

COSSARO Candidate Species at Risk Evaluation
for
Heart-leaved Plantain (*Plantago cordata*)

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

Assessed by COSSARO as ENDANGERED

December 2011

Final

PART 1

CURRENT STATUS AND DISTRIBUTION

Current Designations:

GRANK – G4 (Assessed 16 December 1994) (NatureServe, accessed Dec. 2011)

NRANK Canada – N1 (NatureServe, accessed Dec. 2011)

COSEWIC – ENDANGERED (Assessed 2011) (COSEWIC, 2011a)

SARA – ENDANGERED (Schedule 1) (Environment Canada, 2011a)

ESA 2007 – ENDANGERED (Ontario Ministry of Natural Resources, 2011)

SRANK – S1 (NHIC, 2011)

Distribution in Ontario:

In Ontario, Heart-leaved Plantain occurs at 2 sites (element occurrences or EOs) in the extreme southwestern portion of the province in Lambton and Middlesex Counties (COSEWIC 2011b). The former Camp Ipperwash site (owned by the Dept. of National Defense) was shown to MNR botanists by members of the Kettle Point First Nation in 1984. The Parkhill site (private land), was discovered in 1987 (Brownell 1998). Both sites were still occupied in 2010 (COSEWIC 2011b). NHIC data show that the species occurred historically at 5 other sites (EOs), 4 of them in Essex, Lambton, and Middlesex Counties in the mid to late 1800s, and at another site where plants were observed in 1967. However, plants were not found at any of the historical sites when they were searched in the 1980s and 1990s (Brownell 1998). The species is at the northern edge of its range in Ontario.

Distribution and Status Outside Ontario:

Heart-leaved Plantain occurs only in North America (Hill 2007), and in Canada only in Ontario. It occurs, or did occur, in 20 states in the eastern U.S.A. from Indiana and Wisconsin to New York and south to Louisiana and Florida, but is now known to occur in only 12 states in this range (37% fewer states; Hill 2007). It has 3 centres of abundance currently where it is ranked S3: Missouri, New York, and Georgia (NatureServe 2011). Heart-leaved Plantain can be locally abundant at some sites. For example, there are more than 10,000 individuals at the extant Missouri sites (NatureServe 2011), and Hill (2007) identified 30 populations and subpopulations in New York State, at least 3 of which contain more than 1,000 plants. State maps of the species distribution by county suggest it is generally highly localized within its range in the U.S.A. (USDA Natural Resources Conservation Service web site 2011), as it is in Canada (ROM 2011).

PART 2

ELIGIBILITY FOR ONTARIO STATUS ASSESSMENT

2.1 APPLICATION OF ELIGIBILITY CRITERIA

Taxonomic Distinctness

Yes. Heart-leaved Plantain (*Plantago cordata*) is considered a distinct species.

Designatable Units

No. There is no known differentiation within the species in Ontario that would merit consideration of more than one designatable unit. It is restricted to one small geographic area.

Native Status

Yes. Records for this species date back to 1863 in Ontario (COSEWIC 2011b).

Presence/Absence

Present. The species is still known to occur at 2 sites (EOs) in southwestern Ontario. The last survey confirming its presence was conducted in 2010 (COSEWIC 2011b).

2.2 ELIGIBILITY RESULTS

1. The putative taxon or DU is valid. **Yes**
2. The taxon or DU is native to Ontario. **Yes**
3. The taxon or DU is present in Ontario, extirpated from Ontario or extinct? **Present**

PART 3

ONTARIO STATUS BASED ON COSSARO EVALUATION CRITERIA

3.1 APPLICATION OF PRIMARY CRITERIA (Rarity and Declines)

1. Global Rank

Not in Any category. Heart-leaved Plantain is ranked G4 (NatureServe 2011).

2. Global Decline

Endangered. Heart-leaved Plantain occurs only in North America. It formerly occurred in 19 states, the District of Columbia (Hill 2007), and Ontario, but has been extirpated from the D.C. and 6 states (Iowa, Kentucky, Florida, Virginia, Maryland, and South Carolina (NatureServe 2011, Hill 2007). Hill's (2007) assessment of current and historical occurrences in the USA suggested the species has declined in every state compared to its historical distribution. Brownell (1998) cited a detailed assessment of occurrence in the U.S.A. performed by Mymudes and Les (1993) who stated at the time that the percentage of site extirpation within individual counties in the states where it was known to occur ranged from 15-100%, or 57% overall. NatureServe (2011) reported that the "population has declined drastically everywhere except Missouri, where it appears to be stable". With a non-cyclic global decline of $\geq 50\%$, the species qualifies for endangered status under this criterion.

3. Northeastern North America Ranks

Endangered. Ranks are provided by jurisdiction for Heart-leaved Plantain in Appendix 1. Heart-leaved Plantain is ranked as S1 in Ontario, and S1, S2, SH, or SX in 10 of the 11 other jurisdictions in northeastern North America where it occurs (91%). As the outcome is $>75\%$, the species qualifies for endangered status under this criterion.

4. Northeastern North America Decline

Endangered. Consolidated, up-to-date information on changes in the net area occupied in the northeast is not available, and information on trends of occupancy is unavailable for 4 states. However, quantitative information from 7 of the 11 states in the northeastern U.S.A. where the species was known to occur suggests the number of counties occupied in these states has declined by 60% to 100% compared to historical times (see Appendix 1; data from Hill 2007). Hill (2007) reported that new populations have been discovered in some areas in the U.S., and the 2 extant sites in Ontario were also discovered recently (1984 and 1987; Brownell 1998). However, the weight of evidence suggests there has been enough of a reduction in the area occupied overall for the species to qualify as endangered under this category.

5. Ontario Occurrences

Endangered. There are only 2 known element occurrences in Ontario that are currently occupied (COSEWIC 2011b), qualifying the species for endangered status under this criterion.

6. Ontario Decline

Threatened. COSEWIC (2011b) concluded that the species had been recorded at 7 sites in total in Ontario, but by 1900 no plants were found at the 4 historical sites known between 1863 and 1894. When checked between 1981 and 2006, it appeared that Heart-leaved Plantain habitat at these sites had been greatly altered due to forest clearing for agriculture or settlements, grazing, flooding, the scouring of rivers, and reduced water quality (Environment Canada 2011). The species was known to be present at another site in 1967, but the site had been cleared of trees and the plants extirpated by the time it was checked in 1984. Only 2 populations (one with 2 sub-populations) that were discovered relatively recently remain in Ontario. If the 4 historical sites are taken into account, the decline in occupancy of known sites (EOs or element occurrences) would be 5/7 or 71%. If only the sites known since 1960 are considered, the decline would be 1 of 3 or 33%.

Surveys have not always differentiated between mature and juvenile plants, making it difficult to ascertain the magnitude of a decline. Table 1 below suggests the Ipperwash population may have declined by 23.3% over a 16-year period (mature and juvenile plants combined; or 14.6% over 10 years), and the population of mature plants at Parkhill by 65.6% in 13 years (or 50.4% over 10 years). When the juvenile and mature plants from both sites are combined, an overall decline of ~46.7% during a 13-16 year period (or 29.2% to 35.9% over 10 years) is suggested. In contrast, Environment Canada (2011) and COSEWIC (2011b) concluded that populations of mature plants are stable.

With only 2 occurrences, a decline of ~47% in total number of plants and 71% in documented Ontario sites, the species merits classification as Threatened under this category.

Table 1. Results of surveys for Heart-leaved Plantain at the 2 extant sites in Ontario (data from COSEWIC 2011b and Environment Canada 2011).

Population	Past		Recent	
	Maximum Count	Year	Maximum Count	Year
Ipperwash	5082 ramets (1 population, includes all ages)	1993	3,897 (2 sub-populations consisting of 3850 and 47 plants - all ages).	Surveyed in 2009 and presence confirmed in 2010 (Environment Canada 2011).
Parkhill	3200 (mature; 1 population) and 10,469 seedlings = 13,669	1997 for mature plants, 1988-89 for seedlings	800-1100 mature and 5,000 juvenile (1 pop.)	2010
Total (all ages)	18,751		9,697 to 9,997	

7. Ontario's Conservation Responsibility

Not in any category. Based on range maps provided by NatureServe (2011) and the Royal Ontario Museum (2011), Ontario accounts for <1% of the species range and population.

3.2 APPLICATION OF SECONDARY CRITERIA (Threats and Vulnerability)

8. Population Sustainability

Not in any category. Data provided by COSEWIC (2011b) and Environment Canada (2011) suggest that large numbers of juvenile plants continue to be found at the 2 extant sites in Ontario (see Table 1 above). Since there is no evidence of recruitment failure, the species does not qualify for endangered, threatened, or special concern status under this criterion.

9. Lack of Regulatory Protection for Exploited Wild Populations

Not in any Category. The Camp Ipperwash population of Heart-leaved Plantain occurs on Department of National Defense (DND) property where it is protected by federal legislation. However, negotiations continue for transfer of the site to First Nations. Heart-leaved Plantain was harvested by local Aboriginal people for medicinal purposes in the past (Brownell 1998) and the practice might have been widespread (Environment Canada 2011). Allen and Oldham (1985) suggested that the species is no longer harvested by the local people, and neither Environment Canada (2011) nor COSEWIC (2011b) provided data suggesting there has been any recent harvest. The other population (Parkhill) is on private property. There is no evidence that the species is at risk from exploitation today at either of the 2 sites. Heart-leaved Plantain is currently protected under Ontario's *Endangered Species Act, 2007* and the federal *Species at Risk Act*.

10. Direct Threats

Threatened. There are 7 sites where the species has been observed in Ontario. Environment Canada (2011) reported severe habitat degradation at 4 of the historical sites that were occupied at some time during 1863-1894. At the historical site last known to be occupied in 1967, a survey showed that habitat was "largely cleared of trees, heavily grazed and trampled". No similar changes have been reported at the 2 extant sites where the plants have been present over the last 22 to 26 years.

The draft Heart-leaved Plantain Recovery Strategy (Environment Canada 2011) concluded that the highest level of concern at the Parkhill site is nutrient loading from agricultural runoff, removal of riparian vegetation, and timber harvesting (which has occurred quite close to the this site, according to COSEWIC 2011b). Except for nutrient loading, COSEWIC did not consider these threats to be high at the former Camp Ipperwash site. However, there is uncertainty about the future of the Ipperwash site because negotiations continue for its transfer from the Department of National Defense (under whose ownership the federal SAR Act would definitely apply) to First Nations, and work is underway to address decommissioning of potentially

unexploded ordnance (personal communication Ruben Boles, Environment Canada, December 2011). Aboriginal people used Heart-leaved Plantain for medicinal purposes in the past but there is no evidence that this is occurring now (Environment Canada 2011).

Environment Canada (2011), COSEWIC (2011b) and Hill (2007) suggested eutrophication of streams along which Heart-leaved Plantain occurs may be followed by an increase in algae that could entrap dispersing seeds, threatening the ability of plantain seeds to germinate and survive. While Environment Canada (2011) identified this as a threat at both Ontario sites, no data were presented to confirm either the level of eutrophication at these sites or whether seeds had actually become trapped in algae and failed to germinate.

A degree of protection for the streams in which the species is found could be provided by the federal *Fisheries Act* (1985) if the streams are permanent or intermittent and qualify as “fish habitat”.

Because of the threats identified by Environment Canada (2011) and COSEWIC (2011b), and the higher severity assigned to at least one site (50% of the 2 provincial occurrences), the species qualifies as “Threatened” under this criterion.

11. Specialized Life History or Habitat-use Characteristics

Special Concern. Heart-leaved Plantain is an early spring flowering perennial, herbaceous, semi-aquatic plant 20-50 cm tall with a basal rosette of large, heart-shaped leaves, and massive, fleshy roots that help to anchor the plant in the periodically flooded situations in which it occurs (COSEWIC 2011b). The short-lived seeds are dispersed by water in “slow-moving ephemeral [intermittent] streams” (COSEWIC 2011b) and require bare soil on which to germinate (Hill 2007). Habitat has been described variously as exclusively along intermittent streams that flow through silver maple swamps in Ontario (COSEWIC 2000), clear, shallow streams and seepages in mature woods (COSEWIC 2011b), streams flowing over limestone or dolomitic rock (sedimentary rock; COSEWIC 2011b), gravelly or rocky beds of shallow, clear streams or springs, or sandstone rubble, or even the silt-laden water of tidal flats (NatureServe 2011).

Heart-leaved plantain seeds are susceptible to drying and entanglement in algae in eutrophied streams (COSEWIC 2011b), factors that could reduce reproductive success. However, Table 1 illustrates that there are large numbers of immature plants at the 2 sites where it occurs in Ontario. This suggests the species life history characteristics are not so specialized that it qualifies for a ranking other than special concern at most under this criterion.

3.3 COSSARO EVALUATION RESULTS

1. Criteria satisfied in each status category

The number of primary and secondary criteria met in each status category:

**ENDANGERED – [4/0]
THREATENED – [1/1]
SPECIAL CONCERN – [0/1]**

The Number of Ontario-specific criteria met in each status category are:

ENDANGERED – [1]
THREATENED – [1]
SPECIAL CONCERN – [0]

2. Data Deficiency

No. There was sufficient information on which to base an evaluation of the risk status of Heart-leaved Plantain.

3. Status Based on COSSARO Evaluation Criteria

The application of COSSARO evaluation criteria suggests that Heart-leaved Plantain is **Endangered** in Ontario.

PART 4

ONTARIO STATUS BASED ON COSEWIC EVALUATION CRITERIA

4.1 APPLICATION OF COSEWIC CRITERIA

Regional (Ontario) COSEWIC Criteria Assessment

Criterion A – Decline in Total Number of Mature Individuals.

A2a - Threatened.

Environment Canada (2011) and COSEWIC (2011b) concluded that the populations of mature plants at the Ipperwash and Parkhill sites are stable. This is difficult to corroborate because surveys for Heart-leaved Plantain have not always differentiated between mature and juvenile plants. Table 1 above suggests the Ipperwash population may have declined by 23.3% over a 16 year period (mature and juvenile plants combined; ~14.6% over 10 years), and the population of mature plants at Parkhill by 65.6% in 13 years (or ~50.4% over 10 years). An overall decline of ~47% during a 13-16 year period (29.2% to 35.9% over 10 years) is suggested when the juvenile and mature plants from both sites are combined. This would qualify Heart-leaved Plantain as Threatened under COSEWIC criterion A2a (a reduction of $\geq 30\%$ in the number of mature individuals over 10 years as determined from direct observation where the reduction may not have ceased or may not be understood or may not be reversible).

Criterion B – Small Distribution Range and Decline or Fluctuation . B2a(iii), B2b(iii) - Endangered.

COSEWIC (2011b) stated that the area of occupancy is 24 km². Heart-leaved Plantain occupies <500 km², occurs at fewer than 5 sites, and may be experiencing a decline in habitat quality (iii). Therefore, it qualifies for endangered status under this COSEWIC criterion.

Criterion C – Small and Declining Number of Mature Individuals

C1 - Threatened.

Surveys (Table 1) suggest there were no more than 10,000 individual plants of all ages at the 2 sites combined in Ontario in 2009-2010. Although we cannot determine the precise rate of decline of the population of mature plants for both sites because adults and juveniles were pooled during surveys at the Ipperwash site, the data in Table 1 suggest it is reasonable to believe a decline of mature plants had reached at least 10% within 10 years. Combined with a population <10,000, this would qualify the species for threatened status under this criterion.

Criterion D – Very Small or Restricted Total Population

D2 - Threatened.

There are only 2 extant sites occupied in Ontario today (Table 1; COSEWIC 2011b, Environment Canada 2011), meeting COSEWIC's requirements for "Threatened" status in this category.

Criterion E – Quantitative Analysis

Insufficient information.

There are no population projections available to assist in determining the probability of persistence.

Rescue Effect

No.

COSEWIC (2011b) suggests seed dispersal from other populations is unlikely. Heart-leaved Plantain seeds are dispersed by water (Brownell 1998), and since the species is at the northern edge of its range at the extant sites in Ontario, it is doubtful water flowing from outside Ontario would bring seeds to these sites.

Special Concern Status

No.

The species qualifies as endangered or threatened under most of the criteria above.

4.2 COSEWIC EVALUATION RESULTS

1. Criteria satisfied in each status category

**ENDANGERED – Yes
THREATENED – Yes
SPECIAL CONCERN – No**

2. Data Deficiency

No. There was sufficient information on which to base an evaluation of the risk status of Heart-leaved Plantain.

3. Status Based on COSEWIC Evaluation Criteria

The application of COSEWIC evaluation criteria suggests that Heart-leaved Plantain is **Endangered** in Ontario.

PART 5

ONTARIO STATUS DETERMINATION

5.1 APPLICATION OF COSSARO AND COSEWIC CRITERIA

COSSARO and COSEWIC criteria give the same result. **Yes.**

5.2 SUMMARY OF STATUS EVALUATION

Heart-leaved Plantain (*Plantago cordata*) is an early spring flowering perennial, herbaceous, semi-aquatic plant 20-50 cm tall with a basal rosette of large, heart-shaped leaves. It is adapted to temporarily flooded habitat, owing to massive, fleshy roots that anchor the adult plants. Its short-lived seeds disperse in water and germinate on bare soil. Habitat in northeastern North America has been described variously as along intermittent streams flowing through silver maple swamps; clear, shallow streams and seepages in mature woods; streams flowing over limestone or dolomitic rock; gravelly or rocky beds of shallow, clear streams or springs; sandstone rubble; and silt-laden water of tidal flats. It occurs only in eastern North America, and reaches the northern edge of its range in Ontario. It is ranked as extirpated, presumed extirpated, imperiled, or critically imperiled in 91% of 11 northeastern jurisdictions. Five historical sites known in Ontario are no longer occupied, and it has declined 47% over 22-26 years at the 2 extant sites near the southernmost point of Lake Huron. The species' decline since the 1990s, occurrence at only 2 sites over a small area, and status as imperiled or extirpated in other jurisdictions in northeastern North America suggest Heart-leaved Plantain qualifies for endangered status in Ontario.

Information Sources

1. Literature Cited

Allen, G. and M. Oldham. 1984. *Plantago cordata* on the Ipperwash Military Reserve: a report to the COSEWIC plant sub-committee. Unpublished Report, Ontario Ministry of Natural Resources, Chatham, Ontario.

Brownell, V. 1998. Update COSEWIC status report on Heart-leaved Plantain *Plantago cordata* in Canada, in COSEWIC assessment and update status report on heart-leaved plantain *Plantago cordata* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.

COSEWIC. 2011a. Wildlife species search. Plantain, Heart-leaved | *Plantago cordata* http://www.cosepac.gc.ca/eng/sct1/SearchResult_e.cfm?commonName=bluehearts&scienceName=&Submit=Submit . Last updated April 2009. Accessed Nov. 16 2011.

COSEWIC. 2011b. COSEWIC status appraisal summary on Heart-leaved Plantain *Plantago cordata* in Canada. Two-month Status Appraisal Summary, Sept. 2011.

COSEWIC. 2000. COSEWIC assessment and update status report on the Heart-leaved Plantain *Plantago cordata* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.

Environment Canada. 2011. Recovery strategy for the Heart-leaved Plantain (*Plantago cordata*) in Canada (Proposed). Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa.

Hill, S.R. 2007. Conservation assessment for the Heartleaf Plantain (*Plantago cordata* Lam.). Prepared for the USDA Forest Service, Eastern Region. INHS Technical Report 2007 (42). Accessed at https://www.ideals.illinois.edu/bitstream/handle/2142/18103/INHS2007_42.pdf?sequence=1, on Nov. 18, 2011.

Mymudes, M.S. and D.H. Les. 1993. Morphological and genetic variability in *Plantago cordata* (Plantaginaceae), a threatened aquatic plant. *American Journal of Botany* 80(3): 351-359

NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.3. NatureServe, Arlington, Virginia. www.natureserve.org/explorer . Last updated July 2011. Accessed November 11 2011.

Natural Heritage Information Centre (NHIC). 2011. Element Summary Report for *Plantago cordata* Ontario Ministry of Natural Resources, Peterborough, Ontario. <https://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/speciesDetailReport.do?elID=160006> Last updated July 2010. Accessed Nov. 16 2011

Royal Ontario Museum (ROM). 2011. Ontario's species at risk web site. Accessed Nov. 16, 2011. <http://www.rom.on.ca/ontario/risk.php>

USDA Natural Resources Conservation Service web site, accessed Nov. 16, 2011.
http://plants.usda.gov/java/county?state_name=Tennessee&statefips=47&symbol=PLCO2

2. Community and Aboriginal Traditional Knowledge Sources

No community or Aboriginal traditional knowledge received through submissions to COSSARO.

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APPENDIX 1

NORTHEASTERN NORTH AMERICA STATUS RANK AND DECLINE

	Subnational Rank	Sources	Decline	Sources
CT	Not present			
DE	Not present			
IL	S1	NatureServe	72%: Occurred historically in 25 counties but now only 7	Hill (2007)
IN	S1		89%: Occurred historically in 9 counties but now only 1	Hill (2007)
IA	SH	NatureServe	No information	
LB	Not present			
KY	SX	NatureServe	No information	
MA	Not present			
MB	Not present			
MD	SH	NatureServe	100%: 1 county, now extirpated.	Hill (2007)
ME	Not present			
MI	S1	NatureServe	73%: 15 counties, now 4	Hill (2007)
MN	Not present			
NB	Not present			
NF	Not present			
NH	Not present			
NJ	Not present			
NS	Not present			
NY	S3	NatureServe	11 counties occupied historically - no information on decline	Hill (2007)
OH	S1	NatureServe	85%: 13 counties, 2 extant	Hill (2007)
ON	S1	NatureServe	60%: 5 historical sites, now 2	COSEWIC (2011)
PA	Not present			
PE	Not present			
QC	Not present			
RI	Not present			
VA	SH	NatureServe	100%: 2 historical counties, now 0	Hill (2007)
VT	Not present			
WI	S1	NatureServe	6 historical counties, current unknown	Hill (2007)
WV	Not present			

Occurs as a native species in 11 of 29 northeastern jurisdictions
 Srank or equivalent information available for 11 of 11 jurisdictions = (100%)
 S1, S2, SH, or SX in 10 of 11 = (91%)