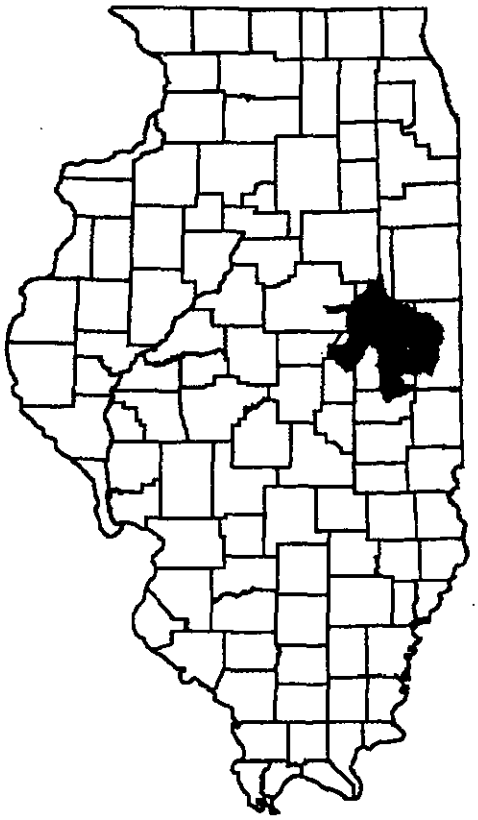
Volume 3

Living Resources

HEADWATERS AREA ASSESSMENT



ILLINOIS DEPARTMENT OF NATURAL RESOURCES

HEADWATERS AREA ASSESSMENT

VOLUME 3: LIVING RESOURCES

Illinois Department of Natural Resources
Office of Scientific Research and Analysis
Natural History Survey Division
607 East Peabody Drive
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About This Report

The Headwaters area is perhaps unique in all of Illinois. In this area of approximately 25 miles by 50 miles in east central Illinois is found the source of the Vermilion, Embarras, Sangamon, Mackinaw, Kaskaskia, and Little Vermilion rivers -- rivers and streams that ultimately drain almost one-third of the state. The area is not generally considered "resource rich" in the sense of vast and complex forest, wetland or prairie ecosystems. It does exert, however, an undue influence on such ecosystems downstream. The streams that originate in the Headwaters area are among the most pristine and scenic in the state.

This report is part of a series of reports on areas of Illinois where a public-private partnership has been formed. These assessments provide information on the natural and human resources of the areas as a basis for managing and improving their ecosystems. The determination of resource rich areas and development of ecosystem-based information and management programs in Illinois are the result of three processes -- the Critical Trends Assessment Program, the Conservation Congress, and the Water Resources and Land Use Priorities Task Force.

Background

The Critical Trends Assessment Program (CTAP) documents changes in ecological conditions. In 1994, using existing information, the program provided a baseline of ecological conditions.[1] Three conclusions were drawn from the baseline investigation:

1. the emission and discharge of regulated pollutants over the past 20 years has declined, in some cases dramatically,
2. existing data suggest that the condition of natural ecosystems in Illinois is rapidly declining as a result of fragmentation and continued stress, and
3. data designed to monitor compliance with environmental regulations or the status of individual species are not sufficient to assess ecosystem health statewide.

Based on these findings, CTAP has begun to develop methods to systematically monitor ecological conditions and provide information for ecosystem-based management. Five components make up this effort:

1. identify resource rich areas,
2. conduct regional assessments,
3. publish an atlas and inventory of Illinois landcover,
4. train volunteers to collect ecological indicator data, and
5. develop an educational science curriculum which incorporates data collection

[1] See *The Changing Illinois Environment: Critical Trends*, summary report and volumes 1-7.

At the same time that CTAP was publishing its baseline findings, the Illinois Conservation Congress and the Water Resources and Land Use Priorities Task Force were presenting their respective findings. These groups agreed with the CTAP conclusion that the state's ecosystems were declining. Better stewardship was needed, and they determined that a voluntary, incentive-based, grassroots approach would be the most appropriate, one that recognized the inter-relatedness of economic development and natural resource protection and enhancement.

From the three initiatives was born Conservation 2000, a six-year program to begin reversing ecosystem degradation, primarily through the Ecosystems Program, a cooperative process of public-private partnerships that are intended to merge natural resource stewardship with economic and recreational development. To achieve this goal, the program will provide financial incentives and technical assistance to private landowners. The Rock River and Cache River were designated as the first Ecosystem Partnership areas.

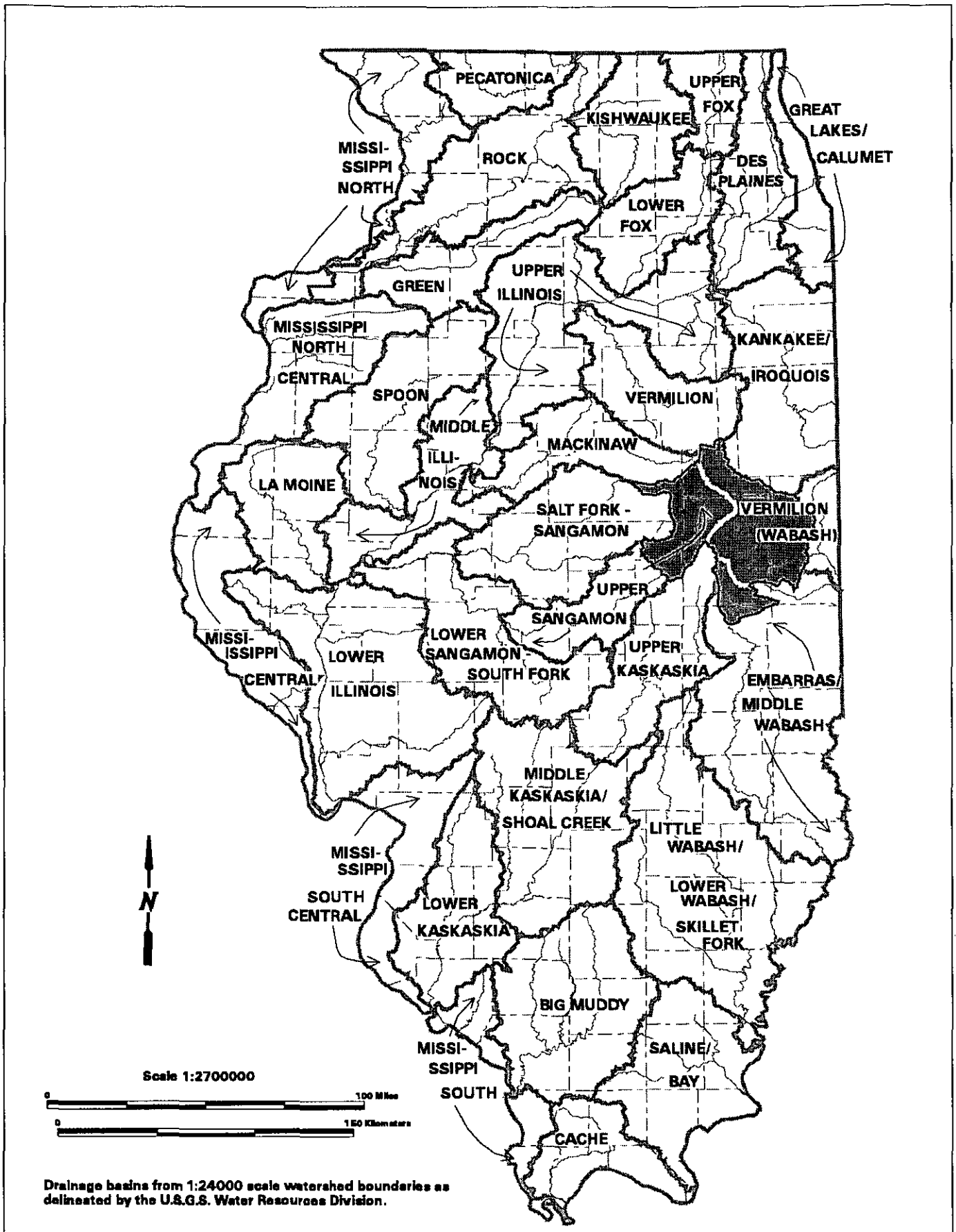
At the same time, CTAP identified 30 Resource Rich Areas (RRAs) throughout the state. In RRAs where Ecosystem Partnerships have been formed, CTAP is providing an assessment of the area, drawing from ecological and socio-economic databases to give an overview of the region's resources -- geologic, edaphic, hydrologic, biotic, and socio-economic. Although several of the analyses are somewhat restricted by spatial and/or temporal limitations of the data, they help to identify information gaps and additional opportunities and constraints to establishing long-term monitoring programs in the partnership areas.

The Headwaters Area Assessment

The Headwaters assessment area (HAA) is an approximately 1,675 mile^2 (1,072,202 acre) area including much of Champaign County and portions of Ford, Livingston, McLean, Iroquois, Vermilion, Douglas, Piatt, and De Witt counties in central Illinois. This area includes the headwaters of the Sangamon and Embarras rivers and the watersheds of the Middle Fork and Salt Fork in the headwaters of the Vermilion River. The HAA is composed of 32 subbasins from these three major drainage basins.[2] These include 24 subbasins in the Vermilion (Wabash) drainage basin, five subbasins in the Upper Sangamon basin, and three in the Embarras/Middle Wabash basin. Two of these subbasins the Middle Fork Vermilion River and Embarras River subbasins, were designated as "Resource Rich Areas " (Suloway et al. 1996)[3] because they contain significant natural community diversity. Ecological conditions in the HAA are particularly important to a large region of Illinois because land use practices affecting stream quality in the HAA can have environmental consequences reaching far downstream from the headwaters region.

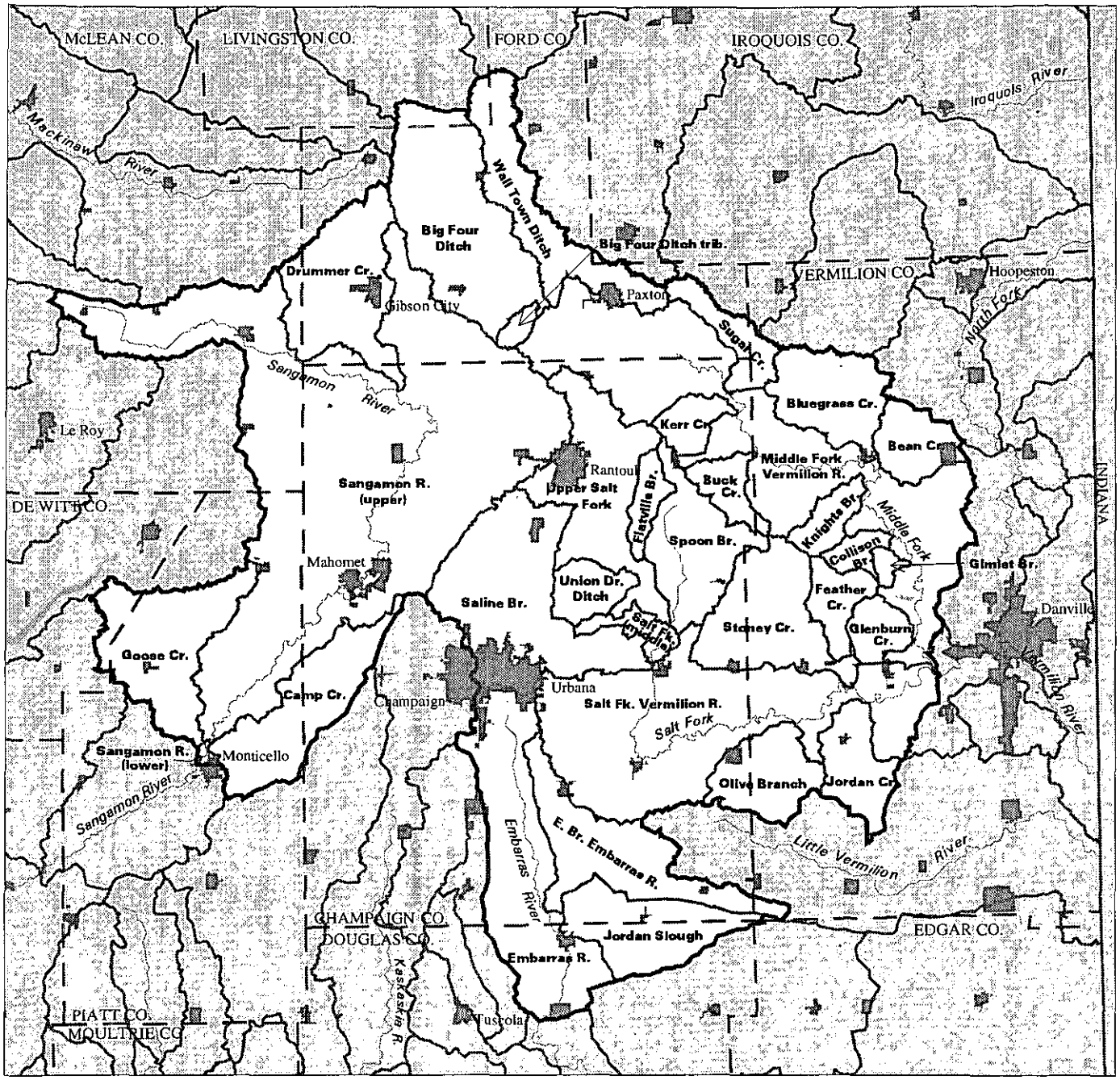
[2] The basins were defined by the Illinois Environmental Protection Board.

[3] Suloway, L., Joselyn, M., and P. W. Brown. 1996. Inventory of Resource Rich Areas in Illinois: An Evaluation of Ecological Resources. IDNR/EEA-96/08 167 pp.



Drainage basins from 1:24000 scale watershed boundaries as delineated by the U.S.G.S. Water Resources Division.

Major Drainage Basins of Illinois and Location of the Headwaters Assessment Area



Subbasins in the Headwaters assessment area. Subbasin boundaries depicted are those determined by the Illinois Environmental Protection Agency.

This assessment is comprised of five volumes. In Volume 1, *Geology* discusses the geology, soils, and minerals in the assessment area. Volume 2, *Water Resources*, discusses the surface and groundwater resources and Volume 3, *Living Resources*, describes the natural vegetation communities and the fauna of the region. Volume 4 contains three parts: Part I, *Socio-Economic Profile*, discusses the demographics, infrastructure, and economy of the area, focusing on the two counties with the greatest amount of land in the area -- Champaign and Ford counties; Part II, *Environmental Quality*, discusses air and water quality, and hazardous and toxic waste generation and management in the area; and Part III, *Archaeological Resources*, identifies and assesses the archaeological sites, ranging from the Paleoindian Prehistoric (B.C. 10,000) to the Historic (A.D. 1650), known in the assessment watershed. Volume 5, *Early Accounts of the Ecology of the Headwaters Area*, describes the ecology of the area as recorded by historical writings of explorers, pioneers, early visitors and early historians.

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Introduction

Physiographic Characteristics

TheHeadwaters Assessment Area (HAA) is an approximately 1,675.3-mile^2 (1,072,212.9 acre) area including much of Champaign County and portions of Ford, Livingston, McLean, Iroquois, Vermilion, Douglas, Piatt, and De Witt counties in east-central Illinois (Figure 1). This assessment area includes the headwater portions of the Sangamon and Embarras rivers and the watersheds of the Middle Fork and Salt Fork of the Vermilion River (Figures 1 and 2). The HAA occurs in the Bloomington Ridged Plain physiographic division, which is comprised of a series of arched morainal ridges (Willman et al. 1975). Most (92.25%) of the HAA lies within the Grand Prairie Section of the Grand Prairie Natural Division (Table 1, Figure 3), at 12,992,000 acres it is the single largest natural division in Illinois. The Vermilion River drainage (Middle Fork and Salt Fork of the Vermilion River) is part of the Vermilion River Section of the Wabash Border Natural Division (Schwegman et al. 1973).

Table 1. Natural Divisions occurring in the Headwaters Assessment Area.

Division & Section	Acres[1]	% of HAA
Grand Prairie/Grand Prairie Section	989,181	92.3
Wabash Border/Grand Prairie Section	83,032	7.7
Total:	1,072,213	100.0

[1]Based on the Illinois Natural Divisions database, Illinois Department of Natural Resources (1997a).

Elevation within the basin ranges from about 900 ft. above sea level in the upper reaches of the Sangamon River watershed near Saybrook in McLean County to about 580 ft. above sea level at the juncture of the Salt Fork and Middle Fork of the Vermilion River. Much of the basin is a rather level to gently rolling plain of glacial till. Topographic relief is provided by glacial moraines and by the dissection of the glacial drift by the headwater streams forming valleys and ravines. The surface geology of the assessment area is primarily characterized by deep Woodfordian-aged glacial drift, a substage of Wisconsinan glaciation and the most recent Pleistocene glacial episode. Thickness of glacial drift in the HAA ranges from between 50-to-200 ft.; locally, drift exceeds 400 ft. in thickness in Ford County (Lineback 1979). Little bedrock is exposed in the HAA. Along the lower reaches of the Salt Fork and Middle Fork rivers are small outcrops of

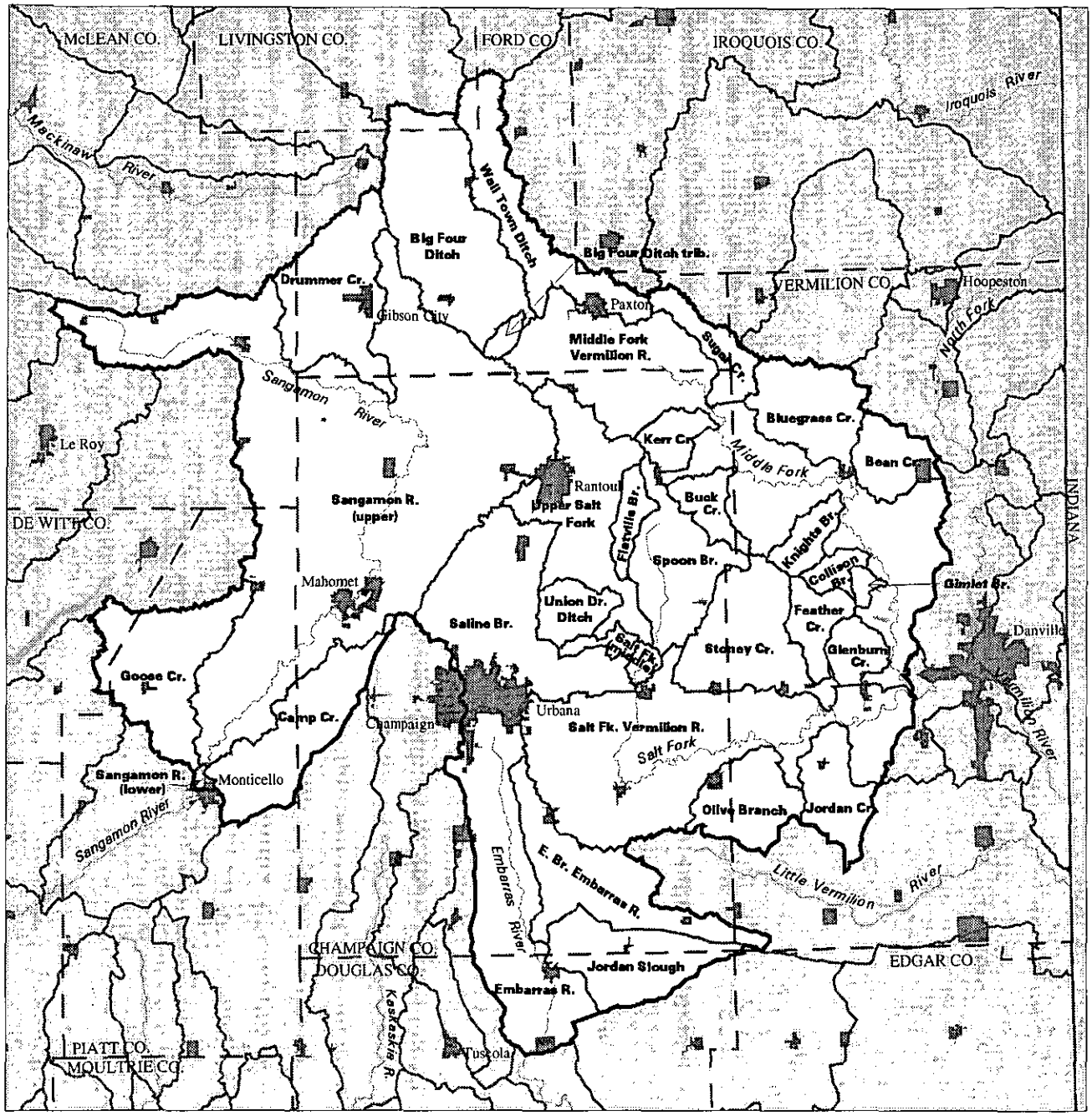

Figure 1. Subbasins in the HeadwatersAssessment Area. Subbasin bondaries are those determined by the Illinois Environmental Protection Agency.

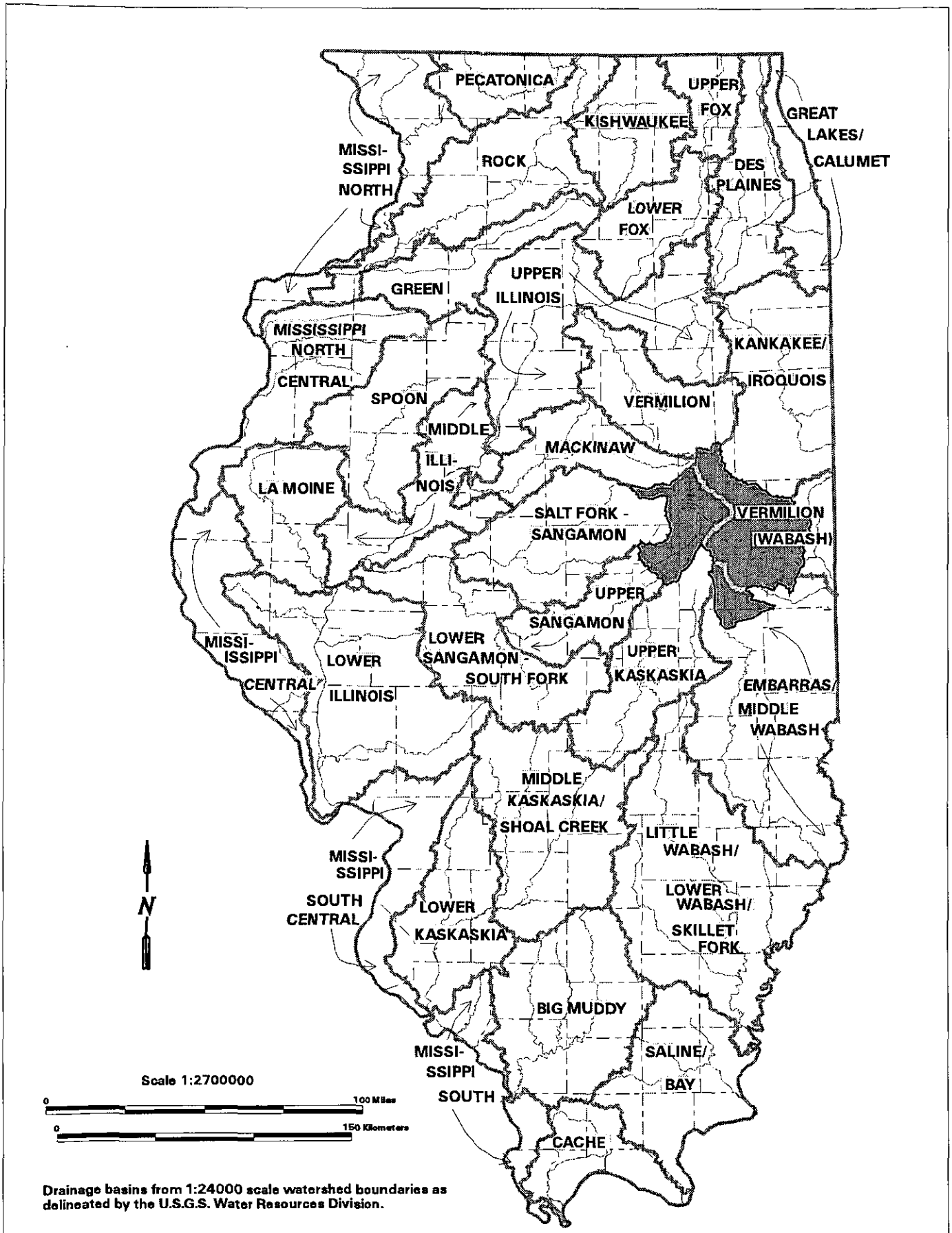

Figure 2. Major drainage basins of Illinois and location of the Headwaters Assessment Area.

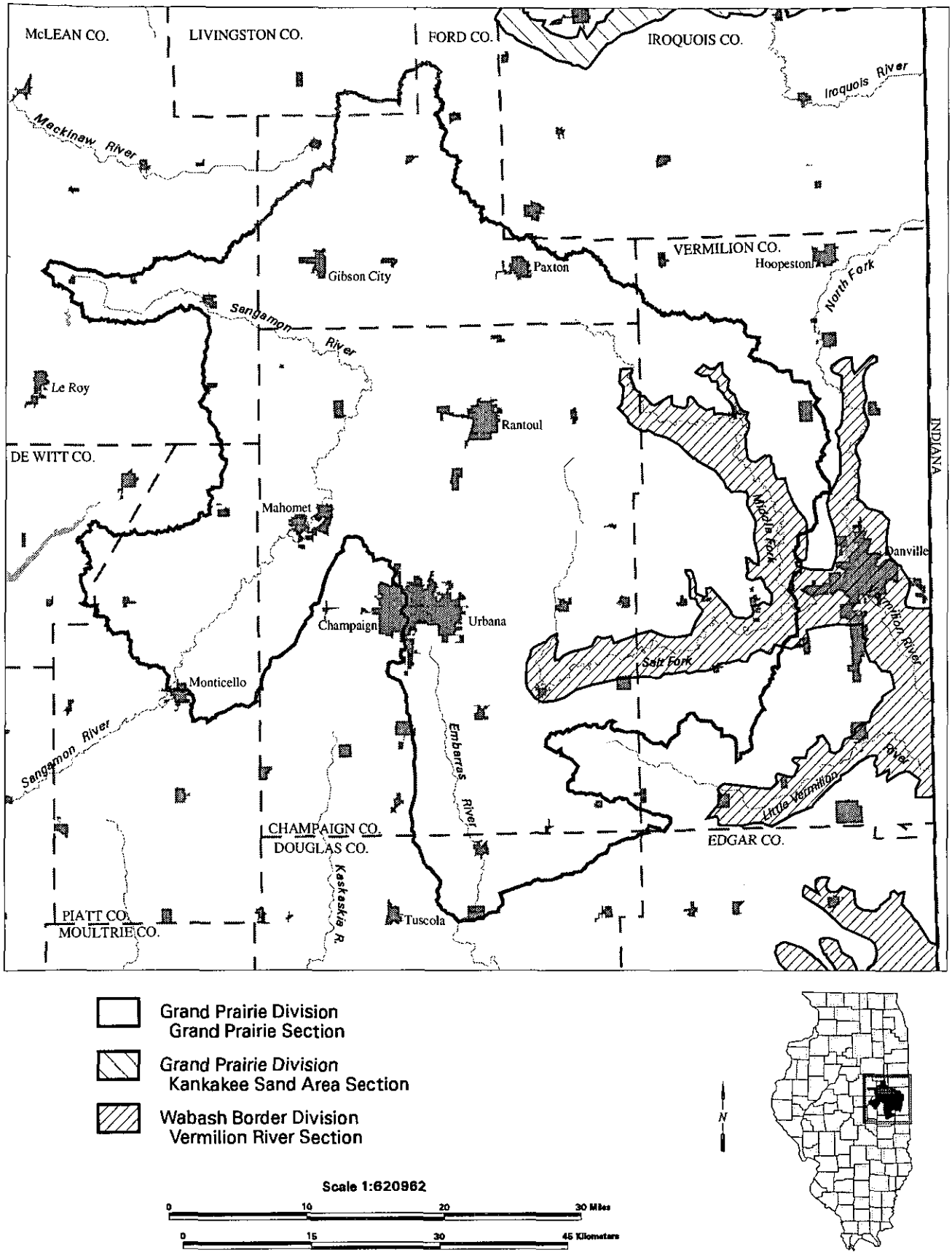

Figure 3. Natural divisions in the Headwaters Asessment Area based on the classification developed by Schwegman (1973).

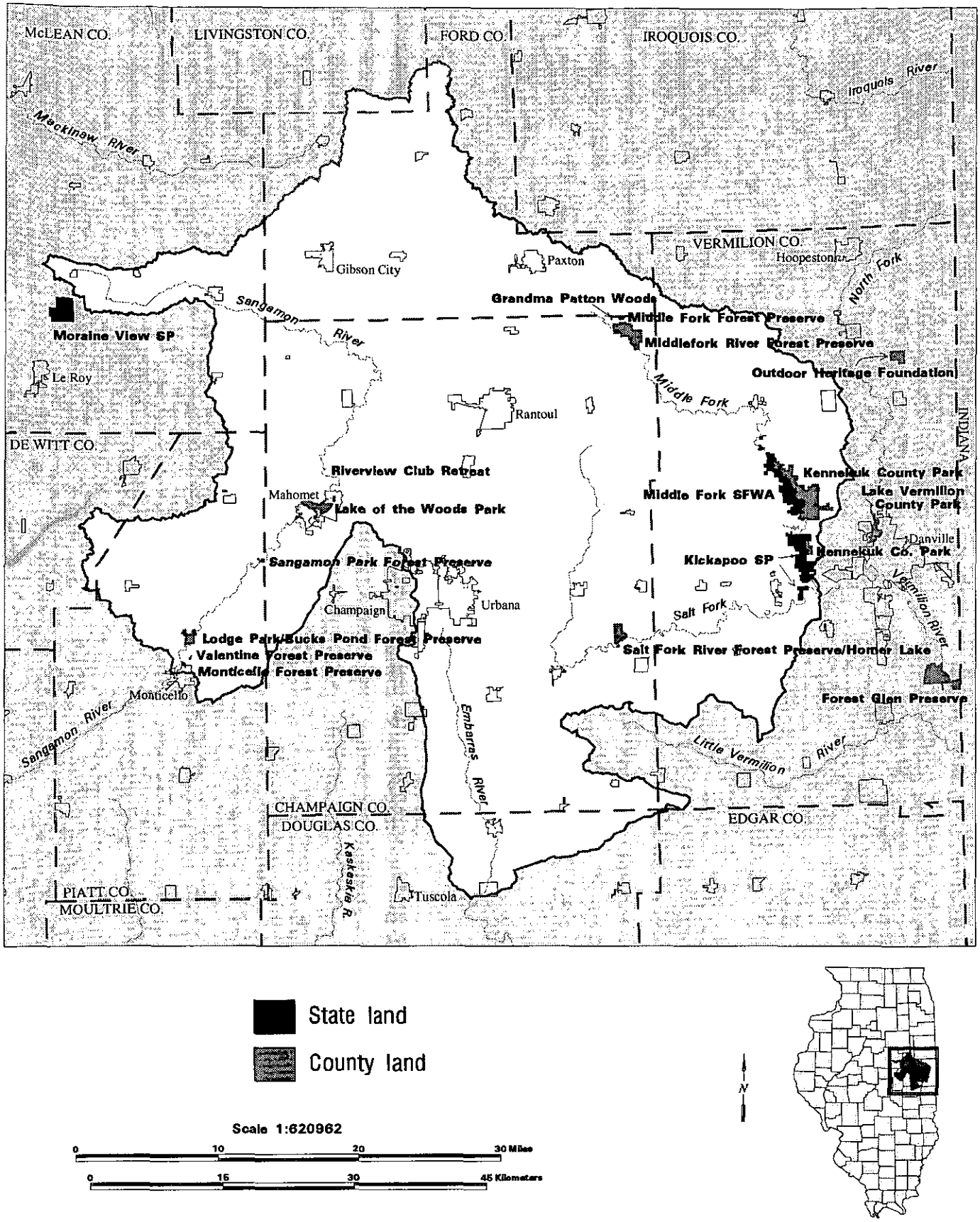

Figure 4. State and county land in the Headwaters Assessment Area. State land in the area is limited to Kickapoo Sate Park (SP) and the Middle Fork State Fish and Wildlife Area. (SFWA).

shale and sandstone. Soils in the HAA, predominately mollisols (formed under grassland vegetation) with a silt-loam texture, are developed largely in loess deposits ranging from about 10" to 60" in depth and the underlying medium to fine-textured Wisconsinan till and outwash materials. Drainage characteristics throughout the HAA range from poorly drained to somewhat well-drained (Mount 1982). Soils developed under forest or savanna vegetation are primarily concentrated in stream valleys or associated with moraines (Fehrenbacher et al. 1982). Gravelly glacial till is exposed locally, particularly on eroding slopes bordering the rivers.

Vermilion River Basin

The Vermilion River drains 1,434 square miles in east central Illinois, of which 1,238 square miles are drained by its three largest tributaries, the Salt Fork, Middle Fork, and North Fork (Figure 1). The Vermilion River lies over a buried bedrock valley but has not eroded through the deep glacial deposits. Only in the lower reaches does the river reach and flow over bedrock. The Vermilion River is formed by the confluence of the Middle Fork and the Salt Fork near Catlin and enters the Wabash River near Cayuga, Indiana. The Salt Fork originates in Champaign County, has a gravel, rubble, and sand substrate, is 71 miles in length, and has a drainage area of 506 square miles. The Middle Fork originates in Livingston County, has a substrate of predominantly sand and gravel with some rubble, is 83 miles long, and has a drainage area of 438 square miles. Of the three tributaries to the Vermilion, the Middle Fork has the best water quality. The Salt Fork receives moderate to heavy pollution from urban areas in its drainage.

The Middle Fork is a free flowing and relatively undegraded representative of what once occurred in the basin. The Middle Fork is the only federal and state designated Wild and Scenic River in Illinois. Kickapoo State Park and the Middle Fork State Fish and Wildlife Area are located along its course (Figure 4).

The North Fork of the Vermilion River is outside the HAA and will not be discussed in this report.

Sangamon River Basin

The Sangamon River basin drains 5,419 square miles in the geographic center of Illinois and forms the largest watershed of any of the tributaries of the Illinois River. The Sangamon River rises one half mile north of Ellsworth in McLean County (Figure 1) and follows a looping course flowing first east, then southwest, then north, and finally west to the Illinois River at Muscooten Bay. The river flows more than 240 miles and averages 121 feet in width. The substrate is coarse sand with considerable silt, gravel, and rubble. Brush piles, sand and gravel bars, and undercut banks are common. There are many floodplain and river bottom pools in the lower reaches of the river in Mason and Cass counties. The Sangamon is timbered throughout its course.

The Sangamon River was originally formed by meltwater from a Pleistocene ice sheet. The old meandering river bed of the Sangamon forms the northern boundary of Cass, Menard, and Christian counties and the southern boundary of the western half of Mason County. The river has been subject to numerous artificial changes. Major reaches between Decatur and Springfield and between Petersburg and Beardstown have been channelized. The last five miles of the river have been diverted so that the Sangamon empties into Muscooten Bay instead of nine miles north at Browning. Removal of riparian vegetation, channelization, and agricultural runoff have led to the decline of the Sangamon River as an aquatic resource.

Embarras River Basin

The Embarras River, the second largest tributary to the Wabash River in Illinois, has its headwaters in the Champaign morainic system south of Champaign-Urbana (Figure 1). It empties into the Wabash River near Billett in Lawrence County. The Embarras River is approximately 194 miles long and drains an area of 2,440 square miles in 11 counties. The stream width varies from a small creek in Champaign County to 113 feet near its mouth. In the HAA, the Embarras River is a small, low gradient, highly modified stream. The stream has been channelized to increase drainage of the surrounding land, and the natural riparian vegetation has been removed to create agricultural fields. The substrate of the stream is predominantly mud, changing in places to sand and gravel. Habitats include silt- and sand-bottomed pools and sandy raceways. Chemicals applied to cropland and silt are the primary sources of pollution.

Climate Patterns

The climate in the HAA is typical of many continental locations, in that there are rather wide temperature fluctuations. Precipitation is also variable. The average high temperature in the summer is in the mid 80's (°F) with average lows in the low 60's. Winter highs are generally in the low to mid 30's with lows in the high teens to low 20's. Record temperature extremes range from -25° F to a high of 109° F. There is an average of six continuous months without frost each year.

Precipitation is highest during April through August (averages of 3.94 to 4.46 inches per month) and lowest in January (1.83 inches) and February (1.97 inches), with a yearly average of 39.7 inches.

Information in this section has been taken from the Headwaters Area Assessment, Volume 2 (Illinois Department of Natural Resources 1997b). See that volume for a more detailed discussion of climate patterns and long-term trends in the HAA.

Vegetation History

The presettlement vegetation in Illinois can be described generally as prairie and forest. Interpretations of the original distribution of prairie and forest (Vestal 1931, Anderson 1970, Iverson et al. 1989) consistently indicate a predominance of prairie occupying about 60% of the state's total land area. The native vegetation of the HAA was mostly tall-grass prairie with forests and savannas concentrated in areas protected somewhat from fires, particularly along the major drainages. Estimates of the amounts of prairie and forest at the time of European settlement in the HAA can be inferred from county-wide data. The counties forming the majority of the HAA (Champaign, Ford, and Vermilion) were approximately 6.3%, 3.6%, and 20.8% forested, respectively, at the time of the Government Land Office survey around 1820. Prairie totaled approximately 93.7%, 96.4%, and 79.1%, respectively, for those counties (Iverson et al. 1989). Taking a conservative estimate of an average of 85% prairie, this totals 911,381 acres of prairie in the presettlement landscape of the HAA. Proportionately, this represents a greater percent-cover of prairie compared with statewide totals. Total area of savanna at that time is unclear. The HAA is within the transition zone of prairie and forest (Anderson 1983) and probably supported considerable amounts of tall-grass savanna (Nuzzo 1986). However, savannas typically were spatially dynamic and their total area and distribution varied on the presettlement landscape depending on several factors including local conditions of climate and fire frequency and intensity (Taft 1997). Fire is generally considered to have been a major ecological factor in the maintenance of tall-grass prairie, savanna, and open woodland vegetation in the Midwest (Anderson 1970, 1983, 1990; Axelrod 1985; Taft et al. 1995). Fire, drought, and grazing animal herds collectively are considered to have had important impacts on community structure and species composition of vegetation within the Grand Prairie Natural Division (Gleason 1913, Rogers and Anderson 1979).

Total area of presettlement wetlands in the HAA, based on acreage of hydric soils, can be inferred from county-wide data. For example, Champaign County (about 283,000 wetland acres), Ford County (about 140,000 wetland acres), and Vermilion County (about 245,000 wetland acres), were originally about 42-to-45% wetland (estimated wetland acres taken from Havera et al. [1994]; percent of county area generated using county acreage from the Illinois Geographic Information System). Most of this was wet prairie, prairie potholes, and floodplain forest. The prairie-dominated upland plains of the HAA were characterized by scattered prairie pothole ponds (Iverson, unpublished map). Among the first industries in the region were tile factories which provided the means to drain the soils. Once the prairies could be drained and plowed, and railroads were developed in the region, the prairies quickly were converted to cropland and pasture.

Current Land Cover

The characterization of the land cover of the HAA is based on information from the Land Cover of Illinois database (Illinois Geographic Information System), which was derived

from Landsat Thematic satellite imagery acquired between 1991 and 1995. Currently, the landscape of the HAA is dominated by agricultural land uses, chiefly cropland (about 82%) (Table 2, Figure 5).

Table 2. Land Cover for the Headwaters Assessment Area[1].

Land Cover	Acres	Percent
Cropland	879,717	82.0
Grassland	120,138	11.3
Urban/Built-up	32,720	3.1
Upland forest	23,937	2.2
Bottomland forest	7,820	0.7
Water	4,210	0.4
Non-forested wetlands	3,656	0.3
Total acres:	1,072,198	100.0

[1]Acreages from the Land Cover of Illinois database, (Illinois Geographic Information System).

Grassland occupies 11.3% of the land area (Table 2) and includes pastures, hay, idle fields, road and railroad rights-of-way, and a small amount of remnant prairies. This is the second most abundant land cover type in the HAA. One-fourth of the grassland acreage is within 100 feet of a road, and grassland forms a distinct grid pattern on the landscape where non-native cool-season species border croplands and roadways (Figure 6). Although there are over 120,000 acres of grassland in the HAA (Table 2), a total of only about 7.9 acres of high-quality (undegraded) prairie remains, scattered among three separate sites. An unknown quantity of degraded prairie persists locally, particularly along railroad rights-of-way. Some of this degraded prairie has high restoration potential.

The third most abundant land cover type in the HAA is urban/built-up land, which accounts for about 3.1% of the HAA (Table 2), distributed primarily among small towns and cities, with Champaign-Urbana being the largest (Figure 7).

About 2.9% of the HAA remains forested (Table 2). Estimates of presettlement forest cover averaged perhaps 15% and ranged from about 4% in Ford County to about 21% for Vermilion County (Iverson et al. 1989). About 229 acres of forest has been judged high-quality. As in the presettlement landscape, forests are concentrated on the slopes and bottomlands bordering the major rivers and associated tributaries (Figure 8); 47% of the forests are within 300 feet of a stream (as measured from the stream centerline) and 67% are within 600 feet of a stream (see below). Sixty-nine percent of the HAA forests occur in the Vermilion River subbasin and are concentrated along the lower Middle Fork and Salt Fork rivers (Figure 8).

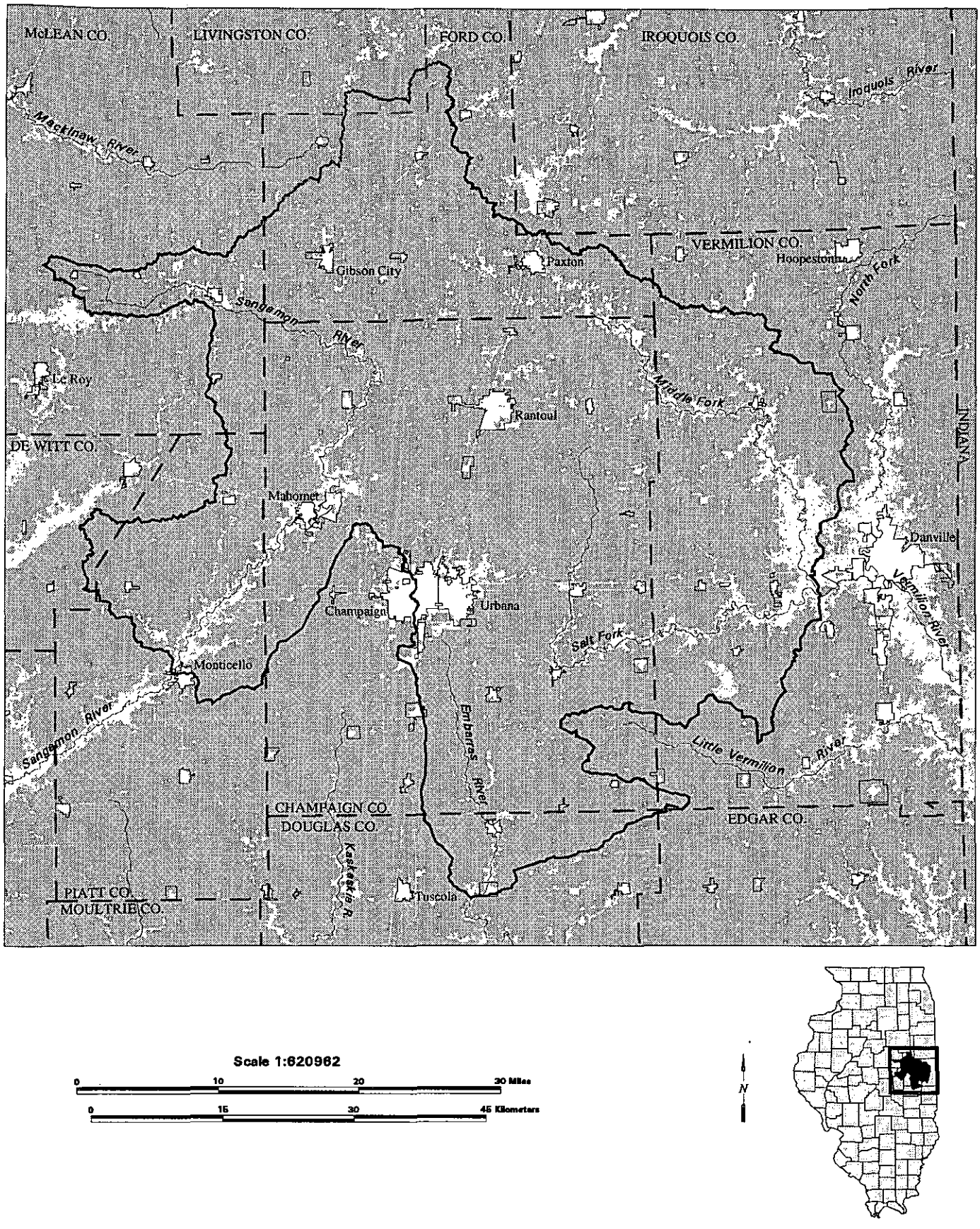

Figure 5. Cropland in the Headwaters Assessment Area. Cropland depicted on this map includes row crops and small grains from the Land Cover of Illinois Database (Illinois Geographic Information System), which is based on Landset Thematic Mapper(TM) satellite imagery from 1991-1995.

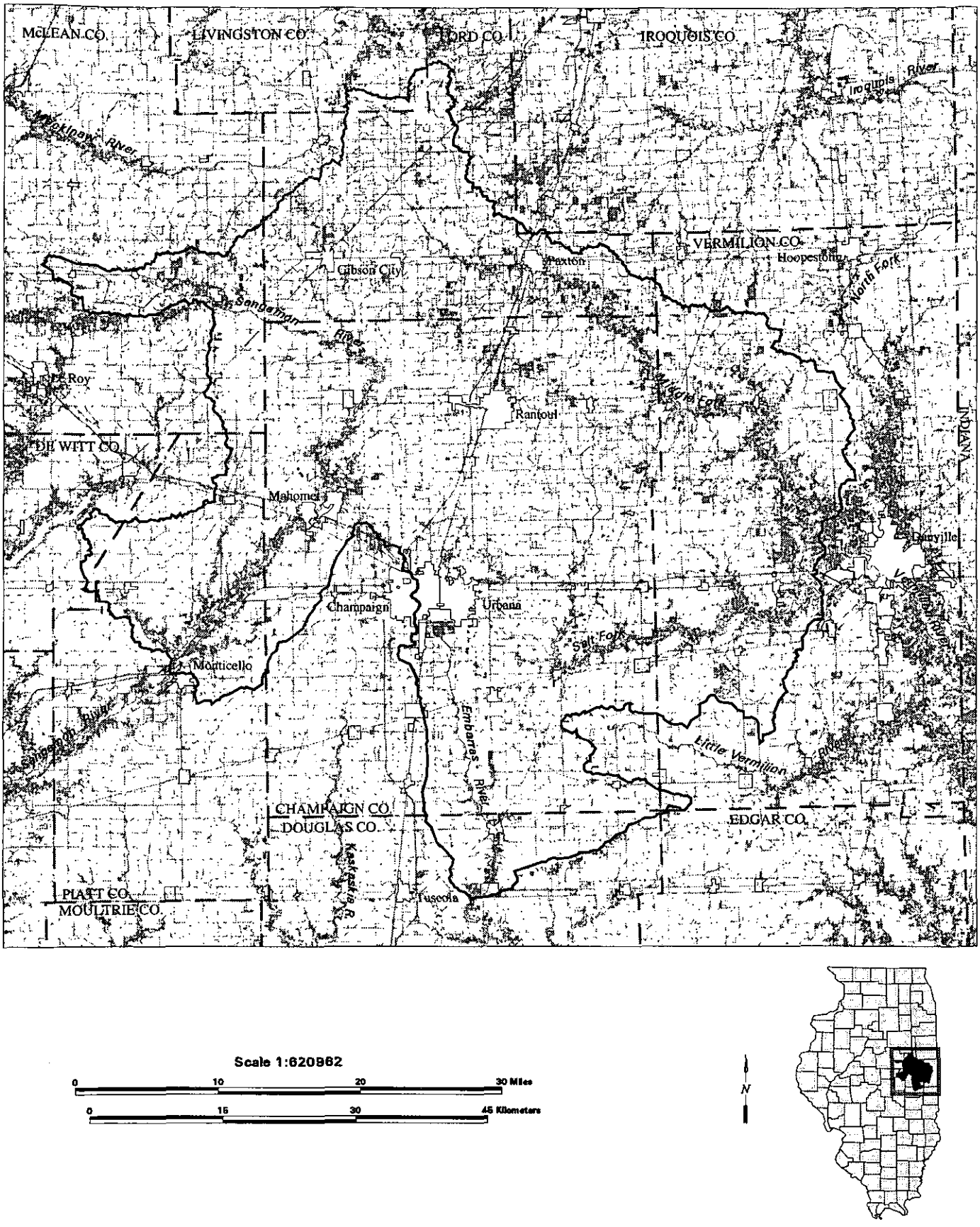

Figure 6. Grasslands in the Headwaters Assessment Area. Grasslands depicted on this map are non urban grasslands from the Land Cover of Illinois Database (Illinois Geographic Information Systems), which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

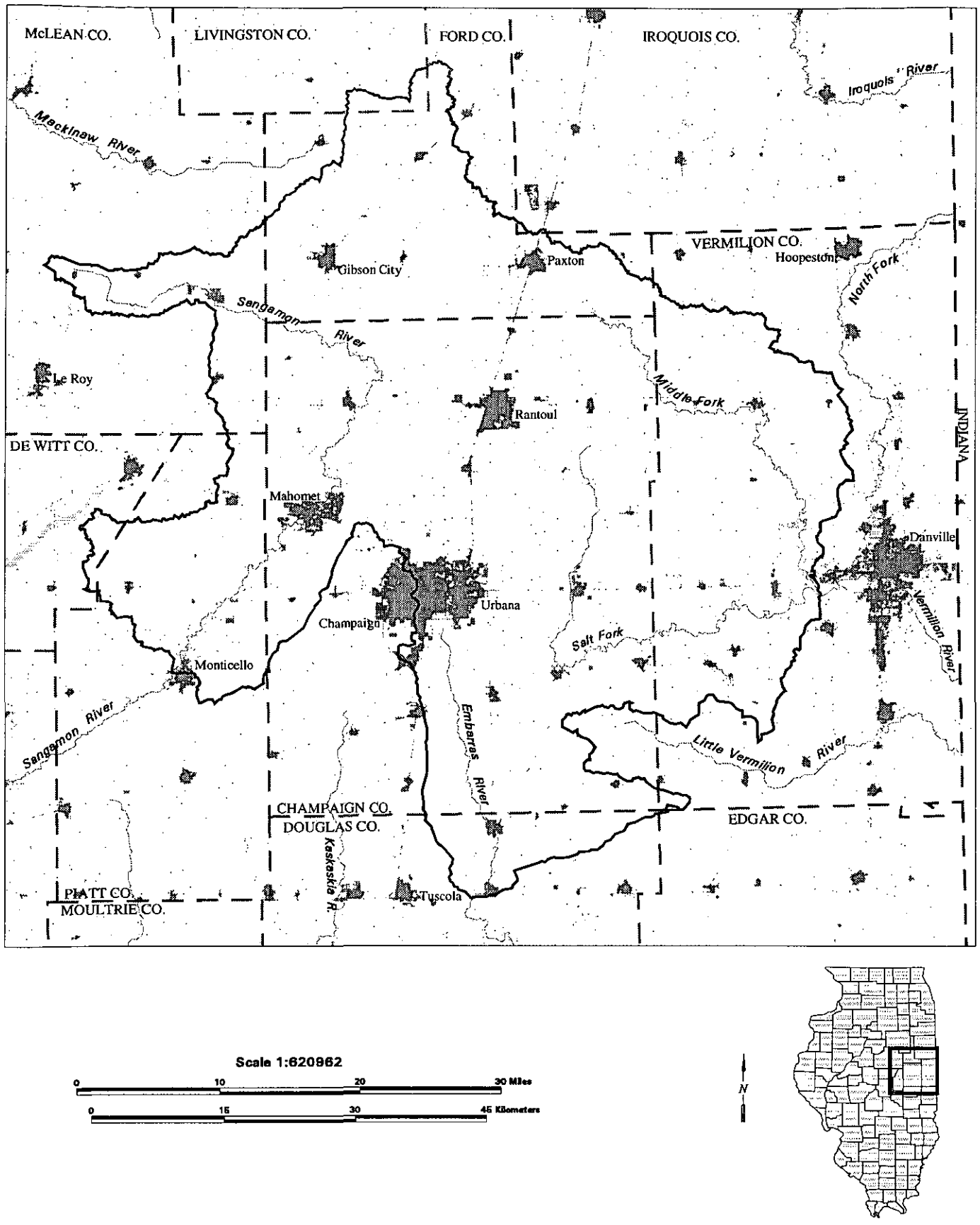

Figure 7. Urban Land in the Headwaters Assessment Area. Urban land depicted on this map includes urban/built-up land and urban grassland from the Land Cover of Illinois Database (Illinois Geographic Information Systems), which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

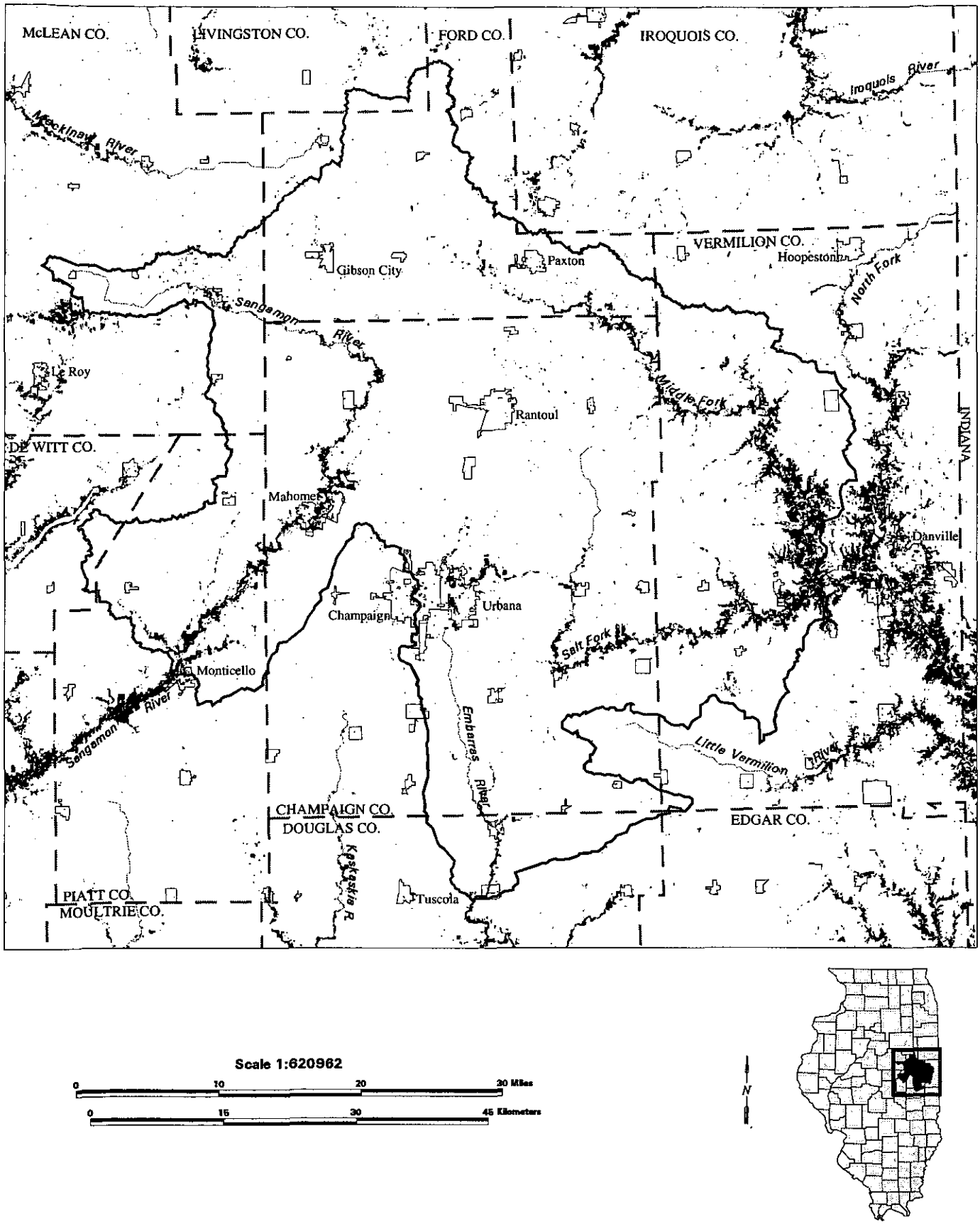

Figure 8. Forest in the Headwaters Assessment Area. Forest depicted on this map includes upland and bottomland forest from the Land Cover of Illinois Database (Illinois Geographic Information Systems), which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

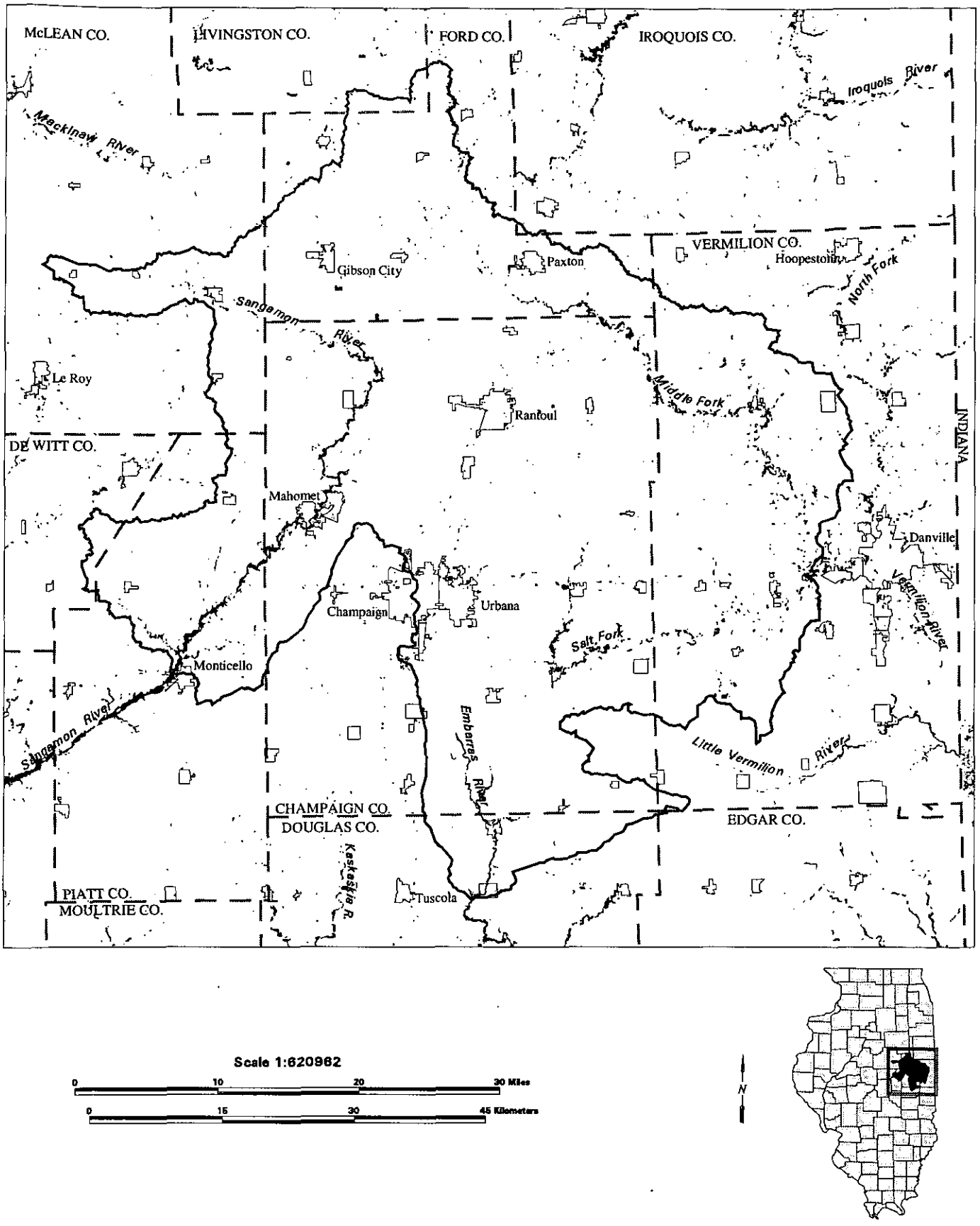

Figure 9. Wetlands in the Headwaters Assessment Area. Wetlands depicted on this map include non forested wetlands and and bottomland forest from the Land Cover of Illinois Database (Illinois Geographic Information Systems), which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

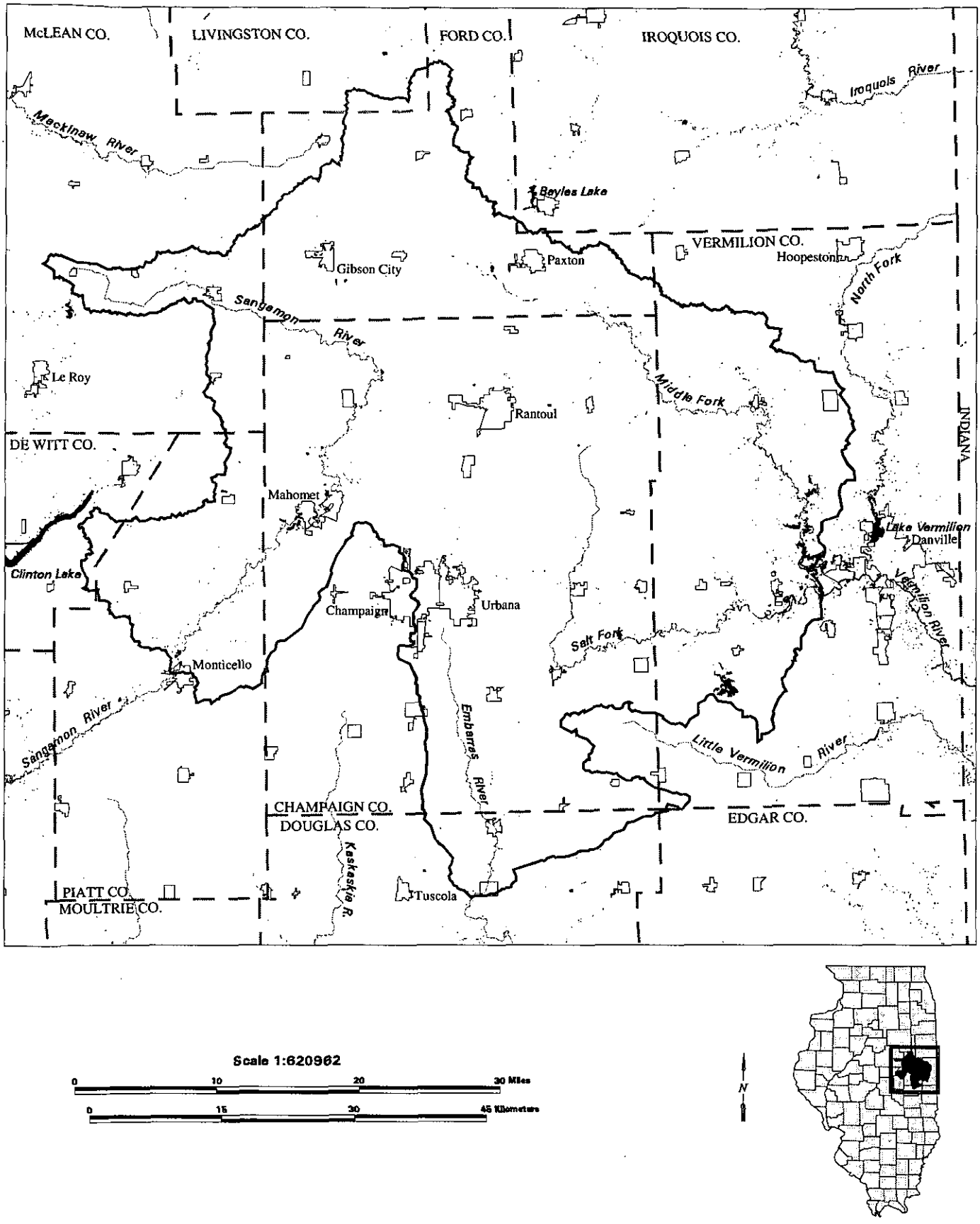

Figure 10. Open water in the Headwaters Assessment Area from the Land Cover of Illinois Database (Illinois Geographic Information Systems), which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

Table 3. Wetland and deepwater habitat of the Headwaters Assessment Area (HAA)[1].
(Total acreage in the HAA = 1,072,215 acres[2])

Category	Acreage	% of Wetland Area	% of HAA Area
Shallow Water Wetlands			
Palustrine Wetlands			
Shrub-Scrub Wetlands	247.0	2.1	0.0
Forested Wetlands			
Bottomland Forest	7246.6	62.9	0.7
Swamp	1.1	0.0	0.0
Emergent Wetlands			
Shallow Marsh/Wet Meadow	2120.5	18.4	0.2
Deep Marsh	182.3	1.6	0.0
Open Water Wetlands	1405.0	12.2	0.1
Subtotal Palustrine	**11202.5**	**97.3**	**1.0**
Lacustrine Wetlands			
Shallow Lake	25.9	0.2	0.0
Lake Shore	0.0	0.0	0.0
Emergent Lake	0.0	0.0	0.0
Subtotal Lacustrine	**25.9**	**0.2**	**0.0**
Riverine Wetlands			
Perennial Riverine	8.6	0.1	0.0
Intermittent Riverine	274.7	2.4	0.0
Subtotal Riverine	**283.3**	**2.5**	**0.0**
Total Wetlands	**11511.8**	**100.0**	**1.1**
Deepwater Habitat			
Deepwater Lake	1436.7		0.1
Deepwater River	2783.1		0.3
Total Deepwater	**4219.8**		**0.4**

[1] Adapted from Suloway and Hubbell (1994).
[2] Based on Illinois Wetlands Inventory database, Illinois Geographic Information System.

Wetlands also have declined dramatically in area. Based on the Land Cover of Illinois database (Illinois Geographic Information System), a current estimate of total wetland area in the HAA (bottomland forest and nonforested wetlands combined) is about 11,476 acres, or 1% of the HAA (Table 2, Figure 9[page 14]). This is a drastic change from estimates of over 40% wetland coverage before European settlement (see above). Nonforested wetlands such as marshes, wet meadows, and ponds, currently occupy only 0.3% of the HAA. Moreover, of the total wetland area remaining in the HAA, only about 8 acres are high-quality and relatively undegraded (about 0.08% of remaining wetland acreage, or 0.0007% of the HAA acreage).

The Illinois Wetlands Inventory (IWI) provides more detailed information about the different types of wetland acreage in the area. For the Headwaters area, the IWI data were derived from high-altitude photography taken between 1981 and 1985. IWI data are the most recent comprehensive wetland data available for the state. Based on IWI data, wetlands occupy about 11,512 acres, or 1.1% of the total area (Table 3 [page 16]). Nearly 63% of the wetlands in the HAA are bottomland forest, followed by shallow marsh/wet meadow (18.4%) and open water wetlands (12.2%). These proportions are similar to the percentages for the state (60.5% bottomland, 13.0% shallow marsh/wet meadow, and 11.4% open water wetland, Suloway and Hubbell 1994). Approximately 52% of the nonforested wetlands in the HAA occur in the Vermilion River watershed, 35% in the Sangamon, and 13% in the Embarras.

The mean size of contiguous forested wetlands is 12.3 acres, and there are 582 separate forested wetlands in the HAA. The two largest contiguous tracts of forested wetlands (673 and 456 acres) are located on the Sangamon River between Mahomet and Monticello. Of the twelve contiguous forested wetland tracts greater than 100 acres, eight are located along the Sangamon River. The mean acreage for emergent wetlands is 1.8 acres; there are 1,218 separate emergent wetlands in the HAA. The largest contiguous emergent wetland is an 86-acre area along the Embarras River east of Tolono. Of the 12 emergent wetlands greater than 25 acres, 5 occur in the Sangamon River watershed, 4 in the Embarras River watershed, and 3 occur in the Vermilion River watershed.

Open water covers about 0.4% of the total HAA (Tables 2 and 3) and is concentrated in the larger streams such as the Middle Fork, Salt Fork, and the Sangamon rivers and several strip mine lakes in the eastern part of the Headwaters area (Figure 10 [page15]). There are no natural lakes in the HAA; all the large bodies of standing water were artificially created.

Several of the land cover types are concentrated along the streams, particularly bottomland forest. Approximately 37% of the upland forest, 27% of the grassland, 49% of the nonforested wetlands, and 77% of the bottomland forest are found within 300 feet of a stream, an area which occupies only 14% of the total land area of the HAA. Fifty-eight percent of the upland forest, 42% of the grassland, 63% of the nonforested wetlands, and 93% of bottomland forest occur within 600 feet of a stream, an area which occupies 27% of the total land area of the HAA. In fact, it is possible to trace the larger streams, such as

the Sangamon, Embarras, and Middle and Salt Forks of the Vermilion River, on maps depicting forest, grassland, and wetland cover (Figures 6, 8, and 9). In spite of the concentration of these habitats along streams, the stream corridors are nonetheless largely cropland (63% of the land within 300 feet and 70% of the land within 600 feet of a stream), or grassland (22% of the 300-foot buffer and 18% of the 600-foot buffer).

Biologically Significant Features of Natural Communities

County, State, and Federal Land

Although the majority of the land in the HAA is being used for agricultural purposes (see above), 13,715 acres (1.3% of the HAA) have been set aside by the state or the various counties in the HAA as state parks, fish and wildlife areas, or forest preserves (Table 4, Figure 4). These areas give some level of protection to the natural communities in the area, and in some cases they are the only refuge for certain endangered species or natural communities. However, these areas do not always offer adequate protection, and they are not all situated in the most biologically important areas. There is no federally protected land in the HAA.

Table 4. State and county owned land in the Headwaters Assessment Area
(There is no federally owned land in the Headwaters Assessment Area)

Name	Acres
State Land:	
Kickapoo State Park	2,784
Middle Fork State Fish & Wildlife Area	4,221
Total state land:	7,005
County Land - Piatt County	
Lodge Park/Bucks Pond Forest Preserve	495
Monticello Forest Preserve	25
Sangamon Park Forest Preserve	76
Valentine Forest Preserve	24
County Land - Champaign County	
Grandma Patton Woods	10
Lake of the Woods Park	844
Middle Fork Forest Preserve	54
Middlefork River Forest Preserve	1,454
Riverview Club Retreat	8
Salt Fork River Forest Preserve/Homer Lake	700
County Land - Vermilion County	
Kennekuk Cove County Park	3,020
Total County Land:	6,710

Natural Areas and Nature Preserve

In 1978, an inventory of "natural areas" in Illinois was completed by the University of Illinois and the Natural Land Institute under a contract with the Illinois Department of Conservation (now the Illinois Department of Natural Resources). The original inventory was a three-year project that consisted of surveys to find, evaluate, describe, and classify natural areas of statewide significance (White 1978). The Illinois Natural Areas Inventory (INAI) is an ongoing process. The methods and criteria established during the original inventory are still used today to continually update the INAI by re-evaluating the previously defined natural areas or finding new sites that qualify.

The INAI established seven categories of natural areas based on significant features. The categories are: I - High Quality Natural Communities; II - Habitat for Endangered Species; III - Habitat for Relict Species; IV - Outstanding Geological Areas; V - Approved Natural Areas and Restoration Sites; VI - Unique Natural Areas; and VII - Outstanding Aquatic Areas. The INAI established a grading system to designate natural quality (White 1978). The natural quality of a community or area was graded from "A" (relatively stable or undisturbed) to "E" (very early successional or severely disturbed). In general only A and B communities are designated as significant or exceptional features.

Twenty-three sites within the HAA have been identified by the INAI (Table 5, Figure 11). Fourteen of these sites qualify as Category I natural areas for the INAI and comprise a total of 251.4 acres, or 0.023% of the total area of the HAA (Table 6). The area of all Category I and II INAI natural areas in the HAA, including buffer lands, totals about 2,112 acres (about 0.2% of the HAA) (Table 6). When including acreage of riverine natural areas (Category VII sites), the total is 4,290 acres (0.4% of the HAA). Natural areas of the HAA are discussed in more detail in the next chapter of this assessment.

Table 5. Natural Areas in the Headwaters Assessment Area (HAA) and surrounding area[1].

NA#[2]	County	Acres	Acres in HAA	Name
18	**Piatt**	**198.4**	**198.4**	**Lodge Park**
23	Vermilion	1.2		Willow Creek Seep
41	Vermilion	190.9		Russell M. Duffin Nature Preserve
45	**Vermilion**	**62.4**	**62.4**	**Horseshoe Bend**
51	**Champaign**	**59.2**	**59.2**	**Trelease Woods**
52	**Champaign**	**63.0**	**63.0**	**Brownfield Woods**
104	**Vermilion**	**5.7**	**5.7**	**Camp Drake**
352	**Champaign**	**41.5**	**41.5**	**Nettie Hart Woodland Memorial**
454	Douglas	2.1		Murdock Railroad Prairie
493	**Vermilion**	**2.6**	**2.6**	**Harmattan Stripmine**
494	**Vermilion**	**585.7**	**585.7**	**Middle Fork, Vermilion River**
495	Vermilion	151.8		Vermilion River
550	**Ford**	**17.2**	**17.2**	**Clarence West Railroad Prairie**

Table 5. Continued

NA#[2]	County	Acres	Acres in HAA	Name
788	McLean	1,690.1		Mackinaw River
804	**Vermilion**	**9.7**	**9.7**	**Windfall Prairie**
805	**Vermilion**	**141.2**	**141.2**	**Orchid Hill**
810	**Vermilion**	**65.8**	**65.8**	**Middlefork Woods**
879	Vermilion	11.6		Forest Glen Seep
992	**Ford**	**6.6**	**6.6**	**Prospect Cemetery Prairie**
993	Ford	18.2		Clarence Railroad Prairie
1037	Iroquois	5.4		Loda Cemetery Prairie
1043	Piatt	711.7		Robert Allerton Park
1073	**Vermilion**	**1.7**	**1.7**	**Fairchild Cemetery Prairie & Savanna**
1117	**Champaign**	**1.6**	**1.6**	**Mahomet Site**
1119	**Douglas**	**476.5**	**0.8**	**Embarras River - Camargo**
1140	Vermilion	114.0		Little Vermilion River
1141	Vermilion	468.3		North Fork Vermilion River
1142	**Vermilion**	**849.2**	**849.2**	**Kennekuk Cove County Park**
1420	Vermilion	1.0		Pellville Cemetery
1427	**Vermilion**	**95.1**	**95.1**	**Salt Fork Vermilion River**
1428	**Champaign**	**0.9**	**0.9**	**Sangamon Phlox Site**
1429	**Champaign**	**164.7**	**164.7**	**Spoon River**
1449	**Piatt**	**1,554.8**	**1,305.7**	**Sangamon River**
1453	Moultrie	192.2		West Okaw River
1472	Edgar	65.6		North Fork Brouilletts Creek
1511	**Vermilion**	**12.9**	**12.9**	**Kinney's Fork Seeps**
1512	**Vermilion**	**21.0**	**21.0**	**Middle Fork Seeps**
1515	Douglas	88.8		Kaskaskia River - Chicken Bristle
	Total in HAA:		**3,712.6**	

[1] Bold type indicates natural areas within the HAA.
[2] The number of the natural area (NA#) refers to the number designated in the Natural Heritage Database (Illinois Department of Natural Resources 1997a) and in Figure 11.

Table 6. Category 1 natural communities represented in the Headwaters Assessment Area (HAA).
(Category 1 indicates natural communities that have remained relatively undisturbed and in high quality condition: Grade A and B)[1].

Community type	Grades in HAA	Acres of Category 1 in the HAA			Acres of Category 1 in Illinois			% of Illinois Category 1 in the HAA		
		Grade A	Grade B	Total	Grade A	Grade B	Total	Grade A	Grade B	Total
Dry-mesic upland forest	B	0.0	49.0	49.0	986.0	2084.0	3070.0	0.0%	2.4%	1.6%
Mesic upland forest	A,B	107.0	17.0	124.0	1058.0	1473.0	2531.0	10.1%	1.2%	4.9%
Wet-mesic floodplain forest	A	56.0	0.0	56.0	497.0	2617.0	3114.0	11.3%	0.0%	1.8%
Mesic prairie	A	3.9	0.0	3.9	54.0	220.0	274.0	7.2%	0.0%	1.4%
Glacial-drift hill prairie	A	4.0	0.0	4.0	14.0	20.0	34.0	28.6%	0.0%	11.8%
Dry-mesic savanna	B	0.0	2.0	2.0	0.3	8.9	9.2	0.0%	22.5%	21.7%
Seep	A	6.0	0.0	6.0	31.0	63.0	94.0	19.4%	0.0%	6.4%
Calcareous seep	A	2.0	0.0	2.0	13.0	1.5	14.5	15.4%	0.0%	13.8%
Eroding bluff	A	4.5	0.0	4.5	22.0	8.0	30.0	20.5%	0.0%	15.0%
Total:		183.4	68.0	251.4	2675.3	6495.4	9170.7			

[1] White and Madany (1978).

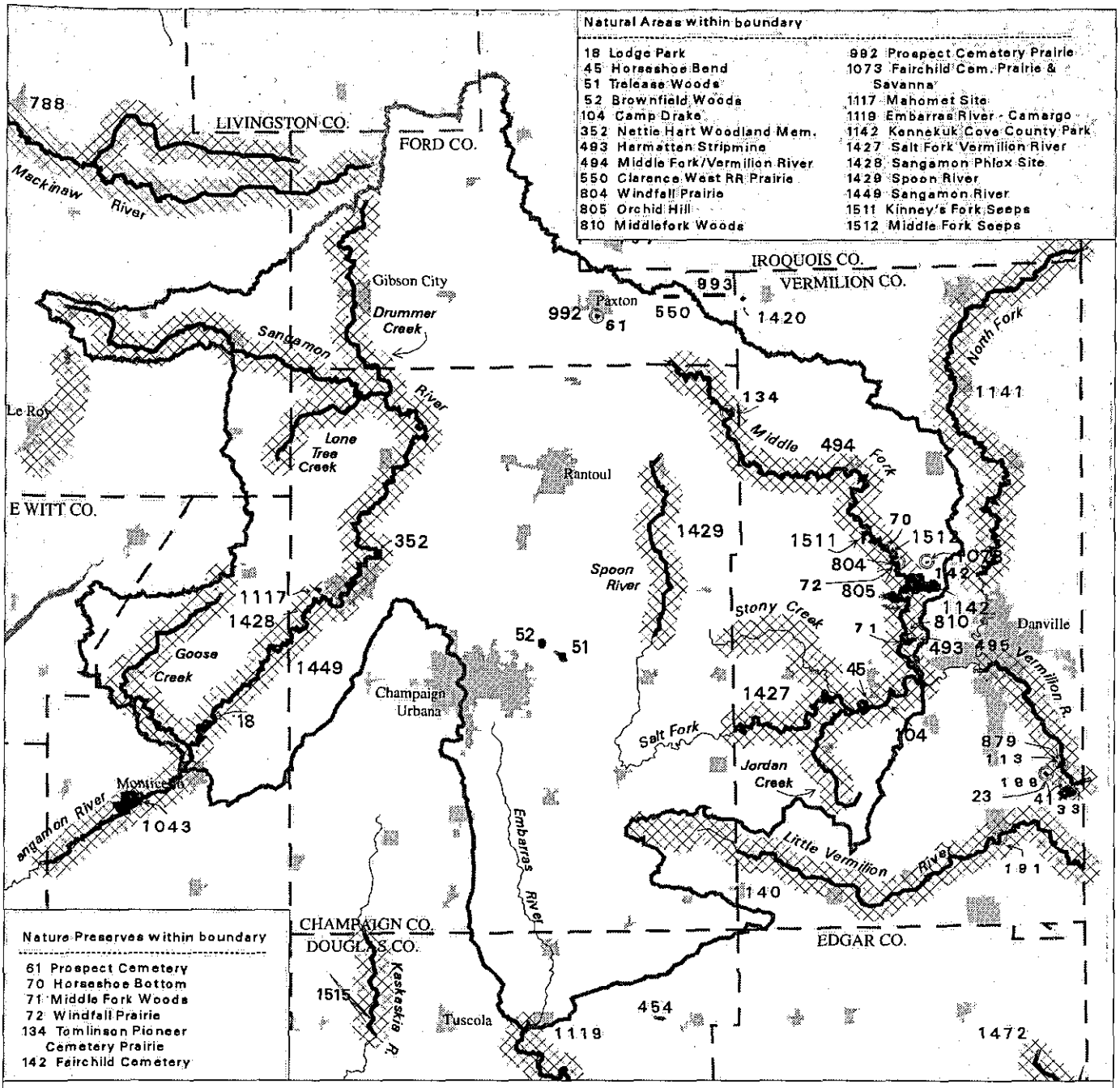

Figure 11. Natural areas, nature preserves and biologically significant stream segments in the Headwaters Assessment Area.

The purpose of the INAI is to identify high-quality natural areas and other significant features in Illinois. Identification, however, does not automatically ensure that an area will be protected. Once an area is selected, further action is required to protect it. The highest level of protection offered is for the area to be designated as an Illinois Nature Preserve. This means that the area has been formally protected in perpetuity by the landowner through the state. The majority of nature preserves in Illinois are publicly owned, but many are maintained in private ownership. Almost every nature preserve falls within a natural area. Four sites within the HAA (three in Vermilion County and one in Ford County), totaling 236 acres, have been established as nature preserves (Table 7, Figure 11).

Table 7. Nature Preserves in the Headwaters Assessment Area (HAA) and surrounding area[1].

NP#[2]	Corr.-NA[3]	County	Acres	Acres in HAA	Name
33	41	Vermilion	160.0		Russell M. Duffin
61	**992**	**Ford**	**5.0**	**5.0**	**Prospect Cemetery**
70	**494**	**Vermilion**	**91.0**	**91.0**	**Horseshoe Bottom**
71	**810**	**Vermilion**	**79.0**	**79.0**	**Middle Fork Woods**
72	**804**	**Vermilion**	**61.0**	**61.0**	**Windfall Prairie**
107	1037	Iroquois	3.4		Loda Cemetery Prairie
113	879	Vermilion	15.0		Forest Glen Seep
134	-	Champaign	1.0		Tomlinson Pioneer Cemetery
142	1073	Vermilion	0.5		Fairchild Cemetery Savanna
191	1140	Vermilion	41.4		Carl Flierman's River
199	23	Vermilion	28.6		Howard's Hollow Seep
		Total in HAA:		**236.0**	

[1] Bold type designates nature preserves within the HAA.

[2] The nature preserve number (NP#) refers to the number designated in the Natural Heritage database (Illinois Department of Natural Resources 1997a) and in Figure 5.

[3] Each of the nature preserves is associated with a corresponding natural area (Corr.-NA) referred to in Table 5.

Biological Stream Categorization and Biologically Significant Streams

Illinois streams have also been categorized according to their quality. One stream quality index used to identify high quality streams is the Biological Stream Characterization (BSC). The BSC was developed by the Illinois Department of Conservation and the Illinois Environmental Protection Agency (Hite and Bertrand 1989), and is derived from data on fish populations, water quality, and aquatic macroinvertebrates. In the BSC, stream segments are categorized from "A" (highest quality) to "E" (lowest quality). Twenty-four stream segments in Illinois currently are considered to be in the "A" category, and 50 in the "B" category.

Another study, entitled the "Biologically Significant Illinois Streams" (Page et al. 1992) was conducted to expand the list of high-quality streams beyond the BSC "A" streams by considering additional data on biodiversity; specifically, data on endangered and threatened species (fishes, crustaceans, mussels, and plants) and on mussel diversity. The expanded list identified the most important streams that should be protected and managed for their outstanding biological characteristics. Protection of streams identified in the Biologically Significant Streams (BSS) report (Page et al. 1992) will constitute a major step toward the protection of 100% of the stream-dependent biodiversity.

Nine streams in the HAA (five in the Vermilion basin and four in the Sangamon basin) were recognized as Biologically Significant Streams (Page, et al. 1992) because of their fish and mussel diversity (Table 8, Figure 11). In the Vermilion River basin the BSSs are the Middle Fork of the Vermilion River, Salt Fork of the Vermilion River (from the Champaign County line to the Middle Fork), Jordon Creek, Stoney Creek, and Spoon River in Champaign County. The BSSs in the Sangamon River basin are the Sangamon River (from its source in McLean County to the Piatt/Macon County line), Lone Tree Creek, Drummer Creek in Ford and Champaign Counties, and Goosed Creek in Piatt County. These streams provide the best opportunities in the basin for the protection of large numbers of native species. The BSSs of the HAA are described in more detail in the chapter on Aquatic Biota.

Table 8. Biologically significant stream segments in the Headwaters Assessment Area.

Site Description	Length (miles)
Lone Tree Creek	8.1
Drummer Creek	17.0
Spoon River	12.4
Goose Creek	19.5
Sangamon River, source to Piatt/Macon county line	77.5
Middle Fork Vermilion River	46.0
Jordan Creek	8.8
Stony Creek	12.0
Salt Fork Vermilion River, Co. line to Middle Fork	23.6
Total miles:	224.9

Threatened and Endangered Species

At least 46 species of state threatened or endangered plants and animals occur in the HAA, including 2 species (clubshell mussel and Indiana Bat) that are federally endangered (Table 9). Of the state's 363 threatened or endangered plants, only about 1% are known to occur in the HAA. For other taxa, the percentage of the state's threatened or endangered species that occur in the area are as follows: mollusks (48%), insects (9%), fishes (20%), amphibians (40%), reptiles (8%), birds (43%), and mammals (22%). This

list includes only those species known to breed in the area; i.e. migrant and overwintering birds are not included in this list (those species are mentioned in the chapter on bird communities).

Table 9. Threatened and endangered species occurring in the Headwaters Assessment Area[1].
(SE = state endangered; ST = state threatened; FE = federally endangered)

Plants:		
Ear-leafed foxglove	*Tomanthera auriculata*	ST
False hellebore	*Veratrum woodii*	ST
Sangamon phlox	*Phlox pilosa ssp*	SE
Wolf's bluegrass	*Poa wolfii*	SE
Mollusks:		
Spike	*Elliptio dilatata*	ST
Clubshell	*Pleurobema clava*	SE, FE
Rabbitsfoot	*Quadrula cylindrica*	SE
Slippershell mussel	*Alasmidonta viridis*	SE
Salamander mussel	*Simpsonaias ambigua*	SE
Wavyrayed lampmussel	*Lampsilis fasciola*	SE
Round hickorynut	*Obovaria subrotunda*	SE
Kidneyshell	*Ptychobranchus fasciolaris*	SE
Purple lilliput	*Toxolasma lividus*	SE
Rayed bean	*Villosa fabalis*	SE
Rainbow	*Villosa iris*	SE
Little spectaclecase	*Villosa lienosa*	SE
Insects:		
Swamp metalmark	*Calephelis muticum*	SE
Fish:		
Bigeye shiner	*Notropis boops*	SE
Blacknose shiner	*Notropis heterolepsis*	SE
Bluebreast darter	*Etheostoma camurum*	SE
Eastern sand darter	*Ammocrypta pellucida*	SE
Iowa darter	*Etheostoma exile*	SE
Pallid shiner	*Hybopsis amnis*	SE
Amphibians:		
Silvery salamander	*Ambystoma platineum*	SE
Four-toed salamander	*Hemidactylium scutatum*	ST
Reptiles:		
Kirtland's snake	*Clonophis kirtlandii*	ST

Table 9. Continued

Birds:		
Pied-billed Grebe	*Podilymbus podiceps*	ST
American Bittern	*Botaurus lentiginosus*	SE
Least Bittern	*Ixobrychus exilis*	SE
Black-crowned Night-Heron	*Nycticorax nycticorax*	SE
Yellow-crowned Night-Heron	*Nycticorax violaceus*	ST
Northern Harrier	*Circus cyaneus*	SE
Sharp-shinned Hawk	*Accipiter striatus*	SE
Red-shouldered Hawk	*Buteo lineatus*	SE
King Rail	*Rallus elegans*	ST
Upland Sandpiper	*Bartramia longicauda*	SE
Barn Owl	*Tyto alba*	SE
Long-eared Owl	*Asio otus*	SE
Short-eared Owl	*Asio flammeus*	SE
Brown Creeper	*Certhia americana*	ST
Bewick's Wren	*Thryomanes bewickii*	SE
Veery	*Catharus fuscescens*	ST
Loggerhead Shrike	*Lanius ludovicianus*	ST
Henslow's Sparrow	*Ammodramus henslowii*	SE
Mammals:		
Indiana bat	*Myotis sodalis*	SE, FE
River otter	*Lontra canadensis*	SE

[1] This list only includes those species that are reproducing in the area (e.g. migrant and wintering birds are not mentioned in this table).

Natural Vegetation Communities

The description of the vegetation for the Headwaters Assessment Area (HAA) is organized into six sections: 1) a comparison of the biodiversity in the HAA to statewide patterns; 2) threatened and endangered species; 3) disturbance, habitat quality, and restoration potential; 4) natural areas and nature preserves; 5) terrestrial natural community descriptions; and 6) summary recommendations.

Comparison Of Biodiversity In The HAA To Statewide Patterns

In general, habitat loss in the Grand Prairie Natural Division and the HAA appear to exceed rates for the state as a whole. With the possible exception of forest, rates of habitat degradation also exceed statewide trends. Trends for each community class are described below.

Prairie - About 0.01% of the original area of prairie in the state persists in a high-quality condition (White 1978). However, only about 179 acres (0.0014%) of relatively undisturbed prairie remain throughout the Grand Prairie Natural Division , mostly (142 acres) in the 9,531,000-acre Grand Prairie Section (White 1978). Champaign County was estimated to have about 592,300 acres of prairie; currently, a mere 1 acre (0.00017%) is undegraded and in a high-quality condition (Robertson and Schwartz 1994). Based on an estimate of 85% for the total cover of prairie in the HAA, about 0.00087% (about 9 ten-thousandths of one percent) of the original area remains in an undegraded condition. This is actually an overestimate since recently a portion of one of the three high-quality remnants of prairie in the HAA was destroyed by landowners while simultaneously negotiating a sale price on the land to a nonprofit prairie conservation group. Most acreage of relatively undisturbed prairie in the state is from land less suitable for agriculture such as sand deposits (~47%) or steep loess hills (~16%).

Forest - About 30% of the original area of forest remains statewide (Iverson et al. 1989), though only about 0.3% of this and 0.1% of original forest area remains in a high-quality condition. Due to imprecise knowledge of forest coverage in the presettlement assessment area (ranging from 4% to 21% for the predominant counties of Champaign, Ford, and Vermilion) it is not clear whether the 3% total area of forest in the HAA exceeds the statewide rate of habitat loss and degradation. Using the estimate of 15% forest cover in the HAA at the time of early settlement, about 20% of original total area of forest remains, and about 0.72% of the remaining forest cover (approximately 31,758 acres) and 0.14% of original forest extent remains in a high-quality condition.

Savanna - Savannas have declined in area throughout Illinois and the Midwest, perhaps more than any other community class (Taft 1997), and the HAA is no exception to this trend. Two small fragments of tall-grass savanna, totaling about 2 acres, remain in the HAA in an undegraded condition (see sections on Natural Areas and Natural Communities below).

Wetlands - Natural wetlands in Illinois have declined from presettlement statewide estimates of about 23% of the land area to about 2.6% (Havera et al. 1994), or about 11% of the original total. The approximately 0.9% of the HAA remaining as wetland, totaling about 2% of original area, far exceeds the statewide trends in loss of wetland acres.

The species richness of vascular plants within the HAA at the time of European settlement is unknown. About 716 plant taxa have been reported from within the assessment area (Appendix 1). This probably underestimates species richness of both native and non-native taxa in the HAA. The estimates compare to about 2,200 native taxa and 3,102 total taxa reported from Illinois (Mohlenbrock 1986). The extraordinary loss of habitat in the HAA also results in reduction in population sizes for species, particularly those sensitive to habitat degradation. As populations decline in size, they become more likely to undergo local extinctions. Richness of native species has probably declined in the HAA since European settlement as a result of reduced population sizes, local extirpations, habitat destruction and degradation; in contrast, non-native taxa have increased. At the statewide scale, prairie species appear to form a somewhat resistant species pool. Despite the tremendous loss of prairie habitat in Illinois, only about five taxa have been extirpated from the state (Taft 1995a). However, numerous prairie species occur at low population levels in the state, and about 103 are listed as threatened and endangered (Herkert 1991, Taft 1995a).

Illinois Threatened and Endangered Species

Four species listed by the Illinois Endangered Species Protection Board (IESPB) as threatened or endangered species have been reported relatively recently from within the HAA (Table 10). These species are Sangamon phlox (*Phlox pilosa* subsp. *sangamonensis* [state endangered]), Wolf's bluegrass (*Poa wolfii* [state endangered]), ear-leaved foxglove (*Tomanthera auriculata* [state threatened]), and false hellebore (*Veratrum woodii* ([state threatened]) (Illinois Department of Natural Resources 1997). One species, Mead's milkweed *(Asclepias meadii* [state endangered, federally threatened]), occurs within a one-mile buffer of the assessment boundary. Four other threatened and endangered species, historically known from Champaign County have been extirpated from the county (see Table 10 and discussion below). Three additional taxa, plus a population of false hellebore and an extant population of the prairie white fringed orchid occur near (> 1 mile) the assessment area boundary and are included since suitable habitat is present for each within the boundary of the HAA. These three taxa include a sedge *(Carex communis* [state endangered]), Queen-of-the-prairie (*Filipendula rubra* [state threatened]), and prairie white-fringed orchid (*Platanthera leucophaea* [state endangered, federally threatened]). Note that two of the taxa reported from nearby but outside the boundaries of the

HAA are listed by the U.S. Fish and Wildlife Service as federally threatened species. Each threatened and endangered species is discussed briefly in the following accounts.

Table 10. Illinois threatened and endangered plant species reported from the Headwaters Assessment Area.
(SE = Illinois endangered, ST = Illinois threatened)

Common Name[1]	Scientific Name[1]	Status	Habitat
Ear-leafed foxglove	*Tomanthera auriculata*	ST	mesic prairie
False hellebore	*Veratrum woodii*	ST	mesic forest
Heart-leaved plantain*	*Plantago cordata**	SE	gravel bars of clear streams
Mead's Milkweed	*Asclepias meadii*	SE, FT	mesic prairie
Prairie dandelion*	*Nothocalais cuspidata**	SE	dry mesic prairies
Prairie white-fringed orchid*	*Platanthera leucophaea**	SE, FT	mesic to wet prairies
Sangamon phlox	*Phlox pilosa spp. sangamonensis*	SE	mesic prairie
White lady's slipper*	*Cypripedium candidum**	SE	wet-mesic prairies and fens
Wolf's bluegrass	*Poa wolfii*	SE	hill prairie
Threatened and endangered species known from just outside the HAA boundary and buffer zone.			
False hellebore	*Veratrum woodii*	ST	mesic forest
Prairie white-fringed orchid	*Platanthera leucophaea*	ST	fens, sand prairies, seeps
Queen of the prairie	*Filipendula rubra*	SE, FT	mesic to wet prairies
Fibrous-rooted sedge	*Carex communis*	SE	open rocky woods

[1] * indicates species extirpated from the HAA

Species Known From Within the Boundary of the Headwaters Assessment Area

Sangamon phlox (*Phlox pilosa* L. subsp. *sangamonensis* Levin and Smith) - This subspecies of the common prairie phlox is endemic to the HAA. Presently, there are only two known extant populations, both in Champaign County (Herkert 1991). Population(s) formerly occurred in Piatt County but could not be located in recent surveys (Solecki, pers. com.). Among the extant populations, one is in a degraded railroad right-of-way that supports a few prairie species while the other, protected on private land, occurs on a ridge adjacent to the Sangamon River in a woodland opening. These two stations are representative of the habitats where populations of the Sangamon phlox have been found along only a few miles of the Sangamon River (e.g., prairie, blufftops, and prairie openings). Morphologically, the Sangamon phlox is very similar to downy phlox *(P. pilosa)* and can be distinguished from it primarily by the absence of stipitate-glandular hairs on the corolla tube (Levin and Smith 1965; modified by pers. obs.).

Since this subspecies is restricted to a small area along the Sangamon River, its preservation merits consideration as a high-priority conservation goal for the HAA. The population in the degraded right-of-way is vulnerable to damage from highway and railroad maintenance and vehicle accidents and trespass. Strong consideration should be given towards vegetation management to enhance habitat suitability for this species at the two stations (prescribed fire and brush cutting where needed to maintain open habitat), and establishing additional colonies of this subspecies at former collection localities. Reintroduction can be accomplished using seed from the vulnerable roadside population.

These activities should only be performed with the consultation of the Illinois Endangered Species Protection Board and the Illinois Department of Natural Resources, Natural Heritage Division, Springfield. This species can be identied most easily when in bloom (May to mid-June).

Wolf's bluegrass (*Poa wolfii* Scribn.) - This native cool-season bluegrass species has been found mostly in open woodland situations in Illinois. Until recently, this species was known from only small, scattered populations in two west-central Illinois counties. However, in 1991 a population was discovered in a Vermilion County seep near the bank of the Middle Fork of the Vermilion River. Wolf's bluegrass is not typically a seep species but has been found in Missouri on moist ledges and along streams (Steyermark 1963). Wolf's bluegrass ranges from Virginia to Ohio, north to Minnesota, and south to Missouri (Herkert 1991). The population in the HAA occurs below a steep slope where, due to saturation from the seep, vegetation and soil have been actively slumping. Consequently, this species is not secure at the single station within the HAA. Efforts should be made to find and protect additional populations in the HAA, perhaps where suitable habitat occurs near the seep population. May is the best month to search for this species.

Ear-leaved foxglove (*Tomanthera auriculata* (Michx.) Raf.) - This annual species in the figwort family has been found in several Illinois counties. However, due to dramatic losses in its prairie habitat, this species has become quite rare. In the HAA, ear-leaved foxglove is known from a historic collection made in 1933 from a railroad right-of-way (RR R-O-W). Judging from available data (Illinois Department of Natural Resources 1997), this station recently was searched without finding any plants. A small population was found recently just outside of the HAA boundary in abandoned RR R-O-W in Vermilion County (Taft, pers. obs.). It is possible that other stations will be found in prairie habitat in RR R-O-W within the HAA boundary. This species demonstrates a level of disturbance adaptation and occurs most frequently in degraded prairie remnants. Ear-leaved foxglove ranges from Ohio to Minnesota and south to Kansas and Missouri (Herkert 1991). Opportunities for conserving this species in the HAA would be enhanced if vegetation management activities, including prescribed fire and brush cutting, were applied to the many miles of degraded prairie in RR R-O-W found throughout the HAA. This species can be readily identified when in bloom (August) or in fruit (September) and acquires a distinctive purplish coloration to the leaves during late summer and autumn.

False hellebore (*Veratrum woodii* Robbins) - This perennial member of the lily family is found in only six states (Ohio, Indiana, Iowa, Missouri, Oklahoma, and Illinois). This species often persists vegetatively for many years without flowering. Though often found vegetatively, false hellebore has distinctive, plicately veined leaves that make identification easy. Two large populations occur within the HAA, one in mesic upland forest and the other on a narrow terrace adjacent to a wetland.

In addition to these taxa, four other species historically occurred in Champaign County, and thus most likely were within the HAA, and now evidently have been extirpated from the county for many years. These taxa are white lady's slipper *(Cypripedium candidum)* ,

prairie dandelion (*Nothocalais cuspidata*), heart-leaved plantain *(Plantago cordata)* , and prairie white-fringed orchid, *(Platanthera leucophaea).* White lady's slipper was noted to have occurred in a prairie 20 miles northeast of Champaign (Gleason 1908). Though efforts were underway in 1908 to preserve this site, the prairie apparently was destroyed. Prairie dandelion was collected twice from Champaign County, the last collection from 1901 in a waste area in a cemetery partially in Urbana and Champaign, adjacent to the present-day location of the Illinois Natural History Survey. Heart-leaved plantain was collected most recently in 1879 from a woody swamp in Urbana where it probably occurred in a clear, gravelly stream, its typical habitat. This habitat has been eliminated from the Champaign County portion of the HAA. Prairie white-fringed orchids were collected several times, most recently in 1886, from wet prairies in Urbana, a habitat that also has been eliminated from Urbana as well as the county.

Species Known from Sites Near the Boundary of the Headwaters Assessment Area

Mead's milkweed (*Asclepias meadii* Torr.) - Though never a common species, habitat destruction and degradation have made Mead's milkweed one of the rarest prairie species in North America. Its extreme sensitivity to habitat degradation make this one of the most reliable indicators of undisturbed prairie. A single plant occurs in a small area of high-quality mesic prairie in a RR R-O-W just outside the HAA boundary. In recent years this plant has not been found and seldom blooms. Mead's milkweed is an obligate outbreeding species that requires association with a genetically diverse population to achieve production of viable seeds (Bowles, pers. comm.). No seed production has been known from any Illinois plants currently known to exist. The long-term survival of this species in Illinois apparently will require vigilent reintroduction of cloned individuals from Illinois stock together with genetically distinct material from outside Illinois.

Fibrous-rooted sedge (*Carex communis* L.H. Bailey) - This sedge is mostly a species of mesic to dry-mesic upland forests and has been found at two localities in Vermilion County (>1 mile) outside the HAA. Additional inventory work particuarly in beech-maple forests in the eastern portion of the HAA may yield new discoveries of this species. Fibrous-rooted sedge is most easily identified in late April through May. It is closely related to and possibly confused with the common savanna sedge (*C. pensylvanica*). *Carex communis* ranges throughout the northeastern United States and adjacent Canada reaching its south and west distribution limits in South Carolina and Arkansas (Gleason 1952).

Queen-of-the-prairie (*Filipendula rubra* (Hill) Robins.) - One colony of this species occurs in a degraded RR R-O-W. At that locality this species probably is a remnant of a former wet prairie community that was destroyed. Queen of the prairie occurs in a variety of natural communities in Illinois including graminoid fen, mesic sand prairie, and seeps (Herkert 1991). It is unlikely that any populations of this distinctive species occur undetected within the HAA.

Prairie white-fringed orchid (*Platanthera leucophaea* (Nutt.) Lindl.) - Though formerly widespread in prairie and wetland communities throughout the northern half of Illinois, habitat destruction and degradation have reduced the prairie white-fringed orchid to scattered localities primarily in northeastern Illinois. A small population of a few plants persists in a mesic to wet-mesic prairie remnant just outside (>1 mile) the boundary of the HAA. In recent years, a few populations have been found in degraded prairie and wetland remnants in northeastern Illinois. Degraded prairie within the HAA may support small, undetected populations of this species. Though this orchid is a very distinctive species, it can be surprisingly cryptic. The best search time for this species is in late June or early July when flowering occurs. Annual fluctuation in population size has been positively correlated to rainfall amount (Bowles et al. 1992).

Disturbance, Habitat Quality, and Restoration Potential

In addition to habitat loss through conversion to cropland, most remnant plant communities in the HAA have experienced anthropogenic disturbances that have resulted in differing levels of degradation. Fire absence, fragmentation, and exotic species introductions are other typical consequences of intensive habitat conversion that have implications for habitat restoration potential. These issues are discussed below.

Disturbance is a general term referring to any perturbation. Plant communities (or ecosystems) are **degraded** when recovery to original condition is unlikely under normal circumstances. Degraded lands can be distinguished further by those that can be *restored* to original condition through management efforts and those which, at best, can be *reclaimed* for only limited use in severe examples (e.g., strip mining), or *rehabilitated* to a condition somewhat similar to the original but where compositional differences remain (Lovejoy 1975). Degraded lands are ***derelict*** when land uses become very limited (Brown and Lugo 1994). Perturbations that exceed the intensity, frequency, or duration of the natural disturbance regime can result in loss of species lacking tolerance or adaptations to the new levels. When certain "keystone" species, or assemblages of other taxa, are extirpated from a community, the system's capability for restoration is diminished and integrity is lowered. A common source of degradation in Illinois plant communities is over grazing; however, multiple factors often are interacting.

Fire is an example of a large-scale natural disturbance in many midwestern plant communities and fire frequency is an important determining factor for many community characteristics. The compositional and structural characteristics of many native Illinois plant communities demonstrate some level of fire dependency. Fire absence in these communities can result in profound changes in community characteristics. For example, vegetational changes common throughout Illinois, such as from prairie to shrub thicket or forest, or oak-dominated woodland to maple-dominated forest, are attributable to reduced fire frequency and fire absence.

Fragmentation is a process describing landscape patterns where habitat remnants become isolated by land conversions. Fragmented habitats often undergo alterations in many environmental conditions. Increased surface area of edge compared to volume can

result in changes in soil moisture conditions and levels of solar radiation, as well as increased opportunity for exotic species invasions and wind damage (Gelhausen et al., in review). High levels of fragmentation limit restoration potential of degraded sites since species immigration, needed to compensate for the local extirpations of plants with low population levels, is seriously challenged (Taft 1996, 1997). Fragmented habitats support fewer species and at lower population levels compared to less fragmented habitats. Species at lower population levels are prone to local extirpation.

Integrity is lowered not only by the loss of native species but also by the introduction of **exotic** (non-native, adventive) **species**. Adventive taxa in a system may be sorting into disturbance or habitat niches that result in the replacement of native taxa. The establishment of adventive taxa can result in arrested development and interfere with rates of recovery processes. The recovery potential of plant communities with appropriate ecological restoration and management is an area of much needed additional research. Specific and general recommendations for restoration of natural communities in the HAA, including exotic species control measures, are offered in the "Summary Conclusions" section following descriptions of Natural Communities.

Natual Areas and Nature Preserves

The Illinois Natural Areas Inventory (INAI) was conducted over a three-year period during the mid 1970's to document remaining significant and exceptional examples of the natural communities in Illinois (White 1978). The INAI established seven categories of natural areas based on significant features. The categories are: I - High Quality Natural Communities; II - Habitat for Endangered Species; III - Habitat for Relict Species; IV - Outstanding Geological Areas; V - Approved Natural Areas and Restoration Sites; VI - Unique Natural Areas; and VII - Outstanding Aquatic Areas. The INAI established a grading system to rank natural quality (White 1978). The natural quality of a community type was graded from "A" (relatively stable or undisturbed) to "E" (very early successional or severely degraded). In general only A and B communities are designated as significant or exceptional features.

Twenty-three sites within the HAA have been identified by the INAI (Table 5, Figure 11). Fourteen of these sites qualify as Category I natural areas for the INAI and comprise a total of 251.4 acres, or 0.023% of the total area of the HAA (Table 6). This compares to 0.07% of Category I acreage for the entire state (White 1978). The high-quality natural communities within the HAA include remnants of dry-mesic upland forest (Grade B), mesic upland forest (Grades A and B), wet-mesic floodplain forest (Grade A), mesic prairie (Grade A), glacial drift hill prairie (Grade A), dry-mesic savanna (Grade B), seeps (Grade A), and eroding bluff community (Grade A). The remaining natural areas are mostly Category II sites (threatened and endangered species localities) and Category VII sites (high-quality stream segments). Area of all Category I and II INAI natural areas, including buffer lands, total about 3,712 acres (about 0.3%) in the HAA (Table 5). When including acreage of riverine natural areas (Category VII sites), the total is 4,290 acres

(0.4% of the HAA). Comparison of the area of Category I natural communities in relation to the total remaining in Illinois is described under each community type below.

The purpose of the INAI is to identify high-quality natural areas and other significant features in Illinois. But identification does not automatically ensure that an area will be protected. Once an area is selected, further action is required to protect it. The highest level of protection offered is for the area to be designated as an Illinois Nature Preserve. This means that the area has been formally protected in perpetuity by the landowner through the state. The majority of nature preserves in Illinois are publicly owned, but many are maintained in private ownership. Four sites within the HAA (three in Vermilion County and one in Ford County), totaling 236 acres, have been established as nature preserves (Table 7, Figure 11). Each of these nature preserves falls within a natural area.

Terrestrial Natural Community Descriptions

The natural communities within the HAA (Table 11) were determined by examining data from several sources. These include descriptions of existing community types as well as plant communities inferred to have occurred prior to European settlement and large-scale alteration of the landscape. Since native vegetation in the HAA has been so greatly converted, modified, and degraded, some of the following community types may no longer persist. Community classification follows White and Madany (1978). Botanical nomenclature follows Mohlenbrock (1986). Scientific names corresponding to the common names used in this text are in the summary species list for the HAA (Appendix 1).

Table 11. Terrestrial natural communities known to occur or believed to have formerly occurred in the Headwaters Assessment Area[1].

Forest
- **Upland Forest**
  - dry upland forest
  - dry-mesic upland forest
  - mesic upland forest
  - wet-mesic upland forest
- **Floodplain Forest**
  - mesic floodplain forest
  - wet-mesic floodplain forest
  - wet floodplain forest

Prairie
- **Prairie**
  - dry-mesic prairie
  - mesic prairie
  - wet-mesic prairie
  - wet prairie
- **Hill Prairie**
  - glacial drift hill prairie

Savanna
- **Savanna**
  - dry-mesic savanna
  - mesic savanna
  - wet-mesic savanna
  - wet savanna

Wetland
- **Seep & Spring**
  - seep
  - calcareous seep

Primary
- **Cliff**
  - sandstone cliff
  - eroding bluff community

[1] Adapted from the Illinois Natural Areas Inventory's natural community classification (White and Madany 1978).

Specific data sources include known community types found in INAI sites, descriptions of vegetation in publications and technical reports, and habitat descriptions in the Illinois Department of Natural Resources (1997) Natural Heritage Database. Floodplain forests in the HAA have been described by Boggess 1964; Bell 1974; and Taft 1986. Upland forests have been described by McDougall 1919; Jones 1942,1947; Boggess 1964; Boggess and Bailey 1964; Illinois Nature Preserves Commission unpublished report Item 22; and Illinois Department of Natural Resources (1997). Few published data are available describing prairie vegetation from within the HAA; however, substantial unpublished floristic data from mesic prairies and glacial-drift hill prairies are available. These data were found in the natural areas files at the Illinois Natural History Survey (INHS) and in unpublished sample and inventory data from mesic prairies in the HAA (Taft, unpublished data). The species lists were compiled by numerous botanists over a period of several years. Present savanna descriptions are from the natural areas files at the INHS and personal observation. General descriptions of savanna characteristics are summarized from White (1978) and Taft (1997). Descriptions of wetland vegetation in the HAA (not including floodplain forest) has been limited. Marsh vegetation has been described by Taft (1986). Seeps in Vermilion County have been the focus of relatively intensive floristic inventories (Evers [natural areas files at INHS]; Morris et al., unpublished report).

Forest

Forests in the HAA belong to the Prairie Peninsula Section in the Northern Division of the Oak-Hickory Forest Region (Braun 1950). Due to a level of protection from the presettlement prairie fires, forests in the HAA were concentrated primarily on the slopes, ravines, and bottomlands associated with the major drainages and in protected areas associated with moraines (Gleason 1912). Forest subclasses include **upland forest** and **bottomland forest**. These forest types are characterized below. Of the 3% of the HAA remaining as forest (31,758 acres), about 0.72% of the remainder (229 acres) and 0.14% of the original total (about 160,831 acres) remains in a state of high ecological integrity (White 1978; Illinois Department of Natural Resources; IGIS). Considerable descriptive data are available on the remaining forests in the HAA.

Common ecological problems associated with forest communities, in general, include habitat degradation, fragmentation, exotic species introductions, and in upland forests, fire absence. A typical source of habitat degradation in forests is over grazing, which often produces changes in the compositional and structural characteristics of forest communities. As in much of Illinois, grazing-sensitive species probably have been eliminated from many forest remnants in the HAA. In contrast, species that increase with grazing (e.g., thorn-bearing taxa [e.g., red haw, honey locust, Missouri gooseberry, and *Rubus* spp.], exotic species [e.g., Osage orange, multiflora rosa, and garlic mustard], and certain weedy native species) are often abundant in grazed forests. In many cases, abundance of exotic species appears to be directly proportional to the historic grazing intensity. Recovery of these sites following cessation of grazing appears to be slow. Complete restoration may not be possible without intensive management including species reintro-

duction. Fire absence in upland forest communities typically results in compositional changes in more mesic sites and primarily structural changes in drier sites, such as increases in both stem density of woody plants and shade. The result is often a reduction in cover and diversity of the herbaceous ground flora, typically the most diverse stratum in Illinois woodlands (Taft et al. 1995).

Upland Forest

The total extent of upland forest in the HAA is estimated to be about 23,938 acres, or about 2.2% of the total HAA (IGIS data). Upland forest communities can be classified further by soil-moisture characteristics. *Xeric, dry, dry-mesic, mesic*, and *wet-mesic upland forest* communities are recognized in Illinois in context with increasing available soil moisture (White and Madany 1978). Major tree species respond in predictable ways along these soil-moisture gradients (Adams and Anderson 1980; Fralish 1994; Taft et al. 1995). Most of the following community types are known to occur in the HAA. A few species that are characteristic of certain community types are confined to theVermilion River Section of the Wabash Border Natural Division (east sector).

Dry Upland Forest - Dry upland forests (on nonsandy sites) are uncommon and localized in central Illinois on ridge crests and upper slopes with xeric exposures (south and southwest-facing aspects). No dry upland forest communities in the HAA have been described in detail. Remnants of this community type may occur bordering hill prairies in the HAA and other exposed upland habitats. A total of 27 acres of Grade B dry upland forest was reported for the Grand Prairie Section and an unknown amount of Grade C dry upland forest has been reported for the Vermilion River Section (White 1978).

The **dominant canopy species** in dry upland forests are white oak and black oak. Occasional species include shingle oak, chinquapin oak, shagbark hickory, and white ash. **Subcanopy trees** and shrubs include shadbush, rough leaved dogwood, flowering dogwood (east sector), red-bud, hazelnut,and hop hornbeam. Characteristic **ground-cover species** include everlasting, savanna sedge (*Carex pensylvanica*), poverty oat grass, woodland sunflower, field goldenrod, and yellow pimpernel. Several prairie/savanna species can be present including feverfew, cylindric blazing star, and prairie dock. This community type probably was more common in the HAA in pre-European settlement times and, perhaps locally, graded into savanna habitats. Canopy composition of this community type would be relatively stable since mesophytic species like sugar maple would be limited by soil-moisture conditions. However, structural characteristics of the community could change with long fire-free intervals as oak and hickory species tolerant of dry conditions may increase in density.

No threatened or endangered species are known from dry forest habitats in the HAA. The primary ecological problems in dry upland forest are damaging grazing and fire absence. Relatively few exotic species pose severe problems in dry forests compared with other forest communities.

Dry-Mesic Upland Forest - Dry-mesic upland forest occurs in the HAA on the upper slopes and ridges of the dissected terrain bordering major streams. The total extent in the HAA is unknown. Forty-nine acres of dry-mesic upland forest among two sites in the HAA are recognized as high quality and of statewide significance by the INAI. This is about 2.4% of the Grade B total and 1.6% of all high-quality dry-mesic upland forest (Grades A & B) remaining in Illinois (Table 6).

Dominant canopy species are white oak, black oak, shagbark hickory, and white ash where forest composition has not been altered by logging or a history of grazing. Occasional tree species are red oak, shagbark hickory, hackberry, black walnut, black cherry, chinquapin oak, and shingle oak. **Common subcanopy species** include sugar maple, shadbush, blue beech, hop hornbeam, black cherry, and slippery elm. Typical **shrubs** include red-bud, flowering dogwood (east sector), Missouri gooseberry, black raspberry, elderberry, black haw, and prickly ash. **Ground-cover species** include the vines poison ivy and Virginia creeper, and several herbaceous species (e.g., everlasting, Jack-in-the-pulpit, rattlesnake fern, black gramma, curly styled wood sedge, spring beauty, fall coral root, sensitive fern, poverty oat grass, squirrel corn, Dutchman's breeches, bottlebrush grass, slender wild rye, false rue anenome, common phlox, Solomon's seal, Christmas fern, bloodroot, fire pink [east sector], false Solomon's seal, early meadow rue, Virginia spiderwort, and red trillium).

No threatened or endangered species are known from dry-mesic forest habitats in the HAA. The major ecological problems associated with dry-mesic upland forests are degradation from grazing, habitat fragmentation, and fire absence. Fire absence can lead towards an increased importance of sugar maple in the subcanopy stratum and potentially lesser importance of oaks in the canopy. Where oaks have been removed by selective logging practices, black cherry, shagbark hickory, slippery elm, and possibly sugar maple are among the species that gain prominence in the canopy. Exotic species in dry-mesic upland forest may include the shrub multiflora rose and herb garlic mustard.

Mesic Upland Forest - Mesic upland forest is probably the most prevalent upland forest type in the HAA, though no data are available on the total extent. Mesic upland forests are found on lower slopes, in ravines, on high terraces of the major streams and tributaries, and occasionally as isolated remnants of former larger blocks of forest. A total of 124 acres of this community type in the HAA is recognized by the INAI as high-quality and of statewide ecological significance. This is about about 0.5% of the forest cover in the HAA, and 10% of the Grade A total and 4.9% of the total high-quality mesic upland forest (Grades A & B) remaining in Illinois (White 1978; Illinois Department of Natural Resources 1997).

Species composition is relatively rich including numerous taxa at each forest stratum. Sometimes no species are dominant. Characteristic **canopy tree species** include sugar maple, shagbark hickory, white oak, red oak, basswood, and American elm. Occasional tree species include black maple (east sector), bitternut hickory, pignut hickory, false shagbark hickory, mockernut hickory, hackberry, American beech, blue ash, butter-

nut, black walnut, yellow poplar, bur oak, chinquapin oak, and black oak. **Subcanopy species** include Ohio buckeye, shadbush, blue beech, red haw, Kentucky coffeetree, red mulberry, hop hornbeam, black cherry, sassafras, and slippery elm. Typical **shrubs** include paw paw, redbud, flowering dogwood (east sector), gray dogwood, hazelnut, wahoo, wild hydrangea, spicebush, wild plum, choke cherry, Missouri gooseberry, black raspberry, elderberry, bladderpod, nannyberry, black haw, and prickly ash. **Woody vines** include bittersweet, Virginia creeper, bristly catbrier, poison ivy, and riverbank grape.

Herbaceous ground-cover composition includes a rich assortment of species, particularly spring ephemerals. Selected taxa reported from the HAA include doll's eyes, Jack-in-the-pulpit, wild ginger, several sedges (e.g., *Carex albursina, C. hirtifolia, C. jamesii, C. sparganioides*), blue cohosh, spring beauty, yellow lady's slipper orchid, toothwort, white trout lily, white snakeroot, wild geranium, liverleaf, waterleaf, false rue anemone, large twayblade orchid, sweet cicely, ginseng, common phlox, mayapple, Soloman's seal, Christmas fern, bloodroot, false Soloman's seal, white trillium, red trillium, horse gentian, bellwort, and downy-blue violet.

False hellebore (*Veratrum woodii*) is the only species listed as threatened or endangered by the IESPB known from mesic forest habitat in the HAA (see previous section on "Threatened and Endangered Species"). *Carex communis* is a sedge listed by the IESPB as an endangered species that has been found recently in Vermilion County in mesic upland forest outside the HAA. Further floristic inventory work within the eastern sector of the HAA (i.e., Vermilion River Section of the Wabash Border Natural Division) may yield additional discoveries of this taxon. Workers should gain familiarity with the distinctions among *Carex* Section Montanae to facilitate recognition of this taxon which is superficially similar to the common *C. pensylvanica*.

The major ecological problems associated with mesic upland forests are degradation from grazing, habitat fragmentation, and logging. Among the more abundant exotic species within mesic upland forest are the shrubs amur honeysuckle and multiflora rose and the herb garlic mustard.

Wet-Mesic Upland Forest - This community type is rare and local within the HAA. No data are available on the total extent and no high-quality remnants have been identified within the HAA. Typically, wet-mesic upland forest occurs where there are localized drainage limitations within an upland forest. Often, drainage is limited by a slowly permeable subsoil horizon. Local areas of seepage may contribute to saturated soils and can support this natural community. Where depressions occur in an upland forest, ponding may occur for variable periods. At Middle Fork Woods Nature Preserve in Vermilion County a series of small forested upland depressions that retain water during some spring months are critical habitat for the silvery salamander (see section on "Amphibians and Reptiles"). Characteristic **canopy species** include swamp white oak, shagbark hickory, and white ash. A subcanopy is absent. Ground-cover species may include a few wetland sedges.

Floodplain Forest

Floodplain forests are characterized by edaphic conditions of poor drainage and slow permeability. Local areas of sand and gravel increase permeability. Floodplain forest communities in Illinois include *mesic*, *wet-mesic*, and *wet floodplain forest* and are classified according to characteristics of flooding. Wet floodplain forest occurs in the floodplain bordering rivers and, for this report, includes the river bank. Wet-mesic to mesic floodplain forests occur on low and high terraces, respectively. The total extent of floodplain forest in the HAA is estimated to be about 7,820 acres, or about 0.7% of the total area (IGIS data). In general, the flooding regime, including depth and duration of flooding, is a strong selective force on composition and species richness in floodplain forests (Bell 1974) and also in regulating tree growth (Robertson 1992). Wet floodplain forests are often seasonally flooded and/or have perched water during a portion of the year, often in late winter and spring. Generally, flooding is of shorter duration and less frequency in mesic floodplain forests. Wet-mesic floodplain forests are intermediate. Diversity of species composition tends to increase from wet to mesic floodplain forest. Compositional changes favoring more flood tolerant tree species like silver maple appear to have occurred since presettlement conditions along the Sangamon River valley (King and Johnson 1977) and may have occurred in floodplain forests within the HAA.

Ecological problems in floodplain forest involve siltation from silt-laden flood waters, changes in the hydrological regime (e.g., stream entrenchment or increased flooding duration and frequency due to changes in the upper watershed), grazing, and exotic species invasion. A description of the composition of floodplain forest for the HAA follows.

Mesic Floodplain Forest - There is no estimate of the proportion of the approximately 7,820 acres of floodplain forest within the HAA that is mesic floodplain forest. No areas have been identified from within the HAA by the INAI as high-quality, undegraded remnants. Compared with other floodplain forest communities, a relatively greater diversity of tree species often can be found in examples of this high terrace community since the relatively brief flooding duration and lower flooding frequency pose fewer limitations to species. Common to occasional **canopy tree species** include sugar maple, green ash, sycamore, bur oak, chinquapin oak, red oak, basswood, and American elm. **Subcanopy species** include Ohio buckeye, red mulberry, and slippery elm. **Shrubs and vines** include paw paw, redbud, gray dogwood, prickly ash, Virginia creeper, poison ivy, and riverbank grape. **Ground-cover species** include many taxa also found in mesic upland forests: Jack-in-the-pulpit, toothwort, Dutchman's breeches, blue bells, common phlox, mayapple, Solomon's seal, bloodroot, black snakeroot, false Solomon's seal, and downy-blue violet.

One very large population of false hellebore, listed as a threatened species by the IESPB (see previous section on "Threatened and Endangered Species"), occurs associated with a mesic floodplain forest community within the HAA. This species, more typically, is found in mesic upland forests. Ecological problems include over grazing and exotic

species invasions. Exotic species typically associated with mesic floodplain forest include garlic mustard, motherwort, Osage orange, white mulberry, and multiflora rose.

Wet-Mesic Floodplain Forest - There is no estimate of the proportion of the approximately 7,820 acres of floodplain forest within the HAA that is wet-mesic floodplain forest. A total of 56 acres of wet-mesic floodplain forest, found at one location bordering the Sangamon River, has been identified from within the HAA by the INAI as a high-quality (Grade A) and statewide-significant natural community (Table 7). This is about 1.8% of the total high-quality (Grades A & B) wet-mesic floodplain forest in Illinois. It is particularly noteworthy that this natural area represents 11.3% of the statewide total of Grade A wet-mesic floodplain forest (Table 7).

Common to occasional **canopy species** include silver maple, bitternut hickory, mockernut hickory, hackberry, honey locust, green ash, black walnut, sycamore, cottonwood, shingle oak, pin oak, and American elm. **Subcanopy species** include box elder, red haw, red mulberry, black willow, and slippery elm. **Shrubs and Vines** include paw paw, Missouri gooseberry, common blackberry, elderberry, bristly catbrier, buckbrush, poison ivy, and riverbank grape. **Ground-cover species** include giant ragweed, false nettle, several sedges (e.g., *Carex frankii, C. davisii, C. grayi, C. grisea,* and *C. granularis*), wild chervil, enchanter's nightshade, honewort, Aunt Lucy, Virginia wild rye, annual bedstraw, white avens, cow parship, Virginia waterleaf, wood nettle, blue bells, common phlox, goldenglow, black snakeroot, common snakeroot, cup plant, and common blue violet.

No threatened or endangered plant species currently are known from wet-mesic floodplain forests in the HAA. Ecological problems include changes in the watershed that alter the flooding regime, severe grazing, and exotic species introductions. Exotic species include garlic mustard, motherwort, moneywort, Osage orange, white mulberry, and multiflora rose.

Wet Floodplain Forest - There is no estimate of the proportion of the approximately 7,820 acres of floodplain forest within the HAA that is wet floodplain forest. No areas have been identified from within the HAA by the INAI as high-quality, undegraded remnants. Compared with other floodplain forest communities, fewer tree species can be found in examples of this natural community since flooding frequency and duration, typically, are limiting for many species. Common to occasional **canopy species** include silver maple, hackberry, green ash, sycamore, and cottonwood. **Subcanopy species** include box elder and black willow. **Shrubs and vines** include elderberry, bristly catbrier, poison ivy, and riverbank grape. **Ground-cover species** include giant ragweed, panicled aster, false nettle, enchanter's nightshade, honewort, Aunt Lucy, Virginia wild rye, annual bedstraw, white avens, spotted touch-me-not, wood nettle, blue bells, clearweed, goldenglow, and common blue violet.

No threatened or endangered plant species are known from wet floodplain forests within the HAA. Ecological problems include changes in the watershed that alter the flooding

regime, severe grazing, and exotic species introductions. Exotic species include garlic mustard, creeping Charlie, and moneywort.

Prairie

Four prairie subclasses are recognized in Illinois: **Prairie** (tall-grass prairie on silt-loam soils), **Sand Prairie, Hill Prairie** (including loess and glacial drift hill prairie), and **Shrub Prairie** (White and Madany 1978). The Prairie subclass, like upland forest communities, is further distinguished by soil-moisture regime (dry, dry-mesic, mesic, wet-mesic, and wet). Considering the distribution of prairie and forest in Illinois at the time of European settlement (about 1820), as mentioned previously, most of the HAA was tall-grass prairie (Anderson 1970; Iverson et al. 1989). Based on remnant prairies in the HAA and inferring from soil-moisture conditions that were prevalent prior to extensive agricultural development, the following community types are/were present: *tall-grass prairie (*including *dry-mesic, mesic, wet-mesic,* and *wet*) and *glacial drift hill prairie*. However, due to the near-complete elimination of prairie vegetation from within the HAA, few examples remain to document the characteristic species that were associated with undegraded natural communities for all soil-moisture conditions that presently or formerly occurred in the region.

Common ecological problems associated with tall-grass prairie, in general, include fragmentation, exotic species invasions, fire absence, and habitat degradation. Small, isolated fragments tend to support many species at low population levels (thus prone to local extinction) too remote to be enhanced through natural mechanisms of species dispersal. Small, isolated prairie remnants also may be lacking appropriate pollinator species for successful sexual reproduction of many outcrossing species. The greater edge-to-volume ratios of small sites offer greater opportunities for exotic species invasions since the matrix areas typically are dominated by non-native vegetation. Exotic species pose some of the most severe threats to the integrity of existing high-quality prairie remnants in the HAA. Highly fragmented and developed landscapes also lead to altered fire regimes often eliminating fire from prairie remnants until restoration efforts commence. Fire absence results in ecological changes, such as encroachment of woody plants, that can eliminate many shade-intolerant prairie species. Fire absence also can lead to a severe invasion of exotic cool-season grasses like the ubiquitous species meadow fescue, smooth brome, and Kentucky bluegrass. Over-grazing by domestic stock typically degrades prairie remnants by eliminating many species and promoting the increase of several weedy native and non-native taxa. Soil disturbances such as past efforts at cultivation, or soil scraping (typical of many RR R-O-Ws) result in loss of species and opportunities for the establishment of weedy taxa. All of these factors and combinations of factors tend to result in loss of species diversity and ecological integrity for all prairie community types.

Prairie

Approximately 85% (911,381 acres) of the HAA was tall-grass prairie. About 7.9 acres at three prairie remnants remain in a high-quality, undegraded, condition. In addition, there are noteworthy remnants of tall-grass prairie in RR R-O-Ws within the HAA that persist in a degraded condition. An unknown quantity remains that with proper management may be restored to a high-quality condition. These sites largely have been identified by local conservation groups, such as the Grand Prairie Friends; these remnants provide valuable seed sources for prairie reconstruction and restoration efforts.
Many important prairie species respond in predictable ways along soil-moisture gradients. The characteristic species of each soil-moisture class for tall-grass prairie are described below. Comprehensive floristic descriptions are available from the HAA for mesic prairie and glacial-drift hill prairie. For prairie communities lacking detailed descriptions from within the HAA, floristic composition of remnants in central Illinois outside the HAA is used to provide a general characterization.

Dry-Mesic Prairie - Dry-mesic prairies have virtually been eliminated from the HAA. They most likely occurred on crests and upper slopes of the major moraines on well-drained and somewhat permeable soils with moderate water-holding capacity. No areas of high-quality dry-mesic prairie are known from the HAA.

Common **grass species** include panic grass, crested hair grass, little blue stem, Indian grass, prairie dropseed, and porcupine grass. Common to occasional **sedge species** include *Carex bicknellii, C. meadii*, and *C. tetanica*. Characteristic **forbs** include green milkweed, sky-blue aster, heath aster, false boneset, bastard toadflax, purple prairie clover, sessile-leaved tick trefoil, pale purple coneflower, flowering spurge, rough blazing star, hoary puccoon, wild bergamont, black eyed Susan , wild petunia, rosinweed, showy goldenrod, and yellow pimpernel. **Shrubs** include leadplant, New Jersey tea, smooth sumac, pasture rose, and prairie willow.

Typical ecological problems in remnants include fire absence (and consequential woody plant encroachment), habitat degradation from soil disturbances, and exotic species invasion and establishment. Common exotic species include asparagus, white sweet clover, yellow sweet clover, parsnip, Canada blue grass, and Kentucky bluegrass.

Mesic Prairie - Mesic prairie occurs in an intermediate soil-moisture zone on the landscape between dry-mesic prairie and wet-mesic prairie. Soils can be moderately well-drained but are often saturated during short periods of the growing season. A total of 3.9 acres of high-quality mesic tall grass prairie remains in the HAA. This is 1.4% of the total high-quality mesic prairie remaining in Illinois and 7.2% of the Grade A total (Table 7). Undegraded mesic tall-grass prairie is among the most species-dense plant communities in North America. Typical remnants contain from 15 to 30 species in a half-meter-square sampling quadrat. About 100 to 130 taxa of vascular plants can be found in individual, small (5 acre), pioneer cemetery remnants in central Illinois.

Common **grass species** include big blue stem, panic grass, prairie switch grass, little blue stem, Indian grass, praire dropseed, and porcupine grass. Common to occasional **sedge species** include *Carex bicknellii, C. brevior, C. meadii,* and *C. tetanica.* Characteristic **forbs** include a diverse assemblage of species (e.g., candle anemone, prairie milkweed, butterfly weed, New England aster, white wild indigo, cream wild indigo, tall coreopsis, prairie Indian plantain, white prairie clover, purple prairie clover, shooting star, pale purple coneflower, rattlesnake master, downy gentian, prairie sunflower, downy sunflower, prairie alumroot, bush clover, praire blazing star, hoary puccoon, spike lobelia, lance-leaved loosestrife , wild bergamont, feverfew, lousewort, prairie phlox, slender mountain mint, drooping coneflower, rosinweed, compass plant, prairie dock, blue-eyed grass, showy goldenrod, Missouri goldenrod, Ohio spiderwort, Missouri ironweed, culver's root, prairie violet, and golden Alexanders). Common **shrubs** include leadplant, New Jersey tea, hazelnut, pasture rose, and prairie willow.

Two species listed as threatened or endangered by the IESPB (Sangamon phlox and auriculate false foxglove) are known to occur historically in prairie habitats of the HAA. Only Sangamon phlox, a subspecies of the common prairie phlox that is endemic to the Sangamon River valley near Mahomet, is known from an extant population from mesic prairie habitat within the HAA. Auriculate false foxglove is not known from extant populations within the HAA although it has been seen recently near the HAA boundary (pers. obs.). Additional survey effort in somewhat disturbed prairie in RR R-O-W within the HAA could reveal new populations of this diminutive but easily recognizable species. In addition, a small population of Mead's milkweed, a species listed as endangered by the IESPB and threatened by the US Fish and Wildlife Service, is found in high-quality mesic prairie habitat within one mile of the HAA boundary. These taxa are discussed in the previous section on "Threatened and Endangered Species."

Typical ecological problems in remnants include fire absence (and consequential woody plant encroachment), soil disturbances, and exotic species invasion and establishment. Common exotic species in mesic tall-grass prairies, particularly those in pioneer cemeteries, include the following taxa: common yarrow, asparagus, awnless brome grass, Queen Anne's lace, Cyprus spurge, orange day lily, amur honeysuckle, white sweet clover, yellow sweet clover, parsnip, Canada bluegrass, Kentucky bluegrass, white poplar, common lilac, common periwinkle, and yucca. Despite a history of fire management, recent sample data from three high-quality mesic tall-grass prairies in central Illinois (including one site from within the HAA) indicate that exotic *Poa* spp. (Kentucky and Canada bluegrass) occur throughout the remnants at nearly 100% frequency among quadrats (Taft, unpublished data). Various control methods have been tested with some of the other serious exotic species (Solecki and Taft 1987, 1989). Control methods are summarized in the "Summary Recommendations" section. Evidence of leaf burn and mortality of plants at the edges of prairies bordering cropland suggests that herbicide drift can be a problem, at least to edge species, and may be an unrealized confounding factor throughout prairie remnants where they occur adjacent to cropland. Off-road vehicle use of RR R-O-Ws is becoming an increasingly damaging problem for prairie remnants. Other damage has been caused by powerline and highway maintenance vehicles and installation of fiber-optic cable.

Wet-Mesic Prairie - This prairie community occurs in an intermediate zone between mesic prairie and wet prairie on somewhat poorly drained sites. Innundation periods are more brief than in wet prairie. No areas of high-quality wet-mesic prairie are known from the HAA.

Common **grass species** include big blue stem, blue-joint grass, and prairie cord grass. Common to occasional **sedges** include *Carex vulpinoidea, C. buxbaumii, C. gravida*, and *C. granularis*. Characteristic **forbs** include grass leaf goldenrod, closed gentian, sawtooth sunflower, winged loosestrife, smooth phlox, false dragonhead, common mountain mint, prairie dock, and woundwort. **Shrubs** are uncommon but may include pussy willow.

A small population of prairie white fringed orchid, a species listed as endangered by the IESPB and threatened by the US Fish and Wildlife Service, occurs in high-quality mesic to wet-mesic prairie habitat near the boundary of the HAA. Ecological problems in wet-mesic prairie are associated primarily with enhanced drainage from tile. Fire absence can result in woody plant encroachment. Exotic species include Kentucky bluegrass.

Wet Prairie - Wet prairies occurred on poorly drained and slowly permeable soils. Due to drainage activities, very few undegraded remnants of wet prairie remain in central Illinois and none are known from within the HAA.

The characteristic **grass** species for the community type is prairie cord grass, now found mostly in roadside ditches; blue-joint grass may also have been present. The **sedges** *Carex stricta* and *C. lanuginosa* may have been important. **Forbs** like New England aster, spotted Joe-Pye weed, sawtooth sunflower, smooth phlox and common mountain mint were probably common. **Shrubs** may have included pale dogwood and pussy willow.

A colony of queen-of-the-prairie, listed by the IESPB as a threatened species, occurs nearby the boundary of the HAA in a degraded RR R-O-W. The soil is saturated by local seepage that may have been wet prairie prior to habitat degradation. Ecological problems, besides the obvious factor of total habitat destruction, include increased tile drainage altering the soil moisture regime.

Hill Prairie

Hill prairies typically occur on slopes with exposure to the south and south-west. Soil moisture conditions are usually very dry on these well drained sites. For classification, hill prairies are distinguished not by soil moisture type but by substrate. In Illinois loess, glacial drift, gravel, and sand hill prairies have been recognized (White and Madany 1978). In the HAA, there are remnants of glacial-drift hill prairies. Hill prairies often occur as openings within forest. During long periods of fire absence, hill prairies often decline in area and many have been eliminated or severely reduced in size due to encroachment of woody plants (McClain 1983; Robertson and Schwartz 1994).

Glacial drift hill prairie - One glacial-drift hill prairie recognized by the INAI occurs within the HAA in the Vermilion River Section of the Wabash Border Natural Division. This four-acre unit of glacial-drift hill prairie in a 10-acre natural area is recognized as high-quality and of statewide-significant. This is about 12% of the high-quality glacial drift hill prairie remaining in Illinois and about 29% of the Grade A total remaining (Table 7). Most of the glacial drift hill prairie remaining in Illinois occurs in the Grand Prairie Natural Division.

Characteristic grasses include big blue stem, side oats gramma, poverty oat grass, little blue stem, and Indian grass. **Characteristic forbs** include rough false foxglove, slender false foxglove, everlasting, columbine, green milkweed, sky-blue aster, pogoda plant, false boneset, Indian paintbrush, purple prairie clover, pale purple coneflower, stiff gentian, western sunflower, slender bush clover, cylindric blazing star, yellow flax, hoary puccoon, spike lobelia, lousewort, prairie phlox, prairie dock, field goldenrod, fragrant ladies' tresses, yellow pimpernel, and hairy meadow parsnip. **Common woody plants** associated with glacial-drift hill prairies include shadbush, leadplant, New Jersey tea, flowering dogwood, hazelnut, red cedar, chinquapin oak, and smooth sumac.

No threatened or endangered species are known from glacial drift hill prairie in the HAA. One endangered species, Wolf's blue grass, occurs on prairie sod within a calcareous seep in a glacial-drift hill prairie remnant. This colony may have been established in the hill prairie community and slumped down slope into an adjoining high-quality seep community.

Ecological problems are woody encroachment due to periods of fire absence, slumping of an unstable slope, exotic species invasion, and grazing. Restoration activities (e.g., fire management and brush-cutting) have been underway at the natural area and may be reversing the trends and extending the margins of the hill prairie. However, due to a saturated, steep slope at the base of the natural area, parts of the prairie have been slumping down slope towards the Middle Fork of the Vermilion River. White sweet clover, Kentucky bluegrass, and Canadian blue grass typically form the chief exotic species problems in glacial-drift hill prairies. A common seed source for these species in some hill prairies is horse manure. Horse trails also can be a serious degradation factor, particularly on steep slopes prone to erosion and compaction. It is possible that there remain a few, small, unmanaged hill prairies associated with slopes along the Middle Fork River. Prompt management including prescribed fire and brush cutting can enhance any remaining sites.

Savanna

Savanna habitats occur throughout many parts of North America. The Midwest, located between the eastern forests and grasslands of the great plains, has the environmental conditions and fire history that supported many savanna habitats (Anderson 1983; Taft 1997). Savannas are characterized by scattered, open-grown trees, with or without shrubs, and a continuous herbaceous ground cover typically dominated by graminoid

species (grasses and sedges) and numerous forbs. Density and percent cover of trees vary and are intermediate between open prairie and closed woodland or forest. In the dissected terraine of major river valleys, such as the Middle and Salt forks of the Vermilion River and the Sangamon River, savannas often occurred associated with a mixture of vegetation types including prairie, woodland, and forest. Midwestern savanna-like habitats have several unifying characteristics. These include: 1) open-canopied structure (relative to closed forest); 2) canopy dominance by a few species of oaks; 3) a ground cover usually rich in species associated with tallgrass prairie; 4) a majority of floristic diversity contained in the ground-cover; and 5) dependence on fire and other disturbances for maintenance of diversity and stability. Oak-dominated systems particularly appear dependent on periodic fire for persistence (Lorimer 1985; Abrams 1992). In a period of a few decades of fire absence, savannas in the Midwest were altered through vegetational changes and habitat destruction. There was a rapid conversion of open savanna to closed woodland and forest. The once widespread oak savannas have become among the rarest plant communities (e.g., Curtis 1959; White 1978; Nelson 1985). Presently in the Midwest former savanna and open-woodland areas can still be recognized locally by the form and density of the oldest trees in the closed woodland. Some small remnants persist where woody encroachment has been retarded (though not stopped) by droughty edaphic conditions. In addition, many savanna-like areas have been structurally maintained by livestock grazing. Typically, the ground cover at pastured sites is floristically degraded and dominated by non-native species.

Three savanna subclasses are recognized in Illinois: **savanna** (generally on fine-textured soils), **sand savanna**, and **barrens** (local inclusions of a prairie flora within an otherwise forested landscape) (White and Madany 1978). Savanna subclasses are further distinguished to community type by soil-moisture characteristics. Based on inferred edaphic characteristics in the HAA prior to settlement, the following savanna community types probably were present: *dry-mesic savanna, mesic savanna, wet-mesic savanna*, and *wet savanna*. These communities sometimes merge gradually with other community types (e.g., dry upland forest, prairie).

Compared with other habitat types, relatively few threatened and endangered plant species appear to be dependent on savanna habitats. Floristically, savannas contain species of both prairie and open woodlands, though many taxa appear to reach their greatest frequency in transitional (ecotonal) areas such as savannas. A few rare plant species that may have occurred in savanna habitats within the HAA include Hill's thistle (*Cirsium pumilum*), Wolf's bluegrass (*Poa wolfii*), auriculate false foxglove (*Tomanthera auriculata*), and buffalo clover (*Trifolium reflexum*).

Fire absence, fragmentation, habitat degradation (in particular, heavy grazing), and exotic species are primary ecological problems associated with savanna habitats. Areas of former savanna, and possibly barrens, may occur in the HAA that could be restored or at least rehabilitated with prompt vegetation management. Restoration activities including brush cutting, prescribed fire, and exotic species control, long have been under way at

two sites in the HAA that have many savanna characteristics. The following community descriptions are generalized depictions of the (former) undegraded condition.

Dry-mesic savanna - Dry-mesic savanna/open woodland probably occurred in the HAA on the upper slopes and ridge tops of areas dissected by the major streams such as the Middle Fork River. In the absence of fire, these areas rapidly developed into closed woodlands. Management at one site using prescribed fire is restoring a dry-mesic open woodland character to a formerly closed woodland habitat. Continued fire management may result in the development of a more open savanna-like habitat. There are two noteworthy remnants of dry-mesic savanna in the HAA totalling about three acres. One two-acre site is a Grade B community recognized by the INAI representing about 22% of the total high-quality dry-mesic savanna remaining in Illinois (Table 7); the other is a somewhat degraded one-acre site that is a dedicated Illinois Nature Preserve (Tomlinson Cemetery Prairie Nature Preserve).

Tree species in dry-mesic savanna include white oak and black oak. In the presettlement vegetation, black oak was more common at the transitional zone from prairie to savanna in the uplands of McLean County, perhaps due to greater fire resistance (Rogers and Anderson 1979). Occasional species include chinquapin oak, white ash, blue ash, and shagbark hickory. **Subcanopy** stratum characteristics are dependent on the recent fire history and may include many of the previous species in stages of recruitment. **Shrubs** include leadplant, New Jersey tea, gray dogwood, hazelnut, pasture rose, and prairie willow. **Ground-cover species** include a rich assortment of graminoid and forb species from prairie, savanna, and open woodland habitats. Important graminoid species (grasses and sedges) include big blue stem, Canada brome grass, poverty oat grass, hairy panic grass, bottlebrush grass, nodding fescue, little blue stem, Indian grass, and the sedges *Carex pensylvanica* and *C. hirsutella*. Characteristic forb species include little pussy toes, arrowleaf aster, Canadian milk vetch, pale Indian plantain, wild hyacinth, shooting star, pale purple coneflower, woodland sunflower, yellow star grass, feverfew, French grass, early buttercup, starry catchfly, small false solomon's seal, yellow pimpernel, Virginia spiderwort, Ohio spiderwort, Venus's looking glass, and Culver's root.

No threatened or endangered species currently are known from dry-mesic savanna habitats in the HAA. See general comments regarding threatened and endangered species and ecological problems. A small population of a rare but unlisted orchid species, green fringed orchid, occurs in dry-mesic savanna habitat in the HAA.

Mesic savanna - Mesic savannas typically were associated with prairie groves on level to slightly rolling terraine. Mesic savannas also may have occurred associated with riparian corridors. Mesic savannas are particularly dependent on recurrent fire for maintenance. Without periodic fire, the soil-moisture conditions allow rapid development of woody vegetation cover. Consequentially, due to several factors (e.g., fire absence, habitat loss, and over-grazing) undegraded remnants, though formerly widespread, are among the rarest plant communities in the Midwest and none are known from the HAA.
The compositional characteristics for mesic savannas in the HAA are poorly known. The

most **characteristic tree species** of mesic savannas is bur oak. Shagbark hickory, blue ash, and white oak may be common to occasional at some sites. **Shrubs** are similar to dry-mesic savanna. **Ground-cover species** may include greater importance of mesic prairie species. Big blue stem and Indian grass probably were abundant. Many of the ground-cover species from dry-mesic savanna probably also were present in mesic savannas.

Threatened and endangered species and ecological problems associated with mesic savannas are similar to dry-mesic savanna and are discussed in the general comments for Savanna habitats.

Wet-mesic and *Wet savanna* - About 38% of the floodplain of the Mackinaw River valley was characterized by the Government Land Office survey as savanna (Thomas and Anderson 1990). Similarly, savannas may have occurred associated with floodplains of the major streams in the HAA. No noteworthy remnants are known from the HAA.

Species composition in wet to wet-mesic savannas in most of the HAA was probably similar to that described for the Mackinaw River basin. There the most abundant tree species were, in rank-abundance order, sycamore, white oak, American elm, and cotton-wood. Ocassional species included silver maple, bur oak, chinquapin oak, and black walnut. This community was probably influenced by not only fire but also flooding. Fire-sensitive sycamore must have been most abundant closest to the river and protected in the wettest portions of the floodplain while white oak likely was restricted to terraces with better soil-drainage properties compared with the floodplain. Subcanopy and shrub strata were probably not well established but may have included box elder and elder-berry. Characteristic ground-cover species may have included autumn bent grass, giant ragweed, sedges *(Carex amphibola, Carex grayi, Carex sparganioides),* stout wood reed, sawtooth sunflower, Jerusalem artichoke, goldenglow, and prairie cord grass.

Wetland

There are about 11,512 acres of wetland within the HAA, or about 1.1% of the total area (Table 3). Wetland community types in the HAA, following the natural community classification of White and Madany (1978), include *floodplain forests* (about 63% of total), *marsh* (20%), (possibly) *shrub swamp, seeps, pond,* and *lake* (Table 11). Wetlands in the HAA are concentrated along the three major riparian corridors (Figure 9). About 64 acres of wetland (0.56% of wetland total) are recognized as high-quality and undegraded natural communities (Table 7), mostly wet-mesic floodplain forest. Flood-plain forests were described previously under the Forest community class.

Marsh

Marshes are palustrine wetlands characterized by having water at or near the surface during most of the growing season, dominance by herbaceous vegetation, with organic or mineral soils (White and Madany 1978). A total of about 2,303 acres (0.2% of total area)

of emergent marsh vegetation occur in the HAA. No areas of marsh vegetation are recognized by the INAI as high-quality, undegraded sites.

Characteristic graminoid species include the grasses fowl manna grass and reed canary grass, and the following sedges: *Carex frankii, C. granularis, C. hystricina, Eleocharis erythropoda,* and bulrushes *Scirpus acutus, S. atrovirens*, and *S. pendulus*. **Common forb** and other **monocot species** include swamp milkweed, water hemlock, common boneset, blue flag, common water horehound, field mint, clearweed, pale dock, arrowleaf, and common cat-tail. Black willow is a common small tree associated with marshes in the HAA.

No threatened or endangered species are known to occur within the marsh community type in the HAA. A large population of false hellebore, listed as a threatened species by the IESPB, occurs adjacent to a marsh on a floodplain terrace. Ecological problems in marsh include siltation, altered flooding regimes, invasion of exotic species, and over-abundance of aggressive, disturbance-tolerant native species. Siltation and altered flooding regime can reduce the integrity of a marsh. When changes in flooding dynamics result in increased frequency and/or duration of flooding, species intolerant of the new levels will decline and species tolerant of the new levels will increase. Increasers under conditions of siltation and increased flooding often include reed canary grass, common red reed, river bulrush, and common cat-tail.

Compared with upland habitats, relatively few exotic species are present in wetland communities (Havera et al. 1994). However, a few taxa (e.g., *Lythrum salicaria* [purple loosestrife] and *Rhamnus fragula* [glossy buckthorn]) are serious pests that can threaten the diversity of a wetland site. These aggressive taxa have not yet been reported in floristic surveys from within the HAA although they are recorded from Champaign and Vermilion counties (Mohlenbrock and Ladd 1978) and may be present in the HAA at least as small populations.

Shrub Swamp

A shrub swamp is a wetland with at least 50% cover of shrubs (White and Madany 1978). A portion of some marsh and seep complexes in the HAA are partially dominated by shrubs and may qualify for this distinct natural community designation. No areas of shrub swamp in the HAA are considered high-quality, undegraded natural areas. Species composition includes many taxa from the marsh community type. However, shrubs are dominant including these species: false indigo bush, buttonbush, pale dogwood, gray dogwood, and pussy willow. No threatened or endangered species are reported from shrub swamp habitat within the HAA. Ecological problems are similar to the marsh community type.

Seep

Seeps are wetland communities characterized by a constant diffuse flow of ground water, typically from the lower portions of slopes of glacial moraines, ravines, and terraces (White and Madany 1978). The water chemistry of the ground water controls to some extent species composition and is influenced by the material it flows through. In Illinois, five different seep community types are recognized: *seeps* are circumneutral and occur where the ground water is not strongly influenced by bedrock or parent material chemistry; *acid (gravel) seeps* occur associated with sandstone bedrock or gravel; *calcareous seeps* occur where the ground water is mineralized by alkaline bedrock (e.g., limestone) and/or soil parent materials like glacial drift; *sand seeps* emerge from sand deposits and may be calcareous, acid, or neutral; *spring communities* occur where a channel is formed. In the HAA, seeps tend to have circumneutral pH, ranging from pH 6.6 to 8.4 with a mean of 7.8; both organic and mineral soils are found in seeps in the HAA (Morris et al. 1996). *Seeps, calcareous seeps*, and *spring* are community types known to occur in the HAA.

Seep - Seeps are localized in the HAA and most commonly associated with the forested riparian areas bordering the Middle Fork of the Vermilion River. Two Grade A (essentially undisturbed) *seeps*, each three acres in size, are known from the HAA, about 6.4% of the undegraded seep acreage in Illinois and about 20% of the Grade A total remaining (Table 7).

Herbaceous species include a diverse assortment of **graminoid and forb species** including sweet flag, angelica, cowslip, sedges*(Carex comosa, C. hystricina, C. stricta),* white turtlehead, common horsetail, scouring rush, cinnamon wild herb, common boneset, green-stemmed Joe-Pye weed , rush *(Juncus brachycephalus),* spotted touch-me-not, rice cutgrass, fringed loosestrife, whorled loosestrife, meadow parsnip, grass-of-Parnassus, swamp wood betony, fowl blue grass, lizard's tail, spikemoss, rough leaf goldenrod, and skunk cabbage. Characteristic **woody plants** include false indigo bush, pale dogwood, black ash, spicebush, and pussy willow.

Ecological problems associated with seeps include degradation by over grazing and alterations to the watershed that influence ground water discharge. Exotic species include creeping Charlie, self heal, and narrow-leaved cat-tail.

Calcareous seep - One seep with a ground-water pH measured at 8.4 (Morris et al. 1996) is a calcareous (alkaline) seep. This two-acre site is a high-quality (Grade A) natural community, accounting for about 14% of the total undegraded calcareous seep remaining in Illinois (Table 7). Deposits of tufa, concretions of calcium carbonate, are present and locally abundant.

Common species include a sedge (*Carex hystricina*), white turtlehead, common horsetail, scouring rush, spotted Joe-Pye weed, common boneset, spotted touch-me-not, rush *(Juncus dudleyi),* rice cut grass, whorled loosestrife, grass-of-Parnassus, swamp wood

betony, common mountain mint, prairie willow, lizard's tail, bulrush *(Scirpus americanus),* water parsnip, and rough-leaf goldenrod.

Wolf's bluegrass, an endangered species in Illinois (Herkert 1991), is present in this seep community. However, this taxon is more of an open woodland species and may have become established in the seep from slumping action of vegetation upslope (see discussion in the section on "Threatened and Endangered Species"). Ecological problems at this site include slumping of an unstable eroding bluff and visitor impacts to the saturated soils.

Lake and Pond

Lakes and ponds are open-water habitats. In the HAA there are natural and artificial examples of pond; all lakes are artificial empounments.

Pond

Natural ponds include shallow-water wetlands that are not excavated or impounded. No high-quality natural pond remnants are known from the HAA. There are an estimated 137 natural ponds in the HAA totaling about 102 acres (IGIS data). Most of these probably have been degraded directly or indirectly by livestock or other agricultural activities. No descriptive data are available on the floristic composition of natural ponds in the HAA. Typical species of natural ponds include coontail, duckweed, spatterdock, common cat-tail, and common bladderwort. Near the Middle Fork of the Vermilion River are some old strip-mine ponds where several of the above species have become established with some interesting additional taxa (e.g., mosquito fern, watershield, and waterclover).

No species listed as threatened or endangered by the IESPB are known from pond communities in the HAA. Ecological problems include drainage, degradation from livestock use, and siltation.

Primary Habitats

Primary communities include glade and cliff communities. No glades are present within the HAA. However, small exposures of cliffs are present in the HAA.

Cliff

The cliff subclass includes *sandstone cliff community* and *eroding bluff community*, both present within the HAA.

Sandstone cliff community - Small areas of sandstone are exposed along the Salt Fork of the Vermilion River (pers. obs.). No areas are recognized as high-quality natural commu-

nities by the INAI. No plant community descriptions have been made for the HAA. A typical species is columbine; wild sarsaparilla is uncommon in the HAA but is found associated with sandstone habitat in the Middle Fork River area.
Few exotic species pose problems in sandstone cliff communities and there are no salient ecological problems.

Eroding bluff community - Eroding bluffs consists of vertical exposure of eroded unconsolidated material such as glacial drift (White and Madany 1978). A total of 4.5 acres of Grade A eroding bluff community, about 15% of the statewide total of undegraded eroding bluff community, are present within the HAA associated with the Salt Fork of the Vermilion River. Eroding bluffs, typically, are maintained by the erosive action of streams. Floristic composition is predominately species that can become established and reproduce rapidly since the community is prone to frequent slumping disturbance. No plant community descriptions have been made for eroding bluffs in the HAA.

Because of the brief period for establishment of plants, some weedy exotic species may be occasional members of the eroded bluff community. Ecological problems may include altered flooding regimes that may result in more rapid undercutting of bluffs resulting in more rapid erosion.

Cultural Habitats

This class describes communities formed by anthropogenic activities and disturbances and includes cropland, pastureland, successional fields, developed land, tree plantations, artificial lakes and ponds, and prairie reconstructions. This is the major community class in the HAA comprising about 96.3% of the total land area. No threatened or endangered species are known from cultural habitats in the HAA. These areas impose some of the most challenging ecological problerms for natural habitats in the HAA (see discussion below). One exception is the prairie reconstruction, termed prairie restoration by the INAI (White and Madany 1978). This is the only community type mentioned below (briefly) since it is the only example in the Cultural community class of an effort to create a natural community.

Prairie Restoration - Typically, prairie reconstructions are plantings of prairie species on grassland soils where the original natural community has been destroyed. Prairie species are planted, sometimes in an effort to produce a warm-season grassland and sometimes with the goal of attempting to recreate the original prairie community. Prairie reconstructions often are low in diversity and strongly dominated by a few species. The total area of prairie reconstruction is unknown from within the HAA. None have developed into communities that mimic undegraded tall-grass prairie in species richness or structure. Nevertheless, two sites in particular, the Meadowbrook Prairie and a prairie reconstruction on grounds managed by the Illinois Natural History Survey, provide sites for educational field trips serving school children throughout Champaign and Urbana.

Summary and Recommendations

Trends in the HAA among the terrestrial community classes of Forest, Prairie, Savanna, and Wetland, including all natural communities within these classes, indicate that habitat loss exceeds statewide averages. Habitat degradation among remnants of these community classes exceeds statewide rates for all classes except Forest. A slightly greater percent of forest remains in the HAA in a relatively undegraded condition compared with forest throughout Illinois. However, although some old-growth and old second-growth forest tracts remain that appear to lack a damaging grazing history, removal of key ecological processes in these forest fragments has resulted in some dramatic changes in community composition and structure since the time of European settlement of the region.

Despite the availability of a great deal of descriptive information regarding natural communities in the HAA, there remain many knowledge gaps, particularly the distribution, abundance, qualitative condition, and ecological trends among remnants. This is particularly true for silt-loam prairies, formerly the most abundant community class in the basin. Though floristic information is available for the few remnants, there is a lack of quantitative data. Further, since remnnats tend to have floristic differences (no two sites are the same), the fact that so little prairie remains suggests we have a poor resolution of the original (presettlement) species diversity for the HAA. Particularly lacking are data on wet and wet-mesic prairies, natural communities that were formerly common. Additional survey efforts in the HAA may identify new populations of threatened or endangered species and noteworthy remnants of natural communities, particularly in the Vermilion River Section of the Wabash Border Natural Division.

Many of the most challenging conservation issues in the HAA are addressed primarily at the community and ecosystem levels. There are serious ecological problems that threaten the long-term maintenance of biodiversity in the HAA. Throughout the natural community descriptions for the HAA are consistent references to a set of related ecological problems. These are habitat fragmentation, habitat degradation, exotic species invasion, and, for several community types, fire absence. The following five steps are recommended as an approach for gaining further insights of the natural communities in the HAA and developing a plan for the long-term maintenance of biodiversity.

1. Inventory

The Illinois Natural Areas Inventory (INAI) provides data on the distribution and abundance of statewide-significant natural communities (White 1978). However, many natural communities occur in Illinois that, though they do not meet the critical qualitative standards of the INAI for undegraded and statewide-significant natural areas, contain regionally noteworthy and exceptional natural features. Many natural communities in the HAA, although somewhat degraded, retain relatively high levels of ecological integrity and have potential for further improvement through restoration efforts. Since the INAI sites are few and small in total area, the somewhat degraded but restorable natural communities that remain are critical for the long-term maintenance of biodiversity in the

region. Remnants among all community classes (e.g., forest, prairie, savanna, wetland) need to be identified. For example, since no high quality dry-mesic, wet-mesic, or wet tall-grass prairie remnants are known from the HAA, identification of the degraded remnants is central to any recovery effort for these community types. Floristic Integrity Assessment, a method for evaluating the natural quality of habitat remnants that employs numerous parameters of community characteristics (including floristic inventory data and INAI grades), is a promising technique for distinguishing remnants of native vegetation that have restoration potential (Taft et al. 1997).

2. Map

All results from natural community inventory efforts should be categorized and mapped to provide a spatial context for the locations of habitats with differing ecological condition. This will aid in identifying concentrations of noteworthy natural communities which can serve as focus areas. Trends in total area of each community class among qualitative units would serve as an aid in measuring success in restoration efforts (see below).

3. Protection

The natural communities with the greatest integrity need to be protected from further anthropogenic degradation (e.g., damaging levels of grazing, off-road vehicle impacts, soil grading in RR R-O-W). Inventory and mapping in the basin will aid in the prioritization of protection efforts. Highly isolated remnants pose distinct conservation and protection challenges compared with clusters of restorable natural communities. Staff of the Illinois Nature Preserves Commission (524 S. Second St., Springfield, IL 62701) are familiar with the various protection options and incentives for private landowners.

4. Identification and prioritization of ecological problems

As previously indicated, a host of related ecological problems consistently are present among remnant natural communities in the HAA (habitat fragmentation, habitat degradation, exotic species invasion, and fire absence). Some problems can be addressed more readily than others. *Habitat fragmentation* is a widespread problem with potentially devastating consequences for ecological integrity often resulting in an interruption of biological interactions, ecological processes, species migrations, and a reduction in habitat heterogeneity (Wilcove et al. 1986). A consequence, typically, is loss of species diveristy. However, solutions to restoring biological connectivity and ecosystem-level process are extraordinarily complex and costly if the goal is to re-create corridors for all species among regional habitats. High levels of fragmentation may impose limits on maintaining or enhancing biodiversity in the long-term.

In contrast, *habitat degradation* is a widespread problem that can be slowed and/or minimized at many sites by removing the degradation factor (e.g., grazing, soil disturbances), although restoration to predisturbance condition in severe cases may require intensive vegetation management. It is difficult to find a private woodland in Illinois that does not bear indications of past cattle grazing. The effects of over-grazing can be

persistent. Certain species (e.g., many ferns, orchids, trilliums, blue cohosh, bellflower, bloodroot, several grass and sedge species) appear to be sensitive to grazing disturbance and are often absent while certain grazing increasers (e.g., unpalatable species, thorn-bearing species, and plants with bristly fruits) are dominant. For instance, a typical situation in Illinois woodlands is a ground-cover and shrub flora dominated by common snakeroot, white snakeroot, buckbrush, Missouri gooseberry, blackberries (*Rubus* spp.), Virginia creeper, and the exotic garlic mustard. Usually, confounding influences, such as grazing, increased shade, and siltation or other soil disturbances, are involved.

Exotic species invasion can be considered both a species-level and a community-level problem. Some community-level management activities address more than one ecological problem. For example, garlic mustard invasion can be reversed with appropriately timed applications of fire (Nuzzo 1991; Schwartz and Heim 1996). Other serious exotic pests, such as purple loosestrife, require direct treatment or biological control (Thompson et al. 1987; Malecki et al. 1993). Exotic species known to pose severe ecological problems occur in the HAA and recommended control measures are summarized in Table 12.

Table 12. List of invasive exotic species known or suspected to occur in the Headwaters Assessment Area, and recommended eradication methods[1].

Species	Cut & Apply Stump-Treatmt Herbicide	Foliar Herbicide Application	Prescribed Fire	Cut &/or Hand Pull (get root)	Dig Root	Bio-Control	Cover w/ Black Plastic
Adam's needle		?	?		X		
Amur honeysuckle	X						
Asparagus	X				X		
Awnless brome grass		X					
Black locust	X - Garlon 4						
Canadian blue grass			X				
Common lilac	X						
Common periwinkle		X		X			
Common yarrow		X		X			
Cyprus spurge		?		X	X		
Garlic mustard		X	X	X			
Glossy buckthorn	X						
Ground ivy		X	?	X			
Kentucky blue grass			X				
Meadow fescue		X	X		X		
Moneywort		X	?				
Motherwort		?		X	X		
Multiflora rose	X						
Orange day lily		X			X		X
Osage orange	X						
Purple loosetrife		X		X		X	
Queen Anne's lace		X					
White mulberry	X						
White poplar	X		X				
White sweet clover			X	X			
Wild parsnip[2]		X		X	X		
Yellow sweet clover			X	X			

[1] The recommended herbicide is typically Round-up (glyphosate) except for black locust (Solecki 1997).
[2] This species has phototoxic properties and skin contact should be avoided.

Fire is an ecological force that historically influenced many aspects of natural communities in the HAA. Many community types require fire for maintenance of community characteristics and diversity. Fire absence has resulted in changes in forest structure, composition, and diversity. Invasion of mesophytic species such as sugar maple into oak-hickory forests is a statewide phenomenon related to fire absence also occurring in central Illinois and the HAA. Many forests in Illinois are dominated in the canopy by oaks but have few oak saplings. Rather, shade-tolerant (and fire intolerant) species like sugar maple often are extraordinarily more common and dense than prior to settlement. An obvious consequence of this change is the possible loss of oak woodlands and the plant and wildlife species that depend on them. A rich assemblage of spring wildflowers can still be found in some woodlands because these spring ephemerals largely escape the ensuing shade of the dense overstory and thus selectively persist while typically only a few shade-tolerant species can be found in the summer and fall. Also, the spring flora often has been spared direct effects of cattle grazing because livestock, typically, have been rotated historically to fescue pastures during spring months. Infrequent application of prescribed fire appear unlikely to reverse these trends. Rather, a long-term program of repeated applications of prescribed fire is often necessary before compositional stability is achieved. Nevertheless, prescribed fires can be implemented to a wide variety of remnants and community types, at little cost, and achieve measurable improvements in many parameters of ecosystem integrity.

5. Application of appropriate vegetation management

Once the ecological problems for a natural community are identified and prioritized according to restoration effort and gain, a program of vegetation management needs to be implemented. Record keeping is vital to tracking activities and levels of success in implementing each treatment plan. Floristic Quality Assessment (Taft et al. 1997) methods may provide a framework useful in measuring progress of each restoration activity.

BIRDS

Introduction

Information in this section is derived from standard references of Illinois, including the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997), The Illinois Breeding Bird Atlas (Illinois Department of Natural Resources, in prep), Avian Ecological Investigations (Illinois Department of Natural Resources, unpublished reports), the Birds of the Middlefork Valley checklist (Illinois Department of Conservation 1986), and the results of extensive field work by personnel from the Illinois Natural History Survey (much of it ongoing and not yet published).

The Headwaters Assessment Area (HAA) is typical of primarily agricultural areas of central and east-central Illinois. Virtually all non-agricultural habitats exist in narrow riparian areas where the terrain is too steep to plow. These areas are chronically fragmented (Figure 5) and will likely remain so for the foreseeable future. For many birds of forest habitats, these are likely population "sinks" in which there is insufficient reproductive success to replace adults that die each year of natural causes. For these reasons, the best management strategy may be to focus on enhancing habitat for birds of agricultural habitats, wetlands, grasslands, and shrublands, and for improving stopover habitat for migrating birds en route to northern breeding areas or southern wintering areas. Nevertheless, the existence of several large public land holdings creates some opportunities for reducing the negative effects of fragmentation.

Bird species composition in the HAA is typical for the agricultural portions of the state except that the breeding species list has benefited from the existence of several large public land holdings (Table 4, Figure 4), including the Middle Fork State Wildlife Area [MFWA], Middle Fork Forest Preserve [MFFP] Kennekuk Cove County Park [KC], and Kickapoo State Park [KSP], on which there are restored prairies, wetlands, savannas, riparian forest, and upland forest. The list has also benefited from the activities of many excellent bird watchers in the area, especially Steve Bailey, Mary Jane Easterday, Marilyn Campbell, and Robert Chapel. As a result, we know far more about the birds of this area than we do about any other primarily agricultural partnership area and we have a far better grasp of how we can improve habitat even in areas that will always be primarily agricultural. Approximately 270 bird species regularly occur in the HAA (Table 13). This represents approximately 90% of the 300 species that regularly occur in the state (Illinois Ornithological Records Committee 1997). Of these 270 species, over 140 breed or formerly bred in the area (Table13). Several nesting species have been extirpated from the site, including several that are globally extinct (Passenger Pigeon *Ectopistes migratorius* and Carolina Parakeet *Conuropsis carolinensis*) and some that are extinct or are nearly so in Illinois (American Swallow-tailed Kite, *Elanoides forficatus;* Swainson's

Hawk, *Buteo swainsoni*; Greater Prairie-Chicken, *Tympanuchus cupido*; Sandhill Crane, *Grus canadensis*; Long-billed Curlew, *Numenius americanus*; and Bachman's Sparrow, *Aimophila aestivalis*). The locally extirpated Wild Turkey has been successfully reestablished in several sites, especially along the Middle Fork where it nests in shrublands and restored prairies adjacent to forest.

The use of non-agricultural habitats by migrating birds is quite remarkable. Huge concentrations of migrants build up in forest, shrubland, and residential areas when bad weather forces them to stop in the area. These concentrations are one of the most attractive aspects of living in this area for birdwatchers.

The bird species that live in the HAA are ecologically diverse, and although some species are able to live in a variety of habitats, many species are adapted to living in only one or a few habitats (Table 13). The sections following Table 13 describe the bird communities typically found in the major habitat types on the HAA, as well as unique environmental problems and management solutions for bird communities in each habitat.

Table 13. Bird species that regularly occur in the Headwaters Asessment Area. These are species that are likely to be present all or most years. This list excludes extinct species and many wandering or "vagrant" species that have been recorded in the area. The purpose is to list only those species that have or could have significant populations in the area. The table also lists the habitats that are most likely to be occupied during each season.

Species[1,2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Red-throated Loon *Gavia stellata*			L
Common Loon *Gavia immer*			L
Pied-billed Grebe - ST ***Podilymbus podiceps***	W L	L	L W
Horned Grebe *Podiceps auritus*			L
Double-crested Cormorant - ST ***Phalarocorax auritus***			L
American Bittern - SE ***Botaurus lentiginosus***	W (r)		W
Least Bittern - SE ***Ixobrychus exilis***	W (r)		W
Great Blue Heron *Ardea herodias*	L W Fs F	L W	L W
Great Egret - ST ***Ardea albus***			L W
Snowy Egret - SE ***Egretta thula***			W
Little Blue Heron - SE ***Egretta caerulea***			L W

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Cattle Egret *Bubulcus ibis*			C G W
Green Heron *Butorides virescens*	L W Fs		L W Fs
Black-crowned Night-Heron - SE ***Nycticorax nycticorax***	L W Fs (r)		Fs W
Yellow-crowned Night-Heron - ST ***Nycticorax violaceus***	W Fs (r)		Fs
Tundra Swan *Cygnus columbianus*			L W
Greater White-fronted Goose *Anser albifrons*		L W	L W
Snow Goose *Chen caerulescens*		L C	L W C
Canada Goose *Branta canadensis*	L W C	L W C R	L W C R
Wood Duck *Aix sponsa*	Fs W		Fs W L
Green-winged Teal *Anas crecca*			W L
American Black Duck *Anas rubripes*			W L Fs C
Mallard *Anas platyrhynchos*	W C L Fs G	W C L Fs	W C L Fs
Northern Pintail *Anas acuta*			W L C
Blue-winged Teal *Anas discors*	W G		W L
Northern Shoveler *Anas clypeata*			W L
Gadwall *Anas strepera*			W L
American Wigeon *Anas americana*			W L
Canvasback *Aythya valisineria*			L W
Redhead *Aythya americana*			L W
Ring-necked Duck *Aythya collaris*			L W
Greater Scaup *Aythya marila*			L
Lesser Scaup *Aythya affinis*			L

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Oldsquaw *Clangula hyemalis*			L
Surf Scoter *Melanitta perspicillata*			L
White-winged Scoter *Melanitta fusca*		L	L
Common Goldeneye *Bucephala clangula*		L	L
Bufflehead *Bucephala albeola*		L	L
Hooded Merganser *Lophodytes cucullatus*	F S		L Fs W
Common Merganser *Mergus merganser*		L	L
Red-breasted Merganser *Mergus serrator*			L
Ruddy Duck *Oxyura jamaicensis*			L W
Turkey Vulture *Cathartes aura*	F G C Fs Sav	F G C Fs Sav	F G C S Sav Fs
Osprey - SE ***Pandion haliaetus***			L
Bald Eagle - SE, FT ***Haliaeetus leucocephalus***		L	L
Northern Harrier - SE ***Circus cyaneus***	G W (r)	G C W	G C W
Sharp-shinned Hawk - SE ***Accipiter striatus***	F (r)	F S R Fs Sav	F S R Fs Sav
Cooper's Hawk *Accipiter cooperii*	F S Sav	F S R Sav	F S R Sav
Northern Goshawk *Accipiter gentilis*		F S	F S W L
Red-shouldered Hawk - SE ***Buteo lineatus***	Fs (r)	Fs	Fs
Broad-winged Hawk *Buteo platypterus*	F (r)		F
Red-tailed Hawk *Buteo jamaicensis*	C G R S	C G R S	C G R S
Rough-legged Hawk *Buteo lagopus*		C G	
Golden Eagle *Aquila chrysaetos*			F S G
American Kestrel *Falco sparverius*	R C G Sav	R C G Sav	R C G Sav

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Merlin			All
Falco columbarius			
Peregrine Falcon - SE, FE			All
Falco peregrinus			
* Ring-necked Pheasant	C G S	C G S	C G S
Phasianus colchicus			
Wild Turkey	F S Sav Fs	F S Sav Fs C	F S Sav Fs C
Meleagris gallopavo			
Northern Bobwhite	S G C	S G C	S G C
Colinus virginianus			
Yellow Rail - SE			G W
Coturnicops noveboracensis			
King Rail - ST	W (r)		G W
Rallus elegans			
Virginia Rail	W (r)		W G
Rallus limicola			
Sora	W (r)		W G
Porzana carolina			
Common Moorhen - ST			W
Gallinula chloropus			
American Coot	W (r)	L	W L
Fulica americana			
Sandhill Crane - SE			W G C
Grus canadensis			
Black-bellied Plover			L W
Pluvialis squatarola			
American Golden-Plover			W L C G
Pluvialis dominicus			
Semipalmated Plover			W
Charadrius semipalmatus			
Killdeer	L W R G	C R G	L W R G
Charadrius vociferus			
Greater Yellowlegs			W
Trings melanoleuca			
Lesser Yellowlegs			W
Tringa flavipes			
Solitary Sandpiper			W
Tringa solitaria			
Willet			W
Catoptrophorus semipalmatus			
Spotted Sandpiper	L		W L
Actitis macularia			
Upland Sandpiper - SE	G (r)		G
Bartramia longicauda			

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Hudsonian Godwit *Limosa haemastica*			W
Ruddy Turnstone *Arenaria interpres*			W L
Sanderling *Calidris alba*			W L
Semipalmated Sandpiper *Calidris pusilla*			W
Western Sandpiper *Calidris mouri*			W
Least Sandpiper *Calidris minutilla*			W
White-rumped Sandpiper *Calidris fuscicollis*			W
Baird's Sandpiper *Calidris bairdii*			W
Pectoral Sandpiper *Calidris melanotos*			C W G
Dunlin *Calidris alpina*			W L
Stilt Sandpiper *Calidris himantopus*			W
Buff-breasted Sandpiper *Tryngites subruficollis*			W G
Short-billed Dowitcher *Limnodromus griseus*			W
Long-billed Dowitcher *Limnodromus scolopaceus*			W
Common Snipe *Gallinago gallinago*			W G
American Woodcock *Scolopax minor*	F Fs S		F Fs S
Wilson's Phalarope - SE ***Phalaropus tricolor***			W
Red-necked Phalarope *Phalaropus lobatus*			L W
Franklin's Gull *Larus pipixcan*			L W C
Bonaparte's Gull *Larus philadelphia*			L W C
Ring-billed Gull *Larus delawarensis*		L W C	L W C
Herring Gull *Larus argentatus*		L	W L C

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Caspian Tern *Sterna caspia*			L
Common Tern - SE ***Sterna hirundo***			L
Forster's Tern - SE ***Sterna forsteri***			L W
Black Tern - SE ***Chilidonias niger***			L W
* Rock Dove *Columba livia*	R C	R C	R C
Mourning Dove *Zenaida macroura*	R C S	R C S	R C S
Black-billed Cuckoo *Coccyzus erythropthalmus*	S		F S Sav
Yellow-billed Cuckoo *Coccyzus americanus*	F S Fs Sav		F S Fs Sav
Barn Owl - SE ***Tyto alba***	C G R [(r)]	C G	C G
Eastern Screech-Owl *Otus asio*	R S	R S	R S
Great Horned Owl *Bubo virginianus*	F C R Fs Sav	F C R Fs Sav	F C R Fs Sav
Snowy Owl *Nyctea scandiaca*			C
Barred Owl *Strix varia*	F Fs	F Fs	F Fs
Long-eared Owl - SE ***Asio otus***	F S [(r)]	F S	F S
Short-eared Owl - SE ***Asio flammeus***	G [(r)]	G	G
Northern Saw-whet Owl *Aegolius acadicus*	F Fs [(r)]	F S	F S
Common Nighthawk *Chordeiles minor*	R Sav		R G C
Whip-poor-will *Caprimulgus vociferus*	F Sav		F Sav
Chimney Swift *Chaetura pelagica*	R F S Fs Sav		All
Ruby-throated Hummingbird *Archilochus colubris*	F S R Fs Sav		F S R Fs Sav
Belted Kingfisher *Ceryle alcyon*	L W	L W	L W
Red-headed Woodpecker *Melanerpes erythrocephalus*	Fs R C	F Fs Sav	F Fs C R Sav

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Red-bellied Woodpecker *Melanerpes carolinus*	F Fs S R Sav	F Fs S R Sav	F Fs S R Sav
Yellow-bellied Sapsucker *Sphyrapicus varius*	F Fs (r)	F Fs R Sav	F Fs R Sav
Downy Woodpecker *Picoides pubescens*	F Fs R S Sav	F Fs R S Sav	F Fs R S Sav
Hairy Woodpecker *Picoides villosus*	F Fs Sav R	F Fs R S Sav	F Fs R S Sav
Northern Flicker *Colaptes auratus*	S F R Sav Fs	S F R Sav Fs	S F R Sav Fs
Pileated Woodpecker *Dryocopus pileatus*	F Fs Sav	F Fs Sav R	F Fs Sav R
Olive-sided Flycatcher *Contopus borealis*			F Fs R S Sav
Eastern Wood-Pewee *Contopus virens*	F Fs R Sav		F Fs R Sav
Yellow-bellied Flycatcher *Empidonax flaviventris*			F S Fs
Acadian Flycatcher *Empidonax virescens*	F Fs		F Fs
Alder Flycatcher *Empidonax alnorum*			W S Sav
Willow Flycatcher *Empidonax traillii*	W S		W S Sav
Least Flycatcher *Empidonax minimus*	F Sav (r)		F S R Fs Sav
Eastern Phoebe *Sayornis phoebe*	R Fs		R Fs
Great Crested Flycatcher *Myiarchus crinitus*	F Fs Sav		F Fs S R Sav
Eastern Kingbird *Tyrannus tyrannus*	S G C Sav		S G A F C Sav
Horned Lark *Eremophila alpestris*	C G	C G	C G
Purple Martin *Progne subis*	L R W G		L W G
Tree Swallow *Tachycineta bicolor*	L W Fs G		L W Fs G
Northern Rough-winged Swallow *Stelgidopteryx serripennis*	L W Fs G		L W G
Bank Swallow *Riparia riparia*	L W G		L W G
Cliff Swallow *Hirundo pyrrhonota*	L W G (r)		L W G

Table 13. *Continued*

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Barn Swallow *Hirundo rustica*	C R W L G S		C R W L G S
Blue Jay *Cyanocitta cristata*	R F Fs S C Sav	R F Fs S C Sav	R F Fs S C Sav
American Crow *Corvus brachyrhynchos*	C R S F Fs	C R S F Fs	C R S F Fs
Black-capped Chickadee *Parus atricapillus*	F S R Fs Sav	F S R Fs Sav	F S R Fs Sav
Carolina Chickadee *Parus carolinensis*	F S R Fs Sav	F S R Fs Sav	F S R Fs Sav
Tufted Titmouse *Parus bicolor*	F R Fs Sav	F R Fs Sav	F R Fs Sav
Red-breasted Nuthatch *Sitta canadensis*	F R (r)	R	F R
White-breasted Nuthatch *Sitta carolinensis*	F R Fs Sav	F R Fs Sav	F R Fs Sav
Brown Creeper - ST ***Certhia americana***	Fs (r)	F Fs R	F Fs R
Carolina Wren *Thryothorus ludovicianus*	R F Fs S Sav	R F Fs S Sav	R F Fs S Sav
Bewick's Wren - SE ***Thryomanes bewickii***	R S (r)		R S
House Wren *Troglodytes aedon*	R F S Sav		R F S Sav
Winter Wren *Troglodytes troglodytes*		F Fs W	F Fs W
Sedge Wren *Cistothorus platensis*	W G		W G
Marsh Wren *Cistothorus palustris*			W
Golden-crowned Kinglet *Regulus satrapa*		F Fs R Sav	F Fs R Sav
Ruby-crowned Kinglet *Regulus calendula*			F S Sav
Blue-gray Gnatcatcher *Polioptila caerulea*	F Fs S Sav		F Fs S Sav
Eastern Bluebird *Sialia sialis*	C G R S Sav	S F R C Sav	S F C G R Sav
Veery - ST ***Catharus fuscescens***	F Fs (r)		F Fs R Sav
Gray-cheeked Thrush *Catharus minimus*			F Fs R Sav
Swainson's Thrush *Catharus ustulatus*			F S R Fs Sav

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Hermit Thrush *Catharus guttatus*		S F R Fs Sav	S F R Fs Sav
Wood Thrush *Hylocichla mustelina*	F		F R Fs Sav
American Robin *Turdus migratorius*	R S F Fs	R S F Fs	R S F Fs C G
Gray Catbird *Dumetella carolinensis*	S Fs R Sav		S Fs R Sav
Northern Mockingbird *Mimus polyglottos*	R S	R S	R S
Brown Thrasher *Toxostoma rufum*	S R C G Sav		S R C Sav
American Pipit *Anthus rubescens*			C W
Cedar Waxwing *Bombycilla cedrorum*	R S F Fs Sav	R S F Fs Sav	R S F Fs Sav
Northern Shrike *Lanius excubitor*		G C S	
Loggerhead Shrike - ST ***Lanius ludovicianus***	G S C	G S C	G S C
* European Starling *Sturnus vulgaris*	R C F Fs Sav	R C	R C
White-eyed Vireo *Vireo griseus*	S Fs Sav		S Fs Sav
Bell's Vireo *Vireo bellii*	S G		S G R
Solitary Vireo *Vireo solitarius*			F Fs Sav
Yellow-throated Vireo *Vireo flavifrons*	F Fs Sav		F Fs R Sav
Warbling Vireo *Vireo gilvus*	S R Fs Sav		S R F Fs Sav
Philadelphia Vireo *Vireo phiadelphicus*			S F R Sav
Red-eyed Vireo *Vireo olivaceus*	F Fs Sav		F Fs S R Sav
Blue-winged Warbler *Vermivora pinus*	S		S F R Sav Fs
Golden-winged Warbler *Vermivora chrysoptera*			F S Fs R Sav
Tennessee Warbler *Vermivora peregrina*			F R S Fs Sav
Orange-crowned Warbler *Vermivora celata*			S F R Sav Fs

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Nashville Warbler *Vermivora ruficapilla*			S F R Sav Fs
Northern Parula *Parula americana*	Fs F		F Fs R Sav
Yellow Warbler *Dendroica petechia*	S W		S W R Sav Fs
Chestnut-sided Warbler *Dendroica pensylvanica*			S F Fs R Sav
Magnolia Warbler *Dendroica magnolia*			F S R Fs Sav
Cape May Warbler *Dendroica tigrina*			R F Fs Sav
Black-throated Blue Warbler *Dendroica caerulescens*			F R Fs Sav
Yellow-rumped Warbler *Dendroica coronata*			F S R Fs Sav
Black-throated Green Warbler *Dendroica virens*			F R Fs Sav
Blackburnian Warbler *Dendroica fusca*			F Fs R Sav
Yellow-throated Warbler *Dendroica dominica*	Fs		F Fs
Pine Warbler *Dendroica pinus*			F Fs Sav R
Prairie Warbler *Dendroica discolor*	S (r)		S
Palm Warbler *Dendroica palmarum*			Fs S F R W G Sav
Bay-breasted Warbler *Dendroica castanea*			F R Fs S Sav
Blackpoll Warbler *Dendroica striata*			F Fs R S Sav
Cerulean Warbler *Dendroica cerulea*	F Fs (r)		F Fs R Sav
Black-and-white Warbler *Mniotilta varia*			F R Fs Sav S
American Redstart *Setophaga ruticilla*	Fs		F Fs S R Sav
Prothonotary Warbler *Protonotaria citrea*	Fs(r)		Fs
Worm-eating Warbler *Helmitheros vermivorus*	F(r)		F
Ovenbird *Seiurus aurocapillus*	F		F R S Sav

Table 13. Continued

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Northern Waterthrush *Seiurus noveboracensis*			Fs R
Louisiana Waterthrush *Seiurus motacilla*	F		F Fs
Kentucky Warbler *Oporornis formosus*	F		F Sav Fs
Connecticut Warbler *Oporornis agilis*			S F Fs Sav R
Mourning Warbler *Oporornis philadelphia*			S F Fs Sav R
Common Yellowthroat *Geothlypis trichas*	G C W S R Sav		G C W S R Sav
Hooded Warbler *Wilsonia citrina*	F [r]		F R
Wilson's Warbler *Wilsonia pusilla*			S F Fs R Sav
Canada Warbler *Wilsonia canadensis*			F Fs S R Sav
Yellow-breasted Chat *Icteria virens*	S		S Sav
Summer Tanager *Piranga rubra*	F Sav		F Sav R
Scarlet Tanager *Piranga olivacea*	F Fs Sav		F Fs Sav R
Northern Cardinal *Cardinalis cardinalis*	R F Fs S C Sav	R F Fs S C Sav	R F Fs S C Sav
Rose-breasted Grosbeak *Pheucticus ludovicianus*	F Fs Sav S		F Fs R S Sav
Blue Grosbeak *Guiraca caerulea*	S[r]		S
Indigo Bunting *Passerina cyanea*	F Fs S		F Fs S C
Dickcissel *Spiza americana*	G C		G C
Eastern Towhee *Pipilo erythrophthalmus*	S F	S F	S F Fs R
American Tree Sparrow *Spizella arborea*		S G C R W Sav	S G C R W Sav
Chipping Sparrow *Spizella passerina*	R F		R F Sav G S
Clay-colored Sparrow *Spizella pallida*			S
Field Sparrow *Spizella pusilla*	S G W C	S G W	S G C W

Table 13. Continued

Species[1,2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Vesper Sparrow *Pooecetes gramineus*	C G		C G
Lark Sparrow *Chondestes grammacus*	S C G		S C G
Savannah Sparrow *Passerculus sandwichensis*	G	G	G C W
Grasshopper Sparrow *Ammodramus savannarum*	G		G
Henslow's Sparrow - SE ***Ammodramus henslowii***	G (r)		G
Le Conte's Sparrow *Ammodramus leconteii*			G W
Nelson's Sharp-tailed Sparrow *Ammodramus nelsoni*			W
Fox Sparrow *Passerella iliaca*		S Fs F	S Fs F R Sav
Song Sparrow *Melospiza melodia*	R S W C G	R S W C G	R S W C G
Lincoln's Sparrow *Melospiza lincolnii*			S W Fs R
Swamp Sparrow *Melospiza georgiana*	W (r)	W Fs S G	S W Fs G
White-throated Sparrow *Zonotrichia albicollis*		R S F Fs Sav	R S F Fs Sav
White-crowned Sparrow *Zonotrichia leucophrys*		S R G	S R G
Harris' Sparrow *Zonotrichia querula*			S R
Dark-eyed Junco *Junco hyematis*		R S F Fs G Sav	R S F Fs G Sav
Lapland Longspur *Calcarius lapponicus*		C G	C G
Smith's Longspur *Calcarius pictus*			G C
Snow Bunting *Plectrophenax nivalis*		C G	
Bobolink *Dolichonyx oryzivorus*	G (r)		G W
Red-winged Blackbird *Agelaius phoeniceus*	W C R G S Sav	C G	W C R G S Sav
Eastern Meadowlark *Sturnella magna*	G C	G C	G C
Western Meadowlark *Sturnella neglecta*	G C (r)		G C

Table 13. Continued

Species[1,2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Yellow-headed Blackbird - SE			W
Xanthocephalus xanthocephalus			
Rusty Blackbird		C R	R C Fs W
Euphagus carolinus			
Common Grackle	R W Fs F	C	R Fs C
Quiscalus quiscula			
Brown-headed Cowbird	All	C R	All
Molothrus ater			
Orchard Oriole	S R W		S R W F Fs
Icterus spurius			
Baltimore Oriole	R F Fs S Sav		F Fs R S Sav
Icterus galbula			
Purple Finch		F Fs R	F Fs R S Sav
Carpodacus purpureus			
* House Finch	R S	R S	F Fs R S Sav
Carpodicus mexicanus			
Red Crossbill		F R	F R
Loxia curvirostra			
White-winged Crossbill		F R	F R
Loxia leucoptera			
Common Redpoll		G S R F	
Carduelis flammea			
Pine Siskin	R S F (r)	R S F	R S F
Carduelis pinus			
American Goldfinch	S R G	S R G F Fs Sav	S R G F Fs Sav
Carduelis tristis			
Evening Grosbeak		R F Fs	R F Fs
Coccothraustes vespertinus			
* House Sparrow	R C	R C	R C
Passer domesticus			

[1] Bold type indicates state threatened (ST), state endangered (SE), and/or federally endangered (FE) species.
[2] * designates an introduced species.
[3] Breeding = species that currently or historically have bred in the area.
[4] Winter = species present from December through February.
[5] Migrant = species present during the March-May and late August-November periods.
[6] The following habitat codes are used:
L = Lakes, ponds, impoundments, rivers, larger streams
C = Crops
G = Grassland (inlcuding pasture and hayfield)
W = Wetland (seasonally flooded, open habitats such as marshes and sedge meadows)
Fs = Forested swamp (forested wetland, including wet floodplain forest)
Sav = Savannah
F = Upland and mesic forest
R = Residential areas (including urban centers and the "urban forest")
S = Shrublands (open habitats dominated by shrubs, including old fields).
[7] (r) designates a species that is currently a rare and local breeder and may be locally extirpated.
Some of these species are good candidates for re-establishment in restored habitats.

Forest

Regularly Occurring Species

Typical Species - Upland and mesic forests of the region have been well characterized (Kendeigh 1982; Blake 1986; Blake and Karr 1987) and are somewhat depauperate because of the pronounced area-sensitivity of many species (Blake1986). Nevertheless, virtually all forest songbirds characteristic of this latitude have significant, predictable breeding populations in the remaining forest patches. These include such common, widespread species as the Wild Turkey, Yellow-billed Cuckoo, Ruby-throated Hummingbird, Red-bellied, Hairy, and Downy woodpeckers, Great Crested Flycatcher, Eastern Wood-Pewee, Blue Jay, Carolina and Black-capped Chickadees [the two species come in contact in this zone with Black-capped Chickadees mostly in the west and Carolina Chickadees to the east], Tufted Titmouse, White-breasted Nuthatch, House and Carolina Wrens, Yellow-throated and Red-eyed Vireos, Scarlet Tanager, Northern Cardinal, Rose-breasted Grosbeak, Indigo Bunting, and Brown-headed Cowbird. Many other less common species also breed in the area, including the Wood Thrush (widespread in more mesic woodlands, even in small woodlots such as Trelease Woods [TW], a remnant forest patch in central Champaign County, owned by the University of Illinois), Ovenbird (only in a few large, relatively flat upland forests such as the Illinois Power property south of the MFWA), Worm-eating Warbler (steep forested hillsides in KC), Northern Parula and Yellow-throated Warbler (in sycamores in mesic ravines and along rivers), Hooded Warbler (irregular breeders in MFWA), American Redstarts (several colonies in sycamores and around strip mine ponds in KSP and scattered pairs along the MF River and along Lake Mingo), Louisiana Waterthrush (along most forested streams), Acadian Flycatcher (in most mesic ravines in MFFP, MFWA, KC, KSP), Cooper's Hawk (estimated 10-15 pairs in MFFP, MFWA, KC, and KSP), Pileated Woodpecker (all along the MF river), Broad-winged Hawk (rare, but present in KC), and the Barred Owl, Great Horned Owl, Kentucky Warbler, and Summer Tanager (KC). Several forest species that are rare statewide appear to be absent from this area at least in most years, including Black-and-white and Cerulean Warblers.

Threatened and endangered species - A few state threatened (ST) and state endangered (SE) species occur in the HAA. There are several records of Sharp-shinned Hawks (SE) from the MF area. Long-eared Owls (SE) have nested in cedar glades adjacent to forests in the MFWA. Veeries (ST) breed in very small numbers in mesic ravines, usually adjacent to swampy sites.

Exotic Species - European Starlings were introduced from Europe in the late nineteenth century and reached Illinois by 1922 (Bohen and Zimmerman 1989). They are now one of the most abundant species in the state, and they can have detrimental effects on native species because they usurp breeding cavities from woodpeckers in many woodlots.

Population Dynamics and Management

Many bird species are declining across part or all of their breeding range in the Midwest (Peterjohn et al. 1994). The causes of such changes are probably related to problems with reproducing in highly fragmented landscapes. Major factors influencing productivity of forest birds in the HAA are predation on eggs or young in nests and brood parasitism by Brown-headed Cowbirds. Cowbirds lay their eggs in the nests of other species, and often destroy one of the hosts eggs when they lay their own. Cowbird young also grow faster than their host young and out-compete them for food, often leading to the starvation of the host young. Rates of nest predation and brood parasitism generally increase as a habitat becomes more fragmented, creating more feeding habitat for cowbirds and travel corridors for mammalian predators, such as raccoons, that often inhabit the edges of open country (Robinson et al. 1995). Ongoing studies suggest that levels of nest predation and brood parasitism are high in this region of Illinois (Brawn and Robinson 1996; S. Robinson, unpubl. data). Most forests in the HAA are probably population sinks for many species. However, it is interesting that many of these populations are relatively stable, or at least haven't been declining consistently (Brawn and Robinson 1996). This suggests that their populations depend upon productivity from outside the region, which demonstrates a need to monitor nesting success as well as populations.

Most of the woodlands in the HAA occur in relatively narrow corridors along rivers, where predation and parasitism rates are likely high. For this reason, there is little potential to create "source" habitat for forest birds (where productivity will be greater than the amount needed to replace the adults). The best places for forest restoration are small openings in the midst of larger tracts that have the potential to be at least 500 acres; below this size, nest predation and parasitism levels are extremely high statewide (Robinson et al., in press). There are several sections along the Middle Fork River that could be enlarged by allowing regeneration of oak forest on ridgetops and along the old floodplain terrace. Given the importance of oaks to migrant birds, restoration efforts should seek to enhance oaks, especially white oaks. Restoration in more mesic sites should also focus on oaks and sycamores.

Wetland

Although wetlands may have historically accounted for over 40% of the land in the HAA, only about 11,500 acres of wetland habitat remains. This represents about 1.1% of the HAA (Table 3, Figure 9). Most of the wetlands have been drained for agricultural purposes (see the discussion of wetlands in the introduction to this report).

Regularly Occurring Species

Typical Species - The presence of several restored wetlands in the area makes it possible to characterize "typical" wetland species in the HAA in spite of the enormous loss of wetland habitat that has taken place. Breeding species include Pied-billed Grebe

(KSP), Least Bittern (KC), Great Blue Heron (rookeries present), Green Heron, Canada Goose, Wood Duck, Mallard, Northern Harrier (KC), Red-shouldered Hawk (forested wetlands only: no known breeding pairs currently), Killdeer, Spotted Sandpiper (strip-mine ponds), Barred Owl (forested) Belted Kingfisher, Red-headed Woodpecker (forested), Pileated Woodpecker (forested), Eastern Wood-Pewee (forested), Acadian Flycatcher (forested), Willow Flycatcher (shrubby), Eastern Phoebe, Great Crested Flycatcher (forested), Purple Martin, Tree Swallow, Northern Rough-winged Swallow, Bank Swallow, Barn Swallow, Carolina Wren, Sedge Wren (grassy), Blue-gray Gnatcatcher (forested), Wood Thrush (forested), Gray Catbird (shrubby), White-eyed Vireo (shrubby), Yellow-throated Vireo (forested), Warbling Vireo (riparian willows and cottonwoods), Red-eyed Vireo, Northern Parula (forested), Yellow Warbler (shrubby), Yellow-throated Warbler (forested), American Redstart (young forested wetlands), Prothonotary Warbler (forested), Kentucky Warbler (forested), Common Yellowthroat, Indigo Bunting, Song Sparrow (shrubby), Swamp Sparrow (cattails), Red-winged Blackbird, Common Grackle, and Orchard Oriole (shrubby).

Threatened and Endangered Species - A fair number of state threatened or endangered species occur in the wetlands of the HAA. These include the Pied-billed Grebe (ST) at KSP, Least Bittern (ST) at KC, and Northern Harrier (SE) at KC. Several other threatened or endangered species could recolonize restored wetlands in the area, including American Bittern (SE), Great Egret (ST), Common Moorhen (ST), King Rail (ST), and Virginia Rail (ST) in marshes, Red-shouldered Hawk (ST) (which nests just outside of the partnership area in forested wetlands of Forest Glen County Park) and Brown Creeper (ST) in forested wetlands. Veeries (ST) occasionally nest in forested wetlands.

Exotic species - European Starlings are the only exotic species that is commonly found in the wetlands of the HAA (particularly among the dead snags in flooded, forested wetlands). Introduced Mute Swans have also been found in the area, but are not known to breed here.

Population Dynamics and Management

The major conservation problems for wetland birds in the HAA are a lack of large areas of contiguous habitat for birds of forested wetlands (Veery, Brown Creeper, Red-shouldered Hawk) and the scarcity of grass and sedge-dominated marshy habitat for bitterns, rails, moorhens, wrens, and harriers. Where this habitat exists, it attracts nesting populations. Limited data on nesting success of birds of shrubby wetlands suggest that nest predation is a problem for some species (Yellow Warbler), but that other species may be able to nest successfully (e.g., Orchard Oriole). Wetland habitats are also used heavily by migrating waterfowl and shorebirds.

Wetland habitats should be a very high conservation and management priority for the region, especially grassy and sedge-dominated wetlands that are large enough to attract

breeding birds, especially threatened and endangered species such as the Least and American Bitterns, King Rail, Marsh Wren, and Common Moorhen, as well as ducks (e.g., Blue-winged Teal), Sedge Wrens, Swamp Sparrows, Great Egrets, and Green Herons. Wetlands within restored grasslands should increase their potential to attract Short-eared Owls and Northern Harriers. Maintaining marshy borders around waterfowl management units will increase their potential to attract rare species as well. Restoration of forested wetlands should be coordinated with restoration of upland forests within large blocks to increase nesting success.

Savanna

Savannas used to be found along the dissected terrain of the major river valleys in the area, such as the Sangamon River, and the Middle and Salt forks of the Vermilion River. In recent decades since fire has been effectively suppressed, savanna habitats have been greatly altered through vegetation changes and habitat destruction. Savannas are now one of the rarest plant communities in the region (see the chapter on vegetation communities).

Regularly Occurring Species

Typical Species - Savanna birds are generally a subset of forest birds with a scattering of shrubland birds and a few species that actually prefer open, scattered trees. In the HAA, perhaps the most typical species are the Whip-poor-will, Red-headed Woodpecker, Great Crested Flycatcher, Eastern Wood-Pewee, Blue Jay, American Robin, Eastern Bluebird, Yellow-throated Vireo, Summer Tanager, Baltimore Oriole, and Indigo Bunting. The only known nesting Least Flycatchers in the HAA are in a restored savanna at the MFFP. Summer Tanagers clearly prefer tall oaks along open areas. Other species that remain common in savannas include Red-tailed Hawks, Cooper's Hawks, Great Horned Owls, Wild Turkeys, Ruby-throated Hummingbirds, Northern Flickers, Red-bellied, Hairy, and Downy woodpeckers, both chickadees, Tufted Titmice, White-breasted Nuthatches, House Wrens, Scarlet Tanagers, Northern Cardinals, Rose-breasted Grosbeaks, Field Sparrows, and Brown-headed Cowbirds. Savannas with shrub thickets will attract birds of successional communities (e.g., Blue-winged Warbler, Yellow-breasted Chat, Rufous-sided Towhee, Indigo Bunting, American Goldfinch).

Threatened and Endangered Species - Historically, the Common Barn-Owl (SE) may have been associated with this habitat, but not recently. The preference of Long-eared Owls (SE) for cedar glades adjacent to open areas suggests a possible association with savanna-like habitats.

Exotic Species - European Starlings are now one of the most abundant species in Illinois,. They are detrimental to some native savanna species, particularly other cavity nesting species (such as woodpeckers and bluebirds) because they compete for nest sites.

Population Dynamics and Management

There have been no detailed studies of the nesting success of birds in savanna habitat from this region. However, studies are underway elsewhere in the state (J.D. Brawn, unpubl. data), that should address this issue. Results of these studies have already shown that savannas are associated with high populations of Brown-headed Cowbirds. Many savanna nesting species, however, are at least partially resistant to cowbird parasitism. For example, some species may abandon parasitized nests or reject cowbird eggs (Rothstein and Robinson 1994) and some species nest in cavities that are inaccessible to cowbirds. Oak savannas appear to be heavily used by migrating birds, especially warblers and vireos. Oak restoration on upland ridges might also enhance populations of Cerulean Warblers, which nest just outside the area.

Prairie/Grassland

Native prairie habitat is extremely rare in the HAA. Less than eight acres of high quality prairie vegetation remains in the area (see the section on land cover in the introduction to this volume). However, many bird species that historically lived in prairies are also able to live in grassland habitat such as hay fields, and sometimes pastures. These habitats are also relatively uncommon in the HAA. Although there are about 120,000 acres of "grassland" in the HAA (11.2% of the HAA); one fourth of this habitat occurs within 100 feet of a road, usually as narrow strips along the edges of country roads (see the introductory chapter, and Figure 6). Pastures in the area are mostly heavily grazed and little-used by grassland birds. They are also favored sites for foraging Brown-headed Cowbirds. Even though patches of available grassland habitat in the HAA are small and heavily used, they nonetheless have potential for restoration.

Regularly Occurring Species

Typical Species - The restored prairies and grasslands in this region have a rich bird community. Typical species include Red-tailed Hawk, American Kestrel, Northern Bobwhite (grasslands with shrubs), Eastern Kingbird (shrubs), Barn Swallow, Sedge Wren (rare: tall, dense grass), Horned Lark (newly burned), Loggerhead Shrike (shrubs with short grass), Brown Thrasher (shrubs), Bell's Vireo (shrubs), Common Yellowthroat, Dickcissel, Savannah Sparrow (short grass), Grasshopper Sparrow, Vesper Sparrow (open grasses), Henslow's Sparrow (tall, dense grass), Field Sparrow (shrubs), Lark Sparrow (shrubs in sandy soils), Bobolink (taller grass), Eastern Meadowlark, and Red-winged Blackbird.

Threatened and Endangered Species - Many threatened and endangered species currently nest in restored grasslands in the Middle Fork area, including the Northern Harrier (SE), Short-eared Owl (SE), Upland Sandpiper (SE), and Henslow's Sparrow (SE). King Rails (ST) also have the potential to return to restored grasslands.

Exotic Species - Two introduced species are found in the grasslands of the HAA. The Ring-necked Pheasant, which is native to Asia, was first released in Illinois in about 1890 (Bohlen and Zimmerman 1989) and they continue to be released. Pheasants are abundant in prairie remnants statewide and they also nest abundantly in many restored prairies. European Starlings feed in grasslands following grazing, mowing, or burning.

Population Dynamics and Management

Some grassland habitat in the HAA has been created as a result of the Conservation Reserve program (CRP). However, these habitats may disappear with changing farm policy. For this reason, it is important to maintain reliable preserves for grassland birds. The noteworthy success of restored prairies at KC and MFFP, among others, demonstrate the outstanding potential of prairie restoration efforts for attracting rapidly declining grassland birds. The restoration at the MFFP, for example, has substantial numbers of Bobolinks and Henslow's Sparrow and the restoration site at KC has Northern Harriers and Henslow's Sparrows.

In spite of the success of these sites for attracting birds, their nesting success may be low. Nesting success of grassland species appears to be low in small grassland fragments elsewhere in the state, but we lack data from this region. Studies from elsewhere in the state should provide valuable clues about enhancing restoration. For example, it may be necessary to reduce woody vegetation within restorations because they are associated with higher levels of nest predation and parasitism. Small shrub thickets, however, should be maintained to provide habitat for Bell's Vireo, Willow Flycatcher, Yellow Warbler, and Yellow-breasted Chat. Herkert et al. (1993) provide guidelines for restoring prairies for birds. Some grazing may be allowable on restorations to provide conditions for Loggerhead Shrikes, Upland Sandpipers, and Savannah Sparrows. Some areas, however, should only be grazed, mowed, or burned at three-year intervals to maintain habitat for Bobolinks, Sedge Wrens, and Henslow's Sparrows.

Migrants also use grasslands in the HAA, which may be important stopover habitats for Smith's Longspurs, pipits, rails, bitterns, wrens, and various shorebirds. In fact, a significant portion of the global population of the Lesser Golden Plover and Smith's Longspur migrate through the HAA, and these species would likely benefit from increased grassland habitat.

Lakes, Ponds, Impoundments, Creeks, and Rivers

Compared to the rest of the state, the creeks and rivers of the HAA are in relatively good condition (see aquatic section below); six streams in the HAA are designated as Biological Significant Stream segments (Table 8, Figure 11). Nonetheless, as with several other habitats, creeks and rivers have been greatly altered. There are no natural lakes or ponds in the HAA, and all open water combined accounts for only about 0.4% (4,200 acres) of the area (Table 2, Figure 10).

Regularly Occurring Species

Typical Species - All of the habitats covered under this heading offer a common habitat feature for birds—open, permanent water and a littoral zone. Typical breeding species include Great Blue Heron, Green Heron, Canada Goose, Mallard, Wood Duck (forested streams and Lake Mingo), Cooper's Hawk (riparian corridors), Killdeer, Spotted Sandpiper (strip-mine ponds), Belted Kingfisher, Eastern Phoebe (streams), Willow Flycatcher (willows), all swallows and martins, Warbling Vireo (willows), Yellow Warbler (willows), Common Yellowthroat, Louisiana Waterthrush (forested streams), Song Sparrow, Red-winged Blackbird, Common Grackle (shores), Orchard Oriole (willows), and Baltimore Oriole (riparian corridors). Prothonotary Warblers nest in flooded backwaters of rivers.

Threatened and Endangered Species - There are no threatened or endangered species breeding in these aquatic habitats in the HAA, although enhancement of marshy lake borders would attract wetland species.

Exotic Species - The only exotic species found in these habitats in the HAA is the Mute Swan, which occasionally may visit ponds in the area, but is not known to breed here.

Population Dynamics and Management

We lack detailed data on population size and nesting success of birds in these aquatic habitats. Studies of the nesting success of birds in riparian corridors of different widths could provide data that could be usefully combined with information aimed at the design of erosion-control buffer strips along creeks. For example, restoration to promote more natural flood pulses would help create the kinds of disturbances necessary for some floodplain species (e.g., Prothonotary Warbler) and perhaps enhance mudflats for migrant shorebirds. Restoring wetland vegetation (e.g., cattails) along lakes and trees along creeks and rivers would provide valuable nesting habitat. Restored corridors with woody vegetation (trees and shrubs) also provide excellent winter habitat for many species. But the most important role of these aquatic habitats for birds is as migratory stopover habitat for loons, grebes, herons, swans, geese, ducks, shorebirds, terns, and gulls. A study identifying which kinds of aquatic habitats are most attractive to migrants would be very helpful.

Cultural Habitats: Cropland

Agricultural areas generally provide poor quality habitat for most birds - diversity in cropland is much lower than in the original habitats. However, it is nonetheless important to consider the role of agricultural habitats for supporting bird populations in the HAA because most land within the HAA has been usurped for agricultural purposes. Over 82% of the HAA acreage is currently used for crop production (Table 2, Figure 5).

Regularly Occurring Species

Typical Species - Cropland bird communities are notable mainly for the many non-native species that nest in them (see below) and for a few native grassland species that appear to thrive in them, with Horned Larks being a good example. Other species found in cropland include the American Kestrel, Killdeer, Mourning Dove, Barn Swallow, American Crow, Common Grackle, Red-winged Blackbird, and Vesper Sparrow (Warner 1994). Where there are wooded or shrubby areas along streams within cropland, other nesting species include Red-tailed Hawk, Great Horned Owl, Eastern Screech-Owl, Eastern Bluebird (where nesting boxes are provided), Indigo Buntings, Common Yellowthroat, Field Sparrow, and Song Sparrow. Farmsteads with tall shade trees often have nesting Warbling Vireos, House Wrens, Chipping Sparrows, and Baltimore Orioles. Eastern Phoebes often nest in farm buildings, as do Barn Swallows.

Threatened and Endangered Species - The Loggerhead Shrike (ST) is the only threatened or endangered species typically found in Illinois cropland habitats, and they are rare in the HAA.

Exotic Species - A number of exotic species are abundant in cropland in the HAA, including Ring-necked Pheasants, Rock Doves, European Starlings, and House Sparrows.

Population Dynamics and Management

Warner (1994) documented the extent to which intensively used agricultural areas have few nesting birds and low nesting success. These areas aren't suitable for game species such as pheasants, and they often have high populations of feral cats, which are nest predators. However, CRP acreage can produce breeding habitat for some native grassland species such as Henslow's, Grasshopper, and Savannah sparrows. Enhancement of grassy roadsides, shrubby streamsides, and riparian corridors can enormously increase the bird diversity within agricultural landscapes. Early mowing of hay adversely affects many species.

Intensively farmed areas offer very little in the way of stopover habitat for migrant birds, except around farmsteads and flooded fields, which are used by large numbers of shorebirds (especially Lesser Golden Plovers and Pectoral Sandpipers). In winter, flocks of Snow Buntings and Lapland Longspurs join the resident Horned Larks, and Rough-legged Hawks to forage over some fields.

Cultural Habitats: Successional Fields

Successional habitats, such as abandoned fields and pastures, are relatively uncommon in the HAA. These habitats, which are often dominated by non-native species of shrubs and vines, may be structurally similar to native successional habitats that historically occurred along the edges of meandering rivers or in large treefall gaps. Such habitats usually have

dense cover and are often rich in fruit producing plants, and therefore offer rich habitat for breeding and migrating birds. However, given the scarcity of natural shrublands in the Midwest, we know little about them. Nonetheless, many local bird species that use shrubby vegetation now depend almost entirely on anthropogenic disturbances to set back succession.

Regularly Occurring Species

Typical Species - Successional habitats dominated by forbs, shrubs, and saplings offer rich habitat for many breeding birds. Typical breeding species include Northern Bobwhite, Ring-necked Pheasant, American Woodcock (wet areas), Mourning Dove (especially with conifers), Yellow-billed Cuckoo, Black-billed Cuckoo (rare this far south), Ruby-throated Hummingbird, Northern Flicker, Downy Woodpecker, Eastern Kingbird, Willow Flycatcher (wet), Blue Jay, both chickadees, House Wren, Carolina Wren, Gray Catbird, Brown Thrasher, American Robin, Eastern Bluebird, Blue-gray Gnatcatcher, Cedar Waxwing, White-eyed and Bell's vireos, Yellow Warbler, Prairie Warbler (rare-KC), Blue-winged Warbler, Common Yellowthroat, Yellow-breasted Chat, Red-winged Blackbird, Orchard Oriole, Baltimore Oriole (scattered trees), Northern Cardinal, Rose-breasted Grosbeak, Indigo Bunting, House Finch, American Goldfinch, Eastern Towhee, Lark Sparrow [sandy soil], Field Sparrow, and Song Sparrow.

Threatened and Endangered Species - Long-eared Owls (SE) occasionally nest in cedar glades that result from succession.

Exotic Species - Ring-necked Pheasants can be abundant in early successional fields. House Finches are native to the western United States, but since a captive population was released on Long Island in the 1940's they have spread westward and are now common in the HAA, where they often nest in successional fields.

Population Dynamics and Management

Successional habitats add greatly to local diversity and at least a few species are declining nationally and have few or no remaining natural habitats (e.g., Prairie Warbler, Yellow-breasted Chat) or are rare in Illinois (e.g., Bell's Vireo, Lark Sparrow). For some of these species, Illinois may contain a significant portion of their global population (e.g., Orchard Oriole, Bell's Vireo). For these reasons, maintaining successional vegetation may be an important part of a conservation strategy in the HAA.

Shrubland birds are presently the object of intensive study in the HAA (S.K. Robinson, E.J. Heske, and J.D. Brawn, in progress). The information gathered from this study will help land managers to design strategies that will benefit both game and non-game species and provide relatively stable habitat for some declining species. Nest predation rates in successional fields are very high for most, but not all species, whereas brood parasitism levels are low for all but a few species. Most species have adaptations that enable them

to cope with nest predation (aggressive nest defense, rapid re-nesting following losses of nests to predators, a long nesting season allowing many nesting attempts) and cowbird parasitism (abandonment of parasitized nests, inappropriate diet for cowbird nestlings, ejection of cowbird eggs, long or late nesting season that continues after cowbirds stop parasitizing nests in mid-July). As a result, most species do not appear to be in real trouble. The exceptions mostly include neotropical migrants that have a short breeding season and are parasitized (Yellow-breasted Chat, Orchard Oriole). It appears that even relatively small shrublands (<5 acres) can provide habitat for many shrubland species because of their resistance to parasitism and nest predation. The MFWA area, in particular, has a high potential to manage for early successional species.

Shrublands are also very heavily used by migrating species, especially when mingled with scattered trees. Shrubland-preferring migrants include Black-billed Cuckoo, Northern Saw-whet Owl [mainly in evergreens], Yellow-bellied Flycatcher, Alder Flycatcher, Least Flycatcher, Philadelphia Vireo, Golden-winged Warbler, Orange-crowned Warbler, Chestnut-sided Warbler, Mourning Warbler, Connecticut Warbler, Wilson's Warbler, Canada Warbler, and Lincoln's Sparrow. Shrubland habitats therefore provide real benefits to migrant birds and greatly increase local biodiversity.

Cultural Habitats: Developed Land

Residential and urban areas represent about 3.1% of the HAA (Table 2, Figure 7). These areas, scattered with lawns, parks, and other manicured vegetation, offer suitable breeding habitat for relatively few bird species.

Regularly Occurring Species

Typical Species - Developed lands contain an unusual mix of species that can use ornamental shrubs (e.g., Northern Mockingbird, Northern Cardinal, Song Sparrow), shade trees (e.g., Baltimore Oriole, Warbling Vireo, Black-capped Chickadee, Tufted Titmouse, Eastern Wood-Pewee), short mowed grass (e.g., American Robin, Common Grackle, Northern Flicker, American Crow, Brown-headed Cowbird, Mourning and Rock doves, European Starling, and Chipping Sparrow), and can nest safely in human structures (e.g., American Kestrel, [especially farmsteads], Killdeer [roofs, roads], Common Nighthawk [roofs], Chimney Swift, Eastern Phoebe, Barn Swallow, Purple Martin, House and Carolina Wrens, American Robin, Eastern Bluebird [farmsteads], European Starling, House Sparrow and House Finch). Other species commonly found in residential and urban areas include Red-tailed Hawk [in more sparsely inhabited areas], Eastern Screech-Owl, Great Horned Owl, Ruby-throated Hummingbird, Red-bellied Woodpecker ["urban forests"], White-breasted Nuthatch, Brown Thrasher, Common Yellowthroat, and American Goldfinch. This community has no parallel in the natural world and is characterized by abnormally high population densities of species that occasionally or regularly depredate nests (e.g., Blue Jay, American Crow, House Wren, Gray Catbird, Common Grackle, and

Brown-headed Cowbird). Bird feeders further augment populations of many of these species, especially the House Finch, by increasing winter survival.

Use by Threatened and Endangered Species - Now that the Bewick's Wren is practically absent from the region, there are no threatened or endangered species in the developed habitats of the HAA other than the Loggerhead Shrike, which rarely forages in mowed grass of rural farmsteads.

Exotic Species - Huge populations of introduced European Starlings, House Sparrows, Rock Doves, and House Finches live in developed areas, and compete for nest sites and food at bird feeders.

Population Dynamics and Management

High populations of predatory birds and cats may make it difficult for many species that build open-cup nests in accessible locations to nest successfully. However, more data are needed because nesting success of bird species of developed areas has never been systematically studied. Such studies could lead to recommendations for enhancing populations of the native species that have adapted to human developments.

Although not well suited to support many native breeding birds, developed land, such as tree-lined residential areas, can be very important stopover habitat for migrating landbirds. Migrating birds make heavy use of shade trees in developed areas and, when available, also use shrubs. Typical migrants of urban forests include Cooper's and Sharp-shinned hawks [both forage at bird feeders], Common Nighthawk, Ruby-throated Hummingbird [especially at feeders], Northern Flicker, Yellow-bellied Sapsucker, Red-breasted Nuthatch [conifers], Brown Creeper, Hermit Thrush, Golden-crowned Kinglet, Ruby-crowned Kinglet, Cedar Waxwing, Red-eyed Vireo, Tennessee Warbler, Cape May Warbler [conifers], Black-throated Green Warbler, Blackburnian Warbler, Bay-breasted Warbler, Blackpoll Warbler, American Redstart, Eastern Towhee [feeders], Dark-eyed Junco [feeders], American Tree Sparrow, White-crowned Sparrow, White-throated Sparrow, Rusty Blackbird, Evening Grosbeak [feeders], Purple Finch [feeders], Pine Siskin [feeders, conifers], and American Goldfinch [feeders].

Overall Habitat Quality and Management Concerns

Even though the HAA is one of the most intensively farmed regions of the state, existing public landholdings are relatively large and often contiguous. For this reason, habitat quality for birds is surprisingly good and has the potential to get even better.

For breeding birds, we recommend the following strategy for improving habitats:

Forests - Forest restoration efforts should be concentrated in areas that have the potential to contain at least a 500-acre core. Upland forests should be managed to maintain oaks and floodplain forests should contain sycamores.

Grasslands - Where possible, grasslands should be at least 100 acres, should be burned or mowed on a schedule that leaves some areas unmanaged for at least three years, and should contain small wetlands. Woody vegetation should be kept to a minimum.

Wetlands - Restoration of forested wetlands should be of highest priority within the largest habitat blocks. Grassy wetlands, especially sedge meadows and marshes, should be restored and enhanced whenever possible, including along the margins of lakes.

Shrublands - These habitats can be managed simultaneously for game and nongame birds.

Developed and Agricultural Areas - Any plantings that add cover and nest sites should be encouraged, especially to provide habitat during the nonbreeding season.

Mammals

Introduction

Information in this section has been compiled from range maps and known records in Hoffmeister (1989), the 1982-1995 portion of the Illinois Natural Heritage Database (Illinois Department of Natural Resources1997), and unpublished surveys of many sites in the area by E. J. Heske and J. E Hofmann. Because the University of Illinois, several University-owned research and natural areas, and some large, well-surveyed state properties (notably the Middle Fork Fish and Wildlife Area [MFFWA] and Kickapoo State Park [KSP]) lie within the Headwaters Assessment Area [HAA], the mammalian fauna of this area is relatively well-known. Taxonomy follows Wilson and Reeder (1993).

Mammal species known or likely to occur in the HAA are listed in Table 14. The 46 species in this table constitute ca. 74% of the 62 species listed as extant in Illinois by Hoffmeister (1989). Designations of population status of these species in Table 14 are probabilities, based on the experience in this region and subjective opinions of E. J. Heske and J. E. Hofmann. One federally endangered (Indiana bat) and one state endangered species (River Otter) are included in this table.

The HAA lies in an area where the southern limits of the geographic ranges of some species in Illinois (e.g., western harvest mouse, meadow vole, least weasel) overlap with the northern limits of other species in Illinois (e.g., southeastern shrew). It is of interest to monitor changes in the distribution of these species over time as a potential indicator of biotic responses to climate change (i.e., global warming) or anthropogenic changes in the landscape.

Table 14. Mammal species known or likely to occur in the Headwaters Assessment Area[1].

Common name[2]	Order *Scientific Name*	Habitat[3]	Abundance[4,5]
Marsupials	Didelphimorphia		
Virginia opossum	*Didelphis virginiana*	W, G, F	C
Insectivores	Insectivora		
masked shrew	*Sorex cinereus*	W, G, F (mesic)	U?
southeastern shrew	*Sorex longirostris*	W, G, F	U?
northern short-tailed shrew	*Blarina brevicauda*	G, F	C
least shrew	*Cryptotis parva*	G	C
eastern mole	*Scalopus aquaticus*	G, F	C
Bats	Chiroptera		
little brown bat	*Myotis lucifugus*	F, caves, buildings	C
Indiana bat - FE,SE	*Myotis sodalis*	F, caves	R
northern long-eared bat	*Myotis septentrionalis*	F, caves, buildings	C
silver-haired bat	*Lasionycteris noctivagans*	F, caves (hibernation)	U?

Table 14. Continued

Common name[2]	Order *Scientific Name*	Habitat[3]	Abundance[4,5]
eastern pipistrelle	*Pipistrellus subflavus*	F, caves, buildings	C
big brown bat	*Eptesicus fuscus*	F, caves, buildings	C
red bat	*Lasiurus borealis*	F	C
hoary bat	*Lasiurus cinereus*	F	U?
evening bat	*Nycticeius humeralis*	F, buildings	U?
Rabbits	Lagomorpha		
eastern cottontail	*Sylvilagus floridanus*	G, F	C
Rodents	Rodentia		
eastern chipmunk	*Tamias striatus*	F	C
woodchuck	*Marmota monax*	G, F (edges)	C
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	G	C
Franklin ground squirrel	*Spermophilus franklinii*	G	R?
gray squirrel	*Sciurus carolinensis*	F	C
fox squirrel	*Sciurus niger*	F	C
southern flying squirrel	*Glaucomys volans*	F	C
beaver	*Castor canadensis*	W	C
western harvest mouse	*Reithrodontomys megalotis*	G	C
deer mouse	*Peromyscus maniculatus*	G	C
white-footed mouse	*Peromyscus leucopus*	W, G, F (mostly F)	C
meadow vole	*Microtus pennsylvanicus*	G	C
prairie vole	*Microtus ochrogaster*	G	C
woodland vole	*Microtus pinetorum*	F	U?
muskrat	*Ondatra zibethicus*	W	C
southern bog lemming	*Synaptomys cooperi*	W, G	U?
* Norway rat	*Rattus norvegicus*	buildings	C
* house mouse	*Mus musculus*	G, buildings	C
meadow jumping mouse	*Zapus hudsonius*	W, G	U?
Carnivores	Carnivora		
coyote	*Canis latrans*	W, G, F	C
red fox	*Vulpes vulpes*	W, G, F	C
gray fox	*Urocyon cinereoargenteus*	F	U?
raccoon	*Procyon lotor*	W, G, F	C
least weasel	*Mustela nivalis*	G	U?
long-tailed weasel	*Mustela frenata*	W, G, F	C
mink	*Mustela vison*	W, G (mostly W)	C
badger	*Taxidea taxus*	G	U
striped skunk	*Mephitis mephitis*	W, G, F	C
river otter (SE)	*Lontra canadensis*	W	U
Even-toed ungulates	Artiodactyla		
white-tailed deer	*Odocoileus virginianus*	W, G, F	C

[1] Compiled from range maps and known records reported in Hoffmeister (1989); Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997); E. J. Heske (in litt).; and J. E. Hofmann (in litt).

[2] Bold type indicates a federally endangered (FE) or state endangered (SE) species; * = exotic species.

[3] Habitats: W = wetland, G = grassland, F = forest.

[4] Abundance: C = common, U = uncommon, R = rare, ? = status uncertain.

[5] Subjective estimate based on personal experience of E. J. Heske and J. E. Hofmann.

Forest

Typical Species

Mammal species known to occur in the HAA that are restricted to forested habitats include the Indiana bat, hoary bat, silver-haired bat, eastern chipmunk, gray and fox squirrels, southern flying squirrel, woodland vole, and gray fox. Species that are primarily associated with forested habitats but occasionally occur in other habitats include the red bat, white-footed mouse, and raccoon. All other species of bats use forested habitats extensively, although many may roost in caves, abandoned mines, or buildings. Some species, such as eastern cottontail, woodchuck, and white-tailed deer, require wooded habitat at certain times of the year or specialize in forest edges. Additional habitat generalists typically found in forests in the HAA are listed in Table 14.

Most species of mammals associated with forests are not restricted to one type of forest (i.e., upland, floodplain, or flatwoods), and use a variety of forest types seasonally or opportunistically. However, species that hibernate (woodchucks, eastern chipmunks) or are primarily fossorial (woodland voles) need well-drained, uninundated soils. Gray fox are more abundant in upland forests than swamps, but also may be abundant in bottomland forests. Fox squirrels are more strongly associated with upland forests whereas gray squirrels can be abundant in both upland and floodplain forests, but both gray and fox squirrels overlap extensively in their habitat use and can be found in a variety of forest types. Tree squirrels, flying squirrels, and chipmunks tend to be most abundant in forests with a heavy component of mast-producing trees such as oaks and hickories. Raccoons are most abundant in forest tracts with proximity to water.

Threatened and Endangered Species

Of the nine mammal species listed as endangered or threatened in Illinois (Illinois Endangered Species Protection Board, 1994), only the Indiana bat has been reported in forested areas in or near the HAA (two records). Habitat requirements for the Indiana bat are discussed below.

Habitat Requirements and Distributions of Listed and Rare Forest-dwelling Species

Indiana bat (*Myotis sodalis*) — Indiana bats are federally endangered as well as state endangered. They congregate in a limited number of caves or mines for hibernation but are more widely dispersed during the summer. Indiana bat maternity colonies roost primarily beneath slabs of exfoliating bark on dead trees, but have also been found beneath the shaggy bark of certain live hickories and in tree cavities (Cope et al., 1974; Humphrey et al., 1977; Gardner et al., 1991; Callahan, 1993; Kurta et al., 1993a, b). Males and nonreproductive females may also roost in caves or abandoned mines. Roost trees used by this species have been located in both upland and flood-

plain forests; most are relatively large (> 22 cm dbh). Tree species that have been used by maternity colonies in Illinois are slippery elm, northern red oak, shagbark hickory, silver maple, cottonwood, post oak, bitternut hickory, white oak, American elm, sycamore, and green ash[1] (Gardner et al., 1991; Gardner and Hofmann, unpublished data; Kurta et al., 1993a, b). Indiana bats forage in and along the canopy of both riparian and upland forests (Humphrey et al., 1977; LaVal et al., 1977; Brack, 1983; Clark et al., 1987; Gardner et al., 1991). In recent years the Indiana bat has been recorded in 22 counties in the southern two-thirds of Illinois during the summer (Illinois Department of Natural Resources1997).

A maternity colony of Indiana bats was found within the HAA along the Middle Fork of the Vermilion River in southern Ford Co. in 1990 (Illinois Department of Natural Resources1997; Gardner et al. 1996). There are no suitable hibernation sites for this species in this region.

Exotic Species

The Norway rat and house mouse are the only known exotic mammals in the area. The Norway rat, in particular, is most strongly associated with human structures. Both species may be found in woodlots in close proximity to human structures, but neither is generally considered a forest species. These species are now so widespread that they are part of the mammalian fauna across the United States. There is not much that can be done to rectify this situation, and their presence is not of great concern.

Information Gaps

Data on the status of populations of several forest mammal species are not available. Additional surveys to monitor the status and distribution of the Indiana bat in the HAA should be conducted. Additional information on the distribution and population status of the silver-haired bat, hoary bat, evening bat, woodland vole, and gray fox also would be valuable. Because forest habitat is fragmented and reduced in area in many parts of the HAA, it would be valuable to assess the effects of this fragmentation on the distribution of species that specialize in forested habitat. Preliminary surveys suggest that forest specialists, such as flying squirrels, chipmunks, and woodland voles, may become extirpated from isolated forest tracts in heavily fragmented areas.

Enhancement and Restoration Potential

The larger forested areas that are connected to potential riparian dispersal corridors, such as the Middle Fork Fish and Wildlife Area, should be evaluated regarding their ability to attract and support bobcat. Protecting both upland and floodplain forested tracts, and maintaining dispersal corridors such as forested riparian zones among them, could enhance the suitability of these areas as habitat for bobcat and gray fox. The protection of

[1] Scientific names of plants are given in Appendix 1.

forested riparian corridors and re-establishment of trees along banks where they no longer occur will make rivers and streams more suitable as river otter habitat and will benefit other species that use riparian zones for foraging (e.g., bats) or as travel routes. Managing forests to maintain large snags with exfoliating bark or live hickories with shaggy bark could provide roosting habitat for Indiana bats, as well as for other species of forest-roosting bats.

Wetland

Typical Species

Mammal species occurring in the HAA whose life history requires wetland habitats include beaver, muskrat, mink, and river otter. In addition, all species of bats found in the HAA use wetland areas, primarily as foraging habitat. The southern bog lemming and meadow jumping mouse use wetlands extensively in addition to grasslands. Other habitat generalists that use wetlands are listed in Table 14. Because the same subset of mammal species found in the HAA are likely to be associated with lakes, ponds, impoundments, creeks, and rivers as well as marshes, this section should serve as a report on mammals in aquatic and wetland habitats in general. Small mammals such as the southern bog lemming and meadow jumping mouse may be found in mesic areas without open water, whereas the larger mammals such as the river otter, beaver, muskrat, and mink require open water habitats.

Threatened and Endangered Species

In April 1996, 15 river otters (6 male, 9 female) were released into Mingo Lake, which drains into the Middle Fork of the Vermilion River (B. Bluett, IDNR, pers. comm.). No systematic survey of the area has been conducted to evaluate the success of the release or the current distribution of the otters. The Indiana bat forages above water or in forested wetlands and may also roost in trees in floodplain forest during the summer.

Habitat Requirements and Distributions of Listed and Rare Wetland Species

River otter (*Lontra canadensis*) -- River otters are endangered in Illinois. They occupy a variety of aquatic habitats, from coastal swamps and marshes to high mountain lakes (Toweill and Tabor, 1982). They are abundant in estuaries, the lower reaches of rivers, and the tributaries and lakes of unpolluted river systems, but scarce in densely populated areas, especially if the water is polluted (Toweill and Tabor 1982). In Illinois, river otters have been found in shallow lakes, sloughs, cypress swamps, rivers, streams, drainage ditches, and ponds (Anderson 1982, Anderson and Woolf 1984). Habitat used by river otters in northwestern Illinois has the following characteristics: isolation from the main river channel (providing a relatively stable water level), extensive riparian forest (or emergent herbaceous vegetation), the persistence of open water during winter, good water

quality (and healthy fish populations), the presence of suitable den sites (*e.g.* beaver lodges, log piles, exposed tree roots), and minimal human disturbance (Anderson and Woolf 1984). The shape of river otter home ranges is determined by the type of habitat and their size is influenced by prey abundance, topography, weather conditions, and the individual's reproductive status (Melquist and Hornocker 1983). At the Lamine River Wildlife Area in Missouri, otter home ranges were 11-78 km in length (Erickson *et al.* 1984). Only a portion of the range is used at any time; activity centers are located in areas with abundant food and suitable shelter and are changed frequently (Melquist and Hornocker 1983). River otters may travel long distances, 160 km or more, in search of suitable habitat (Jackson 1961).

River otters disappeared from most of Illinois in the mid 1800s, but persisted in the Cache River area and possibly in northwestern Illinois. There are no published records for this species in the HAA (Hoffmeister 1989). Reintroductions have recently been attempted in several watersheds in Illinois, including the release of 15 river otters into the eastern HAA in April 1996.

Exotics

The house mouse is the only introduced species that can occasionally be found in wetland habitats. This species is so widespread that it is now part of the mammalian fauna across the United States. There is not much that can be done to rectify this situation. However, its presence does not appear to be detrimental to native species.

Information Gaps

Much of the HAA once consisted of wetlands, but most emergent wetlands now exist as isolated habitat patches. The ability of wetland-associated mammals to disperse between such wetlands should be examined. Data on the status and distribution of the river otters released in 1996 should be obtained, and the success of this reintroduction attempt should be evaluated by regular monitoring. Beaver have been increasing in abundance throughout the state. The status of beaver populations in the HAA, and their impacts on the physical structure of riparian systems, should be evaluated. Population status of mink in this region should also be evaluated.

Enhancement and Restoration Potential

Reduction of silt and chemical runoff into wetland habitats will improve their ability to attract and support reintroduced river otters.

Grassland

Typical Species

Mammal species in the HAA that are restricted to grassland include the least shrew, thirteen-lined and Franklin's ground squirrels, western harvest mouse, deer mouse, meadow vole, prairie vole, least weasel, and badger. Population sizes of prairie and meadow voles vary greatly from year to year (Getz et al. 1987). Other species strongly associated with grasslands include the southeastern shrew, masked shrew, northern short-tailed shrew, eastern cottontail, woodchuck, southern bog lemming, and meadow jumping mouse. Additional species that use grasslands include the habitat generalists listed in Table 14.

Most of the grassland species that occur in the region are not restricted to native or undisturbed grassland habitat. Rather, the structure of rights-of-way, small hay fields and other agricultural field edges, pastures, old fields, prairie restorations, and similar constructed or disturbed sites may provide suitable habitat for many of these species. Thirteen-lined ground squirrels are most abundant in short grasses, whereas Franklin's ground squirrels are found in grasses of intermediate height. Both species prefer areas that provide an unobstructed view; thus, tall grasses are inhabited rarely. The southern bog lemming, meadow jumping mouse, and to a lesser extent the meadow vole, generally prefer more mesic grasslands. Eastern cottontails and woodchucks are most abundant where grassland habitat occurs in proximity to other habitat types, and may be considered edge species. Other species use a variety of grassland habitats opportunistically.

Threatened and Endangered Species

None of the mammal species primarily associated with grasslands in the HAA is listed as threatened or endangered in Illinois.

Exotics

Two introduced species live in the grassland habitats of the HAA. The Norway rat and house mouse are both strongly associated with human structures, but both species can also be found in grasslands in proximity to human structures. The house mouse in particular can sometimes reach substantial numbers in grasslands near buildings. These species are now so widespread that they are part of the mammalian fauna across the United States. There is not much that can be done to rectify this situation, and it is not one for concern.

Information Gaps

Additional information on the population status and distribution of the Franklin's ground squirrel, western harvest mouse, meadow jumping mouse, and least weasel would be useful. Franklin's ground squirrel, in particular, appears to have become uncommon throughout much of its former range in Illinois. Although Franklin's ground squirrels were known from several sites within the HAA (Hoffmeister 1989), there are no recent records or observations of the species. Status of the badger in Illinois was recently investigated by Warner and Ver Steeg (1995); however, population status in the HAA should be determined more precisely. Although the red fox is not strictly a grassland species, it is often associated with grasslands and other open habitats. There are suggestions that recent increases in the abundance of coyotes could have negatively affected populations of red fox, and status of red fox populations in the HAA should be evaluated.

Enhancement and Restoration Potential

Restored grasslands could provide valuable sites for reintroductions of Franklin's ground squirrels in areas where they no longer occur. An increase in the abundance of ground squirrels and other small grassland mammals in the region could benefit badgers.

Amphibians and Reptiles

Introduction

Information in this section has been compiled from range maps in Smith (1961), the Illinois Natural Heritage Database (Illinois Department of Natural Resources1997), the Illinois Amphibian and Reptile Vouchered Database (a computer database that contains information on specimens from museum, university, and private collections), unvouchered records from the literature, and unvouchered records taken from reliable biologists and naturalists. There has not been a systematic survey of the amphibians and reptiles of the Headwaters Assessment Area (HAA), but Phil Smith, noted herpetologist and ichthyologist at the Illinois Natural History Survey, collected throughout this region from the early 1940s to the early 1960s. The HAA contains portions of three of Smith's (1961) 11 Herpetofaunal Divisions for the state; Prairie, Woodlands of the Grand Prairie, and Wabash Border.

Amphibian and reptile species that are known or likely to occur in the HAA are listed in Table 15. The 21 amphibian species and 27 reptile species in Table 15 represent 49% of the amphibian species and 43% of the reptile species known from the state. One species, the eastern massasauga, *Sistrurus massasauga,* has been extirpated from the HAA, probably as a result of the draining of prairie wetlands. However, a healthy population of massasaugas is known to occur just west of the western border of the HAA. It is possible that this species could eventually be reintroduced in the HAA. Three state-listed species, the silvery salamander (state endangered - SE), four-toed salamander, (state threatened - ST), and Kirtland's snake (ST) are included in Table 15. There are no exotic amphibian or reptile species in the HAA.

Most amphibian and reptile species are not restricted to a single habitat type. For example, all but two of Illinois' amphibians require some type of aquatic habitat (wetland, pond, creek, or river) for breeding but the adults can also be found in a variety of terrestrial habitats. Reptiles are usually found in close proximity to aquatic habitats because they can find an abundance of prey items in these productive habitats.

Forest

Typical Species

Amphibian species known or likely to occur in the HAA that are typical of forested habitats include the redback salamander, slimy salamander, spring peeper, and both species of gray treefrog. As outlined above, most amphibians also require aquatic habitats for breeding. The two salamanders are the exceptions. They lay their eggs on land in

forested uplands. The remaining forest species breed in wetlands and ponds. Among the reptiles of the HAA, the racer, rat snake, and box turtle are typical of forested areas.

Threatened and Endangered Species

Two of the listed species in Table 15, the silvery salamander (SE) and the four-toed salamander (ST) are restricted to the forested areas in the HAA that have upland ponds. In the HAA, these species are known only from Kickapoo State Park (KSP) and the Middle Fork Fish and Wildlife Area (MFFWA). This is the only known Illinois location for the silvery salamander. These threatened and endangered species have the following habitat requirements:

Four-toed salamander - This primarily terrestrial salamander is associated with undisturbed forests containing seeps or bogs. Recently, however, Illinois specimens have been taken in wooded ravines near rocky, spring-fed creeks. The activity period in Illinois is probably late March to October. Females congregate near woodland ponds in March and April for egg laying and brooding. Nests are situated so that the larvae fall directly into the water when the eggs hatch. The most common nest sites are in sphagnum mats but grass hummocks, leaf litter, rotten logs and undercut stream banks are also used. The main threats are to the breeding ponds and include draining and stocking with fish.

Silvery salamander - This salamander inhabits underground burrows and runways constructed by rodents and shrews in forested areas. Adults come to the surface to migrate to woodland ponds and wetlands for courtship and breeding during late winter. These ponds must be fishless and must retain water until the aquatic larvae transform into terrestrial juveniles, usually mid-June.

Information Gaps

The only data on population size of forest amphibians and reptiles of the HAA are for four-toed and silvery salamanders. There are between t10 and 20 four-toed salamanders breeding at a small pond in the MFFWA (Phillips 1995). Several abundance studies have been conducted at KSP on the silvery salamander population. The most recent investigation (Pollowy 1992) documented 182 adults. Abundance information for any of the other species would be valuable.

Enhancement and Restoration Potential

Creation of fishless upland ponds and wetlands would benefit both the listed salamanders currently found in the HAA. On a broader scale, maintaining small, temporary fishless ponds in forests of the HAA would benefit almost all the reptiles and amphibians of the HAA as well as other species groups that depend on them for food. Creating or restoring small ponds in upland forests is particularly valuable because these habitats are among the rarest in the HAA and the state.

Table 15. Amphibian and reptile species known or likely to occur in the Headwaters Assessment Area, with an indication of habitat preference and relative abundance.

Common Name[1,2]	*Scientific Name*	Habitat[3]	Abundance[4]
Amphibians			
marbled salamander	*Ambystoma opacum*	F,W,L	U
smallmouth salamander	*Ambystoma texanum*	U	C
spotted salamander	*Ambystoma maculatum*	F,W,L	U
silvery salamander - SE	***Ambystoma platineum***	F,W,L	R
tiger salamander	*Ambystoma tigrinum*	W,P,L	U
four toed salamander - ST	***Hemidactylium scutatum***	F,W,L	R
two-lined salamander	*Eurycea bislineata*	F,R	C
redback salamander	*Plethodon cinerus*	F	C
slimy salamander	*Plethodon glutinosus*	F	U
mudpuppy	*Necturus maculosus*	R	U
American toad	*Bufo americanus*	U	C
Fowler's toad	*Bufo woodhousii*	F,W,P	C
cricket frog	*Acris crepitans*	L,R	C
striped chorus frog	*Pseudacris triseriata*	U	C
spring peeper	*Pseudacris crucifer*	F,W	U
Cope's gray treefrog	*Hyla chrysoscelis*	F,W	C
eastern gray treefrog	*Hyla versicolor*	F,W	C
bullfrog	*Rana catesbeiana*	U	C
green frog	*Rana clamitans*	F,W,L	C
northern leopard frog	*Rana pipiens*	F,W,P	U
plains leopard frog	*Rana blairi*	W,P	U
Reptiles			
snapping turtle	*Chelydra serpentina*	W,L,R	C
painted turtle	*Chrysemys picta*	W,L,R	C
slider	*Trachemys scripta*	W,L,R	C
Blanding's turtle	*Emydoidea blandingii*	W	R
musk turtle	*Sternotherus odoratus*	W,L,R	R
map turtle	*Graptemys geographica*	L,R	U
false map turtle	*Graptemys pseudogeographica*	L,R	U
spiny softshell turtle	*Apalone spinifer*	W,L,R	U
box turtle	*Terrapene carolina*	F	C
slender glass lizard	*Ophisaurus attenuatus*	P	R
Ring neck snake	*Diadophis punctatus*	U	U
eastern hognose snake	*Heterodon platirhinos*	F,W,P,	U
racer	*Coluber constrictor*	U	U
smooth green snake	*Opheodrys vernalis*	W,P	U
rat snake	*Elaphe obsoleta*	F,W,P	U
fox snake	*Elaphe vulpina*	W,P,C	C
milk snake	*Lampropeltis triangulum*	F,W,P	U
Kirtland's snake - ST	***Clonophis kirtlandii***	W,P,C	R
prairie kingsnake	*Lampropeltis calligaster*	F,W,P	C
plains garter snake	*Thamnophis radix*	U	C
common garter snake	*Thamnophis sirtalis*	U	C
smooth earth snake	*Virginia valeriae*	F	R

Table 15. Continued

Common Name[1,2]	*Scientific Name*	Habitat[3]	Abundance[4]
brown snake	*Storeria dekayi*	U	C
red-bellied snake	*Storeria occipitomaculata*	F,W	U
queen snake	*Regina septemvittata*	R	U
Graham's crayfish snake	*Regina grahamii*	W,L	U
northern water snake	*Nerodia sipedon*	U	C

[1] Nomenclature follows Collins (1990) unless noted.

[2] Bold type indicates a state threatened (ST) or state endangered (SE) species.

[3] Habitats: F = forest, W = wetland, P = prairie and savanna, L = lakes, ponds, impoundments R = rivers & creeks, C = cultural, U = ubiquitous (all habitats).

[4] Abundance: C = common, U = uncommon, R = rare, ? = status uncertain.

Wetland

Typical Species

As outlined above, all but two of the amphibians of the HAA require some type of aquatic habitat for breeding. Most adult amphibians leave the immediate vicinity of wetlands, but the bullfrog and plains leopard frog complete their entire life cycle in aquatic habitats, including wetlands. These species may also be found in ponds, lakes, creeks, and rivers. Among the reptiles of the HAA, only the Blanding's turtle is restricted to wetlands. Other species such as the plains garter snake and common garter snake are typical wetland inhabitants, but are also found in other habitats.

Threatened and Endangered Species

Kirtland's snakes (ST) were originally found near wetlands in the HAA if the surrounding landscape was native prairie. The current status of Kirtland's snakes in the HAA is not known. Silvery (SE) and four-toed (ST) salamanders are known to breed in a single wetland each in KSP and MFFWA. These threatened and endangered species have the following habitat requirements:

Kirtland's snake - Wet prairies with abundant cover are preferred, especially those that are seasonally flooded and adjacent to upland habitats. This species also utilizes crayfish burrows as shelter although they have been taken in vacant lots in some urban areas where crayfish burrows have been completely destroyed. In these situations they rely on boards and other surface debris for cover. They are also associated with the grassy areas around spillways and dams of impoundments.

Silvery and four-toed salamander - See discussion under forests.

Information Gaps

The only data on population size of wetland amphibians and reptiles of the HAA are for four-toed and silvery salamanders. There are between 10 and 20 four-toed salamanders breeding at a small pond in the MFFWA (Phillips1995). Several abundance studies have been conducted at KSP on the silvery salamander population. The most recent investigation (Pollowy 1992) documented 182 breeding adults. Abundance information for any of the other wetland species would be valuable, in particular for Kirtland's snake.

Enhancement and Restoration Potential

Restoring prairie wetlands in the HAA would benefit a variety of amphibians and reptiles and enhance the suitability of the HAA as habitat for Kirtland's snake and the massasauga.

Prairie

Typical Species

Of the amphibian species listed in Table 15, the tiger salamander and striped chorus frog are typical of prairie habitats in the HAA. The tiger salamander requires fishless ponds and wetlands for breeding. Because of the destruction and degradation of these habitats, the tiger salamander has declined drastically in the HAA. The striped chorus frog has a shorter larval period and therefore can breed in more temporary aquatic habitats, such as flooded fields and ditches. Reptile species in the HAA that are typical of prairie habitats include the smooth green snake, fox snake, and plains garter snake. Of these grassland species, the smooth green snake is most dependent on native grassland. The other species can tolerate more disturbed habitats such as mowed rights-of-way, pastures, old fields, and agricultural edges.

Other species, such as the smallmouth salamander, prairie kingsnake, and brown snake, can be found in grasslands of the HAA. They can also tolerate disturbed grassland habitats.

Threatened and Endangered Species

Kirtland's snakes (ST) were originally found in prairie habitats in the HAA where there was abundant moisture. The current status of Kirtland's snakes in the HAA is not known. Habitat requirements of this species are described in the discussion of wetlands.

Information Gaps

Abundance information for any of the prairie species of the HAA would be valuable. It would be especially informative to document the distribution and abundance of the tiger salamander in the HAA because we have several historical accounts of this species to use as a comparison. It would also be helpful to document whether Kirtland's snake still occurs in the HAA. There are 10 historic locations for Kirtland's snake in the HAA but there has been only one documented sighting in the last 20 years.

Enhancement and Restoration Potential

Restoration of native prairie would benefit a variety of amphibians and reptiles and enhance the suitability of the HAA as habitat for Kirtland's snake, smooth green snake, and tiger salamander.

Lakes, Ponds, and Impoundments

Typical Species

Of the amphibian species listed in Table 15, the tiger salamander, bullfrog, and cricket frog are typical of ponds, lakes, and impoundments in the HAA. The tiger salamander requires fishless ponds and wetlands for breeding. Because of the destruction and degradation of these habitats, the tiger salamander has declined drastically in the HAA. The cricket frog and bullfrog have developed strategies for co-existing with fish and are therefore more widely distributed than the tiger salamander. Among the reptiles of the HAA, the snapping turtle, painted turtle, spiny softshell, common garter snake, Grahams' crayfish snake, and northern water snake are typical of lakes, ponds, and impoundments. Of these species, Graham's crayfish snake is most dependent on lakes, ponds, and impoundments.

Threatened and Endangered Species

The silvery (SE) and four-toed (ST) salamanders are known from wooded ponds in KSP and MFFWA. Kirtland's snakes (ST) are known from the grassy areas around the spillways of impoundments in other parts of central Illinois. It is possible that this species will eventually be found near impoundments such as Homer Lake in the HAA. Habitat requirements are discussed in the sections on forests and wetlands.

Information Gaps

There are no abundance data for amphibians and reptiles of ponds, lakes and impoundments of the HAA. It would be especially informative to document the distribution and

abundance of the tiger salamander in the HAA because we have several historical accounts of this species to use as a comparison.

Enhancement and Restoration Potential

Leaving at least part of the shore around ponds, lakes, and impoundments unmowed and providing forest or grassland connections among ponds, lakes, and impoundments in the HAA would benefit a variety of amphibians and reptiles and enhance the suitability of the HAA as habitat for Kirtland's snake.

Creeks and Rivers

Typical Species

Of the amphibian species listed in Table 15, the cricket frog and bullfrog are typical of creeks and rivers in the HAA. Among the reptiles of the HAA, the snapping turtle, map turtle, spiny softshell turtle, queen snake, and northern water snake are typical of creeks and rivers. Of these species, the map turtle and queen snake are most dependent on creeks and rivers.

Threatened and Endangered Species

None of the listed species known from the HAA are found in creeks or rivers although Kirtland's snakes (ST) may be seasonally associated with river floodplains.

Information Gaps

No distribution or abundance data are available for amphibians and reptiles of the HAA creeks and rivers. Abundance information for any of the species would be valuable. It would be especially informative to document whether the smooth softshell turtle, *Apalone mutica*, occurs in the creeks and rivers of the HAA. It requires clean sandy-bottomed creeks and rivers and its presence indicates excellent water quality. There is a possibility that this turtle might inhabit the higher quality stretches of the Middle Fork system.

Enhancement and Restoration Potential

Restoring riparian zone along creeks and rivers in the HAA would benefit a variety of amphibians and reptiles and enhance the suitability of the HAA as habitat for the smooth softshell turtle.

Cultural Habitats

Typical Species

Of the amphibian species listed in Table 15, the smallmouth salamander, American toad, striped chorus frog, and bullfrog are typical of cultural habitats in the HAA, including cropland, pasture, successional field, developed land, and tree plantations that provide adequate breeding sites (ditches, flooded fields, stock tanks). Among the reptiles of the HAA, the racer, fox snake, plains garter snake, common garter snake, brown snake, and northern water snake are typical of cultural habitats in the HAA.

Threatened and Endangered Species

In the 1940s, Kirtland's snakes (ST) were collected from abandoned urban lots and agricultural ditches around Champaign and Urbana. Their absence in these same areas today is probably an indication that they did not thrive in these habitats. The most recent record for this species from an urban setting is a 1975 specimen collected in Villa Grove along the Embarras River. Habitat requirements of Kirtland's snakes are discussed in the section on wetlands.

Information Gaps

There are no abundance data for amphibians and reptiles of cultural habitats of the HAA, but it would be useful to determine to what extent these disturbed habitats can support viable populations.

Enhancement and Restoration Potential

Small stock ponds and farm ponds can provide important breeding sites for amphibians of the HAA if the ponds are fish free. Most of these ponds are not capable of supporting sport fisheries so this does not present a conflict between amphibian conservation and recreation opportunities.

Overall Habitat Quality and Management Concerns

Overall, opportunities for amphibians and reptiles in the HAA are poor. Compared to pre-settlement, the present landscape of the HAA lacks a significant amount of native prairie, especially wet prairie. As noted above, this is probably the reason the eastern massasagua is no longer present in the HAA. This may also explain the scarcity (or absence) of Kirtland's snake in the HAA. Another habitat whose decline or disappearance in the HAA since European settlement that has severely affected amphibians and reptiles include temporary ponds in upland forests and prairie streams.

The most critical management concern for the HAA is habitat fragmentation. Under current conditions natural habitats in the HAA are mostly restricted to small patches separated from each other by agricultural or developed land. Habitat connectedness is important for amphibians because they usually travel long distances between their breeding and nonbreeding habitats. For example, the American toad spends most of its time in upland habitats such as forests or prairies but migrates to lowland areas for breeding. Reptiles require habitat connections because many species move to upland retreats for winter hibernation.

Terrestrial Insects: Butterflies and Skippers

Introduction

The information presented in this section has been compiled from distributional records in Irwin and Downey (1973), from range maps in Opler and Malikul (1992), and from the personal knowledge of James G. Sternburg, a resident entomologist with 50 years of experience in observing, photographing, and collecting butterflies in the Headwaters Assessment Area (HAA). The insect fauna of the HAA is relatively well-known. This reflects the long-term presence in the HAA of the Illinois Natural History Survey and the University of Illinois, both of which are located in Champaign County. Nevertheless, no single source exists that treats, in detail, the butterflies and skippers of the HAA.

The butterflies and skippers known to have been collected in the four counties of the HAA (Champaign, Ford, Piatt, Vermilion) are listed in Table 16 along with species deemed by the writer to be of likely or possible occurrence. The reader is referred to the Mackinaw River Area Assessment report (Illinois Department of Natural Resources 1997) for detailed information from McLean County. No information is available concerning the population status in the HAA for any of the species listed.

Typical Species

The distributions of the butterflies and skippers of a geographic area are tied to the distributions of the host plants and nectar sources of each species. Few species are rigidly habitat-specific as adults. On the contrary, wandering adults are often observed far removed from their larval feeding sites. Thus, for example, forest species can be observed in prairies, savannas, wetlands, and in areas of cultivation and disturbance.

Forest

Typical forest species likely to be observed in the HAA include two swallowtails whose caterpillars feed on understory shrubs. These are the Giant Swallowtail on prickly ash and wafer ash and the Spicebush Swallowtail on spicebush. Another shrub feeding species is the Spring Azure on dogwoods. The Northern Pearly Eye, whose larvae feed on bottle brush grass and sea oats, is likely to be present. Among the skippers, Juvenal's Dusky Wing, feeding on oaks, is likely to be encountered.

Prairie

Although few records are available from the HAA, a number of prairie species are to be expected. Among the butterflies, the Dione Copper may be found on docks, the Eastern

Tailed Blue on legumes, the Gorgone Checkerspot on sunflowers, and the Monarch on milkweeds.

Savanna

Few, if any species in the HAA, are likely to be restricted in distribution to savannas. Several species, however, are often encountered in savanna situations. These include three butterflies, namely, Edwards Hairstreak on scrub oak, the Little Copper on sour dock, and the Regal Fritillary on birdsfoot violet. Also to be expected, are the Dusted Skipper on big and little bluestem and the Silver Spotted Skipper on legumes.

Wetland

Two willow-feeding butterflies probably can be found in the HAA. These are the Acadian Hairstreak and the Viceroy. The Bronze Copper and the Purplish Copper, both feeders on docks, are likely to be present. The Least Skipper, a grass feeder, will occur.

Cultural Habitats

Many butterflies and skippers are commonly found in distributed areas, cultivated areas, and in urban and suburban developments. Indeed some, such as the Cabbage Butterfly and the Alfalfa Butterfly, have pest status. Both certainly occur in the HAA. Species of broad host range, such as the Painted Lady, occur commonly in cities and towns, as does the Tiger Swallowtail, which feeds on a wide variety of commonly cultivated trees and shrubs. The Common Sooty Wing, feeding on amaranths and lambs quarters, occurs in yards and gardens.

Information Gaps

The HAA should be resurveyed for all species of butterflies and skippers. Many species formerly present have not been sighted in recent years according to James Sternberg (pers. com). Sixty-three of the 70 species of butterflies thought to be of present or possible occurrence have been recorded and 148 of a possible 280 county records for the four counties listed have been made. The situation is much poorer in the case of the skippers. Only 24 of the 35 species likely have been recorded, and only 32 of 140 possible county records are available.

The handsome Regal Fritillary is in decline throughout its range. This species could benefit (if indeed it still exists in the HAA) from detailed study and management attention.

Table 16. Butterflies and skippers known (+) or likely (-) to occur in the Headwaters Assessment Area[1].

Species[2,3,4]	Habitat[5]	Champaign	Ford	Piatt	Vermilion
Pipe Vine Swallowtail					
Battus philenor	F	+	-	+	+
Black Swallowtail					
Papilio polyxenes	P,C	+	+	-	+
Giant Swallowtail					
Papilio cresphontes	F	+	-	+	+
Tiger Swallowtail					
Papilio glaucus	F,C	+	+	-	+
Spicebush Swallowtail					
Papilio troilus	F	-	-	-	+
Zebra Swallowtail					
Eurytides marcellus	F	+	-	+	+
Checkered White					
Pontia protodice	F,C	+	-	-	+
* Cabbage Butterfly					
Pieris rapae	F,C	+	+	-	+
* Alfalfa Butterfly					
Colias eurytheme	P,C	+	+	-	+
Clouded Sulphur					
Colias philodice	P,C	+	+	-	+
Dog Face					
Colias cesonia	W,C	+	-	-	+
Cloudless Sulphur					
Phoebis sennae	W,C	+	-	-	+
Little Sulphur					
Eurema lisa	P,C	+	+	-	+
Sleepy Orange					
Eurema nicippe	W,C	+	-	-	-
Dainty Sulphur					
Nathalis iole	P,C	+	+	-	+
Falcate Orange Tip					
Anthocharis midea	F	+	+	-	+
Swamp Metalmark - SE					
Calephelis mutica	W	-	-	-	+
Northern Metalmark					
Calephelis borealis	F	-	-	-	-
Coral Hairstreak					
Satyrium titus	P,C	-	-	+	-
Striped Hairstreak					
Satyrium liparops	F,W	-	-	+	-
Banded Hairstreak					
Satyrium calanus	F,P,S	+	-	+	+
Hickory Hairstreak					
Satyrium caryaevorum	F	-	-	-	-

Table 16. Continued

Species[2,3,4]	Habitat[5]	Champaign	Ford	Piatt	Vermilion
Edwards' Hairstreak					
Satyrium edwardsii	S	-	-	-	-
Acadian Hairstreak					
Satyrium acadica	W	+	+	-	-
Red-Banded Hairstreak					
Calycopsis cecrops	P,C	-	-	-	-
Henry's Elfin					
Incisalia henrici	F	-	-	+	+
Eastern Pine Elfin					
Incisalia niphon	F,C	-	-	-	-
Olive Hairstreak					
Mitourea gyrnea	P,C	-	-	+	-
Southern Hairstreak					
Fixenia favonius	F,W	-	-	-	-
White-Hairstreak					
Parrhasius m-album	F	+	-	+	+
Gray Hairstreak					
Strymon melinus	F,P,C	+	-	+	+
Bronze Copper					
Lycaena hyllus	W	+	+	+	+
Dione Copper					
Lycaena dione	P	+	+	+	-
Purplish Copper					
Lycaena helloides	W	-	-	-	+
Little Copper					
Lycaena phlaes	P,S,C	+	-	-	+
Reakirt's Blue					
Hemiargus isola	P,S,C	-	-	-	-
Eastern Tailed Blue					
Everes comyntas	P,S,C	+	+	+	+
Spring Azure					
Celastrina argiolus	F,C	+	-	-	+
Harvester					
Feniseca tarquinius	F,W	+	-	+	+
American Snout					
Libytheana carinenta	F,W	+	-	+	+
Goatweed Butterfly					
Anea andria	F,C	+	-	+	+
Hackberry Butterfly					
Asterocampa celtis	F,W,C	+	+	-	+
Tawny Emperor					
Asterocampa clyton	F,W,C	+	+	+	+
Red-spotted Purple					
Liminitis arthemis	W	+	+	-	+

Table 16. Continued

Species[2,3,4]	Habitat[5]	Champaign	Ford	Piatt	Vermilion
Viceroy					
Liminitis archippus	W	+	+	-	+
Red Admiral					
Vanessa atalanta	F,C	+	-	-	+
American Painted Lady					
Vanessa virginiensis	F,P,C	+	-	-	+
Painted Lady					
Vanessa cardui	F,P,S,C	+	+	-	+
Buckeye					
Junonia coenia	P,W,C	+	-	-	-
Milbert's Tortoise Shell					
Nymphalis milberti	F,W,C	-	-	-	-
Mourning Cloak					
Nymphalis antiopa	F,C	+	-	-	+
Question Mark					
Polygonia interrogationis	F,C	+	+	-	+
Hop Merchant					
Polygonia comma	F,C	+	+	-	+
Gray Comma					
Polygonia progne	F,W	+	-	+	+
Silvery Checkerspot					
Chlosyne nycteis	F,C	+	+	+	+
Gorgone Checkerspot					
Chlosyne gorgone	P	+	-	+	+
Harris Checkerspot					
Chlosyne harrissii	P,W	-	-	-	+
Pearl Crescent					
Phyciodes tharos	F,P,S,C	+	+	-	+
Baltimore					
Euphydryas phaeton	W	-	-	+	+
Silver-bordered Fritillary					
Boloria selene	P,W	+	-	-	-
Meadow Fritillary					
Boloria bellona	P,W	+	-	+	+
Regal Fritillary					
Speyeria idalia	P,S	+	-	-	-
Great Spangled Firtillary					
Speyeria cybele	W,P,C	+	+	-	+
Aphrodite					
Speyeria aphrodite	W,P,C	+	-	-	-
Variegated Fritillary					
Euptoieta claudia	P,C	-	-	-	+
Monarch					
Danaus plexippus	P,S,W,C	+	+	-	+

Table 16. Continued

Species[2,3,4]	Habitat[5]	Champaign	Ford	Piatt	Vermilion
Northern Pearly Eye					
Enodia anthedon	F,W	+	-	+	+
Eyed Brown					
Lethe eurydice	W	+	-	-	-
Little Wood Satyr					
Megisto cymela	F,P	+	-	-	+
Common Wood Nymph					
Cercyonis pegala	P,S,W,C	-	+	+	+
Eufala Skipper					
Lerodea eufala	C	-	-	-	-
Pepper and Salt Skipper					
Amblyscirtes hegon	F	-	-	-	-
Roadside Skipper					
Amblyscirtes vialis	F,C	-	-	-	-
Dusted Skipper					
Atrytonopsis hianna	P,S	-	-	-	-
Dion Skipper					
Euphyes dion	W	+	-	-	-
Black Dash					
Euphyes conspicuus	P,W	+	-	-	-
Two Spotted Skipper					
Euphyes bimacula	W	-	-	-	-
Dun Skipper					
Euphyes vestris	P,W,C	-	-	-	-
Hobomok Skipper					
Poanes hobomok	F	-	-	-	+
Zabulon Skipper					
Poanes zabulon	F	+	-	-	+
Byssus Skipper					
Problema byssus	P	-	-	-	-
Delaware Skipper					
Atrytone delaware	P,W,C	-	-	-	+
Sachem					
Atalapodes campestris	C	+	-	-	+
Little Grassy Wing					
Pompeius verna	C	+	-	-	-
Northern Broken Dash					
Wallengrenia egerement	C	+	-	-	-
Peck's Skipper					
Polites peckius	C	+	-	-	+
Tawny-edged Skipper					
Polites themistocles	P,C	+	-	-	+
Crossline Skipper					
Polites origenes	P,C	-	-	-	-

Table 16. Continued

Species[2,3,4]	Habitat[5]	Champaign	Ford	Piatt	Vermilion
Leonard's Skipper					
Hesperia leonardus	P	-	-	-	+
Fiery Skipper					
Hylephila phyleus	C	+	-	-	-
* European Skipper					
Thymelicus lineola	W,C	-	-	-	-
Least Skipper					
Ancyloxypha numitor	W	+	+	-	+
Swarthy Skipper					
Nastra lherminier	P,S,C	-	-	-	+
Common Sooty Wing					
Pholisora catullus	C	-	+	-	-
Checkered Skipper					
Pyrgus communis	C	+	-	-	-
Sleepy Dusky Wing					
Erynnis brizo	F	+	-	-	-
Wild Indigo Dusky Wing					
Erynnis baptisiae	P,C	-	-	-	-
Mottled Dusky Wing					
Erynnis martialis	F,P	+	-	-	+
Horace's Dusky Wing					
Erynnis horatius	F	+	-	-	-
Juvenal's Dusky Wing					
Erynnis juvenalis	F	+	-	-	-
Scalloped Sooty Wing					
Staphylus hayhursti	F,C	+	-	-	+
Southern Cloudy Wing					
Thorybes bathyllus	F	-	-	-	-
Northern Cloudy Wing					
Thorybes pylades	F	-	-	-	+
Hoary Edge					
Acholaris lyciades	F	-	-	-	-
Silver-spotted Skipper					
Epargyreus clarus	P,S,C	+	-	-	+

[1] Sources of data for this table are listed in the reference section of this report.
[2] Scientific and common names follow Opler and Malikul (1992).
[3] Order of treatment follows Irwin and Downey (1973), except that skippers follow butterflies.
[4] Bold type indicates an Illinois endangered species (SE); * = introduced species.
[5] Habitats: F=forest, P=prairie, S=savanna, W=wetland, C=cultural.

Aquatic Biota

Introduction

The Headwaters Assessment Area (HAA) contains portions of three drainage basins in east-central Illinois: the Vermilion River basin, the Sangamon River basin, and the Embarras River basin (Figure 1). Characteristics of these basins are described in the introduction to this volume. The aquatic biotas of these basins differ substantially from one another. Therefore, for most of this chapter data are presented separately for each basin.

Statewide Comparison of Aquatic Biota

The HAA supports a large diversity of aquatic species: at least 92 species of fishes (Table 17), 44 species of unionid mussels (Table 18), and 16 species of malacostracans (macro-crustaceans) (Table 19). This represents 49% of the 187 fishes (including 12 that have been extirpated), 55% of the approximately 80 mussels (including approximately 30 that have been extirpated), and 23% of the 71 malacostracans that have been known to occur in Illinois. The fishes, mussels, and crustaceans of the HAA show species specific preferences for streams of different sizes (Tables 20-22) and within these streams they occupy a wide variety of aquatic habitats (Tables 23-25).

The Vermilion River basin portion of the HAA, with 79 fishes, 37 mussels, and 15 crustaceans (Tables 17,18, and 19), is especially diverse, with records for seven endangered or threatened species of fishes and 12 state endangered or threatened mussels. Sixty-two fishes, 30 mussels, and 9 crustaceans have been reported for the Sangamon River basin portion of the HAA, including 3 state endangered mussels, 1 state endangered fish, and 1 state threatened mussel (Tables 17, 18, and 19). The portion of the Embarras River in the HAA is highly modified; it supports 32 species of fishes, 16 mussels, and 6 crustaceans and includes one state endangered mussel (Tables 17, 18, and 19).

Although some species have disappeared from the region in recent decades, populations of rare species persist in some streams. With improvements in water quality, those species that have been extirpated could return and natural communities could become reestablished in areas where they have been eliminated or altered.

The HAA also supports a large diversity of smaller aquatic macroinvertebrates (Table 26). Unfortunately, existing data on the distribution and natural community associations of these species are inadequate to summarize typical, unique, or rare species, or to identify exotic species. Other than the studies conducted by Brigham (1979) throughout the Embarras, Vermilion, and Wabash drainage's in Illinois, few extensive surveys of aquatic macroinvertebrate populations have been conducted.

Nevertheless, based on existing information, the aquatic macroinvertebrate populations of the HAA appear to be as diverse as those of many other watersheds in Illinois that have been surveyed in a similar manner. Presently, over 490 species of aquatic macroinvertebrates representing 7 phyla, 23 orders, 90 families, and 270 genera are known to occur, or thought likely to occur, in the HAA (Table 26). This information is based upon records from one or more of the headwater drainages and/or from records from other aquatic habitats within the counties located in the HAA. Most of these species are relatively common in Illinois. Records for species included in Table 26 have been obtained from the following sources: Frison (1935), Ross (1944), Burks (1953), Wooldridge (1967), Lauck (1959), W. Brigham (1972), A. Brigham (1979), Wetzel (1992), W. Brigham (unpublished), and the Illinois Natural History Survey (INHS) Collections.

Current literature discussing federal and state listed threatened and endangered species, species under consideration for such listing, or other species considered rare or of special concern (Herkert 1992, 1994; Illinois Endangered Species Protection Board 1994; U.S. Department of Interior, Fish and Wildlife Service 1995, 1996) does not include any aquatic macroinvertebrates other than unionid mussels.

Table 17 . Freshwater fishes recorded for the Headwaters Assessment Area, by drainage[1].

Family *Scientific Name*[2,3]	Common Name	Drainage[4] Vermilion	 Sangamon	 Embarras
Petromyzontidae				
Ichthyomyzon unicuspis	silver lamprey	X		
Lepisosteidae				
Lepisosteus osseus	longnose gar	X		
Anguillidae				
Anguilla rostrata	American eel	X		
Clupeidae				
Dorosoma cepedianum	gizzard shad	X		
Cyprinidae				
Campostoma anomalum	central stoneroller	X#	X	X#
Campostoma oligolepis	largescale stoneroller	X		
Cyprinella lutrensis	red shiner	X	X#	
Cyprinella spiloptera	spotfin shiner	X#	X	X
Cyprinella whipplei	steelcolor shiner	X#	X	X
* *Cyprinus carpio*	common carp	X	X	
Ericymba buccata	silverjaw minnow	X	X	X
Hybognathus nuchalis	Mississippi silvery minnow	X	X	X
***Hybopsis amblops* - SE**	**bigeye chub**	X		
***Hybopsis amnis* - SE**	**pallid shiner**		X	
Luxilus chrysocephalus	striped shiner	X#	X#	X
Lythrurus fumeus	ribbon shiner			X
Lythrurus umbratilis	redfin shiner	X	X#	X#
Macrhybopsis storeriana	silver chub	X		

Table 17. Continued

Family *Scientific Name*[2,3]	Common Name	Drainage[4] Vermilion	Sangamon	Embarras
Nocomis biguttatus	hornyhead chub	X	X	
Notemigonus crysoleucas	golden shiner	X	X	X
Notropis atherinoides	emerald shiner	X		
***Notropis boops* - SE**	**bigeye shiner**	X		
Notropis dorsalis	bigmouth shiner		X	
***Notropis heterolepis* - SE**	**blacknose shiner**		X	
Notropis ludibundus	sand shiner	X	X[#]	X
Notropis rubellus	rosyface shiner	X		
Notropis volucellus	mimic shiner	X		
Phenacobius mirabilis	suckermouth minnow	X	X	X
Pimephales notatus	bluntnose minnow	X[#]	X[#]	X[#]
Pimephales promelas	fathead minnow		X	
Pimephales vigilax	bullhead minnow	X	X	
Rhinichthys atratulus	blacknose dace	X	X	
Semotilus atromaculatus	creek chub	X		X
Catostomidae				
Carpiodes carpio	river carpsucker	X		
Carpiodes cyprinus	quillback	X	X	
Carpiodes velifer	highfin carpsucker	X		
Catostomus commersoni	white sucker	X	X	
Erimyzon oblongus	creek chubsucker	X	X	X
Erimyzon sucetta	lake chubsucker	X		
Hypentelium nigricans	northern hog sucker	X	X	
Ictiobus bubalus	smallmouth buffalo		X	
Ictiobus niger	black buffalo		X	
Minytrema melanops	spotted sucker	X		X
Moxostoma anisurum	silver redhorse	X	X	
***Moxostoma carinatum* - ST**	**river redhorse**	X		
Moxostoma duquesnei	black redhorse	X		
Moxostoma erythrurum	golden redhorse	X	X	
Moxostoma macrolepidotum	shorthead redhorse	X	X	
Ictaluridae				
Ameiurus melas	black bullhead	X	X	X
Ameiurus natalis	yellow bullhead	X	X	X
Ictalurus punctatus	channel catfish	X	X	
Noturus flavus	stonecat	X	X	
Noturus gyrinus	tadpole madtom	X	X	
Noturus miurus	brindled madtom	X		X
Noturus nocturnus	freckled madtom		X	
Pylodictis olivaris	flathead catfish	X	X	
Esocidae				
Esox americanus	grass pickerel	X	X	X
Esox lucius	northern pike	X		X

Table 17. Continued

Family *Scientific Name*[2,3]	Common Name	Drainage[4] Vermilion	Sangamon	Embarras
Atherinidae				
Labidesthes sicculus	brook silverside	X	X	X
Fundulidae				
Fundulus notatus	blackstripe topminnow	X	X	X
Poeciliidae				
Gambusia affinis	mosquitofish	X		
Moronidae				
Morone mississippiensis	yellow bass		X	
Centrarchidae				
Ambloplites rupestris	rock bass	X	X	
Chaenobryttus gulosus	warmouth	X	X	
Lepomis cyanellus	green sunfish	X	X	X#
Lepomis humilis	orangespotted sunfish	X	X	X
Lepomis macrochirus	bluegill	X	X	X
Lepomis megalotis	longear sunfish	X	X	X
Lepomis microlophus	redear sunfish	X	X	X
Micropterus dolomieu	smallmouth bass	X	X	
Micropterus punctulatus	spotted bass	X		X
Micropterus salmoides	largemouth bass	X	X	
Pomoxis annularis	white crappie	X	X	
Pomoxis nigromaculatus	black crappie	X	X	
Percidae				
***Ammocrypta pellucida* - SE**	**eastern sand darter**	X		
Etheostoma asprigene	mud darter		X	X
Etheostoma blennioides	greenside darter	X#		
Etheostoma caeruleum	rainbow darter	X		X
***Etheostoma camurum* - SE**	**bluebreast darter**	X		
Etheostoma chlorosomum	bluntnose darter		X	
***Etheostoma exile* - SE**	**Iowa darter**	X		
Etheostoma flabellare	fantail darter	X	X	
Etheostoma nigrum	johnny darter	X	X#	X#
Etheostoma spectabile	orangethroat darter	X	X#	
Etheostoma zonale	banded darter	X	X	
Percina caprodes	logperch	X	X	
Percina maculata	blackside darter	X	X	X
Percina phoxocephala	slenderhead darter	X	X	
Percina sciera	dusky darter	X		
Stizostedion canadense	sauger	X		
Stizostedion vitreum	walleye		X	
Sciaenidae				
Aplodinotus grunniens	freshwater drum		X	

[1] Data from the Illinois Natural History Survey Fish Collection.
[2] Bold type indicates a state endangered species (SE) or state threatened species (ST); * = non-native species.
[3] Total number of species: Vermilion River 79; Sangamon River 62; Embarras 32.
[4] # = common species.

Table 18. Freshwater mussels recorded from the Headwaters Assessment Area, by drainage[1].

Family Sub-family *Scientific Name*[2,3]	Common Name	Drainage[4] Vermilion	Sangamon	Embarras
Unionidae				
Ambleminae				
Amblema plicata	threeridge	L	L#	D
Cyclonaias tuberculata	purple wartyback	D		
***Elliptio dilatata* - ST**	**spike**	D	L	
Fusconaia flava	Wabash pigtoe	L	L#	L
Megalonaias nervosa	washboard	D		
***Pleurobema clava* - SE, FE**	**clubshell**	D		
Pleurobema sintoxia	round pigtoe	L	L	L
***Quadrula cylindrica* - SE**	**rabbitsfoot**	D		
Quadrula metanevra	monkeyface		D	
Quadrula pustulosa	pimpleback	L	L#	L
Quadrula quadrula	mapleleaf	L		D
Tritogonia verrucosa	pistolgrip	L	L	D
Uniomerus tetralasmus	pondhorn	L	L	D
Anodontinae				
Alasmidonta marginata	elktoe	L	L	L
***Alasmidonta viridis* - SE**	**slippershell mussel**	L	L	
Anodonta suborbiculata	flat floater		L	
Anodontoides ferussacianus	cylindrical papershell	L#	L#	L#
Arcidens confragosus	rock-pocketbook		L	
Lasmigona complanata	white heelsplitter	L#	L#	L#
Lasmigona compressa	creek heelsplitter	L	L	
Lasmigona costata	flutedshell	L	L	
Pyganodon grandis	giant floater	L#	L#	L#
***Simpsonaias ambigua* - SE**	**salamander mussel**	D	D	
Strophitus undulatus	squawfoot	L	L#	
Utterbackia imbecillis	paper pondshell	D	L	L
Lampsilinae				
Actinonaias ligamentina	mucket	L		
Lampsilis cardium	plain pocketbook	L#	L#	L#
***Lampsilis fasciola* - SE**	**wavyrayed lampmussel**	L		
Lampsilis siliquoidea	fatmucket	L#	L#	L#
Lampsilis teres	yellow sandshell	D		
Leptodea fragilis	fragile papershell		L#	
Ligumia recta	black sandshell	D		
***Obovaria subrotunda* - SE**	**round hickorynut**	D		
Potamilus alatus	pink heelsplitter	D	L#	
Potamilus ohiensis	pink papershell		L	
***Ptychobranchus fasciolaris* - SE**	**kidneyshell**	D		
***Toxolasma lividus* - SE**	**purple lilliput**	D		
Toxolasma parvus	lilliput	L	L	D

Table 18. Continued

Family Sub-family *Scientific Name*[2,3]	Common Name	Drainage[4] Vermilion	Sangamon	Embarras
Truncilla donaciformis	fawnsfoot		L	
Truncilla truncata	deertoe		L#	
Venustaconcha ellipsiformis	ellipse	D	L	
***Villosa fabalis* - SE**	**rayed bean**	D		
***Villosa iris* - SE**	**rainbow**	D		
***Villosa lienosa* - SE**	**little spectaclecase**	D	D	L
Corbiculidae				
* *Corbicula fluminea*	Asian clam	L#		

[1] Data from the Illinois Natural History Survey Mollusk Collection.
[2] Bold type indicates a state endangered species (SE), state threatened species (ST), or federally endangered species (FE); * = non-native species.
[3] Total number of species: Vermilion River 38; Sangamon River 30; Embarras 16.
[4] # = common species; L = Live post-1980; D = Dead.

Table 19. Freshwater crustaceans recorded from the Headwaters Assessment Area, by drainage[1].

ORDER Family *Scientific Name*[2]	Common Name	Drainage[3] Vermilion	Sangamon	Embarras
ISOPODA (Isopods)				
Asellidae				
Caecidotea beattyi		X		
Caecidotea forbesi		X		X
Caecidotea intermedia		X		
Caecidotea kendeighi		X	X	
Lirceus sp.		X	X	
AMPHIPODA (Amphipods)				
Crangonyctidae				
Bactrurus mucronatus		X		
Crangonyx gracilis		X		
Crangonyx minor		X	X	X
Hyalellidae				
Hyalella azteca		X		
DECAPODA (Crayfishes & shrimps)				
Cambaridae				
Procambarus acutus	White River crawfish	X	X	X#
Procambarus gracilis	prairie crayfish	X	X	X
Orconectes immunis	calico crayfish	X	X	
Orconectes propinquus	clearwater crayfish	X#		
Orconectes virilis	virile crayfish	X#	X	X#
Cambarus diogenes	devil crawfish	X#	X	X#
Fallicambarus fodiens			X	

[1] Data from the Illinois Natural History Survey Crustacean Collection.
[2] Total number of species = Vermilion River 15; Sangamon River 9; Embarras 6.
[3] # = common species.

Table 20. Freshwater fishes recorded for the Headwaters Assessment Area[1].

Family *Scientific Name*[2,3]	Common Name	Headwaters	Creeks	Small Rivers	Medium Rivers	Standing Water
Petromyzontidae						
Ichthyomyzon unicuspis	silver lamprey				X	
Lepisosteidae						
Lepisosteus osseus	longnose gar				X	
Anguillidae						
Anguilla rostrata	American eel				X	
Clupeidae						
Dorosoma cepedianum	gizzard shad			X	X	X
Cyprinidae						
Campostoma anomalum	central stoneroller	X	X	X		
Campostoma oligolepis	largescale stoneroller		X	X		
Cyprinella lutrensis	red shiner		X	X	X	
Cyprinella spiloptera	spotfin shiner		X	X	X	
Cyprinella whipplei	steelcolor shiner		X	X	X	
* *Cyprinus carpio*	common carp			X	X	X
Ericymba buccata	silverjaw minnow		X	X	X	
Hybognathus nuchalis	Mississippi silvery minnow	X	X	X		
***Hybopsis amblops* - SE**	**bigeye chub**			X	X	
***Hybopsis amnis* - SE**	**pallid shiner**			X	X	
Luxilus chrysocephalus	striped shiner	X	X	X	X	
Lythrurus fumeus	ribbon shiner		X	X		
Lythrurus umbratilis	redfin shiner		X	X	X	
Macrhybopsis storeriana	silver chub				X	
Nocomis biguttatus	hornyhead chub		X	X		
Notemigonus crysoleucas	golden shiner			X	X	X
Notropis atherinoides	emerald shiner				X	
***Notropis boops* - SE**	**bigeye shiner**		X	X		
Notropis dorsalis	bigmouth shiner		X	X	X	
***Notropis heterolepis* - SE**	**blacknose shiner**		X	X		
Notropis ludibundus	sand shiner		X	X	X	
Notropis rubellus	rosyface shiner		X	X	X	
Notropis volucellus	mimic shiner				X	
Phenacobius mirabilis	suckermouth minnow		X	X	X	
Pimephales notatus	bluntnose minnow	X	X	X	X	
Pimephales promelas	fathead minnow		X	X		
Pimephales vigilax	bullhead minnow			X	X	
Rhinichthys atratulus	blacknose dace	X	X			
Semotilus atromaculatus	creek chub	X	X			
Catostomidae						
Carpiodes carpio	river carpsucker			X	X	
Carpiodes cyprinus	quillback		X	X	X	
Carpiodes velifer	highfin carpsucker			X	X	
Catostomus commersoni	white sucker		X	X	X	
Erimyzon oblongus	creek chubsucker	X	X	X		

Table 20. Continued

Family *Scientific Name*[2,3]	Common Name	Headwaters	Creeks	Small Rivers	Medium Rivers	Standing Water
Erimyzon sucetta	lake chubsucker		X			X
Hypentelium nigricans	northern hog sucker		X	X	X	
Ictiobus bubalus	smallmouth buffalo				X	
Ictiobus niger	black buffalo				X	
Minytrema melanops	spotted sucker		X	X		
Moxostoma anisurum	silver redhorse			X	X	
***Moxostoma carinatum* - ST**	**river redhorse**			X		
Moxostoma duquesnei	black redhorse		X	X	X	
Moxostoma erythrurum	golden redhorse		X	X	X	
Moxostoma macrolepidotum	shorthead redhorse			X	X	
Ictaluridae						
Ameiurus melas	black bullhead		X	X	X	X
Ameiurus natalis	yellow bullhead		X	X	X	X
Ictalurus punctatus	channel catfish			X	X	X
Noturus flavus	stonecat		X	X		
Noturus gyrinus	tadpole madtom		X	X		
Noturus miurus	brindled madtom		X	X	X	
Noturus nocturnus	freckled madtom		X	X		
Pylodictis olivaris	flathead catfish			X	X	X
Esocidae						
Esox americanus	grass pickerel	X	X	X		X
Esox lucius	northern pike			X	X	X
Atherinidae						
Labidesthes sicculus	brook silverside			X	X	X
Fundulidae						
Fundulus notatus	blackstripe topminnow		X	X	X	
Poeciliidae						
Gambusia affinis	mosquitofish	X	X			X
Moronidae						
Morone mississippiensis	yellow bass		X	X	X	X
Centrarchidae						
Ambloplites rupestris	rock bass		X	X	X	
Chaenobryttus gulosus	warmouth		X	X	X	X
Lepomis cyanellus	green sunfish		X	X	X	X
Lepomis humilis	orangespotted sunfish		X	X	X	
Lepomis macrochirus	bluegill		X	X	X	X
Lepomis megalotis	longear sunfish		X	X	X	
Lepomis microlophus	redear sunfish		X	X	X	X
Micropterus dolomieu	smallmouth bass		X	X	X	X
Micropterus punctulatus	spotted bass		X	X	X	
Micropterus salmoides	largemouth bass		X	X	X	X
Pomoxis annularis	white crappie		X	X	X	X
Pomoxis nigromaculatus	black crappie		X	X	X	X

Table 20. Continued

Family *Scientific Name*[2,3]	Common Name	Headwaters	Creeks	Small Rivers	Medium Rivers	Standing Water
Percidae						
***Ammocrypta pellucida* - SE**	**eastern sand darter**			X	X	
Etheostoma asprigene	mud darter		X	X	X	
Etheostoma blennioides	greenside darter	X	X	X	X	
Etheostoma caeruleum	rainbow darter	X	X	X	X	
***Etheostoma camurum* - SE**	**bluebreast darter**		X			
Etheostoma chlorosomum	bluntnose darter		X	X	X	
***Etheostoma exile* - SE**	**Iowa darter**	X	X			X
Etheostoma flabellare	fantail darter	X	X	X		
Etheostoma nigrum	johnny darter	X	X	X	X	
Etheostoma spectabile	orangethroat darter	X	X	X		
Etheostoma zonale	banded darter		X	X	X	
Percina caprodes	logperch		X	X	X	
Percina maculata	blackside darter	X	X	X	X	
Percina phoxocephala	slenderhead darter		X	X	X	
Percina sciera	dusky darter		X	X	X	
Stizostedion canadense	sauger			X	X	
Stizostedion vitreum	walleye			X	X	
Sciaenidae						
Aplodinotus grunniens	freshwater drum			X	X	

[1] Data from the Illinois Natural History Survey Fish Collection.
[2] Bold type indicates a state endangered species (SE) or state threatened species (ST); * = non-native species.
[3] Total number of species = 92 (91 native, 1 introduced).

Table 21. Freshwater mussels recorded from the Headwaters Assessment Area[1].

Family Sub-family *Scientific Name*[2,3]	Common Name	Headwaters & Creeks	Small Rivers	Medium Rivers	Standing Water
Unionidae					
Ambleminae					
Amblema plicata	threeridge		X	X	
Cyclonaias tuberculata	purple wartyback			X	
***Elliptio dilatata* - ST**	**spike**		X	X	
Fusconaia flava	Wabash pigtoe		X	X	
Megalonaias nervosa	washboard			X	
***Pleurobema clava* - SE, FE**	**clubshell**		X	X	
Pleurobema sintoxia	round pigtoe		X	X	
***Quadrula cylindrica* - SE**	**rabbitsfoot**		X	X	
Quadrula metanevra	monkeyface			X	
Quadrula pustulosa	pimpleback		X	X	
Quadrula quadrula	mapleleaf		X	X	

Table 21. Continued

Family Sub-family *Scientific Name*[2,3]	Common Name	Headwaters & Creeks	Small Rivers	Medium Rivers	Standing Water
Tritogonia verrucosa	pistolgrip		X	X	
Uniomerus tetralasmus	pondhorn	X	X		X
Anodontinae					
Alasmidonta marginata	elktoe		X	X	
***Alasmidonta viridis* - SE**	**slippershell mussel**	X	X		
Anodonta suborbiculata	flat floater				X
Anodontoides ferussacianus	cylindrical papershell	X	X		X
Arcidens confragosus	rock-pocketbook			X	
Lasmigona complanata	white heelsplitter	X	X	X	X
Lasmigona compressa	creek heelsplitter	X	X		
Lasmigona costata	flutedshell		X	X	
Pyganodon grandis	giant floater	X	X	X	X
***Simpsonaias ambigua* - SE**	**salamander mussel**		X	X	
Strophitus undulatus	squawfoot		X	X	X
Utterbackia imbecillis	paper pondshell		X	X	X
Lampsilinae					
Actinonaias ligamentina	mucket		X	X	
Lampsilis cardium	plain pocketbook		X	X	
***Lampsilis fasciola* - SE**	**wavyrayed lampmussel**		X	X	
Lampsilis siliquoidea	fatmucket		X	X	X
Lampsilis teres	yellow sandshell		X	X	
Leptodea fragilis	fragile papershell		X	X	
Ligumia recta	black sandshell			X	
***Obovaria subrotunda* - SE**	**round hickorynut**		X	X	
Potamilus alatus	pink heelsplitter		X	X	
Potamilus ohiensis	pink papershell		X	X	
***Ptychobranchus fasciolaris* - SE**	**kidneyshell**			X	
***Toxolasma lividus* - SE**	**purple lilliput**		X	X	
Toxolasma parvus	lilliput	X	X	X	X
Truncilla donaciformis	fawnsfoot			X	
Truncilla truncata	deertoe			X	
Venustaconcha ellipsiformis	ellipse		X	X	
***Villosa fabalis* - SE**	**rayed bean**		X	X	
***Villosa iris* - SE**	**rainbow**		X	X	
***Villosa lienosa* - SE**	**little spectaclecase**		X	X	
Corbiculidae					
* *Corbicula fluminea*	Asian clam	X	X	X	X

[1] Data from the Illinois Natural History Survey Mollusk Collection.

[2] Bold type indicates a state endangered species (SE), state threatened species (ST), or federally endangered species (FE); * = non-native species.

[3] Total number of species = 45 (44 native, 1 introduced).

Table 22. Freshwater crustaceans recorded from the Headwaters Assessment Area[1].

ORDER Family *Scientific Name*[2]	Common Name	Headwaters	Creeks	Small Rivers	Medium Rivers	Standing Water
ISOPODA (Isopods)						
Asellidae						
Caecidotea beattyi		Springs				
Caecidotea forbesi						X
Caecidotea intermedia		X	X	X	X	
Caecidotea kendeighi		Springs				
Lirceus sp.		X	X			
AMPHIPODA (Amphipods)						
Crangonyctidae						
Bactrurus mucronatus		Springs				
Crangonyx gracilis						X
Crangonyx minor		Springs				
Hyalellidae						
Hyalella azteca		X	X	X	X	X
DECAPODA (Crayfishes & shrimps)						
Cambaridae						
Procambarus acutus	White River crawfish		X	X	X	X
Procambarus gracilis	prairie crayfish			burrower		
Orconectes immunis	calico crayfish	X	X	X	X	X
Orconectes propinquus	clearwater crayfish		X	X	X	
Orconectes virilis	virile crayfish		X	X	X	X
Cambarus diogenes	devil crawfish			burrower		
Fallicambarus fodiens						X

[1] Data from the Illinois Natural History Survey Crustacean Collection.
[2] Total number of species = 16.

Table 23. Freshwater fishes recorded from the Headwaters Assessment Area, by habitat[1].

Family *Scientific Name*[2,3]	Common Name	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
Petromyzontidae						
Ichthyomyzon unicuspis	silver lamprey		X	X		
Lepisosteidae						
Lepisosteus platostomus	shortnose gar		X		X	X
Anguillidae						
Anguilla rostrata	American eel		X	X		
Clupeidae						
Dorosoma cepedianum	gizzard shad		X			X
Cyprinidae						
Campostoma anomalum	central stoneroller	X	X			
Campostoma oligolepis	largescale stoneroller	X	X			
Cyprinella lutrensis	red shiner		X	X		
Cyprinella spiloptera	spotfin shiner		X	X		
Cyprinella whipplei	steelcolor shiner		X	X		

Table 23. Continued

Family *Scientific Name*[2,3]	Common Name	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
* *Cyprinus carpio*	common carp			X	X	
Ericymba buccata	silverjaw minnow		X	X		
Hybognathus nuchalis	Mississippi silvery minnow		X	X		
***Hybopsis amblops* - SE**	**bigeye chub**		X	X		
***Hybopsis amnis* - SE**	**pallid shiner**			X		
Luxilus chrysocephalus	striped shiner		X	X		
Lythrurus fumeus	ribbon shiner			X		
Lythrurus umbratilis	redfin shiner		X	X		
Macrhybopsis storeriana	silver chub			X		
Nocomis biguttatus	hornyhead chub		X	X		
Notemigonus crysoleucas	golden shiner			X	X	X
Notropis atherinoides	emerald shiner			X		
***Notropis boops* - SE**	**bigeye shiner**			X		
Notropis dorsalis	bigmouth shiner		X	X		
***Notropis heterolepis* - SE**	**blacknose shiner**			X		
Notropis ludibundus	sand shiner		X	X		
Notropis rubellus	rosyface shiner		X	X		X
Notropis volucellus	mimic shiner		X	X		
Phenacobius mirabilis	suckermouth minnow	X	X			
Pimephales notatus	bluntnose minnow		X	X		
Pimephales promelas	fathead minnow			X		
Pimephales vigilax	bullhead minnow		X	X		
Rhinichthys atratulus	blacknose dace	X	X			
Semotilus atromaculatus	creek chub			X		
Catostomidae						
Carpiodes carpio	river carpsucker		X	X		
Carpiodes cyprinus	quillback		X	X		
Carpiodes velifer	highfin carpsucker		X	X		
Catostomus commersoni	white sucker		X	X		
Erimyzon oblongus	creek chubsucker		X	X		
Erimyzon sucetta	lake chubsucker			X		
Hypentelium nigricans	northern hog sucker	X	X			
Ictiobus bubalus	smallmouth buffalo			X		
Ictiobus niger	black buffalo			X		
Minytrema melanops	spotted sucker			X		
Moxostoma anisurum	silver redhorse		X	X		
***Moxostoma carinatum* - ST**	**river redhorse**	X	X			
Moxostoma duquesnei	black redhorse		X	X		
Moxostoma erythrurum	golden redhorse		X	X		
Moxostoma macrolepidotum	shorthead redhorse		X	X		
Ictaluridae						
Ameiurus melas	black bullhead			X	X	
Ameiurus natalis	yellow bullhead			X	X	
Ictalurus punctatus	channel catfish		X	X	X	
Noturus flavus	stonecat	X				
Noturus gyrinus	tadpole madtom		X	X		
Noturus miurus	brindled madtom	X				
Noturus nocturnus	freckled madtom		X	X		
Pylodictis olivaris	flathead catfish			X	X	

Table 23. Continued

Family *Scientific Name*[2,3]	Common Name	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
Esocidae						
Esox americanus	grass pickerel			X	X	
Esox lucius	northern pike			X	X	
Atherinidae						
Labidesthes sicculus	brook silverside			X	X	X
Fundulidae						
Fundulus notatus	blackstripe topminnow			X		
Poeciliidae						
Gambusia affinis	mosquitofish			X	X	
Moronidae						
Morone mississippiensis	yellow bass			X	X	
Centrarchidae						
Ambloplites rupestris	rock bass			X		
Chaenobryttus gulosus	warmouth			X	X	
Lepomis cyanellus	green sunfish			X		X
Lepomis humilis	orangespotted sunfish			X		
Lepomis macrochirus	bluegill			X	X	
Lepomis megalotis	longear sunfish			X		
Lepomis microlophus	redear sunfish			X	X	
Micropterus dolomieu	smallmouth bass			X	X	X
Micropterus punctulatus	spotted bass		X	X		
Micropterus salmoides	largemouth bass			X	X	X
Pomoxis annularis	white crappie			X	X	X
Pomoxis nigromaculatus	black crappie			X	X	X
Percidae						
***Ammocrypta pellucida* - SE**	**eastern sand darter**		X			
Etheostoma asprigene	mud darter	X		X		
Etheostoma blennioides	greenside darter	X				
Etheostoma caeruleum	rainbow darter	X				
***Etheostoma camurum* - SE**	**bluebreast darter**					
Etheostoma chlorosomum	bluntnose darter			X	X	
***Etheostoma exile* - SE**	**Iowa darter**			X	X	
Etheostoma flabellare	fantail darter	X				
Etheostoma nigrum	johnny darter		X	X		
Etheostoma spectabile	orangethroat darter	X		X		
Etheostoma zonale	banded darter	X				
Percina caprodes	logperch		X	X		
Percina maculata	blackside darter			X		
Percina phoxocephala	slenderhead darter	X	X			
Percina sciera	dusky darter	X	X			
Stizostedion canadense	sauger			X		
Stizostedion vitreum	walleye			X		
Sciaenidae						
Aplodinotus grunniens	freshwater drum			X		

[1] Data from the Illinois Natural History Survey Fish Collection.

[2] Bold type indicates a state endangered species (SE) or state threatened species (ST); * = non-native species.

[3] Total number of species = 92 (91 native, 1 introduced).

Table 24. Freshwater mussels recorded from the Headwaters Assessment Area, by habitat[1].

Family Sub-family *Scientific Name*[2,3]	Common Name	Streams			Standing Water
		Riffles	Runs	Pools	Littoral Zone
Unionidae					
Ambleminae					
Amblema plicata	threeridge		X	X	
Cyclonaias tuberculata	purple wartyback			X	
***Elliptio dilatata* - ST**	**spike**		X	X	
Fusconaia flava	Wabash pigtoe		X	X	
Megalonaias nervosa	washboard			X	
***Pleurobema clava* - SE, FE**	**clubshell**		X	X	
Pleurobema sintoxia	round pigtoe		X	X	
***Quadrula cylindrica* - SE**	**rabbitsfoot**		X	X	
Quadrula metanevra	monkeyface			X	
Quadrula pustulosa	pimpleback		X	X	
Quadrula quadrula	mapleleaf		X	X	
Tritogonia verrucosa	pistolgrip		X	X	
Uniomerus tetralasmus	pondhorn	X	X		X
Anodontinae					
Alasmidonta marginata	elktoe		X	X	
***Alasmidonta viridis* - SE**	**slippershell mussel**	X	X		
Anodonta suborbiculata	flat floater				X
Anodontoides ferussacianus	cylindrical papershell	X	X		X
Arcidens confragosus	rock-pocketbook			X	
Lasmigona complanata	white heelsplitter	X	X	X	X
Lasmigona compressa	creek heelsplitter	X	X		
Lasmigona costata	flutedshell		X	X	
Pyganodon grandis	giant floater	X	X	X	X
***Simpsonaias ambigua* - SE**	**salamander mussel**		X	X	
Strophitus undulatus	squawfoot		X	X	X
Utterbackia imbecillis	paper pondshell		X	X	X
Lampsilinae					
Actinonaias ligamentina	mucket		X	X	
Lampsilis cardium	plain pocketbook		X	X	
***Lampsilis fasciola* - SE**	**wavyrayed lampmussel**		X	X	
Lampsilis siliquoidea	fatmucket		X	X	X
Lampsilis teres	yellow sandshell		X	X	
Leptodea fragilis	fragile papershell		X	X	
Ligumia recta	black sandshell			X	
***Obovaria subrotunda* - SE**	**round hickorynut**		X	X	
Potamilus alatus	pink heelsplitter		X	X	
Potamilus ohiensis	pink papershell		X	X	
***Ptychobranchus fasciolaris* - SE**	**kidneyshell**			X	
***Toxolasma lividus* - SE**	**purple lilliput**		X	X	
Toxolasma parvus	lilliput	X	X	X	X

Table 24. Continued

Family / Sub-family / *Scientific Name*[2,3]	Common Name	Streams: Riffles	Streams: Runs	Streams: Pools	Standing Water: Littoral Zone
Truncilla donaciformis	fawnsfoot			X	
Truncilla truncata	deertoe			X	
Venustaconcha ellipsiformis	ellipse		X	X	
***Villosa fabalis* - SE**	**rayed bean**		X	X	
***Villosa iris* - SE**	**rainbow**		X	X	
***Villosa lienosa* - SE**	**little spectaclecase**		X	X	
Corbiculidae					
* *Corbicula fluminea*	Asian clam	X	X	X	X

[1] Data from the Illinois Natural History Survey Mollusk Collection.
[2] Bold type indicates a state endangered species (SE), state threatened species (ST), or federally endangered species (FE); * = non-native species.
[3] Total number of species = 45 (44 native, 1 introduced).

Table 25. Freshwater crustaceans recorded from the Headwater Assessment Area, by habitat[1].

ORDER / Family / *Scientific Name*[2]	Common Name	Streams: Riffles	Streams: Runs	Streams: Pools	Standing Water: Littoral	Standing Water: Open Water
ISOPODA (Isopods)						
Asellidae						
Caecidotea beattyi		Springs				
Caecidotea forbesi					X	
Caecidotea intermedia		X		X		
Caecidotea kendeighi		Springs				
Lirceus sp.		X	X			
AMPHIPODA (Amphipods)						
Crangonyctidae						
Bactrurus mucronatus		Springs				
Crangonyx gracilis				X	X	
Crangonyx minor		Springs				
Hyalellidae						
Hyalella azteca		X	X	X	X	
DECAPODA (Crayfishes & shrimps)						
Cambaridae						
Procambarus acutus	White River crawfish			X	X	
Procambarus gracilis	prairie crayfish			burrower		
Orconectes immunis	calico crayfish			X	X	
Orconectes propinquus	clearwater crayfish	X				
Orconectes virilis	virile crayfish	X	X		X	
Cambarus diogenes	devil crawfish			burrower		
Fallicambarus fodiens						

[1] Data from the Illinois Natural History Survey Crustacean Collection.
[2] Total number of species = 16.

Table 26. Aquatic macroinvertebrates, exclusive of the Crustacea and unionoidean Mollusca, recorded from the Headwaters Assessment Area[1].

Phylum NEMATODA - Nematode Worms
(species indeterminate)

Phylum NEMATOMORPHA - Horsehair Worms
Parachordodidae
Gordius sp.
Paragordius sp.

Phylum BRYOZOA - Moss Animacules
Phylactolaemata
Plumatellidae
(species indeterminate)

Phylum TURBELLARIA - Flatworms
Tricladida
Planariidae
Dugesia tigrina

Phylum ANNELIDA - Segmented Worms
Class APHANONEURA - Suction-Feeding Worms
Aeolosomatida
Aeolosomatidae
Aeolosoma hemprichi
Aeolosoma variegatum
Class BRANCHIOBDELLAE - Crayfish Worms
Branchiobdellida
Cambarincolidae
(species indeterminate)
Class OLIGOCHAETA - Oligochaete Worms
Haplotaxida
Haplotaxidae
Haplotaxis gordioides
Lumbriculida
Lumbriculidae
(species indeterminate)
Tubificida
Enchytraeidae
(species indeterminate)
Naididae
Chaetogaster diaphanus
Chaetogaster diastrophus
Chaetogaster limnaei
Dero digitata
Dero nivea
Dero furcata
Nais communis
Nais pardalis
Nais simplex
Nais variabilis
Ophidonais serpentina
Paranais frici
Pristina breviseta
Pristina leidyi
Pristinella osborni
Slavina appendiculata
Stylaria lacustris
Tubificidae
Aulodrilus pigueti
Branchiura sowerbyi
Ilyodrilus templetoni
Limnodrilus cervix
Limnodrilus claparedianus
Limnodrilus hoffmeisteri
Tubifex tubifex
Lumbricidae
Eisenia foetida
Class HIRUDINEA - Leeches
Rhynchobdellida
Glossiphoniidae
Helobdella triserialis
Helobdella stagnalis
Placobdella multilineata
Placobdella ornata
Placobdella parasitica
Placobdella papillifera
Gnathobdellida
Hirudinidae
Haemopis marmorata
Haemopis terrestris
Pharyngobdellida
Erpobdellidae
Erpobdella punctata

Phylum ARTHROPODA - Arthropods
Class ARACHNIDA
Hydrachnida - Aquatic Mites
(species indeterminate)

Table 26. Continued

Class INSECTA - Insects
Ephemeroptera - Mayflies
Baetidae
Acerpenna harti
Baetis armillatus
Baetis dubius
Baetis flavistriga
Baetis intercalaris
Baetis punctiventris
Baetis veteris
Callibaetis fluctuans
Cloeon cognatum
Labiobaetis frondalis
Labiobaetis propinquus
Procloeon rubropictum
Procloeon rufostrigatum
Procloeon walshi
Baetiscidae
Baetisca lacustris
Caenidae
Amercaenis ridens
Caenis amica
Caenis hilaris
Caenis latipennis
Ephemerellidae
Seratella frisoni
Timpanoga lita
Ephemeridae
Ephemera simulans
Hexagenia limbata
Hexagenia rigida
Pentagenia vittigera
Heptageniidae
Heptagenia diabasia
Leucrocuta hebe
Leucrocuta maculipennis
Nixe inconspicua
Nixe perfida
Stenacron interpunctatum
Stenonema femoratum
Stenonema mediopunctatum
Stenonema mexicanum integrum
Stenonema modestum
Stenonema pulchellum
Stenonema terminatum
Isonychiidae
Isonychia bicolor
Isonychia rufa
Isonychia sicca
Leptophlebiidae
Leptophlebia cupida
Leptophlebia nebulosa
Paraleptophlebia ontario
Paraleptophlebia praepedita
Polymitarcidae
Ephoron leukon
Tortopus primus
Potamanthidae
Anthopotamus myops
Anthopotamus verticis
Odonata - Damselflies and Dragonflies
Zygoptera - Damselflies
Calopterygidae
Calopteryx maculata
Hetaerina americana
Coenagrionidae
Anomolagrion hastusm
Argia apicalis
Argia fumipennis violacea
Argia moesta
Argia sedula
Argia tibialis
Enallagma antennatum
Enallagma aspersum
Enallagma basidens
Enallagma carumculatum
Enallagma civile
Enallagma exsulans
Enallagma geminatum
Enallagma signatum
Enallagma vesperum
Ischnura posita
Ischnura verticalis
Lestidae
Archilestes grandis
Lestes disjunctus
Lestes dryas
Lestes rectangularis
Lestes unguiculatus
Anisoptera - Dragonflies
Aeshnidae
Aeshna constricta
Aeshna umbrosa
Anax junius

Table 26. Continued

Boyeria vinosa
Epiaeschna heros
Nasiaeschna pentacantha
Cordulegasteridae
Cordulegaster obliquus
Corduliidae
Epitheca princeps
Gomphidae
Gomphus fraternus
Gomphus graslinellus
Gomphus vastus
Hagenius brevistylus
Ophigomphus repinsulensis
Progomphus obscurus
Libellulidae
Celithemis elisa
Celithemis eponina
Celithemis verna
Erythemis simplicicollis
Erythrodiplax connata
Libellula luctuosa
Libellula lydia
Libellula pulchella
Libellula semifasciata
Pachydiplax longipennis
Pantala flavescens
Pantala hymenaea
Perithemis tenera
Sympetrum ambiguum
Sympetrum internum
Sympetrum obtrusum
Sympetrum rubicundulum
Sympetrum semicinctum
Sympetrum vincinum
Tramea lacerata
Macromiidae
Didymops transversa
Macromia georgina
Petaluridae
Tachopteryx thoreyi

Plecoptera - Stoneflies

Capniidae
Allocapnia granulata
Allocapnia mystica
Allocapnia recta
Allocapnia vivipara
Leuctridae
Zealeuctra narfi
Nemouridae
Amphinemura varshava
Perlidae
Acroneuria abnormis
Acroneuria arida
Acroneuria evoluta
Acroneuria filicis
Acroneuria frisoni
Acroneuria internata
Agnetina flavescens
Attaneuria ruralis
Neoperla catharae
Neoperla clymene
Neoperla osage
Neoperla stewarti
Perlinella drymo
Perlinella ephyre
Perlodidae
Clioperla clio
Hydroperla crosbyi
Isoperla bilineata
Isoperla nana
Pteronarcyidae
Pteronarcys pictetii
Taeniopterygidae
Strophopteryx fasciata
Taeniopteryx burksi
Taeniopteryx nivalis

Heteroptera - True Bugs

Belostomidae
Belostoma flumineum
Belostoma lutarium
Benacus griseus
Lethocerus americanus
Lethocerus uhleri
Corixidae - Water Boatmen
Hesperocorixa nitida
Hesperocorixa obliqua
Hesperocorixa vulgaris
Palmocorixa buenoi
Palmocorixa gillettei
Ramphocorixa acuminata
Sigara alternata
Sigara grossolineata
Sigara hubbelli

Table 26. Continued

Sigara modesta
Trichocorixa calva
Trichocorixa kanza
Trichocorixa naias
Gerridae - Pond Skaters
Aquarius remigis
Rheumatobates tenuipes
Hebridae - Velvet Water Bugs
Merragata hebroides
Mesoveliidae - Water Treaders
Mesovelia mulsanti
Nepidae - Water Scorpions
Nepa apiculata
Ranatra australis
Ranatra buenoi
Ranatra fusca
Ranatra nigra
Notonectidae - Backswimmers
Buenoa margaratacea
Buenoa scimitra
Notonecta irrorata
Notonecta raleighi
Notonecta undulata
Pleidae
Neoplea striola
Veliidae - Little Water Striders
Microvelia americana
Rhagovelia oriander

Coleoptera - Beetles

Dryopidae
Helicus lithophilus
Dytiscidae
Agabus sp.
Acilius semisculcatus
Celina angustata
Copelatus glyphicus
Copelatus chevrolati
Cybister fimbriolatus
Desmopachria convexa
Graphoderes librus
Hydroporus sericus
Hygrotus laccophilinus
Hygrotus nubilus
Laccophilus maculosus
Laccophilus proximus
Laccophilus fasciatus
Matus ovatus
Coptotomus venustus
Coptotomus lenticus
Coptotomus loticus
Uvarus lacustris
Thermonectes ornaticollis
Thermonectes basilaris
Elmidae
Ancyronix variegatus
Dubiraphia minuta
Dubiraphia quadrinotata
Macronychus glabratus
Stenelmis sexlineata
Stenelmis vittipennis
Gyrinidae
Dineutus assimilus
Dineutus horni
Haliplidae
Peltodytes duodecimpunctatus
Peltodytes edentulus
Peltodytes lengi
Peltodytes litoralis
Peltodytes muticus
Peltodytes pedunculatus
Peltodytes sexmaculatus
Haliplus borealis
Haliplus connexus
Haliplus faciatus
Haliplus connexus
Haliplus ohiensis
Haliplus pantherinus
Haliplus tortilipenis
Haliplus triopsis
Haliplus variomaculatus
Helodidae
Cyphon sp.
Prionocyphon discoideus
Hydrophilidae
Berosus aculeatus
Berosus infuscatus
Berosus pantherinus
Berosus peregrinus
Berosus striatus
Chaetarthria atra
Chaetarthria pallida
Cymbiodyta acuminata
Cymbiodyta fimbriata
Dibolocelus ovatus

Table 26. Continued

Enochrus cintus
Enochrus ochraceus
Enochrus pygmaeus
Enochrus sayi
Helophorus sp.
Hydrobius fuscipes
Hydrochara obtusata
Hydrochus neosquamifer
Hydrochus scabratus
Hydrochus squamifer
Hydrophilus triangularis
Laccobius agilis
Paracymus confusus
Paracymus subcupreus
Sperchopsis tesselatus
Tropisternus blatchleyi modestus
Tropisternus collaris striolatus
Tropisternus glaber
Tripisternus lateralis nimbatus
Tropisternus natator
Hydraenidae
Hydraena pennsylvanica
Noteridae
Hydrocanthus iricolor
Scirtidae
Cyphon sp.
Scirtes sp.

Trichoptera - Caddisflies

Helichopsychidae
Helicopsyche borealis
Glossosomatidae
Protoptila lega
Protoptila maculata
Hydropsychidae
Ceratopsyche cheilonis
Cheumatopsyche aphanta
Cheumatopsyche campyla
Cheumatopsyche pettiti
Cheumatopsyche speciosa
Diplectrona modesta
Hydropsyche bidens
Hydropsyche frisoni
Hydropsyche incommoda
Hydropsyche orris
Hydropsyche simulans
Potamyia flava
Hydroptilidae
Hydroptila ajax
Hydroptila angusta Ross
Hydroptila armata
Hydroptila consimilis
Hydroptila grandiosa
Hydroptila hamata
Hydroptila perdita
Hydroptila spatulata
Ithytrichia clavata
Mayatrichia ayama
Neotrichia minutisimella
Neotrichia vibrans
Neotrichia falca
Orthotrichia cristata
Ochrotrichia tarsalis
Ochrotrichia xena
Glossosomatidae
Protoptila lega
Protoptila maculata
Ceraclea alagmua
Ceraclea tarsipunctata
Ceraclea transversus
Leptoceridae
Ceraclea alagmua
Ceraclea tarsipunctata
Ceraclea transversus
Leptocerus americanus
Nectopsyche candida
Oecetis avara
Oecetis cinerascens
Oecetis inconspicua
Triaenodes abus
Triaenodes injusta
Triaenodes tardus
Limnophilidae
Anabolia consocius
Hesperophylax designatus
Ironoquia lyratus
Limnephilus submonilifer
Pycnopsyche subfasciata
Molannidae
Molanna blenda
Molanna uniophila
Philopotamidae
Chimarra obscura

Table 26. Continued

Phryganeidae
Agrypnia vestitax
Banksiola crotchi
Phryganea sayi
Ptilostomis ocellifera
Ptilostomis semifasciata
Polycentropodidae
Cernotina calcea
Cyrnellus fraternus
Neureclipsis bimaculatus
Neureclipsis crepuscularis
Nyctiophylax vestitus
Polycentropus cinereus
Polycentropus crassicornis
Polycentropus flavus
Polycentropus interruptus
Rhyacophilidae
Rhyacophila fenestra
Rhyacophila lobifera
Uenoidae
Neophylax concinnus

Diptera - Flies

Ceratopogonidae
Ceratopogoninae
Alluaudomyia bella
Bezzia apicata
Bezzia dentata
Bezzia glabra
Bezzia opaca
Bezzia setulosa
Clinohelea bimaculata
Culicoides haematopotus
Culicoides multipunctatus
Culicoides sanguisuga
Culicoides stellifer
Culicoides variipennis
Jenkinshelea albaria
Johannsenomyia argentata
Mallochohelea caudelli
Nilobezzia schwarzi
Palpomyia flavipes
Palpomyia hirta
Palpomyia opacithorax
Palpomyia subasper
Palpomyia trivialis
Parabezzia petiolata
Probezzia pallida
Probezzia xanthogaster
Stilobezzia antennalis
Stilobezzia coquilletti
Stilobezzia pallidiventris
Forcipomyiinae
Atrichopogon fusculus
Atrichopogon fusinervis
Atrichopogon levis
Atrichopogon peregrinus
Forcipomyia brevipennis
Forcipomyia cilipes
Forcipomyia concolor
Forcipomyia elegantula
Forcipomyia hirtipennis
Forcipomyia longitarsis
Forcipomyia pergandei
Forcipomyia pilosa
Forcipomyia squamipes
Dasyheleinae
Dasyhelea major
Dasyhelea mutabilis
Chaoboridae
Chaoborus punctipennis
Chironomidae
Tanypodinae
Ablabesmyia monilis
Alotanypus venusta
Coelotanypus concinnus
Conchapelopia rurika
Larsia decolorata
Labrundinia pilosella
Macropelopia decedens
Procladius bellus
Procladius culiciformis
Psectrotanypus dyari
Tanypus stellatus
Diamesinae
Diamesa nivoriunda
Orthocladinae
Bryophaenocladius flavoscutellatus
Bryophaenocladius pleuralis
Camptocladius flavibasis
Camptocladius stercoraria
Chasmatonotus bimaculatus
Corynoneura celeripes
Corynoneura similis
Cricotopus bicinctus

Table 26. Continued

Cricotopus trifasciatus
Epoicocladius flavens
Eukiefferiella brevinervis
Hydrobaenus johannseni
Hydrobaenus pilipes
Parametriocnemus lundbecki
Rheocricotopus effusus
Smittia lasiops
Chironominae
Chironomus attenuatus
Chironomus harti
Chironomus plumosus
Chironomus riparius
Cryptochironomus fulvus
Dicrotendipes fumidus
Dicrotendipes modestus
Dicrotendipes neomodestus
Dicrotendipes nervosus
Gillotia alboviridis
Glyptotendipes lobiferus
Lauterborniella perpulcher
Lauterborniella varipennis
Micropsectra nigripilus
Micropsectra polita
Parachironomus abortivus
Parachironomus tenuicaudatus
Paratendipes subaequalis
Polypedilum apicatum
Polypedilum convictum
Polypedilium halterale
Polypedilum scalaenum
Pseudochironomus pseudoviridis
Stenochironomus hilaris
Stictochironomus devinctus
Stictochironomus flavicingula
Tanytarsus confusus
Tanytarsus muticus
Tribelos jucundus
Xenochironomus festivus
Culicidae
Anopheles sp.
Culex sp.
Empididae
(species indeterminate)
Ephydridae
(species indeterminate)
Psychodidae
(species indeterminate)
Simuliidae
Simulium spp.
Stratiomyidae
(species indeterminate)
Tabanidae
(species indeterminate)
Tipulidae
Erioptera sp.
Limonia sp.
Tipula sp.

Phylum MOLLUSCA - Mollusks (not including Unionidae)
Gastropoda - Snails
Ancylidae
Ferrissia sp.
Hydrobiidae
Limnaeidae
Fossaria sp.
Stagnicola sp.
Physidae
Physa sp.
Pelecypoda - Bivalve Mollusks
Sphaeriidae
(species indeterminate)

[1] Data are from the Illinois Natural History Survey Insect and Annelida collections, and literature cited in this document.

Common Species

Vermilion River Basin

Seventy-nine species of fishes are known from the portion of the Vermilion River basin in the HAA (Table 17). The most common species include the spotfin shiner, steelcolor shiner, striped shiner, bluntnose minnow, central stoneroller, and the greenside darter. Some of these species are common throughout Illinois but the greenside darter is restricted to Wabash River tributaries, and the steelcolor shiner is common only in the Wabash River basin.

Forty-two species of mussels have been reported from the Vermilion River basin in Illinois (Table 18). In the Vermilion portion of the Headwaters region, 37 species of unionids have been found. Twenty of the 37 mussels known from this portion of the Vermilion have been found alive since 1980. Of those 20, 5 are common: the cylindrical papershell, white heelsplitter, giant floater, plain pocketbook, and fatmucket. All five are widespread and common statewide.

Fifteen species of malacostracans (macro-crustaceans) are found in the portion of the Vermilion River basin in the HAA (Table 19). Three of the six crayfishes: the clearwater crayfish, virile crayfish, and devil crawfish are common in this region and throughout most of Illinois.

The predominant aquatic macroinvertebrate groups collected from the Middle Fork - Vermilion River basin sites studied by Brigham (1979) include Ephemeroptera, Heteroptera, Coleoptera, Coenagrionidae (Odonata), Hydropsychidae (Trichoptera), Chironomidae (Diptera), *Physa* spp. (Gastropoda), and Tricladida. In the Salt Fork Vermilion River basin the predominant aquatic macroinvertebrate groups collected include Chironomidae (Diptera), oligochaetes (Annelida), Heteroptera, Ephemeroptera, Coenagrionidae (Odonata), Hydropsychidae (Trichoptera), and Amphipoda (for the Jordan Creek sites only).

Sangamon River Basin

Sixty-two species of fishes are known from the region (Table 17). The most common are the striped shiner, red shiner, sand shiner, redfin shiner, bluntnose minnow, johnny darter and orangethroat darter, all of which are common throughout most of Illinois.

Forty-seven species of mussels have been reported from the entire Sangamon River drainage in Illinois. A survey comparing changes in the fauna of the Sangamon River drainage since the 1950s was conducted in 1987-89 (Schanzle and Cummings, 1991). In the portion of the Sangamon River basin in the HAA, 30 species of unionids have been found (Table 18). Twenty-seven of these 30 mussels have been found alive since 1980. Of these 27, 12 are common: the threeridge, Wabash pigtoe, pimpleback, cylindrical

papershell, white heelsplitter, giant floater, squawfoot, plain pocketbook, fatmucket, fragile papershell, pink heelsplitter, and deertoe. All are relatively widespread and common statewide.

Nine species of malacostracans (macro-crustaceans) are found in the Sangamon basin portion of the HAA (Table 19). Three of the crayfishes: the calico crayfish, virile crayfish, and devil crawfish, are common in this region and throughout most of Illinois.

Unfortunately, aquatic macroinvertebrate surveys of the magnitude summarized by Brigham (1979) have not been conducted in Sangamon River basin. Although a few limited surveys for macroinvertebrates probably have been conducted, data resulting from those surveys are not readily available in reports or published papers. Specimens collected from the upper Sangamon River basin, if deposited in the INHS Collections, most likely remain unidentified and have yet to be included in any electronic database.

Embarras River Basin

Thirty-two species of fishes are known from the HAA region of the Embarras River (Table 17). The most common species include the redfin shiner, bluntnose minnow, central stoneroller, green sunfish, and the johnny darter. These species are common throughout most of Illinois.

Forty-four species of mussels have been reported from the entire Embarras River drainage. In the portion of the Embarras basin in the HAA, only 16 species of unionids have been found (Table 18). Eleven of these 16 mussels have been found alive since 1980. Of these 11, 5 are common and include the cylindrical papershell, white heelsplitter, giant floater, plain pocketbook, and fatmucket. All five of these mussels are widespread and common statewide.

Six species of malacostracans (macro-crustaceans) are found in the headwaters of the Embarras (Table 19). Three of the crayfishes (the White River crawfish, virile cray-fish, and devil crawfish) are common. These species are common throughout most of Illinois.

The predominant aquatic macroinvertebrate groups collected from the Embarras River basin by Brigham (1979) include Chironomidae (Diptera), oligochaetes (Annelida), Heteroptera, Ephemeroptera, Coenagrionidae (Odonata), Hydropsychidae (Trichoptera), and Amphipoda (for Jordan Creek sites only).

Threatened and Endangered Fishes

Vermilion River Basin

State endangered (SE) fishes (Table 17) known from the section of the Vermilion River Basin within the HAA are the bigeye chub (last observed in 1962), the bigeye shiner (observed in 1989), the bluebreast darter (observed in 1996), the Iowa darter (observed in 1991), and the eastern sand darter (observed in 1996). The river redhorse, a state threatened species, was last observed in the region in 1996.

The *bigeye chub* (SE) has not been observed in the area since 1962 and may be extirpated.

The *bigeye shiner* (SE) is found in Vermilion County in the North Fork near Alvin and in Little Vermilion River from Route 1 to Indiana. It once also occurred in the Middle Fork but has been absent from that river for decades. Few populations of the species persist elsewhere in Illinois.

The *bluebreast darter* (SE) occurs in Illinois only in Vermilion County in the Middle Fork from Potomac to the Vermilion River, and in the Salt Fork one mile south of Oakwood. All occurrences of the species in Illinois are in the HAA.

A relict population of the *Iowa darter* (SE) has persisted in abandoned gravel quarries near Fairmount, Vermilion County, and during high water spills into the headwaters of Jordan Creek. Elsewhere in Illinois, the Iowa darter is found only in the northern part of the state where more suitable habitat is found.

The *eastern sand darter* (SE) occurs in Vermilion County in the North Fork near Alvin, in the Middle Fork from Potomac to the Vermilion River, and in the Vermilion River, four miles east of Westville. Elsewhere in Illinois the species is found only in the Embarras (south of the HAA) and Little Wabash rivers.

The *river redhorse* (ST) is found in Illinois only in the Middle Fork and Salt Fork rivers in the HAA and in the Kankakee and Fox rivers in northern Illinois.

Sangamon River Basin

Two state endangered fishes are recorded for the portion of the Sangamon River basin within the HAA (Table 17): the pallid shiner, last observed in 1928, and the blacknose shiner, last observed in 1901. Downstream Sangamon basin records are available for the western sand darter (*Ammocrypta clara*), last observed in 1900. This species may have occurred in the HAA at one time, although no records exist. It appears that these three species probably no longer occur in the basin; none has been observed since 1928.

Embarras River Basin

No endangered fishes are known from the Embarras River basin.

Threatened and Endangered Mussels

Vermilion River Basin

This region historically supported 12 state threatened or endangered mussels, one of which (the clubshell), is also federally endangered (FE) (Table 18).

Historical records or recent collections of weathered-dead shells of the *spike* (ST) are available for the Middle Fork River near Collison and Armstrong. There are no recent records of live spikes in the Vermilion portion of the HAA.

The federally endangered *clubshell* (SE, FE) was historically widespread in the Vermilion River drainage. No recent live records are known, but a fresh-dead shell was collected in the North Fork near Alvin in 1980. The last live occurrence for the clubshell in the HAA of the Vermilion was probably in the 1920s.

The *rabbitsfoot* (SE) was historically found in the Vermilion River at the I-74 bridge, North Fork near Alvin and Bismark, the Salt Fork at the junction with the Middle Fork, and the Middle Fork near Penfield and Armstrong. Recent records of live rabbitsfoot mussels are available for the North Fork and the last live occurrence for the rabbitsfoot in the HAA of the Vermilion was probably in the 1920s.

The *slippershell* (SE) was historically found in Jordan Creek (1955) and the Middle Fork near Armstrong and Collison (1991). In the Vermilion section of the HAA, a live slippershell was found in Bean Creek (Middle Fork Vermilion River drainage) near Potomac, Vermilion County (1989).

The *salamander mussel* (SE) is known from four localities in the Vermilion River drainage: Salt Fork near Oakwood (date unknown) and Homer Park (1919); Stony Creek near Muncie (1988, 1994); and the Middle Fork, near Collison (1991). Although none of the specimens were collected alive, the shells from Stony Creek were in good condition and it is possible that this species is still extant in the creek.

The *wavy-rayed lampmussel* (SE) was historically widespread in the Vermilion River drainage. Streams in the HAA that historically supported this species include the Middle Fork, the Salt Fork and its tributaries, Spoon River, and Jordan Creek. Recent live records in the HAA include the Middle Fork near the Illinois Power Plant and Collison (1991) in Vermilion County.

The *round hickorynut* (SE) was widely distributed in the Vermilion River in former times. A live individual was found in the Salt Fork near Catlin (1980) just outside the boundary of the HAA. This species is likely still extant, but rare in the Vermilion River drainage.

Historical records or recent collections of weathered-dead shells of the *kidneyshell,* (SE) in the HAA are available for the Middle Fork River near Collison and Armstrong and a tributary to the Middle Fork just north of Collison Creek. There are no recent records of live kidneyshells in the region.

Records of the *purple lilliput* (SE) in the HAA are available for the Spoon, Salt Fork, and Middle Fork. No recent collections of live purple lilliputs are known from the region.

Historical records or weathered-dead shells of the *rayed bean* (SE) are known from the Salt Fork at Homer (1956) and Homer Park (1957). No live individuals have been found since 1956, but a fresh-dead shell was collected in the Middle Fork near Armstrong in 1991 and it may still occur in the region.

Historical records or weathered-dead shells of the *rainbow* (SE) are known from the Salt Fork near Homer, Muncie, and Oakwood and the Middle Fork near Collison. No recent collections of live rainbows are known from the region.

The *little spectaclecase* (SE) was formerly widely distributed in the portion of the Vermilion River drainage within the HAA. Although no recent collections of live individuals are known, fresh-dead shells were found in Jordan Creek in 1988 and 1996.

Sangamon River Basin

This part of the Sangamon River drainage historically has supported five special status species including three state endangered species, one state threatened, and one species of special concern (Table 18).

A historical record for the *slippershell* (SE) in the headwaters region of the Sangamon River drainage is known from Lone Tree Creek near Gibson City, Champaign County (1956). Recent live records exist for the Sangamon River near Saybrook (1988) and Arrowsmith (1987), both in McLean County.

Museum records available for the *salamander mussel* (SE) include the Sangamon River (no locality or date) and Athens, Menard County (no date, presumably late 1800s). In 1991, a single weathered dead valve of this species was found in the Sangamon River at the I-74 bridge. Given the fragility of the shell of this species, it is possible that it may still exist in the upper part of the drainage.

A single specimen of the *little spectaclecase* (SE) is known from the Sangamon River above Mahomet, Champaign County (1929) (INHS #1373). This is the only record of

this species outside of the Wabash River drainage in Illinois, and this mussel is most likely extirpated from the Sangamon River drainage.

Historical records or recent collections of weathered-dead shells of the *spike* (ST) in the HAA are available for the Sangamon River near Mahomet. A recent collection of a live spike was made near Fisher in 1988.

Historical records or recent collections of weathered, dead shells of the *ellipse* in the HAA are available for the Sangamon River near Mahomet and Fisher. A recent collection of a live ellipse was made near Saybrook in 1988. Although this species is not officially on the Illinois threatened or endangered species list, it is on a "watch list" and may be listed soon.

Embarras River Basin

The only endangered species in the region of the Embarras River within the HAA is the *little spectaclecase* (SE) (Table 18). A single live individual of the little spectaclecase was found near Camargo in Douglas County in 1989.

Non-native Species

The common carp has been introduced to the all three drainages in the HAA. It can be found in almost any type of habitat but prefers warm sluggish waters of streams and lakes and is very tolerant of high turbidity and low oxygen levels. Native to Eurasia, the common carp has been present in Illinois since the earliest surveys in the 1880s, making its effect on native species difficult to determine. The species tends to destroy vegetation and increase water turbidity by dislodging plants and rooting around in the substrate, causing a deterioration of habitat for species requiring vegetation and clear water. The species attains a large size and has become an important commercial food species in Illinois; however, it may have done so at the expense of ecologically similar native species such as carpsuckers and buffalos. It was distributed throughout Illinois by the time of Forbes and Richardson's (1908) survey of Illinois fishes and was described as abundant in all parts of the state by Smith (1979). It remains common in most areas of Illinois.

The Asian clam is found only in the Vermilion River drainage in this region. Native to Asia, the species was first documented by collections in the Vermilion River in 1985. Effects of the Asian clam on native species and communities are difficult to measure, but the species probably competes with native mussels for food.

Two other non-native species that are having major impacts on aquatic communities have not yet been found in the HAA. The zebra mussel (*Dreissena polymorpha*) and the rusty crayfish (*Orconectes rusticus*) are contributing to declines in native mussels and crayfishes in other parts of the U. S. and are expected to have the same impact in Illinois.

Of the aquatic macroinvertebrate taxa known or thought likely to occur in the HAA (Table 26), none is thought to have been introduced.

Water Quality

Vermilion River Basin

The Illinois Water Quality Report (Illinois Environmental Protection Agency 1990) describes water quality conditions for designated uses including aquatic life, swimming, drinking water, recreation, secondary contact, and fish consumption based on a wide variety of biotic and abiotic monitoring programs. They rated the Middle Fork as "Full Support" (water quality meets the needs of all designated uses protected by applicable water quality standards). The lower portion of the Salt Fork was rated "Partial Support/ Minor Impairment" (water quality has been impaired, but only to a minor degree).

The Biological Stream Characterization (BSC) of Hite and Bertrand (1989) rated the Spoon River, Jordan Creek, and the Middle Fork of the Vermilion River from Knights Branch to its mouth as "A" Streams (Unique Aquatic Resource) [for more information about the BSC see the introduction to this volume]. The Salt Fork and remaining stream miles of the Middle Fork were rated as "B" Streams (Highly Valued Aquatic Resource). Tributaries to the Vermilion River rated as "B" Streams include Saline Branch Ditch from the Boneyard to its mouth, Sugar Creek, Buck Creek, Windfall Creek, Glenburn Creek, Stony Creek, Knights Branch, Upper Salt Fork Ditch, and an unnamed tributary to the Spoon River in Champaign County.

Smith (1971) gave the Little Vermilion-Vermilion River System a variable rating but noted that the outstanding stream in the system and one of the finest in Illinois was the Middle Fork. Water quality problems in the system include domestic sewage, siltation, and dredging.

Sangamon River Basin

In the Illinois Water Quality Report (Illinois Environmental Protection Agency 1990), the majority of the Sangamon River was rated as "Partial Support/Minor Impairment." A 16.8-mile segment below Lake Decatur was rated as "Non Support." Below the "Non Support" segment, the Sangamon improves to "Partial Support/Moderate Impairment." Stream channelization, agricultural runoff, and municipal pollution contribute to the lower ratings.

The Biological Stream Characterization (Hite and Bertrand, 1989) rated Drummer and Goose creeks as "A" Streams (Unique Aquatic Resource). Tributaries to the Sangamon rated as "B" Streams (Highly Valued Aquatic Resource) included several unnamed headwater streams, West Branch Drummer Creek, and an unnamed tributary to Goose Creek (Piatt County). The majority of the mainstem of the Sangamon River was rated as a "C" Stream (Moderate Aquatic Resource).

Smith (1971) gave the Sangamon River a variable rating. The headwaters of the Sangamon River, Kickapoo Creek, and some small tributaries near the mouth are rated as "Good" and other areas of the Sangamon were rated as "Fair." Problems noted were siltation, impoundments, and industrial, agricultural, and domestic pollution.

Embarras River Basin

The Illinois Water Quality Report (Illinois Environmental Protection Agency 1990) rated 160.6 stream miles of the Embarras River mainstem, including the upper reaches, as "Partial Support/Minor Impairment." The remaining stream miles of the Embarras (below Charleston) were rated as "Full Support."

The Biological Stream Characterization (Hite and Bertrand 1989) rated the upper Embarras River in Champaign and Douglas counties as a "C" Stream (Moderate Aquatic Resource). Other segments of the Embarras River were rated as "B" Streams (Highly Valued Aquatic Resource).

Smith (1971) rated the Embarras River as "Variable." The headwaters above Lake Charleston were rated as "Fair" to "Poor" with oil field pollution and siltation cited as water quality problems. Smith rated the middle section of the Embarras as one of Illinois' "Outstanding" streams.

Biologically Significant Streams

Nine streams in the HAA, four in the Vermilion basin, and two in the Sangamon basin, were recognized as Biologically Significant Streams (Page, et al. 1992) because of their fish and mussel diversity (Figure 11) [for more information about the BSS classification see the introduction to this volume]. These streams provide the best opportunities in the basin for the protection of large numbers of native species.

Vermilion River Basin

1. *Middle Fork Vermilion River, Champaign and Vermilion counties.* One of the three prongs of the Vermilion River, the clear, gravel -bottomed Middle Fork is 25-60 feet wide and up to 6 feet deep. The substrate consists of sand, gravel, and cobble although some areas of the stream bed are covered with a layer of silt. The deepest part of many of the pools are paved with large pebbles. Stream habitats include many boulder riffles, extensive sand and gravel raceways, and clear pools with a sand and silt substrate. Some vascular aquatic vegetation is present. In a study of vascular plants in the streams of Champaign County, Tazik et. al. (1991) reported that the Middle Fork of the Vermilion has the most vegetated sites and the highest species diversity in Champaign County. A high diversity of mussels is present including the state endangered (SE) wavy-rayed lampmussel.

Also present are the eastern sand darter (SE), and the bluebreast darter (SE). The wooded riparian zone varies from a few feet to over a half mile. This segment of the Middle Fork runs through the Middle Fork River County Forest Preserve, Middle Fork State Fish and Wildlife Area, and Kickapoo State Park. As mentioned above, from its mouth to Knights Branch, the Middle Fork is rated as a Class "A" stream in the Biological Stream Classification (BSC) of Hite and Bertrand (1989). The Middle Fork is the only federal and state designated Wild and Scenic River in Illinois.

2. *Salt Fork Vermilion River, Champaign County line to Middle Fork, Vermilion County.* The Salt Fork in Vermilion County is a high gradient small river (depth to five feet, width 50-95 feet) with large riffles and pools. Some vascular aquatic vegetation is present and semi-aquatic vegetation occupies small vegetated islands in the river. The substrate consists of sand, gravel, and cobble/boulders with very little silt. The bluebreast darter (SE) is present in this area. A high mussel diversity is also present including the endangered wavy-rayed lampmussel (SE), and the round hickorynut (SE). Riparian vegetation consists of hardwood trees, the majority being sycamore and soft maple.

3. *Jordan Creek, Vermilion County.* Jordan Creek, a BSC "A" Stream, is 11 miles long and has an average width of 13 feet. In the lower reaches of Jordan Creek the substrate consists of bedrock and gravel. Gravely pools and steep riffles are the predominant stream habitats. In the upper reaches cobble, bedrock, sand, and silt comprise the substrate and long quiet pools are the common stream habitat. Beginning at its confluence with the Salt Fork, the riparian zone gradually decreases from a fairly wide zone of hardwood trees (sycamore, cottonwood, silver and sugar maple) to a few feet of grass before eventually giving way to row crop agriculture. The upper half of Jordan Creek has been dredged. Fresh-dead shells of the little spectaclecase (SE) were found here in 1988 and 1996. The Iowa darter (SE) is present only in the headwaters of Jordan Creek where it washes out of abandoned gravel quarries near Fairmount.

4. *Stony Creek, Vermilion County.* Stony Creek is a small tributary to the Salt Fork Vermilion River. The substrate consists largely of gravel, cobble, and bedrock. Beginning at its confluence with the Salt Fork, the riparian zone gradually decreases upstream from a fairly wide zone of hardwood trees (sycamore, cottonwood, silver and sugar maple) to a few feet of grass before eventually giving way to row crop agriculture and pasture. Fresh-dead shells of the state endangered salamander mussel have been found there in recent years.

5. *Spoon River, Champaign County.* The Spoon River in Champaign County is rated as an "A" stream (Unique Aquatic Resource) under the Biological Stream Characterization (Hite and Bertrand 1989). For this reason, it is also considered a Biologically Significant Stream segment.

Sangamon River Basin

1. *Sangamon River, from its source (McLean County) to Piatt/Macon County line.* Within this stretch the Sangamon River varies from a large creek (width 4-6 feet) to a small river (width 35-50 feet). Depths range to four feet. Stream habitats include sand and mud bars, rapids, riffles, and fairly deep pools. Filamentous algae is the dominant aquatic vegetation. The substrate consists of sand, gravel, and cobble. In some areas silt is mixed with the sand and muck and is found along the shore. Riparian vegetation varies from a narrow zone of dense weedy vegetation in the upper reaches to flood plain woodlands in Champaign and Piatt counties. Lodge Park, Lake of the Woods County Forest Preserves, and Allerton Park Natural Area are located along this stretch of the Sangamon. A high diversity of mussels is present including the slippershell (SE).

2. *Lone Tree Creek, Champaign County.* Lone Tree Creek is a natural, medium-sized stream (10-15 feet wide) with medium turbidity. Depths range to five feet. The substrate consists of sand with some gravel and cobble. No vascular aquatic vegetation is present. The stream has a very narrow riparian zone consisting of weeds which soon give way to row crop agriculture. A high diversity of mussels is present.

3. *Drummer Creek, Ford and Champaign counties.* Drummer creek, in Ford and Champaign counties is rated as an "A" stream (Unique Aquatic Resource) under the Biological Stream Characterization (Hite and Bertrand 1989). For this reason, it is also considered a Biologically Significant Stream segment.

4. *Goose Creek, Piatt County.* Goose Creek, in Piatt County is rated as an "A" stream (Unique Aquatic Resource) under the Biological Stream Characterization (Hite and Bertrand 1989). For this reason, it is also considered a Biologically Significant Stream segment.

Environmental Problems

This section describes general environmental problems affecting streams throughout Illinois. Most of this discussion applies to the HAA.

Stream ecosystems are fragmented by landscape changes that render stream habitats unsuitable for aquatic organisms and by instream modifications that eliminate stream habitats. Smith (1971) ranked the causes of extirpation or declines in fish species in Illinois as follows: siltation (as the primary factor responsible for the loss of 2, and decimation of 14, species), drainage of bottomland lakes, swamps, and prairie marshes (0, 13), desiccation during drought (0, 12), species introductions (2, 7), pollution (2, 5), impoundments (0, 4), and increased water temperatures (0, 1). All of these factors render habitats unsuitable for many aquatic species throughout Illinois and lead to extirpations.

Streams in Illinois naturally have wooded floodplains that are extremely important in maintaining a healthy aquatic environment. The vegetation on a floodplain shades the stream and keeps it from becoming excessively hot during the summer, stabilizes the streambank and reduces erosion, and acts as a filter that removes topsoil and pesticides, which would otherwise reach the stream as water drains from croplands. During periods of high water, vegetated floodplains provide feeding and spawning areas for many species of aquatic organisms and nurseries for developing larvae. When floodplains are converted to crop production as they have been throughout much of Illinois, they no longer provide these benefits to aquatic organisms.

Another major landscape change that has negatively impacted streams has been the tiling of land for agriculture. Land that once drained slowly drains quickly once it is tiled. Rapid drainage of land increases the pulse of a flood and increases the intensity and duration of low-flow once the water has moved downstream. These artificially extreme fluctuations in water levels subject stream organisms to environmental conditions to which they are not adapted and can lead to the extirpation of populations.

Siltation, increased water temperatures, and desiccation follow the removal of riparian vegetation and the tiling of fields as land is prepared for agriculture. The excessive siltation associated with the removal of floodplain vegetation is among the most damaging forms of stream pollution. The clean rock and gravel substrates that are normally characteristic of riffles and other stream habitats with fast-flowing water provide living space for many species of aquatic insects and other invertebrates and important spawning habitat for many species of fishes. The deposition of silt covers the rocks, leaving no place for small organisms to hide or for fishes to hide their eggs. Silt can also cover the leaves of aquatic plants and, if sufficient to prevent gas exchange or photosynthesis, will cause the plants to die. The reduction of plant life in a stream has a cascading negative impact on the stream ecosystem. Many animals, in particular insect larvae and fishes, use the plants as places to hide and forage. Some fishes use plants to hide from predators, others use plants as sites from which to ambush prey. As plants are eliminated, populations of insects and fishes are reduced or eliminated because they have fewer places to live.

The impact of increased water temperatures resulting from the loss of riparian vegetation and reduced water flow during warm seasons is difficult to separate from the effects of siltation and other factors that occur concomitantly. However, throughout Illinois, increased water temperatures *per se* are probably especially harmful to cool-water species, such as northern pike, and species dependent on springs and spring-fed streams, such as the southern redbelly dace (*Phoxinus erythrogaster*), and many species of amphipods, isopods, and crayfishes.

Stream desiccation is thought to be primarily an effect of the artificially extreme fluctuations in water levels that follow tiling of fields for agriculture. The rapid drainage of surrounding land increases the intensity and prolongs the duration of low-flow once the water has moved downstream. A drought that historically would have had the impact of decreasing the flow in a stream can now lead to a dry stream bed.

Floodplains of large rivers normally have low areas that fill with water during floods and survive year-round as shallow lakes. These lakes provide primary habitat for a wide variety of plants and animals, and because they naturally have luxuriant plant growth, they are important feeding areas for waterfowl. They also provide spawning areas, nurseries for larvae, and overwintering refugia for fishes. Unfortunately, most of the bottomland lakes in Illinois have been drained to create cropland, and those that remain have become shallow and barren because of the tremendous silt loads deposited in them each year during periods of high water. The shallow muddy lakes no longer support the plant life that was fundamental to successful completion of the life cycles of many aquatic species.

The impacts of introduced fishes include competition, predation, inhibition of reproduction, environmental modification, transfer of parasites and diseases, and hybridization. Freshwater mussels and crayfishes have been seriously impacted in Illinois in recent decades by non-native invaders, most notably the zebra mussel and the rusty crayfish. Nalepa (1994) documented the severe decline in native mussels due to the invasion of zebra mussels in Lake St. Clair over a six-year period. He found that mussel densities declined from $2.4/m^2$ in 1986 to $0/m^2$ in 1992 in areas heavily infested with zebra mussels. The rusty crayfish, introduced through its use as fishing bait, is rapidly spreading through Illinois and displacing native crayfishes (Taylor and Redmer 1996).

Point sources of pollution include industrial wastes and domestic sewage. In Illinois, considerable progress has been made in identifying and eliminating point sources of pollution, and water quality has improved as a result. Nonpoint sources are now a larger problem than are point sources and include siltation and agricultural pesticides that reach streams following the removal of floodplain vegetation.

Impounding a stream converts it into a standing body of water that lacks the riffles, runs, pools, and other habitats that stream-inhabiting organisms require. When a stream is dammed, most native species are eliminated from the inundated area, and upstream and downstream populations become isolated from one another. Dams block migrations of fishes that in many species are necessary for reproduction. The loss of migratory fishes from a stream ecosystem can lead to the loss of mussels that use the migratory fishes as hosts for their (glochidial) larva.

Channelization is the straightening of a stream to enhance drainage of the surrounding land. The straightening converts the diversity of habitats in a stream to one continuous straight channel that supports few species. Because of their sedentary nature, mussels are particularly susceptible to the effects of channelization.

Potential Management Strategies for Aquatic Species

Management strategies for stream ecosystems must consider each watershed on an individual basis. Attempting to correct problems locally without consideration of up-

stream activities and downstream implications will result in only partial, and probably temporary, improvement.

Correction of some factors that have led to stream habitat fragmentation in past decades is relatively easy. Important initiatives include building sewage treatment plants and avoiding the construction of mainstream impoundments when possible. Other initiatives, such as stopping the removal of riparian vegetation, cessation of stream channelization, and the drainage of bottomland lakes, require more public education and governmental action, for example providing better incentives to landowners. Assuming that pollution will be held at current levels or reduced, nothing will be more beneficial to the biota of Illinois streams than to have natural riparian vegetation restored. Siltation, desiccation, and higher than normal temperatures would all be reduced to acceptable levels if streams were lined with native plants that shaded the stream, stabilized the banks, and filtered sediment and chemicals from runoff before they reached the stream.

Most introductions of non-native fishes have been done in an effort to improve sport or commercial fishing, and usually governmental agencies have been responsible for the introductions. We now know that non-native species alter ecosystems, and the long-term effect of any introduction is likely to be negative rather than an improvement.
Given the opportunity, streams will restore themselves and often the best approach to restoration may be to encourage restoration of the native vegetation of the drainage basin; and particularly in the riparian zone, correct any additional existing pollution problems; and let the stream return to natural conditions. In some instances additional measures, such as reintroducing extirpated species, may be advisable.

Information Gaps

East-central Illinois, including the HAA, has been fairly well studied with respect to fishes, crayfishes, and mussels. However, additional survey work in the smaller tributaries would better define the limits of some of the species, especially mussels, and possibly uncover additional populations of state endangered species.

Long-term population monitoring of selected species and communities is needed throughout the state to provide information on trends in biological resources and on the success of various management strategies. Mark-recapture studies also are badly needed to understand normal movements of fishes and other aquatic organisms and, hence, to provide baseline data for interpreting the impacts of environmental alterations and management strategies.

Although there have been some historical as well as recent faunal studies conducted on the aquatic macroinvertebrates occurring in Illinois [e.g. Coleoptera (beetles) (Wooldridge 1967), Ephemeroptera (mayflies) (Burks 1953), Plecoptera (stoneflies) (Frison 1935), Trichoptera (caddisflies) (Ross 1944), Hemiptera (true bugs) (Lauck 1959), Diptera (flies) (Malloch 1915 a, b), and Annelida (segmented worms) (Wetzel 1992)], the major groups of aquatic macroinvertebrates known to occur in the HAA

(Table 26) have not been as well studied as fishes, mussels, and crustaceans. Brigham (1979) provided the most recent surveys for aquatic macroinvertebrates in two of the HAA basins (the Embarras and Vermilion rivers) but those surveys are already 20 years old, and the aquatic macroinvertebrate fauna of the Sangamon River basin has never been studied extensively.

There are extensive historical and recent collections of aquatic macroinvertebrates in the permanent INHS Collections; however, much of this information is not easily retrievable because either specimens have not yet been identified or the identified material has not yet been incorporated into a searchable database. Once specimens have been identified and incorporated into a database, comparisons between historical material and that obtained more recently could be made to evaluate changes in distribution and abundance. Moreover, long-term monitoring of selected groups of aquatic macroinvertebrates in habitats throughout the state — particularly in headwater streams and, to a lesser extent, in small ponds, lakes, and wetland areas — would provide needed information on population trends and habitat associations.

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Appendix 1

List of vascular plant species known from the Headwaters Assessment Area.

Class		FOREST								PRAIRIE		SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest				Prairie	Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w		dm	m wm w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**															
Alsike clover*	*Trifolium hybridum**															x
alternate leaved dogwood	*Cornus alternifolia*												se			
American bindweed	*Calystegia sepium*									m		sa				
American black currant	*Ribes americanum*			m									se	ma		
American bulrush	*Scirpus americanus*												se			
American elm	*Ulmus americana*			m		**m**	**wm**									
American gromwell	*Lithospermum latifolium*			m												
American hop	*Humulus lupulus*					m										x
amur honeysuckle*	*Lonicera maackii**			m												
angelica	*Angelica atropurpurea*												se			
anise-root	*Osmorhiza longistylis*			m												
annual bedstraw	*Galium aparine*			m				w								x
arrowleaf	*Sagittaria latifolia*													ma		
arrowleaf aster	*Aster sagittifolius*			m								sa				
asparagus*	*Asparagus officinalis**									m						x
Aunt Lucy	*Ellisia nyctelea*						wm									
autumn bent grass	*Agrostis perennans*											sa				
awl-fruited sedge	*Carex tribuloides*						wm							ma		
awned graceful sedge	*Carex davisii*			m			wm					sa		ma		
awnless brome grass*	*Bromus inermis**									m						x
balsam groundsel	*Senecio pauperculus*															x
bare stem tick trefoil	*Desmodium nudiflorum*	d	dm													
barnyard grass	*Echinochloa muricta*													ma		
barnyard grass*	*Echinochloa crus-galli**															x
basswood	*Tilia americana*			**m**		**m**										
bastard toadflax	*Comandra umbellata*									m	gdh					
beak grass	*Diarrhena americana*			m												
Bebb's oval sedge	*Carex bebbii*									m						
beech	*Fagus grandifolia*			**m**												
beggar ticks	*Bidens tripartita*													ma		
biennial gaura	*Gaura biennis*									m						
big bluestem	*Andropogon gerardii*									**m**	**wm**	gdh	sa			
birds-foot trefoil*	*Lotus corniculatus**															x
bitter cress	*Cardamime pensylvanica*			m										ma		
bitternut hickory	*Carya cordiformis*			**m**			wm									
bittersweet	*Celastrus scandens*			m						m	gdh					x
black ash	*Fraxinus nigra*												se			
black bindweed*	*Polygonum convolvulus**															x

Appendix 1. Continued

Class	FOREST							PRAIRIE				SAVANNA	WETLAND			CULTURAL
Sub-class	Upland Forest				Floodpln Forest			Prairie			Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]	d	dm	m	wm	m	wm	w	dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																
black cherry	*Prunus serotina*		dm	m		m							sa				x
black gramma	*Brachyletrum erectum*		dm	m													
black haw	*Viburnum prunifolium*		dm	m								gdh					
black locust*	*Robinia pseudoacacia**			m													
black maple	*Acer nigrum*			m													
black medic*	*Medicago lupulina**																x
black nightshade	*Solanum ptycanthum*																x
black oak	*Quercus velutina*	**d**	**dm**	m					m				sa				
black raspberry	*Rubus occidentalis*		dm	m					m								x
black snakeroot	*Sanicula canadensis*			m		m											
black walnut	*Juglans nigra*		dm	**m**		m	wm								ma		x
black willow	*Salix nigra*						wm	w							ma		
black-eyed Susan	*Rudbeckia hirta*			m					m			gdh		se			
bladdernut	*Staphylea trifolia*			m		m											
bloodroot	*Sanguinaria canadensis*		dm	m		m											
blue ash	*Fraxinus quadrangulata*		dm	m													
blue beech	*Carpinus caroliniana*		dm	**m**													
blue bells	*Mertensia virginica*			m		m											
blue cohosh	*Caulophyllum thalictroides*			**m**													
blue flag	*Iris shrevei*														ma		
blue joint grass	*Calamagrostis canadensis*									wm	w						
blue lobelia	*Lobelia siphilitica*					m								se	ma		
blue skullcap	*Scutellaria lateriflora*														ma		
blue vervain	*Verbena hastata*														ma		
blue-eyed grass	*Sisyrinchium albidum*								m			gdh					
blue-eyed Mary	*Collinsia verna*			m													
bluestem goldenrod	*Solidago caesia*			m													
bottlebrush grass	*Elymus hystrix*		dm	m									sa				
bottlebrush sedge	*Carex hystricina*													se	ma		
bouncing bet*	*Saponaria officinalis**																x
box elder	*Acer negundo*						**wm**	w									x
bracted green orchid	*Coeloglossum viride*			m													
bramble	*Rubus trivialis*			m													
bridal wreath*	*Spiraea prunifolia**								m								
bristly catbrier	*Smilax hispida*			m			wm	w									
bristly sedge	*Carex conjuncta*														ma		
broad leaved galium	*Galium circaezans*		d dm	m													
broad leaved panic grass	*Dichanthelium clandestinum*					m											
broad-leaved sedge	*Carex albursina*			m													
broadleaf goldenrod	*Solidago flexicaulis*			m													
brome grass	*Bromus purgans*		d dm														
brome hummock sedge	*Carex bromoides*													se			
brook flat sedge	*Cyperus rivularis*													se	ma		
brookweed	*Samolus valerandii*					m											
broom sedge	*Andropogon virginicus*																x
brown eyed Susan	*Rudbeckia triloba*					m											
buckbush	*Symphoricarpos orbiculatus*		dm	m		m	wm										
buckhorn plantain*	*Plantago lanceolata**			m													x

Appendix 1. Continued

Class		FOREST				PRAIRIE				SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest				Prairie	Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w		dm	m wm w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**															
bull thistle*	*Cirsium vulgare**															x
bulrush	*Scirpus atrovirens*												se	ma		
bulrush	*Scirpus fluviatalis*													ma		
bur cucumber	*Sicyos angulatus*												se			
bur oak	*Quercus macrocarpa*			m		**m**	**wm**					**sa**				
bush clover	*Lespedeza capitata*									m	gdh					
butterfly weed	*Asclepias tuberosa*									m						
butternut	*Juglans cinerea*			m		m										
button bush	*Cephalanthus occidentalis*													ma		
Canada bluegrass**	*Poa compressa**			m						m		sa				x
Canada brome grass	*Bromus pubescens*	d	dm													
Canada thistle*	*Cirsium arvense**															x
Canada wild rye	*Elymus canadensis*									m	gdh					
Canadian milk vetch	*Astragalus canadensis*											sa				
cancer-root	*Conophilis americana*			m												
candle anemone	*Anemone cylindrica*									m						
carpet weed*	*Mollugo verticillata**															x
catfoot	*Gnaphalium obtusifolium*															x
catnip*	*Nepeta cataria**			m								sa				
cheat grass*	*Bromus tectorum**															x
chickory*	*Cichorium intybis**															x
chinquapin oak	*Quercus prinoides* var.	**dm**	**m**			m					gdh					
Christmas fern	*Polystichum acrostichoides*	dm	m													
cinnamon willow herb	*Epilobium coloratum*												se	ma		
clammy ground cherry	*Physalis heterophylla*									m						
clammy hedge hyssop	*Gratiola neglecta*													ma		
clearweed	*Pilea pumila*									wm				ma		
closed gentian	*Gentiana andrewsii*									wm						
cockspur thorn	*Crataegus crus-galli*			m						m	gdh					
columbine	*Aquilegia canadensis*	sb									gdh		se			
common begger ticks	*Bidens frondosa*												se			
common blackberry	*Rubus allegheniensis*			m			wm			m						
common blackberry	*Rubus pensylvanicus*															x
common bladderwort	*Utricularia vulgaris*														po	
common blue violet	*Viola pratincola*			m			wm			m						
common boneset	*Eupatorium perfoliatum*												se	ma		
common buckthorn*	*Rhamnus cathartica**			m												x
common bur sedge	*Carex grayi*			m		m									po	
common burdock	*Arctium minus**											sa		ma		x
common carrion flower	*Smilax lasioneuron*											sa				
common cat-tail	*Typha latifolia*												se	ma		
common chickweed*	*Stellaria media**															x
common choke cherry	*Prunus virginiana*			m												
common cinquefoil	*Potentilla simplex*									m						
common crab grass*	*Digitaria sanguinalis**															x
common foxtail	*Alopecurus carolinianus*															x
common goats beard*	*Tragopogon pratensis**															x
common hemp	*Cannabis sativa**															x

Appendix 1. Continued

Class		FOREST				PRAIRIE				SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest		Floodpln Forest		Prairie		Hill Prairie		Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w	dm m wm w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**													
common horehound*	*Marrubium vulgare**			m										
common horestail	*Equisetum arvense*										se	**ma**		x
common lilac*	*Syringa vulgaris**								m					x
common milkweed	*Asclepias syriaca*								m		sa			x
common morning glory*	*Ipomoea purpurea**													x
common mountain mint	*Pycnanthemum virginianum*								mwm	gdh		se		
common mouse ear*	*Cerastium vulgatum**			m					m					
common nettle	*Urtica dioica*				m									
common pepper grass	*Lepidium virginicum*			m										x
common periwinkle*	*Vinca minor**								m					
common phlox	*Phlox divaricata*			m		m	wm							
common plantain	*Plantago rugelii*													x
common ragweed	*Ambrosia artemisiifolia*			m					m		sa			x
common red reed	*Phragmites australis*											ma		
common satin grass	*Muhlenbergia frondosa*				m	wm								x
common smartweed*	*Polygonum hydropiper**											ma		x
common snakeroot	*Sanicula gregaria*			m										
common tussock sedge	*Carex stricta*										se	ma		
common water horehound	*Lycopus americanus*											ma		
common water plantain	*Alisma plantego-aquatica* var.											ma		
common wood sedge	*Carex blanda*			m										
common yarrow*	*Achillea millefolium**			m					m		sa			x
compass plant	*Silphium laciniatum*								**m**					
coontail	*Ceratophyllum demersum*												po	
copper shouldered oval	*Carex bicknellii*								m		sa			
corn speedwell*	*Veronica arvensis**													x
cottonwood	*Populus deltoides*			m		m	wm	w				se	ma	
cow parsnip	*Heracleum lanatum*						wm							
cowslip	*Caltha palustris*											se		
cream wild indigo	*Baptisia leucophaea*								**m**					
creeping Charlie*	*Glechoma hederacea**			m			wm							x
creeping smartweed*	*Polygonum cespitosum* var.			m										x
crested hair grass	*Koeleria macrantha*								dm					
crown vetch*	*Coronilla varia**													x
culver's root	*Veronicastrum virginicum*								m					
cup plant	*Silphium perfoliatum*						wm				sa		ma	
curly dock*	*Rumex crispus**			m									ma	x
curly styled wood sedge	*Carex rosea*		dm	m										
curttop lady's thumb	*Polygonum lapathifolium*												ma	
cylindric blazing star	*Liatris cylindracea*	d								gdh				
cyprus spurge*	*Euphorbia cyparissias**								m					
daisy fleabane	*Erigeron strigosus*								m					x
dandelion*	*Taraxacum officinale**													x
Depthford pink*	*Dianthus armeria**													x
dewberry	*Rubus flagellaris*	d	dm											
ditch stonecrop	*Penthorum sedoides*												ma	x
dodder	*Cuscuta gronovii*			m										
doll's eyes	*Actaea pachypoda*		dm	m										

Appendix 1. Continued

Class		FOREST				PRAIRIE				SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest				Prairie	Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w		dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																		
dotted smartweed	*Polygonum punctatum*																ma		
downy gentian	*Gentiana puberulenta*									m									
downy skullcap	*Scutellaria incana*		dm	m															
downy sunflower	*Helianthus mollis*									m									
downy-blue violet	*Viola sororia*			m		m	wm												
drooping coneflower	*Ratibida pinnata*									m		gdh							
duckweed	*Lemna minor*																**ma**	po	
Dudley's rush	*Juncus dudleyi*									m				se					
Dutchman's breeches	*Dicentra cucullaria*		dm	m		m													
dwarf bindweed	*Calystegia spithamaea*	d										sa							
dwarf larkspur	*Delphinium tricorne*			m		m													
ear-leafed foxglove - ST	***Tomanthera auriculata* -ST**									m									
early buttercup	*Ranunculus fascicularis*											sa							
early goldenrod	*Solidago juncea*									m									x
early meadow rue	*Thalictrum dioicum*		dm	m															
ebony spleenwort	*Asplenium platyneuron*	d	dm																
elderberry	*Sambucus canadensis*		dm	m			wm	w				sa							
elm-leaved goldenrod	*Solidago ulmifolia*	d	dm								gdh								
enchanter's nightshade	*Circaea lutetiana*			m			wm												
European high bush	*Viburnum opulus**									m									x
European spindle tree*	*Euonymus europaeus**			m															
evening primrose	*Oenothera biennis*									m		sa							x
everlasting	*Antennaria plantaginifolia*		dm							m	gdh								
fall coral-root	*Corallorhiza odontorhiza*		dm	m															
false boneset	*Brickellia eupatorioides*										gdh								
false buckwheat	*Polygonum scandens*			m															
false dragonhead	*Physostegia virginiana*									m									
false hellebore - ST	***Veratrum woodii* - ST**			m		m													
false indigo bush	*Amorpha fruticosa*													se					
false mermaid	*Floerkea proserpinacoides*			m															
false nettle	*Boehmeria cylindrica*													se					
false red top	*Tridens flavus*																		x
false rue anenome	*Isopyrum biternatum*		dm	m															
false shagbark hickory	*Carya ovalis*			m															
false Solomon's seal	*Smilacina racemosa*		dm	**m**		m					gdh								
false sunflower	*Heliopsis helianthoides*									m		**sa**							
fen thistle	*Cirsium muticum*													se					
feverfew	*Parthenium integrifolium*	d	dm							m	gdh	sa							
field garlic*	*Allium vineale**																		x
field goldenrod	*Solidago nemoralis*									dm	gdh								x
field milkroot	*Polygala sanguinea*									m									x
field mint	*Mentha arvensis* var. *villosa*																ma		
field penny cress*	*Thlaspi arvense* *																		x
field pepper grass*	*Lepidium campestre**																		x
field thistle	*Cirsium discolor*									m									x
firepink	*Silene virginica*		dm	m															
fleabane daisy	*Erigeron annuus*									m		sa							x
flower of an hour*	*Hibiscus trionum**																		x

Appendix 1. Continued

Class		FOREST				PRAIRIE		SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest		Floodpln Forest		Prairie	Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm m wm	m	wm w	dm m wm w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**											
flowering dogwood	*Cornus florida*		**dm** m				gdh					
flowering spurge	*Euphorbia corollata*					m	gdh	sa				
fowl blue grass	*Poa palustrus*									ma		
fowl manna grass	*Glyceria striata*				wm					ma		
fox sedge	*Carex vulpinoidea*					m						x
foxglove beard tongue	*Penstemon digitalis*		dm m			m						
foxtail barley*	*Hordeum jubatum**											x
foxtail*	*Setaria glauca**											x
fragile fern	*Cystopteris protusa*		dm m									
fragrant ladies' tresses	*Spiranthes magnicamporum*						gdh					
French grass	*Psoralea onobrychis*							sa				
fringed loosestrife	*Lysimachia ciliata*		m									
frost grape	*Vitis vulpina*		m									
frostweed	*Helianthemum bicknellii*											
garlic mustard*	*Alliaria petiolata**		dm m		m wm w							
giant foxtail	*Setaria faberi*											x
giant ragweed	*Ambrosia trifida*				wm w		gdh					x
ginseng	*Panax quinquefolius*		m									
glossy buckthorn*	*Rhamnus frangula**									ma		
goat's beard*	*Tragopogon dubius**											x
golden Alexanders	*Zizia aurea*					m						
golden ragwort	*Senecio aureus*								se			
goldenglow	*Rudbeckia laciniata*				wm w							
goldenseal	*Hydrastis canadensis*		m	m								
goosefoot	*Chenopodium standleyanum*		m									
grape honeysuckle	*Lonicera prolifera*	d					gdh	sa				
grass leaf golderod	*Euthamia graminifolia*					wm						
grass sedge	*Carex jamesii*		m									
grass-of-Parnassus	*Parnassia glauca*								se			
gray dogwood	*Cornus racemosa*		m	m		m						
great bulrush	*Scirpus acutus*									ma		
green amaranth*	*Amaranthus hybridus **											x
green ash	*Fraxinus pennsylvanica*			m	**wm**							
green dragon	*Arisaema dracontium*		m									
green fringed orchid	*Platanthera lacera*							sa				
green milkweed	*Asclepias viridiflora*					dm	gdh					
green stemmed Joe Pye	*Eupatorium purpureum*		m									
green violet	*Hybanthus concolor*		m									
ground cherry	*Physalis virginiana*					m						
groundnut	*Apios americana*								se			
hackberry	*Celtis occidentalis*		m	m	**wm**							
hair grass	*Agrostis hyemalis*											x
hairy aster	*Aster pilosus*		m				gdh					x
hairy fruited lake sedge	*Carex trichocarpa*									ma		
hairy green sedge	*Carex hirsutella*	d	dm				gdh					
hairy meadow parsnip	*Thaspium barbinode*		dm				gdh	sa				
hairy mountain mint	*Pycnanthemum pilosum*	d	dm									
hairy panic grass	*Dichanthelium acuminatum*	d	dm			m						

Appendix 1. Continued

Class		FOREST								PRAIRIE				SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest				Prairie				Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w		dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																		
hairy wood sedge	*Carex hirtifolia*			m															
harbinger of spring	*Erigenia bulbosa*			m		m													
hawthorn	*Crataegus pedicellata*																		x
hazelnut	*Corylus americana*		dm	m							m			gdh	sa				
heath aster	*Aster ericoides*									dm				gdh					
hoary puccoon	*Lithospermum canescens*										**m**			gdh					
hoary tick trefoil	*Desmodium canescens*		dm	m															
hoary vervain	*Verbena stricta*																		x
hog peanut	*Amphicarpa bracteata*	d	dm							dm				gdh					
honewort	*Cryptotaenia canadensis*			m			wm												
honey locust	*Gleditsia triacanthos*					m	wm	w											x
honeysuckle*	*Lonicera tatarica**			m							m								
hooked buttercup	*Ranunclus recurvatus*			m															
hop hornbeam	*Ostrya virginiana*		**dm**	m										gdh					
horse gentian	*Triosteum perfoliatum*			m															
horse-nettle	*Solanum carolinense*																		x
horsetail milkweed	*Asclepias verticillata*										m			gdh		se			x
Illinois tick trefoil	*Desmodium illinoense*										m								
Indian grass	*Sorghastrum nutans*										**m**			**gdh**		se			
Indian hemp	*Apocynum cannabinum*													gdh			ma		
Indian hemp	*Apocynum sibiricum*										m				sa				
Indian paintbrush	*Castilleja coccinea*													gdh		se			
Indian plantain	*Cacalia atriplicifolia*	d	dm												sa				
Indian tobacco	*Lobelia inflata*			m															
inland rush	*Juncus interior*										m								
inland sedge	*Carex interior*															se			
intermediate dogbane	*Apocynum X medium*													gdh					
Iowa crabapple	*Malus ioensis*			m															
ivy leaved morning glory*	*Ipomoea hederacea**			m															x
Jack-in-the pulpit	*Arisaema triphyllum*		dm	m		m													
Japanese barberry	*Berberis thunbergii**																		x
Japanese honeysuckle*	*Lonicera japonica**										m								
Jerusalum artichoke	*Helianthus tuberosus*											wm							x
jimpson weed*	*Datura stramonium**																		x
jointed rush	*Juncus nodosus*															se			
Kentucky bluegrass*	*Poa pratensis**			m							m								x
Kentucky coffee tree	*Gymnocladus dioica*					m													
kingnut hickory	*Carya laciniosa*			m															
lace grass	*Eragrostis capillaris*																		x
lamb's quarters*	*Chenopodium album**																		x
lance-leaved loosestrife	*Lysimachia lanceolata*										m					se			
large twayblade	*Liparis liliifolia*			m							m								
late boneset	*Eupatorium serotinum*																		x
late figwort	*Scrophularia marilandica*			m											sa				
late golden rod	*Solidago gigantea*											wm	w				ma		
leadplant	*Amorpha canescens*										**m**			gdh	sa				
leafcup	*Polymnia canadensis*			m															
Leconte's violet	*Viola affinis*			m															

Appendix 1. Continued

Class		FOREST								PRAIRIE			SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest			Floodpln Forest					Prairie		Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w		dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																
lily of the valley*	*Convallaria majalis**										m						
lions paw	*Prenanthes alba*			m							m						
little blue stem	*Schizachyrium scoparium*										**dm**		**gdh**	sa			
little pussy toes	*Antennaria neglecta*										dm		gdh				
live-forever*	*Sedum purpureum**										m						
liverleaf	*Hepatica nobilis* var. *acuta*			m													
lizard's tail	*Saururus cernuus*							w							ma		
long awned bracted sedge	*Carex gravida*										m				ma		
long haired panic grass	*Dichanthelium villosissimum*										dm	m					
long leaved ammania	*Ammannia coccinea*																x
loose headed bracted sedge	*Carex sparganioides*			m		m	wm										
lopseed	*Phryma leptostachya*			m													
lousewort	*Pedicularis canadensis*										m		gdh				
love grass	*Eragrostis pectinacea*																x
low hop clover*	*Trifolium campestre**										m						x
maidenhair fern	*Adiantum pedatum*		dm														
marsh blazing star	*Liatris spicata*													se			
marsh fleabane	*Erigeron philadelphicus*														ma		
marsh pink	*Sabatia angularis*														ma		
marsh yellow cress	*Rorippa islandica* var.														ma		
Maryland senna	*Cassia marilandica*													se			
mayapple	*Podophyllum peltatum*		dm	**m**		m											
meadow anenome	*Anemone canadensis*										wm						
meadow fescue*	*Festuca pratensis**										m						x
meadow parsnip	*Oxypolis rigidior*													se			
meadow sedge	*Carex granularis*						wm								ma		
Mead's stiff sedge	*Carex meadii*										m			sa			
Miami mist	*Phacelia purshii*					m											
Missouri goldenrod	*Solidago missouriensis*										m						
Missouri gooseberry	*Ribes missouriense*		dm	**m**			wm				m						
Missouri ironweed	*Vernonia missurica*										m						
mockernut hickory	*Carya tomentosa*			m			wm										
monarda	*Monarda bradburiana*																
moneywort*	*Lysimachia nummularia**						wm	w									
monkey flower	*Mimulus alatus*			m		m											
moonseed	*Menispermum canadense*			m													
mosquito fern	*Azolla mexicana*															po	
moth mullein*	*Verbascum blattaria**																x
motherwort*	*Leonurus cardiaca**			m			wm										x
muhly	*Muhlenbergia sobolifera*			m													
multiflora rose*	*Rosa multiflora**			m		m	wm				m						x
nannyberry	*Viburnum lentago*			m													
narrow leaved cattail*	*Typha augustifolia**													se	ma		
narrow leaved oval sedge	*Carex tenera*										m						
New England aster	*Aster novae-angliae*										m			se			
New Jersey tea	*Ceanothus americanus*		d								m		gdh	sa			
nimble will	*Muhlenbergia schreberi*																x
nodding beggar ticks	*Bidens cernua*														ma		

Appendix 1. Continued

Class		FOREST									PRAIRIE				SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest					Prairie		Hill Prairie		Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w			dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																		
nodding fescue	*Festuca obtusa*			m															
nodding pagonia	*Triphora trianthophora*			m															
nodding spurge	*Chamaesyce maculata*																		x
northern bittercress	*Cardimine douglasii*					m													
Ohio buckeye	*Aesculus glabra*			**m**		m													
Ohio spiderwort	*Tradescantia ohiensis*										m				sa				
one-flowered broomrape	*Orobanche uniflora*			m															
Ontario aster	*Aster ontarionis*			m							m								
orange day lily*	*Hemerocallis fulva**										m								x
orchard grass*	*Dactylis glomerata**																		x
Osage orange*	*Maclura pomifera**			m		m													x
ox-eye daisy*	*Leucanthemum vulgare**																		x
pagoda plant	*Blephilia hirsuta*			m															
pale beard tongue	*Penstemon pallidus*	d	dm								m								
pale dock	*Rumex altissimus*																ma		
pale leaved sunflower	*Helianthus strumosus*			m							m		gdh						
pale purple coneflower	*Echinacea pallida*										m		gdh						
pale touch-me-not	*Impatiens pallida*			m															
panic grass	*Dichanthelium latifolium*			m															
panic grass	*Dichanthelium oligosanthes*										m								
panicled aster	*Aster simplex*						wm											po	x
panicled tick trefoil	*Desmodium paniculatum*															se			
parsnip*	*Pastinaca sativa**										m								x
partridge pea	*Cassia fasciculata*												gdh		sa				x
pasture rose	*Rosa carolina*	d									m		gdh		sa				
path rush	*Juncus tenuis*			m															x
paw paw	*Asimina triloba*			**m**		m													
peach leaved willow	*Salix amygdaloides*							w											
pellitory	*Parietaria pensylvanica*			m															
pignut hickory	*Carya glabra*	d	dm	m															
pin oak	*Quercus palustris*						wm												
plains oval sedge	*Carex brevior*										m								
plains three awn grass	*Aristida oligantha*																		x
pogoda plant	*Blephilia ciliata*												gdh						
poison hemlock*	*Conium maculatum**						wm												x
poison ivy	*Toxicodendron radicans*		dm	m		m	wm	w											
pokeweed	*Phytolacca americana*			m															x
porcupine grass	*Stipa spartea*										dm				sa				
poverty oat grass	*Danthonia spicata*	d	dm										gdh						
prairie alumroot	*Heuchera richardsoniip*										m								
prairie blazing star	*Liatris pycnostachya*										**m**		gdh			se			
prairie brome	*Bromus kalmii*												gdh			se			
prairie cinquefoil	*Potentilla arguta*										**m**								
prairie cord grass	*Spartina pectinata*											wm	w						
prairie dock	*Silphium terebinthinaceum*										**m**		**gdh**			se			
prairie dropseed	*Sporobolus heterolepis*										m								
prairie Indian plantain	*Cacalia plantaginea*										m					se			
prairie lily	*Lilium philadelphicum*										m								

Appendix 1. Continued

Class		FOREST								PRAIRIE					SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest				Prairie				Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w		dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																		
prairie milkeed	*Asclepias sullivantii*										m								
prairie panic grass	*Dichanthelium leibergii*									dm									
prairie parsley	*Polytaenia nuttallii*										m								
prairie phlox	*Phlox pilosa*										**m**			gdh					
prairie rose	*Rosa setigera*			m															
prairie sunflower	*Helianthus rigidus*										m				sa				
prairie switchgrass	*Panicum virgatum*										m			gdh	sa				
prairie violet	*Viola pedatifida*										**m**								
prairie willow	*Salix humilis*										m			gdh	sa	se			
prickly ash	*Zanthoxylum americanum*		dm	m			m												
prickly lettuce*	*Lactuca serriola**																		x
prickly sedge	*Carex stipata*																ma		
purple loosestrife*	*Lythrum salicaria**																ma		
purple meadow rue	*Thalictrum dasycarpum*														sa				
purple oxalis	*Oxalis violacea*			m							m								
purple prairie clover	*Dalea purpurea*										**m**			gdh					
purple rocket	*Iodanthus pinnatifidus*			m															
purslane speedwell	*Veronica peregrina*																		x
pussy willow	*Salix discolor*															se	ma		
putty root orchid	*Aplectrum hyemale*			m															
Queen Anne's lace*	*Daucus carota**										m				sa				x
rattlebox	*Crotalaria sagittalis*										m								
rattlesnake fern	*Botrichium virginianum*		dm														ma		
rattlesnake master	*Eryngium yuccifolium*										**m**								
red bulrush	*Scirpus pendulus*												w				ma		
red cedar	*Juniperus virginiana*	d	dm								*m*			gdh					
red clover*	*Trifolium pratense**										m								x
red haw	*Crataegus mollis*			**m**			wm												x
red maple	*Acer rubrum*																		
red mulberry	*Morus rubra*			m															
red oak	*Quercus rubra*		**dm**	**m**			m												
red seeded dandelion*	*Taraxacum laevigatum**																		x
red top	*Agrostis alba*															se			x
red trillium	*Trillium recurvatum*		dm	m															
redbud	*Cercis canadensis*		dm	**m**			m							gdh					
reed canary grass*	*Phalaris arundinacea**																ma		x
rice cutgrass	*Leersia oryzoides*																ma		
Riddell's goldenrod	*Solidago riddellii*															se			
rigid golden rod	*Solidago rigida*										m			gdh					
river bulrush	*Scirpus fluviatilis*																ma		
riverbank grape	*Vitis riparia*			m		m	wm	w		m						se			
rosinweed	*Silphium integrifolium*										**m**			gdh					
rough avens	*Geum laciniatum*						wm										ma		
rough bedstraw	*Galium asprellum*														sa				
rough blazing star	*Liatris aspera*										m								
rough clustered sedge	*Carex cephalophora*														sa				
rough dropseed	*Sporobolus asper*										m								x
rough false foxglove	*Agalinis aspera*													gdh		se			

Appendix 1. Continued

Class		FOREST								PRAIRIE			SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest				Prairie		Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w		dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																
rough leaf goldenrod	*Solidago patula*			m											se				
rough leaved dogwood	*Cornus drummondii*	d	dm																x
rough pig weed*	*Amaranthus retroflexus**			m															
rough stemmed false	*Agalinis gattingeri*													gdh					
rough wild lettuce	*Prenanthes aspera*									m									
rue anenome	*Thalictrum thalictroides*		dm	m															
Russian olive*	*Elaeagnus umbellata**																		x
sandbar willow	*Salix exigua*							w		m									
Sangamon phlox - SE	***Phlox pilosa ssp. sangamonensis* - SE**									**m**									
sassafras	*Sassafras albidum*		dm	m															x
savanna sedge	*Carex pensylvanica*	d	dm									gdh	sa						
saw-toothed sunflower	*Helianthus grosseserratus*										wm				ma				
scarlet oak	*Quercus coccinea*	d	dm	m															
scorpion grass	*Myosotis verna*																		x
scouring rush	*Equisetum hyemale*											gdh			se	ma			x
Scribner's panic grass	*Dichanthelium oligosanthes*									dm			sa						
sedge	*Carex aggregata*					m													
sedge	*Carex annectens*															ma			
sedge	*Carex artitecta*	d	dm	m															
sedge	*Carex cristatella*										wm					ma			
sedge	*Carex frankii*						wm									ma			
sedge	*Carex glaucodea*	d	dm																
sedge	*Carex gracilescens*			m															
sedge	*Carex lanuginosa*										wm		sa						
sedge	*Carex leavenworthii*																		x
sedge	*Carex molesta*									m									
sedge	*Carex oligocarpa*			m		m													
sedge	*Carex projecta*															ma			
sedge	*Carex shortiana*					m													x
sedge	*Carex suberecta*														se				
self heal *	*Prunella vulgaris**			m						m					se				
Seneca snakeroot	*Polygala senega*		dm																
sensitive fern	*Onoclea sensibilis*															ma			
sessile flowered yellow	*Rorippa sessiliflora*															ma			
sessile leaved tick trefoil	*Desmodium sessifolium*									dm									
shadbush	*Amelanchier arborea*		dm	m								gdh			se				
shagbark hickory	*Carya ovata*	d	**dm**	m									sa						
shepherd's purse*	*Capsella bursa-pastoris**																		x
shingle oak	*Quercus imbricaria*	d	dm	m			wm					gdh	sa						
shining bedstraw	*Galium concinnum*			m															
shooting star	*Dodecatheon meadia*	d	dm							m			sa						
short headed rush	*Juncus brachycarpus*															ma			
Short's aster	*Aster shortii*			m															
showy goldenrod	*Solidago speciosa*									*m*			*sa*						
showy orchis	*Galearis spectabilis*			m															
showy tick trefoil	*Desmodium canadense*									m					se				
Siberian elm*	*Ulmus pumila**																		x

Appendix 1. Continued

Class		FOREST							PRAIRIE			SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest			Prairie		Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w	dm	m	wm w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**															
side flowered aster	*Aster lateriflorus*						wm	w					se			
side-oats grama	*Bouteloua curtipendula*										**gdh**					
silver maple	*Acer saccharinum*						wm	**w**	m							x
skunk cabbage	*Symplocarpus foetidus*												se			
sky-blue aster	*Aster azureus*								dm		gdh					
sleepy catchfly	*Silene antirrhina*											sa				x
slender bush clover	*Lespedeza virginica*										gdh					
slender false fox-glove	*Agalinis tenuifolia*										gdh					
slender monutain mint	*Pycnanthemum tenuifolium*								m		gdh		se			
slender muhly	*Muhlenbergia tenuiflora*		dm													
slender spike rush	*Eleocharis verrucosa*												se?			
slender three seeded	*Acalypha gracilens*								dm	m						
slender wild rye	*Elymus villosus*		dm	m												
slippery elm	*Ulmus rubra*		dm	**m**		**m**	wm									
small false Solomon's seal	*Smilacina stellata*			m							gdh	sa				
small fruited agrimony	*Agrimonia parviflora*			m										ma		
small skullcap	*Scutellaria leonardii*								m							
small-flowered crowfoot	*Ranunculus abortivus*			m										ma		
smartweed	*Polygonum pensylvanicum*													ma		
smooth blue aster	*Aster laevis*								m							
smooth crab grass*	*Digitaria ischaemum**															x
smooth ground cherry	*Physalis subglabrata*															x
smooth hedge nettle	*Stachys tenuifolia*													ma		
smooth phlox	*Phlox glabberima*									wm						
smooth rock cress	*Arabis laevigata*			m												
smooth ruellia	*Ruellia strepens*			m												
smooth sumac	*Rhus glabra*	d	dm								gdh					
smooth yellow violet	*Viola pubescens*			m												
sneezeweed	*Helenium autumnale*						wm									
soft agrimony	*Agrimonia pubescens*			m												
soft-stemmed bulrush	*Scirpus tabernaemontanii*													ma		
Solomon's seal	*Polygonatum commutatum*		dm	m		m						sa				
sorrel	*Oxalis dillenii*											sa				x
sour dock*	*Rumex acetosella**			m												
spatterdock	*Nuphar luteum*														po	
spicebush	*Lindera benzoin*			m		m										
spiderwort	*Tradescantia subaspera*					m	wm									
spike lobelia	*Lobelia spicata*								m		gdh					
spike rush	*Eleocharis erythropoda*													**ma**		
spike rush	*Eleocharis obtusa*													ma		
spike rush	*Eleocharis smallii*													ma		
spikemoss	*Selaginella eclipes*												se			
spotted Joe-Pye weed	*Eupatorium maculatum*												se	ma		
spotted touch-me-not	*Impatiens capensis*					m							se	ma		
spreading dogbane	*Apocynum androsaemifolium*															
spreading oval sedge	*Carex normalis*								m							
spreading witch grass	*Panicum dichotomiflorum*															x
spring avens	*Geum vernum*			m												x

Appendix 1. Continued

Class		FOREST				PRAIRIE		SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest		Floodpln Forest		Prairie	Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d dm m wm		m wm w		dm m wm w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**											
spring beauty	*Claytonia virginica*	dm **m**										
squirrel corn	*Dicentra canadensis*	dm m										
starry catchfly	*Silene stellata*	m						sa				
stickseed	*Hackelia virginiana*	m										
sticktight	*Bidens vulgata*	m								ma		x
stiff bedstraw	*Galium obtusum*	m										
stiff gentian	*Gentianella quinquefolia*	m					gdh		se			
stout wood reed	*Cinna arundinacea*	m		m wm								
straw colored flat sedge	*Cyperus strigosus*											x
sugar maple	*Acer saccharum*	dm **m**		**m**					se			x
sulfur cinquefoil*	*Potentilla recta**											x
summer grape	*Vitis aestivalis*	m										
swamp buttercup	*Ranunculus septentrionalis*			m wm						ma		
swamp marigold	*Bidens aristosa*	m										
swamp milkweed	*Asclepias incarnata*								se	ma		
swamp tickseed	*Bidens comosa*									ma		
swamp white oak	*Quercus bicolor*		**wm**		wm							
swamp wood betony	*Pedicularis lanceolata*								se			
sweet cicely	*Osmorhiza claytonii*	m										
sweet flag	*Acorus americanus*											
sweet-scented bedstraw	*Galium triflorum*	m										
sycamore	*Platanus occidentalis*			m **wm w**			gdh			ma		x
tall alumroot	*Heuchera americana*	d dm										
tall bellflower	*Campanula americana*			*m wm*								
tall blackberry	*Rubus argutus*	m										
tall blue lettuce	*Lactuca biennis*	m										
tall boneset	*Eupatorium altissimum*					m	gdh					
tall coreopsis	*Coreopsis tripteris*					m	gdh		se			
tall golden rod	*Solidago canadensis*	m				m						x
tall thistle	*Cirsium altissimum*											x
tall water hemp	*Amaranthus tuberculatus*											x
tall white lettuce	*Prenanthes altissima*	m										
thicket parsley	*Perideridia americana*					m		sa				
thimblweed	*Anemone virginiana*	dm m					gdh					
three awn grass	*Aristida longispica*											x
three seeded mercury	*Acalypha rhomboidea*	m										
tickseed	*Desmodium glutinosum*	dm m										
tiger lily*	*Lilium lancifolium**											x
Timothy*	*Phleum pratense**											x
toothed cress	*Arabis shortii*									ma		
toothwort	*Dentaria laciniata*	dm m		m								
torrey rush	*Juncus torreyi*									ma		
tree of heaven*	*Ailanthus altissima**											x
trumpet creeper	*Campsis radicans*	m				m						
upright smilax	*Smilax ecirrhata*	m										
velvet leaf*	*Abutilon theophrasti**	m										x
Venus's looking glass	*Triodanis perfoliata*							sa				x
violet bush clover	*Lespedeza violacea*											

Appendix 1. Continued

Common Name[3,4]	Scientific Name[3,4]	Class: FOREST							PRAIRIE				SAVANNA	WETLAND			CULTURAL
		Sub-class: Upland Forest				Floodpln Forest			Prairie			Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
		Natural Community[1,2]: d	dm	m	wm	m	wm	w	dm	m	wm	w	gdh	sa	se	ma	s, po	all
Virginia creeper	*Parthenocissus quinquefolia*		dm	m		m												
Virginia knotweed	*Polygonum virginianum*			m														
Virginia rock cress	*Sibara virginica*																	x
Virginia spiderwort	*Tradescantia virginiana*	d	dm											sa				
Virginia waterleaf	*Hydrophyllum virginianum*			m			**wm**											
Virginia wild rye	*Elymus virginicus*			m			wm											
wafer ash	*Ptelea trifoliata*		dm															
wahoo	*Euonymus atropurpureus*			m														
water hemlock	*Cicuta maculata*															ma		
water parsnip	*Sium suave*															ma		
water willow	*Justicia americana*																s	
waterclover	*Marsilea quadrifolia*																po	
waterleaf	*Hydrophyllum appendiculatum*			m														
watershield	*Brasenia schreberi*																po	
waxy meadow rue	*Thalictrum revolutum*															ma		
wayfaring tree*	*Viburnum lantana**																	x
wedge grass	*Sphenopholis obtusata* var.								m									
western sunflower	*Helianthus occidentalis*											gdh						
white ash	*Fraxinus americana*		dm	**m**														
white avens	*Geum canadense*			m			wm		m				sa					
white clover*	*Trifolium repens**																	x
white grass	*Leersia virginica*			m		m												
white lady's slipper orchid	*Cypripedium candidum*								m									
white mulberry*	*Morus alba**			m					m									
white oak	*Quercus alba*	d	**dm**	**m**								gdh	sa					
white pine*	*Pinus strobus**																	x
white poplar*	*Populus alba**								m									
white prairie clover	*Dalea candida*								m									
white snakeroot	*Eupatorium rugosum*			m														
white sweet clover*	*Melilotus alba**								m			gdh	sa					x
white trillium	*Trillium flexipes*			m														
white trout lily	*Erythronium albidum*			**m**														
white turtlehead	*Chelone glabra*													se				
white vervain	*Verbena urticifolia*						wm											x
white wild indigo	*Baptisia lactea*								m									
whorled loosestrife	*Lysimachia quadrifolia*													se				
whorled milkwort	*Polygala verticillata*								m			gdh						
wild bean	*Strophostyles helvola*																	x
wild bergamont	*Monarda fistulosa*								m				sa					
wild chervil	*Chaerophyllum procumbens*			m			wm									ma		
wild flax	*Linum medium*													se				
wild garlic	*Allium canadense*			m					m			gdh	sa					
wild geranium	*Geranium maculatum*		dm	m									sa					
wild ginger	*Asarum canadense*			m														
wild hyacinth	*Camassia scilloides*								m				sa					
wild hydrangea	*Hydrangea arborescens*			m														
wild lettuce	*Lactuca canadensis*			m					m									x
wild lily	*Lilium michiganense*			m														

Appendix 1. Continued

Class		FOREST							PRAIRIE			SAVANNA	WETLAND			CULTURAL
Sub-class		Upland Forest				Floodpln Forest			Prairie		Hill Prairie	Savanna	Seep	Marsh	Other	Cultural
Natural Community[1,2]		d	dm	m	wm	m	wm	w	dm	m	wm	w	gdh	sa	se	ma	s, po	all
Common Name[3,4]	**Scientific Name[3,4]**																	
wild onion	*Allium burdickii*			m														
wild onion	*Allium tricoccum*			m														
wild petunia	*Ruellia humilis*									m								
wild plum	*Prunus americana*			m														
wild sarsaparilla	*Aralia nudicaulis*		dm															
wild strawberry	*Fragaria virginiana*		dm							m			gdh	sa				
wild sweet crab apple	*Malus coronaria*			m														
wild yam	*Dioscorea villosa*			m														
winged loosestrife	*Lythrum alatum*									wm								
wirestem grass	*Muhlenbergia mexicana*			m														
witch grass	*Panicum capillare*			m														
witch hazel	*Hamamelis virginiana*			m														
Wolf's bluegrass - SE	***Poa wolfii* - SE**												gdh					
wood gray sedge	*Carex grisea*			m			wm											
wood nettle	*Laportea canadensis*						wm	w										
wood sage	*Teucrium canadense*					m	wm									ma		x
wood sorrel	*Oxalis stricta*			m						m								x
woodland agrimony	*Agrimonia rostellata*			m														
woodland blue grass	*Poa sylvestris*			m														
woodland lettuce	*Lactuca floridana*			m														
woodland sunflower	*Helianthus divaricatus*	**d**	dm															
woolly mullein*	*Verbascum thapsus**																	x
woundwort	*Stachys palustris*									wm								
yellow bellwort	*Uvularia grandiflora*		dm	m														
yellow crown beard	*Verbesina helianthoides*	d	dm															
yellow flax	*Linum sulcatum*												gdh					
yellow giant hyssop	*Agastache nepetoides*			m														
yellow ironweed	*Verbesina alternifolia*						wm								se			
yellow lady's slipper orchid	*Cypripedium pubescens*			m														
yellow pimpernel	*Taenidia integerrima*	d											gdh	sa				
yellow poplar	*Liriodendron tulipifera*			m														
yellow rocket*	*Barbarea vulgaris**			m										sa				x
yellow star grass	*Hypoxis hirsuta*									m			gdh					
yellow sweet clover*	*Melilotus officinalis**									m			gdh					x
yucca*	*Yucca flaccida**									m								

[1] Bold Community codes indicate characteristic species for that habitat.

[2] Habitat codes for each community are as follows:

d = dry	gdh = glacial drift hill
dm = dry-mesic	sa = savanna
m = mesic	se = seep
wm = wet-mesic	s = stream
w = wet	p = pond

[3] Threatened or endangered species are in high boldhighlight: SE = state endangered; ST = state threatened.

[4] * = exotic species.

Appendix 2

Plant species from Appendix 1, listed by scientific name.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
*Abutilon theophrasti**	velvet leaf*	*Andropogon virginicus*	broom sedge
Acalypha gracilens	slender three seeded mercury	*Anemone canadensis*	meadow anenome
Acalypha rhomboidea	three seeded mercury	*Anemone cylindrica*	candle anemone
Acer negundo	box elder	*Anemone virginiana*	thimblweed
Acer nigrum	black maple	*Angelica atropurpurea*	angelica
Acer rubrum	red maple	*Antennaria neglecta*	little pussy toes
Acer saccharinum	silver maple	*Antennaria plantaginifolia*	everlasting
Acer saccharum	sugar maple	*Apios americana*	groundnut
*Achillea millefolium**	common yarrow*	*Aplectrum hyemale*	putty root orchid
Acorus americanus	sweet flag	*Apocynum androsaemifolium*	spreading dogbane
Actaea pachypoda	doll's eyes	*Apocynum cannabinum*	Indian hemp
Adiantum pedatum	maidenhair fern	*Apocynum sibiricum*	Indian hemp
Aesculus glabra	Ohio buckeye	*Apocynum* X *medium*	intermediate dogbane
Agalinis aspera	rough false foxglove	*Aquilegia canadensis*	columbine
Agalinis gattingeri	rough stemmed false foxglove	*Arabis laevigata*	smooth rock cress
		Arabis shortii	toothed cress
Agalinis tenuifolia	slender false fox-glove	*Aralia nudicaulis*	wild sarsaparilla
Agastache nepetoides	yellow giant hyssop	*Arctium minus**	common burdock
Agrimonia parviflora	small fruited agrimony	*Arisaema dracontium*	green dragon
Agrimonia pubescens	soft agrimony	*Arisaema triphyllum*	Jack-in-the pulpit
Agrimonia rostellata	woodland agrimony	*Aristida longispica*	three awn grass
Agrostis alba	red top	*Aristida oligantha*	plains three awn grass
Agrostis hyemalis	hair grass	*Asarum canadense*	wild ginger
Agrostis perennans	autumn bent grass	*Asclepias incarnata*	swamp milkweed
*Ailanthus altissima**	tree of heaven*	*Asclepias sullivantii*	prairie milkeed
Alisma plantego-aquatica		*Asclepias syriaca*	common milkweed
var. *parvifloru*	common water plantain	*Asclepias tuberosa*	butterfly weed
*Alliaria petiolata**	garlic mustard*	*Asclepias verticillata*	horsetail milkweed
Allium burdickii	wild onion	*Asclepias viridiflora*	green milkweed
Allium canadense	wild garlic	*Asimina triloba*	paw paw
Allium tricoccum	wild onion	*Asparagus officinalis**	asparagus*
*Allium vineale**	field garlic*	*Asplenium platyneuron*	ebony spleenwort
Alopecurus carolinianus	common foxtail	*Aster azureus*	sky-blue aster
*Amaranthus hybridus **	green amaranth*	*Aster ericoides*	heath aster
*Amaranthus retroflexus**	rough pig weed*	*Aster laevis*	smooth blue aster
Amaranthus tuberculatus	tall water hemp	*Aster lateriflorus*	side flowered aster
Ambrosia artemisiifolia	common ragweed	*Aster novae-angliae*	New England aster
Ambrosia trifida	giant ragweed	*Aster ontarionis*	Ontario aster
Amelanchier arborea	shadbush	*Aster pilosus*	hairy aster
Ammannia coccinea	long leaved ammania	*Aster sagittifolius*	arrowleaf aster
Amorpha canescens	leadplant	*Aster shortii*	Short's aster
Amorpha fruticosa	false indigo bush	*Aster simplex*	panicled aster
Amphicarpa bracteata	hog peanut	*Astragalus canadensis*	Canadian milk vetch
Andropogon gerardii	big bluestem	*Azolla mexicana*	mosquito fern

Appendix 2. Continued

Scientific Name[1,2]	Common Name[1,2]
Baptisia lactea	white wild indigo
Baptisia leucophaea	cream wild indigo
*Barbarea vulgaris**	yellow rocket*
*Berberis thunbergii**	Japanese barberry
Bidens aristosa	swamp marigold
Bidens cernua	nodding beggar ticks
Bidens comosa	swamp tickseed
Bidens frondosa	common begger ticks
Bidens tripartita	beggar ticks
Bidens vulgata	sticktight
Blephilia ciliata	pogoda plant
Blephilia hirsuta	pagoda plant
Boehmeria cylindrica	false nettle
Botrichium virginianum	rattlesnake fern
Bouteloua curtipendula	side-oats grama
Brachyletrum erectum	black gramma
Brasenia schreberi	watershield
Brickellia eupatorioides	false boneset
*Bromus inermis**	awnless brome grass*
Bromus kalmii	prairie brome
Bromus pubescens	Canada brome grass
Bromus purgans	brome grass
*Bromus tectorum**	cheat grass*
Cacalia atriplicifolia	Indian plantain
Cacalia plantaginea	prairie Indian plantain
Calamagrostis canadensis	blue joint grass
Caltha palustris	cowslip
Calystegia sepium	American bindweed
Calystegia spithamaea	dwarf bindweed
Camassia scilloides	wild hyacinth
Campanula americana	tall bellflower
Campsis radicans	trumpet creeper
*Cannabis sativa**	common hemp
*Capsella bursa-pastoris**	shepherd's purse*
Cardamime pensylvanica	bitter cress
Cardimine douglasii	northern bittercress
Carex aggregata	sedge
Carex albursina	broad-leaved sedge
Carex annectens	sedge
Carex artitecta	sedge
Carex bebbii	Bebb's oval sedge
Carex bicknellii	copper shouldered oval sedge
Carex blanda	common wood sedge
Carex brevior	plains oval sedge
Carex bromoides	brome hummock sedge
Carex cephalophora	rough clustered sedge
Carex conjuncta	bristly sedge
Carex cristatella	sedge
Carex davisii	awned graceful sedge
Carex frankii	sedge
Carex glaucodea	sedge
Carex gracilescens	sedge
Carex granularis	meadow sedge
Carex gravida	long awned bracted sedge
Carex grayi	common bur sedge
Carex grisea	wood gray sedge
Carex hirsutella	hairy green sedge
Carex hirtifolia	hairy wood sedge
Carex hystricina	bottlebrush sedge
Carex interior	inland sedge
Carex jamesii	grass sedge
Carex lanuginosa	sedge
Carex leavenworthii	sedge
Carex meadii	Mead's stiff sedge
Carex molesta	sedge
Carex normalis	spreading oval sedge
Carex oligocarpa	sedge
Carex pensylvanica	savanna sedge
Carex projecta	sedge
Carex rosea	curly styled wood sedge
Carex shortiana	sedge
Carex sparganioides	loose headed bracted sedge
Carex stipata	prickly sedge
Carex stricta	common tussock sedge
Carex suberecta	sedge
Carex tenera	narrow leaved oval sedge
Carex tribuloides	awl-fruited sedge
Carex trichocarpa	hairy fruited lake sedge
Carex vulpinoidea	fox sedge
Carpinus caroliniana	blue beech
Carya cordiformis	bitternut hickory
Carya glabra	pignut hickory
Carya laciniosa	kingnut hickory
Carya ovalis	false shagbark hickory
Carya ovata	shagbark hickory
Carya tomentosa	mockernut hickory
Cassia fasciculata	partridge pea
Cassia marilandica	Maryland senna
Castilleja coccinea	Indian paintbrush
Caulophyllum thalictroides	blue cohosh
Ceanothus americanus	New Jersey tea
Celastrus scandens	bittersweet
Celtis occidentalis	hackberry
Cephalanthus occidentalis	button bush
*Cerastium vulgatum**	common mouse ear*
Ceratophyllum demersum	coontail
Cercis canadensis	redbud
Chaerophyllum procumbens	wild chervil
Chamaesyce maculata	nodding spurge
Chelone glabra	white turtlehead
*Chenopodium album**	lamb's quarters*
Chenopodium standleyanum	goosefoot

Appendix 2. Continued

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
*Cichorium intybis**	chickory*	*Diarrhena americana*	beak grass
Cicuta maculata	water hemlock	*Dicentra canadensis*	squirrel corn
Cinna arundinacea	stout wood reed	*Dicentra cucullaria*	Dutchman's breeches
Circaea lutetiana	enchanter's nightshade	*Dichanthelium acuminatum*	
Cirsium altissimum	tall thistle	var. *fascicula*	hairy panic grass
*Cirsium arvense**	Canada thistle*	*Dichanthelium clandestinum*	broad leaved panic grass
Cirsium discolor	field thistle	*Dichanthelium latifolium*	panic grass
Cirsium muticum	fen thistle	*Dichanthelium leibergii*	prairie panic grass
*Cirsium vulgare**	bull thistle*	*Dichanthelium oligosanthes*	panic grass
Claytonia virginica	spring beauty	*Dichanthelium oligosanthes*	
Coeloglossum viride	bracted green orchid	var. *scribneri*	Scribner's panic grass
Collinsia verna	blue-eyed Mary	*Dichanthelium villosissimum*	
Comandra umbellata	bastard toadflax	var. *praecoci*	long haired panic grass
*Conium maculatum**	poison hemlock*	*Digitaria ischaemum**	smooth crab grass*
Conophilis americana	cancer-root	*Digitaria sanguinalis**	common crab grass*
*Convallaria majalis**	lily of the valley*	*Dioscorea villosa*	wild yam
Corallorhiza odontorhiza	fall coral-root	*Dodecatheon meadia*	shooting star
Coreopsis tripteris	tall coreopsis	*Echinacea pallida*	pale purple coneflower
Cornus alternifolia	alternate leaved dogwood	*Echinochloa crus-galli**	barnyard grass*
Cornus drummondii	rough leaved dogwood	*Echinochloa muricta*	barnyard grass
Cornus florida	flowering dogwood	*Elaeagnus umbellata**	Russian olive*
Cornus racemosa	gray dogwood	*Eleocharis erythropoda*	spike rush
*Coronilla varia**	crown vetch*	*Eleocharis obtusa*	spike rush
Corylus americana	hazelnut	*Eleocharis smallii*	spike rush
Crataegus crus-galli	cockspur thorn	*Eleocharis verrucosa*	slender spike rush
Crataegus mollis	red haw	*Ellisia nyctelea*	Aunt Lucy
Crataegus pedicellata	hawthorn	*Elymus canadensis*	Canada wild rye
Crotalaria sagittalis	rattlebox	*Elymus hystrix*	bottlebrush grass
Cryptotaenia canadensis	honewort	*Elymus villosus*	slender wild rye
Cuscuta gronovii	dodder	*Elymus virginicus*	Virginia wild rye
Cyperus rivularis	brook flat sedge	*Epilobium coloratum*	cinnamon willow herb
Cyperus strigosus	straw colored flat sedge	*Equisetum arvense*	common horestail
Cypripedium candidum	white lady's slipper orchid	*Equisetum hyemale*	scouring rush
Cypripedium pubescens	yellow lady's slipper orchid	*Eragrostis capillaris*	lace grass
Cystopteris protusa	fragile fern	*Eragrostis pectinacea*	love grass
*Dactylis glomerata**	orchard grass*	*Erigenia bulbosa*	harbinger of spring
Dalea candida	white prairie clover	*Erigeron annuus*	fleabane daisy
Dalea purpurea	purple prairie clover	*Erigeron philadelphicus*	marsh fleabane
Danthonia spicata	poverty oat grass	*Erigeron strigosus*	daisy fleabane
*Datura stramonium**	jimpson weed*	*Eryngium yuccifolium*	rattlesnake master
*Daucus carota**	Queen Anne's lace*	*Erythronium albidum*	white trout lily
Delphinium tricorne	dwarf larkspur	*Euonymus atropurpureus*	wahoo
Dentaria laciniata	toothwort	*Euonymus europaeus**	European spindle tree*
Desmodium canadense	showy tick trefoil	*Eupatorium altissimum*	tall boneset
Desmodium canescens	hoary tick trefoil	*Eupatorium maculatum*	spotted Joe-Pye weed
Desmodium glutinosum	tickseed	*Eupatorium perfoliatum*	common boneset
Desmodium illinoense	Illinois tick trefoil	*Eupatorium purpureum*	green stemmed Joe Pye weed
Desmodium nudiflorum	bare stem tick trefoil	*Eupatorium rugosum*	white snakeroot
Desmodium paniculatum	panicled tick trefoil	*Eupatorium serotinum*	late boneset
Desmodium sessifolium	sessile leaved tick trefoil	*Euphorbia corollata*	flowering spurge
*Dianthus armeria**	Depthford pink*	*Euphorbia cyparissias**	cyprus spurge*

Appendix 2. Continued

Scientific Name[1,2]	Common Name[1,2]
Euthamia graminifolia	grass leaf golderod
Fagus grandifolia	beech
Festuca obtusa	nodding fescue
*Festuca pratensis**	meadow fescue*
Floerkea proserpinacoides	false mermaid
Fragaria virginiana	wild strawberry
Fraxinus americana	white ash
Fraxinus nigra	black ash
Fraxinus pennsylvanica	green ash
Fraxinus quadrangulata	blue ash
Galearis spectabilis	showy orchis
Galium aparine	annual bedstraw
Galium asprellum	rough bedstraw
Galium circaezans	broad leaved galium
Galium concinnum	shining bedstraw
Galium obtusum	stiff bedstraw
Galium triflorum	sweet-scented bedstraw
Gaura biennis	biennial gaura
Gentiana andrewsii	closed gentian
Gentiana puberulenta	downy gentian
Gentianella quinquefolia	stiff gentian
Geranium maculatum	wild geranium
Geum canadense	white avens
Geum laciniatum	rough avens
Geum vernum	spring avens
*Glechoma hederacea**	creeping Charlie*
Gleditsia triacanthos	honey locust
Glyceria striata	fowl manna grass
Gnaphalium obtusifolium	catfoot
Gratiola neglecta	clammy hedge hyssop
Gymnocladus dioica	Kentucky coffee tree
Hackelia virginiana	stickseed
Hamamelis virginiana	witch hazel
Helenium autumnale	sneezeweed
Helianthemum bicknellii	frostweed
Helianthus divaricatus	woodland sunflower
Helianthus grosseserratus	saw-toothed sunflower
Helianthus mollis	downy sunflower
Helianthus occidentalis	western sunflower
Helianthus rigidus	prairie sunflower
Helianthus strumosus	pale leaved sunflower
Helianthus tuberosus	Jerusalum artichoke
Heliopsis helianthoides	false sunflower
*Hemerocallis fulva**	orange day lily*
Hepatica nobilis var. *acuta*	liverleaf
Heracleum lanatum	cow parsnip
Heuchera americana	tall alumroot
Heuchera richardsoniip	prairie alumroot
*Hibiscus trionum**	flower of an hour*
*Hordeum jubatum**	foxtail barley*
Humulus lupulus	American hop
Hybanthus concolor	green violet
Hydrangea arborescens	wild hydrangea
Hydrastis canadensis	goldenseal
Hydrophyllum appendiculatum	waterleaf
Hydrophyllum virginianum	Virginia waterleaf
Hypoxis hirsuta	yellow star grass
Impatiens capensis	spotted touch-me-not
Impatiens pallida	pale touch-me-not
Iodanthus pinnatifidus	purple rocket
*Ipomoea hederacea**	ivy leaved morning glory*
*Ipomoea purpurea**	common morning glory*
Iris shrevei	blue flag
Isopyrum biternatum	false rue anenome
Juglans cinerea	butternut
Juglans nigra	black walnut
Juncus brachycarpus	short headed rush
Juncus dudleyi	Dudley's rush
Juncus interior	inland rush
Juncus nodosus	jointed rush
Juncus tenuis	path rush
Juncus torreyi	torrey rush
Juniperus virginiana	red cedar
Justicia americana	water willow
Koeleria macrantha	crested hair grass
Lactuca biennis	tall blue lettuce
Lactuca canadensis	wild lettuce
Lactuca floridana	woodland lettuce
*Lactuca serriola**	prickly lettuce*
Laportea canadensis	wood nettle
Leersia oryzoides	rice cutgrass
Leersia virginica	white grass
Lemna minor	duckweed
*Leonurus cardiaca**	motherwort*
*Lepidium campestre**	field pepper grass*
Lepidium virginicum	common pepper grass
Lespedeza capitata	bush clover
Lespedeza violacea	violet bush clover
Lespedeza virginica	slender bush clover
*Leucanthemum vulgare**	ox-eye daisy*
Liatris aspera	rough blazing star
Liatris cylindracea	cylindric blazing star
Liatris pycnostachya	prairie blazing star
Liatris spicata	marsh blazing star
*Lilium lancifolium**	tiger lily*
Lilium michiganense	wild lily
Lilium philadelphicum	prairie lily
Lindera benzoin	spicebush
Linum medium	wild flax
Linum sulcatum	yellow flax
Liparis liliifolia	large twayblade
Liriodendron tulipifera	yellow poplar

Appendix 2. Continued

Scientific Name[1,2]	Common Name[1,2]
Lithospermum canescens	hoary puccoon
Lithospermum latifolium	American gromwell
Lobelia inflata	Indian tobacco
Lobelia siphilitica	blue lobelia
Lobelia spicata	spike lobelia
*Lonicera japonica**	Japanese honeysuckle*
*Lonicera maackii**	amur honeysuckle*
Lonicera prolifera	grape honeysuckle
*Lonicera tatarica**	honeysuckle*
*Lotus corniculatus**	birds-foot trefoil*
Lycopus americanus	common water horehound
Lysimachia ciliata	fringed loosestrife
Lysimachia lanceolata	lance-leaved loosestrife
*Lysimachia nummularia**	moneywort*
Lysimachia quadrifolia	whorled loosestrife
Lythrum alatum	winged loosestrife
*Lythrum salicaria**	purple loosestrife*
*Maclura pomifera**	Osage orange*
Malus coronaria	wild sweet crab apple
Malus ioensis	Iowa crabapple
*Marrubium vulgare**	common horehound*
Marsilea quadrifolia	waterclover
*Medicago lupulina**	black medic*
*Melilotus alba**	white sweet clover*
*Melilotus officinalis**	yellow sweet clover*
Menispermum canadense	moonseed
Mentha arvensis var. *villosa*	field mint
Mertensia virginica	blue bells
Mimulus alatus	monkey flower
*Mollugo verticillata**	carpet weed*
Monarda bradburiana	monarda
Monarda fistulosa	wild bergamont
*Morus alba**	white mulberry*
Morus rubra	red mulberry
Muhlenbergia frondosa	common satin grass
Muhlenbergia mexicana	wirestem grass
Muhlenbergia schreberi	nimble will
Muhlenbergia sobolifera	muhly
Muhlenbergia tenuiflora	slender muhly
Myosotis verna	scorpion grass
*Nepeta cataria**	catnip*
Nuphar luteum	spatterdock
Oenothera biennis	evening primrose
Onoclea sensibilis	sensitive fern
Orobanche uniflora	one-flowered broom rape
Osmorhiza claytonii	sweet cicely
Osmorhiza longistylis	anise-root
Ostrya virginiana	hop hornbeam
Oxalis dillenii	sorrel
Oxalis stricta	wood sorrel
Oxalis violacea	purple oxalis
Oxypolis rigidior	meadow parsnip
Panax quinquefolius	ginseng
Panicum capillare	witch grass
Panicum dichotomiflorum	spreading witch grass
Panicum virgatum	prairie switchgrass
Parietaria pensylvanica	pellitory
Parnassia glauca	grass-of-Parnassus
Parthenium integrifolium	feverfew
Parthenocissus quinquefolia	Virginia creeper
*Pastinaca sativa**	parsnip*
Pedicularis canadensis	lousewort
Pedicularis lanceolata	swamp wood betony
Penstemon digitalis	foxglove beard tongue
Penstemon pallidus	pale beard tongue
Penthorum sedoides	ditch stonecrop
Perideridia americana	thicket parsley
Phacelia purshii	Miami mist
*Phalaris arundinacea**	reed canary grass*
*Phleum pratense**	Timothy*
Phlox divaricata	common phlox
Phlox glabberima	smooth phlox
Phlox pilosa	prairie phlox
***Phlox pilosa ssp. sangamonensis* - SE**	**Sangamon phlox - SE**
Phragmites australis	common red reed
Phryma leptostachya	lopseed
Physalis heterophylla	clammy ground cherry
Physalis subglabrata	smooth ground cherry
Physalis virginiana	ground cherry
Physostegia virginiana	false dragonhead
Phytolacca americana	pokeweed
Pilea pumila	clearweed
*Pinus strobus**	white pine*
*Plantago lanceolata**	buckhorn plantain*
Plantago rugelii	common plantain
Platanthera lacera	green fringed orchid
Platanus occidentalis	sycamore
*Poa compressa**	Canada bluegrass**
Poa palustrus	fowl blue grass
*Poa pratensis**	Kentucky bluegrass*
Poa sylvestris	woodland blue grass
***Poa wolfii* - SE**	**Wolf's bluegrass - SE**
Podophyllum peltatum	mayapple
Polygala sanguinea	field milkroot
Polygala senega	Seneca snakeroot
Polygala verticillata	whorled milkwort
Polygonatum commutatum	Solomon's seal
Polygonum cespitosum	

Appendix 2. Continued

Scientific Name[1,2]	Common Name[1,2]
var. *longisetum**	creeping smartweed*
*Polygonum convolvulus**	black bindweed*
*Polygonum hydropiper**	common smartweed*
Polygonum lapathifolium	curttop lady's thumb
Polygonum pensylvanicum	smartweed
Polygonum punctatum	dotted smartweed
Polygonum scandens	false buckwheat
Polygonum virginianum	Virginia knotweed
Polymnia canadensis	leafcup
Polystichum acrostichoides	Christmas fern
Polytaenia nuttallii	prairie parsley
*Populus alba**	white poplar*
Populus deltoides	cottonwood
Potentilla arguta	prairie cinquefoil
*Potentilla recta**	sulfur cinquefoil*
Potentilla simplex	common cinquefoil
Prenanthes alba	lions paw
Prenanthes altissima	tall white lettuce
Prenanthes aspera	rough wild lettuce
*Prunella vulgaris**	self heal *
Prunus americana	wild plum
Prunus serotina	black cherry
Prunus virginiana	common choke cherry
Psoralea onobrychis	French grass
Ptelea trifoliata	wafer ash
Pycnanthemum pilosum	hairy mountain mint
Pycnanthemum tenuifolium	slender monutain mint
Pycnanthemum virginianum	common mountain mint
Quercus alba	white oak
Quercus bicolor	swamp white oak
Quercus coccinea	scarlet oak
Quercus imbricaria	shingle oak
Quercus macrocarpa	bur oak
Quercus palustris	pin oak
Quercus prinoides	
var. *acuminata*	chinquapin oak
Quercus rubra	red oak
Quercus velutina	black oak
Ranunclus recurvatus	hooked buttercup
Ranunculus abortivus	small-flowered crowfoot
Ranunculus fascicularis	early buttercup
Ranunculus septentrionalis	swamp buttercup
Ratibida pinnata	drooping coneflower
*Rhamnus cathartica**	common buckthorn*
*Rhamnus frangula**	glossy buckthorn*
Rhus glabra	smooth sumac
Ribes americanum	American black currant
Ribes missouriense	Missouri gooseberry
*Robinia pseudoacacia**	black locust*
Rorippa islandica	
var. *fernaldiana*	marsh yellow cress
Rorippa sessiliflora	sessile flowered yellow cress
Rosa carolina	pasture rose
*Rosa multiflora**	multiflora rose*
Rosa setigera	prairie rose
Rubus allegheniensis	common blackberry
Rubus argutus	tall blackberry
Rubus flagellaris	dewberry
Rubus occidentalis	black raspberry
Rubus pensylvanicus	common blackberry
Rubus trivialis	bramble
Rudbeckia hirta	black-eyed Susan
Rudbeckia laciniata	goldenglow
Rudbeckia triloba	brown eyed Susan
Ruellia humilis	wild petunia
Ruellia strepens	smooth ruellia
*Rumex acetosella**	sour dock*
Rumex altissimus	pale dock
*Rumex crispus**	curly dock*
Sabatia angularis	marsh pink
Sagittaria latifolia	arrowleaf
Salix amygdaloides	peach leaved willow
Salix discolor	pussy willow
Salix exigua	sandbar willow
Salix humilis	prairie willow
Salix nigra	black willow
Sambucus canadensis	elderberry
Samolus valerandii	brookweed
Sanguinaria canadensis	bloodroot
Sanicula canadensis	black snakeroot
Sanicula gregaria	common snakeroot
*Saponaria officinalis**	bouncing bet*
Sassafras albidum	sassafras
Saururus cernuus	lizard's tail
Schizachyrium scoparium	little blue stem
Scirpus acutus	great bulrush
Scirpus americanus	American bulrush
Scirpus atrovirens	bulrush
Scirpus fluviatalis	bulrush
Scirpus fluviatilis	river bulrush
Scirpus pendulus	red bulrush
Scirpus tabernaemontanii	soft-stemmed bulrush
Scrophularia marilandica	late figwort
Scutellaria incana	downy skullcap
Scutellaria lateriflora	blue skullcap
Scutellaria leonardii	small skullcap
*Sedum purpureum**	live-forever*
Selaginella eclipes	spikemoss
Senecio aureus	golden ragwort
Senecio pauperculus	balsam groundsel
Setaria faberi	giant foxtail
*Setaria glauca**	foxtail*
Sibara virginica	Virginia rock cress
Sicyos angulatus	bur cucumber
Silene antirrhina	sleepy catchfly
Silene stellata	starry catchfly

Appendix 2. Continued

Scientific Name[1,2]	Common Name[1,2]
Silene virginica	firepink
Silphium integrifolium	rosinweed
Silphium laciniatum	compass plant
Silphium perfoliatum	cup plant
Silphium terebinthinaceum	prairie dock
Sisyrinchium albidum	blue-eyed grass
Sium suave	water parsnip
Smilacina racemosa	false Solomon's seal
Smilacina stellata	small false Solomon's seal
Smilax ecirrhata	upright smilax
Smilax hispida	bristly catbrier
Smilax lasioneuron	common carrion flower
Solanum carolinense	horse-nettle
Solanum ptycanthum	black nightshade
Solidago caesia	bluestem goldenrod
Solidago canadensis	tall golden rod
Solidago flexicaulis	broadleaf goldenrod
Solidago gigantea	late golden rod
Solidago juncea	early goldenrod
Solidago missouriensis	Missouri goldenrod
Solidago nemoralis	field goldenrod
Solidago patula	rough leaf goldenrod
Solidago riddellii	Riddell's goldenrod
Solidago rigida	rigid golden rod
Solidago speciosa	showy goldenrod
Solidago ulmifolia	elm-leaved goldenrod
Sorghastrum nutans	Indian grass
Spartina pectinata	prairie cord grass
Sphenopholis obtusata var. *major*	wedge grass
*Spiraea prunifolia**	bridal wreath*
Spiranthes magnicamporum	fragrant ladies' tresses
Sporobolus asper	rough dropseed
Sporobolus heterolepis	prairie dropseed
Stachys palustris	woundwort
Stachys tenuifolia	smooth hedge nettle
Staphylea trifolia	bladdernut
*Stellaria media**	common chickweed*
Stipa spartea	porcupine grass
Strophostyles helvola	wild bean
Symphoricarpos orbiculatus	buckbush
Symplocarpus foetidus	skunk cabbage
*Syringa vulgaris**	common lilac*
Taenidia integerrima	yellow pimpernel
*Taraxacum laevigatum**	red seeded dandelion*
*Taraxacum officinale**	dandelion*
Teucrium canadense	wood sage
Thalictrum dasycarpum	purple meadow rue
Thalictrum dioicum	early meadow rue
Thalictrum revolutum	waxy meadow rue
Thalictrum thalictroides	rue anenome
Thaspium barbinode	hairy meadow parsnip
Thlaspi arvense *	field penny cress*
Tilia americana	basswood
***Tomanthera auriculata* - ST**	**ear-leafed foxglove - ST**
Toxicodendron radicans	poison ivy
Tradescantia ohiensis	Ohio spiderwort
Tradescantia subaspera	spiderwort
Tradescantia virginiana	Virginia spiderwort
*Tragopogon dubius**	goat's beard*
*Tragopogon pratensis**	common goats beard*
Tridens flavus	false red top
*Trifolium campestre**	low hop clover*
*Trifolium hybridum**	Alsike clover*
*Trifolium pratense**	red clover*
*Trifolium repens**	white clover*
Trillium flexipes	white trillium
Trillium recurvatum	red trillium
Triodanis perfoliata	Venus's looking glass
Triosteum perfoliatum	horse gentian
Triphora trianthophora	nodding pagonia
*Typha augustifolia**	narrow leaved cattail*
Typha latifolia	common cat-tail
Ulmus americana	American elm
*Ulmus pumila**	Siberian elm*
Ulmus rubra	slippery elm
Urtica dioica	common nettle
Utricularia vulgaris	common bladderwort
Uvularia grandiflora	yellow bellwort
***Veratrum woodii* - ST**	**false hellebore - ST**
*Verbascum blattaria**	moth mullein*
*Verbascum thapsus**	woolly mullein*
Verbena hastata	blue vervain
Verbena stricta	hoary vervain
Verbena urticifolia	white vervain
Verbesina alternifolia	yellow ironweed
Verbesina helianthoides	yellow crown beard
Vernonia missurica	Missouri ironweed
*Veronica arvensis**	corn speedwell*
Veronica peregrina	purslane speedwell
Veronicastrum virginicum	culver's root
*Viburnum lantana**	wayfaring tree*
Viburnum lentago	nannyberry
*Viburnum opulus**	European high bush cranberry*
Viburnum prunifolium	black haw
*Vinca minor**	common periwinkle*
Viola affinis	Leconte's violet
Viola pedatifida	prairie violet
Viola pratincola	common blue violet
Viola pubescens	smooth yellow violet
Viola sororia	downy-blue violet
Vitis aestivalis	summer grape
Vitis riparia	riverbank grape
Vitis vulpina	frost grape
*Yucca flaccida**	yucca*
Zanthoxylum americanum	prickly ash
Zizia aurea	golden Alexanders

[1] Indicates introduced species.

[2] Bold type indicates state endangered (SE) or state threatened (ST) species.

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