Affected Environment

Chapter Three

AFFECTED ENVIRONMENT

THIS CHAPTER DESCRIBES the existing environment of the Ice Age Complex and the surrounding region. It focuses on the park resources, uses, and facility and socioeconomic characteristics that could potentially be affected by each of the alternatives.

GEOLOGIC AND SOIL RESOURCES

The Ice Age Complex at Cross Plains ("Ice Age Complex" or "complex") straddles two distinctly different landscapes. The northern and eastern edges were covered by glaciers during the Late Wisconsin glaciation, which began 25,000 to 30,000 years ago. Excellent examples of end moraine, ice marginal and subglacial channels, glacial outwash, and ice marginal lakes are within the boundaries. The remainder of the complex is in the driftless area and was apparently never glaciated. Its hills and valleys are a product of millions of years of hillslope and stream erosion on sedimentary bedrock that consists of sandstone and dolomite. The soils in this area consist of weathered bedrock covered by windblown silt called loess.

At some time in the past, solution of the dolomite resulted in the formation of cave passages that likely run beneath the area. A collapse of over-lying sandstone into one of these caves has resulted in at least two sinkholes. One of sinkholes now drains water from Shoveler Pond into this likely cave system during the spring when water levels are high.

During the Late Wisconsin glaciation, this erosional landscape was modified by torrents of glacial meltwater that flowed down Black Earth Creek valley and lesser amounts that flowed from the ice margin along what is now Timber Lane and Old Sauk Pass Road. This water flowed northward along the ice margin before draining into the Black Earth Creek valley, first along the ice edge and later beneath the ice in what is now called Cross Plains gorge.

Early morning dew drops.

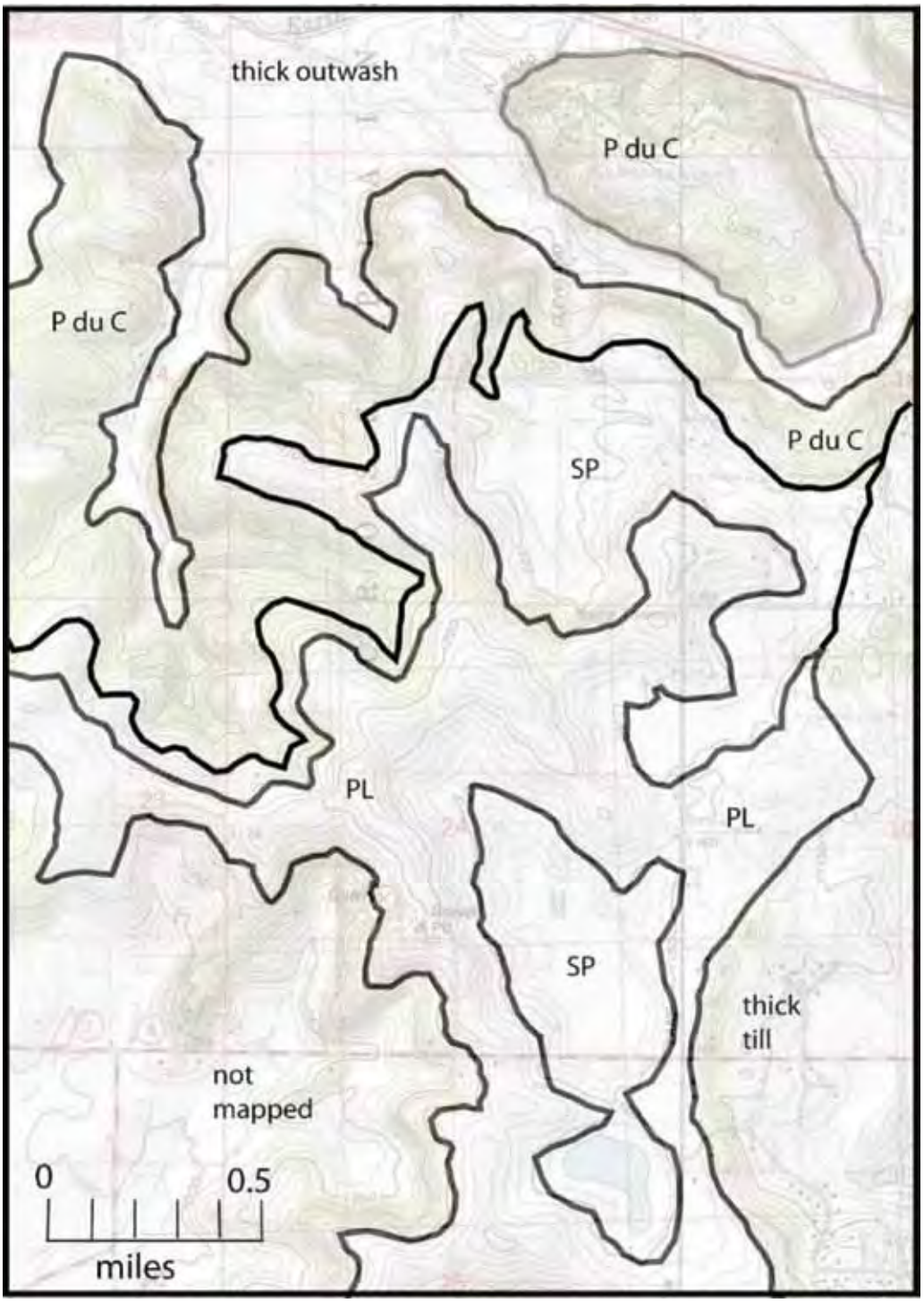
Bedrock Geology

The bedrock in the Ice Age Complex is all sedimentary and consists primarily of sandstone and dolomite of Paleozoic age. Figure 10 shows the distribution of bedrock units at the complex. Figure 11 portrays a north-south cross section though the complex showing the sedimentary rock units. Cambrian sandstone does not crop out at the surface, but it is close to the surface in Black Earth Creek valley. There are small surface outcrops of the remaining rock units at the complex, and not all of these have been mapped. There are no other large outcrops.

All of the remaining sedimentary rocks exposed at the Ice Age Complex are Ordovician age. The oldest rock unit exposed in outcrop is dolomite of the Prairie du Chien Group. The best exposures are along the walls of Cross Plains gorge and along steep slopes facing Black Earth Creek. Fossils called "stromatolites" dominate the rocks deposited during this time, but they are rare and are not an important part of the resource.

Figure 11 shows that sand and gravel cover the bedrock units in most valley bottoms and under the Johnstown moraine, so rock is not mapped there. Because most of the contacts are covered, this map portrays the likely distribution of rocks, but it should not be used for site-specific purposes without drilling or further research.

Figure 10: Distribution of near-surface bedrock units at the Ice Age Complex

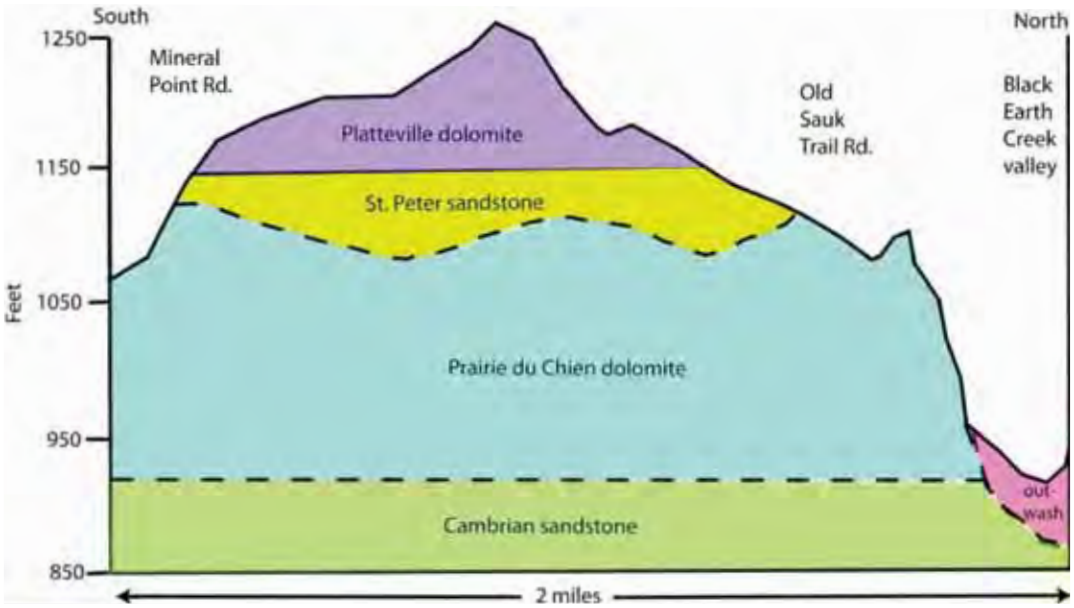


Notes:

a. Only three units occur near the surface beneath windblown silt (loess).

b. PL is Platteville dolomite, SP is St. Peter sandstone, P du C is Prairie du Chien dolomite.

FIGURE 11: NORTH-SOUTH CROSS-SECTION THROUGH THE ICE AGE COMPLEX



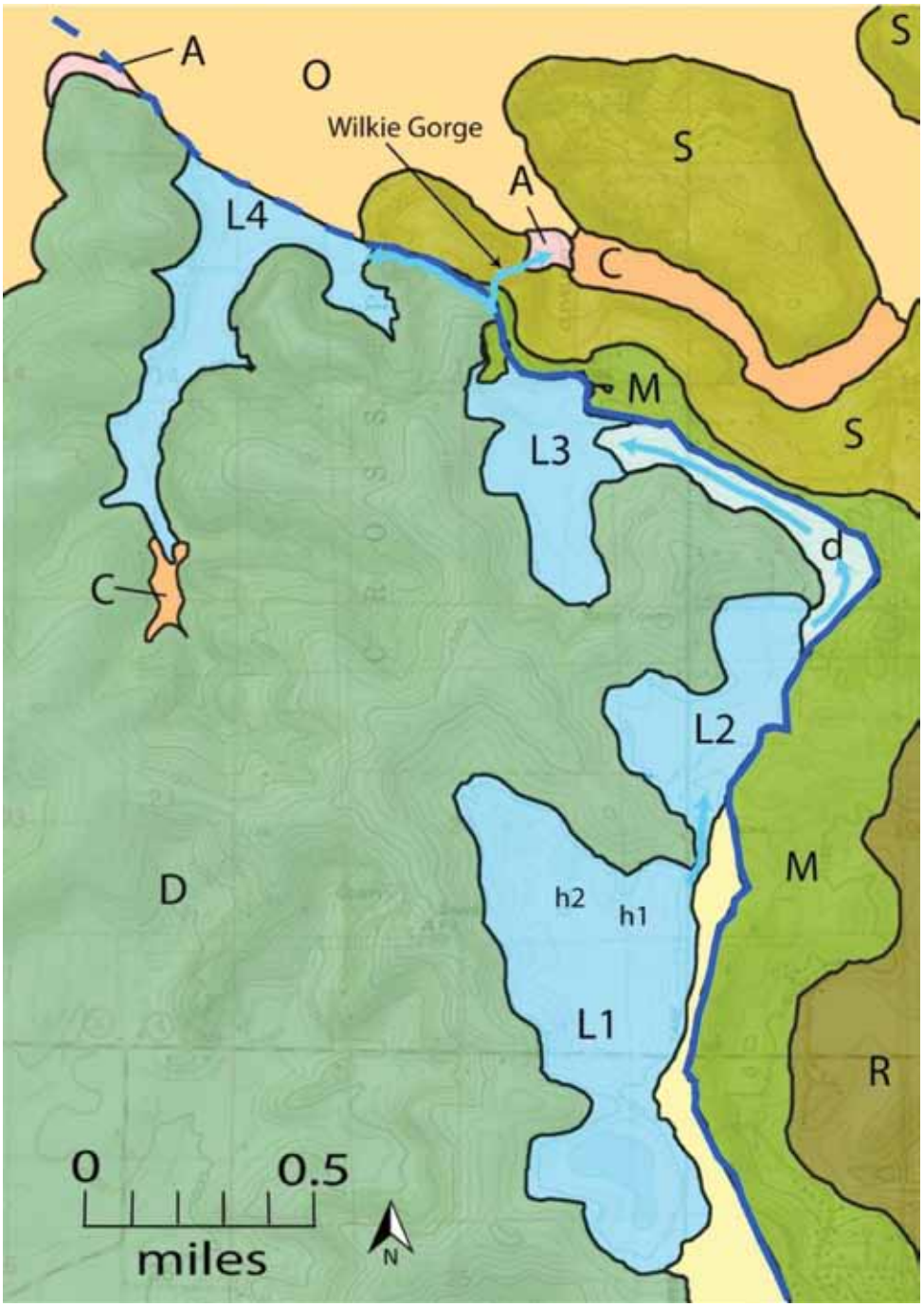
The materials above the bedrock are too thin to show on figure 11. Contacts between bedrock units are mostly projected into the cross-section from logs of wells located south, east, and west of the complex. Because most of the contacts are covered, this cross section portrays the likely distribution of rocks but should not be used for site-specific purposes without drilling or other further research. In particular, the bottom contact of the St. Peter sandstone is quite variable over short distances, and its thickness varies considerably.

The Prairie du Chien dolomite is overlain by the St. Peter sandstone. Although most of the sandstone was deposited in the shallow ocean, part of the St. Peter sandstone consists of wind blown sand. All of it is made up of well-rounded, quite pure quartz sand. St. Peter sandstone is the surface rock in much of the central part of the Ice Age Complex. It is well exposed at the sinkhole near the northeastern edge of the Shoveler Pond ("h1" on figure 12). It is also exposed along the trail just south of the Wilkie farm buildings. St. Peter sandstone contains some trace fossils, such as worm burrows, but they are not seen in the small outcrops at the Ice Age Complex. Fossils are not an important part of this resource.

Figure 12 shows that several shallow lakes were present when the ice was at the Johnstown moraine. L1 is the highest; L2 was just slightly lower and was damned by ice in the present position of Old Sauk Road; and L3 was substantially lower than L1 and L 2. Possible sinkholes are depicted by h1 and h2.

Platteville dolomite of the Sinnipee Group was deposited in the sea about 450 million years ago. It is well exposed in the Wingra Stone quarry north of Mineral Point Road and the road cut on Mineral Point Road. There are low exposures of it elsewhere. Corals, mollusks, and brachiopods are common, especially farther west in the driftless area. They are very difficult to find in the dolomite at the complex, and they are not an important part of the resource. The Platteville dolomite is the youngest bedrock in the Ice Age Complex. Many of the surrounding hills that are part of the viewscape, especially those to the west, are capped with the even younger Galena dolomite. West Blue Mound, the highest hill that can be seen from the Ice Age Complex, is capped by even younger Silurian dolomite.

Figure 12: Detailed map of glacial and related deposits in the Ice Age Complex



Notes:

C = colluvium
M is the Johnstown moraine
D is driftless area
R is thick till not in moraine
d is a drainage ways
A is alluvial fan
O is outwash
S is steep slope controlled by bedrock with patchy till cover

There is also colluvium at the base of most steep slopes, but it is too narrow to map at this scale

The remaining geologic and soil resources result from earth surface processes such as weathering, erosion, and glaciation.

Karst Topography. Karst topography develops when limestone bedrock is eroded and dissolved by surface and groundwater. Caves and caverns are common in limestone, and a common surface expression of karst is the sinkhole, or sink. A sinkhole forms where surface water finds a path down into the limestone. Solution of the limestone takes place, slowly enlarging the opening and allowing more water to pass through. In some cases a sinkhole can form rapidly when the roof of the cave collapses.

Shoveler Sink drains into a sinkhole at times of high water. It has no other outlet. The location of the sinkhole is shown as h1 on figure 12. The land around the sinkhole appears to have been modified by human activity. There is another depression north of the h1 sinkhole. This might be a sinkhole, or it might be an abandoned small quarry that was mined at some time in the past. When viewed in 2009, there was no evidence of water entering the ground through this depression.

When the glacier was present just to the east, it is possible that these sinkholes were actually springs where groundwater discharged. Water under pressure would have been forced through the groundwater system, and would have been able to come to the surface outside the ice-covered area. There were likely also springs discharging glacial melt water into the upper part of the Sugar River basin at the southwest edge of the Ice Age Complex.

Glacial Deposits. The most recent glaciation, the late Wisconsin Glaciation, began in Wisconsin about 30,000 calendar years ago. Ice from Canada, north of the eastern part of the Lake Superior basin, advanced southwestward down the Green Bay–Lake Winnebago lowland. This lobe of ice is called the Green Bay lobe, and its maximum extent lies along the eastern and northern edges of the Ice Age Complex.

Johnstown Moraine. Moraines are ridges of glacial debris. They form wherever sand and gravel and till are piled up either on or adjacent to a glacier. End moraines are those that form at the edge (end) of the glacier as debris is carried to the ice margin and released as the glacier ice melts. The moraine at the outer edge of the southern Green Bay lobe is called the Johnstown moraine.

In much of southern Wisconsin, moraines are only about 50 feet high and 0.25 to 0.5 mile wide. The best place to see the moraine at the Ice Age Complex is northwest of the intersection of Cleveland Road and Old Sauk Pass. There is a single crested ridge up to 50 feet high. There are scattered erratics on the surface.

Glacial Lakes. Glacial lakes are also called ice-dammed lakes. When the glacier sat at the Johnstown moraine, the climate was very cold, and there was permafrost in front of and beneath the glacier edge. Meltwater was probably only produced on warm days for a month or two in summer. Water that was produced by melting was dammed between the glacier and the hills of the driftless area landscape to the west in several small basins at the Ice Age Complex. Lake L1 on figure 12 had the highest level. There is still silty lake sediment at least up to an elevation of 1,150 feet and perhaps slightly higher. A narrow band of outwash sand separates the finer silty lake sediment from the till in the Johnstown moraine. Lake L2 seems to have been just slightly lower than Lake L1. Water from Lake L2 drained through a drainage way into Lake L3.

It appears that Lake L3 drained through an ice-marginal channel along the ice edge across the ridge north of Old Sauk Pass and into Black Earth Creek valley before Cross Plains gorge was cut. At some point, perhaps when climate warmed enough to allow melting at the bottom of the glacier near its edge, water found its way under the ice and down the steep slope on the side of Black Earth Creek valley. It was this flow of water that eroded Cross Plains gorge.

Lake L4 formed in a north-flowing tributary valley of Black Earth Creek between the glacier edge and the Driftless Area upland. It could have been dammed directly by the ice, or it could have been dammed by the accumulating outwash in Black Earth Creek valley.

Cross Plains Gorge and Black Earth Creek Valley. Cross Plains gorge is a submarginal chute, a type of channel that carries water from the ice edge down under the ice. Its location was probably determined by a pre-existing weakness or opening in the ice such as a crevasse. The water in Lake L3 (on figure 12) was about 200 feet higher than the Black Earth Creek valley, and water would naturally take the steepest path available to the bottom of the valley. Once water made its way beneath the ice to the bottom of Black Earth Creek valley, water under high pressure and flowing rapidly cut the deep gorge that we see today. Black Earth Creek valley now has outwash sand and gravel over 200 feet thick that was deposited by braided streams flowing beneath and in front of the glacier.

Soils

Tens of millions of years of erosion by rainwash on slopes and by streams produced most of the hills and valleys in the landscape today. Soils on bedrock in the driftless area are of two main origins. Weathering of sandstone produced quartz sand, and weathering of dolomite produced a clayey residuum that is distinctly different. Over both of these weathering products, windblown silt, called loess, was deposited during the last glaciation. In general, soils in the unglaciated part of the Ice Age Complex are thin silt loams that are susceptible to erosion on steep slopes. Soils are thicker near the base of slopes.

Soils on the moraine are also silt loam soils for the most part. In places where the loess cover is thin, rocks from the underlying till show through. Soils on the former lake beds (refer to figure 12) are silty and sandy with few stones. In its comprehensive plan (VCP 2008), the village of Cross Plains commented on the productive nature of these soils: "Dane County is one of the most productive agricultural counties in Wisconsin." At the same time, the comprehensive plan notes that "the County is in the third most threatened farm area in the country." One of the reasons for this threat is the rapid pace of development that removes productive soils from cultivation (VCP 2008, p. 17).

WATER QUALITY

The region surrounding the Ice Age Complex contains one of the Midwest's most important trout fishing streams, the Black Earth Creek. This small spring-fed stream runs from the terminal moraine near Cross Plains, northwest to the Wisconsin River, traversing a number of scenic hill-and-valley landscapes along the way. The creek and its surrounding lands provide a number of recreational opportunities such as fishing, hiking, snowshoeing, cross-country skiing, and horseback riding. Because of its high recreational and ecological value, the creek was named as one of Wisconsin's "Land Legacy" areas, which are regions of the state that are important in meeting the state's recreation and conservation needs. Within the proposed complex, the glacier originally impounded four proglacial lakes. Today, the southernmost proglacial lake has been divided in two by County Trunk S (Mineral Point Road) and consists of two water-filled basins: Coyle Pond and Shoveler Sink. The other proglacial lakes are dry and filled with agricultural crops. There are a few intermittent streams that bisect the complex. One follows a deep ravine on the south side of the former Wilkie property before emptying onto the former McNutt property at the western edge of the proposed site. There is at least one spring north of Old Sauk Pass that has been partially developed to include a stock tank. The spring drains northward toward Black Earth Creek. In the center of the complex, south of Old Sauk Pass, water runoff travels north to a depression where it enters and flows through the gorge, eventually reaching Black Earth Creek.

Nearly all of the Ice Age Complex is a groundwater recharge area, meaning surface water goes into the groundwater system. However, much of the precipitation that falls on the uplands runs off on the surface. Some of that water flows northward to Black Earth Creek, some southward to the Sugar River, and some eastward to the Yahara River basin. Because the walls and the floor of Cross Plains gorge are steep, precipitation that falls there does not remain in the gorge, but instead flows northward towards Black Earth Creek. Shoveler Sink and Coyle Pond sit on the surface water divide between these basins.

SOUNDSCAPES

There is abundant natural quiet within most of the complex given its isolation from road noise and from an urban center. While there are farms throughout the site, they are small farms, not large agricultural operations, and generate little unnatural sound. As one moves from the center of the complex towards its northern and eastern edges along U.S. Highway 14 and Timber Lane, natural quiet dissipates and road noises begin to dominate. Similarly, the sound of traffic from the two roads (Old Sauk Pass and Mineral Point Road) that traverse the site becomes louder the closer one moves towards those roads. This sound assessment is based on experience of the team members writing this plan; a formal sound inventory has not been conducted at the complex.

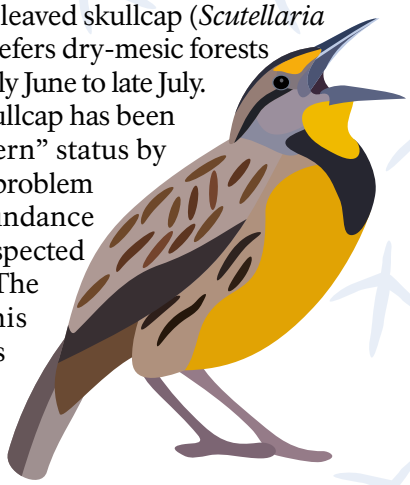
VEGETATION AND WILDLIFE

The Wisconsin Department of Natural Resources notes that the Ice Age Complex comprises three ecological landscapes: Western Coulee and Ridges, Central Sand Hills, and Southeast Glacial Plains. Although this combination of landscapes in the complex indicates a variety of native vegetation, southern dry-mesic forest dominated the site before European settlement.

The southern dry-mesic forest is prominently red and white oak, with shagbark hickory, black cherry, white oak, and basswood as canopy associates. Disturbance history and landscape position have allowed variability within the areas of southern dry-mesic forest. This variability includes areas dominated by large white oak, some greater than 24 inches in diameter, and open grown; some areas dominated by red oak with white birch and big-tooth aspen as canopy associates; and other areas with a very widely spaced canopy and a dense tall shrub layer composed mostly of common buckthorn and prickly ash.

The southern mesic forest can be found in the narrow bottoms of steep ravines. This forest is characterized by a canopy of sugar maple with basswood and ironwood as associates. The shrub layer has a moderate cover, with eastern prickly gooseberry as a common species. The forest ground layer has many species that bloom in the spring and include wild ginger, sharp-lobed hepatica, jack-in-the-pulpit, mayapple, and bloodroot. Spring ephemerals are also present, although not abundant. Shoveler Sink is currently fringed by reed canary grass with some sedges and smartweeds. Many of the uplands have been planted into prairie with big bluestem and switch grass, as well as smooth brome grass for hay and pasturing. Many of the open fields in the Ice Age Complex are cropped for corn and soybeans or remain as old fields.

There is one rare plant in the Ice Age Complex: the heart-leaved skullcap (*Scutellaria ovata*). This plant prefers dry-mesic forests and flowers from early June to late July. The heart-leaved skullcap has been given "special concern" status by the state, wherein a problem with the species abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.



Because oak openings, also called "oak savanna," are so rare today in comparison to their large historic range, restoring oak openings has been given special attention in recent years. The Board of Regents at the University of Wisconsin has noted that "In the 1800s, oak savanna (or oak openings) once covered more than 5,000,000 acres in Wisconsin . . . now, only a few thousand [acres] of this native landscape remain" (UW 2001). The Ice Age Complex historically contained oak openings. In the absence of fire, many of the historic oak openings have converted to closed-canopy forests. According to Wisconsin's Natural Heritage Inventory Program, "the presence of several areas with open-grown and semi-open-grown oaks and some residual savanna ground layer species such as Tinker's weed, indicates that there is a possibility of restoring the critically imperiled globally rare oak opening natural community within the project area" (WDNR et al. 2006).

Some invasive plants are well-established within the Ice Age Complex, including common buckthorn, Tatarian honeysuckle, prickly ash, and reed canary grass. Other invasive plants that occur and present possible future threats to diversity include garlic mustard, winged burning-bush, star-of-Bethlehem, multiflora rose, Asian bittersweet, Japanese barberry, and common burdock. Numerous other invasive species are present in the old field and planted prairie areas.

There are two species of birds that are listed as "threatened" on a state level in the Ice Age Complex and two species that have a special concern status. The threatened birds are Henslow's sparrow, which prefers old fields, open grasslands, wet meadows, unmowed highway right-of-ways, undisturbed pastures, timothy hay fields, and fallow land grown up to tall weeds; and the Hooded warbler, which is found in large upland forest tracts in southern Wisconsin, where they occur in pockets of dense understory near small or partial canopy openings. The breeding season for the Henslow's sparrow extends from mid-May through mid-July. The breeding season for the hooded warbler starts a bit later (in late May) and also extends through mid-July.

The two birds of special concern are the western meadowlark and the yellow-billed cuckoo. The western meadowlark inhabits pastures and small grain fields, as well as other short, open grasslands and agriculture fields, including hayfields. The yellow-billed cuckoo prefers open deciduous woodlands with dense shrubby undergrowth, especially along the backwaters of a major river or slow-moving creek.

The WDNR staff have observed the red-headed woodpecker, a "species of greatest conservation need," in the walnut grove bordering the south side of Old Sauk Pass. This presence indicates that red-headed woodpeckers would be expected to nest in cavity trees if oak opening is restored.

Shoveler Sink, a remnant glacial depression, provides excellent habitat for migratory birds such as waterfowl, shorebirds, songbirds, and waterbirds seeking a freshwater pond, marsh, and grassland. An online checklist program ("eBird") for recreational and professional bird watchers highlights this important resource, in that at least 17 species of waterfowl have been observed using the pond. Waterbirds recorded include several species of herons and large numbers of geese and cranes that stage there (eBird 2008). The presence of food and water are two important resources present at Shoveler Sink that allow for large numbers of individuals from many species to accumulate during migration. The pond provides floating and submerged plants in the open water zone and is surrounded by an emergent zone that includes cattails, smartweed, and arrowheads whose tubers provide important food for migrating waterfowl and geese.

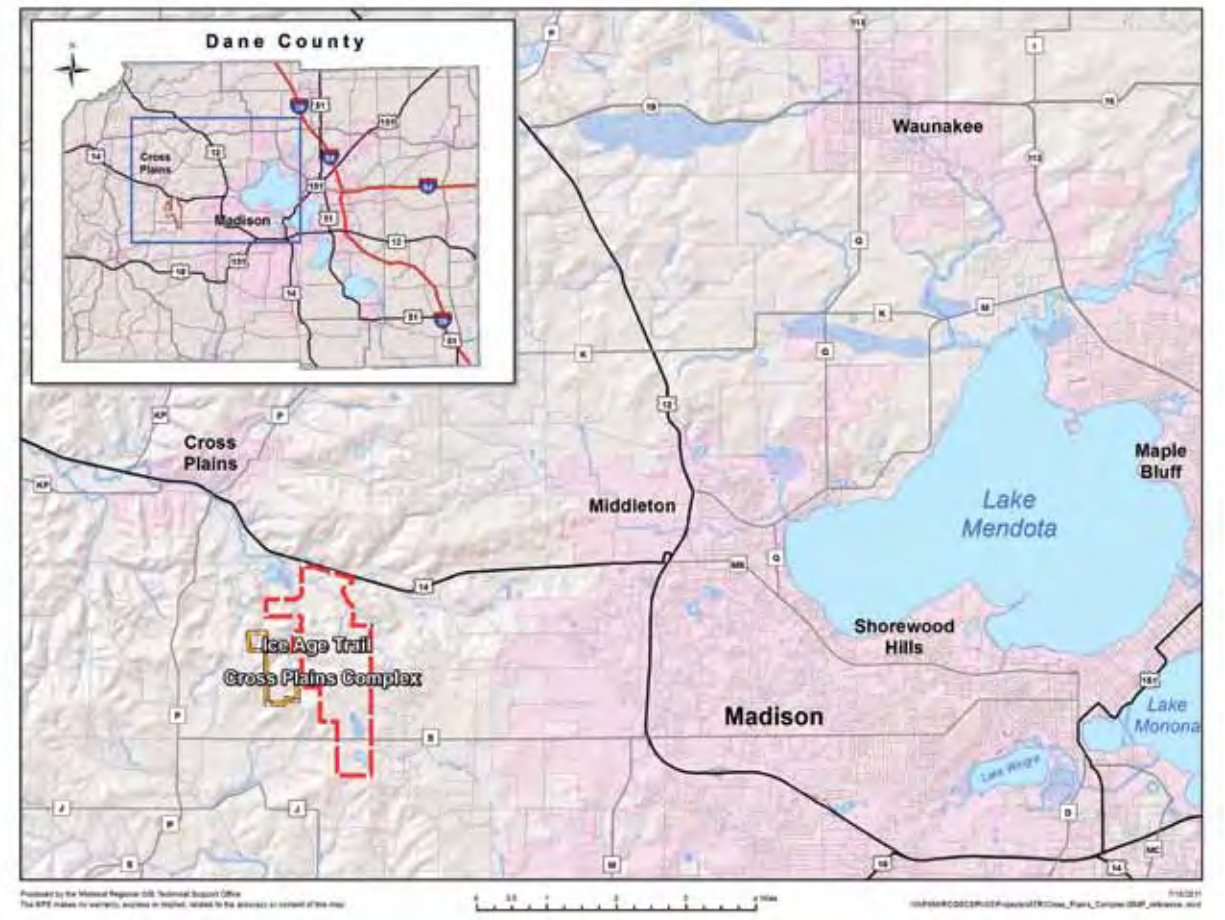
Shoveler Sink is also an important area for breeding amphibians, which in turn, makes it very attractive for waterbirds such as herons and cranes. Stresses to migratory birds include habitat destruction and habitat alteration (Duncan 2002). Many similar ponds and depressions have been filled for agriculture and development, both of which could threaten the viability of this valuable resource. As this depression is maintained through direct precipitation and runoff from the surrounding landscape, nutrient runoff could pose an indirect threat if not monitored closely.

The grasslands surrounding Shoveler Sink, as well as the old agricultural fields in the complex, such as the former McNutt lands, support several conservative grassland obligate species like Henslow's sparrow (8–10 nesting pairs in 2008); eastern meadowlark; one western meadowlark; several bobolink; and dickcissel.

SOCIOECONOMICS

The Ice Age Complex is located in the town of Cross Plains, Wisconsin, about 10 miles west of the center of Madison (figure 13).

FIGURE 13: MAP OF DANE COUNTY AND THE ICE AGE COMPLEX



This area is increasing in population. The population in the town of Cross Plains grew by 7.5% in the 1990s to about 1,320. Over the life of this plan, the Wisconsin Department of Administration projects that the population will continue to grow to 1,742, a 16.6% increase. The village of Cross Plains grew from 2,362 to 3,084 in the 1990s — a 23% increase. This growth makes the village of Cross Plains among the fastest growing communities in Dane County (other communities are Middleton and Madison). The county had a population in 2000 of 426,526 and is also a fast-growing area. Dane County is estimated to have a population of 505,385 by 2030. In comparison, the 2030 estimate for the village of Cross Plains is 3,654. Note that these growth projections are from the Wisconsin Department of Administration, but the village of Cross Plains used a different method (acceptable levels of residential development) in its recent comprehensive plan (VCP 2008) to come up with a projection for the village of Cross Plains of 6,084 by 2030. Extrapolating this method to the overall Dane County population, the projection for Dane County would be 841,478. Therefore, using this alternate estimating method, population growth could be even stronger.

Today, the median age of the town of Cross Plains is closer to middle-aged, with the average age at about 40 years, slightly higher than Dane County. The population of the village of Cross Plains is relatively young (40% are between ages of 20 and 44) and relatively well-educated (60% have attended at least some college in comparison to 50% statewide) (VCP 2008, p. 9).

Like many local governments around the country, Cross Plains has been struggling in recent years to increase tax revenues and retain open space. There has been pressure to develop the lands that comprise the complex in order to increase property tax revenue, but at the same time, there is tremendous support for keeping these lands free from development. The vision stated in the *Village of Cross Plains Comprehensive Plan* includes these sentences: "The rich natural resources of the village and surrounding countryside and the Black Earth Creek in particular will continue to be a defining feature of the community due to careful preservation efforts" and "Though ties with Madison will strengthen, the village will retain its character and identity." Among the specific goals of the comprehensive plan are to "limit conversion of farmland" and "safeguard against increased future erosion."

Although land use is typically a separate consideration in a socioeconomic analysis, impacts on land use would be the same because all of the GMP/EIS alternatives would change how land is used in essentially the same way. Each of the alternatives proposes working with private owners of all of the land in the complex to protect it from incompatible uses, such as dense development, either by publically acquiring the land or by employing another land protection tool, such as the purchase of an easement. All of the alternatives would change land use in this way, and their impacts on land use do not differ (see chapter 4 for impacts that could result from each alternative).

VISITOR EXPERIENCE

NPS *Management Policies 2006* state that the enjoyment of park resources and values is part of the fundamental purpose of all parks and that the National Park Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. Because many forms of recreation can take place outside a national park setting, the National Park Service seeks to

> provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in a particular unit
>
> defer to local, state, and other federal agencies; private industry; and nongovernmental organizations to meet the broader spectrum of recreational needs and demands that are not dependent on a national park setting

Unless mandated by statute, the National Park Service will not allow visitors to conduct activities that

> would create an unsafe or unhealthful environment for other visitors or employees
>
> are contrary to the purposes for which the park was established
>
> would unreasonably interfere with the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park; NPS interpretive, visitor service, administrative, or other activities; NPS concessioner or contractor operations or services; or other existing, appropriate park uses

Part of the purpose of the Ice Age Complex is to "provide outdoor recreation and educational opportunities in support of and compatible with the conservation and enjoyment of the nationally significant scenic, historic, natural, and cultural resources within the Complex." Each of the action alternatives proposed in this document are designed to meet the purpose of the complex but in different ways. The impact analysis presented in chapter 4 estimates impacts on the ability of visitors to experience Ice Age resources under each alternative.