
Emergency Contingency Survey of State Forest Land in Emmet County



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**MICHIGAN STATE
UNIVERSITY
EXTENSION**



Cover photograph: Recent windthrow generating a small-scale light gap within mature mesic northern forest surveyed on state forest land in Emmet County (All photographs by Joshua Cohen).

INTRODUCTION

In the summer of 2006, the Forest, Minerals and Fire Management Division of the Department of Natural Resources commissioned Michigan Natural Features Inventory (MNFI) to conduct an ecological survey of forest on state land in Emmet County proposed by the Mackinaw Forest Council for designation as a biodiversity conservation area. The Mackinaw Forest Council recommended a total of 14 sites for consideration, which totaled 2005 acres (Figures 1 and 2). The proposed area falls within the Gaylord Forest Management Unit, Indian River Compartments 101, 102, 104, and 105. The purpose of the MNFI survey was to assess the quality of the forest and determine if any of the sites recommended by the Mackinaw Forest Council qualified for consideration as high-quality examples of mesic northern forest as defined by MNFI's grading and ranking criteria and standard Natural Heritage methodology (Appendix 1 details MNFI's grading and ranking criteria for mesic northern forests).

METHODS

When applying Natural Heritage and MNFI methodology, three factors are considered while assessing a site's quality: size, landscape context, and condition. If a site meets defined requirements for these three criteria it is categorized as a notable example of that natural community type and entered into MNFI's database as an element occurrence and given a ranking based on the consideration of its size, landscape context, and condition. A growing season survey was conducted to assess the condition of the sites, while a combination of ground surveys, aerial photographic interpretation, and Geographic Information System (GIS) analysis were employed to determine the size and the landscape context of the 14 forest sites.

Surveys were conducted August 14-18, 2006. Surveys involved running cardinal direction transects throughout the entire extent of the 14 sites or polygons, cataloging the native flora, describing the sites' structural attributes and ecological processes, aging canopy dominants, analyzing the soils, noting current anthropogenic disturbance, ground-truthing aerial photographic interpretation using Global Positioning Systems (both Garmin and HP IPAQ units were utilized), and surveying adjacent forest to assess landscape context. To maximize the area surveyed through each of the sites, transect surveys were employed. Depending on the shape and size of the polygon, transects were typically oriented either

east-west or north-south and spaced approximately 0.2 mile. GPS points were typically taken every tenth of a mile along the transects (Figures 3-8).

RESULTS

Within this section location, landscape and abiotic context, site summaries, and site specific biodiversity management recommendations are provided for each of the surveyed areas.

SITE 1

Location

This site occurs just south of Wormwood Road in sections 19 and 30 and in the southwestern corner of section 20 of T37N, R6W. The site falls within Gaylord Forest Management Unit, Indian River Compartment 101, and includes or includes portions of stands 5 (M9), 6 (M9), 7 (M9), 8 (M9), and 9 (M9).

Landscape and Abiotic Context

This polygon falls within Sub-subsection VII.6.2 and the Landtype Associations (LTAs) 1122 and 2222 (Figures 1 and 2). LTA 1122, which is characterized by steep moraine ridges, few lakes, and well drained sandy loam soils, occurs in all but the southeastern corner of this polygon where LTA 2222 is found. LTA 2222 is characterized by large, broad moraine ridges, few lakes and well drained sandy loam soils. The site occurs on rolling to steep topography with well-developed pit and mound topography. Soils are slightly acidic (pH of 5.5-6.0) loamy sands.

Site Summary

This stretch of forest is predominantly mature uneven-aged (80-100 years old) northern hardwoods with some pockets of older trees (approximately 130 years) and scattered older trees throughout (Photograph 1). Canopy dominants include sugar maple, beech, white ash, and red oak. Diameters are primarily 30-50cm (~12-20 in) with some scattered larger trees and pockets of larger trees 60-70cm (~24-28 in). Hemlock is an important subcanopy component in the northwestern portion of the polygon. Low to moderate levels of coarse woody debris were observed. Coarse woody debris is dominated by early- and mid-successional species of small diameters, 20-30cm (8-12in), although some scattered large-diameter beech snags and windthrow were noted. A high percentage of the acreage is composed of early-successional forest of bigtooth aspen and/or white birch, especially in the southern half of the polygon. Numerous roads and old skid trails pass throughout the area. Management history for the site as a whole is varied with some areas having old cut stumps throughout and other areas having none. More recently cut areas (70-90 years ago) with aspen clones and white birch do not

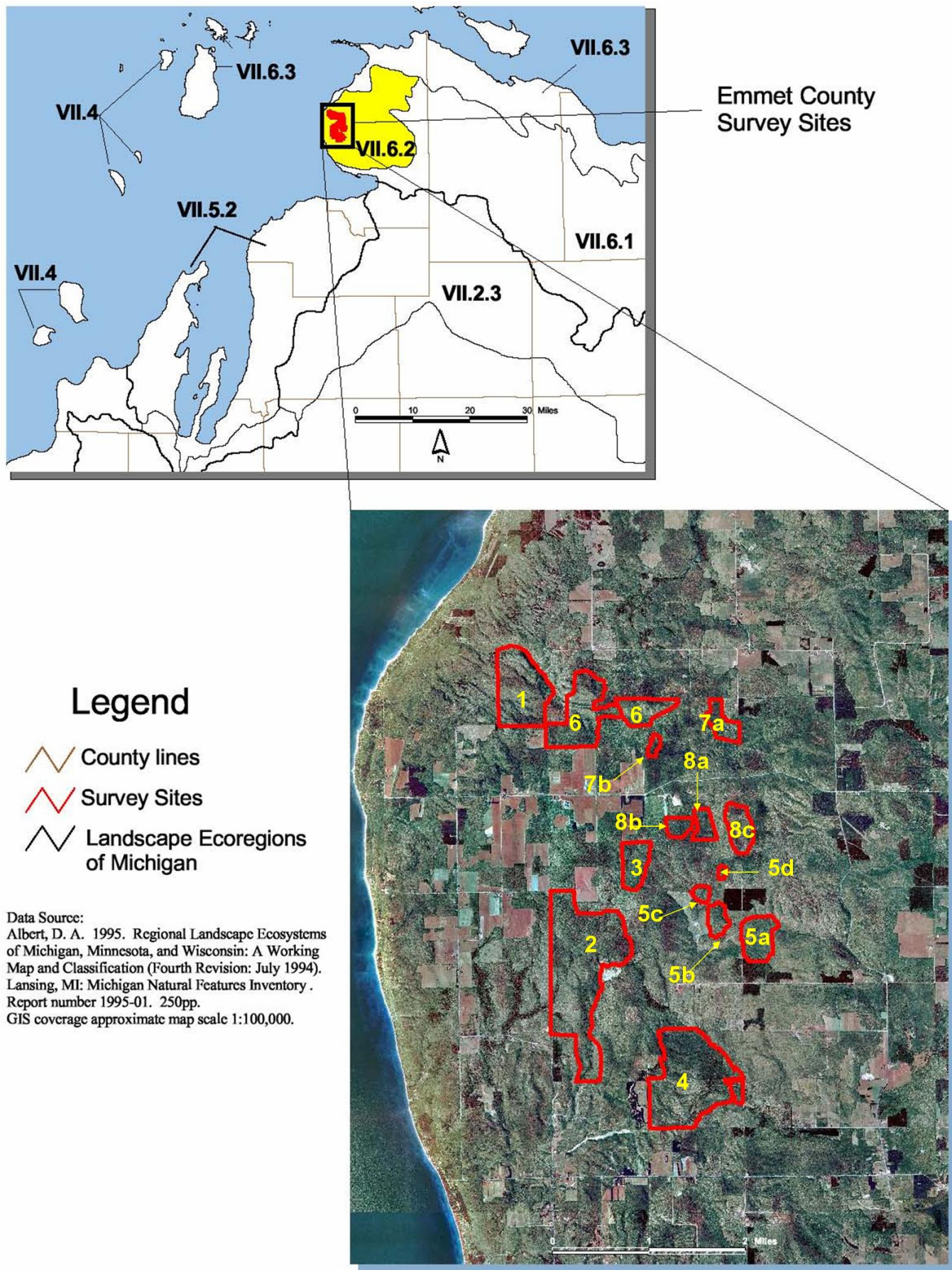
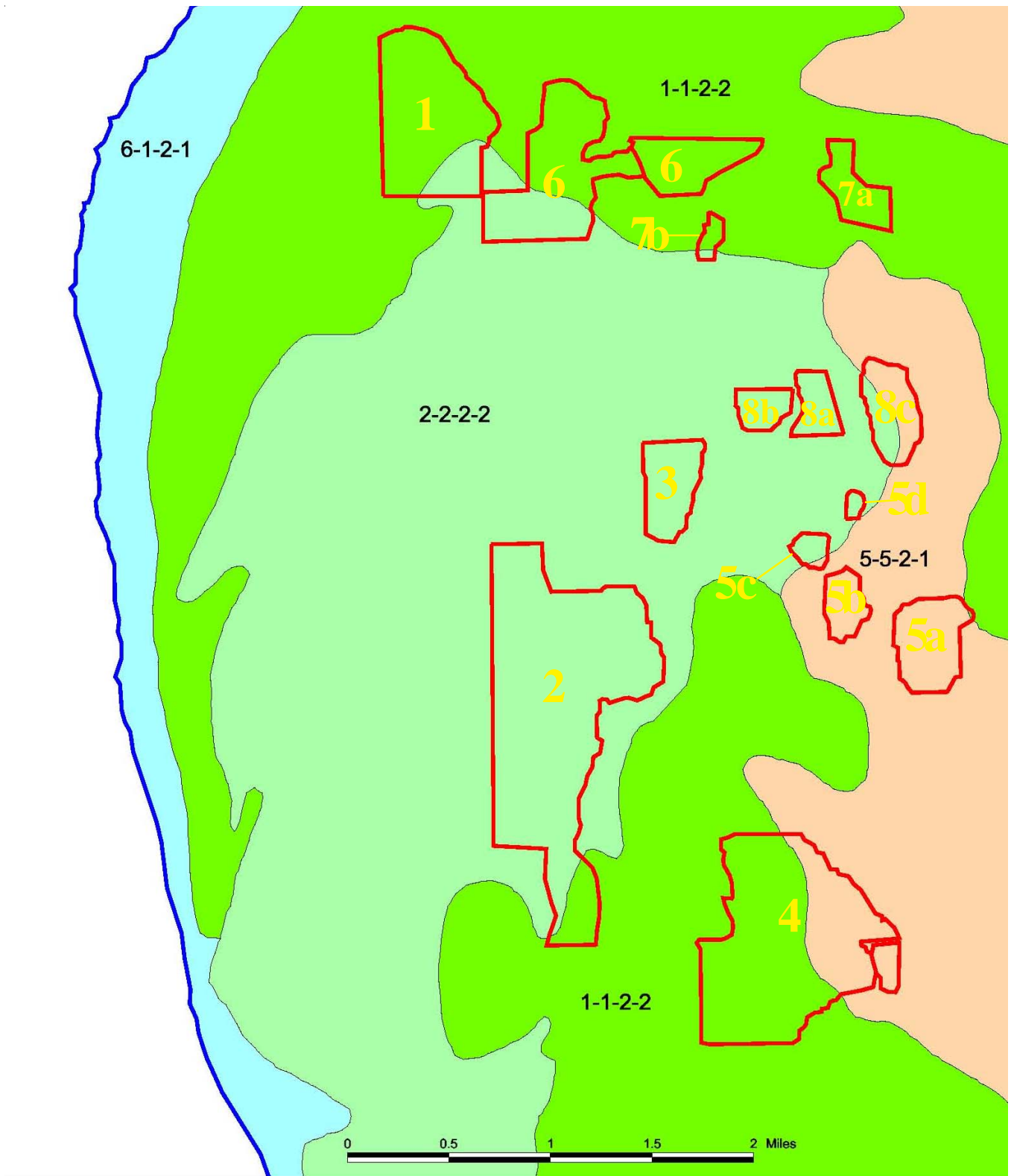


Figure 1. The 2005 acres of surveyed forest fall within Sub-subsection VII.6.2 in Emmet County (Top). Surveys were conducted in 14 polygons that were treated as 8 sites (Bottom, overlying 1998 aerial imagery).



 Emmet County survey sites

Land type association

1-1-2-2 Moraine ridges, steep, broken topography, few kettle lakes, well drained to moderately well drained, sandy loam

2-2-2-2 Moraines or till plains, large, broad ridges, few or no lakes, well drained to moderately well drained, sandy loam

5-5-2-1 Outwash plain, narrow channel - floodplain, well drained to moderately well drained, sand or loamy sand

6-1-2-1 Lake plain, flat, well drained to moderately well drained, sand or loamy sand



Figure 2. Emmet County survey sites overlying Landtype Associations (Corner and Albert 1999).

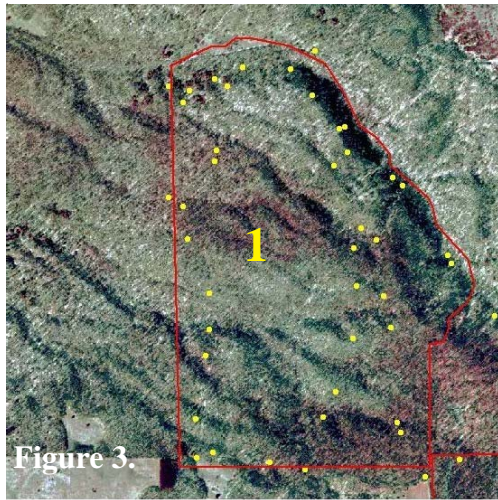


Figure 3.



0 0.4 Miles

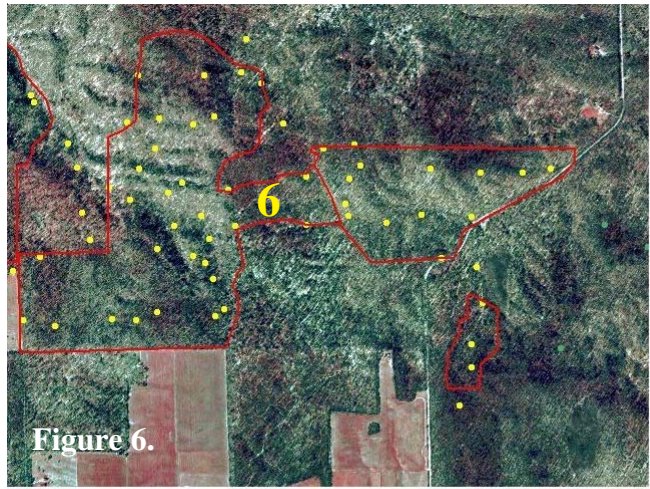
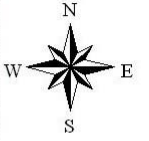


Figure 6.



0.5 0 0.5 1 Miles

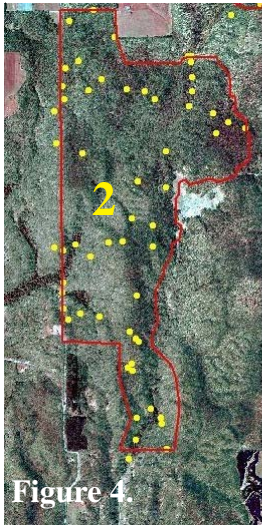


Figure 4.



0 0.9 Miles

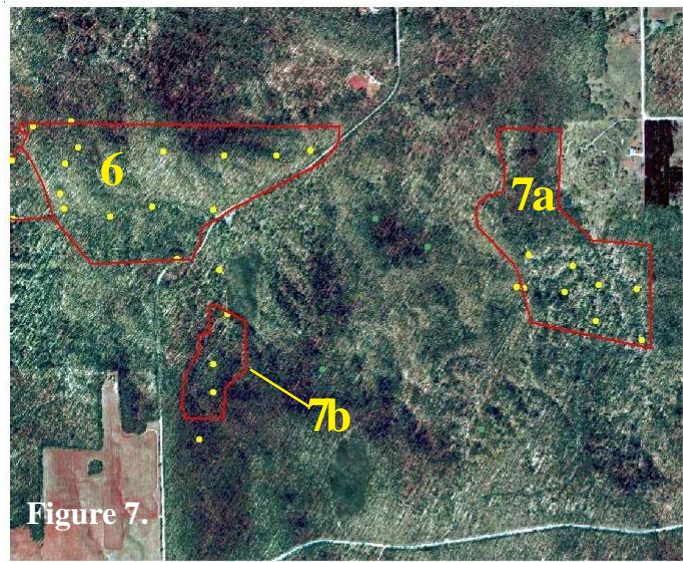
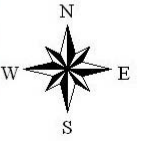


Figure 7.



0.4 0 0.4 0.8 Miles

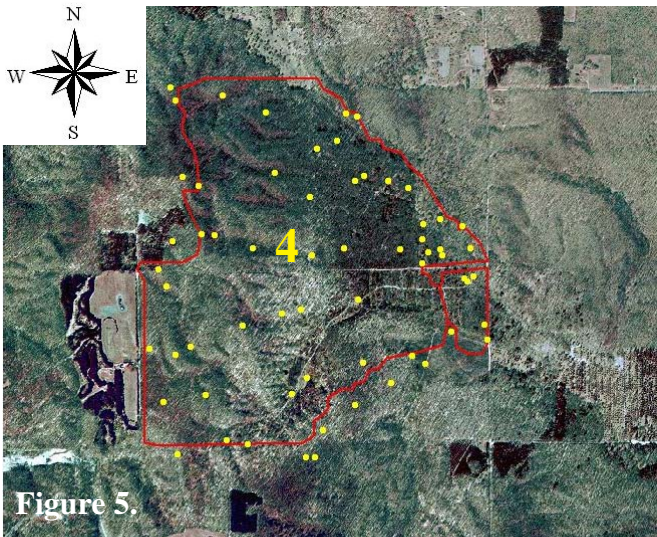
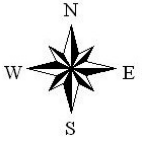


Figure 5.



0.6 0 0.6 1.2 Miles

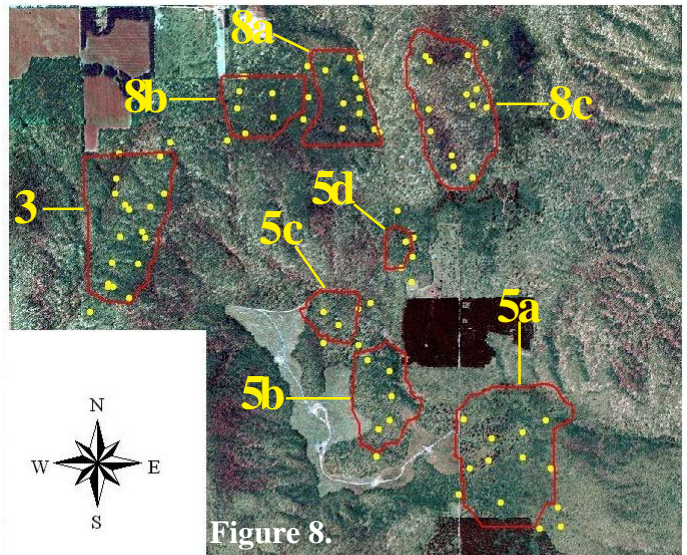
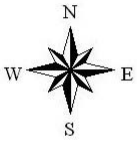


Figure 8.



0.7 0 0.7 1.4 Miles

Figures 3-8. GPS points were taken within each polygon approximately every tenth of a mile along cardinal transects that were typically separated by two tenths of a mile (Polygons and GPS points overlying 1998 aerial imagery).

SITE 1 (continued)

have cut stumps. Many of the larger residual trees have logging damage on their root collars and boles.

Aerial photographic interpretation indicates that Canada yew was likely an important component of the shrub layer just eight years ago. No Canada yew was observed during the survey and it appears as if deer have decimated this plant population (Deer were observed throughout the polygon).

The native flora for this site is typical of mesic northern forest occurring on loamy sands. During the survey, forty-four native species were noted (A list of these species is provided in Appendix 2). As noted above, the canopy is dominated by sugar maple, beech, white ash, and red oak with bigtooth aspen and white birch occurring as local dominants. Canopy associates include black cherry and basswood. Hemlock is important in the subcanopy in the northwestern portion of the polygon and striped maple and ironwood are also important in this layer along with beech and sugar maple. The understory is dominated by shade-tolerant saplings of beech and sugar maple with striped maple and American fly honeysuckle also prevalent. Prevalent ground cover species include hairy sweet cicely, jack-in-the-pulpit, wild leek, spinulose woodfern, doll's eyes, blue cohosh, Canada violet, maiden hair fern, common trillium, and blue-stemmed goldenrod.

Portions of the western and northwestern extent of the polygon were classified as a CD-ranked mesic northern forest (See Figure 9 for polygon delimiting extent of occurrence). The estimated acreage of this occurrence is 19 acres.

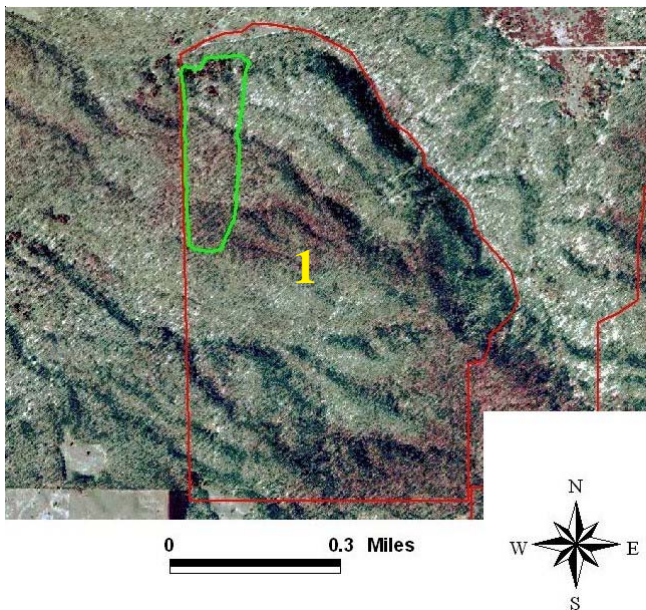


Figure 9. Green polygon outlines CD-ranked mesic northern forest element occurrence in Site 1.

Site Specific Biodiversity Management Recommendations

Allow natural processes to operate unhindered in the mature northern hardwoods in the western and northwestern extent of the site. It is recommended that the late-successional features of the forest within this polygon be maintained and enhanced. As a general guideline, leaving trees that are greater than 60cm dbh (~24in) will help maintain the late-successional attributes of this area. Where possible, maintain clusters of large trees as opposed to scattered large trees. Another general guideline for this area is to allow trees to senesce and die on their own. If managers wish to create snags and coarse woody debris in an area which is lacking in these attributes, allowing trees to reach their growth potential prior to girdling them to create snags and coarse woody debris is advised. The recuperation of the site's Canada yew population depends on reducing the deer densities within this local landscape. In addition to direct means of reducing the deer herd, such as culling and increased harvest intensity, reduction of intensive silvicultural management in the surrounding area may help reduce deer pressure within adjacent northern hardwood stands.



Photograph 1. Like much of the area surveyed, most of site 1 is composed of mature, second-growth northern hardwood forest. The species composition and structure of these stands has been driven primarily by anthropogenic disturbance factors.

SITE 2

Location

This site occurs just south of Middle Village Road in sections 5 and 8 of T36N, R6W and falls within the Gaylord Forest Management Unit, Indian River Compartment 102, and includes or includes portions of stands 14 (M9), 16 (M9), 17 (C6), 18 (C6), 19 (M6), 20 (A3), 22 (E6), 23 (M6), 46 (M9), and 404 (G0).

SITE 2 (continued)

Landscape and Abiotic Context

This site falls within Sub-subsection VII.6.2 and the LTAs 1122 and 2222 (Figures 1 and 2). LTA 1122 is characterized by steep moraine ridges, few lakes, and well drained sandy loam soils and LTA 2222 is characterized by large, broad moraine ridges, few lakes and well drained sandy loam soils. LTA 1122 occurs in the southeastern corner of the site, while LTA 2222 covers the remainder. The site occurs on rolling to steep topography with well-developed pit and mound topography. Soils are slightly acidic (pH of 5.0-6.0) sandy loams and loamy sands.

Site Summary

This site constitutes a large area of predominantly mature northern hardwoods intermixed with white birch and aspen stands. Old large trees of sugar maple and beech occur scattered throughout the site and in small scattered clumps with some small pockets of trees > 60cm (~24in) and approximately 120 years old. Some large shade-tolerant trees are younger (closer to 100) and have quickly reached large diameters, 60-70cm (~24-28in) due to excellent growing conditions provided by the slightly acidic, sandy loams and the moderated climate due to the proximity to Lake Michigan. Mid-tolerant species (i.e., white ash, basswood, red oak, and black cherry) are pervasive throughout the site and indicate that the severity of the logging disturbance 80-100 years ago was substantial. Cores from bored mid-tolerant species ranged in age from 77-108 years.

In the southern half of the site there are three linear seepage areas that support narrow bands of hardwood-conifer swamp dominated by hemlock and cedar with black ash and yellow birch. Numerous hemlocks > 50cm (~20in) occur within these seepage areas. One cored hemlock of 51.8cm (~20in) was estimated to be 177 years old.

Low to moderate levels of coarse woody debris were observed. Coarse woody debris is dominated by early- and mid-successional species of small diameters, 20-30cm (8-12in), although some scattered large-diameter beech snags and beech and sugar maple windthrow were noted. A significant percentage of the acreage is composed of early-successional forest of bigtooth aspen and/or white birch. Numerous roads and old skid trails pass throughout the area. Management history for the site as a whole is varied with some areas having old cut stumps throughout and other areas having none. Many of the larger residual trees have logging damage on their root collars and boles. A large area of clear cut occurs just east of the central portion of the polygon and part of this clear cut falls within the

polygon. In addition, recently harvested northern hardwoods occur within the polygon just northeast of this clear cut area.

Aerial photographic interpretation indicates that Canada yew was likely an important component of the shrub layer just eight years ago, especially in the northern half of the polygon. One sprig of Canada yew was found in an area of blowdown in a seepage ravine, suggesting that deer have decimated this plant population. Intensive cutting on immediately adjacent private lands to the east and west of this site could have lead to the temporary increase in browse pressure on Canada yew.

The native flora for this site is typical of mesic northern forest occurring on sandy loam and loamy sands. During the survey, forty-one native species were noted (A list of these species is provided in Appendix 2). As noted above, the canopy is dominated by sugar maple, beech, and white ash with bigtooth aspen and white birch occurring as local dominants. Canopy associates include black cherry and basswood and occasional red oak. Sugar maple and beech are dominant in the subcanopy and hemlock occurs in the subcanopy in southern portions of the site. The understory is dominated by shade-tolerant saplings of beech and sugar maple with striped maple, ironwood, and American fly honeysuckle also characteristic. Prevalent ground cover species include hairy sweet cicely, wild leek, spinulose woodfern, sharp-lobed hepatica, doll's eyes, blue cohosh, Canada violet, maiden hair fern, common trillium, sugar maple seedlings, and blue-stemmed goldenrod.

No portions of this polygon were classified as high-quality examples of mesic northern forest. However there are numerous small pockets of older trees of large diameter (>60cm) which have been indicated in Figure 10.

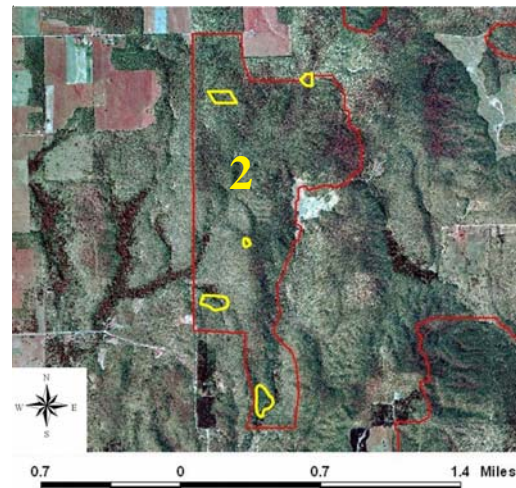


Figure 10. Yellow polygons outline small concentrations of large diameter trees (>60cm) within site 2.

Site Specific Biodiversity Management Recommendations

It is recommended that the late-successional features of the forest within this polygon be maintained and enhanced. As a general guideline, leaving trees that are greater than 60cm dbh (~24in) will help maintain the late-successional attributes of this area. Where possible, maintain clusters of large trees as opposed to scattered large trees (Photograph 2). As noted above, Figure 10 indicates several locations where there are pockets of large-diameter trees. Another general guideline for this area is to allow trees to senesce and die on their own. If managers wish to create snags and coarse woody debris in an area which is lacking in these attributes, allowing trees to reach their growth potential prior to girdling them to create snags and coarse woody debris is recommended. The recuperation of the site's Canada yew population depends on reducing the deer densities within this local landscape. In addition to direct means of reducing the deer herd, such as culling and increased harvest intensity, reduction of intensive silvicultural management in the surrounding area may help reduce deer pressure within adjacent northern hardwood stands. Reduction of deer densities may also allow for hemlock and cedar regeneration within the seepage ravines. Protecting intermittent streams and seeps, especially where hemlock and cedar are prevalent, by abiding by best management practices and following riparian management guidelines is encouraged.



Photograph 2. Leaving concentrations of large diameter trees (>60cm) will help maintain the forest's late-successional attributes. This photo is from the northeastern portion of site 2.

SITE 3

Location

This site occurs .25 east of Hannah Road in the southeastern portion of section 32 of T37N, R6W and falls within the Gaylord Forest Management Unit, Indian River Compartment 101, and includes portions of stands 28 (M9) and 29 (M9).

Landscape and Abiotic Context

This polygon falls within Sub-subsection VII.6.2 and the Landtype Association 2222 (Figures 1 and 2). LTA 2222 is characterized by large, broad moraine ridges, few lakes and well drained sandy loam soils. The site occurs on rolling topography with moderate pit and mound topography. Soils are slightly acidic (pH of 6.0) sandy loams and loamy sands.

Site Summary

Much of this site has been already managed, particularly the southern portion of the polygon. Recently managed areas experienced heavy rutting along skid trails. Portions of forest that were not recently managed are small- to moderate-diameter (30-50cm or ~12-20in) northern hardwood forests of sugar maple and beech with a heavy component of mid-tolerant species, especially white ash (70-90 years old) and black cherry. White birch is also locally dominant. Old cut stumps occur throughout the more mature forest. A small valley in the northwestern portion of the polygon contains a small pocket of large-diameter sugar maple trees (one measured sugar maple was 78cm or ~31in). Despite the large-diameter trees in this portion of the canopy, there were no snags or coarse woody debris from the large size class (> 60cm or ~24in) represented. Low levels of coarse woody debris were observed throughout the site. Coarse woody debris is dominated by early- and mid-successional species of small diameters (20-30cm or 8-12in). Numerous roads and skid trails (old and new) pass throughout the area.

During the survey, twenty-two native species were noted (A list of these species is provided in Appendix 2). As noted above, the canopy is dominated by sugar maple, beech, and white ash. Canopy associates include black cherry and paper birch. Sugar maple and beech are dominant in the subcanopy. The understory is dominated by shade-tolerant saplings of beech and sugar maple with striped maple and elderberry also common. Prevalent ground cover species include sugar maple seedlings, hairy sweet cicely, wild leek, spinulose woodfern, blue cohosh, Canada violet, maiden hair fern, and wild sarsaparilla. Several seepage areas occur throughout the site and are dominated in the ground cover by spotted touch-me-not, which has been heavily browsed by deer.

No portions of this polygon were classified as high-quality examples of mesic northern forest. The small pocket of large-diameter sugar maple in the northwestern portion of the polygon is indicated in Figure 11.

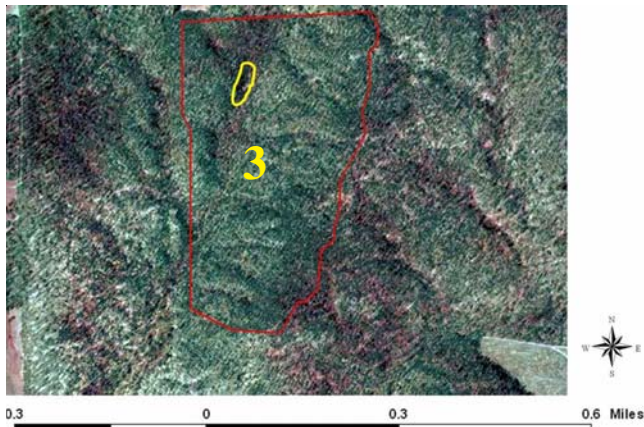


Figure 11. The yellow polygon outlines a small concentration of large diameter sugar maple (one measured sugar maple was 78cm or ~31in).

Site Specific Biodiversity Management Recommendations

The heavy rutting evident in recently managed portions of this site likely resulted from skidding on saturated loams (Photograph 3). Harvesting similar sites in the late summer, fall, or winter should help avoid such soil damage. During surveys, it was noted that a beech of moderate diameter (39.5cm or ~15in) was marked for girdling. On sites where beech can attain diameters of 80cm, it is advised to allow these trees to reach their full growth potential prior to girdling them for coarse woody debris and snags. It is recommended that the late-successional features of the forest within this polygon be maintained and enhanced. Where possible, preserve clusters of large trees as opposed to scattered large trees. For example, the small pocket of large-diameter sugar maple in the northwestern portion of the polygon could be maintained. Consider leaving large sugar maple and beech trees (>50cm or ~20in) to allow them to get bigger and contribute to future coarse woody debris loads. Protecting intermittent streams and seepage areas by abiding by best management practices and following riparian management guidelines is encouraged.



Photograph 3. Heavy rutting, observed in managed portions of Site 3, can be avoided by harvesting during periods when loamy soils are dry.

SITE 4

Location

This site occurs north and south of Webb Road in sections 9 and 16 of T36N, R6W and falls within the Gaylord Forest Management Unit, Indian River Compartment 102, and includes or includes portions of stands 23 (M6), 25 (R6), 28 (M9), 29 (M9), 30 (M3), 31 (M9), 32 (A5), 33 (M6), 34 (A3), 35 (M6), 36 (M1), 37 (M3), 38 (M1), 39 (M3), 40 (M1), 41 (M3), 42 (M1), 43 (M3), 44 (M1), and 45 (M3).

Landscape and Abiotic Context

This polygon falls within Sub-subsection VII.6.2 and the Landtype Associations 1122 and 5521 (Figures 1 and 2). LTA 1122 is characterized by steep moraine ridges, few lakes, and well drained sandy loam soils. LTA 5521 is a narrow outwash channel with well drained sandy soils. The western half of this site is characterized by steep topography of morainal ridges of LTA 1122, while the topography of the eastern half, which corresponds to the outwash channel of LTA 5521, is moderate to gently rolling. Moderate pit and mound topography occurs throughout. Soils are acidic to slightly acidic (pH of 4.5-5.5) loamy sands and sands.

Site Summary

This polygon is predominantly mature uneven-aged (80-100 years old) northern hardwoods with some pockets of older trees (approximately 120 years) and scattered older trees throughout. Canopy dominants include sugar maple, beech, and white ash with some areas containing large-diameter hemlock. Diameters are primarily 30-50cm (~12-20in) with some scattered larger trees and pockets of larger trees 60-70cm (~24-28in). Many of the larger residual trees have logging damage on their root collars and boles. Low to moderate levels of coarse woody debris were observed. Coarse woody debris is dominated by early- and mid-successional species of small diameters (20-30cm or 8-12in), although some scattered large-diameter beech snags and windthrow were noted. Numerous roads and old skid trails criss-cross the area and old cut stumps occur throughout the entire polygon. The eastern portion of the polygon north of Webb Road is dominated by small-diameter (20-30cm) aspen stands and young northern hardwoods with a heavy component of black cherry in the canopy. The eastern portion of the polygon south of Webb Road has been recently and intensively managed. Much of this area has been managed through patch cuts for black cherry and is characterized by an open overstory with scattered black cherry and a dense understory layer with raspberries, blackberries, and sapling black

SITE 4 (continued)

cherry. A portion of a large clear cut was also included in the polygon occurring in the southeastern corner and an area of clear cut on private land occurs within the polygon along the northeastern edge. The mapped polygon also includes a sliver of red pine plantation in the west-central portion of the polygon just off of Webb Road.

The native flora for this site is typical of mesic northern forest occurring on loamy sands and sands. During the survey, forty-two native species were recorded (A list of these species is provided in Appendix 2). As noted above, the canopy is dominated by sugar maple, beech, and white ash with aspen and black cherry occurring as local dominants. Canopy associates include hemlock and basswood. The subcanopy is dominated by sugar maple and beech while the understory is dominated by shade-tolerant saplings of beech and sugar maple with localized dominance by black cherry, raspberries, blackberries, and Canada yew. Heavy deer herbivory has greatly reduced the cover and height of the Canada yew (Photograph 4). Significant portions of the polygon formerly dominated by Canada yew now contain only the dead stems of chronically browsed yew. Intensive management surrounding this site likely increased deer densities within this local landscape and is contributing to the demise of this uncommon and declining shrub. Prevalent ground cover species include hairy sweet cicely, jack-in-the-pulpit, wild leek, spinulose woodfern, doll's eyes, blue cohosh, wild sarsaparilla, sugar maple seedlings, Canada mayflower, common trillium, and downy solomon seal. Several seepage ravines were noted in the southwestern portion of the polygon and support dense populations of spotted touch-me-not and sedges.



Photograph 4. Canada yew, dominant in the background, has been greatly reduced in cover and height within site 4 due to heavy deer herbivory.

A small (approximately 5 acres) hemlock-dominated stand in the east-central portion of the polygon was classified as a D-ranked mesic northern forest (See Figure 12 for polygon delimiting extent of occurrence and Photograph 5).

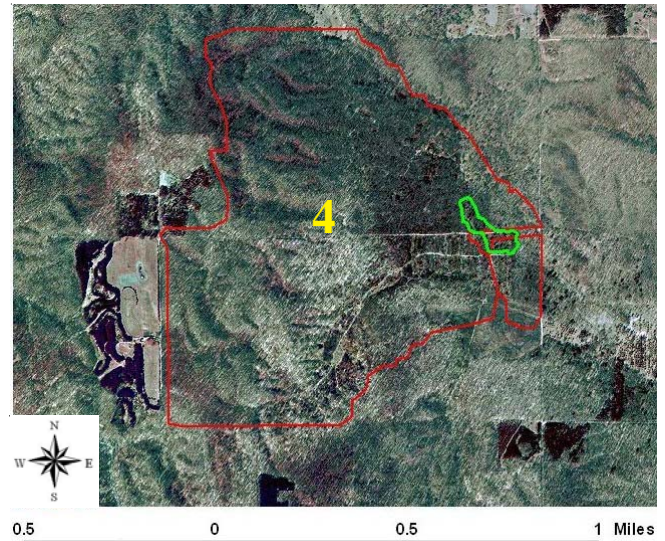


Figure 12. Green polygon outlines CD-ranked mesic northern forest element occurrence in Site 4.



Photograph 5. A small stand of large-diameter hemlock occurs in the east-central portion of Site 4.

Site Specific Biodiversity Management Recommendations

Allow natural processes to operate unhindered in the hemlock-hardwood forest in the east-central portion of the polygon. It is recommended that the late-successional features of the forest within this polygon be maintained and enhanced. As a general guideline, leaving trees that are greater than 60cm (~24in) dbh will help maintain the late-successional attributes of this area. Where possible, maintain clusters of large trees as opposed to scattered large trees. Another general guideline is to allow trees to senesce and die on their own. If managers wish to create snags and coarse woody debris in an area which is lacking in

SITE 4(continued)

these attributes, permitting trees to reach their growth potential prior to girdling them to create snags and coarse woody debris is advised. The integrity of this site's Canada yew population and the potential for hemlock to regenerate depends on reducing the deer densities within this local landscape. In addition to direct means of reducing the deer herd, such as culling and increased harvest intensity, reduction of intensive silvicultural management in the surrounding area may help reduce deer pressure.

SITE 5

Location

This site is composed of 4 polygons that occur within the Gaylord Forest Management Unit: Polygon 5a is located just east of Wressell Road in the west-central portion of section 3, T36N, R6W; Polygon 5b is located just west of Wressell Road in the north-eastern portion of section 4, T36N, R6W; Polygon 5c is also located west of Wressell road in the northern portion of section 4, T36N, R6W and along the southern edge of section 33, T36N, R7W; and Polygon 5d is located just east of Frank Road in the southeastern corner of section 33, T36N, R7W. Polygon 5a occurs within the Indian River Compartment 104 and includes portions of stands 39 (M5), 40 (M5), 45 (M6), and 46 (M9). Polygon 5b occurs within the Indian River Compartment 102 and includes portions of stands 5 (M6) and 6 (A3). Polygon 5c occurs within the Indian River Compartment 102 and includes portions of stand 7 (M6) in section 4 and a sliver of private land in section 33. Polygon 5d occurs within the Indian River Compartment 101 and includes portions of stand 23 (M9).

Landscape and Abiotic Context

This site falls within Sub-subsection VII.6.2 and the Landtype Associations 2222 and 5521 (Figures 1 and 2). LTA 2222 is characterized by large broad moraine ridges, few lakes, and well drained sandy loam soils. LTA 5521 is a narrow outwash channel with well drained sandy soils. Polygons 5a and 5b occur within the narrow outwash channel while, Polygon 5d occurs on LTA 2222. Polygon 5c occurs primarily on the broad moraine ridges but its southeastern corner falls within the narrow outwash channel. In general, the soils of the outwash channel are acidic sands while the morainal soils tend to be slightly less acidic and are loamy sands and sandy loams.

Site Summary

Polygon 5a contains a small grove of large-diameter white pine (50-80cm or ~20-32in) which occurs as a scattered supercanopy over small-diameter northern

hardwoods (15-35cm or 6-14in) in the northwestern half of the polygon. Canopy composition of the young northern hardwoods is primarily sugar maple and black cherry. The southeastern half of Polygon 5a is composed of early-successional forest dominated by small-diameter (10-20cm or 4-8in) aspen and black cherry.

Polygon 5b is a stand of recently harvested northern hardwoods. Canopy dominants include sugar maple, white ash, and black cherry. Sugar maple, favored by the recent management, is currently dominant in all vegetative layers. An east-facing slope occurs along the northeastern portion of this polygon. This area was less intensively managed and supports a greater diversity of groundcover species compared to the more intensively managed portion of this polygon.

Polygon 5c is a small polygon that is primarily mature, uneven-aged (80-100 years old) northern hardwoods. Canopy dominants include sugar maple, beech, and white ash with some scattered black cherry. Low to moderate levels of coarse woody debris were observed. The southern portion of the polygon is characterized by greater black cherry prevalence in the canopy.

Polygon 5d contains areas that have been recently managed, especially in the southern portion of the polygon. Canopy dominants include sugar maple, white ash, and black cherry. Sugar maple, favored by the recent management, is currently dominant in all vegetative layers in the managed areas. The unmanaged northern portion of the polygon supports small-diameter northern hardwoods with black cherry and beech as the prevalent canopy trees.

During the survey of these four polygons, thirty-one native species were noted (A list of these species is provided in Appendix 2). Canopy dominants include beech, sugar maple, white ash, and black cherry with white pine occurring in the supercanopy of Polygon 5a. Shade tolerant species such as sugar maple and beech are prevalent in the subcanopy and understory layer. Within recently managed portions of forest in Polygons 5b and 5d, sugar maple is especially prevalent in the understory layer along with elderberry, raspberries, and blackberries. Ground cover that is common across these four areas includes wild sarsaparilla, common trillium, spinulose woodfern, wild leek, blue cohosh, sugar maple seedlings, Canada mayflower, and downy solomon seal

No portions of these polygons were classified as high-quality examples of mesic northern forest. The small pocket of mature northern hardwoods in Polygon 5c is indicated in Figure 13.

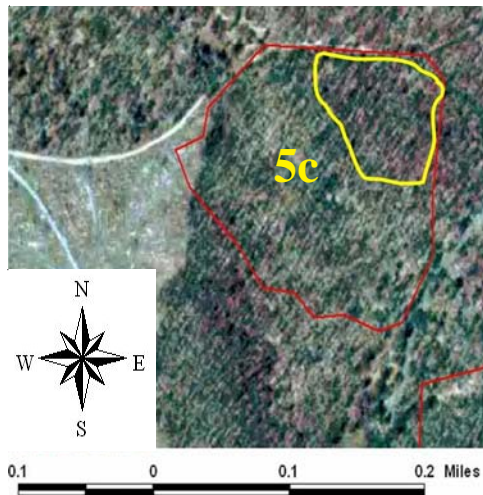


Figure 13. The yellow polygon outlines a small concentration of large-diameter sugar maple, beech, and white ash within polygon 5c.

Site Specific Biodiversity Management Recommendations

Maintain the small stand of mature northern hardwoods in Polygon 5c. Maintain the scattered, supercanopy white pine in Polygon 5a. Allow young black cherry and aspen stands south of the white pine grove to function as a nurse crop for white pine: allow this early-successional forest to senesce and eventually convert to a white pine-dominated forest.

SITE 6

Location

This site is a large polygon that occurs in T37N, R6W in sections 20, 28, and 29 between Johnston Road and Wilderness Road and falls within the Gaylord Forest Management Unit, Indian River Compartment 101, and includes portions of stands 8 (M9), 10 (M9), 11 (M9), and 13 (M9).

Landscape and Abiotic Context

This polygon falls within Sub-subsection VII.6.2 and the LTAs 1122 and 2222 (Figures 1 and 2). LTA 1122 is characterized by steep moraine ridges, few lakes, and well drained sandy loam soils. Portions of this site occurring on this LTA are characterized by steep to moderate topography and slightly acidic (pH 5.0), loamy sands and sands. LTA 2222, which is characterized by large broad moraine ridges, few lakes, and well drained sandy loam soils, occurs in the southwestern portion of the polygon on rolling topography. Soils within this portion of the site were significantly richer and were dark sandy loams of moderate to slight acidity (6.5-6.8 pH).

Site Summary

This stretch of forest is predominantly mature, uneven-aged (80-100 years old) northern hardwoods with

some pockets of older trees (approximately 130 years) and scattered older trees throughout. Canopy dominants include sugar maple, beech, and white ash with white birch and bigtooth aspen as canopy associates. Diameters are primarily 30-50cm (~12-20in) with some scattered larger trees and pockets of larger trees 60-70cm (~24-28in). Low to moderate levels of coarse woody debris were observed. Coarse woody debris is dominated by early- and mid-successional species of small diameters (20-30cm or 8-12in) although some scattered large-diameter beech and sugar maple snags and windthrow were noted. Several bigtooth aspen clones occur scattered throughout the site, particularly in the eastern block of the polygon. Numerous roads and old skid trails pass throughout the area. Management history for the site as a whole is varied with some areas having old cut stumps throughout and other areas having none. A recent and extensive final harvest to control beech bark disease occurred in the northcentral portion of the polygon.

In general, the forest occurring on the broad moraine (LTA 2222) is characterized by mature northern hardwood forest dominated by tall sugar maple, beech and white ash with a rich herbaceous layer growing on the dark sandy loams. Moderate levels of coarse woody debris and snags occur within this portion of the polygon and compared to the forest on LTA 1122, larger-diameter trees (50-60cm or ~20-24in) are more prevalent here, likely due to the high nutrient levels provided by the slightly acidic loams. The forest occurring on the steep moraine ridges (LTA 1122) contains both mature northern hardwoods, younger stands of northern hardwoods, and patches of early-successional forest dominated by aspen. Beech increases in canopy importance in the mature northern forest occurring on these steep moraines and early-successional species such as bigtooth aspen and white birch and mid-tolerants such as white ash and black cherry are more prevalent. The more acidic loamy sands and sands found on these steep moraines have much shallower organic horizons and support lower floristic diversity compared to the sandy loams of the broad moraine.

Aerial photographic interpretation indicates that Canada yew was likely an important component of the shrub layer throughout much of this polygon just eight years ago. Canada yew was rare within this site and it appears as if deer have decimated this plant population.

The native flora for this site is typical of mesic northern forest occurring on loamy sand and sandy loam. During the survey, forty-three native species

SITE 6 (continued)

were noted (A list of these species is provided in Appendix 2). As noted above, the canopy is dominated by sugar maple, beech, and white ash with bigtooth aspen occurring as a local dominant. Canopy associates include white ash, black cherry, aspen, yellow birch, and basswood. Sugar maple and beech are dominant in the subcanopy. The understory is dominated by shade-tolerant saplings of beech and sugar maple with striped maple, ironwood, elderberry, and American fly honeysuckle also characteristic. Prevalent ground cover species include hairy sweet cicely, jack-in-the-pulpit, wild leek, spinulose woodfern, sharp-lobed hepatica, doll's eyes, blue cohosh, Canada mayflower, Canada violet, maiden hair fern, common trillium, sugar maple seedlings, and blue-stemmed goldenrod. Species diversity, density, and height of ground cover species are significantly greater on the sandy loams of the broad moraine compared to on the sands and loamy sands of the steep moraine ridges. Spotted touch-me-not and sensitive fern are local dominants in the numerous seepage ravines that occur in the eastern half of the northwestern quarter of section 29.

The southwestern portion of the polygon in the southern half of the northwestern quarter of section 29 was classified as a CD-ranked mesic northern forest (See Figure 14 for polygon delimiting extent of occurrence and Photograph 6). The estimated acreage of this occurrence is 70 acres.. This polygon includes the mature northern hardwoods occurring on the broad moraine ridges of LTA 2222 and also a small acreage of mature northern hardwoods occurring on the steep moraine ridges of LTA 1122.

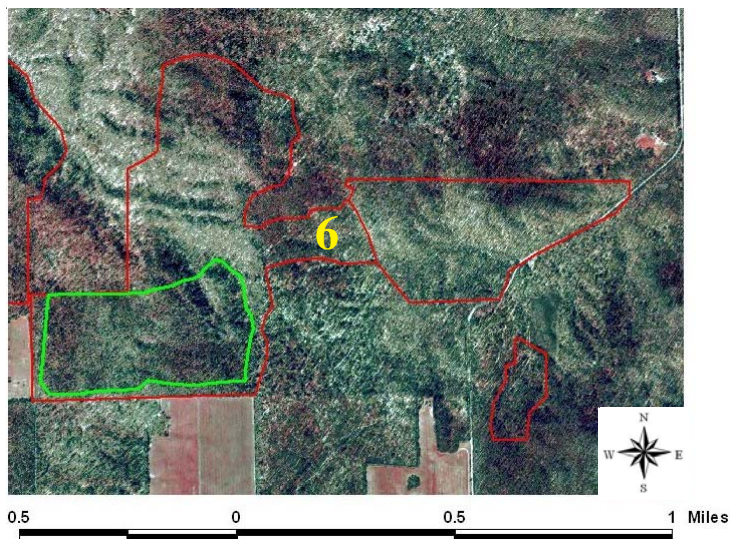


Figure 14. Green polygon outlines CD-ranked mesic northern forest element occurrence in Site 6.



Photograph 6. Although some scattered large-diameter beech and sugar maple snags and windthrow were noted, coarse woody debris in Site 6 and throughout the surveyed area is dominated by early- and mid-successional species of small diameters (20-30cm or 8-12in) .

Site Specific Biodiversity Management Recommendations

Allow natural processes to operate unhindered in the southwestern portion of the polygon. It is recommended that the late-successional features of the forest within this polygon be maintained and enhanced. As a general guideline, leaving trees that are greater than 60cm (~24in) dbh will help maintain the late-successional attributes of this area. Where possible, maintain clusters of larger tree as opposed to scattered large trees. Another general guideline is to allow trees to senesce and die on their own. Throughout this site, many small-diameter (<50cm or <20in) trees were marked to be girdled. If managers wish to create snags and coarse woody debris in an area which is lacking in these attributes, allowing trees to reach their growth potential prior to girdling them to create snags and coarse woody debris is advised. The recuperation of the site's Canada yew population depends on reducing the deer densities within this local landscape. In addition to direct means of reducing the deer herd, such as culling and increased harvest intensity, reduction of intensive silvicultural management in the surrounding area may help reduce deer pressure.

As noted above numerous seepage areas and intermittent streams occur in the eastern half of the northwestern quarter of section 29. Protect intermittent streams and seepage areas by following best management practices and riparian management guidelines.

SITE 7

Location

This site is composed of 2 polygons found west of Wilderness Road in T37N, R6W in section 28: Polygon 7a is located in the northeastern corner of section 28 and Polygon 7b is located just east of Wilderness Road in the west-central portion of section 28. Both polygons fall within the Gaylord Forest Management Unit, Indian River Compartment 101. Polygon 7a includes portions of stand 18 (M9) and the northern half of this polygon falls on private land. Polygon 7b includes portions of stand 16 (M9).

Landscape and Abiotic Context

This site falls within Sub-subsection VII.6.2 and the LTAs 1122 and 2222 (Figures 1 and 2). LTA 1122 is characterized by steep moraine ridges, few lakes, and well drained sandy loam soils. LTA 2222 is characterized by large broad moraine ridges, few lakes, and well drained sandy loam soils. Polygon 7a falls entirely in LTA 1122, while all but the southern edge of Polygon 7b falls within LTA 1122. Soils throughout both polygons were sandy loams and loamy sands, and topography was steep to moderate.

Site Summary

Polygon 7a was recently managed (within the last 10 years) and is dominated by an open canopy of sugar maple and beech over a dense understory of sugar maple and beech saplings, and thick raspberry and blackberry thickets, which are heavily concentrated along the numerous skid trails, logging decks, and more open areas. Striped maple is locally abundant. Residual basal area was estimated to range between 70 ft² and 90 ft² of basal area. The northern portion of this polygon occurs on private land and was not surveyed.

Polygon 7b is a small stand of primarily mature, uneven-aged northern hardwoods. Canopy dominants include sugar maple, beech, and white ash. Low levels of coarse woody debris were observed. Scattered large-diameter trees (50-70cm or ~20-28in) occur within this polygon, especially along the steep slopes adjacent to the seep/intermittent stream that passes through the center of the polygon. An ORV trail also passes through the center of this polygon. Old cut stumps were noted throughout this site.

During the survey, forty-three native species were noted (A list of these species is provided in Appendix 2). As noted above, the canopy is dominated by sugar maple, beech, and white ash. Sugar maple and beech are dominant in the subcanopy. The understory is dominated by shade-tolerant saplings of beech and

sugar maple with striped maple, ironwood, elderberry, and American fly honeysuckle also characteristic. Blackberry and raspberry species are dominant in the recently managed polygon. Prevalent ground cover species include hairy sweet cicely, jack-in-the-pulpit, wild leek, spinulose woodfern, doll's eyes, blue cohosh, Canada mayflower, Canada violet, common trillium, and sugar maple seedlings.

No portions of these polygons were classified as high-quality examples of mesic northern forest. The small strip of mature northern hardwoods in Polygon 7b is indicated in Figure 15.

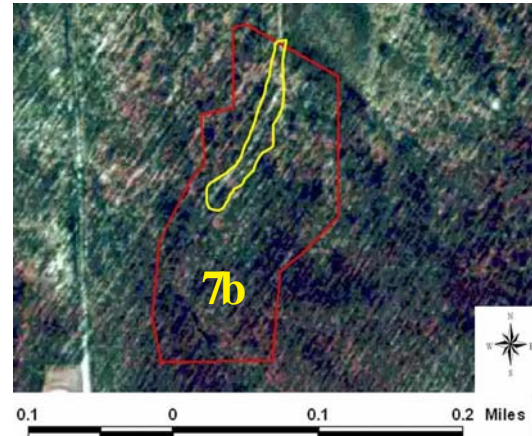


Figure 15. The yellow polygon outlines a small concentration of large-diameter northern hardwoods along a seepage within polygon 7b.

Site Specific Biodiversity Management Recommendations

Maintain the small stand of mature northern hardwoods in Polygon 7b. Protect the seep/intermittent stream by following best management practices and riparian management guidelines. It appears as if several of the large trees along the steep slopes above this seepage area were marked for harvest. If this is indeed the case, it is recommended that the prescribed harvest of these large-diameter trees occurring within a riparian area be reconsidered.

SITE 8

Location

This site is composed of 3 polygons found in close proximity to Frank Road in T37N, R6W in sections 33 and 34: Polygon 8a occurs just west of Frank Road in the northeastern quarter of section 33; Polygon 8b occurs west of Frank Road in the northwestern quarter of section 33; and Polygon 8c occurs east of Frank road along the northeastern edge of section 33 and in the northwestern quarter of section 34. Polygon 8a falls within Gaylord Forest Management Unit, Indian River Compartment 101 and includes portions of stands 26 (M9) and 27 (M9) and the northern third of this polygon falls on private land. Polygon 8b also

SITE 8 (continued)

occurs in Indian River Compartment 101 and includes portions of stand 26 (M9). Polygon 8c occurs in Indian River Compartment 101 and Compartment 105. Within Compartment 101 and section 33, Polygon 8c includes portions of stands 20 (M9) and 23 (M9). The segment of polygon 8c that falls within Compartment 105 and section 34 includes portions of stands 75 (M9) and 80 (M6).

Landscape and Abiotic Context

This site falls within Sub-subsection VII.6.2 and the LTAs 2222 and 5521 (Figures 1 and 2). LTA 2222 is characterized by large broad moraine ridges, few lakes, and well drained sandy loam soils. LTA 5521 is a narrow outwash channel with well drained sandy soils. Polygons 8a and 8b occur on the broad moraine ridges of LTA 2222, while the western half of Polygon 8c occurs on LTA 2222 and the eastern half falls on LTA 5521. In general, the soils of the outwash channel of LTA 5521 are moderately acidic sands while the morainal soils of LTA 2222 tend to be slightly less acidic and are loamy sands and sandy loams. Topography for this site is gently rolling with mild pit and mound topography.

Site Summary

These polygons are predominantly mature, uneven-aged (80-100 years old) northern hardwoods with some pockets of older trees and scattered older trees throughout. Canopy dominants include sugar maple, beech, and white ash with black cherry, basswood, and white birch as common canopy associates. Diameters are primarily 30-50cm (~12-20in) with some scattered larger trees and pockets of larger trees 60-70cm (~24-28in). Many of the larger residual trees have logging damage on their root collars and boles. Low to moderate levels of coarse woody debris were observed. Coarse woody debris is dominated by early- and mid-successional species of small diameters (20-30cm or 8-12in) although some scattered large-diameter beech snags and windthrow were noted. Numerous roads and old skid trails criss-cross the area and old cut stumps occur throughout the entire site. Along the eastern edge of polygon 8c, there are patches of younger northern hardwoods dominated by black cherry. The northern third of Polygon 8b, which occurs on private land, was recently intensively cut with primarily white ash removed.

The native flora for this site is typical of mesic northern forest occurring on loamy sands and sandy loams. During the survey, thirty-three native species were noted (A list of these species is provided in

Appendix 2). As stated above, the canopy is dominated by sugar maple, beech, and white ash. Canopy associates include black cherry, white birch, and basswood. The subcanopy is dominated by sugar maple and beech with occasional ironwood. The understory is dominated by shade-tolerant saplings of beech and sugar maple with striped maple, American fly honeysuckle, and elderberry as typical shrubs. Prevalent ground cover species include hairy sweet cicely, jack-in-the-pulpit, wild leek, spinulose woodfern, doll's eyes, blue cohosh, wild sarsaparilla, Canada violet, maiden hair fern, common trillium, and downy solomon seal.

No portions of these polygons were classified as high-quality examples of mesic northern forest. However the small pocket of older trees of large diameter (>60cm or >~24in) within polygon 8a has been indicated in Figure 16.

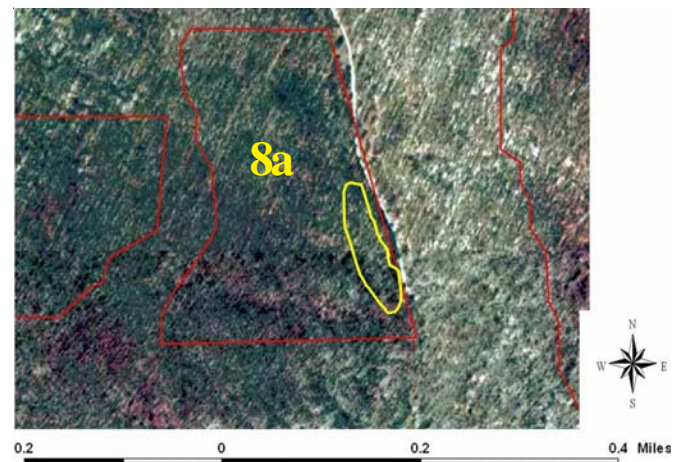


Figure 16. The yellow polygon outlines a small concentration of large-diameter sugar maple, beech, and white ash within polygon 8a.

Site Specific Biodiversity Management Recommendations

It is recommended that the late-successional features of the forest within this polygon be maintained and enhanced. As a general guideline, leaving trees that are greater than 60cm (~24in) dbh will help maintain the late-successional attributes of this area. Where possible maintain clusters of large trees as opposed to scattered large trees. For example, maintain the small stand of mature northern hardwoods in Polygon 8a. Another general guideline is to allow trees to senesce and die on their own. If managers wish to create snags and coarse woody debris in an area which is lacking in these attributes permitting trees to reach their growth potential prior to girdling them to create snags and coarse woody debris is suggested.

LANDSCAPE LEVEL BIODIVERSITY MANAGEMENT RECOMMENDATIONS

The following recommendations focused on enhancing biodiversity within this landscape are provided for your consideration. Allow natural processes to operate unhindered in areas identified as element occurrences of mesic northern forest. Increase the size of these core areas by managing adjacent mature northern hardwoods likewise or by extending the harvest rotation within adjacent stands. Maintain and enhance late-successional features of managed forest. Where possible, maintain clusters of large trees as opposed to scattered large trees. As a general guideline, leaving trees that are greater than 60cm dbh (~24in) will help maintain the late-successional attributes of this area. Death of large diameter trees generates long-lasting snags and/or coarse woody debris and creates the canopy openings that drive the gap-phase dynamics of these systems. Long-lived, large-diameter coarse woody debris can provide nurse logs for the establishment of hemlock and yellow birch seedlings. Another general guideline is to allow trees to senesce and die on their own. If managers wish to create snags and coarse woody debris in an area which is lacking in these attributes, allowing trees to reach their growth potential prior to girdling them to create the snags and coarse woody debris is recommended.

The recuperation of the Canada yew population and the regeneration potential of hemlock and cedar within this area depend on reducing the deer densities within the local landscape. In addition to direct means of reducing the deer herd, such as culling and increased harvest intensity, reduction of intensive silvicultural management throughout the landscape may help reduce deer pressure within northern hardwood stands.

It is important to protect seepage areas and intermittent streams, especially where hemlock and cedar are prevalent, by following best management practices and riparian management guidelines.

DISCUSSION

According to the Department of Natural Resources Conservation Area Guidance document and Work Instruction 1.4 on Biodiversity Management on State Forest Land, high-quality natural communities that are A or B ranked and are rare, imperiled, or critically imperiled in the state or globally (G1, G2, G3, and/or S1, S2, S3; see Appendix 3 for definition of global and state ranks) qualify for consideration as Ecological Reference Areas. Based on the assessment of the 14 polygons, no part of the 2005 acres of surveyed area would currently qualify for consideration as an

Ecological Reference Area. However that does not preclude the consideration of this area or portions thereof as either High Conservation Areas or Special Conservation Areas or the potential for portions of the area to, in time, qualify for consideration as Ecological Reference Areas.

Three new element occurrences of mesic northern forest were documented within the surveyed forest (Figures 9, 12, and 14). Portions of the western and northwestern extent of Site 1 were classified as a CD-ranked mesic northern forest. A small (approximately 5 acres) hemlock-dominated stand in the east-central portion of Site 4 was classified as a D-ranked mesic northern forest. Within Site 6, the southwestern portion of the polygon in the southern half of the northwestern quarter of section 29 was classified as a CD-ranked mesic northern forest. The low element occurrence ranking for these three sites is primarily due to their small sizes and poor condition rankings. Low condition ranks were assigned because these sites are second-growth stands that are just developing characteristic of late-successional forest. The structure and species composition of these stands has been primarily driven by anthropogenic disturbance factors (i.e., turn-of-the-century logging) as opposed to the natural process of gap-phase dynamics. Coarse woody debris and snags are primarily confined to small diameter classes and early-successional and mid-tolerant species. The species composition of the overstory and understory of these sites has been drastically altered. Examination of the notes of the original land surveyors for this general area suggests that approximately 80% of the canopy was composed of shade-tolerant species and that hemlock was more prevalent in the canopy circa 1800. Canopy coverage of mid-tolerant species and early-successional species has increased within these three sites and in the surrounding landscape. High levels of deer herbivory have drastically altered the species composition and structure of the understory of these sites. Of particular note is the dramatic decline of Canada yew, which occurred as an understory dominant throughout much of this area less than ten years ago. Despite these ecological short-comings, these occurrences (especially the two CD-ranked elements) and the surrounding mature forest could potentially be restored to higher quality mesic northern forest given time (at least a century) and reduction of deer densities. As noted in MNFI's ranking criteria for element occurrences (Appendix 1), protection of C-ranked "occurrences helps conserve the biotic diversity on a regional or local level and (is) important to state-wide conservation only if no higher-ranked occurrences exist."

DISCUSSION(continued)

A landscape-level assessment of the current status of high-quality mesic northern forest in the Northern Lower Peninsula provides the context for evaluating the conservation significance of the Mackinaw Forest Council's recommended area and the portions identified through this survey as new mesic northern forest element occurrences. Prior to this survey, only 27 mesic northern forest element occurrences were known from the Northern Lower Peninsula and of those, only eight are B-ranked or higher. Of these eight high-quality mesic northern forests, three are found on islands within the Great Lakes. Of the five high-quality mesic northern forests occurring on the mainland of Northern Lower Michigan, only one has been documented on state forest land, a tract of old-growth forest along Walloon Lake in Charlevoix County. Prior to this survey, within Emmet County, there was only one documented mesic northern forest element occurrence that occurs on private land in sub-subsection VII.2.3 on LTAs 3321 and 5521.

The Emmet County survey sites fall within Subsection VII.6 (Presque Isle Subsection) and Sub-subsection VII.6.2 (Stutsmanville Sub-Subsection) of the regional landscape ecosystems of Michigan hierarchical landscape classification (Albert 1995, Figure 1). Prior to this survey, within Subsection VII.6 there were only six documented occurrences of mesic northern forest and only three occurrences that are B-ranked or higher. Of these six occurrences, five occur on islands within the Great Lakes. The sole occurrence of high-quality mesic northern forest that is found within Subsection VII.6 occurs within Sub-subsection VII.6.1 and is found on University of Michigan and Little Traverse Nature Conservancy property.

Prior to this survey, there were no documented occurrences of high-quality mesic northern forest within Sub-subsection VII.6.2 and no documented occurrences on LTAs 1122, 2222, and 5521 of Subsection VII.6. Within the Northern Lower Peninsula, across all Subsections, prior to this survey, there were three mesic northern forest element occurrences in MNFI's database found on steep moraine ridges, with few lakes, and well drained sandy loam soils (LTA 1122). All three of these occurrences are from Subsection VII.4, two of the occurrences are found on Great Lakes islands, and the occurrence on the mainland is on private land. Within the Northern Lower Peninsula, across all Subsections, prior to this survey, there were six mesic northern forest element occurrences in MNFI's database found on large, broad moraine ridges, with few lakes and well drained sandy

loam soils (LTA 2222). All six of these occurrences are from Sub-subsection VII.5.2, all are found on the mainland, and five are found on private land while one occurs on a nature preserve. Within the Northern Lower Peninsula, across all Subsections, prior to this survey, there was only one mesic northern forest element occurrence in MNFI's database found on narrow outwash channel with well drained sandy soils (LTA 5521). This lone site is found in Sub-subsection VII.2.3 on private land.

Given the complete lack of high-quality mesic northern forest within Sub-subsection VII.6.2 and on Landtype Associations 1122, 2222, and 5521 on state land, portions of the surveyed area, especially the newly identified element occurrences of mesic northern forest, merit consideration as High Conservation Areas or Special Conservation Areas and over time could qualify for consideration as Ecological Reference Areas. The three element occurrences occur on the range of Landtype Associations found within the surveyed area. The occurrence from site 1 occurs within LTA 1122, the occurrence within Site 4 falls within LTA 5521, and the occurrence from site 6 occurs primarily in LTA 2222 but portions also fall within LTA 1122 (Figure 2). Based on their potential to provide future representation of high-quality mesic northern forest within Subsection VII.6.2 on three different landforms or Landtype Associations, it is recommended that management within these sites be restricted to stewardship activities (i.e., invasive plant removal). In addition, given the small size of these occurrences, it is suggested that these element occurrences function as the core of much larger areas that are unmanaged. Historically mesic northern forests dominated vast areas of mesic uplands of the Great Lakes occupying hundreds to thousands of acres. Based on MNFI's current grading criteria (Appendix 1), mesic northern forests over 100 acres in area merit an A rank for size, while forests 50-99 acres merit a B rank. Buffering the element occurrences with at least 100 acres of unmanaged mature northern hardwoods would increase the probability that in 100 years these areas would increase from their current CD or D rank to a B rank and could then qualify for consideration as Ecological Reference Areas.

ACKNOWLEDGEMENTS

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Appendix 1. Element occurrence ranking criteria.

Rank	Explanation
A	Excellent Occurrence. Protection of A-ranked occurrences is essential to conservation of the maximum diversity and viability of an element in the state. A-ranked communities are essentially undisturbed by humans, or have nearly recovered from early human disturbance; they are further distinguished by being an extensive, well-buffered, etc. occurrence. Species composition shows little departure from original structure and composition (except in seral or disturbance dependent communities). A-ranked populations of a sensitive species are large in number of individuals, stable or growing, show good reproduction, and exist in a natural, sustainable habitat.
B	Good Occurrence. Protection of these occurrences is important to the survival of an element in Michigan, especially if very few or no A-ranked occurrences exist, or in natural regions of the state where there are few or no A-ranked occurrences. A B-ranked community is still recovering from early disturbance or recent light disturbance but eventually will reach an A-rank. Presence of exotic species (if only localized and/or a minor component of the flora), recoverable departure from original structure and composition for the site (except in seral and disturbance dependent communities) result in a B-rank. Nearly undisturbed occurrences, or those essentially recovered from disturbance are downgraded to a B-rank if they have poor buffer or narrow boundary configuration. B-ranked populations of a sensitive species are at least stable, in a minimally disturbed habitat, and of moderate population size.
C	Fair Occurrence. Protection of these occurrences helps conserve the biotic diversity on a regional or local level and are important to state-wide conservation only if no higher-ranked occurrences exist. A C-ranked community is in an early stage of recovery from disturbance, or its structure and composition have been altered such that the original vegetation of the site will never rejuvenate, yet with management and time partial restoration of the community is possible. C-ranked populations of sensitive species are in clearly disturbed habitats, small in size and/or number, and possibly declining.
D	Poor Occurrence. Protection of these occurrences is seldom worthwhile except for historical reasons or only if no better occurrences exist. D-ranked communities are severely disturbed, their structure and composition have been greatly altered, and recovery to original conditions, despite management and time, essentially will not take place. D-ranked populations of sensitive species are very small with a high likelihood of dying out or being destroyed, and exist in highly disturbed and vulnerable habitat

Appendix 1. Element occurrence grading criteria.

NATURAL COMMUNITY GRADING CRITERIA

Mesic Northern Forest (Northern Hardwood Forest and Hemlock-Hardwood Forest)

Grade A: Condition-grade A occurrences have common to abundant very old growth trees (trees are 50-70 cm dbh with sugar maple 170+ years old and hemlock 220-250+ years old). There is either no evidence of cutting, or only minor cutting of random individuals without any species elimination. All-aged stands are preferred, but other age-class distribution are acceptable if stand is essentially recovered from previous natural and/or artificial disturbances. For example, stands must be ungrazed (no gaps in age-class distribution) or recovered from past light grazing (age-class gap with a minor component of thorny species). (Single-aged stands predating European settlement may have originated from Indian disturbances and should be downgraded). Light harvest of fallen timber is acceptable for condition-grade A occurrences. Quality-grade A occurrences have tree species composition that resembles presettlement records from General Land Office surveys (unless survey bias is suspected or presettlement forest was disturbed). Understory diversity may be poor in quality-grade A stands due to canopy closure and should not affect quality-grade. However, natural disturbance regimes must be intact for quality-grade A occurrences.

Grade B: Condition-grade B occurrences have very old growth trees as occasional with common to abundant old growth trees (approximately 140-220 yrs. old). Other combinations (e.g., abundant old growth only) are possible, but stand should be recoverable to condition-grade A with time. Past cutting is acceptable if light and no major canopy species were eliminated. Moderate grazing of very old growth stands are condition-grade B occurrences. Light grazing is acceptable in mixed very old growth and old second growth stands.

Grade C: Quality- and condition-grade C occurrences have suffered disturbances that preclude their recovery to grade A levels, except over a long period of time (>120? years). Examples include stands with rare to occasional very old and/or old growth trees that are poorly reproducing or have had a major canopy species eliminated, old second growth stands with trees predominantly 40-50 cm dbh (120-140 years old), if species composition is natural, as well as heavy grazing in very old growth or moderately heavy grazing in old growth stands. Occurrences with large areas of heavy burns, abundant windthrow, or common tree mortality are quality-graded relative to recovery time. Stands greatly dissimilar from presettlement survey composition (unless survey was biased or stand disturbed) are quality-grade C.

Benchmark Quality Standard: See quality-grade A criteria above; also high native plant species density and diversity (equitability and richness) relative to environmental conditions and cover type; heterogeneous plant community zonation with the presence of the full range of plant communities expected for the site; good buffer of associated natural communities; and unaltered (or artificially mimicked) natural disturbance regime.

Minimum Element Occurrence Specificattons: Exceptional significance: EO Rank B and 50 acres. Notable significance: EO Rank B and 25 acres.

Element Occurrence Size-Classes: Large: 100+ acres; Moderate: 50-99 acres; Small: 25-49 acres; Very Small: less than 25 acres.

Boundary Mapping: For large occurrences, outline the entire area on map and simply identify smaller included occurrences of other community types (e.g. other forest types that interdigitate with Mesic Northern Forest, like Dry-mesic Northern Forest) without drawing their boundaries; draw boundaries of other included community types if they are easily defined (e.g. a lake type, a swamp type) or if they are separate element occurrences.

Exemplary Occurrences: Porcupine Mountains, Ontonagon and Gogebic Co.; Sylvania Recreation Area, Gogebic Co.; Huron Mountains, Marquette Co.; North Fox Island, Leelanau Co.

Appendix 2. Plant species observed during Emmet County State Forest Survey. Capitalized scientific and common names indicate non-native species. Life form acronyms are as follows: Nt, native; P, perennial; Ad, adventive; B, biannual; A, annual. "C" is the Coefficient of Conservation for each species.

Site: Site 1
 Locale: Emmet County
 Date: 14-Aug 2006 6 hours
 By: Joshua Cohen

FLORISTIC QUALITY DATA	Native	44	100.00%	Adventive	0	0.00%
44 NATIVE SPECIES	Tree	13	29.50%	Tree	0	0.00%
44 Total Species	Shrub	6	13.60%	Shrub	0	0.00%
4.8 NATIVE MEAN C	W-Vine	0	0.00%	W-Vine	0	0.00%
4.8 W/Adventives	H-Vine	0	0.00%	H-Vine	0	0.00%
31.7 NATIVE FQI	P-Forb	16	36.40%	P-Forb	0	0.00%
31.7 W/Adventives	B-Forb	0	0.00%	B-Forb	0	0.00%
2.4 NATIVE MEAN W	A-Forb	1	2.30%	A-Forb	0	0.00%
2.4 W/Adventives	P-Grass	0	0.00%	P-Grass	0	0.00%
AVG: Fac. Upland (+)	A-Grass	0	0.00%	A-Grass	0	0.00%
	P-Sedge	3	6.80%	P-Sedge	0	0.00%
	A-Sedge	0	0.00%	A-Sedge	0	0.00%
	Fern	5	11.40%			

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ACEPEN	5 Acer pensylvanicum	3 FACU	Nt Tree	STRIPED MAPLE
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACTPAC	7 Actaea pachypoda	5 UPL	Nt P-Forb	DOLL'S EYES
ADIPEP	6 Adiantum pedatum	1 FAC-	Nt Fern	MAIDENHAIR FERN
ALLTRI	5 Allium tricoccum	2 FACU+	Nt P-Forb	WILD LEEK
ARANUD	5 Aralia nudicaulis	3 FACU	Nt P-Forb	WILD SARSAPARILLA
ARITRI	5 Arisaema triphyllum	-2 FACW-	Nt P-Forb	JACK IN THE PULPIT
BETALL	7 Betula alleghaniensis	0 FAC	Nt Tree	YELLOW BIRCH
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
BOTVIR	5 Botrychium virginianum	3 FACU	Nt Fern	RATTLESNAKE FERN
CXLACU	6 Carex lacustris	-5 OBL	Nt P-Sedge	SEDGE
CXPEDU	5 Carex pedunculata	5 UPL	Nt P-Sedge	SEDGE
CXPLAN	8 Carex plantaginea	5 UPL	Nt P-Sedge	SEDGE
CAUTHA	5 Caulophyllum thalictroides	5 UPL	Nt P-Forb	BLUE COHOSH
DRYCAR	5 Dryopteris carthusiana	-2 FACW-	Nt Fern	SPINULOSE WOODFERN
FAGGRA	6 Fagus grandifolia	3 FACU	Nt Tree	AMERICAN BEECH

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 1 continued.

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
FRAAME	5 Fraxinus americana	3 FACU	Nt Tree	WHITE ASH
GALTRR	4 Galium triflorum	2 FACU+	Nt P-Forb	FRAGRANT BEDSTRAW
GERROB	3 Geranium robertianum	5 UPL	Nt A-Forb	HERB ROBERT
HEPACU	8 Hepatica acutiloba	5 UPL	Nt P-Forb	SHARP LOBED HEPATICA
HUPLUC	5 Huperzia lucidula	-1 FAC+	Nt Fern Ally	SHINING CLUBMOSS
LONCAN	5 Lonicera canadensis	3 FACU	Nt Shrub	AMERICAN FLY HONEYSUCKLE
LYCOBS	5 Lycopodium obscurum	3 FACU	Nt Fern Ally	GROUND PINE
MAICAC	4 Maianthemum canadense	0 FAC	Nt P-Forb	CANADA MAYFLOWER
MITREP	5 Mitchella repens	2 FACU+	Nt P-Forb	PARTRIDGE BERRY
OSMCLI	4 Osmorhiza claytonii	4 FACU-	Nt P-Forb	HAIRY SWEET CICELY
OSTVIR	5 Ostrya virginiana	4 FACU-	Nt Tree	IRONWOOD; HOP HORNBEAM
POLPUB	5 Polygonatum pubescens	5 UPL	Nt P-Forb	DOWNY SOLOMON SEAL
POPGRA	4 Populus grandidentata	3 FACU	Nt Tree	BIG TOOTHED ASPEN
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
QUERUB	5 Quercus rubra	3 FACU	Nt Tree	RED OAK
RIBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
RUBOCC	1 Rubus occidentalis	5 UPL	Nt Shrub	BLACK RASPBERRY
RUBSTR	2 Rubus strigosus	-2 FACW-	Nt Shrub	WILD RED RASPBERRY
SAMCAN	3 Sambucus canadensis	-2 FACW-	Nt Shrub	ELDERBERRY
SMIRAC	5 Smilacina racemosa	3 FACU	Nt P-Forb	FALSE SPIKENARD
SOLCAE	7 Solidago caesia	3 FACU	Nt P-Forb	BLUE STEMMED GOLDENROD
TILAME	5 Tilia americana	3 FACU	Nt Tree	BASSWOOD
TRIBOR	5 Trientalis borealis	-1 FAC+	Nt P-Forb	STARFLOWER
TRIGRA	5 Trillium grandiflorum	5 UPL	Nt P-Forb	COMMON TRILLIUM
TSUCAN	5 Tsuga canadensis	3 FACU	Nt Tree	HEMLOCK
VIBACE	6 Viburnum acerifolium	5 UPL	Nt Shrub	MAPLE LEAVED ARROW WOOD
VIOCAN	5 Viola canadensis	5 UPL	Nt P-Forb	CANADA VIOLET

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 2.

Locale: Emmet County
 Date: 15-Aug 2006 9 hours
 By: Joshua Cohen

FLORISTIC QUALITY DATA	Native	42	93.30%	Adventive	3	6.70%
42 NATIVE SPECIES	Tree	13	28.90%	Tree	0	0.00%
45 Total Species	Shrub	3	6.70%	Shrub	0	0.00%
4.6 NATIVE MEAN C	W-Vine	0	0.00%	W-Vine	0	0.00%
4.3 W/Adventives	H-Vine	0	0.00%	H-Vine	0	0.00%
29.6 NATIVE FQI	P-Forb	18	40.00%	P-Forb	2	4.40%
28.6 W/Adventives	B-Forb	0	0.00%	B-Forb	0	0.00%
2.4 NATIVE MEAN W	A-Forb	2	4.40%	A-Forb	1	2.20%
2.6 W/Adventives	P-Grass	0	0.00%	P-Grass	0	0.00%
AVG: Fac. Upland (+)	A-Grass	0	0.00%	A-Grass	0	0.00%
	P-Sedge	1	2.20%	P-Sedge	0	0.00%
	A-Sedge	0	0.00%	A-Sedge	0	0.00%
	Fern	5	11.10%		0	

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ACEPEN	5 Acer pensylvanicum	3 FACU	Nt Tree	STRIPED MAPLE
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACTPAC	7 Actaea pachypoda	5 UPL	Nt P-Forb	DOLL'S EYES
ADIPED	6 Adiantum pedatum	1 FAC-	Nt Fern	MAIDENHAIR FERN
ALLTRI	5 Allium tricoccum	2 FACU+	Nt P-Forb	WILD LEEK
ARANUD	5 Aralia nudicaulis	3 FACU	Nt P-Forb	WILD SARSAPARILLA
ASTMAC	4 Aster macrophyllus	5 UPL	Nt P-Forb	BIG LEAVED ASTER
BETALL	7 Betula alleghaniensis	0 FAC	Nt Tree	YELLOW BIRCH
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
BOTVIR	5 Botrychium virginianum	3 FACU	Nt Fern	RATTLESNAKE FERN
CXPLAN	8 Carex plantaginea	5 UPL	Nt P-Sedge	SEDGE
CAUTHA	5 Caulophyllum thalictroides	5 UPL	Nt P-Forb	BLUE COHOSH
CIRLUT	2 Circaea lutetiana	3 FACU	Nt P-Forb	ENCHANTER'S NIGHTSHADE
DRYCAR	5 Dryopteris carthusiana	-2 FACW-	Nt Fern	SPINULOSE WOODFERN
EPIHEL	0 EPIPACTIS HELLEBORINE	5 UPL	Ad P-Forb	HELLEBORINE
FAGGRA	6 Fagus grandifolia	3 FACU	Nt Tree	AMERICAN BEECH
FRAAME	5 Fraxinus americana	3 FACU	Nt Tree	WHITE ASH

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 2 continued.

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
GALTET	0 GALEOPSIS TETRAHIT	5 UPL	Ad A-Forb	COMMON HEMP NETTLE
GALTRR	4 Galium triflorum	2 FACU+	Nt P-Forb	FRAGRANT BEDSTRAW
GERROB	3 Geranium robertianum	5 UPL	Nt A-Forb	HERB ROBERT
HEPACU	8 Hepatica acutiloba	5 UPL	Nt P-Forb	SHARP LOBED HEPATICA
IMPCAP	2 Impatiens capensis	-3 FACW	Nt A-Forb	SPOTTED TOUCH ME NOT
LONCAN	5 Lonicera canadensis	3 FACU	Nt Shrub	AMERICAN FLY HONEYSUCKLE
LYCANN	5 Lycopodium annotinum	0 FAC	Nt Fern Ally	STIFF CLUBMOSS
LYCOBS	5 Lycopodium obscurum	3 FACU	Nt Fern Ally	GROUND PINE
MAICAC	4 Maianthemum canadense	0 FAC	Nt P-Forb	CANADA MAYFLOWER
MITREP	5 Mitchella repens	2 FACU+	Nt P-Forb	PARTRIDGE BERRY
OSMCLI	4 Osmorhiza claytonii	4 FACU-	Nt P-Forb	HAIRY SWEET CICELY
OSTVIR	5 Ostrya virginiana	4 FACU-	Nt Tree	IRONWOOD; HOP HORNBEAM
POLPUB	5 Polygonatum pubescens	5 UPL	Nt P-Forb	DOWNY SOLOMON SEAL
POPGRA	4 Populus grandidentata	3 FACU	Nt Tree	BIG TOOTHED ASPEN
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
PRUVUL	0 PRUNELLA VULGARIS	0 FAC	Nt P-Forb	LAWN PRUNELLA
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
RIBBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
SAMCAN	3 Sambucus canadensis	-2 FACW-	Nt Shrub	ELDERBERRY
SMIRAC	5 Smilacina racemosa	3 FACU	Nt P-Forb	FALSE SPIKENARD
SOLCAE	7 Solidago caesia	3 FACU	Nt P-Forb	BLUE STEMMED GOLDENROD
THUOCC	4 Thuja occidentalis	-3 FACW	Nt Tree	ARBOR VITAE
TILAME	5 Tilia americana	3 FACU	Nt Tree	BASSWOOD
TRIBOR	5 Trientalis borealis	-1 FAC+	Nt P-Forb	STARFLOWER
TRIGRA	5 Trillium grandiflorum	5 UPL	Nt P-Forb	COMMON TRILLIUM
TSUCAN	5 Tsuga canadensis	3 FACU	Nt Tree	HEMLOCK
VEROFF	0 VERONICA OFFICINALIS	5 UPL	Ad P-Forb	COMMON SPEEDWELL
VIOCAN	5 Viola canadensis	5 UPL	Nt P-Forb	CANADA VIOLET

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 3.

Locale: Emmet County
 Date: 15-Aug 2006 2.5 hours
 By: Joshua Cohen

FLORISTIC QUALITY DATA

22 NATIVE SPECIES	Native	22	100.00%	Adventive	0	0.00%
22 Total Species	Tree	7	31.80%	Tree	0	0.00%
4.7 NATIVE MEAN C	Shrub	2	9.10%	Shrub	0	0.00%
4.7 W/Adventives	W-Vine	0	0.00%	W-Vine	0	0.00%
22.2 NATIVE FQI	H-Vine	0	0.00%	H-Vine	0	0.00%
22.2 W/Adventives	P-Forb	9	40.90%	P-Forb	0	0.00%
1.8 NATIVE MEAN W	B-Forb	0	0.00%	B-Forb	0	0.00%
1.8 W/Adventives	A-Forb	1	4.50%	A-Forb	0	0.00%
	P-Grass	0	0.00%	P-Grass	0	0.00%
	A-Grass	0	0.00%	A-Grass	0	0.00%
	P-Sedge	0	0.00%	P-Sedge	0	0.00%
	A-Sedge	0	0.00%	A-Sedge	0	0.00%
	Fern	3	13.60%			

AVG: Fac. Upland (+)

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ACEPEN	5 Acer pensylvanicum	3 FACU	Nt Tree	STRIPED MAPLE
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACTPAC	7 Actaea pachypoda	5 UPL	Nt P-Forb	DOLL'S EYES
ADIPED	6 Adiantum pedatum	1 FAC-	Nt Fern	MAIDENHAIR FERN
ALLTRI	5 Allium tricoccum	2 FACU+	Nt P-Forb	WILD LEEK
ARANUD	5 Aralia nudicaulis	3 FACU	Nt P-Forb	WILD SARSAPARILLA
ARITRI	5 Arisaema triphyllum	-2 FACW-	Nt P-Forb	JACK IN THE PULPIT
BETALL	7 Betula alleghaniensis	0 FAC	Nt Tree	YELLOW BIRCH
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
BOTVIR	5 Botrychium virginianum	3 FACU	Nt Fern	RATTLESNAKE FERN
CAUTHA	5 Caulophyllum thalictroides	5 UPL	Nt P-Forb	BLUE COHOSH
DRYGAR	5 Dryopteris carthusiana	-2 FACW-	Nt Fern	SPINULOSE WOODFERN
FAGGRA	6 Fagus grandifolia	3 FACU	Nt Tree	AMERICAN BEECH
FRAAME	5 Fraxinus americana	3 FACU	Nt Tree	WHITE ASH
IMPAL	6 Impatiens pallida	-3 FACW	Nt A-Forb	PALE TOUCH ME NOT
MAICAC	4 Maianthemum canadense	0 FAC	Nt P-Forb	CANADA MAYFLOWER
OSMCLI	4 Osmorhiza claytonii	4 FACU-	Nt P-Forb	HAIRY SWEET CICELY
POLPUB	5 Polygonatum pubescens	5 UPL	Nt P-Forb	DOWNY SOLOMON SEAL
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
RUBSTR	2 Rubus strigosus	-2 FACW-	Nt Shrub	WILD RED RASPBERRY
SAMCAN	3 Sambucus canadensis	-2 FACW-	Nt Shrub	ELDERBERRY
TRIGRA	5 Trillium grandiflorum	5 UPL	Nt P-Forb	COMMON TRILLIUM

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 4.

Locale: Emmet County
 Date: 16-Aug
 By: Joshua Cohen

2006 9 hours

FLORISTIC QUALITY DATA	Native	42	93.30%	Adventive	3	6.70%
42 NATIVE SPECIES	Tree	11	24.40%	Tree	0	0.00%
45 Total Species	Shrub	8	17.80%	Shrub	0	0.00%
4.3 NATIVE MEAN C	W-Vine	0	0.00%	W-Vine	0	0.00%
4 W/Adventives	H-Vine	0	0.00%	H-Vine	0	0.00%
27.9 NATIVE FQI	P-Forb	15	33.30%	P-Forb	1	2.20%
27 W/Adventives	B-Forb	0	0.00%	B-Forb	1	2.20%
2.2 NATIVE MEAN W	A-Forb	2	4.40%	A-Forb	1	2.20%
2.4 W/Adventives	P-Grass	0	0.00%	P-Grass	0	0.00%
Fac. Upland (+)	A-Grass	0	0.00%	A-Grass	0	0.00%
	P-Sedge	3	6.70%	P-Sedge	0	0.00%
	A-Sedge	0	0.00%	A-Sedge	0	0.00%
	Fern	3	6.70%		0	0.00%

ACRONYM

ACEPEN	5	Acer pensylvanicum
ACESAU	5	Acer saccharum
ACTPAC	7	Actaea pachypoda
ADIPED	6	Adiantum pedatum
AGRPUB	5	Agrimonia pubescens
ALLTRI	5	Allium tricoccum
ARANUD	5	Aralia nudicaulis
ARITRI	5	Arisaema triphyllum
BETPAP	2	Betula papyrifera
CXINTU	3	Carex intumescens
CXPEDU	5	Carex pedunculata
CXPLAN	8	Carex plantaginea
CAUTHA	5	Caulophyllum thalictroides
CIRLUT	2	Circaea lutetiana
CORAME	5	Corylus americana
DRYCRI	6	Dryopteris cristata
FAGGRA	6	Fagus grandifolia

W WETNESS PHYSIOGNOMY

3	FACU	Nt Tree
3	FACU	Nt Tree
5	UPL	Nt P-Forb
1	FAC-	Nt Fern
5	UPL	Nt P-Forb
2	FACU+	Nt P-Forb
3	FACU	Nt P-Forb
-2	FACW-	Nt P-Forb
2	FACU+	Nt Tree
-4	FACW+	Nt P-Sedge
5	UPL	Nt P-Sedge
5	UPL	Nt P-Sedge
5	UPL	Nt P-Sedge
5	UPL	Nt P-Forb
3	FACU	Nt P-Forb
4	FACU-	Nt Shrub
-5	OBL	Nt Fern
3	FACU	Nt Tree

COMMON NAME

STRIPED MAPLE
SUGAR MAPLE
DOLL'S EYES
MAIDENHAIR FERN
SOFT AGRIMONY
WILD LEEK
WILD SARSAPARILLA
JACK IN THE PULPIT
PAPER BIRCH
SEDGE
SEDGE
SEDGE
BLUE COHOSH
ENCHANTER'S NIGHTSHADE
HAZELNUT
CRESTED SHIELD FERN
AMERICAN BEECH

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 4 continued.

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
FRAAME	5 Fraxinus americana	3 FACU	Nt Tree	WHITE ASH
GALTET	0 GALEOPSIS TETRAHIT	5 UPL	Ad A-Forb	COMMON HEMP NETTLE
GALTRR	4 Galium triflorum	2 FACU+	Nt P-Forb	FRAGRANT BEDSTRAW
GERROB	3 Geranium robertianum	5 UPL	Nt A-Forb	HERB ROBERT
IMPPAL	6 Impatiens pallida	-3 FACW	Nt A-Forb	PALE TOUCH ME NOT
LONCAN	5 Lonicera canadensis	3 FACU	Nt Shrub	AMERICAN FLY HONEYSUCKLE
LYCANN	5 Lycopodium annotinum	0 FAC	Nt Fern Ally	STIFF CLUBMOSS
MAICAC	4 Maianthemum canadense	0 FAC	Nt P-Forb	CANADA MAYFLOWER
OSMCLI	4 Osmorhiza claytonii	4 FACU-	Nt P-Forb	HAIRY SWEET CICELY
OSMLON	3 Osmorhiza longistylis	4 FACU-	Nt P-Forb	SMOOTH SWEET CICELY
OSTVIR	5 Ostrya virginiana	4 FACU-	Nt Tree	IRONWOOD; HOP HORNBEAM
POLPUB	5 Polygonatum pubescens	5 UPL	Nt P-Forb	DOWNY SOLOMON SEAL
POPBAL	2 Populus balsamifera	-3 FACW	Nt Tree	BALSAM POPLAR
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
PRUVIR	2 Prunus virginiana	1 FAC-	Nt Shrub	CHOKO CHERRY
RIBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
RUBOCC	1 Rubus occidentalis	5 UPL	Nt Shrub	BLACK RASPBERRY
RUBSTR	2 Rubus strigosus	-2 FACW-	Nt Shrub	WILD RED RASPBERRY
SAMCAN	3 Sambucus canadensis	-2 FACW-	Nt Shrub	ELDERBERRY
SMIRAC	5 Smilacina racemosa	3 FACU	Nt P-Forb	FALSE SPIKENARD
TAXCAN	5 Taxus canadensis	3 FACU	Nt Shrub	CANADIAN YEW
TILAME	5 Tilia americana	3 FACU	Nt Tree	BASSWOOD
TRIGRA	5 Trillium grandiflorum	5 UPL	Nt P-Forb	COMMON TRILLIUM
TSUCAN	5 Tsuga canadensis	3 FACU	Nt Tree	HEMLOCK
VERBLA	0 VERBASCUM BLATTARIA	4 FACU-	Ad B-Forb	MOTH MULLEIN
VEROFF	0 VERONICA OFFICINALIS	5 UPL	Ad P-Forb	COMMON SPEEDWELL
VIOCAN	5 Viola canadensis	5 UPL	Nt P-Forb	CANADA VIOLET

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 5.

Locale: Emmet County
 Date: 16-Aug 2006 3 hours
 By: Joshua Cohen

FLORISTIC QUALITY DATA	Native	34	89.50%	Adventive	4	10.50%
34 NATIVE SPECIES	Tree	8	21.10%	Tree	0	0.00%
38 Total Species	Shrub	8	21.10%	Shrub	1	2.60%
4.3 NATIVE MEAN C	W-Vine	0	0.00%	W-Vine	0	0.00%
3.8 W/Adventives	H-Vine	0	0.00%	H-Vine	0	0.00%
25 NATIVE FQI	P-Forb	14	36.80%	P-Forb	2	5.30%
23.7 W/Adventives	B-Forb	0	0.00%	B-Forb	0	0.00%
2.5 NATIVE MEAN W	A-Forb	0	0.00%	A-Forb	1	2.60%
2.8 W/Adventives	P-Grass	0	0.00%	P-Grass	0	0.00%
Fac. Upland	A-Grass	0	0.00%	A-Grass	0	0.00%
	P-Sedge	2	5.30%	P-Sedge	0	0.00%
	A-Sedge	0	0.00%	A-Sedge	0	0.00%
	Fern	2	5.30%		0	0.00%

AVG:

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACTPAC	7 Actaea pachypoda	5 UPL	Nt P-Forb	DOLL'S EYES
ADIPED	6 Adiantum pedatum	1 FAC-	Nt Fern	MAIDENHAIR FERN
AGRPUB	5 Agrimonia pubescens	5 UPL	Nt P-Forb	SOFT AGRIMONY
ALLTRI	5 Allium tricoccum	2 FACU+	Nt P-Forb	WILD LEEK
APOAND	3 Apocynum androsaemifolium	5 UPL	Nt P-Forb	SPREADING DOGBANE
AQUCAN	5 Aquilegia canadensis	1 FAC-	Nt P-Forb	WILD COLUMBINE
ARANUD	5 Aralia nudicaulis	3 FACU	Nt P-Forb	WILD SARSAPARILLA
ARITRI	5 Arisaema triphyllum	-2 FACW-	Nt P-Forb	JACK IN THE PULPIT
CXINTU	3 Carex intumescens	-4 FACW+	Nt P-Sedge	SEDGE
CXPLAN	8 Carex plantaginea	5 UPL	Nt P-Sedge	SEDGE
CAUTHA	5 Caulophyllum thalictroides	5 UPL	Nt P-Forb	BLUE COHOSH
CORAME	5 Corylus americana	4 FACU-	Nt Shrub	HAZELNUT
DRYCAR	5 Dryopteris carthusiana	-2 FACW-	Nt Fern	SPINULOSE WOODFERN
EPIHEL	0 EPIPACTIS HELLEBORINE	5 UPL	Ad P-Forb	HELLEBORINE
FAGGRA	6 Fagus grandifolia	3 FACU	Nt Tree	AMERICAN BEECH
FRAAME	5 Fraxinus americana	3 FACU	Nt Tree	WHITE ASH

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 5 continued.

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
GALTET	0 GALEOPSIS TETRAHIT	5 UPL	Ad A-Forb	COMMON HEMP NETTLE
GALTRR	4 Galium triflorum	2 FACU+	Nt P-Forb	FRAGRANT BEDSTRAW
LONCAN	5 Lonicera canadensis	3 FACU	Nt Shrub	AMERICAN FLY HONEYSUCKLE
MAICAC	4 Maianthemum canadense	0 FAC	Nt P-Forb	CANADA MAYFLOWER
MITREP	5 Mitchella repens	2 FACU+	Nt P-Forb	PARTRIDGE BERRY
OSMCLI	4 Osmorhiza claytonii	4 FACU-	Nt P-Forb	HAIRY SWEET CICELY
OSTVIR	5 Ostrya virginiana	4 FACU-	Nt Tree	IRONWOOD; HOP HORNBEAM
PINSTR	3 Pinus strobus	3 FACU	Nt Tree	WHITE PINE
POLPUB	5 Polygonatum pubescens	5 UPL	Nt P-Forb	DOWNY SOLOMON SEAL
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
PRUVIR	2 Prunus virginiana	1 FAC-	Nt Shrub	CHOKE CHERRY
RIBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
RUBALL	1 Rubus allegheniensis	2 FACU+	Nt Shrub	COMMON BLACKBERRY
RUBOCC	1 Rubus occidentalis	5 UPL	Nt Shrub	BLACK RASPBERRY
RUBSTR	2 Rubus strigosus	-2 FACW-	Nt Shrub	WILD RED RASPBERRY
TAXCAN	5 Taxus canadensis	3 FACU	Nt Shrub	CANADIAN YEWE
TILAME	5 Tilia americana	3 FACU	Nt Tree	BASSWOOD
TRIGRA	5 Trillium grandiflorum	5 UPL	Nt P-Forb	COMMON TRILLIUM
VEROFF	0 VERONICA OFFICINALIS	5 UPL	Ad P-Forb	COMMON SPEEDWELL
VINMIN	0 VINCA MINOR	5 UPL	Ad Shrub	PERIWINKLE

Appendix 2. Plant species observed during Emmet County State Forest Survey, Sites 6 and 7.

Locale: Emmet County
 Date: 17-Aug
 By: Joshua Cohen
 2006 7 hours

FLORISTIC QUALITY DATA	Native	42	95.50%	Adventive	2	4.50%
42 NATIVE SPECIES	Tree	11	25.00%	Tree	0	0.00%
44 Total Species	Shrub	4	9.10%	Shrub	0	0.00%
4.4 NATIVE MEAN C	W-Vine	0	0.00%	W-Vine	0	0.00%
4.2 W/Adventives	H-Vine	0	0.00%	H-Vine	0	0.00%
28.7 NATIVE FQI	P-Forb	17	38.60%	P-Forb	1	2.30%
28 W/Adventives	B-Forb	0	0.00%	B-Forb	1	2.30%
2.2 NATIVE MEAN W	A-Forb	3	6.80%	A-Forb	0	0.00%
2.3 W/Adventives	P-Grass	0	0.00%	P-Grass	0	0.00%
Fac. Upland (+)	A-Grass	0	0.00%	A-Grass	0	0.00%
	P-Sedge	2	4.50%	P-Sedge	0	0.00%
	A-Sedge	0	0.00%	A-Sedge	0	0.00%
	Fern	5	11.40%		0	0.00%

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
ACEPEN	5 Acer pensylvanicum	3 FACU	Nt Tree	STRIPED MAPLE
ACESAU	5 Acer saccharum	3 FACU	Nt Tree	SUGAR MAPLE
ACTPAC	7 Actaea pachypoda	5 UPL	Nt P-Forb	DOLL'S EYES
ADIPED	6 Adiantum pedatum	1 FAC-	Nt Fern	MAIDENHAIR FERN
ALLTRI	5 Allium tricoccum	2 FACU+	Nt P-Forb	WILD LEEK
ARITRI	5 Arisaema triphyllum	-2 FACW-	Nt P-Forb	JACK IN THE PULPIT
BETALL	7 Betula alleghaniensis	0 FAC	Nt Tree	YELLOW BIRCH
BETPAP	2 Betula papyrifera	2 FACU+	Nt Tree	PAPER BIRCH
CXALBU	5 Carex albursina	5 UPL	Nt P-Sedge	SEDGE
CXPEDU	5 Carex pedunculata	5 UPL	Nt P-Sedge	SEDGE
CAUTHA	5 Caulophyllum thalictroides	5 UPL	Nt P-Forb	BLUE COHOSH
CIRLUT	2 Circaea lutetiana	3 FACU	Nt P-Forb	ENCHANTER'S NIGHTSHADE
DRYCAR	5 Dryopteris carthusiana	-2 FACW-	Nt Fern	SPINULOSE WOODFERN
EPIVIR	10 Epifagus virginiana	5 UPL	Nt P-Forb	BEECH DROPS
FAGGRA	6 Fagus grandifolia	3 FACU	Nt Tree	AMERICAN BEECH
FRAAME	5 Fraxinus americana	3 FACU	Nt Tree	WHITE ASH
GALTRR	4 Galium triflorum	2 FACU+	Nt P-Forb	FRAGRANT BEDSTRAW

Appendix 2. Plant species observed during Emmet County State Forest Survey, Sites 6 and 7 continued.

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
GERROB	3 Geranium robertianum	5 UPL	Nt A-Forb	HERB ROBERT
GEUCAN	1 Geum canadense	0 FAC	Nt P-Forb	WHITE AVENS
HUPLUC	5 Huperzia lucidula	-1 FAC+	Nt Fern Ally	SHINING CLUBMOSS
IMPCAP	2 Impatiens capensis	-3 FACW	Nt A-Forb	SPOTTED TOUCH ME NOT
LONCAN	5 Lonicera canadensis	3 FACU	Nt Shrub	AMERICAN FLY HONEYSUCKLE
LYCOBS	5 Lycopodium obscurum	3 FACU	Nt Fern Ally	GROUND PINE
MAICAC	4 Malanthemum canadense	0 FAC	Nt P-Forb	CANADA MAYFLOWER
MITREP	5 Mitchella repens	2 FACU+	Nt P-Forb	PARTRIDGE BERRY
ONOUSEN	2 Onoclea sensibilis	-3 FACW	Nt Fern	SENSITIVE FERN
OSMCLI	4 Osmorhiza claytonii	4 FACU-	Nt P-Forb	HAIRY SWEET CICELY
OSTVIR	5 Ostrya virginiana	4 FACU-	Nt Tree	IRONWOOD; HOP HORNBEAM
POLPUB	5 Polygonatum pubescens	5 UPL	Nt P-Forb	DOWNY SOLOMON SEAL
POPGRA	4 Populus grandidentata	3 FACU	Nt Tree	BIG TOOTHED ASPEN
POPTRE	1 Populus tremuloides	0 FAC	Nt Tree	QUAKING ASPEN
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
RANABO	0 Ranunculus abortivus	-2 FACW-	Nt A-Forb	SMALL FLOWERED BUTTERCUP
RIBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
SAMCAN	3 Sambucus canadensis	-2 FACW-	Nt Shrub	ELDERBERRY
SMIRAC	5 Smilacina racemosa	3 FACU	Nt P-Forb	FALSE SPIKENARD
SOLCAE	7 Solidago caesia	3 FACU	Nt P-Forb	BLUE STEMMED GOLDENROD
STRROS	5 Streptopus roseus	0 FAC	Nt P-Forb	ROSE TWISTED STALK
TAXCAN	5 Taxus canadensis	3 FACU	Nt Shrub	CANADIAN YEW
TILAME	5 Tilia americana	3 FACU	Nt Tree	BASSWOOD
TRIGRA	5 Trillium grandiflorum	5 UPL	Nt P-Forb	COMMON TRILLIUM
VERDEN	0 VERBASCUM DENSIFLORUM	5 UPL	Ad B-Forb	MULLEIN
VEROFF	0 VERONICA OFFICINALIS	5 UPL	Ad P-Forb	COMMON SPEEDWELL
VIOCAN	5 Viola canadensis	5 UPL	Nt P-Forb	CANADA VIOLET

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 8.

Locale: Emmet County
 Date: 18-Aug 2006 4 hours
 By: Joshua Cohen

FLORISTIC QUALITY DATA

	Native	31	100.00%	Adventive	0	0.00%
31 NATIVE SPECIES	Tree	9	29.00%	Tree	0	0.00%
31 Total Species	Shrub	4	12.90%	Shrub	0	0.00%
4.6 NATIVE MEAN C	W-Vine	0	0.00%	W-Vine	0	0.00%
4.6 W/Adventives	H-Vine	0	0.00%	H-Vine	0	0.00%
25.5 NATIVE FQI	P-Forb	12	38.70%	P-Forb	0	0.00%
25.5 W/Adventives	B-Forb	0	0.00%	B-Forb	0	0.00%
2.5 NATIVE MEAN W	A-Forb	2	6.50%	A-Forb	0	0.00%
2.5 W/Adventives	P-Grass	0	0.00%	P-Grass	0	0.00%
	A-Grass	0	0.00%	A-Grass	0	0.00%
	P-Sedge	1	3.20%	P-Sedge	0	0.00%
	A-Sedge	0	0.00%	A-Sedge	0	0.00%
	Fern	3	9.70%		0	0.00%

AVG: Fac. Upland (+)

ACRONYM

ACEPEN	5 Acer pensylvanicum
ACESAU	5 Acer saccharum
ACTPAC	7 Actaea pachypoda
ADIPED	6 Adiantum pedatum
ALLTRI	5 Allium tricoccum
ARANUD	5 Aralia nudicaulis
ARITRI	5 Arisaema triphyllum
BETALL	7 Betula alleghaniensis
BETPAP	2 Betula papyrifera
CXPEDU	5 Carex pedunculata
CAUTHA	5 Caulophyllum thalictroides
DRYCAR	5 Dryopteris carthusiana
FAGGRA	6 Fagus grandifolia
FRAAME	5 Fraxinus americana
GALTRR	4 Galium triflorum
GERROB	3 Geranium robertianum
HUPLUC	5 Huperzia lucidula

W WETNESS PHYSIOGNOMY

3 FACU	Nt Tree
3 FACU	Nt Tree
5 UPL	Nt P-Forb
1 FAC-	Nt Fern
2 FACU+	Nt P-Forb
3 FACU	Nt P-Forb
-2 FACW-	Nt P-Forb
0 FAC	Nt Tree
2 FACU+	Nt Tree
5 UPL	Nt P-Sedge
5 UPL	Nt P-Forb
-2 FACW-	Nt Fern
3 FACU	Nt Tree
3 FACU	Nt Tree
2 FACU+	Nt P-Forb
5 UPL	Nt A-Forb
-1 FAC+	Nt Fern Ally

COMMON NAME

STRIPED MAPLE
SUGAR MAPLE
DOLL'S EYES
MAIDENHAIR FERN
WILD LEEK
WILD SARSAPARILLA
JACK IN THE PULPIT
YELLOW BIRCH
PAPER BIRCH
SEDGE
BLUE COHOSH
SPINULOSE WOODFERN
AMERICAN BEECH
WHITE ASH
FRAGRANT BEDSTRAW
HERB ROBERT
SHINING CLUBMOSS

Appendix 2. Plant species observed during Emmet County State Forest Survey, Site 8 continued.

ACRONYM	C SCIENTIFIC NAME	W WETNESS	PHYSIOGNOMY	COMMON NAME
LONCAN	5 Lonicera canadensis	3 FACU	Nt Shrub	AMERICAN FLY HONEYSUCKLE
OSMCLI	4 Osmorhiza claytonii	4 FACU-	Nt P-Forb	HAIRY SWEET CICELY
OSTVIR	5 Ostrya virginiana	4 FACU-	Nt Tree	IRONWOOD; HOP HORNBEAM
POLPUB	5 Polygonatum pubescens	5 UPL	Nt P-Forb	DOWNY SOLOMON SEAL
PRUSER	2 Prunus serotina	3 FACU	Nt Tree	WILD BLACK CHERRY
PRUVIR	2 Prunus virginiana	1 FAC-	Nt Shrub	CHOKE CHERRY
RANABO	0 Ranunculus abortivus	-2 FACW-	Nt A-Forb	SMALL FLOWERED BUTTERCUP
RIBCYN	4 Ribes cynosbati	5 UPL	Nt Shrub	PRICKLY or WILD GOOSEBERRY
SAMCAN	3 Sambucus canadensis	-2 FACW-	Nt Shrub	ELDERBERRY
SMIRAC	5 Smilacina racemosa	3 FACU	Nt P-Forb	FALSE SPIKENARD
SOLCAE	7 Solidago caesia	3 FACU	Nt P-Forb	BLUE STEMMED GOLDENROD
TILAME	5 Tilia americana	3 FACU	Nt Tree	BASSWOOD
TRIGRA	5 Trillium grandiflorum	5 UPL	Nt P-Forb	COMMON TRILLIUM
VIOCAN	5 Viola canadensis	5 UPL	Nt P-Forb	CANADA VIOLET

Appendix 3. Global and state element ranking criteria

Global and State Element Ranking Criteria

GLOBAL RANKS

- G1** = critically imperiled globally because of extreme rarity (5 or fewer occurrences range-wide or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
- G2** = imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
- G3** = either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. a single western state, a physiographic region in the East) or because of other factor(s) making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.
- G4** = apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- G5** = demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- GH** = of historical occurrence throughout its range, i.e. formerly part of the established biota, with the expectation that it may be rediscovered (e.g. Bachman's Warbler).
- GU** = possibly in peril range-wide, but status uncertain; need more information.
- GX** = believed to be extinct throughout its range (e.g. Passenger Pigeon) with virtually no likelihood that it will be rediscovered.

STATE RANKS

- S1** = critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
- S2** = imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
- S3** = rare or uncommon in state (on the order of 21 to 100 occurrences).
- S4** = apparently secure in state, with many occurrences.
- S5** = demonstrably secure in state and essentially ineradicable under present conditions.
- SA** = accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range.
- SE** = an exotic established in the state; may be native elsewhere in North America (e.g. house finch or catalpa in eastern states).
- SH** = of historical occurrence in state and suspected to be still extant.
- SN** = regularly occurring, usually migratory and typically nonbreeding species.
- SR** = reported from state, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.
- SRF** = reported falsely (in error) from state but this error persisting in the literature.
- SU** = possibly in peril in state, but status uncertain; need more information.
- SX** = apparently extirpated from state.