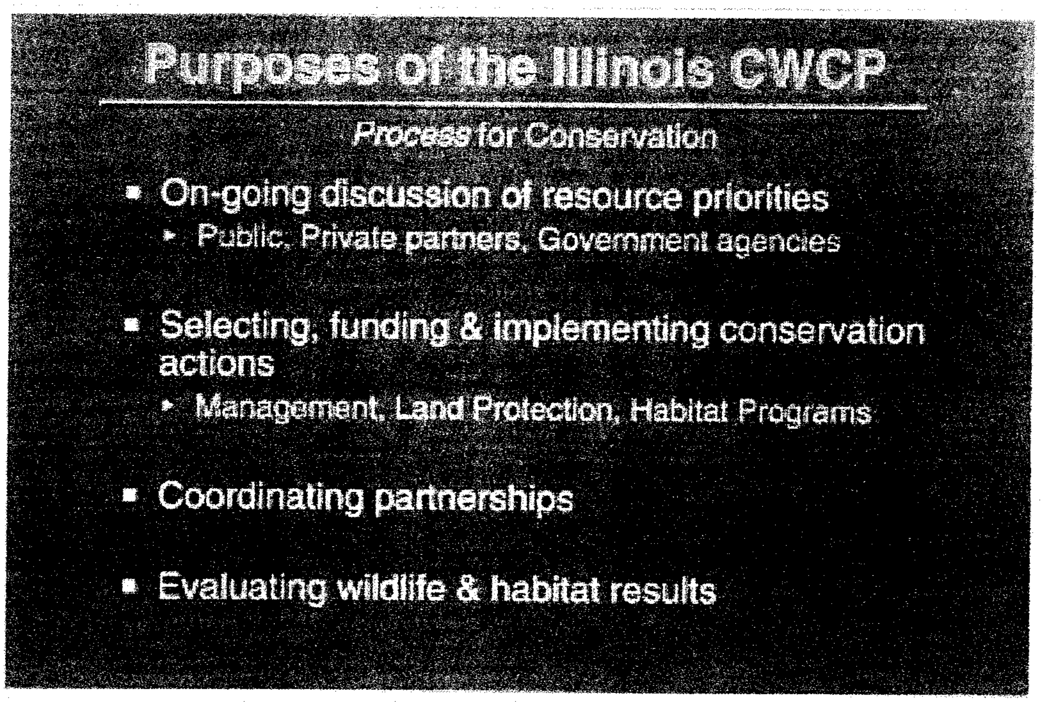

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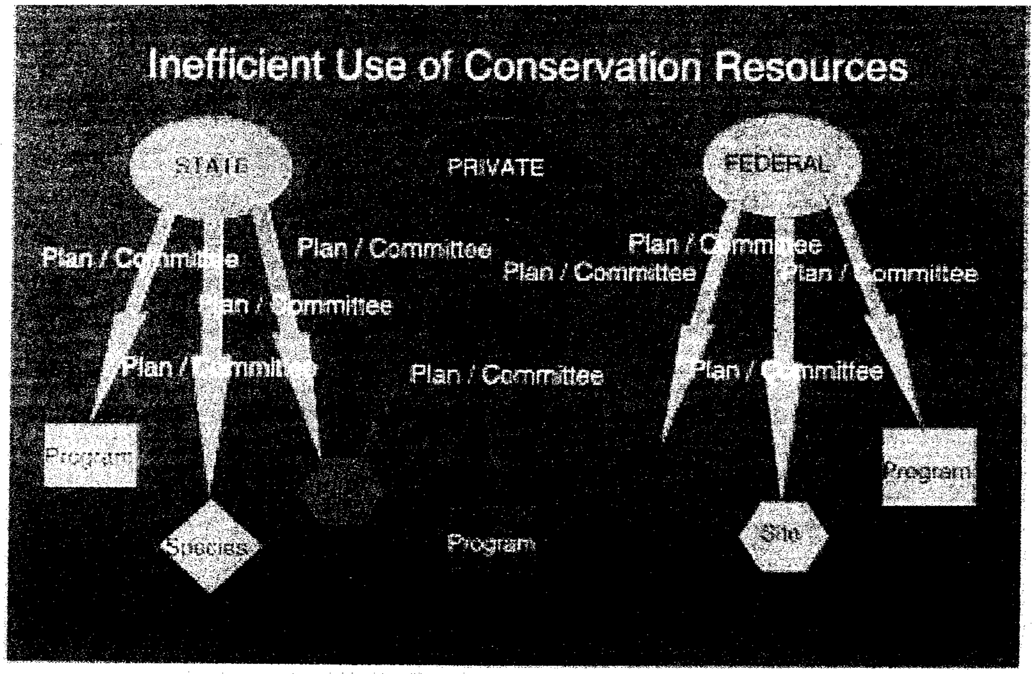


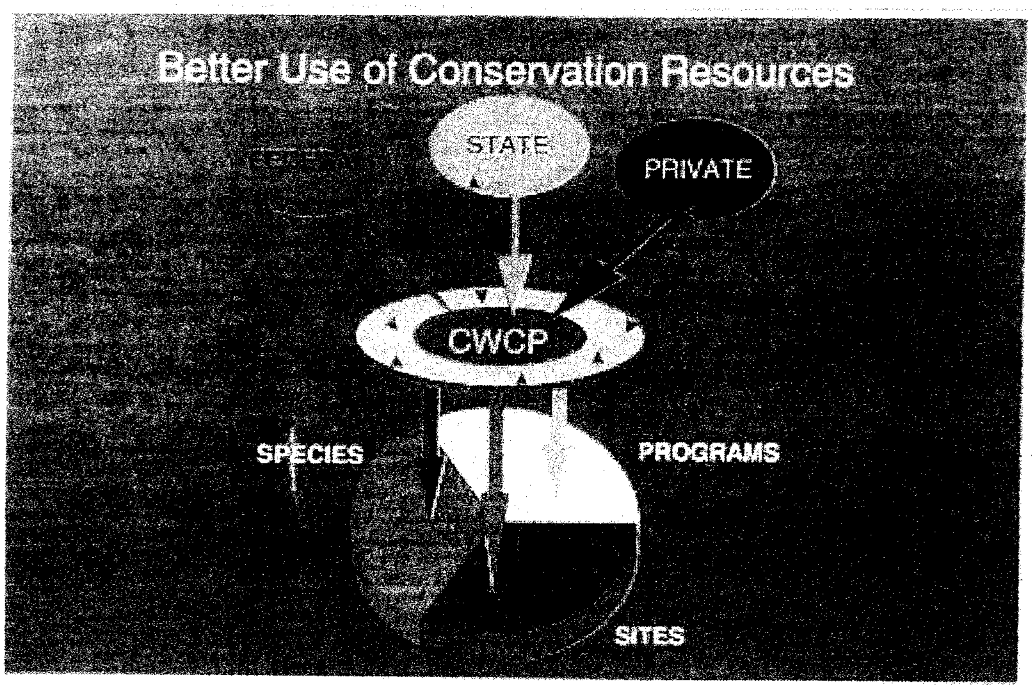

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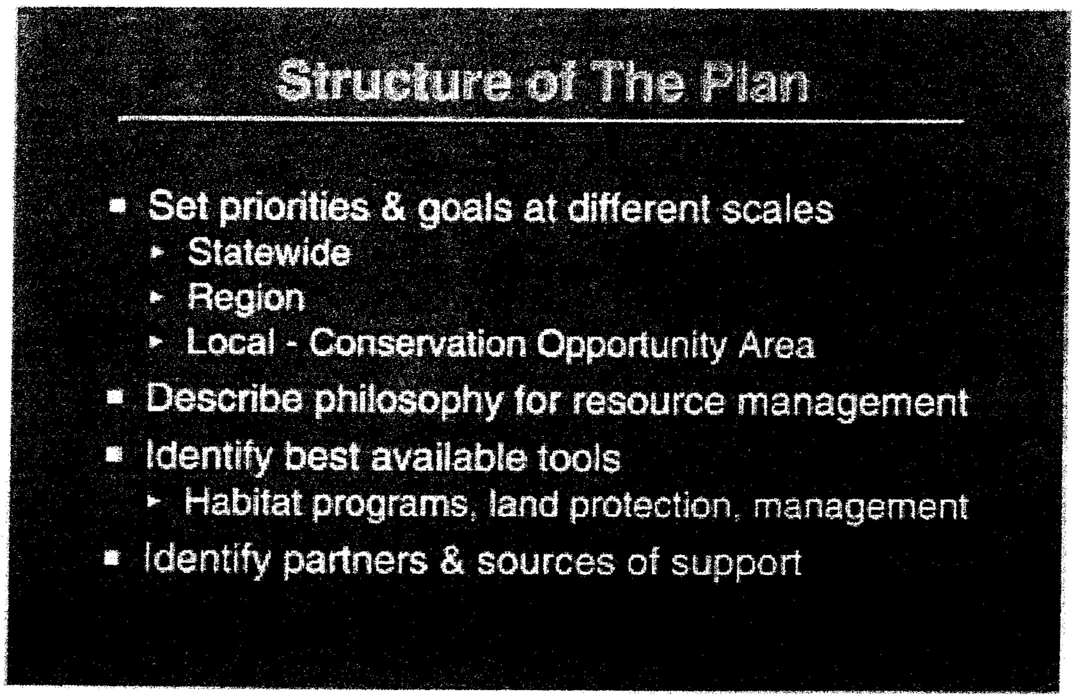


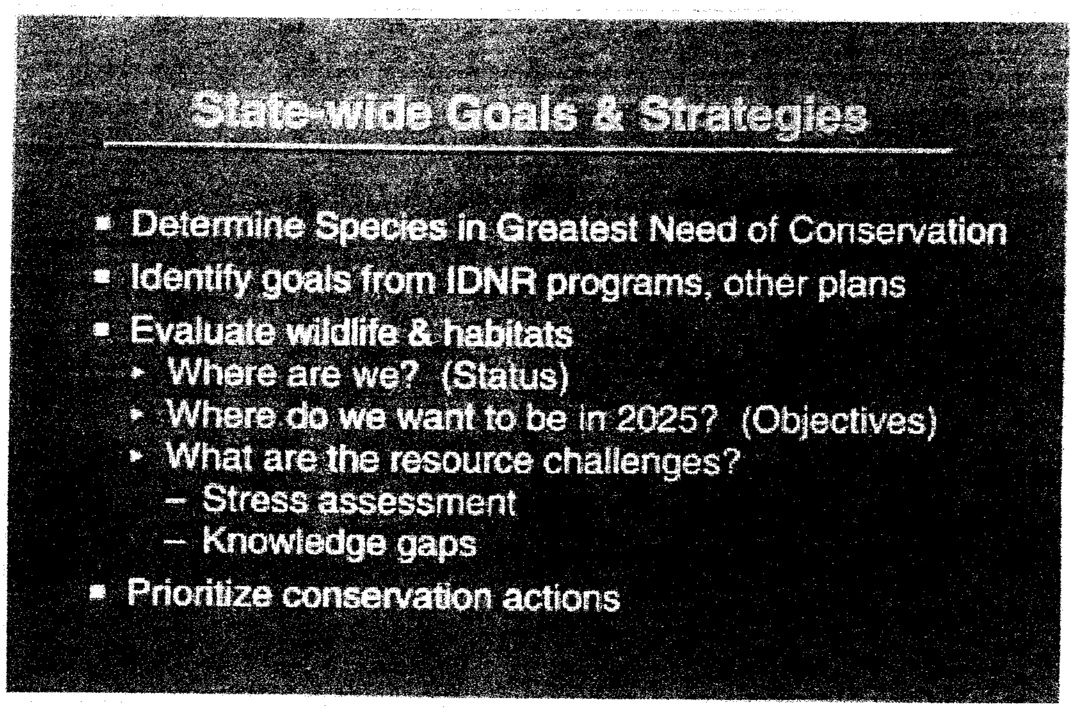

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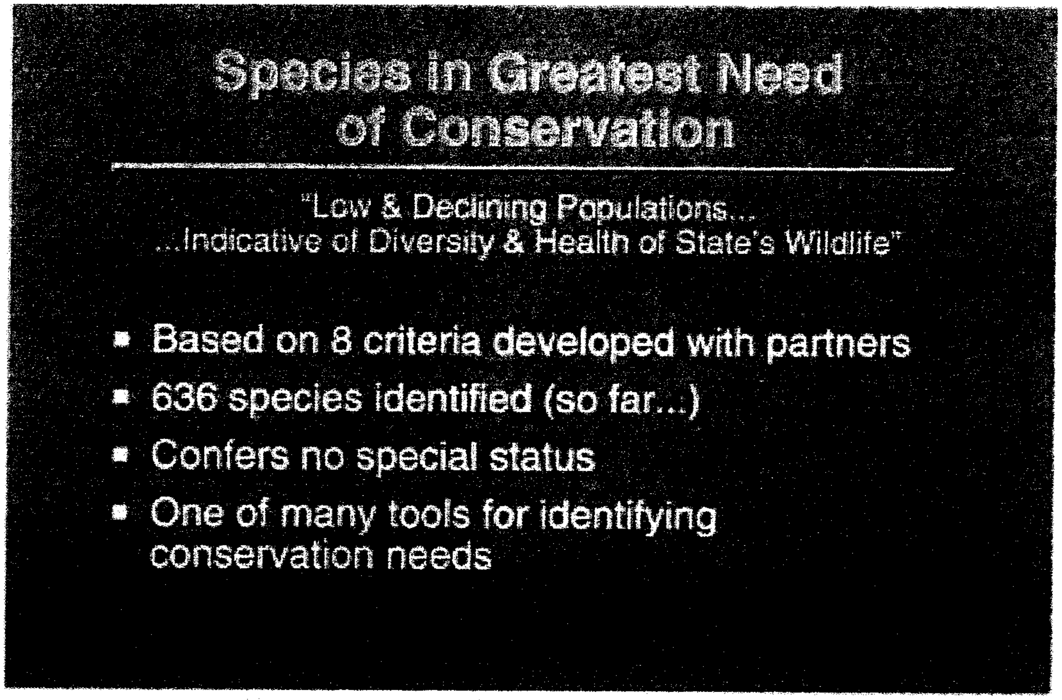


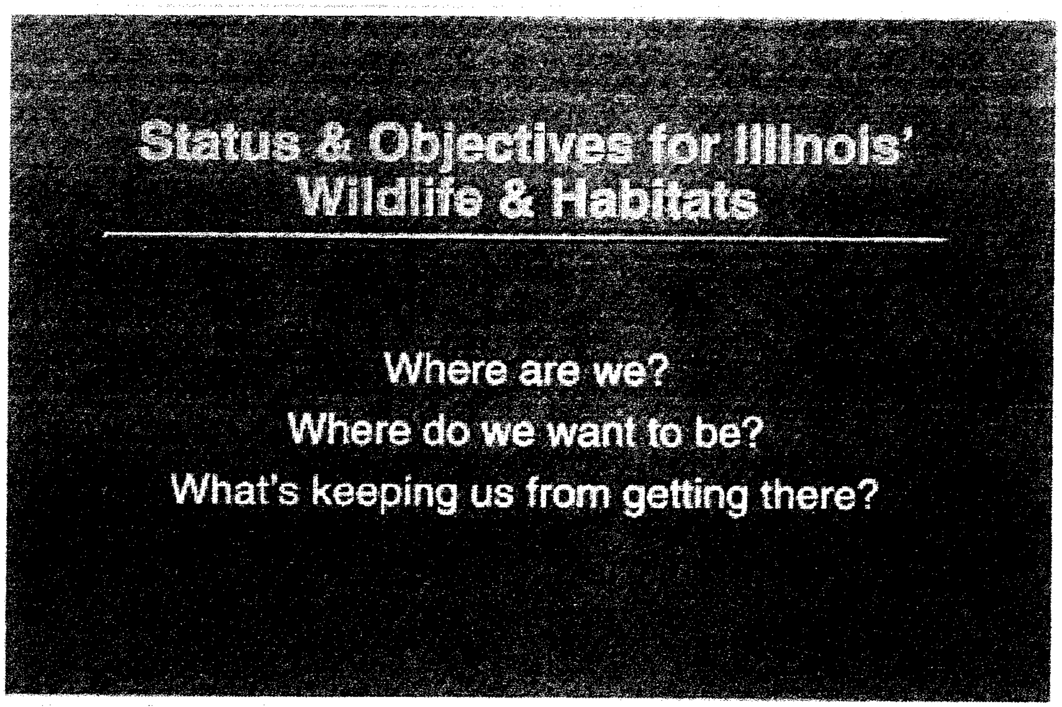

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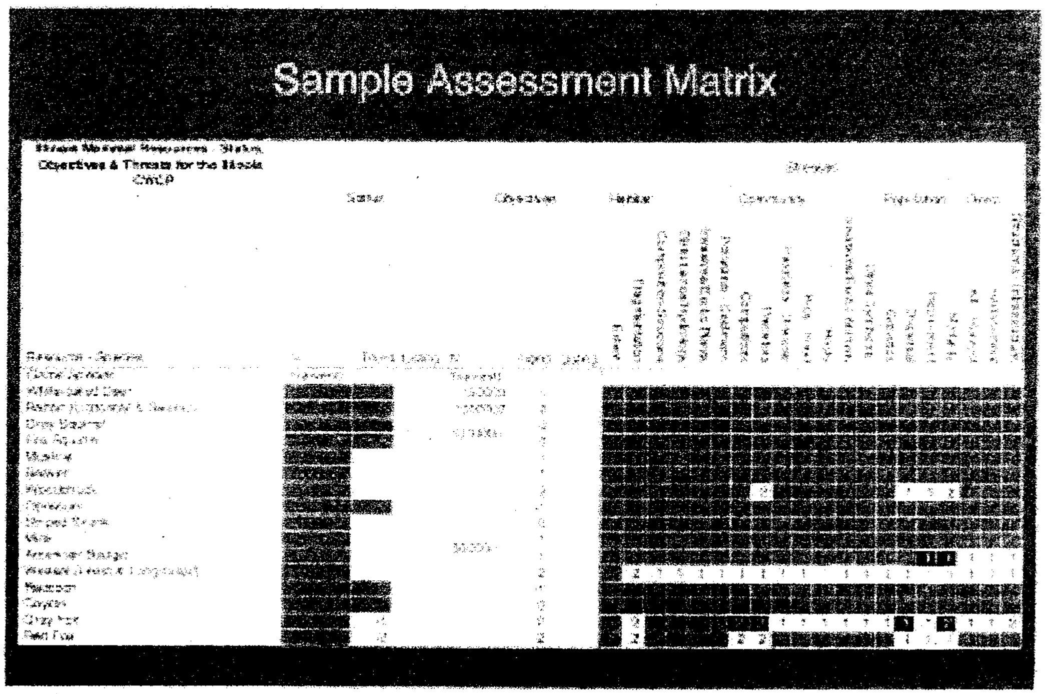


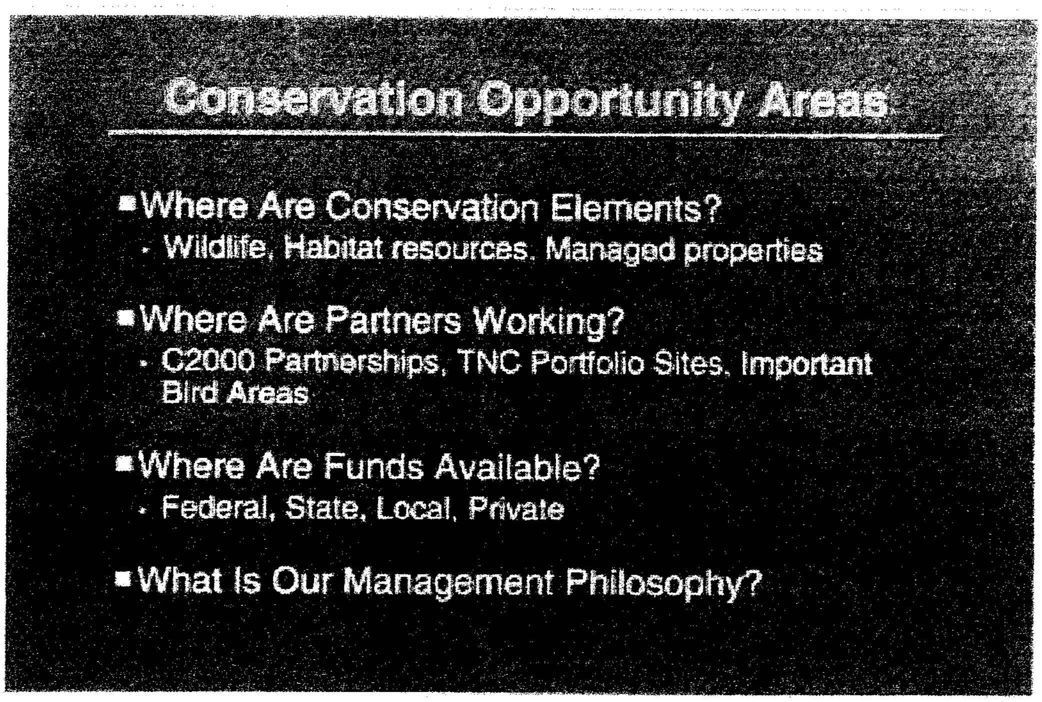

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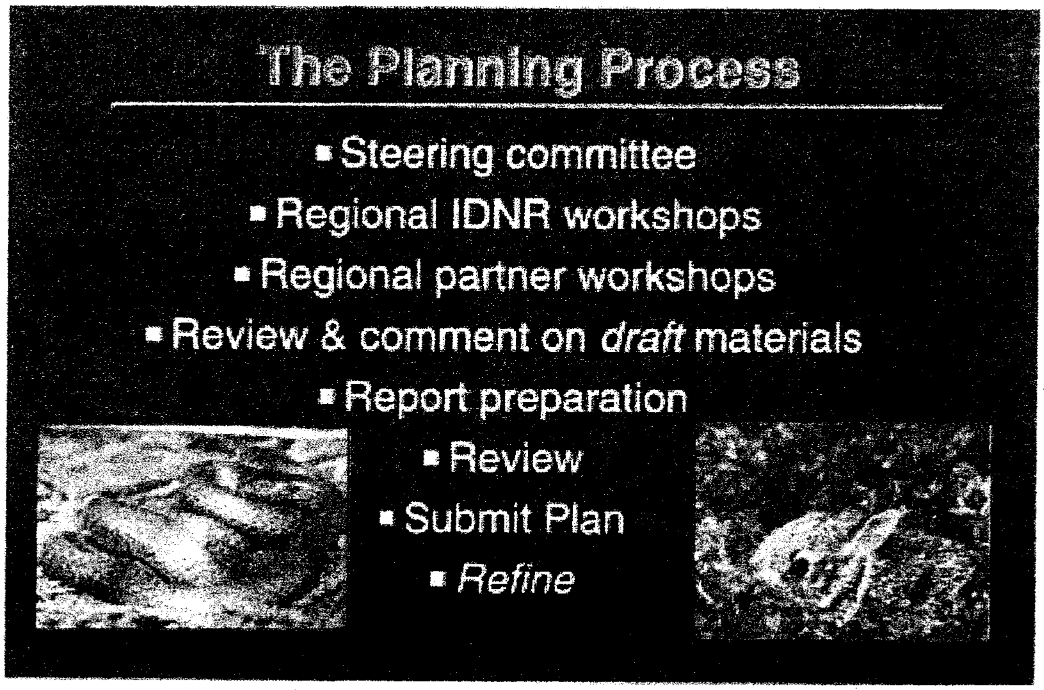


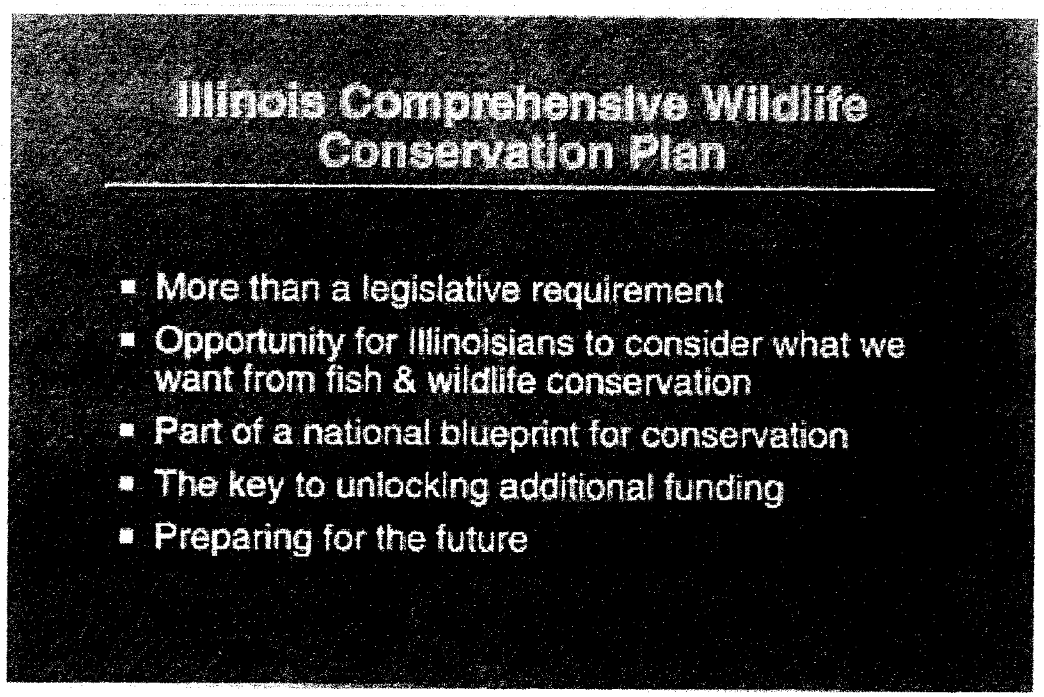

**Appendix X.** Selected scenes from the Comprehensive Wildlife Conservation Plan/Strategy website: http://dnr.state.il.us/orc/wildliferesources/theplan/.

**STATE WILDLIFE GRANT PROGRAM**

**State of Illinois**

**Final Performance Report**

**Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems**

**Project 6 - Implementation, Evaluation and Review Strategy**

Objectives:

1. Develop a strategy to implement, evaluate and periodically review the Comprehensive Wildlife Conservation Plan/Strategy
2. Solicit comments on the draft Comprehensive Wildlife Conservation Plan/Strategy from Illinois Department of Natural Resources staff, other land and water conservation agencies and organizations, and the public.

Project Description:

Meetings with staff, Plan/Strategy steering committee, other agencies and organizations and regional experts were conducted to determine the best strategies for implementing the plan. Considering conservation objectives at different spatial scales, existing monitoring efforts were considered, and additional monitoring tools proposed, for documenting changes in the distribution and abundance of priority species and changes in the location and relative condition of key habitats. Monitoring efforts were described to explicitly consider the effectiveness of conservation actions. Strategies for adapting conservation priorities and actions to new information or changing conditions were developed. Protocols for formally updating the Comprehensive Wildlife Conservation Plan/Strategy at intervals not to exceed 10 years are described in the plan/strategy. After these jobs were completed, the draft Plan/Strategy was made available to conservation partners, stakeholders, and the public for a comment period of 52 days, on the website developed in Job 5.2, in print, and in alternative formats as requested.

Approach:

The Plan/Strategy is designed to be used as a scientific process. Based on existing conditions (assumed to be changing) and existing knowledge (assumed to be imperfect and incomplete), various conservation actions were hypothesized to address stresses affecting species and habitats, resulting in conservation actions were hypothesized to address stresses affecting species and habitats, resulting in predicted outcomes or objectives. Maximizing conservation benefits and increasing efficiency requires an iterative process of planning (setting priorities and goals, selecting strategies), implementation (carrying out conservation actions, such as habitat restoration), and evaluation (monitoring results, measuring effectiveness).

*Research, Monitoring & Evaluation*

Illinois' natural resource management agencies are committed to employing a statewide wildlife management approach that is adaptive, ecosystem-based, and well-coordinated among conservation partners (Illinois Department of Natural Resources with other state, federal, and non-governmental organizations). A pillar of this progressive management approach is the integration of a robust program of science comprised of research, monitoring, and evaluation. The purpose of research, monitoring, and evaluation is to provide critical information on the status, trends, threats, and processes of Illinois' Species in Greatest Need of Conservation and the ecosystems upon which they depend. Rigorously acquired scientific information is a vital feed to enlightened management actions and policy decisions. The goal of research, monitoring, and evaluation is to provide the best possible and technically sound information to resource managers, decision-makers, and the public at large.

*Research* is an organized search for information about critical characteristics of an entity under study, and occurs along a continuum ranging from basic to applied questions. Too often, this continuum is incorrectly characterized as a dichotomy. Answers to more basic questions (e.g., "what are the effects of physiological stress on largemouth bass?") are a requisite for answering more applied questions (e.g., "will changes in angling regulations improve the condition of the largemouth bass fishery?").

*Monitoring* is the ongoing examination of a group or a system and takes three forms. *Sentinel monitoring* is an ongoing survey to detect unforeseen changes. The early detection of invasive Asian carp in the Illinois River system was possible because of an ongoing sentinel monitoring program. *Implementation monitoring* is an assessment that conservation actions are being practiced to the extent or intensity desired. *Effectiveness monitoring* is the measuring of the effects of some conservation action, relative to the effects of other actions (including no action), and the basis of modern adaptive management approaches. Effective monitoring, regardless of form, benefits from appropriate methodologies and effort across space and time scales. Traditional and emerging techniques (e.g., improved fish passage, de-channelization, wetland and floodplain restoration, re-introductions, reserve designs) are significant investments of funding and personnel time, but seldom have been approached to rank the effectiveness of alternatives and measure cost efficiency.

*Evaluation* is a retrospective examination of a broad class of actions (e.g., land conservancy, easements, riparian buffers, prescribed fire, stream bank stabilization) undertaken as larger programs (e.g., Conservation Reserve program, Conservation Reserve Enhancement Program, Acres for Wildlife). The purpose of evaluation is to determine whether the programs are performing as advertised and thereby worth continued investment. Such evaluations are often the least "scientific" looking and may be less amenable to rigorous analysis given the large number of variables affecting outcomes. Nonetheless, information from monitoring and research feeds into coarse-scale evaluations.

*Institutions* - Illinois has many institutions and organizations contributing to the scientific information base available to managers. First are the Illinois Scientific Surveys (Illinois Natural History Survey, Illinois State Water Survey, Illinois State Geological Survey, and the Illinois State Museum) of the Illinois Department of Natural Resources. The Illinois Natural History Survey, in particular, has a critical mass of expertise, infrastructure, and effort contributing to the state's living resource management mandate.

A host of universities (University of Illinois, Eastern Illinois University, Northern Illinois University, Western Illinois University, Southern Illinois University, and others) have varying expertise and commitment to studying ecological sciences as do other organizations (e.g., Field Museum, Shedd Aquarium, Illinois Academy of Sciences, The American Fisheries Society, The Wildlife Society). Illinois has formal relationships with many federal agencies for science and management including U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Geological Survey, and the Great Lakes Fishery Commission. Consequently, research, monitoring, and evaluation of diverse resource issues are on-going statewide.

*Existing monitoring programs* - On-going protocols for assessing the condition of wildlife and habitat resources at a statewide scale were considered for use in evaluating implementation of the Plan/Strategy. Biologists familiar with each program described the purpose of the monitoring effort, the parameters that are measured, the geographic scale of monitoring, and the history of the program (e.g., how long has data been collected and analyzed). Some of these programs have been recently evaluated for robustness of design, inference strength, usefulness/duplicity with other programs, and cost functions. Those findings have been summarized. Other programs remain in need of evaluation to determine if continuation, modification, and/or augmentation are warranted. Similarly, at regional and local scales, biologists were asked to identify on-going monitoring programs that can assess progress towards regional and local wildlife and habitat objectives. Few of these programs have been critically evaluated.

*Augmenting monitoring programs* - Using the methods described in Projects 2, 3 and 4 for describing the status, stresses, and actions needed to conserve wildlife and habitats, a number of information gaps were identified for taxonomic groups, guilds, and habitat types. Further, as conservation actions were related to stresses alleviated and species and habitats benefitted, performance indicators were identified. Not all performance indicators are currently measured.

Having identified these monitoring gaps, several programs have been described and can be implemented in the short-term if resources (especially trained personnel) are available. In other cases, current information is too sparse and/or field protocols must be developed before programs can be implemented.

*Coordination of monitoring* - On-going monitoring needs to be coordinated among agencies and organizations to avoid duplicate efforts and ensure necessary information is being collected. Many monitoring programs are cooperative efforts, but a statewide system for accessing diverse monitoring information on wildlife and habitat resources does not exist. One of the essential functions of Plan/Strategy implementation and revision will be coordinating monitoring programs, summarizing results, and sharing those data with resource professionals, administrators, research scientists, and the public.

*Review & Revision of the Plan/Strategy*

*Internal Review* - Illinois Department of Natural Resources staff were involved in developing components of the Plan/Strategy at all stages of the planning process. In many cases, development involved relatively few individuals with particular areas of expertise, whereas review was open to all staff. The stages at which review was specifically requested of agency staff were (1) on the criteria for selecting the Species in Greatest Need of Conservation (Project 1), (2) the lists of Species in Greatest Need of Conservation and the criteria applying to each (Project 1), (3) the ranking of stresses to the Species in Greatest Need of Conservation and their habitats (Project 3), (4) the proposed conservation actions to address the stresses affecting Species in Greatest Need of Conservation and their habitats (Project 4), and (5) the draft Plan/Strategy (Project 7). In all cases, documents were made available on the Plan/Strategy website (Job 5.2), an email notice and deadline were sent, and printed documents were made available upon request. The first three of the above topics were addressed by individual review procedures. The first four topics were addressed by a 47-day comment period on a partial draft Plan/Strategy (12 January 2005 to 1 March 2005). The final draft Plan/Strategy covered all topics and was available for a 52-day comment period (9 May 2005-30 June 2005).

*Partner Review* - The involvement of partners in developing and reviewing the Plan/Strategy was very similar to internal staff participation, as described previously. Review was specifically requested from partners on (1) the lists of Species in Greatest Need of Conservation and the criteria applying to each (Project 1), (2) the ranking of stresses to the Species in Greatest Need of Conservation and their habitats (Project 3), (3) the proposed conservation actions to address the stresses affecting Species in Greatest Need of Conservation and their habitats (Project 4), and (4) the draft Plan/Strategy (Project 7). In all cases, documents were made available on the Plan/Strategy website (Job 5.2), an email notice (or hard copy notice, if requested) and deadline were sent, and printed documents were made available upon request. Additionally, review periods were posted on the Plan/Strategy webpage, and an announcement of the final review of the draft Plan/Strategy was published in the March 2005 *Outdoor Illinois* magazine (the Illinois Department of Natural Resources' primary publication). The first two topics were addressed by individual review periods. The first three topics were addressed by a 47-day comment period on a partial draft Plan/Strategy (12 January 2005 to 1 March 2005). The final draft Plan/Strategy covered all topics and was available for a 52-day comment period (9 May 2005-30 June 2005).

*Public Review* - Through the planning, review and revision processes, private conservation organizations and citizens' groups played a dual role as "conservation partners" and important representatives of the "public." Through Job 5.1, various efforts were made to inform the interested public in the planning process. The vast majority of persons contacting the planning coordinator claimed affiliation with one or more partner organization. Other individuals were given the same opportunities for review and notices as described for partners (above). Additionally, an announcement of the final review of the draft Plan/Strategy was published in the March 2005 *Outdoor Illinois* magazine.

*Ten-Year Revision* - Experiences from developing the initial Plan/Strategy are the foundation for the outline to updating and revising the Plan/Strategy through the year 2015 (Tables 1, 2). At least 24 months should be scheduled for a thorough revision to the Plan/Strategy to allow adequate time for updating information, hosting planning workshops, and review of draft documents. Keeping with an adaptive management framework, the need and process for revising the Plan/Strategy will be influenced by changing resource conditions, development of challenges and opportunities, and the relative success of conservation actions taken during implementation. Having accepted the responsibility of developing a Plan/Strategy, the Department of Natural Resources needs to commit staff to oversight of implementation, revision, and coordination with partners of the Plan/Strategy.

*Implementation of the Plan/Strategy*

Shortly after the Illinois Comprehensive Wildlife Plan/Strategy was delivered to the National Advisory Acceptance Team, the planning process transitioned to the challenge of plan implementation. The initial step was to inform Illinois Department of Natural Resources staff, conservation partners, and the public that a final Plan/Strategy was available, and had been accepted by the U.S. Fish & Wildlife Service. Recognizing the Plan/Strategy represents a conservation vision with a 20-year horizon, the second challenge was to begin to operationalizing the Plan/Strategy into short-term benchmarks of progress and coordination of the diverse conservation actions and natural resource monitoring are on-going among agencies, organizations, and individuals.

Results:

*Research, Monitoring & Evaluation*

Knowledge of the distribution and abundance of wildlife species is a key element of Plan/Strategy. The development of the Plan/Strategy utilized species distribution information developed as part of the GAP Analysis Program conducted at the Illinois Natural History Survey. The GAP database provides a centralized and comprehensive source of data for all terrestrial vertebrate species in Illinois. These distributions need to be checked for accuracy and distributions with low accuracy need to be refined using additional survey data. This comprehensive database of predicted species information needs to be maintained, updated, and made accessible in order to help guide conservation management decisions in the future. An aquatic GAP Analysis could provide helpful distribution information for fishes, mussels and other aquatic wildlife.

Assessing the stresses to Illinois' Species in Greatest Need of Conservation also revealed several factors that might have profound effects on a number of populations, but are poorly understood (Appendix II of the Plan/Strategy). Genetics of rare species (often in small, isolated populations), recruitment, dispersal, mortality, and diseases were among the factors biologists suspected as problematic, but lacking in reliable information.

*Aquatic invertebrates* - The Illinois Environmental Protection Agency maintains a large monitoring program and database of water quality and benthic macroinvertebrates for Illinois' streams. The Illinois Environmental Protection Agency and Illinois Department of Natural Resources would benefit from greater sharing of water quality, macroinvertebrate and fish data. Department of Natural Resources Restoration Ecologists are working with Fisheries biologists to begin sampling mussels at many of the same locations sampled for fishes in basin surveys. Historical and modern records of freshwater mussel communities in Illinois rivers and streams are compiled in the Illinois Natural History Survey's mussel database. It is possible to query the database for particular species, streams, scientists, and time periods. The objective is for data from all on-going mussel surveys to be incorporated into this system. The tool is valuable for examining species distributions, locating priority streams (with high diversity and conservative species), and identifying gaps in sampling effort. All known occurrences of threatened and endangered species are further recorded in the Illinois Department of Natural Resources' Biotics 4 database. Basic and applied research is necessary to understand stresses to these populations and to develop conservation actions. Experimental propagation, modeled after work with *Lampsilis higginsi* in the Mississippi River, should be refined with other species in other systems (e.g., *Pleurbema clava* in the Vermilion River system) and evaluated as an effective conservation action.

*Terrestrial Invertebrates* - Entomologists with the Illinois Natural History Survey, universities, and other institutions and organizations have done surveys of particular sites within the state. However, for most species, information on statewide distribution, abundance, and conservation need are lacking or dispersed. Effects of management on insect populations remain poorly documented, but some evidence suggests conservative insect species are adversely affected by intensive disturbance-based management (e.g., annual prescribed burning), particularly in the highly fragmented native prairies and savannas present in the Midwest. More than 20% of the Species in Greatest Need of Conservation are insect inhabitants of prairies and savannas. These and related insect species may serve as indicators of the health of insect populations in general. Monitoring may be accomplished by sampling, at least once annually, randomly selected prairie and savanna sites, representing different natural divisions. Widespread use of insecticides, both for lawn care and agriculture, continues (e.g., large areas were sprayed for soybean aphid in 2004). Although less persistent than organochlorine pesticides, those commonly in use (e.g., pyrethroids) are highly toxic to invertebrates. The effects on invertebrate communities, both terrestrial and aquatic, and their vertebrate predators, are poorly known. For example, low abundance of invertebrates in intensively cropped areas is implicated in increased movements and reduced survival of pheasant broods (Warner et al. 1999).

*Fishes* - The Illinois Natural History Survey maintains a fisheries collections database (Fisheries Analysis System) for the state. Illinois Department of Natural Resources Fisheries biologists conduct regular basin surveys of all watersheds in the state on a 5-year rotation, at approximately 500 sites. Population abundance and diversity are compiled into the Index of Biotic Integrity metric. The Department of Natural Resources also samples fish communities at 21 sites on the Illinois River, and 118 sites on the Mississippi, Wabash, and Ohio Rivers annually. In cooperation with U.S. Fish & Wildlife Service, U.S. Geological Survey, and Illinois Department of Natural Resources, the Long-Term River Monitoring Program measures ecological parameters on the Illinois and Mississippi rivers. All known occurrences of threatened and endangered species are tracked in the Department of Natural Resources' Biotics 4 database. Propagation of threatened species (e.g., red-spotted sunfish), or surrogates, needs investigation as an effective conservation action. Some evidence indicates that aquatic life (mussels and fish) are affected by endocrine disrupting compounds in sewage effluent and other sources, though the magnitude of this effect in Illinois is unknown. The Biologically Significant Streams analysis, completed in 1992 (Page et al. 1992), has received extensive use from watershed groups, environmental interests, municipalities, consultants and state and federal agencies. However, much more recent data are available, and the classification needs to be updated.

The Illinois Department of Natural Resources' Division of Fisheries collects distribution, abundance, and angler satisfaction information for sportfish in rivers and streams, impoundments, and Illinois' portion of Lake Michigan. Annual surveys on 259 state and public impoundments evaluate sportfish populations, angler effort and success, and identify management needs. Supplemental fish stocking evaluations are conducted in 32 state and public impoundments. In Lake Michigan, lake trout, yellow perch, and salmonid species are monitored annually to measure relative abundance, food habits and demographics. Spring fish stock assessment surveys are conducted between Chicago and Waukegan, and available stocks of non-salmonid sportfish within harbors and nearshore areas on Lake Michigan are estimated.

The Illinois Department of Natural Resources has Species Management Plans for several sportfishes, including crappie (black, white, hybrid), bluegill, redear sunfish, channel catfish, grass carp, largemouth and smallmouth bass, muskellunge, northern pike, tiger muskie, rainbow trout, sauger, walleye, yellow perch, and white, striped and hybrid striped bass. These documents provide an overview of biology, status of the fishery, catch and growth rate data, propagation and stocking, regulations, stock assessment, and habitat management for each species.

*Amphibians* - The Illinois Natural History Survey houses specimens and other records of amphibians reported from throughout Illinois. Recently, county-by-county distribution maps for each species (before and after 1980) have been compiled and published (Phillips et al. 1999). However, sampling is largely opportunistic, and distribution of many species is poorly known. Globally and in Illinois, there is concern for apparent local amphibian extinctions and widespread decreases in abundance. Data are largely inadequate to quantify changes in abundance and distribution, and to confidently identify causes for changes. Statistically-rigorous and easily-conducted protocols have been developed to survey calling frogs and toads (anuran calling surveys), but have not been widely attempted or maintained in Illinois. All of the states bordering Illinois are currently conducting anuran calling surveys, some for more than 15 years. Surveys for salamanders–and aquatic salamanders in particular–are very difficult. All known occurrences of threatened and endangered species are tracked in the Department of Natural Resources' Biotics 4 database.

*Reptiles* - Monitoring efforts for reptiles are very similar to those for amphibians (see Phillips et al. 1999 for recent county distribution maps). And, as with amphibians, data are largely inadequate to quantify changes in abundance and distribution, and to confidently identify causes for those changes. Survey methods for reptiles are varied (drift fences, pitfall traps, cover boards, aquatic traps/nets), but are laborious and not attempted in any systematic fashion. All known occurrences of threatened and endangered species are tracked in the Department of Natural Resources' Biotics 4 database.

*Birds* - Of all the groups, birds have the most complete monitoring. Because they are relatively easy to record, and large-scale distribution and abundance data are available for long time periods, birds are and likely will remain key indicators of conservation effectiveness. However, changes in migratory bird populations and communities may reflect conditions locally or those thousands of miles away. The North American Breeding Bird Survey is a well-known, long-term, continental sentinel monitoring program, with 103 routes through Illinois (Sauer et al. 2004). Though coverage is poor for many species (e.g., nocturnal birds), the Breeding Bird Survey is currently the most important monitoring program for Illinois' birds in greatest need of conservation. The Christmas Bird Count is a century-old effort to document early winter distribution and abundance (http://www.audubon.org/bird/cbc/). Volunteers count birds within a 15-mile diameter circle on one day from mid-December to early January in 73 circles in Illinois. The Great

Backyard Bird Count is a recent effort to measure late-winter distribution and abundance (http://www.birdsource.org/gbbc/). Within Illinois, the Spring Bird Count is a 33-year old effort to document bird diversity and abundance in early May. Held on the Saturday on or between 4-10 May, Spring Bird Count gives a one-day, county-level view of the abundance of birds, coinciding with the peak of Neotropical bird migration, and supplementing Breeding Bird Survey data for early-nesting species.

Species-specific monitoring is on-going for wintering trumpeter swans (reports of collared birds), wintering bald eagles (along major rivers), and nesting bald eagles. Smaller-scale bird monitoring efforts are common for individual sites and guilds (e.g., migratory shorebirds at Chautauqua National Wildlife Refuge, heron rookeries), but generally lack coordination and a central access structure. All known breeding season occurrences of threatened and endangered species are tracked in the Department of Natural Resources' Biotics 4 database.

The Illinois Department of Natural Resources has conducted spring call counts for northern bobwhite and ring-necked pheasants on established routes since the 1950s (Cole 2004a, b). Additionally, August brood surveys for pheasants help predict the size and age structure of the autumn flock (Cole 2004c). Mourning dove abundance is indexed with spring call counts and in August prior to the hunting season (Cole 2004d). Successful archery and firearm deer hunters are asked to report locations and numbers of wild turkeys observed. Woodcock are surveyed by the U.S. Fish & Wildlife Service through the Singing-ground Survey, harvest Information program and Wing-collection Survey (Kelley 2004). In 2003, 17 singing-ground routes were sampled in Illinois. Harvest of upland game birds, doves and woodcock are estimated with annual harvest surveys completed by a random sample of Illinois hunters (e.g., Miller at al. 2004a), and harvests of wild turkeys are monitored via a call-in harvest reporting system.

Resident giant Canada geese are banded annually in Illinois. In the 1980s, samples were not large enough for robust analyses. Since this time banding effort has increased and better tools are available to estimate survival and emigration relative to environmental and other factors (i.e., band recovery models in Program MARK). Since 1993, Mississippi Flyway states have used helicopters to survey breeding giant Canada geese. These surveys use a stratified random sampling design (i.e., strata of low, medium, and high goose density) to obtain precise and reliable population estimates. Current surveys do not estimate the probability of detecting geese, and may be biased negatively. Pre-season wood duck banding is conducted annually in Illinois. Speculation exists that wood duck harvest has increased since the implementation of Adaptive Harvest Management; analysis of band recovery data for Illinois-banded wood ducks will help guide harvest and habitat management.

Waterfowl have been aerially inventoried along the Illinois and Mississippi Rivers of Illinois since 1948. These data are useful for identifying population trends, especially in light of their long-term nature.

These data constitute an index of duck abundance, not a population estimate. Future monitoring should consider revising these aerial inventories so they constitute a formal sample survey and, therefore, generate population estimates. The Federal Parts Collection Survey estimates age ratios of waterfowl and other migratory game birds in the fall flight by examining wings of hunter-harvested birds. Generally, age ratios of ducks are declining over the long term and may not reflect habitat quality in Illinois (i.e., age-ratios are largely dependent on breeding habitat conditions outside of Illinois). Waterfowl harvest is estimated annually with surveys of a random sample of waterfowl hunters (Miller et al. 2004b), and the harvest of Canada geese in quota zones is monitored with a call-in reporting system.

The recreational birding community in Illinois is large and highly skilled. While their efforts are largely self-directed, the observations reported through the "Illinois Birders Exchange Thoughts" listserve, and published quarterly in Illinois Ornithological Society's journal, *The Meadowlark*, are remarkably thorough and detailed. Indeed, *The Meadowlark* is as close to a comprehensive bird information source as exists for Illinois, as Christmas Bird Count, Spring Bird Count, many Breeding Bird Survey, local surveys and other observations are reported here. Using citizen-scientists for conservation monitoring is the model adopted by the Bird Conservation Network to track grassland bird communities at various sites in the Chicago region.

Deficiencies in bird monitoring include protocols for effectively monitoring shorebirds and marsh birds. Marsh birds, including rails and bitterns, appear to be declining in abundance, but existing data on abundance, distribution, and population trends, primarily derived from Breeding Bird Survey data, are often not adequate for robust analyses. Conway and Timmermans (2004) detailed a standardized protocol for marsh bird monitoring, providing a framework for consistent data collection concurrent with monitoring in other regions of North America. Coordination will be particularly important with the Northeastern Illinois Wetland Bird Survey, conducted since 1980. These surveys are conducted in a part of the state with unique wetland features threatened by rapid urban growth. Analysis of Northeastern Illinois Wetland Bird Survey data is used to monitor status and trends of wetland bird species and their habitat, evaluate the impact of surrounding land use changes, and develop mitigation and conservation actions. Research on species such as least bitterns and pied-billed grebes may improve our understanding of factors affecting marsh-nesting birds.

Many species of shorebirds migrate long distances annually, from breeding grounds in arctic Canada to wintering regions in South America. They are a largely ephemeral group, often spending only a few days in any one location. Combined with their small size and sometimes cryptic plumage, shorebird monitoring programs have been difficult to implement at large scales. Systematic ground counts of migratory waterbirds have been conducted weekly at Chautauqua National Wildlife Refuge, a Western

Hemisphere Shorebird Reserve Network site (de Szalay et al. 2000), during fall and spring since 1996. Shorebirds are sometimes counted at Carlyle Lake and other locations. Because uncertainty exists about the amount and type of shorebird data collected, researchers should attempt to compile data on shorebird abundance, use and timing of migration from all possible sources, and develop a unified sampling strategy to reliably estimate populations of migratory shorebirds at a meaningful spatial scale (e.g., the Illinois River valley). Research on high priority species (e.g., American golden-plover, greater yellowlegs) frequently encountered in Illinois should examine turnover rates, habitat use, and body condition.

One goal is to increase the number of multiple-species wading bird rookeries by 25%. However, monitoring of rookeries is sparse and constrained by time and funding. A coordinated multi-state monitoring effort of mixed-species wading bird colonies is needed to monitor these species of concern. Additional information on the distribution, reproductive success, foraging ecology, habitat characteristic, survival and bio-accumulation of contaminants are needed to ensure healthy populations of wading birds, such as great egrets and black-crowned night-herons, in Illinois.

From 1906 to 1909, A. O. Gross and H. A. Ray, under the direction of S. A. Forbes, conducted a series of bird surveys throughout Illinois. These surveys were repeated by R. Graber and J. Graber from 1956 to 1958 (Graber and Graber 1963). Collectively these surveys provide a detailed record of the status of bird populations in Illinois. Illinois has the opportunity to build upon these classic and valuable surveys by repeating this work in 2006-2008, and integrating modern survey techniques to create a link between historical data and current monitoring efforts. Conducting these surveys will provide a view of how the distribution and abundance of bird species has changed over the last century.

A recent analysis using two climate-prediction models suggests Illinois can expect enormous shifts in bird distributions and communities over the next century with many species becoming rare or extirpated in Illinois, and others expanding their ranges into the state (Matthews et al. 2004). Over future decades if expected trends continue, prioritizing species for conservation action will have to consider climate-induced range shifts that cannot be managed–or at least must be addressed at scales well beyond Illinois.

*Mammals* - As a group, monitoring of the mammal Species in Greatest Need of Conservation is largely opportunistic, and distribution and abundance of several species is poorly known. Several caves and abandoned mines are surveyed annually for hibernating bats. Recent studies have documented wider-than-expected distributions and greater-than-assumed abundances of badgers and bobcats. The river otter was recently removed from the list of Illinois threatened species, now occurring in all major watersheds in Illinois, with an estimated population of 4,600 animals in the Illinois, Kaskaskia and Wabash landscape management units (Bluett 2004a). All known occurrences of threatened and endangered species are tracked in the Department of Natural Resources' Biotics 4 database. Better information is needed for Franklin's ground-squirrels on distribution, abundance, and dispersal abilities of juveniles and adults. Unanswered, but important, conservation questions include reserve design (large patches versus clusters of smaller grasslands to support a metapopulation) and life history differences between the state-threatened Franklin's ground-squirrel and the common 13-lined ground-squirrel.

Distribution and abundance of game mammals are indexed with a number of tools in Illinois. The spotlight survey has been conducted by Department of Natural Resources staff since 1981 on spring nights along standardized 25-mile routes, and assists in setting furbearer hunting and trapping seasons. The target species are raccoon, white-tailed deer, eastern cottontail, domestic cats, opossums and striped skunks, though other species, such coyotes, beavers, bobcats, river otters, muskrats, mink, and gray and red fox (Bluett 2004b). The archery deer hunter survey, developed in Missouri as a cost-effective and statistically-robust way to monitor terrestrial mammals, has been conducted in Illinois since 1991 (Bluett 2004c). Data are collected by archery deer hunters who volunteer to keep standardized daily logs of their efforts (hours afield) and wildlife observations from 1 October through 14 November. In 2003, 1,569 volunteers logged approximately 93,360 hours of wildlife observations. The archery deer hunter survey provides the most, and in some cases the only, reliable information on population trends of bobcat, coyote, gray fox and red fox. The technique also monitors raccoons, gray and fox squirrels, white-tailed deer and wild turkeys. Furbearer Sign Surveys are conducted in late winter and early spring by trained Department of Natural Resources staff at a stratified random sample of Basin Survey Sites to link the presence/absence of river otters, beavers, and mink to existing databases on biotic and abiotic features (Bluett 2004a). Basin Survey Sites are fixed stations established by the Illinois Environmental Protection Agency and Illinois Department of Natural Resources to monitor surface water quality, shoreline characteristics, diversity and abundance of fishes, and other metrics of biotic integrity for riverine systems. Eight survey sites have been established in southern Illinois to monitor occurrence of swamp rabbits (Cole 2004e).

Hunter harvest of furbearers, rabbits and squirrels are estimated by annual surveys of a random sample of Illinois hunters (Miller at al. 2004a). Trapper harvest is similarly estimated by randomized trapper surveys (Miller et al. 2003) and with the Fur Harvest Survey. The Fur Harvest Survey provides estimates of (1) numbers of pelts sold by Illinois furtakers, (2) value of pelts sold by Illinois furtakers, and (3) distribution of the harvest among resource users (Bluett 2004d). State law requires licensed fur buyers to maintain records and submit reports of all raw furs purchased. Archery and firearm harvest of white-tailed deer has been monitored at check-in stations since modern seasons began in 1957.

*Invasive Species* - Invasive species are a primary threat to native ecosystems and to many of Illinois' Species in Greatest Need of Conservation. While hundreds of exotic species are known to occur in Illinois, not all species pose the same degree of ecological threat. Lowe et al. (2000) attempted to identify the most problematic invasive species on a global scale. In Illinois, a prioritization tool is needed to help resource managers direct limited control efforts to species causing or likely to cause the most harm. Such a prioritization will require estimates of the ecological "costs" (changes in diversity and productivity at the levels of primary producer, primary consumer, secondary consumer, etc.) exacted by different invasive species in different habitats. Developing a spatial database of invasive species distributions and abundance, utilizing data from Critical Trends Assessment Project and other programs, could help predict the spread of invasive species, determine factors influencing this spread, and direct control efforts. The Illinois Natural History Survey should serve as a center for information on invasive species, including research for new, effective control techniques.

*Wildlife Diseases* - The Illinois Department of Natural Resources' Division of Wildlife Resources, Illinois Natural History Survey and the University of Illinois-College of Veterinary Medicine have an on-going partnership to investigate wildlife disease outbreaks and diagnose unknown causes of wildlife mortality. West Nile Virus was first confirmed in two dead crows in September of 2001. By the end of 2002, West Nile Virus had been confirmed in 100 of 102 counties, and Illinois led the nation with 884 human cases, and 66 deaths. The Illinois Department of Public Health maintains a sophisticated disease surveillance system to monitor animals and insects that can potentially carry the virus: dead crows and blue jays, mosquitoes and horses. The surveillance system also includes infectious disease physicians, hospital laboratory directors and infection control practitioners, local health departments and staff from Illinois Department of Public Health. Declines in blue jays, American crows and black-capped chickadees were apparent on Chicago-area Christmas Bird Counts in 2002 (Moskoff 2003).

Since the first case of Chronic Wasting Disease, a fatal neurological disease of cervids, was confirmed in Illinois in November of 2002, intensive and widespread testing has been conducted to determine the range and prevalence to the disease, and to monitor Chronic Wasting Disease-eradication efforts. In counties with confirmed Chronic Wasting Disease-positive animals, testing is done on all suspect animals (exhibiting clinical signs of Chronic Wasting Disease), some road-killed animals, and animals taken under urban population control permits and by Illinois Department of Natural Resources sharpshooters in Chronic Wasting Disease eradication zones. In the 2002-2003, 2003-04 and 2004-05 hunting seasons, voluntary samples were taken from deer brought to check stations within counties throughout Illinois as a widespread surveillance effort to confirm the limited distribution of Chronic Wasting Disease in Illinois.

*Critical Trends Assessment Program* - Products of the Illinois Department of Natural Resources' Critical Trends Assessment Program, including a land cover atlas, inventories of resource rich areas, watershed assessments and ecosystem monitoring and have been used extensively in developing this report. Land cover provides detailed information on the extent of habitats in Illinois, and ecosystem monitoring is valuable for assessing the condition of and stresses to forests, wetlands, grasslands, and stream habitats throughout the state. Digital land cover databases need to be updated approximately every five years. Critical Trends Assessment Program professional scientists monitor 600 randomly-selected sites in four habitats (150 of each habitat) on public and private land. In forests, wetlands, and grasslands, data on herbaceous and woody vegetation, birds, and insects are collected. They measure ecological indicators such as the presence of threatened and endangered species, species richness, species diversity, and dominance of native vs. non-native species. In streams, aquatic insects are the primary assemblage used as indicators of condition.

*Illinois Natural Areas Inventory* - Identification and monitoring of areas with high quality habitat, presence of unique or important species and species assemblages, and rare natural areas is necessary to the preservation of the remaining valuable ecological areas in the state. Many forests, prairies, wetlands, grasslands, savannas, lakes, ponds, and streams were identified as high quality natural areas in the Illinois Natural Areas Inventory completed in 1978. An updated inventory of high quality sites is necessary to include important sites not identified or included in the original Illinois Natural Areas Inventory. The Illinois Natural Areas Inventory database is a valuable source of information on condition of the state's natural resources. A program to monitor the health of these sites over time is necessary to protect and preserve them.

*Owned, Managed & Leased Properties Project* - Comprehensive and reliable information on the Illinois Department of Natural Resources' land holdings is critical for conservation planning, implementation, and assessment. A spatial database with detailed information on boundaries, ownership, funding source, management practices and goals, activities, and restrictions on these lands has been started for many of the Department-owned, managed, or leased properties. A complete and centralized geographic information system database that includes all state parks, conservation areas, forests, and fish and wildlife areas would provide valuable information for conservation-related activities.

*Conservation Reserve Enhancement Program* - The Conservation Reserve Enhancement Program is a voluntary program to assist landowners in protecting environmentally sensitive land, decreasing erosion, restoring wildlife habitat, increasing populations of threatened and endangered species, and safeguarding ground and surface water. This U.S. Department of Agriculture program supports conservation practices such as filter strips and forested buffers to help protect streams, lakes, and rivers from sedimentation and agricultural runoff, and development and restoration of wetlands. Currently limited to the Illinois River Basin, about 110,000 of 232,000 eligible acres have been enrolled. Demand exceeds funding to enroll additional acres. Research is underway to estimate the quality and quantity of Conservation Reserve Enhancement Program habitat and its use by resident and migratory wildlife. These evaluations of plants, wildlife, and quality of habitat will help evaluate the effectiveness of the Conservation Reserve Enhancement Program in Illinois and quantify its benefits.

*Illinois Conservation Practices Tracking System & MANAGE* - The Illinois Conservation Practices Tracking System is an interagency effort, including the Illinois Department of Natural Resources, U.S. Department of Agriculture, Illinois Environmental Protection Agency, and the University of Illinois Cooperative Extension Service, to map the location of various conservation practices, such as Conservation Reserve Program, Conservation Reserve Enhancement Program, and Wetland Reserve Program contracts. As funding and staffing are available, data from additional counties and watersheds are being added to the system. The system enables partner agencies to effectively focus conservation actions. The Illinois Department of Natural Resources, the Illinois Nature Preserves Commission, and the U.S. Forest Service are currently developing the MANAGE system to assist field staff in monitoring the locations of stewardship activities (e.g., prescribed fires, invasive species control). Future plans call for modules with wildlife and fisheries applications.

*Land-Water Interface* - With 26,000 miles of streams and 644,000 acres of surface water (excluding lake Michigan), the land-water interface is essential for conservation in Illinois. Yet, the relationships among soils, land use practices, nutrients, drainage waters, erosion, wetlands, streams and other habitats are often poorly understood.

*Forest* - The extent of various forest types are confidently measured by land cover data. Statewide composition and condition information is being gathered by the Critical Trends Assessment Program, and the U.S. Forest Service monitors plots throughout Illinois and reports on forest condition every 10 years. Early successional forest species are highly represented in Species in Greatest Need of

Conservation; but the extent and condition of these habitats is unknown. High-density mid-successional forest is perceived as most common, with young and open, mature oak forests thought to be becoming more scarce.

*Open Woodland/Savanna/Barren* - The extent of these open woodland habitats is best-estimated as "open woodland/partial canopy" category of land cover, though early successional forest and shrublands are also likely included. Many open woodland/savanna and shrub/successional species are among the Species in Greatest Need of Conservation. The extent and condition of these habitats is largely unknown, though perceived as very poor due to destruction and lack of management.

*Grassland* - Grasslands are an important habitat for many species in Illinois, including many endangered and threatened vertebrate and invertebrate species. Land cover data was problematic because of the inability to distinguish between categories of grassland (prairies, golf courses, roadside vegetation, etc.). Although the Critical Trends Assessment Program documents grasslands are in poor condition, scientists must sample 8.6 grassland sites on average before one is found that meets minimum sampling criteria. Deriving better information about the extent and condition of grasslands on a statewide scale will require a multi-step approach. Key features contributing to the wildlife value of grasslands include floral diversity, nesting season disturbance, winter cover, patch width and juxtaposition relative to other habitats. Accuracy of satellite imagery in identifying grassland should be verified.

*Shrub/successional* - The extent of shrub/successional habitat is best-estimated as "open woodland/partial canopy" category of land cover (which also includes the open woodland habitats described above). Many shrub/successional species are among the Species in Greatest Need of Conservation. Composition and condition of shrub/successional habitat unknown, but perceived as poor due to invasive shrubs, destruction, and lack of management.

*Wetland* - Wetlands are an important habitat for most of the vertebrate species in Illinois, including many endangered and threatened species. As part of the U.S. Fish & Wildlife Service's National Wetlands Inventory, an inventory of the wetlands of Illinois was completed utilizing mid-1980s photography, and is the sole source of statewide data. An updated inventory is essential to determine the extent of the resource and evaluating the effectiveness of wetland policies and programs. Advances in remote sensing technology, analysis software, and computing abilities will produce a more accurate and detailed inventory. Ephemeral wetlands are difficult to identify because they may be dry for a large part of the growing season, but provide essential habitat for many Species in Greatest Need of Conservation (e.g., salamanders, frogs, shorebirds, fairy shrimp). Because of their small size, these wetlands are easily converted or drained. Any wetland inventory must ensure the extent and condition of this wetland type is quantified.

Several large-scale wetland restoration efforts are ongoing within the Illinois River Valley (e.g., Conservation Reserve Enhancement Program, Emiquon Project, Hennepin & Hopper Lakes Project, Spunky Bottoms Project). Dr. Frank Bellrose produced >130 wetland maps of the Illinois River valley, each hand drawn with detailed vegetation types and zones, from 1939-1959. Although these recently-discovered maps do not cover all sites in all years, it is timely to convert these maps into Geographic Information System coverages, compare these "historic" conditions to contemporary wetland characteristics, and distribute these data as references for wetland restoration and evaluation efforts in Illinois and the upper Midwest. While large- and small-scale wetland restoration are under way, degradation of natural wetlands continues. Additional research is needed on the ecological aspects (such as quality invasive species, and contaminants) of both restored and high-quality sites.

Managed moist-soil areas are wetlands where water conditions, vegetation, and/or seed banks are manipulated to encourage growth of seed-producing vegetation (Low and Bellrose 1944, Fredrickson and Taylor 1982). Moist-soil management is employed throughout the U.S. to provide managed habitats for waterbirds that are rich in food resources, and is a common waterfowl habitat management practice in Illinois. Manipulating water levels and seed banks requires active management, and managers may not have the resources to evaluate the success of their management practices. The combined contribution of moist-soil sites managed by public agencies to foraging carrying capacity for waterfowl and other wildlife is not known.

*Lake & Pond* - Illinois Department of Natural Resources Fisheries biologists collect information on aquatic vegetation and water quality in conjunction with fish community sampling on the state's, lakes and ponds. These data are stored in the Fisheries Analysis System, maintained by the Illinois Natural History Survey. The system needs a comprehensive analysis, integration with other biological data sources, selected indicators of ecological integrity, and expansion to other taxa (invertebrates, phytoplankton, zooplankton). Inshore and offshore in southern Lake Michigan, water quality and habitat use/availability are also measured in conjunction with fish assemblage monitoring by the Illinois Department of Natural Resources, supported by Federal Aid (U.S. Fish & Wildlife Service) and the Great Lakes Fishery Commission. The program provides information on the status and trends of lake quality and fish ecological integrity, but could be improved with integration of other biological data sources and expanded effort.

*Stream* - Currently, conservation planning and implementation of stream habitat is hindered by the lack of a classification scheme for the diversity of stream types. An ecological classification of rivers in Illinois, Wisconsin, and Michigan is being developed to predict riverine site habitats and biological reference conditions from mapped landscape and local variables. These models will produce region-wide summaries of current ecological status, and coupled with a land transformation model, provide risk assessments for the river systems of the upper Midwest.

Habitat in Illinois' streams is characterized with the statewide Critical Trends Assessment Project. The Long-Term River Monitoring program also tracks aquatic vegetation and water quality in conjunction with fish and macroinvertebrate monitoring in the Illinois River (La Grange Reach) and Pool 26 of the Mississippi River. The Long-Term River Monitoring program provides status and trend data associated with operating the navigation system and ecosystem restoration efforts on the Mississippi and Illinois rivers. Field work is completed by the Illinois Natural History Survey's Illinois River Biological Station and Great Rivers Field Station, with support from the U.S. Army Corps of Engineers and the U.S. Geological Survey. Additional monitoring needs include enhanced floodplain assessments, integration with Conservation Reserve Enhancement Program, Wildlife Habitat Incentives Program, Conservation Reserve Program and other large scale programs, indicators of ecological integrity, and expansion to other taxa (invertebrates, phytoplankton, zooplankton).

Small, wadable streams, often with rocky substrates, host several of the aquatic Species in Greatest Need of Conservation, but are not covered by the Department of Natural Resources' traditional stream basin surveys. Information on historic and current coolwater stream habitat in Illinois is rare (Pickering 1950, Rudey 1999). Additional monitoring for fishes, mussels, other macroinvertebrates, zoo- and phytoplankton, water quality, and habitat structure in these habitats is needed to track the status and trends of these resources, and assess the stresses caused by pollutants, sediments, invasive species, and altered hydrology. When unnecessary dams are identified and removed in Illinois (e.g., Fox River), monitoring the responses of river fish and mussel communities, habitat availability and returning normalized hydrograph will be important to evaluate resource recovery and conservation success. Results can then be used to predict the costs and benefits of dam removal in other systems. Lastly, sentinel monitoring at the Chicago Waterway will assess the effectiveness of the aquatic nuisance species barrier, designed to prevent biological invasions of the Great Lakes from the Illinois River, and vice versa.

The U.S. Army Corps of Engineers, Illinois-Indiana Sea Grant and Great Lakes Fishery Commission can support this work.

*Cave* - Cave habitats are monitored only sporadically in Illinois, and largely in conjunction with biological monitoring. Water quality is measured periodically in select caves where Illinois cave amphipod surveys are conducted, and conditions are recorded during bat hibernacula surveys.

*Primary Habitats* - Glades, bluffs, cliffs, algific slopes and beaches that qualify as Illinois Natural Areas Inventory sites, as high-quality communities, threatened/endangered species habitat, and unique geological features, are monitored periodically as part of Illinois Natural Areas Inventory surveillance. No other formal monitoring of primary communities occurs.

*Cultural Habitats* - More information is necessary on many aspects of wildlife-agriculture interactions in Illinois. Waste grain is a particularly important source of energy for migratory, wintering and resident wildlife in the contemporary landscape of North America (Warner et al. 1989, Krapu et al. 2004). Efficiency of harvest has increased in recent decades, possibly reducing abundance of waste grain for wildlife (Krapu et al. 2004), while adoption of no-till and reduced-tillage methods may have offset this change. Additionally, genetically modified crop varieties are increasingly common in North America, but consequences to wildlife are largely unknown. Because much of Illinois' farmland is planted to grains annually, and myriad wildlife species use waste and natural plant seeds in harvested fields, current and precise estimates of waste grain abundance in the state are warranted. Crop damage, and wildlife control of agricultural pests, are certainly affected by the amount and relative positions of cropland and other habitats, but too poorly known to be effectively managed.

As developed areas expand in Illinois, the rural-urban interface and wildlife-human interactions are increasingly important. Strategies for conserving desirable species, managing deer and mesopredators (e.g., cats, raccoons), and minimizing human-wildlife conflicts need to be developed. Studying growth patterns and predicting future developments will help protect important habitats, viable populations, and valuable green infrastructure.

*Review & Revision of the Plan/Strategy*

*Review* - A partial draft comprehensive wildlife conservation plan/strategy was made available for public comment on the plan/strategy's website on 12 January 2005, and comments were requested by 1

March 2005. Twenty-eight (28) individuals and organizations requested and were sent hard copies of the partial draft. More than 140 sets of comments were received. With revisions and additions, the complete final draft of the comprehensive wildlife conservation plan/strategy was made available from 9 May to 30 June 2005. Forty-four (44) hard copy and disk copies of the final draft were sent upon request to individuals and organizations. About 80 sets of comments were received. For both the partial draft and the final draft, most agencies and organizations delivered 'compiled' comments that several persons had contributed towards, suggesting a larger, but unknown, number of reviewers of the documents, compared to the number of reviews received. After additional revisions, the Illinois Comprehensive Wildlife Conservation Plan & Strategy was delivered to the National Acceptance Advisory Team on 29 July 2005.

*Revision* - As natural resource conditions change, human priorities evolve, conservation action progress, and new information becomes available, the plan/strategy will need to be revised. As the lead natural resources agency in Illinois, the Illinois Department of Natural Resources has responsibility for updating and revising the comprehensive wildlife conservation plan/strategy. Several expected types of updates will need to be made with varying frequency (Table 1). Unexpected revisions and updates likely will be required as well.

The Comprehensive Wildlife Conservation Plan & Strategy is required to be revised at intervals not to exceed ten years. However, the Illinois Department of Natural Resources may elect to formally revise the entire Plan/Strategy at any earlier time. The essential steps that were used successfully in the initial planning process have been modified, and the time that will be required to complete each stage has been estimated (Table 2). Conditions at the time of revision will guide whether each of these steps are appropriate, and indicate if others are necessary.

*Implementation*

The National Advisory Acceptance Team voted to accept the Illinois Comprehensive Wildlife Conservation Plan/Strategy on 20 September 2005. To inform conservation partners and the public, an email notice was sent to those involved in the planning process on 5 October 2005, and a press release was issued on 31 October 2005. The accepted version of the Plan/Strategy was posted on the website (http://dnr.state.il.us/orc/wildliferesources/theplan/), and compact discs and hard copies of the Plan/Strategy were sent out on request. Subsequent to approval of the Plan/Strategy, articles on the "Wildlife Action Plan" were written and printed in the *Outdoor Illinois* and *Illinois Steward* magazines (Walk 2006a, b).

*Internal Implementation* - Three follow-up workshops were held on 12, 17, and 20 October 2005 for Department of Natural Resources biologists. Staff were given an update of the end of the planning process, examples of how implementation might affect them, and time for division-level discussions of next steps. From these discussions, and a set of questions answered by all Office of Resource Conservation staff (Appendix I), implementation plans for the divisions (Fisheries, Habitat Resources, Wildlife Resources, and the Nature Preserves Commission) began to be developed.

*Coordinating Implementation* - Having developed the Illinois Comprehensive Wildlife Conservation Plan/Strategy, the Illinois Department of Natural Resources is also the agency to lead implementation of the Plan/Strategy. Further, the steering committee composed of agency staff and external representatives was identified as the vehicle to be revised and expanded to represent other agencies and organizations and to help coordinate implementation. The Illinois Department of Natural Resources has taken steps to form the "Illinois Fish & Wildlife Action Team," with an initial meeting held in September 2006 (Appendix II).

Implementation of the Plan/Strategy will be a long-term, incremental endeavor, requiring leadership and persistence. It is likely to be many years before a full accounting of how, and how well, the Illinois Comprehensive Wildlife Conservation Plan/Strategy was implemented.

Conclusions:

Project 6 refines the prioritized conservation actions proposed in Project 4 (element 4), outlines a strategy for monitoring species, habitats and the effectiveness of conservation actions and adapting conservation actions to new information and changing conditions (element 5). By evaluating and modifying, if necessary, the planning process herein described, Project 6 outlines improved and efficient procedures for reviewing the plan at intervals not to exceed 10 years (element 6). Project 6 was coordinated with other agencies and organizations that manage land and water areas in the State, and administer programs affecting priority species and habitats (element 7), and the public contributed to revision of the plan (element 8).

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**Table 1.** Expected updates to the Illinois Comprehensive Wildlife Conservation Plan & Strategy, and their relative frequency.

*Perpetual revisions:*

- Update databases contributing to the Action Plan, including the Biotics 4 database, Fisheries basin surveys, mussel database, conservation practices tracking database
- Communicate with partner agencies and organizations on implementation, monitoring, evaluation, and revision to conservation actions
- Listen to public natural resource concerns, and respond as appropriate
- Assist in local or region 'step-down' conservation planning, including development of Conservation Opportunity Areas

*Annual to biennial revisions:*

- Compile the results of surveys, research, and monitoring programs
- Respond to emerging issues and developing opportunities
- Evaluate the effectiveness of conservation actions, and modify as indicated

*Two- to five-year revisions:*

- Evaluate the status, distribution, and stresses to the Species in Greatest Need of Conservation. The Endangered Species Protection Board formally reviews the state's lists of threatened and endangered species at 5-year intervals (scheduled for 2009 and 2014). Updating the lists of Species in Greatest Need of Conservation can be largely integrated into the activities of the Endangered Species Technical Advisory Committees.
- Evaluate the location and relative condition of habitat types. Land cover analyses have recently been updated at 4-5 year intervals, and this should continue, as land use (especially with respect to development) changes very rapidly in many parts of Illinois. Periodic reports for the Critical Trends Assessment Program provide an excellent summary of the overall condition of Illinois' forests, grasslands, wetlands, and streams.
- Identify priority survey and research efforts to determine status, assist in restoration, and improve conservation of wildlife and habitat resources.

**Table 2.** Timeline and activities for 10-year revision to the Illinois Comprehensive Wildlife Conservation Plan & Strategy.

| Time to Due Date | Activity |
|---|---|
| -24 months | Select revision team (coordination, information management, and partner/public contact) |
| -23 months | Form steering committee of internal and external partners to guide process |
| -22 months | Revision team reviews plan/strategy, existing databases, and other conservation plans |
| -20 months | Based on current conditions, revision team refines process outlined here |
| -18 months | Revision team identifies than assists experts in performing status and stress assessment for Species in Greatest Need of Conservation and habitats |
| -16 months | Illinois Department of Natural Resources and partners revise wildlife and habitat goals |
| -12 months | Regional planning workshops to identify issues, revise conservation strategies, and modify Conservation Opportunity Areas |
| -10 months | Revision team develops draft document |
| -4 months | Review - Illinois Department of Natural Resources, partners and public |
| -2 months | Final revision |
| Completion | Delivery of revised plan/strategy |
| + 2 months | Approval of revised plan/strategy; share revised plan/strategy with conservation partners and the public |

**Appendix I.** Questions to given to all biologists in the Illinois Department of Natural Resources's Office of Resource Conservation at workshops in October 2005. Based on these responses, each division or section began working on their approach to implementing the Illinois Comprehensive Wildlife Conservation Plan/Strategy.

**Illinois Wildlife Action Plan - Division/Section Discussion Meetings**

*Purpose:* Develop a written implementation plan for the Division/Section of ________________, delivered to Mike Conlin by Friday, November 4, 2005.

Division/Section Implementation Plan format:

Each division's role in implementing the Illinois Wildlife Action Plan is important, and different. This implementation plan should be organized by program. The Illinois Wildlife Action Plan includes work each of the divisions proposed. **How** to accomplish that work is also up to you.

Focus questions for staff:

These questions are provided to help you discuss implementation of the Action Plan today, and to give feedback for your administrators. Division chiefs will use your responses in building the divisions' implementation plans.

What is your role and the division's role in implementation?

What do you get out of the Action Plan? How will it help you do your job?

What additional tools do you need to fulfill your role? (Information/answers, program or administrative support, equipment, etc.)

What training do you need?

***Appendix I, continued.***

Knowing more work needs to be done that IDNR can accomplish on it's own...

What objectives are the division's priorities, statewide and regionally?

On what objectives will you and the division play a leading role?

On what objectives will you and the division play a supporting role? What agency/organization will be the lead?

How are you going to work with partners?

Which Conservation Opportunity Areas should be the first for focusing implementation? (Considering factors such as ease of working within the area, showing and measuring success, cost, expertise, division priorities, etc.)

What are the specific actions to be done there?

Who is going to do them?

With what resources?

What defines 'success'?

The Illinois Wildlife Action Plan sets 20-year objectives. What are 1-year, 3-year, 5-year mile stones for the division to work towards?

***Appendix I, continued.***

What biological data do you collect? What questions does it answer?

What additional monitoring is needed, to meet state, regional, and site objectives? How frequently does it need to be done?

What monitoring programs need to be re-evaluated?

When it comes to performance measurement, what outputs (things you do) and outcomes (things you try to achieve) make the most sense to track?

Identify and prioritize your research needs.

What are specific ways you'd recommend changing administrative processes or communication channels?

What are your questions that haven't been answered yet?

**Appendix II.** Draft outline for the composition, purpose and functions of the "Illinois Fish & Wildlife Action Team" for implementation of the Illinois Comprehensive Wildlife Conservation Plan/Strategy ("Illinois Wildlife Action Plan").

## ILLINOIS FISH AND WILDLIFE ACTION TEAM

### I. Background

In 2001, the US Congress created the State Wildlife Grants Program and charges states with developing proactive Wildlife Action Plans (formerly referred to as Comprehensive Wildlife Conservation Plans) to conserve wildlife before they become more rare and more costly to protect. At the initial stages of developing the Action Plan, a Steering Committee was created to help guide and coordinate it's development. In addition to IDNR staff, this Committee included representatives from the National Wild Turkey Federation, Ducks Unlimited, the Illinois Audubon Society, and The Nature Conservancy. With federal approval of the Illinois Wildlife Action Plan, the emphasis has shifted toward implementation. The new Illinois Fish and Wildlife Action Team will be charged with ensuring that the actions described in the Action Plan become on-the-ground results, facilitating communications and collaboration among organizations, and shaping future priorities for wildlife and habitat conservation through updates to the Action Plan. This document provides an overview of the committee structure for the Illinois Fish and Wildlife Action Team.

### II. Proposed Illinois Fish and Wildlife Action Team

Over 150 agencies and organizations comprising scientists, sportsmen, conservationists, government agencies, and other members of the community, have been part of the planning process, and therefore, have a vested interest in working together to more effectively achieve the wildlife and habitat goals identified in the Illinois' Wildlife Action Plan. All of these partners are valuable and critical to successful implementation. Each will contribute in different ways in implementation of the Action Plan.

***Appendix II, continued.***

The proposed Illinois Fish and Wildlife Action Team would be comprised of a smaller group of organizations, or "core partners." On a statewide scale, the core partners provide either: (1) significant resources, staff, and/or implementation activities (tactical needs), or (2) recruit support, function as an umbrella organization, and/or represent key constituent interests (strategic needs). Representatives from the core partners would have some level of decision-making capacity, and/or the capacity to direct limited resources, within their respective organizations.

**A. Proposed Chair**

As the State of Illinois' primary natural resources conservation agency, the IDNR accepted responsibility for developing and implementing the Action Plan. Within this capacity, the IDNR would chair the Illinois Fish and Wildlife Action Team. The IDNR chair is Deputy Director Leslie Sgro.

**B. Illinois Fish and Wildlife Action Team Members**

Members of the Illinois Fish and Wildlife Action Team would be comprised of core partners, providing either tactical or strategic needs on a statewide basis. As part of the Action Team, the IDNR has **preliminarily** identified core partners for consideration (Table A). This preliminary list of potential Illinois Fish and Wildlife Action Team core partners includes a total of 25 separate organizations. These potential members have formally invited by Acting Director Sam Flood to represent their organization on the Illinois Fish and Wildlife Action Team via a "letter of invitation."

***Appendix II, continued.***

**Table A.** Preliminary Illinois Fish and Wildlife Action Team core partners candidates.

| | |
|---|---|
| Assoc. of Illinois Soil & Water Conservation Districts | Illinois Dept. of Natural Resources (Chair) |
| Chicago Wilderness | Illinois Dept. of Agriculture |
| Ducks Unlimited | Illinois Dept. of Transportation |
| American Fisheries Society - Illinois Chapter | Illinois Endangered Species Protection Board |
| National Wild Turkey Federation | Illinois Environmental Protection Agency |
| Pheasants Forever | Illinois Farm Bureau |
| Prairie Rivers Network | Illinois Federation for Outdoor Resources |
| Quail Unlimited | Illinois Forestry Development Council |
| Sierra Club | Illinois Nature Preserves Commission |
| The Nature Conservancy | US Army Corps of Engineers |
| The Wildlife Society - Illinois Chapter | USDA Natural Resources Conservation Service |
| Illinois Audubon Society | US Fish & Wildlife Service |

### C. Proposed Workgroup Structure

In order to carry out the detailed work of the Illinois Fish and Wildlife Action Team, a proposed set of topical workgroups would be created. A primary set of workgroups would relate directly to the seven campaigns identified in the Action Plan (streams, invasive species, forests, farmland

***Appendix II, continued.***

protection, wetlands, land/water stewardship, green cities). Two additional workgroups would include IDNR Coordination and Teaming With Wildlife (TWW) Coalition/Advocacy (Figure A). All 150 plus partners are valuable and critical to successful implementation. Proposed members of the various workgroups would be comprised of appropriate "working partners." This larger group of working partners would have: (1) a vested interest in conservation and aid in efforts to implement the Action Plan, or (2) a focus on specific implementation of actions by campaigns. Representatives from the working partners would have more of a technical or local level of interest within their respective organizations.

1. **Proposed Workgroup Leads**: Core partners on the Illinois Fish and Wildlife Action Team would be identified to serve as workgroup leads. The primary role of the workgroup leads entails coordinating logistics for the workgroup and reporting of activities/progress to the Illinois Fish and Wildlife Action Team.

2. **Workgroup Members:** Members of the various working groups would be comprised of working partner organizations, providing key technical and specific implementation activities on a campaign basis. Working partner organizations would be invited to participate on the various workgroups by the Illinois Fish and Wildlife Action Team.

## III. Steps Taken to Date

### A. Review and Comment

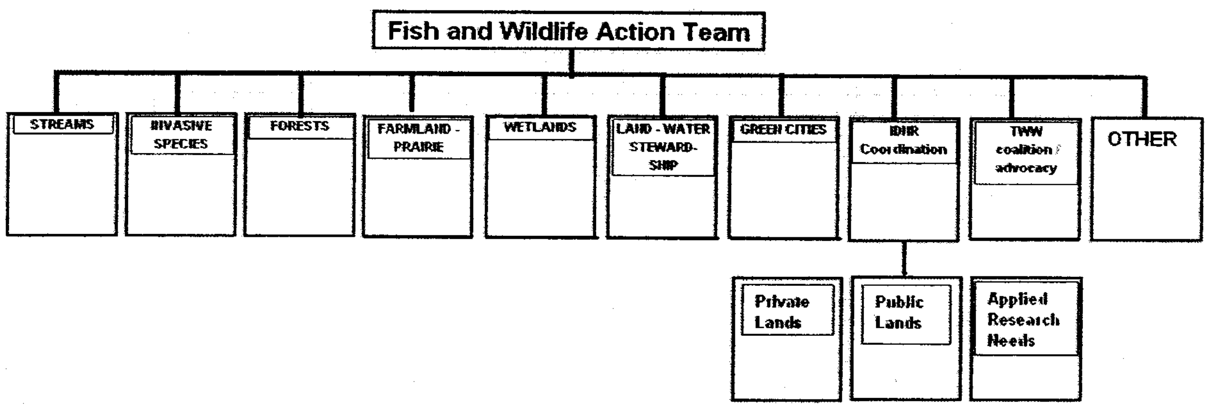
Members of the previous Steering Committee, (National Wild Turkey Federation, Ducks Unlimited, Illinois Audubon Society, The Nature Conservancy and IDNR staff) have reviewed and provided comments/suggestions to this proposal. A revised proposal for the Action Team, incorporating comments and suggestions from the previous Steering Committee, has been reviewed and approved by IDNR Senior Management.

***Appendix II, continued.***

### B. First Meeting of the Illinois Fish and Wildlife Action Team

Letters inviting potential core partners to participate as members of the Illinois Fish and Wildlife Action Team sent on July 27, 2006. Preparations for the first meeting of the Illinois Fish and Wildlife Action Team comprised of accepting core partners are underway. The time frame for the first Action Team meeting is September 2006.

**Figure A.** Proposed workgroup structure for the Illinois Fish & Wildlife Action Team.



**STATE WILDLIFE GRANT PROGRAM**

**State of Illinois**

**Final Performance Report**

**Grant T-2-P-1: Development of an Illinois Comprehensive Wildlife Conservation Plan and Supporting Information Systems**

**Project 7 - Report Development**

Objectives:

Incorporate comments on the draft Comprehensive Wildlife Conservation Plan/Strategy, develop and print the final document.

Project Description:

Comments on the draft Plan/Strategy were received from the public, stakeholders, conservation organizations and agencies, including the Regional Development Assistance Team. These comments were compiled, edited, and incorporated into a final Comprehensive Wildlife Conservation Plan/Strategy. The review and revision process required a number of iterations before a final version was produced. A small number of copies of the final document were printed, and it is available electronically for use by the Illinois Department of Natural Resources, partner organizations, and other land and water conservation agencies.

Approach:

Draft text, tables, and figures for the Plan/Strategy were developed concomitantly with identifying Species in Greatest Need of Conservation (Project 1) and determining their distribution and abundance (Project 2), describing detrimental factors (Project 3), and selecting conservation actions and Conservation Opportunity Areas (Job 4.1). Many biologists and conservationists contributed information, text, tables and figures for these tasks, that were then compiled and edited by the Plan Coordinator. Two drafts of the Plan/Strategy were made available for partner and public comment, after which the Plan Coordinator made appropriate revisions to the Plan/Strategy prior to submitting the final Comprehensive Wildlife Conservation Plan/Strategy to the National Advisory Acceptance Team prior to October 1$^{st}$, 2005, and making the complete technical document available to conservation partners and the public. A full and making the complete technical document available to conservation partners and the public. A full color executive summary version was also developed for broader distribution to partners and the public, directing them to the technical report for further information.

Results:

A full accounting of the process for developing the final Comprehensive Wildlife Conservation Plan/Strategy is described in detail through Projects 1-6 of Grant T-2-P-1. This report describes the drafting, approval, and production of the final Plan/Strategy, and of a brief summary document.

A partial draft of the Plan/ Strategy was reviewed by partners and the public during a 47-day comment period (12 January 2005 to 1 March 2005). Topics included in the partial draft were (1) the criteria for selecting the Species in Greatest Need of Conservation, (2) the lists of Species in Greatest Need of Conservation and the criteria applying to each, (3) the ranking of stresses to the Species in Greatest Need of Conservation and their habitats, and (4) the proposed conservation actions to address the stresses affecting Species in Greatest Need of Conservation and their habitats. Twenty-eight (28) individuals and organizations requested and were sent hard copies of the partial draft. More than 140 sets of comments were received.

The final draft Plan/Strategy was available for a 52-day comment period (9 May 2005-30 June 2005). Forty-four (44) hard copy and disk copies of the final draft were sent upon request to individuals and organizations. About 80 sets of comments were received. For both the partial draft and the final draft, most agencies and organizations delivered 'compiled' comments that several persons had contributed towards, suggesting a larger, but unknown, number of reviewers of the documents, compared to the number of reviews received.

After final revisions, the Illinois Comprehensive Wildlife Conservation Plan & Strategy, along with a supplemental disc of "Information on the Distribution & Abundance of Illinois' Species in Greatest Need of Conservation" was delivered to the National Acceptance Advisory Team on 29 July 2005. At their 20 September 2005 meeting, the National Advisory Acceptance Team voted to accept the Illinois Comprehensive Wildlife Conservation Plan & Strategy. The final (accepted) Plan/Strategy was posted online (http://dnr.state.il.us/orc/wildliferesources/theplan/), and hard copies and compact disc copies were sent out upon to request (Appendix I - please refer to the compact disc copy of the *Illinois Comprehensive Wildlife Conservation Plan & Strategy* and *Information on the Distribution & Abundance of Illinois' Species in Greatest Need of Conservation* included with this report).

A non-technical summary document was also produced for wider distribution to partners and the public. This document was designed to inform readers of the content of the Illinois Comprehensive Wildlife Conservation Plan & Strategy (commonly referred to as the Illinois Wildlife Action Plan). More than 50,000 copies were printed of the 8-page, full color summary document (see Appendix I).

Conclusions:

Project 7 fulfilled the State's obligation to submit a Plan/Strategy that addressed the 8 required elements to the US Fish & Wildlife Service by 1 October 2005. The Illinois Comprehensive Wildlife Conservation Plan/Strategy is being used by the Illinois Department of Natural Resources, partner organizations, and other land and water conservation agencies to develop, prioritize, implement and evaluate conservation actions.

**Appendix I.** The Illinois Comprehensive Wildlife Conservation Plan-Strategy (accompanying compact disc). *Delivered 29 July 2005, accepted 20 September 2005.*

Contents:

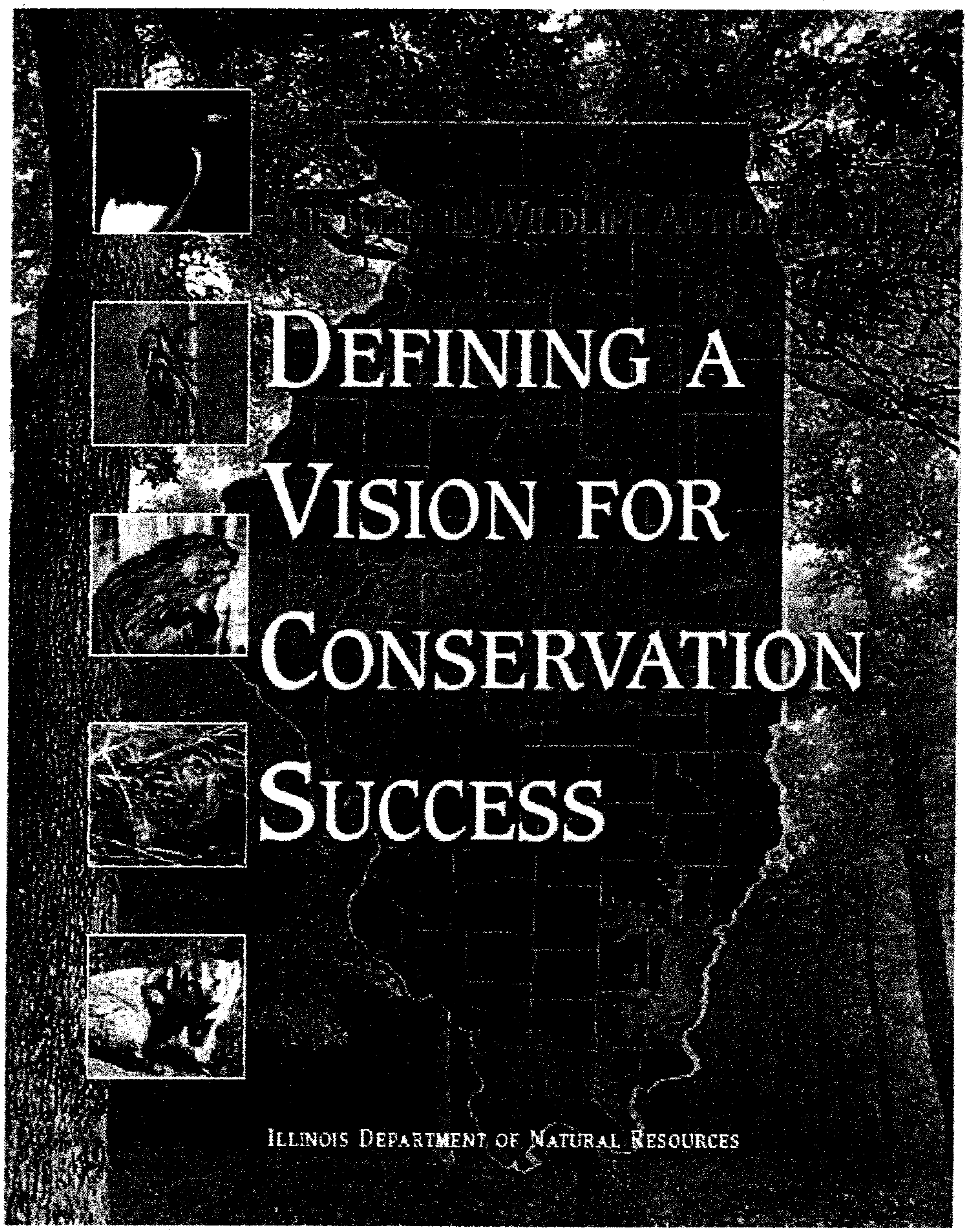
A. Illinois Comprehensive Wildlife Conservation Plan-Strategy, version 1.0 (78,456 KB)

B. Supplement - Distribution & Abundance Information (*folder*)

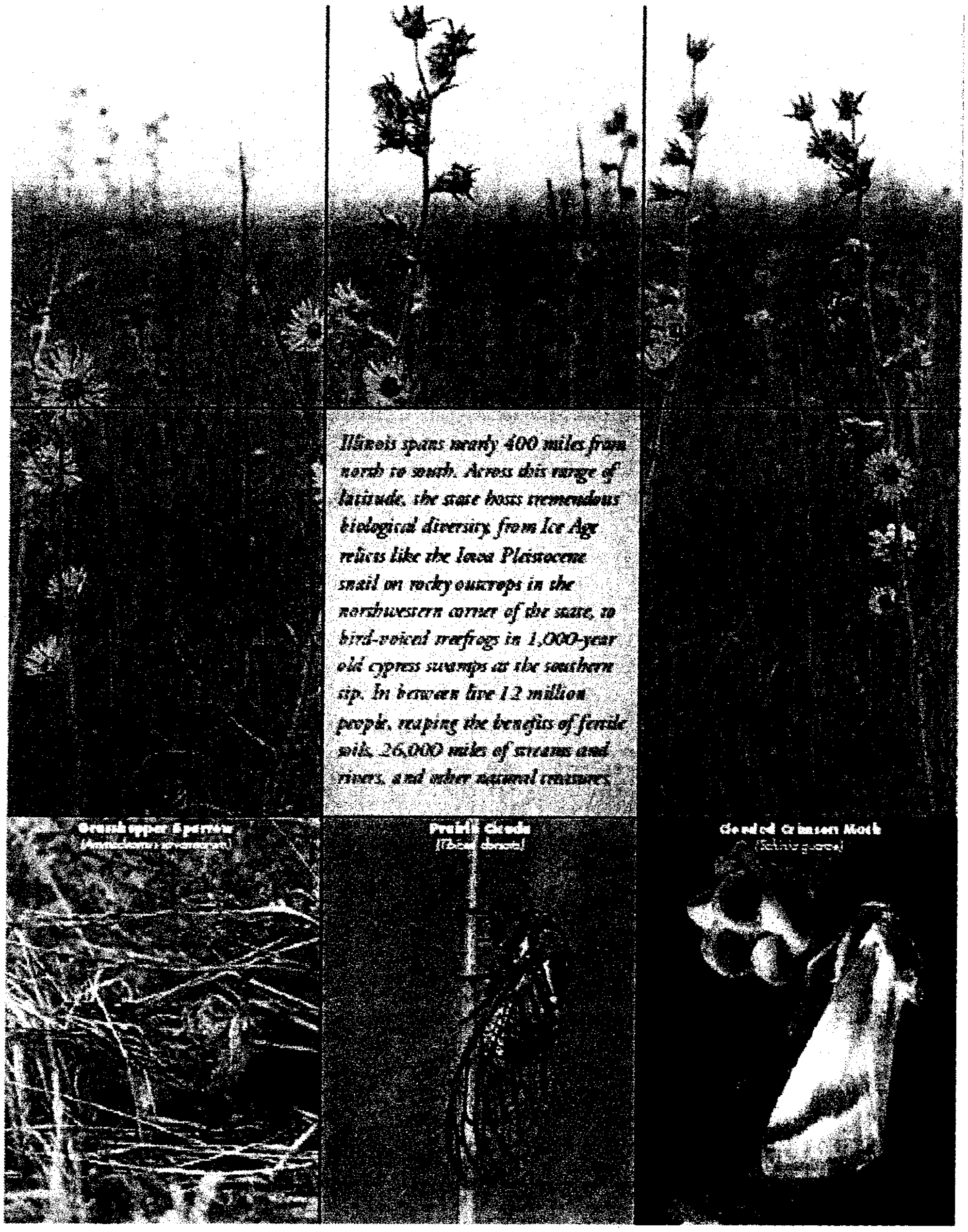
1. READ ME - GUIDE TO CONTENTS (34 KB)
2. From threatened & Endangered Species of Illinois (8,335 KB)
3. From INHS Mussel database (5,096 KB)
4. From INHS Fishes database (12,855 KB)
5. From Amphibians & Reptiles of Illinois (2,150 KB)
6. From Breeding Bird Atlas (28,933 KB)
7. From Illinois GAP Analysis (*folder*)
    - Amphibians (2,909 KB)
    - Reptiles (4,658 KB)
    - Migratory-only Birds (4.996 KB)
    - Mammals (4,815 KB)

*All files are Adobe Acrobat format.*

**Appendix II.** Draft of the non-technical summary version of the Illinois Comprehensive Wildlife Conservation Plan-Strategy, "*The Illinois Wildlife Action Plan: Defining a Vision for Conservation Success.*"



## *Appendix II, continued.*



## *Appendix II, continued.*

Changes in wildlife and habitat have been a mixed bag of shortcomings and successes in recent decades. Bald eagles and river otters, once endangered, are now thriving. Meanwhile, greater prairie-chickens—the signature bird of the tallgrass prairie–barely hang on in The Prairie State. Water quality and many fish populations have improved dramatically, but a quarter of our freshwater mussels are extinct or extirpated. Game animals like white-tailed deer, wild turkeys, and Canada geese are doing well, while bobwhite are not. The amount of forest in Illinois has doubled over the past century, but in spite of efforts like the Conservation Reserve Program, was have less than half as much grassland today as in 1950. The Mississippi Flyway and Lake Michigan shoreline continue to bring spectacular concentrations of migratory birds to Illinois and the state has long been a leader in identifying and conserving high-quality natural areas. Exotic plants, animals and diseases continue to arrive—harming native wildlife, degrading natural areas, and complicating conservation efforts.

**The Illinois Wildlife Action Plan applies the principles of conservation biology to a coordinated set of on-the-ground actions.** The Wildlife Action Plan began by considering all wildlife and involving everyone with an interest in wildlife conservation - conservationists, sportsmen, scientists, and members of the community. All forms of wildlife - aquatic and terrestrial, vertebrates and invertebrates, endangered species, game and non-game - are included in the Wildlife Action Plan, by focusing on the habitat they need, rather than a cumbersome species-by-species approach. More than 800 people willingly assisted with developing the plan through workshops, contributing information and ideas, and offering critical reviews. The Illinois Wildlife Action Plan meets the challenge of linking resources with the diverse conservation efforts of various organizations and individuals into a strategic framework that effectively protects species.

**The Illinois Wildlife Action Plan is a proactive and dynamic process.** By identifying wildlife with declining populations or special needs, conservation will be more effective—and less controversial—than if such efforts wait until the populations become endangered and very difficult and costly to recover. This philosophy is simply stated as "keeping common species common." The plan is being updated continuously as we learn more about our natural resources, monitor progress, evaluate effectiveness, and respond to changing conditions.

**The Illinois Wildlife Action Plan defines a vision for conservation success.** The goals defined in the Wildlife Action Plan are based on the diversity and abundance of wildlife that maintain the state's biodiversity for the long-term, and satisfy our recreational and economic needs for angling, hunting, trapping, and wildlife-viewing. These wildlife objectives are translated into the habitat needed to support them - how much is needed, the quality that should be maintained, and locations where it will have the greatest benefit. The vision of the Illinois Wildlife Action Plan fulfills our responsibility to conserve wildlife and the places they live for future generations.

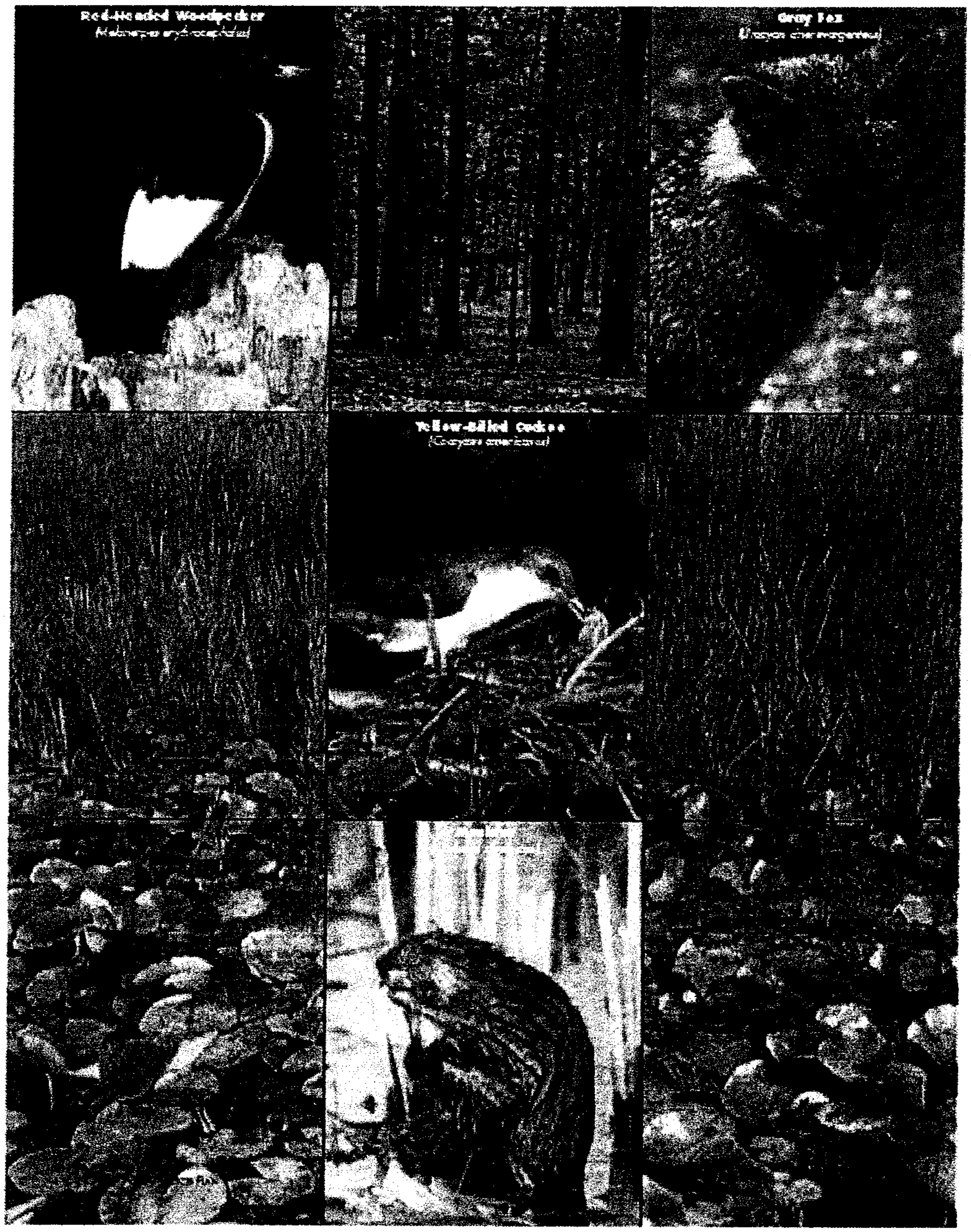
**The Illinois Wildlife Action Plan is a science-based approach to identifying conservation priorities and crafting solutions.** Scientists compiled and analyzed an enormous amount of data to assess the location, size and condition of all of Illinois's wildlife and habitat. Using a consistent set of criteria, scientists identified species in greatest need of conservation - those species of wildlife with low or declining populations, or indicative of the health and diversity of the health and diversity of Illinois's wildlife and habitat. (See table, draft pg 10)

In much of Illinois, agriculture and development limit available habitat. The condition of most habitats are degrading due to fragmentation, absence of natural disturbances such as fire, invasive species, and other factors. Invasive species in particular are an increasing problem, and conservationists need new prevention and control tools to successfully meet the challenge. Changes in the human population are affecting how we conserve wildlife: dealing with urban sprawl, providing access to natural areas and open space, and accommodating changes in recreational preferences.

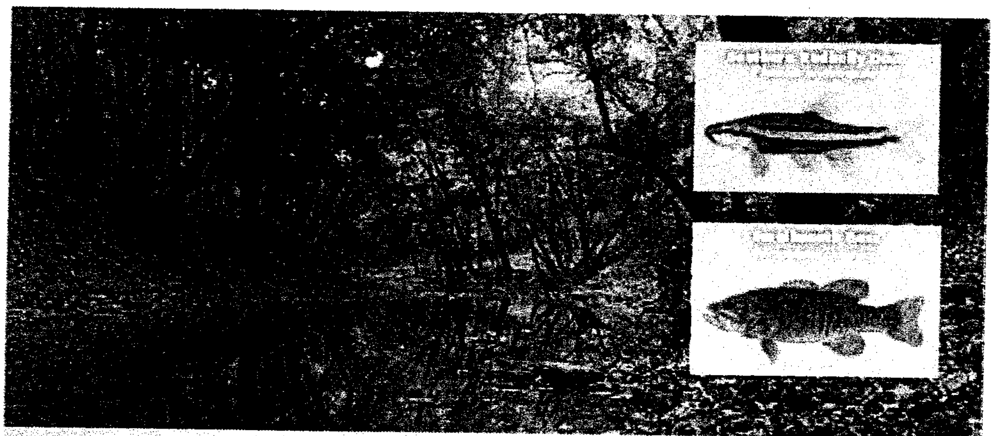
The actions described in the Wildlife Action Plan emphasize a broad spectrum of natural resource benefits beyond addressing the challenges facing wildlife and habitat challenges: clean water, soil conservation, human health and safety, economic diversity, and sustainability. The actions range from interstate projects that enhance shared resources such as our large bordering rivers and the Great Lakes, to improvements at specific natural areas.

With an excellent network of universities, museums, the Illinois Natural History Survey, and other institutions, Illinois has a knowledge of its biological resources that is envied by most other states. Still, there are gaps in the knowledge of poorly known species and habitats, and new ideas need to be cultivated to address chronic and emerging

## *Appendix II, continued.*



## *Appendix II, continued.*



problems. Monitoring wildlife responses through protocols described in the action plan will ensure conservation actions are contributing to natural resource goals. Through adaptive management and a dynamic Wildlife Action Plan, new challenges and opportunities that arise will be addressed quickly.

**The Illinois Wildlife Action Plan tailors our actions to different scales, and matches conservation partners with sources of support.** Every action is linked to a problem it is designed to solve, and focused on a natural resource objective it will help achieve. The next step is to determine the best tool for each job, whether it be a program supported by a state or federal agency, to local land protection or habitat management. Knowing the partners who are already working at each scale, or in each area, the Illinois Wildlife Action Plan matches them with the sources of support they need - equipment, personnel, funding - to turn the vision for wildlife conservation in Illinois into an on-the-ground reality.

At the statewide level, actions are grouped into seven overlapping campaigns, based on habitats and common issues.

*Farmland & Prairie Campaign* - Expanding and improving grassland, shrub and wetland habitats in agricultural landscapes, with economic incentives and technical assistance for private land owners.

*Forests Campaign* - Improving wildlife habitat, ecological integrity, and economic value of the state's forests and savannas with through appropriate, sustainable forestry practices.

*Wetlands Campaign* - Restoring and enhancing wetlands for wildlife habitat, reduced flooding, and improved water quality.

*Streams Campaign* - Reduce sedimentation and enhance biodiversity by protecting riparian areas, stabilizing stream banks, and repairing in-stream habitat.

*Exotic Species Campaign* - Working together to prevent, contain and manage exotic plants, animals and diseases that threaten natural areas, wildlife and human health.

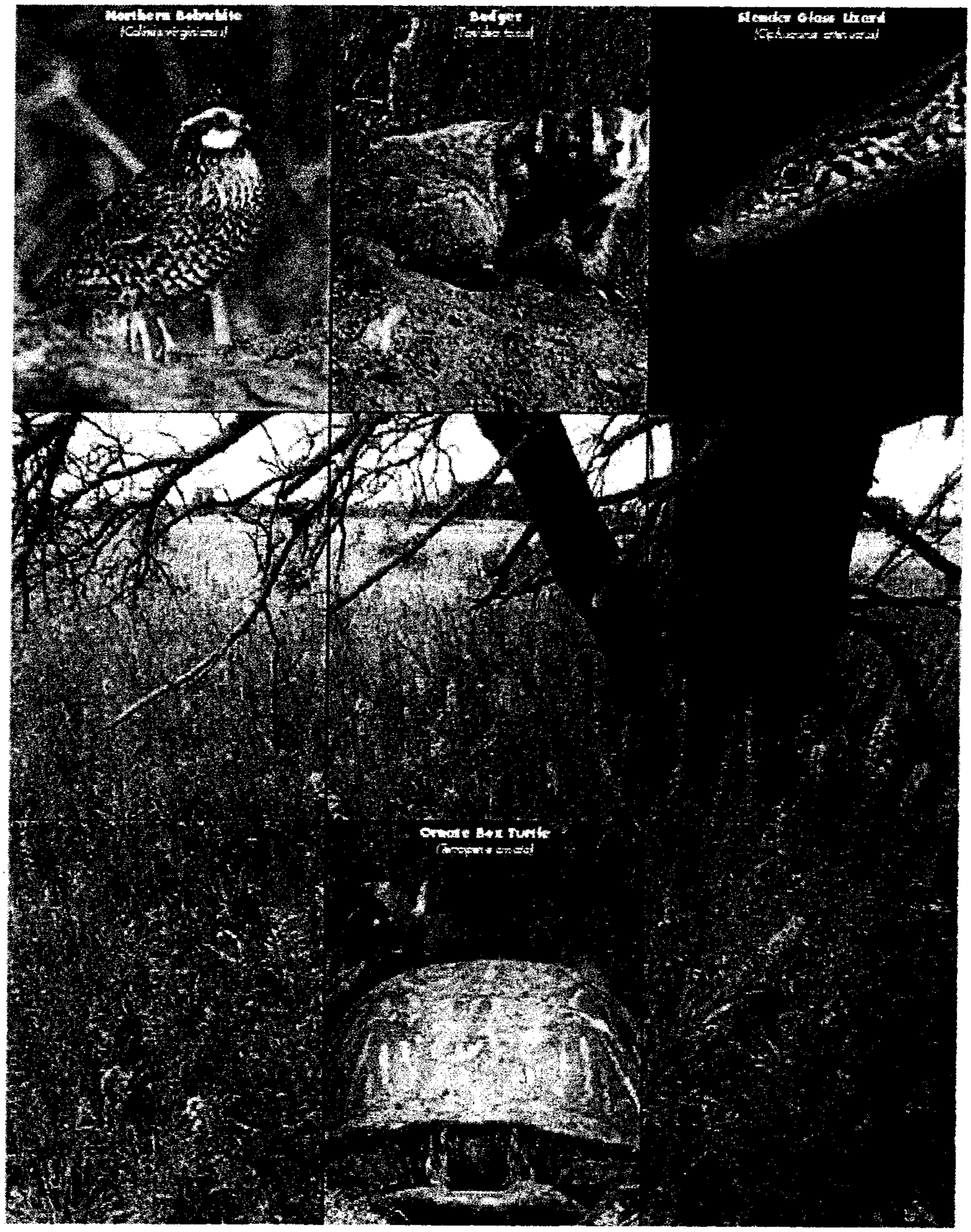
*Land & Water Stewardship Campaign* - Providing public and private land owners with the knowledge and tools to best manage healthy forests, grasslands, wetlands, streams and lakes with abundant wildlife.

*Green Cities Campaign* - Making cities and towns more livable through smart growth, protecting open space, and providing wildlife recreation opportunities.

For each of the 14 Natural Divisions of Illinois—distinctive regions with similar geologic history and biological features—biologists identified the key habitat types and fish and wildlife species unique or important to the region. Recognizing issues vary regionally, and actions need to be centered on regional needs, the approaches outlined for each natural division reflect the diversity of Illinois. (See Western Forest-Prairie inset map and land use chart, chart pg 13.)

**Conservation Opportunity Areas** are sites with special importance for conserving species in greatest need of conservation and natural communities. While not every species occurs in one of these areas, efforts here are essential to conserving wildlife and natural areas for future generations to appreciate and enjoy. (See Conservation Opportunity Area map page 8)

***Appendix II, continued.***

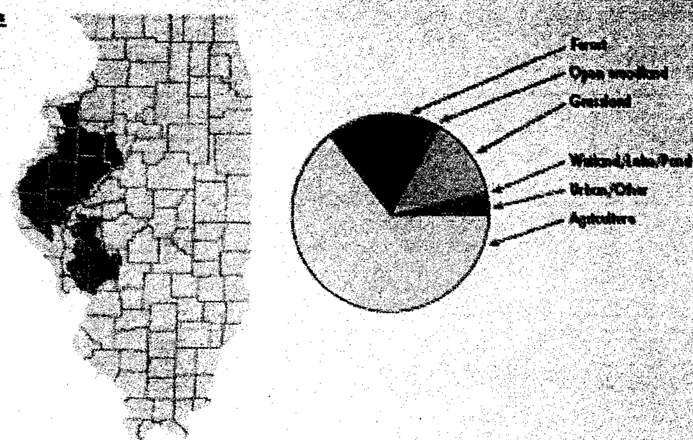


*Appendix II, continued.*

## Samples from the Western Forest–Prairie Natural Division

**Natural Communities**
Savannas
Barrens
Hill Prairies

**Emphasis Wildlife**
Bewick's wren
Slender glass lizard
Northern bobwhite




## The Illinois Wildlife Action Plan

Using a philosophy of "keeping common species common," scientists, sportsmen, conservationists, and members of the community worked together on the Wildlife Action Plan, advocating creative and sensible solutions. By focusing on wildlife and natural areas before problems become severe, the Action Plan is a cost-effective, long-term approach. Conserving and restoring natural places will ensure clean water for people and wildlife. Pollution and diseases affecting wildlife, such as DDT and the West Nile Virus, are often early indicators of problems that, if left unchecked, can affect people, too. Wildlife, and the places they live, are important to us, our family traditions, and future generations. They're worth the investment.

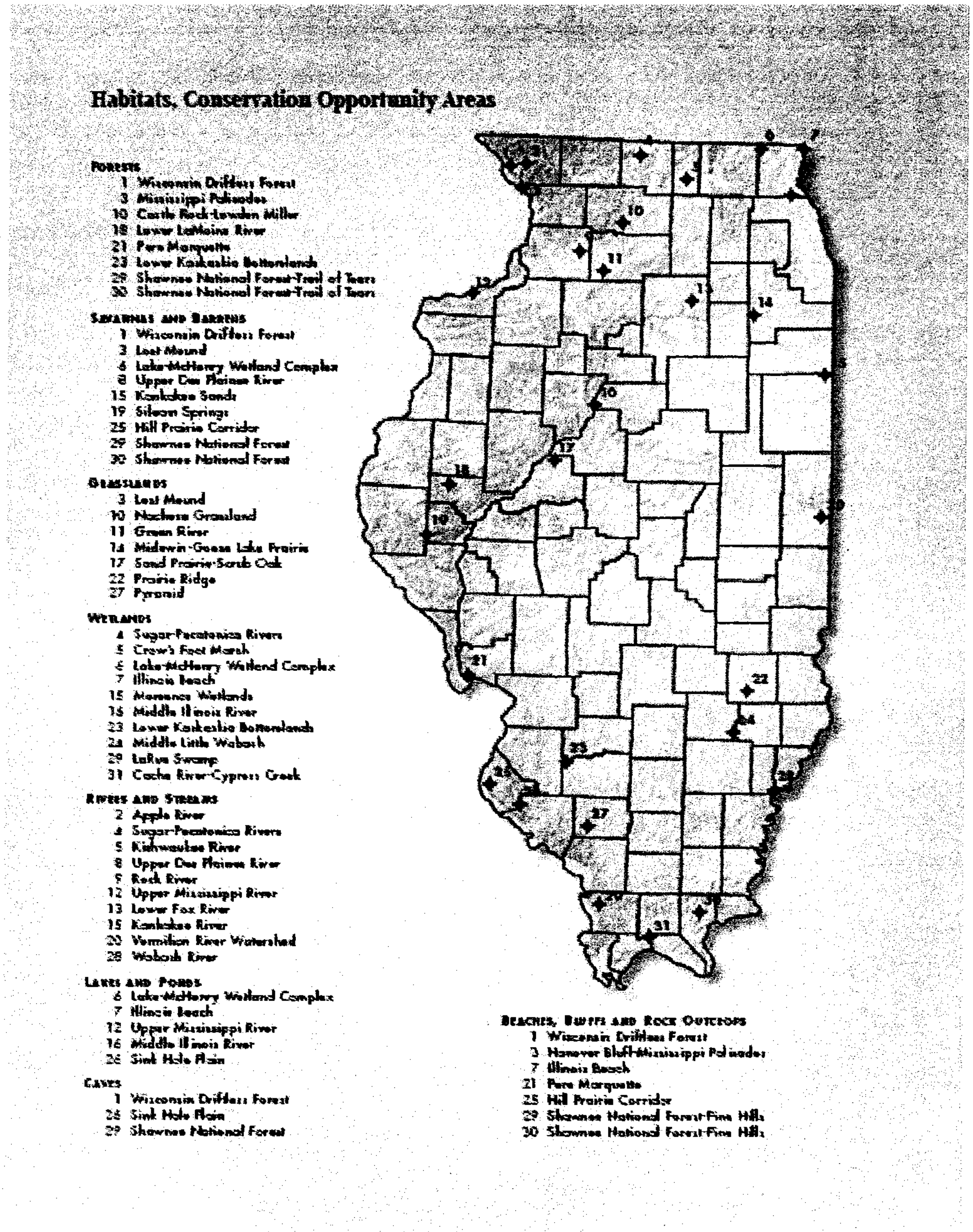
Development of the Illinois Wildlife Action Plan was supported by State Wildlife Grant Program funding (Federal Aid Project T-2-P-1). For more information and copy of the complete Illinois Wildlife Action Plan, please visit: http://dnr.state.il.us/orc/wildliferesources/theplan/

### Illinois Wildlife—An Accounting

| Wildlife | Total number | Species in greatest need of conservation* | Threatened or endangered |
|---|---|---|---|
| Mussels | 61** | 29 | 24 |
| Snails | 170 | 25 | 2 |
| Insects | About 17,000 | 347 | 12 |
| Crustaceans | 207 | 22 | 10 |
| Fish | 187 | 80 | 31 |
| Amphibians | 41 | 14 | 8 |
| Reptiles | 60 | 22 | 16 |
| Birds | 300*** | 83 | 32 |
| Mammals | 59 | 20 | 9 |
| Totals | About 18,000 | 638 | 144 |

* Based on seven criteria including: low or declining populations, dependence on a rare or vulnerable habitat, and usefulness as an indicator of the health of a community or habitat.
** An additional 19 species are extinct or have been extirpated from Illinois.
*** Approximate number of regularly occurring species. Including vagrants and accidentals, 432 species have been documented.

*Appendix II, continued.*



| Category | Budget - Amended | Expenditures - Final | Deviation from Budget |
|---|---|---|---|
| Personnel | $ 682,622 | $ 691,102 | + 1% |
| Benefits | $ 214,153 | $ 204,669 | - 4% |
| Travel | $ 42,137 | $ 29,055 | - 31% |
| Commodities | $ 20,335 | $ 14,634 | - 28% |
| Equipment | $ 7,920 | $ 8,397 | + 6% |
| Contractual | $ 48,958 | $ 64,239 | + 31% |
| Total Direct Cost | $ 1,012,124 | $ 1,012,139 | - |
| Indirect Cost | $ 202,426 | $ 202,430 | - |
| Total Cost | $ 1,214,550 | $ 1,214,570 | - |

* Category savings were applied toward production of color & glossy brochure

| Expenditures | Jobs 1.1; 2.1; 3.3; & 4.1 | Job 2.3 | Job 2.4 | Job 2.5 | Job 2.6 | Job 4.3 | Jobs 5.1 & 5.2 | Job 6 | Job 7 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Personnel | $ 60,636 | $ 147,658 | $ 87,968 | $ 26,277 | $ 104,940 | $ 138,884 | $ 68,038 | $ 40,900 | $ 15,801 | $ 691,102 |
| Benefits | $ 16,038 | $ 48,005 | $ 29,992 | $ 3,149 | $ 35,093 | $ 43,175 | $ 12,929 | $ 10,856 | $ 5,432 | $ 204,669 |
| Travel | $ 3,753 | $ 819 | $ 1,974 | $ 13,599 | $ 2,112 | $ 1,351 | $ 990 | $ 2,657 | $ 1,800 | $ 29,055 |
| Commodities | $ 2,282 | $ 512 | $ 277 | $ 5,037 | $ 3,964 | $ 595 | $ 1,747 | $ 220 | $ - | $ 14,634 |
| Equipment | $ 2,653 | $ 2,781 | $ - | $ - | $ - | $ 2,963 | $ - | $ - | $ - | $ 8,397 |
| Contractual | $ 5,373 | $ 1,709 | $ 1,475 | $ 1,938 | $ 1,000 | $ 3,120 | $ 20,994 | $ 15,978 | $ 12,652 | $ 64,239 |
| Total Direct Cost | $ 90,779 | $ 201,483 | $ 121,686 | $ 49,999 | $ 147,109 | $ 190,089 | $ 104,697 | $ 70,611 | $ 35,686 | $ 1,012,139 |
| Indirect Cost | $ 18,157 | $ 40,297 | $ 24,337 | $ 10,001 | $ 29,422 | $ 38,018 | $ 20,939 | $ 14,122 | $ 7,137 | $ 202,430 |
| Total Cost | $ 108,936 | $ 241,781 | $ 146,023 | $ 60,000 | $ 176,531 | $ 228,107 | $ 125,636 | $ 84,733 | $ 42,823 | $ 1,214,570 |

| Amended Allotment | Jobs 1.1; 2.1; 3.3; & 4.1 | Job 2.3 | Job 2.4 | Job 2.5 | Job 2.6 | Job 4.3 | Jobs 5.1 & 5.2 | Job 6 | Job 7 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Personnel | $ 60,636 | $ 147,980 | $ 85,000 | $ 28,847 | $ 99,000 | $ 139,608 | $ 62,151 | $ 43,134 | $ 16,266 | $ 682,622 |
| Benefits | $ 16,631 | $ 47,943 | $ 25,186 | $ 6,553 | $ 37,185 | $ 41,281 | $ 18,353 | $ 16,201 | $ 4,820 | $ 214,153 |
| Travel | $ 4,200 | $ 2,781 | $ 5,000 | $ 12,700 | $ 4,427 | $ 1,130 | $ 2,100 | $ 5,799 | $ 4,000 | $ 42,137 |
| Commodities | $ 1,803 | $ 500 | $ 2,500 | $ 5,000 | $ 4,000 | $ 770 | $ 1,500 | $ 3,262 | $ 1,000 | $ 20,335 |
| Equipment | $ 3,760 | $ 1,160 | $ - | $ - | $ - | $ 3,000 | $ - | $ - | $ - | $ 7,920 |
| Contractual | $ 3,750 | $ 1,119 | $ 4,000 | $ 900 | $ 2,500 | $ 4,300 | $ 20,592 | $ 2,197 | $ 9,600 | $ 48,958 |
| Total Direct Cost | $ 90,779 | $ 201,483 | $ 121,686 | $ 50,000 | $ 147,112 | $ 190,089 | $ 104,696 | $ 70,593 | $ 35,686 | $ 1,012,124 |
| Indirect Cost | $ 18,157 | $ 40,297 | $ 24,337 | $ 10,000 | $ 29,422 | $ 38,018 | $ 20,939 | $ 14,119 | $ 7,137 | $ 202,426 |
| Total Cost | $ 108,936 | $ 241,780 | $ 146,023 | $ 60,000 | $ 176,534 | $ 228,107 | $ 125,635 | $ 84,712 | $ 42,823 | $ 1,214,550 |

| Original Allotment | Jobs 1.1; 2.1; 3.3; & 4.1 | Job 2.3 | Job 2.4 | Job 2.5 | Job 2.6 | Job 4.3 | Jobs 5.1 & 5.2 | Job 6 | Job 7 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Personnel | $ 58,070 | $ 149,952 | $ 85,000 | $ 17,496 | $ 105,000 | $ 133,408 | $ 62,151 | $ 55,792 | $ 16,266 | $ 683,135 |
| Benefits | $ 17,194 | $ 44,431 | $ 25,186 | $ 5,184 | $ 31,112 | $ 37,181 | $ 18,353 | $ 16,475 | $ 4,820 | $ 199,936 |
| Travel | $ 4,200 | $ 2,000 | $ 5,000 | $ 8,320 | $ 4,500 | $ 8,000 | $ 2,100 | $ 6,000 | $ 4,000 | $ 44,120 |
| Commodities | $ 1,900 | $ 400 | $ 2,500 | $ 5,000 | $ 4,500 | $ 1,500 | $ 1,500 | $ 3,000 | $ 1,000 | $ 21,300 |
| Equipment | $ 1,900 | $ 2,800 | $ - | $ - | $ - | $ 3,000 | $ - | $ - | $ - | $ 7,700 |
| Contractual | $ 7,515 | $ 1,900 | $ 4,000 | $ 14,000 | $ 2,500 | $ 7,000 | $ 20,592 | $ 856 | $ 9,600 | $ 67,963 |
| Total Direct Cost | $ 90,779 | $ 201,483 | $ 121,686 | $ 50,000 | $ 147,112 | $ 190,089 | $ 104,696 | $ 82,123 | $ 35,686 | $ 1,023,654 |
| Indirect Cost | $ 18,157 | $ 40,297 | $ 24,337 | $ 10,000 | $ 29,422 | $ 38,018 | $ 20,939 | $ 16,424 | $ 7,137 | $ 204,731 |
| Total Cos[illegible] | $ 108,936 | $ 241,780 | $ 146,023 | $ 60,000 | $ 17[illegible] | $ 228,107 | $ 125,635 | $ 98,547 | $ 42,823 | $ 1,228,38[illegible] |