

Section IV. Major Ecosystems and Habitat Types

Conserving and restoring habitat in rapidly urbanizing areas is both a challenge and a laudable endeavor but within the project area, the stakes are particularly high. The lands surrounding Lake St. Clair are home to several globally imperiled natural communities: lakeplain prairie, lakeplain oak openings and Great Lakes marsh. These communities are particularly vulnerable to the suppression of natural processes such as flooding, fire and water level fluctuation, which tend to be eliminated in developed lands. In both conserving and restoring these communities, restoring the underlying processes that shape them is as important as restoring the plant and animal species that live in them.

Habitat is a word with a wide range of interpretations. A reference book defines habitat as “the type of environment in which an organism of a particular species is likely to be found¹.” A natural community is a distinct grouping of plants and animals that live together in a common habitat.” Ecosystem, a broader term, encompasses “the total physical and biological environment in a given area with an emphasis on the relationships and connections among the various parts².” Technically, “habitat” is more species-focused, while “natural community” is focused on groups of different species associated with a particular habitat and “ecosystem” focuses on multiple natural communities and/or habitats and their interrelationship within a larger system. For purposes of this document, where the focus is on protecting and restoring communities of plants and animals within a given habitat and system, we will use the terms loosely and interchangeably.



Ojibway Prairie Provincial Nature Reserve, Windsor, Ontario

The habitat types described in this plan integrate land cover data with field and other data on particular natural communities and species. Land cover is a term used frequently in interpreting satellite imagery which can show how wet or dry the landscape is, the type of vegetation growing on it and where there is no vegetation. Since many habitats are defined by the type of vegetation in that particular environment, land cover is an important indicator of habitat type.

FACT

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Land cover data are derived from the National Oceanic and Atmospheric Administration’s (NOAA) Coastal Change Analysis Program (C-CAP), which measures landcover data from satellite imagery with a 30-meter pixel resolution. The Coastal Land Cover Analysis Classification Scheme (www.csc.noaa.gov/crs/lca/tech_cls.html) used by C-CAP is used in this document as a framework within which the natural communities around Lake St. Clair are described. This classification

scheme is based on the scheme found in the original NOAA Coastal Change Analysis Program (C-CAP): *Guidance for Regional Implementations*³, which summarizes original C-CAP methods and procedures. The present C-CAP land cover classes reflect a consolidation based on implementation experience. Additionally, some C-CAP classes have been consolidated or reordered within this project to better reflect the land cover and habitats that characterize the Lake St. Clair region.

Specific terrestrial natural communities that are represented within the C-CAP land cover classes are named in accordance with *Michigan's Natural Communities: Draft List and Descriptions*⁴ (http://web4.msue.msu.edu/mnfi/data/MNFI_Natural_Communities.pdf). Aquatic natural communities are named in accordance with terms defined in *Classification of Wetlands and Deepwater Habitats of the United States*⁵. Headings such as “Grasslands” and “Emergent Wetlands”, for example are actual C-CAP land cover types, while subheadings such as “Lakeplain Oak Opening” and “Lacustrine Open Water” are specific natural communities.

IV. A. Upland/Terrestrial

Within the C-CAP classification system, uplands are lands lying above sea level where saturated soils and standing water are absent. In many ways, they are defined by what they are not, rather than by what they are. Uplands are not wetlands; they are not under water or seasonally flooded. They have non-hydric soils and are not moist enough for wetland plants to survive. The upland category includes developed lands, cultivated lands, grasslands, deciduous forest, evergreen forest, mixed forest and scrub/shrub⁶. Within the project area, C-CAP satellite data show over 675,000 acres (273,163 hectares) of uplands⁷.

IV. A. 1. High intensity developed land

High intensity developed land consist of lands which have been altered significantly by people and are covered with structures and other impervious surface. Included in this category are cities, towns, villages, strip developments along

FACT

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highways, transportation, power, and communications facilities and areas such as those occupied by mills, shopping centers, industrial and commercial complexes, and institutions that may, in some instances, be isolated from urban areas⁸. High intensity developed lands consist of both heavily built up urban areas and buildings in more suburban settings with large areas of constructed surfaces. Vegetation, when present, covers less than 20 percent of the landscape. Cities clearly fall into this category, but airports, apartment complexes, factories and industrial complexes, malls, interstate

highways and large agricultural facilities also appear here, although they occur in far more rural settings⁹. Within the project area, high intensity developed lands occupy almost 50,000 acres (20,234 hectares), or 6 percent of the total area, mostly occurring in the Michigan portion, in Detroit and its northern suburbs¹⁰. In the Canadian portion of the project area, high intensity developed lands are concentrated in the Windsor area¹¹.

From a habitat perspective, developed lands provide few opportunities for plants or animals and development tends to fragment existing habitat in the surrounding landscape. However, the inclusion of developed lands is important for documenting changes in land cover over time. Analysis of the C-CAP land cover data between 1995 and 2000 show a net increase of 4,800 acres (1,942.5 hectares) in total high and low intensity developed land within the project area and a commensurate re-



Detroit skyline

HIGHLIGHT

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duction in all non-developed land categories¹². While some of the non-developed lands lost may not be high quality habitat (e.g., agricultural lands) they can potentially be restored, a proposition that is much more difficult for lands that have been built or paved over. As such, loss of any undeveloped lands is a loss in actual or potentially valuable habitat. C-CAP data, which is collected at five-year intervals, will allow for land cover change analysis over longer time frames.

High intensity developed lands generally have little habitat value. In recent years, peregrine falcons, normally a cliff-nesting species, have successfully established a breeding population in the skyscrapers of downtown Detroit, but this is the exception rather than the rule¹³. Areas that do provide habitat can be particularly significant given the relative scarcity of alternatives in urbanized areas. Natural areas in urban parks that are connected to larger habitat patches outside urban areas can serve as critical ecological corridors. These areas, especially those with forests, ponds or wetlands, can be valuable places for migratory birds amidst a sea of concrete and rooftops.

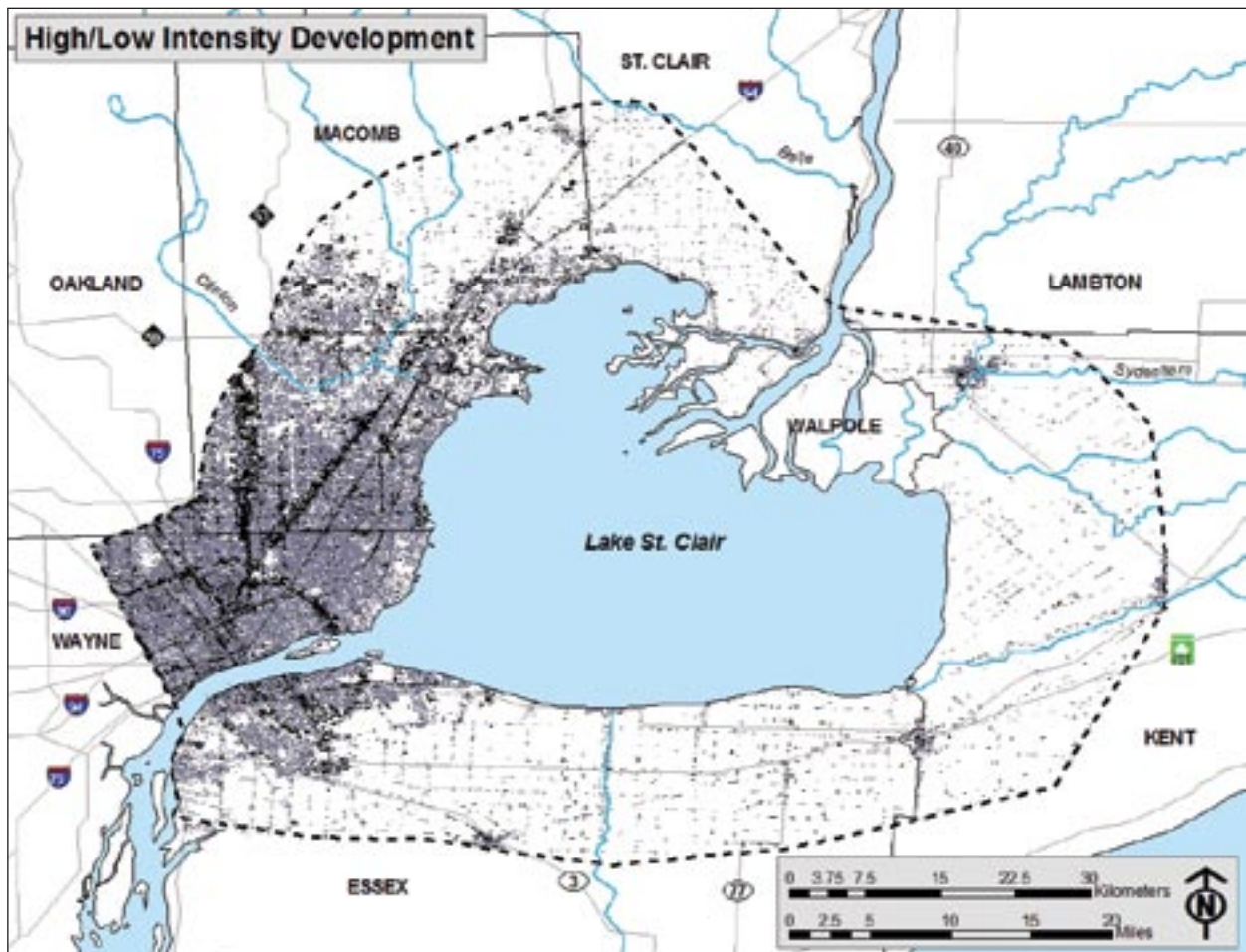


Figure IV A 2 -1
High and low intensity developed lands

IV. A. 2. Low intensity developed lands

Low intensity developed lands are those with a mixture of constructed materials and vegetation. Constructed materials generally account for 50 to 70 percent of the total area. Suburban neighborhoods with single family housing are typical, but many land uses are represented here. Often, in land cover maps derived from satellite data, a tiny patch

of low intensity development will be surrounded by another land cover category, reflecting, for example, a cluster of farm buildings in the midst of agricultural fields¹⁴. Within the project area, about 125,000 acres (50,585 hectares), or 16 percent of the total area, consist of low intensity developed lands, and again, these are concentrated in Michigan¹⁵. Although some of these areas may be quite rural, C-CAP considers constructed surfaces in determining whether or not an area is developed.

HIGHLIGHT

The low intensity developed land cover class includes built and unbuilt surfaces. Built areas account for approximately 50 to 70 percent of this land cover class.

As with high-intensity developed areas, low intensity developed areas also have little habitat value and areas that do provide habitat can be particularly significant given the relative scarcity of alternatives in these suburban areas. Low-intensity development will likely have more “open space” but much of this will be in the form of lawns and intensively managed green space around buildings--still with little habitat value. The incremental ecological significance of these areas will depend on the extent to which the green space is managed to pro-

vide some habitat value (e.g., as a wetland) or biological diversity (wet meadow versus turf). Again, large parks that are connected to large habitat patches outside urban areas can serve as important ecological corridors.

IV. A. 3. Cultivated Land

Cultivated lands are those that have been planted, tilled, or harvested. Orchards, groves and nurseries are cultivated lands with crops that are produced on woody, single stemmed trees, such as apples, cherries, peaches and nuts. Tree nurseries that provide seedlings for the plantation industry are included in cultivated lands as well, although pine plantations without a visible geometric pattern are assigned to the category “Evergreen Forest”¹⁶. Cultivated lands also include areas that are planted with vines and bushes, woody, multi-stemmed plants which produce crops such as berries, grapes and nuts. In the Essex/Chatham Kent region, for example, berries and grapes are a common crop¹⁷. Common row crops in both the Canadian and U.S. portions of the project area include soybeans, corn and wheat^{18, 19, 20}. Croplands are lands that are planted to row crops such as corn, soybeans or rye on a regular basis. Within the C-CAP classification scheme, the category reflects the land’s status at a specific time. For example, fields which are left fallow as part of

a rotation schedule are classified as grasslands during that time and as croplands only when they are actively being cultivated. C-CAP used a three season classification system in Michigan and a two-season classification system in Canada. Croplands can also include lands devoted to seed production, and sod farms²¹.

FACT

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Historically, agriculture has been very important in the project area; farms lined the western shore of Lake St. Clair by the late 1800s²². As Detroit, and to a much

lesser extent, Windsor began to grow, agriculture declined in importance, but it continues to play an important role further north, particularly in the Canadian portion of the project area, where it constitutes over 77 percent of the project area.

Cultivated lands make up the single largest category of land cover within the project area, occupying almost 50 percent of the total area, but most of these lands are in the Canadian portion. In 1995, they occupied 386,037 acres (156,223 hectares) and decreased to 377,987 acres (152,996 hectares) in 2000, a 2 percent loss²³. In some ways, this figure obscures the shift away from agriculture in the U.S. portion of the project area, as the rapid change in southeastern Michigan is diluted by the sheer number of acres still in agricultural production in the Canadian portion. On the Michigan side of Lake St. Clair, the greatest losses of cultivated land were in Macomb County where development is extending north from the Detroit area. On the Ontario side of the lake, development is concentrated on the southern shore of

the lake, while most of the eastern shore is still primarily agricultural²⁴. The vast majority of cultivated lands occur in Ontario, but smaller patches also occur in the Michigan portion of the project area²⁵. The amount of land occupied by agriculture and its relative contribution to the economy in the region have decreased over the years, but the potential impact of agricultural practices on environmental quality is still enormous, particularly as it affects water quality in wetlands, streams, rivers, and Lake St. Clair itself.



Cultivated Lands

Regionally, the seven county area of southeast Michigan has experienced a 13 percent loss in agricultural lands between 1990 and 2000²⁶. The three southeast Michigan counties that lie partially within the study area lost 63,900 acres (25,859 hectares) of agricultural land--a 15.4 percent loss. The agricultural land losses are primarily due to development (See Section 2. A. 4. b. Land use trends).

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The overall habitat value of cultivated lands ranges widely, depending on a number of factors. Agriculture has been implicated in the decline of about 40% of endangered species, and historically, was the primary cause of habitat loss and fragmentation in the lower 48 states^{27, 28}. Providing connections between the remaining areas of high quality habitat is critical. Fencerows along roads, windbreaks and shelter belts between fields can provide both food and cover for birds, small mammals, and some reptiles and amphibians, as well as vital linkages or corridors between larger habitat

patches. Additionally, they attract pollinators and other beneficial insects. Within these corridors, native plants which provide berries, nectar or seeds are particularly valuable for wildlife. Unfortunately, fencerows are disappearing as the size of farm fields increases. Vegetative buffers along stream corridors can provide additional habitat, as over 70% of all terrestrial animal species use stream corridors at some point in their life cycle²⁹. Buffers also improve water quality by preventing erosion and filtering out fertilizer and agricultural chemicals.

The habitat value of row crops tends to be low, but a few avian species such as horned lark, killdeer and vesper sparrow will use them for breeding, and others such as ring-necked pheasant, American crow, American kestrel and barn

swallow will forage in them regularly. Mammals such as white-footed deer mouse and meadow vole are also attracted to croplands, and are a valuable food source for predators although they are generally considered pests^{30, 31}.

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Row crops can also provide a critical resource for migratory and over wintering birds. Waste grains in agricultural fields around Lake St. Clair provide a valuable supplement to marsh vegetation for dabbling ducks such as mallard, American black duck, American wi-

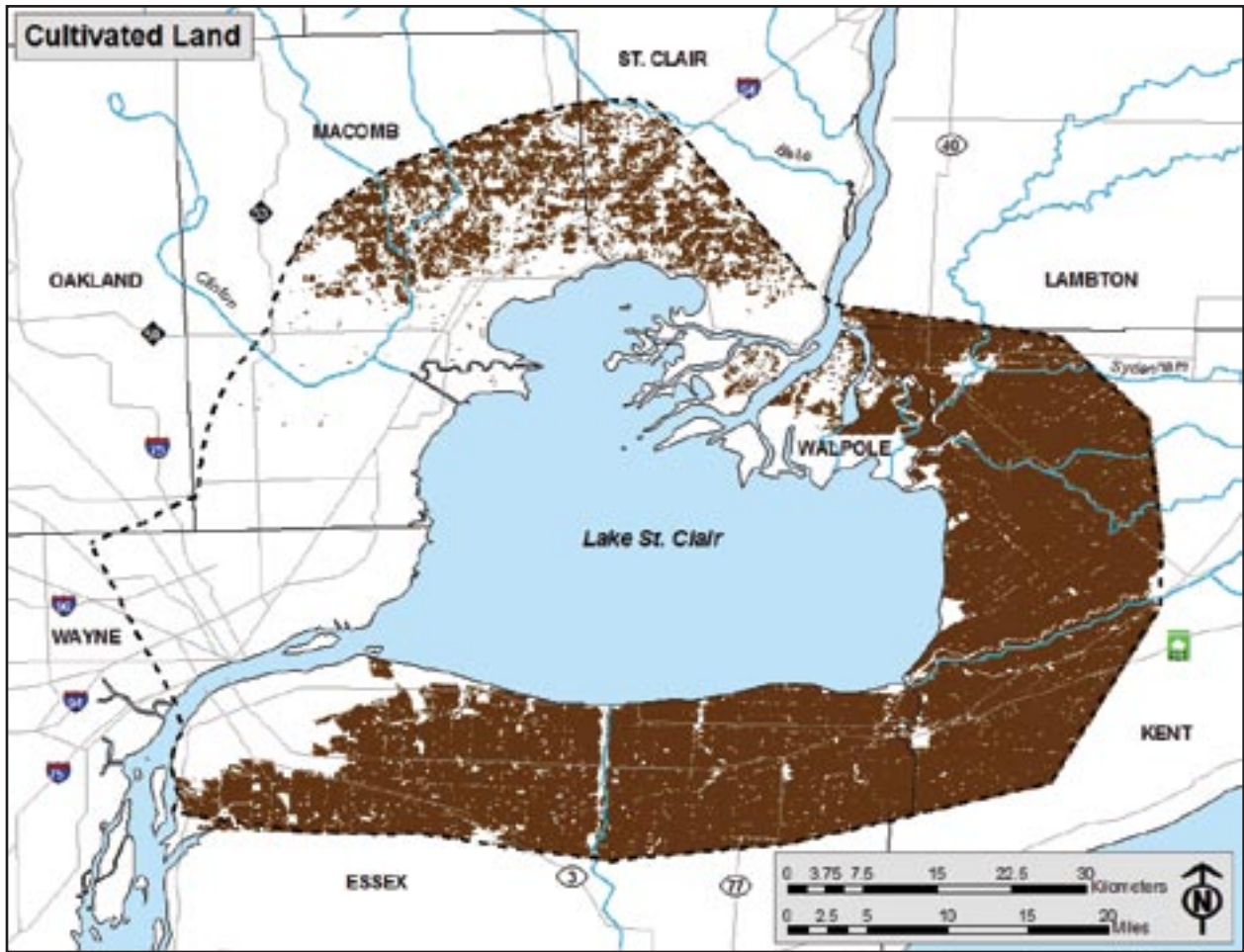


Figure IV A 3 - 1
Cultivated Lands

geon, green-winged teal, blue-winged teal, northern pintail and wood duck³². Large numbers of black-bellied and American golden plover have been reported from agricultural fields along the eastern shore of Lake St. Clair during spring migration³³, and when fields are flooded, species such as dunlins and ruddy turnstones are also present (Paul Pratt, 2004, personal communication).

In some cases, the use of cultivated crops by wildlife may lead to what is quite reasonably considered “wildlife damage” by farmers. In spite of this, it is often possible to encourage targeted species, while minimizing damage from pest

FACT
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species. Orchards with grassy herbaceous groundcover can provide cover, forage and nest sites for species such as eastern kingbird, eastern bluebird, orchard oriole and northern bobwhite. While small mammals may become pests, predators such as American kestrel and eastern screech-owl readily use nest boxes and can help keep their populations in check^{34, 35}.

Many of the structures associated with agricultural land uses have provided valuable habitat as well; holes in wooden fence posts provide nest cavities for eastern bluebird and barns and silos provide nest sites for birds such as eastern phoebe, barn owl and cliff and barn swallows^{36, 37}.

Timing of activities such as mowing, cultivating, and pesticide application has a huge impact on the habitat value of cultivated lands; if disruption can be avoided during the breeding season (i.e., spring and early summer) the lands

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may provide opportunities for breeding and foraging. While organic farming is clearly preferable for wildlife, restricting the use of pesticides until later in the season affords some degree of protection to birds which normally eat plant based foods, but rely on insects for feeding nestlings³⁸.

Agricultural lands have attributes that both sustain habitats and degrade them. Land stewardship is a key issue for agriculture. Intensive monoculture, tilled row

cropping with no buffers, and high uses of pesticides and fertilizers bode poorly for habitats and the ecosystem while sustainable agricultural practices such as buffer strips, integrated pest management, and minimum tillage can allow these lands to retain some habitat value.

IV. A. 4. Grassland

Grasslands are covered with herbaceous vegetation such as grasses, sedges, and forbs or wildflowers and have less than 10 percent of their area covered by woody species. Within the C-CAP classification system, they include managed landscapes, such as parks, golf courses and cemeteries, as well as natural habitats such as prairies, meadows and fens. They

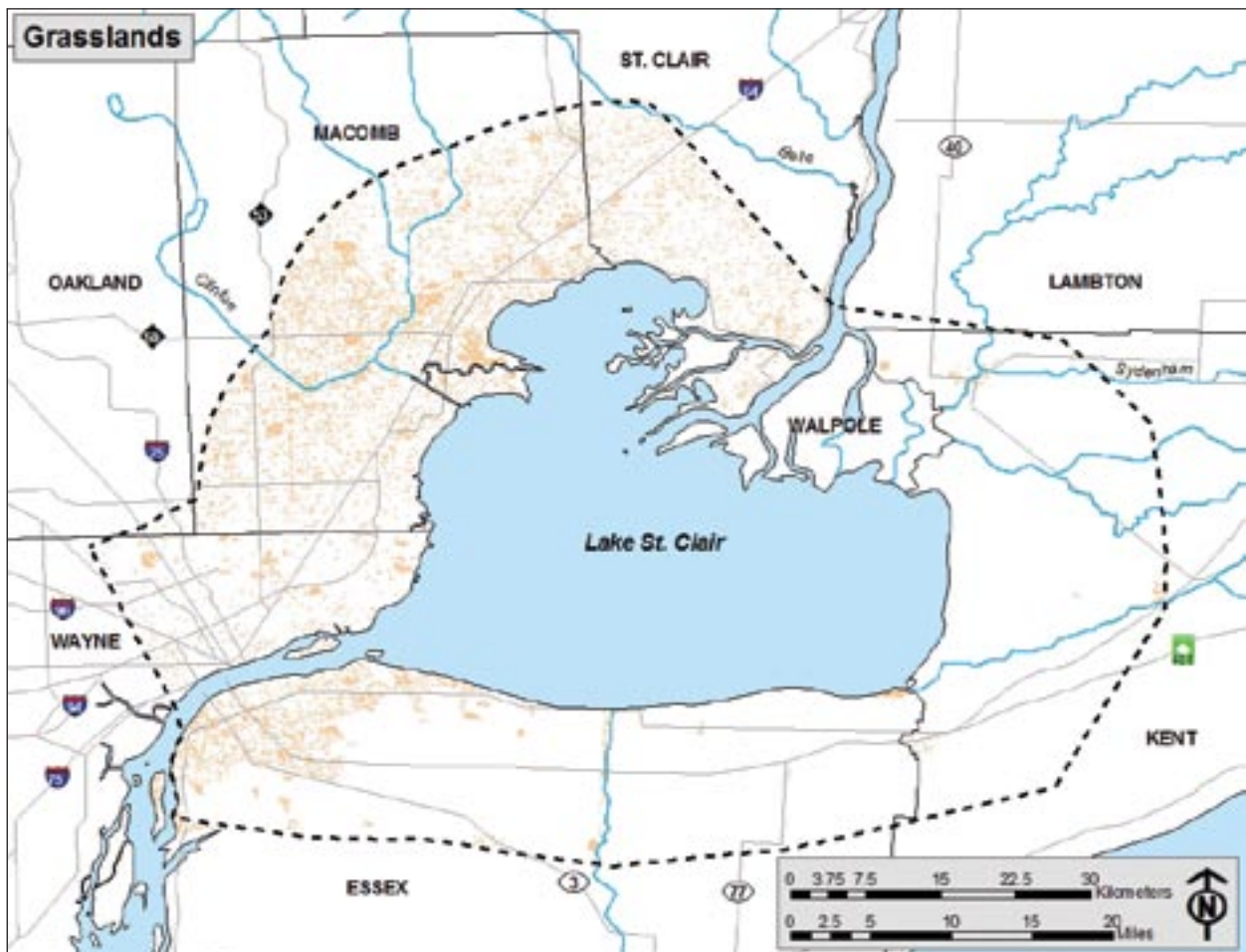


Figure IV A 4 - 1
Grasslands

also can include cultural grasslands, such as pasture, hayfields and rangeland, which are not fertilized and may or may not be mowed, but do not necessarily consist of native species³⁹. Within the project area, grassland has increased from about 54,500 acres (22,055 hectares) in 1995 to about 58,000 acres (23,471 hectares) in 2000, an increase of 7.1 percent. The majority of this increase is due to agricultural fields that have been taken out of cultivation⁴⁰.

HIGHLIGHT

Native grassland communities such as lakeplain prairie are among the region's rarest, and are considered globally imperiled.

The habitat value of these lands varies tremendously; old, neglected cemeteries often function as refugia for prairie plants, and fallow fields may have considerable habitat value for wildlife, but the mowed lawns of parks and golf courses have little to offer.

Native grassland communities such as lakeplain prairie are among the region's rarest, and are considered globally imperiled. Historically, Wayne, Macomb and

St. Clair Counties had over 60,000 acres (24,281 hectares) of lakeplain prairie. Today, less than 1,000 acres (405 hectares) remain in Wayne and St. Clair Counties⁴¹. In Ontario, similar losses have occurred, with less than 1 percent of the original prairie cover remaining⁴². Because of the way that C-CAP classifies land cover categories, lakeplain mesic sand prairie, the upland form of this grassland community will be discussed within this section. Two wetland forms of lakeplain prairie are included with emergent wetlands (see section II.C.2.b.2. Lakeplain wet prairie & lakeplain wet-mesic prairie). Another similarly related habitat, lakeplain oak opening, is included with upland deciduous forest communities (see section II.C.1.e.3. Lakeplain oak opening/oak savanna).

While a few rare species can only survive in native grasslands, many others can persist in a wider range of grassland types. Ring-necked pheasants, for example, are surprisingly common in the unmowed vacant lots of Detroit. With the decline in agriculture in the area, however, cultural grasslands such as hayfields and pastures are disappearing rapidly. Grassland quality is not the only factor affecting habitat suitability; for many vulnerable species, area is a critical factor. Species such as bobolink, savanna sparrow, Henslow's sparrow (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Ammodramus_henslowii.pdf) and upland sandpiper are most likely to occur on parcels larger than 140 acres (57 hectares)^{43, 44, 45}. In a fragmented landscape, these parcels are increasingly rare, and will not persist without deliberate planning.

IV. A.4.a. Cultural grasslands and old fields

Pastures and hayfields are lands that are planted with grasses, legumes or a mixture of both, and used either for livestock grazing, or the production of hay or seed. Typically, they are planted with perennials, and not tilled⁴⁶. Hayfields differ from pastures in that they are cut two or three times a year for hay, while pastures are grazed by livestock that may remove part or all of the vegetation during the growing season. Fallow fields are fields that are no longer being cultivated, but have been plowed in the last three years. Fields that haven't been plowed in the last three years fall into the category of old field, and if left indefinitely, will be invaded by shrubs.



Ojibway Prairie Provincial Nature Reserve, Windsor

FACT

Mowing in spring can destroy nests and nesting birds; delaying harvest until late June or July allows birds to nest successfully at least once during the breeding season.

problem with alfalfa, which is harvested early in the season. Delaying harvest until late June or July allows birds to nest successfully at least once during the breeding season^{47, 48}.

Pasture is also often planted with desirable grasses and/or legumes, but differs in that it is not mowed but rather grazed by livestock. The habitat value of pasture varies with the length of time that livestock remain in a given area; in pastures that are grazed continuously, habitat value is low; while livestock may be able to graze without destroying active bird nests, as cover is removed, predation increases. When pastures are rotationally grazed, in contrast, many more birds and more species are able to breed successfully^{49, 50}.

Fallow fields are increasingly an indication that the land is no longer being farmed, but may also be a stage in a planned crop rotation. As part of a crop rotation, the land is often planted with a cover crop, which can provide benefits to both the soil and wildlife⁵¹. If the land is no longer being farmed it

initially has bare soil exposed but is gradually invaded by sun-loving annuals such as ragweed, lamb's quarters and foxtail. By the third year, perennial grasses and forbs are more common, with typical species including brome grass, goldenrod, daisy fleabane and spotted knapweed.

HIGHLIGHT

Timing of activities such as mowing, cultivating, and pesticide application has a huge impact on the habitat value of cultivated lands.

regularly, within 5 or 10 years it will gradually be invaded by shrubs to become shrub/scrub lands (to be discussed in Section IV. A. 8. Scrub/shrub)⁵².

A number of species utilize cultural grasslands, particularly if shelterbelts and fencerows are left in the area. Common birds that nest in them include American kestrel, eastern kingbird, eastern bluebird, savanna sparrow, vesper sparrow,

Hayfields are planted specifically for hay production and traditionally have been planted with cool season grasses such as timothy, orchard grass and tall fescue, and legumes, such as alfalfa and white clover. Warm season, native grasses such as switchgrass, big bluestem and Indian grass can also be utilized. Hayfields can be harvested from one to three times a year and the timing of mowing is a critical factor affecting the habitat potential of a particular piece of land. Mowing in spring can destroy nests and nesting birds, a particular



Photo: Norm Klopfenstein, Natural Resources Conservation Service

If left uncultivated for more than three years, fallow fields are categorized as old fields and are dominated by perennial grasses and forbs, with widely scattered shrubs. Typically, old fields are dominated by non-native grasses such as smooth brome, quackgrass, timothy and orchard grass. Common forbs include Queen Anne's Lace, chicory, goldenrods, asters, daisy fleabane, spotted knapweed, clover, sweet clover, mullein, curly dock and thistles. Unless the field is mowed or burned

chipping sparrow, field sparrow, song sparrow, bobolink, red-winged blackbird, mallard, blue-winged teal, northern bobwhite quail, killdeer, eastern meadowlark, American goldfinch and brown thrasher. Red-tailed hawk, northern harrier (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Circus_cyaneus.pdf) and swallows commonly forage in them⁵³.

FACT

Rare species that utilize cultural grasslands include grasshopper sparrow, Henslow's sparrow, northern harrier and short-eared owl.

⁵⁴. Cultural grasslands and old fields also provide habitat for a number of small mammals including eastern mole, masked shrew, northern short-tailed shrew, meadow vole, deer mouse, least weasel, woodchuck and thirteen-lined ground squirrel. Larger mammals include red fox, American badger, and white-tailed deer⁵⁵.

Rare species that utilize cultural grasslands include grasshopper sparrow (Species of special concern), Henslow's sparrow (Threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Ammodramus_henslowii.pdf), northern harrier (Species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Circus_cyaneus.pdf) and short-eared owl (Endangered - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Asio_flammeus.pdf)⁵⁶.

⁵⁶.

IV. A. 4. b. Lakeplain mesic sand prairie

Lakeplain mesic sand prairies are the driest sort of lakeplain prairies and are found inland from the lake, in sand deposits within the silt or clay glacial lakeplain. They may experience high water tables in spring but are subject to drought later in the summer. Soils range from loam to medium sand, and have a wide range of pH values (5.4 to 8.0). They do not flood, but can remain moist through spring^{57, 58, 59}. As mentioned earlier, lakeplain mesic sand prairies are considered globally endangered but publicly accessible examples still can be found within the project area in the Ojibway Prairie Complex in Windsor and in Algonac State Park. The largest remaining areas of lakeplain prairie and lakeplain oak opening occur on Walpole Island.



Great spangled fritillary on butterfly milkweed

Although lakeplain mesic sand prairies are the driest of three types, in general, lakeplain prairies tend to be moister than prairies found further west and have many more wildflowers. Typically, trees do not grow in prairies because

there is not enough rainfall. In contrast, in lakeplain prairies trees do not establish because there is too much water⁶⁰. Lakeplain prairies occur in sandy areas that lie over clay lakeplain. In spring, as winter snows melt, the water accumulates on the clay layer, creating a seasonally high water table. Historically, these prairies occupied the space between Great Lakes marshes and forest further inland. As water levels rose, trees would be flooded out and prairie would expand into the newly opened area. As water levels fell, trees would once again begin to grow and the prairies would shift closer to the lake and contract in size. In many areas, the natural fluctuation of the water levels has been eliminated, jeopardizing the long-term survival of these communities⁶¹.

Fire has been another significant factor in the maintenance of lakeplain prairie. The combination of accumulated plant fuels and summer drought made these systems prone to wildfires and limited the spread of woody vegetation. Prairie

species are adapted to frequent fires and in some cases require them for seed germination. Fire prevents invasion by woody plants, selects against many non-native species, converts the stubble and dead vegetation of the previous year to nutrients and exposes the soil for warming early in spring. It is particularly critical for the shorter species, which often bloom early in spring. When shaded by tall dead vegetation, they cannot obtain adequate energy from the sun to flower and fail to bloom or die out completely.

Historically, Native Americans used fire as a management tool to clear land and create habitat for game and this was a significant factor in maintaining prairie in the area in the past. Initially, early settlers adopted the Native Americans' methods but as the land became more developed, fire was suppressed in most areas. Without fire, prairies have converted to scrub lands, savanna and forest^{62,63}.

Management of lakeplain mesic sand prairie remnants includes restoring natural hydrology when possible and restoring a natural fire regime with prescribed burning. Invasive species such as honeysuckle, common buckthorn, spotted knapweed and sweet white clover must be controlled as they can often out-compete the native species. Aggressive native shrubs such as dogwoods, hawthorns and prickly ash must also be controlled to prevent the shading out of prairie grasses and forbs⁶⁴.



Little Bluestem

Typical plant species in mesic sand lakeplain prairie include little bluestem, Penn sedge, yellow wild indigo, round-headed bush clover, butterfly milkweed, wood rush, sky-blue aster, early goldenrod, grey goldenrod, rigid goldenrod, rough blazing star and tall coreopsis^{65,66,67}.

Grassland bird populations have been declining in recent years and prairies provide critical habitat for such species as bobolink, eastern meadowlark, savanna sparrow, eastern kingbird, vesper sparrow, northern bobwhite, field sparrow and upland sandpiper^{68,69}. Typical mammals found in prairies include northern short-tailed shrew, thirteen-lined ground squirrel, deer mouse, meadow vole, American badger and white-tailed deer⁷⁰.

Rare plants that are found in lakeplain mesic sand prairie include white false indigo (Species of special concern), trailing wild bean (Species of special concern) and pink milkwort (Extirpated in Michigan, Endangered in Canada)^{71,72}. Rare animals include blazing star borer (Species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_beeriana.pdf), Culver's root borer (Species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_sciata.pdf), red-legged spittlebug (Species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Prosapia_ignipectus.pdf), northern harrier (Species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Circus_cyaneus.pdf), Short-eared owl (Endangered - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Asio_flammeus.pdf), Cooper's hawk (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Accipiter_cooperii.pdf), Henslow's sparrow (Threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Ammodramus_henslowii.pdf), grasshopper sparrow (Species of special concern) and migrant logger-head shrike (Endangered - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Lanius_ludovicianus_migrans.pdf)^{73,74,75,76,77}.

CASE STUDY

Walpole Island's rare plants, animals and natural communities⁷⁸

Walpole Island is in the species rich Carolinian Zone of southern Ontario and supports a rich mosaic of natural areas and features of global importance. These include Carolinian forest, coastal waterways, one of the largest wetland systems in the Great Lakes Basin and large areas of tallgrass prairie and oak savanna. These ecosystems provide habitat for many rare plant and animal species including some that occur nowhere else in Canada. The people of Walpole Island First Nation have lived off the land and successfully managed these ecosystems for thousands of years. Traditional philosophies, practices and values have contributed to the maintenance of these ecosystems and the species they support on Walpole Island, while they have been lost or severely fragmented on adjacent land.

Some 108 plant species, 2 mammals, 24 birds, 11 reptiles, 11 fish, 12 lepidoptera and 27 mussels that are found on Walpole Island are considered rare in Ontario (Appendix 1). Many species are considered rare in Canada because they are at the extreme northern limit of their range. Such have often have high evolutionary significance for the species as a whole because they may be genetically and morphologically divergent from the central populations⁷⁹.

Of the vascular plant species, eight are listed as Endangered and six as Threatened in Canada to date. At least three species - white prairie gentian, showy goldenrod and chestnut sedge are found nowhere else in Canada and several other plants have their Canadian stronghold on Walpole Island. Some of these, of which dense blazing-star is an excellent example, are not at all rare on Walpole Island. Most of these plants are prairie and savanna specialists, although some, like goldenseal, occur in woodland and forest.

Perhaps the most important bird considered at risk is the northern bobwhite. Natural populations of this species have been extirpated from mainland Canada. Although it is sometimes introduced as a game bird, re-introductions may not be sustainable on the mainland where habitat has been destroyed. On Walpole Island northern bobwhite is found throughout most of the prairies and savannas. Redhead, Canvasback and Ruddy Duck are other rare birds of potential economic importance.

The rarest fish found in the waters around Walpole Island is certainly northern madtom. This species is listed as Endangered in Canada and limited to extreme southwestern Ontario. Lake St. Clair is one of only three locations where it is found in Canada. Freshwater mussel species are suffering dramatic declines in populations throughout much of the Great Lakes region and the rest of North America. Eleven species of mussels once found in the waters around Walpole Island may now be extirpated, but on the other hand some areas of the shoreline, where invasion by zebra mussels seem to be restricted, may be providing an important refuge for native mussels. This may provide an opportunity for recovery of some of the most threatened species⁸⁰.

Natural Communities

The islands of Walpole Island First Nation form part of what has been described as “a splendid example of a bird’s-foot delta”, with channels that spread from north to south⁸¹. Generally the land is flat and low-lying, but highest at the north end of the complex and around the edge. Poor drainage due to high water levels is prevalent throughout the islands. A series of dikes separates the land from extensive marshes to the south that make up most of the delta.

The deltaic deposits of Walpole Island form a complex of gently grading ridges and sloughs with different moisture regimes that support a diversity of vegetation communities⁸². The deposits are composed mainly of fine to medium sands and coarse silts that have been carried down the St. Clair River. The soils of Walpole Island have these deposits as their parent materials and are mostly imperfectly to poorly drained fine sandy loams, but pockets of sand are present at the north end of the island. Low-lying wet areas have additional silt and loams⁸³. Chernozemic soils that have developed under prairie are very distinctive and are well represented on Walpole Island⁸⁴.

Tallgrass Prairies

Many of the prairies on Walpole Island are in excellent condition because of the regular burns that occur. They represent the most outstanding prairie complex in Ontario, with the greatest species richness⁸⁵ and a high concentration of rare species. There are 110 prairie indicator plant species that have been recorded here. Some of the prairies many have expanded since the First Nations started maintaining a permanent settlement on the islands in the early 1800s. Other areas have more recently been lost to agricultural and development. Estimates from 1972 and 1998 air photos suggest that prairies at Walpole Island have been reduced from about 730 ha (1,804 acres) to about 470 ha (1,161 acres), a loss of 36%⁸⁶. Some of

this is a result of conversion to agriculture and housing, but most is due to encroachment by forest and woodland in the absence of regular fires.

All the prairie vegetation types and ecosites that are found on Walpole Island are considered extremely rare in Ontario and have a provincial ranking of S1⁸⁷.

Oak Savanna

Walpole Island contains some of the most significant areas of oak savanna remaining in Canada. Increasing development on Walpole Island means that the use of fire to manage and maintain savannas has been reduced. An estimated 570 ha (1,409 acres) of oak savanna in 1972, based on aerial photography, was reduced to some 360 ha (890 acres) by 1998, a 37% loss mainly attributable to closing in of the tree canopy. All oak savanna vegetation types are considered extremely rare in Ontario with a provincial ranking of S1.

Deciduous Forests

On Walpole Island, forest and woodland occupies some 1780 ha (4,398 acres). Much of it is on wetter soils and not all is considered well-developed, mature Carolinian forest. The amount of forest on Walpole Island has increased almost 400 ha (988 acres) since 1972 as a result of the growing in of savanna. These younger forests are losing or have lost the characteristic savanna elements and do not have the same structural and species diversity as older forest ecosystems. For recovery and management purposes it is important to distinguish the areas that should be protected as “true” forest from treed areas that are overgrown savannas that may need to be restored.

Marshes

Walpole Island contains over 12,000 ha (29,600 acres) of World Class Wetlands, one of the largest wetland complexes in the Great Lake basin, composed primarily of cattail and sedge marshes, swamps and swales⁸⁸. The wetlands on Walpole Island are an enormously important resource that forms the economic base of the community through fishing, hunting and harvesting other aquatic life. The marshes at the south end of Walpole Island are an important staging area for migrating waterfowl on the Atlantic and Central Mississippi flyways. Since European settlement some 88 percent of the original wetlands in Lambton County and Chatham Kent have been drained⁸⁹. On Walpole, St. Anne, Squirrel and Pottawatamie Islands of the Walpole Island First Nation about 6,240 ha (13,350 acres) of the original wetlands have been drained and converted to farmland since the 1910.

About 88% of the Walpole Island marshes are currently diked for waterfowl management. The first dikes were installed in the early 1950s and diking has continued as recently as 2002. Waterfowl hunting is an economic mainstay for Walpole Island. Hunting by individuals takes place and there are six hunting clubs. The Walpole Island Marsh Committee manages two baited sanctuaries in addition to sanctuaries operated by each of the hunting clubs.

Open water Coastal Communities

The open water and coastal communities of Walpole Island First Nation occupy the south channel of the St. Clair River, the Bassett Channel, the Johnston Channel and the Chenail Ecarte (The Snye) as well as Goose Lake and many smaller openings in the marshes. In the south the marshes open up and grade into several square kilometres of open water in Lake St. Clair including Walpole and Johnston Bays. These open water areas share their economic and ecological importance with the wetlands. Most of the banks of the St. Clair River and Chenail Ecarte are hardened.

The Sydenham River, one of the most biologically rich rivers in southern Ontario, enters the Chenail Ecarte opposite St. Anne Island. In addition to waterfowl and fish, the freshwater mussel population is particularly diverse in the Sydenham River and Lake St. Clair and includes several species at risk. What appears to be an important refugium for freshwater mussels from Zebra Mussel infestations has been found in the waters of WIFN, and is being studied by Environment Canada.

IV. A. 5. Deciduous forest

Within the C-CAP classification scheme, deciduous forests are lands that have at least 20 percent tree cover, composed of species that lose their leaves in response to seasonal changes. It includes southern mesic dry forest, southern mesic forest and lakeplain oak opening. C-CAP satellite data can also include developed areas with dense tree canopy such as the Grosse Pointes (located just north of Detroit) in this land cover category. Deciduous forest has decreased within the project area from over 54,000 acres (21,853 hectares) in 1995 to about 53,000 acres (21,448 hectares) in 2000, a decrease of about 2.5 percent. The largest losses were due to development.

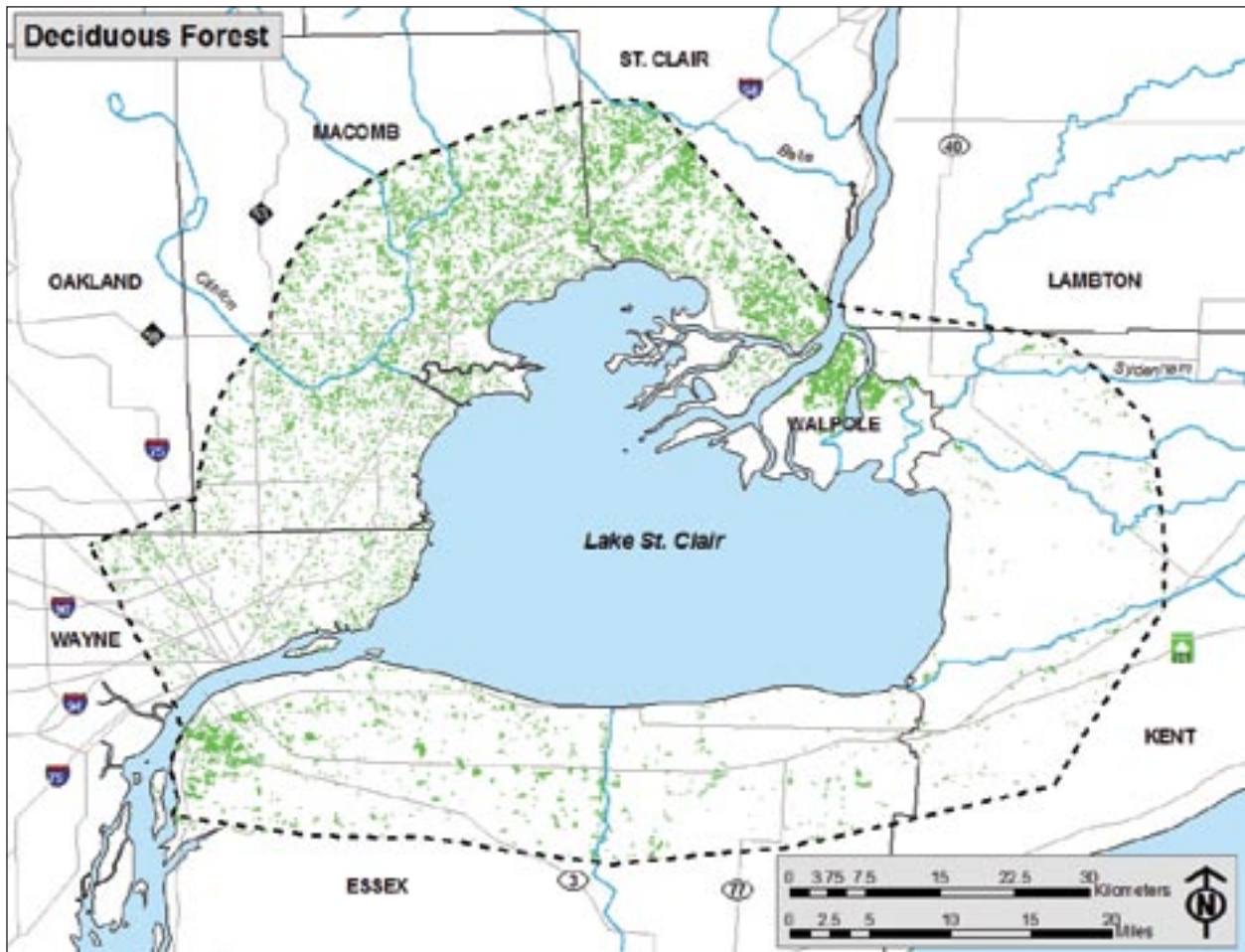


Figure IV A 5 - 1
Deciduous forest

Historically, much of the project area was forested, but by the late 1800s the majority of forest had been logged and converted to agriculture. Of the remaining woodlands, most exist as small, unconnected patches. For small animals, roads, parking lots and even lawns may form an effective barrier to movement. In addition, the amount of forest interior is a critical factor for many species. Cerulean warbler (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Dendroica_cerulea.pdf) and scarlet tanager, for example, both require large expanses of forest to nest successfully. As forest patches shrink the amount of "edge" increases in relation to forest interior. Forest birds are particularly vulnerable to this edge effect as the brown-headed cowbird, a nest parasite, thrives at the forest edge. Although some species such as white-tailed deer or yellow-billed cuckoo prefer edge and have increased their range since the forests were cleared, it is generally the more common animals which have increased at the expense of the rarer species.

IV. A. 5. a. Dry mesic southern forest

Dry mesic southern forest is an oak and hickory dominated forest type, which is located in the southern portion of the state. It occurs on well drained, sandy loam or loam soils that are slightly acid to neutral. Typically, it occurs on

coarse-textured moraines, glacial outwash, kames and sand lakeplain⁹⁰. It is relatively uncommon within the project area as the water table tends to be high and heavy clay soils are prevalent. Historically, dry mesic southern forest covered less than 1 percent of the project area and most of this was located in and around the present day city of Algonac⁹¹. A portion of this forest is preserved within Algonac State Park.

FACT

In the past, oak-hickory forests were maintained by fire. Their droughty soils and characteristic southern exposures made them susceptible to natural fires prior to European settlement.

In the past, oak-hickory forests were maintained by fire. Their droughty soils and characteristic southern exposures

made them susceptible to natural fires prior to European settlement⁹². Fire was also used by Native Americans as a management tool to keep the forest understory open and stimulate the regrowth of ground layer vegetation for game species such as white-tailed deer⁹³. Most oaks have thick bark and can tolerate frequent fires. Additionally, they grow back from root sprouts following particularly severe fires. Because more mesic species cannot survive in these conditions, oaks were able to successfully compete. With the suppression of fire beginning in the 1930s, however, oak hickory forests have been invaded by more mesic species such as red maple which are gradually replacing young oak trees in the understory⁹⁴. Oaks are not tolerant of shade and oak seedlings will not survive in the forest floor unless an opening is created. On particularly steep slopes they may still persist as light is better able to penetrate but for the most part, oaks will not regenerate without some sort of disturbance to open the forest canopy^{95,96}.



New Jersey Tea

Dominant tree species in dry mesic southern forest include white oak, black oak, red oak and pignut hickory. Within the project area, bur oak assumes a more prominent role than it does elsewhere and scarlet oak is also frequent. Other common associates may include black cherry, shagbark hickory, sassafras, black walnut, white ash and ironwood. In the understory, species such as flowering dogwood, gray dogwood, witch-hazel, arrow-wood viburnum, maple-leaved viburnum, blueberries, huckleberries and New Jersey Tea

are common. Historically, American chestnut would have been an important component of this community but its populations were devastated by the chestnut blight^{97,98}.

FACT

Because sufficient light is available from the open canopies of the dry mesic forests, plants in the ground-layer bloom throughout the growing season.

Dry mesic forests tend to have a more open canopy than mesic forest types and relatively high levels of light reach the forest floor⁹⁹. Because sufficient light is available, plants in the groundlayer bloom throughout the growing season¹⁰⁰. Early blooming species include wood anemone, Penn sedge, wild geranium, blue co-

hosh and Solomon's seal. Ferns such as maidenhair fern, bracken fern, and interrupted fern are common also. Later in the season, bottlebrush grass, clustered-leaved tick trefoil, tall white lettuce, spreading dogbane and blue-stemmed goldenrod are typical¹⁰¹.

Dry-mesic forests are rich in a variety of animal foods and acorns and hickory nuts are a particularly valuable crop for wildlife. Small mammals such as gray, flying and fox squirrel and eastern chipmunk are common, as well as raccoon, Virginia opossum, white-tailed deer and red fox. Typical bird species that frequent dry mesic forests include scarlet tanager, black-capped chickadee, downy woodpecker, rose-breasted grosbeak, northern cardinal, blue jay, northern oriole and red-headed woodpecker. Other common avian inhabitants include wild turkey, eastern wood-peewee, great crested flycatcher, blue jay, black-capped chickadee, tufted titmouse, white-breasted nuthatch, yellow-throated vireo and ovenbird^{102, 103}.

Rare plants found in southern dry-mesic forest include Virginia snakeroot (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Aristolochia_serpentaria.pdf), fire pink (State threatened) and tinted spurge (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Euphorbia_commutata.pdf)¹⁰⁴.



Northern Oriole

IV. A. 5. b. Mesic southern forest

Mesic southern forest (http://web4.msue.msu.edu/mnfi/abstracts/botany/Trillium_undulatum.pdf) is typically dominated by American beech and sugar maple. Within the project area, it occurs on the moist, rich soils of silty, clayey glacial lakeplain, where it often grades into southern swamp¹⁰⁵. Elsewhere in the state, it is common on medium or fine-textured ground moraine, and fine textured end moraine on soils which range from loams to clays¹⁰⁶. Historically, beech-maple forest covered half of the state, when both northern and southern forms were considered. Today, the majority lies in the northern portion of the state and makes up 19% of Michigan's forest. Within the project area, only small, isolated patches persist¹⁰⁷.

Sugar maple and American beech are extremely successful as forest dominants in much of the state because they are both very shade tolerant and their abundant seedlings can reproduce in the heavy shade of their canopy. Their abundant leaves are high in nutrients, and break down rapidly, enriching the soil. They are not fire tolerant but their leaf litter in spring and fall resists its passage. Once their dense canopy has closed in, species like oaks, which need high levels of light, gradually disappear from the forest¹⁰⁸.

On the glacial lakeplain, however, a number of factors interact to lessen this dominance. Sugar maple is sensitive to the wetter clay soils and does not compete as effectively on them. American beech is comparatively more successful

on wet soils but because of the heavy clays, tree roots are shallow, and windthrow is more common, creating frequent gaps that shade intolerant species can exploit¹⁰⁹. Because of this, mesic forest on the lakeplain differs from the beech-maple forest found elsewhere in the state. Dominant tree species in mesic forest in the project area include American beech, red oak, swamp white oak and bur oak. Although bur oak is normally considered a savanna species, it is also common on the clay soils of the Maumee lakeplain and was historically common in the Great Black Swamp of southeast-

HIGHLIGHT

Mesic forest on the lakeplain differs from the beech-maple forest found elsewhere in the state; dominant tree species in the project area include American beech, red oak, swamp white oak and bur oak.



ern Michigan and northwestern Ohio. Other tree species in mesic forest include basswood, white ash, yellow birch, black cherry, sugar maple, shagbark hickory, bitternut hickory, black walnut, tuliptree and historically, American elm^{110, 111}.

Light is a limiting factor in the understory during much of the growing season, as mesic forests have such a dense canopy. Over half of the wildflowers bloom early in spring before the trees leaf out. Many are ephemeral, with underground storage organs such as rhizomes, corms or bulbs, and bloom, set seed and die back by early summer. Ephemeral species include Dutchman's breeches, squirrel corn, trout lilies, and spring beauty. Other spring blooming species include common trillium, sweet cicely, wild geranium, bloodroot, wild ginger, hepatica, mayapple and wood phlox. Shade tolerant understory species include hop-hornbeam, flowering dogwood and maple-leaf viburnum¹¹².



Bur oak leaves and bark

These rich forests provide a variety of habitats that are used by invertebrates, amphibians, songbirds and mammals. Southern mesic forests are particularly important for salamanders which breed in ephemeral pools in spring. Typical species include spotted salamander, blue-spotted salamander and red-backed salamanders. White-tailed deer, raccoon, and Virginia opossum are common as well as a variety of small mammals such as white-footed deer mice, northern short-tailed shrew and masked shrew¹¹³. Birds in the southern mesic forest include red-bellied woodpecker, downy woodpecker, northern flicker, least flycatcher, Acadian flycatcher, ovenbird, wood thrush, red-eyed vireo, northern cardinal, white-breasted nuthatch, black-capped chickadee, eastern wood-peewee and rose-breasted grosbeak¹¹⁴.

Rare plants in southern mesic forest include goldenseal (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/botany/Hydrastis_canadensis.pdf), smooth carrion flower (State species of special concern), showy orchis (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/botany/Galearis_spectabilis.pdf), Oswego tea (State endangered), ginseng (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Panax_quinquefolius.pdf), crane fly orchid (State endangered), painted trillium (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/botany/Trillium_undulatum.pdf) and prairie trillium (State species of special concern). The cerulean warbler (State species of special concern) is found here as well¹¹⁵.

IV. A. 5. c. Lakeplain oak opening/oak

savanna

Lakeplain oak openings (http://web4.msue.msu.edu/mnfi/abstracts/ecology/Lakeplain_oak_opening.pdf) are dominated by widely spaced oaks, with a ground layer that contains both forest and lakeplain prairie species. Like the closely related lakeplain prairies, they are considered globally imperiled. In the 1800s, surveyor's records showed 76,411 acres of lakeplain oak openings in the state. Today, about a thousand acres or 1.5% remain with comparable losses in Ontario^{116, 117}. Lakeplain oak openings occur within the glacial lakeplain on sand ridges, level sandplains or within depressions. Typically, soils are sandy and mildly alkaline, but they can also occur on silty/clayey soils. On drier sites,



Lakeplain oak opening, Walpole Island First Nation
Photo: Laura Lodisio, USEPA

HIGHLIGHT

Lakeplain oak openings are dominated by widely spaced oaks, with a ground layer that contains both forest and lakeplain prairie species.



such as sandy beach ridges, black oak and white oak dominate. On poorly drained flat sites, bur oak, swamp white oak and pin oak form a wet savanna type^{118, 119}.

Like prairie, lakeplain oak openings are fire dependent systems. Differing fire regimes can produce very different results; frequent, low intensity fires create an open understory, and large spreading oaks, while infrequent, high intensity fires kill the trees and stimulate suckering.

ing^{120, 121}. On drier sites, in the absence of fire, other trees grow up, and the oaks are eventually replaced by more shade tolerant species such as maples and beeches^{122, 123, 124}. On wetter sites a high water table may inhibit some potential invaders¹²⁵.

In the dry-mesic lakeplain oak openings, scattered black and white oaks dominate and typical understory species include serviceberry, New Jersey Tea, gray dogwood and huckleberry. The groundlayer is dominated by graminoids including big bluestem, little bluestem, Indian grass and Penn sedge but ferns such as bracken fern and interrupted fern are common also. Typical wildflowers include bastard toadflax, hoary pucoon, false Solomon's seal, hog peanut, wood betony, woodland sunflower, yellow pimpernel, wild lupine, slender bushclover, arrow-leaved violet and yellow false foxglove^{126, 127, 128}.

On wetter sites, bur oak, pin oak and swamp white oak replace the dry-mesic oaks, and the understory includes buttonbush, silky dogwood and red-osier dogwood. Shellbark hickory may be present also. Graminoids include bluejoint grass, prairie cordgrass and sedges. A variety of ferns such as royal fern, marsh fern and sensitive fern are abundant. Common herbaceous species include starry false Solomon's seal, black snakeroot, ground-nut, Culver's root, tall coreopsis, Virginia mountain mint and prairie dock^{129, 130, 131}.



Yellow False Foxglove



Wild Lupine

Lakeplain oak openings provide habitat for many of the same invertebrates that utilize lakeplain prairie: wild indigo duskywing (State species of special concern), Culver's root borer (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_sciata.pdf), blazing star borer (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_beeriana.pdf), silphium borer moth (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_silphii.pdf) and red-legged spittlebug (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Prosapia_ignipectus.pdf). Many are intimately tied to host plants which are found only in high quality prairie and savanna. While fire is critical to the survival of oak openings, it is important that refugia be provided during burning to ensure the survival of these insects^{132, 133}.

Lakeplain oak openings are also home to a wide variety of birds. Songbird species include indigo bunting, eastern towhee, chipping and field sparrow, eastern blue-

bird, American goldfinch, northern oriole, blue-winged warbler and brown thrasher. They are also used by red-headed woodpecker, sharp-shinned hawk, redtail hawk, eastern kingbird, mourning dove, American kestrel, upland sandpiper, killdeer, ruffed grouse and wild turkey¹³⁴.

HIGHLIGHT

Like prairie, lakeplain oak openings are fire dependent systems. Frequent, low intensity fires create an open understory, and large spreading oaks, while infrequent, high intensity fires kill the trees and stimulate suckering.



Rare plants include Hill's thistle (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Cirsium_hillii.pdf), Leiberg's panic grass (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Panicum_leibergii.pdf), pale beardstongue (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Penstemon_calycosus.pdf), wild bean (State endangered), honey-flowered Solomon's seal, (Federally listed endangered, State endangered), prairie buttercup (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/botany/Ranunculus_rhomboideus.pdf), sand grass (State threatened) and purple milkweed (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/botany/Asclepias_purpurascens.pdf)¹²³¹³⁵. Cooper's Hawk (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Accipiter_cooperii.pdf) is also found in lakeplain oak opening.

IV. A. 6. Evergreen forest

Within the C-CAP classification scheme, evergreen forest consists of lands with over 20 percent tree cover consisting mostly of species which retain their leaves or needles year-round. Historically, there were no native upland evergreen forests within the project area. Lands within the project area that are identified as evergreen forest by C-CAP satellite data are most likely pine plantations, Christmas tree farms or densely landscaped residential areas. Today, land classified as evergreen forest occupies almost 6000 acres (2,428 hectares) within the project area, with little change in the last few years.

IV. A. 7. Mixed forest

According to the C-CAP classification scheme, mixed forests are lands with over 20 percent tree cover, with both deciduous and evergreen species present but with less than 75 percent coverage by either type. Historically, no native upland mixed deciduous / evergreen forests were noted, and those identified as mixed forest by C-CAP satellite data probably consist of degraded forest which has been invaded by pines, or densely planted developed areas. About 2,700 acres (1,092 hectares) of mixed forest occur within the project area, and reflect little change between 1995 and 2000.

IV. A. 8. Scrub/shrub

According to C-CAP, scrub/ shrub lands are areas dominated by shrubs and small trees that are less than five meters tall. The shrub canopy is usually greater than 20 percent of the total vegetation. This may represent a successional stage between old field and forest or trees may be stunted because of harsh environmental conditions¹³⁶. Within the project area there are 3,753 acres (1,519 hectares) of scrub/shrub lands, which make up less than 1 percent of the total area¹³⁷.

Typically, scrub/shrub lands are old fields that are gradually reverting to forest, and contain many of the herbaceous species found earlier in the description of cultural grasslands and old fields, such as smooth brome, goldenrod, Queen Anne's lace and chicory. Typical shrubs include natives such as gray dogwood, blackberry, red raspberry, northern dewberry, hazelnut and staghorn sumac and introduced species such as common buckthorn, autumn olive and honeysuckle. Trees that gradually begin to appear include hawthorn, crabapple, quaking aspen, red maple and oaks¹³⁸.

Common bird species that utilize scrub/shrub lands include rufous-sided towhee, blue-winged warbler, yellow warbler, gray catbird, chipping sparrow, field sparrow and song sparrow¹³⁹.

IV. A. 9. Bare Land

According to C-CAP, bare lands can occur on rock, sand or clay substrate. They can range from natural settings, such as bedrock, desert pavement, volcanic material, glacial debris and sand dunes, to man-made features such as gravel pits and strip mines. In any case, vegetation covers less than ten percent of the land¹⁴⁰. Within the project area, a few sand or gravel pits may fall into this category but the majority of these lands consist of sites which are being cleared for construction. They provide little habitat, and be a significant source of soil erosion and sedimentation. Bare lands increased from 1,723 acres (697 hectares) in 1995 to 2,163 acres (875 hectares) in 2000, an increase of 25 percent.

IV. B. Wetlands and deepwater habitat

According to Cowardin et al.¹⁴¹, “wetlands are lands where saturation with water is the dominant factor determining soil development and the types of plant and animal communities living in the soil and on its surface.” While there are

HIGHLIGHT

“Wetlands are lands where saturation with water is the dominant factor determining soil development and the types of plant and animal communities living in the soil and on its surface.”

Cowardin et al.

a number of different systems for classifying wetlands, three criteria are common to most of them; wetlands have saturated soils or are flooded for at least part of the year; wetlands often have soil conditions that are different from those in the adjacent uplands; and wetlands contain plants which are adapted to flooding¹⁴². C-CAP classifies all freshwater wetlands as palustrine, including aquatic beds, emergent wetlands, scrub/shrub wetlands and forested wetlands. In some cases, natural communities which function as an integrated system may be split into two different categories, as the emergent zone of marshes for example, fall into the

palustrine emergent category and their submergent zone is categorized as aquatic bed¹⁴³. Other systems of classification include additional freshwater categories for riverine and lacustrine wetlands for systems which are associated with rivers or lakes¹⁴⁴. As mentioned earlier, headings such as “Palustrine Emergent Wetland” are actual CCAP land cover types, while subheadings within them such as “Lacustrine Aquatic Bed” or “Riverine Open Water” are specific natural communities.

Prior to European settlement, the entire periphery of Lake St. Clair was surrounded by wetlands, including emergent marsh along the shoreline and wet prairies, meadows and swamps further inland. In deeper water, wild celery beds were

HIGHLIGHT

Prior to European settlement, the entire periphery of Lake St. Clair was surrounded by wetlands, including emergent marsh along the shoreline and wet prairies, meadows and swamps further inland.

an important source of food for migrating waterfowl. Because the land was fertile and the climate moderated by the lake, it was quickly settled and cleared for farming. Large scale drainage began in the mid nineteenth century. In 1873, there were still 18,000 acres of coastal wetland around Lake St. Clair on the Michigan shore but by 1973, only 5,000 of them remained¹⁴⁵. On the Ontario shore of the lake, about 32,000 acres remained in 1978¹⁴⁶.

Within the project area as a whole, C-CAP satellite data show about 51,000 acres of wetland, including forested

wetlands. The majority of the lands are located around the northern end of Lake St. Clair. Between 1995 and 2000, about 42 acres were converted to developed or agricultural lands.

IV. B. 1. C-CAP land cover class: Unconsolidated shores

Unconsolidated shores are highly dynamic systems altered by changing lake levels, wave activity, sedimentation and erosion. They include beaches, bars and flats, and are regularly flooded and redistributed by the action of tides or currents. Because conditions are constantly changing, they generally do not have vegetation other than pioneer plants, which grow for brief periods of time¹⁴⁷. Despite this lack of vegetation, these lands are valuable foraging grounds for avian species such as black-bellied plover and American golden-plover during the migration¹⁴⁸.

According to C-CAP satellite data there are only about 750 acres of unconsolidated shores within the project area and this amount shows little change.

FACT

Within the project area, palustrine emergent wetlands include the emergent zone of inland and Great Lakes marshes, wet meadows, lakeplain wet prairies and lakeplain wet-mesic prairies.

IV. B. 2. C-CAP land cover class: Palustrine emergent wetlands

Palustrine emergent wetlands are characterized by rooted, upright, herbaceous plants, which are adapted to seasonally saturated or inundated soils and usually persist until the next growing season. Typically, at least 80 percent of their area is covered with plants and they are dominated by perennials. Within the project area, palustrine emergent wetlands include the emergent zone of inland and Great Lakes marshes, wet meadows,

lakeplain wet prairies and lakeplain wet-mesic prairies^{149, 150}. Although it is difficult to accurately assess wetland area as it expands and contracts as water levels go up and down, according to the most recent project data it occupies over 22,000 acres or about 3 percent of the total area¹⁵¹.

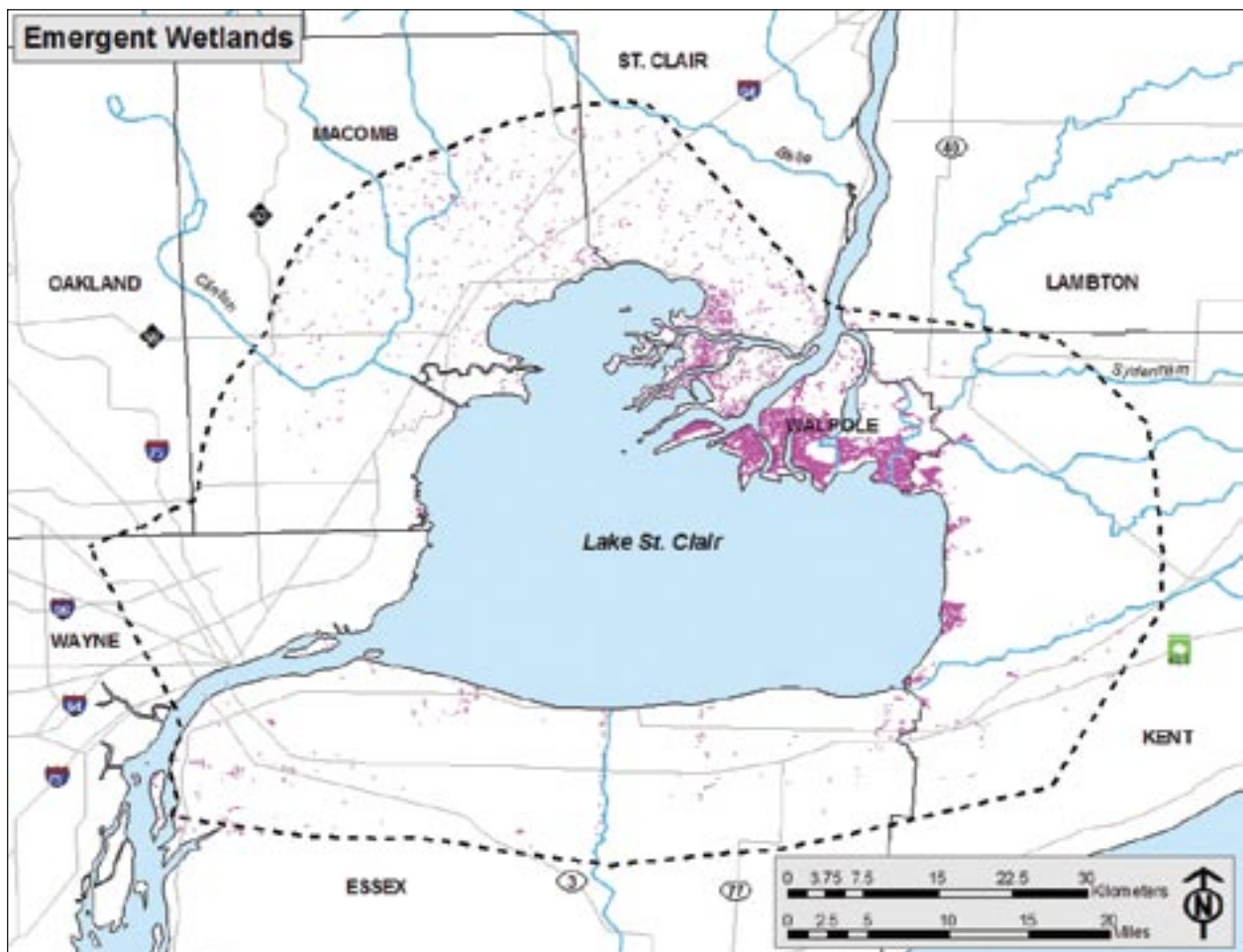


Figure IV B 2 - 1
Emergent wetlands

IV. B. 2. a. Inland marsh

Inland marshes are a common wetland type throughout Michigan, on poorly drained muck (organic) soils. They are often associated with streams or inland lakes and are characterized by an emergent zone, which may have saturated soils or shallow water and a submergent zone that tends to be permanently flooded, with water depths ranging between six inches and three or more feet during the growing season. Within the project area inland marshes are less common, occurring in shallow depressions in the lakeplain with poorly drained soils. Historically, they were found adjacent to

southern swamps, floodplain forest and lakeplain prairie or in scattered small depressions throughout the broader landscape. Inland marshes may also be associated with southern shrub-carr^{152, 153}.

Marshes are highly productive systems with plentiful nutrients and circum-neutral soils¹⁵⁴. Bacteria are active in nitrogen fixation and rates of decomposition are relatively rapid. The accumulated organic layer is the result of high turnover rather than the slow decomposition that is characteristic of bogs. Peat may or may not accumulate¹⁵⁵. Periodic exposure of the soils as water levels fall (drawdown) can be critical in providing the oxygen necessary for aerobic decomposition as standing water tends to be poorly oxygenated. Although many wetland plants are adapted to low oxygen availability, when anaerobic conditions persist, decomposition slows and partially decayed vegetation tends to accumulate. With drawdown, the dead plant materials are exposed to oxygen and aerobic decomposition proceeds at a much faster rate¹⁵⁶.



Muskrat

Photo: John Schafers. MDNR

Inland marshes depend on both rainwater and runoff from surrounding lands and are heavily influenced by their drainage basins. In many areas, groundwater is also a significant source of water although this is less common in the lakeplain where groundwater flow is limited by the heavy clay soils. Inland marshes undergo characteristic cycles as water levels go up and down in response to drought or changes in the water table. During drought large areas of mudflats are exposed, triggering germination of the seeds of emergents that spread while the soil is exposed. As the water

levels rise annuals are flooded out but perennials persist. Over time, muskrats eat the emergents, creating patches of open water, which are utilized by a variety of waterfowl. During the next period of drought, mudflats are once again exposed and the cycle continues^{157, 158, 159}.

FACT

Inland marshes depend on both rainwater and runoff from surrounding lands and are heavily influenced by their drainage basins.

water, submerged and floating leaved plants like wild celery, pondweed, duckweed, yellow pond lily and sweet-scented water lily are characteristic¹⁶⁰. Invasive species such as common reed and purple loosestrife are an increasing problem and will be discussed later (see section III. M. Invasive species).

In the emergent zone, plants like arrowhead, pickerel weed, sedges and cattail are typical along the shoreline in shallow water and in the submergent zone, in deeper

Inland marshes are among the most productive wetlands for waterfowl, shorebirds and furbearers such as the muskrat and also provide spawning and nursery habitat for some fish if the water is deep enough. The abundant insects found there provide food for fish, amphibians, reptiles and birds, while the dense vegetation serves as cover. Marshes that are connected to lakes or rivers can serve as spawning grounds and nurseries for fish species such as northern pike and largemouth bass. Common mammalian residents include muskrat, mink and raccoon. Eastern cottontail and deer often feed in marshes. In addition to waterfowl, other avian species that utilize inland marshes include greater and lesser yellowlegs, red-winged blackbird and black tern.

Rare animals found in inland marshes include black-crowned night heron (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Nycticorax_nycticorax.pdf), king rail (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Rallus_elegans.pdf), northern harrier (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Circus_cyaneus.pdf), Forster's tern (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Sterna_forsteri.pdf), spotted turtle (Threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Clemmys_guttata.pdf) and Blanding's turtle (Species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Emys_blandingii.pdf). Rare plants include lake cress (State threatened), yellow nutgrass (state species of special concern), spearwort (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Ranunculus_ambigens.pdf) and wild rice (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Zizania_aquatica_var_aquatica.pdf)¹⁶¹.



Blanding's Turtle

IV. B. 2. b. Lakeplain wet prairie & lakeplain wet-mesic prairie

Lakeplain prairie was initially introduced in the upland section. While mesic sand lakeplain prairie is an upland form of prairie, lakeplain wet prairie (http://web4.msue.msu.edu/mnfi/abstracts/ecology/Lakeplain_wet_prairie.pdf) and lakeplain wet-mesic prairie (http://web4.msue.msu.edu/mnfi/abstracts/ecology/Lakeplain_wet-mesic_prairie.pdf) both appear with the C-CAP classification scheme as emergent wetland. Natural disturbance regimes including fire and seasonal flooding, which were discussed earlier in the upland section, are also critical to the survival of each of these prairie types. Lakeplain wet prairie occupies the wettest end of the spectrum, occurring on sand lakeplain and on deposits of dune sand within the clay lakeplain. It is generally found close to the shore, between Great Lakes marsh, and lakeplain wet-mesic prairie. Soils consist of poorly drained medium sands, to silty clay loams and can be somewhat alkaline, ranging from a pH of 7.0 to 8.0. Water levels fluctuate both seasonally and annually. Lakeplain wet-mesic prairie is a bit dryer than lakeplain wet prairie and is generally found further inland, on sand lakeplain with soils that can range from a pH of 6.0 to 8.0. Typically, it is flooded in spring and



Pottowatomi Prairie, Walpole Island First Nation

experiences drought conditions in summer and fall, although it can contain patches that remain moist throughout the growing season^{162, 163}. Although most wet and wet mesic lakeplain prairie was drained and farmed in the 1800s, sizable high-quality remnants still exist within the St. Clair Delta on both the U.S. and Walpole Island First Nation portions. Additional large remnants survive within the project area in Algonac State Park and in the Ojibway Prairie Complex in Windsor. As in the case of lakeplain mesic sand prairie, management includes using prescriptive fire, controlling

HIGHLIGHT

Although most wet lakeplain prairie was drained and farmed in the 1800s, sizable high-quality remnants still exist within the St. Clair Delta on both the U.S. and Walpole Island First Nation portions.

by the presence of wet prairie grasses such as blue-joint grass and prairie cordgrass, rush, twig-rush, and sedges. In the more mesic forms, big bluestem, little bluestem, Indian grass, and switchgrass are common. Typical wildflowers include swamp milkweed, blue flag, Canada anemone, bushy aster and whorled loosestrife in the wetter areas and Virginia mountain mint, dense blazing star, Ohio goldenrod, tall coreopsis, colic root, tall sunflower, black-eyed Susan and grass-leaved goldenrod elsewhere. Lakeplain prairies are among the most diverse plant communities in the project area, with up to 200 species occurring at a single site.

HIGHLIGHT

Lakeplain prairies are among the most diverse plant communities in Michigan, with up to 200 species occurring at a single site.

Rare plant species include three-awned grass (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Aristida_longespica.pdf), short-fruited rush (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Juncus_brachycarpus.pdf), Leiberg's panic grass (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Panicum_leibergii.pdf), yellow nutgrass (State species of special concern), seedbox (State threatened), chestnut sedge (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Fimbristylis_puberula.pdf), cross-leaved milkwort (State threatened), pink milkwort (extirpated in Michigan, federally listed in Canada - http://web4.msue.msu.edu/mnfi/abstracts/botany/Polygala_incarnata.pdf), Clinton's bulrush (State species of special concern), northern appressed clubmoss (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/botany/Lycopodiella_subappressa.pdf), purple milkweed (State spe-

invasive species such as sweet white clover, spotted knapweed, purple loosestrife and common reed and restoring the original hydrology of the site whenever possible.

Lakeplain wet prairie and lakeplain wet-mesic prairie have many features in common with each other and with lakeplain mesic sand prairie (see section II. C. 1. d. 2. Lakeplain mesic sand prairie). With their tall grasses and flowers, they resemble upland grassland more than a typical wetland, such as a marsh. They are distinguished from other sorts of lakeplain prairie

Common wildlife species that utilize wet prairies include mallard and blue-winged teal, frogs, turtles, northern water snake, crayfish and a number of furbearers, including muskrat, raccoon, mink and weasel. Within the prairie, enormous ant mounds and crayfish chimneys are hidden by the tall grasses. Historically, bison and elk utilized prairies as habitat but the only remaining ungulate is the white-tailed deer, which feeds along the prairie edge.



Eastern fox snake
Photo: John Schafers. MDNR

cies of special concern - http://web4.msue.msu.edu/mnfi/abstracts/botany/Asclepias_purpurascens.pdf), eastern prairie fringed orchid (Federally listed as threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Platanthera_leucophaea.pdf), white lady's-slipper orchid (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Cypripedium_candidum.pdf), Gattinger's gerardia (State endangered), Skinner's gerardia (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/botany/Agalinis_gattingeri.pdf) and Sullivant's milkweed (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Asclepias_sullivantii.pdf)^{164, 165, 166}.

A number of rare animals are found in the wetland lakeplain prairie types, including eastern fox snake (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Elaphe_vulpina_gloydi.pdf), spotted turtle (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Clemmys_guttata.pdf) and Blanding's turtle (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Emys_blandingii.pdf). Rare birds that nest in lakeplain prairie include least bittern (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Ixobrychus_exilis.pdf) and king rail (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Rallus_elegans.pdf). Rare insects such as red-legged spittlebug (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Prosapia_ignipectus.pdf), wild indigo dusky wing (State species of special concern), Culver's root borer (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_sciata.pdf), blazing star borer (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_beeriana.pdf) and silphium borer moth (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Papaipema_silphii.pdf) are intimately tied to host plants that are found only in high quality prairie¹⁶⁷. Historically, the eastern massasauga (state species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Sistrurus_catenatus.pdf) was also known to occur in these wet grasslands, particularly on Walpole Island and Belle Isle.

IV. B. 2. c. Great Lakes marsh

Great Lakes Marshes (http://web4.msue.msu.edu/mnfi/abstracts/ecology/Great_lakes_marsh.pdf) are extremely diverse and productive wetlands that are found along the Great Lakes shoreline. They generally occur as part of a wetland complex that includes submergent and emergent marsh, mudflats, wet meadows and shrub swamps^{168, 169}. They differ from inland marshes in several significant ways; their water levels are tied to those of the Great Lakes; they are subject to large short term variations in water level caused by wind or barometric pressure, their substrates are mineral as organic materials are flushed out by currents, oxygen levels are higher, they tend to have a more gradual shoreline, which results in greater zonation; and shoreline erosion and sediment re-deposition are greater because of the influence of wind, wave action and ice scour^{170, 171}.

Historically, Lake St. Clair was surrounded by Great Lakes Marsh but much of that marsh has been filled in. On the Michigan side of the lake shoreline development has been extensive while on the Canadian side, agricultural uses predominate. Sizable remnants remain on the St. Clair Delta, including St. John's Marsh, and Dickinson Island in Michigan and on Walpole Island First Nation on the Canadian side of the lake. Smaller remnants also persist, including the St. Clair Marshes complex in Mitchell's Bay, Ruscom Shores marsh and the Thames River marsh on the Canadian side of the lake and in Anchor Bay and at the mouth of the Clinton River on the U.S. side¹⁷².

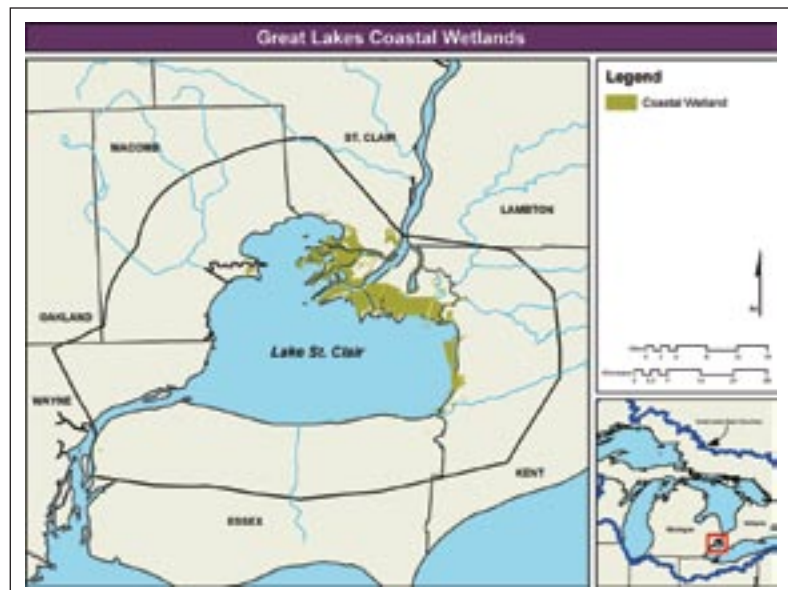


Figure IV B 2 c - 1
Great Lakes coastal wetlands

The diverse coastal wetland communities within Lake St. Clair provide habitat for a wide range of organisms: invertebrate production is higher in marshes than open water; marshes function as spawning grounds and nursery cover for fish; an incredible variety of birds utilize the marshes for feeding, nesting, and foraging during the migration. Marshes around Lake St. Clair also provide nesting and/or foraging grounds for great blue heron (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Great_Blue_Heron_Rookery.pdf), black crowned night heron (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Nycticorax_nycticorax.pdf), American bittern (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Botaurus_lentiginosus.pdf), least bittern (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Ixobrychus_exilis.pdf), black tern (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Chlidonias_niger.pdf), king rail (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Rallus_elegans.pdf) and northern harrier (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Circus_cyaneus.pdf)¹⁸⁰.

The St. Clair River Delta is one of the most critical areas for waterfowl breeding and staging during the migration in the entire Great Lakes Region. Waterfowl that breed in the St. Clair Delta include dabbling ducks; mallard, black

HIGHLIGHT

The St. Clair River Delta is one of the most critical areas for waterfowl breeding and staging during the migration in the entire Great Lakes Region.

duck, and blue-winged teal and one diving duck species--redhead. Far more species of waterfowl use the delta during the migration, as it is located on both the Atlantic Flyway and the Mississippi Flyway. Over 800,000 ducks pass through the area annually. Diving ducks such as canvasback, redhead and scaup feed on the wild celery, waterweed and pondweed of the submergent marsh, before heading southeastward to the Chesapeake Bay, although up to 15,000 overwinter on Belle Isle and the Detroit River. Dabbling ducks such

as green-winged teal, northern shoveler and northern pintail feed on the eelgrass, widgeon grass and seeds of sedges, bulrushes, wild rice, pondweeds and smartweeds. The area is a major staging ground for tundra swan and migratory Canada geese, as well^{181, 182}.

Lake St. Clair marshes provide valuable habitat for over 65 species of fish, either permanently, or on a temporary basis for spawning, nursery areas, shelter or feeding. Permanent residents include rock bass, bluegill, bullheads, channel catfish and white perch. A number of gamefish use the area also; northern pike, muskellunge, which spawns in the delta wetlands, walleye, yellow perch, smallmouth bass and crappie. Thirty-nine species of amphibians and reptiles use Lake St. Clair's marshes including salamanders, frogs, toads, turtles and snakes. Common mammals include muskrat, mink, raccoon, opossum and red fox^{183, 184}.

Rare birds that nest or forage in the marshes around Lake St. Clair include king rail (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Rallus_elegans.pdf), least bittern (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Ixobrychus_exilis.pdf), black-crowned night heron (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Nycticorax_nycticorax.pdf), common tern (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Sterna_hirundo.pdf), Forster's tern (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Sterna_forsteri.pdf), bald eagle (Federally listed as threatened, State threatened), northern harrier (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Circus_cyaneus.pdf), marsh wren (State species of special concern) and Louisiana waterthrush (State species of special concern). Rare reptiles include Blanding's turtle (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Emys_blandingii.pdf) and eastern fox snake (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Elaphe_vulpina_gloydi.pdf) and rare fish include northern madtom (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Noturus_stigmosus.pdf), pugnose shiner (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Notropis_anogenus.pdf) and pugnose minnow (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Opsopoeodus_emiliae.pdf). Rare plants associated with the marshes include swamp rose mallow (State species of special concern) and wild rice (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Zizania_aquatica_var_aquatica.pdf)^{185, 186, 187}.

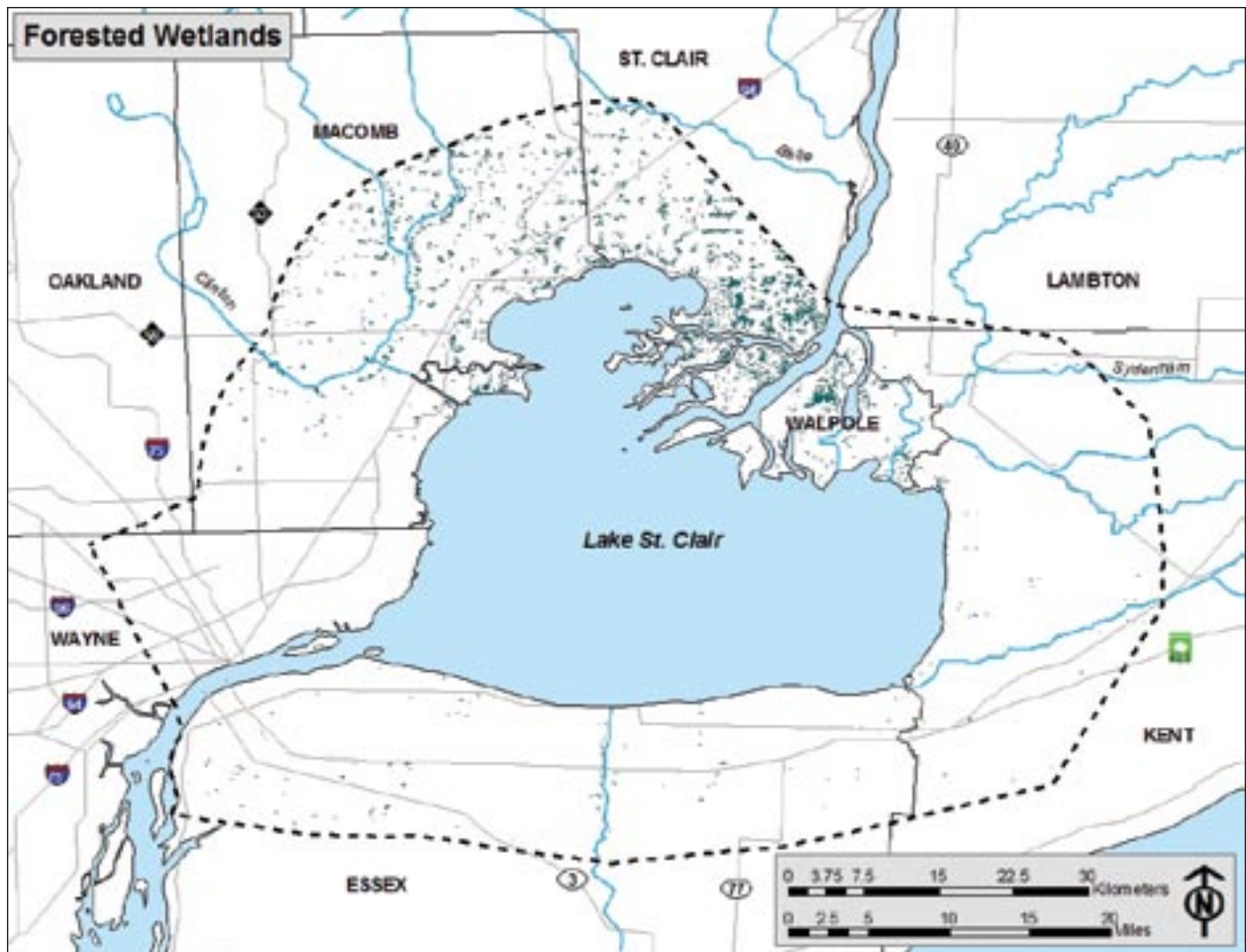


Figure IV B 3 - 1
Forested Wetlands

IV. B. 3. C-CAP land cover class: Palustrine forested wetlands

Palustrine forested wetlands include southern swamps and southern floodplain forests¹⁸⁸. Historically, forested wetlands were common within the project area prior to the extensive logging of the nineteenth century. The flat, poorly drained soils, the thick clay layer underlying a thin layer of sand or loam and a high water table resulted in an abundance of lowland hardwood forest throughout the Maumee lakeplain¹⁸⁹. Within the project area, wetland forest has declined from 17,113 acres to 16,686 acres between 1995 and 2000¹⁹⁰.

IV. B. 3. a. Southern swamp

Southern swamps are forested wetlands in isolated low areas with high water tables. Because they are not adjacent to rivers or streams, they do not experience flooding, although they may experience saturated soils and standing water in spring. Within the project area, they occur on low lying clay soils on the glacial lakeplain. Moisture and nutrients are generally available throughout the year but oxygen levels are low and the plants found there are adapted to these conditions. Swamps tend to have a high proportion of organic materials in their soils^{191, 192}.



Pin oak leaves and bark

Although nutrient levels are high, more mesic species such as sugar maple and American beech cannot invade because of the low levels of oxygen in spring. In prolonged periods of drought, they may gain a foothold but as wetter conditions return, they die off and are replaced by the black ash and red and silver maples, which can tolerate short periods of low oxygen. Windthrow is another important source of disturbance in southern swamps; trees tend to have shallow roots because of the high water table and heavy clays and as a result, are more easily uprooted during storms. The dead trees provide nest sites and dens for birds and small mammals, as well as habitat for invertebrates such as ants, termites and beetles¹⁹³. In the resulting gaps, shade intolerant species such as ashes and oaks can regenerate.

Typical tree species in Southern swamps include black ash, red maple, silver maple and historically, American elm. The massive die-offs of elms caused by Dutch elm disease resulted in rising water tables in many swamps and this rise contributed to increased mortality in other species. Other species which are commonly found in swamps include swamp white oak, pin oak, blackgum and American hornbeam¹⁹⁴.

Southern swamps have a high proportion of vines, including poison ivy, wild yam, hog peanut, groundnut and wild grape. Common shrubs include buttonbush, spicebush, silky dogwood, common elderberry and nannyberry. In areas which are inundated in spring, wildflowers are sparse, but in slightly drier spots, a fairly rich spring flora can develop. Typical species include green dragon, wood phlox, bishop's cap, wild geranium, mayapple, sweet Cicely, black snakeroot and honeysuckle. Sedges are particularly abundant and ferns such as sensitive fern, marsh fern and royal fern are common. Later in the season, Michigan lily, fringed loosestrife and spotted jewelweed are common¹⁹⁵.



Spicebush berries

Rare plants in southern swamps include showy orchis (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/botany/Galearis_spectabilis.pdf), false hop sedge (State threatened), pumpkin ash (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/botany/Galearis_spectabilis.pdf), Shumard oak (State species of special concern) and twinleaf (State species of special concern)¹⁹⁶. The cerulean warbler (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Dendroica_cerulea.pdf), Indiana bat (Federally listed endangered, State endangered) and red-shouldered hawk (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Buteo_lineatus.pdf) are found here as well¹⁹⁷.

IV. B. 3. b. Southern floodplain forest

Southern floodplain forests are a deciduous forest type that occurs on mineral-rich soils along large streams or rivers, on the adjacent flats. In contrast with southern swamps, they are flooded each spring but dry out by midsummer. Soils are circumneutral loams or silt loams and are enriched by the layer of silt which accompanies each season's inundation¹⁹⁸.

HIGHLIGHT
Floodplain forests are among the most diverse plant communities in the state. Flooding, bank cutting and sediment deposition result in characteristic land forms.

Floodplain forests are among the most diverse plant communities in the state. The processes of flooding, bank cutting and sediment deposition result in characteristic land forms; sandbars and mudflats, levees or ridges along the water where coarser sediments are deposited and terraces behind the levees. The lowest terraces, which flood most frequently, have poorly

drained clay or silty clay soils. The plants that occur here are adapted to extremely low oxygen levels. Higher terraces, which flood less frequently, have better drainage and levels of oxygenation. Patterns of species distribution follow the variations in micro-site conditions¹⁹⁹.

On recently deposited soils of sandbars and mudflats, fast-growing cottonwoods and willows are typical. Higher up, on the levee, swamp white oak, bur oak, shagbark hickory, American hornbeam and redbud are common. Behind the levee on the first terrace, silver maple and red ash are common as they can tolerate the extremely low oxygen levels that are present during flooding. American elm was formerly an important component of this community, prior to the advent of Dutch elm disease. On the second terrace where drainage is better, bur oak and shagbark hickory appear again and species such as red oak, white ash and tuliptree appear for the first time^{200, 201}.

In spring, cool air settles in the low river valleys where the water warms up slowly and as a result the trees do not leaf out until much later than higher areas nearby. Because of this, they are a refuge for more southern species which would suffer frost damage on the adjacent uplands, where temperatures rise earlier in spring but late frosts are common. Later

FACT

Because of the flooding, fewer seedlings and saplings survive and as a result, floodplain forest tends to be more open, with very large trees.

in summer the floodplains are hotter and more humid than the uplands nearby. Southern species which reach their limit in Michigan's southern floodplain forest and Ontario's Carolinian Forest include honey locust, Ohio buckeye, paw-paw, redbud, blue ash, Kentucky coffee-tree, sycamore and hackberry²⁰².

In the southern mesic forest described earlier, in the absence of fire, shade tolerant species such as beeches and maples will eventually dominate, as less shade tol-

erant species cannot develop under their dense shade. On the floodplain, in contrast, the shallow-rooted trees are prone to frequent wind throw and upheaval during flood events. The resulting gaps are exploited by shade intolerant trees that continue to make up a permanent part of the community.

Because of the flooding, fewer seedlings and saplings survive and as a result, floodplain forest tends to be more open, with very large trees. Multi-stemmed trees are common. The understory in the lowest areas tends to have fewer plants also. As in southern swamps, vines such as poison ivy are common because they can cling to trees and rise above the flood waters. Moonseed, wild yam, wild grape and bittersweet are typical. Sedges, nettles and members of the carrot family are particularly well represented also. In the lowest areas there are few spring wildflowers because of the spring floods but green-headed coneflower, calico aster, purple Joe-Pye-weed and spotted jewelweed bloom later in the season. At slightly higher elevations where flooding is less severe, wild flowers such as green dragon, cut-leaf toothwort, yellow trout-lily and spring cress appear. Common floodplain shrubs include buttonbush, ninebark, American bladder-nut, spicebush and prickly-ash²⁰³.

The riparian corridor within southern floodplain forest can often provide vital linkages for wildlife, particularly in urban areas. White-tail deer, fox and coyote can travel along the river's edge and other mammals such as raccoon, opossum, muskrat, weasel, beaver, bats, squirrels, chipmunk and flying squirrel are typical. Small mammals, such as voles and shrews are common and provide a valuable food source for numerous carnivores²⁰⁴.



Giant swallowtail on purple Joe-Pye-weed

Floodplain forests are particularly rich in bird species because of water availability, specialized nesting habitats and the abundance of insects and other invertebrates along the river's edge. Insectivorous species such as eastern phoebe, great crested flycatcher, blue-gray gnatcatcher, rough-winged swallow, northern oriole and warbling vireo are often found here²⁰⁵. Wood duck utilize cavities in trees along the river and mallards and American black duck are also typical.

Rare plants found in floodplain forest include cup-plant (Threatened), Virginia water horehound (Threatened), twin-leaf (State species of special concern), showy orchis (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Buteo_lineatus.pdf), false hop sedge (State threatened), red mulberry (Threatened), pumpkin ash (http://web4.msue.msu.edu/mnfi/abstracts/zoology/Buteo_lineatus.pdf), Shumard oak (State species of special concern) and wahoo (Species of special concern). The cerulean warbler (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Dendroica_cerulea.pdf), Louisiana water thrush (State species of special concern), Indiana bat (Federally listed endangered, State endangered) and red-shouldered hawk (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/zoology/Buteo_lineatus.pdf) are also found here.

IV. B. 4. Palustrine scrub/shrub (Southern shrub carr)

Southern shrub carr is a shrub-dominated community which undergoes fluctuating water levels. It can occur along streams, rivers and lakes, typically in glacial outwash, ice contact topography, or end moraine. Soils are neutral to slightly alkaline muck, and retain moisture²⁰⁶. According to C-CAP satellite data, about 12,000 acres (4,856 hectares) of southern scrub carr remain²⁰⁷. Large tracts of forested and scrub-shrub wetlands probably occurred historically in the downstream areas of the Clinton River watershed²⁰⁸. High-quality remnants still persist in the St. Clair Delta, in St. John's Marsh and on Walpole Island.

Within the southern shrub-carr, typical shrub species present include gray dogwood, silky dogwood, red-osier dogwood, elderberry, winterberry and buttonbush. Herbaceous species such as water plantain, blue-joint grass, swamp milkweed, marsh bellflower, marsh fern and boneset are also present. In much of the project area, this system has been

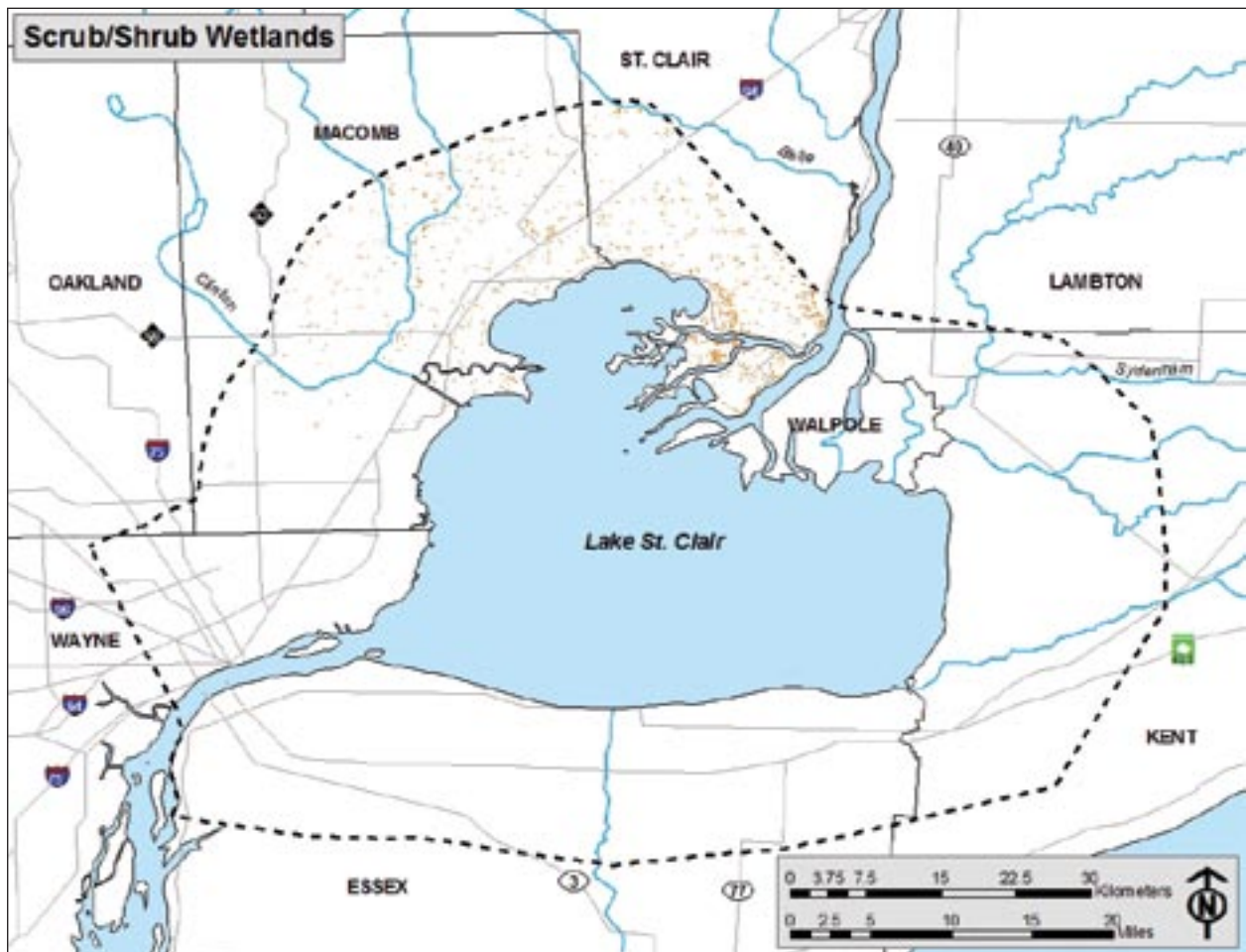


Figure IV B 4 - 1
Scrub/shrub wetlands

destroyed, as land was cleared nearly up to the water's edge for agriculture. A related community, the inundated shrub swamp is dominated by buttonbush and plants adapted to deeper water levels^{209, 210}.

Southern shrub carr provides habitat for furbearing mammals such as muskrats, mink, beaver and raccoons, as well as deer and rabbits. The shrubby vegetation provides valuable cover for songbirds such as song sparrow, swamp sparrow, marsh wren and yellow warbler. The northern copperbelly water snake (State Endangered and Federally Threatened) is also found here²¹¹.

IV. B. 5. Open water

Within the C-CAP classification scheme open water consists of all areas of open water, generally with cover of less than 25 percent of vegetation or soil. Open water can occur as lakes (lacustrine), rivers (riverine), reservoirs, ponds, streams or oceans.



Buttonbush fruit

IV. B. 5. a. Lacustrine open water (basin > 8 hectares)

Lake St. Clair is productive and provides habitats for a diverse biota including invertebrates, fish, mammals, and waterfowl²¹². The historical fish communities in Lake St. Clair contained abundant lake sturgeon (http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Acipenser_fulvescens.pdf) and runs of cold water fishes, including lake trout, lake whitefish, and lake herring that once supported commercial fishing in the lake²¹³. Many of the native fishes have been eliminated

by commercial fishing, habitat destruction, wetland losses, introduction of exotic fishes, invasion by exotic species, and degradation of water and substrate quality. Recent recreational fishing is primarily for yellow perch, walleye, smallmouth bass, muskellunge, white and freshwater drum.

HIGHLIGHT

The historical fish communities in Lake St. Clair contained abundant lake sturgeon and runs of coldwater fishes that once supported commercial fishing in the lake. Many of the native fishes have now been eliminated.

from the St. Clair delta and offshore from the Clinton River), and in the nearshore areas around the lake. Lake sturgeon dominated assemblages were found near the eastern outlets of the south and cut off channels where there are faster currents²¹⁴ and sandy substrates (Chris Marvin, Environment Canada, Burlington, Ontario, personal communication). Assemblages heavily dominated by invading round goby and endemic yellow perch were in shallower waters. Assemblages dominated by gizzard shad and mimic shiner were found at a variety of depths. Assemblages with a high percentage of shiners and mimic shiners as well as a diverse even mix of fish species were primarily in the nearshore areas.

Recent survey data of fish from the MDNR were analyzed by the USGS Great Lakes Aquatic Gap project (Burke Greer, personal communication). Fish assemblages dominated by yellow perch, spottail shiner, and trout perch were found in the deeper open waters of the lake, in Anchor Bay (in a location downstream

The MDNR data on surveys of fish spawning throughout Lake St. Clair show that Lake St. Clair proper, its near shore areas and St. Clair flats are highly productive spawning areas. These spawning sites support fish communities and fish-

ROBERT HAAS - MDNR TRAWL-CAUGHT FISH DATA FOR LAKE ST CLAIR STANDARDIZED TO CPUE (Fish/HA)

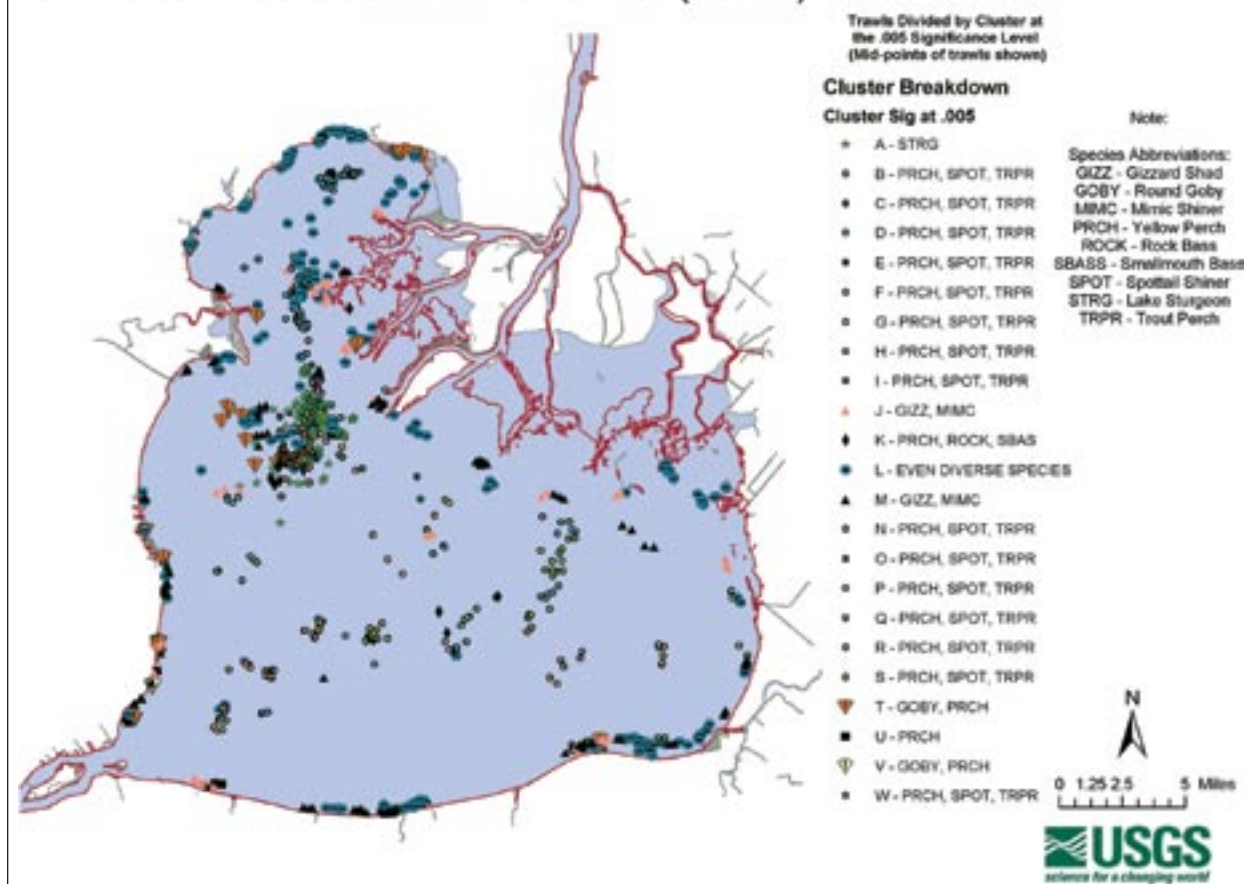


Figure IV B 5 a – 1
Fish Assemblages across Lake St Clair

eries in Lake Huron, Lake Erie, Lake St Clair, and in the St Clair and Detroit rivers. The MDNR data show thirty species spawning in the lower reaches of the St Clair River and the estuary-like St Clair flats region. Included are alewife, bluegill, carp, channel catfish, freshwater drum, gizzard shad, lake sturgeon, lake whitefish, largemouth bass, muskellunge, northern pike, smallmouth bass, walleye, white bass and yellow perch. Anchor Bay supports twenty-seven species at many spawning sites including alewife, blue gill, carp, channel cat, gizzard shad, lake sturgeon, largemouth bass, muskellunge, northern pike, smallmouth bass, walleye, and yellow perch. The nearshore areas of the eastern and western coastlines of Lake St Clair including the Clinton and Thames river mouths as well as other smaller tributaries are spawning grounds for twenty-five species including bluegill, carp, channel catfish, muskellunge, northern pike, white bass and yellow perch. The mouths of the Clinton and Thames rivers historically have also been spawning grounds for sea lamprey. The reason for their limited spread within Lake St Clair is due to lack of spawning habitat in the tributaries to Lake St Clair required for sea lamprey spawning. No fish spawning was observed in the offshore, deeper areas of the lake.

Surveys of zooplankton from different parts of Lake St. Clair showed that cladocerans or waterfleas, particularly bosminids, were the predominant group in both abundance and biomass. In other Great Lakes copepods are usually dominant. Lake St. Clair may be considered more typical cladoceran habitat because it is shallow, productive, and currently does not contain dense populations of plankton eating fish, such as lake herring, which previously occupied the lake. Zooplankton are important food for young fish.

The benthic macroinvertebrates of Lake St. Clair are diverse. A survey of 47 stations, which covered the entire lake and the lower St. Clair River, found 101 taxa of invertebrates. In general the system supports organisms associated with

relatively unpolluted waters²¹⁵. Benthic invertebrates are a predominant component of food webs leading to fish for shallow waters.

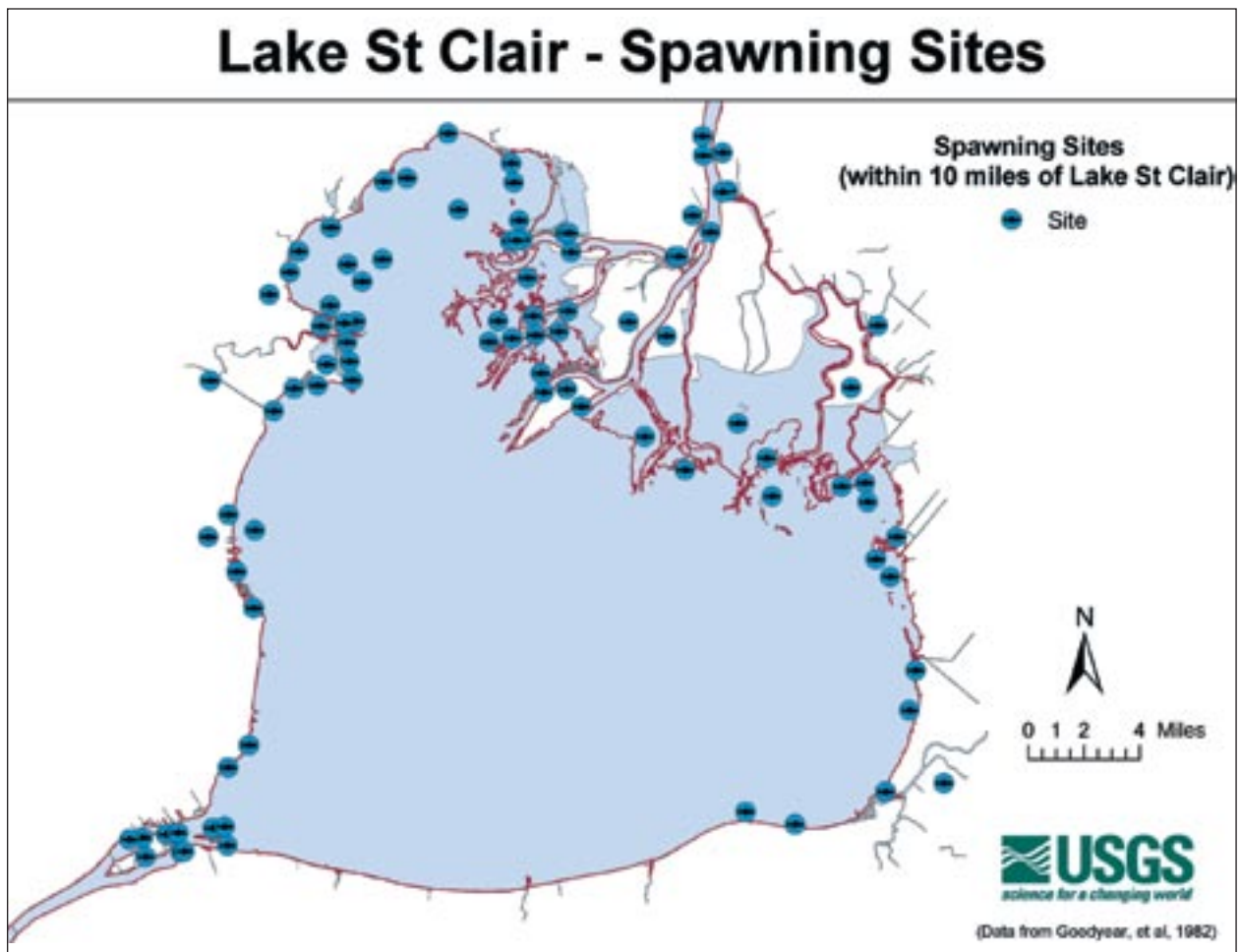


Figure IV B 5 a – 1
Fish Assemblages across Lake St Clair

IV. B. 5. b. Riverine open water

The Clinton River is the major watershed to Lake St. Clair on the American side of the lake. Historically, numerous high gradient reaches in the Clinton River provided excellent habitat for species such as smallmouth bass and served as spawning areas for potamodromous stocks of species such as sturgeon and walleye²¹⁶. During surveys in 1990 and 1991, the Michigan Department of Natural Resources (MDNR) estimated that over 50% of the walleye population

HIGHLIGHT

Historically, numerous high gradient reaches in the Clinton River provided excellent habitat for species such as smallmouth bass and served as spawning areas for potamodromous stocks of species such as sturgeon and walleye.


was contributed by stocked fingerlings. For the Clinton River watershed, the MDNR lists 52 species of fish in the database developed by the USGS Great Lakes Regional Aquatic Gap Analysis Project (Paul Steen, personal communication.). Some of the recreational fishes include brook trout, brown trout, rainbow trout, northern pike, largemouth bass, walleye, yellow perch, bluegill, black crappie, white crappie and bluegill. Other larger fish include carp, channel catfish, and golden redhorse. Other species of native lampreys, darters, dace, minnows, shiners, sculpins, and chubs are important in the Clinton River ecosystem.

The head of the Detroit river is also home to spawning for many of the already listed species especially lake sturgeon. Spawning grounds are thought to be around Peach Island. USGS has recently built lake sturgeon spawning habitat offshore from Belle Isle²¹⁷.

A survey of the Clinton River in 1977-1978 found 26 species of freshwater mussels, including four species on Michigan's rare and endangered species list. This number compares with 31 species found between 1870 to 1933²¹⁸. Urban pollution has destroyed mussel habitat in parts of the river basin.

The Thames River in Ontario was designated a Canadian Heritage River in 2000. The Thames sustains one of the most diverse fish communities in Canada. The watershed's complex system provides a broad range of habitats for

GAP
Relatively few published current data on aquatic biota and habitat are available on Lake St. Clair and its tributaries.




some 88 fish species. Walleye, longnose gar, bullheads, bass and Chinook salmon are just some of the species found here. Approximately 30 species of freshwater mussels are also recorded (www.chrs.ca/Rivers/Thames/Thames-F_e.htm#2).

The Sydenham River, a tributary in northwestern Lake St Clair, is found in the Mixedwood Plains Ecozone, the most diverse ecozone in Canada²¹⁹. The aquatic

community historically supported 80 fishes and 34 species of freshwater mussel. However, this river's diversity has declined. Fourteen aquatic species (8 fishes, 5 mussels, and 1 turtle) are designated as endangered, threatened by the Committee on the Status of Species at Risk in Canada (COSEWIC)²²⁰. Metcalfe and Smith reported that surveys between 1971 and 1991 suggested that the mussel communities were in decline. Only 13 to 26 of native species were still present²²¹.

Relatively few published current data on aquatic biota and habitat are available on Lake St. Clair and its tributaries. The delta area of the St. Clair River is included generally in the lacustrine sections of this report.

FACT
Aquatic Beds are characterized by plants that form a continuous layer on or at the water's surface.




IV. B. 6. Palustrine aquatic beds

Aquatic Beds are characterized by plants that form a continuous layer on or at the water's surface. They can include algal mats, detached floating mats and rooted plants which are submerged or have floating leaves, and at least 80 percent of their area is vegetated. Aquatic Beds can occur within inland and Great Lakes marshes where they are often referred to as the submergent

zone. Aquatic Beds can also occur further out from the shore, where there is sufficient light to permit plant growth. The C-CAP classification scheme refers to all freshwater bodies of water as palustrine, but many wetland ecologists use the term palustrine to refer only to non-tidal bodies of water that are smaller than 8 hectares.

FACT
The C-CAP classification scheme refers to all freshwater bodies of water as palustrine, but many wetland ecologists use the term palustrine to refer only to non-tidal bodies of water that are smaller than 8 hectares.



water that are smaller than 8 hectares. Similarly, the terms riverine and lacustrine may be used to denote systems in rivers or lakes. While it may be confusing, the term Palustrine in this section's heading (IV. B. 6.) refers to the C-CAP land cover type, and the individual habitats described in the subsections below (IV. B. 6. a., b., & c.) are named to reflect their aquatic setting²²².

IV. B. 6. a. Palustrine (proper) aquatic beds

Palustrine aquatic beds occur in ponds or non-tidal

bodies of water that are smaller than 8 hectares. They are characterized by plants that form a continuous layer on or at the water's surface. They can include algal mats, detached floating mats, and rooted plants, which are submerged, or have floating leaves. Again, at least 80 percent of their area is covered by some sort of vegetation. In marshes, aquatic beds are often referred to as the submergent zone, where they occur in association with emergent vegetation along the shoreline. Aquatic beds can also occur further out from the shore, where there is sufficient light to permit plant growth²²³.

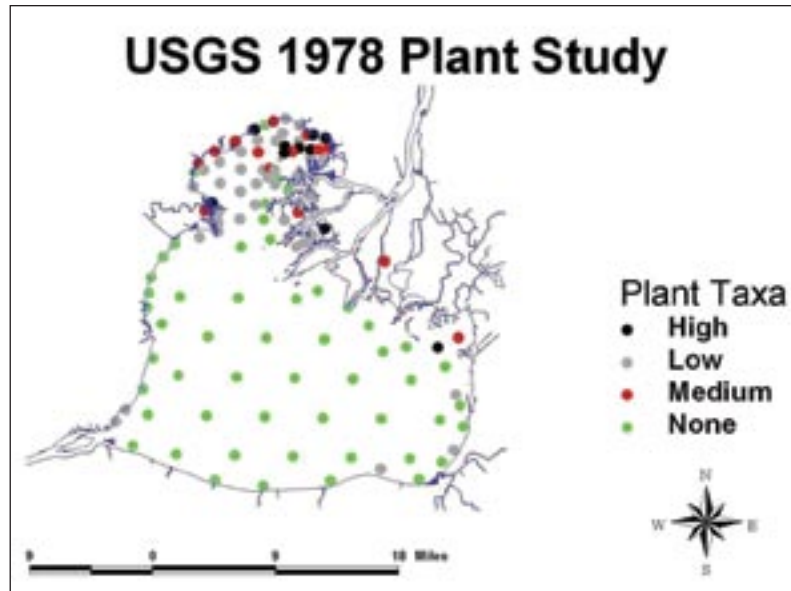


Figure IV B 6 b – 1

The distribution of aquatic vegetation across Lake St. Clair
(Robert Haas, Bruce Manny, Don Schloesser)

IV. B. 6. b. Lacustrine aquatic beds

Lacustrine aquatic beds occur in lakes and are characterized by plants that form a continuous layer on or at the water's surface. Like palustrine aquatic beds, they can include algal mats, detached floating mats, and rooted plants, which are submerged, or have floating leaves. Again, at least 80 percent of their area is covered by some sort of vegetation. In marshes, aquatic beds are often referred to as the submergent zone, where they occur in association with emergent vegetation along the shoreline. Aquatic beds can also occur further out from the shore, where there is sufficient light to permit plant growth²²⁴. In areas protected from strong wave action, such as Anchor Bay, the bottom is almost entirely populated with plants, whereas they are scarce in the main part of the lake where the bottom is scoured by waves²²⁵.

At least 21 submersed aquatic plant taxa occur in the St. Clair system²²⁶. Of these, seven taxa are common in Anchor Bay: wild celery, muskgrass, Eurasian watermilfoil, waterweed, as well as varieties of pondweed such as variable pondweed, redhead grass and narrow-leaf pondweed.

In Mitchell Bay, 15 taxa of submersed vegetation were found, but only four species contributed over 90% of the overall mean biomass, i.e., wild celery, muskgrass, horned pondweed and Eurasian water milfoil²²⁷. Six taxa are common in Lake St. Clair proper: wild celery, muskgrass, redhead grass, Eurasian watermilfoil, waterweed, and water stargrass²²⁸.

Exotic species are also found in aquatic beds. Curly pondweed, an exotic submersed macrophyte taxa appears early in spring, is colonized by invertebrates that are eaten by waterfowl on their northern migration, and is also important as spawning substrate for fish²²⁹. Another exotic submersed macrophyte, Eurasian water milfoil can crowd out other underwater plants used by fish and waterfowl, but it provides an over wintering mat of decaying vegetation on which many aquatic invertebrates can feed²³⁰.

In summer of 1994, unusually high quantities of submersed aquatic macrophytes floated into nearshore waters of the western and southern shores of Lake St. Clair, creating a nuisance²³¹. Intensive sampling of 126 stations in the Lake St. Clair system in 1995 showed an increase in number of taxa, greater distribution, and greater abundance of aquatic macrophytes compared with earlier studies in 1978²³². Macrophytes occurred at 92% of the stations, including the deeper waters, compared with 59% of the stations during 1978. Figure 2 shows the biodiversity of submersed macrophytes in 1995. Pondweed narrow-leaf forms, unknown narrow-leaf forms, Pondweed broad-leaf forms, water milfoil species, curly pondweed and an unknown submersed sedge entered Lake St. Clair proper between 1978 and 1995. During this time period, clarity of the water increased allowing greater light penetration, presumably because of removal

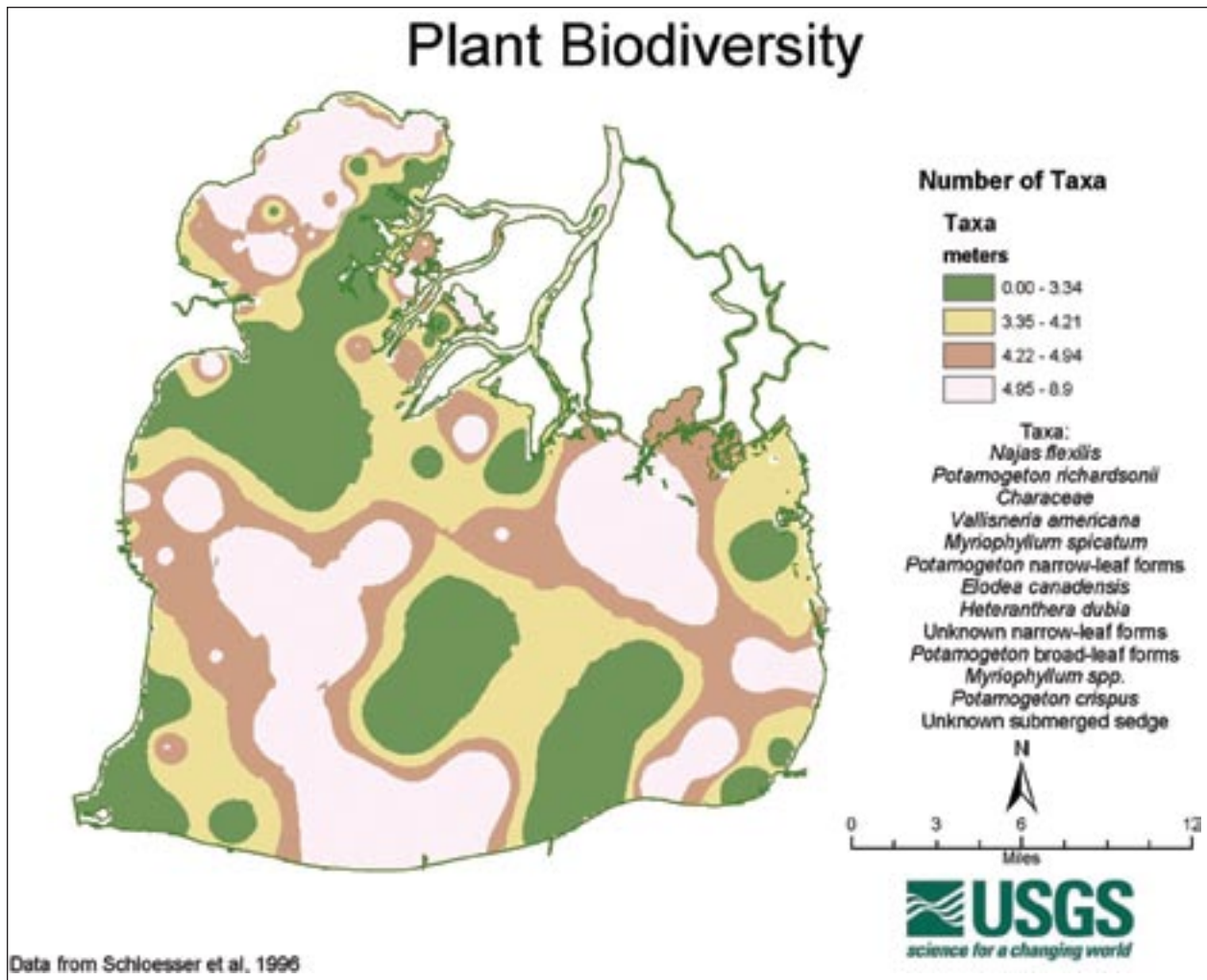


Figure IV B 6 b – 2
The number of plant taxa found in Lake St. Clair

of suspended materials by the invading zebra mussels. In addition discharges of sewage increased, which added plant nutrients such as phosphorus and nitrogen to the water²³³.

The introduction and spread of the exotic zebra mussel throughout Lake St. Clair has decimated native unionid mussel populations. Historically North America supported the greatest diversity of freshwater mussels in the world. The rivers draining into Lake St. Clair, the St. Clair delta and the Detroit River were home to a diverse assemblage of freshwater mussels that are now rare, including rayed bean (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Villosa_fabalis.pdf), purple lilliput (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Toxolasma_lividus.pdf), purple wartyback (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Cyclonaias_tuberculata.pdf), northern riffleshell (Federal and state endangered - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Epioblasma_torulosa_rangiana.pdf), snuffbox (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Epioblasma_triquetra.pdf), wavy-rayed lamp (State threatened - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Lampsilis_fasciola.pdf), hickorynut (State species of special concern - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Obovaria_olivaria.pdf) and round hickory nut (State endangered - http://web4.msue.msu.edu/mnfi/abstracts/aquatics/Obovaria_subrotunda.pdf) (Personal communication, Doug Sweet, 2005). Urban development and pollution has destroyed mussel habitat in most of the area, however, and they have been devastated by the introduction of zebra mussels; native mussel diversity and abundance has been drastically reduced. Zebra mussels attach to a unionid's shell where they interfere with activities such as feeding, respiration, excretion, and locomotion, and effectively starve it to death. Although native mussels have been extirpated from most of Lake St. Clair, refuge sites exist,

primarily in shallow waters (< 1 m) of the St. Clair delta and the eastern shore of the lake. The St. Clair delta refuge site discovered in 1998-2001 (Figure 3) includes both wave-washed flats with firm sandy substrates and wetland areas with soft, muddy sediments²³⁴. More recent observations through 2004 indicate that these refuge areas are remaining stable for native mussels (Donald W. Schloesser, USGS, personal communication, 2004).

Burrowing mayflies are sensitive to environmental degradation and are absent or low in numbers from areas with poor sediment and water quality. Extensive sampling of the sediments of Lake St. Clair in 1985 produced an average of 279 burrowing mayfly nymphs per square meter, with the highest density being 3,099 nymphs per square meter (Schloesser et al. 1991). Subsequent sampling for burrowing mayfly nymphs at a single station in Lake St. Clair have shown a decline in nymphs to less than 100 nymphs per square meter in the spring of 2004 (Donald W. Schloesser, USGS, personal commun., 2004).

IV. B. 6. c. Riverine aquatic beds

Urban and industrial development has altered the fish community in riverine ecosystems. A survey of the Clinton River drainage by Smith et al. (1981)²³⁵ failed to collect three fish species that require slow, weedy areas for spawning, i.e., the central mudminnow, grass pickerel and brook stickleback²³⁶. Of the 52 species of fish listed by the MDNR (see below) for the Clinton River, probably a number of these fish depend on the aquatic bed of the river for spawning and nursery areas.

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