

COSEWIC
Assessment and Status Report

on the

Bluehearts
Buchnera americana

in Canada



ENDANGERED
2011

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:

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For additional copies contact:

COSEWIC Secretariat
c/o Canadian Wildlife Service
Environment Canada
Ottawa, ON
K1A 0H3

Tel.: 819-953-3215

Fax: 819-994-3684

E-mail: COSEWIC/COSEPAC@ec.gc.ca

<http://www.cosewic.gc.ca>

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COSEWIC Assessment Summary

Assessment Summary – November 2011

Common name

Bluehearts

Scientific name

Buchnera americana

Status

Endangered

Reason for designation

A hemiparasitic herbaceous plant which grows in three small populations within the Great Lakes sand dunes habitat in southwestern Ontario. Its small population size and threats associated with water-level changes, disruption of natural processes including fire suppression, recreational activities, and invasive plants place the species at ongoing risk.

Occurrence

Ontario

Status history

Designated Threatened in April 1985. Status re-examined and designated Endangered in April 1998. Status re-examined and confirmed in May 2000 and November 2011.



COSEWIC
Executive Summary

Bluehearts
Buchnera americana

Wildlife species description and significance

Bluehearts (*Buchnera americana*) is a hemiparasitic herbaceous vascular plant ranging in height from 40 to 80 cm; plants are usually unbranched, have hairy stems and stalkless, 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 September. Fruits are oblong capsules about 7 mm long.

Distribution

Bluehearts is extant in Ontario and 17 states from Ohio and Indiana to Florida and Texas. The species is extirpated from Michigan, New Jersey, Pennsylvania and the District of Columbia. It is known only from historical records in Maryland, Delaware, New York and North Carolina. The areas of greatest concentration are in Tennessee, Kentucky, western Illinois, Missouri, and eastern Kansas and Oklahoma. In Canada, this species is confined to a 10 km stretch of Lake Huron shoreline in southwestern Ontario. Approximately 1% of the global range of Bluehearts is in Canada. The range of the species in Canada extends over an area of 18.6 km².

Habitat

In Ontario, Bluehearts grows on the edges of wet, interdunal depressions near Lake Huron. Associated plants include prairie species such as Butterfly Milkweed, Indian Grass, Little Bluestem, and Big Bluestem. Elsewhere in its range, it inhabits prairies, open woods, pine barrens, and beaches.

Biology

The species is hemiparasitic on the roots of a great variety of deciduous and coniferous trees including White Pine, Red Ash, Eastern Cottonwood, and White Oak and may parasitize other plants. However, Bluehearts can mature without the parasitic attachment. It has been described as a perennial plant, although it may survive primarily as an annual in Ontario and in other northern states. The small seeds of Bluehearts require light for germination and can remain viable in the soil for at least three years based on limited testing. Bluehearts may be butterfly-pollinated, but self-pollination may be widespread.

Population sizes and trends

Bluehearts undergoes large population fluctuations from year to year. All known Canadian sites were surveyed in 1981 and 2009 and some received intermittent surveys in other years. The most ever counted was 2182 in 1981. In contrast, only 488 plants were counted in 2009. Numbers have fluctuated widely in the intervening years. Significant decreases in numbers occurred during years of high water levels such as in 1986 and in 1997. In 1988, there was a lengthy summer drought that may have reduced numbers of flowering plants. However, the relationship between water levels and Bluehearts numbers does not apply at all Ontario sites and further study is required.

Threats and limiting factors

Major natural limiting factors include the species' very specific habitat requirements and the dynamic nature of habitat. Historically, the major anthropogenic impact in Ontario was a drastic reduction in amount of natural interdunal habitat due to conversion for cottages and residences. Although development is a potential threat, there has been virtually no development in Bluehearts habitat since 2000. Bluehearts is a seral species that disappears from stable communities and depends on periodic disturbances, such as fire and inundation. As such, disruption of ecological and natural processes including fire suppression, the installation of deer exclosures, and changes in Lake Huron water levels (partially due to climate change) may be altering habitat. This species is also threatened by trampling associated with recreational activities including off-road vehicle use, harvesting, cottage and residential development, and the detection and removal of unexploded ordnance. Invasive plant species, especially European Common Reed, are a potential threat.

Protection, status, and ranks

Bluehearts is listed as Endangered in Canada under Schedule 1 of the *Species at Risk Act*. In Ontario, the species is listed as Endangered under the *Endangered Species Act*, 2007. The NatureServe Global Rank is possibly secure (G5?). Bluehearts is ranked nationally in Canada as critically imperilled (N1) and provincially as critically imperilled (S1) in Ontario. One population of Bluehearts occurs within Pinery Provincial Park. Other Canadian populations are not in protected areas.

TECHNICAL SUMMARY

Buchnera Americana

Bluehearts

Range of occurrence in Canada: Ontario

Buchnéra d'Amérique

Demographic Information

| | |
|--|--------------------------------|
| Generation time <i>One year lifespan assuming an annual life cycle. However, seeds will persist at least 3 years in seed bank</i> | 2+ yrs |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? <i>The lack of consistent survey effort at most sites, combined with the wide fluctuations of numbers between years, makes it impossible to estimate the total number of individuals. The 2009 survey had the lowest numbers on record.</i> | Unknown, but decline suspected |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] | Unknown |
| Suspected percent reduction in total number of mature individuals over the last 10 years. <i>Decline is expected based on extirpation of several smaller subpopulations; however, the decline is difficult to document due to lack of consistent monitoring efforts; however, it is likely <10%.</i> | Unknown |
| Suspected percent change in total number of mature individuals over the next 10 years. | Unknown |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future. | Unknown |
| Are the causes of the decline clearly reversible and understood and ceased? | No |
| Are there extreme fluctuations in number of mature individuals? <i>Populations do fluctuate but data are not robust enough to be considered as an order of magnitude.</i> | No |

Extent and Occupancy Information

| | |
|--|--------------------|
| Estimated extent of occurrence <i>The calculated EO is 18.6 km²; however, under COSEWIC guidelines the EO cannot be less than the IAO. Actual area of occupancy (AO) = 1.22 km²</i> | 28 km ² |
| Index of area of occupancy (IAO) | 28 km ² |
| Is the total population severely fragmented? | No |
| Number of "locations*" | 3 |
| Is there an [observed, inferred, or projected] continuing decline in extent of occurrence? | No |
| Is there an observed continuing decline in index of area of occupancy? <i>It is projected that there will be a loss of some subpopulations.</i> | Yes |
| Is there an [observed, inferred, or projected] continuing decline in number of populations? <i>The Ipperwash Beach population is not considered to be viable over the long term.</i> | Yes |
| Is there an observed continuing decline in number of locations? | Yes |
| Is there an observed continuing decline in 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? <i>Though the populations fluctuate, data are not robust enough to determine the application of an extreme fluctuation.</i> | No |

Number of Mature Individuals (in each population)

| Population | N Mature Individuals |
|--|---------------------------|
| former Camp Ipperwash/Richmond Park Lake | 1940 to 448 |
| Pinery Provincial Park | 95 to 0 (100 in 2011) |
| Ipperwash Beach | Unknown to ~40 |
| Total | 2182 (1981) to 488 (2009) |

Quantitative Analysis

| | |
|--|----------|
| Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years]. | Not done |
|--|----------|

Threats (actual or imminent, to populations or habitats)

| |
|--|
| <p>Disruption of ecological and natural processes are the primary threat at present; trampling associated with recreational activities including off-road vehicle use, harvesting, shoreline development, detection and removal of unexploded ordnance, and invasive plant species are considered ongoing threats.</p> <ul style="list-style-type: none"> • Pinery Provincial Park – primarily vegetation succession partially due to White-tailed Deer exclosures. • Former Camp Ipperwash – site decommissioning and the destruction of habitat through removal of ordnance. • Ipperwash Beach – trampling, shoreline development, and vegetation succession. |
|--|

Rescue Effect (immigration from outside Canada)

| | |
|---|-----------|
| <p>Status of outside population(s)? <i>Extirpated (SX) Michigan, New Jersey, Pennsylvania, Washington DC; Historical (SH) Delaware, Maryland, New York, North Carolina⁺; critically imperilled (S1) Georgia⁺, and Indiana; Critically imperilled to imperilled (S1S2) Virginia; imperilled (S2) Ohio and Texas; vulnerable (S3) Illinois; vulnerable to apparently secure (S3S4) Arkansas⁺, Kentucky, and Tennessee; apparently secure (S4) Alabama⁺, Kansas, Louisiana⁺, Mississippi⁺, Missouri; secure (S5) Oklahoma; unranked (SNR) Florida⁺ and South Carolina⁺.</i></p> <p><i>⁺ indicates states where both <i>Buchnera americana</i> and <i>B. floridana</i> occur but are not assigned separate ranks</i></p> | Declining |
| <p>Is immigration known or possible? <i>Immigration unknown and very unlikely from nearest extant sites in southern Ohio and northwest Indiana.</i></p> | No |
| <p>Would immigrants be adapted to survive in Canada?</p> | Probably |
| <p>Is there sufficient habitat for immigrants in Canada? <i>There is little suitable habitat between Ontario and nearest extant population in Indiana, and the populations occur on one of the last high-quality coast dune grassland complexes in southern Ontario.</i></p> | No |
| <p>Is rescue from outside populations likely?</p> | No |

Current Status

COSEWIC: Endangered (November 2011)

Status and Reasons for Designation

| | |
|--|--|
| Status: Endangered | Alpha-numeric code: B1ab(ii,iii,iv)+2ab(ii,iii,iv) |
| Reasons for designation: A hemiparasitic herbaceous plant which grows in three small populations within the Great Lakes sand dunes habitat in southwestern Ontario. Its small population size and threats associated with water-level changes, disruption of natural processes including fire suppression, recreational activities, and invasive plants place the species at ongoing risk. | |

Applicability of Criteria

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Trends are unknown and recent declines are estimated to be less than thresholds. |
| Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Endangered B1ab(ii,iii,iv)+2ab(ii,iii,iv) as the EO is <<5,000 km ² , the IAO is <<500 km ² , it occurs in 3 locations and there is a projected decline in the IAO, an observed decline in the quality of habitat, and a projected decline in the number of populations. |
| Criterion C (Small and Declining Number of Mature Individuals): Meets Threatened C2a(i) as the total population is <10,000, there is a continuing decline in the number of mature individuals, and no population is known to contain >1000 mature individuals. |
| Criterion D (Very Small or Restricted Total Population): Meets Threatened D1 as the Canadian population is estimated to be <1000 mature individuals; also meets Threatened D2 as it occurs in 3 locations and multiple threats and limiting factors make it prone to human activities or stochastic events. |
| Criterion E (Quantitative Analysis): Not done. |

PREFACE

Since the 2000 assessment of Bluehearts (COSEWIC 2000), several sites have apparently been extirpated, but population size and trends are difficult to determine due to the lack of consistent survey effort and wide fluctuations of numbers between years. The 2009 field survey documented the lowest numbers of Bluehearts on record for all three extant sites and one site had no plants. The present report is updated with the 2009 survey as well as ongoing monitoring conducted by Pinery Provincial Park from 2006 to 2010. Land tenure at the former Camp Ipperwash and former Ipperwash Provincial Park is changing and the future of these populations is uncertain. Bluehearts is now listed as Endangered under the Ontario *Endangered Species Act*. The species' North American status has been updated through contact with experts from across Bluehearts range.



COSEWIC HISTORY

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. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2011)

| | |
|------------------------|--|
| Wildlife Species | A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. |
| Extinct (X) | A wildlife species that no longer exists. |
| Extirpated (XT) | A wildlife species no longer existing in the wild in Canada, but occurring elsewhere. |
| Endangered (E) | A wildlife species facing imminent extirpation or extinction. |
| Threatened (T) | A wildlife species likely to become endangered if limiting factors are not reversed. |
| Special Concern (SC)* | A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. |
| Not at Risk (NAR)** | A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. |
| Data Deficient (DD)*** | A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction. |

* 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. Definition of the (DD) category revised in 2006.



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

COSEWIC Status Report

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Bluehearts *Buchnera americana*

in Canada

2011

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and classification

Scientific name: *Buchnera americana* L.

Synonyms: *Buchnera breviflora* Pennell

English Common names: Bluehearts; American Bluehearts

French Common name: Buchnéra d'Amérique

Family name: Orobanchaceae – Broom-Rape Family (formerly Scrophulariaceae)

Major plant group: Eudicot flowering plant

This report treats *B. americana* in the strict sense for purposes of North American distribution and status. Some authors, including Kartesz (1996), treat *B. americana* as conspecific with *B. floridana* Gand., which is relatively common in the southern United States (North Carolina to Texas). However, the forthcoming *Flora of North America* (Bruce Sorrie pers. comm. 2010), the previous COSEWIC status report (COSEWIC 2000), most southern floras, and Pennell (1935) treat *B. americana* and *B. floridana* as distinct species. The two have several morphological differences (Table 1) and distinct soil preferences. Their ranges overlap in the southeastern U.S. (Bruce Sorrie, pers. comm. 2010).

Table 1. Morphological differences between *Buchnera americana* and *B. floridana* (from Clewell 1985; Radford *et al.* 1968; Vincent 1982).

| | <i>B. americana</i> | <i>B. floridana</i> |
|-----------------|---|--|
| Corolla tubes | 10-14 mm long | 6-10 mm long |
| Calyx | 6-7 mm long | 4-5 (6) mm long |
| Capsules | 6-8 mm long | 4-6 (6.5) mm long |
| Mid-stem leaves | <ul style="list-style-type: none">• Ovate-lanceolate,• irregularly and coarsely toothed,• widest at or below middle,• prominently 3-veined | <ul style="list-style-type: none">• Oblong to oblanceolate,• entire or remotely and finely toothed,• widest at or above middle,• obscurely, or not at all, 3-veined |

Morphological description

Bluehearts is an herbaceous vascular plant, 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).



Figure 1. Bluehearts at Ipperwash July 2009 (Photos by Allan Harris).

In Ontario, flowering typically begins in mid-July and lasts until early September, or occasionally into late September (MacKenzie pers. comm. 2011). Fruits are oblong capsules about 7 mm long. Although usually considered to be perennial (NatureServe 2010), Ontario plants are apparently annual (Brownell 1985).

Population spatial structure and variability

Genetic, morphometric, and meristic data are unavailable for Canadian populations. However, the rarity and disjunct nature of its preferred habitat (Great Lakes sand dunes) probably represent an ecological barrier to dispersal isolating the Canadian part of its range from the U.S. The closest extant Bluehearts populations are at the southern end of Lake Michigan, 480 km west of the Ontario sites.

Designatable units

The Canadian population is represented by a single designatable unit within the Great Lakes Plains Ecological Area (COSEWIC 2010).

Special significance

Bluehearts is of particular interest and significance because of its hemiparasitic life style, its considerable disjunction from the core populations in the U.S., and its specificity to a narrow habitat range in Ontario where it relies on water level fluctuations to maintain its open habitat. It is rare throughout the northeast and is ranked as critically imperilled, imperilled, possibly extirpated or presumed extirpated in 10 of the 12 northeast states in which it occurs (NatureServe 2010), making the Ontario populations particularly important for the species' survival.

DISTRIBUTION

Global range

Bluehearts (*Buchnera americana s.str.*) is extant in 17 states from Ohio and Indiana to Florida and Texas (Figure 2). The species is extirpated from Michigan, New Jersey, Pennsylvania, the District of Columbia and probably New York (although ranked SH; NatureServe 2010). Northern Ohio populations were last confirmed before 1900 (Greg Schneider pers. comm. 2009) and New York populations were last confirmed in 1920 (Rich Ring pers. comm. 2009), and are presumed extirpated. It is known only from historical records (at least 20 years old) in Maryland, Delaware, and North Carolina. The areas of greatest concentration are in Tennessee, Kentucky, western Illinois, Missouri, and eastern Kansas and Oklahoma (Brownell 1985; Bruce Sorrie pers. comm. 2010).

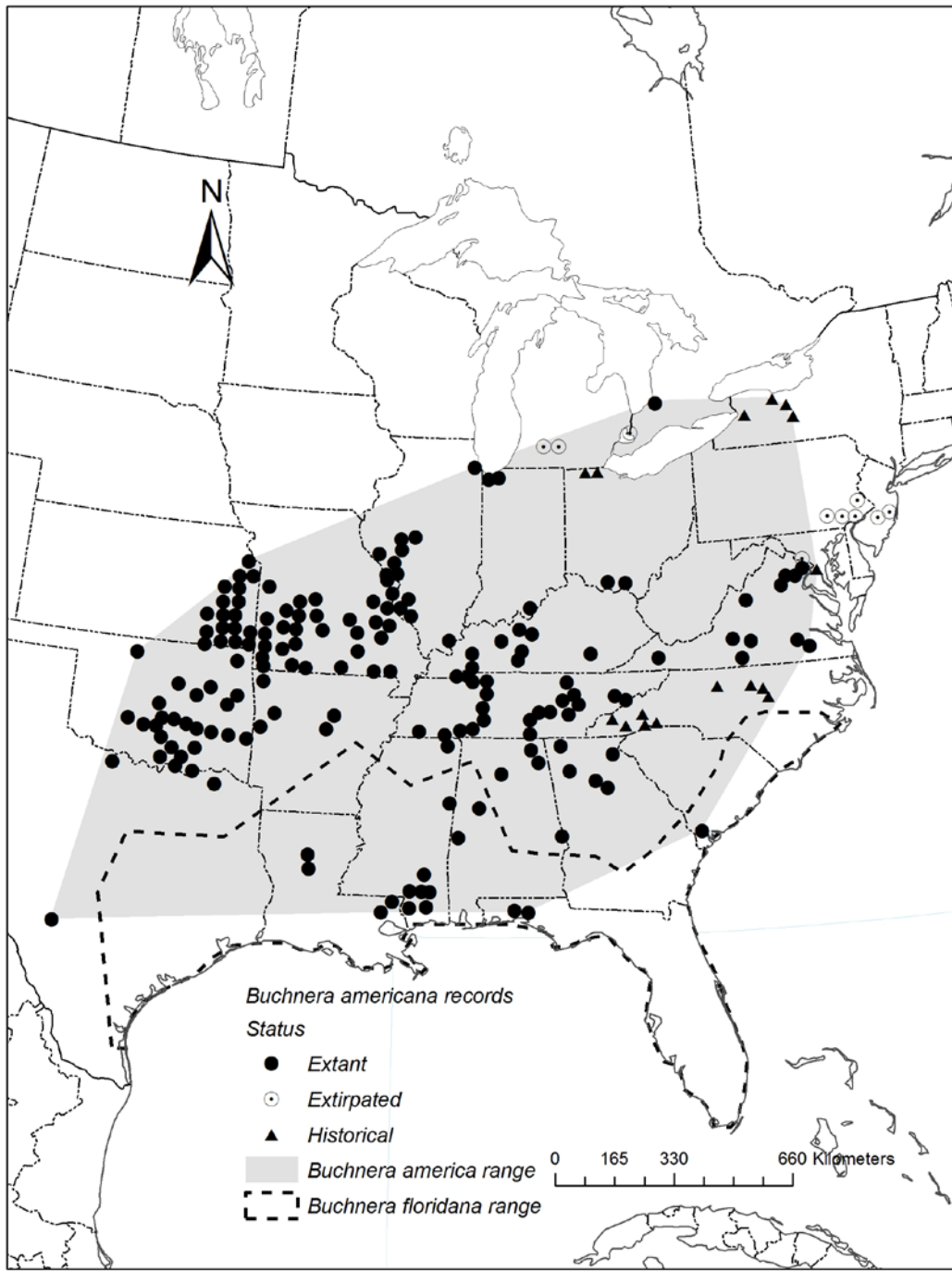


Figure 2. Distribution of Bluehearts in North America (based on records from Bruce Sorrie, pers. comm 2010). Extirpated sites are excluded from the range, but historical sites (but not known to be extirpated) are included.

The total global range (as measured by convex polygon) is approximately 21 million km² (Figure 2). However, large portions of this range are unoccupied by Bluehearts. In particular (as noted by COSEWIC 2000), there is a gap in distribution of several hundred kilometres between populations on the southern Great Lakes and those farther south on the Appalachian and Ozarkian uplands.

Canadian range

In Canada, this species is confined to a 10 km stretch of Lake Huron shoreline in southwestern Ontario (Figure 3; Oldham and Brinker 2009). The closest extant populations are at the southern end of Lake Michigan in Indiana, 480 km west of the Ontario occurrences (Kartesz and BONAP 2011).

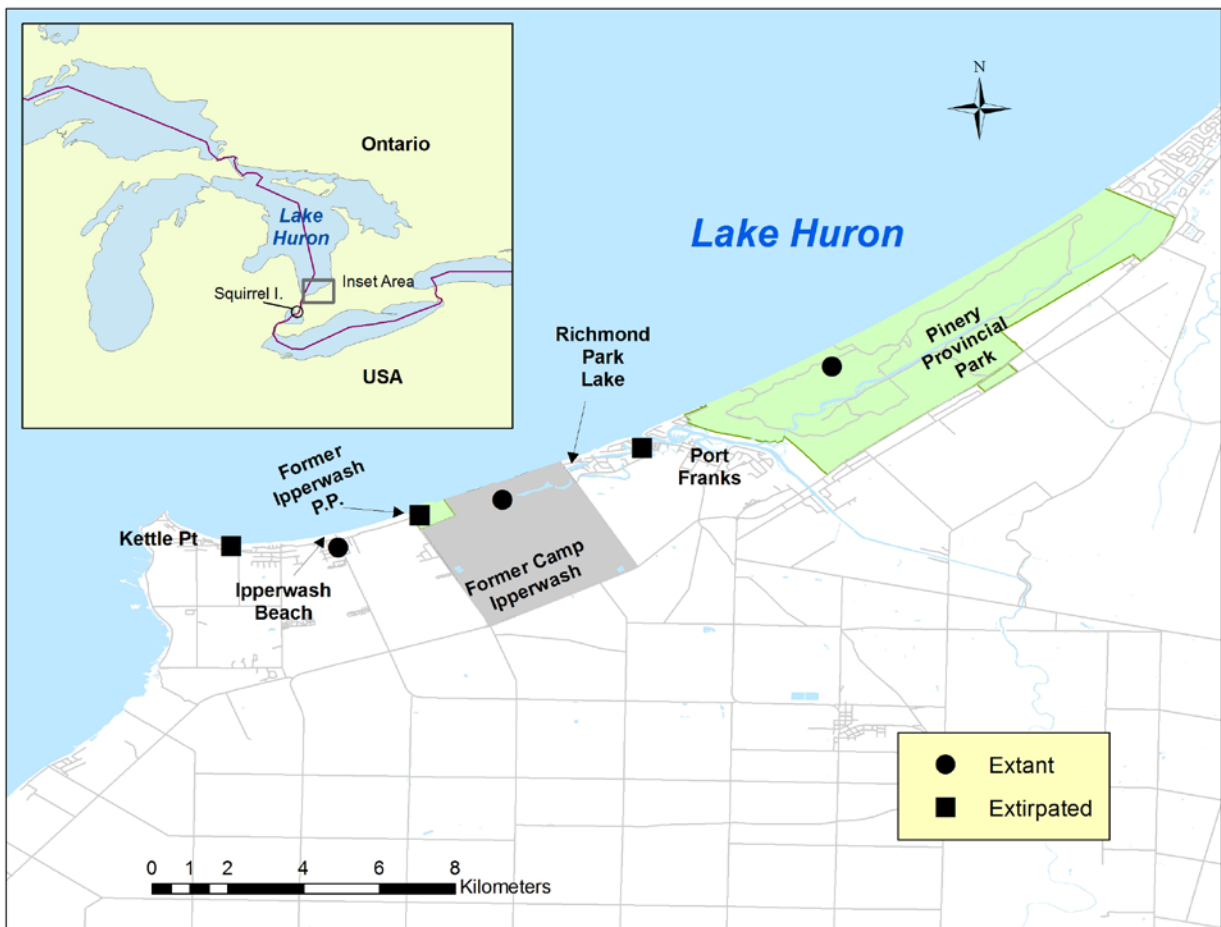


Figure 3. Distribution of Bluehearts locations in Ontario, 2009.

Approximately 1% of the global range of Bluehearts (as measured by convex polygon) is in Canada (Figure 2), but most of the Canadian range is unsuitable habitat and not occupied by the species. The extent of occurrence (EO) is 18.6 km² as measured by convex polygon (Harris and Foster 2010). The index of area of occupancy (IAO) is 28 km² (as measured with a 2 km X 2 km grid, of which about one-half falls in Lake Huron) (Harris and Foster 2010). COSEWIC (2000) estimated the “biological” area of occupancy (i.e., “the total area of habitat occupied by all existing populations” as defined in COSEWIC 2010) at 1.22 ha in 1999.

The earliest records of Bluehearts in Canada date back to the late 1800s from the Port Franks - Ipperwash area (Brownell 1985). It was later discovered at Squirrel Island in Lake St. Clair in 1910 (Dodge 1914). A September 9, 1891 collection by J. Dearness from the “shore of Lake Huron near mouth of Sauble R.” (TRT 191491) is probably actually from the Ausable River mouth in Lambton County, rather than the Sauble River in Bruce County because there is another Dearness specimen (CAN 96129) from Sept 8, 1891 at Port Franks. The species was subsequently discovered at several other sites in the 1980s and 1990s in the Kettle Point to the Pinery area.

As described below, there are three extant Bluehearts populations in Canada. The rate of genetic exchange among these populations is unknown, but probably less than one successful gamete per generation. Several small groups of plants discovered in the Kettle Point to Port Franks area in the 1980s and 1990s (COSEWIC 2000) could represent recently colonized sites outside the main occurrences, but could also be previously undiscovered individuals.

This report recognizes three locations in Canada, defined by different threats related to land tenure. There are also four apparently extirpated populations (Figure 3, Table 2).

Table 2. Canadian Bluehearts sites 1979 to 2009 (primary sources: COSEWIC 2000; MacKenzie pers. comm. 2009, 2011; Harris and Foster 2010).

| Year | Former Camp Ipperwash | Richmond Park Lake | Pinery Provincial Park | Ipperwash Beach | Former Ipperwash Provincial Park | Kettle Point First Nation | Port Franks Poplar Lodge | Squirrel Island |
|------------------------|--|-----------------------|------------------------------|--------------------|---|---------------------------------|-----------------------------------|--------------------|
| 1979 | - | - | 51 | - | 12 | - | - | - |
| 1980 | - | 250 | 98 | - | 5 | - | - | - |
| 1981 | 1410 | 530 | 95 | - | 12 | 90 | 45 | - |
| 1982 | - | - | 12 | - | 13 | - | - | - |
| 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 | - | 0 | - | - | - |
| 1990 | - | 129 | 12 | - | 0 | 300 | - | - |
| 1991 | - | 23 | 12 | - | - | - | - | - |
| 1992 | - | 1332 | 15 | - | 0 | 0 | - | - |
| 1993 | ca700 ³ | 444 | 11 | 20 ² | 2 | - | - | - |
| 1994 | "several small populations" ca700 ⁸ | 1971 | 25 | - | 1 | 0 | - | - |
| 1996 | - | - | - | - | - | 0 | - | - |
| 1997 | - | 462 | 3 | 88 | 0 | 0 | 0 | - |
| 2002 | 38* ⁵ | 164 ⁵ | - | - | - | - | - | - |
| 2004 | - | - | 0 | - | - | - | - | - |
| 2005 | 58* ⁵ | 665 ⁵ | - | - | - | - | - | - |
| 2006 | - | - | 34 | - | - | - | - | - |
| 2007 | - | - | 551 | - | - | - | - | - |
| 2008 | 100's ¹ | 150 ⁴ | 90 | - | - | - | - | - |
| 2009 | 422 | 26 | 0 | ~40 ⁶ | 0 | 0 | 0 | - |
| 2010 | 330+ ⁷ | - | 21 ⁶ | ~40 ⁶ | - | - | - | - |
| 2011 | - | - | 100 ⁹ | - | - | - | - | - |
| 2011 Status | Extant: Single location | | Extant | Extant | Probably Extirpated | Extirpated | Extirpated | Extirpated |

"-" = no survey

¹ Sarah Mainguy pers. comm. 2009

² Mike Oldham pers. comm. 2010

³ Sutherland *et al.* 1994

⁴ Bryant 2010

⁵ P.A. Woodliffe pers. comm. 2010

⁶ Environment Canada 2011

⁷ Nernberg 2011

⁸ COSEWIC 2000

⁹ MacKenzie 2011

* partial count by viewing through the fence

Former Camp Ipperwash – Extant

Bluehearts is distributed in wet meadows along about 2 km of dunes in the former Camp Ipperwash. Wet swales are separated by dry dune habitat and stands of Eastern White Cedar (*Thuja occidentalis*), Eastern Red Cedar (*Juniperus virginianus*) and other trees. COSEWIC (2000) estimated 0.69 ha of habitat. Richmond Park Lake immediately east of former Camp Ipperwash is considered to be part of the same “location”. It consists of about 0.7 ha of high-quality wet meadow on private undeveloped land flanked by the former military reserve and cottages. Collectively, this location supports the largest number of plants and most suitable habitat in Canada. Although complete surveys have been infrequent, a maximum of 1940 plants were observed in 1981 and a minimum of 448 in 2009 (Table 2). Tenure of the former Camp Ipperwash is under negotiation between members of the Kettle and Stoney Point First Nation and the Department of National Defence. The immediate fate of the habitat and population is uncertain due to potential habitat disruption resulting from the decommissioning of the site prior to ceding the property to First Nations ownership (see **Habitat Protection and Ownership**).

Pinery Provincial Park - Extant

Bluehearts occurs in 12 wet meadows within about 18 ha at the west end of the park. Most of the plants (typically about 85%) occur in a 36 m² meadow within a deer-exclosure fence (COSEWIC 2000). Eleven other nearby wet meadows have each supported several plants periodically. The fence was originally erected to keep park visitors from impacting the site. It may no longer be true that the majority of Bluehearts plants within Pinery lie within this particular fenced wet meadow (MacKenzie pers. comm. 2011). Total numbers in the park are highly variable and have ranged from 594 plants in 1984 to 0 plants in 2009 (Table 2). Although no plants were observed in 2009 (Harris and Foster 2009; MacKenzie pers. comm. 2010), 21 plants were recorded in 2010 and ~100 flowering individuals were seen in 2011 (MacKenzie pers. comm. 2011). Pinery Provincial Park has a mandate to conserve species at risk and has an ongoing Bluehearts monitoring program. The primary threat at this location is vegetation succession (see **THREATS AND LIMITING FACTORS**).

Ipperwash Beach - Extant

A population of 88 plants was discovered in September 1997 in wet meadows near the Ipperwash Beach. The plants are on undeveloped private land and adjacent Crown land. The primary threat at this location is human use and possibly vegetation succession (see **THREATS AND LIMITING FACTORS**). The population is not considered to be viable over the long term (Environment Canada 2011).

Squirrel Island - Extirpated

Bluehearts was discovered in 1910 at this island at the mouth of the St. Clair River at Lake St. Clair (Dodge 1914). It presumably occupied wet prairie habitat. Subsequent surveys by numerous botanists have not rediscovered the species (Bowles 2005).

Former Ipperwash Provincial Park - Extirpated

Up to 54 plants have been seen at this site (Table 2) but none have been formally documented since 1986 (although occasional plants were observed between 1986 and 1997; Alf Rider pers. comm. 2009). The wet meadow has become overgrown with cedars and shrubs and is accumulating organic debris (Harris and Foster 2010). The population showed a continuous decline since park road and parking lot development occurred in the 1970s. The road may have altered drainage and improved conditions for woody species. In 1997, the population was predicted to soon become extirpated due to changes in the habitat (Alf Rider pers. comm. 1997; C. Van den Bygaart pers. comm. 1997). No plants were observed in the 2009 survey and Bluehearts habitat degradation has continued through succession to cedar forest. Potential wet meadow habitat exists about 50 m southeast of the historical site, although no plants were observed there in 2009 (Dobbyn and Crins 2009). Although this assessment concludes that Bluehearts is presumed to be extirpated at this site Dobbyn and Crins (2009) concluded that the site could still support Bluehearts and the absence of plants could be due to poor inventory and the unfavourable growing conditions of 2009.

Kettle Point First Nation - Extirpated

This site formerly consisted of a 46 m X 46 m stand on an undeveloped subdivision lot (COSEWIC 2000). 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 (Alf Rider 1997 pers. comm.). The 2009 survey saw no plants and Bluehearts is presumed to be extirpated at this site.

Port Franks, Poplar Lodge - Extirpated

About 45 plants were first reported in 1981 (formerly occurred) at this site and were last seen in 1984 in a 36 m² 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 (Alf Rider pers. comm. 1997). The 2009 survey saw no plants and Bluehearts is presumed to be extirpated at this site.

Changes in the range of this species are difficult to assess because the plant apparently remains dormant in the seedbank in some years (COSEWIC 2000). Nonetheless, habitat degradation and apparent absence of plants in successive surveys suggest that Bluehearts has disappeared from two sites since the last status report (COSEWIC 2000). Its known Canadian range did not change substantially between 1981 and 2000 when fairly extensive field studies were conducted in the Ipperwash and Port Franks area.

Bluehearts populations in Canada do not meet the threshold for “severely fragmented” (IUCN Standards and Petitions Working Group 2008). Three populations are known in Canada with two of the three populations (former Camp Ipperwash and Pinery) supporting almost 100% of the Canadian population, each consisting of several hundred adult plants. The populations are considered large enough to be viable. Numbers of individuals within the subpopulations are, however, highly variable between years. These two populations are separated by about 6 km and comprise over 90% of the total area of habitat presently occupied by the species. The intervening habitat consists of sand plain which, although altered by human activities, may include patches of suitable habitat.

Search effort

In 2009 a thorough search was conducted of all known Canadian sites with the exception of Squirrel Island where Bluehearts has not been observed for decades. Surveys at Ipperwash, Port Franks, and Kettle Point were conducted by two observers (Robert Foster and Allan Harris) with the assistance of Al Sandilands at former Camp Ipperwash and Alf Rider at other sites (Harris and Foster 2010). Fieldwork was conducted on July 27, 28, and 29, 2009 for a total of 51 person-hours. Bluehearts was near peak flowering on these dates, with most flowers at full anthesis. Surveys were conducted by walking through suitable habitat and counting all plants observed. Precise search areas were determined using maps, GPS coordinates, and descriptions from previous fieldwork. In addition, as part of the deregulation process for former Ipperwash Provincial Park, a species at risk inventory of the park was initiated by Ontario Parks (Dobbyn and Crins 2009)

At Pinery Provincial Park, park staff surveyed all known Bluehearts “subpopulations” in July and August, 2009 as part of an ongoing monitoring program (MacKenzie pers. comm. 2009).

These surveys were supplemented with observations by other botanists. In 2008, Sarah Mainguy mapped Bluehearts observations at former Camp Ipperwash, but did not conduct population counts because fieldwork was done in late fall and winter when accurate stem counts could not be completed. Other observations by Mike Oldham (pers. comm. 2009), Alf Rider (pers. comm. 2009), and Bryant (2010), although not systematic searches, were also considered in assessing the species’ status. Previous search effort (1980 to 1997) is described in COSEWIC (2000).

Bluehearts is a large, conspicuous plant that grows in open habitat and is unlikely to be overlooked or confused with other species. Distinctive seed capsules persist on tall stems even into the winter. This species undergoes wide population fluctuations from year to year, however, making it very difficult to estimate population trends.

HABITAT

Habitat requirements

Bluehearts habitat typically consists of moist sandy or gravelly soil in open woods, prairies, and interdunal swales (Brownell 1985; NatureServe 2010). It is often associated with limestone, sandstone or shale bedrock (Craig Freeman pers. comm. 2009). The species was formerly found in pine barrens in New Jersey (David Snyder pers. comm. 2010). Bluehearts also occupies Great Lakes dune habitat in Ontario and Indiana (Michael Homoya pers. comm. 2009) and Gulf beaches in Louisiana (Chris Reid pers. comm. 2009).

Fire and other disturbances are often important to suppress growth of trees and shrubs and maintain open Bluehearts habitat (NatureServe 2010). Anthropogenic disturbed habitats include fields, powerline right-of-ways, and ditches (NatureServe 2010).

In Ontario, Bluehearts is primarily found on the edges of wet interdunal depressions in fine sand, between 200 m and 500 m from the Lake Huron shoreline. Associated plants include prairie species such as Butterfly Milkweed (*Asclepias tuberosa*), Indian Grass (*Sorghastrum nutans*), Little Bluestem (*Schizachyrium scoparium*), and Big Bluestem (*Andropogon gerardii*). Other associates typical of wet calcareous meadows include American Grass-of-Parnassus (*Parnassia glauca*), Twig-rush (*Cladium mariscoides*), Low Nut-rush (*Scleria verticillata*), Grass Pink (*Calopogon tuberosus*), Slender Blazing Star (*Liatris cylindracea*), and Ohio Goldenrod (*Solidago ohioensis*) (Brownell 1985, Harris and Foster 2010). A more complete list of plant associates is found in Appendix 1. More detailed habitat descriptions are found in Brownell (1985), Klinkenberg and Edwards (1979), and Klinkenberg and Crabe (1980).

Although no habitat information is available for the Squirrel Island site, it presumably was tallgrass prairie and/or oak savannah habitat types, which were common in the area (Bowles 2005).

Habitat trends

Habitat degradation may have contributed to the extirpation of some smaller Ontario occurrences over the last ten years, but most losses occurred prior to this period. Human alteration of habitat probably caused the extirpation of the Port Franks, Kettle Point, and former Ipperwash Provincial Park occurrences. Direct human damage by vegetation clearing and soil disturbance are evident at the Port Franks and Kettle Point sites (Alf Rider pers. comm. 2009). Increased growth of woody vegetation may have been caused by altered hydrology due to road construction at Ipperwash Provincial Park (Alf Rider pers. comm. 2009).

Habitat at Pinery Provincial Park and former Camp Ipperwash sites appears to have changed little in the last ten years (Figure 4). COSEWIC (2000) noted habitat degradation due to human recreational use near campgrounds. Although the park has recently undertaken measures to reduce human traffic in one of the 12 meadows inhabited by Bluehearts, it is likely that the concerns raised by COSEWIC (2000) would still apply to the remaining eleven sites. Encroachment of Eastern White Cedar in wet meadows at the Pinery has been observed recently, possibly related to White-tailed Deer (*Odocoileus virginianus*) culls beginning in the late 1990s (MacKenzie pers. comm. 2009). The deer population was reduced from about 1100 to about 70 animals. Prescribed burning of some Bluehearts meadows in the Pinery was implemented in 2008 although the long-term response of Bluehearts is not yet known (MacKenzie pers. comm. 2009). More prescribed burning opportunities exist.



Figure 4. Bluehearts habitat: Ipperwash (above), Pinery (below) July 2009. (Photos by Allan Harris.)

Bluehearts habitat at former Camp Ipperwash experienced damage from trucks and all-terrain vehicles between the 1940s about the 1990s (Thompson *et al.* 1994). Although all-terrain vehicle use continues, most of the habitat degradation appears to have occurred before the mid-1990s. Encroachment by woody vegetation into the sand dunes is less apparent here than at Pinery Provincial Park, possibly due to higher deer populations and higher level of browsing. The species is apparently “somewhat tolerant” of human disturbance (Burns and Cusick 1984), and in the U.S. is known to inhabit hayfields, roadsides, and similar habitats.

As discussed in **THREATS**, water level changes on Lake Huron may have contributed to habitat degradation. Brownell (1985) noted that Bluehearts and other wet meadow species declined during the 1970s when Lake Huron levels were low. Drying of interdunal swales could increase competition from woody plants or other species. Similarly, prolonged high water levels could impair germination and survival of Bluehearts.

Interdunal wet meadow habitat in Ontario is naturally uncommon and fragmented. Human development has caused further fragmentation. Further habitat changes are likely to occur as Lake Huron water levels continue to fall through the effects of global warming or increased discharge through the St. Clair River (International Upper Great Lakes Study 2009). Formation of new habitat is possible as the dune systems adjust to changing water regimes, as long as sand erosion and deposition processes are allowed to continue, invasive species do not become prevalent, and losses of newly formed habitat to shoreline development do not occur.

BIOLOGY

There is little information of the biology of Bluehearts. The following is based largely on summaries in NatureServe (2010), Brownell (1985), COSEWIC (2000), and contacts with experts summarized in Table 3.

Table 3. State ranks for Bluehearts in North America (NatureServe 2009).

| Province / State | S-Rank |
|------------------|--------------------|
| Ontario | S1 |
| Alabama | S4 ⁺ |
| Arkansas | S3S4 ⁺⁺ |
| DC | SX |
| Delaware | SH |
| Florida | SNR ⁺ |
| Georgia | S1 ⁺ |
| Illinois | S3 |
| Indiana | S1 |
| Kansas | S4 [*] |
| Kentucky | S3S4 |
| Louisiana | S4 ⁺⁺ |
| Maryland | SH |
| Michigan | SX |
| Mississippi | S4 ⁺⁺ |
| Missouri | S4 |
| New Jersey | SX |
| New York | SH |
| North Carolina | SH ⁺ |
| Ohio | S2 |
| Oklahoma | S5 [*] |
| Pennsylvania | SX |
| South Carolina | SNR ⁺ |
| Tennessee | S3S4 [*] |
| Texas | S2 |
| Virginia | S1S2 |

* updated from NatureServe 2009

⁺ indicates states where both *Buchnera americana* and *B. floridana* occur but are not assigned separate ranks

Life cycle and reproduction

In most of its range, Bluehearts appears to be a perennial or biennial plant based on root structure and tagging studies (Brownell 1985, Ostlie 1990, Bruce Sorrie pers. comm. 2010). However, it may survive primarily as an annual in Ontario and possibly other northern states. Populations fluctuate widely between years, and Ontario plants do not survive more than one year based on observations of transplants and potted plants (COSEWIC 2000). Beginning in 2010 Pinery Provincial Park began tagging all observations of this species, which may aid in tracking long-term occurrences (MacKenzie 2011).

The small seeds of Bluehearts require light for germination and can remain viable in the soil for at least 3 years (Ostlie 1990), suggesting that the species may form seed banks. Pennell (1935) suggested that this species is butterfly-pollinated, but also noted that self-pollination may occur. It is still not known whether or not this species is an obligate out-crosser, or whether self-fertilization is possible (Ostlie 1990).

Dispersal

Seed dispersal mechanisms are unknown. Reticula on the seed coat may aid in water dispersal by trapping air and increasing buoyancy (Kuijt 1969 cited in NatureServe 2010). However, given that much of the species' North American range is in prairie and open woodland, other dispersal mechanisms are probably also used.

There is no natural disjunction between extant Ontario populations that would severely limit dispersal for an extended period of time. The maximum distance between populations is approximately 3 km with small patches of suitable sand dune and beach habitat between them (although fragmented by human disturbance). Dispersal of seeds and/or pollen between populations is feasible over the long-term.

Interspecific interactions

This species is hemiparasitic on the roots of a great variety of trees including Eastern White Pine (*Pinus strobus*), Red Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood (*Populus deltoides*), and White Oak (*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).

POPULATION SIZES AND TRENDS

Sampling effort and methods

Monitoring of Bluehearts in Pinery Provincial Park was conducted annually between 1980 and 1994 and then from 2006 to 2009 (MacKenzie pers. comm. 2009). Complete surveys at the former Camp Ipperwash were completed in 1981 and 2009 (Dobbyn and Crins 2009), and partial surveys were done in 1996 and 2008 (COSEWIC 2000; Harris and Foster 2010). Due to the lateness of the season, Sutherland *et al.* (1994) considered their inventories at the former Camp Ipperwash inadequate to detect trends from estimates made in 1981. Several small populations were discovered scattered in wet meadows. Other areas were surveyed opportunistically by various botanists (Table 2). Sampling techniques are described under **Search Effort**.

Abundance

The lack of consistent survey effort at most sites, combined with the wide fluctuations of numbers between years, makes it impossible to estimate the total number of individuals in Canada. Population counts from the individual sites are summarized in Table 2. All known Canadian sites were surveyed in 1981 and 2009. The highest single year count was 2182 in 1981. In contrast only 488 plants were counted in 2009. Numbers have fluctuated widely in the intervening years. Numbers of plants at the Pinery and former Camp Ipperwash are believed to have increased between 1979 and 1983 (COSEWIC 2000).

Fluctuations and trends

This species undergoes large population fluctuations from year to year (Table 2). Maximum and minimum counts of adult plants at extant sites are as follows:

- Pinery Provincial Park: 594 (1984) to 0 (2009)
- Former Camp Ipperwash: 1410 (1981) to 448 (2009)
- Richmond Park Lake (part of the former Camp Ipperwash location): 1971 (1994) to 26 (2009)
- Ipperwash Beach: 88 (1997) 20 (1993)

Bluehearts was last seen at Port Franks in 1984, at Kettle Point in 1983, and at the former Ipperwash Provincial Park in 1994. Habitat has been degraded at all three sites and, along with Squirrel Island, these sites are considered extirpated.

Although detailed analyses have not been conducted, some evidence suggests that Bluehearts is present in lower numbers in years with exceptionally high or low Lake Huron water levels. The decrease in plant numbers in the mid-1980s may 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. Bluehearts numbers were relatively high in 1981 when water levels were slightly above average during the growing season. However, the Richmond Park Lake population did not show the same trend during the early 1990s (Table 2) and other factors must also be involved. Further research and monitoring is required to determine the relationship between Bluehearts numbers and the timing, magnitude, and duration of flooding and drawdown.

NatureServe (2010) estimates that Bluehearts has undergone a global short-term decline of 10-30% associated with numerous extirpated occurrences throughout its range due to loss of habitat by physical destruction and succession.

The number of mature Bluehearts in Canada undergoes “extreme fluctuations” between years as defined by COSEWIC. These are “changes in the total number of mature individuals ... that occur rapidly and frequently, and are typically of more than one order of magnitude” (Source: adapted from IUCN 2001). Populations at the Pinery, Richmond Lake Park, and Kettle Point have undergone fluctuations of over an order of magnitude on several occasions between 1979 and 2009 (Table 2), but data are not robust enough to apply the B criteria based on the “extreme fluctuation.”

Rescue effect

The likelihood of natural reintroduction of Bluehearts from the U.S. is very low. Historical populations from northern Ohio and New York state populations have not been seen in many decades. The closest extant populations are at the southern end of Lake Michigan in Indiana, 480 km west of the Ontario occurrences. The rarity and disjunct nature of its preferred habitat (prairie or Great Lakes sand dunes) probably represent a barrier to dispersal.

THREATS AND LIMITING FACTORS

Changes in ecological and natural processes are the primary threat to existing populations of Bluehearts across its global range. Shoreline development, disturbance from all-terrain vehicles, road construction, mining, and other development and recreational activities also threaten many extant sites (NatureServe 2010).

Changes in ecological and natural processes

Bluehearts is a seral species that disappears from stable communities and depends on periodic disturbances, such as fire and inundation (Ostlie 1990). Both fire and flooding are known to be important to maintain savannah and interdunal wet meadow habitats along the southern Lake Huron shoreline in Lambton County. Fire is probably less important in interdunal wet meadows where water level fluctuations may play a similar role in restricting competing vegetation. Loss of the natural fire regime has led to successional change in many parts of the species' range and the demise of many Bluehearts populations as prairies and open woodlands become overgrown with trees and shrubs (NatureServe 2010). Prescribed burning on a rotational 3-4 year cycle is the primary management technique used for this species in Indiana, Illinois, Missouri, and Ohio (COSEWIC 2000). Vegetation succession is probably the primary threat to the Pinery population of Bluehearts (MacKenzie pers. comm. 2009). Eastern White Cedar and other woody vegetation is increasing in some wet meadows, possibly related to decreased deer browsing following deer culls and may also be related to the deer exclosures surrounding Bluehearts populations (Environment Canada 2011). Prescribed burning has been attempted in some wet meadows, but is not feasible for all sites.

Water level fluctuations on Lake Huron are natural and presumably are integral in maintaining interdunal swale habitat. Such regular water-level fluctuations have presumably been ongoing for centuries and may be both positive (maintaining open habitat) and negative (contributing to mortality) for Bluehearts numbers in a given year. However, Lake Huron water levels have declined over the past decade, probably due to climate change, isostatic rebound, and increased discharge through the St. Clair River (International Upper Great Lakes Study 2009). These dropping water levels may be causing Bluehearts populations to decline beyond the range of variation seen since monitoring was initiated.

Recreational activities

Trampling by pedestrians and vehicles was identified as a threat at Ipperwash Beach, Pinery Provincial Park, and the former Camp Ipperwash in COSEWIC (2000). This threat has probably been diminished at the Pinery through management of access, although human traffic persists at a lower level and the threat of plant picking by park visitors continues to be a potential threat (MacKenzie pers. comm. 2011). Current annual park visitation exceeds 500,000 (MacKenzie pers. comm. 2011). Off-road vehicles continue to be a threat at the former Camp Ipperwash, where vehicle tracks were evident throughout the dunes in 2009.

Invasive species

Invasive plants are a potential threat to all Ontario populations. Although the former Camp Ipperwash and Pinery locations are not heavily occupied by invasive plant species, there are some small patches of Common Reed (*Phragmites australis*) in some swales. It is expected that Common Reed will become an increasing threat particularly since the European genotype have recently reached the area.

Both native and introduced genotypes of *Phragmites australis* are now found within Pinery Provincial Park. Threats from invasive species are accelerating rapidly within the park. Currently occurring species and additional species of invasive plants will likely become a more significant threat in the coming years (e.g. Japanese Barberry, *Berberis thunbergii*) (MacKenzie pers. comm. 2011).

Large sections of moist sand shoreline are dominated by Common Reed and cattail (*Typha* spp.) elsewhere in the Port Franks area.

Detection and removal of unexploded ordnance

Decommissioning of the former Camp Ipperwash site prior to ceding the property to First Nations ownership will involve removal of unexploded ordnance (munitions), entailing digging and removal of some vegetation. Although environmental values will be recognized during decommissioning (Mansfield, pers. comm. 2010), impacts on Bluehearts habitat and population are uncertain.

Residential and cottage development

Historically, the major threat in Ontario was a drastic reduction in amount of natural interdunal habitat due to conversion for cottages and residences and appears to have led to the extirpation of the populations at Port Franks and the Chippewas of Kettle and Stony Point First Nation Reserve. Although there has been little loss of habitat to development in the last ten years, new management objectives for the former Camp Ipperwash and former Ipperwash Provincial Park are uncertain.

Loss of pollinators

Loss of pollinators through insecticide application or loss of vector breeding habitat is also a potential threat (NatureServe 2010).

Limiting factors

Major natural limiting factors include habitat specificity and the dynamic nature of the habitat (COSEWIC 2000). Fluctuating water level is an extremely important factor in maintaining open areas required for this species (COSEWIC 2000).

PROTECTION, STATUS, AND RANKS

Legal protection and status

In Canada, Bluehearts was assessed by COSEWIC as Threatened in April 1985 (Brownell 1985). The status was re-examined and assessed as Endangered in April 1998 and again in May 2000 (COSEWIC 2000). The species was included on Schedule 1 of the *Species at Risk Act* (SARA) in 2003 when the Act was proclaimed (Environment Canada 2010). As such, it is protected on federal lands through the general prohibitions under SARA. In Ontario, the species is listed as Endangered under the *Endangered Species Act, 2007*, which legally protects all plants on all lands in Ontario (OMNR 2010).

In the United States, Bluehearts is officially protected by legislation designating it as Endangered in Indiana and New York, Endangered (Extirpated) in Maryland, Probably Extirpated in Michigan, Extirpated in Pennsylvania, Threatened in Ohio and Special Concern in Georgia (Table 3). It is newly listed as Threatened in Illinois (Mankowski pers. comm. 2010).

Non-legal status and ranks

Nature Serve (2009) provides the following ranks. The Global Rank treats *Buchnera americana* as including *B. floridana*.

Global Rank: G5? (Nature Serve 2009)

National Rank (Canada): N1

National Rank (US): N5

Subnational Ranks (S-ranks) as provided by NatureServe (2009) and updated in Table 3 are as follows:

SX: DC, MI, NJ, PA
SH: DE, MD, NC*, NY
S1: GA, IN, ON
S1S2: VI
S2: OH, TX
S3: IL
S3S4: AR*, KY, TN*
S4: AL*, KS*, LA*, MS*, MO,
S5: OK*
SNR: FL*, SC*

* indicates states where both *Buchnera americana* and *B. floridana* occur but are not assigned separate ranks

The General Status Rank is “At Risk” for Ontario and Canada (Wild Species 2005).

Habitat protection and ownership

Most of the habitat within Pinery Provincial Park is designated Nature Reserve zone where human disturbance is minimized. The areas surrounding these meadows still sustain intensive camping and recreation. The park has implemented deer population control, protected some Bluehearts habitat in deer exclosures, made efforts to restrict human access, restored some habitat by decommissioning some campsites, and implemented prescribed burning on some sites (MacKenzie pers. comm. 2009).

The Richmond Park Lake portion of the former Camp Ipperwash location is on private land that is flanked by cottages on one side and the former military camp on the other.

The Ipperwash Military Reserve and Ipperwash Provincial Park were awarded to the Kettle and Stony Point First Nation in 1998 and 2007 respectively. Until 1995, Camp Ipperwash was administered by the Department of National Defence (DND) as an infantry training facility; it remained (and is presently) under the control of DND while decommissioning activities continue. These lands will continue to be afforded some protection under SARA.

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Ben Dolbeare, Illinois Division of Natural Heritage, Invasive Species Biologist

Jennifer Doubt, Federal Biodiversity Information Partnership (chaired by Canadian Museum of Nature), Chief Collection Manager – Botany

Matt Elliott, Georgia Natural Heritage Program

Chris Firestone, Pennsylvania Natural Heritage Program, Botanist

Craig Freeman, Kansas Natural Heritage Inventory

Christopher Frye, Maryland Natural Heritage Program, Botanist

Dr. Lynn Gillespie, Federal Biodiversity Information Partnership (chaired by Canadian Museum of Nature), Research Scientist

Randy Heidorn, Illinois Nature Preserves Commission

Bruce Hoagland, Oklahoma Natural Heritage Inventory, Coordinator/Plant Community Ecologist

Michael A. Homoya, Indiana Natural Heritage Data Center, Botanist/Plant Ecologist

Amy Jenkins, Florida Natural Areas Inventory, Senior Botanist

Tara Kieninger, Illinois Department of Natural Resources, Natural Heritage Database Manager

Tara Littlefield, Kentucky Natural Heritage Program, Botanist

Alistair MacKenzie, Pinery Provincial Park, Natural Heritage Education and Resource Management Supervisor

Sarah Mainguy, Botanist, North South Environmental

Anne Mankowski, Illinois Endangered Species Protection Board, Director

William McAvoy (Bill), Delaware Natural Heritage Program, Botanist
Angela McConnell, Canadian Wildlife Service, Ontario Region
Patrick Nantel, Parks Canada, Conservation Biologist, Species at Risk Program
Mike Oldham, Ontario Natural Heritage Information Centre, Botanist/Herpetologist
Cindy Osborne, Arkansas Natural Heritage Program, Data Manager / Environmental Review Coordinator
Mike Penskar, Michigan Natural Features Inventory, Senior Conservation Scientist – Botany
Bert Pittman, South Carolina Heritage Trust, Botanist
Jackie Poole, Texas Wildlife Diversity Program, Botanist
Christopher S. Reid, Louisiana Natural Heritage Program, Botanist
Alf Rider, Naturalist, Kettle Point, Ontario
Richard Ring, New York Natural Heritage Program, Botanist
Al Schotz, Alabama Natural Heritage Program, Botanist / Community Ecologist
Greg Schneider, Ohio Natural Heritage Program, Program Administrator, Data Manager
Jon Siemien, District of Columbia Fisheries & Wildlife, Acting Program Manager
David Snyder, New Jersey Natural Heritage Program, Botanist
Sonia Schnobb, COSEWIC Secretariat, Administrative Assistant
Dr. Gilles Seutin, Parks Canada, Coordinator, Species at Risk Program
Bruce A. Sorrie, University of North Carolina Herbarium
Heather Sullivan, Mississippi Natural Heritage Program, Botanist
John Townsend, Virginia Division of Natural Heritage, Staff Botanist
Ken Tuininga, Canadian Wildlife Service, Ontario Region
Malissa Underwood, Missouri Natural Heritage Program, Botanist
Theo Witsell, Arkansas Natural Heritage Program, Botanist

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BIOGRAPHICAL SUMMARY OF REPORT WRITERS

Allan Harris is a biologist with over 20 years' experience in northern Ontario. He has a B.Sc. in Wildlife Biology from the University of Guelph and an M.Sc. in Biology from Lakehead University. After spending seven years as a biologist with Ontario Ministry of Natural Resources, he co-founded Northern Bioscience, an ecological consulting company based in Thunder Bay, Ontario. Al has authored or coauthored dozens of scientific papers, technical reports, and popular articles, including COSEWIC status reports for Bogbean Buckmoth, Rapids Clubtail, Laura's Clubtail, Patterned Green Tiger Beetle, Small-flowered Lipocarpha, and Drooping Trillium. Al also authored the Ontario provincial status report for woodland caribou, and has authored or coauthored national and provincial recovery strategies for vascular plants and birds. He is a member of the Committee on the Status of Species at Risk in Ontario (2008 - 2012).

Robert Foster is co-founder and principal of Northern Bioscience, an ecological consulting firm offering professional consulting services supporting ecosystem management, planning, and research. Dr. Foster has a B.Sc. in Biology from Lakehead University and a D.Phil in Zoology from the University of Oxford. Rob has worked as an ecologist in Ontario for over 15 years, and has authored or coauthored COSEWIC status reports on the Bogbean Buckmoth, Rapids Clubtail, Laura's Clubtail, Northern Barrens Tiger Beetle, and Drooping Trillium, as well as recovery plans for rare plants, lichens, and odonates.

COLLECTIONS EXAMINED

Canadian Museum of Nature (CAN) (Courtesy Jennifer Doubt, Chief Collection Manager, Botany Section):

J. Dearness, September 8, 1891
Port Frank, Ontario
CAN 96129

J.H. Soper and J.K. Shields, August 2, 1950
Between Port Frank and Stony Pt.
CAN 228786

W. Botham, September 14, 1969
Lambton County: Bosanquet Twp., Pinery Prov. Park.
CAN 497474

Green Plant Herbarium (TRT) Department of Natural History Royal Ontario Museum (Courtesy Jenny Bull and Tim Dickerson):

J. Dearness; September 9, 1891
Shore of Lake Huron near mouth of Sauble R.
TRT 191491

Appendix 1. Vegetation data in Bluehearts habitat at former Camp Ipperwash, July 2009.

The following vegetation data were collected at former Camp Ipperwash on July 29 2009 by Allan Harris and Robert Foster. Quadrats were placed in Bluehearts habitat in interdunal swales. Quadrat size was 5 m X 5 m. Percent cover of all vascular plant species was estimated to the nearest 1%. Less than 1% given a value of 0.1%.

Vegetation layer codes are provided after the species name for tree and shrub species:

Layer 3 = 2 to 10 m tall

Layer 4 = 0.5 to 2 m tall

Layer 5 = < 0.5 m tall

Exotic species are indicated *.

| Species | Percent Cover | | | |
|--------------------------------|---------------|-----------|-----------|-----------|
| | Quadrat 1 | Quadrat 2 | Quadrat 3 | Quadrat 4 |
| <i>Agrostis gigantea</i> * | 2 | 0.1 | 0.1 | |
| <i>Andropogon gerardii</i> | 55 | | 2 | 2 |
| <i>Arctostaphylos uva-ursi</i> | | | 1 | |
| <i>Artemisia campestris</i> | | | 0.1 | |
| <i>Aster brachyactis</i> | | 2 | 0.1 | |
| <i>Aster laevis</i> | | | 0.1 | |
| <i>Aster lateriflorus</i> | | | 0.1 | 1 |
| <i>Betula papyrifera</i> 5 | | | 0.1 | 0.1 |
| <i>Buchnera americana</i> | 0.1 | | 1 | |
| <i>Calamovilfa longifolia</i> | | 9 | | |
| <i>Calopogon tuberosa</i> | | 0.1 | | |
| <i>Carex aurea</i> | | 0.1 | 4 | |
| <i>Carex eburnea</i> | 1 | | 1 | |
| <i>Cladium mariscoides</i> | 12 | 30 | | 70 |
| <i>Cornus stolonifera</i> 5 | | | 0.1 | |
| <i>Cypripedium calceolus</i> | 0.1 | | | |
| <i>Diplotaxis tenuifolia</i> * | 0.1 | | | |
| <i>Eleocharis pauciflora</i> | 30 | | | |
| <i>Eleocharis smallii</i> | | 20 | | |
| <i>Equisetum fluviatile</i> | | | 1 | |
| <i>Equisetum variegatum</i> | 0.1 | 40 | | 0.1 |
| <i>Erigeron</i> sp. | | 0.1 | | 2 |
| <i>Euthamia graminifolia</i> | | | 2 | 0.1 |
| <i>Fragaria vesca</i> | | 0.1 | | |
| Herb sp. | | 0.1 | | |
| <i>Hypericum kalmianum</i> | | 2 | 7 | 2 |

| Species | Percent Cover | | | |
|---------------------------------|---------------|-----------|-----------|-----------|
| | Quadrat 1 | Quadrat 2 | Quadrat 3 | Quadrat 4 |
| <i>Juncus alpinoarticulatus</i> | 0.1 | | | |
| <i>Juncus balticus</i> | 1 | 0.1 | 70 | |
| <i>Juniperus communis</i> | 1 | | | |
| <i>Juniperus virginiana</i> | | | 0.1 | 0.1 |
| <i>Liatris cylindracea</i> | 20 | | 2 | |
| <i>Liriodendron tulipifera</i> | 0.1 | | | |
| <i>Lobelia kalmii</i> | 0.1 | | | |
| <i>Maianthemum stellatum</i> | 0.1 | | 0.1 | |
| Moss sp. | 25 | | 1 | |
| <i>Panicum sp.</i> | 6 | 2 | 1 | 15 |
| <i>Parnassia glauca</i> | | 3 | 0.1 | 2 |
| <i>Pinus banksiana</i> 5 | | | 1 | |
| <i>Pinus resinosa</i> 3 | 3 | | | |
| <i>Pinus resinosa</i> 5 | | | 0.1 | |
| <i>Pinus strobus</i> 5 | | | 0.1 | |
| <i>Poa pratensis</i> * | 0.1 | | 1 | |
| <i>Populus balsamifera</i> 5 | | | 0.1 | |
| <i>Potentilla anserina</i> | | | | 1 |
| <i>Potentilla argentea</i> * | 0.1 | | 0.1 | |
| <i>Potentilla fruticosa</i> 5 | 5 | 1 | 0.1 | 4 |
| <i>Prunus pensylvanica</i> 5 | | | 2 | |
| <i>Prunus pumila</i> 5 | 1 | | | |
| <i>Salix myricoides</i> 5 | | | 3 | |
| <i>Salix spp.</i> 4 | | | | 3 |
| <i>Salix spp.</i> 5 | 0.1 | | | 0.1 |
| <i>Scirpus pungens</i> | | | | 0.1 |
| <i>Scleria verticillata</i> | | 55 | | 45 |
| <i>Senecio sp.</i> | 0.1 | | 1 | |
| <i>Sisyrinchium montanum</i> | 0.1 | | | |
| <i>Solidago nemoralis</i> | | | 0.1 | |
| <i>Solidago ohioensis</i> | 1 | 1 | 1 | 1 |
| <i>Thuja occidentalis</i> 4 | | 1 | | |
| <i>Thuja occidentalis</i> 5 | 0.1 | 4 | 4 | |
| <i>Triantha glutinosa</i> | 3 | 0.1 | 0.1 | 3 |
| <i>Triglochin palustris</i> | 0.1 | 1 | | 8 |