COSEWIC
Assessment and Update Status Report

on the

Heart-leaved Plantain
Plantago cordata

in Canada

ENDANGERED
2000

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

Please note: Persons wishing to cite data in the report should refer to the report (and cite the author(s)); persons wishing to cite the COSEWIC status will refer to the assessment (and cite COSEWIC). A production note will be provided if additional information on the status report history is required.

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Brownell, V.R. 1998. Update COSEWIC status report on the Heart-leaved Plantain *Plantago cordata* in Canada, *in* 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. 1-15 pp.

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Brownell, V.R. 1985. COSEWIC status report on the Heart-leaved Plantain *Plantago cordata* in Canada [with appended update by G.M. Allen and M.J. Oldham, November 1984]. Committee on the Status of Endangered Wildlife in Canada. 54 pp.

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The report originally prepared by the author has been modified by Erich Haber, Co-Chair, Species Specialist Group for Plants and Lichens, to more closely conform to the new standardized format. Information from the author's original report (Brownell 1985) has been included.

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COSEWIC
Assessment Summary

Assessment summary – May 2000

Common name
Heart-leaved Plantain

Scientific name
Plantago cordata

Status
Endangered

Reason for designation
Two remaining populations with narrow habitat tolerance threatened by ongoing habitat degradation.

Occurrence
Ontario

Status history
Designated Endangered in April 1985. Status re-examined and confirmed Endangered in April 1998 and in May 2000.

COSEWIC
Executive Summary

Heart-leaved Plantain
Plantago cordata

Species information

Heart-leaved Plantain is a perennial herb with massive, fleshy, branching roots and a basal rosette of large, heart-shaped leaves. Small flowers are loosely borne in a narrow spike at the top of a 10-50 cm tall leafless stalk. The fruit is a capsule containing finely pitted, dark brown seeds, 2.5-3.5 mm long.

Distribution

The species was historically widely distributed in eastern North America in 19 states and one province. It is now extirpated in 6 states and has its centre of abundance in Missouri. It is found in Canada at only two sites in southwestern Ontario.

Habitat

Heart-leaved Plantain is associated with the occurrence of limestone and dolomitic rock, often growing in shallow, clear streams within cracks of the bedrock or in gravel, in heavily wooded situations. The Middlesex County, Ontario, population is situated in a wet mesic, mature sugar maple forest with localized occurrence of silver maple, red maple, ash and basswood along the intermittent stream.

Biology

The species is an early spring flowering herbaceous perennial. Its flowers are bisexual and tend to reproduce sexually through cross-pollination, with pollen being carried by wind. Seeds are short-lived when dry but float readily and are adapted for dispersal within the streambed of the parent plants. Some asexual reproduction may occur through the formation of young plantlets as root sprouts.

Population sizes and trends

Only two populations are presently known from southwestern Ontario with a total of fewer than 10,000 mature plants and many thousands of seedlings. Numbers of plants seem to be stable at the two sites.

Limiting factors and threats

The main natural limiting factors include habitat specificity and dynamic nature of the habitat. In Ontario, this species is only known to occur along intermittent streams in mature silver maple swamp. It is sensitive to water quality including eutrophication and siltation. The major anthropogenic impact is a drastic reduction in amount of mature wet woods due to conversion for agriculture and alteration of natural stream courses through ditching, damming, siltation, pollution and stream flow changes. Cattle grazing and trampling has eliminated one of the known Ontario populations. Harvesting for medicinal purposes by local Indians occurred in the past.

Special significance of the species

This species is of special significance because of its traditional use as a medicinal plant by native peoples of eastern North America. It is also the only semi-aquatic species of plantain in North America.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.

** Formerly described as “Not In Any Category”, or “No Designation Required.”

*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.

Environment Canada | Environnement Canada
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Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

Update
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2000

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SPECIES INFORMATION

Name and classification

Scientific name: *Plantago cordata* Lam.
Common names: Heart-leaved Plantain
Family name: Plantaginaceae (plantain family)
Major plant group: Angiosperm (dicot flowering plant)

Description

Heart-leaved Plantain is a perennial herb with massive, fleshy, branching roots and a basal rosette of large, heart-shaped leaves (Figure 1). Small flowers are loosely borne in a narrow spike at the top of a 10-50 cm tall leafless stalk. The fruit is a capsule containing several finely pitted, dark brown seeds, 2.5-3.5 mm long.

Figure 1. Illustrations of Heart-leaved Plantain: (a) habit, (b) capsule with sepals and corolla lobes attached, (c) capsule, (d) seed (illustrations courtesy Agriculture and Agri-Food Canada).

DISTRIBUTION

Global range

Plantago cordata is characterized by a widespread geographical range within which it is highly localized (Ormes 1986). The original North American range was Ohio to Mich. and Minn., s. to w. VA., Ala. and La., also locally along the coast from N.Y. to D.C. (Gleason and Cronquist 1963). *P. cordata* has been reported historically in 19 states and one province (Brownell 1983; Bender 1986, Mymudes and Les 1993, Oldham 1995, The Nature Conservancy 1997).

It is now extirpated in 6 states and its centre of abundance is in Missouri (Orzell 1983, 1984, Ormes 1986, The Nature Conservancy 1997). Extensive surveys by the Natural Heritage Programs and U.S. Fish and Wildlife Service since the mid-1980s revealed many large populations that were not known to still exist at the time of the status report by Brownell (1983); however, they also showed that many sites have been destroyed by pollution and development (U.S. Department of the Interior 1985). The general range of this species in North America is shown in Figure 2.

Canadian range

In Canada, this species is confined to 2 locations in southwestern Ontario that were discovered after the original status report was written (Figure 3).

HABITAT

Plantago cordata is associated with the occurrence of limestone and dolomitic rock, often growing in shallow, clear streams within cracks of the bedrock or in gravel, in heavily wooded situations (Mymudes 1991). It is often located close to limestone quarries or gravel pits. In New York it occupies an atypical habitat: the intertidal zone of the Hudson River. In Ontario, it occupies intermittent streams in mature, deciduous woods. The soil at the Lambton Co. site is a clay loam with a pH of 7.2 (Allen and Oldham 1984). Major herbaceous associates at the Middlesex site are Swamp Buttercup (*Ranunculus hispidus* ver. *caricetorum*), Poison Ivy (*Rhus radicans* ssp. *rydbergii*), Water Pimpernel (*Samolus floribundus*), and Fowl Manna Grass (*Glyceria striata*) (Oldham and McLeod 1990). The dominant trees at both sites are Sugar Maple, Silver Maple, Red Maple, Blue Beech, Shagbark Hickory, White Ash, Black Ash and Basswood. The Middlesex County population is situated in a wet mesic, mature sugar maple forest with localized occurrence of silver maple, red maple, ash and basswood along the intermittent stream. Spicebush is a frequent shrub at the site.

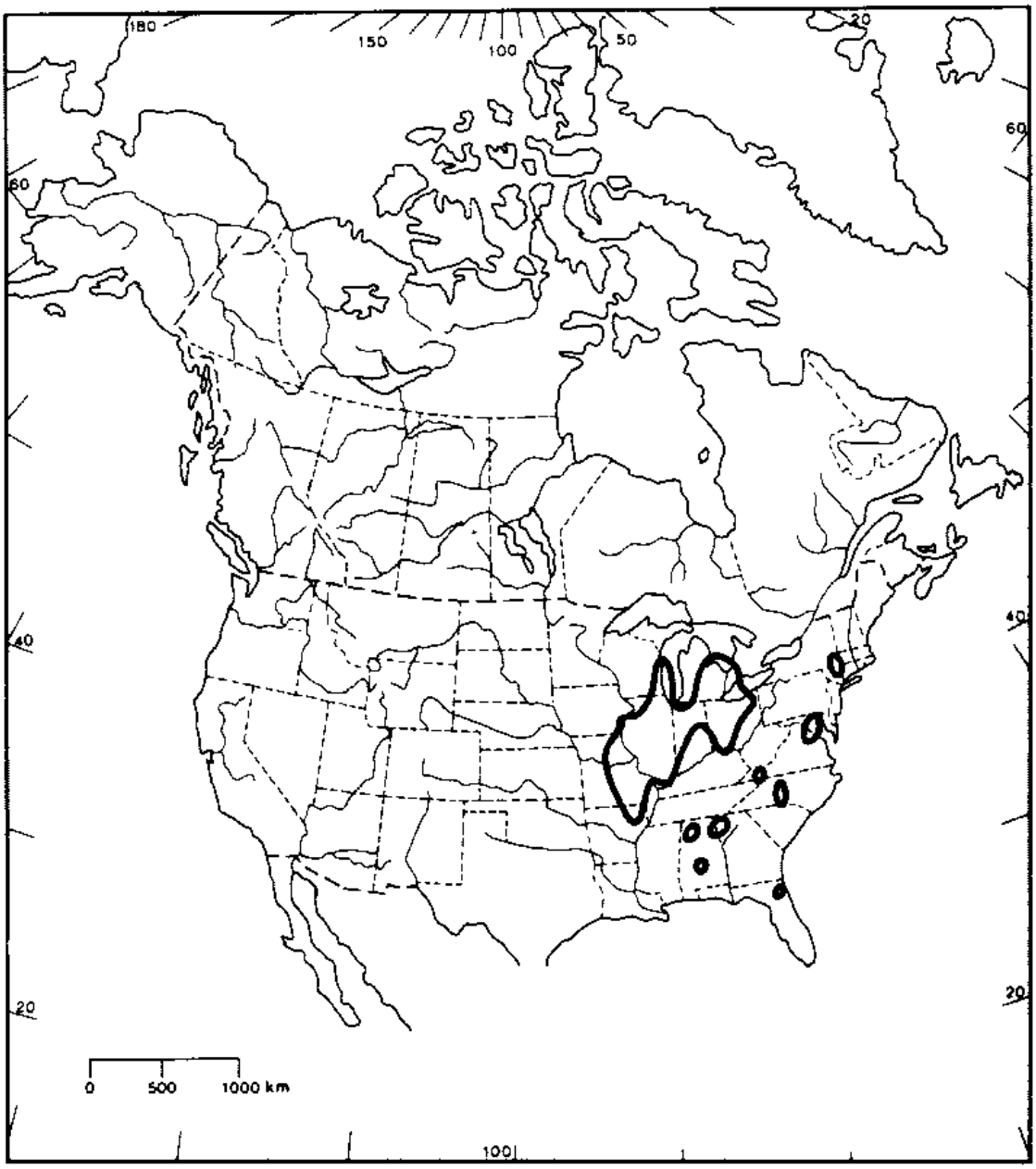

Figure 2. Distribution of Heart-leaved Plantain in North America (Keddy 1987).

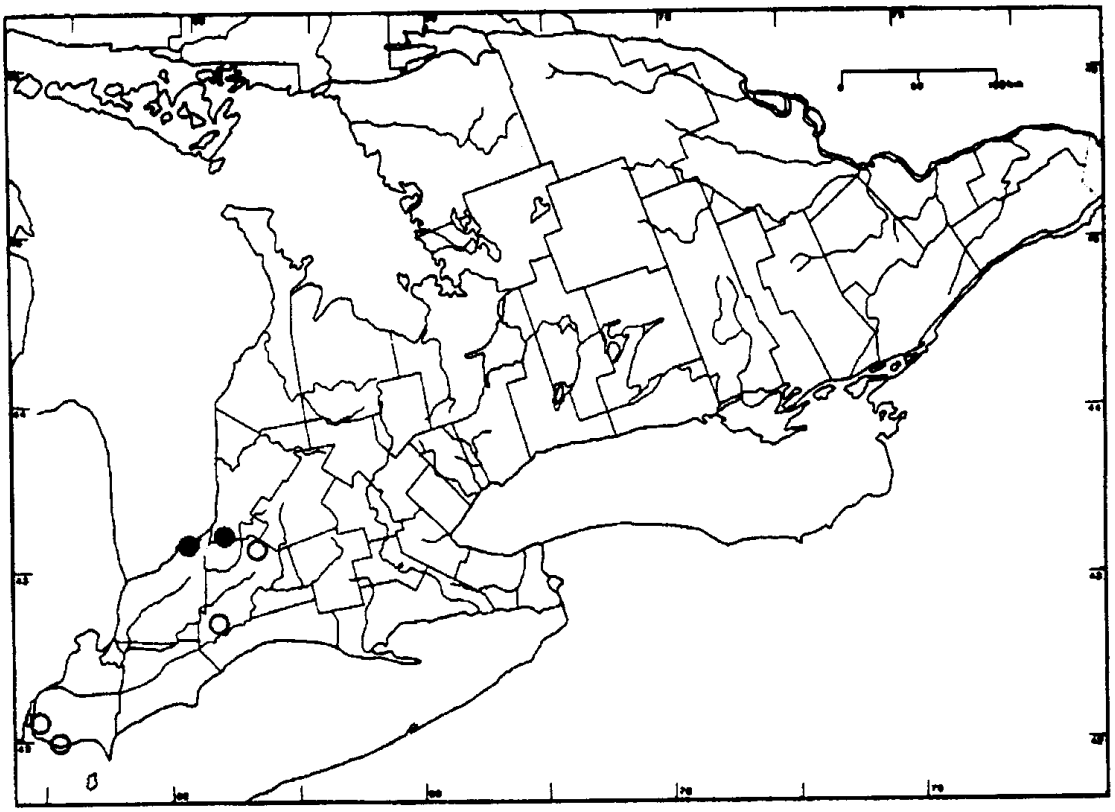

Figure 3. Distribution of Heart-leaved Plantain in Ontario and Canada after Keddy 1987 (open circles represent specimens in Canadian herbaria collected prior to 1925; solid circles are specimen localities post-1964).

BIOLOGY

Heart-leaved Plantain is a short-day plant, flowering in mid-April in Ontario. Plants have bisexual flowers with a tendency to be protogynous, with the pistil maturing before the stamens, thereby promoting outcrossing. Self-pollination may also occur. Pollination is effected by wind. New plants may sprout from roots of parent plants. Seeds remain attached to a spongy placenta when shed. They are highly buoyant. Their hygroscopic mucilaginous coat enables the seed to adhere to objects floating in the water. The species is adapted to dispersal and re-establishment within the streambed of origin. Seeds, however, have a very short life span of possibly only several months once they dry out (data from Brownell 1985). Stromberg *et al*. (1981) provide information on the ecology and reproduction of *Plantago cordata* in southeastern Wisconsin.

Based on 54 plants, Oldham and McLeod (1990) reported an average of 1.44 fruiting stalks per plant at the Parkhill site and 1.26 fruiting stalks per plant at the former Camp Ipperwash (Allen and Oldham 1984). The number of seed capsules per plant varied from 65 to 108 with an average of 86.4 seed capsules per fruiting stalk. Stromberg and Stearns (1989) reported an average of 2.5 seeds per capsule in Wisconsin. At Parkhill there was a ratio of 1 flowering plant to 3.4 seedlings in 1988.

Although the species is strongly protogynous, flowers with mature anthers and receptive stigmas can occur simultaneously on the same spike (Mymudes and Les 1993). Self-compatibility and the presence of several spikes at different stages of maturity on the same plant allow for self-pollination.

Mymudes (1991) and Mymudes and Les (1993) in a study of 10 populations from 6 states and Ontario found no variation in allelic frequencies for 21 genetic loci coding for 11 soluble enzymes in plants close to or north of the glacial boundary (from Wisconsin, Ontario, Missouri and Illinois). This lack of variation indicates founder effects and genetic bottlenecks resulting from known as well as suspected population crashes. Two small North Carolina sites have a unique genetic composition. The species is an apparent allopolyploid with fixed heterozygosity observed at 67% of the loci surveyed. Electrophoretic variation was mostly partitioned among populations. There is little within-population genetic variation in *P. cordata*.

POPULATION SIZES AND TRENDS

Heart-leaved Plantain has been assigned a Global Rank of G4 (Oldham 1996). Keddy (1987) reported the status of P. cordata as possibly extirpated in Iowa, Michigan, and Virginia; endangered in Alabama, Illinois, Indiana, Kentucky, Maryland, North Carolina, Ohio and Wisconsin; threatened in Arkansas and New York.

Mymudes and Les (1993) prepared North American distribution maps based on historical and extant populations of *P. cordata*. The percent of site extirpation by county varied from 15-100% and they estimated that 57% of the historic sites for the species have been lost. *P. cordata* is considered a historical record and probably extirpated from D.C., Florida, Iowa, Kentucky, Maryland and Virginia and there are less than 5 sites (S1 rank) in Alabama, Illinois, Indiana, Michigan, North Carolina, Ohio, Tennessee, Wisconsin, and Ontario (The Nature Conservancy 1997). It is listed as S2 in Arkansas, and S3 in Georgia, New York and Missouri. Clements and Mitchell (1991) report 13 extant sites in NY including one of the largest known. Ormes (1986) suggests that there are more than 100 sites in Missouri, which is the centre of abundance; however, Mymudes and Les (1993) report 28 as extant. This species was thought to have become extirpated in Michigan, but the first plants to be seen since 1925 were discovered in Hillsdale Co. in 1990, and in 1995 it was rediscovered in Ionia County (Voss 1996).

In Ontario a Subnational Rank of S1 has been assigned to this species (Oldham 1996). The status of Heart-leaved Plantain populations is summarized as follows:

Extant populations in Ontario

1. Former Camp Ipperwash (Department of National Defence property), Lambton Co. – Site shown to OMNR personnel in 1984 by Bill Henry and Rachel Shawkence of the Potawatomi Indian community at Kettle Point (Allen and Oldham 1984, 1985). Four subpopulations subsequently identified as a result of biological inventories (Sutherland *et al*. 1994, Thompson *et al*. 1994) and a monitoring program (MacKinnon Hensel & Associates 1994). In 1989 P. Prevett, A. Woodliffe and M. Oldham counted 3700 mature plants (Oldham and McLeod 1990), and a total of 5083 plants were counted in 1993 (MacKinnon Hensel & Associates 1994). The latter study reported the following subpopulations:

    1a. About 5000 plants along an unnamed intermittent stream draining into Jericho Creek.
    1b. 3 plants.
    1c. 79 plants.
    1d. One plant along a different unnamed intermittent stream.

2. Near Parkhill, Middlesex County – Discovered by M. Oldham in 1987. About 3200 mature plants were counted on 10 July 1997, by the author along a privately owned, 203 m stretch of intermittent stream. Population numbers are relatively stable based on results of OMNR monitoring program. 3,066 mature plants and 10,469 seedlings were counted in 1988 (1 flowering plant: 3.4 seedlings) (Oldham and McLeod 1990). Six steel metal stakes have been placed in the colony to act as reference points for monitoring.

A total of about 8,149 mature plants existed in Ontario in 1995 (Oldham 1995), and based on field investigations at the Parkhill site in 1997 by the author, the total Ontario population is estimated to be approximately the same in 1997. The author conducted searches of 16 woodlots in the vicinity in July 1997; however, no additional sites for this species were found. The woodlots appeared to be unsuitable due to a number of factors: ditching through the forest, past and current selective logging and clearcutting, and past heavy grazing.

Populations known or assumed extirpated

In Ontario 70% of sites (5 historical records) have been extirpated due to habitat alteration for agriculture.

1. Essex Co., Colchester Station, near Amherstburg, J. Macoun, June 10, 1882 (TRT, CAN, GH, US). Area searched in 1981 by Brownell and Oldham.

2. Essex Co., near Canard River, Booth, May 17, 1863 (US). Area searched by Oldham.

3. Middlesex Co., Biddulph Twp., Lucan, north of Lucan High School. J. Dearness, June 11, 1894. Searched by Oldham, Allen and McLeod.

4. Middlesex Co., Glencoe. Old record searched by Oldham, Allen and McLeod in 1990 but no suitable habitat found (Oldham and McLeod 1990).

5. Lambton Co., Bosanquet Twp., NW of Thedford. Last seen in 1967. Location searched in 1981 by author and M.J. Oldham and also in 1984 by M.J. Oldham and Bill Henry. Habitat severely degraded by cattle.

LIMITING FACTORS AND THREATS

Major natural limiting factors include habitat specificity and dynamic nature of habitat. Effects of land use and factoring affecting decline on the Heart-leaved Plantain in an Illinois stream system have been described by Bowles and Apfelbaum (1988, 1989). In Ontario, this species is only known to occur along intermittent streams in mature silver maple swamp. It is sensitive to water quality including eutrophication and siltation. Eutrophication reduces recruitment by stimulating the growth of algae (Mymudes 1991). The algae entrap the seeds and kill the seedlings. In order to protect this species, high water quality must be maintained, which may require securing the upstream watershed. A large buffer of woods on either side of the stream is needed to prevent cutting and to provide shade (Ormes 1986).

The major anthropogenic impact is a drastic reduction in amount of mature wet woods due to conversion for agriculture and alteration of natural stream courses through ditching, damming, siltation, pollution and stream flow changes. Cattle grazing and trampling has eliminated one of the known Ontario populations. Harvesting for medicinal purposes by local Indians occurred in the past.

SPECIAL SIGNIFICANCE OF THE SPECIES

This species is of special significance because of its traditional use as a medicinal plant by native peoples of eastern North America (see references in Brownell 1985). It is also the only semi-aquatic species of plantain in North America.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The extant Canadian populations occur on private land and on land occupied by First Nations. The private landowner of the Middlesex County population was initially contacted by OMNR in 1988 and has allowed monitoring at the site. The Ipperwash Department of National Defence property has been occupied by the Kettle Point and Stony Point First Nations since 1995. During the process of negotiations to turn the title of the National Defence property over to the First Nations, the First Nations have requested level 3 decommissioning, which would involve removal of all tree cover and searching the soil for explosives to a depth of several metres (Bob Woods, DND, pers. comm. 1997). This would eliminate 62% of the Canadian population of Heart-leaved Plantain.

Three populations are under public ownership in Illinois, one in Indiana and several in Missouri (Ormes 1986, Bowles *et al*. 1988).

This species was listed under *The Endangered Species Act* in Ontario in 1987 and was designated by COSEWIC as nationally endangered in 1985. *Plantago cordata* was under review for possible listing as either a federally threatened or endangered species in the United States (U.S. Department of the Interior 1985); however, it was removed from consideration in 1989 (Mymudes and Les 1993).

SUMMARY OF STATUS REPORT

In 1985 when *P. cordata* was listed as endangered in Canada, all of the known plants were found on federally owned land managed by the Department of National Defence. Presently none of the plants are within land managed by a public agency. In 1997, only two populations were known from Ontario, comprising a total of about 8149 mature plants based on counts in 1995 and 1997. The populations have a highly restricted range in Canada and are at risk from land use for agriculture and residential purposes.

TECHNICAL SUMMARY

DISTRIBUTION

Extent of occurrence: < 1km^2 of habitat
Area of occupancy: < 1 km^2

POPULATION INFORMATION

Total number of individuals in the Canadian population: > 10,000 including seedlings
Number of mature reproducing individuals in the Canadian population: 8,149 in 1995
Generation time: 2 – 3 years
Total population trend: possibly stable
Rate of decline (if appropriate) for total population: N/A
Number of known populations: 2 with one having 4 subpopulations
Is the total population fragmented? YES
number of individuals in smallest population: 3200 mature individuals (but subpopulations may be as small as 1 plant)
number of individuals in largest population: 5083 mature individuals
number of extant sites: 2
number of historic sites from which species has been extirpated: at least 5
Does the species undergo fluctuations in numbers? unknown
If yes, what is the maximum number? unknown
minimum number? unknown
Are these fluctuations greater than one order of magnitude?

LIMITING FACTORS AND THREATS

Forest stream habitat loss from conversion for agriculture and alteration of natural stream courses through cattle trampling, ditching, damming, siltation, pollution and stream flow changes. Threat from decommissioning.

RESCUE POTENTIAL

Does the species exist outside Canada? YES
Is immigration known or possible? unlikely since nearest populations in USA are quite disjunct
Would individuals from the nearest foreign population be adapted to survive in Canada? possibly
Would sufficient suitable habitat be available for immigrants? very little

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Michael J. Oldham, Botanist, Natural Heritage Information Centre, Peterborough, Ontario. Tel. 705-755-2160, E-mail: michael.oldham@mnr.gov.on.ca

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THE AUTHOR

Vivian R. Brownell received an honours B.Sc. from the University of Guelph in 1978 with a specialization in field botany. After graduating, she worked for several government departments including the Ontario Ministry of Natural Resources and the Canadian Parks Service, Ontario Region. Since 1983, she has worked as a biological consultant for municipalities, conservation authorities and government agencies. Her work primarily involves biological inventory and evaluation, rare species management, evaluation of natural areas and wildlife habitat and natural heritage systems planning. Recently she has developed a computer software program (NADEP) that incorporates a databasing system and facilitates the evaluation of natural areas. She has authored or co-authored many papers in scientific journals and books on the subject of alvars, prairies, savannas, sand and rock barrens, orchid classification and plant geography. A complete list of papers, articles and reports can be obtained from the Canadian biodiversity guide to botanical specialists and literature that is accessible on the Internet at http://www.cciw.ca/eman-temp/scientists/botanists/intro.html.

FIELDWORK CONDUCTED

The contractor undertook fieldwork July 9-11, 1997.