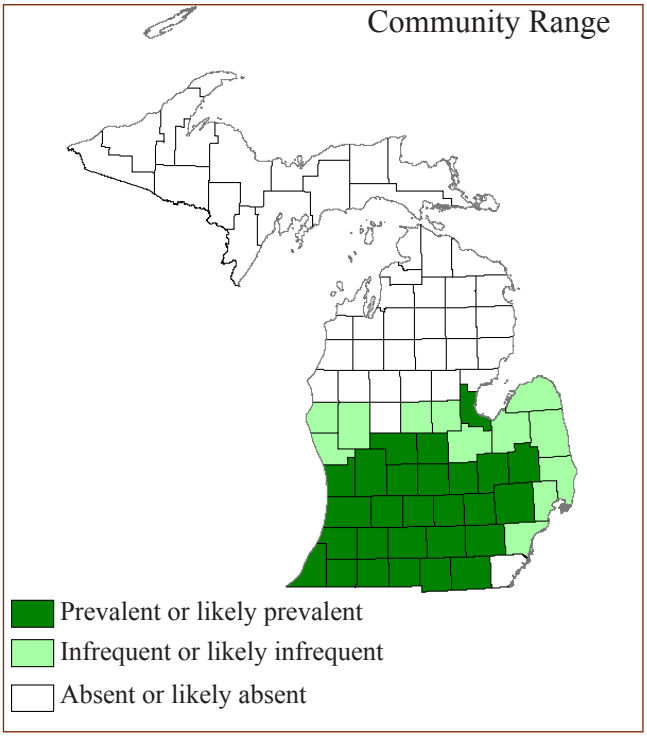
Rich Tamarack Swamp — Community Abstract

Photo by Joshua G. Cohen



Overview: Rich tamarack swamp is a groundwater-influenced, or minerotrophic, forested wetland community that is typically dominated by tamarack (*Larix laricina*) and occurs on deep organic soils (i.e., peat and muck) in southern Michigan. This natural community type was known as relict conifer swamp in previous versions of the natural community classification.

Global and State Rank: G4/S3

Range: Rich tamarack swamp occurs in Minnesota, Wisconsin, Indiana, Michigan and Ontario. In Michigan, rich tamarack swamp is thought to be restricted to the southern Lower Peninsula, although no statewide survey for the community has been conducted. Rich tamarack swamp represents a type of rich conifer swamp, a more widespread, minerotrophic, forested wetland that is usually dominated by northern white cedar (see abstract for rich conifer swamp). Throughout northern Michigan and near the tension zone in mid Michigan, northern white cedar (*Thuja occidentalis*) replaces tamarack as the dominant tree species in groundwater-influenced, forested wetlands. Acidic, rainwater-influenced (ombrotrophic) tamarack and black spruce swamps also occur in southern Michigan and are classified as poor conifer swamp (Kost et al. 2007). Many large wetland complexes contain zones of both minerotrophic tamarack swamp (i.e. rich tamarack swamp) near the upland edge where groundwater seeps occur, as well as ombrotrophic tamarack swamp (i.e., poor conifer swamp) near the center of the complex. In the ombrotrophic zone, deep peat separates the vegetation from the influence of groundwater and sphagnum mosses acidify the surface water and peat.

Rank Justification: Analysis of the General Land Office (GLO) survey notes reveals that tamarack-dominated wetlands were common throughout southern Lower Michigan during the mid 1800s (Comer et al. 1995). In fact, tamarack swamps were the most common type of conifer swamp in all sub-subsections (Albert 1995) of southern Lower Michigan expect for those occupying the thumb region (i.e., Huron, Lapeer, Sanilac and Tuscola Counties), where mixed conifer swamps were more abundant (Comer et al. 1995). While information is not readily available for deciphering the type of tamarack swamp (i.e., rich tamarack swamp or poor conifer swamp) from the GLO data, tamarack-dominated wetlands overall occupied 196,526 ha (485,624 acres) of southern Lower Michigan. Comparisons between the GLO and 1978 MIRIS land cover data reveal that less than 1% or 1,149 ha (2,839 acres) of tamarack swamp remain in southern Lower Michigan (Albert 2001). Tamarack swamps

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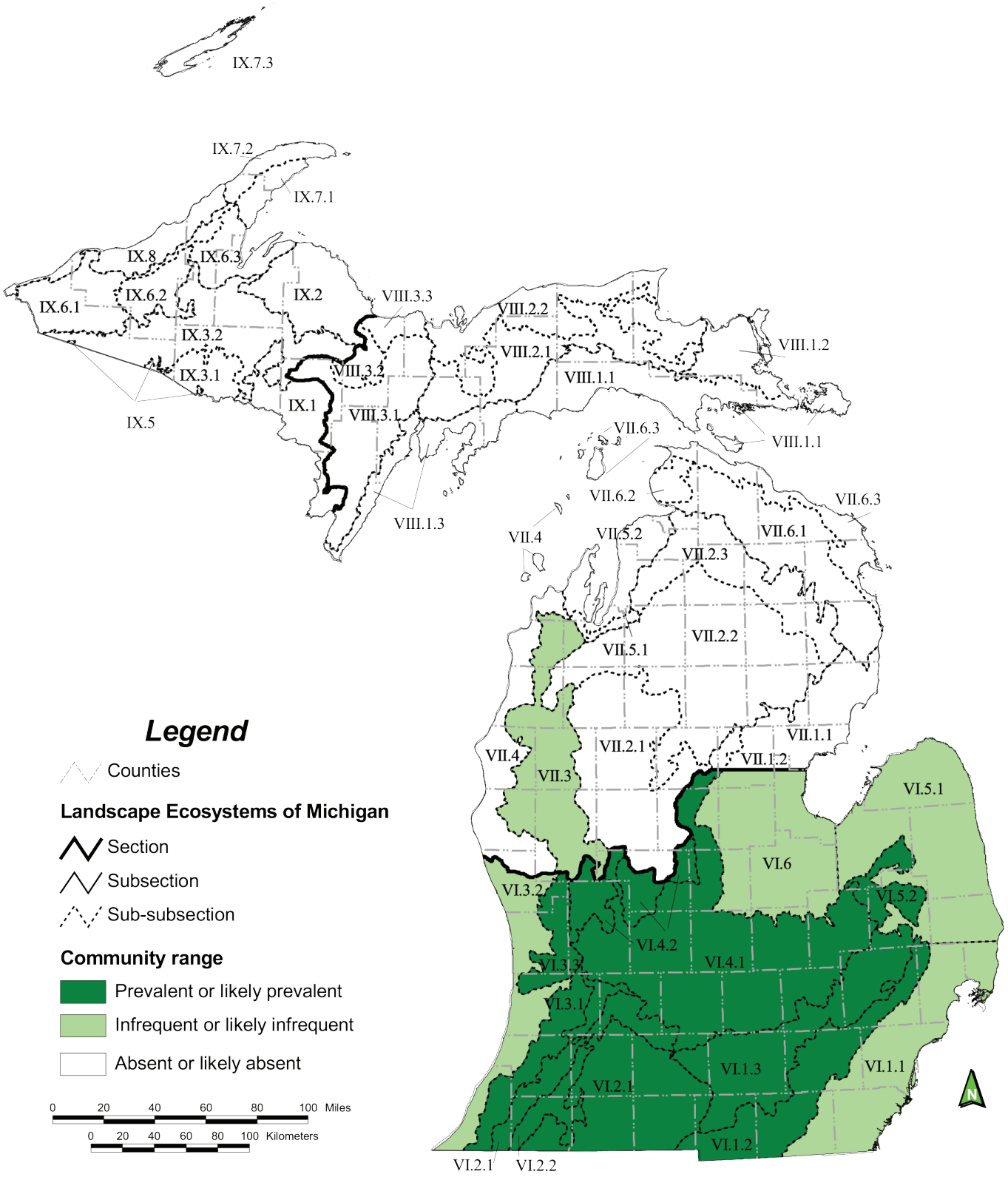

Ecoregional map of Michigan (Albert 1995) depicting distribution of rich tamarack swamp (Albert et al. 2008)

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were frequently drained and logged and subsequently used for agriculture, mined for peat, or abandoned and converted to wet meadow, shrub-carr or hardwood swamp. Tamarack logs were commonly utilized for fence posts, house and barn beams, and the early auto industry used tamarack for wheel spokes.

Landscape and Abiotic Context: Rich tamarack swamp occurs in outwash channels, outwash plains, and kettle depressions throughout southern Lower Michigan. The community typically occurs in association with headwater streams and/or adjacent to inland lakes. Rich tamarack swamps are often found where groundwater seeps occur at the base of moraines. The organic soils underlying rich tamarack swamp are typically composed of a thin layer of muck overlying 2 – 5 m of fibric and woody peat (Kost 2001). Underlying the peat there is usually a layer of marl, a calcium carbonate precipitate that accumulates as sediment on lake bottoms.

Natural Processes: Rich tamarack swamp is a groundwater-dependent, tamarack-dominated wetland community. Its hydrology is maintained by calcareous groundwater that permeates the muck and peat soils. Because glacial till in southern Michigan is typically high in calcium and magnesium, the groundwater that reaches the surface has high levels of alkalinity and dissolved nutrients. The pH values of the muck and peat soils underlying rich tamarack swamp are typically near 8.0, with surface water alkalinity measuring near 300 mg CaCO3/L and conductivity values near 600 uS (Kost 2001, Merkey 2001).

Because of the strong influence of groundwater on the community, water levels in rich tamarack swamps tend to fluctuate less than in many other wetland types (Merkey 2001). However, seasonal water fluctuations are common and may be related to the varied microtopography of tamarack swamps. The tamarack roots form large hummocks that stand elevated above adjacent mudflats. During winter and spring, water typically fills the spaces between tamarack root-hummocks, while in summer and fall, exposed mud flats occupy these areas.

Windthrow, insect outbreak, beaver flooding, and fire are all important forms of natural disturbance for rich tamarack swamp. Because tamarack is shade-intolerant (Curtis 1959), disturbance events that result in increased light to the understory and ground layer are especially important for maintaining the tamarack component of the community.

Trees growing in the anaerobic conditions associated with a high water table and muck and peat soils tend to be shallowly rooted and are thus especially prone to windthrow. The light gaps created by windthrow help to regenerate tamarack and maintain the community's dense shrub layer. In addition, the coarse woody debris that results from windthrow also adds to the community's complex structure and microtopography.

Periodic outbreaks of larch sawfly (*Pristophora erichsonii*) and eastern larch beetle (*Dendroctonus simplex*), both native insect species, and the introduced tamarack casebarer (*Coleophora laricella*) can cause significant tamarack mortality. The defoliation associated with an insect outbreak results in increased light reaching the understory and ground layer, and like windthrow, may promote tamarack regeneration and shrub-layer density. However, in rich tamarack swamps where red maple is widely distributed, these defoliation events may alter community structure by promoting the growth of red maple. Once red maple reaches the overstory its broad canopy effectively reduces the amount of light available to the understory and results in a significant reduction in shrub-layer cover and species richness as well as a loss of many shade-intolerant ground flora species (Kost 2001).

Long-term flooding resulting from beaver dams or other forms of blocked drainage such as road construction through a wetland can cause mass tamarack mortality and a conversion of rich tamarack swamp or other forested wetlands to wet meadow or marsh. However, beaver may have also contributed to the establishment of rich tamarack swamp when sources of tamarack seeds were accessible for colonization of abandoned beaver floodings. Tamarack may have also colonized sites where beaver flooding destroyed a hardwood-dominated swamp forest community.

Like long-term flooding, fire may cause extensive tamarack mortality (Curtis 1959) and create new opportunities for seedling establishment on freshly exposed organic soils. While fire is not a frequent form of disturbance directly within rich tamarack swamps, its influence on the surrounding landscape is very important to the long-term viability of the community.

The role of fire in maintaining rich tamarack swamp is especially important in the interlobate region of southern Michigan where fire was responsible for maintaining the open condition of many of the region's natural communities including oak barrens, prairies, wet meadows, and prairie fens. With the widespread absence of fire in southern Michigan, tamarack has completely colonized many sites that were previously occupied by prairie fen, thus forming many of the rich tamarack swamps we see today. The photo on the first page shows rich tamarack swamp encroaching on prairie fen in the foreground. In addition to maintaining many community types in an open condition, fire also severely restricted the distribution of thin-barked, fire-intolerant tree species such as red maple. Aided by fire suppression, red maple has come to assume a leading role in the understory of many southern Michigan oak forests and frequently occurs in the canopy as well. In the past, the lack of red maple in the surrounding uplands meant disturbance events such as windthrow and insect outbreaks, which create light gaps, helped facilitate tamarack regeneration and the long-term viability of rich tamarack swamp. With red maple now abundant in the surrounding uplands and widely distributed in many rich tamarack swamps, these disturbance events may not be enough to maintain the tamarack component of the ecosystem and many former conifer swamps are now dominated by hardwoods. As evidence of this conversion, it is common to find dead, standing and downed tamarack in hardwood swamps that occur on deep, organic soils in southern Michigan. The conversion of these conifer swamps to hardwood swamps also results in a severe reduction in shrub-layer cover and the loss of many species (Kost 2001). Because many of the dominant shrub species are prolific fall fruit producers, migrating and over-wintering songbirds as well as small mammals that rely on the fruit may be adversely impacted by the conversion to hardwood swamp.

Vegetation Description: The structure of the community is largely shaped by tamarack, the dominant tree species. The roots of tamarack often form extensive mats that stand elevated above pools of water or mudflats and provide a substrate for a diverse wetland ground flora. In addition, the tamarack root mats form a varied microtopography, adding to the biocomplexity and high species richness of the community. Tamarack windthrows also add to the heterogeneous structure of the ground and shrub layers. Because of the open branching and spire-shape of tamarack, the shrub layer of rich tamarack swamp receives a high level of light and is typically both very dense and diverse. In fact, the shrub layer may contain as many as 28 species, with multiple species intertwined and over topping one another so that total shrub-layer cover may reach 90 – 130% (Kost 2001).

In addition to tamarack, other common tree species include: black ash (*Fraxinus nigra*), yellow birch (*Betula alleghaniensis*), American elm (*Ulmus americana*), red maple, swamp white oak (*Quercus bicolor*), quaking aspen (*Populus tremuloides*), red cedar (*Juniperus virginiana*), and, in some locations, white pine (*Pinus strobus*) and northern white cedar.

Photo by Michael Kost

Poison sumac is one of several dominant shrub species in rich tamarack swamp that provide critical food resources to wildlife during the fall migration and winter.

Common tall shrub species include: poison sumac (*Toxicodendron vernix*), winterberry (*Ilex verticillata*), smooth highbush blueberry (*Vaccinium corymbosum*), grey dogwood (*Cornus foemina*), silky dogwood (*Cornus amomum*), swamp rose (*Rosa palustris*), hazelnut (*Corylus americana*), nannyberry (*Viburnum lentago*), juneberry (*Amelanchier arborea*), black chokeberry (*Aronia prunifolia*), and pussy willow (*Salix discolor*). Other large shrubs that may occasionally

occur in rich tamarack swamp include spice bush (*Lindera benzoin*), mountain holly (*Nemopanthus mucronatus*), hornbeam (*Carpinus caroliniana*), alternate-leaved dogwood (*Cornus alternifolia*), Bebb's willow (*Salix bebbiana*), and elderberry (*Sambucus canadensis*).

Low shrub species common to rich tamarack swamp include: swamp gooseberry (*Ribes hirtellum*), dwarf raspberry (*Rubus pubescens*), bog birch (*Betula pumila*), wild raspberry (*Rubus* spp.), sage willow (*Salix candida*), swamp fly honeysuckle (*Lonicera oblongifolia*), alder-leaved buckthorn (*Rhamnus alnifolia*), common juniper (*Juniperus communis*), shrubby cinquefoil (*Potentilla fruticosa*), and bog willow (*Salix pedicellaris*).

Common woody vines include: poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and riverbank grape (*Vitis riparia*).

Because of the high frequency of canopy disturbance and open structure of tamarack, the ground flora is composed of a heterogeneous mixture of shade-tolerant and -intolerant wetland plants. In addition, the stark difference in moisture levels between the elevated root hummocks and saturated mudflats also significantly increases the diversity of wetland species found in the ground flora. While mosses are prevalent throughout the ground layer, sphagnum mosses (*Sphagnum* spp.) are usually only locally distributed. The following list contains common ground flora species occurring in rich tamarack swamp:

SCIENTIFIC NAME	COMMON NAME
Aster puniceus (*A. firmus*)	smooth swamp aster
Aster lanceolatus	eastern lined aster
Bidens cernuus	nodding bur-marigold
Bidens coronatus	tall swamp-marigold
Boehmeria cylindrica	false nettle
Calamagrostis canadensis	blue-joint grass
Caltha palustris	marsh-marigold
Campanula aparinoides	marsh bellflower
Cardamine pensylvanica	Pennsylvania bitter cress
Carex alata	winged sedge
Carex comosa	sedge
Carex hystericina	sedge
Carex lacustris	sedge
Carex leptalea	sedge
Carex stricta	sedge
Cicuta bulbifera	water hemlock
Dryopteris carthusiana	spinulose woodfern
Equisetum fluviatile	water horsetail
Galium asprellum	rough bedstraw
Galium labradoricum	bog bedstraw
Galium tinctorium	stiff bedstraw
Glyceria striata	fowl manna grass
Impatiens capensis	spotted touch-me-not
Leersia oryzoides	cut grass
Lemna minor	small duckweed
Lycopus uniflorus	northern bugle weed
Lysimachia thyrsiflora	tufted loosestrife
Maianthemum canadense	Canada mayflower
Onoclea sensibilis	sensitive fern
Osmunda regalis	royal fern
Pilea pumila	clearweed
Rubus pubescens	dwarf raspberry
Sagittaria latifolia	common arrowhead
Scutellaria lateriflora	mad-dog skullcap
Senecio aureus	golden ragwort
Solidago patula	swamp goldenrod
Solidago rugosa	rough goldenrod
Symplocarpus foetidus	skunk-cabbage
Thelypteris palustris	marsh fern
Trientalis borealis	starflower
Viola spp.	violet

Michigan indicator species: Tamarack, poison sumac, smooth highbush blueberry, winterberry, black chokeberry, alder-leaved buckthorn, black ash, yellow birch, and sedge (*Carex leptalea*).

Other noteworthy species: Many of the rare plants associated with rich tamarack swamp include species that are more commonly found in open prairie fen. These shade-intolerant species may occur on the edges of rich tamarack swamp or within light gaps that have remained in an open condition. Species that fit this group include water parsnip (*Berula erecta*, state threatened), prairie Indian-plantain (*Cacalia plantaginea*, state special concern), narrow-leaved reedgrass (*Calamagrostis stricta*, state threatened), white lady slipper (*Cypripedium candidum*, state threatened), English sundew (*Drosera anglica*, state special concern), queen-of-the-prairie (*Filipendula rubra*, state threatened), mat muhly (*Muhlenbergia richardsonis*, state threatened), wild sweet William (*Phlox maculata*, state threatened), Jacob's ladder

(*Polemonium reptans*, state threatened), prairie dropseed (*Sporobolus heterolepis*, state special concern), and edible valerian (*Valeriana edulis* var. *ciliata*, state threatened). Bog bluegrass (*Poa paludigena*, state threatened), a rare species most commonly found in hardwood-dominated swamps and floodplains, may also occur in rich tamarack swamp.

Rare animal species associated with rich tamarack swamp include: tamarack tree cricket (*Oecanthus laricis*, state special concern), Mitchell's satyr butterfly (*Neonympha m. mitchellii*, state endangered), eastern massasauga (*Sistrurus c. catenatus*, state special concern), Blanding's turtle (*Emydoidea blandingii*, state special concern), and spotted turtle (*Clemmys guttata*, state threatened).

Conservation/management: The presence of conifer-dominated wetlands in southern Michigan contributes significantly to the region's overall biodiversity. The rich tamarack swamps in southern Michigan represent the southern range of the minerotrophic conifer swamps in the Midwest. Because they are dominated by tamarack and not by northern white cedar like their more widespread, northern counterpart, the rich tamarack swamps in southern Michigan represent a unique type of minerotrophic conifer swamp.

Protection of rich tamarack swamp includes protecting the site's hydrology. This may include avoiding surface water inputs to the community from drainage ditches and agricultural fields, and protecting groundwater recharge areas by maintaining native vegetation types in the uplands around rich tamarack swamps. Long-term flooding from road construction through the center of a rich tamarack swamp or clogged road culverts can result in mass tamarack mortality. Because rich tamarack swamp is a groundwater-dependent community, protecting the quantity and quality of the groundwater is critical.

Invasion by red maple can cause a rich tamarack swamp to shift to hardwood domination. This shift begins to occur as red maple reaches the overstory. The broad canopy of red maple prevents direct sunlight from reaching smaller tamaracks and results in a rapid loss of tamarack and other shade-intolerant species. The dense shrub layer, which is characteristic of rich tamarack swamp, is significantly reduced under a hardwood canopy and, thus, species that rely on fruit during the fall migration and winter are adversely impacted. Reducing red maple cover in rich tamarack swamps by girdling red maple in conjunction with herbicide application may be effective in preventing the loss of the shrub layer and shade-intolerant species such as tamarack. Ideally, this type of management would accompany the use of prescribed fire in the upland forests adjacent to the swamp and hydrologic restoration where necessary. Significantly reducing red maple cover in both the upland and lowland forests will help ensure that characteristic natural disturbance events, such as windthrow and insect outbreaks, result in tamarack regeneration.

Invasive species that occur in rich tamarack swamp include: glossy buckthorn (*Rhamnus frangula*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), reed (*Phragmites australis*), and bittersweet nightshade (*Solanum dulcamara*). While bittersweet nightshade is not typically a threat to a site's overall species richness, each of the other invasive species listed above can negatively influence species richness and alter community structure. Glossy buckthorn, in particular, is probably the greatest threat to species diversity and community structure in rich tamarack swamp. This species has colonized similar habitats throughout the Midwest and can completely dominate the shrub and ground layers. Treatment for removing glossy buckthorn can be accomplished with cutting, accompanied by herbicide application (Reinartz 1997) and by using spot-burning to eliminate seedlings (Jack McGowan-Stinski 1999 pers. comm.).

Research needs: Because tamarack plays a critical role in structuring rich tamarack swamp, studies aimed at better understanding the factors that influence its ability to regenerate will help managers maintain the long-term viability of this community type. The role of red maple and other hardwoods in altering community structure is also an important research topic. An historical study, using GLO notes, of the distribution of red maple in relation to tamarack-dominated swamps as well as other types of conifer swamp would help managers to better understand the differences between past successional processes and those observed today. Gaining an understanding of the effects of fire and other forms of natural disturbance on rich tamarack swamp will also help managers better understand the ecosystem. Little attention has been given to the importance of rich tamarack swamp for maintaining certain rare plant and animal species. In addition, the role of rich tamarack swamp in providing both thermal cover and important

food reserves during fall migration and winter will be useful for understanding the significance of this community type in maintaining regional biodiversity.

Similar communities: Rich conifer swamp, hardwood-conifer swamp, southern hardwood swamp, poor conifer swamp, prairie fen, and southern wet meadow.

Other Classifications:

Michigan Natural Features Inventory Pre-settlement Vegetation (MNFI):
Lowland Conifer – Tamarack

Michigan Department of Natural Resources (MDNR): T-Tamarack.

Michigan Resource Information Systems (MIRIS): 4233 (Tamarack).

The Nature Conservancy National Classification (Faber-Langendoen 2001, Natureserve 2001):

CODE; ALLIANCE; ASSOCIATION; COMMON NAME

I.B.2.N.g.3; *Larix laricina* Saturated Forest Alliance; *Larix laricina – Acer rubrum* / (*Rhamnus alnifolia*, *Vaccinium corymbosum*) Forest; Tamarack – Red Maple / (Alderleaf Buckthorn, Highbush Blueberry) Forest; Central Tamarack – Red Maple Rich Swamp.

Related Abstracts: rich conifer swamp, hardwood-conifer swamp, poor conifer swamp, prairie fen, southern wet meadow, prairie Indian-plantain, small white lady-slipper, English sundew, mat muhly, prairie dropseed, tamarack tree cricket, eastern massasauga, Mitchell's satyr butterfly, Blanding's turtle, spotted turtle.

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