
Chapter 3: Affected Environment

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3.1 Introduction

This chapter describes the proposed Hackmatack NWR Study Area in southeast Wisconsin and northeast Illinois and its local and regional setting. The Study Area's physical environment, habitats, species, and human environment are all described. This description provides a thorough overview of the Study Area's current features so the effects of the proposal (establishing a new refuge) can be weighed within the larger context of its surroundings (The Greater Milwaukee and Chicago metropolitan areas).

3.2 Physical Environment

The Hackmatack Study Area is located in portions of Walworth, Racine, and Kenosha Counties in Wisconsin and McHenry and Lake Counties in Illinois encompassing 350,000 acres (54 square miles). Its approximate boundary is defined by a 30-mile radius from the village of Richmond, Illinois on the state border. The Study Area lies approximately 50 miles from downtown Milwaukee and Chicago. Located 20 miles west of Lake Michigan, the Study Area's varied landscape of lakes, streams, ridges, and valleys is intersected on the east by the Fox River.

3.2.1 Topography, Geology, and Soils

The Study Area falls within the physiographic morainal section. The topography and soils are a result of glaciers advancing and retreating from 13,000 to 26,000 years ago. These glaciers formed the many "moraines" or ridges in the area, left behind "glacial meltwater" or lakes and marshes, created rivers that scoured out valleys, and changed lake levels and shorelines. The "glacial drift" or raw soil materials left behind by the glaciers has been naturally weathered and sorted to create "outwash" in the lowlands and "till" in the uplands. More recently, this drift has been covered over by "loess" or wind-blown dust in some areas, and peat has built up in undrained basins. Over time, all of these processes have shaped the land within and around the Study Area (Sullivan, 1997).

The elevation ranges from 650 to 950 feet above mean sea level. A few pockets of the land on the western side of the Study Area range from 950 to 1150 feet above mean sea level.

The bedrock foundation is very old sedimentary rock, a magnesium-rich limestone known as dolomite, or more specifically Niagara dolomite (Sullivan, 1997). This dolomite has commercial value where it is close to the surface, both as dimensional building stone and, when crushed, as an aggregate for construction or as an agricultural soil conditioner. Even though the deposit is in fact dolomite, it is often referred to as Lannon stone or limestone, primarily calcium carbonate. Gravel and sand deposits are scattered within the Study Area. They are important sources of concrete aggregate, gravel for road

subgrade and surfacing, sand for mortar, and molding sand. The largest concentration lies to the north of the Study Area in Waukesha County (SEWRPC, 1997).

The soils are those typical of much of the Midwest. They include alfisols, which naturally form under hardwood forest cover and have a clay-enriched subsoil with high native fertility making them prime farmland; mollisols, which naturally form under grassland cover, have deep, high organic matter, and are also prime for farmland (especially if drained); and to a much lesser extent histosols, which consists mostly of organic materials, include mucks and peats, and due to their poor drainage and acidity are not prime for agricultural soils.

3.2.2 Climate

The climate of the Study Area ranges from continental to humid continental with wide variations closer to Lake Michigan. The winters are cold and snowy while the summers are warm and wet to hot and humid. About two-thirds of the annual precipitation falls during the growing season (freeze-free period). The average annual temperature is about 50°F, with an average temperature of 30°F in the winter and 70°F in the summer (Climatology of the United States, 2011).

The pronounced moderating effect of Lake Michigan is well illustrated by the fact that the growing season of 140 to 150 days along the east-central coastal area is of the same duration as in the southwestern Wisconsin valleys. The average date of last spring freeze is typically early May, while the first autumn freezes occur in mid-October (Climatology of the United States, 2011).

The long-term mean annual precipitation is between 30 and 35 inches over most of the area. Thunderstorms average about 45 per year and occur mostly in the summer. Occasional hail, wind, and lightning damage are also reported. The mean dates of first snowfall of consequence, an inch or more, is usually in early December with an average annual duration of snow cover of 85 days. Normal annual snowfall exceeds 38 inches (970 mm) in Chicago and is closer to 52 inches near Milwaukee (Climatology of the United States, 2011; and Climate of Milwaukee, 2011).

3.2.3 Hydrology and Water Quality

Water Resources

Since the landscape of the Study Area is considered “young” geologically and has just emerged from underneath the glaciers, much of the land is poorly drained. An elaborate network of branching streams and rivers has not yet formed, and some of the land does not drain at all. The water in the many depressions that dot the landscape is either evaporated or absorbed into the ground (Sullivan, 1997).

A continental divide runs just to the east of the Study Area, splitting the drainage of rivers and streams between Lake Michigan to the east and the Mississippi River to the west. The Fox River, Nippersink Creek, and various other rivers, streams, and creeks within the Study Area generally flow to the Illinois River and then on to the Mississippi River. The rest of the landscape contains numerous lakes, wetlands, bogs, and seeps of various sizes that play a part in the hydrology of the area. Most of the Study Area lies within the Upper Fox River Watershed with a small portion on the western edge in the Kishwaukee Watershed.

Water Quality

The existing rural areas within the Study Area allow most of the rain that falls to recharge groundwater or reenter the atmosphere. However, in the highly developed urban and intensive row crop agricultural locations in and near the Study Area, much of the rain that falls becomes surface run-off. This water mixes with chemicals applied to or contained in the surface and degrades the water's quality. While the Study Area has several groundwater aquifers from which local residents obtain drinking water, increased surface run-off has increased the potential for groundwater contamination by harmful pollutants. This is especially true in areas with highly permeable soils and subsurface materials such as sand and gravel.

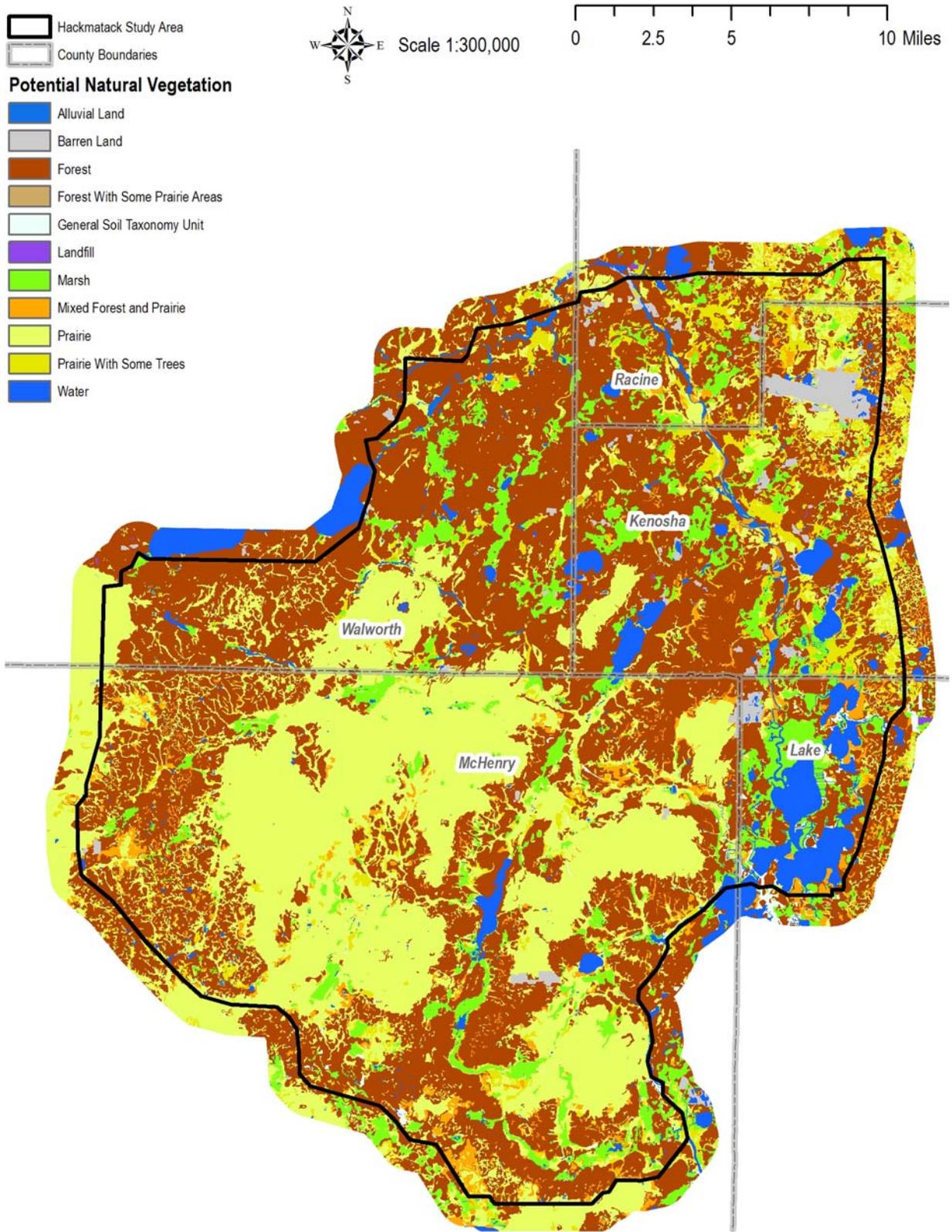
Five Class III Special Resource Groundwater Protection Areas have been established in McHenry County within or adjacent to nature preserves containing unique wetland natural communities that depend on a constant flow of clean, cool groundwater from shallow aquifers. McHenry County's rivers and streams represent some of the highest quality stream resources in northeastern Illinois. According to the Illinois Environmental Protection Agency and the Illinois DNR, most of these freshwater sources maintain healthy aquatic systems with biological integrity ratings of Class A or B (on a scale of A to E). The Kishwaukee River, Nippersink Creek, and Boone Creek are examples of these high-quality streams.

3.3 Biological Environment

3.3.1 Habitats

The varied landscape that was left behind after the glaciers finally retreated supported a wide variety of habitats that in turn support a wide variety of species. The Wisconsin portion of the Hackmatack Study Area lies in the Southeast Glacial Plains Ecological Landscape. Historically, this landscape supported a mosaic of prairie, oak forests, oak savanna, maple-basswood forests, marshes, and fens (Figure 6). The Illinois portion of the Study Area lies within the Northeastern Morainal Natural Division (NMND). This landscape historically consisted of wetlands, oak savanna, woodlands and prairie. Today, with the exception of lands in the existing conservation estate, only small, often isolated pockets of these habitats exist in the Study Area along with sculpted remnants of moraines, kames, kettle marshes, and bogs from its glacial past.

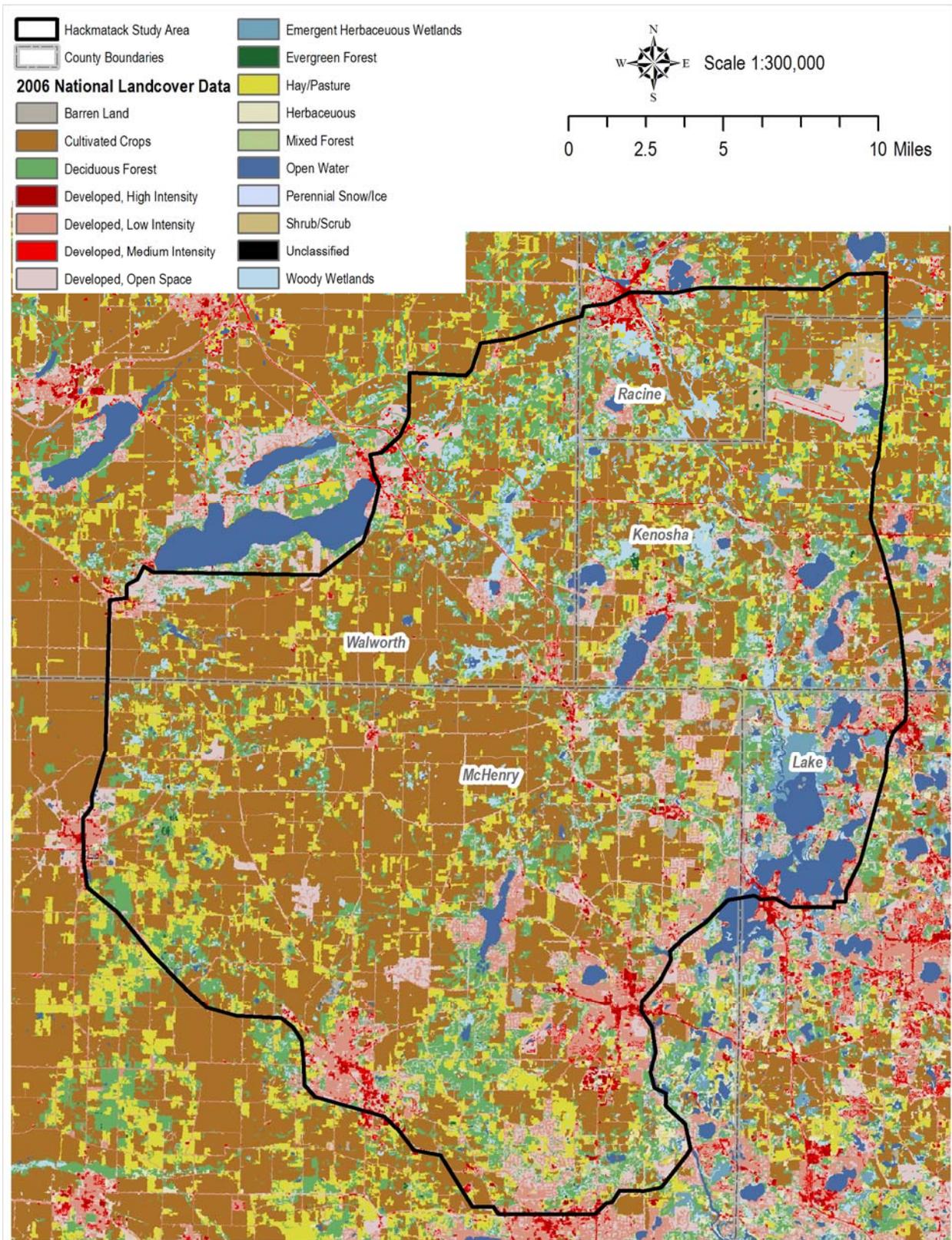
Figure 6: Potential Natural Vegetation of the Study Area



Agricultural and urban land use practices have drastically changed the land cover of the Study Area since Euro-American settlement. The current vegetation is primarily agricultural cropland (over 50 percent). Remaining forests occupy only about 10 percent of the land and consist of oak, maple-basswood and lowland hardwoods (Figure 7).

Two habitat types account for most of the sensitive species in the Study Area: wetlands and grasslands. Historically, as much as 22 percent of the Study Area may have been wetland while 21 percent may have been grassland; an additional five percent may have been savanna. The remainder of the landscape was most likely forest and mixed forest/prairie. The glacial history of the Study Area produced a rich variety of wetlands and water bodies including fens, bogs, marshes, swamps, ponds, lakes, and streams that attract abundant and diverse wildlife. While prairie was a dominate vegetation community on the landscape historically, only a patchwork of these grasslands too rugged or wet for agriculture still exist today.

Figure 7: Current Land Cover of the Study Area (Source: USFWS, Midwest Region)



Wetlands

Inventory information shows that about half of the original wetland area of Wisconsin has been lost to land use changes, primarily agricultural drainage and road, urban, and industrial development. Many of the remaining wetlands are in an altered or disturbed condition due to partial drainage, vegetation clearing, grazing, periodic plowing, and other agricultural uses. Some of these remaining wetlands (less than 25 percent of the original amount) are interspersed among the former prairie and oak savanna areas of southern and east-central Wisconsin within and near the Study Area. For Wisconsin, 32 percent of the state's threatened and endangered plants and animals are wetland dependent (Wisconsin Ecological Landscapes Handbook, 2001).

The remaining natural wetlands (excluding floodplain forest) occupy about one percent of Illinois, and only 6,800 acres are considered high quality. Marsh-type wetlands are scarce, highly degraded, and critical for the Species in Greatest Need of Conservation (i.e., species meeting one or more of eight criteria used when developing wildlife conservation strategies). Remaining wetlands are in poor condition due to fragmentation, siltation, altered hydrological conditions, and invasive species. Invasive plant species such as reed canary grass, common reed, Eurasian milfoil, and purple loosestrife can dominate disturbed wetlands and exclude native plant species, resulting in a loss of biodiversity. Wetland bird and insect communities are especially sensitive to changes in hydrology, plant species composition, and habitat loss (Illinois DNR, 2005).

The Illinois DNR has identified the Lake-McHenry County Wetland Complex, located within the Refuge Study Area, as a Conservation Opportunity Area in the Illinois Wildlife Action Plan. This area includes priority resources to conserve including "several rare wetland types including fens and bogs, rare wetland and grassland species-some not found elsewhere in Illinois," (Illinois DNR, 2005).

Grasslands (and Oak Savanna)

The prairie grasslands in Wisconsin are comprised of the tallgrass prairie that was intermixed with oak savanna. Tallgrass prairies, along with oak savanna, are among the most decimated and threatened natural communities in the Midwest and the world. Less than one percent of Wisconsin's original prairie still exists today even though soils and topography in Wisconsin have been preserved more than in other states. Most native prairies found today are small remnants, less than 10 acres in size with very few exceeding 50 acres, and are too small to support the full species diversity of the past. Mesic (moderately moist) prairie, which was the most common type in pre-settlement days, is almost gone now, with only about 100 acres known to exist today (Wisconsin Ecological Landscapes Handbook, 2001). Similarly, the oak savanna that once covered 5.5 million acres in Wisconsin, now covers fewer than 500 acres with a similar species diversity to that of the past (Wisconsin Natural Heritage Inventory, 2011).

Before settlement, prairie grasslands covered an estimated 21 million acres of Illinois. Now less than 2,600 acres of native prairie dot the state's landscape. Even though much of Illinois' native prairie has been destroyed, nearly one-fifth of the state is categorized as "grassland" habitat due to temporary agricultural programs. Most of the historic grasslands have been plowed, heavily grazed, or frequently mowed; and few are large or connected enough to support area-sensitive species. Often dominated by introduced grasses, especially fescue, these grasslands do not resemble native prairies as most are planted to monocultures or are otherwise highly manicured. The relatively high prices received for corn and soybeans in recent years have led to an accelerated conversion of these grasslands to row crop agriculture. Only a small portion of the state's land categorized as "grassland" habitat is actually functioning as a natural grassland ecosystem (Illinois DNR, 2005).

3.3.2 Ecological Systems

Prairie-Forest Border

The Study Area occurs within the Prairie-Forest Border Ecoregion as described by The Nature Conservancy (TNC), modified from Bailey (U.S. Forest Service) in 1994. This ecoregion is a transition zone between tallgrass prairie and northern forest. Much of the region was covered by glaciers in the last Ice Age, resulting in a varied landscape of rolling hills and extensive flatlands formed by moraines, drumlin fields, pitted outwash, and glacial lakes. Fire occurred regularly acting in concert with climate to create a shifting mosaic of oak savanna, forest, and prairie based on fire intervals, topography, and weather patterns.

Many different plant communities occur within the ecoregion, including globally significant oak savannas and a variety of prairies. Sixty-three plant and animal species occur within the ecoregion that are globally rare or federally listed. Thirteen plant communities, ten animal, and six plant species are endemic to the ecoregion, found only in this part of the world.

The Southwestern Great Lakes Morainal Section of the Prairie-Forest Border ecoregion encompasses the Hackmatack Study Area. This landform is characterized by ground and end moraines vegetated by oak savanna. Extensive wetlands and oak barrens occur in glacial lake plains; and sugar maple-basswood forests occur locally where there are natural fire breaks created by rivers or rugged, kettle-moraine topography. Extensive prairies occur in flat outwash plains, now mostly agricultural fields; lakes and wetlands are common, particularly in the pitted outwash region. This section has a long growing season, fertile soils, and relatively flat topography, well suited for both agriculture and development.

As mentioned previously, the Wisconsin portion of the Hackmatack Study Area lies in the Southeast Glacial Plains Ecological Landscape while the Illinois portion of the Study Area lies within the Northeastern Morainal Natural Division (NMND).

Southeast Glacial Plains Ecological Landscape

This ecological landscape makes up the bulk of the noncoastal land area in southeast Wisconsin. It is primarily composed of glacial till plains and moraines. Soils are lime-rich tills overlain in most areas by a silt-loam loess cap. Agricultural and residential interests throughout the landscape have significantly altered the historical vegetation. Most of the rare natural communities that remain are associated with large moraines or in areas where the Niagara Escarpment occurs close to the surface. Historically, vegetation in the Southeast Glacial Plains consisted of a mix of prairie, oak forests, savanna, and maple-basswood forests. Wet-mesic prairies, southern sedge meadows, emergent marshes, and calcareous fens were found in lower portions of the landscape. End moraines and drumlins supported savannas and forests. Fire suppression has allowed many existing forest patches that were formerly savannas to succeed to hardwood forest (Wisconsin Department of Natural Resources [DNR], 2005).

The Southeast Glacial Plains Ecological Landscape has the highest aquatic productivity for plants, insects, invertebrates, and fish of any Ecological Landscape in Wisconsin. Most riparian zones have been degraded through forest clearing, urban development, and intensive agricultural practices. Kettle lakes are common on end moraines and in outwash channels. In addition to Horicon Marsh, this Ecological Landscape contains important fens, tamarack swamps, wet prairies, and wet-mesic prairies that contain rare plants and animals. However, most wetlands have experienced widespread ditching, grazing, and infestation by invasive plants. Watershed pollution in the Ecological Landscape is about average

according to rankings by Wisconsin DNR, but groundwater pollution is worse than average compared to the rest of the state (Wisconsin DNR, 2005).

Northeastern Morainal Natural Division

This natural division is the most recently glaciated in Illinois. Drainage is poorly developed, thus abundant marshes, natural lakes, and bogs are distinctive features. With diverse wetland, prairie, forest, savanna, and lake communities, this northeastern section of Illinois hosts the greatest biodiversity in the state and the largest human population. As is true statewide, natural land cover has been extensively altered, though urbanization is considerably more extensive than elsewhere (Illinois DNR, 2005).

3.3.3 Plants and Animals

The Wisconsin Wildlife Action Plan contains a list of Species of Greatest Conservation Need (SGCN) for the Southeast Glacial Plains Ecological Landscape. All vertebrate, native wildlife species in Wisconsin were evaluated for their level of risk using the following seven criteria: global relative abundance, global distribution, global threats, global population trend, state rarity, state threats, and state population trend. Within each of the **vertebrate** major taxonomic groups (i.e., birds, fish, herptiles, and mammals), each species was ranked based on scientific literature and the best professional judgment of a team of experts and then selected as SGCN. **Invertebrates** were assessed using a modified process that incorporated information on the status of knowledge for different invertebrate taxa groups. Although a considerable amount of information has been gathered over the last decade, data on invertebrate species distribution, occurrence, population trend, and life history are insufficient to conduct the type of detailed evaluation that was carried out for vertebrates.

The Illinois Wildlife Action Plan contains a list of critical species for the Northeastern Morainal Natural Division. These SGCN should be managed within a natural division if they are to be effectively conserved in Illinois. The following criteria were used to select the SGCN:

- Threatened or endangered in Illinois or federally and within the state, global conservation rank indicator of G1, G2, or G3
- Rare, significantly declining in abundance or distribution from historical levels, dependent upon a rare or vulnerable habitat for one or more life history needs
- Endemic to Illinois or disjunct from the rest of its range

The Illinois portion of the population represents a significant proportion of its global population, representative of a broad array of other species found in a particular habitat. Status is poorly known, but available evidence suggests conservation concern. The following species descriptions were taken from these two state plans and their respective landscape or division groupings mentioned above unless otherwise noted.

Plants

The plant species within the Study Area are too numerous to list and have not all been documented. However, within and near the Study Area, the Nippersink Creek Watershed contains 790 native plant species while Glacial Park contains 416 species. Many of the plants in both of these conservation areas are state-threatened or endangered. One of those species of particular note is the eastern prairie fringed orchid (wet prairie, sedge meadow, marsh habitat), which is federally-threatened. Also within the Study Area and McHenry County, the Alden Sedge Meadow contains 362 native plant species and Lake

Elizabeth contains 217 species, again with several that are state-threatened or endangered. Two other conservation areas within McHenry County, North Branch (217 species) and Winding Creek (197 species), both have a good diversity of native plant species with several that are state-endangered.

Hackmatack – Tamarack

The American tamarack tree has been known by different names to different people over the centuries including eastern larch, American larch, red larch, black larch, takmahak, and hackmatack. It is from this tree that the Study Area gets its name, Hackmatack, a Native American word for the tamarack. While tamarack trees are more common in northern Wisconsin, Minnesota, and Michigan; they reach as far south as the Study Area, in southeast Wisconsin and northeast Illinois. The Study Area contains a few remaining stands of tamarack representing relics of a time in the geologic past, thousands of years ago, when northeastern Illinois and southeastern Wisconsin lay in the grip of a massive continental glacier. It is but one of dozens of rare species and globally significant natural communities that can be found in this area.

Mammals

Mammals are generally abundant within and near the Study Area. Some of the common mammals include Virginia opossum, coyote, common raccoon, striped skunk, northern flying squirrel, American beaver, white-tailed deer, and eastern cottontail rabbit (Macdonald, 1984). However, the Wisconsin Wildlife Action Plan lists the following SGCN: Franklin's ground squirrel; eastern red, hoary, northern long-eared and silver-haired bats; prairie and woodland voles; and water shrew. The Illinois Wildlife Action Plan lists only the Franklin's ground squirrel as a critical species. The Franklin's ground squirrel is most often found in dense grassland vegetation, while the water shrew prefers cold-water streams, bogs, and swamps.

Birds

The Study Area is also home to many common species of breeding and migratory birds. The diverse array of habitat, especially wetlands and grasslands, supports a diverse group of bird species. Therefore, the Wisconsin Wildlife Action Plan lists the following as SGCN:

- Forest, woodland, savanna: Acadian, Least and Willow Flycatchers, Yellow-billed Cuckoo, **Black-billed Cuckoo**, Blue-winged Warbler, Black-throated Blue Warbler, Canada Warbler, Yellow-throated Warbler, Kentucky Warbler, Golden-winged Warbler, Prothonotary Warbler, Hooded Warbler, Cerulean Warbler, Brown Thrasher, Louisiana Waterthrush, **Red-headed Woodpecker**, Wood Thrush, Bell's Vireo, **Loggerhead Shrike**, Veery, Whip-poor-will, Red Crossbill, Red-Shouldered Hawk, and Bald Eagle
- Wetland or waterfowl: **American Bittern**, American Golden Plover, American Woodcock, **Common Tern**, **Forster's Tern**, **Black Tern**, Blue-winged Teal, Canvasback, Dunlin, Hudsonian Godwit, Marbled Godwit, King Rail, Lesser Scaup, Redhead Grebe, Red-necked Grebe, and Horned Grebe, Rusty Blackbird, Short-billed Dowitcher, Whooping Crane, Solitary Sandpiper, Buff-breasted Sandpiper, **Upland Sandpipers**, Snowy Egret, Whimbrel, Yellow-crowned Night-heron, American Black Duck, Osprey, Trumpeter Swan, and **Wilson's Phalarope**
- Grassland: **Bobolink**, Dickcissel, Eastern and Western Meadowlark, Grasshopper, Field, Vesper, Lark, **Henslow's Sparrows**, Northern Bobwhite Quail, **Northern Harrier**, Barn Owl, and Short-eared Owl

Similarly, the Illinois Wildlife Action Plan lists species bolded above plus the following as critical species:

- Woodland: Northern Flicker
- Wetland or waterfowl: Least Bittern, Black-crowned Night-heron, Piping Plover, Yellow and Black Rail, Common Moorhen, Sandhill Crane, Greater Yellowlegs, and Yellow-headed Blackbird
- Grassland: Swainson's Hawk

Of particular note is the federally-endangered Whooping Crane, which has been seen in the Hackmatack Study Area. As the eastern migratory population of whooping cranes expands, the marshes and bogs of this region may become increasingly important to this critically imperiled species. Also, many of the bird species that rely on prairie grasslands, including Henslow's Sparrow, Short-eared Owl, Bobolink, and Dickcissel are threatened, endangered, or in steep population decline across their range. The Hackmatack Study Area presently contains a patchwork of wetlands and grasslands, which, if connected, could greatly enhance habitat for these species of conservation concern. Throughout the Study Area both public and private lands are home to significant species such as Cooper's Hawks (dense deciduous forest habitat) and nesting pairs of Sandhill Cranes (open, fresh water wetland habitat). Migrating Ospreys and Bald Eagles use the Fox River and nearby Chain 'O' Lakes area during spring and fall.

Fish and Mussels

Fish and mussel populations are specific to individual streams, lakes, and rivers within the Study Area. The Fox River supports a modest fishery with many different forage and game species present. There is also a diverse and relatively abundant mussel population in the Fox River. Some of the common fish species in the local lakes include channel catfish, carp, crappie, largemouth bass, muskellunge, northern pike, bluegill, walleye, smallmouth bass, and pumpkinseed. Many of the non-game species in the Study Area waters are listed as SGCN in the Wisconsin Wildlife Action Plan. These include: gravel chub, greater redhorse, **lake chubsucker**, **lake sturgeon**, least darter, longear sunfish, Ozark minnow, redbfin shiner, redbside dace, river redhorse, slender madtom, **starhead topminnow**, **banded killifish**, black buffalo, **pugnose shiner**, western sand darter, and American eel. Similarly, the Illinois Wildlife Action Plan lists species bolded above plus the following as critical fish species: Iowa darter, blacknose shiner, blackchin shiner, longnose sucker, bowfin, and critical mussel species: creek heelsplitter, rainbow, black sandshell, salamander mussel, slippershell, spike, and purple wartyback.

The waters of Nippersink Creek and its tributary streams, as well as the numerous glacial lakes within the Study Area, support eighteen of these fish species of critical or SGCN including the Iowa darter, blacknose shiner, blackchin shiner, starhead topminnow, banded killifish, bowfin, lake chubsucker, river redhorse, redbfin shiner, large scale stoneroller, mottled sculpin, southern redbelly dace, blacknose dace, brook stickleback, brown bullhead, American brook lamprey, central mudminnow, and pugnose shiner.

Additionally these same aquatic resources also support eight mussel species identified as critical in the Illinois Wildlife Action Plan. These eight, the **creek heelsplitter**, **rainbow**, **black sandshell**, **slippershell**, **spike**, **fluted shell**, **ellipse** and **purple wartyback** are among 22 varieties of native mussels found in the Nippersink Creek watershed in Illinois.

Reptiles and Amphibians

The Hackmatack Study Area, with its many diverse wetland habitats, is home to a truly diverse group of reptiles and amphibians. This is especially unique and noteworthy in an area with so much intermixed development and cultivation. McHenry County Conservation District areas alone are home to 29 species including three salamanders, nine frogs, 10 snakes, and seven turtles (McHenry County Conservation District Biological Database, 2011).

Several of these species are listed as SGCN in the Wisconsin Wildlife Action Plan and/or as critical species in the Illinois Wildlife Action Plan. That Wisconsin list includes: **Blanding's turtle**, butler's garter snake, **eastern massasauga rattlesnake**, four-toed salamander, northern ribbon snake, pickerel frog, queen snake, mudpuppy, yellow-bellied racer, northern cricket frog, and **western ribbon snake**. The Illinois list includes the bolded species above plus the following: smooth green snake and Blanchard's cricket frog.

The more common frogs and toads occurring across the Study Area include spring peepers, green frogs, leopard frogs, bullfrogs, chorus frogs, Cope's gray tree frogs, Eastern gray tree frogs, and American toads. Important populations of the Blanding's Turtle, which is state-listed in both Wisconsin and Illinois are known to occur throughout the Hackmatack Study Area. (McHenry County Conservation District Ecological Database 2011).

Insects

Similar to many of the other species groups, the Study Area is home to a diverse group of insects. These invertebrates help form the base of the food chain that sustains higher forms of life within the native ecosystems of the Study Area. Six conservation areas in McHenry County have species lists for butterflies. The Alden Sedge Meadow has 33 species, Winding Creek has three species, Glacial Park has 57 species recorded, Hebron Peatland has 17 species, North Branch Preserve has 21 species, and Lake Elizabeth has 34 species. These range from fritillaries, swallowtails, and monarchs to sulphurs, skippers, and hairstreaks found within prairie, savanna, sedge meadow, and barren habitat types amongst others (McHenry County Conservation District Biological Database, 2011). While the Wisconsin Wildlife Action Plan lists 450 insects as SGCN for the entire state, it did not break the species down by Ecological Landscapes. However, the Illinois Wildlife Action Plan for the Northeastern Morainal Natural Division area lists the following species as critical: hoary elfin (woodland edge habitat), swamp metalmark (moist, open area habitat), Karner blue (open, sandy lupine habitat), elfin skimmer dragonfly (bog and fen habitat), Hine's emerald dragonfly (calcareous spring-fed marsh and sedge meadow habitat), silver-bordered fritillary (wet meadow habitat), and silvery checkerspot (woodland edge, roadside, marsh habitat).

A number of remnant-dependent butterflies have been identified by the Illinois Wildlife Action Plan as occurring in the prairies, wetlands, and savannas within the Hackmatack Study Area. These are those species most in need of conservation. These include the **silver bordered fritillary**, **Aphrodite fritillary**, **Edward's hairstreak**, **purplish copper**, **silvery blue**, **dion skipper**, **broad-winged skipper**, **mottled duskywing**, and **two-spotted skipper**. (Source: McHenry County Conservation District Ecological database)

Threatened and Endangered Species

The proposed Study Area provides habitat for 109 species of concern that include federal- and state-threatened and endangered species and FWS Birds of Conservation Concern. The list includes 49 birds, five fishes, five mussels, one amphibian, two reptiles, and 47 plants. Many of these are listed in their respective groupings above. Sixty-five separate populations of state-listed plants and 92 individual populations of state-listed animals are known to occur in the Illinois section of the Study Area alone.

Several federally-protected species in this Study Area occur in McHenry County and include the threatened prairie bush-clover and eastern prairie fringed orchid as well as the endangered whooping crane. Prairie bush-clover is endemic to midwestern prairies and prefers moist microenvironments; therefore, it is often outcompeted by woody competition (U.S. Fish and Wildlife Service Lespedeza *Leptostachya* Recovery Plan; U.S. Fish and Wildlife Service, Twin Cities, Minnesota; 1988). The eastern prairie fringed orchid requires full sun and occurs in tallgrass silt-loam or sand prairies, sedge meadows, fens, and occasionally sphagnum bogs.(U.S. Fish and Wildlife Service Eastern Prairie Fringed Orchid Recovery Plan; Fort Snelling, Minnesota; 1999).

Once extirpated from most of its historic breeding range, whooping cranes predominately nested in the northern tallgrass prairie but also depended on highly productive wetland ecosystems for nesting, overwintering, and migratory stopover. Today, a newly established flock of over 60 birds, originating from captive-reared birds, use the Study Area during migration and possibly for breeding in the future.

3.4 Land Use and Management Status

The rich geologic past that sculpted the landscape leaving behind a great diversity of habitats, which house an even greater diversity of plant and animal species, gives the area a unique ecological value. The Study Area also has a long growing season, rich soils, and close proximity to Lake Michigan, Milwaukee, and Chicago, which gives the area a high economic value. Understanding land use and ownership is important for assessing the impact of conservation actions including establishing a new refuge. Over half of the Study Area is either cultivated crops (43 percent) or hay/pasture (12 percent), while nearly one-fifth is developed (18 percent). A similar amount of the Study Area is forest or wetlands (20 percent) with open water covering an additional four percent.

3.4.1 Ownership and Management

The vast majority of the Study Area is in private ownership. However, the area encompasses over 60 publicly- and privately-owned parks, preserves, and conservation areas with natural ecosystems totaling about 23,000 acres. Many of the parks and preserves in the Study Area primarily conserve natural ecosystems (as opposed to developed, multi-use recreational parks). Lake County Forest Preserve District, McHenry County Conservation District, Illinois DNR, and Wisconsin DNR own and manage the bulk of these natural areas.

In addition, private land trusts are active in the Study Area. The Land Conservancy of McHenry County has protected approximately 2,000 acres of land in McHenry County through private conservation easements and acquisition. The Geneva Lakes Conservancy, Kettle Moraine Land Trust, and Liberty Prairie Conservancy are also active in the area.

Natural Areas and Nature Preserves

Both Wisconsin and Illinois have programs that designate Natural Areas (WI) or Nature Preserves (IL). These programs assist private and public landowners in protecting high-quality natural areas and the habitats of endangered and threatened species. The State Natural Areas protect outstanding examples of native communities, significant geological formations, and archeological sites. The natural areas are surviving islands of native ecosystems that once existed across the area and offer visitors a chance to experience a variety of intact wetland, prairie, and glacial landscapes. Collectively, the Study Area contains 24 state-designated natural areas totaling about 3,444 acres.

Significant lands and facilities within the Study Area include Chain O'Lakes State Park, Bong State Recreation Area, Glacial Park, Lakewood Forest Preserve, Moraine Hills State Park, and Bloomfield Wildlife Area. The Richard Bong State Recreation Area is one of the largest open, undeveloped areas left in southeast Wisconsin.

Audubon Important Bird Areas

The Audubon Society's Important Bird Areas (IBA) Program is a global effort to identify and conserve areas that are vital to birds and other biodiversity. An IBA provides essential habitat for one or more species of birds and often comprises a mixture of public and private land. IBA designation is special recognition that these sites provide critical habitat for sensitive birds. The Study Area contains or is nearby to two IBAs:

1. Located in northeastern Illinois, the Lake-McHenry Wetlands Complex IBA comprises one of the state's largest concentrations of natural wetlands and glacial lakes. The IBA includes the Grass, Marie, Nippersink, Bluff, Fox, Pistakee, Channel, Petite, Catherine, and Redhead Lakes along with the Fox River and the surrounding lands that interconnect them.
2. Richard Bong State Recreation Area supports significant populations of grassland birds, such as Bobolink, Eastern Meadowlark, Henslow's Sparrow, Field Sparrow, and Savanna Sparrow.

Natural Area Inventory Sites

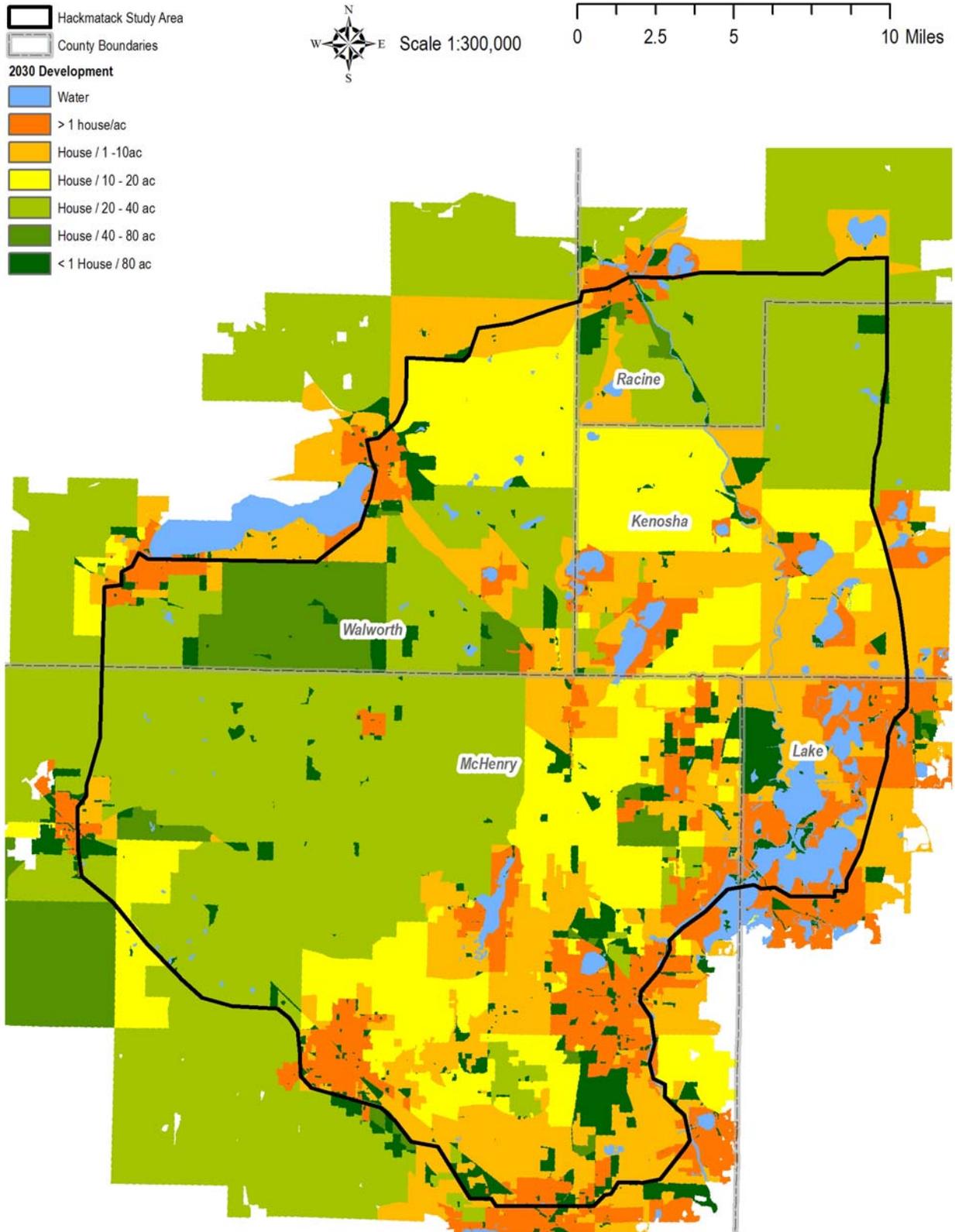
Both Illinois and Wisconsin have assembled an inventory of high-quality natural areas that support rare natural communities and endangered species. The sites identified within Illinois and Wisconsin include a rich diversity of native flora and fauna on both public and private lands. Information from the Natural Area Inventory is used to guide and support land acquisition and protection programs by all levels of government as well as private landowners and conservation organizations. The natural communities inventoried include bogs, fens, marshes, prairies, meadows, oak savannas, and woodlands. The Study Area includes 230 natural area inventory sites.

3.4.2 Land Use Trends

Residential Development

Less than two hours from the growing urban centers of Chicago and Milwaukee, the Study Area and its surroundings face steady development pressure. The State Wildlife Action Plans for both Wisconsin and Illinois cite fragmentation as a leading threat to the integrity of the area's habitats. Even though there is a strong conservation heritage and a good base of conserved lands, the area's habitats are still at risk of becoming islands in a rising sea of development (Figure 8). As these lands become increasingly fragmented and degraded, the wildlife that depend on them decline, as do the opportunities for experiencing such places.

Figure 8: Projected Residential Housing Development, 2030 (Source: Hammer et al., 2004)



According to a 2007 report in the Chicago Tribune, “[T]he population of the seven-county Chicago metro area experienced a growth rate of 63 percent between 1950 and 2006, and that rate jumps to 261 percent by removing the city of Chicago from the equation .” The article notes, “Scott Goldstein, housing expert for the Chicago-based Metropolitan Planning Council, said he believes Rockford won’t be the last stop [in Chicago’s sprawl], I absolutely think it’s going to expand for many, many more miles.” (Fermata, Inc., 2010).

A 1999 Openlands report, *Under Pressure: Land Consumption in the Chicago Region 1999-2028*, examined likely future development patterns in a 13-county area around Chicago including portions of Indiana and Wisconsin. According to the report, residential and commercial development is expanding faster than the population growth of the region. The report indicates that more than 50 percent of the Hackmatack Study Area is at medium to high risk of being developed by the year 2028 (Fermata, Inc., 2010).

The October 2010, *Go To 2040 Comprehensive Regional Plan* by the Chicago Metropolitan Agency for Planning (CMAP), describes significant demographic changes for the seven county region around the city of Chicago in the coming decades. Between 2010 and 2040, the region’s population is expected to grow more than 25 percent. Historically this growth has happened rapidly in the outlying areas of the region. The demographics will also change in terms of age distribution, racial and ethnic background, and where people choose to live.

Between 1990 and 2000, McHenry County’s population grew 42 percent. While that growth slowed to 18.7 percent between 2000 and 2010 to a total of 308,760 people, the *McHenry County 2030 Comprehensive Plan* adopted April 20, 2010 anticipates a projected population of 495, 000 by 2030. The plan recognizes the need for planning efforts that recognize the importance of groundwater use and recharge, protection of streams, rivers, lakes and wetlands and the wealth of McHenry County’s natural resources. (<http://www.mchenrycounty2030plan.com/>)

Critical natural lands that surround Chicago such as Indiana Dunes, the Kankakee River, and the Hackmatack Study Area are directly in the path of this surge. While the economic recession has slowed this rate of growth, it is likely to return to full force with economic recovery. Some land within the Hackmatack Study Area has already been slated for development (Fermata, Inc., 2010).

Agriculture

As previously mentioned, over 50 percent of the Study Area is in agricultural land use. McHenry County, which includes the majority of the Study Area, is deeply rooted in agriculture, where it dominates the landscape. The 2030 Comprehensive Plan for McHenry County included a goal “to preserve the most productive farmland as a source for viable agricultural activities that will enhance the County’s economy and contribute to its rural character.” The plan also states that, “The County should encourage small-scale farming as a means of creating a larger degree of agricultural self-sufficiency around the large urban areas.” Agriculture, and all the input businesses it supports, is important for the economy of McHenry County as well as other portions of the Study Area.

Aggregate Resources

The mining and production of crushed stone, sand, and gravel is an important use of the land in portions of the Study Area as well, especially McHenry County in Illinois. The 2030 Comprehensive Plan for McHenry County included a goal to “protect productive and valuable aggregate resources ensuring their availability for future generations” and states that “[t]he county has a generous supply of natural

aggregates...that are used to supply several industries including construction and agriculture.” The mining industry, and the related industries it supports, is important for the economy of McHenry County as well as other portions of the Study Area.

3.4.3 Land Use Planning

Due to land use trends of the past (cultivation of natural areas) and the current land use trends mentioned above (urban sprawl development), landscape-level conservation has become a focus. As both the Illinois and Wisconsin Wildlife Action Plans note, landscape-level conservation that connects protected but fragmented landscapes (parks and preserves) is one key to ensuring long-term sustainability of native flora and fauna populations. Ecological corridors connecting sites both small and large maintain paths for migration and dispersal. Biodiversity also depends on restoration and management of native ecosystems. When landscapes are reconnected and restored, the result is a whole that is far greater than the sum of its parts (Fermata, Inc., 2010).

Protected lands within the Study Area exist within the much larger matrix of unprotected public and private lands that support natural systems in the region. Various groups have plans in place to further protect this landscape. The Chicago Wilderness collaboration has a Biodiversity Recovery Plan “to protect the natural communities of the Chicago region and to restore them to long-term viability, in order to enrich the quality of life of its citizens and to contribute to the preservation of global biodiversity.” The Chicago Wilderness Green Infrastructure Plan was developed to bring the Biodiversity Recovery Plan to life and provide “a visionary, regional-scale map of the Chicago Wilderness region that reflects both existing green infrastructure—forest preserve holdings, natural area sites, streams, wetlands, prairies, and woodlands—as well as opportunities for expansion, restoration, and connection.” The Regional Greenways and Trails Plan (2009) for northeastern Illinois and the Natural Areas Plan for southeastern Wisconsin (SEWRPC, 1997) identify actions to protect and manage critical habitats for plants and animals and generally improve ecosystems.

The CMAP regional land use plan was the result of significant public input that consistently called for protection of the region’s network of parks and open space. *Go To 2040* calls for an additional 150,000 acres of land to be preserved across the region over the next 30 years. The goal is to conserve a network of land and water that protects biodiversity, follows waterway corridors, expands existing preserves, and creates new preserves in the region. (http://goto2040.org/parks_open_space).

A few other organizations are focused on sensible development and expansion of local communities. Metropolis Strategies, formerly Metropolis 2020, promotes principles of economic development, redevelopment, and open space preservation. Metropolis Strategies has proposed actions to help the region develop in a manner that will protect its economic vitality, while maintaining its high quality of life.

In the Centennial Celebration of The Burnham Plan of Chicago in 2009, twenty-one green legacy projects were identified as critical to protect the green infrastructure of the region. The proposed Hackmatack NWR was recognized for its ability to preserve some of the region’s most dramatic landscapes (<http://www.openlands.org/special-projects/89-burnham-plan-centennial.html>).

The regional growth strategies of the CMAP and the SEWRPC seek to reduce the region’s excessive rate of land consumption, preserve important open spaces (especially environmental corridors), and promote improved water quality.

3.5 Socioeconomic Environment

3.5.1 Local Culture

The local culture of the Hackmatack Study Area is primarily focused around farming. However, with development over the years and urban sprawl from Chicago and Milwaukee, an urban culture has been introduced as well. And yet, the history of this area throughout the twentieth century demonstrates a prevailing public interest in preserving nature and its associated benefits for ecosystems, recreation, and innovative economic development.

3.5.2 Archeological and Cultural Resources

Native American History and Early Settlement

The earliest evidence of human activity near the Study Area dates to approximately 12,000 years ago, when highly nomadic Paleo-Indian clans came primarily to hunt larger animals at upland bogs and sloughs. These clans were followed by Archaic-Indians, Woodland-Indians, and Mississippian-Indians. By 2,000 years ago, there was a gradual shift from total dependence on hunting and gathering to a more settled culture that incorporated agriculture. These people lived in total dependence on the local ecosystems and helped shape the character and health of natural communities through practices, such as setting fires that supported their procurement of food, medicine, and materials important to their daily lives (Sullivan, 1997).

Eventually, the Illini and Potawatomi people inhabited the area. During the summer most of them inhabited “towns” near rivers or lakes, but during the winter they would move away to “hunting camps.” But then, with the arrival of French-Canadian and European settlers, came disease that practically eliminated most Native Americans. Eventually trading of goods, trapping, and fur trading became popular in the area. Over time, with more settlement and development, Europeans dominated the area, fires were suppressed, forest and prairies were cleared, and wetlands were drained (Sullivan, 1997).

The proposed Refuge lands fall squarely within the original Potawatomi estate. The federal government recognized the land as Potawatomi land since the United States came into being and officially confirmed the land as Potawatomi territory, as well as other Indian nations, under the 1825 treaty of Prairie du Chien. Shortly thereafter, an official proposed that the area, which includes the proposed Refuge lands would be part of a great Potawatomi Reservation. The federal government abandoned this plan, however, with the government's growing preference to remove all Indian nations to the West. In 1829, Potawatomi representatives ceded a large swath of territory in northern Illinois to the United States. In 1830, the federal government enacted into law its policy of Western removal via the Indian Removal Act.

The Potawatomi Community informed the Service and others of its continuing interest in and rights related to these lands and the greater Potawatomi estate. The Potawatomi have maintained a constant physical and not just historic connection to the proposed refuge lands.

Archeological and Geological Sites

Southeastern Wisconsin has a significant geologic heritage that has played an important role in both scientific research and in the industrial and architectural development of the area. The geologic sites on which this heritage is founded are few in number and disappearing rapidly. Nearly all remaining sites,

even those on public land, are threatened, in large part because their basic value and importance are unrecognized (SEWRPC, 1997).

A variety of inventories and surveys of historic sites have been conducted by various units and agencies of government in the southeast region of Wisconsin. The Study Area includes seven counties, most notably: Walworth, Racine, and Kenosha. These inventories and surveys have resulted in more than 14,000 historic sites in the region. As of 1985, 254 sites and 20 districts were listed on the National Register of Historic Places. Seven of these sites are within or adjacent to the Study Area (SEWRPC, 1997). One such site is Wehmhoff Mound in Kenosha County. This lone effigy mound was listed on the National Register of Historic Places in 1985.

Three significant geological areas exist within the southeastern Wisconsin portion of the Study Area as well. The Burlington Crevasse Fillings in Racine County is a good example of crevasse fill. The Voree Quarry in Walworth County is an old, water-filled quarry, exposing the unusual Brandon Bridge Formation of dolomite rock. The Lyons Glacial Deposits in Walworth County are outstanding examples of kettle and kame topography. All three sites are owned by a private conservancy (SEWRPC, 1997).

3.5.3 Human Population

The population base within a two-hour drive of the Hackmatack Study Area is estimated to be over 12 million. However, according to the 2010 US Census, the approximate population of the Study Area itself is 170,000. Increases in population from 1990-2000 varied across the Study Area ranging from zero to 7.3 percent, with an average of 2.6 percent for the decade. The population increase from 2000-2010 had less variability across the Study Area ranging from 0.32 to 4.19 percent and an average of 1.7 percent for the decade. The predicted change in population from 2010-2015 ranges from a decrease of 0.14 percent to an increase of 1.93 percent with an average of a 0.9 percent increase for the decade. The area immediately to the southeast of the Hackmatack Study Area has experienced dramatic growth and density in population. Growth patterns predict a more dramatic impact on the surrounding areas in the near future.

In addition, McHenry County's Hispanic population currently stands at 11 percent. It rose by 4 percent in the last 10 years. This trend is expected to continue. Two school districts in the Study Area indicate that between 40 and 50 percent of their kindergarten populations are of Latino origin.

3.5.4 Economic Activities and Trends

The average household size across the Study Area ranges from two to three people with a median age of 35-45 years old. The majority of the Study Area has a median household income between 41,000 and 70,000 dollars per year with part of the southern portion of the Study Area earning between 70,000 to 84,000 dollars per year. A few isolated spots have a median household income between 84,000 to 110,000 dollars per year. However, the unemployment rate across the Study Area in 2010 was between 8 and 15 percent, with only a few areas between 4 and 8 percent (US Census, 2010).

In McHenry and Walworth Counties, of which portions occupy the majority of the Study Area, most employment is in manufacturing; educational, health, and social services; and retail trade. Fifty-four percent of the population has a high school diploma. Slightly more of the population (55 percent) has a high school diploma or has attended some college with no degree. An additional 20 percent and 15 percent of the population has a bachelor's degree, respectively (US Census, 2010).

Important economically and near the Study Area, Lake Geneva has been recognized as one of the nation's distinctive destinations (one of the 2009 Dozen Distinctive Destinations listed by the National Trust for

Historical Preservation, with Woodstock listed in 2007). Furthermore, Chicago-O'Hare and Milwaukee Airports offer global air connections, and both are less than one hour's drive from the Study Area. Finally, rail service via Metra connects the Study Area and Chicago (Fermata, Inc., 2010).

3.5.5 Recreational Activities and Trends

Both Illinois (2009) and Wisconsin (2005) Statewide Comprehensive Outdoor Recreation Plans (SCORP) have documented that opportunities for outdoor recreation are in short supply in the densely populated regions of northeastern Illinois and southeastern Wisconsin.

The Illinois SCORP reports that the total amount of outdoor recreation land in Illinois is low in comparison to other states. Although Illinois has the fifth highest population of all states, the state ranks in the bottom 10 percent for the per-capita amount of lands and facilities for outdoor recreation among all states.

The Wisconsin SCORP divides the state into regions. The Hackmatack Study Area falls within the Lower Lake Michigan Coastal Region. According to Wisconsin's SCORP, nature-based and viewing/learning opportunities in this region are inadequate in proportion to the size of the population. The SCORP also identifies the top five Land Legacy Areas in each region—areas thought to be critical in meeting the state's present and future conservation and recreation needs. Two of the five areas are within the Hackmatack Study Area: Bong Grassland and Illinois Fox River. The SCORP states, "These sites should be considered the highest priority recreation areas to preserve and protect in each region." Lastly, the Wisconsin SCORP identifies the recreation supply shortages in each region. Within the Lower Lake Michigan Coastal Region, the plan cites shortages in campgrounds, parks, mountain bike trails, water trails, wildlife areas, boat launches, fishing piers, and nature centers (Fermata, Inc., 2010).

It is not surprising, then, that according to the Service report titled, *Wildlife Watching Trends: 1991-2006*, the most populated states have participation rates below the national average for wildlife watching. Illinois ranks 42nd in the percent of population that participates in wildlife watching while Wisconsin ranks 21st. In 2006, Illinois and Wisconsin residents spent, on average, seven to eight days wildlife watching. And, on average, those participants spent 36-47 dollars per day on trips away from home to watch wildlife (Fermata, Inc., 2010).

Demographically, the majority of wildlife watchers in Illinois and Wisconsin are from rural areas; female, over 35 years old; and white, with a high school education or greater. The spread of participants across income levels is proportional to the population as a whole. This implies that wildlife watching appeals to people of all income levels (Fermata, Inc., 2010).

Currently within and near the Study Area, Glacial Park provides equestrian, snowmobile, and cross-country ski trails. Big Foot Beach State Park and Chain O'Lakes State Park offer quality boating, fishing, and camping opportunities. The Fox River and many other lakes within the project area provide great fishing and boating opportunities as well. Paddlers can canoe and kayak on the Nippersink Water Trail, while Wisconsin DNR Wildlife Areas and some McHenry County Conservation District sites offer hunting opportunities. The Richard Bong State Recreation Area and the White River State Trail provide horse riding and snowmobiling opportunities. And all of these areas offer great wildlife viewing. The wide range of managing entities within the Study Area increases visitors' recreational choices, as each offers its own suite of outdoor activities (Fermata, Inc., 2010).

Furthermore, the Chicago Wilderness Leave no Child Inside initiative is working in the Chicago metropolitan area to raise awareness of the issue that fewer children experience nature today than in the

past. They have developed teacher and parent resources; and public events, programs, and sites where parents can discover nature with their children.

3.6 Conclusion

Data from the McHenry County Conservation District, the Illinois and Wisconsin DNRs and SEWRPC suggest that the Hackmatack Study Area supports richly diverse flora and fauna, including many species listed as state- or federally-threatened or endangered. In addition, the Service has identified numerous local bird species as Birds of Conservation Concern, a designation meant to stimulate conservation efforts to prevent these species from becoming threatened and endangered.

Two extensive studies support and expand upon these findings. In 2005, both Illinois and Wisconsin completed State Wildlife Action Plans. These plans inventoried the states' natural habitats and wildlife populations, and identified threats to those habitats and species, as well as conservation opportunities for keeping common species common and reversing the decline of sensitive species. These plans provide a scientifically rigorous ecological framework with which to assess the biological implications of creating Hackmatack NWR.

Both the Illinois and Wisconsin State Wildlife Action Plans note that conserving sensitive species requires the protection and restoration of high-quality habitats. Connecting these high quality habitats helps sustain an interdependent web of species and natural communities. Chicago Wilderness (a consortium of 250 regional businesses, conservation organizations, and public agencies in Wisconsin, Illinois, and Indiana) and SEWRPC have identified ecological corridors throughout the Hackmatack Study Area that will, if protected and restored, help ensure the long-term sustainability of local ecological systems and sensitive species (Fermata, Inc., 2010).