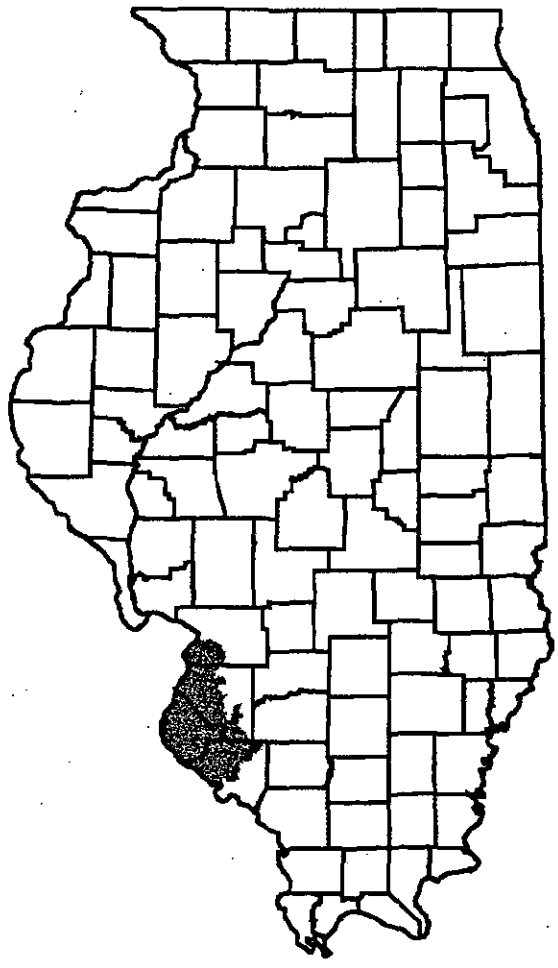
Volume 3

Living Resources

SINKHOLE PLAIN AREA ASSESSMENT



ILLINOIS DEPARTMENT OF NATURAL RESOURCES

SINKHOLE PLAIN AREA ASSESSMENT

VOLUME 3: LIVING RESOURCES

Illinois Department of Natural Resources
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About This Report

The Sinkhole Plain Area Assessment examines a karst/cave area in southwestern Illinois bordering the Mississippi River. Because significant natural community and species diversity is found in portions of the area, much of the Sinkhole Plain has been designated a state Resource Rich Area.[1]

This report is part of a series of reports on areas of Illinois where a public-private partnership has been formed to protect natural resources. 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.[2] 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

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[1] See *Inventory of Resource Rich Areas in Illinois: An Evaluation of Ecological Resources.*
[2] 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.

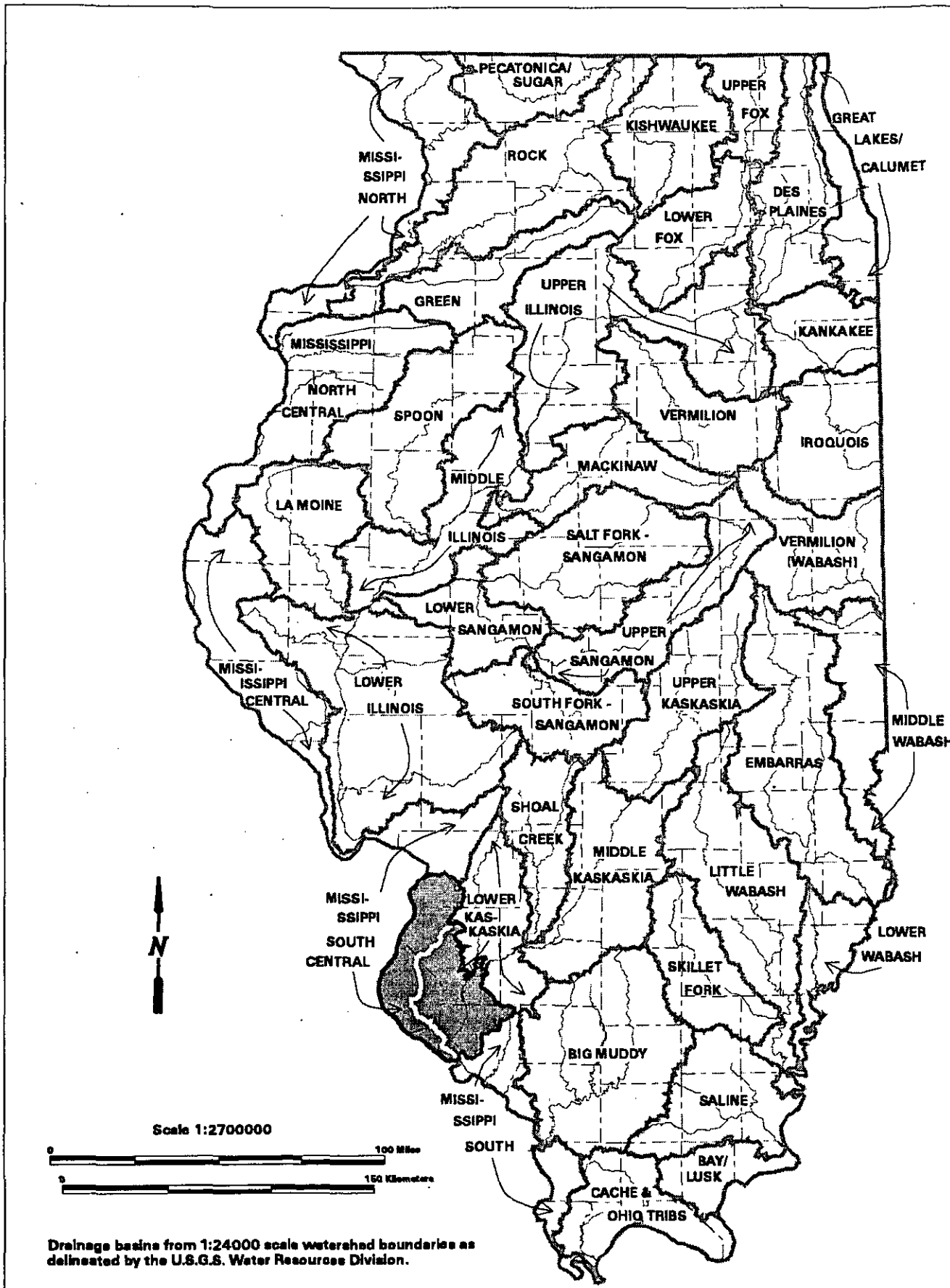
From the three initiatives was born Conservation 2000, a six-year program to begin reversing ecosystem degradation, primarily through the Ecosystems Program, a cooperative process of public-private partnerships that are intended to merge natural resource stewardship with economic and recreational development. To achieve this goal, the program provides 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 and other areas 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 Sinkhole Plain Area Assessment

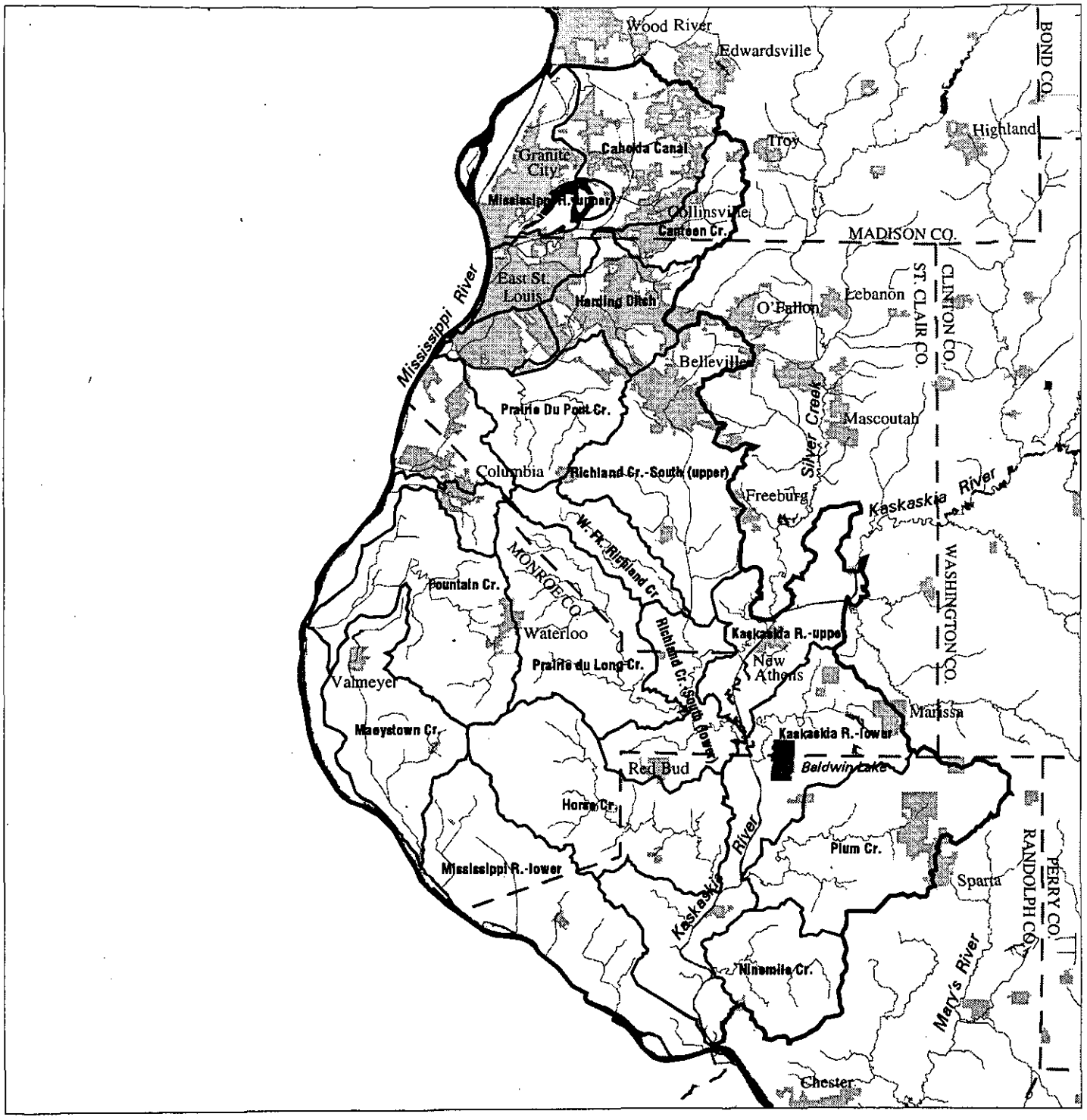
The Sinkhole Plain Area Assessment covers an area of about 1,228 miles2 (785,822 acres) in southwestern Illinois bordering the Mississippi River. It includes all of Monroe, much of St. Clair, and portions of Randolph and Madison counties. The area encompasses 17 subbasins along the Mississippi and Kaskaskia Rivers, of which six have been designated as a "Resource Rich Area" because they contain significant natural community diversity. The Sinkhole Plain Ecosystem Partnership was subsequently formed around this core area of high quality ecological resources.

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,



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 Sinkhole Plain Assessment Area



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Scale 1:534000

0 20 Miles

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Subbasins in the Sinkhole Plain Assessment Area. Subbasin boundaries depicted are those determined by the Illinois Environmental Protection Agency.

infrastructure, and economy of the area, focusing on the three counties with the greatest amount of land in the area — Monroe, Randolph and St. Clair; 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 known in the area. Volume 5, *Early Accounts of the Ecology of the Sinkhole Plain*, 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

The Sinkhole Plain Assessment Area (SPAA) is an approximately 1,228 square-mile (785,822-acre) area including all of Monroe County, more than half of St. Clair County, and portions of Madison and Randolph counties (Figure 1). This Assessment Area includes portions of the Mississippi River south-central watershed and the lower Kaskaskia watershed (Figure 2). Major streams include the Mississippi River, which forms the western boundary of the SPAA, and the Kaskaskia River, which enters the Mississippi River in Randolph County. The SPAA occurs in two Physiographic divisions of Illinois, the Ozark Plateaus Province (Salem Plateau Section) and the Central Lowland Province (both Springfield Plain and Mt. Vernon Hill Country Sections; Leighton et al. 1948; Willman et al. 1975). The Ozark Plateaus Province is relatively rugged, with rocky hills and limestone bluffs along the Mississippi River and associated drainages. The Central Lowland Province is a gently rolling plain of glacial till covered by loess sometimes over 20 ft. in depth and is dissected by intermittent streams and drainages, here associated with the lower Kaskaskia River. The western portion of the SPAA is a lowland area bordering the Mississippi River and borders the eroded upland plateau of Mississippian age limestone. Elevation within the Sinkhole Plain Assessment Area varies from 746 ft. above sea level on the plateau east of Maeystown in Monroe County to a minimum of about 360 ft above sea level in Randolph County at the bank of the Mississippi River at the southern limit of the Assessment Area.

The name Sinkhole Plain refers to the fact that numerous sinkholes dot the landscape particularly on the limestone uplands of Monroe County. These sinkholes generally form when soil collapses into a crevice in the underlying bedrock or, rarely, from the collapse of a cave roof (Panno and Weibel 1998)[1].

Portions of four Natural Divisions (Schwegman et al. 1973) occur within the boundaries of the SPAA (Table 1, Figure 3). Natural Divisions within the SPAA include the Lower Mississippi River Bottomlands Division, the Middle Mississippi Border Division, the Ozark Division, and the Southern Till Plain Division. About one-third (33.4%) of the Assessment Area, its southeastern portion, lies within the Mt. Vernon Hill Country Section of the Southern Till Plain Division. All of the portion of the Assessment Area bordering (within about 10 miles of) the Mississippi River lies within the Northern Section of the Lower Mississippi River Bottomlands Division (24.1%). The approximately 10 mile-wide band lying between these two divisions and parallel to the Mississippi River lies within the Northern Section of the Ozark Division (19.3%). The northeastern-central portion of the Assessment Area lies within the Effingham Plain Section of the Southern Till Plain

[1] For more information on the formation of sinkholes see Sinkhole Plain Area Assessment, Volume 1 (Illinois Department of Natural Resources 1998).

Division (14.1%). A relatively small area (ca. 7% of the SPAA) trending southwest from Collinsville, Madison County falls within the Glaciated Section of the Middle Mississippi Border Division. Finally, a small portion (0.3%) of the extreme southeast corner of the Assessment Area east of Ellis Grove lies within the Central Section of the Ozark Division. The Mississippi River itself includes about 2% of the area of the SPAA.

Table 1. Natural divisions occurring in the Sinkhole Plain Assessment Area.[1]

Division & Section	Acres	% of SPAA
Middle Mississippi River Border/Glaciated Section	54,014.61	6.9
Southern Till Plain/Effingham Plain Section	111,145.78	14.1
Southern Till Plain/Mt. Vernon Hill Country Section	262,591.85	33.4
Ozark/Northern Section	151,548.86	19.3
Ozark/Central Section	2,176.11	0.3
Lower Mississippi River Bottomlands/Northern Section	189,110.09	24.1
Major Water Bodies/Mississippi River Section	15,234.80	1.9
Total:	**785,822.10**	**100.0**

[1] Based on the Illinois Natural Divisions Database (Illinois Department of Natural Resources 1997)

Though the region was not covered by Wisconsinan glaciation soils in the upland portions of the Assessment Area are covered by wind-deposited loess dating to the Wisconsinan era. The thickest loess can reach a depth of more than 20 feet (Fehrenbacher et al. 1984). Soil type and depth vary considerably in the SPAA. There are soils characterized as thick loess (over 60 in. thick) prairie soils (Herrick-Virden-Piasa Association SW of Millstadt, St. Clair County and the Tama-Muscatine-Sable Association from Belleville to Collinsville, St. Clair and Madison counties within the Glaciated Section of the Middle Mississippi Border Division). There also are thick loess forest soils (over 60 in. thick) such as the Alford-Muren-Iva Association which predominates in the Northern Section of the Ozark Division, to moderately thick to thin loess forest soils (10 to 60 in. thick) as in the Hosmer-Stoy-Weir Association. The latter association is predominant in the southern half of the Mt. Vernon Hill Country Section of the Southern Till Plain Division. There are thin to thick loess or loamy materials with or without residuum on interbedded sandstone, siltstone, and shale which is restricted to the southwestern margin of the Northern Section of the Ozark Division (along the bluffs).

The floodplains (bottomlands) throughout the Lower Mississippi River Bottomlands Division (Northern Section) have soils made up of sandy to clayey alluvial sediments (the Lawson-Sawmill-Darwin Association). The floodplain of the Kaskaskia River and its tributaries within the SPAA are characterized by an alluvium of silt, sand and gravel with characteristics of forest soils (the Haymond-Petrolia-Karnak Association), and loamy, silty and clayey lacustrine (lake) sediments dating from Wisconsinan glaciation (the Markland-Colp-Del Rey Association). Drainage characteristics throughout the SPAA range from poorly drained, particularly in the river bottoms, to well-drained, particularly on the steep uplands (Fehrenbacher et al. 1982).

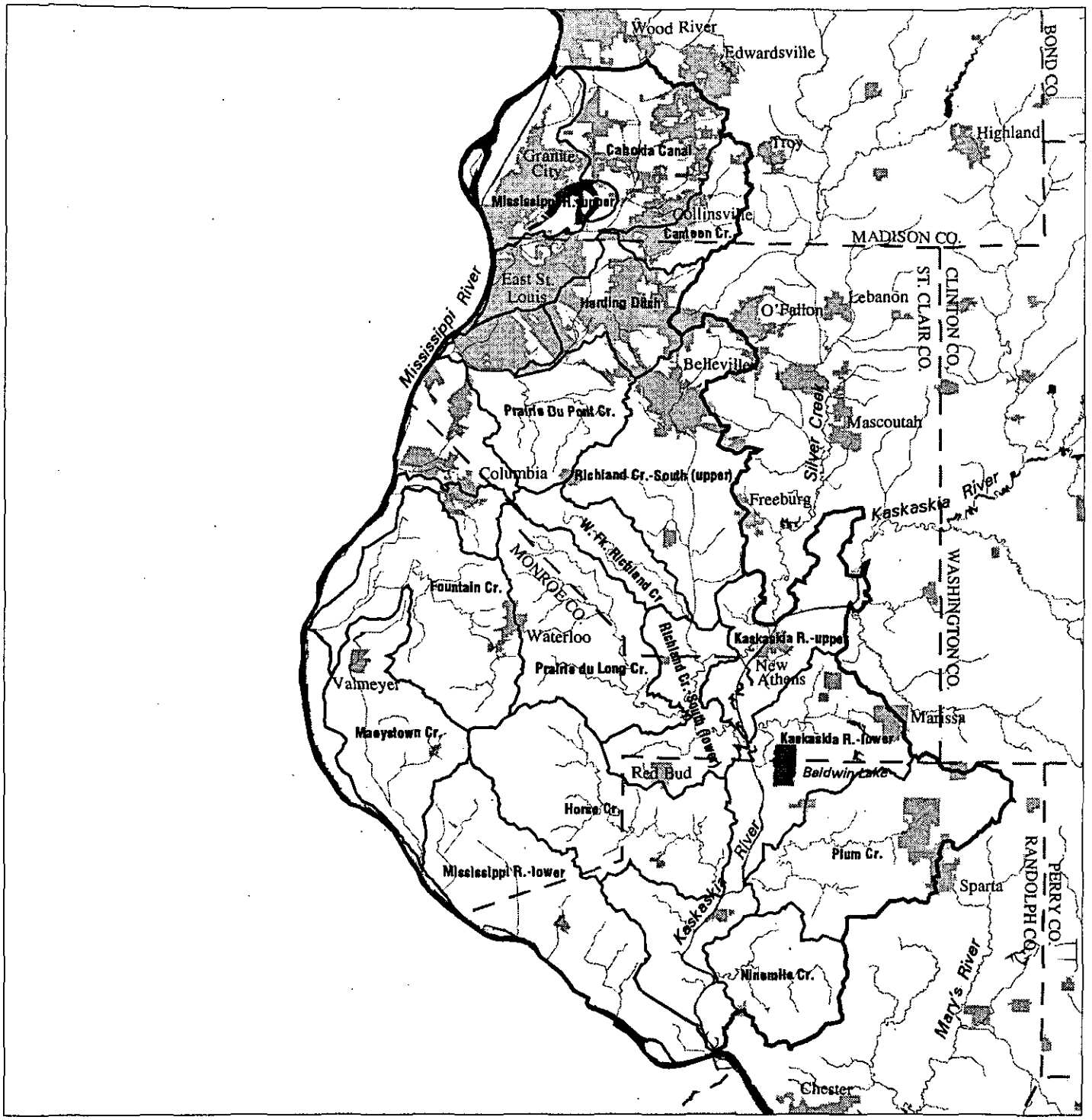


Figure 1. Subbasins in the Sinkhole Plain Assessment Area. Subbasin boundaries depicted are those determined by the Illinois Environmental Protection Agency.

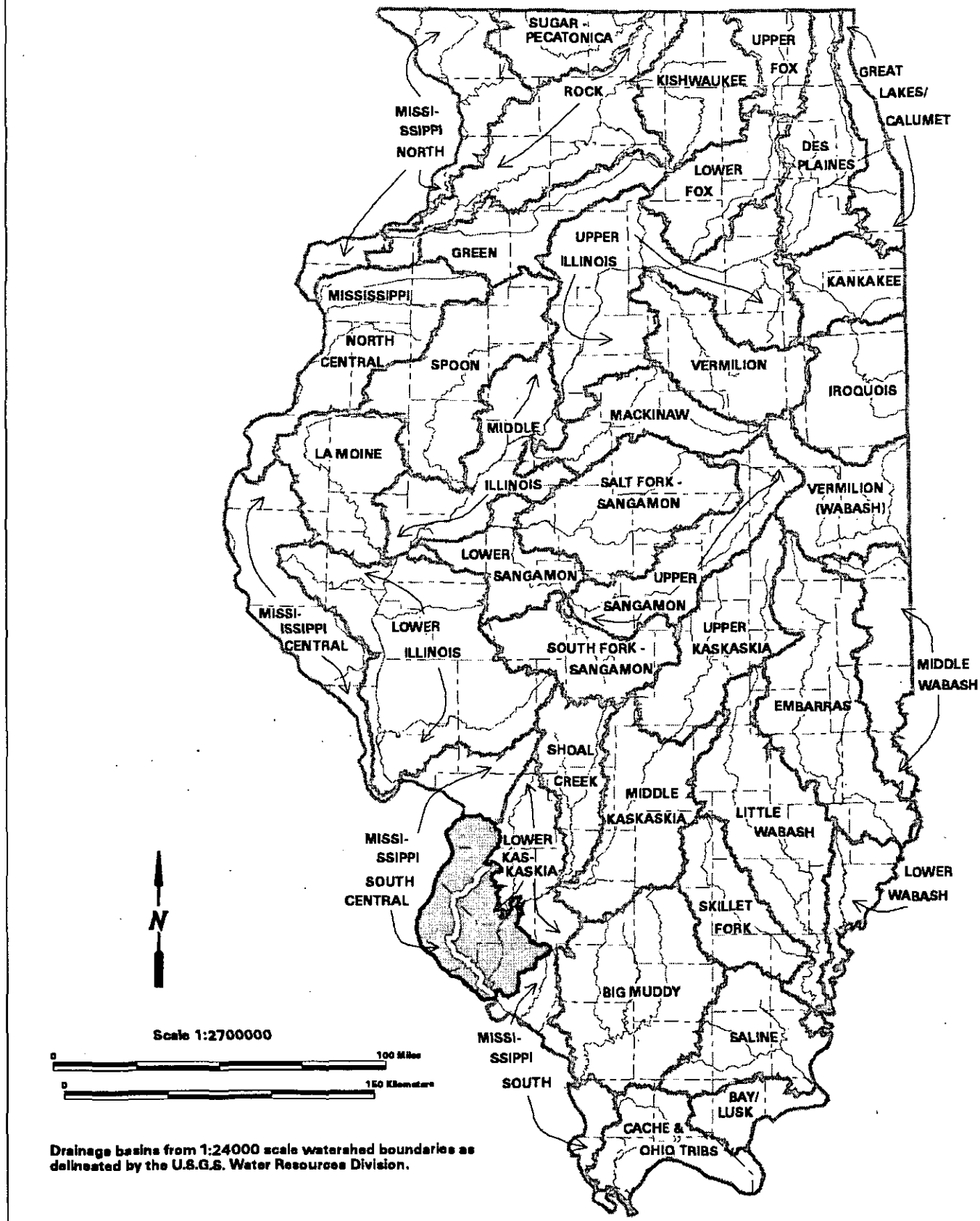
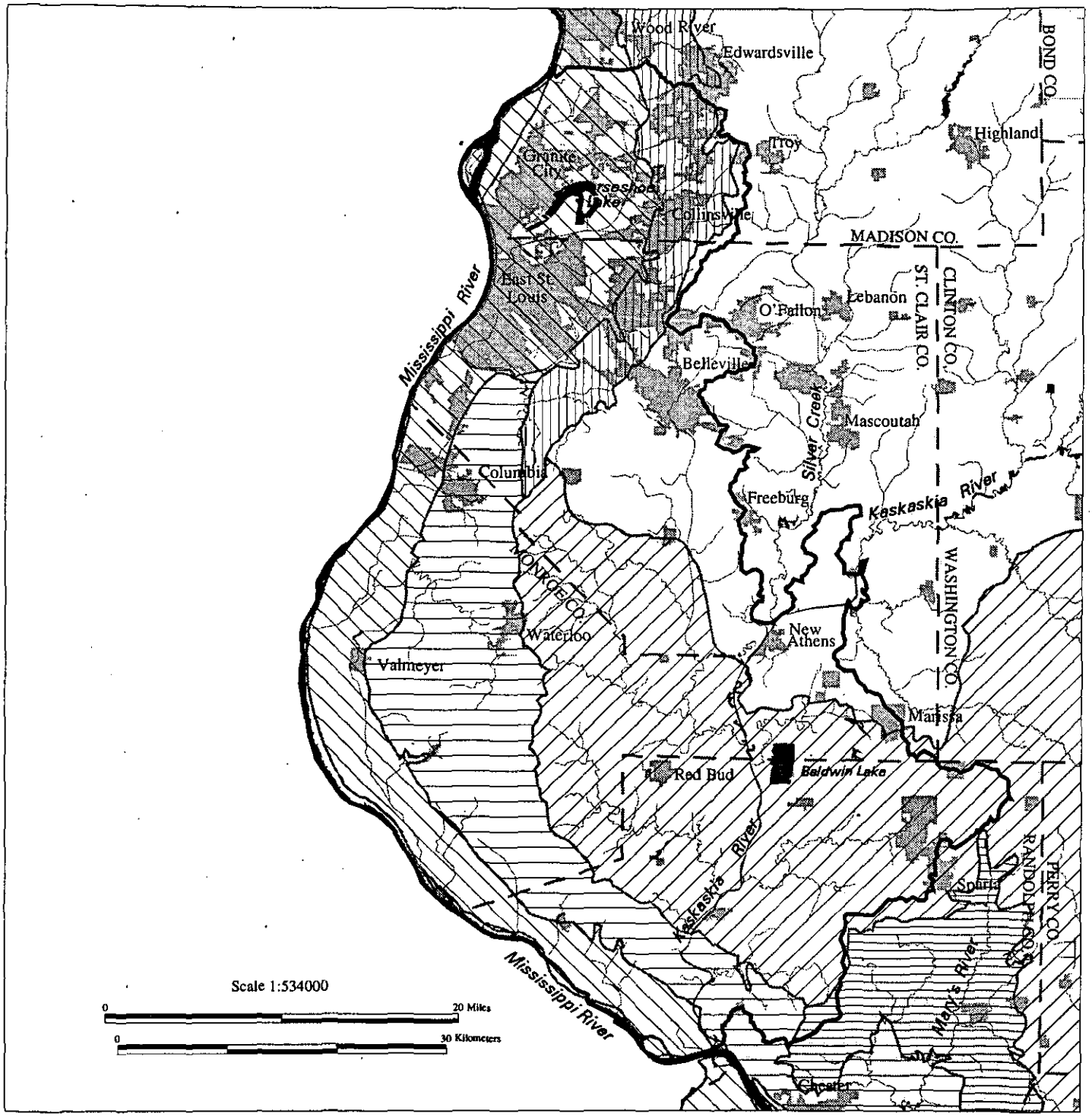
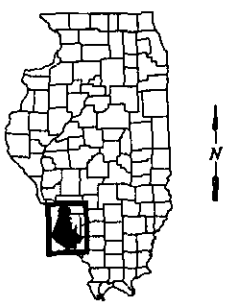


Figure 2. Major drainage basins of Illinois and location of the Sinkhole Plain Assessment Area





- Lower Mississippi River Bottomlands Division - Northern Section
- Middle Mississippi Border Division Glaciated Section
- Ozark Division Central Section
- Ozark Division Northern Section
- Southern Till Plain Division Effingham Plain Section
- Southern Till Plain Division Mt Vernon Hill Country Section

Figure 3. Natural Divisions in the Sinkhole Plain Assessment Area based on the classification developed by Schwegman (1973).

In summary, most of the soils in the Sinkhole Plain Assessment Area are light and moderately dark loess and alluvial forest soils. Dark and moderately dark prairie soils are very uncommon, are limited to the geographic center of Monroe County, and to a northeast-trending narrow band from southwest of Millstadt to Collinsville. Because the parent rock is primarily Mississippian age limestone, soils are predominantly alkaline (high pH).

Climate Patterns[1]

The climate in the Sinkhole Plain Area Assessment (SPAA) is typical of many continental locations, in that there are rather wide temperature fluctuations. The average high temperature (°F) in the summer is in the 80's and 90's with average lows in the 60's. Winter highs are generally in the 30's and 40's with lows in the 20's. Record temperature extremes range from a low of -20° F to a high of 114° F. There is an average of just over six months without frost each year.

Precipitation is highest during March through December (averages of 3.07 to 4.44 inches per month) and lowest in January (1.90 inches) and February (2.59 inches), with a yearly average of 41.67 inches.

Vegetation History

The presettlement vegetation in Illinois (prior to 1820) 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. Some estimates of the amounts of prairie and forest at the time of European settlement in the Sinkhole Plain Assessment Area can be inferred from countywide data. Based on the original land surveys in Illinois at the time of the Government Land Office survey around 1820, Monroe County was 87% forested (218,000 acres) and 10.4% (26,100 acres) prairie. Randolph County was similar, 73.8% forested (277,700 acres) and 24.9% prairie (93,500 acres). The situation was somewhat reversed for Madison County, which was 40.2% forested (188,200 acres) and 57.8% prairie (270,600 acres), and for St. Clair County which was 49.4% forested (210,700 acres) and 50.3% prairie (214,700 acres). The prairies were primarily located in the eastern portions of the counties outside of the SPAA, which was primarily forested. Taking a conservative estimate of 70% forest in the Assessment Area prior to settlement, the total estimate of presettlement forest area would be about 550,075 acres of forest and there was a maximum of 235,747 acres of prairie in the presettlement landscape of the SPAA. Proportionately, this represents a lesser percent-cover of prairie (maximum 30%) and greater percent- cover of forest compared with the early statewide totals.

[1] Information in this section has been taken from the Sinkhole Plain Area Assessment, Volume 2 (Illinois Department of Natural Resources 1998). See that volume for a more detailed discussion of climate patterns and long term trends in the SPAA.

The total area of savanna at that time is unclear. The SPAA is within the general area of the transition zone of prairie and forest (Anderson 1983) and probably supported some tallgrass savanna (Nuzzo 1986). Other savannas were probably present in barrens on thin soil over the limestone areas. The present limestone glades and southern flatwoods are savanna-like. However, savannas typically were unstable 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 tallgrass prairie, savanna, and open woodland vegetation in the Midwest (Anderson 1970, 1983, 1990; Axelrod 1985, Taft et al. 1995).

Current Land Cover

The characterization of the land cover of the SPAA 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. Figures given for high quality acreages are based on the Illinois Natural Areas Inventory[1] Grade "A" and "B" land. They are meant only to reflect the areas that remain in an undegraded condition and to provide an opportunity to compare statewide trends of habitat destruction.

Currently, the landscape of the SPAA is dominated by agricultural land uses, chiefly cropland (about 380,051 acres [48.4%], Table 2). Most of this is in the Lower Mississippi Bottomlands Natural Division, often called the American Bottoms, which has been almost completely transformed into cropland (Figure 4). The soils of the American Bottoms are considered to be among the best agricultural soils in the country (Fehrenbacher et al. 1984). Cropland is least common on the Ozark Division slopes and in the urban areas in and near East St. Louis.

Table 2. Current land Cover for the Sinkhole Plain Assessment Area.[1]

Land Cover	Acres	% of SPAA
Cropland	380,051	48.4
Upland forest	124,458	15.8
Grassland	113,335	14.4
Urban/Built-up	86,433	11.0
Bottomland forest	36,856	4.7
Water	24,845	3.2
Nonforested wetlands	19,839	2.5
Total:	**785,821**	**100.0**

[1] Data from the Land Cover of Illinois Database (Illinois Geographic Information System).

[1] For a more complete description of the Illinois Natural Areas Inventory, see the section on "Biologically Significant Features of Natural Communities" later in this chapter.

Approximately 20.5% of the SPAA remains forested, with 15.8% in upland forest and 4.7% in bottomland forest (Table 2). Presettlement forest cover ranged from about 87.0% in Monroe County to about 40.2% for all of Madison County (Iverson et al. 1989). As in the presettlement landscape, upland forest is best developed on the slopes and eroded ravines of the Ozark Division where agriculture has not been practical (Figure 5).

There are 1,521 separate forested wetlands in the SPAA. They are found in the Southern Till Plain Division along the lower Kaskaskia River and its associated tributaries and in the Lower Mississippi River Bottomlands Division. The mean size of contiguous bottomland forest is 19.0 acres (range 0.1 to 1,255 acres). The two largest contiguous tracts (1,255 acres each) are located along the Mississippi River near Prairie du Rocher and on the Kaskaskia River near New Athens; the next three largest tracts are located along the Mississippi River. About 870.5 acres within the SPAA (0.55% of the remaining forest and 0.1% of the land area) remains as high-quality (undegraded) forest.

Urban development has been considerable in the northern third of the SPAA as East St. Louis, Granite City, Collinsville, and Belleville have expanded (Figure 6). Urban/built-up areas occupy 86,443 acres or 11.0% of the SPAA (Table 2).

Grasslands (non-urban grasslands) occupy 113,335 acres or 14.4% of the land area of the SPAA (Table 2). They are widely scattered in the Ozark Division but are most frequent today in the southeastern third of the SPAA in the Southern Till Plain Division east of the Kaskaskia River from New Athens south to the Mississippi River (Figure 7). The grassland cover class includes pastures, hay, idle fields, road and railroad rights-of-way, and remnant prairies. A total of only about 173 acres of high-quality (undegraded) prairie remains in the Assessment Area primarily in central Monroe and southwestern St. Clair counties (Table 3). This is only 0.02% of the current land area of the SPAA, dramatically decreased from the estimated 30% undegraded prairie of the presettlement landscape.

The Illinois Wetlands Inventory (IWI) provides more detailed information about the wetlands in the area. IWI data for the Sinkhole Plain area was derived from high-altitude photography taken between 1981 and 1985. Wetlands occupy about 54,053 acres or 6.9% of the SPAA area compared to 3.5% of the total area of the state (Suloway and Hubbell 1994; Table 2).

Three categories of wetlands exist in the Assessment Area, palustrine, lacustrine, and riverine. Palustrine (vegetated) wetlands are the most frequent, totaling 53,141 acres (98.3% of the wetlands, 6.8% of the Assessment Area). Within this category, bottomland (floodplain) forest predominates with 29,354 acres (54.3% of the total wetlands, 3.7% of the SPAA). Only about 321 acres are high-quality and relatively undegraded (about 0.6% of current wetland acreage; Table 3). Statewide, 60.5% of palustrine wetlands are comprised of bottomland forest. Shallow marsh/wet meadow wetlands account for 20.3% and open water wetlands account for 15.1% of the wetland acreage in the Assessment Area, slightly higher than the statewide percentages of 13.01% and 11.4%, respectively. Scrub-shrub wetland accounts for 5.1% of the area, followed by deep marsh (3.2%).

Emergent wetlands range in size from less than 0.1 acre to 436 acres, with a mean size of 4.1 acres. There are 3,012 separate emergent wetlands in the SPAA. The five largest emergent wetlands (larger than 266 acres) are located in the Mississippi River floodplain near Fults and the former location of Valmeyer. Lacustrine (lake) wetlands total 0.7% (360.5 acres) of the wetlands (<0.04% of the Assessment Area) and riverine wetlands total 1.0% (552.1 acres) of the wetlands (0.1% of the Assessment Area). Wetland data are summarized in Table 4. Wetlands and open water are concentrated along the Mississippi and Kaskaskia riparian corridors (Figures 8 and 9). The open water areas include Horseshoe Lake southeast of Granite City (an old oxbow of the Mississippi River) and Baldwin Lake southwest of Marissa (an artificial lake created by Illinois Power as a source of cooling water).

Table 3. Category I natural communities in the Sinkhole Plain Assessment Area.

Community type	Grades in SPAA	Acres of category I in the SPAA			Acres of category I in Illinois			% of Illinois Category I in the SPAA		
		Grade A	Grade B	SPAA Total	Grade A	Grade B	IL Total	Grade A	Grade B	% of IL Total
Dry upland forest	A,B	54.0	30.0	84.0	333.0	334.0	667.0	16.2	8.0	12.6
Dry-mesic upland forest	A,B	103.0	25.5	128.5	986.0	2084.0	3070.0	10.4	1.2	4.2
Mesic upland forest	A,B	84.0	0.0	84.0	1058.0	1473.0	2531.0	7.9	0.0	3.3
Dry/dry-mesic/mesic upland forest[2]	A,B	42.0	92.0	134.0	2377.0	3891.0	6268.0	1.8	2.4	2.1
Wet-mesic floodplain forest	A,B	77.0	30.0	107.0	497.0	2617.0	3114.0	15.5	1.1	3.4
Wet flodplain forest	A,B	149.0	65.0	214.0	336.0	2522.0	2858.0	44.3	2.6	7.5
Southern flatwoods	A	119.0	0.0	119.0	323.0	311.0	634.0	36.8	0.0	18.8
Wet-mesic prairie[3]	N/A	N/A	N/A	N/A	26.0	99.0	125.0	-	-	-
Mesic sand prairie[3]	N/A	N/A	N/A	N/A	69.0	90.0	159.0	-	-	-
Loess hill prairie	A,B	95.0	78.0	173.0	158.0	214.0	372.0	60.1	36.4	46.5
Shrub swamp/Pond[4]	B	0.0	93.0	93.0	231.0	1200.0	1431.0	0.0	7.8	6.5
Limestone glade	A,B	15.0	64.0	79.0	80.0	104.0	184.0	18.8	61.5	42.9
Terrestrial cave[5]	A,B	-	-	-	-	-	-	-	-	-
Aquatic cave community[5]	A,B	-	-	-	-	-	-	-	-	-
Total:		**738.0**	**477.5**	**1215.5**	**6474.0**	**14939.0**	**21413.0**			

[1] Category I indicates natural communities that have remained relatively undisturbed and in high-quality condition, either Grade A and B (White and Madany 1978).

[2] There is a complex of dry/dry-mesic and mesic Grade A and B upland forest at Stemler Cave Woods Nature Preserve (St. Clair County) with an undetermined amount of each community.

[3] Data on area of these category I natural communities are not avaialable (N/A) for the SPAA.

[4] Ninety-three acres of Grade B shrub swamp and pond habitat occurs at Levee Lake in Madison County. The seperate amounts for each community have not been determined so they are combined in this table. The totals for this community type shown for all Illinois represent the combined Grades A and B shrub swamp and pond acrage in the state.

[5] The extent of these natural communities is not measured in acres.

Table 4. Wetlands habitat of the Sinkhole Plain Assessment Area[1].

Category	Acreage	% of Wetland Area	% of Assessment Area
Palustrine Wetlands			
Shrub-Scrub Wetlands	2,731.81	5.1	0.3
Forested Wetlands			
Bottomland Forest	29,354.06	54.3	3.7
Swamp	207.85	0.4	0.0
Emergent Wetlands			
Shallow Marsh/Wet Meadow	10,953.45	20.3	1.4
Deep Marsh	1,709.10	3.2	0.2
Open Water Wetlands	8,184.62	15.1	1.0
Subtotal Palustrine	**53,140.89**	**98.3**	**6.8**
Lacustrine Wetlands			
Shallow Lake	277.10	0.5	0.0
Lake Shore	83.43	0.2	0.0
Emergent Lake	0.00	0.0	0.0
Subtotal Lacustrine	**360.53**	**0.7**	**0.0**
Riverine Wetlands			
Perennial Riverine	106.74	0.2	0.0
Intermittent Riverine	445.33	0.8	0.1
Subtotal Riverine	**552.07**	**1.0**	**0.1**
Total Wetlands:	**54,053.49**	**100.0**	**6.9**

[1] Adapted from Suloway and Hubbell (1994).

The total area of presettlement wetlands in the SPAA, based on the acreage of hydric soils, can be inferred from countywide data. For example, Monroe County currently has 17,461 total wetland acres, or 6.9% of its land cover; presettlement wetland acreage has been estimated as about 56,300 wetland acres, or 24% of the county (current acreage from Suloway and Hubbell 1994; estimated wetland acres per county taken from Havera et al. 1994). St. Clair County (as a whole) currently has 33,293 wetland acres, or 7.8% land cover; presettlement wetland acreage has been estimated as about 77,600 wetland acres, or 21% in that county. Randolph County currently has 25,055 total wetland acres, or 6.7% of land cover; presettlement wetland acreage has been estimated as about 65,400 wetland acres, or 19% of the county. Finally, Madison County currently has 22,113 total wetland acres, or 4.7% of land cover; presettlement wetland acreage has been estimated as about 45,900 wetland acres, or 12% of land cover in the county. The trend has been for a significant loss of wetlands, an estimated loss of 87,394 acres, from about 12%-24% (average 18%, 141,448 acres) of the land area in presettlement times to 4.7%-7.8% (ca. 6.9%, 54,054 acres, Table 3) of the current land area. Most of this loss was of floodplain forest which was cleared for agriculture in the American Bottoms.

Figure 4. Cropland in the Sinkhole Plain Assessment Area. Cropland depicted on this map includes row crops and small grains from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

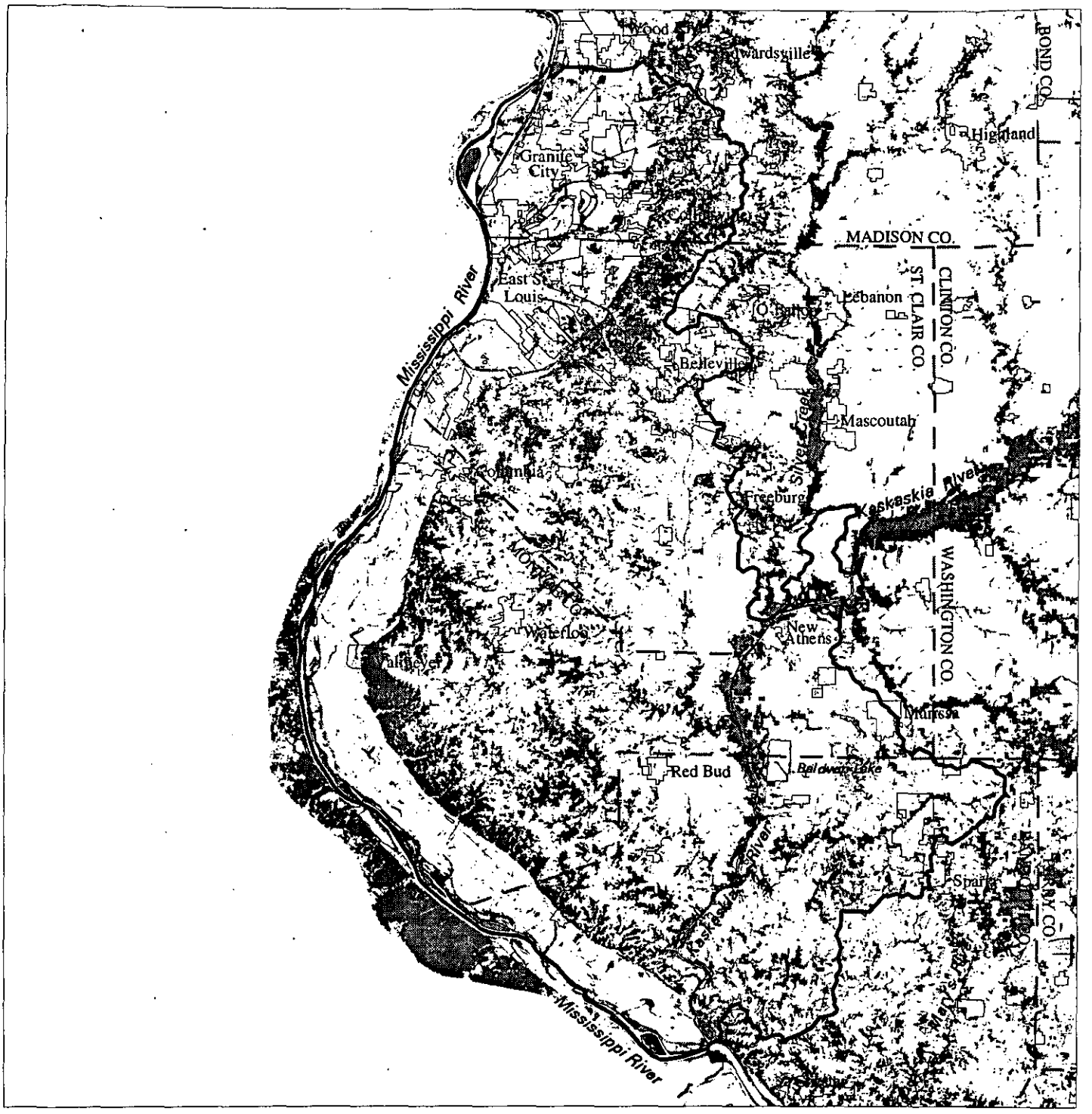


Figure 5. Forest in the Sinkhole Plain Assessment Area. Forest depicted on this map includes upland and bottomland forest from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

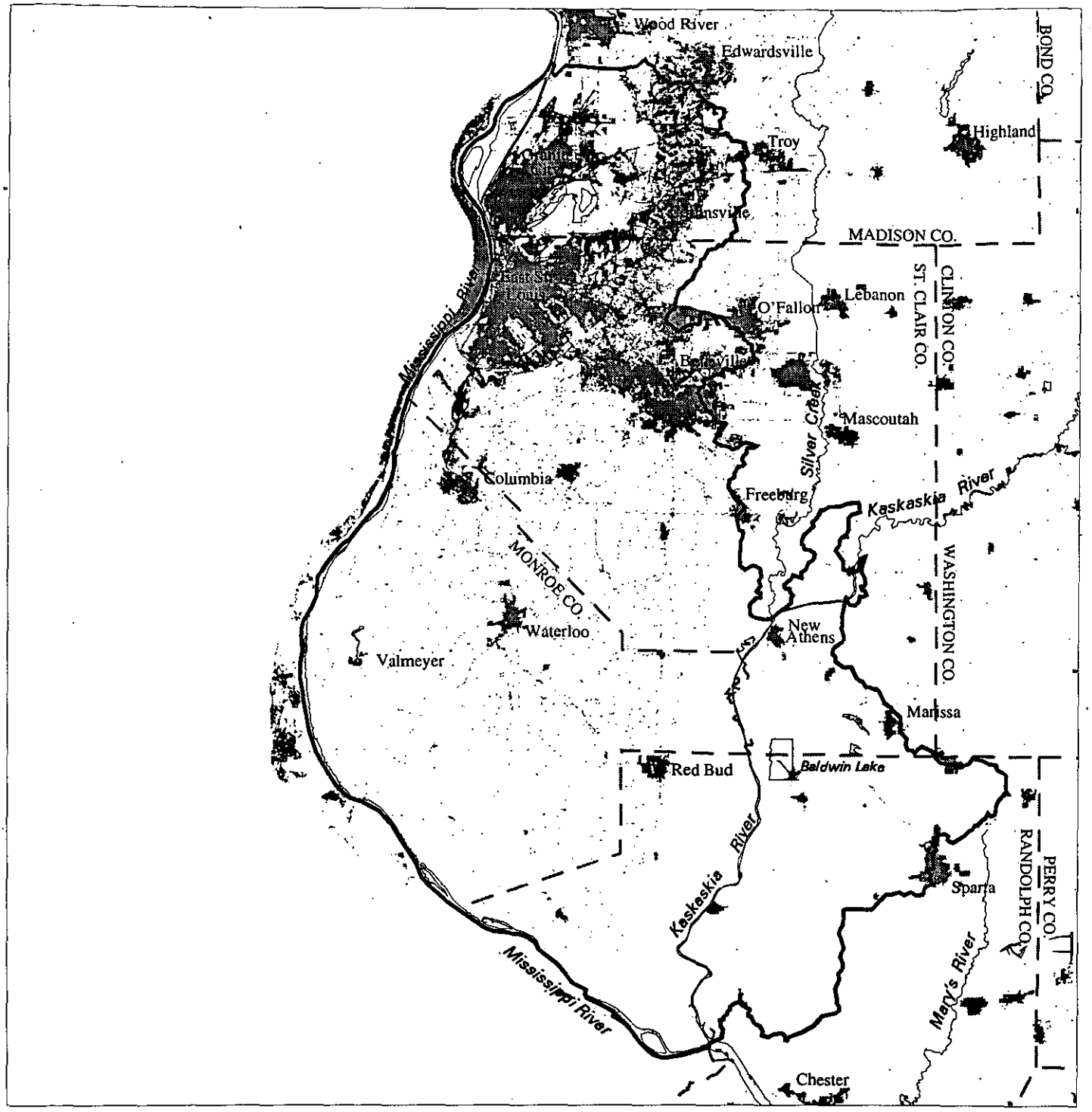


Figure 6. Urban land in the Sinkhole Plain Assessment Area. Urban land depicted on this map includes urban/built-up land and urban grassland from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

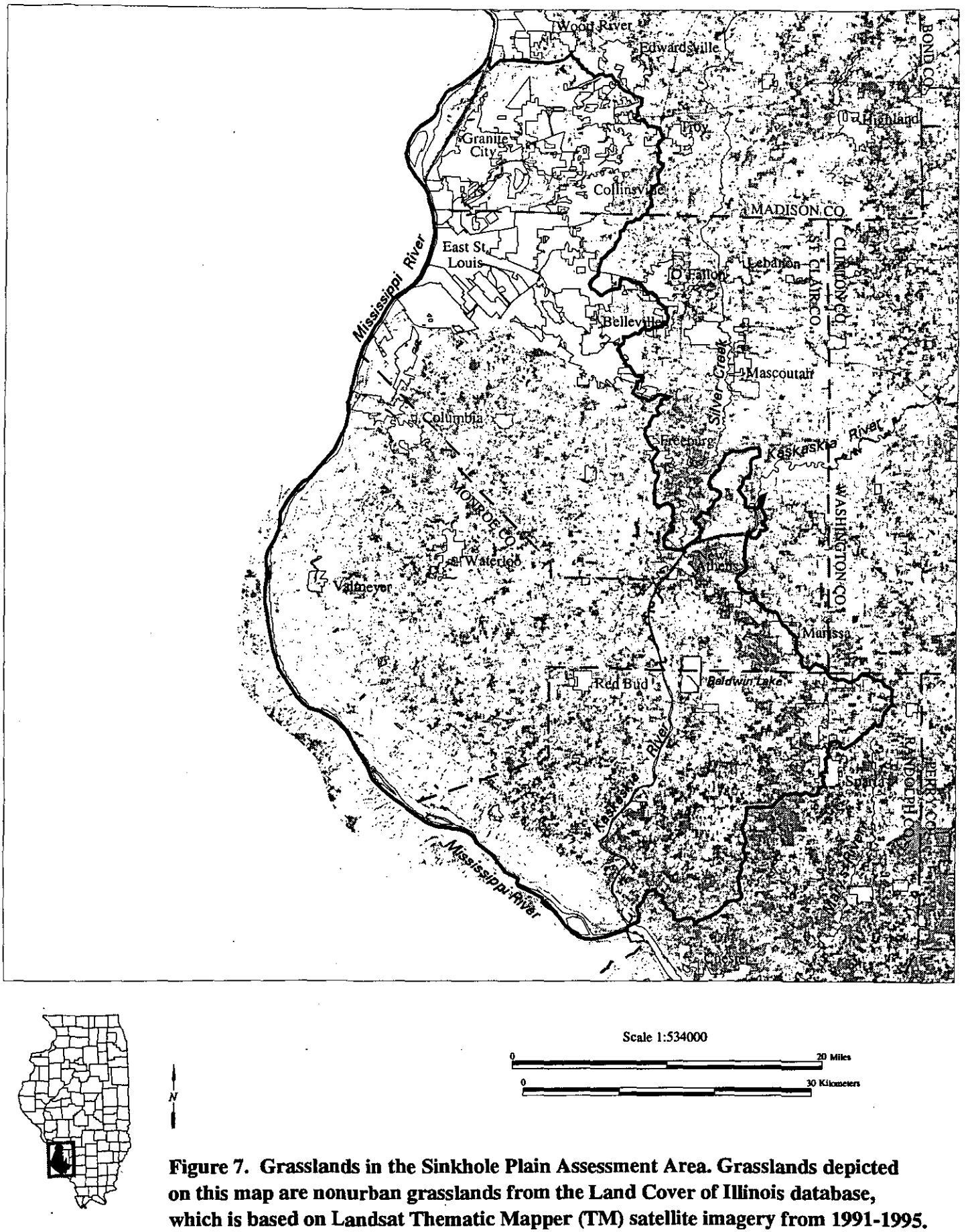


Figure 7. Grasslands in the Sinkhole Plain Assessment Area. Grasslands depicted on this map are nonurban grasslands from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

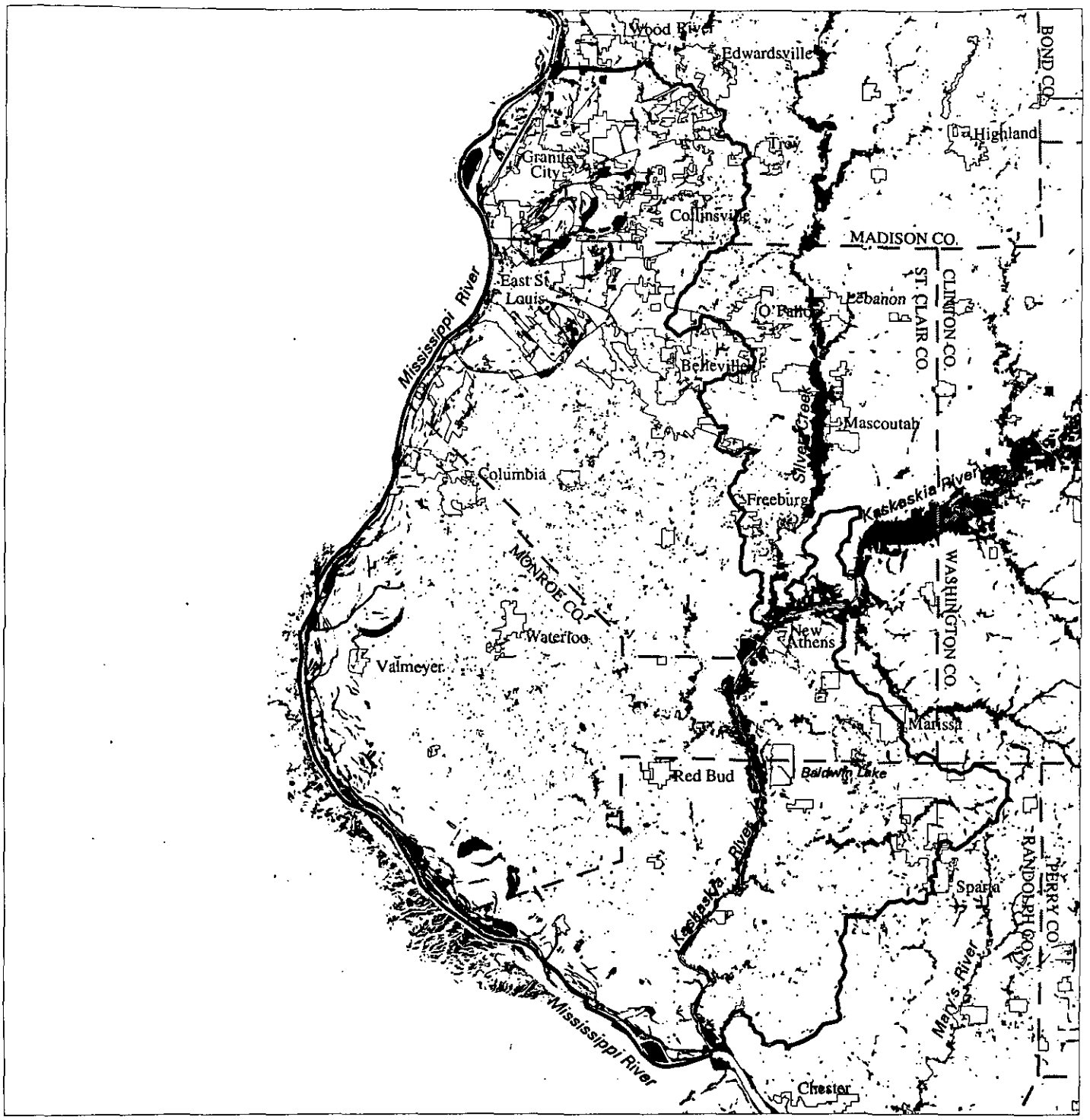


Figure 8. Wetlands in the Sinkhole Plain Assessment Area. Wetlands depicted on this map include nonforested wetlands and bottomland forest from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

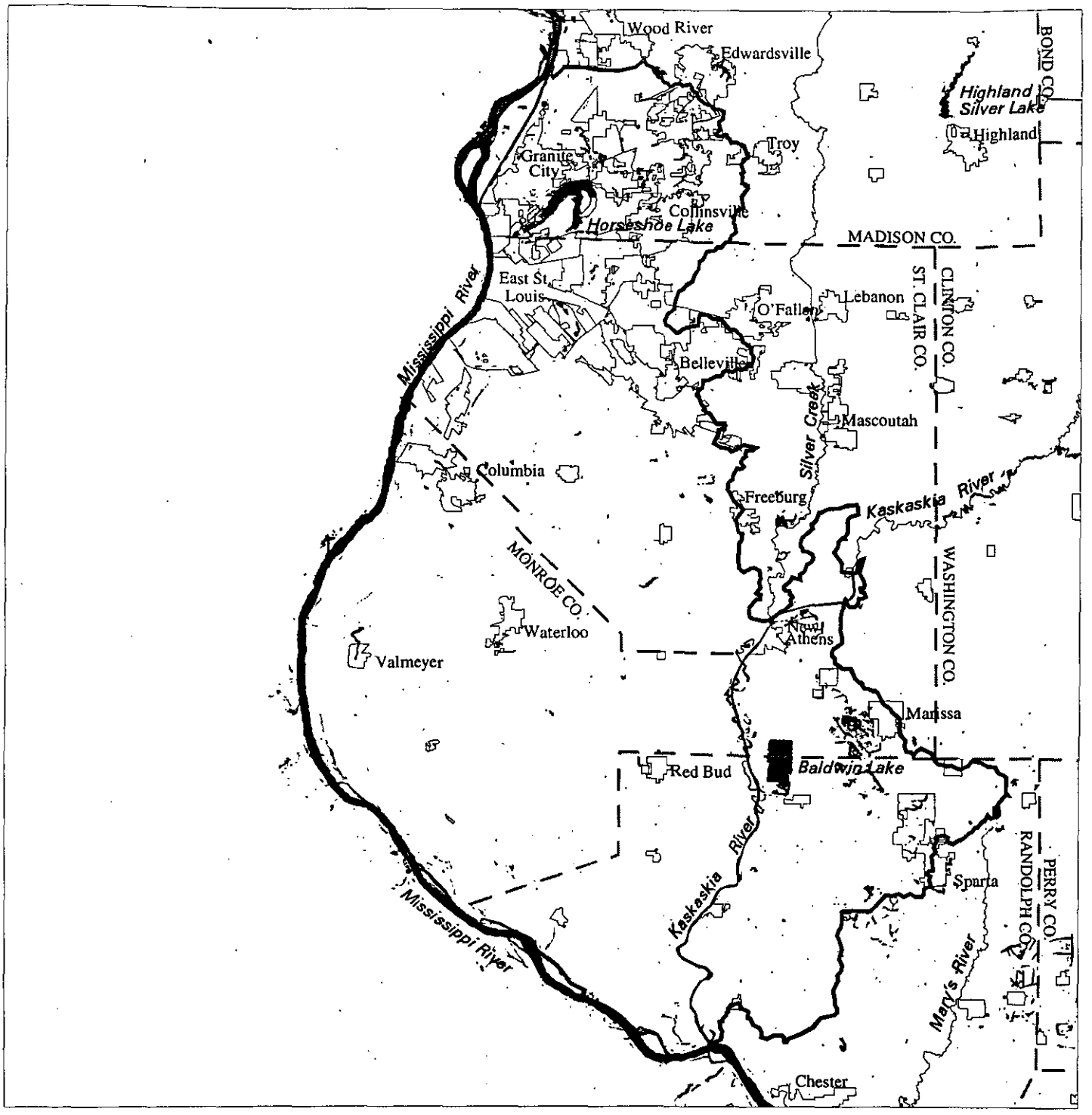


Figure 9. Open water in the Sinkhole Plain Assessment Area from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

Biologically Significant Features of Natural Communities

State and Federal Land

Although the majority of the land in the SPAA is used for agricultural purposes, 4,070 acres (2.6% of the SPAA) have been set aside by the State of Illinois as parks and conservation areas (Table 5, Figure 10). This figure does not include several state owned nature preserves in the area (see below). These parks and conservation 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.

Table 5. State land in the Sinkhole Plain Assessment Area[1].
(There is no federally owned land in the SPAA)

Name	Acres
Frank Holten State Park	1,082
Horseshoe Lake State Park	3,052
Kaskaskia River State Fish and Wildlife Area	15,936
Total State Land:	**20,070**

[1] This table does not include any natural areas or nature preserves that may be state owned

Natural Areas and Nature Preserves

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 reevaluating 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" (late successional or lightly disturbed) communities are designated as significant or exceptional features.

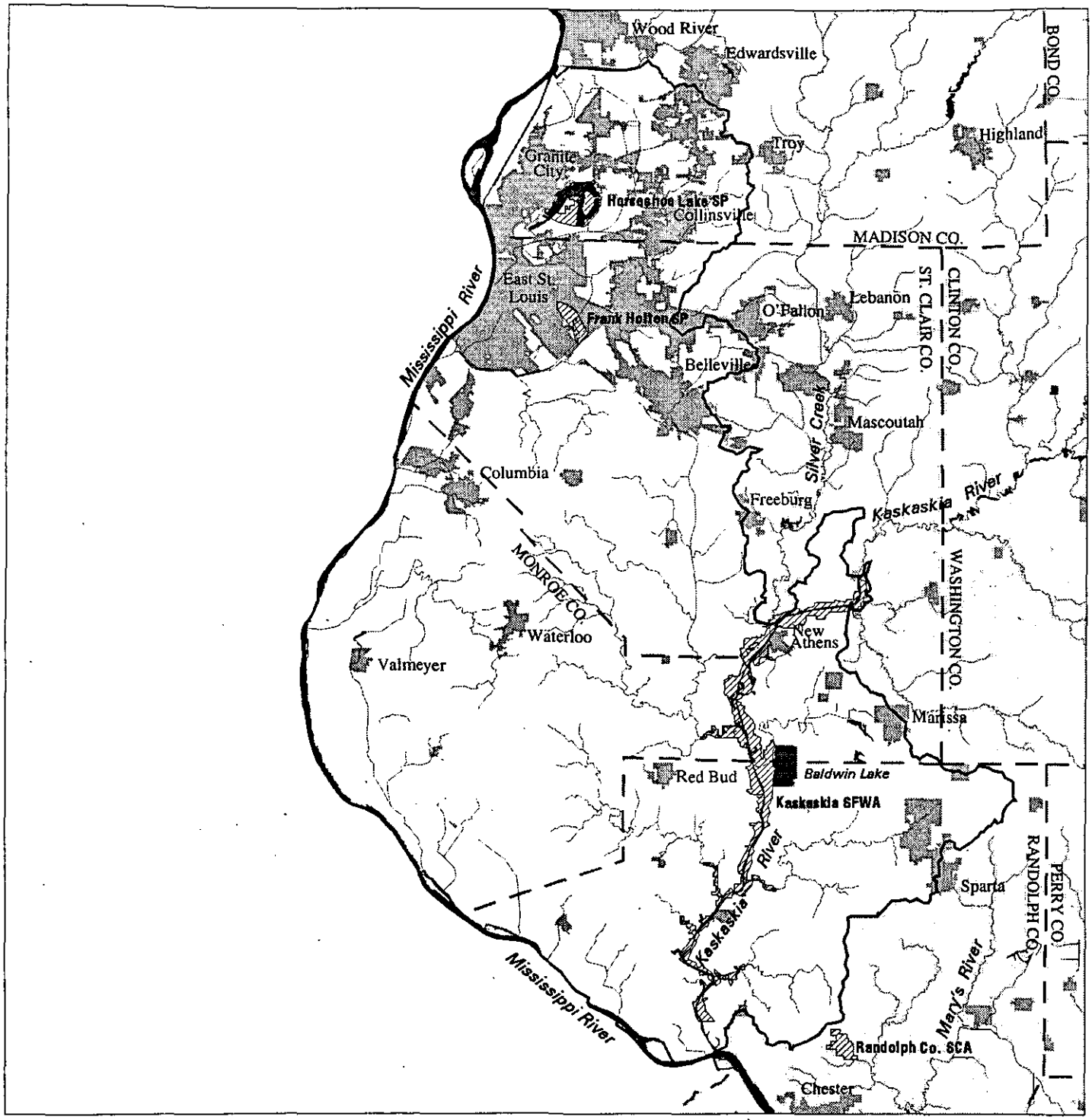


Figure 10. State land in the Sinkhole Plain Assessment Area. State land is limited to parks (SP), conservation areas (SCA), forests (SF), and fish and wildlife areas (SFWA).

Thirty-two terrestrial and wetland natural areas and 12 geological natural areas (including 8 caves) are found in the SPAA (Table 6, Figure 11). Terrestrial and wetland natural areas often include multiple natural plant communities. Six hill prairies, 11 forests, 5 glades, 1 silt-loam prairie, and 3 wetlands, plus 9 zoological sites, are found within the 44 total natural areas in the SPAA. Five of the natural areas are located in Madison Co., 15 are in St. Clair Co., 6 are in Randolph Co., and the remaining 18 are in Monroe Co. Sixty-four remnants (excluding caves) meet Category I classification as high-quality, undegraded natural communities. The total area of Category I natural areas is 1215.5 acres (0.15%) of the SPAA (Table 3). This amount is greater than the proportion for the entire state (0.07%) that meets Category I criteria of the INAI (White 1978). Comparisons of the area of individual Category I natural communities in relation to the total remaining in Illinois are made under each community type, when possible, in the Natural Vegetation Communities chapter of this report in the section on Terrestrial Natural Community Descriptions.

Table 6. Natural areas in the Sinkhole Plain Assessment Area and surrounding region.[1]

NA#[2]	County	Acres[3,4]	Acres in SPAA[3,4]	Name
24	St. Clair	41.75		Julius J. Knobeloch Woods
25	St. Clair	59.90		Silver Creek Marsh
26	**St. Clair**	**21.51**	**21.51**	**Baer Brothers Woodlot**
29	**St. Clair**	**89.98**	**89.98**	**Freeburg Rod and Gun Club**
97	Randolph	66.52		Behnken Tract
99	**Randolph**	**87.79**	**87.79**	**Prairie Du Rocher-south**
184	**Madison**	**99.03**	**2.70**	**Bohm Woods**
198	**Monroe**	**45.49**	**45.49**	**Rahe's Woods**
199	**Monroe**	**137.13**	**137.13**	**Monroe City Hill Prairie**
200	**Monroe**	**722.78**	**722.78**	**Potato Hill Hill Prairie**
201	**Monroe**	**501.02**	**501.02**	**Columbia Hill Prairie**
202	**Monroe**	**99.28**	**99.28**	**Miles Prairie**
236	**St. Clair**	**26.39**	**26.39**	**Marissa Woods Nature Preserve**
237	**St. Clair**	**16.98**	**16.98**	**Dupo Prairie**
238	**St. Clair**	**49.42**	**49.42**	**Sugar Loaf Hill Prairie**
239	St. Clair	219.66		Freeburg Woods
242	St. Clair	179.37		Jackson Slough Woods
304	**Madison**	**230.34**	**230.34**	**Levee Lake**
307	**St. Clair**	**68.27**	**68.27**	**Lively Branch Woods**
308	St. Clair	126.54		Wagon Lake
756	**Monroe**	**82.84**	**82.84**	**Camp Vandeventer**
757	**Monroe**	**27.59**	**27.59**	**Bradley Branch Woods**
758	**Monroe**	**(154.24)**	**(154.24)**	**Saltpeter Cave Area**
759	**Monroe**	**77.12**	**77.12**	**Renault Geological Area**
760	**Monroe**	**223.40**	**223.40**	**Chalfin Bridge Hill Prairie**
761	**Monroe**	**244.54**	**244.54**	**Renault Herpetological Area**
762	**Monroe**	**(9,148.14)**	**(9,148.14)**	**Fogelpole Cave**
785	**Monroe**	**(503.63)**	**(503.63)**	**Madonnaville Cave**
786	**Monroe**	**(4,020.60)**	**(4,020.60)**	**Dry Run Cave System**

Table 6. Continued.

NA#[2]	County	Acres[3, 4]	Acres in SPAA[3, 4]	Name
828	Randolph	75.50		Rockcastle Creek Area
830	**Randolph**	**3.35**	**3.35**	**Modoc Northwest Geological Area**
832	**St. Clair**	**98.37**	**98.37**	**Wirth Island**
833	**St. Clair**	**206.47**	**206.47**	**New Athens Woods**
834	St. Clair	131.08		Silver Creek Woods
835	**St. Clair**	**178.32**	**178.32**	**Stemler Cave Woods**
837	**St. Clair**	**2.58**	**2.58**	**Floraville Geological Area**
838	**St. Clair**	**787.57**	**787.57**	**Falling Spring**
865	Washington	57.37		West End Sportsman's Club Woods
866	Washington	197.15		Sipple Slough Woods
870	Washington	71.70		Johnson Woods
938	**Randolph**	**477.25**	**477.25**	**Demint Prairie/Prairie Du Rocher Herpetological Area**
939	**St. Clair**	**(2,779.78)**	**(2,779.78)**	**Stemler Cave Area**
1016	**Monroe**	**(2,740.25)**	**(2,740.25)**	**Illinois Caverns Cave System**
1017	**Monroe**	**(1,076.64)**	**(1,076.64)**	**Renault Cave System**
1045	**Monroe**	**1,422.37**	**1,422.37**	**Fults Hill Prairie--Kidd Lake Marsh**
1302	**Madison**	**32.87**	**32.87**	**Poag Railroad Prairie**
1303	**Madison**	**1.60**	**1.60**	**Chouteau Catchfly Site**
1305	**Madison**	**104.86**	**104.86**	**Eagle Park Marsh**
1306	**Monroe**	**(0.00)**	**(0.00)**	**Pautler Cave**
1307	**Randolph**	**2,986.88**	**1,066.38**	**Mississippi River - Mudds Landing**
1309	**Randolph**	**0.00**	**0.00**	**Leemon Site**
1310	Randolph	0.00		Reily Lake Area
1311	**Randolph**	**0.00**	**0.00**	**Sparta Site**
1312	**St. Clair**	**2.25**	**2.25**	**East St. Louis (Alorton) Heron Colony**
1313	**St. Clair**	**38.42**	**38.42**	**Fairmont City Site**
1483	**St. Clair**	**0.00**	**0.00**	**Audubon Avenue Heron Colony**
Total acres in SPAA:			**7177.23**	

[1] Bold type indicates natural areas within the SPAA.

[2] The number of the natural area (NA#) refers to the number designated in the Natural Heritage database (Illinois Department of Natural Resources 1997) and in Figure 11.

[3] Natural areas with a 0.00 acreage figure do not have an established boundary and therefore have not had their area calculated.

[4] Cave areas are in parentheses "()". The given area is an estimate of the underground extent of the cave system and is not included in the total acres of natural areas in the SPAA.

Nature preserves are areas of land or water in public or private ownership that are formally dedicated to receive maximum protection of significant natural features. The central goal of the nature preserve system, currently with about 268 preserves in the state, is to protect and preserve examples of all significant natural features found in Illinois for the purposes of scientific research, education, conserving biodiversity, and esthetic enjoyment. Nature preserves are administered largely by the Illinois Nature Preserves Commission (INPC).

Preserves usually are the shared responsibility of the INPC, the Illinois Department of Natural Resources, and land owners (McFall and Karnes 1995).

Nine sites dedicated as Illinois Nature Preserves occur within the SPAA (Table 7); each contains noteworthy remnants of natural communities. Four of the nature preserves occur in Monroe County, four are in St. Clair County, and one is located in Madison Count (Figure 11). Each Nature Preserve is described briefly in the following chapter.

Table 7. Nature preserves in the Sinkhole Plain Assessment Area and surrounding region.[1]

NP#[2]	Corr-NA[3]	County	Acres	Acres in SPAA	Name
30	**1045**	**Monroe**	**532.00**	**532.00**	**Fults Hill Prairie**
87	**184**	**Madison**	**10.10**	**5.45**	**William & Emma Bohm Memorial**
101	24	St. Clair	54.42		Julius J. Knobeloch Woods
102	**236**	**St. Clair**	**30.07**	**30.07**	**Marissa Woods**
140	**835**	**St. Clair**	**120.00**	**120.00**	**Stemler Cave Woods**
177	**762**	**Monroe**	**25.71**	**25.71**	**Fogelpole Cave**
189	**786**	**Monroe**	**117.69**	**117.69**	**Armin Krueger Speleological**
252	184	Madison	7.42		E. Dora Bohm Memorial
270	**939**	**St. Clair**	**2.50**	**2.50**	**Pruitt Sinkholes**
278	**761**	**Monroe**	**19.50**	**19.50**	**Brickey-Gonterman Memorial Hill Prairie**
271	**939**	**St. Clair**	**1.00**	**1.00**	**Stemler Cave**
Total acres in SPAA:				**853.92**	

[1] Bold type designates nature preserves within the SPAA.
[2] The nature preserve number (NP#) refers to the number designated in the Natural Heritage database (Illinois Department of Natural Resources 1997) and in Figure 11.
[3] Each of the nature preserves is associated with a corresponding natural area (Corr.-NA) referred to in Table 6.

Biological Stream Categorization and Biologically Significant Streams

Illinois streams have also been categorized based on 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 (Bertrand et al. 1995) 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). Thirty-five stream segments in Illinois, totaling 612 miles (4.5% of the statewide total) are rated as "A" streams, while 4545 miles (33.6%) fall into the "B" or "Highly Valued Aquatic Resource" category.

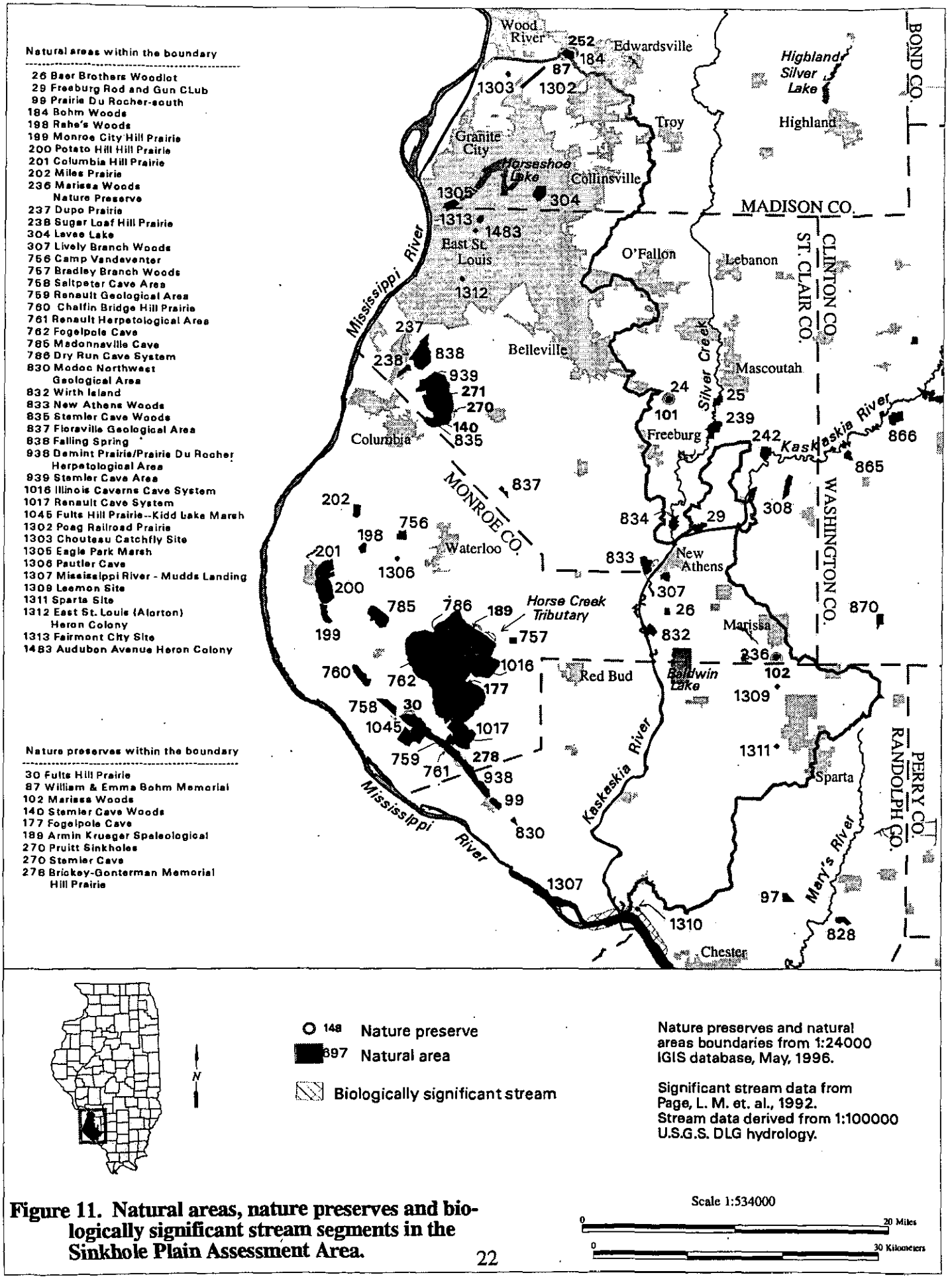


Figure 11. Natural areas, nature preserves and biologically significant stream segments in the Sinkhole Plain Assessment Area.

Another study, "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.

Two streams in the Sinkhole Plain Assessment Area were recognized as Biologically Significant Streams (Page et al. 1992) because of their mussel and/or fish diversity (Table 8). These sections are: A tributary to Horse Creek, Mammoth Cave, Monroe County and the Mississippi River, river miles 114 to 119, Randolph County. Additionally, the entire lengths of Fountain Creek (29.5 miles) in Monroe County and Nine Mile Creek (18.3 miles) in Randolph County are rated as "B" streams or "Highly Valued Aquatic Resources". These streams provide the best opportunities in the basin for the protection of large numbers of native species.

Table 8. Biologically significant stream segments in the Sinkhole Plain Assessment Area.

Site Description	Length (miles)
Tributary to Horse Creek	1.0
Mississippi River, River mile 114-119, Randolph County	5.9
Total:	**6.9**

Threatened and Endangered Species

At least 74 species of threatened or endangered plants and animals occur in the SPAA (Table 9). This number includes 2 that are federally threatened and 3 that are federally endangered. Only 6.6% (24 of 363 listed) of all of the threatened or endangered plant species monitored by the Illinois Endangered Species Protection Board currently occur or historically occurred within the Sinkhole Plain Assessment Area. For other taxa, the percentage of the state's threatened or endangered species that occur in the area are as follows: mollusks (12%), crustaceans (16.7%), fishes (6.7%), amphibians (20%), reptiles (30.8%), birds (85.7%), and mammals (33.3%).

This list includes only those species that are known to breed in the SPAA. Migrant bird species and those that only overwinter in the area are not listed in Table 9; these species will be mentioned in the chapter that describes bird communities.

Table 9. Threatened and endangered species occurring in the Sinkhole Plain Assessment Area.

(SE = state endangered; ST = state threatened; FE = federally endangered; FT = federally threatened)

Common name	Scientific name	Status
Plants:		
pale false foxglove	*Agalinis skinneriana*	ST
Bradley's spleenwort	*Asplenium bradleyi*	SE
decurrent false aster	*Boltonia decurrens*	ST, FT
woolly buckthorn	*Bumelia lanuginosa*	SE
Hale's corydalis	*Corydalis halei*	SE
Whitlow grass	*Draba cuneifolia*	SE
small burhead	*Echinodorus tenellus*	SE
spurge	*Euphorbia spathulata*	SE
slender heliotrope	*Heliotropium tenellum*	SE
mud plantain	*Heteranthera reniformis*	SE
crested coral root orchid	*Hexalectris spicata*	SE
dwarf bedstraw	*Galium virgatum*	SE
western wild lettuce	*Lactuca ludoviciana*	SE
long-leaved panic grass	*Panicum longifolium*	SE
bead grass	*Paspalum dissectum*	SE
mock bishop's weed	*Ptilimnium nuttallii*	SE
Missouri orange coneflower	*Rudbeckia missouriensis*	SE
sour dock	*Rumex hastatulus*	SE
fame flower	*Talinum calycinum*	SE
New York fern	*Thelypteris noveboracensis*	SE
prairie spiderwort	*Tradescantia bracteata*	SE
buffalo clover	*Trifolium reflexum*	SE
royal catchfly	*Silene regia*	SE
spring ladies' tresses	*Spiranthes vernalis*	SE
Birds:		
Pied-bilxled Grebe	*Podilymbus podiceps*	ST
Double-crested Cormorant	*Phalarocorax auritus*	ST
American Bittern	*Botaurus lentiginosus*	SE
Least Bittern	*Ixobrychus exilis*	SE
Great Egret	*Ardea albus*	ST
Snowy Egret	*Egretta thula*	SE
Little Blue Heron	*Egretta caerulea*	SE
Black-crowned Night-Heron	*Nycticorax nycticorax*	SE
Yellow-crowned Night-Heron	*Nycticorax violaceus*	ST
Osprey	*Pandion haliaetus*	SE
Mississippi Kite	*Ictinia mississippiensis*	SE
Bald Eagle	*Haliaeetus leucocephalus*	SE, FT
Northern Harrier	*Circus cyaneus*	SE
Sharp-shinned Hawk	*Accipiter striatus*	SE
Red-shouldered Hawk	*Buteo lineatus*	SE
Peregrine Falcon	*Falco peregrinus*	SE, FE

Table 9. Continued.

Common name	Scientific name	Status
Yellow Rail	*Coturnicops noveboracensis*	SE
King Rail	*Rallus elegans*	ST
Common Moorhen	*Gallinula chloropus*	ST
Upland Sandpiper	*Bartramia longicauda*	SE
Wilson's Phalarope	*Phalaropus tricolor*	SE
Common Tern	*Sterna hirundo*	SE
Forster's Tern	*Sterna forsteri*	SE
Least Tern	*Sterna antillarum*	SE, FE
Black Tern	*Chilidonias niger*	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
Marsh Wren	*Cistothorus palustris*	ST
Veery	*Catharus fuscescens*	ST
Loggerhead Shrike	*Lanius ludovicianus*	ST
Swainson's Warbler	*Limnothlypis swainsonii*	SE
Henslow's Sparrow	*Ammodramus henslowii*	SE
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	SE
Mammals:		
river otter	*Lontra canadensis*	SE
Indiana bat	*Myotis sodalis*	SE, FE
bobcat	*Lynx rufus*	ST
Amphibians:		
Illinois chorus frog	*Pseudacris streckeri illinoensis*	ST
Reptiles:		
timber rattlesnake	*Crotalus horridus*	ST
Great Plains rat snake	*Elaphe guttata emoryi*	ST
coachwhip snake	*Masticophis flagellum*	ST
eastern massasauga	*Sistrurus catenatus*	SE
Aquatic Biota:		
Fish		
western sand darter	*Ammocrypta clara*	SE
bigeye shiner	*Notropis boops*	SE
Freshwater mussels		
butterfly	*Ellipsaria lineolata*	ST
spike	*Elliptio dilatata*	ST
ebonyshell	*Fusconaia ebena*	ST
Freshwater crustaceans		
isopod	*Caecidotea spatulata*	SE
amphipod	*Gammarus acherondytes*	SE

Natural Vegetation Communities

The description of the vegetation for the Sinkhole Plain Assessment Area (SPAA) is organized into six sections: 1) Comparison to Statewide Patterns, 2) Threatened and Endangered Species, 3) Disturbance, Habitat Quality, and Restoration Potential, 4) Natural Areas and Nature Preserves, 5) Natural Community Descriptions, and 6) Summary and Recommendations.

Comparison of Biodiversity in the SPAA to Statewide Patterns

In general, habitat loss rates in the Sinkhole Plain Assessment Area appear to be less than rates for the state as a whole. On a percentage loss basis, prairies and wetlands have fared better in the SPAA than in the state as a whole. However, a higher percentage of forest acreage has been lost in the SPAA as compared to that of the state overall.

Trends for each community class are described below. Considering the entire SPAA, 1215.5 acres (0.15%) remain in an undegraded, high quality ecological condition (White 1978, Illinois Department of Natural Resources [IDNR] 1997; Table 3). In all of Illinois only 0.07% of the total area of the state remains in a high-quality condition (White 1978). The SPAA total, then, exceeds the state average more than twofold. Nevertheless, this is a very tiny percentage of the presettlement area of undisturbed land. High quality natural areas are described in more detail in subsequent sections of this report.

Prairie - About 0.01% of the presettlement acreage of prairie in the state persists in a high-quality condition (White 1978). About 173 acres (0.02% of the land cover) of relatively undisturbed prairie remain throughout the SPAA (Table 3). Most acreage of relatively undisturbed prairie in the Assessment Area, as in Illinois overall, is from agriculturally less suitable lands such as sand deposits or, especially, steep loess hills. An unknown quantity of degraded prairie persists locally in the Assessment Area, particularly as small hill prairies on the bluffs bordering the major rivers and possibly along some railroad rights-of-way. Some of this degraded prairie has restoration potential, particularly the remaining hill prairies.

Forest - About 30% of the presettlement acreage of forest remains statewide (Iverson et al. 1989), although only about 0.3% of of the remaining forest (0.1% of presettlement forest area) remains in a high-quality condition. About 20.5% (161,314 acres) of the SPAA is forested, compared with estimates of presettlement forest cover ranging from about 87.0% in Monroe County to about 40.2% for all of Madison County. About 870.5 acres within the SPAA (0.16% of the presettlement forested area, 0.11% of total land cover) remain as high-quality forest (Table 3). If an estimated figure of 70% presettlement forest cover for the SPAA is used, then 71% (388,761 acres, 49.5% of the total Assessment Area acreage)

of the presettlement forest has been lost. This is a higher rate of forest loss in the SPAA than the statewide rate of loss.

Savanna - Savannas have decreased in area throughout Illinois and the Midwest, perhaps more than any other community class (Taft 1997). No areas of high quality savanna remain in the SPAA. Presettlement acreage of savanna in the SPAA is unknown, as are any figures on the remaining acreage of degraded savannas. One known occurrence of degraded savanna vegetation is in the Fults Hill Prairie Nature Preserve.

Wetlands - Natural wetland acreage in Illinois has decreased from presettlement statewide estimates of about 23% of the land area to about 2.6% of the state (Havera et al. 1994), or about 11% of the presettlement wetland total. Statewide, only about 6,000 acres remain in a high-quality condition (White 1978) representing 0.65% of the remaining (0.07% of the presettlement area) wetland area (Havera et al. 1994). About 6.9% (54,053 acres) of the SPAA remains as wetland (Table 2), approximately 87,395 acres or 38% (62% remain) of original wetlands have been lost since settlement of the area began. This, however, is much less than the statewide loss of wetland acreage and reflects the retention of considerable areas of wetlands along the Mississippi and Kaskaskia rivers. Approximately 307 acres (93.0 acres shrub swamp/pond, 6.5% of the Illinois total, and 214.0 acres of wet floodplain forest, 7.5% of the Illinois total) of high quality (Category I) wetlands remain in the SPAA (Table 3). This is 5.1% of the high quality wetland remaining in Illinois and represents a significant natural resource and feature of the SPAA

Primary - Primary communities refer to communities in which soil is thin or absent and the parent material (generally bedrock) is at or near the surface (White 1978). Within the SPAA primary communities include the limestone glades and limestone cliffs. The communities are maintained at an early stage of succession by disturbances such as erosion. Because of their rugged nature, there has not been extensive habitat destruction except in areas of quarrying or urban development. Figures are not available on total acreage of this type of land cover in the SPAA because the vegetation cover may be recorded as upland forest or grasslands. There are 79.0 acres of high-quality limestone glades known in the Assessment Area and this is 42.9% of the total acres of similar habitat remaining in Illinois (Table 3). The only non-vegetated portions are the areas of vertical bluffs, whose vertical area is not generally included in acreage figures. These areas are of great significance to biodiversity in the SPAA because they shelter a unique assemblage of specially adapted species, as well as threatened and endangered species (Table 10).

Vascular plants - The species richness of vascular plants within the SPAA at the time of European settlement is unknown. However, there are some early records from the area. Early botanical explorers surveyed and inventoried the area earlier than most other parts of Illinois because of the proximity to St. Louis where most botanical activity in the midwestern United States began. About 1075 plant taxa have been reported from within the Assessment Area (Appendix I) in the last 150 years. Of these, 878 (81.6%) are native to the Assessment Area and 198 (18.4%) are introduced. These figures indicate that a lesser percent of non-native plants occur in the SPAA than in the state as a whole.

Statewide, 71% of the taxa known are native and 29% are introduced species. Appendix 2 is an alphabetical listing of scientific names of the plants reported from the SPAA along with their corresponding common names. The compilation may underestimate somewhat the species richness of both native and non-native taxa in the SPAA, but it is thought to be rather complete considering the long history of botanical work in the area. The list was based on a variety of sources including herbarium records in the Illinois Natural History Survey herbarium, Mohlenbrock and Ladd (1978), literature and reports cited at the end of this section, and the Illinois Natural Heritage database (Illinois Department of Natural Resources 1997). The estimate compares to about 2,200 native taxa and 3,102 total taxa reported from Illinois (Mohlenbrock 1986); the compilation represents 34.7% of the total Illinois flora (40% of the native flora).

The loss of habitat in the SPAA has resulted in a reduction in the number of individuals of most native species, particularly those sensitive to habitat degradation. As populations decline in size, they are more likely to undergo local extinctions. Richness of native species has probably declined in the SPAA since European settlement as a result of reduced population sizes, local extinctions, habitat destruction and degradation, and the introduction of non-native species. 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 become extinct in the state (Taft 1995). However, many prairie species occur at low population levels in the state and about 103 are listed as threatened and endangered (Herkert 1991, 1994; Taft 1995).

Illinois Threatened and Endangered Species

Twelve plant species listed by the Illinois Endangered Species Protection Board (IESPB) as threatened or endangered (T&E) are known to currently exist within the SPAA (Table 10) Nine additional T&E species and two watch-list (monitored) species have been reported from within the SPAA but have not been relocated and may have become extirpated from the region (Table 10). Three additional species listed by the IESPB currently occur within the mapped area (Figure 1, Table 10) and are included in the table because suitable habitat is present for each within the boundary of the SPAA. Finally, Table 11 lists seventeen additional T&E plant species that currently occur or have been found historically in Madison, Monroe, Randolph, and St. Clair counties and should be sought within the SPAA. A combination of these four categories of T&E species results in a total of 41 listed T&E species known or historically known from within and in the vicinity of the SPAA (Tables 9, 10, and 11) . Of the twenty-one listed plant species that have been reported from within the boundary of the SPAA, nine (43%) have disappeared in the last 100 years. Compared to all of Illinois, 6.3% (23 of 363 listed) of all of the threatened or endangered plant species monitored by the IESPB currently occur or historically occurred within the SPAA.

Three of the plant species included in tables 10 and 11 are also federally threatened or endangered plant species. One species currently known within the SPAA on the Mississippi River floodplain, the decurrent false aster (*Boltonia decurrens*), is listed by the U.S. Fish

and Wildlife Agency as a federally threatened species (U.S. Fish and Wildlife Service 1988, Herkert 1991). Decurrent false aster is endemic to Illinois and a few stations along the Mississippi River in Missouri (Schwegman and Nyboer 1985). Nearby in Madison County the federally threatened prairie white fringed orchid (*Platanthera leucophaea*) once occurred, and a small population of the federally endangered small whorled pogonia (*Isotria medeoloides*) was once known from Randolph County as recently as 1987; both are outside of the SPAA.

Table 10. Illinois threatened or endangered plant species from the Sinkhole Plain Assessment Area[1].

Common Name	Scientific Name	Status[2]	Habitat	Location[3] in[4]	Location[3] near	Range (U.S. and SPAA)
bead grass	*Paspalum dissectum*	SE	disturbed sites, shallow water	H		Southeastern U.S. Historical record from St. Clair Co. along Mississippi River before 1893.
Bradley's spleenwort	*Asplenium bradleyi*	SE	sandstone cliffs		X	Eastern U.S.; known in 4 counties in S. Illinois, the Randolph Co. site is within the mapped area.
buffalo clover	*Trifolium reflexum*	SE	dry-mesic savannas, flatwoods, and prairies		X	Eastern and central U.S. and Canada; known from St. Clair and Washington cos. within the mapped area.
butternut	*Juglans cinerea*	WL	calcareous woods	H		Eastern U.S. and adjacent Canada. Widespread in Illinois, declining due mostly to disease. Known historically from Monroe Co. within the SPAA.
crested coral root orchid	*Hexalectris spicata*	SE	dry calcareous woods and dry prairies	X		Southern U.S. Known from 4 localities in IL and in the SPAA from Monroe and Randolph cos.
decurrent false aster	*Boltonia decurrens*	ST, FT	alluvial prairie and marshland	X		Floodplains of Illinois and Mississippi rivers. Presently known from 11 cos. along the Illinois River. In the SPAA, known from St. Clair and Madison cos.
dwarf bedstraw	*Galium virgatum*	SE	dry barrens, glades, and rocky woods	X		South-central U.S. In Illinois known from only one location in Monroe Co. that is also in the SPAA.
fame flower	*Talinum calycinum*	SE	dry barrens, cliffs		X	South-central U.S. Known from a single population in Randolph Co. within the mapped area.
Hale's corydalis	*Corydalis halei*	SE	limestone bluffs, barrens remnants, sandy soil	H		Southeastern U.S. Historically known (1965) from Monroe Co. within the SPAA.
long-leaved panic grass	*Panicum longifolium*	SE	limestone ledges in wooded ravines	H		Eastern U.S. Historically known (1962) from Monroe Co. within the SPAA.
Missouri orange coneflower	*Rudbeckia missouriensis*	SE	limestone glades and loess hill prairies	X		South-central U.S. Known from Monroe and Randolph cos. in IL, both of which are in the SPAA.

Table 10. Continued.

Common Name	Scientific Name	Status[2]	Habitat	Location[3] in[4]	Location[3] near	Range (U.S. and SPAA)
mock bishop's weed	*Ptilimnium nuttallii*	SE	Mississippi and Ohio River floodplains	X		South-central U.S. Formerly known from 4 cos. in IL. Presently known from Randolph Co.
mud plantain	*Heteranthera reniformis*	SE	Mississippi and Ohio River floodplains	H		South-central and eastern U.S. Formerly known from 6 cos. in IL. One historical record from the floodplain of the Mississippi River in St. Clair Co.
New York fern	*Thelypteris noveboracensis*	SE	Seeps, mesic forests sandstone cliffs	H		Eastern U.S. and Canada. Historically known from Monroe Co.
pale false foxglove	*Agalinis skinneriana*	ST	loess hill prairies, sand prairies	H		Central U.S. and Ontario, Canada; known from 14 cos. in IL; the St. Clair Co. populations may be extirpated.
prairie spiderwort	*Tradescantia bracteata*	SE	dry-mesic silt and sand prairie	X		North-central U.S. In IL known from seven populations in 5 cos. In the SPAA, known from Madison Co.
royal catchfly	*Silene regia*	SE	dry-mesic barrens and prairies.	X		Southeastern U.S. Known from 4 stations in IL in the Wabash and Mississippi drainages. In the SPAA, known from Madison Co.
slender heliotrope	*Heliotropium tenellum*	SE	limestone glades and hill prairies	X	X	South-central U.S. Known from Monroe and Randolph Cos. Monroe Co. population is in the SPAA.
small burhead	*Echinodorus tenellus*	SE	sandy pond margins on river floodplains	H		Southeastern U.S. south to South America. Historical record from Mississippi River floodplain in St. Clair Co. within the SPAA.
sour dock	*Rumex hastatulus*	SE, EXT?	hill prairies, barrens, sand prairies	H		Southeastern U.S. Possibly extirpated in Illinois. Historically known from a sandy area near the Mississippi River in St. Clair Co. (1960).
spring ladies' tresses	*Spiranthes vernalis*	SE	acidic soils in prairies and old fields	X		Southeastern and south central U.S. Known from Pope and Madison (in the SPAA) cos.
spurge	*Euphorbia spathulata*	SE	limestone glade or rock ledge	X		Western and central U.S. In Illinois, known from one location in Monroe Co. that is also in the SPAA.
western wild lettuce	*Lactuca ludoviciana*	SE, EXT	dry to mesic prairies	H		Western and central U.S. Possibly extirpated in Illinois; historically known from Monroe Co. in SPAA.
Whitlow grass	*Draba cuneifolia*	SE	rock ledges along the Mississippi River.	X		Southern U.S. In IL, presently known from Monroe Co. in the SPAA.
woolly buckthorn	*Bumelia lanuginosa*	SE	Dry, open, rocky bluffs along the Mississippi River.	X		South-central U.S. In Illinois known from several populations in Monroe Co. in the SPAA.

Table 10. Continued.

Common Name	Scientific Name	Status[2]	Habitat	Location[3] in[4]	Location[3] near	Range (U.S. and SPAA)
yellow lady's-slipper orchid	*Cypripedium calceolus* var. *pubescens*	WL	Mesic upland forest	H		Eastern U.S. and Canada. Rather widespread in Illinois but declining rapidly. Historically known from Monroe Co. within the SPAA.

[1] Range and habitat information from Herkert (1991, 1994) and Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997).
[2] SE = Illinois endangered, ST = Illinois threatened, WL = Illinois watch list, FT = federally threatened, EXT = extirpated in Illinois
[3] in = within the SPAA, near = on map of SPAA but not within boundary
[4] H = historical record only, X = current record

Table 11. Illinois threatened and endangered plants known to exist outside the Sinkhole Plain Assessment Area but within Madison, Randolph, and St. Clair Counties[1].

Common Name	Scientific Name	Status[2]	Habitat	Location[3]	Range (U.S., Illinois, and SPAA)
bellow's beak sedge	*Carex physorhyncha*	SE	sand or chert outcrops	X	Southern U.S. and Mexico. Known from 4 cos. in SW. Illinois, including Randolph Co.
blue jasmine	*Clematis crispa*	SE	floodplain forests	H	Southeastern U.S. Currently known in Alexander Co., Illinois. Historical record from St. Clair Co.
cinquefoil	*Potentilla millegrana*	SE	mesic prairies	H	Western and central U.S. and adjacent Canada. Historical record from St. Clair Co. where it may still exist.
false mallow	*Malvastrum hispidum*	SE	limestone hill, dolomite prairies	H	North-central U.S. Known through historical records from St. Clair Co. in 1947 and 1950.
grove bluegrass	*Poa alsodes*	SE	forested bluffs, sandstone canyons	H	Eastern Canada, south to northeastern U.S. and the Appalachians. Historical record from St. Clair Co.
heart-leaved plantain	*Plantago cordata*	SE	sand or gravel bars of streams under forest canopy	H	Eastern and central U.S. and adjacent Canada. Historically known from St. Clair Co.
Hill's thistle	*Cirsium hillii*	ST	dry to dry-mesic prairie, loess hill prairies	H	Central U.S. and adjacent Canada Known from at least 15 counties in the N 2/3 of Illinois, historically known from Madison Co.
large ground plum	*Astragalus crassicarpus* var. *trichocalyx*	SE	dry calcareous woods, limestone glades, and dry prairies	H	West-central U.S. extending east to Illinois. Currently known from Jersey and Macoupin cos., historically known from Madison and St. Clair cos.

Table 11. Continued.

Common Name	Scientific Name	Status[2]	Habitat	Location[3]	Range (U.S., Illinois, and SPAA)
oak fern	*Gymnocarpium dryopteris*	SE	sandstone or dolomite cliffs, sand forests	H	Circumpolar, south to northeastern and north-central U.S. and Appalachians. Questionable historical record from 1850 in St. Clair Co.
prairie rose gentian	*Sabatia campestris*	SE	mesic prairies	H	South-central U.S. Historical record from St. Clair Co.
prairie white fringed orchid	*Platanthera leucophaea*	SE, FT	dry-mesic to wet prairies	H	East-central and eastern United States and adjacent Canada. Historically known from Madison Co.
shortleaf pine	*Pinus echinata*	SE	dry sandstone and chert slopes	X	SE U.S. Two current IL populations known, one in Randolph Co.
slender sandwort	*Arenaria patula*	ST	rock ledges, dolomite prairies	H	Southeastern U.S. It is historically known from St. Clair Co.
small whorled pogonia	*Isotria medeoloides*	SE, FE	dry to mesic upland forests	X	Eastern U.S. Known from one small population in Randolph Co. which may be extirpated.
white lady's-slipper	*Cypripedium candidum*	SE	wet-mesic prairies and fens	H	North-central U.S. Historical record from St. Clair Co.
Torrey bulrush	*Scirpus torreyi*	SE	acidic sand pond margins	H	Northeastern and east-central U.S. and Canada. Historical record from St. Clair Co. (1834). May still exist in north-central Illinois.
tubercled orchid	*Platanthera flava* var. *herbiola*	SE	wet-mesic sand prairies and associated thickets	H	Northeastern U.S. and adjacent Canada. Historical record from St. Clair Co.

[1] Range and habitat information from Herkert (1991, 1994) and Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997).
[2] SE = Illinois endangered, ST = Illinois threatened, FE = federally endangered, FT = federally threatened
[3] X = currently found on map of SPAA but not within boundary, H = historical record only

The T&E plant species in and near the Sinkhole Plain Assessment Area have decreased in abundance due to loss of habitat. This is particularly true for species previously known in western St. Clair County sites that are now included within areas of urban development. Several of the species in the tables probably were not very numerous even in presettlement times because they represent species on the edges of their ranges. For example, the spurge (*Euphorbia spathulata*) and dwarf bedstraw (*Galium virgatum*) do not occur anywhere in North America east of their known sites in Monroe County. Others such as Bradley's spleenwort (*Asplenium bradleyi*) and fame flower (*Talinum calycinum*) are not known to occur north of their locations in Randolph County.

The twenty-four threatened and endangered plants included in Table 10 are known from several natural community types in the SPAA. The habitats supporting the most T&E species are the dry, rocky or loess-covered, prairie-glade/cliff complexes which support

eleven taxa historically known from the Assessment Area. Five taxa are known from the Mississippi River floodplain. Five are known primarily from mesic to dry-mesic prairies. The remaining three species are forest plants. Both watch-list species are also restricted to upland forests.

Disturbance, Habitat Quality, and Restoration Potential

In addition to the primary cause of habitat loss through conversion to cropland and urban areas, most remnant plant communities in the SPAA have experienced human-caused 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 briefly 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 mined land), 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 dominant or characteristic "keystone" species, or assemblages of other taxa, are extirpated (removed) 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 overgrazing; however, multiple factors often are interacting.

Fire is an example of a large-scale presettlement disturbance typical of many Midwestern plant communities and fire frequency and timing are important determining factors for maintaining many presettlement 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 extinctions 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 extinction.

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 monopolization of space (and thus lack of opportunity for germination of native species), in arrested development of native species or entire communities, and can 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 SPAA, including exotic species control measures, are offered in the Summary and Recommendations section following the descriptions of Natural Communities.

Natural 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). It established seven categories of natural areas based on significant or exceptional 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 also established a grading system to designate natural quality (White 1978). The natural quality of a community or area was graded as "A" (relatively stable or undisturbed), "B" (late successional or lightly disturbed), or "C" (mid-successional or moderately to heavily disturbed). Grades "D" (early successional or severely disturbed) and "E" (very early successional or severely disturbed) were used for land within a natural area that is used as a buffer for protection of the significant or exceptional feature. In general, only grade "A" or "B" communities are designated as significant or exceptional features.

Thirty-two terrestrial and wetland natural areas and 12 geological natural areas (including 8 caves) are found in the SPAA (Table 6, Figure 11). Terrestrial and wetland natural areas often include multiple natural plant communities. Six hill prairies, 11 forests, 5 glades, 1 silt-loam prairie, and 3 wetlands, plus 9 zoological sites, are found within the 44 total natural areas in the SPAA. Five of the natural areas are located in Madison Co., 15 are in St. Clair Co., 6 are in Randolph Co., and the remaining 18 are in Monroe Co. Sixty-four remnants (excluding caves) meet Category I classification as high-quality, undegraded natural communities. The total area of Category I natural areas is 1215.5 acres (0.15%) of the SPAA (Table 3). This amount is greater than the proportion for the entire state (0.07%) that meets Category I criteria of the INAI (White 1978). Comparisons of the area of

individual Category I natural communities in relation to the total remaining in Illinois are made under each community type, when possible, in the following section on Terrestrial Natural Community Descriptions.

Nine sites dedicated as Illinois Nature Preserves occur within the SPAA (Table 7); each contains noteworthy remnants of natural communities. Four of the nature preserves occur in Monroe County, four are in St. Clair County, and one is located in Madison County (Figure 10). Summarizing from McFall and Karnes (1995), each Nature Preserve is described briefly below.

Armin Krueger Speleological Nature Preserve (Monroe County) - This privately-owned 105 acre nature preserve is unique because most of the dedicated area is below ground. It is located southeast of Burksville at the eastern margin of the Northern Section of the Ozark Natural Division. Natural communities present include terrestrial and aquatic caves and upland forest (forested sinkholes). The Krueger caves are connected to the Dry Run Cave System but not the Illinois Caverns Cave System.

Brickey-Gonterman Memorial Hill Prairie Nature Preserve (Monroe County) - This privately-owned 19.5 acre (17 acres plus 2.5 acre buffer) site is on a bluff overlooking the American Bottoms and encompasses the southeast 1/5th of the Renault Herpetological Natural Area (INAI #761). The nature preserve is located southwest of Renault in the Northern Section of the Ozark Natural Division. It provides habitat for 7 rare or state threatened reptiles and amphibians and contains high-quality limestone cliff communities, as well as loess hill prairie and upland forest.

Fogelpole Cave Nature Preserve (Monroe County) - This IDNR-owned 27.3 acre nature preserve is primarily below ground, although part is above ground. It is located southeast of Maeystown at the eastern margin of the Northern Section of the Ozark Natural Division. Natural communities present include a terrestrial cave with an outstanding vertebrate and invertebrate fauna including a federally endangered bat, as well as an aquatic cave community supporting the cave amphipod, a candidate for federal listing.

Fults Hill Prairie Nature Preserve (Monroe County) - This IDNR-owned 532 acre site was dedicated in 1970 as the 30th Illinois Nature Preserve. It is located along the Mississippi River bluffs at the southwestern margin of the Northern Section of the Ozark Natural Division. The site contains the largest complex of the highest quality, essentially undisturbed, loess hill prairies along the Mississippi River in Illinois. Other natural communities are also present, including upland forest, savanna, limestone glade, limestone cliff, and sinkhole ponds.

Marissa Woods Nature Preserve (St. Clair County) - This IDNR-owned 25 acre site is located south of Marissa near the Randolph Co. border. It is within and representative of the Mt. Vernon Hill Country Section of the Southeastern Till Plain Natural Division. The site preserves relatively undisturbed examples of dry-mesic upland forest and southern flatwoods communities.

Pruitt Sinkholes Nature Preserve (St. Clair County) - This privately-owned 2.5 acre site is an important part of the Stemler Cave system and will protect several sinkholes that drain into Stemler Cave. It is located west of Millstadt on the northeastern margin of the Northern Section of the Ozark Natural Division, within a quarter-mile of Stemler Cave Woods Nature Preserve.

Stemler Cave Nature Preserve (St. Clair County) - This privately-owned one acre site surrounds the entrance to Stemler Cave. The cave supports a population of an endangered invertebrate, the Illinois cave amphipod, and is an outstanding example of karst topography.

Stemler Cave Woods Nature Preserve (St. Clair County) - This IDNR-owned 120 acre nature preserve is located on a sinkhole plain near the entrance to Stemler Cave. It is located west of Millstadt on the northeastern margin of the Northern Section of the Ozark Natural Division. The site protects a remnant of an old-growth dry upland forest community.

William and Emma Bohm Memorial Nature Preserve (Madison County) - This privately owned 10 acre nature preserve is located on the dissected bluff above the American Bottoms west of Edwardsville. Bohm Woods is a fine example of dry-mesic and mesic upland forest and is known for its species-rich herbaceous understory.

Terrestrial Natural Community Descriptions

The Illinois Natural Areas Inventory classification subdivides the natural divisions and sections of Illinois into nine community classes: **Forest, Prairie, Savanna, Wetland, Lake and Pond, Stream, Primary, Cave**, and **Cultural** (White 1978). The smallest unit in the classification is the natural community, which is a subdivision of the community class. A ***natural community*** is a group of organisms interrelated with each other and their environment. They are named by choosing the dominant descriptive features that distinguish one community from the others. Soil moisture is a basic characteristic used to distinguish the communities. The soil moisture classes are *xeric* (excessively drained), *dry* (somewhat excessively drained), *dry-mesic* (well-drained), *mesic* (moderately well-drained), *wet-mesic* (imperfectly drained), *wet* (poorly drained), and *hydric* (nearly always wet). The boundaries between these classes are not always sharp due to seasonal differences in water availability and the subjectivity of the observer.

The natural communities within the SPAA (Table 4 in part, Table 12) were determined by examining data from several sources. These included 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 SPAA has been so greatly converted, modified, and degraded, some of the following community types may no longer persist in a high-quality form. The following describes the natural communities known to occur in the SPAA as well as the characteristics of disturbed land and/or

degraded communities. Community classification follows White and Madany (1978). Botanical nomenclature follows Mohlenbrock (1986) except for certain threatened and endangered species where nomenclature follows that used in Herkert (1991, 1994). Appendix 1 lists all of the vascular plant taxa (all plants other than bryophytes, algae, fungi; 1072 species and 3 additional varieties) known within the Assessment Area by common name followed by their scientific name along with the natural community within which each species has been reported in the SPAA. Appendix 2 presents the scientific names used in this text listed alphabetically with the corresponding common names. The list was compiled primarily from the INAI plant lists from Natural Areas, from vouchered specimens in the Illinois Natural History Survey herbarium, from descriptions of vegetation in publications and technical reports, from habitat descriptions in the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997) and from Mohlenbrock and Ladd (1978).

Table 12. Terrestrial natural communities in the Sinkhole Plain Assessment Area.[1]

FOREST
- **Upland forest**
  - dry upland forest
  - dry-mesic upland forest
  - mesic upland forest
- **Floodplain forest**
  - mesic floodplain forest
  - wet-mesic floodplain forest
  - wet floodplain forest
- **Flatwoods**
  - southern flatwoods

PRAIRIE
- **Prairie**
  - wet-mesic prairie
- **Sand prairie**
  - mesic to dry-mesic sand prairie
- **Hill prairie**
  - loess hill prairie

SAVANNA
- **Savanna**
  - dry-mesic savanna

WETLAND
- **Swamp**
  - swamp
- **Marsh**
  - marsh
- **Seep and spring**
  - seep
  - calcareous spring
  - spring community

LAKE AND POND
- **Pond**
  - pond
- **Lake**
  - lake

STREAM
- **Creek**
- **River**
  - medium-gradient river
  - major river

PRIMARY
- **Glade**
  - limestone glade
- **Cliff**
  - limestone cliff

CAVE
- **Cave**
  - terrestrial cave community
  - aquatic cave community

CULTURAL
- Pastureland
- Successional field
- Developed land
- Tree plantation
- Artificial pond
- Artificial lake
- Prairie restoration
- Cropland

[1] Adapted from White and Madany 1978.

Several significant descriptions of the vegetation communities within the SPAA have been consulted for this report and are listed here rather than within individual community descriptions. Upland forests have been described by Iverson et al. (1989), Hutchison (1982), and Faulkner and Cline (1995). Floodplain forests in the SPAA have been

described by Evans (1975), Shelford (1954), Terpening et al. (1973), and Turner (1936). A historically important description was presented by Hus (1908). Southern flatwoods have been described by Taft et al. (1995). Hill prairies in the SPAA were described by Evers (1955), and Bland and Kilburn (1966). Sand prairies in Illinois have been described by Gleason (1910). Mesic prairies in floodplain areas in Illinois have been described by Turner (1934). Little published data are available describing some prairie vegetation communities from within the SPAA; however, substantial additional unpublished floristic data from mesic prairies are in the natural areas files at the Illinois Natural History Survey (INHS). These species lists were compiled by numerous botanists over a period of several years. General descriptions of savanna characteristics are summarized from White (1978) and Taft (1997). Sinkhole pond vegetation has been described by Bollwinkel (1958). Wetlands (not including floodplain forest) have been described by Turner (1936) and Suloway and Hubbel (1994). Limestone glade vegetation has been described by Kurz (1981). The vegetation of limestone cliffs was described by Ozment (1967).

Forest

Forests are communities that are dominated by trees, with an average canopy cover of 80% or greater. Forests in the Lower Kaskaskia River drainage basin within the SPAA belong to the Prairie Peninsula Section in the Northern Division of the Oak-Hickory Forest Region while forests in the Mississippi South Central drainage basin belong to the Interior Highlands Section of the Southern Division of the Oak-Hickory Forest Region (Braun 1950). The inclusion of two forest sections and portions of four Natural Divisions recognized in Illinois (Schwegman et al. 1973) within this Assessment Area is an indication that the SPAA extends along several distinct phytogeographical and geomorphological areas.

Due to a level of protection from the characteristic presettlement prairie fires, forests in the SPAA primarily were concentrated on the slopes, ravines, and bottomlands associated with the major drainages and in protected areas associated with moraines (Gleason 1913, Figure 5). Forest subclasses include upland forest, floodplain forest, and southern flatwoods. These forest types are characterized below. Approximately 70% (550,075 acres) of the SPAA was once forested based upon original land surveys (Iverson et al. 1989). Of the 20.5% (161,314 acres) of the SPAA remaining as forest, only about 0.16% (870.5 acres) remains in a state of high ecological integrity (White 1978, Illinois Department of Natural Resources 1997). In summary, 71% (388,761 acres, 49.5% of the total Assessment Area acreage) of the presettlement forests has been lost, exceeding statewide averages.

Common ecological problems associated with forest communities, in general, include habitat degradation, fragmentation, exotic species introductions, and particularly in upland forests, fire absence. A typical source of habitat degradation in forests is overgrazing which often produces changes in the compositional and structural characteristics. Just as in much of Illinois, grazing-sensitive species probably have been eliminated from many forest remnants in the SPAA. In contrast, species that increase with grazing (e.g., native thorn-bearing plants such as hawthorns, honey locust, Missouri gooseberry, and blackberry, and

exotic species such as Japanese honeysuckle, Osage orange, multiflora rose, tree-of-heaven, and barberry) are often abundant in overgrazed forest remnants. In many cases, the 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 reintroduction. Fire absence in upland forest communities typically results in compositional changes in more mesic sites and primarily structural changes in drier sites. These changes often result in increases in both stem density of woody plants and shade. This leads to a reduction in cover and diversity of the herbaceous ground flora, typically the most diverse stratum in Illinois woodlands (e.g., Taft et al. 1995).

Upland Forest - The total extent of upland forest in the SPAA is estimated to be about 124,458 acres, or about 15.8% of the total SPAA land cover (Table 2). A total of 430.5 acres (0.35% of the upland forest remaining) of high-quality (Grades A and B) upland forest has been identified by the INAI in the Assessment Area (Table 3). Upland forest communities can be characterized 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). *Xeric upland forests* and *wet-mesic upland forests* have not been identified in the SPAA. *Dry upland forests, dry-mesic upland forests*, and *mesic upland forests* do occur. Existing types can be characterized as follows.

Dry Upland Forest - Dry upland forests are occasional to common on ridge crests and upper slopes with dry exposures (south and southwest facing aspects) and so are most common and, perhaps, restricted to the western portion of the Assessment Area (Middle Mississippi Border Division, Glaciated Section, and Ozark Division, Northern Section, Figures 3 and 5). A total of 84 acres of high-quality (Grades A and B) dry upland forest remains in the SPAA in Monroe and St. Clair counties (Table 3). This is 12.6% of all of the remaining high-quality dry-upland forest remaining in the state. The community can be considered a significant local natural resource.

The dominant **canopy species** in dry upland forests are pignut hickory, sweet pignut hickory, shagbark hickory, mockernut hickory, white ash, white oak, northern red oak, post oak, chinquapin oak, and black oak. **Subcanopy trees** include shadbush, flowering dogwood, hop hornbeam, eastern redbud, witch hazel, blue beech, and blue ash. **Shrubs** include rough-leaved dogwood, gray dogwood, aromatic sumac, smooth sumac, hazelnut, New Jersey tea, and black haw. Common **woody vines** include bristly greenbrier, Virginia creeper, poison ivy, and frost grape. **Ground-cover species** include agrimony, autumn bent grass, pussy toes, smooth rock cress, Drummond's aster, arrowleaf aster, Canada brome grass, sedges (e.g. *Carex albursina, C. blanda, C. pensylvanica, C. rosea*), slender corydalis, mountain dittany, poverty oak grass, bottlebrush grass, shining bedstraw, wild geranium, white avens, false dandelion, wild lettuce, bush clover, woodland muhly, common cinquefoil, Drummond's goldenrod, horse gentian, and golden Alexanders. Several savanna species (see below) can be present in forest openings. This community

type in presettlement times probably locally graded into savanna habitats dependent on local fires. The droughty conditions of these upland forests limit invasion by moisture-loving trees such as sugar maple. Extended fire-free periods can result in an increased density of the oaks and hickories typical of this community.

One state endangered (SE) plant species, the crested coral-root orchid (*Hexalectris spicata*), is known from dry upland forest habitats in the SPAA. This orchid is found in dry calcareous woods, limestone glades, and dry prairie openings (Herkert 1991). Most of the remaining species present are widespread drought resistant species. The most significant features of this community are the frequency of often large hardwood trees, and an abundance of food for wildlife (especially in the form of acorns and nuts).

The primary ecological dangers to the community are from logging, housing and commercial development, grazing damage, and the absence of fire. A few **exotic species** (e.g. barberry, Japanese and amur honeysuckles, Osage orange, white mulberry, multiflora rose) pose ecological problems in dry forests when grazing has occurred.

Dry-Mesic Upland Forest - Dry-mesic upland forest occurs commonly in the SPAA on the upper slopes and ridges of the dissected terrain bordering the major streams and where woodlands occur on the level till plain and eroded uplands. It is probably the most prevalent upland forest type in the Assessment Area. Its total extent in the SPAA is unknown. A total of 128.5 acres of dry-mesic upland forest in the Assessment Area is recognized as of high quality and as being statewide significant by the INAI. This is about 4.2% of all high-quality dry-mesic upland forest (Grades A and B) remaining in Illinois (Table 3).

Dominant **canopy trees** are sweet pignut hickory, shagbark hickory, white ash, white oak, chinquapin oak, northern red oak, post oak, and black oak. Common **subcanopy trees** include sugar maple, shadbush, blue beech, hop hornbeam, eastern redbud, flowering dogwood, wild black cherry, sassafras, and slippery elm. Typical **shrubs** include rough-leaved dogwood, coralberry, and rusty nannyberry. Common **woody vines** include Virginia creeper, poison ivy, bristly greenbrier, and summer grape. **Ground-cover** species include soft agrimony, autumn bent grass, rock cress, wild ginger, whorled milkweed, ebony spleenwort, wood mint, rattlesnake fern, long-awned wood grass, American bellflower, sedges (e.g. *Carex artitecta, C. pensylvanica, C. cephalophora, C. hirsutella, C. jamesii, C rosea*), spring beauty, white snakeroot, pale corydalis, poverty oat grass, shooting star, wild licorice, woodland sunflower, false Solomon's seal, elm-leaved goldenrod, Virginia spiderwort, and bellwort.

No threatened or endangered plant species are known from the dry-mesic upland forest habitats in the SPAA. One watch-list species, yellow lady's-slipper orchid (*Cypripedium calceolus* var. *pubescens*) may occur in moister portions of the community, but there are only historical records of its occurrence in the Assessment Area. Most of the remaining species present are widespread forest species. The most significant features of this community are the frequency of often large hardwood trees and an abundance of food for wildlife (especially in the form of acorns and nuts).

In a similar manner to the dry upland forest, the primary dangers to the dry-mesic upland forest community are from logging, housing and commercial development, grazing damage, and the absence of fire. A few **exotic species** (e.g. Japanese and amur honeysuckles, Osage orange, white mulberry, multiflora rose) pose ecological problems in dry-mesic forests when grazing has occurred. Fire absence can lead towards an increased importance of sugar maple in the subcanopy and potentially lesser importance of oaks in the canopy. Where oaks have been removed by selective logging practices, wild black cherry, shagbark hickory, slippery elm, and sugar maple are among the species that gain prominence in the canopy.

Mesic Upland Forest - Mesic upland forests are found on lower slopes, in ravines, and on high terraces of the major streams and tributaries. They are characteristic of soil-covered moist north-facing slopes, and are found occasionally in protected locations of western exposures. A total of 84 acres of this community type in the SPAA is recognized by the INAI as high quality (Grade A) and of statewide ecological significance (Table 3). This is 3.3% of the total high-quality mesic upland forest (Grades A and B) remaining in Illinois.

Species composition is relatively rich including numerous taxa at each forest layer. Sometimes no species are dominant. Characteristic **canopy trees** include sugar maple, sweet pignut hickory, shagbark hickory, white ash, white oak, northern red oak, basswood, and American elm. Occasional canopy tree species include bitternut hickory, pignut hickory, mockernut hickory, hackberry, butternut, black walnut, bur oak, black oak, and chinquapin oak. **Subcanopy trees** include Ohio buckeye, blue beech, hop hornbeam, wild black cherry, and slippery elm. Typical **shrubs** include paw paw, eastern redbud, gray dogwood, strawberry bush, spicebush, Missouri gooseberry, bladdernut, and red haw. **Woody vines** include Virginia creeper, bristly greenbrier, poison ivy, and riverbank grape. **Herbaceous ground-cover** composition includes a rich assortment of species, particularly spring ephemerals. Selected taxa reported from the SPAA include doll's eyes, maidenhair fern, wild garlic, blue star, American spikenard, wild ginger, green dragon, Jack-in-the-pulpit, goat's-beard, walking fern, lady fern, rattlesnake fern, sedges (e.g. *Carex albursina, C. blanda, C. davisii, C. hirsutella, C. jamesii, C. rosea*), blue cohosh, enchanters nightshade, spring beauty, fragile fern, toothwort, dutchman's breeches, harbinger-of-spring, white trout lily, wild geranium, shining bedstraw, white avens, green violet, liverleaf, waterleaf, false rue anemone, sweet cicely, Virginia bluebells, ginseng, blue phlox, mayapple, Solomon's seal, Christmas fern, bloodroot, false Solomon's seal, smooth ruellia, black snakeroot, common snakeroot, lopseed, Virginia knotweed, rue anemone, white trillium, prairie trillium, woodland spiderwort, horse gentian, broad beech fern, bellwort, and downy blue violet.

One plant species listed as endangered by the IESPB (Table 10) and two watch list (WL) species may occur in the mesic upland forest natural community in the SPAA, the yellow lady's-slipper orchid (*Cypripedium calceolus* L. var. *pubescens*; WL), butternut (*Juglans cinerea*; WL), and New York fern (*Thelypteris noveboracensis*; SE). Records on these three species are all historical, no individuals are known to currently exist within the SPAA.

The major ecological problems associated with mesic upland forests are degradation from grazing, exotic species invasions, habitat fragmentation, and logging. Since this is a wet forest, fire is not considered to be a necessary maintaining factor and may actually be detrimental to the community. Among the abundant **exotic species** within mesic upland forests is the tree, white mulberry; the shrub, amur honeysuckle; and the vine, Japanese honeysuckle.

Floodplain Forest - Floodplain (bottomland) forests are characterized by conditions of poor drainage and slow permeability of soils and are usually classified as wetlands. Local areas of sand and gravel increase permeability. Floodplain forest communities in Illinois include *mesic*, *wet-mesic*, and *wet floodplain forests* and are classified according to characteristics of flooding. All three types occur in the SPAA. *Wet-mesic* to *mesic floodplain forests* occur on low and high terraces, respectively. *Wet floodplain forests* occur on the floodplain bordering rivers and include the forested river bank. The total extent of floodplain forest in the SPAA is estimated to be about 36,856 acres, or about 4.7% of the total land cover (Table 2). A total of 321 acres (0.9% of the floodplain forest remaining) has been identified to be of high-quality (Grades A and B) by the INAI (Table 3). The largest contiguous area of floodplain forest is in the state-owned Kaskaskia State Fish and Wildlife Area (Figure 10). Other significant areas are on the Mississippi River floodplain, but most of these have been lost to agricultural development.

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. Diversity of species composition tends to increase from wet to mesic floodplain forest. Generally, flooding is of shorter duration and less frequent in mesic floodplain forests than in wet-mesic floodplain forests and so mesic floodplain forests have fewer flood-tolerant species. Compositional changes favoring more flood tolerant tree species like silver maple have occurred since presettlement conditions along some Illinois rivers (Nelson et al. 1994). Considerable mortality in floodplain forests occurred in the upper reaches of the Mississippi River floodplain during the severe flooding of 1993. Studies by Yin et al. (1994) found that 32% of the mature trees and 80% of the shrubs died in a study area north of the SPAA at the mouth of the Illinois River along the Mississippi River.

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), clearing for agricultural purposes, and exotic species invasion. The expansion of erosion-prone agricultural land has produced dramatic compositional changes of the vegetation in floodplain natural communities (Nelson et al. 1994). A description of the composition of floodplain forests for the SPAA follows.

Mesic Floodplain Forest - There is no estimate of the acreage of mesic floodplain forest remaining in the Assessment Area. There is no high quality (Grades A or B) mesic

floodplain forest known within the SPAA. This forest community is very similar to and transitional to the mesic upland forest, separated from that only by historic flooding limits. Species which are completely intolerant of flooding do not occur and elements from the wetter floodplain forests occur with limited frequency.

Common to occasional **canopy trees** include silver maple, river birch, green ash, Kentucky coffee tree, hackberry, sweet gum, cottonwood, sycamore, pecan, black walnut, white oak, bur oak, black oak, chinquapin oak, pin oak, northern red oak, basswood, and American elm. **Subcanopy trees** include Ohio buckeye, box elder, red mulberry, persimmon, and slippery elm. Shrubs include paw paw, redbud, Missouri gooseberry, bladdernut, smooth arrowwood, coralberry, spicebush, and downy hawthorn. **Woody vines** include Virginia creeper, poison ivy, summer grape, and riverbank grape. **Ground-cover species** include many of the mesic upland forest wildflowers as well as others, including wild garlic, groundnut, green dragon, Jack-in-the-pulpit, wild ginger, spring beauty, American bellflower, sedges (e.g. *Carex blanda, C. davisii, C. frankii, C. lupulina, C. shortiana*), sweet cicily, toothwort, honewort, Virginia blue bells, mayapple, Solomon's seal, bloodroot, black snakeroot, false Solomon's seal, Ontario aster, lady fern, inland sea oats, Virginia wild rye, nodding fescue, common wood reed, shooting star, and wild yam.

Two plant species listed as threatened or endangered by the IESPB (Table 10) and one watch list species may occur in the mesic floodplain forest natural community in the SPAA: butternut - (*Juglans cinerea*; WL), decurrent false aster (*Boltonia decurrens*; ST, FT), and New York fern (*Thelypteris noveboracensis*; SE). Records on the butternut and New York fern are historical, no individuals are known to currently exist within the SPAA. The decurrent false aster does currently exist on the Mississippi River floodplain in the northwestern portion of the SPAA. It generally is found in open, wet, areas exposed after floods (recently disturbed areas).

The major ecological problems associated with mesic floodplain forests are extended flooding, degradation from grazing, exotic species introductions, clearing for agriculture, and logging. Since this is a moist forest, fire is not considered to be a maintaining factor and may actually be detrimental to the community. The severe flooding of 1993 resulted in relatively greater mortality among mesic floodplain forest species compared with species of the better adapted wet floodplain forests (Nelson et al. 1994). Among the common **exotic species** within mesic floodplain forests are the trees, white mulberry and Osage orange; the shrubs, amur honeysuckle and multiflora rose; the herbs, motherwort, moneywort, and orange day lily; and the grass, reed canary grass.

Wet-Mesic Floodplain Forest - There is no estimate of the proportion of the floodplain forest within the SPAA that is wet-mesic floodplain forest. A total of 107 acres of wet mesic floodplain forest has been identified from within the Assessment Area (near New Athens in St. Clair Co.) by the INAI as high-quality (Grades A or B) and statewide-significant (Table 3). This is about 3.4% of the total high-quality (Grades A and B) wet-mesic floodplain forest in Illinois.

Common to occasional **canopy trees** include silver maple, pecan, kingnut hickory, bitternut hickory, hackberry, honey locust, green ash, black walnut, pin oak, swamp white oak, and American elm. **Subcanopy trees** include box elder, sugarberry, downy hawthorn, red mulberry, persimmon, Kentucky coffee tree, and slippery elm. **Shrubs** include paw paw, swamp privet, spicebush, Missouri gooseberry, elderberry, and the wild bamboo known as giant cane (shrub-like, though not truly woody). **Vines** include poison ivy, raccoon grape, bristly greenbrier, and riverbank grape. **Ground-cover** species include giant ragweed, green dragon, panicled aster, common beggar ticks, false nettle, several sedges (e.g. *Carex emoryi, C. frankii, C. davisii, C. grayi, C. grisea*, and *C. granularis*), streambank chervil, honewort, scouring rush, Aunt Lucy, Virginia wild rye, annual bedstraw, white avens, cow parsnip, wood nettle, spotted touch-me-not, crow poison, clearweed, woodland bluegrass, swamp buttercup, hedge nettle, Virginia bluebells, blue phlox, goldenglow, black snakeroot, common snakeroot, cup plant, and Missouri violet.

Three plant species listed as threatened or endangered by the IESPB (Table 10) may occur in the wet-mesic floodplain forest natural community in the SPAA: decurrent false aster (*Boltonia decurrens*; ST, FT), bead grass (*Paspalum dissectum*; SE), and mock bishop's weed (*Ptilimnium nuttallii*; SE). The false aster and mock bishop's weed are known to currently exist within the SPAA on the Mississippi River floodplain. Both generally prefer open, sandy areas exposed after floods. Beadgrass is found in more open areas on floodplains and only historical records are known of its occurrence in the SPAA.

The major ecological problems associated with wet-mesic floodplain forests are changes in the flooding regime, severe grazing, exotic species introductions, clearing for agriculture, and logging. Since this is a wet forest, fire is not considered to be a maintaining factor, and may actually be detrimental to the community. Among the common **exotic species** within wet-mesic floodplain forests are the shrub, multiflora rose; the vine, Japanese hops; the herbs, moneywort, bitter dock, and motherwort; and the grass, reed canary grass.

Wet Floodplain Forest - There is no estimate of the proportion of the floodplain forest within the SPAA that is wet floodplain forest. A total of 214 acres has been identified as containing high-quality remnants (Grade A or B) of this community within the SPAA by the INAI (Table 3). This is 7.5% of the total high-quality (Grades A and B) wet floodplain forest in Illinois, making this a significant local natural resource. 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. There is generally a considerable amount of bare ground at the margins of the wet floodplain forest because of the scouring effect of floods. The bare ground is quickly colonized by opportunistic annuals as water levels drop. By autumn the river banks are often thick with giant ragweed, smartweed, and water hemp.

Common to occasional **canopy trees** include silver maple, pecan, kingnut hickory, green ash, honey locust, sycamore, and cottonwood. **Subcanopy trees** include box elder, sugarberry, river birch, sandbar willow, and black willow. **Shrubs** include elderberry and swamp privet. **Woody vines** include bristly greenbrier, poison ivy, and riverbank grape.

Ground-cover species include giant ragweed, false nettle, wood nettle, goldenglow, panicled aster, dodder, blue cardinal flower, honewort, Virginia wild rye, annual bedstraw, white avens, spotted touch me not, clearweed, late boneset, creeping lovegrass, common arrowhead, smooth hedge nettle, bur cucumber, rice cutgrass, hedge hyssop, carpet weed, frog fruit, nodding smartweed, American bulrush, common cocklebur, waterhemp, and Missouri violet.

Three plant species listed as endangered by the IESPB (Table 10) may be found in the wet floodplain forest natural community in the SPAA: beadgrass (*Paspalum dissectum*), mud plantain (*Heteranthera reniformis*), and mock bishop's weed (*Ptilimnium nuttallii*). Of these three species, only mock bishop's weed is known to currently occur in the SPAA; the others are known as historical records only.

Ecological problems include changes in the watershed that can alter the flooding regime, severe grazing, and, to a lesser extent, agricultural development and the introduction of exotic species. Few **exotic species** (e.g. moneywort) can survive the frequent inundation in this community.

Flatwoods - Flatwoods are found on level to nearly level soil that has a nearly impermeable or hardpan layer beneath which causes a shallow, perched water table. Plants must adapt to seasonally wet conditions followed by summer drought. Rooting is restricted due to the hardpan layer. Depressions may contain ponds while slight rises may have plants typical of dry soils. Of the three types of flatwoods in Illinois, *Northern*, *Southern,* and *Sand*, only the *Southern flatwoods* occur in the SPAA.

Southern Flatwoods - There is no estimate of the total acreage of southern flatwoods in the SPAA or in Illinois; this natural community is restricted to a band across the Southern Till Plain Natural Division from south-central Illinois to southern Indiana and SW Ohio (Taft et al. 1995). A total area of 119 acres of high-quality (Grade A) flatwoods is known within the Assessment Area in St. Clair and Monroe counties (Table 3). This is nearly 37% of all the Grade A southern flatwoods known to exist in Illinois and, therefore, this community type can be considered a very significant natural resource in the SPAA. The community is generally thought to require occasional fires to maintain its character (Taft et al. 1995).

Common and occasional **canopy trees** include post oak, pin oak, pignut hickory, Texas hickory, blackjack oak, and black oak. **Subcanopy trees** include wild black cherry and persimmon. **Shrubs** include hazel nut, pasture rose, and blackberry. **Woody vines** include southern dewberry, Virginia creeper, poison ivy, summer grape, and riverbank grape. Understory **herbaceous** plants include birthwort, pussy toes, hog peanut, dogbane, sedges (e.g. *Carex artitecta, C. caroliniana, C. cephalophora, C. festucacea*, and *C. hirsutella*), common wood reed, autumn bent grass, partridge pea, sand croton, poverty oatgrass, woodland sunflower, slender spike rush, daisy fleabane, white snakeroot, white avens, dwarf dandelion, rushfoil, slender bush clover, hair grass, crow poison, American feverfew, slender mountain mint, round-fruited panic grass, small passion-flower, low forked chickweed, pale beard tongue, common cinquefoil, Virginia spiderwort, southern dewberry, black raspberry, and common snakeroot.

No threatened or endangered plant species have been recorded in the southern flatwoods within the SPAA. Buffalo clover (*Trifolium reflexum*) has been found in flatwoods just outside of the SPAA at two sites and may occur in areas managed by fire within the SPAA.

Ecological problems include the suppression of fire, the cutting of post oak trees, agricultural or residential development, and the introduction of exotic species. Exotic species are not a major problem in this community, although Japanese honeysuckle, bush honeysuckle, and multiflora rose may ecologically damage the flatwoods.

Prairie

Approximately 30% (235,746 acres) of the SPAA was once prairie based upon original land surveys (Iverson et al. 1989). This varied from 10.4% prairie in Monroe County to 57.8% in all of Madison County. Only 0.073% (173 acres) of the original prairie of the Assessment Area remains in a high quality (Grade A or B) condition and these are in small remnants. Nevertheless, this is seven times the statewide average of remaining prairie. In general, this community class is dominated by warm-season grasses with local low shrubs, on mineral soil. Trees typically cover less than 10% of the area. Six prairie subclasses are recognized in Illinois: prairie (tallgrass prairie on silt-loam soils), sand prairie, gravel prairie, dolomite prairie, hill prairie (including loess and glacial drift hill prairie), and shrub prairie (White and Madany 1978). Of these six types, only (tall grass) prairie, sand prairie, and hill prairies occur in the SPAA. The prairie subclasses (in a similar manner to forests) are further distinguished by characteristics of the soil-moisture regime (*dry*, *dry-mesic*, *mesic*, *wet-mesic*, and *wet*). A very 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. The loess hill prairies survived the best because they generally occupy slopes unsuitable for agriculture. Sand prairies and tall grass prairies, on level non-rocky ground, generally were plowed under for crops.

Common ecological problems associated with tallgrass prairie, in general, include *fragmentation, fire absence, exotic species invasions,* 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 pollinators 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 surrounding areas typically are dominated by non-native vegetation. Highly fragmented and developed landscapes also lead to altered fire regimes often eliminating fire from prairie remnants until restoration efforts commence. Fire absence poses some of the most severe threats to the continued existence of high-quality prairie remnants in the SPAA. It results in ecological changes such as the encroachment of aggressive woody plants that can eliminate many shade-intolerant prairie species. Fire absence also can lead to a severe invasion of exotic species such as cool-season grasses like the ubiquitous meadow fescue, smooth brome, and Kentucky bluegrass. Overgrazing 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 railroad rights-of-way) 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 - Only wet-mesic prairies have been described in the Assessment Area. There may be noteworthy remnants of other types of tallgrass prairie in railroad rights-of-way within the SPAA that persist in a degraded condition, but data on these remnants is lacking. The characteristic species content of the wet-mesic tallgrass prairie community is described below.

Wet-Mesic Prairie - Wet-mesic (tallgrass) prairies are characterized by the presence of surface water after heavy rains, mainly in the winter and spring, and the water table is near the surface. Species composition is a combination of mesic prairie and wet prairie species. The community is found on level ground. The only reported occurrence of this type of prairie community in the SPAA is within the Poag Railroad Prairie in Madison County, a 32.9 acre INAI designated natural area (Table 6). Data on the quality and amount of acreage of the wet-mesic prairie area are not available.

Dominant plants include the **grasses** big bluestem, bluejoint grass, prairie switchgrass, prairie panic grass, and prairie cordgrass. **Other characteristic plants** include sedges (e.g. *Carex annectens, C. hyalinolepis*, and *C. tribuloides*), lance-leaved loosestrife, winged loosestrife, prairie sundrops, prairie phlox, mild water pepper, prairie parsley, pale dock, compass plant, prairie dock, cup plant, prairie blue-eyed grass, Missouri goldenrod, Culver's root, and common ironweed.

Four plant species listed as endangered by the IESPB (Table 10) have been found in the wet-mesic prairie natural community in the SPAA: western wild lettuce (*Lactuca ludoviciana*, thought to be extinct in Illinois), royal catchfly (*Silene regia*), spring ladies'-tresses (*Spiranthes vernalis*), and prairie spiderwort (*Tradescantia bracteata*). In addition, the state endangered cinquefoil (*Potentilla millegrana*), prairie rose gentian (*Sabatia campestris*), prairie white fringed orchid (*Platanthera leucophaea*; also federally threatened), and white lady's slipper (*Cypripedium candidum*) have all been found close to the SPAA in St. Clair and/or Madison Counties and may still exist in the area.

Ecological problems in wet-mesic prairies primarily are associated with enhanced drainage from tile, fire suppression, habitat destruction, isolation, herbicide drift, overgrazing, and exotic species introduction. Fire absence can result in woody plant encroachment. **Exotic species** typical of wet-mesic prairie include smooth brome grass, white sweet clover, parsnip, reed canary grass, and curly dock.

Sand Prairie - Sand prairie communities are found on coarse-textured soils, such as sand, loamy sand, and sandy loam. Sand prairies form on sandy outwash plains and lake plains and may range in soil moisture characteristics from dry to wet. No figures are available on the original acreage of sand prairies in the SPAA. Sand prairie areas in the Assessment

Area are restricted to a small area southwest of Edwardsville. Only one remnant of sand prairie is described from the Assessment Area, a portion of the Poag Railroad Prairie described also, in part, as wet-mesic prairie (see above, Table 6). The quality and acreage of the mesic sand prairie in that natural area has not been determined (Table 3). Sand prairies are much better developed on the Illinois River floodplain and in sand areas of central and east-central Illinois.

Mesic to dry-mesic Sand Prairie - Mesic to dry-mesic sand prairie, while well-drained, has moisture generally available to plants. Low shrubs may occur. Only 159 acres of high quality mesic sand prairie remain in all of Illinois (Table 3). An undetermined amount and quality of mesic sand prairie (less than 30 acres) exists in the SPAA, primarily at the Poag Railroad Prairie in Madison County (Table 6).

Characteristic plants include the **grasses** big bluestem, prairie panic grass, bead grass, sand dropseed, sandbur, prairie switchgrass, arrow feather, common purpletop, little bluestem, and the **non-grass herbs** dogbane, sand milkweed, green milkweed, heath aster, sedges (e.g. *Carex bicknellii, C. brevior, C. muhlenbergii, Cyperus filiculmis,* and *Cyperus schweinitziis*), flowering spurge, tumbleweed, western ragweed, partridge pea, narrow-leaved goosefoot, sand croton, Illinois tick trefoil, poorjoe, Ohio spiderwort, cleft phlox, scouring rush, daisy fleabane, wild strawberry, Carolina cranesbill, sawtooth sunflower, western sunflower, prairie sunflower, golden aster, common peppergrass, hoary vervain, prairie blazing star, evening primrose, prickly-pear, water smartweed, common cinquefoil, black-eyed Susan, hairy Ruellia, rosinweed, prairie dock, blue-eyed grass, Missouri goldenrod, and common goldenrod. Scattered **shrubs** may occur, including prairie willow, aromatic sumac, pale dogwood, Iowa crabapple, smooth sumac, winged sumac, and pasture rose. Occasional **woody vines** include dewberry and riverbank grape.

Three plant species listed as endangered by the IESPB (Table 10) may be found in the dry-mesic and mesic sand prairie natural community in the SPAA: sour dock (*Rumex hastatulus*, possibly extinct in Illinois, often inhabiting disturbed sites), royal catchfly (*Silene regia*), and spring ladies'-tresses (*Spiranthes vernalis*). The sour dock has not been seen in Illinois since 1960 (Herkert 1991).

Ecological problems in mesic sand prairies primarily are associated with fire suppression, habitat destruction, overgrazing, to the introduction of exotic species, and from physical damage by off-road vehicles. Fire absence can result in woody plant encroachment. **Exotic species** that invade sand prairies include Kentucky bluegrass, Canada bluegrass, smooth brome grass, cheat grass, meadow fescue, white sweet clover, parsnip, winged pigweed, and curly dock.

Hill Prairie - Hill prairies typically occur on slopes with exposures from south to west. Soil moisture conditions are usually very dry on these well-drained sites. The classification of hill prairies is based upon substrate type rather than by soil moisture variation. *Loess, glacial-drift, gravel,* and *sand* hill prairies have been recognized in Illinois (White and Madany 1978). In the SPAA nearly all of the hill prairies have been described as loess hill

prairies. There appear to be examples of glacial-drift hill prairie remnants at the margins of some of the loess hill prairies where loess deposits have been removed by natural erosion exposing underlying gravelly glacial till. None of these have been recognized as high-quality glacial-till hill prairie remnants by the INAI and, since the flora is essentially the same as that of the loess hill prairies, they have not been distinguished in Table 12. Hill prairies often occur as openings within forested uplands. During long periods of fire absence, hill prairies often decrease in area and many have been eliminated or severely reduced in size due to the encroachment of woody plants (McClain 1983, Robertson et al. 1995).

Common to occasional **grasses** include big bluestem, side-oats grama, prairie panic grass, June grass, little bluestem, rough dropseed, common purpletop, and Indian grass. Characteristic **non-grass herbs** include three-seeded mercury, rough false foxglove, tall anemone, pussy toes, green milkweed, sky-blue aster, heath aster, aromatic aster, silky aster, false boneset, blue hearts, sedges (e.g. *Carex blanda, C. meadii, C. muhlenbergii, C. umbellata*), purple prairie clover, white prairie clover, panicled tick trefoil, Illinois bundleflower, bastard toadflax, pale purple coneflower, daisy fleabane, flowering spurge, narrow-leaved bluets, round-headed bush clover, slender bush clover, rough blazing star, hoary puccoon, spiked lobelia, marbleseed, pale beard tongue, prairie alumroot, cleft phlox, scurf pea, hairy mountain mint, prairie blue-eyed grass, rough goldenrod, old field goldenrod, Missouri goldenrod, and hairy vervain. **Woody vines** include trumpet creeper and bittersweet. Occasional **shrubs** include leadplant, New Jersey tea, aromatic sumac, rough-leaved dogwood, wafer ash, and smooth sumac. Scattered **trees** may occur, including white ash, honey locust, lance-leaved buckthorn, and, especially, eastern red cedar.

Loess hill Prairie - Loess is a windblown silt deposited following glacial episodes. Loess hill prairies occur in Illinois primarily on steep slopes with south and west-facing exposures along the eastern bluffs of the Illinois and Mississippi rivers where deep loess deposits (up to 40 ft.) are common. Because of the steep slopes, most loess hill prairies have not been converted to agriculture. Instead, grazing has been their primary use. A total of 173 acres of high quality (Grades A and B) loess hill prairie remains at twelve sites in the SPAA. (Tables 3 and 6). This is 46.5% of all of the high-quality loess hill prairie remaining in Illinois. Based on this statistic, the loess hill prairies are the most significant natural community resource in the SPAA. The Fults Hill Prairie Nature Preserve in Monroe County (Figure 11) is probably the best known of these. In addition, this community type has nine T&E species. Within the SPAA, this is equaled only in the limestone cliff and limestone glade communities. Typical plant components are listed below.

Nine species (75% of the total known from the Assessment Area) listed as threatened or endangered by the IESPB (Table 10) are known from loess hill prairies and their associated rock ledges within the SPAA. These include pale false foxglove (*Agalinis skinneriana*, ST), whitlow grass (*Draba cuneifolia*; SE; not a grass at all, actually a small white flowered mustard), spurge (*Euphorbia spathulata*; SE), dwarf bedstraw (*Galium virgatum*;

SE), slender heliotrope (*Heliotropium tenellum*; SE), crested coral-root orchid (*Hexalectris spicata*; SE), western wild lettuce (*Lactuca ludoviciana*; SE, possibly extinct in the state), long-leaved panic grass (*Panicum longifolium*; SE), and Missouri orange coneflower (*Rudbeckia missouriensis*; SE). Six of these listed species (excluding the pale false foxglove, western wild lettuce, and crested coral-root orchid) are known to exist currently in Illinois only in the Sinkhole Plain Assessment Area (Herkert 1991).

Ecological problems in loess hill prairies include fire absence, overgrazing by livestock, quarrying operations, and exotic species invasion. Many loess hill prairies have declined in area or disappeared since the 1950's (McClain 1983). Fire absence appears to be the most likely explanation for these changes. Woody encroachment (especially by the native trees black walnut, honey locust, eastern red cedar, and oaks and the native shrubs rough-leaved dogwood and smooth sumac) during periods of fire absence, especially along their perimeters, reduces their area with time. As hill prairies decline in area, the species diversity likewise declines (Robertson et al. 1995). The use of prescribed and managed burning has been very effective throughout Illinois and the Midwest in restoring hill prairie communities. Overgrazing by livestock not only eliminates certain favored grasses and herbs, but causes severe mechanical damage to slopes increasing erosion and resulting in loss of soil and habitat for the prairie species. Certain exotic species have increased and threaten the integrity of the hill prairies; most are thorny species avoided by livestock, grasses and forbs introduced for livestock, or aggressive opportunistic weeds. These exotic species include the trees, tree-of-heaven, Siberian elm, and Osage orange; the grasses, smooth brome grass, Canada bluegrass, Kentucky bluegrass, and meadow fescue; the shrub, Morrow's honeysuckle; the vine, Japanese honeysuckle; and the herbs, white sweet clover, yellow sweet clover, woolly mullein, and bull thistle.

Savanna

Savanna habitats occur throughout many parts of the North America. The Midwest, intermediate between the eastern forests and grasslands of the great plains, has the environmental conditions and fire history that supported many savanna-like 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 grasses and sedges and numerous other herbs. Density and percent cover of trees varies and is intermediate between open prairie and closed woodland or forest. 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 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, but typically the ground cover is floristically degraded and dominated by non-native species.

According to White and Madany (1978), 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). Savanna subclasses are further distinguished to community type by soil-moisture characteristics. While savannas may have occurred in the SPAA prior to settlement, none have been described from the area today. These communities sometimes merge imperceptibly with open woodland habitats. Southern flatwoods, described previously, are savanna-like in that their vegetation is characterized by open woodlands dominated by oaks with some prairie species in the openings.

Compared with other habitat types, relatively few threatened and endangered plant species appear to be dependent on savanna habitats. One species listed by the IESPB (Table 10) as endangered that is found in the SPAA appears to favor this community, namely, royal catchfly (*Silene regia*). Floristically, savannas contain species of both prairie and open woodlands, though some taxa appear to reach their greatest frequency in transitional (ecotonal) areas such as savannas.

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 SPAA that could be restored or at least rehabilitated with vegetation management. Species known to occur in dry-mesic savannas (or barrens, not distinguished here) have been indicated in Appendix 1.

Wetland

The wetland community class includes natural communities that are flooded or have hydric soils and have a vegetative cover. There are about 54,053 acres of wetland within the SPAA, or about 6.9% of the total area (Table 2). Wetland community class types in the SPAA (Table 4), following natural community classification of White and Madany (1978), include *floodplain forest* (about 54.3% of total wetland present in the SPAA), *marsh* (23.5%, including shallow marsh and deep marsh), and *shrub swamp* (5.5%, including swamp and shrub-scrub woodlands). *Seeps* and *springs* probably also occur in the Assessment Area, especially along the limestone bluffs, because of the porous characteristics of the limestone. Lakes and ponds, and streams are classified separately from wetlands. Wetlands in the SPAA are concentrated along the Kaskaskia and

Mississippi River corridors (Figure 8). A total of 321 acres of floodplain forest (0.9% of the floodplain forest remaining) has been identified to be of high-quality (Grades A and B) by the INAI (Table 3). Floodplain forests were described previously within the forest community class. Characteristics of marshes, shrub swamps, and seeps and springs are provided below.

Marsh - *Marsh* - Marshes are palustrine wetlands characterized by having water at or near the surface during most of the growing season and are dominated by herbaceous vegetation, with organic (peat or muck) or mineral soils (White and Madany 1978). These were formed mostly in glacial potholes, river valleys, and on lake plains. A total of about 12,663 acres (23.5% of the wetland area, 1.6% of the total area) of emergent marsh vegetation occurs in the SPAA (Table 4). None of the marsh vegetation is recognized by the INAI as high-quality (Grades A and B). Generally in marshes, plant species richness declines as water depth increases.

Characteristic **grasses** and **grasslike** species include the **grasses**, prairie cord grass, bluejoint grass, barnyard grass, common reed, fowl manna grass, and rice cutgrass; the **rushes**, marsh rush, Dudley's rush, soft rush, and grass-leaved rush; and the **sedges**, meadow sedge, common lake sedge, fox sedge, spike rush, bulrush, river bulrush, and red bulrush. Common **herbs** include long-leaved ammannia, swamp milkweed, panicled aster, Joe-Pye-weed, southern blue flag, false loosestrife, water hemlock, ditch stonecrop, frog fruit, water smartweed, dotted smartweed, sneezeweed, duckweed, swamp dock, common bur reed, common cattail, marsh purslane, American lotus, cursed crowfoot, toothcup, blue vervain, and Missouri ironweed. **Trees** commonly found in the vicinity of marshes include silver maple, green ash, cottonwood, black willow, and peach-leaved willow all of which are tolerant of periodic inundation.

Two plant species listed as endangered by the IESPB (Table 10) may still occur in or at the margins of the marshes in the SPAA. Mud plantain (*Heteranthera reniformis*) has been reported from the Assessment Area, but no populations are currently known to exist there. Mock bishop's weed (*Ptilimnium nuttallii*) is known to currently exist within the SPAA on the Mississippi River floodplain and is said to grow in marshy areas, but it generally is found in open, sandy areas exposed after floods.

Ecological problems in marshes include siltation (including the introduction of agricultural nutrients), altered flooding regimes, invasion of exotic species (though few in number), and an overabundance of aggressive, disturbance-tolerant native species. 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. Compared with upland habitats, relatively few exotic species are present in wetland communities (Havera et al. 1994). An **exotic species** which has caused ecological problems in local marshes is reed canary grass. Native species which become aggressive under conditions of siltation, agricultural fertilizer runoff, and increased flooding often include the common reed, river bulrush, and common cattail.

Swamp - *Shrub Swamp* - A shrub swamp is a wetland with at least 50% cover of shrubs (White and Madany 1978). Combining the categories shrub/scrub wetlands and swamps (Table 4) reveals that there are about 2,940 acres of shrub swamp wetland in the SPAA. Approximately 93 acres of high quality (Grade B) shrub swamp and pond wetlands occur in the Assessment Area (Table 3). Since the data on the two communities has not been precisely separated, the exact number of acres of high quality shrub swamp is not known. This number represents 6.5% of all of the high quality shrub swamp and pond community habitat combined known in Illinois.

Species composition includes many grasses, sedges and forbs from the marsh community (Appendix I, and above). However, **shrubs** are dominant and include false indigo bush, buttonbush, pale dogwood, gray dogwood, black willow, swamp privet, elderberry, smooth arrowwood, and heart-leaved willow.

No plant species listed as threatened or endangered by the IESPB is known to occur in the shrub swamp natural community in the SPAA.

Ecological problems are essentially the same as those in the marsh community type described above.

Seep and Spring - *Seeps* are wetland communities characterized by a constant diffuse flow of groundwater, typically from the lower portions of slopes of glacial moraines, ravines, and terraces (White and Madany 1978). The water chemistry of the groundwater controls species composition to some extent and is influenced by the material it flows through. A tree cover is often present at seeps. In Illinois, five different seep community types are recognized: *seeps* are circumneutral and occur where the groundwater 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 groundwater 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; and *spring communities* occur where a channel is formed. In the SPAA, high quality (Grades A and B) seeps and springs have not been recorded in the INAI database, but small examples occur in the forested ravines of the limestone bluffs along the margin of the Mississippi River floodplain. These are predominantly calcareous seeps. One example can be seen in the Falling Spring natural area in St. Clair County (Figure 11).

Seep and spring species are not unique to this habitat in the SPAA; they generally include components from adjacent mesic upland forests and shrub swamps. Common horsetail, scouring rush, Joe-Pye-weed, spotted touch-me-not, water parsnip, box-elder, and rough goldenrod are among the species often mentioned as being associated with seeps and springs.

No plant species listed as threatened or endangered by the IESPB is known to occur in seeps in the SPAA.

Ecological problems associated with seeps and springs may include degradation by overgrazing and alterations to the watershed that influence groundwater discharge.

Lake and Pond

Lakes and ponds are open-water habitats. In the SPAA there are both natural and artificial examples of lakes and ponds (Figure 9). The area of open water in the Assessment Area is known to be 24,845 acres (3.2% of the land cover; Table 2). While an exact breakdown of acreage by lake and pond is not available, there are two large lakes worth noting. Baldwin Lake, an artificial lake, is approximately 2000 acres and Horseshoe Lake, a natural oxbow lake of the Mississippi River, is nearly 2000 acres. Other lakes in the Assessment Area include McDonough Lake (natural, about 80 acres), Whispering Willows and Grand Marais Lakes (natural, old oxbow remnants, about 90 acres), and Sportsman Lake (about 80 acres). The remaining lakes and ponds are much smaller and include water in old strip mines, and the water of sinkhole ponds which may or may not be permanent (Bollwinkle 1958). With an additional 1,000 acres of remaining ponds (including farm ponds), about 5,250 acres of ponds and lakes occur in the SPAA. The remaining open water, 19,595 acres, is found in the Mississippi and Kaskaskia rivers and their tributaries. Approximately 93 acres of high quality (Grade B) shrub swamp and pond wetlands occur in the Assessment Area (Table 3) and these were described previously (see *shrub swamp*). The vegetation of the natural ponds and lakes is characterized below.

Pond (natural) - *ponds* - Natural ponds are shallow-water wetlands that are not excavated or impounded. In Illinois, the term pond can include backwater sloughs connected to major rivers as well as sinkhole ponds, which may not contain water all year. Most ponds in the SPAA have been degraded by livestock or other agricultural activities. For the purposes of characterizing vegetation, species from sinkhole ponds and sloughs have been combined in Appendix 1. The description of lake vegetation may serve to characterize that of ponds as well. Lakes and ponds differ only in size; lakes are recognized as exceeding 20 acres (Suloway and Hubbell 1994).

Lake (natural) - *lakes* - The natural lakes of the SPAA were characteristically backwater lakes or sloughs lateral to the river channel, primarily the Mississippi River. As the course of the river changed with time, oxbow lakes were sometimes cut off from the main channel where they persisted until filling in with new silt. There remain numerous lakes along the Mississippi River floodplain and many are interconnected complexes that change configuration depending on seasonal water levels. Horseshoe Lake at the southeast side of Granite City is an example of such a lake. No high-quality lakes (Grades A or B) remain in the study area mostly due to alterations for recreation and agriculture.

Floristic composition of ponds and lakes can be sorted into three categories: shore and mudflat species, emergent wetland species (that grow in water most of the season), and aquatics. Typical **shore and mudflat** species, listed primarily as floodplain forest and cultural land species in Appendix 1 since they are not associated only with lakes and ponds,

include giant ragweed, Spanish needles, nodding bur marigold, false nettle, American bindweed, buttonbush, water hemlock, nut grass, barnyard grass, blunt spike rush, swamp spike rush, common horsetail, creeping love grass, late boneset, green ash, cottonwood, silver maple, honey locust, soft rush, ditch stonecrop, frog fruit, marsh yellow cress, sandbar willow, black willow, brookweed, river bulrush, rice cutgrass, prairie cordgrass, and cocklebur. Common to occasional **emergent wetland** species include halberd-leaved rose mallow, yellow pond lily, common cattail, marsh purslane, false loosestrife, American lotus, water smartweed, pickerel weed, mild water pepper, cursed crowfoot, swamp dock, common arrowhead, lizard's tail, and common bur reed. Typical **aquatic** species include coontail, naiad, common bladderwort, pondweed, fennel-leaved pondweed, leafy pondweed, variable pondweed, duckweed, water meal, and water milfoil.

Four plant species listed as threatened or endangered by the IESPB (Table 10) may occur in and around the ponds in the SPAA. Only historical records are known for three of these within the SPAA: small burhead (*Echinodorus tenellus*; SE), mud plantain (*Heteranthera reniformis*; SE), and bead grass (*Paspalum dissectum*; SE). The fourth, decurrent false aster (*Boltonia decurrens*; ST, FT), does currently exist on the Mississippi River floodplain in the northwestern portion of the SPAA. All four species prefer open muddy or sandy areas in full sun at the margins of ponds on river floodplains. No threatened and endangered species are known from the sinkhole ponds in the uplands.

Ecological problems include, drainage, degradation from livestock use, and siltation. Bellrose et al. (1983) has described the processes of degradation in similar natural lakes along the Illinois River floodplain.

Stream

Streams are permanent flowing waters. The two natural communities recognized, creek and river, are recognized on the basis of size; a creek has a watershed < 200 sq. mi. (520 sq. km.) and a river has a watershed > 200 sq. mi. (520 sq. km.). Creeks and rivers are also described according to gradient. A total of 19,595 acres of open water is found in the Mississippi and Kaskaskia rivers and their tributaries with in the SPAA (see lake and pond discussion above). The segment of the Mississippi River along the western boundary of the Assessment Area covers 15,235 acres (Table 1). No stream sites have been designated as high quality (Grade A and B) natural areas by the INAI. However, two stream segments (Figure 11) have been determined to be of special significance to animal life, namely a tributary to Horse Creek about 1.0 mile long, and a 5.8 mile length of the Mississippi River in Randolph County (rm 114-119). Plants are generally infrequent in this natural community due to the scouring effects of rushing floods. Calm waters in backwaters along creeks and rivers would generally be classified as ponds. River banks are generally classified as part of floodplain forests, and include the woody plants. Open streams occur in the SPAA, the most prominent being the Mississippi and Kankakee rivers and their tributaries (Figures 1, 2, 9). More than a dozen named creeks exist in the Assessment Area. The plants which grow associated with rivers and other streams are listed in Appendix 1,

but are indicated primarily in floodplain forests, and lakes and ponds. A few species are characteristic of streams and their immediate margins and these are listed below.

Plants characteristic of streams and their immediate margins include the **non-grass herbs** tamarisk waterhemp, tall water hemp, nodding bur marigold, common beggar ticks, large water starwort, panicled aster, round-fruited hedge hyssop, water willow, halberd-leaved rose-mallow, false pimpernel, American bulrush, winged monkey flower, sessile-flowered yellow cress, dotted smartweed, common arrowhead, and smooth hedge nettle. Slower moving areas along the river may have typical marsh plants such as common bur reed and common cattail. **Trees** include species listed as typical of wet floodplain forest above, particularly sandbar willow and silver maple..

Primary

This community class includes natural communities where soil is thin or absent, the parent material (bedrock) is near the surface, and the communities are maintained indefinitely at an early stage of succession by the substrate or natural disturbance. Primary subclasses considered here include cliff and glade.

Cliff - This natural community subclass includes vertical exposures of resistant bedrock as well as unconsolidated associated materials. The communities are delimited based upon the type of rock present.

Limestone cliff community - Included here are limestone ledges, which are those areas of the cliffs with a horizontal surface and generally a thin soil layer formed by weathering and accumulation of organic material. Larger ledges may be continuous with limestone glades. The substrate of the limestone cliff community is a hard form of limestone (calcium carbonate with other minerals). These cliffs or bluffs are exposed and mostly limited to the eastern valley wall of the Mississippi River floodplain; because they are steep and cannot be farmed, they clearly stand out as nonagricultural land on the cropland map for the SPAA (Figure 4). No high-quality limestone cliffs have been designated in the SPAA. No figures are available on the total acreage of the community in the SPAA and in Illinois because the cliffs by definition are mostly vertical. Plant species tend to be tough plants adapted to drought, intense sunlight, high pH, and must be able to root in crevices of the rock. Shaded cliff communities also occur and tend to be more moist and support more moisture loving species. Several species of plants are adapted to this severe habitat. This may seem surprising considering the extreme exposure of the cliffs. However, the sparse soil in the limestone crevices is very fertile due to the high mineral content of the substrate. Many species associated with cliffs spread from adjacent habitats, such as hill prairies and forests. However, some species are restricted to the cliffs, including many interesting fern species.

In this list, both sun-tolerant and shade dependent species have been included. Plants such as the ferns, columbine, and dwarf larkspur generally require some shade. Characteristic plants of the limestone cliffs include the **ferns**, ebony spleenwort, walking fern, smooth

cliff brake, purple cliff brake, bladder fern, Fee's lipfern, hairy lipfern, common polypody, common woodsia, and hybrid fragile fern. **Herbaceous plants** include slender three-seeded mercury, cliff onion, columbine, smooth rock cress, sedges (*Carex artitecta*, *C. eburnea*), partridge pea, pale corydalis, prairie tea, dwarf larkspur, hairy tick trefoil, whitlow grass, daisy fleabane, wild licorice, hair-leaf bluets, prairie alumroot, false rue anemone, hairy bush clover, false aloe, evening primrose, prickly pear, pale beard tongue, cleft phlox, and Drummond's goldenrod. **Shrubs** include New Jersey tea, rough-leaved dogwood, wild hydrangea, wafer ash, aromatic sumac, and smooth sumac. **Trees** include shadbush, dwarf hackberry, eastern redbud, eastern red cedar, wild black cherry, chinquapin oak, post oak, and winged elm. **Grasses** include big bluestem, side oats grama, scratch grass, and little bluestem. **Vines** include trumpet creeper, bittersweet, snailseed, Virginia creeper, poison ivy, and winter grape.

Nine plant species (75% of those known from the Assessment Area) listed as endangered by the IESPB (Table 10) may occur in the limestone cliffs (and ledges) natural community in the SPAA. These are the woolly buckthorn (*Bumelia lanuginosa*), Hale's corydalis (*Corydalis halei*), whitlow grass (*Draba cuneifolia*), spurge (*Euphorbia spathulata*), dwarf bedstraw (*Galium virgatum*), slender heliotrope (*Heliotropium tenellum*), crested coral-root orchid (*Hexalectris spicata*), western wild lettuce (*Lactuca ludoviciana*, perhaps extinct in IL), and long-leaved panic grass (*Panicum longifolium*). Hale's corydalis, western wild lettuce, and long-leaved panic grass are not known to currently exist in the SPAA.

Ecological problems on limestone cliffs include exotic species invasion. These include tree-of-heaven, field garlic, Spanish needles, cheat grass, puccoon, Japanese honeysuckle, white sweet clover, yellow sweet clover, Canada bluegrass, Kentucky bluegrass, yellow foxtail, common foxtail, woolly mullein, and wild pansy. The quarrying of limestone for architectural and agricultural use is a potential source of destruction, herbicides applied to roadside cliffs can destroy the community, and rock climbing may degrade the community and damage species populations.

Glade - Glades are local mostly level areas in forest or prairie where bedrock is near or at the surface. Vegetation is often sparse with areas of bedrock exposed. The open nature of glades resembles that of savannas. Glades are usually found on dry to xeric exposures with south or west-facing aspects. There are *sandstone, limestone*, and *shale* glade communities in Illinois (White and Madany 1978). Limestone glade communities are present in the SPAA and are often contiguous with the limestone cliff communities described above.

Limestone glade - The flora and vegetation of the limestone glades are very similar to those of the limestone cliffs described above and to the dolomite prairies and dolomite cliffs elsewhere in Illinois. In addition, they are often a part of complex loess hill prairie systems and species overlap in these communities. The flora is species-rich (Appendix 1). Weathering is often extensive on limestone making conditions more favorable for plant growth as compared to sandstone glades; fissures in the bedrock are common and soil is usually present in them. Nutrient content is higher in limestone than sandstones, which are composed primarily of sterile quartz sand. The total acreage of limestone glades in the

SPAA is not known, but 79 acres of high quality (Grades A and B) glades have been identified by the INAI in the Assessment Area. This is about 43% of all of the high quality limestone glades in all of Illinois, making this an especially important natural resource in the Assessment Area. The following description is based on species that are characteristic of limestone glade habitats in the SPAA.

Typical **trees** include shadbush, Texas hickory, eastern redbud, flowering dogwood, blue ash, chinquapin oak, post oak, black oak, wild black cherry, slippery elm, winged elm, persimmon, and red cedar; **shrubs** include leadplant, New Jersey tea, rough-leaved dogwood, wafer ash, aromatic sumac, smooth sumac, and pasture rose; **vines** include bittersweet and Virginia creeper. **Grasses** include big bluestem, side-oats grama, porcupine grass, prairie panic grass, purple lovegrass, poverty oat grass, Canada wild rye, June grass, three-flowered melic grass, little bluestem, and Indian grass. **Herbs** include rough false foxglove, cliff onion, columbine, Miami mist, prairie alumroot, prairie sunflower, daisy fleabane, doveweed, prairie tea, orange coneflower, flowering spurge, false petunia, goat's rue, false pennyroyal, common goldenrod, small skullcap, rough goldenrod, hoary vervain, prairie dock, Ohio spiderwort, prairie coreopsis, partridge pea, sedges (e.g. *Carex cephalophora, C. gravida, C. normalis*), horsetail milkweed, wood mint, blue aster, dogbane, obedient plant, pussy toes, green milkweed, aromatic aster, silky aster, sand coreopsis, purple prairie clover, whitlow grass, pale purple coneflower, bluets, prairie alumroot, grooved yellow flax, false aloe, stickleaf, monarda, prickly-pear, violet wood sorrel, pale beardtongue, cleft phlox, dwarf plantain, small skullcap, prairie groundsel, Drummond's goldenrod, Venus' looking glass, and hoary vervain.

The list of threatened and endangered plant species is similar to that of the limestone cliffs. Nine plant species (75% of those known from the Assessment Area) listed as endangered by the IESPB (Table 10) may occur in the limestone glades community in the SPAA. These are the woolly buckthorn (*Bumelia lanuginosa*), Hale's corydalis (*Corydalis halei*), whitlow grass (*Draba cuneifolia*), spurge (*Euphorbia spathulata*), dwarf bedstraw (*Galium virgatum*), slender heliotrope (*Heliotropium tenellum*), crested coral-root orchid (*Hexalectris spicata*), western wild lettuce (*Lactuca ludoviciana*, perhaps extinct in IL), and Missouri orange coneflower (*Rudbeckia missouriensis*). Hale's corydalis and western wild lettuce are not known to currently exist in the SPAA.

Ecological problems associated with glades include degradation of the plant community by overgrazing, exotic species invasion, native woody plant encroachment, and quarrying. The **exotic species** involved are the same as listed above for limestone cliffs. As in the case of savannas, fire suppression tends to lead to a steady increase in tree growth which can alter the composition and structure of a glade by producing too much shade for the many sun-dependent species.

Cave

A cave is a feature formed by a geological collapse or dissolution of bedrock and there is generally a portion not penetrated by sunlight. There are no vascular plants characteristic of

this community, and therefore no plant species listed as threatened or endangered by the IESPB, though elements of the limestone cliffs community may be found at the mouth of a cave. Both terrestrial cave and aquatic cave communities occur in the SPAA. Some of the best quality and largest limestone caves in Illinois are found on the sinkhole plain, including Fogelpole Cave, Illinois Caverns, Dry Run Cave system, Krueger Cave system, and Stemler Cave (Figure 11, Table 6, McFall and Karnes 1995). The numerous sinkholes giving the Assessment Area its name were formed when soil collapsed into a crevice in the underlying bedrock or, rarely, from the collapse of a cave roof (Panno and Weibel 1998); this landscape type typified by numerous sinkholes and caves is called *karst* topography. The caves and sinkhole formations are among the most valuable natural resources of the SPAA.

Cultural

This class describes artificial communities formed by human disturbance and includes cropland, pastureland, successional fields, developed land, tree plantations, artificial lakes and ponds, and prairie reconstructions (Table 12). In terms of natural quality, they are all extremely poor. The cultural community results from the destruction of natural communities by people. This is the major community class in the SPAA comprising about 380,051 acres, or 48.4% of the total land area (Table 2, Figures 4, 6, and 7).

With one possible exception, no threatened or endangered species are known from cultural habitats in the SPAA unless intentionally introduced. The decurrent false aster (*Boltonia decurrens*; ST, FT) has been found in floodplain croplands and other disturbed areas on floodplains. This species is very well-adapted to natural disturbance on river floodplains, and may actually require flooding to help eliminate competition by woody plants and other herbs.

The cultural areas, by isolating natural habitats, interrupting landscape-level processes, and providing a habitat for weedy native and non-native plants, impose some of the most challenging ecological problems for natural habitats in the SPAA. 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 that represents an effort to create a natural community.

Characteristic plants of this community class are introduced weedy species (designated by * in Appendix I) and invasive early successional species. Occasionally a large tree will remain from earlier times as a boundary marker tree giving a hint of the type of pre-agricultural natural community that was in the area. It is not unusual for one-third of the plant species of an agricultural region such as the SPAA to be exotic, non-native species. Approximately 18.4% of the plant species in the SPAA are introduced. These figures indicate that, proportionally, fewer non-native plants occur in the SPAA than in the state as a whole. Statewide, 29% of the taxa known are introduced species, and 71% are native. A small number of exotic species (such as corn-*Zea mays*, soybeans-*Glycine max*, and Kentucky bluegrass-*Poa pratensis*) dominate the landscape.

Prairie Reconstruction - Typically, prairie reconstructions are plantings of prairie species on grassland soils where the original natural community has been destroyed. Prairie species are planted in an effort to produce a warm-season grassland or with the goal of attempting to recreate the original prairie community. Prairie reconstructions often are species poor and are strongly dominated by a few aggressive species. An unknown area of prairie reconstructions exist within the SPAA. None have developed into communities that mimic undegraded tallgrass prairie in species richness or structure. Plant species listed as threatened or endangered by the IESPB may be present if they were intentionally introduced.

Summary and Recommendations

Trends in the Sinkhole Plain Assessment Area (SPAA) indicate that habitat loss is less extreme than statewide averages among the community classes of Prairie and Wetland. Habitat loss in the Forest class exceeds statewide rates. A considerably lower percentage of forest land remains in the SPAA in a relatively undegraded condition compared with forests throughout Illinois. In addition, removal of key ecological processes in these forest fragments have resulted in some dramatic changes in community composition and structure since the time of European settlement of the region. Because no data are available on current or past acreages of savannas in the SPAA no conclusions about this community class can be drawn. Early observations at the time of European settlement indicated that savanna-like formations were present and these may have been lost not only through clearing for agricultural use but also through succession to forest because of fire suppression. Trends for the SPAA as a whole, with 1,215.5 acres of high-quality vegetation remaining (0.15% of the total area compared with 0.07% for the entire state) show a rate that is less than the statewide levels of habitat degradation (White 1978). A top priority from the point of view of vegetation conservation should be to carefully manage and rehabilitate the vegetation remnants, to protect and encourage the reproduction of the threatened and endangered plant species, to search for and study any natural community remnants not yet inventoried, and to add additional buffer zones of significant acreage to all remaining natural areas.

Despite the availability of a great deal of descriptive information regarding natural communities in the SPAA, there remain many knowledge gaps, particularly the distribution, abundance, qualitative condition, and ecological trends among remnants. This is particularly true for wet-mesic prairie, sand prairies, swamps, ponds, and savannas. Much more information is available for floodplain forests, upland forests, hill prairies, limestone glades, and limestone cliffs. Although floristic information is available for the few remnants, there is a lack of quantitative data. Further, because remnants tend to have floristic differences (no two sites are the same) and because only a very limited area of prairie remains it appears that we have a poor resolution of the original (presettlement) species diversity for the SPAA. Additional survey efforts in the SPAA may identify new populations of threatened or endangered species and noteworthy remnants of mesic tallgrass prairie.

Many of the most challenging conservation issues in the SPAA are addressed primarily at the community and ecosystem levels. There are serious ecological problems that threaten the long-term maintenance of biodiversity in the SPAA. Throughout the natural community descriptions for the SPAA 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 SPAA 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. 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 SPAA, though 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, mesic, or wet tallgrass prairie remnants are known from the SPAA, identification of any 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). Moreover, funding for basic field inventories of the remaining plant species in the area should be increased to insure that there is accurate data on what plants actually occur in the Assessment Area today. Habitat management cannot be conducted properly without being aware of all of the species that are present and are likely to be affected by such management.

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 human-caused degradation (e.g., damaging levels of grazing, off-road vehicle impacts, soil grading in railroad rights-of-way). 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. The addition of buffer land and corridors around and/or connecting high-quality natural areas may allow the communities to increase in size and may discourage,

with proper management, the influx of exotic species. The establishment of conservation easements or outright purchase of undegraded communities and buffers is needed for long-term protection. 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 SPAA (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 diversity. However, "solutions" to restoring biological connectivity and ecosystem-level process are extraordinarily complex and costly if the goal is to recreate 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 overgrazing 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 central and southern Illinois woodlands is a ground-cover and shrub flora dominated by common snakeroot, white snakeroot, coralberry, Missouri gooseberry, blackberries and Virginia creeper, as well as the introduced Japanese honeysuckle. 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, in northern Illinois, garlic mustard (*Alliaria petiolata*) invasion can be reversed with appropriately timed applications of fire (Nuzzo 1991, Schwartz and Heim 1996). Other serious exotic pests in northern Illinois, such as purple loosestrife (*Lythrum salicaria*), require direct treatment or biological control (Thompson et al. 1987, Malecki et al. 1993). While these two species have not yet invaded the SPAA, other exotic species known to pose severe ecological problems occur in the Assessment Area. Recommended control measures are summarized in Table 13 (adapted from Solecki 1997).

Fire is an ecological force that historically influenced many aspects of natural communities in the SPAA. 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 SPAA. 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 historically typically were rotated 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.

Table 13. List of selected invasive exotic species known or suspected to occur in the Sinkhole Plain Assessment Area and recommended eradication methods.

Common Name[2]	Scientific Name	Cut & Apply Stump-Treatmt Herbicide	Foliar Herbicide Application[1]	Prescribed Fire	Cut &/or Hand pull (get root)	Dig Root	Cover w/ Black Plastic
amur honeysuckle	*Lonicera maackii*	X	X				
asparagus	*Asparagus officinale*	X				X	
bull thistle	*Cirsium vulgare*		X				
Canadian blue grass	*Poa compressa*			X			
common milfoil	*Achillea millefolium*		X		X		
cheat grass	*Bromus tectorum*		X				
cypress spurge*	*Euphorbia cyparissias**		X		X*	X*	
field garlic	*Allium vineale*		X				
foxtail	*Setaria* spp.		X	X			
hedge apple	*Maclura pomifera*	X					
Hungarian brome grass	*Bromus inermis*		X				
Japanese barberry	*Berberis thunbergii*	X	X	X		X	
Japanese honeysuckle	*Lonicera japonica*		X				
Japanese hops*	*Humulus japonicus**		X				
Kentucky blue grass	*Poa pratensis*			X			
kudzu	*Pueraria lobata*		X				
meadow fescue	*Festuca pratensis*		X	X		X	
moneywort	*Lysimachia nummularia*		X				
Morrow's honeysuckle	*Lonicera morrowii*	X	X		X		
motherwort	*Leonurus cardiaca*		X		X	X	
mulitflora rose	*Rosa multiflora*	X	X	X			
orange day lily	*Hemerocallis fulva*		X			X	X
quack grass	*Agropyron repens*		X	X			
Queen Anne's lace*	*Daucus carota**		X				
reed canary grass	*Phalaris arundinacea*		X				
Siberian elm	*Ulmus pumila*	X					
sour and curly dock	*Rumex* spp.		X		X		
Spanish needles	*Bidens bipinnata*		X		X		
tree-of-heaven	*Ailanthus altissima*	X			X		
white mulberry	*Morus alba*	X					
white poplar	*Populus alba*	X		X			
white sweet clover	*Melilotus alba*			X	X		
white willow	*Salix alba*	X					
wild parsnip*	*Pastinaca sativa**		X		X*	X*	
woolly mullein	*Verbascum thapsus*		X	X		X	
yellow sweet clover	*Melilotus officinalis*			X	X		

[1] The recommended herbicide, typically, is Round-up (Glyphosate) (Solecki 1997).

[2] * plant can cause skin rashes.

Birds

Introduction

The Sinkhole Plain Assessment Area (SPAA) has a fairly typical bird species list for areas adjacent to the Mississippi River in Illinois. At least 287 of the 300 species that regularly occur in the state (exclusive of vagrants) can be found in the area (Table 14). Of these 287 species, 150 breed or formerly bred there (Table 14). Of these, 44 are either locally extinct or are rare during the breeding season (species with a "r" in Table 14), which suggests that habitat loss has been a major problem in the region. Other species that are globally extinct (Passenger Pigeon-*Ectopistes migratorius*, Ivory-billed Woodpecker-*Campephilus principalis*, and Carolina Parakeet-*Conuropsis carolinensis*) formerly occurred in the area as did the locally extirpated Swallow-tailed Kite, Greater Prairie-Chicken, Ruffed Grouse, Bewick's Wren, and Bachmans' Sparrow. In addition, there are several species for which there is well substantiated historical breeding evidence, that are now absent or only occur as migrants (Trumpeter Swan, Osprey, Least Tern, Black Tern, Yellow-bellied Sapsucker, Swainson's Warbler, and Yellow-headed Blackbird). Although some could occur as breeding species again with habitat restoration and/or reintroduction, this clearly shows the extent of habitat loss in the region. There are a few locally extirpated species that have become reestablished in the region fairly recently, including the Double-crested Cormorant, Bald Eagle, and Wild Turkey.

Most forest patches are small and narrow and are unlikely to have successful breeding populations of most species (Brawn and Robinson 1996). However, there is a fairly large area of forested land, almost totally under private ownership, along the Mississippi River bluffs in Monroe and Randolph counties. There are also over 15,000 acres of extensive mixed bottomland forest in the largest state owned site in Illinois, the Kaskaskia River State Fish and Wildlife Area (KRFWA). For a good description of the forested (and other) habitats represented in the Kaskaskia river basin, see Nico (1981). These areas have considerable potential to become at least a local "source" area for some bird species in the region. However, this could also be an important area for the restoration of wetland habitats, especially along the Mississippi and Kaskaskia Rivers. Areas such as Moredock and Kidd Lakes in Monroe Co. and the marshes around the East St. Louis area (especially Horseshoe Lake) were formerly much more extensive and harbored large numbers of species, which today are threatened or endangered in the state. Even recently the marshes in the East St. Louis area still harbored some of the biggest heron colonies left in the state. However, aerial surveillence in the spring of 1998 confirmed only one active colony in the area (in a woodlot near Alorton). Nico (1983) gives a good description of the remaining habitat and the associated bird communities that are still found in the Horseshoe Lake State Recreational Area, even with the severe alterations and urban encroachment and degradation to be found in the remaining areas. There is also a fine description of both the

remaining habitats and bird communities to be found throughout the Sinkhole Plain region and surrounding areas that is very up to date (Webster Groves Nature Study Society 1998), which also gives a good historical background to the area. With the floods of 1993 and 1995, which virtually washed away the small towns of Valmeyer and Fults in Monroe Co., there was some discussion both on the state and federal levels to turn at least some of the Mississippi River floodplain in this region over to some type of conservation reserve program. This type of large scale land conversion could present an enormous opportunity for large scale wetland restoration in an area that was historically important for wetlands. We know little, however, about the effects of fragmentation on wetland habitats or how well restoration efforts in wetland areas brings about responses in the recovery of associated bird communities. However, in one of the few efforts to study the response of an avian community to wetland habitat restoration in Illinois wetland (Hickman 1992), data suggest that many wetland associated bird species, including such rare and state endangered species as Pied-billed Grebe and Least Bittern, begin appearing and breeding almost immediately. The use by migratory birds of the forested corridors along the Mississippi and Kaskaskia Rivers is probably intense.

The bird species that live in the SPAA are ecologically diverse and although some species are able to live in a variety of habitats, many species occupy only one or a few habitats (Table 14). The following sections describe the bird communities typically found in the major habitat types of the SPAA, as well as the habitat-specific environmental problems and management solutions for bird communities in each habitat.

Table 14. Bird species that regularly occur in the Sinkhole Plain Assessment Area. These are species that are likely to be present all or most years. This list excludes extinct species and the 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***	**L W** [(r)]		**L W**
Horned Grebe *Podiceps auritus*			L
Eared Grebe *Podiceps nigricollis*			L
Western Grebe *Aechmophorus occidentalis*			L
American White Pelican *Pelecanus erythrorhynchos*			L

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Double-crested Cormorant - ST *Phalarocorax auritus*	W (r)		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*	W		L W
Snowy Egret - SE *Egretta thula*	W (r)		W
Little Blue Heron - SE *Egretta caerulea*	W (r)		L W
Cattle Egret *Bubulcus ibis*	W Fs (r)		C G W
Green Heron *Butorides virescens*	L W Fs		L W Fs
Black-crowned Night-Heron - SE *Nycticorax nycticorax*	L W Fs		Fs W
Yellow-crowned Night-Heron - ST *Nycticorax violaceus*	W Fs (r)		Fs
Tundra Swan *Cygnus columbianus*			L W
Trumpeter Swan *Cygnus buccinator*			L W
Mute Swan *Cygnus olor*			L W
Greater White-fronted Goose *Anser albifrons*		L W C	L W C
Snow Goose *Chen caerulescens*		L W C	L W C
Ross' Goose *Chen rossii*		L W 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	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 C L

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Blue-winged Teal *Anas discors*	W G		W L
Northern Shoveler *Anas clypeata*	W [(r)]	W L	W L
Gadwall *Anas strepera*		W L	W L
American Wigeon *Anas americana*			W L
Canvasback *Aythya valisineria*		W L	W L
Redhead *Aythya americana*		W L	W L
Ring-necked Duck *Aythya collaris*		W L	W L
Greater Scaup *Aythya marila*		W L	W L
Lesser Scaup *Aythya affinis*		W L	W L
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	W L
Hooded Merganser *Lophodytes cucullatus*	Fs [(r)]		W Fs L
Common Merganser *Mergus merganser*		L	L
Red-breasted Merganser *Mergus serrator*			W L
Ruddy Duck *Oxyura jamaicensis*	W [(r)]		W L
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**
Mississippi Kite – SE ***Ictinia mississippiensis***	**Fs** [(r)]		**F Fs**
Bald Eagle - SE, FT ***Haliaeetus leucocephalus***	**Fs L** [(r)]	**Fs L**	**Fs L**
Northern Harrier - SE ***Circus cyaneus***	**G W** [(r)]	**G C W**	**G C W**

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Sharp-shinned Hawk - SE	**F** [(r)]	**F S R Fs Sav**	**F S R Fs Sav**
Accipiter striatus			
Cooper's Hawk	F S Sav	F S R Sav	F S R Sav
Accipiter cooperii			
Northern Goshawk		F S	F S W L
Accipiter gentilis			
Red-shouldered Hawk - SE	**Fs** [(r)]	**Fs**	**Fs**
Buteo lineatus			
Broad-winged Hawk	F [(r)]		F
Buteo platypterus			
Red-tailed Hawk	F C G R S	F C G R S	F C G R S
Buteo jamaicensis			
Rough-legged Hawk		C G	
Buteo lagopus			
Golden Eagle			F S G
Aquila chrysaetos			
American Kestrel	R C G Sav	R C G Sav	R C G Sav
Falco sparverius			
Merlin			All
Falco columbarius			
Peregrine Falcon - SE, FE	**L** [(r)]		**All**
Falco peregrinus			
Wild Turkey	F S Sav Fs	F S Sav Fs C	F S Sav Fs C
Meleagris gallopavo			
Northern Bobwhite	S G C Sav	S G C Sav	S G C Sav
Colinus virginianus			
Yellow Rail - SE			**G W**
Coturnicops noveboracensis			
King Rail - ST	**G 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** [(r)]		**W**
Gallinula chloropus			
American Coot	W [(r)]	L	W L
Fulica americana			
Black-bellied Plover			L W
Pluvialis squatarola			
American Golden-Plover			W L C G
Pluvialis dominica			
Semipalmated Plover			W
Charadrius semipalmatus			
Killdeer	W R G C		W R G C
Charadrius vociferus			

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Black-necked Stilt *Himantopus mexicanus*	W (r)		W
American Avocet *Recurvirostra americana*			W
Greater Yellowlegs *Tringa melanoleuca*			W
Lesser Yellowlegs *Tringa flavipes*			W
Solitary Sandpiper *Tringa solitaria*			W
Willet *Catoptrophorus semipalmatus*			W
Spotted Sandpiper *Actitis macularia*	L		W
Upland Sandpiper - SE ***Bartramia longicauda***	G (r)		G
Hudsonian Godwit *Limosa haemastica*			W
Ruddy Turnstone *Arenaria interpres*			W
Sanderling *Calidris alba*			W
Semipalmated Sandpiper *Calidris pusilla*			W
Western Sandpiper *Calidris mauri*			W
Least Sandpiper *Calidris minutilla*			W
White-rumped Sandpiper *Calidris fuscicollis*			W
Baird's Sandpiper *Calidris bairdii*			W G
Pectoral Sandpiper *Calidris melanotos*			C W G
Dunlin *Calidris alpina*			W
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 (r)		W G

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
American Woodcock *Scolopax minor*	F Fs S		F Fs S
Wilson's Phalarope - SE ***Phalaropus tricolor***			**L W**
Red-necked Phalarope *Phalaropus lobatus*			L W
Laughing Gull *Larus atracilla*			L
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
Thayer's Gull *Larus thayeri*		L	
Iceland Gull *Larus glaucoides*		L	
Lesser Black-backed Gull *Larus fuscus*		L	L
Glaucous Gull *Larus hyperboreus*		L	
Great Black-backed Gull *Larus marinus*		L	
Black-legged Kittiwake *Rissa tridactyla*			L
Caspian Tern *Sterna caspia*			L
Common Tern - SE ***Sterna hirundo***			**L**
Forster's Tern - SE ***Sterna forsteri***			**L W**
Least Tern – SE , FE ***Sterna antillarum***	**L** [(r)]		**L**
Black Tern - SE ***Chilidonias niger***	**W** [(r)]		**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 [(r)]		F S Sav
Yellow-billed Cuckoo *Coccyzus americanus*	F S Fs Sav		F S Fs Sav

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Barn Owl - SE	**C G R Sav** [(r)]	**C G Sav**	**C G Sav**
Tyto alba			
Eastern Screech-Owl	R S Sav	R S Sav	R S Sav
Otus asio			
Great Horned Owl	F C R Fs Sav	F C R Fs Sav	F C R Fs Sav
Bubo virginianus			
Barred Owl	F Fs	F Fs	F Fs
Strix varia			
Long-eared Owl - SE		**F S**	**F S**
Asio otus			
Short-eared Owl - SE		**G**	**G**
Asio flammeus			
Northern Saw-whet Owl		F S	F S
Aegolius acadicus			
Common Nighthawk	R Sav		R G C
Chordeiles minor			
Chuck-wills-widow			F
Caprimulgus carolinensis			
Whip-poor-will	F Sav		F Sav
Caprimulgus vociferus			
Chimney Swift	R F S Fs Sav		All
Chaetura pelagica			
Ruby-throated Hummingbird	F S R Fs Sav		F S R Fs Sav
Archilochus colubris			
Belted Kingfisher	L W	L W	L W
Ceryle alcyon			
Red-headed Woodpecker	Fs R C	F Fs Sav	F Fs C R Sav
Melanerpes erythrocephalus			
Red-bellied Woodpecker	F Fs S R Sav	F Fs S R Sav	F Fs S R Sav
Melanerpes carolinus			
Yellow-bellied Sapsucker		F Fs R Sav	F Fs R Sav
Sphyrapicus varius			
Downy Woodpecker	F Fs R S Sav	F Fs R S Sav	F Fs R S Sav
Picoides pubescens			
Hairy Woodpecker	F Fs Sav R	F Fs R S Sav	F Fs R S Sav
Picoides villosus			
Northern Flicker	S F R Sav Fs	S F R Sav Fs	S F R Sav Fs
Colaptes auratus			
Pileated Woodpecker	F Fs Sav [(r)]	F Fs Sav R	F Fs Sav R
Dryocopus pileatus			
Olive-sided Flycatcher			F Fs R S Sav
Contopus cooperi			
Eastern Wood-Pewee	F Fs R Sav		F Fs R Sav
Contopus virens			
Yellow-bellied Flycatcher			F S Fs
Empidonax flaviventris			

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
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 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
Western Kingbird *Tyrannus verticalis*	S G C Sav (r)		S G A F C 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 *Petrochelidon pyrrhonota*	L W G (r)		L W G
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*	All	All	All
Fish Crow *Corvus ossifra*	F Fs L		F Fs L
Carolina Chickadee *Poecile carolinensis*	F Fs S R Sav	F Fs S R Sav	F Fs S R Sav
Black-capped Chickadee *Poecile atricapillus*	F Fs S R Sav	F Fs S R Sav	F Fs S R Sav
Tufted Titmouse *Baeolophus bicolor*	F R Fs Sav	F R Fs Sav	F R Fs Sav
Red-breasted Nuthatch *Sitta canadensis*		R	F R
White-breasted Nuthatch *Sitta carolinensis*	F R Fs Sav	F R Fs Sav	F R Fs Sav

Table 14. Continued.

Species[1,2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Brown Creeper - ST	**Fs** [(r)]	**F Fs R**	**F Fs R**
Certhia americana			
Carolina Wren	R F Fs S Sav	R F Fs S Sav	R F Fs S Sav
Thryothorus ludovicianus			
Bewick's Wren - SE	**R F S Sav** [(r)]		**R F S Sav**
Thryomanes bewickii			
House Wren	R F S Sav		R F S Sav
Troglodytes aedon			
Winter Wren		F Fs W	F Fs W
Troglodytes troglodytes			
Sedge Wren	W G		W G
Cistothorus platensis			
Marsh Wren - ST	**W** [(r)]		**W**
Cistothorus palustris			
Golden-crowned Kinglet		F Fs R Sav	F Fs R Sav
Regulus satrapa			
Ruby-crowned Kinglet			F S Sav
Regulus calendula			
Blue-gray Gnatcatcher	F Fs S Sav		F Fs S Sav
Polioptila caerulea			
Eastern Bluebird	C G R S Sav	S F R C Sav	S F C G R Sav
Sialia sialis			
Veery - ST			**F Fs R Sav**
Catharus fuscescens			
Gray-cheeked Thrush			F Fs R Sav
Catharus minimus			
Swainson's Thrush			F S R Fs Sav
Catharus ustulatus			
Hermit Thrush		S F R Fs Sav	S F R Fs Sav
Catharus guttatus			
Wood Thrush	F Fs		F R Fs Sav
Hylocichla mustelina			
American Robin	R S F Fs Sav	R S F Fs Sav	R S F Fs C G Sav
Turdus migratorius			
Gray Catbird	S Fs R Sav		S Fs R Sav
Dumetella carolinensis			
Northern Mockingbird	R S	R S	R S
Mimus polyglottos			
Brown Thrasher	S R C G Sav		S R C Sav
Toxostoma rufum			
American Pipit			C W
Anthus rubescens			
Cedar Waxwing	R S F Fs Sav	R S F Fs Sav	R S F Fs Sav
Bombycilla cedrorum			
Loggerhead Shrike - ST	**G S C** [(r)]	**G S C**	**G S C**
Lanius ludovicianus			

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
European Starling * *Sturnus vulgaris*	R C F Fs Sav	R C F Fs Sav	R C F Fs Sav
White-eyed Vireo *Vireo griseus*	S Fs Sav		S Fs Sav
Bell's Vireo *Vireo bellii*	S G		S G
Blue-headed Vireo *Vireo solitarius*			F Fs Sav
Yellow-throated Vireo *Vireo flavifrons*	F Fs		F Fs R
Warbling Vireo *Vireo gilvus*	S R Fs Sav		S R F Fs Sav
Philadelphia Vireo *Vireo philadelphicus*			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
Nashville Warbler *Vermivora ruficapilla*			S F R Sav Fs
Northern Parula *Parula americana*	F Fs		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 Fs Sav	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

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Pine Warbler *Dendroica pinus*	F [(r)]		F Fs Sav R
Prairie Warbler *Dendroica discolor*	S [(r)]		S
Palm Warbler *Dendroica palmarum*			Fs S F R W G Sav C
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		F Fs R Sav
Black-and-white Warbler *Mniotilta varia*	F [(r)]		F R Fs Sav S
American Redstart *Setophaga ruticilla*	Fs		F Fs S R Sav
Prothonotary Warbler *Protonotaria citrea*	Fs		Fs
Worm-eating Warbler *Helmitheros vermivorus*	F		F
Swainson's Warbler - SE ***Limnothlypis swainsonii***	**F Fs** [(r)]		**F Fs**
Ovenbird *Seiurus aurocapillus*	F		F R S Sav
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

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
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*	Sav S		Sav S
Indigo Bunting *Passerina cyanea*	F Fs S Sav		F Fs S C Sav
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 Sav		R F Sav G S
Clay-colored Sparrow *Spizella pallida*			S
Field Sparrow *Spizella pusilla*	S G C Sav	S G W Sav	S G C W Sav
Vesper Sparrow *Pooecetes gramineus*			C G
Lark Sparrow *Chondestes grammacus*	S C G		S C G
Savanna Sparrow *Passerculus sandwichensis*		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 Fs S G	S W Fs G
White-throated Sparrow *Zonotrichia albicollis*		R S F Fs Sav	R S F Fs Sav

Table 14. Continued.

Species[1, 2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
Harris' Sparrow *Zonotrichia querula*			S C R
White-crowned Sparrow *Zonotrichia leucophrys*		S R G	S R G
Dark-eyed Junco *Junco hyemalis*		R S F Fs G Sav C	R S F Fs G Sav C
Lapland Longspur *Calcarius lapponicus*		C G	C G
Smith's Longspur *Calcarius pictus*			C G
Snow Bunting *Plectrophenax nivalis*		C G	
Bobolink *Dolichonyx oryzivorus*			G W
Red-winged Blackbird *Agelaius phoeniceus*	W C R G S Sav	C G F Fs	W C R G S Sav
Eastern Meadowlark *Sturnella magna*	G C	G C	G C
Western Meadowlark *Sturnella neglecta*		G C	G C
Yellow-headed Blackbird - SE ***Xanthocephalus xanthocephalus***	**W** (r)		**W**
Rusty Blackbird *Euphagus carolinus*		C F Fs	R C Fs W
Brewer's Blackbird *Euphagus cyanocephalus*			C G
Common Grackle *Quiscalus quiscula*	R W Fs F	C R F Fs	R F Fs C Sav
Brown-headed Cowbird *Molothrus ater*	All	C R F Fs	All
Orchard Oriole *Icterus spurius*	S R W Sav		S R W F Fs Sav
Baltimore Oriole *Icterus galbula*	R F Fs S Sav		F Fs R S Sav
Purple Finch *Carpodacus purpureus*		F Fs R	F Fs R S Sav
House Finch * *Carpodacus mexicanus*	R S	R S	F Fs R S Sav
Red Crossbill *Loxia curvirostra*		F R	F R
White-winged Crossbill *Loxia leucoptera*		F R	F R
Common Redpoll *Carduelis flammea*		G S R F	
Pine Siskin *Carduelis pinus*	R S F (r)	R S F	R S F

Table 14. Continued.

Species[1,2]	Breeding[3,6,7]	Winter[4,6]	Migrant[5,6]
American Goldfinch *Carduelis tristis*	S R G	S R G F Fs Sav	S R G F Fs Sav
Evening Grosbeak *Coccothraustes vespertinus*		R F Fs	R F Fs
House Sparrow * *Passer domesticus*	R C	R C	R C
Eurasian Tree Sparrow * *Passer montanus*	R C S	R C S	R C S

[1] Bold type indicates an Illinois threatened (ST), Illinois endangered (SE), and/or federally endangered (FE) species.
[2] * = 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 (including 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 = Savanna
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 reestablishment in restored habitats.

Forest

Most of the remaining forest habitat is found along the Mississippi and Kaskaskia Rivers and some of their smaller tributaries, both in the extensive bottomland areas along both rivers and in the fairly extensive tracts of upland forest to be found just back from the floodplain along the Mississippi River in Monroe and Randolph counties (Figure 5).

Regularly Occurring Species

Typical breeding species of forest habitats in the SPAA include: Cooper's Hawk (rare but increasing), Wild Turkey (successfully reintroduced), Yellow-billed Cuckoo, Great Horned Owl, Barred Owl, Whip-poor-will, Red-headed Woodpecker, Red-bellied Woodpecker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Eastern Wood-Pewee, Acadian Flycatcher, Great Crested Flycatcher, Blue Jay, American and Fish Crows, Carolina and Black-capped Chickadee, Tufted Titmouse, White-breasted Nuthatch, Carolina Wren (population fluctuates depending upon winter weather), House Wren, Blue-gray Gnatcatcher, Wood Thrush, American Robin, Yellow-throated Vireo, Red-eyed Vireo,

Northern Parula, Yellow-throated Warbler, American Redstart, Prothonotary Warbler, Worm-eating Warbler, Ovenbird, Louisiana Waterthrush, Kentucky Warbler, Scarlet and Summer Tanagers, Northern Cardinal, Rose-breasted Grosbeak, Indigo Bunting, Brown-headed Cowbird, and Baltimore Oriole (mostly in more open forests). Rarer forest species that also nest within the SPAA include Broad-winged Hawk, Black-billed Cuckoo, Pine Warbler, Black and White Warbler, Cerulean Warbler, and Hooded Warbler.

Threatened and endangered species - Several state threatened (ST) and endangered (SE) species occur in forests in the area. Red-shouldered Hawks (SE) and Mississippi Kites (SE) nest in the heavily forested bottomlands along the Mississippi and Kaskaskia Rivers. Bald Eagles (SE, FT) nest in a few locations along the Mississippi River. Sharp-shinned Hawks (SE) have nested in some of the forested uplands in the area. Brown Creepers (ST) occur in forested wetlands (see below), especially along the Mississippi and Kaskaskia Rivers.

Exotic species - European Starlings were introduced into the U.S. in 1890-1891 and spread to Illinois by 1922 (Bohlen and Zimmerman 1989). They are now one of the most abundant species in Illinois and may be detrimental to native species because they compete with residents for nesting cavities, especially in smaller woodlots.

There are few stands of pine in this area. Pines are not native to the SPAA and pine plantations have unusual bird communities. In addition to more generalized forest species, pine plantations in central and northern Illinois occasionally attract breeding Long-eared Owls (SE) (but mainly in winter), Northern Saw-whet Owls (mainly in winter), Solitary Vireos, Red Crossbills (very erratic), Pine Siskins, Yellow-bellied Sapsuckers, Red-breasted Nuthatches, Pine Warblers, Yellow-throated Warblers, and Black-throated Green Warblers. Some of these species may occasionally try to nest in the SPAA. Chipping Sparrows are often the most abundant species nesting in pine plantations. In winter, pines attract Northern Saw-whet Owls, winter finches (e.g., crossbills, Pine Siskin), Yellow-bellied Sapsuckers, Red-breasted Nuthatches, and Golden-crowned Kinglets.

Population Dynamics and Management

Many bird species are decreasing in abundance across part or all of their breeding range in the Midwest (Peterjohn et al. 1994). The causes of such changes are likely related partly to problems with reproduction in highly fragmented landscapes. The primary factors controlling productivity of birds in the SPAA 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-complete them for food, often leading to the starvation of the host young. Rates of nest predation and brood parasitism generally increase as a habitat become 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). Given the relatively small size of most forest tracts, it is likely that levels of nest predation and brood parasitism by Brown-headed

Cowbirds are extremely high (Robinson et al. 1995). In general, nest predation rates in Illinois forests of less than 500 acres average 70-90% and parasitism levels for cowbird hosts average 70-80%. These levels are so high that woodlots in this region are very likely to be population sinks (Brawn and Robinson 1996) in which reproduction is far below rates necessary to sustain regional populations. Urban developments may increase abundance of some predators.

Remarkably, in spite of low productivity, many species nest commonly in regional woodlots and are not obviously declining. This strongly suggests that their populations are being rescued by the settlement of individuals from much larger forest tracts outside of the region, or even outside of the state (Brawn and Robinson 1996). Therefore, to understand the population dynamics of breeding forest birds, it is necessary to monitor both population size and nesting success. Previous research on this subject in Illinois (Robinson et al., in press) suggests that the best candidates for forest restoration are tracts that are, or can be made, 500 acres or larger. Few forests in the SPAA are large enough to escape extreme levels of parasitism and predation, with the exception of the more heavily forested areas along the Mississippi River bottomlands, the upland forested bluffs just east of the floodplain, and the extensive areas of bottomland forest found along the Kaskaskia River, especially in the KRFWA. The north-south orientation of the wooded Mississippi and Kaskaskia River floodplains may lead to intensive use by migrating forest songbirds.

Wetland

Although historically there had been considerably more wetland in the SPAA (shallow lake and shallow marsh), wetland habitats represent one of the more significant avian habitats in the Sinkhole Plain area, especially the Kidd Lake Marsh Natural Area and Moredock Lake in Monroe County and the Horseshoe Lake area (especially Eagle Park marsh) in Madison County, as well as numerous other smaller wetland areas scattered around the East St. Louis urban and suburban area and along the Mississippi and Kaskaskia River floodplains.

Regularly Occurring Species

Typical wetland species include the Pied-billed Grebe, Great Blue Heron, Black-crowned Night-Heron (SE), Great Egret (ST), Green Heron, Canada Goose, Wood Duck, Mallard, American Coot, Spotted Sandpiper, Killdeer, American Woodcock, Belted Kingfisher, Red-headed Woodpecker (forested), Northern Flicker (forested), Pileated Woodpecker (forested), Acadian Flycatcher (forested), Willow Flycatcher (shrubby), Purple Martin, Tree Swallow, Northern Rough-winged Swallow, Barn Swallow, Blue-gray Gnatcatcher (forested), Gray Catbird (shrubby), Warbling Vireo (forested), Yellow Warbler (shrubby), Cerulean Warbler (forested), American Redstart (forested), Common Yellowthroat, Song Sparrow, Red-winged Blackbird, Common Grackle, and Baltimore Oriole. Rarer species might include the Cattle Egret, Blue-winged Teal, Northern Shoveler, Ruddy Duck, Hooded Merganser (forested), Virginia Rail, Sora, Common Snipe, and Cliff Swallow.

Threatened and endangered species - Many federally threatened (FT) and endangered (FE) and state threatened (ST) and endangered (SE) species occur in the wetland habitats of the SPAA. There are breeding records for Pied-billed Grebe (ST), Double-crested Cormorant (ST), American Bittern (SE), Least Bittern (SE), Yellow-crowned Night-Heron (ST), Mississippi Kite (SE), Bald Eagle (SE, FT), Northern Harrier (SE), Red-shouldered Hawk (SE), King Rail (ST), Common Moorhen (ST), Least Tern (SE, FE), Black Tern (SE), Brown Creeper (ST), Marsh Wren (ST), Yellow-headed Blackbird (ST), and Swainson's Warbler (SE, historically bred in the area, but are likely extirpated from the region). In addition, the East St. Louis area has the largest nesting colonies of Snowy Egrets (SE) and Little Blue Herons (SE) in the state and also has some of the biggest nesting colonies of Great Egrets (ST) and Black-crowned Night-Herons (SE) in the state as well. Notable sites for these species include Horseshoe Lake, Frank Holten State Park, and several areas in the East St. Louis area, as well as numerous other marshes and forested bottomlands along the Mississippi and Kaskaskia Rivers, especially Moredock Lake and Kidd Lake Natural Area and the Kaskaskia River S.F.W.A. Protection of remaining wetlands, especially marshes, is an extremely high priority for this area.

Exotic species - The only non-native wetland species is the Cattle Egret which is commonly found as a breeding species, especially near Horseshoe Lake and Frank Holten State Park.

Population Dynamics and Management

Currently, the main problem for birds inhabiting wetlands is habitat loss and suburban encroachment. Some forested wetland species likely suffer from the same problems with fragmentation that affect forest species (cowbird parasitism and nest predation). We know little, however, about the effects of fragmentation on other wetlands habitats. In fact, there have been no published studies of the population dynamics and nesting success of wetland birds in the region. Potentially, wetland species are more resistant to fragmentation, which may make this habitat a good target for conservation efforts in this landscape. Wetland habitats are also used heavily by migrating waterfowl, shorebirds, rails and long-legged waders (herons, bitterns, and egrets). These habitats therefore have the potential to be important stopover sites for birds during migration. Wetland conservation should be the highest priority in the region for birds for reasons outlined above.

Savanna

Savanna habitats were once widespread in the Midwest, but because of habitat destruction and the absence of fire they are now rare in the SPAA (see section on Natural Vegetation Communities).

Regularly Occurring Species

Savannas share many species with forest habitats. Perhaps the most typical species of savannas would be: Whip-poor-will, Red-headed Woodpecker, Great Crested Flycatcher,

Eastern Wood-Pewee, Blue Jay, House Wren, American Robin, Eastern Bluebird, Baltimore Oriole, Rose-breasted Grosbeak, Indigo Bunting, American Goldfinch, Field Sparrow, Chipping Sparrow, and Summer Tanager. Other forest species remain common in savannas, including the Great Horned Owl, Northern Flicker, Red-bellied, Downy and Hairy Woodpeckers, Black-capped and Carolina Chickadees, White-breasted Nuthatch, Brown-headed Cowbird, Scarlet Tanager, and Northern Cardinal. The open, parklike structure of some savannas also attracts some species that are more characteristic of grassland habitats, such as the Red-tailed Hawk and Northern Bobwhite. For many of these species, Illinois contains a significant portion of their global population.

Threatened and endangered species - None of the species inhabiting savannas in this area are threatened or endangered, although the Barn Owl (SE) may have been a bird of very open savannas.

Exotic species - European Starlings are now one of the most abundant species in Illinois, and they are detrimental to native savanna species because they complete with resident birds (especially woodpeckers) for nesting cavities.

Population dynamics and Management

Savannas may be associated with high levels of cowbird abundance and parasitism levels, although some species may have higher nesting success in savanna restorations than in unburned forest (J.D. Brawn, unpubl. data). Many of the species that are most abundant in savannas are resistant to cowbids (e.g., cavity nesters, American Robins, Baltimore Orioles). Unlike many forest birds, these species are able to recognize cowbird eggs and either eject them from their nests or rebuild the nests over them (Rothstein and Robinson 1994). A detailed study of the effects of savanna restoration on bird populations, ecology, and nesting success is underway in adjacent watersheds (J.D. Brawn, unpubl. data). This study should be fully applicable to savannas in the SPAA.

Savannas also appear to be very favorable habitat for migrants. The heavy use of oaks by spring migrants (Graber and Graber 1983) and by mast-consuming species suggests that savanna restoration should be a high priority for birds in this region.

Prairie/Grassland

Native prairie habitat is rare in the SPAA (see the section on Natural Vegetation Communities), however, many bird species that historically lived in prairies are also able to live in other grassland habitat such as hay fields and sometimes pastures. These habitats are also relatively uncommon in the SPAA. There are only about 113,000 acres of grassland in the basin (14% of the land area). Nonetheless, although patches of available grassland habitat in the SPAA are small, they have considerable potential for restoration and contain many typical grassland species. Pastures in the area are mostly heavily grazed and little-used by grassland birds. They are also favored sites for foraging Brown-headed Cowbirds.

Regularly Occurring Species

Typical species in these habitats include a subset of those found on larger grasslands throughout the state: Red-tailed Hawk, American Kestrel, Northern Bobwhite, Killdeer, Eastern Kingbird, Willow Flycatcher (shrubs), Horned Lark (recently burned), Barn Swallow, Brown Thrasher (shrubs), Sedge Wren, Bell's Vireo (shrubs), Common Yellowthroat, Eastern Meadowlarks, Red-winged Blackbird, Dickcissel, Lark Sparrow (sand areas), Song Sparrow, Grasshopper Sparrow, Field Sparrow, and American Goldfinch. See Table 14 for a more complete list of grassland species found in the SPAA.

Threatened and endangered species - Currently, only three species of threatened or endangered birds breed with any regularity in grasslands of the SPAA. These include the Upland Sandpiper (SE), Loggerhead Shrike (ST), and Henslow's Sparrow (SE). However, the Northern Harrier (SE) and Barn Owl (SE) have been known to occasionally nest in the area. The Short-eared Owl (SE) can be found during migration and winter and may occasionally try to breed. The Greater Prairie Chicken was known to breed in the area as late as the early 1940's when a flock was seen near O'Fallon (Webster Groves Nature Study Society 1998) but they were locally extirpated shortly thereafter.

Exotic species - Only one introduced species is found in the grasslands of the SPAA. European Starlings feed in grasslands following grazing, mowing, or burning.

Population Dynamics and Management

Certain species, such as the Upland Sandpiper, Grasshopper Sparrow, and Bobolink, have declined precipitously as grasslands have been converted to row crops (Herkert 1991). Currently, prairie remnants and other grassland habitats are probably too small to sustain regular breeding populations and successful nesting of most prairie species. For example, the Short-eared Owl is highly area-sensitive and will require larger grasslands than exist currently to maintain a regular breeding population. Large Conservation Reserve Program (CRP) fields attract small numbers of breeding Northern Harriers, Short-eared Owls, Henslow's Sparrows, Sedge Wrens, and Bobolinks. Records of Henslow's Sparrows are few; this species is also area-sensitive and requires taller, ranker grass that has not recently been burned (Herkert 1994). King Rails (ST) and Northern Harriers (SE) would also be good candidates for reestablishment in restored grasslands. Upland Sandpipers (ST) occasionally nest in some areas, but they require mowing, grazing, or burning to keep the grass short. Upland Sandpipers are also area-sensitive and likely require larger grassland areas to maintain a continuous and thriving population in the area. Other rare or locally extirpated species that would be likely to increase rapidly if grasslands were restored include Barn Owl, Sedge Wren, Loggerhead Shrike (ST), and Henslow's Sparrow (SE). Because of the short supply of available grassland, prairie restoration and enhancement will be needed to attract grassland birds.

Removal of woody vegetation may also be beneficial. Shrubland species that would be lost are of little or no regional concern because they have large global populations and are

common throughout Illinois (e.g., Gray Catbird, Brown Thrasher, House Wren). Perhaps the best way to maintain desired shrubland birds (Bells Vireo, Willow Flycatcher, Bewick's Wren [SE], Blue-winged Warbler, Prairie Warbler, Yellow-breasted Chat, Blue Grosbeak) would be to allow willow thickets to grow in low, wet areas that would not burn in most areas. Natural hazel thickets may also have provided habitat for these species historically. The guidelines provided by Herkert et al. (1993) for grassland management should be followed. In particular, dense, tall stands of prairie grasses are rarely used by grassland birds and should be avoided.

Migrant and wintering birds use grasslands as stopover habitat, especially Smith's and Lapland Longspurs, Snow Buntings, LeConte's Sparrows, American and Sprague's Pipits, Loggerhead and Northern Shrikes, various rails, bitterns, American Golden Plovers, Pectoral and Buff-breasted Sandpipers, Short-eared and Snowy Owls, and Rough-legged Hawks.

Lakes, Ponds, and Impoundments

There are several natural lakes or ponds in the SPAA (see section on Aquatic Biota), as well as a number of impoundments.

Regularly Occurring Species

Double-crested Cormorants have begun to recolonize former breeding areas around the edges of some of the larger backwater lakes along the Mississippi River and American White Pelicans are increasing as a non-breeding summer resident all along the Mississippi River, especially near the larger backwater lakes, and may soon begin to nest as well. Peregrine Falcons (SE) and Northern Goshawks are found most often in areas along the Mississippi River and it's larger backwater lakes as well as other large impoundments, where they hunt and harass the large aggregations of waterfowl that occur in these areas during migration and in the winter. Ospreys forage over lakes and ponds during migration. Belted Kingfishers forage and occasionally nest in steep banks along the edges of lakes and ponds. Spotted Sandpipers may occasionally breed around lakes, ponds, and impoundments. Common Grackles, Red-winged Blackbirds, Yellow Warblers, Common Yellowthroats, and Song Sparrows nest along ponds, especially those with gradual shorelines and some emergent vegetation (e.g., *Typha)* along the edge. Eastern Phoebes, Barn Swallows, Purple Martins, and Tree Swallows forage over and along the edges of open-water habitats as long as nest sites are available. Cliff Swallows are particularly found nesting only where there are bridges, dams, or other large human-made structures to attach their mud nests. Green Herons often nest along ponds lined with dense, woody vegetation.

Threatened and endangered species - There are several threatened and endangered species that currently breed and/or forage in and around several of the many backwater and other natural lakes in the area, especially along the Mississippi River floodplain, the East St.

Louis area, and a few other areas. These include Pied-billed Grebe (ST), Double-crested Cormorant (ST), Least Bittern (SE), Great Egret (ST), Snowy Egret (SE), Little Blue Heron (SE), Black-crowned Night-Heron (SE), Yellow-crowned Night-Heron (ST), and Bald Eagle (SE, FT).

Exotic species - The Mute Swan is the only non-native species that would be likely to occur in the area. Although they are rare in Illinois, some may visit local ponds and could eventually establish a breeding population.

Population Dynamics and Restoration

One of the most important roles of lakes, ponds, and impoundments are as resting habitat for migrating waterbirds. These open-water habitats are often the only deepwater habitat available for loons, grebes, scaup, Common Goldeneyes, Buffleheads, and mergansers, all of which dive to catch food. Similarly, gulls and terns often forage over open water during migration. At low water, the edges of lakes are also used by shorebirds, herons, and egrets. All species of swallows use open-water for foraging, especially during cold weather.

A comparative study of the use of various ponds, lakes, and impoundments by migrating birds might help improve their design and management, but probably the most useful way to enhance these habitats is by increasing the amount of emergent vegetation along their edges. This essentially involves creating shallow wetlands along the edges of open water. Also, colonies of waterbirds nesting along the edges of lakes should be protected from disturbances. Nesting platforms could attract Double-crested Cormorants and Ospreys.

Creeks and Rivers

Although the Mississippi River has been highly altered by human activities, it still has many associated river species.

Regularly Occurring Species

Among the species found along creeks and rivers are the following: Canada Goose, Mallard, Wood Duck (forested), Hooded Merganser (forested; rare), Cooper's Hawk (forested corridors), Great Blue Heron, Great Egret, Black-crowned and Yellow-crowned Night-Heron, Green Heron (forested), Osprey (migration), Killdeer, Great Horned Owl (forested), Barred Owl (forested), Belted Kingfisher, Eastern Phoebe (especially near bridges), Willow Flycather (shrubby corridors), Barn Swallow, Northern Rough-winged Swallow, Bank Swallow, Cliff Swallow (especially near bridges), House and Carolina Wrens (in woody debris), Cedar Waxwing, Warbling Vireo (woody corridors, especially cottonwoods and willows), Prothonotary Warbler (forested), Yellow Warbler (shrubby corridors), Common Yellowthroat (grassy and shrubby streamsides), Common Grackle,

Red-winged Blackbird, Baltimore Oriole (woody corridors), Indigo Bunting, and Song Sparrow (shrubby steamsides).

Threatened and endangered species - There are several threatened or endangered speciesin the region which use this type of habitat for breeding, with areas along the Mississippi and Kaskaskia Rivers being the most notable. These include the Double-crested Cormorant (ST), Great Egret (ST), Snowy Egret (SE), Little Blue Heron (SE), Black-crowned (SE) and Yellow-crowned (ST) Night-Herons, Mississippi Kite (SE), Bald Eagle (SE, FT), Red-shouldered Hawk (SE), and Brown Creeper (ST). Most of these birds are restricted to the larger tracts of forested riverbottoms along or adjacent to the Mississippi River.

Populations Dynamics and Management

We lack data on populations and nesting success of birds in riparian corridors of varying widths and of their use by migrants. It would also be interesting to measure the movements of migrants along corridors to determine if they act as flyways. Much concern has been raised recently over the effects of barge and other river traffic on the Mississippi River as well as general habitat deterioration and diminishment of the flood-pulse. There are currently several multimillion dollar habitat rehabilitation projects underway along the Illinois River. Most aspects of these projects are designed to keep sediment-laden water out of floodplain impoundments as much as possible (Illinois Department of Energy and Natural Resources 1994). These techniques should be fully applicable to similar areas along the Mississippi River. This strategy will probably improve areas for some waterfowl, wading and shorebirds, but it is not as clear how replacing the natural floodpulse of the river will affect other avian communities along the river, especially marsh dependent birds and other passerine species. However, increasing the amount of woody riparian corridor habitat should enhance populations of many species and would help restore natural hydrology. Restoring the hydrology would, in turn, improve wetland habitat in the floodplain, both in woody backwaters and in oxbows (see above).

Cultural Habitats: Cropland

Almost half (48.4%) of the SPAA has been converted to cropland (Figure 4, Table 2).

Regularly Occurring Species

Cropland bird communities in the SPAA have about the same bird species that are common statewide in this structurally simple habitat: Mallard, Red-tailed Hawk, American Kestrel, Northern Bobwhite, Killdeer, Rock Dove, Mourning Dove, Great Horned Owl, Eastern Phoebe (farmsteads), Horned Lark, Barn Swallow, American Crow, Eastern Bluebird (where nest boxes are provided), Loggerhead Shrike (ST), European Starlings, House Sparrow, Eurasian Tree Sparrow, Common Grackle, Brown-headed Cowbird, Red-winged Blackbird, Dickcissel (grassy strips and fallow cropland), Grasshopper Sparrow (grassy strips and fallow cropland) and Field Sparrow.

Some species characteristic of recently burned and heavily grazed, dry grasslands have adapted to croplands, including the Horned Lark and Loggerhead Shrike (ST). The shrike, however, also requires spiny hedgerows for nesting; it is now rare in the area.

Exotic species - Introduced species thrive in the agricultural habitats of the SPAA. In fact, four of the most common species in the cropland of the SPAA (Rock Dove, European Starling, House Sparrow, and Eurasian Tree Sparrow) were all introduced from Europe or Asia. The Eurasian Tree Sparrow has not spread as rapidly or extensively as its close relative the House Sparrow, but it has spread a considerable distance north up the Mississippi, Illinois and Sangamon river valleys since it's initial introduction in the St. Louis area in 1870 (Bohlen and Zimmerman 1989).

Intensively farmed areas offer little in the way of stopover habitat except around farmsteads and wet fields in the spring for gulls, shorebirds and longspurs.

Population Dynamics and Management

Warner (1994) documented the low populations and extremely low nesting success of birds in Ford County, an area of very intensive agriculture. On the other hand, increasing grassy cover along roadsides, drainage ditches, and around farmsteads can substantially increase grassland bird habitat. Within an agricultural landscape, the CRP can also benefit cropland birds by providing nesting cover and attracting such species as Dickcissels, Henslows, Grasshopper, and Savanna Sparrows.

Cultural Habitat: Successional Fields

Successional habitats, such as abandoned fields and pastures, are relatively uncommon in the SPAA. These habitats, which are often dominated by non-native plant 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, protective 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 natural shrublands. Nonetheless, many local species that use shrubby vegetation now depend almost entirely on anthropogenic disturbances to set back succession.

Regularly Occurring Species

Typical species include: Northern Bobwhite, American Woodcock (wet areas), Mourning Dove, Yellow-billed Cuckoo, Black-billed Cuckoo (rare), Ruby-throated Hummingbird, Northern Flicker, Downy Woodpecker, Eastern Kingbird, Willow Flycatcher (wet thickets), Blue Jay, Black-capped and Carolina Chickadees, House Wren, Carolina Wren, Gray Catbird, Brown Thrasher, Northern Mockingbird, American Robin, Eastern Bluebird, Cedar Waxwing, Bell's Vireo, White-eyed Vireo, Blue-winged Warbler, Prairie Warbler

(uncommon), Yellow Warbler, Common Yellowthroat, Yellow-breasted Chat, Red-winged Blackbird, Northern Cardinal, Rose-breasted Grosbeak (older thickets), Blue Grosbeak, Indigo Bunting, House Finch, American Goldfinch, Eastern Towhee, Field Sparrow, and Song Sparrow. Successional habitats add greatly to local diversity, although only a few of these species have nationally declining populations (Yellow-breasted Chat, Field Sparrow, Blue-winged Warbler).

Threatened and endangered species - The only threatened species dependent on shrublands in the SPAA is the Loggerhead Shrike (ST).

Exotic species - Most species found in successional habitats are native, although House Finches breed in shrubbery.

Population Dynamics and Management

Although nest predation rates appear to be very high in successional habitats, brood parasitism levels are generally moderate or low (Robinson et al., in press). Some species nesting in these habitats eject cowbird eggs (Gray Catbird, Brown Thrasher, Cedar Waxwing, Eastern Kingbird, Baltimore Oriole, American Robin), nest in cavities that are inaccessible to cowbirds (both Wrens, Chickadees, Eastern Bluebird), abandon many parasitized nests (Yellow Warbler, Field and Chipping Sparrows), defend their nests aggressively (Red-winged Blackbird, Eastern Kingbird, Willow Flycatcher, Common Grackle), have inappropriate diets for cowbird nestlings (House Finch, American Goldfinch), or continue nesting until very late in the season when cowbirds have stopped laying (Mourning Dove, Yellow-billed Cuckoo, Gray Catbird, Cedar Waxwing, White-eyed Vireo, Northern Cardinal, Indigo Bunting, American Goldfinch, Eastern Towhee). As a result, early successional species may be able to thrive even in small patches in agricultural landscapes. An intensive study of habitat requirements, nesting success, and population dynamics of shrubland birds is now underway (S.K. Robinson, J.D. Brawn, and E.J. Heske, unpubl. data). The results of this study should be applicable to shrubland birds in the SPAA. Shrubland species may be excellent target species for lands managed to promote game species, especially Northern Bobwhites.

In addition to use during the breeding season, shrublands are very heavily used by migrating species, especially in habitats mingled with scattered trees. Shrubland-preferring migrants include, Long-eared Owls, 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 are well represented in the SPAA, especially near the Illinois portion of the St. Louis metropolitan area (Table 2, Figure 6). These areas, scattered with lawns, parks, and other manicured vegetation, offer suitable breeding habitat for relatively few bird species.

Regularly Occurring Species

Typical breeding species include: Red-tailed Hawk (in more sparsely inhabited areas), American Kestrel (especially farmsteads), Killdeer, Rock Dove, Mourning Dove, Eastern Screech-Owl, Great Horned Owl, Common Nighthawk, Chinmey Swift, Ruby-throated Hummingbird, Northern Flicker, Red-bellied and Downy Woodpeckers (urban forests), Eastern Wood-Pewee, Eastern Phoebe, Barn Swallow, Purple Martin, Blue Jay, American Crow, Black-capped and Carolina Chickadees, Tufted Titmouse, White-breasted Nuthatch, House Wren, Carolina Wren, Gray Catbird, Brown Thrasher, Northern Mockingbird (especially around farmsteads), American Robin, Eastern Bluebird (farmsteads), European Starling, Warbling Vireo, Common Yellowthroat, House Sparrow, Eurasian Tree Sparrow, Common Grackle, Brown-headed Cowbird, Baltimore Oriole, Northern Cardinal, House Finch, American Goldfinch, Chipping Sparrow, and Song Sparrow.

Developed lands contain an unusual mix of species that can use ornamental shrubs (e.g., Northern Cardinal and Song Sparrow), shade trees (e.g., Baltimore Oriole, Warbling Vireo, Black-capped and Carolina Chickadees, Tufted Titmouse, Eastern Wood-Pewee), pine plantings (e.g. Pine Siskins), 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. Wood Duck (chimneys) American Kestrel, Killdeer (roofs, roads), Common Nighthawk (roofs), Chimney Swift (chimneys), Eastern Phoebe, Barn Swallow, Purple Martin, House and Carolina Wrens, American Robin, Eastern Bluebird, European Starling, House Sparrow and House Finch). This community has no parallel in the natural world.

Threatened and endangered species - There are no threatened or endangered species found in residential or urban areas other than the Loggerhead Shrike, which often forages in mowed grass of rural farmsteads. Barn Owls were formerly a common breeding species in this habitat but have been mostly extirpated in the area as well as most of the rest of the state.

Exotic species - Many species in developed areas are introduced. Huge populations of introduced European Starlings, House Sparrows, Eurasian Tree Sparrows, Rock Doves, and House Finches compete with native species for nest sites and food at bird feeders. House Finches are native to the western United States but after a population was released on Long Island in the 1940's, they spread west from New York and are now common in the urban and rural areas of Illinois.

Migrating birds make heavy use of shade trees in developed areas and, when available, 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, Rusty Blackbird, Evening Grosbeak (feeders), Purple Finch (feeders), Pine Siskin (feeders, conifers), American Goldfinch (feeders), Eastern Towhee (feeders), Dark-eyed Junco (feeders), American Tree Sparrow, White-crowned Sparrow, and White-throated Sparrow.

Population Dynamics and Management

Developed areas are 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 species in rural or urban areas, especially the House Finch, by increasing winter survival.

Nesting success of species of developed areas has not been systematically studied. Such studies could lead to recommendations for enhancing populations of the native species that have adapted to human developments. However, high populations of predatory birds, domestic cats, and other mammalian predators may make it difficult for many species that build open-cup nests in accessible locations to nest successfully.

Management Recommendations

The SPAA contains a substantial area of both upland and bottomland forest as well as several rich wetland bird communities and a major migration corridor. Wetland and forest conservation (including savanna restoration) should clearly be of the highest priority in the SPAA because of relatively large populations of many state threatened and endangered species, especially in the wetlands. Grassland restoration, especially around existing wetlands, would provide habitat for declining grassland birds, help buffer wetlands from surrounding development, and provide nesting habitat for many wetland species. Similarly, wooded buffer strips around wetlands can perform some of the same functions. This coordinated management of wetland habitats, especially large wetlands, or complexes of nearby smaller wetlands, offers the best hope for sustaining populations of endangered and threatened species.

Most forest sites in the SPAA away from the Mississippi and Kaskaskia River valleys and their tributaries, are small and have little potential to be enlarged sufficiently to create tracts large enough to avoid extremely high levels of nest predation and brood parasitism. For these areas, restoration of native plant communities, especially savanna, coupled with

judicious consideration of the needs of migrant birds (some shrubby areas and oak trees) might be the best management strategy. Acquisition or conservation partnerships with private landowners (such is underway in the Kaskaskia River valley) in the remaining larger forested tracts should be a high priority in these areas.

Developed areas, especially urban forest and parks, can be managed to improve habitat by encouraging oaks and leaving shrubby areas for migrants.

Agricultural areas benefit from increased cover provided by CRP fields, shrub-lined drainage ditches, and unmowed roadsides.

Mammals

Introduction

Information in this section has been compiled primarily from range maps and records in Hoffmeister (1989) and the Illinois Natural Heritage Database (Illinois Department of Natural Resources, Division of Natural Heritage; 1981-May 1997). Taxonomy follows Wilson and Reeder (1993).

Mammal species known or likely to occur in the Sinkhole Plain Assessment Area (SPAA) are listed in Table 15. The 43 species in this table represent approximately 74% of the 58 mammal species that currently occur in Illinois (Hoffmeister 1989). Several species whose ranges include only northern Illinois or the southernmost portion of the state are absent from this region. One, the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), occurs in the northern two-thirds of the state, but has been sighted in Madison County in the past (Mohr 1943). Thus, there is a slight possibility that this species also is present in the northern portion of the SPAA. Nine species of bats are included in the table, but the red, hoary, and evening bats probably would be absent from the SPAA during the winter. The silver-haired bat is likely to be present only during spring and autumn migration periods and the Indiana bat has been recorded only during the winter (Illinois Department of Natural Resources 1997). The population status of many mammal species within the SPAA is unknown; in these cases designations in Table 15 are projections based on their status in other parts of Illinois. Of the nine mammal species listed as threatened or endangered in Illinois (Illinois Endangered Species Protection Board 1994), three — the federally endangered Indiana bat, state endangered river otter, and state threatened bobcat — have been recorded recently within the SPAA (Illinois Department of Natural Resources 1997). There are two historical records for the federally endangered gray bat (*Myotis grisescens*) in Madison County (Hoffmeister 1989); this species is not included in Table 15 because of its rarity in Illinois and the lack of recent records in the SPAA (Illinois Department of Natural Resources 1997).

The northern portion of the SPAA encompasses the East St. Louis metropolitan area and consists primarily of urban land; however, fragmented patches of natural, but mostly disturbed habitat (woods, grass/forblands, and emergent wetlands) remain. The rest of the SPAA is largely agricultural. Many mammals are generalists that use a variety of habitat types and have adapted to living in areas that have been transformed by humans. Larger mammals that now commonly occur in agricultural and urban areas include the Virginia opossum, eastern cottontail, fox and gray squirrels, coyote, raccoon, striped skunk, and white-tailed deer. Several species of small mammals, including the eastern mole, short-tailed shrews, deer mouse, and prairie vole, can occupy hayfields, pastures, and fencerows in agricultural areas or other maintained areas such as roadsides, cemeteries, and lawns.

Big brown and little brown bats commonly roost in buildings and other small mammals (such as the white-footed mouse) sometimes enter buildings in search of food and shelter.

The Norway rat and house mouse are the only exotic, non-domesticated mammals that occur regularly in Illinois. These species are strongly associated with human structures (e.g. houses, barns, warehouses), but both can be found in natural habitats near buildings. The house mouse, in particular, can sometimes reach substantial numbers in grasslands near structures. These species are now so widespread that they are part of the mammalian fauna throughout the United States. They could not readily be eliminated from natural habitats and their presence is not a matter of great concern. Large numbers of free-roaming and feral domestic cats (*Felis silvestris*) occur in Illinois as elsewhere (Warner 1985, Coleman and Temple 1996). They can have a serious negative impact on populations of birds and small mammals (especially ground-nesting birds) and reduce prey availability for wild predators (Warner 1985, Churcher and Lawton 1987, Coleman and Temple 1996). There is also the potential for unvaccinated cats to transmit diseases to wild mammals or humans (Coleman and Temple 1996).

Table 15. List of mammal species known or likely to occur in the Sinkhole Plain Assessment Area[1].

Common name[2]	Order *Species name*	Habitat[3]	Population status[4]
Marsupials	Didelphimorphia		
Virginia opossum	*Didelphis virginiana*	F, W, G	C
Insectivores	Insectivora		
southeastern shrew	*Sorex longirostris*	G, F, W	C?
northern short-tailed shrew	*Blarina brevicauda*	F, G, W	C?
southern short-tailed shrew	*Blarina carolinensis*	F, G, W	C
least shrew	*Cryptotis parva*	G	C
eastern mole	*Scalopus aquaticus*	F, G	C
Bats	Chiroptera		
little brown bat	*Myotis lucifugus*	F, caves, buildings	C
Indiana bat - SE, FE	***Myotis sodalis***	**F, caves**	**R**
northern long-eared bat	*Myotis septentrionalis*	F, caves, buildings	U
silver-haired bat	*Lasionycteris noctivagans*	F, caves (hibernation)	U
eastern pipistrelle	*Pipistrellus subflavus*	F, caves	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 (edges)	C
Rodents	Rodentia		
eastern chipmunk	*Tamias striatus*	F	C
woodchuck	*Marmota monax*	G, F (edges)	C

Table 15. Continued

Common name[2]	Order *Species name*	Habitat[3]	Population status[4]
gray squirrel	*Sciurus carolinensis*	F, urban	C
fox squirrel	*Sciurus niger*	F	C
southern flying squirrel	*Glaucomys volans*	F	C
plains pocket gopher	*Geomys bursarius*	G	C?
beaver	*Castor canadensis*	W	C
deer mouse	*Peromyscus maniculatus*	G	C?
white-footed mouse	*Peromyscus leucopus*	F, G, W (mostly F)	C
prairie vole	*Microtus ochrogaster*	G	C
woodland vole	*Microtus pinetorum*	F	U
muskrat	*Ondatra zibethicus*	W	C
southern bog lemming	*Synaptomys cooperi*	G, W	U?
Norway rat *	*Rattus norvegicus*	buildings	C
house mouse *	*Mus musculus*	mostly buildings	C
meadow jumping mouse	*Zapus hudsonius*	G, F, W	U?
Carnivores	Carnivora		
coyote	*Canis latrans*	F, G, W	C
red fox	*Vulpes vulpes*	F, G, W	C
gray fox	*Urocyon cinereoargenteus*	F	U
raccoon	*Procyon lotor*	F, W, G	C
long-tailed weasel	*Mustela frenata*	F, W, G	C
mink	*Mustela vison*	W, G, F	C
badger	*Taxidea taxus*	G	U?
striped skunk	*Mephitis mephitis*	F, G, W	C
river otter - SE	***Lontra canadensis***	**W**	**R**
bobcat - ST	***Lynx rufus***	**F**	**R**
Even-toed ungulates	Artiodactyla		
white-tailed deer	*Odocoileus virginianus*	F, W, G	C

[1] Compiled from range maps and records reported in Hoffmeister (1989), the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997).

[2] Bold type indicates an Illinois endangered (SE), Illinois threatened (ST), and/or federally endangered (FE) species; * = introduced species.

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

[4] Population status: C = common, U = uncommon, R = rare, ? = uncertain. Subjective estimates based largely on experience of J. E. Hofmann and E. J. Heske in Illinois.

Forest

Typical Species

Mammal species known or likely to occur in the SPAA that are restricted to forested habitats are the hoary bat, eastern chipmunk, fox squirrel, southern flying squirrel, woodland vole, and gray fox. Species that are primarily associated with forests but also utilize other types of habitat include the red bat, silver-haired bat, gray squirrel, white-

footed mouse, raccoon, and white-tailed deer. The little brown bat, Indiana bat, big brown bat, northern long-eared bat, eastern pipistrelle, and evening bat forage in forested habitats, but roost in caves, abandoned mines, or buildings as well as trees. Some species, such as the eastern cottontail and woodchuck, specialize in the use of forest edges. Additional habitat generalists that would typically occur in forests in the SPAA are listed in Table 15.

Most species of mammals associated with forests are not restricted to a specific type of forest (i.e. upland forest or floodplain forest). Species that hibernate (e.g. woodchucks, eastern chipmunks) or are primarily fossorial (e.g. eastern moles, woodland voles) need well-drained, uninundated soils. The gray fox requires extensive forest cover and has become less common in parts of Illinois (Hoffmeister 1989). In the SPAA gray foxes may be largely restricted to the forested bluffs above the Mississippi River floodplain in Monroe County and the forested corridor along the Kaskaskia River. Gray squirrels require extensive tracts of mature forest with a dense understory, whereas fox squirrels can occupy open forests, woodlots, and fencerows (Hoffmeister 1989). Consequently, gray squirrel numbers have also declined in Illinois, although Nixon et al. (1978) considered the species common in Madison and Randolph counties as well as most of Monroe County. Gray squirrels also inhabit urban areas, including the SPAA cities of East St. Louis, Granite City, Collinsville, and Belleville (Nixon et al. 1978). Tree squirrels, flying squirrels, and chipmunks tend to be most abundant in forests containing large numbers of mast-producing trees such as oaks and hickories. Raccoons and opossums are most abundant in forest tracts in proximity to water (Hoffmeister 1989).

Threatened and Endangered Species

Fogelpole Cave in Monroe County is one of the most important hibernation sites for the federally endangered Indiana bat in Illinois (Illinois Department of Natural Resources 1997). The area around the main entrances to this cave system is a dedicated Illinois Nature Preserve (McFall and Karnes 1995) and the entrances have been gated to protect the hibernating bats. There are two historical records for this species from St. Clair County (Hoffmeister 1989). Five Indiana bats collected at Blue Pool Cave near Alton in November 1973 would have been hibernating and an individual collected on the Southern Illinois University campus in Edwardsville in early October 1968 was probably migrating. There are no summer records for the Indiana bat in the SPAA during the summer (Illinois Department of Natural Resources 1997, Gardner et al. 1996). A road-killed bobcat found near Sparta in Randolph County in 1995 is the only recent, confirmed record of this state-threatened species within the SPAA (Illinois Department of Natural Resources 1997). In 1982 a bobcat was killed by a police officer in Collinsville and earlier, unconfirmed sightings in Madison County were reported by trappers (Rhea 1982). In addition to these two listed species which occur or have been recorded recently within the SPAA, the federally endangered gray bat has been collected at two localities in Madison County north of the SPAA (Hoffmeister 1989). One specimen was obtained from a cave east of Elsah; several gray bats taken from the Alton sewer system in October 1968 were probably using it as a migratory resting site.

Habitat Requirements and Distribution of Listed Forest Species

Indiana bat — Indiana bats congregate in a limited number of caves and mines for hibernation, but are more widely dispersed during the summer (Barbour and Davis 1969). 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 (*Carya*) and in tree cavities (Cope et al. 1973; Humphrey et al. 1977; Gardner et al. 1991; Kurta et al. 1993a, 1993b, 1996; Callahan et al. 1997). Males and nonreproductive females may also roost in caves or abandoned mines during the summer. Roost trees used by this species have been located in both upland and floodplain forests; most are relatively large with a diameter at breast height of at least 30 cm (Gardner et al. 1991; Kurta 1993a, 1996; Callahan et al. 1997). Tree species that have been used by Indiana bat maternity colonies in Illinois are slippery elm, northern red oak, shagbark hickory, silver maple, cottonwood, post oak, bitternut hickory, white oak, American elm, sycamore, sweet pignut hickory, and green ash[1] (Gardner et al. 1991, Kurta et al. 1993a, Illinois Natural History Survey unpublished data). Indiana bats forage both in and along the edges of the canopy of floodplain and upland forests (Humphrey et al. 1977, LaVal et al. 1977, Brack 1983, Clark et al. 1987, Gardner et al. 1991). There are recent summer records for the Indiana bat in 23 counties in the southern two-thirds of Illinois (Gardner et al. 1996, Illinois Department of Natural Resources 1997). Indiana bats hibernate in several caves and abandoned mines in Illinois; the most significant hibernacula are mines in La Salle and Alexander counties, a cave in Jackson County, and Fogelpole Cave in Monroe County (Illinois Department of Natural Resources 1997). Although there are no summer records for the SPAA, bat surveys have been conducted at few sites in the region (Gardner et al. 1996) and forested habitat in Monroe and Randolph counties may provide potential summer habitat for this species.

Bobcat — Optimal habitat for bobcats in the Midwest would be rough or rolling terrain where large tracts of second-growth forest with dense underbrush were interspersed with open areas (e.g. clearings or successional fields), streams, and rock outcrops (Schwartz and Schwartz 1981, McCord and Cardoza 1982). Bobcats also inhabit floodplain forests along major rivers and swamps (Hoffmeister 1989). Rollings (1945) thought that key factors in bobcat habitat selection were prey abundance, protection from severe weather, the presence of suitable den sites, dense cover, and a lack of human disturbance. Small caves, rock crevices, rock piles, logs, stumps, hollow trees, dense thickets, and brush piles are used as resting sites and natal dens (Jackson 1961, Schwartz and Schwartz 1981, McCord and Cardoza 1982). Bobcats change resting sites frequently, except for females with young who occupy dens in inaccessible areas. Ledges also appear to be an important element of bobcat habitat; they serve as activity centers, especially during courtship, as well as providing protective cover (McCord and Cardoza 1982). Bobcats travel extensively while hunting and require large tracts of suitable habitat (Rollings 1945, McCord and Cardoza 1982). Males in Missouri had annual home ranges of 46 to 72 km^2 and female ranges covered 13 to 31 km^2 (Schwartz and Schwartz 1981). Rhea (1982) identified areas greater than 259 km^2 with more than 50% forest cover and good interspersion of open areas,

[1] Corresponding scientific names are given in Appendix 1

streams, and rocky terrain as optimal habitat for viable breeding populations of bobcats. According to these criteria, the best potential breeding habitat in Illinois is located in the Shawnee Hills region, along the lower Illinois River, and in the northwestern corner of the state. The Illinois Natural Heritage Database includes recent bobcat records from 32 counties, most of which are in southern and northwestern Illinois (Illinois Department of Natural Resources 1997). The Kaskaskia River corridor and forested bluffs in Monroe County provide the most suitable habitat for this species in the SPAA.

Gray bat — The gray bat is one of the few bat species that uses caves as both summer roost and hibernation sites (Decher and Choate 1995). Different caves are occupied during summer and winter, however, due to the different temperature requirements of maternity colonies and hibernating bats (Tuttle 1976a). Gray bats forage almost exclusively over rivers, streams, or lakes within 2 km of a cave (LaVal et al. 1977, Tuttle 1976b). This species may always have been uncommon in Illinois and there are recent records for only seven counties, mostly in the southern portion of the state (Illinois Department of Natural Resources 1997). Caves in the SPAA have the potential to be used by this species, although perhaps only during migration.

Information Gaps

Data on the distribution and population status of several forest-dwelling species in the SPAA are not available. Surveys should be conducted to determine the status of the bobcat and gray fox in the SPAA and to determine if Indiana bats occur in the area during the summer. There are few records for the northern long-eared bat, hoary bat, evening bat, and woodland vole in Madison, St. Clair, Monroe, and Randolph counties (Hoffmeister 1989); therefore, information on the distribution and abundance of these species in the SPAA would be of interest. The northern short-tailed shrew (an inhabitant of both forests and grasslands) has been collected in Madison and St. Clair counties which are on the edge of its range; in these counties its range overlaps that of the southern short-tailed shrew which has recently been recognized as a separate species (Hoffmeister 1989). It would be interesting to determine the distribution, habitat use, and relative abundance of these two species of short-tailed shrew in the SPAA. Because forest habitat in the SPAA is fragmented, it would be valuable to assess the ability of forest species to maintain viable populations and to disperse between forested tracts in an agricultural or urban landscape.

Prairie/Grassland

Typical Species

Mammal species restricted to grassland habitats that are known or likely to occur in the SPAA are the least shrew, plains pocket gopher, deer mouse, prairie vole, and badger. Other species strongly associated with grassland habitats include the southeastern shrew,

short-tailed shrews, eastern cottontail, woodchuck, southern bog lemming, and meadow jumping mouse. Additional habitat generalists of the SPAA that use grasslands are listed in Table 15.

Most mammals designated as grassland species are not restricted to native or undisturbed grasslands. Rather, the vegetative composition and structure of rights-of-way, hayfields, pastures, crop field edges, old fields, prairie restorations, and similar sites provide suitable habitat for many of these species. The southeastern shrew, meadow jumping mouse, and southern bog lemming generally prefer more mesic grasslands (Hoffmeister 1989). Eastern cottontails and woodchucks are most abundant where grassland habitat is adjacent to forested areas and can be considered edge species. The white-footed mouse which is a forest species can be found in grasslands if scattered trees or shrubs are present.

The plains pocket gopher is a species of the Great Plains that has a restricted range in Illinois. It occurs in a band running from the Mississippi River in St. Clair and Madison counties, east and south of the Illinois River, and south of the Kankakee River to the Indiana state line (Hoffmeister 1989). This species is almost entirely fossorial and requires well-drained, friable soils for burrowing. It occurs primarily along roadside and railroad embankments and in agricultural fields that are not deeply plowed, but its burrow systems also can extend into corn and soybean fields (Hoffmeister 1989; Hofmann, in litt.).

Threatened and Endangered Species

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

Information Gaps

Information is needed on the distribution and abundance of several grassland small mammals in the SPAA. There are no records for the southeastern shrew, deer mouse, or southern bog lemming in Madison, St. Clair, Monroe, and Randolph counties, the meadow jumping mouse has been collected at only one locality in these four counties, and the least shrew has been recorded only in Madison County (Hoffmeister 1989). Most specimens of the plains pocket gopher from the area were collected more than 40 years ago (University of Illinois Museum of Natural History Mammal Collection) so current information on the species distribution and abundance is lacking. The status of the badger in Illinois was investigated recently by Warner and Ver Steeg (1995) who documented its presence in Madison and St. Clair counties, but its population status in the SPAA should be determined more precisely. Although the red fox is not strictly a grassland species, it is most often associated with open habitats. There are suggestions that recent increases in the abundance of coyotes may have negatively affected populations of red fox and the status of the red fox in the SPAA should be evaluated. Several hill prairies occur in the SPAA. The persistence of grassland small mammal populations in these prairie remnants and the ability of small mammals to travel between such habitat islands should be investigated.

Wetland

Typical Species

Mammal species in the SPAA that require wetlands or aquatic habitats (lakes, ponds, streams, and rivers) are the beaver, muskrat, mink, and river otter. Beaver, muskrat, and river otter are highly specialized for aquatic life and need open water, whereas mink are more terrestrial but typically occur in proximity to water. Bats occurring in the SPAA would utilize wetlands as well as aquatic habitats for foraging. The southeastern shrew, short-tailed shrews, southern bog lemming, and meadow jumping mouse use emergent wetlands (marshes, sedge meadows, and wet meadows) extensively in addition to other types of habitats. Small mammals such as these are not adapted for aquatic life and occupy the vegetation along the edges of wetlands or sites where standing water is not present. Additional habitat generalists that use wetlands opportunistically are listed in Table 15.

Threatened and Endangered Species

A male river otter trapped along the Kaskaskia River southwest of New Athens in Monroe County during 1990 is the only record of this state endangered species for the SPAA (Illinois Department of Natural Resources 1997). This individual had been released by the Missouri Department of Conservation. Additional sightings of river otters have been reported within the area more recently (Bluett 1997); these sightings probably represent released otters (see below). There were earlier reports of river otters in the southern portion of Randolph County (1983 and 1990) and otter sign was found on Silver Creek in St. Clair County during 1981 (Anderson 1995).

Habitat Requirements and Distribution of Listed Wetland Species

River otter — River otters 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 they are 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 home range 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 to 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, except for females with pups in a den (Melquist and Hornocker 1983). In northwestern Illinois activity was concentrated along tributaries and narrow backwater channels of the Mississippi River during the summer (Anderson 1982) and in areas with access to open water during winter (Anderson and Woolf 1984). River otters may travel long distances, 160 km or more, in search of suitable habitat (Jackson 1961).

There are recent river otter records for at least 35 counties throughout Illinois (Illinois Department of Natural Resources 1997). The main breeding population of otters inhabits the backwaters and tributaries of the Mississippi River in northwestern Illinois (Anderson 1995). Smaller populations occur in the Cache and Big Muddy river systems in southern Illinois and the numbers of reports along the Rock River and the middle section of the Mississippi River have been increasing (Anderson 1995). Since 1994 the Illinois Department of Natural Resources has released river otters from Louisiana in the Kaskaskia, Wabash, and Illinois river systems. Two release sites in the Kaskaskia River system were relatively close to the SPAA: Shoal Creek near Litchfield and Carlyle Lake (Bluett 1997). River otter reintroduction programs also have been conducted in Missouri and Iowa. Released otters or their progeny could disperse into the SPAA and establish a population. The Kaskaskia River State Fish and Wildlife Area and Horseshoe Lake would provide the best habitat in the SPAA for river otters.

Information Gaps

Aquatic habitat within the SPAA should be monitored periodically for river otters. The presence of beavers is considered favorable for otters, but the impact of beaver populations on the physical structure of riparian systems in the SPAA should be evaluated. Numerous isolated wetlands occur in the SPAA and it would be interesting to determine if these wetlands are used by small mammal species other than those occupying surrounding habitat types and assess their ability to move between wetlands.

Enhancement and Restoration Potential

The preservation of upland and floodplain forests would enhance the suitability of the SPAA as habitat for a variety of forest-dwelling species, including the Indiana bat, bobcat, and gray fox. Indiana bats specifically need tracts of mature forest containing large snags. Preservation and restoration of riparian forests also is necessary for the SPAA to provide high-quality habitat for the river otter. Reduction of silt and chemical runoff into aquatic habitats and wetlands would maintain or enhance their ability to support river otter and mink.

Prairie restorations, coupled with the preservation of native prairie and other types of grassland habitats, would provide habitat for badger and red fox. Some of the hill prairies

in the SPAA have suffered encroachment by woody vegetation. Restoration of these areas could increase their suitability as habitat for grassland small mammals, although their isolation may limit the potential for recolonization by such species

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 Resources 1997), the Illinois Amphibian and Reptile Vouchered Database (an Illinois Natural History Survey computer database that contains information on Illinois specimens from museum, university, and private collections), unvouchered records from the literature, and unvouchered records taken from reliable biologists and naturalists. There has been a systematic survey of the amphibians and reptiles of a portion of the Sinkhole Plain Assessment Area (SPAA). Brandon and Ballard (1991) conducted a herpetological survey of Fults Hill Prairie Nature Preserve, Kidd Lake Marsh Natural Area, Prairie Du Rocher Herpetological Area, and Renault Herpetological Area in 1990 and 1991. The SPAA contains portions of four of Smith's (1961) eleven Herpetofaunal Divisions for the state; Lower Mississippi Border Division, Southern Division Woodlands, Sand Areas, and Prairie.

Amphibian and reptile species that are known or likely to occur in the SPAA are listed in Table 16. The 26 amphibian species and 44 reptile species in Table 16 represent 63% of the amphibian species and 72% of the reptile species of the State. The state threatened Illinois chorus frog *(Pseudacris streckeri illinoensis)*, the state threatened Great Plains rat snake *(Elaphe guttata emoryi)*, the state threatened coachwhip *(Masticophis flagellum)*, the state threatened timber rattlesnake *(Crotalus horridus)*, and the state endangered massasauga *(Sistrurus catenatus)* are known to exist in the SPAA. There is a 1957 record of the western hognose snake *(Heterodon nasicus)* from the SPAA, but its continued existence is doubtful.

There have been no reports of exotic reptile species in the SPAA.

When referring to the habitat designations in Table 16, keep in mind that 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. Some species require a combination of two habitat types throughout their life. For example, the Great Plains rat snake requires hill prairie, but individuals forage in both forests and grasslands. On the other hand, some species have narrower habitat requirements than the designations in Table 16 might suggest. For example, the Illinois chorus frog is listed as occurring in wetlands, but it is only found in fishless ponds with sandy substrates that are adjacent to sandy soils.

Table 16. Amphibian and reptile species known or likely to occur in the Sinkhole Plain Assessment Area with an indication of habitat preference and relative abundance.

Common Name[1,2]	Scientific Name[1,2]	Habitat[3]	Relative Abundance[4]
Amphibians			
spotted salamander	*Ambystoma maculatum*	F,W	U
marbled salamander	*Ambystoma opacum*	F,W	U
smallmouth salamander	*Ambystoma texanum*	F,W,P	C
tiger salamander	*Ambystoma tigrinum*	F,W,P,L	C
longtail salamander	*Eurycea longicauda*	F,R	U
cave salamander	*Eurycea lucifuga*	F	U
slimy salamander	*Plethodon glutinosus*	F	C
mudpuppy	*Necturus maculosus*	R	R
eastern newt	*Notophthalmus viridescens*	F,W,L	U
western lesser siren	*Siren intermedia*	W,L,R	U
American toad	*Bufo americanus*	U	C
Fowler's toad	*Bufo woodhousii fowleri*	U	C
cricket frog	*Acris crepitans*	W,L,R	C
Cope's gray treefrog	*Hyla chrysoscelis*	F,W	C
eastern gray treefrog	*Hyla versicolor*	F,W	C
spring peeper	*Pseudacris crucifer*	F,W,L	C
Illinois chorus frog-ST	***Pseudacris streckeri illinoensis***	**W**	**R**
western chorus frog	*Pseudacris triseriata*	F,W,L	C
eastern narrowmouth toad	*Gastrphryne carolinensis*	P,W	R
eastern spadefoot	*Scaphiopus holbrookii*	F,W	R
plains leopard frog	*Rana blairi*	F,P,R,W	U
bullfrog	*Rana catesbeiana*	U	C
green frog	*Rana clamitans*	F,W,R	C
pickerel frog	*Rana palustris*	F,W	U
southern leopard frog	*Rana sphenocephala*	F,W,L	C
wood frog	*Rana sylvatica*	F,W	U
Reptiles			
snapping turtle	*Chelydra serpentina*	W,L,R	C
painted turtle	*Chrysemys picta*	W,L,R	C
map turtle	*Graptemys geographica*	R	C
Ouachita map turtle	*Graptemys ouachitensis*	R	C
false map turtle	*Graptemys pseudogeographica*	R	C
eastern box turtle	*Terrapene carolina*	F,P,R	C
ornate box turtle	*Terrapene ornata*	P	U
red-eared slider	*Trachemys scripta*	W,L,R	C
common musk turtle	*Sternotherus odoratus*	L,R,W	C
spiny softshell turtle	*Apalone spinifera*	W,L,R	C
slender glass lizard	*Ophisaurus attenuatus*	P,C	R
eastern fence lizard	*Sceloporus undulatus*	F,P	C
five-lined skink	*Eumeces fasciatus*	F,P	C
broadhead skink	*Eumeces laticeps*	F,P	C
ground skink	*Scincella lateralis*	F	U
six-lined racerunner	*Cnemidophorus sexlineatus*	P	U
worm snake	*Carphophis amoenus*	F,P	U

Table 16. Continued.

Common Name[1,2]	Scientific Name[1,2]	Habitat[3]	Relative Abundance[4]
racer	*Coluber constrictor*	U	C
ringneck snake	*Diadophis punctatus*	F,P	U
Great Plains rat snake-ST	***Elaphe guttata emoryi***	**F,P**	**R**
black rat snake	*Elaphe obsoleta*	F,W,P	C
fox snake	*Elaphe vulpina*	W,P,C	R
eastern hognose snake	*Heterodon platirhinos*	F,W,P	U
prairie kingsnake	*Lampropeltis calligaster*	P	C
speckled kingsnake	*Lampropeltis getula*	F,P	U
milk snake	*Lampropeltis triangulum*	F,P	U
coachwhip snake-ST	***Masticophis flagellum***	**F,P**	**R**
plainbelly water snake	*Nerodia erythrogaster*	W,R,L	C
diamondback water snake	*Nerodia rhombifer*	W,R,L	C
northern water snake	*Nerodia sipedon*	W,R,L	C
rough green snake	*Opheodrys aestivus*	F	U
bullsnake	*Pituophis catenifer*	P	U
Graham's crayfish snake	*Regina grahamii*	W,L	U
brown snake	*Storeria dekayi*	U	C
redbelly snake	*Storeria occipitomaculata*	F,P	U
flathead snake	*Tantilla gracilis*	F,P	R
western ribbon snake	*Thamnophis proximus*	F,P,W,R	U
plains garter snake	*Thamnophis radix*	P	U
common garter snake	*Thamnophis sirtalis*	U	C
lined snake	*Tropidoclonion lineatum*	F,P	R
earth snake	*Virginia valeriae*	F	U
copperhead	*Agkistrodon contortrix*	F,P	C
timber rattlesnake-ST	***Crotalus horridus***	**F,P**	**R**
eastern massasauga-SE	***Sistrurus catenatus***	**P,W**	**R**

[1] Nomenclature follows Collins (1990) unless noted.
[2] Bold type indicates an Illinois endangered (SE) or Illinois threatened (ST) species.
[3] F = forest W = wetland P = prairie and savanna L = lakes, ponds, impoundments R = rivers & creeks C = cultural U = ubiquitous (all habitats)
[4] C = common U = uncommon R = rare ? = status uncertain

Forest

Typical Species

Amphibian species of the SPAA that are typical of forested habitats include both species of gray treefrog and the slimy salamander. As outlined above, some amphibians also require aquatic habitats for breeding. The gray treefrogs breed in forested wetlands and upland forested ponds. The slimy salamander is one of the few Illinois amphibians that lays terrestrial eggs that do not require an aquatic environment. Among the reptiles of the SPAA, the black rat snake and five-lined skink are typical of forested areas.

Endangered and Threatened Species

The state threatened timber rattlesnake usually occupies three distinct habitats: heavily forested areas for foraging (summer), south or west facing rock outcrops or talus slides containing deep cracks and fissures for denning (fall to mid-spring), and more open woods, fields and other disturbed habitats when moving between these two habitats (fall and spring). In addition, gravid females may occupy rocky open sites close to the den for gestation and birthing (summer). The activity period in Illinois is probably late April to October. The biggest threats the continued existence of the timber rattlesnake in the SPAA are indiscriminate killing and habitat fragmentation.

The status of the timber rattlesnake in the SPAA is not known. Rattlesnakes have been collected and reported within the boundaries of the SPAA within the last five years, but the stability of the populations is not known. Historically, the timber rattlesnake probably inhabited the Mississippi River bluffs throughout the Assessment Area, but indiscriminate killing and deforestation have resulted in fragmentation and isolation of the remaining populations.

Enhancement and Restoration Potential

Maintaining small, temporary, fishless ponds in forests of the SPAA would benefit many of the reptiles and amphibians of the SPAA 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 SPAA and the state. The tiger salamander, American toad, gray treefrog, and southern leopard frog are among the amphibians that breed in this habitat. The black rat snake, brown snake, and northern water snake would benefit from restoration or creation of woodland ponds.

Wetland

Typical Species

Amphibian species of the SPAA that are typical of wetland habitats include the green frog and southern leopard frog. In addition, all of the amphibians found in the SPAA require some type of aquatic habitat for breeding and most breed in wetlands. Among the reptiles of the SPAA, the painted turtle and common garter snake are typical of wetlands.

Enhancement and Restoration Potential

In the SPAA many of the wetlands associated with sinkholes are isolated from natural habitat by development or agriculture. Most of these wetlands occur in upland situations, and as mentioned above upland wetlands are extremely rare in Illinois and the Midwest in general. They can be an important breeding habitat for many amphibians and an important

source of prey items for many reptiles. Even very small, temporary, sinkhole wetlands in the SPAA are important habitat components. Species such as the plains leopard frog, western chorus frog, and American toad can often utilize small, seemingly isolated wetlands. These species have excellent dispersal abilities and can move from wetland to wetland across inhospitable terrain such as agricultural fields and vacant lots. For most amphibians, however, agricultural fields and vacant lots are barriers to dispersal. For these species to persist in the landscape, small wetlands must be connected to other wetlands by corridors of natural vegetation. For this reason, mowing in the vicinity of sinkhole wetlands should be avoided whenever possible. Grassy filter strips should be planted and greenways developed that connect otherwise isolated sinkhole wetlands.

Prairie/Grassland

Typical Species

Of the amphibian species listed in Table 16, Fowler's toad and the western chorus frog are typical of prairie habitats in the SPAA. These species have a short larval period and therefore can breed in more temporary aquatic habitats such as flooded fields and ditches. Reptile species in the SPAA that are typical of prairie habitats include the prairie kingsnake and plains garter snake. Both of these snakes can tolerate disturbed habitats such as mowed right-of-way, pasture, oldfield, and agricultural edge.

Endangered and Threatened Species

The following endangered or threatened species are found in prairie habitats in the SPAA, but all are limited to prairie habitats associated with either sandy substrate (sand prairies) or bluff tops with rock outcrops (hill prairies).

Illinois chorus frog—This small, chubby frog is restricted to sand substrates where it can burrow down into the soil. This frog originally inhabited sand prairie but because this habitat has been greatly reduced in Illinois, these frogs have been reduced to wet areas near agricultural fields where sand prairies were once common. It is seldom seen above ground except during the late winter and early spring breeding season when it can be heard chorusing from a variety of aquatic habitats, including sand ponds, flooded fields, roadside ditches, and marshes. This frog spends most of its life underground, coming to the surface only for a few weeks in March and April to breed. Unlike other fossorial frogs and toads, the Illinois chorus frog digs with its stout front limbs. The breeding call is a quick series of high-pitched whistles. The eggs are laid in small bunches attached to twigs and branches below the water's surface. Hatching occurs in a few days and transformation is complete in about two months. Their diet consists of small insects which they can capture and eat underground. Threats to this species include cultivation and degradation of sand areas and draining of sand ponds. In the SPAA, the Illinois chorus frog is known from the extreme northern boundary, near Edwardsville, as well as in the American Bottoms floodplain in Monroe County.

Great plains rat snake—This constrictor is commonly found around hill prairies, their associated open forests, and rocky glades and ledges. They are secretive and largely nocturnal. During the day they may be found under the cover of rock slabs or surface debris. At night they can be found in the open foraging for small mammals. One of the biggest threats to this species in the SPAA is mortality on the roads surrounding Fults Hill Prairie (Brandon and Ballard 1991). In the SPAA, the Great Plains rat snake is known from the bluffs along the Mississippi River from approximately Fults to Renault.

Massasauga—This venomous snake prefers wet prairie areas with heavy grass cover or floodplain forest adjacent to open fields. In the SPAA, the only known massasauga population is associated with the small area of sandy soils in the northern portion of the area. The activity period in northern Illinois is probably mid-April to October. In some parts of their range, massasaugas move from moist prairie conditions to drier habitats in the spring. Massasaugas are often found in association with crayfish burrows which they use for shelter and hibernation. They may also overwinter in mammal burrows, old tree stumps, and rock crevices. They apparently do not hibernate with other snake species. In the SPAA, the massasauga is known only from one location east of Horseshoe Lake.

Coachwhip snake—This large, slender snake is restricted to the vicinity of Fults in Monroe County where it inhabits hill prairies, their associated open forests, and rocky glades and ledges. The coachwhip is quick and therefore is seldom observed, even in areas where it is known to be abundant. In the SPAA, the coachwhip is known from the bluffs along the Mississippi River from approximately Fults to Renault.

Enhancement and Restoration Potential

At least some of the hill prairies of the SPAA have been under management for several years and are therefore in good shape as far as amphibians and reptiles are concerned. One of the biggest management issues associated with the hill prairies of the SPAA is the number of amphibians and reptiles that are killed by motor vehicles as they migrate from the bluffs to the wetlands of the Mississippi River floodplain.

On the other hand, the small sand prairies of the northern SPAA have been severely degraded and are in desperate need of restoration and management. If the massasauga and Illinois chorus frog are to remain a part of the fauna of the SPAA, these sand habitats must be protected.

Lakes, Ponds, and Impoundments

Typical Species

Of the amphibian species listed in Table 16, the bullfrog and cricket frog are typical of lakes, ponds, and impoundments in the SPAA. Both of these species have developed

strategies for coexisting with fish and are usually more widely distributed than other amphibians. Among the reptiles of the SPAA the snapping turtle, painted turtle, common garter snake, and northern water snake are typical of lakes, ponds, and impoundments.

Enhancement and Restoration Potential

Restoration of fishless, forested ponds in upland areas would benefit the tiger salamander and gray treefrogs. Leaving at least part of the shore around ponds, lakes and impoundments unmowed is vital for most amphibians because it provides cover and refuge from predators. Developing forest or grassland connections among ponds, lakes, and impoundments in the SPAA would benefit a variety of amphibians and reptiles. By connecting the various ponds and lakes with each other and with larger blocks of natural vegetation, the effects fragmentation and small population size can be lessened. If individuals can move among ponds, this makes the whole complex of ponds effectively one large habitat. Restoration of wetlands, especially ponds in sand prairies, would benefit a variety of amphibians and reptiles in the SPAA, most importantly the Illinois chorus frog.

Creeks and Rivers

Typical Species

The cricket frog and green frog are typical of creeks and small rivers in the SPAA, while the mudpuppy is a typical inhabitant of the Mississippi River. Among the reptiles of the SPAA, the northern water snake is typical of creeks and small rivers while the snapping turtle, map turtle, and spiny softshell turtle are typical of the Mississippi and Kaskaskia Rivers.

Enhancement and Restoration Potential

Restoring the riparian zone and associated floodplain forests and wetlands along the Mississippi and lower Kaskaskia rivers would benefit a variety of amphibians and reptiles.

Cultural

Typical Species

Of the amphibian species listed in Table 16, the American toad, western chorus frog, and bullfrog are typical of cultural habitats in the SPAA. These species can be found in cropland, pasture, successional field, developed land, and tree plantations providing that adequate breeding sites (ditches, flooded fields, stock tanks, remnant marshes) are present. Among the reptiles of the SPAA, the common garter snake, brown snake, and northern water snake are typical of cultural habitats in the SPAA.

Enhancement and Restoration Potential

Small stock ponds and farm ponds can provide important breeding sites for amphibians of the SPAA if the ponds are fishless. Most of these ponds are not capable of supporting sport fisheries so this does not present a conflict between amphibian conservation and recreation opportunities. Because the species listed above are not sensitive to moderate habitat fragmentation, they can maintain viable populations in small, remnant patches of natural habitat. For example, the American toad, western chorus frog, and bullfrog do well in patches of cattail marsh under one acre, even when the marsh is surrounded by developed land. It is always best to strive for larger size and connectivity of habitat , but the utility of these smaller areas should not be underestimated. It is important to leave a moderate buffer of unmowed grass around these habitats.

Overall Habitat Quality and Current Management Concerns

Overall, opportunities for amphibians and reptiles in the SPAA are fair. Compared to presettlement, the present landscape of the SPAA lacks a significant amount of floodplain forest and the extensive wetlands of the American Bottoms have been destroyed or degraded.

The most critical amphibian and reptile management concerns for the SPAA Partnership are restoration of the riparian zone and backwater sloughs along the lower Kaskaskia River and Mississippi rivers and reducing the mortality caused by vehicles along the Mississippi River bluffs. Intact riparian zones may act as dispersal corridors for many amphibians and reptiles, thus reducing the effects of habitat fragmentation. In addition, natural habitats in the SPAA are typically found in small patches separated from each other by agricultural or developed land and this will continue as development pressure mounts. Habitat connectedness is important for amphibians because they usually travel long distances between their breeding and non-breeding 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 from lowland foraging areas to upland retreats for winter hibernation.

Aquatic Biota

Introduction

The Sinkhole Plain Assessment Area (SPAA) contains portions of the Mississippi River, the lower Kaskaskia River, and numerous tributaries and springs. It includes portions of four counties: Madison, Monroe, Randolph, and St. Clair.

The Sinkhole Plain in southwestern Illinois includes approximately 10,000 sinkholes and numerous caves and springs (Frankie et al. 1997). Sinkholes are common in this area because of the unstable thick loess soil and easily dissolved limestone bedrock beneath. The majority of the sinkholes are in Monroe County, but southern St. Clair County and northern Randolph County are also part of the sinkhole plain.

The Kaskaskia River rises six miles northwest of Champaign-Urbana in the Champaign morainic system (Page et al. 1992). It flows southwesterly across the state for 270 miles and empties into the Mississippi River in Randolph County near Chester. The width of the river ranges from a drainage ditch in Champaign County to 500 feet in Randolph County. The substrate is primarily sand and gravel with little mud. However, the river has a heavy silt load due to farming operations within the rivers extensive tributary system. Two major impoundments, Shelbyville Reservoir and Carlyle Reservoir, have transformed long stretches of the river that formerly consisted of pool and riffle habitats into standing-water habitats.

The portion of the Kaskaskia River included in the SPAA extends from Fayetteville in St. Clair County to the mouth of the river. In the early 1970's the lowermost 50 miles of natural river were converted to a 36 mile straight navigation channel. A lock and dam just upstream of the mouth impedes the natural flow of the river. During periods of low water in St. Clair and Randolph counties, the bottom is often covered with a layer of fine silt as much as a foot deep that overlays a bed of hard-packed sand and gravel. Shoreline habitat in the navigation channel is limited to artificailly placed riprap, but considerable amounts of woody debris persist in oxbow channel remnants which remain connected to the river at their lower ends.

In addition to the lands drained by the Kaskaskia River and its tributaries, this region includes areas in Monroe and Randolph counties that are drained by small streams flowing directly into the Mississippi River. Pollution from agricultural operations, oil fields, coal mines, and a chemical plant are problems in this area.

The Mississippi River from below the mouth of the Missouri River to the mouth of the Kaskaskia River has a predominately sandy substrate occasionally interrupted by gravel or

boulder riffles along shallow shoreline areas and muddy backwaters. Domestic and industrial pollution is a problem below the major municipalities along the Mississippi River (Page et al. 1992).

Statewide Comparison of Aquatic Biota

The SPAA supports a large diversity of aquatic species. Known from the basin are 95 species of fishes, 29 species of native freshwater mussels, and 17 species of malacostracans (large crustaceans). Some species have disappeared from the drainage in recent decades; however, with improvements in water quality, species that have been extirpated could return and natural communities could become reestablished in areas where they have been eliminated or altered.

The SPAA also supports a moderate diversity of aquatic macroinvertebrates. The only recent survey for aquatic macroinvertebrates conducted within the SPAA was that of Webb et al. (1996, 1998a). Although that study was limited in scope to fauna associated with 10 springs and their springbrooks in Monroe and St. Clair counties, many of the taxa collected during that study represented new records for the counties from which they were collected.

Common Species

Ninety-five species of fishes are known from the SPAA (Tables 17 and 18). Common fishes in the large rivers are gizzard shad, carp, emerald shiners, river shiners, smallmouth buffalos, channel catfish, largemouth bass, white bass, white and black crappies, and freshwater drum. Common fishes in smaller streams include creek chubs, red shiners, sand shiners, central stonerollers, bluntnose minnows, white suckers, green sunfish, bluegills, and johnny darters.

Twenty-nine species of native freshwater mussels have been reported from this region (Tables 19 and 20). However, the fauna of the Mississippi River is very different from the other streams in the Assessment Area. Common species found in the Mississippi River include the pink papershell, giant floater, and fragile papershell. The common mussels in the lower Kaskaskia River include the washboard, mapleleaf, and yellow sandshell (Cummings and Mayer 1997, Illinois Natural History Survey Mollusk Collection data). Very little collecting has been done in this region in the past 20 years and we have almost no data on the mussel fauna of streams exclusive of the Kaskaskia and Mississippi rivers.

Seventeen species of crayfishes, isopods, and amphipods are found in the region (Tables 21 and 22). The most common crayfishes are the virile crayfish, which usually is found over rocky substrates or around woody debris or vegetation, and the calico crayfish, which is found in stream pools. In streams, the most common isopod is *Caecidotea intermedia*, which lives in rocky areas and on woody debris. The most common amphipods are *Hyalella azteca*, which is found on vegetation, usually filamentous algae growing on rocks

or logs, and *Gammarus pseudolimnaeus*, which lives in spring-fed headwaters. In springs and caves, the common isopod is *Caecidotea brevicauda*, and the common amphipod is *Gammarus minus*.

Table 23 lists aquatic macroinvertebrate taxa known or thought likely to occur in the SPAA. Records for species included in Table 23 have been obtained from the following sources: Malloch (1915a, b), Frison (1935), Ross (1944, 1947), Burks (1953), Wooldridge (1967), Lauck (1959), Pechuman et al. (1983), Wetzel (1992), Taylor (1996), Webb et al. (1993, 1996, 1998a, 1998b), and the Illinois Natural History Survey Insect and Annelida Collections.

Although many of the species listed in Table 23 are known to occur in both standing and running water, the paucity of accessible historical records and the limited recent information for taxa known to occur within the SPAA make it difficult to associate most taxa with specific habitat types, such as headwaters, larger streams, small or medium reaches of rivers, or with standing water habitats such as ponds, lakes, and reservoirs. Exceptions to this are the taxa noted by "++" in Table 23 - those known to occur in the SPAA that, to date, have been collected only from spring, springbrook, or cavespring habitats.

Table 17. Freshwater fishes recorded from the Sinkhole Plain Assessment Area[1].

FAMILY Scientific Name[2,3,4]	Common Name	Headwaters	Creeks	Small Rivers	Med. & Lg. Rivers	Standing Water
PETROMYZONTIDAE						
Ichthyomyzon castaneus	chestnut lamprey			X	X	
Ichthyomyzon unicuspis	silver lamprey				X	
ACIPENSERIDAE						
Scaphirhynchus platorynchus	shovelnose sturgeon				X	
POLYODONTIDAE						
Polyodon spathula	paddlefish				X	
LEPISOSTEIDAE						
Lepisosteus oculatus	spotted gar				X	X
Lepisosteus osseus	longnose gar				X	
Lepisosteus platostomus	shortnose gar				X	
AMIIDAE						
Amia calva	bowfin				X	X
HIODONTIDAE						
Hiodon alosoides	goldeye				X	
Hiodon tergisus	mooneye				X	
ANGUILLIDAE						
Anguilla rostrata	American eel				X	
CLUPEIDAE						
Alosa alabamae	Alabama herring				X	
Alosa chrysochloris	skipjack herring				X	
Dorosoma cepedianum #	gizzard shad			X	X	X
Dorosoma petenense	threadfin shad				X	X

Table 17. Continued.

FAMILY *Scientific Name*[2,3,4]	Common Name	Headwaters	Creeks	Small Rivers	Med. & Lg. Rivers	Standing Water
CYPRINIDAE						
Campostoma anomalum #	central stoneroller	X	X	X		
Carassius auratus *	goldfish		X	X	X	
Ctenopharyngodon idella *	grass carp				X	
Cyprinella lutrensis #	red shiner		X	X	X	
Cyprinus carpio * #	common carp			X	X	X
Ericymba buccata	silverjaw minnow		X	X	X	
Erimystax x-punctatus	gravel chub				X	
Hybognathus argyritis	western silvery minnow				X	
Hybognathus nuchalis	Mississippi silvery minnow		X	X	X	
Hybognathus placitus	plains minnow				X	
Lythrurus umbratilis	redfin shiner		X	X	X	
Macrhybopsis aestivalis	speckled chub				X	
Macrhybopsis meeki	sicklefin chub				X	
Macrhybopsis storeriana	silver chub				X	
Notemigonus crysoleucas	golden shiner			X	X	X
Notropis atherinoides #	emerald shiner				X	
Notropis blennius #	river shiner				X	
Notropis boops-SE	**bigeye shiner**		**X**	**X**		
Notropis buchanani	ghost shiner			X	X	
Notropis dorsalis	bigmouth shiner		X	X	X	
Notropis hudsonius	spottail shiner				X	
Notropis ludibundus #	sand shiner		X	X	X	
Notropis nubilus	Ozark minnow		X	X		
Notropis shumardi	silverband shiner				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	
Platygobio gracilis	flathead chub				X	
Semotilus atromaculatus #	creek chub	X	X			
CATOSTOMIDAE						
Carpiodes carpio	river carpsucker			X	X	
Carpiodes cyprinus	quillback		X	X	X	
Catostomus commersoni #	white sucker		X	X	X	
Erimyzon oblongus	creek chubsucker	X	X	X		
Ictiobus bubalus #	smallmouth buffalo				X	
Ictiobus cyprinellus	bigmouth buffalo				X	
Ictiobus niger	black buffalo				X	
Moxostoma anisurum	silver redhorse			X	X	
Moxostoma erythrurum	golden redhorse		X	X	X	
Moxostoma macrolepidotum	shorthead redhorse			X	X	
ICTALURIDAE						
Ameiurus melas	black bullhead		X	X	X	X

Table 17. Continued.

FAMILY *Scientific Name*[2,3,4]	Common Name	Headwaters	Creeks	Small Rivers	Med. & Lg. Rivers	Standing Water
Ameiurus natalis	yellow bullhead		X	X	X	X
Ictalurus furcatus	blue catfish				X	
Ictalurus punctatus #	channel catfish			X	X	X
Noturus exilis	slender madtom		X	X		
Noturus flavus	stonecat		X	X		
Noturus gyrinus	tadpole madtom		X	X		
Noturus nocturnus	freckled madtom		X	X		
Pylodictis olivaris	flathead catfish			X	X	X
ESOCIDAE						
Esox americanus	grass pickerel	X	X	X		X
APHREDODERIDAE						
Aphredoderus sayanus	pirate perch		X			
ATHERINIDAE						
Labidesthes sicculus	brook silverside			X	X	X
MUGILIDAE						
Mugil cephalus	striped mullet				X	
FUNDULIDAE						
Fundulus notatus	blackstripe topminnow		X	X	X	
POECILIIDAE						
Gambusia affinis	mosquitofish	X	X			X
COTTIDAE						
Cottus carolinae	banded sculpin	X	X			
MORONIDAE						
Morone chrysops #	white bass			X	X	
Morone mississippiensis	yellow bass		X	X	X	X
CENTRARCHIDAE						
Ambloplites rupestris	rock bass		X	X	X	
Lepomis cyanellus #	green sunfish		X	X	X	X
Lepomis gulosus	warmouth		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	
Micropterus punctatus	spotted bass		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
PERCIDAE						
***Ammocrypta clara*-SE**	**western sand darter**				**X**	**X**
Etheostoma asprigene	mud darter		X	X	X	
Etheostoma chlorosomum	bluntnose darter		X	X	X	
Etheostoma gracile	slough darter		X	X		
Etheostoma nigrum #	johnny darter	X	X	X	X	
Etheostoma spectabile	orangethroat darter	X	X	X		
Percina caprodes	logperch		X	X	X	
Percina phoxocephala	slenderhead darter		X	X	X	

Table 17. Continued.

FAMILY *Scientific Name*[2,3,4]	Common Name	Headwaters	Creeks	Small Rivers	Med. & Lg. Rivers	Standing Water
Percina shumardi	river darter				X	
Stizostedion canadense	sauger			X	X	
SCIAENIDAE						
Aplodinotus grunniens #	freshwater drum			X	X	

[1] Data from the Illinois Natural History Survey Fish Collection.
[2] Bold type indicates an Illinois endangered (SE) species.
[3] * = introduced species; # = common species.
[4] Total number of species = 95 (92 native, 3 introduced).

Table 18. Freshwater fishes recored from the Sinkhole Plain Assessment Area, by habitat[1].

FAMILY Scientific Name[2,3,4]	Common Name	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
PETROMYZONTIDAE						
Ichthyomyzon castaneus	chestnut lamprey	X	X			
Ichthyomyzon unicuspis	silver lamprey	X	X			
ACIPENSERIDAE						
Scaphirhynchus platorynchus	shovelnose sturgeon		X	X		
POLYODONTIDAE						
Polyodon spathula	paddlefish			X		X
LEPISOSTEIDAE						
Lepisosteus oculatus	spotted gar			X	X	X
Lepisosteus osseus	longnose gar				X	
Lepisosteus platostomus	shortnose gar		X		X	X
AMIIDAE						
Amia calva	bowfin			X	X	
HIODONTIDAE						
Hiodon alosoides	goldeye		X	X		
Hiodon tergisus	mooneye		X	X		
ANGUILLIDAE						
Anguilla rostrata	American eel		X	X		
CLUPEIDAE						
Alosa alabamae	Alabama shad		X	X		
Alosa chrysochloris	skipjack herring		X	X		
Dorosoma cepedianum #	gizzard shad		X			X
Dorosoma petenense	threadfin shad		X	X		
CYPRINIDAE						
Campostoma anomalum #	central stoneroller	X	X			
Carassius auratus *	goldfish		X	X		
Ctenopharyngodon idella *	grass carp		X	X		
Cyprinella lutrensis #	red shiner		X	X		
Cyprinus carpio * #	common carp			X	X	
Ericymba buccata	silverjaw minnow		X	X		
Erimystax x-punctatus	gravel chub	X	X			

Table 18. Continued.

FAMILY *Scientific Name*[2,3,4]	Common Name	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
Hybognathus argyritis	western silvery minnow		X	X		
Hybognathus nuchalis	Mississippi silvery minnow		X	X		
Hybognathus placitus	plains minnow		X	X		
Lythrurus umbratilis	redfin shiner		X	X		
Macrhybopsis aestivalis	speckled chub		X	X		
Macrhybopsis meeki	sicklefin chub		X			
Macrhybopsis storeriana	silver chub			X		
Notemigonus crysoleucas	golden shiner			X	X	X
Notropis atherinoides #	emerald shiner			X		
Notropis blennius #	river shiner		X	X		
***Notropis boops* - SE**	**bigeye shiner**			**X**		
Notropis buchanani	ghost shiner			X		
Notropis dorsalis	bigmouth shiner		X	X		
Notropis hudsonius	spottail shiner			X	X	X
Notropis ludibundus #	sand shiner		X	X		
Notropis nubilus	Ozark minnow		X	X		
Notropis shumardi	silverband shiner		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		
Platygobio gracilis	flathead chub		X	X		
Semotilus atromaculatus #	creek chub			X		
CATOSTOMIDAE						
Carpiodes carpio	river carpsucker		X	X		
Carpiodes cyprinus	quillback		X	X		
Catostomus commersoni #	white sucker		X	X		
Erimyzon oblongus	creek chubsucker		X	X		
Ictiobus bubalus #	smallmouth buffalo			X		
Ictiobus cyprinellus	bigmouth buffalo			X		
Ictiobus niger	black buffalo			X		
Moxostoma anisurum	silver 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 furcatus	blue catfish		X	X		
Ictalurus punctatus #	channel catfish		X	X	X	
Noturus exilis	slender madtom	X	X			
Noturus flavus	stonecat	X				
Noturus gyrinus	tadpole madtom		X	X		
Noturus nocturnus	freckled madtom		X	X		
Pylodictis olivaris	flathead catfish			X	X	

Table 18. Continued.

FAMILY *Scientific Name*[2,3,4]	Common Name	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
ESOCIDAE						
Esox americanus	grass pickerel			X	X	
APHREDODERIDAE						
Aphredoderus sayanus	pirate perch			X		
MUGILIDAE						
Mugil cephalus	striped mullet		X	X		
ATHERINIDAE						
Labidesthes sicculus	brook silverside			X	X	X
FUNDULIDAE						
Fundulus notatus	blackstripe topminnow			X		
POECILIIDAE						
Gambusia affinis	mosquitofish			X	X	
COTTIDAE						
Cottus carolinae	banded sculpin	X				
MORONIDAE						
Morone chrysops #	white bass			X		
Morone mississippiensis	yellow bass			X	X	
CENTRARCHIDAE						
Ambloplites rupestris	rock bass			X		
Lepomis cyanellus #	green sunfish			X		X
Lepomis gulosus	warmouth			X	X	
Lepomis humilis	orangespotted sunfish			X		
Lepomis macrochirus #	bluegill			X	X	
Lepomis megalotis	longear sunfish			X		
Micropterus punctatus	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 clara* - SE**	**western sand darter**		**X**			
Etheostoma asprigene	mud darter	X		X		
Etheostoma chlorosomum	bluntnose darter			X	X	
Etheostoma gracile	slough darter			X		
Etheostoma nigrum #	johnny darter		X	X		
Etheostoma spectabile	orangethroat darter	X		X		
Percina caprodes	logperch		X	X		
Percina phoxocephala	slenderhead darter	X	X			
Percina shumardi	river darter	X				
Stizostedion canadense	sauger			X		
SCIAENIDAE						
Aplodinotus grunniens #	freshwater drum			X		

[1] Data from the Illinois Natural History Survey Fish Collection.
[2] Bold type indicates an Illinois endangered (SE) species.
[3] * = introduced species; # = common species.
[4] Total number of species = 95 (92 native, 3 introduced).

Table 19. Freshwater mussels recorded from the Sinkhole Plain Assessment Area .[1]

ORDER Subfamily *Scientific Name*[2,3,4]	Common Name	Headwaters/ Creeks	Small Rivers	Medium Rivers	Standing Water
UNIONIDAE					
Anodontinae					
Anodonta suborbiculata	flat floater				X
Arcidens confragosus	rock-pocketbook			X	
Lasmigona complanata	white heelsplitter	X	X	X	X
Pyganodon grandis #	giant floater	X	X	X	X
Strophitus undulatus	squawfoot		X	X	X
Utterbackia imbecillis	paper pondshell		X	X	X
Ambleminae					
Amblema plicata	threeridge		X	X	
***Elliptio dilatata* - ST**	**spike**		**X**	**X**	
***Fusconaia ebena* - ST**	**ebonyshell**			**X**	
Fusconaia flava	Wabash pigtoe		X	X	
Megalonaias nervosa	washboard			X	
Quadrula metanevra #	monkeyface			X	
Quadrula nodulata	wartyback			X	
Quadrula pustulosa	pimpleback		X	X	
Quadrula†quadrula #	mapleleaf		X	X	
Tritogonia verrucosa	pistolgrip		X	X	
Uniomerus tetralasmus	pondhorn	X	X		X
Lampsilinae					
***Ellipsaria lineolata* - ST**	**butterfly**			**X**	
Lampsilis cardium	plain pocketbook		X	X	
Lampsilis teres #	yellow sandshell		X	X	
Leptodea fragilis #	fragile papershell		X	X	
Ligumia recta	black sandshell			X	
Obliquaria reflexa	threehorn wartyback			X	
Obovaria olivaria	round hickorynut			X	
Potamilus alatus	pink heelsplitter		X	X	
Potamilus ohiensis #	pink papershell		X	X	
Toxolasma parvus	lilliput	X	X	X	X
Truncilla donaciformis	fawnsfoot			X	
Truncilla truncata	deertoe			X	
CORBICULIDAE					
Corbicula fluminea *	Asian clam	X	X	X	X

[1] Data from the Illinois Natural History Survey Mollusk Collection.
[2] Bold type indicates an Illinois threatened (ST) species.
[3] * = introduced species; # = common species.
[4] Total number of species = 30 (29 native, 1 introduced).

Table 20. Freshwater mussels recorded from the Sinkhole Plain Assessment Area, by habitat.[1]

FAMILY Subfamily *Scientific Name*[2,3,4]	Common Name	Streams			Standing Water
		Riffles	Runs	Pools	Littoral Zone
UNIONIDAE					
Anodontinae					
Anodonta suborbiculata	flat floater			X	X
Arcidens confragosus	rock-pocketbook		X	X	
Lasmigona complanata	white heelsplitter		X	X	X
Pyganodon grandis #	giant floater		X	X	X
Strophitus undulatus	squawfoot		X	X	X
Utterbackia imbecillis	paper pondshell		X	X	X
Ambleminae					
Amblema plicata	threeridge	X	X	X	
***Elliptio dilatata* - ST**	**spike**	**X**	**X**		
***Fusconaia ebena* - ST**	**ebonyshell**	**X**	**X**		
Fusconaia flava	Wabash pigtoe	X	X		
Megalonaias nervosa #	washboard	X	X	X	
Quadrula metanevra	monkeyface	X	X		
Quadrula nodulata	wartyback	X	X		
Quadrula pustulosa	pimpleback	X	X		
Quadrula†quadrula #	mapleleaf	X	X	X	
Tritogonia verrucosa	pistolgrip	X	X		
Uniomerus tetralasmus	pondhorn		X	X	X
Lampsilinae					
***Ellipsaria lineolata* - ST**	**butterfly**		**X**	**X**	
Lampsilis cardium	plain pocketbook	X	X	X	
Lampsilis teres #	yellow sandshell	X	X		
Leptodea fragilis #	fragile papershell	X	X	X	
Ligumia recta	black sandshell	X	X		
Obliquaria reflexa	threehorn wartyback	X	X	X	
Obovaria olivaria	round hickorynut	X	X		
Potamilus alatus	pink heelsplitter	X	X	X	
Potamilus ohiensis #	pink papershell	X	X	X	
Toxolasma parvus	lilliput	X	X	X	X
Truncilla donaciformis	fawnsfoot	X	X		
Truncilla truncata	deertoe	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 an Illinois threatened (ST) species.
[3] * = introduced species; # = common species.
[4] Total number of species = 30 (29 native, 1 introduced).

Table 21. Freshwater crustaceans recorded from the Sinkhole Plain Assessment Area .[1]

ORDER Family *Scientific Name*[2,3,4]		Caves & Springs	Headwaters	Creeks	Small Rivers	Medium Rivers	Standing Water
ISOPODA (Isopods)							
Asellidae							
Caecidotea brevicauda #		X	X				
Caecidotea forbesi							X
Caecidotea intermedia #		X	X	X	X	X	
Caecidotea packardi		X					
***Caecidotea spatulata* - SE**		**X**					
AMPHIPODA (Amphipods)							
Crangonyctidae							
Bactrurus brachycaudus		X					
Crangonyx forbesi		X					
Crangonyx minor		X					
Gammaridae							
***Gammarus acherondytes* - SE**		**X**					
Gammarus minus #		X					
Gammarus pseudolimnaeus #		X	X				
Gammarus troglophilus		X					
Hyalellidae							
Hyalella azteca #			X	X	X	X	X
DECAPODA (Crayfishes & shrimps)							
Cambaridae							
Procambarus acutus	White River crawfish			X	X	X	X
Orconectes immunis #	calico crayfish	X	X	X	X	X	
Orconectes virilis #	virile crayfish		X	X	X	X	
Cambarus diogenes	devil crawfish				burrower		

[1] Data from the Illinois Natural History Survey Crustacean Collection.
[2] Bold type indicates an Illinois endangered (SE) species.
[3] # = common species.
[4] Total number of species = 17.

Table 22. Freshwater crustaceans recorded from the Sinkhole Plain Assessment Area, by habitat.[1]

ORDER Family *Scientific Name*[2,3]	Caves & Springs	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
ISOPODA (Isopods)						
Asellidae						
Caecidotea brevicauda #	X	X				
Caecidotea forbesi					X	
Caecidotea intermedia #	X	X		X		

Table 22. Continued.

ORDER Family *Scientific Name*[2,3]		Caves & Springs	Streams			Standing Water	
			Riffles	Runs	Pools	Littoral	Open Water
Caecidotea packardi		X					
***Caecidotea spatulata* - SE**		**X**					
AMPHIPODA (Amphipods)							
Crangonyctidae							
Bactrurus brachycaudus		X					
Crangonyx forbesi		X					
Crangonyx minor		X					
Gammaridae							
***Gammarus acherondytes* - SE**		**X**					
Gammarus minus #		X					
Gammarus pseudolimnaeus #		X	X				
Gammarus troglophilus		X					
Hyalellidae							
Hyalella azteca #			X	X	X	X	
DECAPODA (Crayfishes & shrimps)							
Cambaridae							
Procambarus acutus	White River crawfish				X	X	
Orconectes immunis #	calico crayfish				X	X	
Orconectes virilis #	virile crayfish		X	X		X	
Cambarus diogenes	devil crawfish				burrower		

[1] Data from the Illinois Natural History Survey Crustacean Collection.
[2] Bold type indicates an Illinois endangered (SE) species.
[3] # = common species.
[4] Total number of species = 17.

Table 23. Aquatic macroinvertebrates, exclusive of the Crustacea and unionid Mollusca, recorded for the Sinkhole Plain Assessment Area.[1]

Phylum CNIDARIA
Class HYDROZOA
Anthomedusae
Hydridae
Hydra sp.

Phylum NEMATODA - Nematode Worms
(unidentified taxa)

Phylum NEMATOMORPHA - Horsehair Worms
Gordiidae
Gordius sp.

Phylum TURBELLARIA - Flatworms
Tricladida
Planariidae
Dugesia dorotocephala
Phagocata gracilis
Phagocata velata

Phylum ANNELIDA - Segmented Worms

Class APHANONEURA - Suction-Feeding Worms
Aeolosomatida
Aeolosomatidae (unidentified taxa)

Table 23. Continued.

Class BRANCHIOBDELLAE - Crayfish Worms
Branchiobdellida
Cambarincolidae (unidentified taxa)

Class OLIGOCHAETA - Oligochaete Worms
Lumbriculida
Lumbricidae (unidentified taxa)
Lumbriculidae (unidentified taxa)
Tubificida
Enchytraeidae (unidentified taxa)
Naididae
Allonais paraguayensis ++
Bratislavia unidentata
Chaetogaster diaphanus
Dero digitata
Dero nivea
Dero pectinata
Nais behningi
Nais bretscheri
Nais communis
Nais elinguis
Nais pardalis
Nais variabilis
Nais sp. LCC1
Ophidonais serpentina
Paranais frici
Pristina aequiseta
Pristina leidyi
Slavina appendiculata
Specaria josinae
Stylaria lacustris
Tubificidae
Aulodrilus pigueti
Branchiura sowerbyi
Ilyodrilus templetoni
Limnodrilus cervix
Limnodrilus claparedianus
Limnodrilus hoffmeisteri
Limnodrilus udekemianus
Quistadrilus multisetosus
Spirosperma cf. *ferox*
Tubifex tubifex
Varichaetadrilus angustipenis ++

Class HIRUDINEA - Leeches
Rhynchobdellida
Glossiphoniidae
Helobdella stagnalis
Placobdella ornata
Pharyngobdellida
Erpobdellidae
Erpobdella punctata

Phylum ARTHROPODA - Arthropods
Acari
Hydracarina (Water Mites)
Crustacea
Amphipoda
Crangonyctidae
Crangonyx forbesi
Gammaridae
Gammarus acherondytes ++
Gammarus minus
Gammarus pseudolimnaeus
Gammarus troglophilus
Hyalellidae
Hyalella azteca
Isopoda
Asellidae
Caecidotea brevicauda
Caecidotea intermedia
Caecidotea packardi
Caecidotea spatulata
Ostracoda
Cypridae
Candona caudata
Cypria opthalmica
Ilyocypris bradyi
Physocypria pustulosa
Decapoda
Cambaridae
Orconectes virilis

Class INSECTA - Insects
Ephemeroptera - Mayflies
Baetidae
Baetis flavistriga
Callibaetis fluctuans
Centroptilum sp.
Labiobaetis dardanus
Procleon sp.
Caenidae
Caenis latipennis
Caenis punctata

Table 23. Continued.

- Ephemeridae
  - *Hexagenia* sp.
- Heptageniidae
  - *Stenonema femoratum*
  - *Stenacron interpunctatum*
- Leptophlebiidae
  - *Leptophlebia* sp.
- Potamanthidae
  - *Anthopotamus myops*

Odonata - Damselflies and Dragonflies

Zygoptera - Damselflies

- Coenagrionidae
  - *Argia tibialis*
  - *Ischnura posita*

Anisoptera - Dragonflies

- Libellulidae
  - *Erythemis simplicicollis*
  - *Pachydiplax longipennis*
  - *Perithemis tenera*

Megaloptera - Dobsonflies

- Sialidae
  - *Sialis* sp.

Plecoptera - Stoneflies

- Capniidae
  - *Allocapnia vivipara*
  - *Attaneuria ruralis*
- Nemouridae
  - *Amphinemura* sp.
- Perlidae
  - *Acroneuria abnormis*
  - *Perlinella drymo*
- Taeniopterygidae
  - *Taeniopteryx burksi*

Heteroptera - True Bugs

- Pleidae
  - *Neoplea striola*
- Nepidae - Water Scorpions
  - *Ranatra buenoi*
  - *Ranatra fusca*
  - *Ranatra nigra*
- Corixidae - Water Boatmen
  - *Corisella edulis*
  - *Hesperocorixa nitida*
  - *Hesperocorixa obliqua*
  - *Palmocorixa buenoi*
  - *Ramphocorixa acuminata*
  - *Sigara alternata*
  - *Sigara hubbelli*
  - *Sigara* sp.
  - *Trichocorixa calva*
  - *Trichocorixa kanza*
- Naucoridae
  - *Pelocoris femoratus*
- Notonectidae - Backswimmers
  - *Buenoa scimitra*
  - *Notonecta indica*
  - *Notonecta (Paranecta) undulata*
  - *Notonecta* sp.
- Mesoveliidae - Water Treaders
  - *Mesovelia mulsanti*
- Gerridae - Pond Skaters
  - *Aquarius remigis*
  - *Gerris insperatus*
  - *Gerris marginatus*
  - *Gerris (Limnoporus) canaliculatus*
  - *Trepobates subnitidus*
- Belostomatidae - True Water Bugs
  - *Belostoma flumineum*
  - *Belostoma lutarium*
  - *Lethocerus americanus*

Coleoptera - Beetles

- Dryopidae
  - *Helichus* sp.
- Dytiscidae
  - *Laccophilus fasciatus*
  - *Laccophilus proximus*
  - *Laccophilus maculosus maculosus*
  - dytiscid sp. 1
- Gyrinidae
  - *Dineutus* sp.
- Haliplidae
  - *Peltodytes sexmaculatus*
  - *Peltodytes* sp.
- Hydrophilidae
  - *Berosus infuscatus*
  - *Berosus peregrinus*
  - *Enochrus diffusus*
  - *Enochrus pygmaeus*
  - *Hydrochara obtusata*
  - *Hydrophilus triangularis*
  - *Tropisternus blatchleyi*
  - *Tropisternus lateralis nimbatus*
  - *Tropisternus mexicanus mexicanus*
  - *Tropisternus mexicanus striolatus*
  - *Tropisternus modestus*
  - *Tropisternus natator*

Table 23. Continued.

Trichoptera - Caddisflies
- Brachycentridae
  - *Brachycentrus numerosus*
- Helicopsychidae
  - *Helicopsyche borealis*
- Hydropsychidae
  - *Cheumatopsyche pettiti*
  - *Diplectrona modesta* ++
  - *Hydropsyche betteni*
  - *Hydropsyche orris*
  - *Potamyia flava*
- Hydroptilidae
  - *Hydroptila scolops*
  - *Hydroptila waubiseana*
  - *Orthotrichia americana*
  - *Ochrotrichia shawnee*
- Leptoceridae
  - *Athripsodes transversus*
  - *Leptocerus americanus*
  - *Oecetis inconspicua*
- Philopotamidae
  - *Chimarra feria*
  - *Chimarra obscura*
- Phryganeidae
  - *Phryganea sayi*
- Polycentropodidae
  - *Cyrnellus fraternus*
  - *Neureclipsis crepuscularis*
  - *Nyctiophylax vestitus*
  - *Polycentropus centralis*
- Psychomyiidae
  - *Rhyacophila fenestra*

Diptera - Flies
- Chaoboridae
  - *Chaoborus punctipennis*
- Chironomidae
  - *Ablabesmyia illinoensis*
  - *Chironomus decorus*
  - *Coelotanypus scapularis*
  - *Conchapelopia* sp.
  - *Cricotopus bicinctus*
  - *Cricotopus* sp. 1
  - *Dicrotendipes nervosus*
  - *Glyptotendipes paripes*
  - *Harnischia curtilamellatus*
  - *Orthocladius* sp.
  - *Phaenopsectra flavipes*
  - *Polypedilum scalaenum*
  - *Procladius bellus*
  - *Procladius sublettei*
  - *Stenochironomus hilaris*
  - *Tanypus neopunctipennis*
  - *Tribelos jucundum*
- Ceratopogonidae
  - *Bezzia* complex
- Culicidae
  - *Aedes cinereus*
  - *Aedes simulans*
  - *Aedes triseriatus*
  - *Aedes vexans*
  - *Aedes fitchi*
  - *Aedes trivittatus*
  - *Aedes dorsalis*
  - *Aedes sollicitans*
  - *Aedes sticticus*
  - *Anopheles barberi*
  - *Anopheles crucians*
  - *Anopheles punctipennis*
  - *Anopheles quadrimaculatus*
  - *Anopheles punctipennis*
  - *Mansonia perturbans*
  - *Culiseta inornata*
  - *Culex restuans*
  - *Culex pipiens*
  - *Culex salinarius*
  - *Culex tarsalis*
  - *Orthopodomyia signifera*
  - *Psorophora ciliata*
  - *Psorophora confinnis*
  - *Psorophora cyanescens*
  - *Psorophora discolor*
  - *Psorophora ferox*
  - *Psorophora howardi*
  - *Psorophora varipes*
  - *Toxorinchites rutilis septentrionalis*
  - *Uranotaenia sapphirina*
- Dixidae
  - *Dixa* sp.
- Psychodidae
  - *Psychoda* sp.
- Simuliidae
  - *Simulium tuberosum* complex
  - *Simulium vittatum* complex
  - Simulium spp.
- Tabanidae
  - *Chrysops pikei*

Table 23. Continued.

Chrysops vittatus	**Phylum MOLLUSCA - Mollusks**
Tabanus equalis	**Gastropoda - Snails**
Tabanus quinquevittatus	Physidae
Tipulidae	*Physella* sp.
Tipula sp.	**Pelecypoda - Bivalve Mollusks**
	Sphaeriidae
	(unidentified taxa)

[1] Data are from the Illinois Natural History Survey Insect and Annelida collections, and literature cited in this document. List compiled by M.J. Wetzel, D.W. Webb, S.J. Taylor, and M.L. Biyal, Illinois Natural History Survey Center for Biodiversity.

++ = those taxa known to occur in the Sinkhole Plain Assessment Area that, to date, have been collected only from spring and springbrook habitats.

Threatened and Endangered Species

Two state endangered fishes are known from the SPAA. The bigeye shiner was found in the Kaskaskia River in 1964 and the western sand darter was found in the Mississippi River near Prairie du Rocher in 1989.

Bigeye shiner: The bigeye shiner usually is found in clear, rather high-gradient streams over a substrate of clean gravel or mixed sand and gravel. It is often found at the margins of streams near beds of emergent vegetation. Once more widespread in Illinois, most remaining populations occur in the east-central and extreme southwestern parts of the state. In 1964, bigeye shiners were found in the Kaskaskia River, 2 miles northeast of Evansville in Randolph County. This habitat is rather atypical for the species and it is not known whether the species still occurs in the Assessment Area.

Western sand darter: The western sand darter is fairly common in clean sandy runs in portions of the upper Mississippi River from Carroll County to Rock Island County. Elsewhere the species survives only in isolated stretches of the Kaskaskia River, in the Sugar River in Winnebago County, and in the Mississippi River just south of Prairie du Rocher in Randolph County. Once found in a few tributaries of the Illinois River, the species now appears to have been extirpated from the entire Illinois River basin.

Three state threatened mussels (spike, ebonyshell, and butterfly) have been reported from this area. We have little recent information on the mussels of this region but it is likely that none of the listed species still exist in the area. A summary of the past occurrence of each species is given below. Data used in these summaries have been taken from Cummings and Mayer (1997) and the Illinois Natural History Survey Mollusk Collection database.

Spike: This mussel was widespread and common in Illinois as recently as the 1960's but has since experienced a severe decline. We have only one historical record for the spike from this region. Six specimens were collected from the Kaskaskia River at New Athens in

St. Clair County in 1931. No other specimens have been collected and this mussel is most likely extirpated from the area.

Ebonyshell: The ebony shell was historically widely distributed in the Upper Mississippi River. It has undergone a marked reduction in range in the past 30 years and has almost been eliminated from the upper Mississippi River system. It has been documented in this area from the Kaskaskia River at New Athens (1931), and Evansville (1956). Subfossil shells were collected from the Mississippi River south of Hartford, Illinois in 1989. The ebonyshell is also most likely extirpated from this area.

Butterfly: The butterfly is a large river species currently confined to a few locations in the Mississippi, Ohio, and Illinois rivers. A single historical record exists for the butterfly in this area. It was collected in the Harlow side channel of the Mississippi River, southeast of Crystal City, Missouri in 1976. Although it still occurs in the Mississippi River further north, the butterfly is probably extirpated from this area.

Two species of crustaceans, the amphipod, *Gammarus acherondytes*, and the isopod *Caecidotea spatulata*, found in this region are state endangered. The crayfish, *Orconectes placidus*, a third state endangered species is known from a region of the Mississippi River just outside the Assessment Area and may occur in the Assessment Area as well.

The cave amphipod, *Gammarus acherondytes*, is found only in the SPAA of Illinois. The species is restricted to small streams in a few caves in Monroe and St. Clair counties (Webb et al. 1996). It is presently under consideration for listing as federally endangered (U.S. Department of the Interior, Fish and Wildlife Service [USDI, FWS] 1997).

The isopod *Caecidotea spatulata* is a state endangered species that was originally described from a collection made 1 mile south of Falling Springs in St. Clair County in 1937. No collections or observations of the species in Illinois other than the original observation have been made and the species may no longer occur here. Elsewhere it has been found only in two counties in Missouri.

The crayfish, *Orconectes placidus*, is common in Illinois only in Big Creek in Hardin County where the species occupies gravelly riffles. Big-river collections such as that made in the Mississippi River 2 miles northeast of Kaskaskia in Randolph County in 1973 (just outside the Assessment Area) usually come from rocky pools or rocky shorelines.

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; USDI, FWS 1996) lists no other aquatic macroinvertebrates other than unionid mussels that are known or thought likely to occur in the SPAA.

Non-native Species

The common carp is found throughout Illinois. 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, 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 common carp 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 grass carp is native to eastern Asia. It was introduced to North America as a biological control for aquatic vegetation in the early 1960's. From its point of introduction in Arkansas it has now spread or been introduced to at least 34 states. The first collection in Illinois was in 1971 and Smith (1979) reported its presence in the Mississippi River as far north as Pike County. Today grass carp are reproducing in Illinois and occur sporadically in the southern one-half of the Illinois portion of the Mississippi River, the southern one-half of the Illinois River, Lake Michigan and the Chicago River in Cook County, the Cache River in Alexander/Pulaski counties, the Big Muddy River in Jackson County, Clear Creek in Alexander County, and the Kaskaskia River in Clinton County.

The species inhabits quiet waters including lakes, ponds, and pools and backwaters of large rivers. Because it feeds on aquatic plants, the grass carp has the potential to destroy habitats that are important to many native species, including threatened and endangered species. Other organisms that rely on aquatic plants, such as waterfowl, also will be negatively affected by the alteration of vegetated aquatic habitats by grass carp.

This goldfish is another introduced species in the Assessment Area. This species is found in streams of a wide range of diversity and was particulary abundant in Harding Ditch in St. Clair County. Its abundance reflects depauperate habitat conditions.

The exotic zebra mussel is widespread in the Mississippi River occurring from Minnesota south to Louisiana. The zebra mussel is having negative impacts on many Illinois species, particularly the native mussels that are restricted to large rivers. Although we have no vouchered specimens of the zebra mussel from the Assessment Area, they most likely occur in the Mississippi River in this region. Zebra mussels have been reported from the Mississippi River upstream at the Melvin Price Lock & Dam near Alton in 1991 and downstream, four miles south of Chester in 1996. The Asian clam has been found at numerous sites throughout the Mississippi River portion of the Assessment Area. Effects of the Asian clam on native species and communities are difficult to measure, but some studies have suggested that the Asian clam may compete with native mussels for food.

Of the aquatic macroinvertebrate taxa known or thought likely to occur in the SPAA (Table 23), none other than one aquatic worm species is thought to have been introduced. *Branchiura sowerbyi* (Annelida: Oligochaeta: Tubificidae) was first reported in the USA from a lake in Ohio in 1932, most likely introduced to the continent with imported aquatic and semiaquatic plants or other aquatic organisms. Originally thought to be restricted to thermally influenced habitats, *B. sowerbyi* is now commonly collected from a variety of stream and lake systems. This species is widespread throughout North America and Europe and has been recorded from all continents except Antarctica. *Branchiura sowerbyi* does not appear to pose any threat to native populations of aquatic macroinvertebrates.

Information Gaps

The SPAA has been fairly well studied with respect to fishes, mussels, and crayfishes. However, additional survey work in the smaller tributaries would better define the distribution limits of some of the species, especially mussels, and possibly uncover additional populations of state endangered and other rare species.

The status of several species, especially amphipods, isopods, and certain freshwater mussels, is uncertain; additional survey work is needed to determine whether these species still occur in the area and, if not, whether they could be successfully reintroduced.

Prior to studies by Webb et al. (1993, 1995, 1996), few groups of aquatic macroinvertebrates present in the SPAA (Table 23) had been studied. Exceptions included scattered records for several species from these counties obtained during statewide surveys for insect groups by Malloch (1915a, b), Frison (1935), Ross (1944, 1947), Burks (1953), Lauck (1959), Ross and Horsfall (1965), Pechuman et al. (1983), and Wooldridge (1967). The recent studies by Webb et al. (1993, 1995, 1996, 1998a, 1998b) provided distributional information for many aquatic species occurring in caves and springs; many of the species collected represented new county records, and a few represented new state records.

Historical and recent collections of aquatic macroinvertebrates from the SPAA are deposited in the permanent Illinois Natural History Survey Collections; much of the information for historical collections 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 of historical material with that obtained during more recent collections could be made to determine 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.

In general, 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.

Water Quality

In the Illinois Water Quality Report (Illinois Environmental Protection Agency 1996) the Mississippi River from the Wood River to the Chain of Rocks Canal was rated as "Partial Support/Moderate Impairment" (water quality conditions impaired to a greater degree inhibiting the waterbody from meeting all the needs for that designated use) as was the Chain of Rocks Canal. The Mississippi River opposite the Chain of Rocks Canal was rated as "Partial Support/Minor Impairment" (water quality impaired, but only to a minor degree). From the Chain of Rocks Canal to the mouth of the Meramec River, industrial and municipal wastewater influences reduces aquatic life use to "Nonsupport" (water quality severely impaired and not capable of supporting the designated uses to any degree). From the Meramec River to the mouth of the Kaskaskia, the rating increased to "Partial Support/Moderate Impairment." Fountain Creek was rated at "Full Support" and Maeystown Creek was rated as "Partial Support/Minor Impairment." Also in the Assessment Area, Harding Ditch, Canal One, and Prairie Du Pont Creek were rated as "Partial Support/Moderate Impairment." The portion of the Kaskaskia River drainage that flows through the Sinkhole Plain was rated as "Partial Support/Minor Impairment" due to nutrients, siltation, and channelization. Plum Creek, a lower tributary to the Kaskaskia, was rated as "Full Support."

The Biological Stream Characterization (Bertrand et al. 1996) rated Nine Mile Creek, a tributary to the Kaskaskia River, and Fountain Creek, a tributary to the Mississippi River, as Class B Streams (Highly Valued Aquatic Resource). The Kaskaskia River included in this region was rated as a Class C Stream (Moderate Aquatic Resource). Other streams in this region rated as Class C Streams include Prairie DuLong Creek, Richland Creek, Maeystown Creek, Prairie Du Pont Creek, and Cahokia Canal from its mouth up to County Ditch. Other streams in this region were rated as Class D Streams (Limited Aquatic Resource) or not rated. The Mississippi River was not rated.

Smith (1971) rated the Kaskaskia River as "Variable." The headwaters have been periodically dredged and the upper section receives agricultural and some industrial pollution. The middle section receives mine wastes and oil field pollution while the lower section has been channelized for barge traffic. The Mississippi River was not rated.

Unique Habitats

One hundred and forty two caves are known to occur within the SPAA. These include: 117 in Monroe County, five in Randolph County, and 20 in St. Clair County. The biota and geology of several of these caves has been discussed in Bretz and Harris (1961) and Webb et al. (1993).

Numerous springs are known to occur within the SPAA (Webb et al. 1993, 1996, 1998a). These include: Auctioneer Spring, Camp Vandeventer Spring, Collier Spring, Dual Springs, Erwin Vogt Spring, Indian Hole, Kelly Spring, Little Carr Spring, Madonnaville Spring, Quirky Quarry Spring, Ritter Spring, Running Spring, Terry Spring, Walsh Spring, several unnamed springs in Monroe County, one unnamed spring in Randolph County, Falling Spring, Sparrow Spring, and Valley Cave Spring in St. Clair County. Aquatic macroinvertebrates reported from these springs are included in Table 23. The state endangered Illinois Cave amphipod, *Gammarus acherondytes* (Crustacea: Amphipoda: Gammaridae), is known from cave streams in the Sinkhole Plain, but has not yet been collected from any of the springs noted above.

Several of the aquatic macroinvertebrates included in Table 23 are considered unique to spring or springbrook habitats; other species may be relatively common in springs or springbrooks, yet rare in surface streams, lakes, wetlands, or ponds away from groundwater influence. *Allonais paraguayensis*, an aquatic worm (Oligochaeta: Naididae) considered rare in United States, was reported from two springs in Monroe County and one spring in St. Clair County. This species recently has been reported from a few other spring habitats in northern and southern Illinois (Webb et al. 1995, 1996, 1998a, 1998b). *Varichaetadrilus angustipenis*, an aquatic worm (Oligochaeta: Tubificidae) considered rare in United States, was reported from three springs in Monroe County. This species also has recently been reported from several spring habitats in northern and southern Illinois (Webb et al. 1995, 1996, 1998a, 1998b) and from a few other sites in Illinois (Wetzel 1982, 1992) influenced by groundwater. Another aquatic worm considered rare in Illinois, *Bratislavia unidentata* (Oligochaeta: Naididae), recently was collected from one spring habitat in St. Clair County (Webb et al. 1996, 1998a). Although known from several states in this country, the collection of *B. unidentata* from this spring represents a new habitat association for the species. Until recently, the caddisfly, *Diplectrona modesta* (Trichoptera: Hydropsychidae) was known from only five localities in Illinois (Ross 1944); four of these sites were directly associated with springs or groundwater discharge. Webb et al. (1996, 1998a) reported this species from a cave spring and its springbrook in Monroe County, from one of the historical spring localities in Kane County (Webb et al. 1998b), and from three new spring localities in Carroll County. Webb et al. (1996, 1998a) also reported two stygophilic amphipods, *Crangonyx forbesi* (Amphipoda: Crangonyctidae) and *Gammarus troglophilus* (Amphipoda: Gammaridae), and one stygophilic isopod, *Caecidotea packardi* (Crustacea: Isopoda: Asellidae) from several spring habitats in Monroe and St. Clair counties.

Biologically Significant Streams

Two streams in the SPAA were recognized as Biologically Significant Streams (Page et al. 1992) because of their mussel and/or fish diversity. These streams provide the best opportunities in the basin for the protection of large numbers of native species.

1. *Tributary to Horse Creek, Mammoth Cave, Monroe County.* The scud, *Gammarus acherondytes*, is a troglodyte occupying a few small streams flowing through caves in

Monroe and St. Clair counties. The tributary of Horse Creek in Mammoth Cave is a clear, gravel and bedrock-bottomed stream supporting several rare troglodytes, including the largest known population of *G. acherondytes*.

2. *Mississippi River, river miles 114 to 119, Randolph County.* This is a large sand-bottomed segment of the river with a narrow band of trees along the muddy shoreline. The small population of *Orconectes placidus* is confined to the brush and large rocks that are scattered along the shore. Protection potential is small.

Environmental Problems

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 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, and they 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 using the migratory fishes as glochidial hosts.

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.

Groundwater in karst (sinkhole) landscapes is particularly susceptible to contamination (Panno et al. 1996). Shallow groundwater in karst regions does not have the benefit of the slow filtering that occurs in clay-rich glacial till or other landscapes. Recharge and movement of water within these aquifers is very rapid and suspended sediments, dissolved contaminants, organic compounds, and bacteria are readily carried into them.

Potential Management Strategies for Aquatic Species

Management strategies for aquatic ecosystems must consider each watershed on an individual basis. Attempting to correct problems locally without consideration of upstream activities and downstream implications will result in 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 including, perhaps 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,

in particular 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.

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Appendix 1

Incomplete list of vascular plants known from the Sinkhole Plain Assessment Area, with notes on their habitat associations.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
adder's-tongue fern	*Ophioglossum vulgatum*				x	x				x										
alfalfa*	*Medicago sativa**																			x
Alsike clover*	*Trifolium hybridum**																			x
alumroot	*Heuchera americana* var. *hirsuticaulis*			x	x				x			x							x	
American bellflower	*Campanula americana*		x	x		x	x												x	x
American bindweed	*Calystegia sepium*									x	x		x	x						x
American bulrush	*Scirpus americanus*					x	x	x			x			x		x	x			
American elm	*Ulmus americana*		x	x	**X**	x	**X**	**X**				x							x	
American feverfew	*Parthenium integrifolium*		x						x	x	x							x		
American germander	*Teucrium canadense* var. *virginicum*					x	x			x	x	x	x	x						
American lotus	*Nelumbo lutea*													**X**		x				
American pennyroyal	*Hedeoma pulegioides*		x						x											
American plum	*Prunus americana*		x																x	
American spikenard	*Aralia racemosa*		x	x	x		x													
American wormseed*	*Chenopodium ambrosioides**						x													x
amur honeysuckle*	*Lonicera maackii**		x	x	x	x				x										x
androsace	*Androsace occidentalis*										x								x	x
angled spike rush	*Eleocharis quadrangulata*													x		x				
anise-root	*Osmorhiza longistylis*		x	x	x	x														
annual bedstraw	*Galium aparine*		x	x		x	x	x			x	x						x	x	x
annual bluegrass*	*Poa annua**			x																x
annual fleabane	*Erigeron annuus*								x	x	x		x							x
annual foxtail	*Alopecurus carolinianus*													x						x
annual ground cherry	*Physalis pubescens*		x				x												x	x
aromatic aster	*Aster oblongifolius*									x		**X**						x		
aromatic sumac	*Rhus aromatica*		x								x	x						x	**X**	
arrow feather	*Aristida purpurascens*										x									
arrowhead	*Sagittaria ambigua ?*														x					
arrowleaf aster	*Aster sagittifolius*		x		x															
asparagus*	*Asparagus officinalis**									x		x	x							x
Aunt Lucy	*Ellisia nyctelea*					x	x													x
autumn bent grass	*Agrostis perennans*		x	x					x											
autumn sedge	*Fimbristylis autumnalis*													x		x				x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
autumn bent grass	*Agrostis perennans*		x	x					x											
autumn sedge	*Fimbristylis autumnalis*													x		x				x
awl-fruited oval sedge	*Carex tribuloides*						x				x			x						
awned flat sedge	*Cyperus aristatus*												x	x		x				
bachelor's buttons*	*Centaurea cyanus**																			x
Baldwin's ironweed	*Vernonia baldwinii*			x								x								
balloon-vine*	*Cardiospermum halicacabum**						x													x
balsam groundsel	*Senecio pauperculus*																			
barnyard grass	*Echinochloa muricata*					x	x	x	x	x	x			x		x				x
barnyard grass*	*Echinochloa crusgalli**						x	x						x		x				x
basswood	*Tilia americana*		x	x	X	x	x													
bastard toadflax	*Comandra umbellata*									x	x	x								
bead grass	*Paspalum setaceum*										x			x						x
bead grass-SE	***Paspalum dissectum-SE***						x	x								x				
bear's-foot	*Polymnia uvedalia*			x	x															
bearded broad-leaved panic grass	*Panicum boscii*			x	x				x									x		
beefsteak plant*	*Perilla frutescens**		x	x			x													x
bellwort	*Uvularia grandiflora*			x	x															
Bermuda grass*	*Cynodon dactylon**																			x
Bertero's burhead	*Echinodorus berteroi*														x	x				
Bicknell's sedge	*Carex bicknellii*									x	x									
biennial gaura	*Gaura biennis*									x	x	x								x
big bluestem	*Andropogon gerardii*									X	x	x	x					x	x	
birdfoot violet	*Viola pedata*										x	x	x							
birthwort	*Aristolochia serpentaria*		x	x					x											
bitter cress	*Cardamine pensylvanica*					x					x			x						x
bitter cress	*Cardamine pratensis ?*																			x
bitter dock*	*Rumex obtusifolius**						x													x
bitternut hickory	*Carya cordiformis*		x	x	x	x														
bittersweet	*Celastrus scandens*			x						x		x						x	x	
bitterweed	*Helenium amarum*																			x
black bindweed*	*Polygonum convolvulus**																			x
black haw	*Viburnum prunifolium*		x		x	x	x													
black locust	*Robinia pseudoacacia*																	x		x
black maple	*Acer nigrum*			x																
black medic*	*Medicago lupulina**											x								x
black nightshade	*Solanum ptycanthum*					x														x
black oak	*Quercus velutina*		X	X	X				X		x		X					x	x	
black raspberry	*Rubus occidentalis*		x	x																x
black snakeroot	*Sanicula canadensis*		x	x	x	x					x	x							x	
black walnut	*Juglans nigra*		x	x	x	X						x						x		

Appendix 1. Continued.

	Class	Forest							Prairie			Sav	Wetland				Primary		
	Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
	Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
Common name[3,4]	Scientific Name[3,4]																		
black willow	*Salix nigra*				x	x	X			x			x	X	X				
black-eyed Susan	*Rudbeckia hirta*		x						x	x	x	x					x		x
blackberry	*Rubus argutus*	x						x											x
blackjack oak	*Quercus marilandica*	x	x					X			x	X							
bladder fern	*Cystopteris bulbifera*		x	x													x	x	
bladdernut	*Staphylea trifolia*		x	x	x	x													
blade duckweed	*Wolffiella gladiata*														x				
bloodroot	*Sanguinaria canadensis*	x	x	x														x	
blue ash	*Fraxinus quadrangulata*	x	x	x	x												x	x	
blue aster	*Aster anomalus*	x	x									x					x		
blue beech	*Carpinus caroliniana*	x	x	x															
blue cohosh	*Caulophyllum thalictroides*		x	x															
blue hearts	*Buchnera americana*										x								
blue lobelia	*Lobelia siphilitica*						x		x				x						
blue phlox	*Phlox divaricata* var. *laphamii*	x	x	x	x	x													
blue star	*Amsonia tabernaemontana*			x															
blue vervain	*Verbena hastata*				x				x	x		x	x						
blue vine	*Cynanchum laeve*		x			x													x
blue-eyed grass	*Sisyrinchium albidum*								x	x	x	x					x	x	
bluecurls	*Trichostema dichotomum*									x									x
bluejoint grass	*Calamagrostis canadensis*								X				x						
bluestem goldenrod	*Solidago caesia*	x	x	x															
bluets	*Hedyotis purpurea* var. *calycosa*		x						x										
blueweed sunflower	*Helianthus ciliaris*																		x
blunt spike rush	*Eleocharis obtusa*												x		x				
blunt-leaved spurge	*Euphorbia obtusata*					x													
bottlebrush grass	*Elymus hystrix*	x	x	x	x							x					x		
bouncing bet*	*Saponaria officinalis**									x									x
box elder	*Acer negundo*				x	X	X												
bracted tick trefoil	*Desmodium cuspidatum longifolium*		x																
bristly foxtail*	*Setaria verticillata**																		x
bristly greenbrier	*Smilax hispida*	x	x	x	x						x								
bristly sunflower	*Helianthus hirsutus*							x	x	x	x							x	
broad beech fern	*Phegopteris hexagonoptera*		x	x															
broad-leaved panic grass	*Panicum latifolium*					x													
bronze fern	*Botrychium dissectum* var. *obliquum*	x																	
brookweed	*Samolus valerandii*				x														
broom sedge	*Andropogon virginicus*																		x
brown-eyed Susan	*Rudbeckia triloba*				x	x			x								x		

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
buckhorn plantain	*Plantago aristata*										x	x								
Buckley's goldenrod	*Solidago buckleyi*		x	x					x			x								
buckwheat*	*Fagopyrum esculentum**																			x
buffalo-bur	*Solanum rostratum*						x				x									
bugle weed	*Lycopus virginicus*					x								x						
bugseed*	*Polycnemum majus**																			x
bull brier	*Smilax bona-nox*											x						x		
bull thistle*	*Cirsium vulgare**										x	x	x							x
bulrush	*Scirpus atrovirens*									x	x			x	x					
bulrush	*Scirpus validus*										x			x		x				
bur cucumber	*Sicyos angulatus*					x	x	x												
bur oak	*Quercus macrocarpa*				x	x	X						X							
burning bush*	*Kochia scoparia**																			x
bush clover	*Lespedeza intermedia*		x																	
bushy aster	*Aster dumosus*		x							x	x									
bushy knotweed	*Polygonum ramosissimum*					x														
butterfly weed	*Asclepias tuberosa* ssp. *interior*		x							x	x		x							x
butternut - WL	***Juglans cinerea - WL***				x	x														
butterweed	*Senecio glabellus*								x							x				x
buttonbush	*Cephalanthus occidentalis*					x									X	X				
buttonbush dodder	*Cuscuta cephalanthi*			x										x	x	x				
Canada bluegrass*	*Poa compressa**									x	x	x						x	x	x
Canada brome grass	*Bromus pubescens*		x		x								x							
Canada wild rye	*Elymus canadensis*				x	x					x	x						x	x	x
Canadian milk vetch	*Astragalus canadensis*			x						x	x	x	x							
Canadian rush	*Juncus canadensis*													x						x
canary grass*	*Phalaris canariensis**																			x
cancerwort*	*Kickxia elatine**																			x
cardinal flower	*Lobelia cardinalis*					x	x	x						x	x					
Carolina buckthorn	*Rhamnus caroliniana*			x	x							x						x	x	
Carolina cranesbill	*Geranium carolinianum*									x	x	x						x		x
Carolina willow	*Salix caroliniana*													x						
carpet weed*	*Mollugo verticillatus**							x												x
cat brier	*Smilax rotundifolia*											x								
catbird grape	*Vitis palmata*			x								x								
catnip*	*Nepeta cataria**												x							x
cattail sedge	*Carex typhina*								x					x						
chamomille*	*Matricaria chamomilla**																			x
charlock*	*Brassica kaber**																			x
chaste tree*	*Vitex agnus-castus**																			x
cheat grass*	*Bromus secalinus* *																			

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
cheat grass*	*Bromus tectorum**										x	x						x	x	x
chickasaw plum	*Prunus angustifolia*											x								x
chickory*	*Cichorium intybus**												x							x
chinquapin oak	*Quercus muhlenbergii*	x	X	x								x						x	X	
Christmas fern	*Polystichum acrostichoides*		x	x																
cigar tree	*Catalpa speciosa*					x						x								
cinnamon fern	*Osmunda cinnamomea*	x						x		x	x				x					
cinquefoil	*Potentilla paradoxa*					x					x					x				
clammy chickweed*	*Cerastium glomeratum**																			x
clammy cuphea	*Cuphea viscosissima*		x		x															x
clammy ground cherry	*Physalis heterophylla*									x	x	x								x
clammy hedge hyssop	*Gratiola neglecta*				x	x	x								x	x	x			x
clammy weed	*Polanisia dodecandra*										x									x
clearweed	*Pilea pumila*			x	x	x	x							x						
cleft phlox	*Phlox bifida*										x	x	x					x	x	
cleft violet	*Viola triloba* var. *dilatata*	x										x								
cliff onion	*Allium stellatum*											x						x	x	
climbing false buckwheat	*Polygonum scandens*				x	x					x				x					x
climbing false buckwheat	*Polygonum setaceum interjectum*													x						
coast blite	*Chenopodium simplex*																			x
cock-spur hawthorn	*Crataegus crus-galli*	x				x														
columbine	*Aquilegia canadensis*	x	x	x														x	x	
common arrowhead	*Sagittaria latifolia*						x							x		x	x			
common barberry*	*Berberis vulgaris**	x																		
common beggar ticks	*Bidens frondosa*	x			x	x	x				x			x	x		x			x
common bladderwort	*Utricularia vulgaris*													x		x				
common blue-eyed grass	*Sisyrinchium angustifolium*	x	x							x		x								
common bugseed*	*Corispermum americanum**																			x
common bur reed	*Sparganium eurycarpum*													x	x	x	x			
common carrion flower	*Smilax lasioneuron*	x		x						x	x									
common cat-tail	*Typha latifolia*									X	x			x	x	x	x			
common catalpa*	*Catalpa bignonioides**																			x
common chickweed*	*Stellaria media**						x												x	x
common chokecherry	*Prunus virginiana*	x		x																
common cinquefoil	*Potentilla simplex*	x	x	x				X		x	x		x							x
common cocklebur	*Xanthium strumarium*				x	x	x													x
common crab grass*	*Digitaria sanguinalis**																			x
common day flower*	*Commelina communis**				x								x	x						x
common dodder	*Cuscuta gronovii*				x		x	x				x								
common foxtail*	*Setaria viridis**											x							x	x
common gaura	*Gaura longiflora*											x								
common goat's beard*	*Tragopogon pratensis**										x		x							x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
common goldenrod	*Solidago canadensis*		x				x			x	x	x	x					x		x
common hop sedge	*Carex lupulina*					x	x							x	x					
common hops	*Humulus lupulus*					x														x
common horehound	*Marrubium vulgare***																			x
common horsetail	*Equisetum arvense*					x	x	x			x			x						x
common ironweed	*Vernonia fasciculata*									x	x			x						
common lake sedge	*Carex lacustris*													X	x	x				
common love grass	*Eragrostis pectinacea*						x	x			x									x
common milkweed	*Asclepias syriaca*									x	x		x							x
common mountain mint	*Pycnanthemum virginianum*									x	x		x							
common mouse-ear chickweed*	*Cerastium vulgatum**										x		x							x
common muhly	*Muhlenbergia frondosa*			x	x	x														
common nettle	*Urtica dioica*		x	x		x	x	x												
common peppergrass	*Lepidium virginicum*										x	x						x	x	x
common polypody	*Polypodium virginianum*				x														x	
common purpletop	*Tridens flavus*								x	x	x	X							x	x
common ragweed	*Ambrosia artemisiifolia*					x		x		x	x	x	x					x	x	x
common reed	*Phragmites australis*													x	x					
common snakeroot	*Sanicula gregaria*		x	x	x	x	x		X		x									
common sunflower*	*Helianthus annuus**						x													x
common tussock sedge	*Carex stricta*									x				x	x					
common water horehound	*Lycopus americanus*					x				x	x			x		x				
common water plantain	*Alisma subcordatum*													x	x	x				
common wood reed	*Cinna arundinacea*		x	x	x	x			x											
common wood sedge	*Carex blanda*		x	x	x	x						x								x
common wood sorrel	*Oxalis dillenii*					x						x						x		x
common woodsia	*Woodsia obtusa*		x	x	x	x												x	x	
compass plant	*Silphium laciniatum*									x	x		x							
coontail	*Ceratophyllum demersum*														x	x				
coral-root orchid	*Corallorhiza wisteriana*			x	x															
coralberry	*Symphoricarpos orbiculatus*		x	x	x	x	x		x			x						x		
corn cockle*	*Agrostemma githago**																			x
corn salad	*Valerianella radiata*						x													x
corn speedwell*	*Veronica arvensis**											x						x		x
corn*	*Zea mays**																			x
cottonweed*	*Froelichia gracilis**										x		x							x
cottonwood	*Populus deltoides*					x		X			x			x	x					
cow herb*	*Vaccaria pyramidata**																			x
cow vetch*	*Vicia cracca**																			x
cream wild indigo	*Baptisia leucophaea*								x		x		x							
creeping burhead	*Echinodorus cordifolius*													x						

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
creeping dayflower	*Commelina diffusa*					x														x
creeping love grass	*Eragrostis hypnoides*					x	x	x			x			x		x				
creeping vervain	*Verbena bracteata*																			x
creeping vervain	*Verbena canadensis*											x						x		
crested bindweed	*Polygonum cristatum*																		x	
crested coral-root orchid - SE	***Hexalectris spicata - SE***	x										x						x	x	
crested dock*	*Rumex cristatus**																			x
crested oval sedge	*Carex cristatella*													x						
crow poison	*Nothoscordum bivalve*					x	x		x											
crowfoot fox sedge	*Carex crus-corvi*							x						x	x					
cudweed	*Gnaphalium obtusifolium*									x	x	x								
cultivated lettuce*	*Lactuca sativa**																			x
culver's root	*Veronicastrum virginicum*			x						x	x	x	x					x		
cup plant	*Silphium perfoliatum*					x				x			x							
curly dock*	*Rumex crispus**									x	x		x	x						x
cursed crowfoot	*Ranunculus sceleratus*										x			x		x				
cut-leaved ground cherry	*Physalis angulata*																			x
cylindric blazing star	*Liatris cylindracea*									x	x	x						x	x	
cypress spurge*	*Euphorbia cyparissias**			x						x										x
daisy fleabane	*Erigeron strigosus*								x	x	x	X						x	x	x
dandelion*	*Taraxacum officinale**									x	x									x
Davis' sedge	*Carex davisii*				x	x	x													
dayflower	*Commelina erecta*										x		x							
decurrent false aster - ST, FT	***Boltonia decurrens - ST, FT***					x	x									x				x
deer-tongue grass	*Panicum clandestinum*			x	x	x			x		x		x							
Deptford pink*	*Dianthus armeria**										x		x							x
devils-claw*	*Proboscidea lousianica**																			x
ditch stonecrop	*Penthorum sedoides*										x			x	x	x				
dog mustard*	*Erucastrum gallicum**																			x
dogbane	*Apocynum cannabinum*								x	x	x	x	x					x		x
dogfennel*	*Anthemis cotula**						x													x
doll's eyes	*Actaea pachypoda*			x	x															
dotted smartweed	*Polygonum punctatum*			x				x						x	x	x	x			
doveweed	*Croton capitatus*											x						x		
downy gentian	*Gentiana puberulenta*			x						x		x								
downy goldenrod	*Solidago petiolaris*			x																
downy hawthorn	*Crataegus mollis*					x	x													
downy skullcap	*Scutellaria incana*	x																x		
downy sunflower	*Helianthus mollis*									x	x									
downy-blue violet	*Viola sororia*	x	x	x	x					x	x									

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
Drummond's aster	*Aster drummondii*		x	x								x	x	x						
Drummond's goldenrod	*Solidago drummondii*		x									x						x	X	
duck salad	*Heteranthera limosa*													x	x					
duckweed	*Lemna minor*													x	x	X				
Dudley's rush	*Juncus dudleyi*									x	x			x		x				
dutchman's breeches	*Dicentra cucullaria*		x	x	x	x														
dutchman's pipe	*Aristolochia tomentosa*			x								x								
dwarf bedstraw - SE	***Galium virgatum - SE***											x						x	x	
dwarf bluets	*Hedyotis pusilla*			x																
dwarf dandelion	*Krigia dandelion*								x		x									
dwarf fleabane	*Conyza ramosissima*																			x
dwarf hackberry	*Celtis tenuifolia*		x	x								x						x	x	
dwarf larkspur	*Delphinium tricorne*			x	x														x	
dwarf mouse-ear chickweed*	*Cerastium pumilum**																			x
dwarf plantain	*Plantago pusilla*			x														x		
dwarf snapdragon*	*Chaenorrhinum minus**																			x
dwarf St. John's-wort	*Hypericum mutilum*										x			x	x	x				
early buttercup	*Ranunculus fascicularius*		x							x										
early goldenrod	*Solidago juncea*			x						x	x		x							
early horse gentian	*Triosteum aurantiacum* var. *illinoense*		x	x	x		x													
early oak sedge	*Carex umbellata*											x								
eastern red cedar	*Juniperus virginiana*			x							x	X						X	x	
eastern redbud	*Cercis canadensis*		x	x	x	x	x											x	x	
ebony spleenwort	*Asplenium platyneuron*		x	x					x			x						x	x	
elderberry	*Sambucus canadensis*					x	x	x			x			x	x	x				x
elephant's foot	*Elephantopus carolinianus*			x	x	x														
elm-leaved goldenrod	*Solidago ulmifolia*			x		x			x			x	x						x	
enchanter's nightshade	*Circaeâ lutetiana* ssp. *canadensis*		x	x	x	x														
English plantain*	*Plantago lanceolata**									x	x									x
evening primrose	*Oenothera biennis*									x	x	x	x					x	x	x
fall panicum	*Panicum dichotomiflorum*					x														x
fall witch grass	*Leptoloma cognatum*										x									
false aloe	*Manfreda virginica*											x						x	x	
false aster	*Boltonia asteroides*					x					x			x						
false boneset	*Brickellia eupatorioides*									x		x						x	x	
false dandelion	*Krigia biflora*		x	x	x				x	x	x		x							
false dandelion	*Pyrrhopappus carolinianus*																			x
false field dodder	*Cuscuta indecora*							x						x						
false flax*	*Camelina sativa**																			x
false foxtail*	*Crypsis schoenoides**																			x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		Cultural
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
false indigo bush	*Amorpha fruticosa*					x								x	X					
false loosestrife	*Ludwigia polycarpa*													x		x				
false nettle	*Boehmeria cylindrica*					x	x	x			x			x	x	x				
false pennyroyal	*Trichostema brachiatum*											x						x	x	
false petunia	*Ruellia caroliniensis*		x	x														x	x	
false pimpernel	*Lindernia dubia*					x	x							x	x	x	x			
false rue anenome	*Isopyrum biternatum*	x	x	x	x														x	
false Solomon seal	*Smilacina racemosa*	x	x	x					x											
false sunflower	*Heliopsis helianthoides*	x	x		x					x	x	x								
fat-hen saltbush*	*Atriplex patula**													x						x
Fee's lip fern	*Cheilanthes feei*											x						x	x	
fennel-leaved pondweed	*Potamogeton pectinatus*															x	x			
fescue oval sedge	*Carex festucacea*								X					x					x	
field bindweed*	*Convolvulus arvensis**																			x
field dodder	*Cuscuta campestris*							x								x				x
field garlic*	*Allium vineale**											x							x	x
field milkwort	*Polygala sanguinea*								x	x	x			x						
field mint	*Mentha arvensis* var. *villosa*						x			x				x	x					
field mustard*	*Brassica rapa**																			x
field oval sedge	*Carex molesta*										x									x
field penny cress*	*Thlaspi arvense**									x	x									x
field pepper grass*	*Lepidium campestre**																			x
fireweed	*Erechtites hieracifolia*								x											x
flatstem spike rush	*Eleocharis compressa*										x			x						
flax*	*Linum usitatissimum**																			x
flax-leaved aster	*Aster linariifolius*											x								
floating manna grass	*Glyceria septentrionalis*													x		x				
flowering dogwood	*Cornus florida*	x	x															x		
flowering spurge	*Euphorbia corollata*	x								x	x	x	x					x	x	
forked chickweed	*Paronychia canadensis*	x									x		x							
fowl manna grass	*Glyceria striata*				x	x					x			x	x	x				
fox sedge	*Carex vulpinoidea*										x			x		x				x
fox-tail barley*	*Hordeum jubatum**																			x
foxglove beard tongue	*Penstemon digitalis*		x						x	x								x		x
foxtail dalea	*Dalea leporina*						x													
fragile fern	*Cystopteris protrusa*	x	x	x	x	x														
fragrant coneflower	*Rudbeckia subtomentosa*									x	x									
Frank's sedge	*Carex frankii*					x			x					x	x					
French grass	*Psoralea onobrychis*					x				x										
fringed brome	*Bromus ciliatus*													x						
fringed puccoon	*Lithospermum incisum*											x						x		
frog fruit	*Phyla lanceolata*							x			x			x		x				

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
frost grape	*Vitis vulpina*		x									x							x	
gama grass	*Tripsacum dactyloides*					x														x
garden chamomile*	*Chamaemelum nobilis**																			x
garden pea*	*Pisum sativum**																			x
giant cane	*Arundinaria gigantea*						x													
giant ragweed	*Ambrosia trifida*					x		x		x	x							x		x
giant wild rice*	*Zizania aquatica**													x		x				
ginseng	*Panax quinquefolius*			x	x															
glaucous campion*	*Silene cserei**																			x
goat grass*	*Aegilops cylindrica**																			x
goat's beard*	*Tragopogon dubius**										x	x						x		x
goat's rue	*Tephrosia virginiana*										X	x	x					x		
goat's-beard	*Aruncus dioicus*			x	x															
golden Alexanders	*Zizia aurea*		x	x	x					x	x									
golden aster	*Heterotheca camporum*			x							x	x								x
golden crownbeard*	*Verbesina encelioides**																			x
goldenglow	*Rudbeckia laciniata*					x		x												
goldenseal	*Hydrastis canadensis*			x	x															
goose grass*	*Eleusine indica**																			x
grape hyacinth*	*Muscari atlanticum**																			x
grass-leaved arrowhead	*Sagittaria graminea*													x		x				
grass-leaved goldenrod	*Euthamia graminifolia*									x	x		x							
grass-leaved rush	*Juncus marginatus*										x			x						
gray dogwood	*Cornus racemosa*		x		x	x			x	x	x	x	x		x					
gray sedge	*Carex annectens annectens*									x	x			x	x					x
Gray's sedge	*Carex grayi*						x	x							x					
great duckweed	*Spirodela polyrhiza*													x	x	x				
Great Plains ladies' tresses	*Spiranthes magnicamporum*									x		x								
great waterleaf	*Hydrophyllum appendiculatum*		x	x	x	x														
greater celandine	*Stylophorum diphyllum*				x	x	x													
green amaranth*	*Amaranthus hybridus**																			x
green ash	*Fraxinus pennsylvanica*			x	x	X	X	X	x					x	x	x				
green dragon	*Arisaema dracontium*			x	x	x	x													
green milkweed	*Asclepias viridiflora*									x	x	x						x		
green thorn	*Crataegus viridis*																			
green violet	*Hybanthus concolor*			x	x	x														
green-flowered milkweed	*Asclepias viridis*			x																
green-headed fox sedge	*Carex conjuncta*					x				x								x		
grooved yellow flax	*Linum sulcatum*									x	x	x						x	x	
groundnut	*Apios americana*					x	x				x				x					
hackberry	*Celtis occidentalis*		x	x	X	x	X	x			x									
hair grass	*Agrostis hyemalis*									x			x							x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland		Floodplain				Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
hair grass	*Muhlenbergia capillaris*		x						x										x	
hair sedge	*Carex eburnea*																	x	x	
hair-leaf bluets	*Hedyotis nuttalliana*			x														x	x	
hairy aster	*Aster pilosus*			x					x	x	x	x	x					x	x	x
hairy bedstraw	*Galium pilosum*		x	x								x	x							
hairy brome*	*Bromus commutatus**			x								x						x		x
hairy bush clover	*Lespedeza hirta*											x							x	
hairy foxtail bristlegrass*	*Setaria faberi**									x	x									x
hairy green sedge	*Carex hirsutella*			x	x	x			x	x										
hairy hawkweed	*Hieracium gronovii*		x								x	x	x							
hairy hawkweed	*Hieracium longipilum*									x		x	x							x
hairy lip fern	*Cheilanthes lanosa*											x							x	
hairy meadow parsnip	*Thaspium barbinode*					x				x	x									
hairy mountain mint	*Pycnanthemum pilosum*									x		X						x		
hairy panic-grass	*Panicum lanuginosum*		x	x	x					x		x	x							x
hairy rock cress	*Arabis hirsuta* var. *pycnocarpa*			x								x							x	
hairy ruellia	*Ruellia humilis*									x	x	x						x		
hairy tick trefoil	*Desmodium ciliare*									x		x							x	
halberd-leaved rose mallow	*Hibiscus laevis*							x						x	x	x	x			
Hale's corydalis - SE	***Corydalis halei - SE***																	x	x	
harbinger-of-spring	*Erigenia bulbosa*				x	x														
hare's ear mustard*	*Conringia orientalis**																			x
hazelnut	*Corylus americana*		x		x		x		x	x	x		X							
heart-leaved skullcap	*Scutellaria ovata*		x	x	x							x						x	x	
heart-leaved willow	*Salix eriocephala*										x				x	x				
heart-leaved willow	*Salix rigida*									x	x			x						
heath aster	*Aster ericoides*									x	x	x	x					x		
hedge mustard*	*Sisymbrium officinale**											x						x		x
hedge nettle	*Stachys palustris*					x	x				x			x						
hedgehog club rush	*Cyperus ovularis*								x		x	x							x	x
hemicarpha	*Scirpus micranthus*						x	x												
henbit*	*Lamium amplexicaule**																			x
hoary alyssum*	*Berteroa incana**																			x
hoary puccoon	*Lithospermum canescens*										x	x								
hoary tick trefoil	*Desmodium canescens*			x								x								
hoary vervain	*Verbena stricta*									x	x	x	x					x	x	x
hog peanut	*Amphicarpaea bracteata*			x		x			x				x		x					
honewort	*Cryptotaenia canadensis*		x	x	x	x	x	x												
honey locust	*Gleditsia triacanthos*			x		x	X	x				x						x	x	
hop hornbeam	*Ostrya virginiana*		x	x	x	x														
hop sedge	*Carex lupuliformis*													x						

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
horse radish*	*Armoracia rusticana**																			x
horse-nettle	*Solanum carolinense*								x	x	x	x								x
horsetail milkweed	*Asclepias verticillata*		x							x	x	x	x					x		x
horseweed	*Conyza canadensis*										x	x	x						x	x
humped bladderwort	*Utricularia gibba*															x				
hybrid fragile fern	*Cystopteris tennesseensis*		x																x	
hybrid vervain	*Verbena x perriana*																			x
Illinois bundleflower	*Desmanthus illinoensis*									x	x	x						x		
Illinois rose	*Rosa setigera setigera*						x													
Illinois rose	*Rosa setigera* var. *tomentosa*						x					x								x
Illinois tick trefoil	*Desmodium illinoense*									x	x							x		
Indian grass	*Sorghastrum nutans*									X	x	X	x					X	x	
Indian heliotrope*	*Heliotropium indicum**											x						x		x
Indian hemp	*Apocynum sibiricum*									x	x	x								
Indian tobacco	*Lobelia inflata*		x																	
inland rush	*Juncus interior*								x	x	x				x				x	
inland sea oats	*Chasmanthium latifolium*		x	x	x	x												x		
Iowa crabapple	*Malus ioensis*	x	x							x	x	x						x		
Italian rye grass*	*Lolium multiflorum**																			x
ivy-leaved morning glory*	*Ipomoea hederacea**		x																	x
Jack-in-the-pulpit	*Arisaema triphyllum*		x	x	x	x														
Jacob's ladder	*Polemonium reptans*	x		x	x	x				x	x		x							
jagged chickweed*	*Holosteum umbellatum**																			x
James' sedge	*Carex jamesii*		x	x																
Japanese barberry*	*Berberis thunbergii**	x			x															x
Japanese brome*	*Bromus japonicus**																	x		x
Japanese hedge parsley*	*Torilis japonica**											x						x		x
Japanese honeysuckle*	*Lonicera japonica**	x	x	x					x			x							x	x
Japanese hops*	*Humulus japonicus**						x													x
Japanese knotweed*	*Polygonum cuspidatum**																			x
Japanese lespedeza*	*Kummerowia striata**																			x
Jerusalem artichoke	*Helianthus tuberosus*					x				x	x	x								
jimson weed*	*Datura stramonium**																			x
Joe-Pye-weed	*Eupatorium purpureum*													x						
Johnson grass*	*Sorghum halapense**																			x
June grass	*Koeleria macrantha*									x	x	x	X					x	x	
Kansas sunflower*	*Helianthus petiolaris**										x									x
Kentucky bluegrass*	*Poa pratensis**		x						x	x	x	x						x	x	x
Kentucky coffeetree	*Gymnocladus dioica*				x															
kingnut hickory	*Carya laciniosa*			x		X	x													
knotty leaved rush	*Juncus acuminatus*														x	x				
knotweed dodder	*Cuscuta polygonorum*							x						x	x					

Appendix 1. Continued.

Common name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
	Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
	Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
	Scientific Name[3,4]																		
knotweed*	*Polygonum aviculare**																		x
Korean clover*	*Kummerowia stipulacea**								x		x								x
kudzu*	*Pueraria lobata**										x								x
lace grass	*Eragrostis capillaris*									x								x	
lady fern	*Athyrium angustum*	x	x	x	x														
lady's thumb*	*Polygonum persicaria**	x			x								x						x
lake cress	*Armoracia aquatica*												x		x				
lamb's quarters*	*Chenopodium album**									x									x
lance-fruited oval sedge	*Carex scoparia*									x			x						
lance-leaved bedstraw	*Galium lanceolatum*	x																	
lance-leaved buckthorn	*Rhamnus lanceolata*										x							x	
lance-leaved loosestrife	*Lysimachia lanceolata*							x	x	x			x						
large passion flower	*Passiflora incarnata*																		x
large water starwort	*Callitriche heterophylla*				x								x			x			
large-flowered coreopsis*	*Coreopsis grandiflora**																		x
late boneset	*Eupatorium serotinum*				x	x	x	x	x	x			x		x				
late figwort	*Scrophularia marilandica*	x	x	x	x					x									
late goldenrod	*Solidago gigantea*		x		x				x	x	x								
late horse gentian	*Triosteum perfoliatum*	x		x						x	x						x		
lawn fescue*	*Festuca elatior**					x													x
leadplant	*Amorpha canescens*								x	x	x	x					x		
leafy phacelia	*Phacelia bipinnatifida*		x	x															
leafy pondweed	*Potamogeton foliosus*														x				
least duckweed	*Lemna perpusilla*												x	x	X				
leatherflower	*Clematis pitcheri*		x		x														x
lesser love grass	*Eragrostis minor*																		x
leucospora	*Leucospora multifida*					x	x			x			x		x				x
little barley	*Hordeum pusillum*										x								x
little bluestem	*Schizachyrium scoparium*								X	X	X	X					X	x	
little pussy toes	*Antennaria neglecta*	x						x	x	x		x							
liverleaf	*Hepatica nobilis* var. *acuta*	x	x	x															
lizard's tail	*Saururus cernuus*				x	x	x							x	x				
long-awned bracted sedge	*Carex gravida*								x								x		
long-awned wood grass	*Brachyelytrum erectum*		x	x															
long-beaked arrowhead	*Sagittaria calycina*														x				
long-flowered tobacco*	*Nicotiana longiflora**																		x
long-leaved ammannia	*Ammannia coccinea*				x	x							x		x				
long-leaved dock	*Rumex maritimus*									x									
long-leaved panic grass - SE	***Panicum longifolium - SE***										x							x	
long-scaled green sedge	*Carex bushii*																		x
long-stalked hummock sedge	*Carex lanuginosa*	x								x			x						

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
lopseed	*Phryma leptostachya*			x	x															
low forked chickweed	*Paronychia fastigiata*								x		x									
low hop clover*	*Trifolium campestre**																			x
lyre-leaved rock cress	*Arabis lyrata*			x							x								x	
mad-dog skullcap	*Scutellaria lateriflora*					x	x							x				x		
maidenhair fern	*Adiantum pedatum*			x	x															
maple-leaved goosefoot	*Chenopodium gigantospermum*	x				x														x
marbleseed	*Onosmodium molle* ssp. *occidentale*											x								
marijuana*	*Cannabis sativa**																			x
marsh elder	*Iva annua*																			x
marsh fleabane	*Erigeron philadelphicus*	x				x			x		x									x
marsh pink	*Sabatia angularis*								x					x						x
marsh purslane	*Ludwigia palustris* var. *americana*					x								x		x				
marsh purslane	*Ludwigia peploides* var. *glabrescens*						x							x		x				
marsh rush	*Juncus dichotomus*													x						
marsh St. John's-wort	*Triadenum tubulosum*													x	x	x				
marsh yellow cress	*Rorippa islandica* var. *fernaldiana*						x				x			x						
Maryland senna	*Cassia marilandica*					x				x								x		
mayapple	*Podophyllum peltatum*	x	x	x	x	x														
mead's stiff sedge	*Carex meadii*									x		x								
meadow fescue*	*Festuca pratensis**								x	x	x	x								x
meadow sedge	*Carex granularis*									x				x						
mermaid weed	*Proserpinaca palustris*										x			x		x				
Mexican azolla	*Azolla mexicana*													x		x				
Miami mist	*Phacelia purshii*			x	x	x													x	x
mild water pepper	*Polygonum hydropiperoides*							x	x					x	x	x				x
milk pea	*Galactia volubilis*											x							x	
milk spurge	*Chamaesyce supina*																		x	x
Missouri goldenrod	*Solidago missouriensis*									x	x	x								
Missouri gooseberry	*Ribes missouriense*	x		x	x										x					
Missouri goosefoot	*Chenopodium missouriense*																			x
Missouri gourd	*Cucurbita foetidissima*																			x
Missouri ironweed	*Vernonia missurica*					x			x	x	x	x		x				x		
Missouri orange coneflower - SE	***Rudbeckia missouriensis - SE***											x						x		
Missouri violet	*Viola missouriensis*					x	x	x												
mistflower	*Eupatorium coelestinum*											x								x
Mock bishop's weed-SE	***Ptilimnium nuttallii - SE***						x	x						x						
mockernut hickory	*Carya tomentosa*	X	x	x																
monarda	*Monarda bradburiana*	x	x			x		x				x							x	
moneywort*	*Lysimachia nummularia**				x	x								x	x					
moonseed	*Menispermum canadense*	x	x	x	x															

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
morning glory*	*Ipomoea purpurea**																			x
Morrow's honeysuckle*	*Lonicera morrowii**											x						x		
mosquito fern	*Azolla caroliniana*													x		x				
moth mullein*	*Verbascum blattaria**																			x
motherwort*	*Leonurus cardiaca**				x	x							x							x
mountain dittany	*Cunila origanoides*	x																	x	
mouse-eared cress*	*Arabidopsis thaliana**																		x	x
mousetail	*Myosurus minimus*							x												x
mud plantain-SE	***Heteranthera reniformis-SE***							**x**						**x**		**x**				
muhly	*Muhlenbergia bushii*				x															
mullein foxglove	*Dasistoma macrophylla*	x	x															x		
mullein pink*	*Lychnis coronaria**																			x
multiflora rose*	*Rosa multiflora**	x	x		x	x														x
munro grass	*Panicum rigidulum*										x		x	x		x				
musk thistle*	*Carduus nutans**											x								x
Muskingum River sedge	*Carex muskingumensis*				x	x									x					
naiad	*Najas guadalupensis*															x				
narrow-leaved bluets	*Hedyotis nigricans*		x									**X**						x		
narrow-leaved cattail sedge	*Carex squarrosa*														x					
narrow-leaved goosefoot	*Chenopodium desiccatum*										x									
narrow-leaved pinweed	*Lechea tenuifolia*	x										x	x							
narrow-leaved umbrellawort	*Mirabilis linearis*																			x
narrow-leaved vervain	*Verbena simplex*									x		x						x	x	
New Jersey tea	*Ceanothus americanus*	x								x	x	x	x					x	x	
New York fern-SE	***Thelypteris noveboracensis-SE***			x	x															
ninebark	*Physocarpus opulifolius*				x															
nodding bur marigold	*Bidens cernua*				x	x	x							x	x		x			
nodding chickweed	*Cerastium nutans*																			x
nodding fescue	*Festuca obtusa*	x			x														x	
nodding smartweed	*Polygonum lapathifolium*				x	x	x			x				x						
nodding spurge	*Chamaesyce maculata*										x								x	x
northern dewberry	*Rubus flagellaris*			x		x				x	x	x	x							
northern red oak	*Quercus rubra*	**X**	**X**	**X**	**X**														x	
nut grass	*Cyperus esculentus*					x	x													x
Nuttall's tick trefoil	*Desmodium nuttallii*									x								x	x	
obedient plant	*Physostegia virginiana*									x	x	x	x					x		
Ohio buckeye	*Aesculus glabra*		x	x	x	x														
Ohio spiderwort	*Tradescantia ohiensis*									x	x	x	x					x	x	
old field goldenrod	*Solidago nemoralis*	x							x	x	x	x	x					x		x
one-flowered broomrape	*Orobanche uniflora*	x	x	x						x										
Ontario aster	*Aster ontarionis*		x		x										x					
orange coneflower	*Rudbeckia fulgida*										x		x					x		x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland		Floodplain				Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
orange day lily*	*Hemerocallis fulva**		x	x		x				x										x
orchard grass*	*Dactylis glomerata**																			x
Osage orange*	*Maclura pomifera**		x	x		x						x								x
pagoda plant	*Blephilia ciliata*		x				x			x	x							x		
pale beard tongue	*Penstemon pallidus*								x			x						x	x	
pale corydalis	*Corydalis flavula*			x	x														x	
pale dock	*Rumex altissimus*									x	x			x						
pale dogwood	*Cornus obliqua*									x	x			x	x					
pale false foxglove - ST	***Agalinis skinneriana - ST***											x								
pale Indian plantain	*Cacalia atriplicifolia*			x								x	x							
pale leafcup	*Polymnia canadensis*			x	x														x	
pale purple coneflower	*Echinacea pallida*			x						x		x	x					x		
pale spiked lobelia	*Lobelia spicata* var. *spicata*									x	x	x	x							
pale touch-me-not	*Impatiens pallida*				x	x									x					
pale-leaved sunflower	*Helianthus strumosus*		x							x	x	x						x		
panicled aster	*Aster simplex*			x		x	x	x						x	x	x	x			
panicled tick trefoil	*Desmodium paniculatum*									x		x							x	
paper mulberry*	*Broussonetia papyrifera**																			x
parsnip*	*Pastinaca sativa**									x	x		x							x
partridge pea	*Cassia fasciculata*		x						x		x	x	x					x	x	
pasture rose	*Rosa carolina*		x						x	x	x	x	x					x	x	
pasture thistle	*Cirsium discolor*		x								x		x							x
path rush	*Juncus tenuis*		x	x			x													x
patience dock*	*Rumex mexicanus**																			x
paw paw	*Asimina triloba*				X	x	x													
peach*	*Prunus persica**											x								
peach-leaved willow	*Salix amygdaloides*					x	x	x						x						
pecan	*Carya illinoinensis*					x	x	X												
pellitory	*Parietaria pensylvanica*		x			x						x							x	x
pencil flower	*Stylosanthes biflora*			x								x								
Pennsylvania sedge	*Carex pensylvanica*		x	x									X							
perennial rye grass*	*Lolium perenne**																			x
persimmon	*Diospyros virginiana*			x		x	x		x			x						x		
Peruvian daisy*	*Galinsoga quadriradiata**																			x
pickerelweed	*Pontederia cordata*													x		x	x			
pignut hickory	*Carya glabra*		X	x	x				X				x							
pin oak	*Quercus palustris*		x			X	X		X		x		x	x						
pinkweed	*Polygonum pensylvanicum*			x		x	x			x				x						x
pinweed	*Lechea stricta*										x	x								
plains muhly	*Muhlenbergia cuspidata*											x						x	x	
plains oval sedge	*Carex brevior*										x	x		x						
plains three awn grass	*Aristida oligantha*											x								x

Appendix 1. Continued.

	Class	Forest							Prairie			Sav	Wetland				Primary		
	Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
	Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
Common name[3,4]	Scientific Name[3,4]																		
pointed tick trefoil	*Desmodium glutinosum*	x	x	x								x						x	
poison ivy	*Toxicodendron radicans*	x	x	x	x	x	x	x		x			x					x	
pokeweed	*Phytolacca americana*	x				x				x									x
pondweed	*Potamogeton nodosus*														x	x			
poorjoe	*Diodia teres*									x	x								x
porcupine grass	*Stipa spartea*								x	x	x	X					x	x	
post oak	*Quercus stellata*	X	X	x				X			x	X					x	x	
poverty grass	*Aristida dichotoma*																		x
poverty oat grass	*Danthonia spicata*	x	x					x			x	x					x		
prairie alumroot	*Heuchera richardsonii*	x							x	x	x						x	X	
prairie aster	*Aster turbinellus*		x								x	x							
prairie blazing star	*Liatris pycnostachya*								x	x									
prairie blue-eyed grass	*Sisyrinchium campestre*								x		x						x		
prairie brome	*Bromus kalmii ?*		x																
prairie cord grass	*Spartina pectinata*				x				X	x			X						
prairie coreopsis	*Coreopsis palmata*								x	x	x	x					x	x	
prairie cup grass*	*Eriochloa contracta**																		x
prairie dock	*Silphium terebinthinaceum*								x	x	x	x					x		
prairie dodder	*Cuscuta pentagona*												x						x
prairie dropseed	*Sporobolus heterolepis*								X	x									
prairie Indian plantain	*Cacalia plantaginea*								x		x						x		
prairie milkweed	*Asclepias sullivantii*								x	x		x							
prairie panic grass	*Panicum oligosanthes*								X	x	x	x					x	x	
prairie parsley	*Polytaenia nuttallii*								x		x						x		
prairie phlox	*Phlox pilosa*		x						x	x	x								
prairie ragwort	*Senecio plattensis*									x	x						x		
prairie spiderwort - SE	***Tradescantia bracteata - SE***								x										
prairie St. John's-wort	*Hypericum sphaerocarpum*								x	x	x						x	x	
prairie sundrops	*Oenothera pilosella*							x	x	x		x							
prairie sunflower	*Helianthus rigidus*								x	x	x	x					x		
prairie switchgrass	*Panicum virgatum*				x				X	x	x	x					x		x
prairie tea	*Croton monanthogynus*										x						x	x	x
prairie trillium	*Trillium recurvatum*	x	x	x	x	x				x									
prairie wedge grass	*Sphenopholis obtusata*	x												x				x	
prairie wedge grass	*Sphenopholis obtusata major*		x	x													x	x	
prairie willow	*Salix humilis*								x	x	x	x							
prickly gooseberry	*Ribes cynosbati*	x																x	
prickly lettuce*	*Lactuca serriola**									x									x
prickly sida*	*Sida spinosa**				x					x						x			x
prickly-pear	*Opuntia humifusa*									x	x	x					x	x	
prostrate amaranth*	*Amaranthus graecizans**									x									x
puccoon*	*Lithospermum arvense**										x						x	x	x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
puffsheath dropseed	*Sporobolus neglectus*											x								x
puncture vine*	*Tribulus terrestris**																			x
purple cliff brake	*Pellaea atropurpurea*																	x	x	
purple coneflower	*Echinacea purpurea*	x	x							x			x							
purple daisy	*Aster patens*		x									x	x							
purple love grass	*Eragrostis spectabilis*									x	x	x						x	x	
purple meadow parsnip	*Thaspium trifoliatum*			x	x					x	x	x								
purple meadow rue	*Thalictrum dasycarpum*		x	x	x					x				x						
purple prairie clover	*Dalea purpurea*									x	x	X						x		
purple sandgrass	*Triplasis purpurea*										x									
purple-headed sneezeweed	*Helenium flexuosum*																			x
purslane speedwell	*Veronica peregrina*									x	x			x						x
purslane*	*Portulaca oleracea **																			x
pussy toes	*Antennaria plantaginifolia*	x	x						x			x						x		
quack grass*	*Agropyron repens**									x										x
Queen Anne's lace*	*Daucus carota**									x	x	x	x							x
raccoon grape	*Ampelopsis cordata*						x					x								
ragged evening primrose	*Oenothera laciniata*										x	x						x		x
ragweed	*Ambrosia bidentata*																			x
rattlebox	*Crotalaria sagittalis*	x																		x
rattlesnake fern	*Botrychium virginianum*	x	x	x					x											
rattlesnake master	*Eryngium yuccifolium*									x	x	x								
Ravenna grass*	*Erianthus ravennae**																			x
red bulrush	*Scirpus pendulus*				x					x	x			x		x				
red clover*	*Trifolium pratense**									x	x									x
red maple	*Acer rubrum*					x									x					
red mulberry	*Morus rubra*		x	x	x	x														
red sprangle top	*Leptochloa filiformis*													x						x
red top	*Agrostis alba*								x		x		x							x
red-rooted sedge	*Cyperus erythrorhizos*				x	x					x					x				x
reed canary grass*	*Phalaris arundinacea**				x	x				x	x			X		x				
rice cutgrass	*Leersia oryzoides*					x	x	x						x	x	X				
rigid goldenrod	*Solidago rigida*									x	x		x					x		
river birch	*Betula nigra*				X	x	x								x	x				
river bulrush	*Scirpus fluviatilis*				x	x								X		x				
riverbank grape	*Vitis riparia*	x		x	X	x	x	x	x	x									x	
riverbank sedge	*Carex emoryi*				x	x								x						
riverbank wild rye	*Elymus riparius*				x	x														
Robin's plantain	*Erigeron pulchellus*	x	x			x				x	x	x								
rock satin grass	*Muhlenbergia sobolifera*		x	x				x											x	
rope dodder	*Cuscuta glomerata*				x			x		x	x			x						
rosinweed	*Silphium integrifolium*									x	x	x	x					x		

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
rough blazing star	*Liatris aspera*									x	x	x						x		
rough buttercup	*Ranunculus hispidus*			x	x															
rough buttercup	*Ranunculus hispidus nitidus*			x	x															
rough cinquefoil*	*Potentilla norvegica**																			x
rough dropseed	*Sporobolus asper*									x	x	x						x	x	
rough false foxglove	*Agalinis aspera*									x		x						x		
rough goldenrod	*Solidago radula*											x						x	x	
rough goldenrod	*Solidago rugosa*			x																
rough pennyroyal	*Hedeoma hispida*									x	x	x						x	x	
rough pigweed*	*Amaranthus retroflexus**																			x
rough sand sedge	*Cyperus schweinitzii*										x									
rough-clustered sedge	*Carex cephalophora*			x					x									x		
rough-leaved dogwood	*Cornus drummondii*	x	x									X	x					x	x	x
round-fruited hedge hyssop	*Gratiola virginiana*					x	x	x							x	x	x			
round-fruited panic grass	*Panicum sphaerocarpon*								x		x	x								
round-headed bush clover	*Lespedeza capitata*									x	X	X	x					x	x	
round-leaved spurge	*Chamaesyce serpens*																			
round-stemmed false foxglove	*Agalinis gattingeri*	x										x								
royal catchfly - SE	***Silene regia - SE***									x	x		x							
Rugel's plantain	*Plantago rugelii*					x			x											x
rush	*Juncus brachycarpus*									x	x			x		x				
rushfoil	*Crotonopsis elliptica*								x											x
rusty nannyberry	*Viburnum rufidulum*			x								x						x	x	
rye*	*Secale cereale**																			x
salsify*	*Tragopogon porrifolius**																			x
salt meadow grass*	*Leptochloa acuminata**													x						x
salt meadow grass*	*Leptochloa fascicularis**						x							x		x				x
salt-marsh cockspur grass	*Echinochloa walteri*							x						x		x				
Sampson's snakeroot	*Psoralea psoralioides* var. *eglandulosa*	x							x	x										
sand bracted sedge	*Carex muhlenbergii*								x		x	x							x	
sand coreopsis	*Coreopsis lanceolata*									x	x	x						x		
sand croton	*Croton glandulosus* var. *septentrionalis*								x		x	x								x
sand dropseed	*Sporobolus cryptandrus*										x		x						x	x
sand milkweed	*Asclepias amplexicaulis*										x	x	x							
sandbar love grass	*Eragrostis frankii*							x												x
sandbar willow	*Salix exigua*					x		x		x	x			X	x	x	x			
sandbur	*Cenchrus longispinus*										x		x							x
sandwort	*Arenaria serpyllifolia*																		x	
sassafras	*Sassafras albidum*	x	x	x	x				x		x	x							x	
sawtooth sunflower	*Helianthus grosseserratus*									x	x		x	x						x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
scarlet oak	*Quercus coccinea*		x																	
scarlet pimpernel*	*Anagallis arvensis**																			x
scouring rush	*Equisetum hyemale* var. *affine*					x	x	x			x	x		x						x
scratch grass	*Muhlenbergia asperifolia*																		x	
scurfy-pea	*Psoralea tenuiflora*											x						x		
seaside heliotrope*	*Heliotropium curassavicum**																			x
sedge	*Carex albursina*		x	x	x															
sedge	*Carex normalis*					x												x		
sedge	*Carex stipata*						x							x						
sedge	*Cyperus ferruginescens*					x								x		x				x
seedbox	*Ludwigia alternifolia*									x	x			x		x				
self heal*	*Prunella vulgaris**									x	x	x	x							x
sensitive fern	*Onoclea sensibilis*					x				x	x			x	x					
sessile-flowered yellow cress	*Rorippa sessiliflora*					x	x							x		x	x			
sessile-leaved tick trefoil	*Desmodium sessilifolium*									x	x	x	x					x	x	
shadbush	*Amelanchier arborea*		x	x								x						x	x	
shagbark hickory	*Carya ovata*		X	X	X	x			X				x							
sheathing dropseed	*Sporobolus vaginiflorus*										x	x							x	x
shepherd's purse*	*Capsella bursa-pastoris**																			x
shingle oak	*Quercus imbricaria*		x		x	x	x					x	x							
shining bedstraw	*Galium concinnum*		x		x						x									
shooting star	*Dodecatheon meadia*		x	x	x					x	x		x							
Short's sedge	*Carex shortiana*		x	x		x														
short-pedicelled chickweed	*Cerastium brachypodum*											x								
short-pointed flat sedge	*Cyperus acuminatus*										x									x
showy goldenrod	*Solidago speciosa*									x	x	x	x							
showy tick trefoil	*Desmodium canadense*									x	x									
Siberian elm*	*Ulmus pumila**											x						x		x
sicklepod	*Arabis canadensis*		x																	
side-flowered aster	*Aster lateriflorus*			x		x	x					x								x
side-oats grama	*Bouteloua curtipendula*									x		X						X	x	
silky aster	*Aster sericeus*											x						x		
silky wild rye	*Elymus villosus*		x	x	x	x														
silver maple	*Acer saccharinum*					X	X	X						x			x	x		x
six-weeks fescue	*Vulpia octoflora*								x		x	x	x					x	x	x
sky-blue aster	*Aster azureus*									x		x						x		
sleepy catchfly	*Silene antirrhina*									x	x	x						x	x	x
slender bulrush	*Scirpus heterochaetus*													x						
slender bush clover	*Lespedeza virginica*		x							x	x	x							x	
slender corydalis	*Corydalis micrantha*		x	x	x	x						x								
slender false foxglove	*Agalinis tenuifolia*										x	x						x		
slender false pimpernel	*Lindernia dubia* var. *anagallidea*						x								x	x				

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
slender heliotrope - SE	***Heliotropium tenellum - SE***											x						x	x	
slender knotweed	*Polygonum tenue*										x								x	x
slender mountain mint	*Pycnanthemum tenuifolium*						x		x	x	x		x							
slender panic grass	*Panicum flexile*													x						x
slender sand sedge	*Cyperus filiculmis*								x	x	x	x						x	x	x
slender spike rush	*Eleocharis verrucosa*								x					x						
slender three awn	*Aristida ramosissima*									x				x						
slender three-seeded mercury	*Acalypha gracilens*								x		x	x							x	x
slender three-seeded mercury	*Acalypha monococca*																		x	
slender wood sedge	*Carex gracilescens*	x	x	x																
slippery elm	*Ulmus rubra*	x	X	X	x	x					x	x		x				x	x	
small burhead - SE	***Echinodorus tenellus - SE***															x				
small false Solomon's-seal	*Smilacina stellata*	x	x	x																
small morning glory	*Ipomoea lacunosa*					x														x
small passion flower	*Passiflora lutea*	x	x	x	x				x										x	
small peppergrass*	*Lepidium densiflorum**									x	x									x
small pinweed	*Lechea mucronata*											x								
small skullcap	*Scutellaria parvula*									x	x	x	x					x	x	
small Solomon seal	*Polygonatum biflorum*		x	x																
small wild bean	*Strophostyles leiosperma*										x									x
small wood sunflower	*Helianthus microcephalus*											x								
small yellow fox sedge	*Carex annectens xanthocarpa*													x						
small-flowered bitter cress	*Cardamine parviflora* var. *arenicola*										x			x						x
small-flowered crowfoot	*Ranunculus abortivus*	x			x															x
small-fruited false flax*	*Camelina microcarpa**																			x
smooth arrowwood	*Viburnum recognitum*				x										x					
smooth aster	*Aster laevis*									x	x		x							
smooth blue aster	*Aster lanceolatus*													x	x					
smooth brome grass*	*Bromus inermis**									x	x	x	x							x
smooth buttonweed	*Spermacoce glabra*													x						
smooth chess	*Bromus racemosus*		x									x							x	
smooth cliff-brake	*Pellaea glabella*																		x	
smooth crab grass*	*Digitaria ischaemum**						x													x
smooth creeping spurge	*Chamaesyce glyptosperma*																	x		
smooth false foxglove	*Aureolaria flava*	x										x								
smooth ground cherry	*Physalis subglabrata*									x	x	x								
smooth hedge nettle	*Stachys tenuifolia*				x	x	x								x	x	x			
smooth lens grass	*Paspalum laeve*																			x
smooth rock cress	*Arabis laevigata*	x																	x	
smooth ruellia	*Ruellia strepens*			x	x															
smooth scouring rush	*Equisetum laevigatum*				x						x	x		x						
smooth sumac	*Rhus glabra*	x			x			x		x	x	x	x					x	x	

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
smooth tick trefoil	*Desmodium glabellum*		x	x								x								x
snailseed	*Cocculus carolinus*								x										x	x
sneezeweed	*Helenium autumnale*					x	x			x			x	x						
snow-on-the-mountain	*Euphorbia marginata*														x					x
soft agrimony	*Agrimonia pubescens*		x	x	x	x					x									
soft rush	*Juncus effusus*					x								x	x	x				
Solomon's seal	*Polygonatum commutatum*		x	x	x	x				x	x								x	
sour dock - SE, EXT	***Rumex hastatulus - SE, EXT***										**x**		**x**							**x**
sour dock*	*Rumex acetosella**									x	x		x							x
sour gum	*Nyssa sylvatica*				x	x			**X**											
southern blue flag	*Iris shrevei*					x		x						x	x	x				
southern dewberry	*Rubus trivialis*						x		x											
southern lake sedge	*Carex hyalinolepis*													x		x				
southern wild rice*	*Zizanopsis miliacea**													x		x				
sow thistle*	*Sonchus oleraceus**																			x
Spanish needles*	*Bidens bipinnata**																		x	x
spear grass	*Poa chapmaniana*																			x
spearmint*	*Mentha spicata**																			x
spicebush	*Lindera benzoin*			x	x	x	x								x					
spiked lobelia	*Lobelia spicata* var. *leptostachys*									x	x	x	x							x
spiny pigweed*	*Amaranthus spinosus**						x													x
spiny sow thistle*	*Sonchus asper**																			x
spotted cat's ear*	*Hypochaeris radicata**																			x
spotted St. John's-wort	*Hypericum punctatum*			x							x	x	x						x	x
spotted touch-me-not	*Impatiens capensis*			x			x	x						x	x					
spreading spurge	*Chamaesyce humistrata*						x				x									x
spreading yellow cress	*Rorippa sinuata*					x								x						
spring beauty	*Claytonia virginica*		x	x	x	x	x			x										
spring ladies' tresses-SE	***Spiranthes vernalis - SE***									**x**	**x**									
spurge - SE	***Euphorbia spathulata - SE***											**x**						**x**	**x**	
star-of-Bethlehem*	*Ornithogalum umbellatum**																			x
starry campion	*Silene stellata*		x	x	x	x				x	x								x	
starved panic grass	*Panicum depauperatum*		x						x											x
stickleaf	*Mentzelia oligosperma*											x						x	x	
stickseed	*Hackelia virginiana*		x		x	x	x													x
stiff bedstraw	*Galium obtusum*							x		x	x			x	x	x				
stiff tick trefoil	*Desmodium rigidum*									x			x							
stink grass*	*Eragrostis cilianensis**																			x
stout rush	*Juncus nodatus*															x				
straw colored flat sedge	*Cyperus strigosus*									x	x			x		x				x
strawberry blite*	*Chenopodium capitatum**																			x
strawberry bush	*Euonymus atropurpurea*			x	x	x	x													

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
streambank chervil	*Chaerophyllum procumbens*					x	x													x
Stuve's bush clover	*Lespedeza stuevei*		x	x								x							x	
sugar maple	*Acer saccharum*			x	**X**	x													x	
sugarberry	*Celtis laevigata*			x			x	**X**												
sulfur cinquefoil*	*Potentilla recta**									x	x	x	x					x		x
summer grape	*Vitis aestivalis*			x		x			x			x								
sunshine rose	*Rosa suffulta*									x	x									x
swamp buttercup	*Ranunculus septentrionalis*					x	x							x						
swamp dewberry	*Rubus hispidus*		x		x				x		x			x	x					
swamp dock	*Rumex verticillatus*					x					x			x	x	x	x			
swamp holly	*Ilex decidua*			x			x													
swamp marigold	*Bidens aristosa*													x						x
swamp milkweed	*Asclepias incarnata*					x					x			x	x	x				
swamp privet	*Forestiera acuminata*						x	x							x					
swamp rose mallow	*Hibiscus lasiocarpus*													x	x	x				x
swamp saxifrage	*Saxifraga pensylvanica*				x					x			x	x						
swamp spike rush	*Eleocharis palustris*													x	x	x				
swamp tickseed	*Bidens tripartita*						x				x			x	x					
swamp white oak	*Quercus bicolor*				x				**X**											
sweet gum	*Liquidambar styraciflua*		x	x	x	x	x		x											
sweet pignut hickory	*Carya ovalis*		**X**	**X**	**X**								x							
sycamore	*Platanus occidentalis*				x	x	x	x				x								
tall anemone	*Anemone virginiana*		x	x							x	x							x	
tall boneset	*Eupatorium altissimum*									x	x	x	x					x	x	
tall coreopsis	*Coreopsis tripteris*									x	x	x	x							
tall ironweed	*Vernonia gigantea*			x							x			x	x					x
tall thistle	*Cirsium altissimum*		x	x																x
tall water hemp	*Amaranthus tuberculatus*					x		x						x			x			x
tamarisk waterhemp	*Amaranthus rudis*					x		x						x			x			x
tansy mustard	*Descurainia pinnata* var. *brachycarpa*			x														x	x	x
tansy mustard*	*Descurainia sophia**																			x
terrestrial starwort	*Callitriche terrestris*													x						x
Texas hickory	*Carya texana*			x					**X**				x					x	x	
three-flowered melic grass	*Melica nitens*		x	x	x					x		x						x	x	
three-seeded mercury	*Acalypha ostryaefolia*						x													x
three-seeded mercury	*Acalypha rhomboidea*					x												x		
three-seeded mercury	*Acalypha virginica*											x							x	x
tick trefoil	*Desmodium cuspidatum*																		x	
tickle grass	*Eragrostis trichodes*										x									
Timothy*	*Phleum pratense**									x	x		x							x
toad rush	*Juncus bufonius*																			x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
tomatillo*	*Physalis ixocarpa**																			x
tooth-cup	*Rotala ramosior*						x							x		x				
toothwort	*Dentaria laciniata*	x	x	x	x															
Torrey's rush	*Juncus torreyi*									x	x					x				
trailing bush clover	*Lespedeza procumbens*											x								
trailing wild bean	*Strophostyles helvula*										x	x								x
Treacle mustard*	*Erysimum repandum**																			x
tree-of-heaven*	*Ailanthus altissima**											x							x	x
trumpet creeper	*Campsis radicans*					x	x					x							x	x
tuckahoe	*Peltandra virginica*														x	x				
tumble mustard*	*Sisymbrium altissimum**																			x
tumbleweed	*Amaranthus albus*										x									x
tumbleweed*	*Salsola kali**						x				x									x
two-rowed bead grass	*Paspalum pubiflorum glabrum*													x						
upland wild timothy	*Muhlenbergia racemosa*											x							x	
upright carrion flower	*Smilax ecirrhata*	x	x	x	x															
variable pondweed	*Potamogeton diversifolius*															x				
velvet leaf*	*Abutilon theophrasti**						x													x
Venus' looking glass	*Triodanis perfoliata*		x								x	x						x	x	x
violet bush clover	*Lespedeza violacea*	x																	x	
violet wood sorrel	*Oxalis violacea*	x	x	x	x			x	x	x	x							x	x	
virgin's bower	*Clematis virginiana*	x			x															
Virginia bluebells	*Mertensia virginica*	x	x	x	x	x														
Virginia creeper	*Parthenocissus quinquefolia*	x	x	x	x			x			x							x	x	x
Virginia knotweed	*Polygonum virginianum*	x	x	x	x															
Virginia plantain	*Plantago virginica*										x	x						x		x
Virginia rock cress	*Sibara virginica*																			x
Virginia spiderwort	*Tradescantia virginiana*	x	x	x				x	x	x		x								x
Virginia wild rye	*Elymus virginicus*	x		x	x	x	x				x	x								x
wafer ash	*Ptelea trifoliata*				x							x						x	x	
walking fern	*Asplenium rhizophyllum*	x	x	x															x	
water hemlock	*Cicuta maculata*				x				x	x				x	x					
water hyssop	*Bacopa rotundifolia*													x		x				
water meal	*Wolffia columbiana*													x	x	x				
water meal	*Wolffia papulifera*													x	x	x				
water milfoil	*Myriophyllum heterophyllum*															x				
water parsnip	*Sium suave*									x				x	x	x				
water pepper*	*Polygonum hydropiper**		x					x			x			x		x				
water smartweed	*Polygonum amphibium*				x						X			x	X	X				
water willow	*Justicia americana*																x			
waxy meadow rue	*Thalictrum revolutum*				x					x	x									
western ragweed	*Ambrosia psilostachya*								x		x	x								x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
western sunflower	*Helianthus occidentalis*									x	x	x	x							
western wild lettuce - SE, EXT	***Lactuca ludoviciana - SE, EXT***									**x**		**x**						**x**	**x**	
wheat*	*Triticum aestivum**																			x
white ash	*Fraxinus americana*	X	X	X								x						x	x	
white avens	*Geum canadense*	x	x	x	x	x	x	x											x	x
white clover*	*Trifolium repens**							x					x							x
white forget-me-not	*Myosotis verna*										x	x						x	x	x
white grass	*Leersia virginica*	x		x	x	x								x						x
white mulberry*	*Morus alba**	x	x	x	x						x									x
white mustard*	*Brassica hirta**																			x
white oak	*Quercus alba*	X	X	X	X			X					X							
white petunia*	*Petunia axillaris**																			x
white poplar*	*Populus alba**									x										x
white prairie clover	*Dalea candida*							x		x	x	X	x					x		
white snakeroot	*Eupatorium rugosum*	x	x	x	x			x				x								
white sweet clover*	*Melilotus alba**									x	x	x	x					x	x	x
white trillium	*Trillium grandiflorum*		x	x	x															
white trout lily	*Erythronium albidum*	x		x	x	x														
white vervain	*Verbena urticifolia*		x		x			x			x	x								x
white violet	*Viola striata*		x	x	x															
white wild indigo	*Baptisia lactea*									x	x		x							
white willow*	*Salix alba**				x						x									
whitlow grass	*Draba reptans*										x	x						x	x	
whitlow grass*	*Draba brachycarpa**																			x
whitlow grass - SE	***Draba cuneifolia - SE***											**x**						**x**	**x**	
whorled milkweed	*Asclepias quadrifolia*		x	x														x		
whorled milkwort	*Polygala verticillata*									x		x	x							
wild bergamot	*Monarda fistulosa*									x	x	x	x						x	
wild black cherry	*Prunus serotina*	x	x	x	X	x		x			x							x	x	x
wild chervil	*Chaerophyllum tainturieri*				x	x														x
wild four-o'clock*	*Mirabilis nyctaginea**									x	x								x	x
wild garlic	*Allium canadense*	x	x	x	x	x				x		x						x	x	
wild geranium	*Geranium maculatum*	x	x	x	x	x				x	x	x								
wild ginger	*Asarum canadense*	x	x	x	x															
wild hyacinth	*Camassia scillioides*			x	x			x				x	x					x	x	
wild hydrangea	*Hydrangea arborescens*		x	x		x													x	
wild kidney bean	*Phaseolus polystachios*	x	x	x																x
wild lettuce	*Lactuca canadensis*	x	x							x	x	x								x
wild licorice	*Galium circaezans*	x	x					x		x		x						x	x	
wild lily	*Lilium michiganense*									x	x									
wild pansy*	*Viola rafinesquii**										x	x						x	x	x

Appendix 1. Continued.

Common name[3,4]	Scientific Name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
		Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
		Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
wild poinsettia	*Euphorbia dentata*										x	x						x	x	x
wild sage	*Salvia reflexa*																			x
wild sensitive plant	*Cassia nictitans*										x	x							x	x
wild strawberry	*Fragaria virginiana*									x	x		x							
wild sweet crab apple	*Malus coronaria*	x											x							
wild sweet potato vine	*Ipomoea pandurata*			x	x															
wild yam	*Dioscorea quaternata*	x	x	x	x															
wild yam	*Dioscorea villosa*	x	x																	
windmill grass*	*Chloris verticillata**																			x
winged elm	*Ulmus alata*											x						x	x	
winged loosestrife	*Lythrum alatum*									x	x			x						
winged monkey flower	*Mimulus alatus*				x	x	x							x		x	x			
winged oval sedge	*Carex artitecta*		x					x				x	x						x	
winged pigweed*	*Cycloloma atriplicifolium**					x					x									x
winged sumac	*Rhus copallina*	x			x			x	x		x	x						x	x	
wingstem	*Verbesina alternifolia*	x			x															x
winter cress*	*Barbarea vulgaris**								x	x		x								x
winter grape	*Vitis cinerea*					x													x	
winter vetch*	*Vicia villosa**																			x
wirestem grass	*Muhlenbergia mexicana*	x												x						
witch grass	*Panicum capillare*											x						x	x	x
witch hazel	*Hamamelis virginiana*	x	x	x																
Wolf's spike rush	*Eleocharis wolfii*		x					x			x		x							
wood betony	*Pedicularis canadensis*			x	x				x			x			x					
wood gray sedge	*Carex grisea*		x	x	x			x												x
wood mint	*Blephilia hirsuta*		x	x														x		
wood nettle	*Laportea canadensis*			x	x	x														
wood sedge	*Carex rosea*	x	x	x		x														
wood sorrel	*Oxalis stricta*				x	x		x			x							x	x	x
woodland agrimony	*Agrimonia rostellata*	x						x	x			x								
woodland blue grass	*Poa sylvestris*	x	x	x	x	x														
woodland bluets	*Hedyotis longifolia*		x	x																
woodland goosefoot	*Chenopodium standleyanum*	x			x															
woodland lettuce	*Lactuca floridana*	x			x								x							
woodland muhly	*Muhlenbergia sylvatica*	x		x								x								
woodland panicum	*Panicum dichotomum*	x	x	x																
woodland spiderwort	*Tradescantia subaspera*	x	x	x															x	
woodland sunflower	*Helianthus divaricatus*	x	x					x	x	x	x	x	x					x		
woolly buckthorn-SE	***Bumelia lanuginosa-SE***																	x	x	
woolly mullein*	*Verbascum thapsus**									x	x	x						x	x	x
yarrow*	*Achillea millefolium**								x	x	x	x	x							x
yellow coneflower	*Ratibida pinnata*									x	x	x	x					x		

Appendix 1. Continued.

Common name[3,4]	Class	Forest							Prairie			Sav	Wetland				Primary		
	Sub-class	Upland			Floodplain			Flatwoods	Prairie	Sand	Hill	Savanna	Marsh	Swamp	Lake/Pond	River	Glade	Cliff	Cultural
	Natural Community[1,2]	d	dm	m	m	wm	w	sf	wm	m	l	dm		ss			lg	lc	
	Scientific Name[3,4]																		
yellow crown beard	*Verbesina helianthoides*	x	x	x	x						x								
yellow dog-tooth violet	*Erythronium americanum*	x		x															
yellow false foxglove	*Aureolaria grandiflora* var. *pulchra*	x	x														x		
yellow foxtail*	*Setaria lutescens**																x	x	x
yellow giant hyssop	*Agastache nepetoides*			x															
yellow lady's-slipper orchid - WL	***Cypripedium calceolus* var. *pubescens* - WL**		**x**	**x**															
yellow pond lily	*Nuphar luteum*				x									**X**	**X**				
yellow star grass	*Hypoxis hirsuta*	x							x	x		x					x		
yellow sweet clover*	*Melilotus officinalis**								x		x	x						x	x
yellow water buttercup	*Ranunculus flabellaris*												x		x				
yerba de tajo	*Eclipta prostrata*				x	x	x						x	x	x				x

[1] d = dry, dm = dry-mesic, m = mesic, wm = wet-mesic, w = wet, sf = southern flatwoods, ss = shrub swamp, l = loess
lg = limestone glade, lc = limestone cliff

[2] Bold and upper case "**X**" denotes dominant species in that natural community.

[3] Bold type indicates an Illinois watch list (WL), Illinois endangered (SE), Illinois threatened (ST), federally endangered (FE), federally threatened (FT), or possibly Illinois extripated (EXT) species.

[4] * = introduced species

Appendix 2

Incomplete list of vascular plants known from the Sinkhole Plain Assessment Area (from Appendix 1), sorted by scientific name.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
*Abutilon theophrasti**	velvet leaf*	*Ambrosia bidentata*	ragweed
Acalypha gracilens	slender three-seeded mercury	*Ambrosia psilostachya*	western ragweed
Acalypha monococca	slender three-seeded mercury	*Ambrosia trifida*	giant ragweed
Acalypha ostryaefolia	three-seeded mercury	*Amelanchier arborea*	shadbush
Acalypha rhomboidea	three-seeded mercury	*Ammannia coccinea*	long-leaved ammannia
Acalypha virginica	three-seeded mercury	*Amorpha canescens*	leadplant
Acer negundo	box elder	*Amorpha fruticosa*	false indigo bush
Acer nigrum	black maple	*Ampelopsis cordata*	raccoon grape
Acer rubrum	red maple	*Amphicarpaea bracteata*	hog peanut
Acer saccharinum	silver maple	*Amsonia tabernaemontana*	blue star
Acer saccharum	sugar maple	*Anagallis arvensis**	scarlet pimpernel*
*Achillea millefolium**	yarrow*	*Andropogon gerardii*	big bluestem
Actaea pachypoda	doll's eyes	*Andropogon virginicus*	broom sedge
Adiantum pedatum	maidenhair fern	*Androsace occidentalis*	androsace
*Aegilops cylindrica**	goat grass*	*Anemone virginiana*	tall anemone
Aesculus glabra	Ohio buckeye	*Antennaria neglecta*	little pussy toes
Agalinis aspera	rough false foxglove	*Antennaria plantaginifolia*	pussy toes
Agalinis gattingeri	round-stemmed false foxglove	*Anthemis cotula**	dogfennel*
Agalinis skinneriana-ST	**pale false foxglove-ST**	*Apios americana*	groundnut
Agalinis tenuifolia	slender false foxglove	*Apocynum cannabinum*	dogbane
Agastache nepetoides	yellow giant hyssop	*Apocynum sibiricum*	Indian hemp
Agrimonia pubescens	soft agrimony	*Aquilegia canadensis*	columbine
Agrimonia rostellata	woodland agrimony	*Arabidopsis thaliana**	mouse-eared cress*
*Agropyron repens**	quack grass*	*Arabis canadensis*	sicklepod
*Agrostemma githago**	corn cockle*	*Arabis hirsuta* var. *pycnocarpa*	hairy rock cress
Agrostis alba	red top	*Arabis laevigata*	smooth rock cress
Agrostis hyemalis	hair grass	*Arabis lyrata*	lyre-leaved rock cress
Agrostis perennans	autumn bent grass	*Aralia racemosa*	American spikenard
*Ailanthus altissima**	tree-of-heaven*	*Arenaria serpyllifolia*	sandwort
Alisma subcordatum	common water plantain	*Arisaema dracontium*	green dragon
Allium canadense	wild garlic	*Arisaema triphyllum*	Jack-in-the-pulpit
Allium stellatum	cliff onion	*Aristida dichotoma*	poverty grass
*Allium vineale**	field garlic*	*Aristida oligantha*	plains three awn grass
Alopecurus carolinianus	annual foxtail	*Aristida purpurascens*	arrow feather
Amaranthus albus	tumbleweed	*Aristida ramosissima*	slender three awn
*Amaranthus graecizans**	prostrate amaranth*	*Aristolochia serpentaria*	birthwort
*Amaranthus hybridus**	green amaranth*	*Aristolochia tomentosa*	Dutchman's pipe
*Amaranthus retroflexus**	rough pigweed*	*Armoracia aquatica*	lake cress
Amaranthus rudis	tamarisk waterhemp	*Armoracia rusticana**	horse radish*
*Amaranthus spinosus**	spiny pigweed*	*Aruncus dioicus*	goat's-beard
Amaranthus tuberculatus	tall water hemp	*Arundinaria gigantea*	giant cane
Ambrosia artemisiifolia	common ragweed	*Asarum canadense*	wild ginger

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]
Asclepias amplexicaulis	sand milkweed
Asclepias incarnata	swamp milkweed
Asclepias quadrifolia	whorled milkweed
Asclepias sullivantii	prairie milkweed
Asclepias syriaca	common milkweed
Asclepias tuberosa ssp. *interior*	butterfly weed
Asclepias verticillata	horsetail milkweed
Asclepias viridiflora	green milkweed
Asclepias viridis	green-flowered milkweed
Asimina triloba	paw paw
*Asparagus officinalis**	asparagus*
Asplenium platyneuron	ebony spleenwort
Asplenium rhizophyllum	walking fern
Aster anomalus	blue aster
Aster azureus	sky-blue aster
Aster drummondii	Drummond's aster
Aster dumosus	bushy aster
Aster ericoides	heath aster
Aster laevis	smooth aster
Aster lanceolatus	smooth blue aster
Aster lateriflorus	side-flowered aster
Aster linariifolius	flax-leaved aster
Aster oblongifolius	aromatic aster
Aster ontarionis	Ontario aster
Aster patens	purple daisy
Aster pilosus	hairy aster
Aster sagittifolius	arrowleaf aster
Aster sericeus	silky aster
Aster simplex	panicled aster
Aster turbinellus	prairie aster
Astragalus canadensis	Canadian milk vetch
Athyrium angustum	lady fern
*Atriplex patula**	fat-hen saltbush*
Aureolaria flava	smooth false foxglove
Aureolaria grandiflora var. *pulchra*	yellow false foxglove
Azolla caroliniana	mosquito fern
Azolla mexicana	Mexican azolla
Bacopa rotundifolia	water hyssop
Baptisia lactea	white wild indigo
Baptisia leucophaea	cream wild indigo
*Barbarea vulgaris**	winter cress*
*Berberis thunbergii**	Japanese barberry*
*Berberis vulgaris**	common barberry*
*Berteroa incana**	hoary alyssum*
Betula nigra	river birch
Bidens aristosa	swamp marigold
*Bidens bipinnata**	Spanish needles*
Bidens cernua	nodding bur marigold
Bidens frondosa	common beggar ticks
Bidens tripartita	swamp tickseed
Blephilia ciliata	pagoda plant
Blephilia hirsuta	wood mint
Boehmeria cylindrica	false nettle
Boltonia asteroides	false aster
Boltonia decurrens - ST, FT	**decurrent false aster - ST, FT**
Botrychium dissectum var. *obliquum*	bronze fern
Botrychium virginianum	rattlesnake fern
Bouteloua curtipendula	side-oats grama
Brachyelytrum erectum	long-awned wood grass
*Brassica hirta**	white mustard*
*Brassica kaber**	charlock*
*Brassica rapa**	field mustard*
Brickellia eupatorioides	false boneset
Bromus ciliatus	fringed brome
*Bromus commutatus**	hairy brome*
*Bromus inermis**	smooth brome grass*
*Bromus japonicus**	Japanese brome*
Bromus kalmii ?	prairie brome
Bromus pubescens	Canada brome grass
Bromus racemosus	smooth chess
*Bromus secalinus **	cheat grass*
*Bromus tectorum**	cheat grass*
*Broussonetia papyrifera**	paper mulberry*
Buchnera americana	blue hearts
Bumelia lanuginosa-SE	**woolly buckthorn-SE**
Cacalia atriplicifolia	pale Indian plantain
Cacalia plantaginea	prairie Indian plantain
Calamagrostis canadensis	bluejoint grass
Callitriche heterophylla	large water starwort
Callitriche terrestris	terrestrial starwort
Calystegia sepium	American bindweed
Camassia scillioides	wild hyacinth
*Camelina microcarpa**	small-fruited false flax*
*Camelina sativa**	false flax*
Campanula americana	American bellflower
Campsis radicans	trumpet creeper
*Cannabis sativa**	marijuana*
*Capsella bursa-pastoris**	shepherd's purse*
Cardamine parviflora var. *arenicola*	small-flowered bitter cress
Cardamine pensylvanica	bitter cress
Cardamine pratensis ?	bitter cress
*Cardiospermum halicacabum**	balloon-vine*
*Carduus nutans**	musk thistle*
Carex albursina	sedge
Carex annectens annectens	gray sedge
Carex annectens xanthocarpa	small yellow fox sedge
Carex artitecta	winged oval sedge

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]
Carex bicknellii	Bicknell's sedge
Carex blanda	common wood sedge
Carex brevior	plains oval sedge
Carex bushii	long-scaled green sedge
Carex cephalophora	rough-clustered sedge
Carex conjuncta	green-headed fox sedge
Carex cristatella	crested oval sedge
Carex crus-corvi	crowfoot fox sedge
Carex davisii	Davis' sedge
Carex eburnea	hair sedge
Carex emoryi	riverbank sedge
Carex festucacea	fescue oval sedge
Carex frankii	Frank's sedge
Carex gracilescens	slender wood sedge
Carex granularis	meadow sedge
Carex gravida	long-awned bracted sedge
Carex grayi	Gray's sedge
Carex grisea	wood gray sedge
Carex hirsutella	hairy green sedge
Carex hyalinolepis	southern lake sedge
Carex jamesii	James' sedge
Carex lacustris	common lake sedge
Carex lanuginosa	long-stalked hummock sedge
Carex lupuliformis	hop sedge
Carex lupulina	common hop sedge
Carex meadii	mead's stiff sedge
Carex molesta	field oval sedge
Carex muhlenbergii	sand bracted sedge
Carex muskingumensis	Muskingum River sedge
Carex normalis	sedge
Carex pensylvanica	Pennsylvania sedge
Carex rosea	wood sedge
Carex scoparia	lance-fruited oval sedge
Carex shortiana	Short's sedge
Carex squarrosa	narrow-leaved cattail sedge
Carex stipata	sedge
Carex stricta	common tussock sedge
Carex tribuloides	awl-fruited oval sedge
Carex typhina	cattail sedge
Carex umbellata	early oak sedge
Carex vulpinoidea	fox sedge
Carpinus caroliniana	blue beech
Carya cordiformis	bitternut hickory
Carya glabra	pignut hickory
Carya illinoinensis	pecan
Carya laciniosa	kingnut hickory
Carya ovalis	sweet pignut hickory
Carya ovata	shagbark hickory
Carya texana	Texas hickory
Carya tomentosa	mockernut hickory
Cassia fasciculata	partridge pea
Cassia marilandica	Maryland senna
Cassia nictitans	wild sensitive plant
*Catalpa bignonioides**	common catalpa*
Catalpa speciosa	cigar tree
Caulophyllum thalictroides	blue cohosh
Ceanothus americanus	New Jersey tea
Celastrus scandens	bittersweet
Celtis laevigata	sugarberry
Celtis occidentalis	hackberry
Celtis tenuifolia	dwarf hackberry
Cenchrus longispinus	sandbur
*Centaurea cyanus**	bachelor's buttons*
Cephalanthus occidentalis	buttonbush
Cerastium brachypodum	short-pedicelled chickweed
*Cerastium glomeratum**	clammy chickweed*
Cerastium nutans	nodding chickweed
*Cerastium pumilum**	dwarf mouse-ear chickweed*
*Cerastium vulgatum**	common mouse-ear chickweed*
Ceratophyllum demersum	coontail
Cercis canadensis	eastern redbud
*Chaenorrhinum minus**	dwarf snapdragon*
Chaerophyllum procumbens	streambank chervil
Chaerophyllum tainturieri	wild chervil
*Chamaemelum nobilis**	garden chamomile*
Chamaesyce glyptosperma	smooth creeping spurge
Chamaesyce humistrata	spreading spurge
Chamaesyce maculata	nodding spurge
Chamaesyce serpens	round-leaved spurge
Chamaesyce supina	milk spurge
Chasmanthium latifolium	inland sea oats
Cheilanthes feei	Fee's lip fern
Cheilanthes lanosa	hairy lip fern
*Chenopodium album**	lamb's quarters*
*Chenopodium ambrosioides**	American wormseed*
*Chenopodium capitatum**	strawberry blite*
Chenopodium desiccatum	narrow-leaved goosefoot
Chenopodium gigantospermum	maple-leaved goosefoot
Chenopodium missouriense	Missouri goosefoot
Chenopodium simplex	coast blite
Chenopodium standleyanum	woodland goosefoot
*Chloris verticillata**	windmill grass*
*Cichorium intybus**	chickory*
Cicuta maculata	water hemlock
Cinna arundinacea	common wood reed
Circaea lutetiana ssp. *canadensis*	enchanter's nightshade
Cirsium altissimum	tall thistle
Cirsium discolor	pasture thistle
*Cirsium vulgare**	bull thistle*

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]
Claytonia virginica	spring beauty
Clematis pitcheri	leatherflower
Clematis virginiana	virgin's bower
Cocculus carolinus	snailseed
Comandra umbellata	bastard toadflax
*Commelina communis**	common day flower*
Commelina diffusa	creeping dayflower
Commelina erecta	dayflower
*Conringia orientalis**	hare's ear mustard*
*Convolvulus arvensis**	field bindweed*
Conyza canadensis	horseweed
Conyza ramosissima	dwarf fleabane
Corallorhiza wisteriana	coral-root orchid
*Coreopsis grandiflora**	large-flowered coreopsis*
Coreopsis lanceolata	sand coreopsis
Coreopsis palmata	prairie coreopsis
Coreopsis tripteris	tall coreopsis
*Corispermum americanum**	common bugseed*
Cornus drummondii	rough-leaved dogwood
Cornus florida	flowering dogwood
Cornus obliqua	pale dogwood
Cornus racemosa	gray dogwood
Corydalis flavula	pale corydalis
Corydalis halei - SE	**Hale's corydalis - SE**
Corydalis micrantha	slender corydalis
Corylus americana	hazelnut
Crataegus crus-galli	cock-spur hawthorn
Crataegus mollis	downy hawthorn
Crataegus viridis	green thorn
Crotalaria sagittalis	rattlebox
Croton capitatus	doveweed
Croton glandulosus var. *septentrionalis*	sand croton
Croton monanthogynus	prairie tea
Crotonopsis elliptica	rushfoil
*Crypsis schoenoides**	false foxtail*
Cryptotaenia canadensis	honewort
Cucurbita foetidissima	Missouri gourd
Cunila origanoides	mountain dittany
Cuphea viscosissima	clammy cuphea
Cuscuta campestris	field dodder
Cuscuta cephalanthi	buttonbush dodder
Cuscuta glomerata	rope dodder
Cuscuta gronovii	common dodder
Cuscuta indecora	false field dodder
Cuscuta pentagona	prairie dodder
Cuscuta polygonorum	knotweed dodder
*Cycloloma atriplicifolium**	winged pigweed*
Cynanchum laeve	blue vine
*Cynodon dactylon**	Bermuda grass*
Cyperus acuminatus	short-pointed flat sedge
Cyperus aristatus	awned flat sedge
Cyperus erythrorhizos	red-rooted sedge
Cyperus esculentus	nut grass
Cyperus ferruginescens	sedge
Cyperus filiculmis	slender sand sedge
Cyperus ovularis	hedgehog club rush
Cyperus schweinitzii	rough sand sedge
Cyperus strigosus	straw colored flat sedge
***Cypripedium calceolus* var. *pubescens* - WL**	**yellow lady's-slipper orchid - WL**
Cystopteris bulbifera	bladder fern
Cystopteris protrusa	fragile fern
Cystopteris tennesseensis	hybrid fragile fern
*Dactylis glomerata**	orchard grass*
Dalea candida	white prairie clover
Dalea leporina	foxtail dalea
Dalea purpurea	purple prairie clover
Danthonia spicata	poverty oat grass
Dasistoma macrophylla	mullein foxglove
*Datura stramonium**	jimson weed*
*Daucus carota**	Queen Anne's lace*
Delphinium tricorne	dwarf larkspur
Dentaria laciniata	toothwort
Descurainia pinnata var. *brachycarpa*	tansy mustard
*Descurainia sophia**	tansy mustard*
Desmanthus illinoensis	Illinois bundleflower
Desmodium canadense	showy tick trefoil
Desmodium canescens	hoary tick trefoil
Desmodium ciliare	hairy tick trefoil
Desmodium cuspidatum	tick trefoil
Desmodium cuspidatum longifolium	bracted tick trefoil
Desmodium glabellum	smooth tick trefoil
Desmodium glutinosum	pointed tick trefoil
Desmodium illinoense	Illinois tick trefoil
Desmodium nuttallii	Nuttall's tick trefoil
Desmodium paniculatum	panicled tick trefoil
Desmodium rigidum	stiff tick trefoil
Desmodium sessilifolium	sessile-leaved tick trefoil
*Dianthus armeria**	Deptford pink*
Dicentra cucullaria	dutchman's breeches
*Digitaria ischaemum**	smooth crab grass*
*Digitaria sanguinalis**	common crab grass*
Diodia teres	poorjoe
Dioscorea quaternata	wild yam
Dioscorea villosa	wild yam
Diospyros virginiana	persimmon
Dodecatheon meadia	shooting star

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
*Draba brachycarpa**	whitlow grass*	*Euonymus atropurpurea*	wahoo
Draba cuneifolia - SE	**whitlow grass - SE**	*Eupatorium altissimum*	tall boneset
Draba reptans	whitlow grass	*Eupatorium coelestinum*	mistflower
Echinacea pallida	pale purple coneflower	*Eupatorium purpureum*	Joe-Pye-weed
Echinacea purpurea	purple coneflower	*Eupatorium rugosum*	white snakeroot
*Echinochloa crusgalli**	barnyard grass*	*Eupatorium serotinum*	late boneset
Echinochloa muricata	barnyard grass	*Euphorbia corollata*	flowering spurge
Echinochloa walteri	salt-marsh cockspur grass	*Euphorbia cyparissias**	cypress spurge*
Echinodorus berteroi	Bertero's burhead	*Euphorbia dentata*	wild poinsettia
Echinodorus cordifolius	creeping burhead	*Euphorbia marginata*	snow-on-the-mountain
Echinodorus tenellus - SE	**small burhead - SE**	*Euphorbia obtusata*	blunt-leaved spurge
Eclipta prostrata	yerba de tajo	***Euphorbia spathulata - SE***	**spurge - SE**
Eleocharis compressa	flatstem spike rush	*Euthamia graminifolia*	grass-leaved goldenrod
Eleocharis obtusa	blunt spike rush	*Fagopyrum esculentum**	buckwheat*
Eleocharis palustris	swamp spike rush	*Festuca elatior**	lawn fescue*
Eleocharis quadrangulata	angled spike rush	*Festuca obtusa*	nodding fescue
Eleocharis verrucosa	slender spike rush	*Festuca pratensis**	meadow fescue*
Eleocharis wolfii	Wolf's spike rush	*Fimbristylis autumnalis*	autumn sedge
Elephantopus carolinianus	elephant's foot	*Forestiera acuminata*	swamp privet
*Eleusine indica**	goose grass*	*Fragaria virginiana*	wild strawberry
Ellisia nyctelea	Aunt Lucy	*Fraxinus americana*	white ash
Elymus canadensis	Canada wild rye	*Fraxinus pennsylvanica*	green ash
Elymus hystrix	bottlebrush grass	*Fraxinus quadrangulata*	blue ash
Elymus riparius	riverbank wild rye	*Froelichia gracilis**	cottonweed*
Elymus villosus	silky wild rye	*Galactia volubilis*	milk pea
Elymus virginicus	Virginia wild rye	*Galinsoga quadriradiata**	Peruvian daisy*
Equisetum arvense	common horsetail	*Galium aparine*	annual bedstraw
Equisetum hyemale var. *affine*	scouring rush	*Galium circaezans*	wild licorice
Equisetum laevigatum	smooth scouring rush	*Galium concinnum*	shining bedstraw
Eragrostis capillaris	lace grass	*Galium lanceolatum*	lance-leaved bedstraw
*Eragrostis cilianensis**	stink grass*	*Galium obtusum*	stiff bedstraw
Eragrostis frankii	sandbar love grass	*Galium pilosum*	hairy bedstraw
Eragrostis hypnoides	creeping love grass	***Galium virgatum - SE***	**dwarf bedstraw - SE**
Eragrostis minor	lesser love grass	*Gaura biennis*	biennial gaura
Eragrostis pectinacea	common love grass	*Gaura longiflora*	common gaura
Eragrostis spectabilis	purple love grass	*Gentiana puberulenta*	downy gentian
Eragrostis trichodes	tickle grass	*Geranium carolinianum*	Carolina cranesbill
Erechtites hieracifolia	fireweed	*Geranium maculatum*	wild geranium
*Erianthus ravennae**	Ravenna grass*	*Geum canadense*	white avens
Erigenia bulbosa	harbinger-of-spring	*Gleditsia triacanthos*	honey locust
Erigeron annuus	annual fleabane	*Glyceria septentrionalis*	floating manna grass
Erigeron philadelphicus	marsh fleabane	*Glyceria striata*	fowl manna grass
Erigeron pulchellus	Robin's plantain	*Gnaphalium obtusifolium*	cudweed
Erigeron strigosus	daisy fleabane	*Gratiola neglecta*	clammy hedge hyssop
*Eriochloa contracta**	prairie cup grass*	*Gratiola virginiana*	round-fruited hedge hyssop
*Erucastrum gallicum**	dog mustard*	*Gymnocladus dioica*	Kentucky coffeetree
Eryngium yuccifolium	rattlesnake master	*Hackelia virginiana*	stickseed
*Erysimum repandum**	Treacle mustard*	*Hamamelis virginiana*	witch hazel
Erythronium albidum	white trout lily	*Hedeoma hispida*	rough pennyroyal
Erythronium americanum	yellow dog-tooth violet	*Hedeoma pulegioides*	American pennyroyal

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
Hedyotis longifolia	woodland bluets	*Hypochaeris radicata**	spotted cat's ear*
Hedyotis nigricans	narrow-leaved bluets	*Hypoxis hirsuta*	yellow star grass
Hedyotis nuttalliana	hair-leaf bluets	*Ilex decidua*	swamp holly
Hedyotis purpurea var. *calycosa*	bluets	*Impatiens capensis*	spotted touch-me-not
		Impatiens pallida	pale touch-me-not
Hedyotis pusilla	dwarf bluets	*Ipomoea hederacea**	ivy-leaved morning glory*
Helenium amarum	bitterweed	*Ipomoea lacunosa*	small morning glory
Helenium autumnale	sneezeweed	*Ipomoea pandurata*	wild sweet potato vine
Helenium flexuosum	purple-headed sneezeweed	*Ipomoea purpurea**	morning glory*
*Helianthus annuus**	common sunflower*	*Iris shrevei*	southern blue flag
Helianthus ciliaris	blueweed sunflower	*Isopyrum biternatum*	false rue anenome
Helianthus divaricatus	woodland sunflower	*Iva annua*	marsh elder
Helianthus grosseserratus	sawtooth sunflower	***Juglans cinerea - WL***	**butternut - WL**
Helianthus hirsutus	bristly sunflower	*Juglans nigra*	black walnut
Helianthus microcephalus	small wood sunflower	*Juncus acuminatus*	knotty leaved rush
Helianthus mollis	downy sunflower	*Juncus brachycarpus*	rush
Helianthus occidentalis	western sunflower	*Juncus bufonius*	toad rush
*Helianthus petiolaris**	Kansas sunflower*	*Juncus canadensis*	Canadian rush
Helianthus rigidus	prairie sunflower	*Juncus dichotomus*	marsh rush
Helianthus strumosus	pale-leaved sunflower	*Juncus dudleyi*	Dudley's rush
Helianthus tuberosus	Jerusalem artichoke	*Juncus effusus*	soft rush
Heliopsis helianthoides	false sunflower	*Juncus interior*	inland rush
*Heliotropium curassavicum**	seaside heliotrope*	*Juncus marginatus*	grass-leaved rush
*Heliotropium indicum**	Indian heliotrope*	*Juncus nodatus*	stout rush
Heliotropium tenellum - SE	**slender heliotrope - SE**	*Juncus tenuis*	path rush
*Hemerocallis fulva**	orange day lily*	*Juncus torreyi*	Torrey's rush
Hepatica nobilis var. *acuta*	liverleaf	*Juniperus virginiana*	eastern red cedar
Heteranthera limosa	duck salad	*Justicia americana*	water willow
Heteranthera reniformis-SE	**mud plantain - SE**	*Kickxia elatine**	cancerwort*
Heterotheca camporum	golden aster	*Kochia scoparia**	burning bush*
Heuchera americana var. *hirsuticaulis*	alumroot	*Koeleria macrantha*	June grass
		Krigia biflora	false dandelion
Heuchera richardsonii	prairie alumroot	*Krigia dandelion*	dwarf dandelion
Hexalectris spicata - SE	**crested coral-root orchid-SE**	*Kummerowia stipulacea**	Korean clover*
Hibiscus laevis	halberd-leaved rose mallow	*Kummerowia striata**	Japanese lespedeza*
Hibiscus lasiocarpus	swamp rose mallow	*Lactuca canadensis*	wild lettuce
Hieracium gronovii	hairy hawkweed	*Lactuca floridana*	woodland lettuce
Hieracium longipilum	hairy hawkweed	***Lactuca ludoviciana-SE, EXT***	**western wild lettuce-SE, EXT**
*Holosteum umbellatum**	jagged chickweed*	*Lactuca sativa**	cultivated lettuce*
*Hordeum jubatum**	fox-tail barley*	*Lactuca serriola**	prickly lettuce*
Hordeum pusillum	little barley	*Lamium amplexicaule**	henbit*
*Humulus japonicus**	Japanese hops*	*Laportea canadensis*	wood nettle
Humulus lupulus	common hops	*Lechea mucronata*	small pinweed
Hybanthus concolor	green violet	*Lechea stricta*	pinweed
Hydrangea arborescens	wild hydrangea	*Lechea tenuifolia*	narrow-leaved pinweed
Hydrastis canadensis	goldenseal	*Leersia oryzoides*	rice cutgrass
Hydrophyllum appendiculatum	great waterleaf	*Leersia virginica*	white grass
Hypericum mutilum	dwarf St. John's-wort	*Lemna minor*	duckweed
Hypericum punctatum	spotted St. John's-wort	*Lemna perpusilla*	least duckweed
Hypericum sphaerocarpum	prairie St. John's-wort	*Leonurus cardiaca**	motherwort*

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]
*Lepidium campestre**	field pepper grass*
*Lepidium densiflorum**	small peppergrass*
Lepidium virginicum	common peppergrass
*Leptochloa acuminata**	salt meadow grass*
*Leptochloa fascicularis**	salt meadow grass*
Leptochloa filiformis	red sprangle top
Leptoloma cognatum	fall witch grass
Lespedeza capitata	round-headed bush clover
Lespedeza hirta	hairy bush clover
Lespedeza intermedia	bush clover
Lespedeza procumbens	trailing bush clover
Lespedeza stuevei	Stuve's bush clover
Lespedeza violacea	violet bush clover
Lespedeza virginica	slender bush clover
Leucospora multifida	leucospora
Liatris aspera	rough blazing star
Liatris cylindracea	cylindric blazing star
Liatris pycnostachya	prairie blazing star
Lilium michiganense	wild lily
Lindera benzoin	spicebush
Lindernia dubia	false pimpernel
Lindernia dubia var. *anagallidea*	slender false pimpernel
Linum sulcatum	grooved yellow flax
*Linum usitatissimum**	flax*
Liquidambar styraciflua	sweet gum
*Lithospermum arvense**	puccoon*
Lithospermum canescens	hoary puccoon
Lithospermum incisum	fringed puccoon
Lobelia cardinalis	cardinal flower
Lobelia inflata	Indian tobacco
Lobelia siphilitica	blue lobelia
Lobelia spicata var. *leptostachys*	spiked lobelia
Lobelia spicata var. *spicata*	pale spiked lobelia
*Lolium multiflorum**	Italian rye grass*
*Lolium perenne**	perennial rye grass*
*Lonicera japonica**	Japanese honeysuckle*
*Lonicera maackii**	amur honeysuckle*
*Lonicera morrowii**	Morrow's honeysuckle*
Ludwigia alternifolia	seedbox
Ludwigia palustris var. *americana*	marsh purslane
Ludwigia peploides var. *glabrescens*	marsh purslane
Ludwigia polycarpa	false loosestrife
*Lychnis coronaria**	mullein pink*
Lycopus americanus	common water horehound
Lycopus virginicus	bugle weed
Lysimachia lanceolata	lance-leaved loosestrife
*Lysimachia nummularia**	moneywort*
Lythrum alatum	winged loosestrife
*Maclura pomifera**	Osage orange*
Malus coronaria	wild sweet crab apple
Malus ioensis	Iowa crabapple
Manfreda virginica	false aloe
*Marrubium vulgare***	common horehound
*Matricaria chamomilla**	chamomille*
*Medicago lupulina**	black medic*
*Medicago sativa**	alfalfa*
Melica nitens	three-flowered melic grass
*Melilotus alba**	white sweet clover*
*Melilotus officinalis**	yellow sweet clover*
Menispermum canadense	moonseed
Mentha arvensis var. *villosa*	field mint
*Mentha spicata**	spearmint*
Mentzelia oligosperma	stickleaf
Mertensia virginica	Virginia bluebells
Mimulus alatus	winged monkey flower
Mirabilis linearis	narrow-leaved umbrellawort
*Mirabilis nyctaginea**	wild four-o'clock*
*Mollugo verticillatus**	carpet weed*
Monarda bradburiana	monarda
Monarda fistulosa	wild bergamot
*Morus alba**	white mulberry*
Morus rubra	red mulberry
Muhlenbergia asperifolia	scratch grass
Muhlenbergia bushii	muhly
Muhlenbergia capillaris	hair grass
Muhlenbergia cuspidata	plains muhly
Muhlenbergia frondosa	common muhly
Muhlenbergia mexicana	wirestem grass
Muhlenbergia racemosa	upland wild timothy
Muhlenbergia sobolifera	rock satin grass
Muhlenbergia sylvatica	woodland muhly
*Muscari atlanticum**	grape hyacinth*
Myosotis verna	white forget-me-not
Myosurus minimus	mousetail
Myriophyllum heterophyllum	water milfoil
Najas guadalupensis	naiad
Nelumbo lutea	American lotus
*Nepeta cataria**	catnip*
*Nicotiana longiflora**	long-flowered tobacco*
Nothoscordum bivalve	crow poison
Nuphar luteum	yellow pond lily
Nyssa sylvatica	sour gum
Oenothera biennis	evening primrose
Oenothera laciniata	ragged evening primrose
Oenothera pilosella	prairie sundrops
Onoclea sensibilis	sensitive fern

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
Onosmodium molle ssp. *occidentale*	marbleseed	*Phacelia purshii*	Miami mist
Ophioglossum vulgatum	adder's-tongue fern	*Phalaris arundinacea**	reed canary grass*
Opuntia humifusa	prickly-pear	*Phalaris canariensis**	canary grass*
*Ornithogalum umbellatum**	star-of-Bethlehem*	*Phaseolus polystachios*	wild kidney bean
Orobanche uniflora	one-flowered broomrape	*Phegopteris hexagonoptera*	broad beech fern
Osmorhiza longistylis	anise-root	*Phleum pratense**	Timothy*
Osmunda cinnamomea	cinnamon fern	*Phlox bifida*	cleft phlox
Ostrya virginiana	hop hornbeam	*Phlox divaricata* var. *laphamii*	blue phlox
Oxalis dillenii	common wood sorrel	*Phlox pilosa*	prairie phlox
Oxalis stricta	wood sorrel	*Phragmites australis*	common reed
Oxalis violacea	violet wood sorrel	*Phryma leptostachya*	lopseed
Panax quinquefolius	ginseng	*Phyla lanceolata*	frog fruit
Panicum boscii	bearded broad-leaved panic grass	*Physalis angulata*	cut-leaved ground cherry
		Physalis heterophylla	clammy ground cherry
		*Physalis ixocarpa**	tomatillo*
Panicum capillare	witch grass	*Physalis pubescens*	annual ground cherry
Panicum clandestinum	deer-tongue grass	*Physalis subglabrata*	smooth ground cherry
Panicum depauperatum	starved panic grass	*Physocarpus opulifolius*	ninebark
Panicum dichotomiflorum	fall panicum	*Physostegia virginiana*	obedient plant
Panicum dichotomum	woodland panicum	*Phytolacca americana*	pokeweed
Panicum flexile	slender panic grass	*Pilea pumila*	clearweed
Panicum lanuginosum	hairy panic-grass	*Pisum sativum**	garden pea*
Panicum latifolium	broad-leaved panic grass	*Plantago aristata*	buckhorn plantain
Panicum longifolium - SE	**long-leaved panic grass-SE**	*Plantago lanceolata**	English plantain*
Panicum oligosanthes	prairie panic grass	*Plantago pusilla*	dwarf plantain
Panicum rigidulum	munro grass	*Plantago rugelii*	Rugel's plantain
Panicum sphaerocarpon	round-fruited panic grass	*Plantago virginica*	Virginia plantain
Panicum virgatum	prairie switchgrass	*Platanus occidentalis*	sycamore
Parietaria pensylvanica	pellitory	*Poa annua**	annual bluegrass*
Paronychia canadensis	forked chickweed	*Poa chapmaniana*	spear grass
Paronychia fastigiata	low forked chickweed	*Poa compressa***	Canada bluegrass**
Parthenium integrifolium	American feverfew	*Poa pratensis**	Kentucky bluegrass*
Parthenocissus quinquefolia	Virginia creeper	*Poa sylvestris*	woodland blue grass
Paspalum dissectum-SE	**bead grass-SE**	*Podophyllum peltatum*	mayapple
Paspalum laeve	smooth lens grass	*Polanisia dodecandra*	clammy weed
Paspalum pubiflorum glabrum	two-rowed bead grass	*Polemonium reptans*	Jacob's ladder
Paspalum setaceum	bead grass	*Polycnemum majus**	bugseed*
Passiflora incarnata	large passion flower	*Polygala sanguinea*	field milkwort
Passiflora lutea	small passion flower	*Polygala verticillata*	whorled milkwort
*Pastinaca sativa**	parsnip*	*Polygonatum biflorum*	small Solomon seal
Pedicularis canadensis	wood betony	*Polygonatum commutatum*	Solomon's seal
Pellaea atropurpurea	purple cliff brake	*Polygonum amphibium*	water smartweed
Pellaea glabella	smooth cliff-brake	*Polygonum aviculare**	knotweed*
Peltandra virginica	tuckahoe	*Polygonum convolvulus**	black bindweed*
Penstemon digitalis	foxglove beard tongue	*Polygonum cristatum*	crested bindweed
Penstemon pallidus	pale beard tongue	*Polygonum cuspidatum**	Japanese knotweed*
Penthorum sedoides	ditch stonecrop	*Polygonum hydropiper**	water pepper*
*Perilla frutescens**	beefsteak plant*	*Polygonum hydropiperoides*	mild water pepper
*Petunia axillaris**	white petunia*	*Polygonum lapathifolium*	nodding smartweed
Phacelia bipinnatifida	leafy phacelia	*Polygonum pensylvanicum*	pinkweed

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]
*Polygonum persicaria**	lady's thumb*
Polygonum punctatum	dotted smartweed
Polygonum ramosissimum	bushy knotweed
Polygonum scandens	climbing false buckwheat
Polygonum setaceum interjectum	climbing false buckwheat
Polygonum tenue	slender knotweed
Polygonum virginianum	Virginia knotweed
Polymnia canadensis	pale leafcup
Polymnia uvedalia	bear's-foot
Polypodium virginianum	common polypody
Polystichum acrostichoides	Christmas fern
Polytaenia nuttallii	prairie parsley
Pontederia cordata	pickerelweed
*Populus alba**	white poplar*
Populus deltoides	cottonwood
*Portulaca oleracea **	purslane*
Potamogeton diversifolius	variable pondweed
Potamogeton foliosus	leafy pondweed
Potamogeton nodosus	pondweed
Potamogeton pectinatus	fennel-leaved pondweed
*Potentilla norvegica**	rough cinquefoil*
Potentilla paradoxa	cinquefoil
*Potentilla recta**	sulfur cinquefoil*
Potentilla simplex	common cinquefoil
*Proboscidea lousianica**	devils-claw*
Proserpinaca palustris	mermaid weed
*Prunella vulgaris**	self heal*
Prunus americana	American plum
Prunus angustifolia	chickasaw plum
*Prunus persica**	peach*
Prunus serotina	wild black cherry
Prunus virginiana	common chokecherry
Psoralea onobrychis	French grass
Psoralea psoralioides var. *eglandulosa*	Sampson's snakeroot
Psoralea tenuiflora	scurfy-pea
Ptelea trifoliata	wafer ash
Ptilimnium nuttallii - SE	**Mock bishop's weed-SE**
*Pueraria lobata**	kudzu*
Pycnanthemum pilosum	hairy mountain mint
Pycnanthemum tenuifolium	slender mountain mint
Pycnanthemum virginianum	common mountain mint
Pyrrhopappus carolinianus	false dandelion
Quercus alba	white oak
Quercus bicolor	swamp white oak
Quercus coccinea	scarlet oak
Quercus imbricaria	shingle oak
Quercus macrocarpa	bur oak
Quercus marilandica	blackjack oak
Quercus muhlenbergii	chinquapin oak
Quercus palustris	pin oak
Quercus rubra	northern red oak
Quercus stellata	post oak
Quercus velutina	black oak
Ranunculus abortivus	small-flowered crowfoot
Ranunculus fascicularius	early buttercup
Ranunculus flabellaris	yellow water buttercup
Ranunculus hispidus	rough buttercup
Ranunculus hispidus nitidus	rough buttercup
Ranunculus sceleratus	cursed crowfoot
Ranunculus septentrionalis	swamp buttercup
Ratibida pinnata	yellow coneflower
Rhamnus caroliniana	Carolina buckthorn
Rhamnus lanceolata	lance-leaved buckthorn
Rhus aromatica	aromatic sumac
Rhus copallina	winged sumac
Rhus glabra	smooth sumac
Ribes cynosbati	prickly gooseberry
Ribes missouriense	Missouri gooseberry
Robinia pseudoacacia	black locust
Rorippa islandica var. *fernaldiana*	marsh yellow cress
Rorippa sessiliflora	sessile-flowered yellow cress
Rorippa sinuata	spreading yellow cress
Rosa carolina	pasture rose
*Rosa multiflora**	multiflora rose*
Rosa setigera setigera	Illinois rose
Rosa setigera var. *tomentosa*	Illinois rose
Rosa suffulta	sunshine rose
Rotala ramosior	tooth-cup
Rubus argutus	blackberry
Rubus flagellaris	northern dewberry
Rubus hispidus	swamp dewberry
Rubus occidentalis	black raspberry
Rubus trivialis	southern dewberry
Rudbeckia fulgida	orange coneflower
Rudbeckia hirta	black-eyed Susan
Rudbeckia laciniata	goldenglow
Rudbeckia missouriensis-SE	**Missouri orange coneflower-SE**
Rudbeckia subtomentosa	fragrant coneflower
Rudbeckia triloba	brown-eyed Susan
Ruellia caroliniensis	false petunia
Ruellia humilis	hairy ruellia
Ruellia strepens	smooth ruellia
*Rumex acetosella**	sour dock*
Rumex altissimus	pale dock
*Rumex crispus**	curly dock*
*Rumex cristatus**	crested dock*
Rumex hastatulus-SE, EXT	**sour dock-SE, EXT**

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
Rumex maritimus	long-leaved dock	*Sicyos angulatus*	bur cucumber
*Rumex mexicanus**	patience dock*	*Sida spinosa**	prickly sida*
*Rumex obtusifolius**	bitter dock*	*Silene antirrhina*	sleepy catchfly
Rumex verticillatus	swamp dock	*Silene cserei**	glaucous campion*
Sabatia angularis	marsh pink	***Silene regia - SE***	**royal catchfly - SE**
Sagittaria ambigua ?	arrowhead	*Silene stellata*	starry campion
Sagittaria calycina	long-beaked arrowhead	*Silphium integrifolium*	rosinweed
Sagittaria graminea	grass-leaved arrowhead	*Silphium laciniatum*	compass plant
Sagittaria latifolia	common arrowhead	*Silphium perfoliatum*	cup plant
*Salix alba**	white willow*	*Silphium terebinthinaceum*	prairie dock
Salix amygdaloides	peach-leaved willow	*Sisymbrium altissimum**	tumble mustard*
Salix caroliniana	Carolina willow	*Sisymbrium officinale**	hedge mustard*
Salix eriocephala	heart-leaved willow	*Sisyrinchium albidum*	blue-eyed grass
Salix exigua	sandbar willow	*Sisyrinchium angustifolium*	common blue-eyed grass
Salix humilis	prairie willow	*Sisyrinchium campestre*	prairie blue-eyed grass
Salix nigra	black willow	*Sium suave*	water parsnip
Salix rigida	heart-leaved willow	*Smilacina racemosa*	false Solomon seal
*Salsola kali**	tumbleweed*	*Smilacina stellata*	small false Solomon's-seal
Salvia reflexa	wild sage	*Smilax bona-nox*	bull brier
Sambucus canadensis	elderberry	*Smilax ecirrhata*	upright carrion flower
Samolus valerandii	brookweed	*Smilax hispida*	bristly greenbrier
Sanguinaria canadensis	bloodroot	*Smilax lasioneuron*	common carrion flower
Sanicula canadensis	black snakeroot	*Smilax rotundifolia*	cat brier
Sanicula gregaria	common snakeroot	*Solanum carolinense*	horse-nettle
*Saponaria officinalis**	bouncing bet*	*Solanum ptycanthum*	black nightshade
Sassafras albidum	sassafras	*Solanum rostratum*	buffalo-bur
Saururus cernuus	lizard's tail	*Solidago buckleyi*	Buckley's goldenrod
Saxifraga pensylvanica	swamp saxifrage	*Solidago caesia*	bluestem goldenrod
Schizachyrium scoparium	little bluestem	*Solidago canadensis*	common goldenrod
Scirpus americanus	American bulrush	*Solidago drummondii*	Drummond's goldenrod
Scirpus atrovirens	bulrush	*Solidago gigantea*	late goldenrod
Scirpus fluviatilis	river bulrush	*Solidago juncea*	early goldenrod
Scirpus heterochaetus	slender bulrush	*Solidago missouriensis*	Missouri goldenrod
Scirpus micranthus	hemicarpha	*Solidago nemoralis*	old field goldenrod
Scirpus pendulus	red bulrush	*Solidago petiolaris*	downy goldenrod
Scirpus validus	bulrush	*Solidago radula*	rough goldenrod
Scrophularia marilandica	late figwort	*Solidago rigida*	rigid goldenrod
Scutellaria incana	downy skullcap	*Solidago rugosa*	rough goldenrod
Scutellaria lateriflora	mad-dog skullcap	*Solidago speciosa*	showy goldenrod
Scutellaria ovata	heart-leaved skullcap	*Solidago ulmifolia*	elm-leaved goldenrod
Scutellaria parvula	small skullcap	*Sonchus asper**	spiny sow thistle*
*Secale cereale**	rye*	*Sonchus oleraceus**	sow thistle*
Senecio glabellus	butterweed	*Sorghastrum nutans*	Indian grass
Senecio pauperculus	balsam groundsel	*Sorghum halapense**	Johnson grass*
Senecio plattensis	prairie ragwort	*Sparganium eurycarpum*	common bur reed
*Setaria faberi**	hairy foxtail bristlegrass*	*Spartina pectinata*	prairie cord grass
*Setaria lutescens**	yellow foxtail*	*Spermacoce glabra*	smooth buttonweed
*Setaria verticillata**	bristly foxtail*	*Sphenopholis obtusata*	prairie wedge grass
*Setaria viridis**	common foxtail*	*Sphenopholis obtusata major*	prairie wedge grass
Sibara virginica	Virginia rock cress	*Spiranthes magnicamporum*	Great Plains ladies' tresses

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
Spiranthes vernalis - SE	**spring ladies' tresses-SE**	*Triosteum aurantiacum* var. *illinoense*	early horse gentian
Spirodela polyrhiza	great duckweed	*Triplasis purpurea*	purple sandgrass
Sporobolus asper	rough dropseed	*Tripsacum dactyloides*	gama grass
Sporobolus cryptandrus	sand dropseed	*Triticum aestivum**	wheat*
Sporobolus heterolepis	prairie dropseed	*Typha latifolia*	common cat-tail
Sporobolus neglectus	puffsheath dropseed	*Ulmus alata*	winged elm
Sporobolus vaginiflorus	sheathing dropseed	*Ulmus americana*	American elm
Stachys palustris	hedge nettle	*Ulmus pumila**	Siberian elm*
Stachys tenuifolia	smooth hedge nettle	*Ulmus rubra*	slippery elm
Staphylea trifolia	bladdernut	*Urtica dioica*	common nettle
*Stellaria media**	common chickweed*	*Utricularia gibba*	humped bladderwort
Stipa spartea	porcupine grass	*Utricularia vulgaris*	common bladderwort
Strophostyles helvula	trailing wild bean	*Uvularia grandiflora*	bellwort
Strophostyles leiosperma	small wild bean	*Vaccaria pyramidata**	cow herb*
Stylophorum diphyllum	greater celandine	*Valerianella radiata*	corn salad
Stylosanthes biflora	pencil flower	*Verbascum blattaria**	moth mullein*
Symphoricarpos orbiculatus	coralberry	*Verbascum thapsus**	woolly mullein*
*Taraxacum officinale**	dandelion*	*Verbena bracteata*	creeping vervain
Tephrosia virginiana	goat's rue	*Verbena canadensis*	creeping vervain
Teucrium canadense var. *virginicum*	American germander	*Verbena hastata*	blue vervain
Thalictrum dasycarpum	purple meadow rue	*Verbena simplex*	narrow-leaved vervain
Thalictrum revolutum	waxy meadow rue	*Verbena stricta*	hoary vervain
Thaspium barbinode	hairy meadow parsnip	*Verbena urticifolia*	white vervain
Thaspium trifoliatum	purple meadow parsnip	*Verbena x perriana*	hybrid vervain
Thelypteris noveboracensis-SE	**New York fern - SE**	*Verbesina alternifolia*	wingstem
*Thlaspi arvense**	field penny cress*	*Verbesina encelioides**	golden crownbeard*
Tilia americana	basswood	*Verbesina helianthoides*	yellow crown beard
*Torilis japonica**	Japanese hedge parsley*	*Vernonia baldwinii*	Baldwin's ironweed
Toxicodendron radicans	poison ivy	*Vernonia fasciculata*	common ironweed
Tradescantia bracteata - SE	**prairie spiderwort - SE**	*Vernonia gigantea*	tall ironweed
Tradescantia ohiensis	Ohio spiderwort	*Vernonia missurica*	Missouri ironweed
Tradescantia subaspera	woodland spiderwort	*Veronica arvensis**	corn speedwell*
Tradescantia virginiana	Virginia spiderwort	*Veronica peregrina*	purslane speedwell
*Tragopogon dubius**	goat's beard*	*Veronicastrum virginicum*	culver's root
*Tragopogon porrifolius**	salsify*	*Viburnum prunifolium*	black haw
*Tragopogon pratensis**	common goat's beard*	*Viburnum recognitum*	smooth arrowwood
Triadenum tubulosum	marsh St. John's-wort	*Viburnum rufidulum*	rusty nannyberry
*Tribulus terrestris**	puncture vine*	*Vicia cracca **	cow vetch*
Trichostema brachiatum	false pennyroyal	*Vicia villosa**	winter vetch*
Trichostema dichotomum	bluecurls	*Viola missouriensis*	Missouri violet
Tridens flavus	common purpletop	*Viola pedata*	birdfoot violet
*Trifolium campestre**	low hop clover*	*Viola rafinesquii**	wild pansy*
*Trifolium hybridum**	Alsike clover*	*Viola sororia*	downy-blue violet
*Trifolium pratense**	red clover*	*Viola striata*	white violet
*Trifolium repens**	white clover*	*Viola triloba* var. *dilatata*	cleft violet
Trillium grandiflorum	white trillium	*Vitex agnus-castus**	chaste tree*
Trillium recurvatum	prairie trillium	*Vitis aestivalis*	summer grape
Triodanis perfoliata	Venus' looking glass	*Vitis cinerea*	winter grape
Triosteum perfoliatum	late horse gentian	*Vitis palmata*	catbird grape

Appendix 2. Continued.

Scientific Name[1,2]	Common Name[1,2]	Scientific Name[1,2]	Common Name[1,2]
Vitis riparia	riverbank grape	*Woodsia obtusa*	common woodsia
Vitis vulpina	frost grape	*Xanthium strumarium*	common cocklebur
Vulpia octoflora	six-weeks fescue	*Zea mays**	corn*
Wolffia columbiana	water meal	*Zizania aquatica**	giant wild rice*
Wolffia papulifera	water meal	*Zizanopsis miliacea**	southern wild rice*
Wolffiella gladiata	blade duckweed	*Zizia aurea*	golden Alexanders

[1] Bold type indicates an Illinois watch list (WL), Illinois endangered (SE), Illinois threatened (ST), federally endangered (FE), federally threatened (FT), or possibly Illinois extirpated (EXT) species.
[2] * = introduced species