

Lake Michigan Wooded Dune and Swale ERA Plan

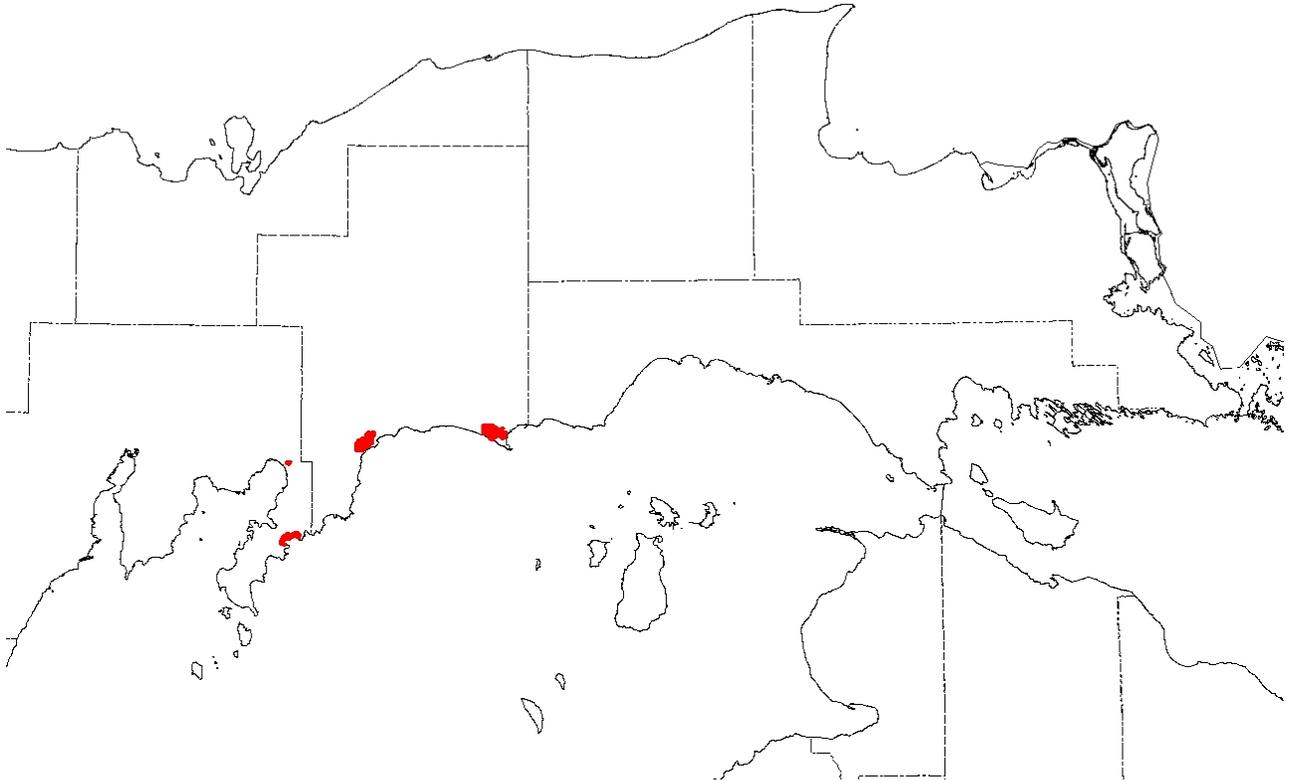


Figure 1. Lake Michigan WDS ERA locator map.

Administrative Information:

- This ERA plan is for four Wooded Dune and Swale (WDS) ERAs, that are all along the Lake Michigan shoreline.
- Three of the WDS ERAs are in the Shingleton FMU, Lake Michigan Shoreline Management Area (MA), and one is in the Garden Thompson Plains MA. They are in Compartments 066, 067, 079, 088, 095 and 096.
- The ERAs are in Delta County, Garden Township, T39N R18W, sections 21, 22, 23, 26, 27, 28, and 29; T40N R18W, sections 3 and 4; Schoolcraft County, Thompson Township, T41N R16W, sections 15, 16, 20-22, 28 and 29; and Mueller Township, T41N R13W, sections 7-9, and 15-18.
- Primary plan author: Kristen Matson, Forest Resources Division (FRD) Inventory and Planning Specialist. Contributors and reviewers include Sherry MacKinnon, Wildlife

Division (WLD) Wildlife Ecologist; Keith Kintigh, FRD Forest Certification and Conservation Specialist; Cody Norton, WLD Wildlife Biologist; Bob Burnham, FRD Unit Manager; Tori Irving and Adam Petrelius FRD Foresters; and Tom Burnis, FRD Forest Technician.

- The majority of these ERAs are on state forest land, but there are some private parcels within the ERAs.
- Two-track roads exist around the perimeter of the ERAs, extending into the ERAs in some places. A snowmobile trail cuts through the Thompson WDS ERA, and is near the Big Bay De Noc WDS ERA. The Thompson ERA contains a pipeline, powerline, and railroad track.
- ERA boundaries are derived from the underlying Natural Community EO boundary which are mapped using NatureServe standards. EO Boundaries are informed by vegetation and other site characteristics including soils, landform, and/or historic aerial imagery. As a result, it is not uncommon for EO/ERA boundaries to differ from forest inventory stand boundaries. If these difference result in potential conflicts with proposed forest activities, consult with the Forest Conservation and Certification Specialist.

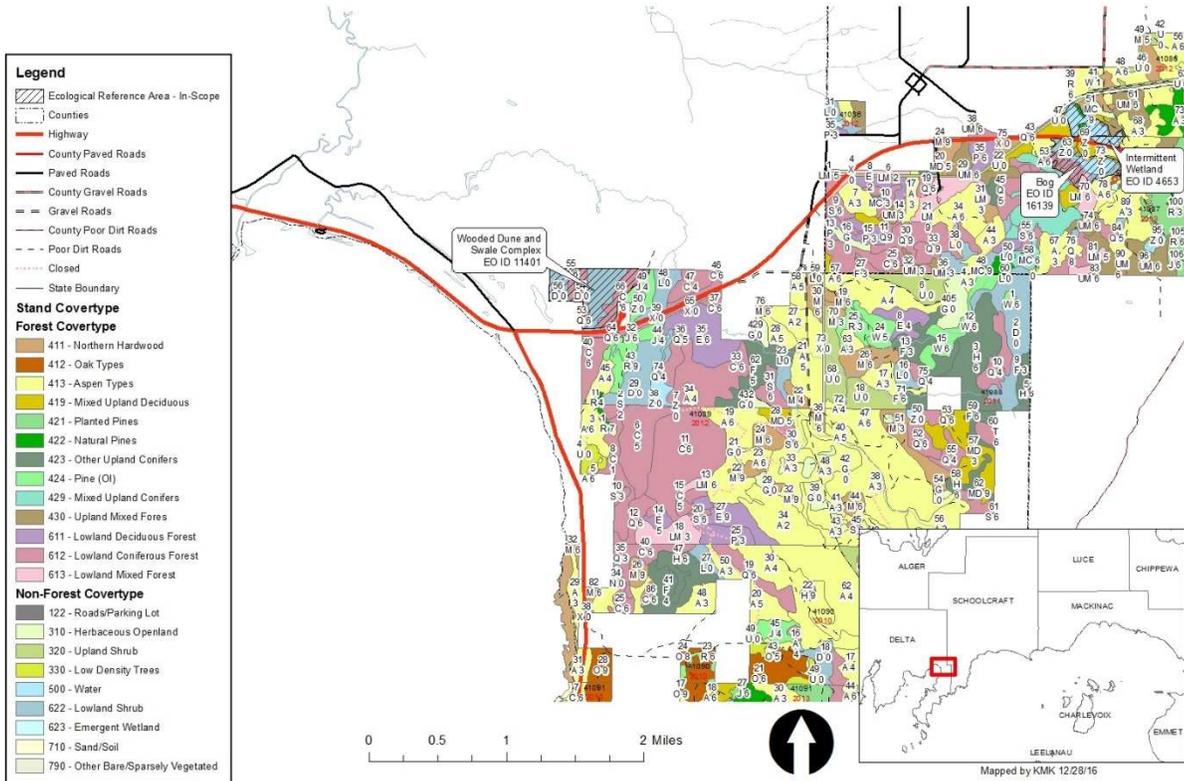


Figure 2. Big Bay De Noc WDS ERA area map with EO ID labels.

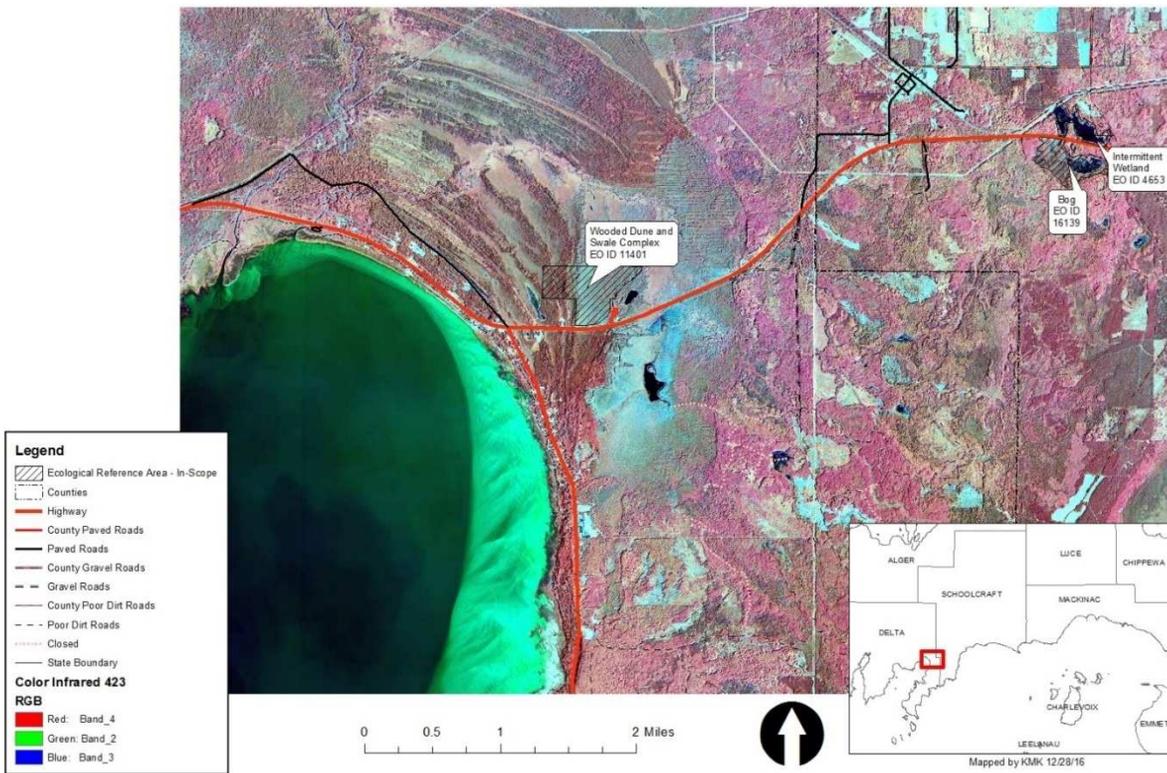


Figure 3. Big Bay De Noc WDS ERA Imagery with EO ID labels.

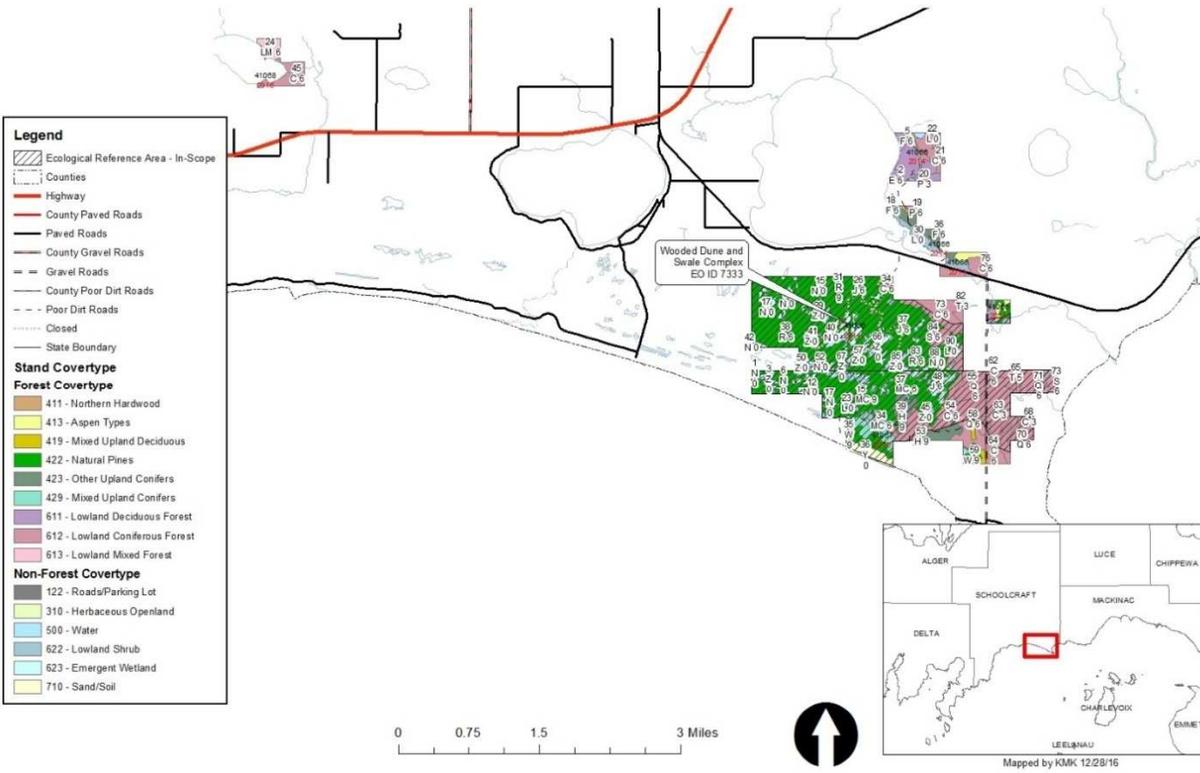


Figure 4. Gulliver WDS ERA area map with EO ID labels.

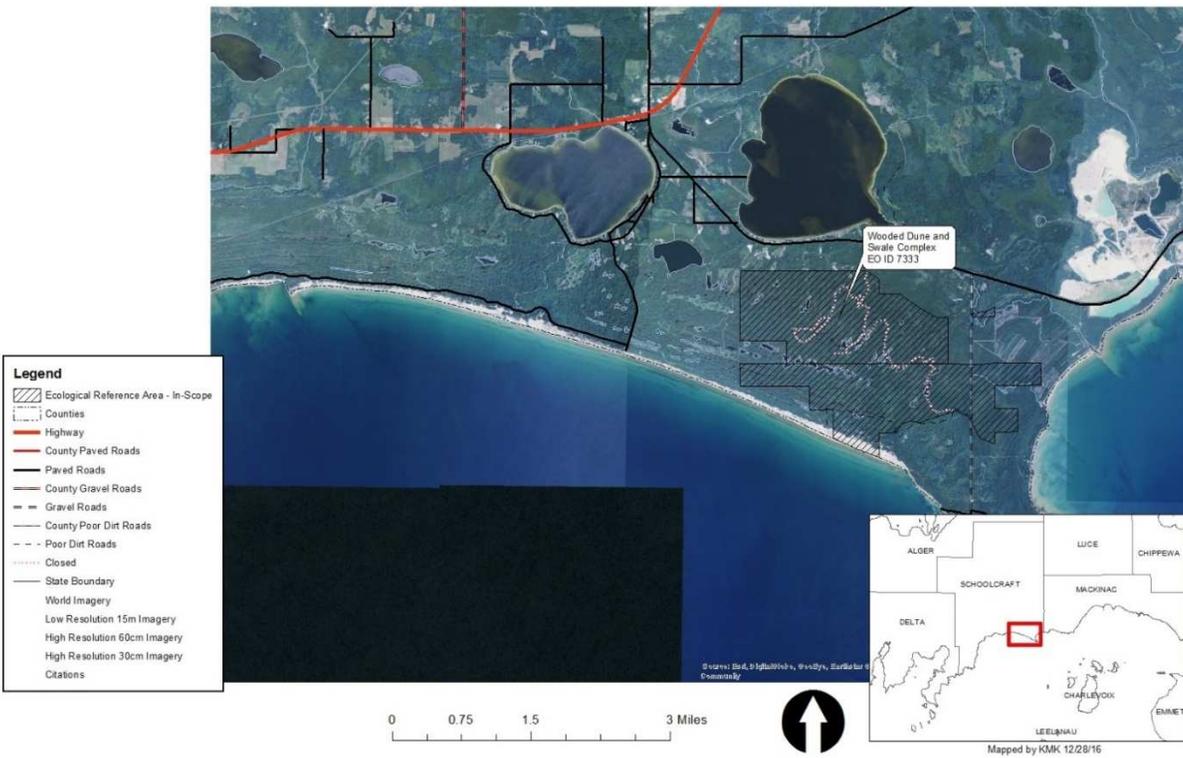


Figure 5. Gulliver WDS ERA Imagery with EO ID labels.

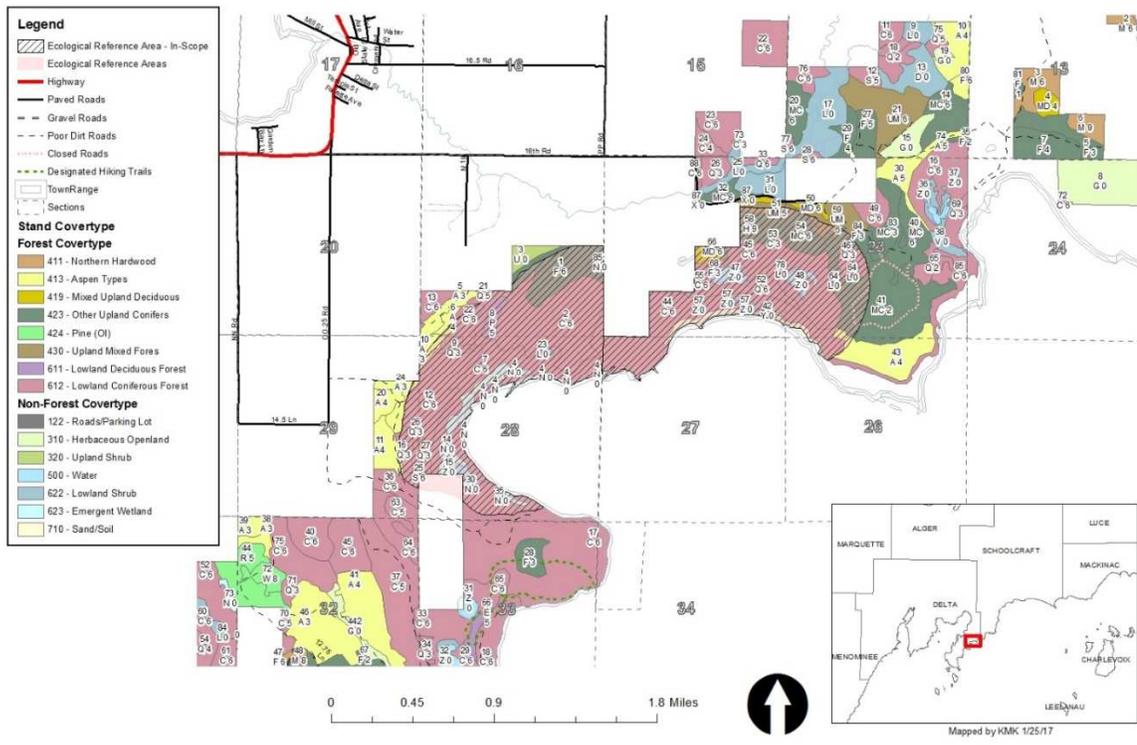


Figure 6. Portage Bay WDS ERA area map with EO ID labels.

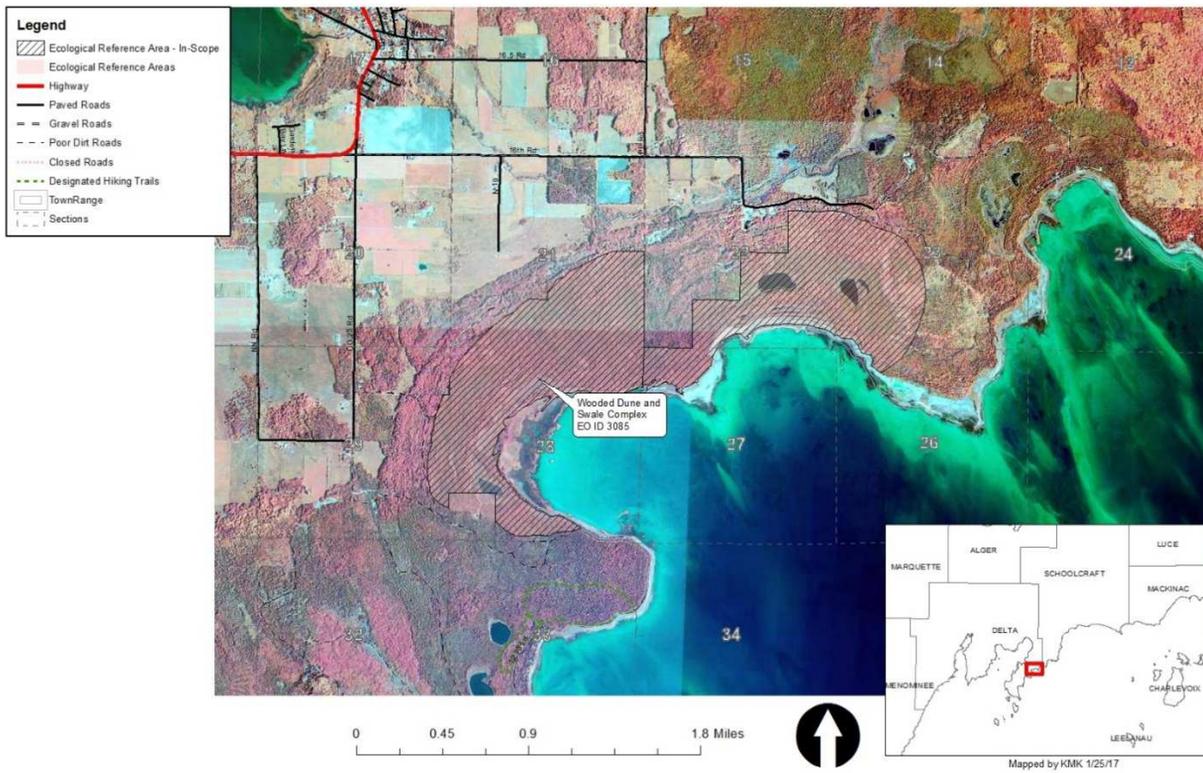


Figure 7. Portage Bay WDS ERA Imagery with EO ID labels.

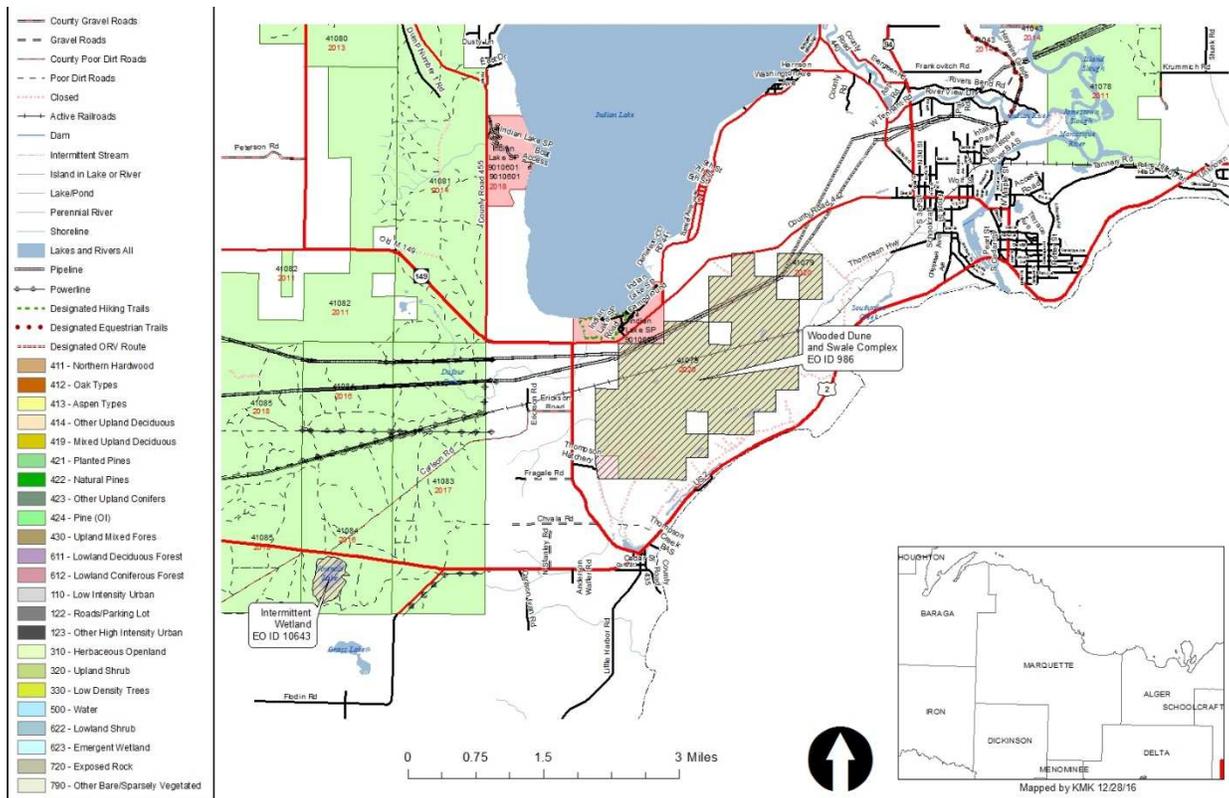


Figure 8. Thompson WDS ERA area map with EO ID labels.

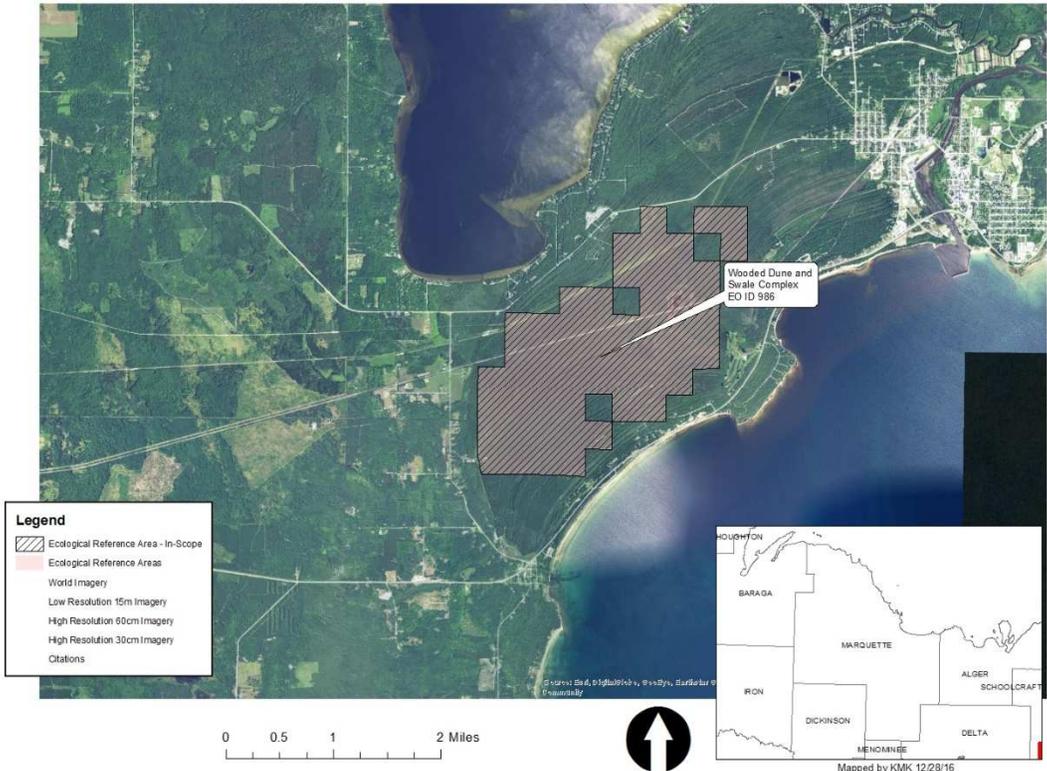


Figure 9. Thompson WDS ERA Imagery with EO ID labels.

Conservation Values

Wooded dune and swale complex is a large complex of parallel wetland swales and upland beach ridges (dunes) found in coastal embayments and on large sand spits along the shorelines of the Great Lakes. The upland dune ridges are typically forested, while the low swales support a variety of herbaceous or forested wetland types, with open wetlands more common near the shoreline and forested wetlands more prevalent further from the lake.

High-quality wooded dune and swale complexes have the full range of natural communities juxtaposed by associated communities with an unaltered natural disturbance regime (windthrow and fire on the forested dunes and hydrology in the swales). Vegetative succession creates a distinct pattern of communities or zones across this landscape complex. The flow of surface streams and groundwater is critical for maintaining saturated to inundated conditions in swales. Because of the close proximity to the shoreline, windthrow is common, especially on the loose organic soils of swales where anaerobic conditions limit the rooting depth of trees. Along-shore currents, waves, and wind create and continuously re-work foredunes along the shoreline. Additional important components of the natural disturbance regime include fire, beaver flooding, and insect epidemics.

Wooded dune and swale is ranked G3 S3, globally very rare locally in a restricted range and rare or uncommon in the state.

1. Big Bay De Noc Wooded Dune and Swale

EO_ID 11401, B rank, Last Observed 2007-07-18

Approximately 125 acres of this WDS are on state forest land. This is an extensive wooded dune and swale complex occurring adjacent to northern Lake Michigan on a silty/clay lakeplain. Thousands of years of lacustrine processes developed the complex patterning of low to high dune ridges and swales of variable depth and width. The site is characterized by complex community structure that includes dry northern forest, mesic northern forest, poor conifer swamp, rich conifer swamp, northern fen, northern shrub thicket, and northern wet meadow. Ridges are characterized by acidic (pH 5.0), fine-textured sands with a thin layer of needle duff. Forested swales and paludified dune ridges supporting conifer swamp species are characterized by shallow, acidic (pH 4.5-5.0) peats overlying fine-textured, wet sands. Open swales have slightly acidic to circumneutral (pH 6.0-7.0) peats of variable depth (40->100 cm) overlying wet, slightly acidic sands (pH 6.0-6.5). The depth of organic soils within the swales is highly variable but tends to increase with distance from the Lake Michigan shoreline. Standing water occurs in some of the open swales. The lake effect influences the local climate with

heavy snow loads, moderated temperatures in the winter and summer, and increased precipitation in the summer (fog and mist).

This wooded dune and swale community is characterized by complex ecological patterning, which results in high species and community diversity in an area with localized anthropogenic disturbance, primarily on the structuring patterning and succession. Forested swales and paludified, low beach ridges support poor conifer swamp and rich conifer swamp. Areas of poor conifer swamp are dominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*) with winterberry (*Ilex verticillata*), Labrador tea (*Ledum groenlandicum*), low sweet blueberry (*Vaccinium angustifolium*), sphagnum species (*Sphagnum* spp.), and three-seeded sedge (*Carex trisperma*). Areas of rich conifer swamp are typically dominated by northern white-cedar (*Thuja occidentalis*).

Shrub-dominated wetland swales are dominated by tag alder (*Alnus rugosa*), winterberry, and slender willow (*Salix petiolaris*). Areas of northern wet meadow are dominated by tussock sedge (*Carex stricta*), lake sedge (*C. lacustris*), and bluejoint grass (*Calamagrostis canadensis*). Swales dominated by northern fen are characterized by bog birch (*Betula pumila*), shrubby cinquefoil (*Potentilla fruticosa*), wiregrass sedge (*Carex lasiocarpa*), sweet gale (*Myrica gale*), bog rosemary (*Andromeda glaucophylla*), and leatherleaf (*Chamaedaphne calyculata*). Areas with pronounced sphagnum hummocks tend to be more acidic and are dominated by leatherleaf and other acidophiles.



Figure 10. Big Bay De Noc WDS. Photo by Bradford S. Slaughter.

2. Gulliver Lake Dunes

EO_ID 7333, BC Rank, Last Observed 2007-07-10

Occurs on approximately 2,345 acres of state forest land. This is a large wooded dune and swale complex occurring adjacent to northern Lake Michigan. Thousands of years of lacustrine processes developed the complex patterning of east-west trending dune ridges (typically 1-3 m high) and swales of variable depth and width in addition to irregular parabolic dunes (3-6 m high). The site is characterized by complex community structure that includes dry northern forest, dry-mesic northern forest, rich conifer swamp, poor conifer swamp, northern fen, mesic northern forest, northern shrub thicket, northern wet meadow, bog, intermittent wetland, interdunal wetland, and emergent marsh. Great Lakes barrens, open dunes, and sand and gravel beach occur within near-shore areas.

Scattered throughout the site are pockets of old-growth hemlock (*Tsuga canadensis*) (one 26" tree was estimated to be 257 years old) and old-growth pines with fire scars. Cored red pine (*Pinus resinosa*) in old-growth pockets ranged from 173-245 years old. Dune ridges are primarily dominated by an even-aged cohort of pines (80+ years old).

Forested swales are dominated by northern white-cedar. Ridges are characterized by acidic (pH 5.5), fine-textured sands with a thin layer of needle duff (4 cm deep). Forested swales have 50 to 100 cm of saturated, slightly acidic to circumneutral (pH 6.0-7.0) peat over sand. Well-developed sphagnum hummock and hollow microtopography occurs in the forested swales, especially in the broader swamps. Open swales have slightly acidic to circumneutral (pH 6.0-8.0) mucks of variable depth (10- >100 cm) overlying wet, slightly acidic (pH 6.0-6.5) sands. Standing water occurs in some of the open swales and ranges from 10-50 cm deep. The lake effect influences the local climate with heavy snow loads, moderated temperatures in the winter and summer, and increased precipitation in the summer (fog and mist).

This wooded dune and swale community is characterized by complex ecological patterning, which results in high species and community diversity in an area with fairly little anthropogenic disturbance on the state lands. Natural ecological processes (i.e., windthrow, fire, and senescence) are the dominant factors structuring patterning and succession. There are numerous single windthrow gaps as well as multiple treefall gaps with windthrow being most prevalent near the lakeshore and in cedar swamps. Paper birch (*Betula papyrifera*) and balsam fir (*Abies balsamea*) contribute the greatest volume of coarse woody debris with small-diameter snags and dead and downed logs but there are scattered white pine (*Pinus strobus*), hemlock, and northern white-cedar snags and dead and downed wood. Tip-ups and snapped boles are common throughout. Well-developed sphagnum hummock and hollow microtopography is prevalent in the broad forested swales. Evidence of fire occurs throughout the site with many larger canopy pines having fire scars on their boles.

Steep, north-facing parabolic dune ridges near the shore are dominated by large-diameter hemlock (24-36") with canopy associates including yellow birch (*Betula alleghaniensis*) and red maple (*Acer rubrum*). Pines dominate south-facing parabolic dunes near the shore and the inland dunes with local dominance by red pine and jack pine (*Pinus banksiana*) with white pine occurring as a supercanopy associate and additional associates including red oak (*Quercus rubra*), big-toothed aspen (*Populus grandidentata*), paper birch, and red maple. Conifers, such as white spruce (*Picea glauca*), northern white-cedar, and balsam fir are prevalent in the canopy closer to the shore. Balsam fir, white spruce, and black spruce are prevalent in the subcanopy along with northern white-cedar, red maple, and paper birch. The understory is dominated by balsam fir with spruces, and white pine and red pine regeneration. Subcanopy and understory density increases in areas with more open canopy due to windthrow and/or senescence of paper birch and balsam fir. The low shrub layer is dominated by low sweet blueberry, Canada blueberry (*V. myrtilloides*), and huckleberry (*Gaylussacia*

baccata) with bearberry (*Arctostaphylos uva-ursi*) and common juniper (*Juniperus communis*) locally dominant, especially near the shore, and Labrador tea prevalent along the margins of jack pine-dominated dune ridges farther inland. The ground cover is dominated by bracken fern with bunchberry, goldthread, starflower, Canada mayflower, twinflower, wild sarsaparilla, wintergreen, stiff clubmoss, and lichens.

Forested swales are dominated by dense northern white-cedar (3-12" DBH range) with black spruce, tamarack, red maple, and scattered white pine and hemlock as canopy associates. The understory of the forested swales contains tag alder, winterberry, black spruce, balsam fir and locally, northern white-cedar regeneration (especially in areas of windthrow and younger swamp forest). Prevalent in the low shrub layer are alder-leaved buckthorn (*Rhamnus alnifolia*), black spruce, northern white-cedar, Labrador tea, leatherleaf, American fly honeysuckle (*Lonicera canadensis*), goldthread (*Coptus trifolia*), false mayflower (*Smilacina trifolia*), oak fern (*Gymnocarpium dryopteris*), sensitive fern (*Onoclea sensibilis*), creeping snowberry (*Gaultheria hispidula*), three-seeded sedge, starflower (*Trientalis borealis*), naked miterwort (*Mitella nuda*), and wild blue flag (*Iris versicolor*).

The shoreline adjacent to the wooded dune and swale complex includes stretches of sand and gravel beach, extensive open dunes with wide dune fields (over 0.15 miles wide in places), interdunal wetlands, and Great Lakes barrens. Areas of open dune are dominated by the dune grasses, especially marram grass (*Ammophila breviligulata*) and sand reed grass (*Calamovilfa longifolia*) with wormwood (*Artemisia campestris*), harebell (*Campanula rotundifolia*), and Lake Huron tansy (*Tanacetum huronense*, state threatened). Great lakes barrens is characterized by a scattered conifer canopy of white pine and white spruce over a dense shrub layer with junipers. Small pockets of interdunal wetland are dominated by rushes (*Juncus* spp.), bulrushes (*Scirpus* and *Schoenoplectus* spp.), and sedges (*Carex* spp.).



Figure 11. The Gulliver Lake WDS complex is characterized by diverse ecological zonation. Photos by Joshua G. Cohen.

3. Portage Bay Wooded Dune and Swale Complex

EO_ID 3085, AB Rank, Last Observed 2006-07-31

This large wooded dune and swale complex occurs along Portage Bay on the Garden Peninsula on a silt/clay lakeplain with low sandy beach ridges. It occurs on approximately 954 acres of state forest land. The Portage Bay site, which occurs along the shore of northern Lake Michigan, is an extensive wooded dune and swale complex with more than seven ecological communities and over 180 native plant species documented. Extensive limestone cobble shore and sand and gravel beach grade to open dunes, which are backed by interdunal wetlands. Farther inland, the dune ridges are dominated by dry northern forest, dry-mesic northern forest, and mesic northern forest while northern wet meadow and rich conifer swamps dominate the swales. The site contains three moderate-sized inland lakes, one with a bog community occurring along the margin.

The beach ridges are dominated by white pine, red pine, balsam fir, and paper birch, with localized hemlock. Characteristic ground cover of the ridges includes low sweet blueberry, starflower, Canada mayflower (*Maianthemum canadense*), bearberry, and trailing arbutus (*Epigaea repens*). Northern white cedar, balsam fir, black spruce, and white spruce dominate the forested swales. Also common in the swales are false mayflower, goldthread, alder-leaved buckthorn, tag alder, Labrador tea, and ebony sedge (*Carex eburnean*).



Figure 12. Portage Bay WDS. Photo by Bradford S. Slaughter.

4. Thompson Wooded Dune and Swale Complex

EO_ID 10679, C Rank, Last Observed 2012-07-20

This extensive wooded dune and swale complex occurs adjacent to Lake Michigan along an embayment on a sandy lakeplain. Approximately 2,163 acres are on state forest land. Thousands of years of lacustrine processes have developed complex patterning of low dune ridges (0.5-2.0 m) and swales of variable depth and width. The soils in this complex range from calcareous dune sand on beach areas to acidic, fine-textured sand mixed with organic material on ridges to acidic to circumneutral sapric or fibric peat deposits over saturated sands in swales. Depth of organics within the swales generally increases with distance from the lakeshore. The lake effect influences the local climate with heavy snow loads, moderated temperatures in the winter and summer, an increased precipitation in the summer (fog and mist).

This wooded dune and swale complex is characterized by complex community structure that includes dry-mesic northern forest, rich conifer swamp, northern shrub thicket, northern wet meadow, and northern fen. The complex ecological patterning results in high species and community diversity in an area with severe anthropogenic disturbance. The low sandy dune ridges are dominated by white pine with canopy associates including red pine, paper birch, red maple, and black spruce. Typical low shrubs include low sweet blueberry, huckleberry, and Labrador tea. Bracken fern (*Pteridium aquilinum*) is dominant in the ground cover with wintergreen (*Gaultheria procumbens*) common. Some low dune ridges have been paludified and are covered in peat and support rich conifer swamp, which dominates the majority of the swales within the complex.

Northern white-cedar dominates the forested swales with tamarack, balsam fir, and white pine as a canopy associate. Scattered tall shrubs include tag alder and winterberry. Typical species of the ground cover in the forested swales include Labrador tea, swamp fly honeysuckle (*Lonicera oblongifolia*), alder-leaved buckthorn, creeping winterberry, false mayflower, starflower, three-seeded sedge, goldthread, and sphagnum mosses. Narrow swales with a high-water table often support northern shrub thickets dominated by tag alder with associates including winterberry, red-osier dogwood (*Cornus stolonifera*), sweet gale, and willows. Bluejoint grass, sedges, and saplings of northern white-cedar and tamarack are also characteristic of the shrub-dominated swales. Swales dominated by northern fen are characterized by bog birch, shrubby cinquefoil, sweet gale, wiregrass sedge, bog goldenrod (*Solidago uliginosa*), small cranberry (*Vaccinium oxycoccos*), pitcher-plant (*Sarracenia purpurea*), and round-leaved sundew (*Drosera rotundifolia*). Open swales that are more acidic tend to be dominated by leatherleaf with well-developed sphagnum hummock and hollow microtopography.



Figures 13 and 14. Thompson WDS. Photo by Bradford S. Slaughter.



High Conservation Value (HCV Attributes):

These wooded dune and swale ERAs are natural communities of regional significance. They are found along the Lake Michigan shoreline, and are part of a large landscape level forest.

Seventeen rare plant species are associated with wooded dune and swale complexes throughout its range (refer to Kost et al. 2007 for a list).

Rare plants associated with near shore dunes that were documented during surveys in the Portage WDS ERA include: dwarf lake iris (*Iris lacustris*, federal/state threatened), Lake Huron tansy (*Tanacetum huronense*, state threatened), Pitcher's thistle (*Cirsium pitcheri*, federal/state threatened), Ram's head lady's-slipper (*Cypripedium arietinum*) and Richardson's sedge (*Carex richardsonii*, state special concern). The Garden Peninsula is noted for numerous migratory songbirds.

Rare plants and animals associated with Gulliver WDS include: Green spleenwort (*Asplenium viride*, state special concern), Pitcher's thistle, Lake Huron tansy, and piping plover (*Charadrius melodus*, endangered).

Rare plants and animals associated with Thompson WDS include: sedge (*Carex albolutescens*, state threatened), Calypso (*Calypso bulbosa*, state threatened), and little brown bat (*Myotis lucifugus*, state concern).

Garden Township Coastal Environmental Area, a Special Conservation Area (SCA), is adjacent to the Portage WDS ERA. There is a Critical Dunes HCVA throughout most the Gulliver WDS. The Gulliver Lake Dune, Portage and Big Bay De Noc ERAs are within larger SCAs for deer winter range. There are known archaeological site near Gulliver and Portage ERAs.

Recreational uses include hiking, birdwatching, gathering and boating.

Threats Assessment

Wooded dune and swale complexes are threatened in various ways. Habitat fragmentation, hydrologic disruption, wetland filling, nutrient loading and invasive species introductions occur from roads, rail grades, utilities, and shoreline development. Additional threats documented in recent surveys (Cohen et al 2008) include deer herbivory which affects hemlock and cedar regeneration and logging on private lands. In some locations, there is intense recreational use including excessive foot traffic, mountain bike trails and ATV use.

Because of the wide diversity of habitats provided by wooded dune and swale complexes, invasive plants threatening the diversity and community structure include species from all ends

of the moisture and light continuums. Particularly aggressive invasives to monitor and promptly control include garlic mustard (*Alliaria petiolata*), Dame's rocket (*Hesperis matronalis*), purple loosestrife (*Lythrum salicaria*), narrow-leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*Typha xglauca*), reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), European marsh thistle (*Cirsium palustre*), spotted knapweed (*Centaurea maculosa*), common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*R. frangula*), autumn olive (*Elaeagnus umbellata*), Eurasian honeysuckles (*Lonicera morrowii*, *L. japonica*, *L. maackii*, *L. sempervirens*, *L. tatarica*, *L. xbella*, and *L. xylosteum*), multiflora rose (*Rosa multiflora*), and Norway maple (*Acer platanoides*).

Off-road vehicle damage was noted in all four of the ERAs. Off-road vehicle damage is prohibiting vegetation establishment, making the dunes more prone to blow out, providing pathways for invasive plants, and damaging populations of rare lakeshore plants. In addition, it was noted that deer herbivory is often limiting cedar and hemlock regeneration in these ERAs.

The following invasive species were noted: spotted knapweed along the open dune area and reed along the shore in Portage Bay WDS; European marsh thistle (*Cirsium palustre*) was found in Big Bay De Noc WDS; spotted knapweed, lawn prunella (*Prunella vulgaris*) and European marsh thistle were noted in Thompson WDS.

Thompson WDS contains road, railroads, powerlines and pipelines that are impacting hydrology. Shoreline development and land fragmentation of private lands surrounding all of these ERAs is a concern.

General Management of ERAs

ERAs will generally not be managed for timber harvest. Management activities or prescriptions in Ecological Reference Areas are limited to low impact activities compatible with the defined attributes and values of the community type, except under the following circumstances:

- i. Harvesting activities where necessary to restore or recreate conditions to meet the objectives of the ERA, or to mitigate conditions that interfere with achieving the ERA objectives. In this regard, forest management activities (including timber harvest) may be used to create and maintain conditions that emulate an intact, mature forest or other successional phases that may be under-represented in the landscape.

ii. Road building only where it is documented that it will contribute to minimizing the overall environmental impacts within the FMU and will not jeopardize the purpose for which the ERA was designated.

iii. Existing and new land use activities should be evaluated in the context of whether they detract from achieving the desired future conditions of the natural community for which the ERA was designated. The acceptability of land use activities within DNR administered ERAs will be evaluated using severity, scope, and irreversibility criteria, as established in DNR IC4199, Guidance for Land Use Activities within DNR Administered Ecological Reference Areas.

iv. Threats such as fire, natural or exotic pests or pathogens may warrant other management measures.

v. Harvesting and other management activities in presently accessible areas located within the peripheral boundary of an ERA that are NOT the natural community of focus and which may or may not be typed as a separate stand or forest type (e.g. an upland island of previously managed aspen within a bog complex) may be prescribed for treatments, contingent upon a determination of no anticipated direct or indirect adverse impact to the defined attributes and values of natural community for which the ERA was designated. The FRD Biodiversity Conservation Program leader shall be consulted regarding the determination of any direct or indirect adverse impact.

vi. Land management activities immediately adjacent to an ERA should consider any anticipated direct or indirect adverse impact to the defined attributes and values of natural community for which the ERA was designated. Management will be adaptive. ERAs will be monitored to determine if implemented management activities are moving the natural communities forward, or maintaining them at their desired future condition. The network of ERAs will be evaluated every five years for their contribution to the overall goal of biodiversity conservation. This review cycle will allow for the potential addition or subtraction of lands from an ERA, designation of new ERAs, or removal of the ERA planning designation.

Management Goals

- Restoration of Wooded Dune and Swale ERA where applicable.
- Allow natural ecological processes to occur.
- Manage for unfragmented forest.

- Invasive Species: Ideally, the best goal would be to eliminate invasive species (or maintain an absence of invasive species), but in some areas, that may not be possible and a goal that recognizes this may be necessary.
- Reduce other Threats (Encroachment of Woody Vegetation, ORVs, etc.).
- The ERA has representation of native plants, indicator species, and rare species.

Management Objectives

The following Management Objectives describe the measures necessary to ensure the maintenance and/or enhancement of the ERA site or sites. Objectives and associated management actions will be prioritized and implemented based upon available resources.

- Identify and reduce illegal ORV access points.
- Identify and prioritize critical areas within the ERA to treat for invasive species.
- Determine if there are impacts to hydrological system.
- Allow blowdown/windthrow and insect mortality to occur without salvage harvest.
- Assess forest regeneration within the planning period. (Cedar regeneration was noted to be negatively impacted by deer browse.)
- Assess EO quality every 10-20 years.
- Work with adaptation specialist to determine threats associated with climate change.

Management Actions

Suggested actions or series of actions that would help to achieve the above objectives.

(M= Maintenance action, R= Restoration action)

- If current data/knowledge are not available regarding the management goals, actions may address needed assessments. (i.e. surveys may be needed) (M, R)
- Identify vectors of invasive species and reduce their introduction to the site (M, R)
- Remove invasive plants using appropriate control methods for that particular species (hand-pull, herbicide, prescribed burn) using partnerships where appropriate, develop Forest Treatment Proposals (FTP) and Pesticide Action Plans (PAP). (M, R)
- Use periodic burning to maintain presence of native plant species, reduce invasives, and to reduce woody encroachment. (M, R)
- Minimal Impact Suppression Tactic (MIST) practices should be used for wildfire response in this area if possible. (M, R)
- Evaluate forest regeneration, and where inadequate, apply sound scientific management to address. (R)
- Close illegal roads and trails. (M, R)
- Work with Law Enforcement Division to patrol for illegal ORV activity, especially along the lakeshore, and enforce state land use rules. (M, R)

- Work with MNFI and other experts to update EO inventory. (M, R)
- Update plan with additional knowledge as it becomes available. (M)
- Consider purchase of high quality inholdings, based on Department priorities and strategies. (R)

Monitoring

Monitoring approaches and indicators appropriate for the natural community and in line with the objectives and management actions suggested, including appropriate frequency and timing considerations. (Unless otherwise specified, monitoring is expected to occur once every 10-year inventory cycle.)

Metric	Current Status	Desired Future status	Assessment
Populations of Invasive species – number and scope by species	Severity unknown (several species were noted – see above threats); treatments should be monitored appropriately; detection monitoring opportunistically or every five years’ max.	Eliminated/fewer occurrences	
Representative and rare species – species occurrences	Baseline EO records; updated when EO’s are updated every 10-20 years or opportunistically	Representation; not decreasing	
Illegal ORV activity – number of new instances and number of citations issued	2006 EO record noted ORV damage along the shoreline.	Eliminated/fewer occurrences	
Regeneration of tree species	Baseline inventory data taken every decade	Regeneration of representative species is desired.	

Additional Resources:

MNFI Natural Community Abstracts: <http://mnfi.anr.msu.edu/pub/abstracts.cfm#Communities>

Michigan Department of Natural Resources Forest Certification Work Instruction 1.4:

http://www.michigan.gov/documents/dnr/WI_1.4BiodMgt_320943_7.pdf