COSEWIC
Assessment and Update Status Report

on the

Bluehearts
Buchnera americana

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

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Bluehearts — Dan Tenaglia, photo taken at Dorris Creek Prairie Conservation Area, Berton County, MO.

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COSEWIC
Assessment Summary

Assessment Summary – May 2000

Common name
Bluehearts

Scientific name
Buchnera americana

Status
Endangered

Reason for designation
Small disjunct populations of restricted occurrence with continued population decline and losses due to a variety of human activities.

Occurrence
Ontario

Status history
Designated Threatened in April 1985. Status re-examined and uplisted to Endangered in April 1998. Status re-examined and confirmed in May 2000. The May 2000 assessment was based on new quantitative criteria applied to information from the existing 1998 status report.

COSEWIC
Executive Summary

Bluehearts
Buchnera americana

Species Information

Bluehearts is a perennial ranging in height from 40 to 80 cm; plants are usually unbranched, have hairy stems and sessile, opposite leaves. A flowering spike of deep purple, stalkless flowers is produced at the top of the plant. In Ontario, flowering begins in mid-July and lasts until early September. Fruits are oblong capsules about 7 mm long. The species is hemiparasitic on a variety of deciduous and coniferous trees, being linked to the root system of these by way of haustorial attachments.

Distribution

Buchnera americana is extant in 11 states from Ohio and Indiana to Georgia and Missouri. The areas of greatest concentration are in Tennessee, Kentucky, Arkansas and Missouri. It occurs as a northern disjunct along a 10 km stretch of Lake Huron in southwestern Ontario.

Habitat

Plants tend to occur along the edges of wet, interdunal depressions in Ontario.

Biology

The species is hemiparasitic on the roots of a great variety of trees including white pine, red ash, eastern cottonwood, white oak and presumably other plants but can mature without parasitic attachment. It has been described as a perennial plant, however there is some question whether it may survive primarily as an annual in Ontario and possibly other northern states. The small seeds of bluehearts require light for germination and can remain viable in the soil for 2.5-3 years based on limited testing. Bluehearts may be butterfly pollinated, but self-pollination, based on colour and morphology, may be widespread.

Population Sizes and Trends

Bluehearts undergoes highly variable population fluctuations from year to year. The total number of plants in 1981 was 2182, which was the only year when all 8 known sites were surveyed. Significant decreases occurred during years of high water levels such as in 1986 and in 1997 when fewer than 600 plants were counted at 6 extant sites. In 1988, there was a lengthy drought during the summer that may have also reduced numbers of flowering plants.

Limiting Factors and Threats

Major natural limiting factors include the very specific habitat requirements and the dynamic nature of habitat. This is a seral species that disappears from stable communities. In Ontario, fluctuating water level is an extremely important factor in maintaining the open conditions favoured by this species. The major anthropogenic impact in Ontario is a drastic reduction in amount of natural interdunal habitat due to conversion for cottages and residences. This species is increasingly threatened by recreational activities. High water levels reduce the numbers of plants present in a given year but contribute to maintaining open habitat required by this species.

Special Significance of the Species

Bluehearts is of particular interest and significance because of its facultative parasitic life style, its considerable disjunction from the core populations in the USA, and its specificity to a narrow habitat range in Ontario where it relies on water level fluctuations to maintain its open habitat.

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.

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Update
COSEWIC Status Report

on the

Bluehearts
Buchnera americana

in Canada

Vivian R. Brownell[1]

1998

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SPECIES INFORMATION

Name and classification

Scientific name: *Buchnera americana* L.

Common name: Bluehearts

Family name: Scrophulariaceae (figwort family)

Major plant group: Angiosperm (dicot flowering plant)

Kartez (1996) treats *B. americana* as including *B. floridana* Gand. which is a relatively common entity in the southern United States (North Carolina to Mississippi). Most southern floras and Pennell (1935), however, recognize *B. floridana* as a distinct species. *B. americana* has a larger corolla (tube 10-12 mm long, the lobes 5-8 mm long) and prominently 3-veined, lance-ovate leaves (Clewell 1985). *B. floridana* has corolla lobes less than 5 mm long and lanceolate-elliptic leaves which are obscurely, or not at all, 3-veined (Radford et al. 1968). Vincent (1982) developed the following key to separate the two taxa:

1. Corolla tubes mostly 10-14 mm long; calyces mostly 6-7 mm long, pubescent throughout with short or long, straight to antrorsely-appressed, simple or minutely callous-based hairs; capsules mostly 6-8 mm long, equalling or slightly longer than calyses; mid-stem leaves mostly ovate-lanceolate, irregularly and coarsely toothed, widest at or below middle…. *B. americana*

2. Corolla tubes mostly 6-10 mm long; calyces mostly 4-5(6) mm long, pubescent throughout or only on upper 1/3 with short, crisped, antrorse, callous-based hairs; capsules mostly 4-6(6.5) mm long, longer than calyses; mid-stem leaves mostly oblong to oblanceolate, entire or remotely and finely toothed, widest at or above middle…..*B. floridana*

The author of this report uses *B. americana* in the strict sense for purposes of North Americana distribution and status.

Description

Bluehearts is a perennial, ranging in height from 40 to 80 cm. It is a facultative parasite on the roots of a variety of trees. Plants are usually unbranched, have hairy stems and sessile, opposite leaves. A flowering spike of deep purple, stalkless flowers is produced at the top of the plant (Figure 1). In Ontario, flowering begins in mid-July and lasts until early September. Fruits are oblong capsules about 7 mm long.

Figure 1. Inflorescence of bluehearts (photo by Dan Tenaglia, taken at Dorris Creek Prairie Cons. Area, Barton County, MO)

DISTRIBUTION

Global range

Buchnera americana is extant in 11 states from Ohio and Indiana to Georgia and Missouri (The Nature Conservancy 1997) (Figure 2). The areas of greatest concentration are in Tennessee, Kentucky, Arkansas and Missouri (Brownell 1981, The Nature Conservancy 1997). It is considered to be extirpated from Pennsylvania (Rhoads and Klein 1993), Michigan, and New Jersey and a historical occurrence in D.C., Delaware, Maryland, North Carolina and New York (The Nature Conservancy 1997). Its status in 6 southern states is unknown.

Canadian range

In Canada, this species is confined to a 10 km stretch of Lake Huron shoreline in south-western Ontario (Figure 3). Its known geographical range in Ontario has not changed since 1981 when fairly extensive field studies were conducted in the Ipperwash/Port Franks area.

HABITAT

This species occupies the edges of wet, interdunal depressions in Ontario. Prairie species such as butterfly milkweed (*Asclepias tuberosa*), Indian grass (*Sorgastrum nutans*), little bluestem (*Schizachyrium scorparium*) and big bluestem (*Andropogon gerardi*) are frequent. More detailed habitat descriptions are found in Brownell (1981), Klinkenburg and Edwards (1979) and Klinkenburg and Crabe (1980).

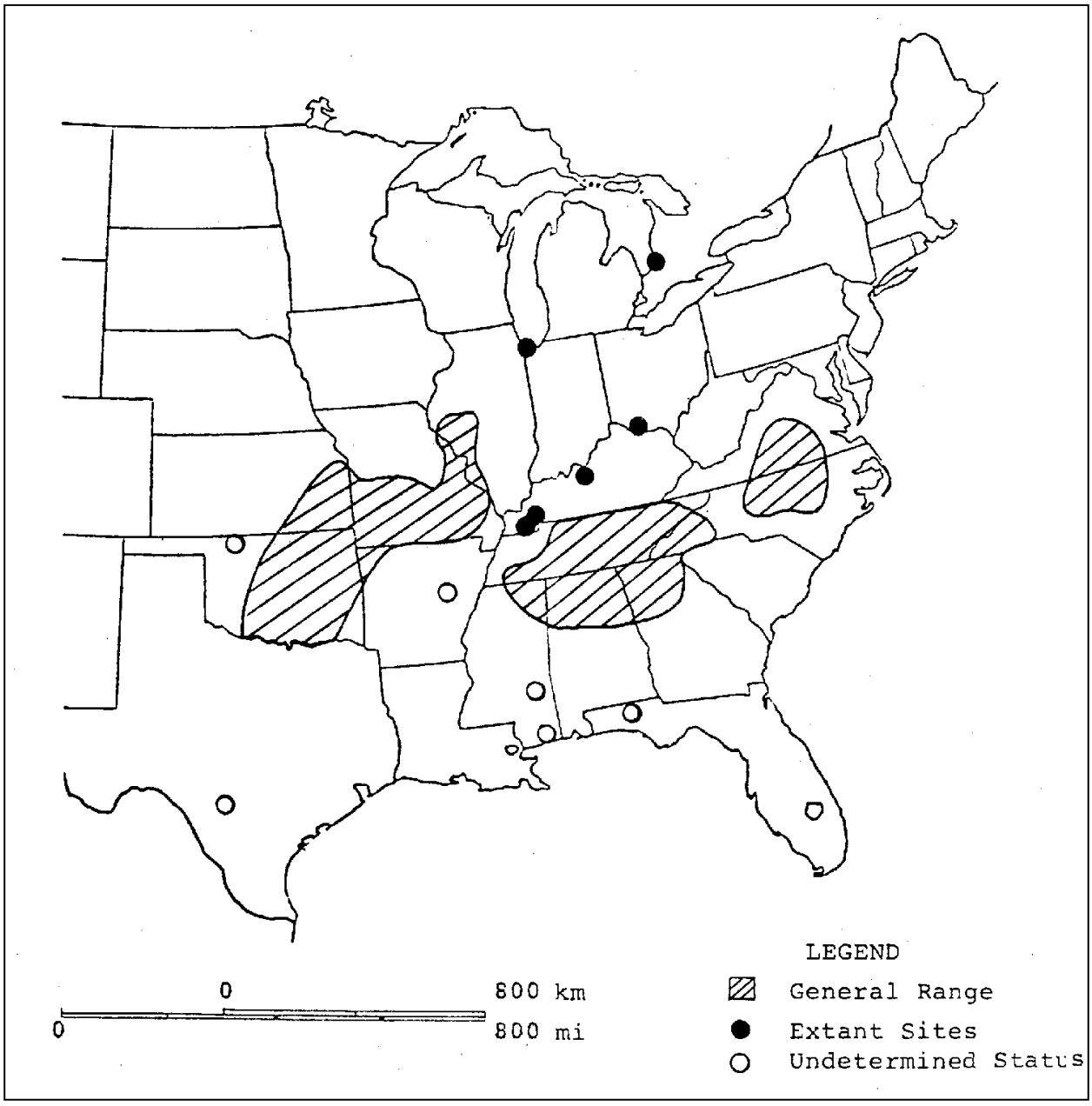

Figure 2. Distribution of bluehearts in North America (map from Brownell1983).

BIOLOGY

This species is hemiparasitic on the roots of a great variety of trees including *Pinus strobus, Fraxinus pensylvanica, Populus deltoides*, and *Quercus alba* (Musselman and Mann 1979; Baird and Riopel 1985; Krause and Weber 1990) and presumably other plants but can mature without parasitic attachment (Voss 1996). Musselman and Mann (1979) found that small trees could be severely damaged if large numbers of haustoria were present, and the effects of parasitism could be heightened during periods of stress such as drought conditions.

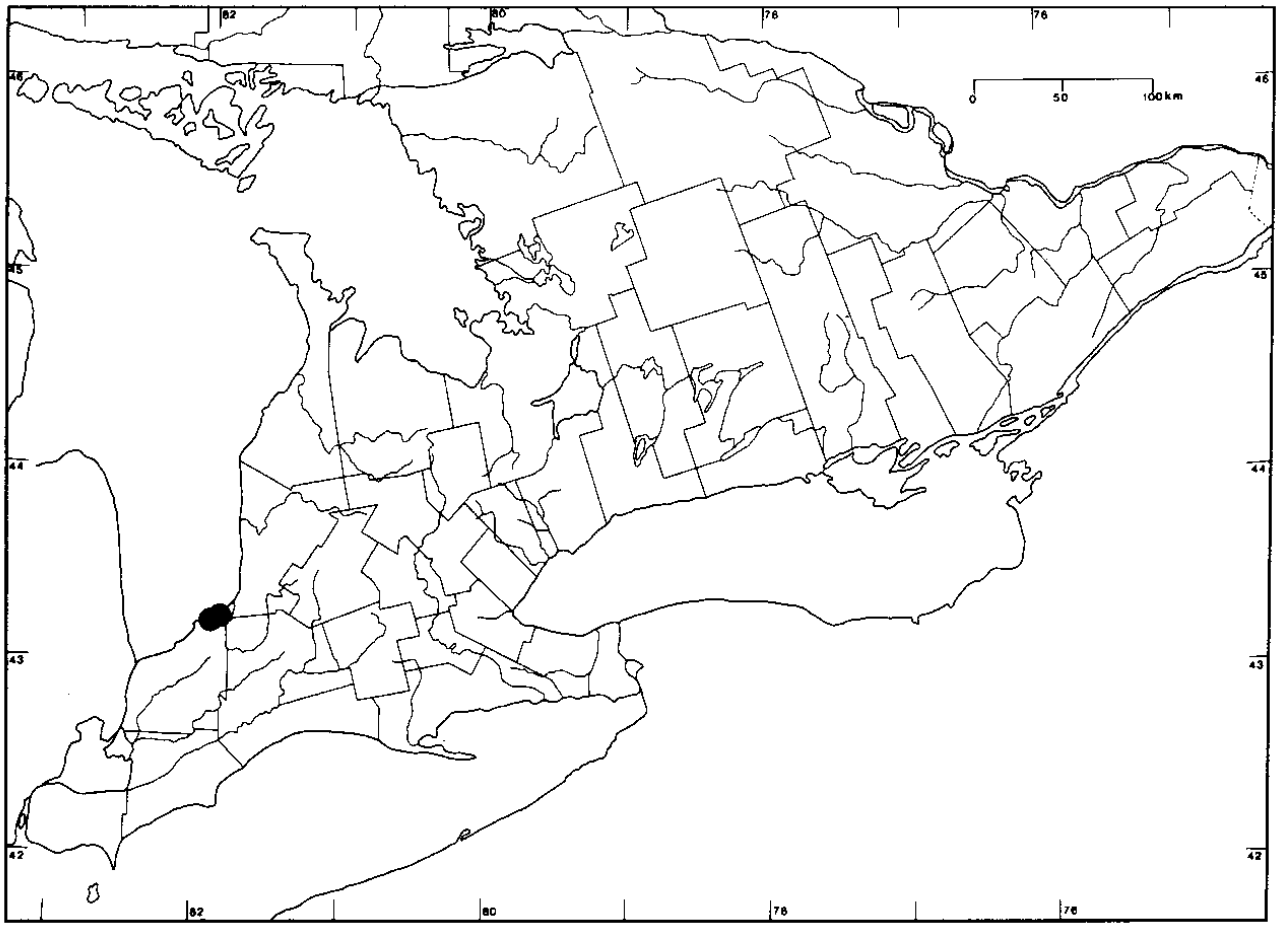

Figure 3. Distribution of extant sites of bluehearts in Ontario (map from White, Maher and Argus (1983).

Buchnera americana has been described as a perennial plant (Brownell 1985, Ostlie 1990), however there is some question regarding whether it may survive primarily as an annual in Ontario and possibly other northern states. Alf Rider maintains that individual plants do not survive more than one year based on observations of transplants and potted plants. Permanently-marked monitoring quadrats have been established by the Indiana Dunes National Lakeshore and Indiana Division of Nature Preserves and by the Illinois Department of Conservation (Ostlie 1990).

The small seeds of *B. americana* require light for germination and can remain viable in the soil for 2.5-3 years based on limited testing (Ostlie 1990). Dr. J. Baskin suggests that this is a fairly good indication that the species may form seed banks in nature, although verification of this has not been attempted.

Pennell (1935) suggested that this species is butterfly pollinated, but also noted that self-pollination, based on colour and morphology, may be widespread. It is still not known whether or not this species is an obligate out-crosser, or whether self-fertilization is possible to set seed (Ostlie 1990).

POPULATION SIZES AND TRENDS

Global Rank: G5? (Oldham 1996). Note: This ranking by The Nature Conservancy is considered by the author to be in error since it is based on treating *B. americana* as including *B. floridana*. *B. americana* in the strict sense ranks about G3 or G4 (Ostlie 1990).

The Nature Conservancy (1997) lists *B. americana* as a historical record or extirpated from D.C., Delaware, Maryland, Michigan, North Carolina, New Jersey, New York, and Pennsylvania. It is reported from Alabama, Florida, Louisiana, Mississippi, Oklahoma, and South Carolina with no status attributed. The species is listed as S1(extremely rare) in Georgia and Virginia. It is listed as S2 in Ohio and Texas, S3 in Illinois, Kansas, and Tennessee, S3S4 in Kentucky and S4 in Arkansas and Missouri.

Ontario Subnational Rank: S1 (Oldham 1996).

	Habitat Size (ha)	No. 1981	No. 1997	Maximum Numbers	Minimum Numbers
Extant Populations in Ontario					
1. Former Ipperwash Military Reserve	0.49	700	-	-	-
2. Former Ipperwash Military Reserve - Bio Lake	0.2	710	-	-	-
3. Richmond Park Lake	0.7	530	462	1971 (1994)	23 (1991)
4. Pinery Provincial Park	0.008	95	3	594 (1984)	3 (1997)
5. Ipperwash Beach	-	-	88	-	-
Severely Reduced Populations Close to Extirpation					
6. Ipperwash (former Provincial Park)	0.004	12	0	54 (1984)	0 (1997)
Extirpated Populations					
1. Kettle Point First Nation	0.005	90	0	450 (1983)	0 (1991-1997)
2. Port Franks Poplar Lodge	0.004	45	0	45 (1981)	0 (1997)

Habitat Details

1. Former Ipperwash military reserve - Army Meadow 1 - about 700 plants counted on 31 July 1981 by Tony Reznicek, William Vanden Bygaart and Terry Crabe in an area 46m X 107m. The area is interlaced with vehicle tracks. D.A. Sutherland (1997 pers. com.) saw about the same number or slightly more during field studies from mid Sept. to Oct. 8, 1993.

2. Former Ipperwash military reserve - Bio Lake area. Three subpopulations were identified on 31 July 1981 by Tony Reznicek, William Vanden Bygaart and Terry Crabe.

2a. Army Meadow 2 - about 260 plants around the shores of a 30m X 60m shallow pond.
2b. Army Meadow 3 - about 300 plants in a 6m X 18m meadow.
2c. Army Meadow 4 - about 150 plants in a 6m X 12m meadow adjacent to Meadow 3.

Due to the lateness of the season, Sutherland et al. (1994) considered their inventories inadequate to detect either an increase or a decline in numbers from estimates made in 1981. However, several small populations were discovered scattered in wet meadows between this site and the site described above.

3. Richmond Park Lake - about 0.7 ha of high quality wet meadow. Private undeveloped land flanked by the former military reserve and cottages.

4. Pinery Provincial Park - About 85% of Pinery plants found in enclosed $36m^2$ meadow. Nine other nearby wet meadows have supported several plants periodically.

5. Ipperwash Beach - Alf Rider and John and Dorothy Tiedje of Sarnia discovered 88 plants in wet meadows on West Parkway Drive on Sept. 25--26, 1997. The plants are primarily on undeveloped private land, but some are on adjacent crown land.

6. Ipperwash (former Provincial Park) - Only a couple of plants have been seen since 1986. The wet meadow has become quite overgrown with cedars and shrubs and is accumulating organic debris. The population has exhibited a continuous decline since park road and parking lot development occurred in the 1970s. The population is expected soon to become extirpated due to changes in the habitat (A. Rider 1997 pers. comm.; C. Van den Bygaart 1997 pers. com.).

7. Kettle Point First Nation- 46m X 46m stand on an undeveloped subdivision lot. In 1990, about 300 plants were present, however several houses have been built on the site and despite frequent checks, no plants have been seen since (A. Rider 1997 pers. comm.).

8. Port Franks, Poplar Lodge - about 45 plants last seen in 1984 in a $36m^2$ area in a marina in the Windsor Park subdivision. The habitat has since become weedy and overgrown, and new houses have been constructed at the site (A. Rider 1997 pers. comm.).

Trends

This species undergoes highly variable population fluctuations from year to year (Appendix 1). The decrease in numbers in 1986 is believed to be due to very high water levels that existed for most of the growing seasons in the wet meadows (Crabe 1989). In 1988, there was a lengthy drought during the summer that may have reduced numbers of flowering plants. In 1997, Lake Ontario water levels were very high again. In 1997, 550 plants were counted in September by Alf Rider, however this did not include the former Camp Ipperwash and Ipperwash Provincial Park which are under occupation. The total number of plants was 2182 in 1981, which was the only year

when all sites were surveyed. This species is apparently extirpated from Squirrel Island where it was reported in 1914 by Dodge.

The Richmond Park Lake and former Military Reserve populations can be classified as excellent (A) according to criteria in Ostlie (1990). The other populations are difficult to categorize because of the great variation in population size from year to year. Although the population at the former Ipperwash Provincial Park may still be considered as extant, it is very close to becoming extirpated.

LIMITING FACTORS AND THREATS

Major natural limiting factors include habitat specification and dynamic nature of habitat. This is a seral species that disappears from stable communities (Ostlie 1990). In Ontario, fluctuating water level is an extremely important factor in maintaining the open conditions favoured by this species. The major anthropogenic impact in Ontario is a drastic reduction in amount of natural interdunal habitat due to conversion for cottages and residences. This species is increasingly threatened by recreational activities (Oldham 1995).

The major limiting factor in the United States is habitat loss from physical disturbance, development and succession. In the United States where *B. americana* occurs primarily in prairie habitats, fire is a necessary disturbance regime for seed germination and growth (Ostlie 1990). Prescribed burning on a rotational 3-4 year cycle is the primary management technique used for this species in Indiana, Illinois, Missouri and Ohio.

SPECIAL SIGNIFICANCE OF THE SPECIES

Bluehearts is of particular interest and significance because of its facultative parasitic life style, its considerable disjunction from the core populations in the USA, and its specificity to a narrow habitat range in Ontario where it relies on water level fluctuations to maintain its open habitat.

EVALUATION AND PROPOSED STATUS

Existing Protection or Other Status

The small population in Pinery Provincial Park is in a public campground designated for recreational use. Ten small sub-populations have been identified and mapped. Eight of the sub-populations are immediately adjacent to campsites and campsite roads and are subject to trampling and picking (Brownell 1997 pers. obs.). Two of the subpopulations are fenced within deer exclosures, however successional changes are now occurring within them. The habitat surrounding the exclosures is intensely browsed by deer which maintain open conditions. The enclosures, which contain the majority of the bluehearts at Pinery, are becoming dominated by white

cedar. The population level at Pinery may not be large enough to sustain itself particularly since encroachment by woody plants is occurring.

All other populations (approximately 97% of the individuals) occur on private lands or on occupied lands. The Richmond Park population is located on private land that is flanked by cottages on one side and the former Canadian Forces Camp Ipperwash on the other.

Ipperwash Provincial Park and adjacent crown land and Camp Ipperwash have been occupied by the Kettle Point First Nations since 1995. Until 1995, Camp Ipperwash was administered by the Department of National Defense (DND) as an infantry training facility. *Buchnera americana* and its habitat at Camp Ipperwash have experienced continued damage from trucks and all-terrain vehicles (Thompson et al. 1994). The site is 1006 ha in extent and is currently owned by the Federal Government. During the current process of negotiations to turn the title of the National Defence property over to The First Nations, The First Nations have requested level 3 decomissioning which would involve removal of all tree cover and searching the soil for explosives to a depth of several metres (Bob Woods, DNF, pers. comm. 1997). This would eliminate 65% of the Ontario population of bluehearts in addition to 21 other provincially rare plant species.

This species is not listed under The Endangered Species Act in Ontario. It was designated by COSEWIC as nationally threatened in 1985.

In the United States, bluehearts is officially protected by legislation designating it as endangered in Indiana, Ohio (Burns and Cusick 1984) and Georgia (Georgia Natural Heritage Program 1989).

Assessment of Status and Author's Recommendation

In 1985, when *B. americana* was listed as threatened in Canada, 65% of the plants were found in provincial parks and on lands owned and managed by the federal Department of National Defence. Presently less than 3% of the plants are within land managed by a public agency and even those are threatened by successional change and recreational activities.

It is recommended that this species be upgraded from threatened to endangered in Canada based on a significant decrease in protection capabilities, a significant decline in one population and extirpation of 2 populations.

TECHNICAL SUMMARY

DISTRIBUTION

Extent of occurrence: < 5 km^2
Area of occupancy: < 1 km^2 (1.4 ha)

POPULATION INFORMATION

Total number of individuals in the Canadian population: 553 in 1997 from 6 of 8 sites
Number of mature reproducing individuals in the Canadian population: unknown
Generation time: one year
Total population trend: unknown
Rate of decline (if appropriate) for total population:
Number of known populations: a total of about 8 sites with several additional subpopulations have been recorded along a 10 km stretch of Lake Huron shoreline habitat and one historic site (1914) on Squirrel Island
Is the total population fragmented? YES
number of individuals in smallest population:0 (based on fluctuating population sizes)
number of individuals in largest population: 1971 in 1994
number of extant sites: 6
number of historic sites from which species has been extirpated: at least 3
Does the species undergo fluctuations in numbers? Yes
If yes, what is the maximum number? 2182 in 1981 at 7 sites
minimum number? 553 in 1997 at 6 sites
Are these fluctuations greater than one order of magnitude? possibly

LIMITING FACTORS AND THREATS

High water levels, cottage development and recreational activities.

RESCUE POTENTIAL

Does the species exist outside Canada? YES
Is immigration known or possible? Possible but not very probable
Would individuals from the nearest foreign population be adapted to survive in Canada? unknown (disturbance factors are different at the nearest US sites)
Would sufficient suitable habitat be available for immigrants? probably

ACKNOWLEDGEMENTS

The following individuals and institutions have been of assistance by supplying data and information. Special thanks are extended to Alf Rider, who conducted several searches for *Buchnera americana* in September 1997 and who has been concerned about the welfare of this species for many years.

Terry Crabe, Chief Park Naturalist, Ontario Ministry of Natural Resources, Pinery Provincial Park, Ontario.
Michael J. Oldham, Botanist, Natural Heritage Information Center, Peterborough, Ontario.
Alf Rider, Naturalist, Kettle Point, Ontario
Donald A. Sutherland, Biologist, Natural Heritage Information Center, Peterborough, Ontario. .
Casey Vanden Bygaart, R.R.#2, Grand Bend, Ontario
Bob Woods, Chief Forester, Department of National Defense, Ottawa, Ontario.

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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.

Appendix 1. Population Size and Trend of Bluehearts in Ontario

(based on Crabe 1981, 1989,1997 pers. com.; Crabe and Vanden Bygaart 1994, and field studies by Vivian Brownell from 8-11 July, 1997 and Alf Rider on Sept. 16, 25, 26, 1997)

Year	1. Former Ipperwash Military Reserve Meadow	2. Fformer Ipperwash Military Reserve Bio Lake	3. Richmond Park Lake Area	4. Pinery Provincial Park	5. Ipperwash Beach	6. Ipperwash (former Provincial Park)	7. Kettle Point First Nation	8. Port Franks Poplar Lodge
1980	-	-	250	98	-	5	-	-
1981	700	710	530	95	-	12	90	45
1982	-	-	-	12	-	-	-	-
1983	-	-	500	511	-	30	450	-
1984	-	-	965	594	-	54	24	32
1985	-	-	-	4	-	19	-	-
1986	-	-	-	69	-	35	-	-
1987	-	-	-	69	-	-	-	-
1988	-	-	60	22	-	0	-	-
1989	-	-	60	14	-	-	-	-
1990	-	-	129	14	-	-	300	-
1991	-	-	23	12	-	-	-	-
1992	-	-	1332	15	-	0	0	-
1993	-	-	444	11	-	2	-	-
1994	-	-	1971	25	-	1	0	-
1995	-	-	-	-	-	-	-	-
1996	ca 700	-	-	-	-	-	0	-
1997	-	-	462	3	88	-	0	0