

Ontario Species at Risk Evaluation Report

for

Red Mulberry (*Morus rubra*)

Committee on the Status of Species at Risk in Ontario
(COSSARO)

Assessed by COSSARO as Endangered

January 2016

Final

Mûrier rouge (*Morus rubra*)

Le mûrier rouge (*Morus rubra*) est un arbre de petite taille qui peut atteindre de 6 à 20 cm de hauteur. L'écorce de l'arbre mature présente des plaques lâches de forme allongée et de couleur havane grisâtre. Les feuilles sont alternes, non lobées, bilobées ou trilobées, longues de 9 à 24 cm, presque aussi larges que longues, longuement acuminées, grossièrement dentées, à face supérieure rugueuse et mate et à sève laiteuse. L'arbre est normalement unisexué et les fleurs, qui sont réunies en chatons vert jaunâtre, apparaissent pendant la feuillaison au printemps. Le mûrier rouge produit des fruits comestibles, sucrés, qui varient du rouge au violet foncé et qui font de 2 à 3 cm de longueur.

Le mûrier rouge est confiné à la zone californienne (7E) du sud de l'Ontario. On le rencontre dans de petites forêts humides reliques à proximité de Windsor, dans les carrières de sable de la pointe Pelée et de Rondeau, dans les terrains boisés de type alvar dans les îles de l'ouest du lac Érié et sur les sols composés de calcaire et de limon sur la péninsule du Niagara ainsi que dans le sud de Halton.

Le nombre d'individus matures et d'emplacements a diminué depuis la dernière évaluation du COSEPAC en 2000. Seulement 217 individus en tout sont connus en Ontario et seulement 105 d'entre eux sont considérés être en âge de se reproduire. Seulement quatre emplacements comptent plus de cinq individus reproducteurs. La plus grande menace qui pèse sur le mûrier rouge est l'hybridation avec le mûrier blanc (*Morus alba*) non indigène. Les effets de la maladie du chancre des rameaux risquent également d'aggraver son déclin. À deux emplacements dans les îles de l'ouest du lac Érié, la nidification par les cormorans à aigrettes (*Phalacrocorax auritus*) représente une menace importante.

Le mûrier rouge est en voie de disparition en Ontario, car seulement 105 individus matures existent encore dans moins de cinq emplacements. Une diminution du nombre d'arbres et d'emplacements a été observée au cours des 15 dernières années. Le mûrier rouge est menacé de disparition de l'Ontario en raison de l'hybridation continue avec le mûrier blanc non indigène; sa persistance à long terme dépendra de la gestion continue.

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Executive summary

Red Mulberry (*Morus rubra*) is a small tree that grows to 6-20 m in height. Mature trees have bark with loose, greyish-tan elongated plates. Leaves are alternate, entire or 1-3 lobed, 9-24 cm long, and nearly as wide, with long tapered tips, coarsely toothed margins, with a rough, dull upper surface and milky sap. Trees are typically unisexual and flowers occur in yellowish-green clusters, appearing as the leaves are expanding in the spring. Red Mulberry produces edible, sweet, red to dark purple fruits that are 2-3 cm long.

Red Mulberry is restricted to the Carolinian Zone (7E) of southern Ontario. It occurs in small moist forest remnants near Windsor, the sand spits of Point Pelee and Rondeau, alvar woodlands on the Western Lake Erie Islands; and on limestone-based, loamy soils on the Niagara Peninsula and in southern Halton.

The number of mature individuals and locations has declined since the last COSEWIC assessment in 2000. Only 217 total individuals are known to occur in Ontario, and only 105 of these are considered to be of reproductive age. Only four sites have more than five reproductive individuals. The greatest threat to Red Mulberry is hybridization with the non-native White Mulberry (*Morus alba*). Effects of twig canker diseases also contribute to declines. At two sites on the Western Lake Erie Islands, nesting by Double-crested Cormorants (*Phalacrocorax auritus*) poses a significant threat.

Red Mulberry is endangered in Ontario because only 105 mature individuals still exist in less than five locations. There has been an observed decline in the number of trees and locations over the last 15 years. Red Mulberry is threatened with extirpation from Ontario because of continued hybridization with the non-native White Mulberry and its long-term persistence will be depend on continued management.

1. Background information

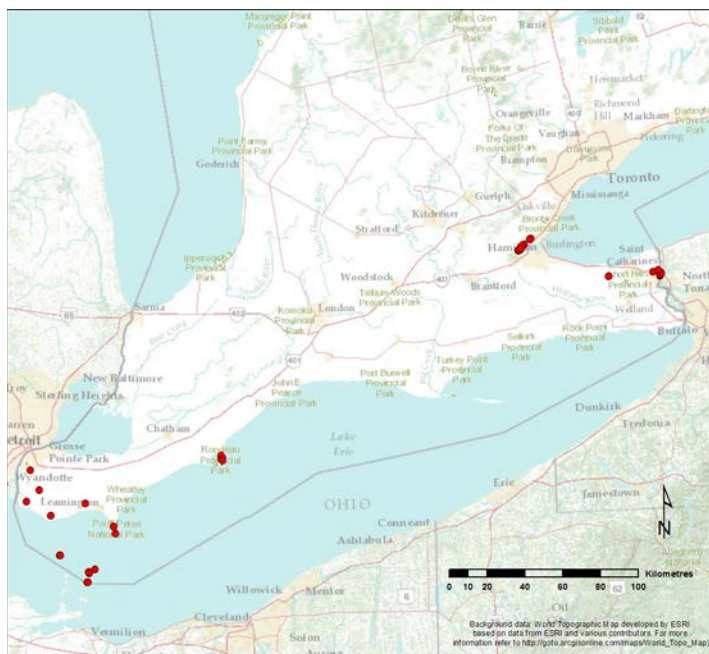
1.1. Current designations

- GRANK: G5 (NatureServe2015) (NatureServe also gives a rank for *Morus rubra var rubra*, but Flora of North America and VASCAN do not recognize this variety).
- NRANK Canada: N2
- COSEWIC: Endangered (November 2014)
- SARA: Endangered (Schedule 1)
- ESA 2007: Endangered (2008)
- SRANK: S2

1.2. Distribution in Ontario

Red Mulberry is at the northern edge of its range in Ontario. The national and provincial range of Red Mulberry is restricted to the Carolinian Zone (7E) of southern Ontario (Figure 1). There are 16 sites where Red Mulberry is still found today. These occur in four general locations: small moist forest remnants near Windsor, the sand spits of Point Pelee and Rondeau, alvar woodlands on the Western Lake Erie Islands, and on the Niagara Escarpment from the Niagara Peninsula to southern Halton. Historically, there were at least 16 other sites, but these no longer occur primarily due to habitat loss.

Figure 1. Current distribution of Red Mulberry in Ontario (COSEWIC 2014).



1.3. Distribution and status outside Ontario

Red Mulberry is native across much of the eastern and central United States. It occurs from Massachusetts west through extreme southwestern Ontario to Minnesota, south to southern Florida, and west to central Texas.

Red Mulberry is globally secure. Of 35 jurisdictions reporting natural occurrences, it is secure in eight and unranked in 20. Five northern states report it as imperiled to vulnerable, or possibly extirpated (Appendix 2) (NatureServe 2015). Populations in the United States are subject to the same threats of hybridization with White Mulberry and twig cankers that are occurring in Ontario.

1.4. Ontario conservation responsibility

Based on the large range of Red Mulberry in eastern North America, global rank, and small population size in Canada, Ontario contains less than 1% of both the range and population of the species.

1.5. Direct threats

Hybridization with White Mulberry appears to be the greatest threat to Red Mulberry, and affects all locations in Ontario. White Mulberry is an introduced species that was widely planted and subsequently dispersed by birds throughout eastern North America (EDDMapS 2015). An Ontario study found that populations of Red Mulberry and White Mulberry include many hybrids, and that most hybrids were genetically more like White Mulberry than Red Mulberry (Burgess *et al.* 2005). The Royal Botanical Gardens, Point Pelee National Park and Fish Point Provincial Nature Reserve have management actions to decrease the number of White Mulberry to reduce the threat of hybridization. Hybridization is probably amplified in southern Ontario by habitat fragmentation that facilitates the invasion of White Mulberry along forest edges.

Diseases that cause twig cankers, blight and dieback also contribute to declines. Double-crested Cormorants and invasive exotic plants also have a negative impact on some Red Mulberry subpopulations in the Lake Erie islands. Double-crested Cormorants can change the chemistry of the soil and kill larger trees. White-tailed Deer (*Odocoileus virginianus*) browsing of young saplings and gastropod grazing of young seedlings reduce recruitment of Red Mulberry in populations where these herbivore populations are high (Essex and Rondeau). All of these threats are in addition to historic habitat loss and fragmentation that have eliminated at least 16 other sites.

1.6. Specialized life history or habitat use characteristics

There are no significant life history or habitat use characteristics for Red Mulberry other than its restricted Canadian range. It occurs in a variety of site conditions including moist forests, floodplains, sandy soils and on shallow limestone. Red Mulberry is wind pollinated, and groupings of trees within the pollen dispersal range are important to ensure the production of sufficient, viable seeds for colonization of new sites. Seeds are primarily dispersed by birds to new sites.

2. Eligibility for Ontario status assessment

2.1. Eligibility conditions

2.1.1. Taxonomic distinctness

Yes. Red Mulberry is a valid species (VASCAN 2015).

2.1.2. Designatable units

No. A single designatable unit is recognized in Canada. Subpopulations and individuals all confined to a relatively small area in southwestern Ontario. While there are habitat differences between locations, there is no evidence to support genetic or ecological differences. (COSEWIC 2014).

2.1.3. Native status

Yes. Red Mulberry is a native species to Ontario (VASCAN 2015).

2.1.4. Occurrence

Red Mulberry currently occurs in Ontario and was inventoried in 2011.

2.2. Eligibility results

Red Mulberry (*Morus rubra*) is eligible for status assessment in Ontario.

3. Ontario status assessment

3.1. Application of endangered/threatened status in Ontario

The technical summary for Red Mulberry is in Appendix 1.

3.1.1. Criterion A – Decline in total number of mature individuals

Insufficient information. Although declines have occurred, trend data are insufficient to quantify declines in mature individuals.

3.1.2. Criterion B – Small distribution range and decline or fluctuation

Endangered B2ab(ii,iii,iv,v):

The index of area of occupancy is below the threshold for Endangered (<104²) and,

- a) there are fewer than 5 locations and the population is considered severely fragmented and,
- b) There are continuing declines that have been observed in the:
 - a. index of area of occupancy (three sites have been lost since 1987)

- b. area, extent and/or quality of habitat (presence of White Mulberry and Double-crested Cormorants, while present for the last three generations, continue to impact habitat quality).
- c. number of locations or subpopulations (three sites have been lost since 1987)
- d. number of mature individuals (observed decline of 6.3% in mature individuals since 1987 (from 112 to 105))

3.1.3. Criterion C – Small and declining number of mature individuals

Endangered C2a(i):

The total population is below the threshold for Endangered (105 mature Red Mulberry), and,

- A. There are continuing declines that have been observed in the in the number of mature individuals and,
 - a. No population no subpopulation contains more than 250 mature individuals (maximum is 54, and most are <10).

3.1.4. Criterion D – Very small or restricted total population

Endangered D1: The total number of mature individuals is below 250. Only 217 individuals are known to occur in Canada, and only 105 of these are considered of reproductive age.

3.1.5. Criterion E – Quantitative analysis

Insufficient information: No quantitative analysis available.

3.2. Application of Special Concern in Ontario

Not applicable.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

Not applicable. Red Mulberry is G5 and <1% of its range and population occurs in Ontario.

3.3.2. Rescue effect

The probability of rescue is very low. First, the period when Red Mulberry fruit are most abundant does not coincide with the period of northerly movement of avian frugivores that migrate over relatively long distances in eastern North America (e.g. thrushes). Second, although long-distance dispersal via birds may be possible for Red Mulberry, populations in bordering states are also subject to hybridization with White Mulberry. While the frequency of hybrid offspring has not been studied outside Ontario, it seems

likely that many of the seeds that might arrive by long-distance dispersal would be hybrids. In addition, given low levels of recruitment from native seed set, even if long-distance seed dispersal occurs it may not result in establishment. Hence significant increases to the Canadian population would not be expected. There is suitable habitat in Ontario, and it is likely that any immigrants that established could survive.

3.4. Other status categories

3.4.1. Data deficient

Not applicable.

3.4.2. Extinct or extirpated

Not applicable.

3.4.3. Not at risk

Not applicable.

4. Summary of Ontario status

4.1. Applicability of criteria for endangered or threatened status in Ontario

Red Mulberry (*Morus rubra*) is classified as Endangered in Ontario based on meeting the following criteria:

4.1.1. Criterion B – Small Distribution Range and Decline or Fluctuation

Endangered. B2ab(ii,iii,iv,v).

4.1.2. Criterion C – Small and Declining Number of Mature Individuals

Endangered C2a(i).

4.1.3. Criterion D – Very Small or Restricted Total Population

Endangered D1.

5. Information sources

Burgess, K.S., M. Morgan, L. Deverno, and B.C. Husband, 2005. Asymmetrical introgression between two *Morus* species (*M. alba*, *M. rubra*) that differ in abundance. *Molecular Ecology* 14: 3471-3483.

COSEWIC. 2014. [COSEWIC assessment and status report on the Red Mulberry *Morus*](#)

[rubra in Canada](#). Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 22 pp.

EDDMapS. 2015. [Early Detection & Distribution Mapping System](#). The University of Georgia - Center for Invasive Species and Ecosystem Health. [website accessed January 24, 2015].

Parks Canada Agency. 2010. Recovery Strategy for the Red Mulberry (*Morus rubra*) in Canada [PROPOSED]. Species at Risk Act Recovery Strategy Series. Parks Canada Agency. Ottawa, Ontario. vii + 25 pp. + 3 Appendices.

Michigan Natural Features Inventory. 2007. [Rare Species Explorer](#) (Web Application). [website accessed Jan 24, 2015].

NatureServe. 2015. [NatureServe Explorer: An online encyclopedia of life](#) [web application]. Version 7.1. NatureServe, Arlington, Virginia. [website accessed 21 November 2015].

Pennsylvania Department of Conservation and Natural Resources. [Invasive plants in Pennsylvania: White Mulberry](#). [website accessed Jan 24, 2015].

[VASCAN \(Database of Vascular Plants of Canada\)](#). 2015. [website accessed Oct 24, 2015].

Appendix 1: Technical summary for Ontario

Species: Red Mulberry (*Morus rubra*)

Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	15-30 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Yes
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	-6.3 % for mature individuals over 25 years
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	Unknown
Are the causes of the decline a. clearly reversible and b. understood and c. ceased?	a. No b. Yes c. No
Are there extreme fluctuations in number of mature individuals?	No

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence. (Request value from MNR or use http://geocat.kew.org/)	18,700 km ²
Index of area of occupancy (IAO). (Request value from MNR or use http://geocat.kew.org/)	104 km ²

Is the total population severely fragmented? (i.e. is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?)	a. Unknown b. Yes
Number of locations (<i>as defined by COSEWIC</i>).	Likely 3-4
Number of NHIC Element Occurrences (<i>Request data from MNR</i>)	16-18
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	No (from COSEWIC), maybe yes
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Yes
Is there an observed, inferred, or projected continuing decline in number of populations?	Yes
Is there an observed, inferred, or projected continuing decline in number of locations?	No
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Yes
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of mature individuals in each sub-population or total population (if known)

Sub-population	N of mature individuals
Chatham-Kent: Rondeau	11
Essex: Fish Point	8
Stone Rd. Alvar	1
East Sister Island	3
Middle Island	0
Point Pelee	2
Anderson/Kingsville	0
For the Birds	1
Mailloux Woods	1
Mitchell's Woods	1
LaSalle	0
Halton: Clappison to Waterdown	5
Hamilton: Berry to Rock Chapel	64
Niagara: Ball's Falls	2
Niagara Glen/Pkwy	4

St. Davids	2
Total, mature* individuals	105
Total individuals (all size classes)	217
Subpopulations presumed extirpated since last update	n/a
Niagara: Pendale [DEAD] 1	n/a
Leawood Court [NOT FOUND] 1	n/a
Essex: Ojibway [NOT FOUND] 1	n/a

* over 10cm dbh

Quantitative analysis (population viability analysis conducted)

Not conducted.

Rescue effect

Rescue effect attribute	Likelihood
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Possibly (Unlikely in COSEWIC)
Would immigrants be adapted to survive in Ontario?	Probably
Is there sufficient suitable habitat for immigrants in Ontario?	Possibly (Limited)
Is the species of conservation concern in bordering jurisdictions?	Yes
Is rescue from outside populations reliant upon continued intensive recovery efforts?	Probably (management of White Mulberry)

Appendix 2: Adjoining jurisdiction status rank and decline Information regarding rank and decline of Red Mulberry

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	S2	n/a	COSEWIC 2014
Quebec	Not Present	n/a	n/a
Manitoba	Not Present	n/a	n/a
Michigan	S2	Unknown. Listed as Threatened in Michigan.	MNFI 2007
Minnesota	SH	n/a	n/a
Nunavut	Not Present	n/a	n/a
New York	S5	Unknown. White Mulberry occurs in NY throughout the range of Red Mulberry	EDDMapS 2015
Ohio	SNR	n/a	n/a
Pennsylvania	S4	Unknown. White Mulberry is present and potential hybridization is noted.	PA DCNR n.d.
Wisconsin	SNR	n/a	n/a

Acronyms:

COSEWIC: Committee on the Status of Endangered Wildlife in Canada

COSSARO: Committee on the Status of Species at Risk in Ontario

ESA: Endangered Species Act

GRANK: global conservation status assessments

IAO: index of area of occupancy

MNRF: Ministry of Natural Resources and Forestry

NHIC: Natural Heritage Information Centre

NNR: Unranked

NRANK: National conservation status assessment

SARA: Species at Risk Act

SH: possibly extirpated

SNR: unranked

SRANK: subnational conservation status assessment

SX: presumed extirpated

S2: Imperiled

S4: Apparently secure

S5: Secure

COSEPAC: Le Comité sur la situation des espèces en péril au Canada