

Shingleton Patterned Fen ERA Plan

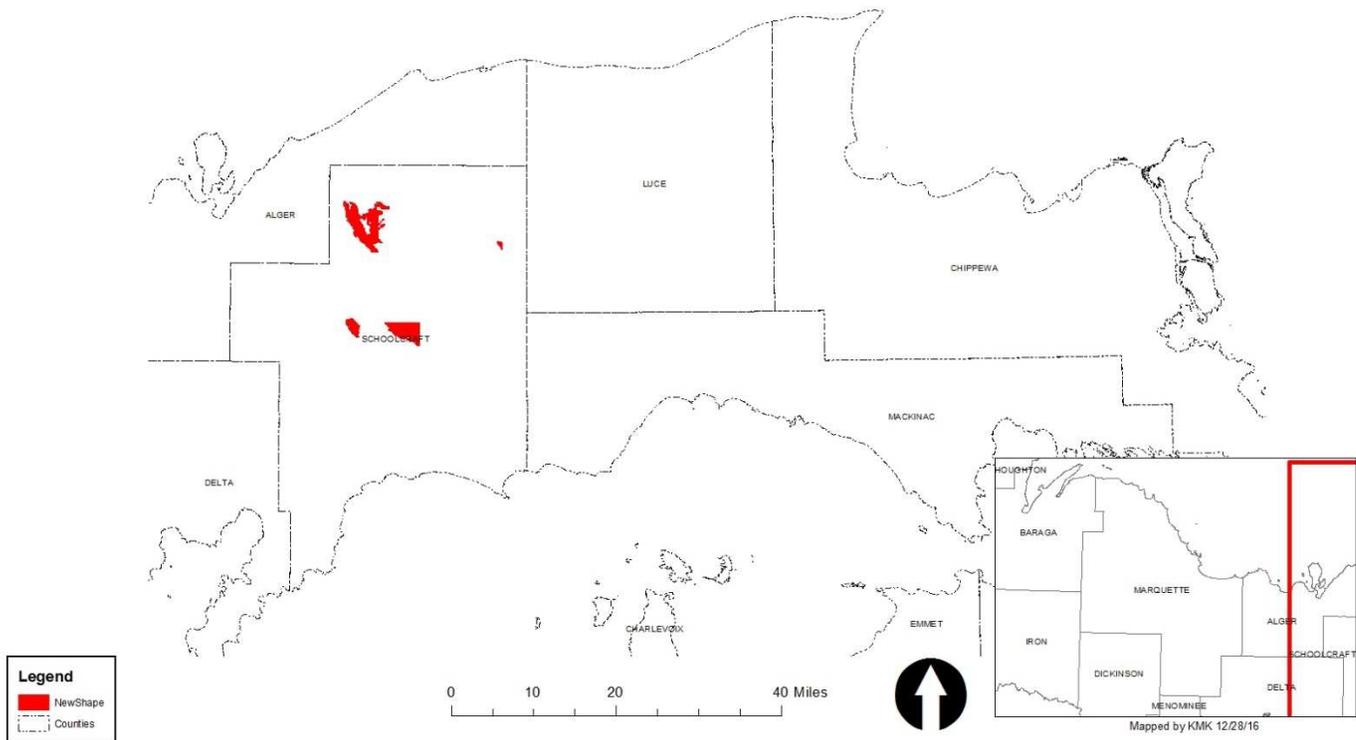


Figure 1. Shingleton Patterned Fen ERA locator map.

Administrative Information:

- The Shingleton Patterned Fen ERA Plan is for five patterned fens located in the central Upper Peninsula.
- These five ERAs are located on State Forest land in the Shingleton FMU, in compartments: 21-26, 28, 31, 32, 113, 147, 153-155, and 161-165. Two of the ERAs are entirely within the Seney Manistique Swamp Management Area (MA), two ERAs are in both the Seney Manistique Swamp MA and the Cusino Complex MA, and one ERA is within the Fox River Complex MA.
- Schoolcraft County, Hiawatha, Manistique and Seney Townships, T46N, R16W sections 1-4, 9-15, 22-26; T47N, R16W sections 25, 27-29, 32-36; T 47N, R15W sections 30-32;

T46N, R15W sections 6, 7, and 19; T46N, R13W sections 21 and 28; T44N, R16W sections 3, 4, 9, 10, 15, 16 and 22; T44N, R15W sections 8-11, 14-17, and 21-23.

- 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; Mario Molin, Adam Petrelius and Tori Irving FRD Foresters; and Robert Tylka, FRD Timber Management Specialist.
- The majority of these ERAs are roadless. A few two track roads extend into the edges of some of the ERAs. Most of the ERAs contain creeks and small ponds. The surrounding ownership is State of Michigan, with some private and corporate lands. Seney National Wildlife Refuge is in the center of these ERAs. Snowmobile trails are near Marsh Creek and East Branch Fox River ERAs.
- Marsh Creek ERA is part of a conservation easement with Department of Environmental Quality (DEQ). A large portion of the Strangmoor bog falls within the Seney National Wildlife Refuge, and documents regarding the bog are located there.
- 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.

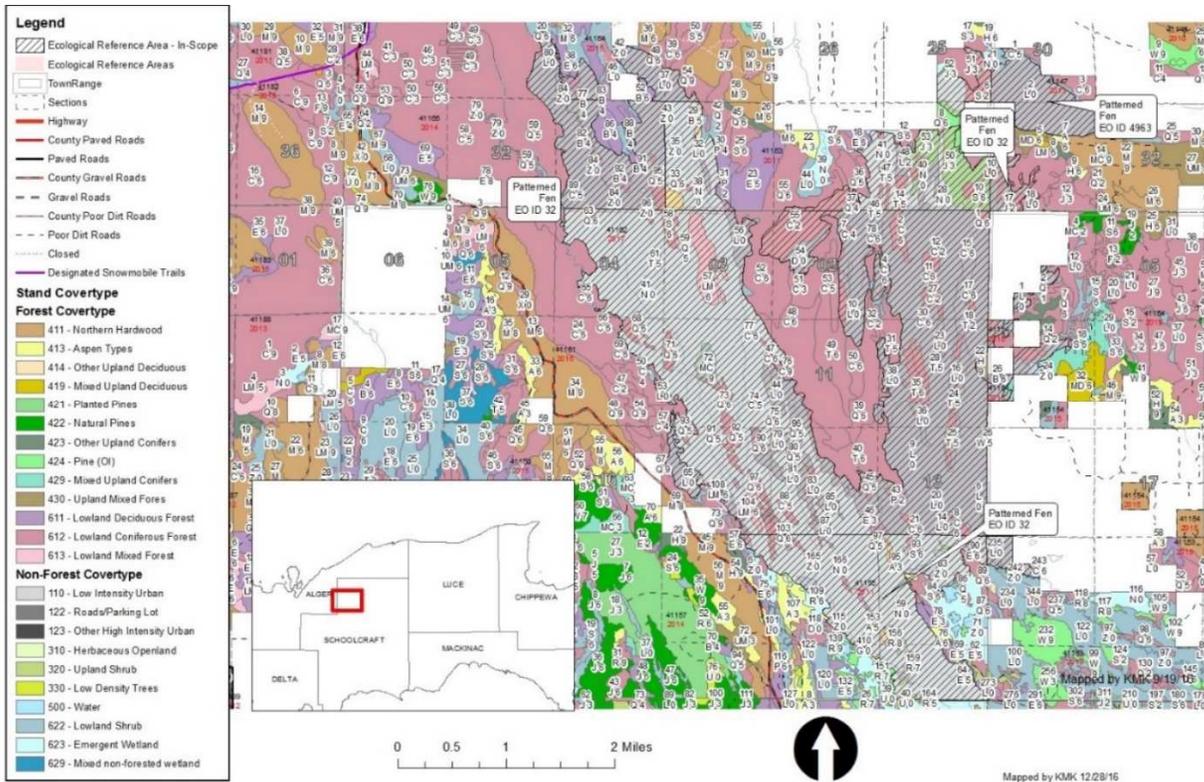


Figure 2. Creighton and Negro Creek Patterned Fens ERA area map with EO ID labels.

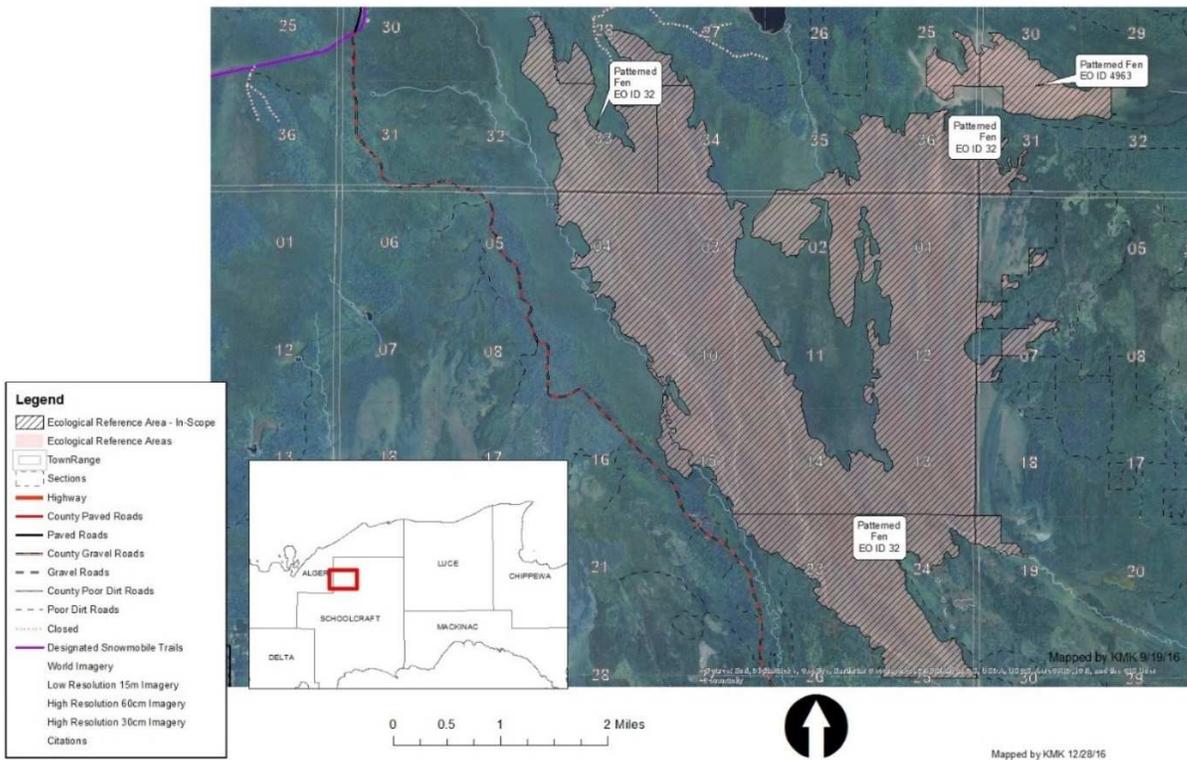


Figure 3. Creighton and Negro Creek Patterned Fens ERA Imagery with EO ID labels.

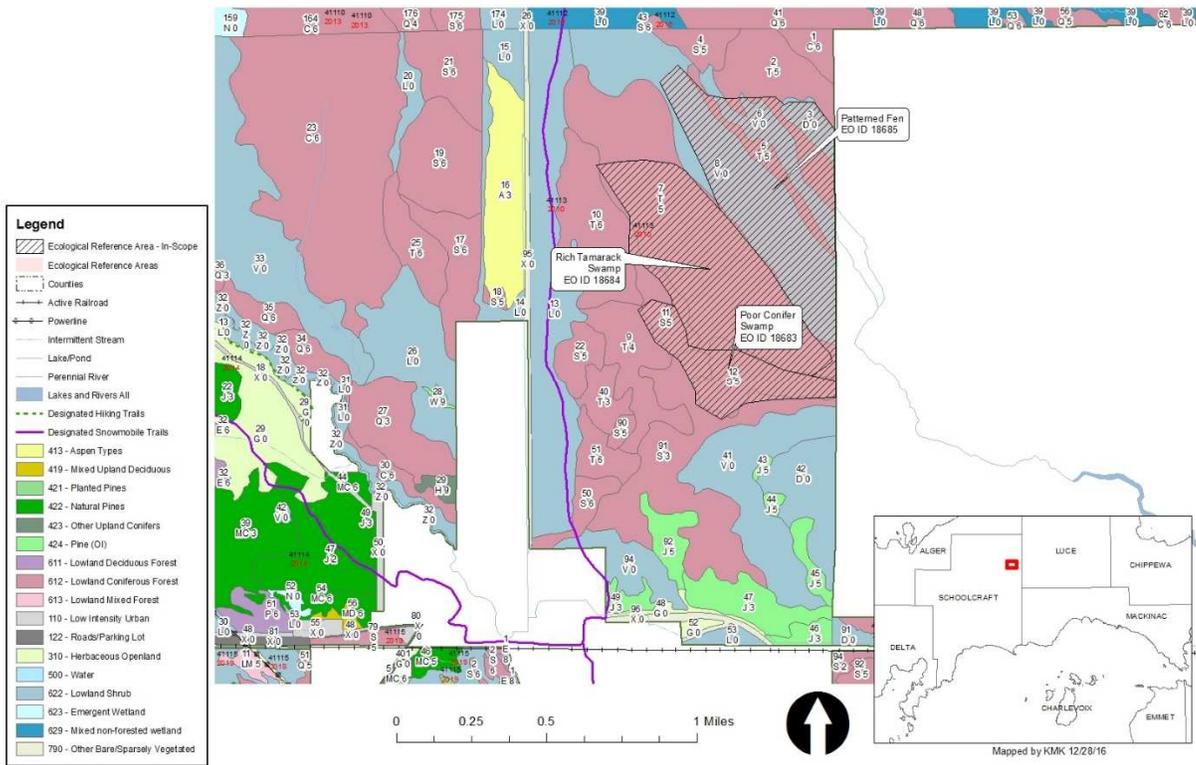


Figure 4. East Branch Fox River Patterned Fen ERA area map with EO ID labels. (Adjacent ERAs covered in a different plan.)

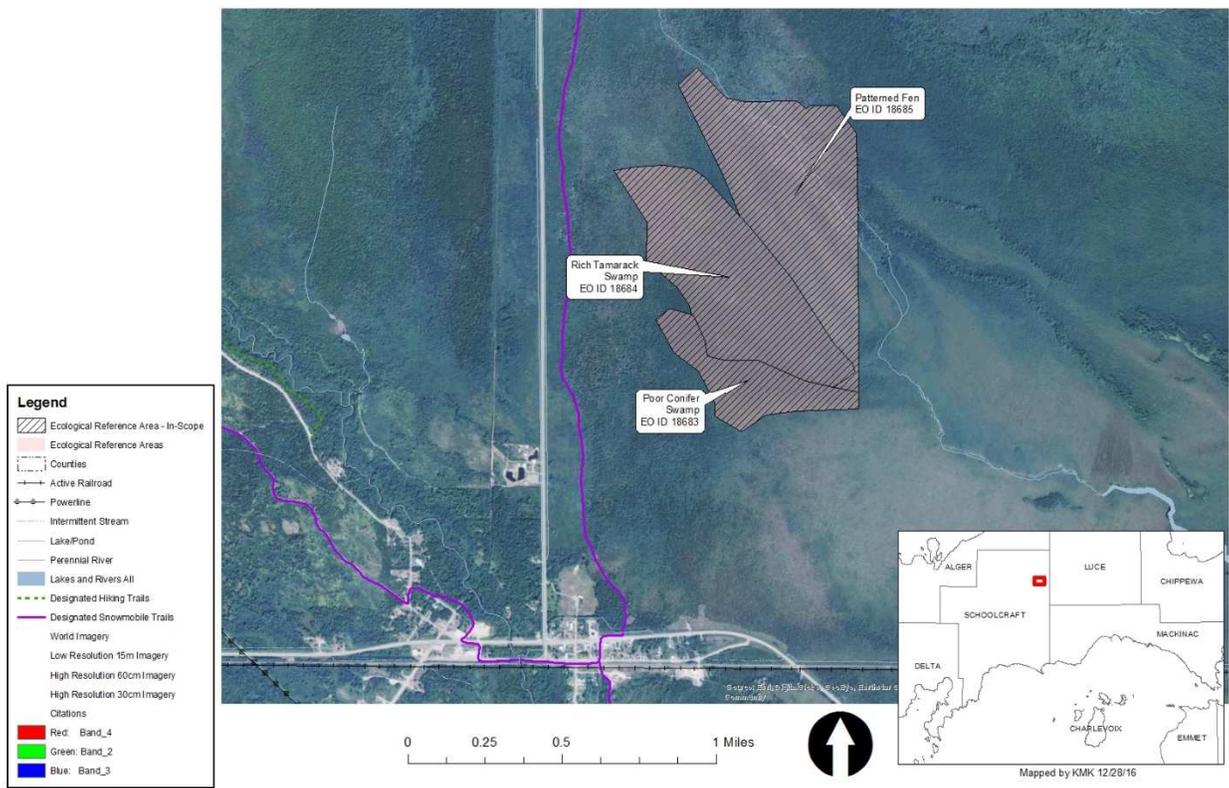


Figure 5. East Branch Fox River Patterned Fen ERA Imagery with EO ID labels. (Adjacent ERAs covered in a different plan.)

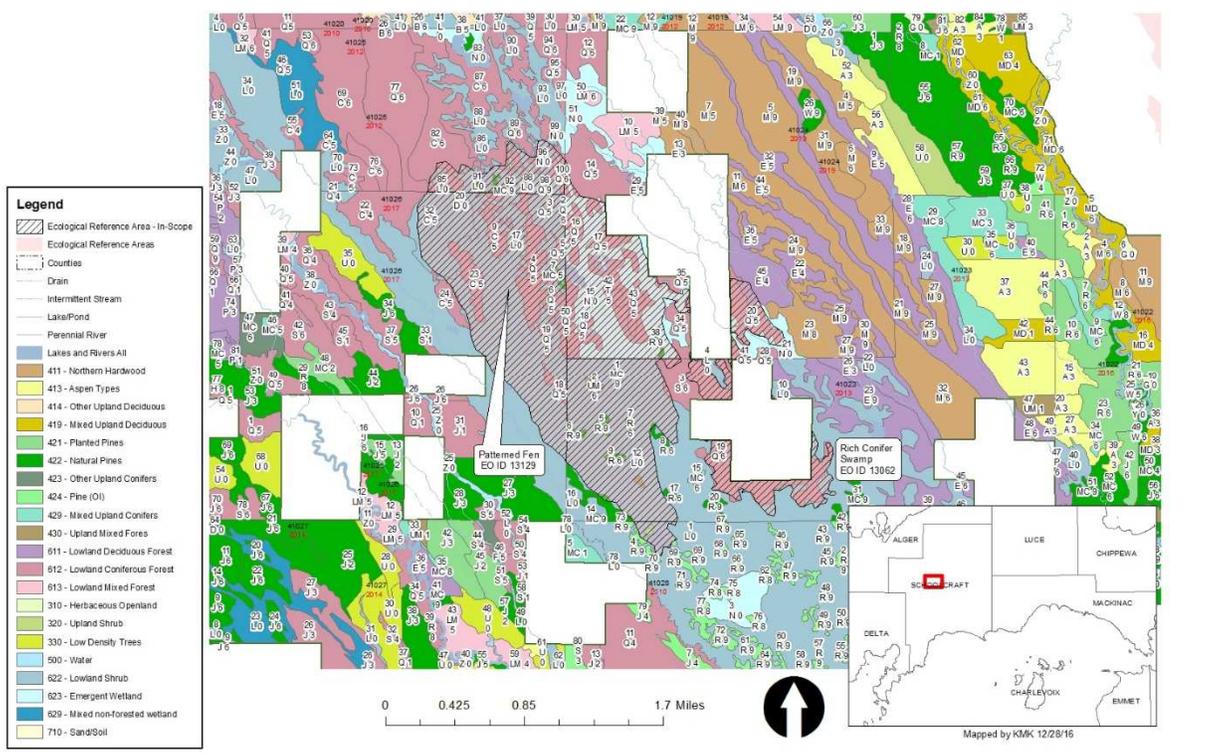


Figure 6. Hay Meadow Patterned Fen ERA area map with EO ID labels. (Adjacent ERA covered in a different plan.)

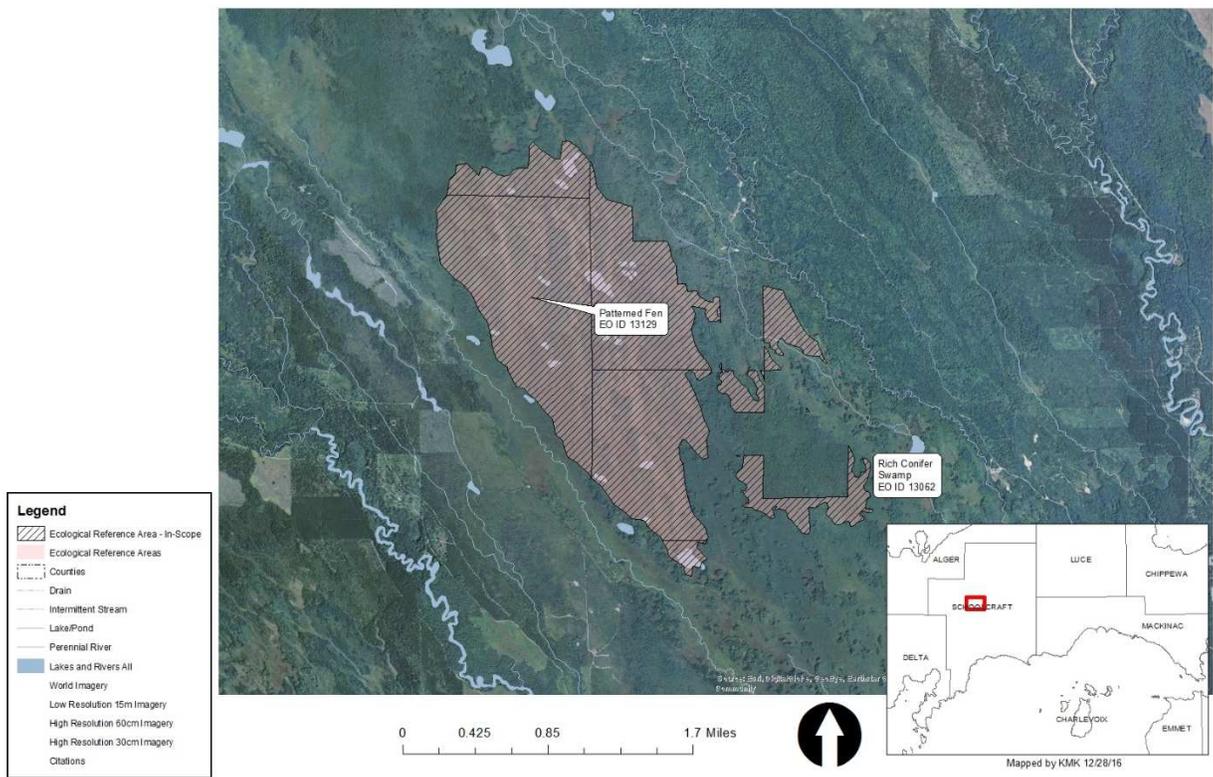


Figure 7. Hay Meadow Pattermed Fen ERA Imagery with EO ID labels. (Adjacent ERA covered in a different plan.)

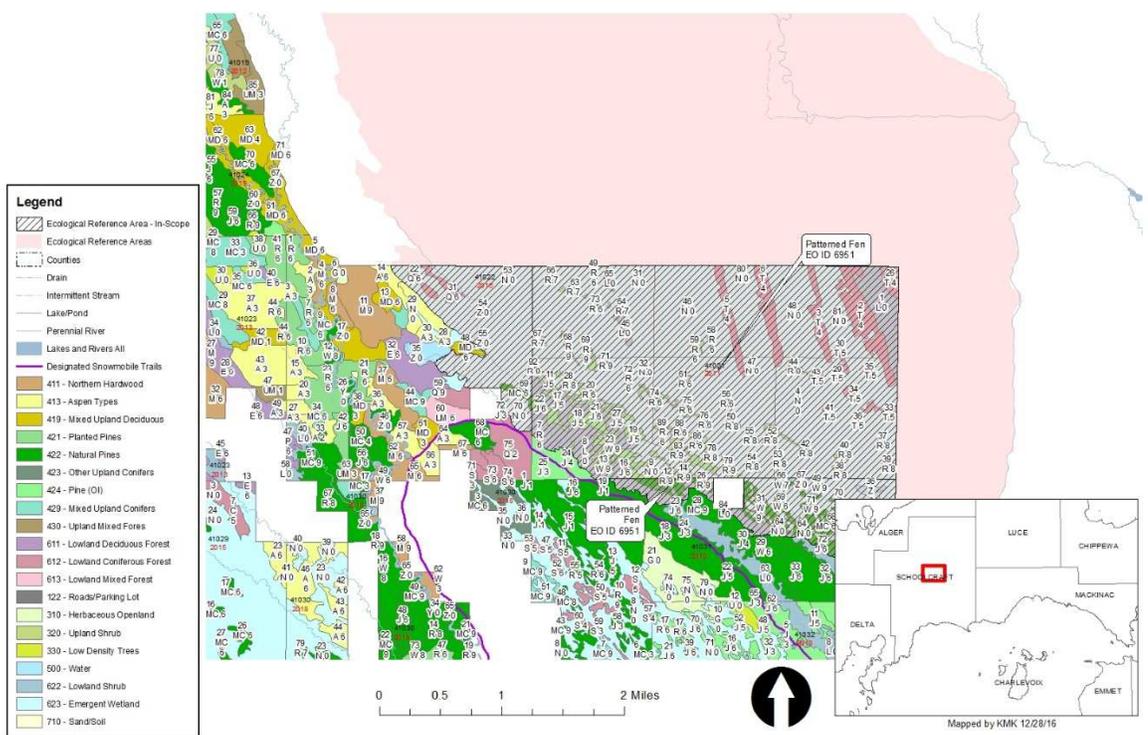


Figure 8. Marsh Creek (Senev Strangmoor) Pattermed Fen ERA area map with EO ID labels.

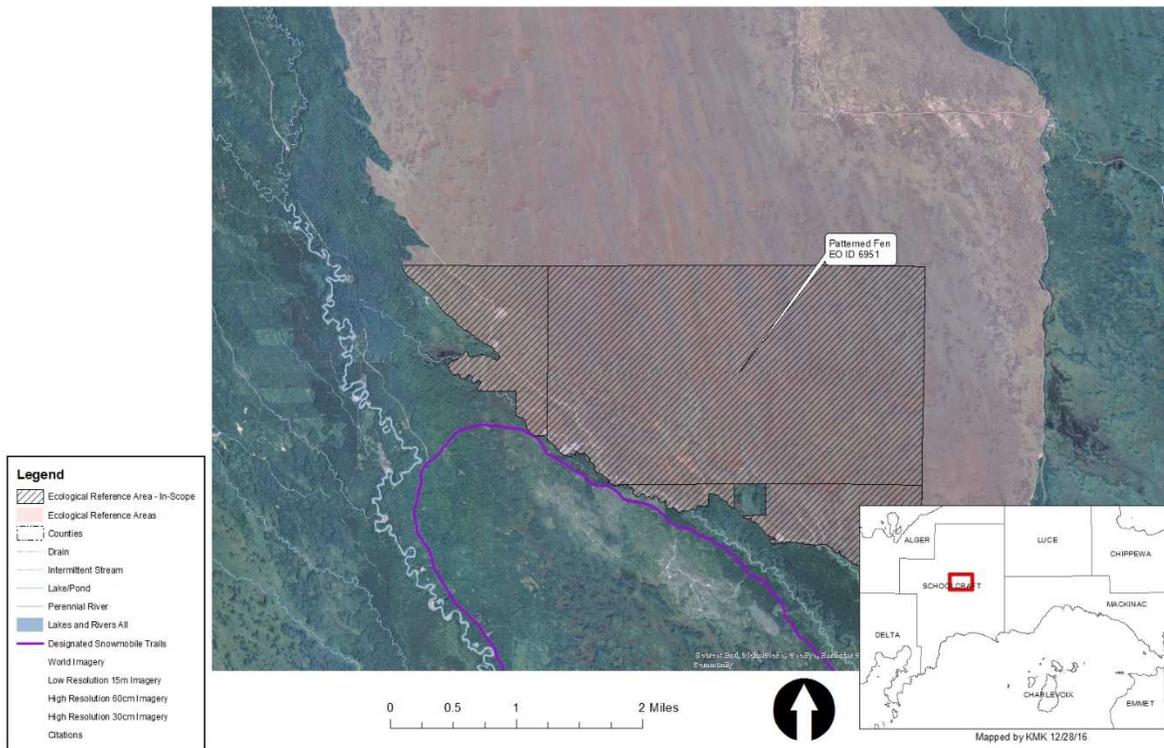


Figure 9. Marsh Creek (Seney Strangmoor) Patterned Fen ERA Imagery with EO ID labels.

Conservation Values

There are five patterned fen ERAs in the Shingleton FMU that are covered in this plan. Patterned fens are GUS2, unranked globally and imperiled within the state. There are only 20 patterned fens within Michigan.

Patterned fen is a minerotrophic shrub- and herb-dominated peatland mosaic characterized by a series of peat ridges (strings) and hollows (flarks) oriented parallel to the slope of the landform and perpendicular to the flow of groundwater. The strings vary in height, width, and spacing, but are generally less than one meter tall, resulting in a faint wave-like pattern that may be discernable only from aerial photographs. The flarks are saturated to inundated open lawns of sphagnum mosses, sedges, and rushes, while the strings are dominated by sedges, shrubs, and scattered, stunted trees. Patterned fens occur in the eastern Upper Peninsula, with the highest concentration found in Schoolcraft County. Patterned fens are also referred to as patterned bogs, patterned peatlands, strangmoor, aapamires, and string bogs.

ERA high-quality patterned fens are undisturbed and associated with high quality wetlands and upland communities. Native plant diversity is characteristic of species documented in baseline

surveys (Cohen et al 2008) and MNFI community descriptions, Invasive species populations should be minimal. Hydrology should be unimpeded by ditching, diking, or damming, and there should be no evidence of past plowing. Protecting the upland area that feeds groundwater into the fen is critical to maintain the quality of groundwater (chemicals, nutrient levels, etc.). Maintenance of periodic fire disturbance is important.

1. Creighton Marsh Patterned Fen: EO_ID 32, LASTOBS: 2007-08-06

This EO is ranked A, excellent estimated viability. The ERA occurs on approximately 7,792 acres of state forest land.

This peatland, which occurs on a poorly drained sand lakeplain, is an extensive, open minerotrophic wetland characterized by a V-shape. Strong string and flark or ribbed patterning is concentrated in the eastern lobe on generally deep (>1 m) sapric, slightly acidic to circumneutral peats (pH 6.0-7.0) over saturated sands. The peatland is surrounded by mesic northern forest (second-growth) and rich conifer swamp and occurs in an unfragmented landscape. Water flow is directed north to south over subtly sloping topography that creates the east-west string and flark patterning. Shrub-dominated strings alternate with sedge-dominated flarks in wide north-south water tracks that are separated by linear bands of shrubs and conifers on “teardrop” islands. This patterned peatland is a landscape-scale occurrence that supports significant ecological diversity and high native species richness. The site is shaped by natural processes and is buffered by extensive wetlands and unfragmented forests. In addition to the patterned fen, the peatland complex encompasses several natural community types including northern wet meadow, northern shrub thicket, rich conifer swamp, dry-mesic northern forest, and dry northern forest. Scattered throughout the wetland are small upland ridges dominated by pines and paper birch (*Betula papyrifera*) on acidic, fine-textured sands. The northeastern portion of the eastern lobe of the peatland was burned by the 1976 Seney Fire, which burned into the peat in areas. Drought impacts are especially apparent in this area.

The patterned peatland supports numerous vegetative zones. The ribbed fen zone, which occurs in the eastern lobe of the occurrence, is characterized by string and flark patterning. The strings are shrub-dominated with shrubs sparse to locally dense, including bog birch (*Betula pumila*), shrubby cinquefoil (*Potentilla fruticosa*), bog rosemary (*Andromeda glaucophylla*), sweet gale (*Myrica gale*), leatherleaf (*Chamaedaphne calyculata*), alder-leaved buckthorn (*Rhamnus alnifolia*), black chokeberry (*Aronia prunifolia*), swamp rose (*Rosa palustris*), and Kalm’s St. John’s-wort (*Hypericum kalmianum*). Graminoids and forbs common on the strings include wiregrass sedge (*Carex lasiocarpa*), dioecious sedge (*C. sterilis*), hair grass (*Deschampsia cespitosa*),

bog aster (*Aster nemoralis*), tall flat-top white aster (*Aster umbellatus*), bog goldenrod (*Solidago uliginosa*), pitcher-plant (*Sarracenia purpurea*), marsh wild timothy (*Muhlenbergia glomerata*), and wild blue flag (*Iris versicolor*).

Scattered, stunted tamarack (*Larix laricina*) and northern white-cedar (*Thuja occidentalis*) occupy some of the strings. Flarks are characterized by livid sedge (*Carex livida*), wiregrass sedge, mud sedge (*C. limosa*), white beak-rush (*Rhynchospora alba*), twig-rush (*Cladium mariscoides*), bluejoint grass (*Calamagrostis canadensis*), Canadian rush (*Juncus canadensis*), three-way sedge (*Dulichium arundinaceum*), large cranberry (*Vaccinium macrocarpon*), bog buckbean (*Menyanthes trifoliata*), spoon-leaf sundew (*Drosera intermedia*), bladderworts (*Utricularia* spp.), and arrow-grass (*Scheuchzeria palustris*). Species typical of flarks often grow on strings in lower densities.

Several low diversity open northern wet meadows are present within the peatland complex and are often associated with beaver activity. These areas of northern wet meadow are characterized by few-seed sedge (*Carex oligosperma*), three-way sedge, marsh cinquefoil (*Potentilla palustris*), Canadian rush, and northern St. John's-wort (*Hypericum boreale*). Several teardrop island "tails" occur within the wetland and are characterized by northern shrub thicket and rich conifer swamp. Areas of rich conifer swamp are dominated by northern white-cedar, tamarack, and red maple (*Acer rubrum*) with understory tag alder (*Alnus rugosa*), winterberry (*Ilex verticillata*), red-osier dogwood (*Cornus stolonifera*), and wild-raisin (*Viburnum cassinoides*). These tall shrubs are also prevalent in the areas of northern shrub thicket. Common ground cover species in both the rich conifer swamp and northern shrub thicket islands include tussock sedge (*Carex stricta*), lake sedge (*C. lacustris*), royal fern (*Osmunda regalis*), tall flat-top white aster, swamp dewberry (*Rubus hispidus*), and rough goldenrod (*Solidago rugose*). Scattered throughout the peatland are small upland islands on acidic sands, occupied by dry-mesic northern forest of white pine (*Pinus strobus*), red maple, and paper birch. In the northeastern portion of the wetland, peat fires have resulted in a depauperate flora.

Two rare plants were documented within this peatland complex. Dwarf raspberry (*Rubus acaulis*, state endangered) occurs in areas with sparse conifer cover and well-developed sphagnum hummock and hollow microtopography at the base of sphagnum hummocks. English sundew (*Drosera anglica*, state special concern) was found in a floating bog mat surrounding a small conifer island.



Figure 10. Creighton Marsh Patterned Fen. Photo by Joshua G. Cohen.

2. East Branch Fox River Patterned Fen: EO_ID 18685, LASTOBS: 2011-08-25

This EO is ranked AB, excellent or good estimated viability. It occurs on approximately 175 acres of state forest land.

A patterned peatland complex consisting of several shrub-dominated to sedge-dominated water tracks that merge into larger areas of open sedge-dominated fen, including a significant area of ribbed or anastomosing fen patterns. The patterned fen is situated in a broad post-glacial drainage channel developed on an extensive peat deposit on outwash over lacustrine sands, and is associated with several other high quality natural communities, including rich tamarack swamp, poor conifer swamp, and muskeg. The fen is developed on deep (>36"), generally medium acid to slightly acid (pH= 6.0-6.5) hemic sedge or mixed peat soils, with hummocks and strings capped by sphagnum mosses that create a thin layer of very strongly acid to strongly acid (pH=5.0-5.5) moss peat. Un-patterned water channels support hummocky fen dominated by dwarf conifers and a variety of shrubs, with small sedge-dominated depressions. Downslope, these water

channels converge, and a significant area of anastomosing strings and broad, shallow flarks have developed.

The eastern portion of the patterned area supports large, broad flarks that have converged and reduced strings to scattered circular islands within the seasonally inundated sedge flats, reminiscent (but on a much smaller scale) of fen patterns at McMahon Lake in Luce County and patterns exhibited in a broad swale within a sand-spit complex at Whitefish Point in Chippewa County. The fen complex supports several sand ridges covered by dry-mesic northern forest (with mesic northern forest of white pine and hemlock on lower slopes and eastern “caps”); adjacent to the larger ridges, dense bands of stunted conifers and tall shrubs have developed. The northernmost water track has been colonized and acidified by sphagnum mosses, and supports muskeg (west) to poor fen (east) before opening up to the eastern, broadest sedge fen zone. The patterned fen grades into rich conifer swamp to the north and to the east.

3. Hay Meadow Fen Patterned Fen: EO_ID 13129, LASTOBS: 1983-08-18

This EO is ranked AB, excellent or good estimated viability. This was adjusted from B following a recent survey. The ERA occurs on approximately 1,381 acres of state forest land.

This patterned fen is a moist fibric sedge peat, with a pH of 5.9. It contains small areas of patterning in large wiregrass sedge water track pools, and conifer islands (on old dunes) with tamarack “tails”, with a willow, tag alder, dogwood shrub border. The patterning is well-defined. There is low-moderate diversity here. The area is relatively undisturbed. Bog birch and black chokeberry (*Aronia melanocarpa*) were found on hummocks or on faint strings.

The Hay Meadow Fen patterned fen contains multiple islands of A-ranked Hay Meadow Dry Northern Forest Element Occurrence in Compartments 23-26 and 28. In addition, the A-ranked Giardia Spa Northern Wet Meadow is adjacent to the patterned fen along the southwest in Compartments 23, 26, and 28.



Figures 11 and 12. Hay Meadow Fen patterned fen. Photos by Joshua G. Cohen.



4. Negro Creek Patterned Fen: EO_ID 4963, LASTOBS: 2007-07-23

This EO is ranked AB, excellent or good estimated viability. The ERA occurs on approximately 433 acres of state forest land.

This large peatland complex occurs on a poorly drained lakeplain with saturated, acidic peats overlying wet, acidic sands. The peatland is characterized by complex ecological zonation with areas of muskeg, bog, and northern shrub thicket dominated by bog birch, in addition to patterned fen. Subtle string and flark patterning occurs perpendicular to the surface flow, which is primarily northwest to southeast and west to east in the eastern portion of the complex. Peats range in depth from 30 to >100 cm and are typically acidic (pH 5.0-5.5) with more minerotrophic (pH 5.5-6.0) areas along the flarks and peatland margin. Fire burned this peatland during the 1976 Seney Fire, killing most of the scattered conifer canopy and possibly diminishing the contrast between strings and flarks by reducing the peat depth and dampening the sphagnum hummock and hollow microtopography. Fire may have also imparted a competitive advantage to sprouting ericaceous shrubs. Deer trails, which crisscross the complex, are visible from 1998 imagery and provide wet microsites within the peatland matrix.

The peatland is dominated by graminoids, sphagnum mosses, and ericaceous shrubs with a scattered and stunted canopy dominated by small (2-4" DBH) jack pine (*Pinus banksiana*), tamarack, and black spruce (*Picea mariana*) of low stature (10-20 ft. tall). Areas of muskeg within the peatland are dominated by scattered black spruce, tamarack, and white pine and a prevalent tall shrub layer with mountain holly (*Nemopanthus mucronata*), black chokeberry, bog birch, and wild-raisin. The low shrub layer within the muskeg is dominated by ericaceous species, namely leatherleaf, bog rosemary, and bog laurel, and the ground cover is dominated by few-seed sedge and small cranberry.

Bog birch dominates the tall shrub layer in shrub-dominated portions along the southern margin of the peatland and along the ecotone between the muskeg and the open peatland. Areas of bog or ericaceous flats are characterized by a dense low shrub layer dominated by leatherleaf with bog laurel, bog rosemary, and black chokeberry with local dominance by bog laurel (possibly favored by fire), a ground cover dominated by few-seed sedge and coastal sedge (*Carex exilis*), and a scattered tall shrub layer with jack pine, black spruce, and mountain holly. Within the patterned fen, flarks are graminoid-dominated with few-seed sedge, livid sedge, bluejoint grass, bog aster, tufted bulrush (*Trichophorum cespitosum*), marsh St. John's-wort (*Triadenum fraseri*), and marsh cinquefoil. The strings

are characterized by patches of low shrubs including bog birch, leatherleaf, bog rosemary, bog laurel, and bog willow (*Salix pedicellaris*) with few-seed sedge and coastal sedge as the prevalent herbaceous cover.



Figure 13. Negro Creek Patterned Fen. Photo by Joshua G. Cohen.

5. Marsh Creek (Seney Strangmoor) Patterned Fen:

This EO is ranked A, excellent estimated viability. The ERA occurs on approximately 7,936 acres of state forest land, and extends onto the Seney National Wildlife Refuge.

This extensive peatland complex occurs on a broad, flat expanse of poorly drained sandy lakeplain with deep peats that are saturated or inundated. The patterned portion occurs in the central block of peatland and is characterized by strong patterning of strings and flarks oriented east-west, perpendicular to the north-south sheet flow. North-south bands of east-west oriented strings and flarks are separated by linear islands of northern shrub thicket and rich conifer swamp. The organic soils within the peatland vary from moderate

(30-50 cm) to deep (>100 cm), well-decomposed sapric to hemic peat over saturated sands. The peats tend to be circumneutral throughout the wetland, with measured pH values generally between 6.5 and 7.0 and becoming slightly more acidic (pH 6.0-6.5) under thin sphagnum layers on hummocks in the open peatland. Within the areas of patterning, the strings were slightly acidic and the flarks and low areas were more influenced by minerotrophic conditions. On the upland ridges a shallow needle duff overlays fine-textured, acidic (pH 4.5-5.0) sands. This patterned peatland complex encompasses several natural community types in addition to patterned fen including northern wet meadow, northern shrub thicket, poor fen, northern fen, rich conifer swamp, dry-mesic northern forest, and dry northern forest. Scattered throughout the wetland are small upland ridges dominated by pines and paper birch on acidic, fine-textured sands.

The central portion of the peatland is characterized by patterned fen that exhibits distinct development of low, wet, sedge-dominated strings. Characteristic species of the flarks include white beak-rush (*Rhynchospora alba*), large cranberry, bog buckbean, rushes, livid sedge, and arrow-grass. Strings are raised one to two feet and are characterized by bog birch, shrubby cinquefoil, bog rosemary, wiregrass sedge, dioecious sedge, and royal fern on sphagnum-covered hummocks.

Scattered throughout the peatland are small upland islands on acidic sands, occupied by dry-mesic northern forest of white pine, red maple, and paper birch or dry northern forest with red pine and scattered white pine. Common ground layer species include huckleberry, Canada blueberry, bracken fern, wintergreen (*Gaultheria procumbens*), Pennsylvania sedge (*Carex pensylvanica*), starflower (*Trientalis borealis*), bunchberry (*Cornus canadensis*), and rough-leaved rice grass (*Oryzopsis asperifolia*). Several ridges contain large, old-growth trees and snags.



Figures 14 and 15. The extensive Marsh Creek patterned fen is characterized by strong patterning of strings and flarks oriented east-west, perpendicular to the north-south sheet flow. Photos by Joshua G. Cohen.



High Conservation Value (HCV) Attributes:

These ERAs are part of a large landscape level forest, with relatively contiguous state land, and the areas contain few roads. These ERAs are characterized by high native floristic diversity. There is a small area of verified type 1 old growth adjacent to the Creighton Marsh ERA. There is an extensive deer wintering complex Special Conservation Area (SCA) west of this area. Numerous creeks and lack of roads make this an area that few people venture into. There has been minimal timber harvesting adjacent to the ERAs.

In the Creighton Marsh ERA, dwarf raspberry (state endangered) and English sundew (state special concern) have been found, and other rare plants have been found nearby. Within the March Creek ERA, surveyors noted moose (*Alces alces*, state threatened), American bittern (*Botaurus lentiginosus*, state special concern), nesting merlin (*Falco columbarius*, state threatened), and northern harrier (*Circus cyaneus*, state special concern). Archaeological sites were found nearby.

The East Branch Fox River ERA is adjacent to a rich tamarack swamp ERA, and a poor conifer swamp ERA. It contains the East Branch Fox River, which is a cold-water stream SCA and high priority trout stream High Conservation Value Area (HCVA). Dwarf raspberry (*Rubus acaulis*, state endangered) was found here. The Hay Meadow Fen ERA contains islands of dry northern forest, and is adjacent to a northern wet meadow, with a rich conifer swamp ERA nearby.

Threats Assessment

Currently, fens are threatened by peat mining, logging, quarrying, agricultural runoff and nutrient enrichment, draining, flooding, off-road vehicle (ORV) activity, and development (Bedford and Godwin 2003). A major threat to patterned fen is hydrologic alteration through ditching, damming, logging, establishment of fire lines, and trail- and road-building activities, which can result in significant changes to peatland composition and structure.

Logging of the surrounding uplands could alter the hydrology of the site. It is best to retain an intact buffer of natural communities surrounding the peatland. If wildfires occur within the peatland, no plow lines should be established within the natural community. Monitoring to detect and further controlling invasive species before they become widespread are critical to the long-term viability of patterned fen. Invasive species that may threaten diversity and community structure of patterned fen include glossy buckthorn (*Rhamnus frangula*), multiflora rose (*Rosa multiflora*), purple loosestrife (*Lythrum salicaria*), narrow-leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*Typha xglauca*), reed canary grass (*Phalaris arundinacea*), and reed (*Phragmites australis*).

Creighton Marsh ERA: One non-native plant species, European marsh thistle (*Cirsium palustre*) was noted within one of the conifer swamp islands. Anthropogenic disturbances are limited to off-road vehicle damage, which was noted along the periphery of the peatland associated with a private hunting camp on the eastern edge of the complex. Continued off-road vehicle damage could create rutting and alter the hydrology in localized areas of the fen.

East Branch Fox River: Historic land use changes associated with logging and clearing along M-77 may have altered hydrology of the peatland, leading to increased woody cover in the general area. Otherwise, the only disturbance noted was a small patch of reed canary grass, potentially associated with an old logging road or clearing. Beaver activity along the stream and in the wettest, sedge-dominated areas of the peatland strongly influence vegetation structure and species composition. Native broadleaf cattail was present in the wetter portions of the fen and has the potential to increase with nutrient loading (including air pollution) or changes to hydrology in the area.

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 patterned fen ERA where applicable.
- 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.
- Allow natural processes to occur.

Management Objectives

Management objectives are the means to achieve the management goals of the specific site and should be time specific if possible. The following Management Objectives describe the measures necessary to ensure the maintenance and/or enhancement of the ERA site or sites. Objectives and associated 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.
- Assess EO quality every 10-20 years.
- Determine if there are impacts to hydrological system.
- Work with local landowners to manage patterned fen on private property directly adjacent to ERA.
- Work with the Seney National Wildlife Refuge when managing ERAs that continue on to their ownership.
- 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 fire) using partnerships where appropriate, develop FTP's and PAP's. (M, R)
- Use periodic burning to maintain presence of native plant species, reduce invasives, and to reduce woody encroachment. (M, R)
- To reduce woody encroachment selective cutting can occur in winter using techniques to avoid impacting hydrology. (R)
- Minimal Impact Suppression Tactic (MIST) practices should be used for wildfire response in this area if possible. (M, R)
- Rehabilitate former fire lines as applicable. (R)
- Timber harvest adjacent to this wetland ERA may negatively impact site hydrology and wildlife habitat. Site hydrology may be impacted by decreasing evapotranspiration potential and increasing surface and sub-surface water flow which can negatively alter vegetation composition within the ERA. Additionally, many amphibians and reptiles are terrestrial hibernators, using upland areas adjacent to wetlands during winter months. These species may also use adjacent upland areas for feeding, seasonal movements to breeding areas, and dispersal of juveniles. Follow BMP Riparian Management Zone (RMZ) buffering guidelines as applicable. (M, R)
- Close illegal roads and trails where feasible. Consult with PRD Trails Specialist when roads and access points need to be closed. (M, R)

- Creating new roads or trails adjacent to this wetland ERA may impact site hydrology by increasing surface and sub-surface water flow which can negatively alter vegetation composition within the ERA. Any creation should be minimized and follow BMP Riparian Management Zone (RMZ) buffering guidelines as applicable. (M)
- Install culverts under roads as needed and ensure that current culverts are functioning. (M, R)
- Work with Law Enforcement Division to increase patrols for illegal ORV activity 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)

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
Representative and rare species – species occurrences	Baseline EO Records; updated when EO’s are updated	No decreases	TBD
Populations of invasive species – number and scope of species	Severity unknown; treatments should be monitored appropriately; detection monitoring opportunistically or every five years’ maximum	Eliminated/fewer occurrences	TBD
Illegal ORV activity – number of new instances and number of citations issued	Moderate; monitored via patrols, reports or opportunistically	Eliminated/fewer occurrences	TBD
Change in EO rank	Various – see above	No decrease	TBD

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