COSEWIC
Assessment and Status Report

on the

Eastern Prickly Pear Cactus
Opuntia humifusa

in Canada

ENDANGERED
2010

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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Klinkenberg, B. and R. Klinkenberg. 1985. COSEWIC status report on the Eastern Prickly Pear Cactus *Opuntia humifusa* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 43 pp.

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COSEWIC
Assessment Summary

Assessment Summary – April 2010

Common name
Eastern Prickly Pear Cactus

Scientific name
Opuntia humifusa

Status
Endangered

Reason for designation
This cactus of sandy habitats is restricted in Canada to two very small locations in extreme southwestern Ontario along the north shore of Lake Erie. The two native populations are primarily at risk from habitat loss and degradation due to vegetation succession and shoreline erosion. Stochastic events could readily eliminate the population on Pelee Island consisting only of a few plants.

Occurrence
Ontario

Status history
Designated Endangered in April 1985. Status re-examined and confirmed Endangered in April 1998, May 2000, and April 2010.

COSEWIC
Executive Summary

Eastern Prickly Pear Cactus
Opuntia humifusa

Species information

Eastern Prickly Pear Cactus (*Opuntia humifusa*) is a low prostrate succulent, forming clumps usually only one or two stem segments tall. Stem segments are fleshy or firm and become wrinkled under water stress. Stems are sparsely covered with clusters of barbed bristles and spines. Flowers appear in June. They are large, waxy and yellow, at times orangey-yellow or reddish at the base of petals. The fruits are oblong and turn brownish-red when mature. The species occurs as small patches or large scattered colonies of thousands of stems.

Distribution

Eastern Prickly Pear Cactus occurs in the United States and Canada. It is widely distributed with its range extending from Massachusetts to Florida in the east and from South Dakota to eastern Texas in the west. Canadian populations are restricted to extreme southwestern Ontario where they occur at Point Pelee and Pelee Island on Lake Erie where the total area of habitat occupied is only about 1063 m^2.

Habitat

In Canada, Eastern Prickly Pear Cactus is restricted to open and semi-open dry sandy environments corresponding with sand spit formations along Lake Erie.

Biology

Eastern Prickly Pear Cactus is a perennial vascular plant that produces yellow flowers along the margins of mature joints. Individuals require between six and eight years to mature and flower from seed. In Canada, flowering occurs between June and August. The species can reproduce sexually from seeds or asexually via layering, detached stem segments taking root and sprouting from the stem base when the above-ground portion of the plant is destroyed. In Canada, where the species is near the northern limits of it range, reproduction is primarily vegetative. Out-crossing is required to produce viable seed. The primary pollinators are bumblebees; however, other species of bee are known to visit the flowers.

Population sizes and trends

In Canada, extant naturally occurring populations of Eastern Prickly Pear Cactus occur at Point Pelee and on Pelee Island on Lake Erie. Two populations have been proposed in some initial genetic studies for plants found in Point Pelee National Park. However, only a single population is recognized at Point Pelee pending further studies. The number of plants on Point Pelee is estimated at 2418 individuals. On Pelee Island, there is a single population in Fish Point Provincial Nature Reserve. The Pelee Island population is estimated to comprise 27 individuals. Although these two populations have been periodically inventoried and monitored, an accurate census of the number of individuals (genets) within each population has been hampered by the species' clump-forming growth habit where the stems of tightly spaced individuals overlap making it difficult to visually estimate the number of individuals within a patch. In 2003, a new inventory method was developed and applied to plants at Point Pelee to facilitate consistent population size estimates and comparative analyses of trends as part of future monitoring efforts. Despite these advances, recent survey efforts at both Point Pelee and Pelee Island continue to reveal new and previously undocumented patches.

Limiting factors and threats

The main limiting factor affecting Canadian populations of Eastern Prickly Pear Cactus is habitat loss. At Point Pelee, there has been a substantial reduction in the extent of suitable habitat for Eastern Prickly Pear Cactus over the past 30 years. The open, dry and sandy habitats that support this species are being lost to succession by woody vegetation. The rate of new habitat creation along the western edge through shoreline accretion has also been correspondingly reduced by coastal development and this has interfered with the natural coastal sediment transport dynamics. As a consequence, there is less suitable habitat available for species colonization. The Pelee Island population is similarly threatened by vegetation succession. Erosion and ice scour related to storm surges also represent episodic threats. The species' inherently slow germination and growth rates limit the rate at which the species can migrate and colonize suitable habitat. Past illegal collection for horticultural purposes and ongoing trampling by hikers and bird watchers also represent threats to this species.

Special significance of the species

Canadian populations of Eastern Prickly Pear Cactus occur near the northern limit of the species North American range. Eastern Prickly Pear Cactus is one of only two cactus species known to occur naturally in Ontario and one of the few particularly winter-hardy North American cacti. The ecological significance of Canadian populations is limited due to localized area of influence. In the central portion of its range, however, the species is recognized for its soil stabilization properties and food source for wildlife. The species is of cultural significance due to its long history of use as a food source by Native Americans. In Canada, the species represents an important cultural symbol synonymous with the warm climate and low latitude of southwestern Ontario.

Existing protection

In Canada, naturally occurring populations of Eastern Prickly Pear Cactus occur entirely within protected areas. The Point Pelee population is contained within Point Pelee National Park, managed by Parks Canada Agency. The Pelee Island population occurs within Fish Point Provincial Nature Reserve and is managed by Ontario Parks. The habitat for Eastern Prickly Pear Cactus also receives protection under federal and provincial legislation including the *Canada National Parks Act, 2008. Provincial Parks and Conservation Reserves Act, 2006,* as well as other statutes and policies. Internationally, as a member of the cactus family the species receives protection afforded under CITES Appendix II. COSEWIC assessed this species in May 2000 as Endangered and currently, this species is listed in Canada as Endangered on Schedule 1 of the federal *Species at Risk Act*.

TECHNICAL SUMMARY

Opuntia humifusa
Eastern Prickly Pear Cactus oponce de l'Est
Range of Occurrence in Canada : Ontario

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines(2008) is being used) In Ontario, period to flowering from seed is in order of 6-8 years. Generation time is likely to be considerably more than this in view of the number of large clumps present on Point Pelee.	Likely >> 8 yrs in Ontario and perhaps more in the order of 10-20 years
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? Some shoreline plants have been lost due to storm events and erosion at the very small Fish Point population and continued vegetation succession will likely cause future declines at Point Pelee. However, there are no reliable data on estimates of actual change in numbers of mature individuals over time due to the difficulty in counting discrete plants and the lack of detailed monitoring using standardized methodology. As well, no data are available on natural mortality verses recruitment rates. However, habitat degradation and loss due to successional changes and shoreline erosion have occurred within the last several generations and is expected to continue with the loss of an unknown number of individuals.	Inferred and projected
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] 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?	Reversible only in part and with declines likely ongoing
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence	63 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value; other values may also be listed if they are clearly indicated (e.g., 1x1 grid, biological AO)). 16 based on 2x2 grid and 9 based on a 1x1 km grid.	<20 km²
Is the total population severely fragmented?	No
Number of "locations*"	2

* See definition of location.

Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	No
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] continuing decline in number of populations?	No
Is there an [observed, inferred, or projected] continuing decline in number of locations?	No
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat? Area of habitat has been lost due to storm events along the coast and successional changes have impacted the quality of habitat at the inland field subpopulation on Point Pelee.	Decline in area and quality
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Point Pelee: west shoreline subpopulation, 1266 genets; inland field subpopulation, 1152 genets	2418 genets
Pelee Island: Fish Point Prov. Nature Res., 27 genets	27 genets
Total The exact number of mature individuals as defined by IUCN/COSEWIC is unknown because of the difficulty in determining the number of sexually and asexually reproducing units present. It is inferred that there are a minimum of 2445 genets present but the total number of "mature individuals" (reproducing sexually and asexually) as defined by COSEWIC is assumed to be larger but likely <10,000.	Likely a minimum of 2445 genets

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	None available

Threats (actual or imminent, to populations or habitats)

Loss and degradation of suitable habitat represents the most imminent threat. Habitat for this species has been lost due to vegetation succession and shoreline erosion. Suppression of natural disturbances and interference with Lake Erie sediment transport dynamics has contributed to the loss of habitat. Human disturbances from hiking and bird watching are also a potential threat to this species, as these activities can result in inadvertent trampling of plants.

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? Relatively secure with a national status of N5	
Is immigration known or possible?	Unknown
Would immigrants be adapted to survive in Canada? Likely if specimens were transplanted from the northern US states.	Possibly
Is there sufficient habitat for immigrants in Canada?	Little
Is rescue from outside populations likely?	No

* See definition of location.

Current Status

COSEWIC: Endangered (April 2010)

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Endangered	B1ab(iii)+2ab(iii)
Reasons for designation: This cactus of sandy habitats is restricted in Canada to two very small locations in extreme southwestern Ontario along the north shore of Lake Erie. The two native populations are primarily at risk from habitat loss and degradation due to vegetation succession and shoreline erosion. Stochastic events could readily eliminate the population on Pelee Island consisting only of a few plants.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Decline percentages of uncertain magnitude.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Endangered B1ab(iii)+2ab(iii); the EO and IAO are within criterion limits and continuing habitat decline is occurring at the only two locations.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Population size is between 2,500 and 10,000 mature individuals with a projected continued population decline of unknown magnitude and no other subcriteria apply.
Criterion D (Very Small or Restricted Total Population): Not applicable. Although present at only two locations with an IAO of <20 km², it is uncertain whether the loss of enough mature individuals would occur over a short time period to result in a rapid decline of the total population.
Criterion E (Quantitative Analysis): None available.

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 (2010)

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.

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune
Canada

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

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Eastern Prickly Pear Cactus

Opuntia humifusa

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SPECIES INFORMATION

Name and classification

Scientific Name:	*Opuntia humifusa* (Raf.) Raf.
Synonyms:	*Cactus humifusus* Raf., *Opuntia compressa* (Salisb.) J.F. Macbr.; *Opuntia rafinesquei* Engelm.; *Opuntia cumulicola* Small; *Opuntia vulgaris* auct. non Mill.; *Opuntia mesacantha* Raf.
Common Names:	Eastern Prickly Pear Cactus, Devil's-tongue, Spreading Prickly Pear, Compressed Cactus; oponce de l'Est
Family:	Cactaceae (cactus family)
Major plant group:	Eudicot flowering plant

Opuntia humifusa (Raf.) Raf. is the accepted scientific name as listed in the Integrated Taxonomic Information System (ITIS 2008). Three varieties are recognized but only *O. humifusa* var. *humifusa* occurs in Canada.

Morphological description

The species is a low, spreading, succulent cactus with jointed, roundish but flattened green stems. The stems are sparsely covered with clusters of barbed bristles and spines. Large, waxy, yellow flowers, at times with orangey-yellow or reddish centres, appear in June. The edible fruit are oblong and turn brownish-red when mature. *Opuntia humifusa* occurs as small patches or large scattered colonies of thousands of stems (Figure 1).

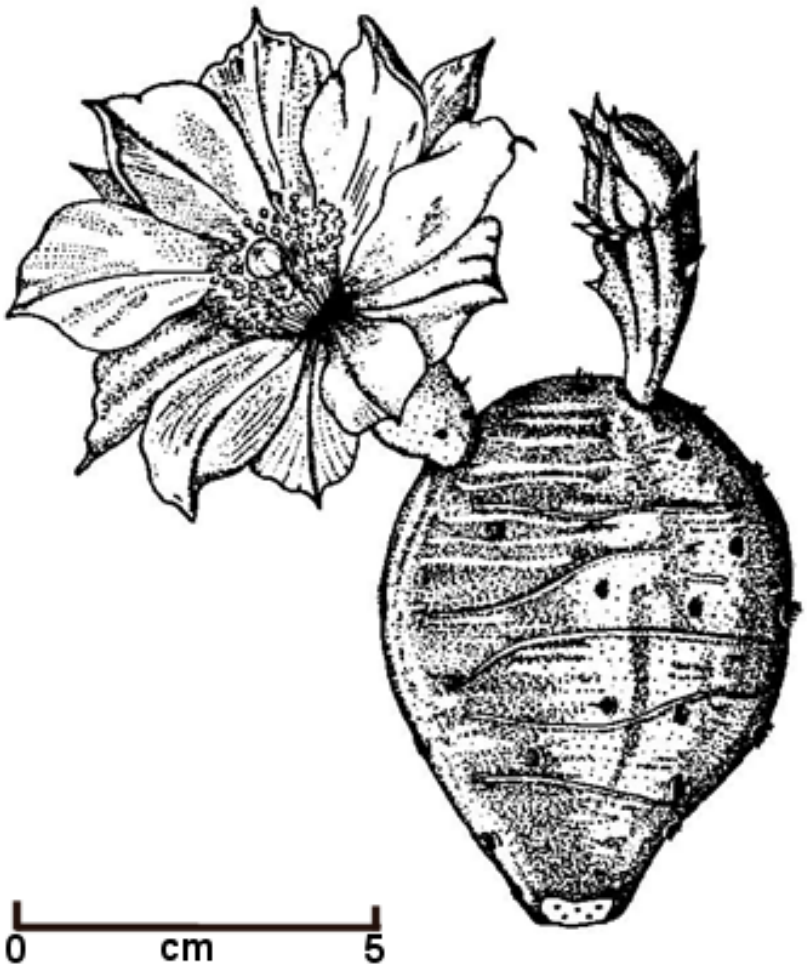

Figure 1. Line drawing of Eastern Prickly Pear Cactus. Reprinted with permission from The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada (Volume 2), copyright 1952. The New York Botanical Garden.

Spatial population structure and variability

There are two naturally occurring populations of *O. humifusa* in Canada. Two populations have been proposed for Point Pelee National Park based on initial genetic studies, but are not recognized as distinct in this report and one occurs on Pelee Island at Fish Point Provincial Nature Reserve. The Pelee Island population is isolated from the mainland populations.

In recent years, several investigators have attempted to describe the genetic relationships among Canadian populations of *O. humifusa*. In 1998, Swain performed allozyme analyses on specimens collected from Point Pelee and determined that there was little genetic variation expressed within the population. It was hypothesized that Point Pelee supported a single population comprised of one to several individuals. Subsequent investigations by Lovett-Doust e*t al*. (2003) re-examined the Point Pelee population by applying DNA fingerprinting technology based on Amplified Fragment

Length Polymorphism (AFLP) to 60 samples collected from Point Pelee National Park. Analysis of the samples identified two distinct categories based on genetic similarity. Distribution mapping of the samples revealed that one category corresponded with samples collected along the western portions of Point Pelee National Park in the coastal dune habitats while the other category corresponded with samples collected further inland in abandoned farmland. The findings of the Lovett-Doust e*t al*. (2003) study, suggest genetic variability of *O. humifusa* at Point Pelee National Park is greater than was previously believed and that there are likely two populations consisting of hundreds of individuals.

The coastal and inland plants at Point Pelee National Park are generally separated by a road and woodland/savannah habitats that traverse the park in a north-south orientation. On average, these mainland populations are separated by a distance of 200 m. The road and woodland/savannah habitats form strips of land that were considered to function as a barrier to certain pollinators (Lovett-Doust, pers. comm. 2009).

It is the view of the Vascular Plants Subcommittee (COSEWIC), however, supported by an independent COSEWIC member reviewer, that the preliminary genetic study by Lovett-Doust *et al*. (2003) is not sufficiently robust to distinguish with certainty two populations in Point Pelee National Park. It is also doubtful that a separation of only 200 m would prevent bee pollinators from moving between the coastal and interior plants.

Hybrids of *O. humifusa* are known to occur, where the species is sympatric with other *Opuntia* species (Benson 1982). In Ontario, populations of *O. humifusa* are isolated and do not overlap with other species, so there is limited potential for hybridization of wild populations.

Designatable units

Considering the very limited extent of occurrence of the two populations and their presence within a single COSEWIC ecological area (Great Lakes Plains), a single designatable unit is recognized.

DISTRIBUTION

Global range

Opuntia humifusa is widely distributed across North America. In Canada, *O. humifusa* is confined to Ontario; however, in the United States its range extends from New England in the east to South Dakota and Nebraska in the west, and south to Texas and Florida. The species is more abundant and common in the southern parts of its range (Figure 2).

Figure 2. North American distribution of *O. humifusa.* The arrows point to outliers in the species' range. (Source: Pinkava, D.J. Opuntia. In: Flora of North America, 1993+. Vol. 4; modified to include portions of range known from northwestern Ohio.)

It has been suggested that *O. humifusa* was introduced into northern Ohio by Native Americans (Moseley 1931). One occurrence of the species is at a long-term First Nation campsite east of Bowling Green and another at a second site near Sandusky where First Nation artifacts are found (Abella and Jaeger 2004). The species is known to be used by Native Americans for medicinal purposes and food (Moerman 1988), and it is also known that Native Americans played a significant role in long-distance plant dispersal during the late Holocene (MacDougall 2003). In spite of such information, there is still uncertainty as to the origins of these northern Ohio populations (Abella and Jaeger 2004). The species is treated as native to the state (NatureServe 2008). No information is available on the species' possible introduction into Ontario by First Nations.

Canadian range

Canadian populations of *O. humifusa* are restricted to southwestern Ontario. Naturally occurring populations occur at Point Pelee and on Pelee Island in Lake Erie. Historically, the Canadian range of *O. humifusa* may have been slightly broader. There are a number of unconfirmed records: one from the former Kent County (now the Municipality of Chatham-Kent) as well as from Elgin and Norfolk counties (Klinkenberg and Klinkenberg 1985). The species was first reported in Canada from Long Point, Norfolk County by Macoun in 1883 and was noted there by G. Backus as recently as the 1950s (J. Robinson pers. comm. 2005).

Determination of the historic range of *O. humifusa* populations in Canada is complicated by the fact that the species has been transplanted to several natural areas as well as gardens primarily along the north shore of Lake Erie. Specimens from natural populations, as well as those of unknown provenance obtained through the horticultural trade, are known to have been planted at Pelee Island, Rondeau, Long Point, Turkey Point and other locations. In some cases, planted specimens have become naturalized making it difficult to confirm naturally occurring populations. This cactus has also been planted in gardens considerably north of its natural occurrence where it tolerates climatic conditions more severe than in its native range.

Opuntia humifusa was thought to occur naturally at two cemetery sites in the Municipality of Chatham-Kent (the extirpated Harwich and extant Howard Township) (Klinkenberg and Klinkenberg 1985); however, it was later confirmed that these occurrences were transplanted from the naturally occurring Point Pelee populations (P.A. Woodliffe pers. comm. 2002). It is questionable whether such inland populations are actually within the limits of this species' range in Ontario and are thus excluded for assessment purposes. The origin of a roadside population in Chatham-Kent continues to remain unknown and its occurrence along a roadside, an unusual and inland location for this cactus, precludes its recognition for assessment purposes. Populations at Turkey Point and Rondeau have also been confirmed as introductions (P. Carson pers. comm. 2003). The Turkey Point Provincial Park plants were first noted in 1986 at which time there was clear evidence of recent planting; however, the origin and provenance of the plants remain unknown. The Rondeau population is apparently increasing in size (Dobbyn pers. comm. 2010) and was believed to have originated from the naturally occurring Pelee Island population (P.A. Woodliffe pers. comm. 2005). However, there is no historic record of the species occurring within the park, and, as well, there is presently a question as to whether some further introductions have been made more recently with plants of unknown provenance (Dobbyn pers. comm. 2010). Based on this uncertainty, the introduced Rondeau population is excluded for assessment purposes. A summary of the current status of populations that are extant, extirpated and of unconfirmed origin or ineligibility for status assessment is presented in Table 1.

Table 1. List of Extant and Extirpated Populations of *Opuntia humifusa.*

Population / Site Name	Location	Origin	Status
Fish Point Provincial Nature Reserve	Pelee Island, Essex County	Native	Extant
Point Pelee National Park – Dune Population	Point Pelee National Park, Essex County	Native	Extant
Point Pelee National Park – Inland Population	Point Pelee National Park, Essex County	Native	Extant
Cedar Beach	Colchester South Township, Essex County	Unknown (no voucher) Source: Lake Erie Sand Spit Recovery Team 2005	Extirpated
Chatham-Kent Roadside	Municipality of Chatham-Kent	Unknown (P.A. Woodliffe pers. comm. 2005)	Extant
Rondeau Provincial Park	Municipality of Chatham-Kent	Believed to be introduced from Fish Point Provincial Nature Reserve (P.A. Woodliffe pers. comm. 2003)	Extant
Harwich Township Cemetery	Harwich Township, Municipality of Chatham-Kent	Introduced from Point Pelee National Park (White 1998)	Extirpated
Howard Township Cemetery	Howard Township, Municipality of Chatham-Kent	Introduced from Point Pelee National Park (White 1998)	Extant
Bradley's Marsh	Dover Township, Municipality of Chatham-Kent	Confirmed Voucher: D.Young 1948 (TRT) Source: ARVPO database at the Peterborough NHIC	Extirpated
West of Port Stanley	Elgin County	Unknown (no voucher) Source: Lake Erie Sand Spit Recovery Team 2005	Extirpated
Long Point	Norfolk County	Unknown (Macoun 1883 -1890, no voucher)	Extirpated
Turkey Point	Norfolk County	Introduced from an unknown location (P. Carson pers. comm. 2003)	Extant
Ruscom Shores Conservation Area	Essex County	Unknown (P.A. Woodliffe pers. comm. 2005)	Extirpated

In Canada, there are presently seven extant populations of *O. humifusa*, but only two are recognized for status assessment as representing naturally occurring populations (Figure 3). Collectively the naturally occurring populations have an extent of occurrence (EO) of approximately 63 km^2. The index of area of occupancy (IAO) of the native populations is 9 km^2 (using a 1 x 1 km grid) and 16 km^2 (using a 2 x 2 km grid). The biological area of occupancy (the actual area occupied by the plants) is approximately 1063 m^2. Refer to Appendix 1 for details of calculation of biological area of occupancy.

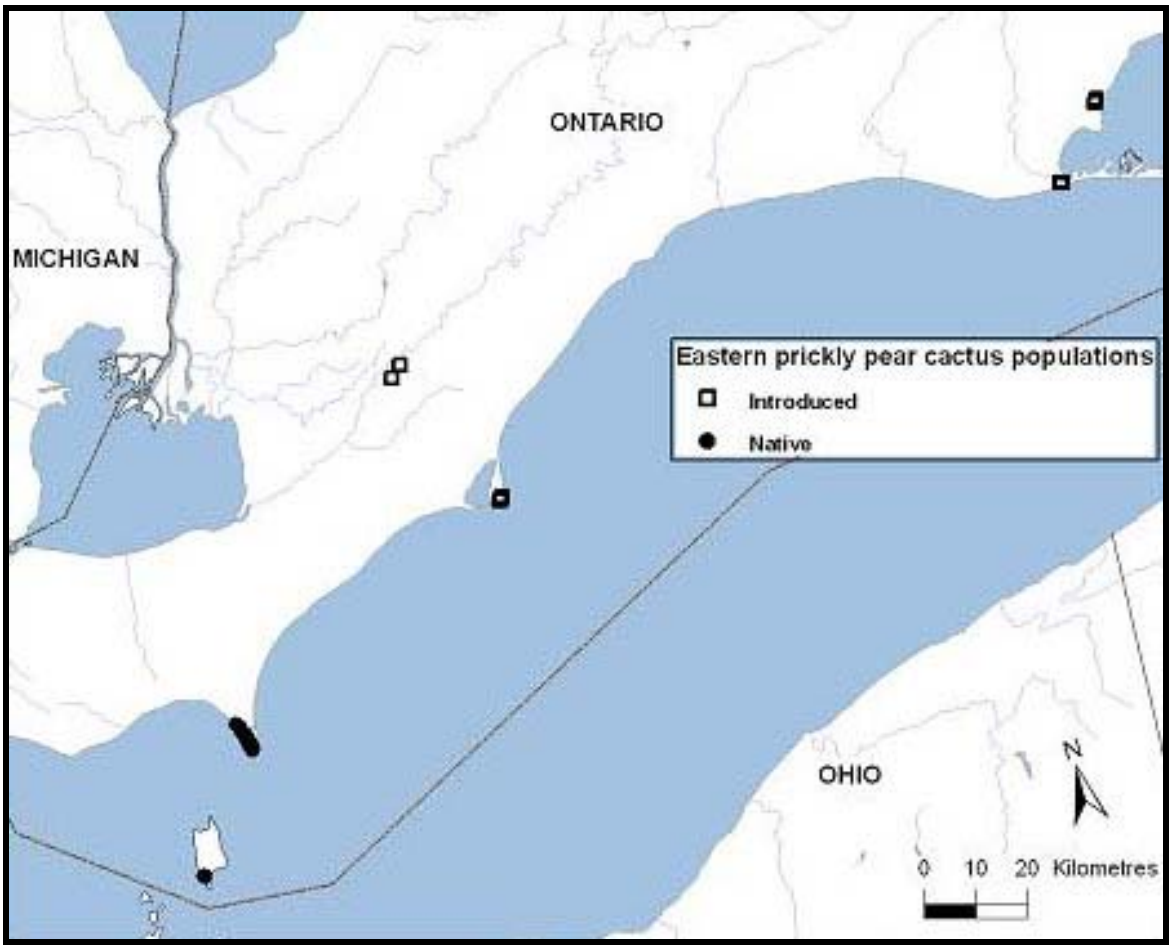

Figure 3. Distribution of extant populations of *O. humifusa* in Canada. The native Point Pelee population covers a more extensive area than any other extant native or introduced populations. (Map provided by A. Filion, Canadian Wildlife Service.)

The main population on Point Pelee is separated from the Fish Point population on Pelee Island by a distance of about 25 km of open water with little exchange likely through natural movement of propagules. Clearly both populations have been extant over a long period of time with plants reproducing both sexually and asexually. However, the continued viability of the Fish Point population, consisting of a small number of plants, is in question. The populations are not considered to be severely fragmented, as defined by COSEWIC/IUCN, because the majority of plants occur in a large viable population that also occupies most of the species' area of occupancy.

HABITAT

Habitat requirements

Across its North American range, *O. humifusa* occupies a wide variety of habitats, although in Canada it is generally associated with dry, open, sandy environments (VanDerWal *et al*. 2007b). In the northeastern United States, *O. humifusa* also occurs on sand dunes as well as in open woodlands and open sandy ridges. *Opuntia humifusa* is generally shade-intolerant but can persist in semi-closed habitats. In addition to the above habitats, populations have been noted in the prairie and deciduous forest regions (Fernald 1950, Whitehead 1995a, Whitehead 1995b), disturbed Pine / Oak woodlands (North Carolina) and climax Sand Sage (*Artemisia filifolia*) communities (northeastern Colorado), where it is probably a relict, and even on New Jersey granite outcrops (VanDerWal *et al*. 2007b).

Around the Great Lakes, *O. humifusa* has been found growing in open oak savannas, cemeteries on sandy substrates, anthropogenic limestone barrens (around Chicago, Illinois), and open oak woods, sand plains and open fields (near Sandusky, Ohio) (VanDerWal *et al*. 2007b). On western Lake Michigan shores, it is found in late seral, shrub-populated dunes while on the young dunes of southern Lake Michigan, it colonizes early seral stages like Beachgrass-Prairie Sandreed (*Calamovilfa longifolia*) communities. In southwestern Michigan, it is also an active colonizer of sandy fields (A.A. Reznicek pers. comm. 2006).

In Canada, natural populations of *O. humifusa* are restricted to dry, sandy habitats, typically associated with dune landforms in close proximity to the Lake Erie shoreline (Reznicek 1982, Klinkenberg and Klinkenberg 1984, Chiarot 1992). The climate is moderated year-round by the Great Lakes (Whitehead 1995a, Whitehead 1995b). Its habitat in Canada is believed to correspond roughly with the limits of the Lake Erie Sand Spit Savannas, which include Point Pelee, where the species can also persist in some later successional habitats such as thicket, woodland and forest (J. Keitel pers. comm. 2006 and 2007).

The Pelee Island population of *O. humifusa* at Fish Point Provincial Nature Reserve is associated primarily with Red Cedar Treed Sand Dune habitat; however, a single individual was recently observed within a Dry-Fresh Hackberry Deciduous Forest several hundred metres beyond the main population (Dobbyn & Hoare 2009).

At Point Pelee, plants of *O. humifusa* distributed along the western side of the sand spit are associated with Little Bluestem–Switchgrass–Beachgrass Open Graminoid Sand Dune, Hoptree Shrub Sand Dune and Red Cedar Treed Sand Dune vegetation types. Plants situated further inland on the sand spit, are associated with Dry–Fresh Red Cedar Coniferous Woodland, Dry Sand Dropseed Open Sand Barrens and former farmlands that have succeeded to Canada Bluegrass Graminoid Meadow and Dry–Fresh Mixed Meadow habitat (Lovett-Doust *et al*. 2003, Dougan & Associates 2007, J. Keitel pers. comm. 2006 and 2007).

VanDerWal *et al*. (2003) and Lovett-Doust and Levi (2003) investigated the success of transplanting *O. humifusa* seedlings to different habitat types at Point Pelee National Park to determine environmental factors limiting growth and survivorship. It was determined that there was a positive correlation with open successional habitats. As these habitats become more closed, *O. humifusa* is excluded by perennial vegetation. At that point, new individuals may disperse to, and establish in what is now back beach as that substrate becomes more stable (VanDerWal *et al*. 2003).

Habitat trends

The habitat for Canadian populations of *O. humifusa* are experiencing significant and ongoing decline. At Point Pelee, suitable habitat is being lost to succession by woody vegetation, especially in Red Cedar savannah in the central portion of the park and a decrease in the rate of shoreline accretion necessary for replenishing the sand spit and creating new habitat for colonization. At Pelee Island, suitable habitat has also been lost due to succession by woody vegetation and erosion of the shoreline. These trends have been observed and documented Maycock (1978), Landplan Collaborative (1990), Geomatics (1992), Kraus (1992), Geomatics (1994), Falkenberg (2000), Smith and Bishop (2002) and North-South Environmental Inc. (2003).

Smith and Bishop (2002) estimate that between 1931 and 2000, approximately 127 ha of Red Cedar Savanna habitat at Point Pelee was lost due to vegetation succession and an additional 4.0 ha was lost to erosion. During the same period, over 50 ha of Red Cedar Savanna became established on old fields and newly stabilized dunes. Dougan & Associates (2005) estimated that habitat for *O. humifusa* at Point Pelee declined from 148 ha in 1931 to 49 ha in 2002.

Although no data are presently available on habitat trends affecting the Pelee Island population, the Open Dune and Red Cedar Savanna habitats that support *O. humifusa* at Fish Point Provincial Nature Reserve have also been noted to be declining as a result of vegetation succession, particularly shrub and low tree growth and shoreline erosion (Kamstra *et al*. 1995).

Habitat protection/ownership

Naturally occurring populations of *O. humifusa* in Canada occur entirely within protected areas. On Point Pelee, plants occur within Point Pelee National Park and are managed by Parks Canada Agency. The Pelee Island population occurs in Fish Point Provincial Nature Reserve and is managed by Ontario Parks. The introduced population at Rondeau Provincial Park, is also managed by Ontario Parks. Much of the potential habitat available for recovery of *O. humifusa* is also contained within Point Pelee National Park and Fish Point Provincial Nature Reserve. These sites are afforded a high level of legislative protection through federal and provincial regulations (*Canada National Parks Act*, 2008; the federal *Species at Risk Act* (SARA), 2002; provincial *Parks and Conservation Reserves Act*, 2006; Ontario's *Endangered Species Act*, 2007).

BIOLOGY

Life cycle and reproduction

The species is a perennial that produces yellow-coloured flowers along the margins of mature joints. Flowering time typically occurs between June and August in Ontario populations. The flowers are waxy, sometimes with red centres and have numerous stamens surrounding a central style. The edible fruit are 3-5 cm long, oblong and change in colour from green to brownish-red as they mature (Klinkenberg and Klinkenberg 1984).

Canadian populations, occurring near the northern limit of the species' range, require between six and eight years to mature and flower from seed, although transplants at Rondeau Provincial Park flowered (a few pads) in about their third year (P.A. Woodliffe pers. comm. 2005). Another transplant of a mature pad taken from an introduced population at Turkey Point in 1990 and planted in a hot southwest-facing residential garden in Walsingham, Ontario, produced a single flower in 1991 and flowered as well in 1992 and 1993 (D.A. Sutherland pers. comm. 2010). Individual plants can have a longevity of decades with a generation time in Ontario likely being much greater than eight years and perhaps more in the order of 10-20 years, although no published information confirms this. In contrast, populations in the southern U.S. can flower and set seed by the end of the second year of growth (Conover and Geiger 1989 as cited in VanDerWal and Lovett-Doust 2003.

Reproduction of *O. humifusa* occurs sexually from seeds as well as asexually via layering (when pads or cladodes attached to the parent plant become rooted into the soil), detached stem segments taking root and/or sprouting occurring from the stem base when the above-ground portion of the plant is destroyed (FEIS 2006).

Cross-pollination is required to produce viable seed (Kevan and Aiello 2001) with pollination from multiple insect pollinators producing the highest quantities of seed with the greatest viability (Kevan and Aiello 2001). Bumblebees (*Bombus* spp.) appear to be the primary pollinators, but flowers were also visited by three leaf-cutting bees (*Megachile frigida*, *M. latimanus* and *M. texana*) and one other bee species (*Agapostemon splendens*) (Kevan and Aiello 2002).

Seed germination and seedling growth have been noted to be slow in Canadian populations of this species (Jock 1984, VanDerWal *et al*. 2007b). This is likely attributable to the slow metabolism of this species that is related to its drought-tolerance (Jock 1984).

Herbivory

There is evidence that birds and mammals play a role in dispersing *O. humifusa* fruit (Kevan *et al*. 2004); however, the extent of herbivory and its impact on Canadian populations is unknown. A potential threat may come from the Cactus Moth (*Cactoblastis cactorum*) (Lepidoptera: Pyralidae), a South American species native to Argentina, Paraguay, Uruguay and southern Brazil. This moth uses *Opuntia* species as its host plant, with females laying three to four eggsticks each consisting of 50 to 90 stacked eggs. Upon hatching, the larvae burrow into cactus pads where they feed and grow for two to four months, depending on the season. The larvae from one eggstick can eat the interior of the equivalent of four cactus pads, leaving only the outer layer or epidermis intact. The resulting wounds also provide access for secondary pathogens like fungi and bacteria (Martin 2005). The effects are often fatal (Zimmermann *et al*. 2000). In temperate regions, Cactus Moth is capable of completing two to three generations per year (Martin 2005).

In recent years, Cactus Moth has appeared in Florida where it is impacting local populations of native *Opuntia* species, including *O. humifusa* (Kaczor 2003). Since 2000, the *C. cactorum* has been expanding its range at approximately 160 km / year (Kaczor 2003). While it has not been detected in Canada, there is a risk for introductions of this pest through importation of horticultural Prickly Pear Cactus species. Although the climatic tolerances of this moth are not known, the Canada Food Inspection Agency has indicated that it is not concerned with it coming to Canada as they doubt that this tropically adapted moth would be able to survive in the harsh winter climate of Canada (B. Gill, pers. comm. 2005).

Physiology

Opuntia humifusa can survive across a wide range of environmental conditions (VanDerWal *et al*. 2007b). In droughty and nutrient-limited environments, more biomass is allocated to the root system for the uptake of these resources and, in light-restricted environments, more resources may be allocated to leaf or stem tissue production to capture available light for photosynthesis (VanDerWal *et al*. 2007b). Cladode form, structure and function have also been shown to differ under various light conditions. Seedlings grown under full light conditions at Point Pelee National Park developed pads that were thick and circular to ovate in shape while those grown under forest canopy cover were elongated. Such plasticity is thought to enable species to better succeed in a wide variety of environments and cope with disturbance (VanDerWal *et al*. 2007b). In addition, *O. humifusa* is winter hardy, surviving freezing conditions by producing its own anti-freeze solutes in the cytoplasm (Kraus 1991).

However, *O. humifusa* is a facultative, early seral species that needs direct sunlight to survive (Chairot 1992). With shading, photosynthesis becomes limited, fecundity and vigour decrease, cladodes become less spiny and the plants are more susceptible to disease and other environmental stressors (Canadian Parks Service 1991, VanDerWal *et al*. 2007b). Dieback and subsequent loss of this shade-intolerant species will

eventually occur in climax communities as it becomes shaded and then replaced by mid- to late-successional species competing for the light and nutrient resources. This was quite apparent in a seedling survival experiment conducted in forested Point Pelee National Park plots, where only 3.9 to 4.4 percent of seedlings remained alive after two years (VanDerWal *et al*. 2007b). Light readings taken at 60 sites showed that the cactus requires more than 30 percent light at ground level in order to survive and that plants growing in higher light conditions achieved greater productivity in terms of cladode growth, flower production and vigour (Ross 1971). Researchers from the University of Windsor more recently determined that 50 to 70 percent lighting is optimal for growth while full light resulted in rapid drying of the sandy soils, contributing to reduced vigour.

Growth in tight clusters with overlapping cladodes may have the effect of sheltering seedlings from overexposure to intense light and heat conditions during their early development (VanDerWal *et al*. 2007b). The large plants in such clusters are sometimes known as “nurse plants”. Seedling survival was found to be greatest (91 to 94%) in the primary and secondary successional habitats where the cactus already grows naturally. It has also been suggested that seed germination may only occur during the high temperatures of the summer months (Benson 1982).

Opuntia humifusa is highly drought tolerant and has low nutrient requirements. VanDerWal *et al*. (2007b), however, found that nutrients were beneficial if lighting conditions were appropriate, with the greatest increase in biomass and cladode numbers experimentally generated under conditions of 70% lighting and high (8x) nutrient availability. Nutrient uptake is believed to be directly proportional to the size of each cactus (VanDerWal *et al*. 2007b). Based on these findings, these researchers felt that cactus growth in the habitats that it currently occupies in Canada is macronutrient-limited.

Living in dynamic coastal environments, *O. humifusa* tolerates some degree of sand burial and, in fact, requires such disturbance to maintain the habitats in which it thrives. Some sand accretion may be beneficial in that it likely promotes vegetative propagation. However, excessive burial in nearshore areas leads to chlorotic basal shoots, significantly reduced growth and low seedling survival (VanDerWal *et al*. 2007b). In addition, both of the naturally occurring populations at Point Pelee have experienced losses or near losses of cactus microsites as a result of severe storm events (VanDerWal *et al*. 2007b). Litter burial may also constrain recruitment in old-field succession (VanDerWal *et al*. 2007b).

Dispersal

Mammals and birds are known to forage on the fruits and disperse the heavy seeds of *O. humifusa*. Evidence of potential fruit dispersers, including small mammals (rodents), Eastern Cottontail (*Sylvilagus floridanus*), Striped Skunk (*Mephitis mephitis*), Raccoon (*Procyon lotor*), Red Fox (*Vulpes vulpes*) and White-tailed Deer (*Odocoileus virginianus*), has been found in the vicinity of the cacti at Point Pelee National Park (Kevan *et al*. 2004). Seeds were extracted from chicken feces, then vernalized (kept at

low temperature) and tested for germinability (as a surrogate for possible seed dispersal agents such as Wild Turkey (*Meleagris gallopavo*) and Northern Bobwhite (*Colinus virginianus*)); cactus seeds were also extracted from deer feces collected in Point Pelee National Park and tested for germinability. Germination rates were too low to ascribe any effects of treatment and no seeds from any fecal extractions germinated (Kevan *et al*. 2004). Seed germination rates are low for *Opuntia* species in general, although laboratory tests suggest that *O. humifusa* seeds collected from rabbit pellets germinated more often than those collected from unconsumed fruit (FEIS 2006). This has been corroborated by Evans *et al*. (2005) who found that seeds retrieved from Eastern Cottontail pellets were highly germinable.

Interspecific interactions

Although Canadian populations of *O. humifusa* reproduce primarily by vegetative means, sexual reproduction is necessary to maintain population viability. Pollination by insects is required to produce viable seed. Bumblebees (*Bombus* spp.) represent key pollinators for Canadian populations of *O. humifusa* (Kevan and Aiello 2002). *Opuntia humifusa* may exhibit other interspecific interactions such as insect parasitism in cacti fruits as has been suggested by Klinkenberg and Klinkenberg (1984); however, such relationships remain poorly understood. There is evidence suggesting small mammals and birds may play a role in dispersing fruit and seed.

Adaptability

Opuntia humifusa is well adapted to the environmental conditions within its Canadian range. In droughty and nutrient-limited environments, it allocates more resources to development of root systems to increase uptake of these limited resources. In shady environments, more resources may be allocated to leaf or stem tissue production to capture available light for photosynthesis. As well as being adapted to water and nutrient stress, *O. humifusa* is winter hardy, surviving freezing conditions by producing its own anti-freeze solutes in the cytoplasm (Kraus 1991).

Germination and growth has been noted as relatively slow for this species (Jock 1984, VanDerWal *et al*. 2007b). Seed germination has been found to be successful in artificial propagation experiments in which hand cross-pollination was used. Experimental transplantation of seedlings to four habitats at Point Pelee National Park confirmed that light levels were the limiting factor for seedling survivorship (VanDerWal and Lovett-Doust 2003).

POPULATION SIZES AND TRENDS

Search effort

In 2008, Point Pelee and Pelee Island were visited to confirm the presence of *O. humifusa* populations and estimate their size and extent. Estimates of population size were based on the methodology developed by Lovett-Doust *et al*. (pers. comm. 2009) for use in monitoring populations at Point Pelee. Because of the growth habit of *O. humifusa* and its tendency to cluster, it is difficult of accurately identify the number of individuals associated with a population. Lovett-Doust *et al*. (pers. comm. 2009) studied a number of patches to determine whether unconnected "plants" (physically separate structures) were the broken up pieces of one original individual, or were in fact an original plant. Through sampling, it was discovered that many "patches" were comprised of multiple genets (individuals). Patches or microsites contained a mean of six genets. Based on the preliminary population data, microsites were defined as clusters of cladodes separated from other similar clusters by distances of greater than 1.0 m.

The extent and number of plants on Point Pelee were documented by using the site data of known microsites provided by Parks Canada. To facilitate the systematic verification of *O. humifusa*, the western shoreline plants and interior plants were subdivided into 12 compartments. The coordinates of microsites within each compartment were recorded using GPS. Microsites and habitat conditions were photo-documented within each compartment. *Opuntia humifusa* was confirmed within each of the 12 compartments surveyed. Three previously undocumented microsites were also documented from the western shoreline plants during the study. A similar methodology was applied to confirm the Pelee Island population.

Additionally, Ontario Parks regularly monitors the existing population of *O. humifusa* at Fish Point Provincial Nature Reserve and has made extensive searches of the Red Cedar Treed Sand Dune community and adjacent communities with appropriate habitat. In 2009, a survey located a previously undocumented individual from the Dry-Fresh Hackberry Deciduous Forest Community several hundred metres north of the main population (S. Dobbyn pers. Comm. 2009).

Abundance

It has previously been estimated that the populations at Point Pelee contain 2070 naturally established genets based on the methodology then employed (L. Lovett-Doust pers. comm. 2005). Given the location data provided by Parks Canada and the data collected in 2008, it is now estimated that the plants in Point Pelee National Park contain 2418 naturally established genets. Of the 2418 estimated genets, 1266 occur along the western shoreline and 1152 in the interior of Point Pelee. The Pelee Island population at the Fish Point Provincial Nature Reserve supports a total of nine microsites with an average of three genets per microsite, comprising a total of 27 genets in 2009 (S. Dobbyn pers. comm. 2009).

Fluctuations and trends

Opuntia humifusa populations have been periodically monitored at Point Pelee by Ross (1971), Jock (1984), Chiarot (1992), Whitehead (1995b), Lovett-Doust and Levi (2003) and VanDerWal *et al*. (2003). Population trends; however, cannot be accurately estimated due to the variability in the sampling methodologies. Conducting an accurate census of the number of individuals (genets) within each population has been hampered by the species' clump-forming growth habit where the stems of tightly spaced individuals overlap making it difficult to visually estimate the number of individuals within a patch. As a consequence the actual number of mature individuals as defined by IUCN/COSEWIC (units reproducing sexually and/or asexually) cannot be determined based on the available information since the number of ramets that also reproduce asexually is unknown. In 2003, a new inventory method was developed and applied to documenting the Point Pelee plants to facilitate consistent size estimates of the western shoreline plants and the interior plants and to facilitate comparative analyses of trends within these areas as part of future monitoring efforts.

Although population trends cannot be readily determined directly based on changes in actual counts of plants, indirect inferences can be made based on the amount of cactus habitat lost at Point Pelee over a number of decades. Based on data in Dougan & Associates (2005), about 66% of *O. humifusa* habitat was lost between 1931-2002 (from 148 ha to 49 ha) at this the larger of the two populations containing about 98% of the total number of plants. Much of the loss likely occurred several decades ago; nevertheless, there must have been a substantial loss over the course of the last three generations. The actual percent loss of mature individuals cannot be determined with certainty due to lack of adequate information on such factors as actual generation time, constancy of habitat decline rate and natural mortality verses recruitment rates.

There is also some anecdotal evidence suggesting that the size of the Point Pelee population has declined due to construction-related activities within Point Pelee National Park in the 1960s (O'Neill 2000, B. Stephenson pers. comm. 2002, A.A. Reznicek pers. comm. 2006), as well as habitat loss resulting from shoreline erosion and vegetation succession (Klinkenberg and Klinkenberg 1984). Impacts to the population, in some instances, were partially offset by Park staff and/or others who relocated patches to other sites, both within and external to the Park, prior to infrastructure improvements (B. Stephenson pers. comm. 2002, G. Allen pers. comm. 2005).

Although successive surveys of *O. humifusa* have recorded greater numbers of patches, this can be attributed to greater survey efforts in areas where the species may have previously been undetected (VanDerWal *et al*. 2007a).

Further confounding the determination of population trends is the difficulty in identifying individuals or genets, due to the tightly clustered growth habit of this species and inconsistencies in methods used by multiple surveyors. With the recent adoption of the methodology proposed by (Lovett-Doust *et al*. 2003) by Parks Canada, it is now possible to perform standardized monitoring which should provide more informative data on population trends.

The discovery in 2008 of a Long Point population by Canadian Wildlife Service staff does not represent the historic population reported in 1883 by Macoun for the area. This recent discovery is known to represent a recent planting (NatureServe 2010).

Rescue effect

Opuntia humifusa is widespread throughout the United States, occurring in 35 states. Its global heritage status rank is G5 (NatureServe 2008). While it is not ranked in most states, it is considered Critically Imperiled (S1) in Wisconsin, Massachusetts and Rhode Island and Vulnerable (S3) in Iowa, Ohio, Pennsylvania and Connecticut.

Considering the distances between the Canadian populations at Fish Point or Point Pelee from the nearest populations in the United States, about 40-60 km respectively over the waters of Lake Erie, it is unlikely that these populations interact naturally. Any interactions would likely be the result of horticultural introductions from the United States. Given the Critically Imperiled (S1) and Vulnerable (S3) status of the species in the northern United States, it is unlikely that these populations could function as a source population for Canada.

LIMITING FACTORS AND THREATS

Limiting factors

The main limiting factor for *O. humifusa* within its natural range in Ontario is its requirement for dry, sandy, open habitats. In southwestern Ontario, such habitats correspond with the Lake Erie sand spits where competing interests for development, recreation and management of other species at risk can overlap. Additional limiting factors include slow seed germination and seedling growth, shade-intolerance, and loss of plants due to burial in nearshore areas.

Loss and degradation of suitable habitat represents the most imminent threat to *O. humifusa*. Habitat for this species has been lost due to vegetation succession and shoreline erosion. Suppression of natural disturbances and interference with sediment transport dynamics along the Lake Erie shoreline has contributed to the loss of suitable habitat on the sand spits. Human disturbances from hiking and bird watching are also a potential threat to this species, as these activities can result in inadvertent trampling of plants (Parks Canada Agency 2003).

The collection of whole specimens, representing genetically unique individuals, and / or their parts for horticultural purposes has in the past posed a threat to native Canadian populations at both sites and particularly at Fish Point Provincial Nature Reserve (Canadian Parks Service 1991, COSEWIC 2000). Reznicek (1982) mentions that “several holes, obviously marking places where plants were removed” were observed in 1981 at Fish Point. However, there appears to have been little if any digging up of clumps at this site since that observation nearly 30 years ago (P.A. Woodliffe pers. comm. 2010). The showy flowers, ease of collection, and establishment and low maintenance requirements of the *O. humifusa* make it a prized garden species. This threat is directly related to public awareness and the need for increased availability of information on this species’ rarity and restricted distribution in Ontario, as well as the proliferation of gardening as a hobby. To date, no evidence of collection for purposes beyond use as a novelty garden specimen has been noted from the Canadian populations. This cactus is now also readily available in garden centres.

Owing to the relatively small area over which this native cactus is distributed, the two native populations may be particularly vulnerable to extinction events (VanDerWal *et al*. 2007b). Local nurseries import *O. humifusa* var*. humifusa* and other varieties of *O. humifusa* from across North America. If horticultural specimens are planted in areas immediately adjacent to the native populations, cross-pollination could result in genetic swamping.

A potential, but likely low, future threat to Canadian populations of *O. humifusa* may come from the Cactus Moth, a native of Argentina, Paraguay, Uruguay and southern Brazil. For details of this threat see section on Herbivory.

Locations based on threat

The two populations at Point Pelee and Fish Point represent two distinct locations. They are separated spatially and are at risk from habitat loss and/or degradation. The main threat to the Point Pelee National Park population is loss of habitat through vegetational succession as a consequence of the suppression of natural disturbances. The loss of shoreline sand spit habitat due to disruption of sediment transport along Lake Erie has also been ongoing at Point Pelee. At the Fish Point site on Pelee Island, shoreline erosion of the habitat adjacent to the very small population has already occurred and is likely the main threat. Erosion is anticipated to increase with storm surges of increased frequency and intensity due to climate change. The loss of this small population is potentially more imminent due to stochastic events than the more gradual loss of habitat at the Point Pelee location.

SPECIAL SIGNIFICANCE OF THE SPECIES

Canadian populations of *O. humifusa* occur near the northern limit of the species' North American range. *Opuntia humifusa* is one of only two species of cactus known to occur naturally in Ontario. The ecological significance of Canadian populations is limited due to the localized area of influence. However, in the central portion of its range, the species is recognized for its soil stabilization properties and food source for wildlife.

The species is of cultural significance due to its long history of use by Native Americans for medicinal purposes (Gilmore 1919). The pads and fruits are also used as a source of food (Elias and Dykeman 1982). Interestingly, researchers are currently evaluating the anti-inflammatory properties of this species (Cho *et al*. 2006).

In Canada, the species also represents an important cultural symbol synonymous with the warm climate and low latitude of southwestern Ontario.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Naturally occurring Canadian populations of *O. humifusa* are presently contained entirely within protected areas: Point Pelee National Park, managed by Parks Canada Agency, and Fish Point Provincial Nature Reserve, managed by Ontario Parks. COSEWIC assessed this species in May 2000 as Endangered and currently, this species is listed in Canada as Endangered on Schedule 1 of the federal *Species at Risk Act*.

Opuntia humifusa and its habitat at the two (or three) naturally occurring populations receive protection under federal and provincial legislation protecting including the *Canada National Parks Act*, 2008, Canadian *Species at Risk Act*, 2002, Ontario *Endangered Species Act*, 2007, *Provincial Parks and Conservation Reserves Act*, 2006 as well as other statutes and policies.

Opuntia humifusa is not listed internationally under the IUCN Red List of Threatened Species (IUCN 2009) or the U.S. *Endangered Species Act* (1973). The entire cactus family is; however, listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2009).

Its global heritage status (G) rank is G5 and its national status (N) rank is N5 in the United States and N1 in Canada (NatureServe 2008). Its state (S) ranks for the 35 states are: Alabama (SNR), Arkansas (SNR), Connecticut (S3), Delaware (SNR), Florida (SNR), Georgia (SNR), Illinois (SNR), Indiana (SNR), Iowa (S3), Kansas (SNR), Kentucky (SNR), Louisiana (SNR), Maryland (SNR), Massachusetts (S1), Michigan (SNR), Minnesota (SNR), Mississippi (SNR), Missouri (SNR), Montana (SNR), New Jersey (SNR), New Mexico (SNR), New York (S4), North Carolina (S5), Ohio (S3), Oklahoma (SNR), Pennsylvania (S3), Rhode Island (S1), South Carolina (SNR), South Dakota (SNR), Tennessee (SNR), Texas (SNR), Utah (SNR), Virginia (S5), West Virginia (S4), and Wisconsin (S1S2) (NatureServe 2008). In Ontario, its provincial (S) rank is S1 (NHIC 2008).

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BIOGRAPHICAL SUMMARY OF REPORT WRITERS

Ken Ursic has a Bachelor of Science Degree in Ecology and a Master's of Science in Botany/Ecology from the University of Guelph. Ken has been an Ecologist with Dougan & Associates since 1995 and has extensive knowledge and expertise in the field of applied terrestrial ecology. He has participated in hundreds of environmental projects for the private and public sectors in Ontario, and provides special expertise in natural heritage systems planning, impact assessment and management strategies for small and large-scale projects. Ken is well versed in relevant policies, current practices, and progressive strategies pertaining to the protection of SAR in Ontario. In addition to being familiar with the range of habitat types in Ontario and being a skilled field botanist, Ken manages numerous projects and is typically involved in all aspects of them. Through his work, Ken has directed and provided field/writing/research support for numerous projects dealing directly or indirectly with SAR assessments. As a member of D&A, Ken was the lead ecologist for the Ecosystem-based Recovery Strategy for

Eastern Prickly Pear Cactus – Lake Erie Sand Spit Savannas in Ontario for Parks Canada as well as the Recovery Strategy for Spotted Wintergreen (*Chimaphila maculata* (L.) Pursh) Populations in Canada.

Heather Pankhurst brings experience in applied ecology and botany, environmental education and habitat restoration projects. Heather has a Bachelor of Science Degree in Biology with a specialization in Biodiversity and a Graduate Certificate in Ecosystem Restoration. She has taken university and college courses in Botany, Applied Ecology, Population Ecology, Wild Species Management and Field Ecology and completed her B.Sc. with the writing of her senior project: Patterns in the distribution of submerged aquatic macrophytes in Georgian Bay, Ont. Heather has been a full-time Ecologist with Dougan & Associates since the spring of 2007. Through her academic and professional work, Heather has reviewed and become familiar with the policies and publications pertaining to SAR in Ontario. She also has experience surveying SAR for ongoing monitoring projects with Dougan & Associates.

Vladimir V. Kricsfalusy has a Master of Science degree in Biology/Botany from Uzhgorod University, Ukraine and a Doctoral Degree from the Academy of Sciences of Ukraine. Vladimir joined Dougan & Associates in 2008 bringing strong professional skills in botany, vegetation sciences and applied ecology gained at Toronto and Region Conservation Authority and Uzhgorod University. He has participated in numerous environmental projects in Canada and Ukraine, and has special expertise in biological inventory, terrestrial monitoring and natural heritage assessment. Vladimir has been conducting population studies of rare and invasive plant species in Eastern Canada as well as in Central and Eastern Europe. Vladimir has expertise in development of conservation strategies for plant species at risk (SAR) to ensure restoration and management of plant populations, vegetation communities and natural habitats. Vladimir has expertise in the application of the Ecological Land Classification (ELC) system for southern Ontario and other approaches (floristic, dominance, and phytotypological) for vegetation classification. His current research interests are focused on plant population biology, vegetation ecology and large-scale diversity patterns of multi-species assemblages of vascular plants.

Appendix 1. Description of biological Area of Occupancy calculation.

Lovett-Doust *et al*. (2003) proposed a method for identifying genetically distinct individuals within patches or “microsites” based on some preliminary population data. Microsites were defined as clusters of cladodes separated from other similar clusters by distances of greater than 1.0 m; microsites were determined to contain a mean of six individuals or genets (Lovett-Doust *et al*. 2003).

Assuming that each individual is spaced maximally from each other, and that there are 6 individuals in a microsite, the area of occupancy occupied by a microsite would be that of a hexagon with 1m sides (2.6 m^2).

Given that there are approximately 403 microsites at Point Pelee National Park and 6 microsites at Pelee Island, the biological Area of Occupancy is approximately 1063 m^2 (409 x2.6 m^2).