COSEWIC
Assessment and Update Status Report

on the

blunt-lobed woodsia
Woodsia obtusa

in Canada

THREATENED
2007

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

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Consaul, L.L. 1994. COSEWIC status report on the blunt-lobed woodsia *Woodsia obtusa* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-20 pp.

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COSEWIC
Assessment Summary

Assessment Summary – April 2007

Common name
Blunt-lobed woodsia

Scientific name
Woodsia obtusa

Status
Threatened

Reason for designation
A species with a highly fragmented distribution in Canada where it is known only from southeastern Ontario and southwestern Quebec at eight small localized sites. One additional population is now considered to be extirpated. The fern occurs almost exclusively on warm and relatively dry calcareous rocky slopes. The total Canadian population consists of fewer than 1400 mature plants. The primary threat is at the largest population due to the anticipated loss of habitat quality and decline in the fern population as a consequence of the presence and spread of an exotic invasive shrub. Most sites, however, are in protected areas or undisturbed sites where recruitment is occurring.

Occurrence
Ontario, Quebec

Status history
Designated Threatened in April 1994. Status re-examined and designated Endangered in May 2000. Status re-examined and designated Threatened in April 2007. Last assessment based on an update status report.

COSEWIC
Executive Summary

blunt-lobed woodsia
Woodsia obtusa

Species information

Blunt-lobed woodsia (*Woodsia obtusa*) is a small to medium-sized fern characterized by the blunt, rounded lobes of its fronds. The leaf stalk (rachis) is straw-coloured, occasionally darker at base and relatively brittle. The blade is coarsely cut and twice divided (2-pinnate), typically composed of 8-17 pairs of leaflets (pinnae). Two chromosomal variants are known and are treated as subspecies; the one found in Canada is *Woodsia obtusa* subsp. *obtusa*.

Distribution

Blunt-lobed woodsia is a widespread and common species in the eastern United States; in Canada, it is known from only nine populations in Ontario and Quebec, all located within 100 km of the US border. In Ontario, populations are concentrated along the Frontenac Axis. In Quebec, two distinct regions contain populations, one located in Gatineau Park and the other in Missisquoi County. Plants are also cultivated and available from nurseries.

Habitat

All Canadian populations are found in the Great Lakes-St.Lawrence Forest Region and all are located on calcareous rock with a southern aspect. The habitat of the species is generally forested, with an average canopy closure of 82%. A recent study on six Canadian sites shows an average soil depth of 3.5 cm on an average slope of 43^{o}. No sites appear to have been drastically modified over the recent years. Most sites are located within abandoned or rarely used areas that are not likely to suffer from direct human disturbance.

Biology

Blunt-lobed woodsia is a perennial, homosporous fern (spores producing male and female gametophytes are identical in size and form) that produces high numbers of spores annually towards the end of summer and beginning of fall. These develop into haploid gametophytes (sex cell producing plantlets). The species is not known to reproduce vegetatively, although bisexual gametophytes can be produced and self fertilize, resulting in completely homozygous individuals.

Population sizes and trends

There are currently four known sites in Ontario, of which only two were mentioned in the original status report. Two more have since been added, one of which was rediscovered in 2001 after initially being found in 1978; the other was found in 2004. All were visited in 2005. Of the five known Quebec populations, one (Champlain Lookout, Gatineau Park) has not been located despite several attempts and is likely extirpated, and two could not be visited due to refusal of access or inability to contact the landowner. The others were visited in 2005. Generally, numbers have increased at sites; however, this is possibly due to more extensive searches or the fact that 2005 was a particularly good season for the species, resulting in vigorous individuals that were easy to locate.

Limiting factors and threats

At a large scale, the major limiting factor for this species would appear to be the availability of suitable calcareous habitat. However, at a small scale, it is more likely that the main limiting factor for the species is microclimate, especially water availability. Site disturbance along the edge of the trailer park at the largest population (Westport-Sand Lake) has likely resulted in promoting the spread of common buckthorn, an aggressive invasive alien shrub that could significantly alter the fern's habitat.

Special significance of the species

Canadian populations may have special significance because they are outlying populations at the northern distributional limit of the species. These populations may therefore have particular genetic characteristics, or patterns of genetic variation that are unusual or rare for the species.

Existing protection or other status designations

Woodsia obtusa is listed as endangered under Schedule 1 of the federal *Species at Risk Act* (SARA). It is listed and protected under the *Endangered Species Act* in Ontario and under the *Loi sur les espèces menacées ou vulnérables* in Quebec.

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

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.

Update
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SPECIES INFORMATION

Name and classification

Scientific name:	*Woodsia obtusa* (Sprengel) Torrey subsp. *obtusa*
Synonyms:	*Polypodium obtusum* (Sprengel)
	Woodsia perriniana (Sprengel) Hooker & Greville
Common names:	Eng.: Blunt-lobed woodsia, Blunt-lobed cliff fern
	Fr.: Woodsie à lobes arrondis, woodsie obtuse
Family:	Dryopteridaceae
Major plant group:	ferns

Morphological description

Blunt-lobed woodsia (*Woodsia obtusa*) is a small to medium-size fern with fronds up to 60 cm long and 15 cm wide (Figure 1). It is characterized by the blunt, rounded lobes of its bright green leaves, which are retained late into the fall. The leaf stalk (rachis) is straw-coloured, occasionally darker at base, not articulate but relatively brittle. The blade is coarsely cut and evidently 2-pinnate with proximal pinnules of lower pinnae usually shallowly lobed or merely dentate. In the field, blunt-lobed woodsia is most often confused with fragile fern (*Cystopteris fragilis*) but has a stiffer aspect, has glands and scales on the axes and veins as well as opaque stipes.

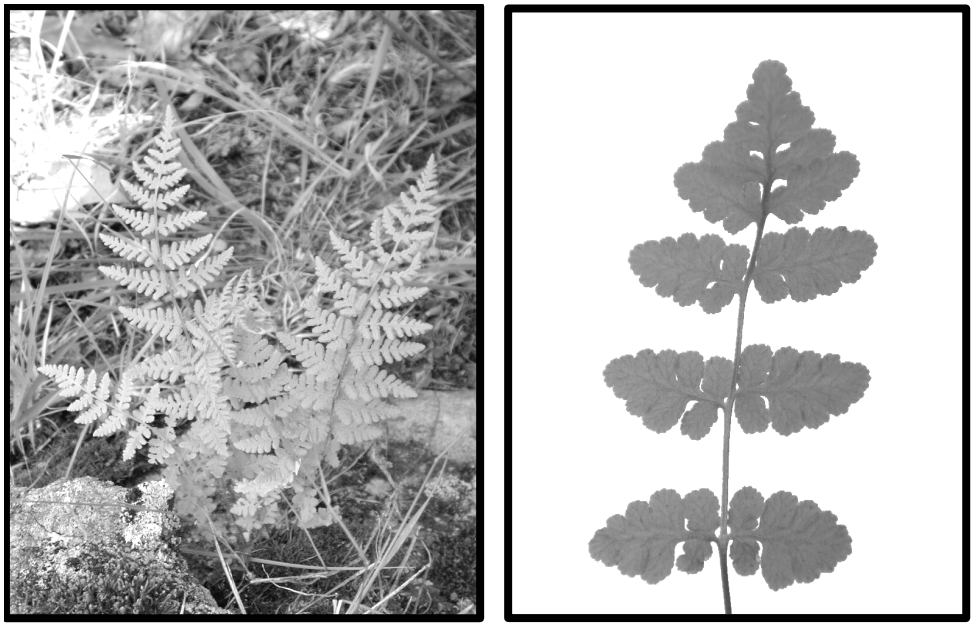

Figure 1. Blunt-lobed woodsia. a) plant growth form; b) leaf shape (Photographs: M. Wild).

Genetic description

Blunt-lobed woodsia comprises two cytotypes that are often treated as subspecies because they show subtle morphological and ecological distinctions and tend to have different distributions. Tetraploid populations (subsp. *obtusa*) are found throughout the eastern part of its range, commonly occurring on limestone. The diploid (subsp. *occidentalis*) is found near the western edge of the species' range, usually on sandstone and granitic substrates. It has been hypothesized that blunt-lobed woodsia might be an autopolyploid derived from *W. oregana* (Brown 1964). However, isozyme and spore ornamentation studies indicate that these species are not closely related, and the discovery of a diploid cytotype of blunt-lobed woodsia suggests a different origin for this taxon (Windham 1993). Blunt-lobed woodsia has been known to hybridize with *W. oregana* subsp. *cathcartiana* (B.L. Robinson) Windham to form the sterile tetraploid hybrid known as W. × *kansana* Brooks (Windham 1993).

Designatable units

There are no designatable units below the species level as only the subspecies *Woodsia obtusa* subsp. *obtusa* is found in Canada. All Canadian populations are located within the Great Lakes Plains Ecological Area as defined in the COSEWIC Operations and Procedures Manual and no significant genetic or morphological differences have been demonstrated for these populations.

DISTRIBUTION

Global range

Blunt-lobed woodsia is widespread in the eastern United States, occurring in all states east of the 100th parallel (except North Dakota and South Dakota), reaching north to south-eastern Canada (Ontario and Quebec) and extending south to south-central Texas and northern Florida (Figure 2). It is generally not found on the Atlantic coastal plain (Brown 1964). It is a common species in the northeastern United States.

Canadian range

The extreme northern limit of this species' range extends into southern Ontario and Quebec; in fact, no Canadian populations are situated more than 100 km from the US border. The first Canadian report of blunt-lobed woodsia was from Missisquoi County in southern Quebec in 1936 by Belval and Raymond (Cinq-Mars 1969). The Canadian extent of occurrence for this species is estimated to be approximately 14 000 km^2. This is based on an area, triangular in shape, ranging from Frontenac Park, ON, north to Gatineau Park, QC, and east to the clumped Quebec populations at Saint-Armand/ Frelighsburg. This amounts to less than 1% of the species' global range. The species' area of occupancy in the Canadian range is estimated to be less than 1 km^2. Of the nine known populations, four occur in Ontario and five in Quebec (Figure 3).

Figure 2. Distribution map of blunt-lobed woodsia in North America (modified from Flora of North America Editorial Committee (1993)).

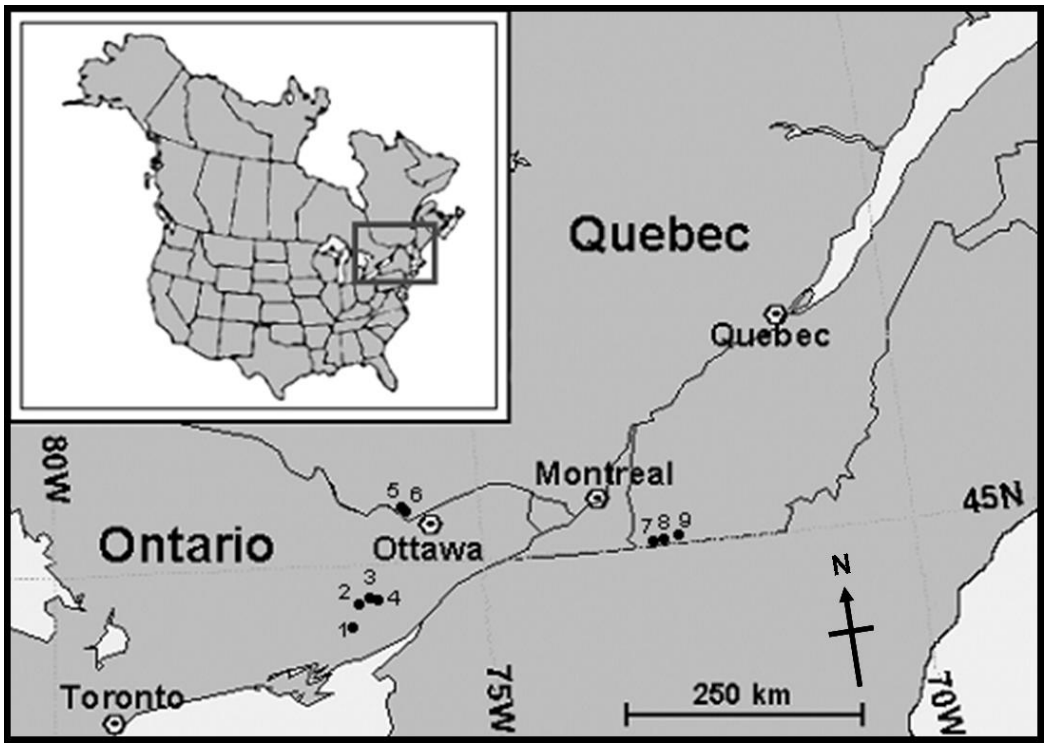

Figure 3. Location of the nine known Canadian populations of blunt-lobed woodsia.

Province of Ontario

All four populations are found on the Frontenac axis, a southern extension of the Precambrian shield extending from the Gananoque and Brockville area along the St. Lawrence River, north to the Westport area. Three populations occur within a few kilometres of each other along the north shores of Big Rideau Lake and Sand Lake near Westport. The other is located in Frontenac Park, approximately 20 km southwest from the others.

Province of Quebec

The five Quebec populations, one of which is likely now extirpated, are found in two distinct regions, separated by several hundred kilometres. Three of these populations are found on dolomite in Missisquoi County; the other two occur on marble bedrock slopes along the Eardley Escarpment in Gatineau Park.

HABITAT

Habitat requirements

All Canadian populations are found in the Great Lakes-St.Lawrence Forest Region (Rowe 1972) and all are located on calcareous rock (marble, dolomite, limestone) with a southern aspect. The habitat of the species is generally forested, consisting of scattered, relatively small trees (10 to 15 m high; 10 to 20 cm diameter breast height). Canopy openness ranges from fairly closed (~7% in Gatineau Park, QC) to fairly open (~20% in Frontenac Park, ON). One population is atypically found in a very open site on a rock outcropping in an abandoned field. Shallow soils over bedrock and the overall xeric nature of the sites are the major cause for the small stature of the trees, although trees appear to be relatively young at several sites, perhaps indicating some recent disturbance (i.e. harvesting of stems, fire, etc.). Generally associated tree species are sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), white oak (*Q. alba*), white ash (*Fraxinus americana*) and ironwood (*Ostrya virginiana*). The shrub layer has low cover on sites where sugar maple and red oak dominate (Quebec sites). Poison ivy (*Rhus radicans*), and prickly gooseberry (*Ribes cynosbati*) are the most frequent shrub species on these sites. In all Ontario sites (although to a lesser degree for the Frontenac Park population), red oak and white oak dominate, eastern red cedar (*Juniperus virginiana*) is a common tree, and shrubs such as fragrant sumac (*Rhus aromatica*) and downy arrowwood (*Viburnum rafinesquianum*) are abundant. The herb layer is very well developed and is most often dominated by Pennsylvania sedge (*Carex pensylvanica*). Other commonly found associated herbaceous species are bottlebrush grass (*Elymus hystrix*), bluestem goldenrod (*Solidago caesia*), marginal shield fern (*Dryopteris marginalis*), and herb-Robert (*Geranium robertianum*). A recent study on six Canadian sites shows an average soil depth of 3.5 cm (range: 0.5 - 9.5 cm) on an average slope of 43^{o} (range: 26 - 88^{o}) under an average 82% closed canopy (range: 40 - 96%) (Wild and Gagnon 2005). Recent soil data collected from Canadian blunt-lobed woodsia populations shows a pH range of 5.9 to 7.1, with an average of 6.6, and a high soil calcium content of almost 10000 ppm on average (Wild and Gagnon 2005).

Habitat trends

Although in some populations the habitat of blunt-lobed woodsia has shown signs of minimal disturbance over the past several years, no sites appear to have been dramatically modified. The sites are generally on steep rock faces, unsuitable for development or agriculture. Most sites are located within abandoned or rarely used areas that are not likely to suffer from direct human disturbance. The one exception possibly being the Westport – Sand Lake site where evidence of garbage dumping and tree removal/felling was reported in the original status report (Consaul 1994). Although no evidence of garbage dumping has been noticed over the past few years, there is recent evidence of tree felling in close proximity to extant plants. Although increased light levels resulting from tree removal could possibly be beneficial to blunt-lobed woodsia, the opening of the canopy appears to have caused an increase in the invasive exotic common buckthorn (*Rhamnus cathartica*). The future spread and increase of common buckthorn could severely impact this, the largest population of the fern in Canada. Common buckthorn has been shown to modify ecosystem properties in woodlands (Heneghan *et al*. 2004), and could therefore have a detrimental effect on the blunt-lobed woodsia population.

Habitat protection/ownership

Five of the nine Canadian populations occur on land benefiting from some level of protection; two are on federal land in Quebec (Gatineau Park, owned by the National Capital Commission) and three are on provincially owned land in Ontario (Frontenac Park, Foley Mountain Conservation Area, and on crown land along the Rideau Trail). The four remaining populations (three in Quebec and one in Ontario) are located on privately owned land. Two of these (Quebec) are currently considered part of “exceptional forest ecosystems” (a Quebec Ministry of Natural Resources classification of conservation significance). Landowners in both provinces have been notified of the species’ presence.

BIOLOGY

Most of the general biological knowledge for this species comes from Brown’s “A monographic study of the fern genus Woodsia” (1964). More recently, research on habitat characteristics and available habitat has been undertaken in Canadian populations. Results from these studies have been reported in Wild (2003) and Wild and Gagnon (2005). Current research is underway on several other aspects of the species’ biology such as spore production, spore viability, spore dispersal potential, gametophyte recruitment and sporophyte survival. These studies are part of a Ph.D. thesis in preparation by M. Wild.

Life cycle and reproduction

Blunt-lobed woodsia is a perennial homosporous fern species. Individual lifespan is unknown, but suspected to be in the order of several decades. Spore production occurs

annually towards the end of summer and beginning of fall. This fern is known to be capable of producing high quantities of spores; Peck *et al*. (1990) estimated 60 million spores per individual in Iowa. Studies are currently underway to actually quantify spore production and viability in Canadian populations, but large numbers of plants have already been produced from single fronds, and from spores contained in the soil, thereby indicating at least some level of viability. In culture, spores take from six to 15 days to germinate and the production of sporophytes takes from three to five months (Brown 1964). This species is not known to reproduce asexually, although (as is the case for most homosporous pteridophytes), bisexual gametophytes can be produced and self-fertilize, which results in a sporophyte that is 100% homozygous. Another important factor for blunt-lobed woodsia is its polyploidy. Polyploids are reputed to have increased vigour, increased ability to tolerate cold and an enhanced capacity for colonization relative to diploids (Rabe and Haufler 1992). Soltis and Soltis (2000) present the results from several studies on the potential for intragametophytic selfing of polyploid ferns, concluding that the available evidence for ferns, while limited, suggests reduced inbreeding depression in polyploids. Although it is highly likely that the isolated populations of blunt-lobed woodsia in Canada are each the result of single spore arrival, implying complete homozygosity, it appears quite possible that the negative components of inbreeding, such as inbreeding depression and the related effects of deleterious recessive genes, are countered by the polyploid nature of blunt-lobed woodsia occurring in these populations, as suggested by Soltis and Soltis (2000).

Herbivory

It has been suggested that significantly fewer phytophagous insects (only 465 documented species) attack ferns compared to flowering plants (over 357000 species). This equates to a ratio of approximately 1 species of insect for every 19 species of fern as opposed to more than 1 species of insect per flowering plant (Hendrix 1980). As for grazing herbivores, ferns appear to be unpalatable to herbivores (Page 1979), and in Canadian populations, no evidence of browsing or grazing has been observed on blunt-lobed woodsia individuals, even in areas of high deer density (M. Wild pers. obs.).

Physiology

Although there is evidence that biologically the species may have weedy characteristics (Brown 1964), it is quite possible that water limitation plays a large role in blunt-lobed woodsia populations in Canada. Bryan and O'Kelley (1967) showed that an absence of calcium in their growing substrate precluded the formation of archegonia, antheridia and sporophytes, thereby demonstrating the necessity for soil with high calcium content.

Dispersal/migration

For ferns in general, the small size and large numbers of spores produced suggests that dispersal is rarely a limiting factor. Recent studies (Wild, unpubl. data) have shown that even at relatively large distances (50 m) from source plants, blunt-

lobed woodsia spores can be found in large quantities in the soil (>100 spores/10 ml soil). This capacity to disperse added to the fact that spores from many fern species are known to remain viable for years in the soil suggests that, theoretically, dispersal is not a limiting factor in the specific case of *W. obtusa*. However, even if suitable habitat is located in proximity to extant populations, the xeric nature of this habitat possibly limits the establishment of young plants, thereby reducing functional dispersal.

Interspecific interactions

Interspecific competition can affect both fern sporophyte and gametophyte generations (Page 1979), although in a species-poor habitat, such as the calcareous rock habitat studied here, interspecific competition is expected to have little effect. Indeed, data collected in Canadian blunt-lobed woodsia populations show a low richness and cover of both vascular and non-vascular plant species in the immediate vicinity of *W. obtusa* individuals (Wild 2003, Wild and Gagnon 2005).

Adaptability

An ongoing experiment (Wild, unpubl. data) has shown that individuals can be grown from spores in a greenhouse for six months and then be subsequently transplanted *in situ* and have relatively high survival rates (approx. 30% after 2 years).

POPULATION SIZES AND TRENDS

Search effort

Most search effort for this report was centred on verifying the presence and abundance of individuals at the known locations. However, ferns have been widely collected within Ontario and Quebec over many decades with the likelihood that most localities for this species are known. The recent discovery of two new populations does indicate that some potential for new discoveries is possible but is highly limited. The specific type of habitat for this species is quite scarce in southeastern Ontario and southwestern Quebec in the regions from which the species is known in Canada.

Ontario sites

Only two Ontario sites were mentioned in the original status report (Consaul 1994). Two have since been added, one of which was rediscovered in 2001 by Daniel Gagnon (UQAM), after initially finding it in 1978; the other was found by Shaun Thompson (OMNR) in 2004. All four were visited during August-September 2005.

1. Frontenac Park
   This population has been visited annually since 2001. Approximately 60 individuals have been recorded there every year since 2001. Although the surrounding area appears suitable, extensive searches have failed to reveal any

other colonies. Over the past four years, at least 20 person hours have been spent searching for the species at this site.

2. Westport – Sand Lake
   Extensive searches in 2005 revealed approximately 500 individuals at this site. A total of eight person hours were spent searching for *W. obtusa* in 2005 (two people/four hours).

3. Westport – Rideau Trail
   This population was found by S. Thompson in 2004. In 2005 this location contained 82 plants. Eight person hours (four people/two hours) were spent searching for the species in 2005.

4. Foley Mountain Conservation Area
   Although this population was not reported in previous status reports, it has existed for at least 25 years, as it was originally discovered by D. Gagnon in 1978, and found again in 2001. Just over 200 plants were found here in 2005, after approximately eight person hours spent searching (four people/two hours).

Quebec Sites

Of the four known sites from the original status report (Consaul 1994), one has still not been found despite several attempts and one has not been visited due to denial of access by the landowner. One new Quebec population was found in 2000.

5. Champlain Lookout, Gatineau Park
   In 1974, this site was described as containing only a few stunted plants (Brunton and Lafontaine 1974). Several searches since 1990 have failed to find any plants at this site; more than 20 person hours have been spent attempting to find the population in recent years. This population is likely extirpated.

6. Eardley Escarpment, Gatineau Park
   This population is estimated to contain over 300 individuals of blunt-lobed woodsia. Exact counts are virtually impossible as a large number of individuals (approx. 200) occur on a steep scree slope where any attempt to get close enough for individual counts would surely be detrimental to the species and its habitat. The entire area surrounding the known sub-populations has been extensively searched a number of times over recent years. At least 40 person hours have been spent searching for the species at this site.

7. Saint-Armand, Missisquoi Co.
   Requests to revisit this site were denied by the landowner; it was last visited in 2001. The location was estimated at that time to contain somewhere between 100 and 200 individuals, spread between two main colonies of approximately 25 m^2 each. Although the current situation of this population is unknown, the remoteness and abruptness of the terrain where the plants are located probably preclude any human disturbance.

8. Chemin Saint-Armand, Missisquoi Co.
   This is the only known Canadian population that does not occur on a rocky southern slope. It is situated on a rock outcropping (approx. 10m long, 5 m wide and 4 m high) in an abandoned field. Originally found in 2000 by Jean Faubert, it was visited in 2005 and a total of 120 plants were found.

9. Frelighsburg, Missisquoi Co.
   This population was last visited in 1993 by J. Labrecque. At that time, very few individuals were found (5-6). Attempts to contact the landowner for permission to revisit in 2005 were unsuccessful.

Abundance

The number of mature individuals found and the approximate areas occupied at the sites are given in Table 1. Counts made by the writer in 2005 represent careful actual counts of plants. These cannot, for the most part, be readily reconciled with earlier counts that were based on less extensive fieldwork by other observers.

Table 1. Size and abundance of known Canadian populations in 2005.

Population	Approximate area	Last visited	Mature individuals	Previously reported numbers
1. Frontenac Park, ON.	$10m^2$	2005	64	47 (1990)
2. Westport – Sand Lake, ON.	$2 \times 500m^2$	2005	499	~28 (1990)
3. Westport – Rideau Trail, ON. (New)	$60m^2$	2005	82	~30 (2004)
4. Foley Mtn Cons. Area, ON.	$100m^2 + 150m^2$	2005	212	~10 (1978)
5. Gatineau Park (Champlain), QC	$<5m^2$	1974	<10	<10 (1974)
6. Gatineau Park (Eardley), QC	$500m^2$	2005	~300	~200 (1972)
7. Saint-Armand, QC	$2 \times 25m^2$	2001	~40	70 (1994)
8. Ch. Saint-Armand, QC (New)	$50m^2$	2005	120	~30 (2000)
9. Frelighsburg, QC	$<5m^2$	1993	5-6	5-6 (1993)
Total	$~1930m^2$		~1330	~430

+Populations identified in the original report (Consaul 1994) as currently or recently verified included numbers 1, 2, 6, & 7.

Fluctuations and trends

Of the four of six populations mentioned in the original status report (Consaul 1994), three (Westport, Frontenac Park and Gatineau Park (Eardley)) have been revisited within the past year and all three have considerably higher numbers of

individuals than previously reported. At all recently visited sites there was some evidence of newly established plants, suggesting that these populations are recruiting individuals. Although it seems that numbers in most populations have increased (Table 1), this is possibly due to more extensive searching as a large number of plants look well established. Differences in summer climate, from year to year, also seem to influence frond size as well as date of senescence and it would appear that 2005 was a particularly good year to search for the species. Given the perennial nature of this species, large fluctuations in population size likely do not occur.

The fact that blunt-lobed woodsia is a species that is relatively hard to identify and generally occurs on steep inaccessible slopes suggests the possibility that there are other populations yet to be discovered. The recent finding of two new populations (Ch. Saint-Armand in 2000 and Westport – Rideau Trail in 2004) in areas well known to field botanists (in Missisqoui County, QC and along the Rideau Trail, ON) would appear to corroborate this.

Rescue effect

Considering that all known Canadian blunt-lobed woodsia locations are relatively close to the United States (<100 km), it is possible that establishment of new Canadian populations from spores originating from the US populations could potentially occur over a long period of time. This is the most likely historical source of propagules for the known Canadian populations. However, the chance of a new population becoming established by long-distance spore dispersal should be considered remote, based on the very limited availability of suitable habitat and the difficulty in individual recruitment and establishment observed for this species (see below).

LIMITING FACTORS AND THREATS

At a large scale, the major limiting factor for this species would appear to be the availability of suitable calcareous habitat; calcium requirement has been shown for *W. obtusa* (Bryan and O'Kelley 1967). However, at a small scale, it is more likely that microclimate is a limiting factor. The south facing rocky slopes where blunt-lobed woodsia is found in Canada are extremely xeric suggesting that water availability is probably crucial. Ongoing research (Wild, unpubl. data) has shown that the addition of water to natural soils containing *W. obtusa* spores greatly increases germination and fertilization rates. Peck and Peck (1986) increased fertilization and subsequent sporophyte development by 83% (from 13% to 96%) by simply adding water to blunt-lobed woodsia gametophytes. This suggests that the lack of water in the Canadian habitats of blunt-lobed woodsia probably contributes to low recruitment and establishment rates.

The main anthropogenic threats occur at the largest population (Westport-Sand Lake). Evidence of former dumping of refuse from the trailer park over the fern site is still evident but no recent dumping had been noted in 2005 (S. Thompson, pers. com.

2007). Brush clearing and tree removal along the top edge of the slope resulted in minimal habitat disruption around the ferns when the branches were thrown down the slope over the ferns. More importantly, however, the opening of the canopy has likely resulted in promoting the establishment and spread of common buckthorn (*Rhamnus cathartica*), an aggressive invasive alien shrub that could significantly alter the fern's habitat and the fern's survival. The establishment of the buckthorn in the area may have resulted from the increased bird activity around bird feeders set up at the trailer park; this would have resulted in a greater chance for buckthorn seeds to be deposited in the area through bird droppings (S. Thompson, pers. com. 2007).

SPECIAL SIGNIFICANCE OF THE SPECIES

Canadian populations may have special significance because they are outlying populations at the northern distributional limit of the species. These populations may therefore have particular genetic characteristics, or patterns of genetic variation that are unusual or rare for the species. The fern is also widely advertised in the nursery trade.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

NatureServe ranks *W. obtusa* as G5 (globally secure) and as N5 (nationally secure) in the US. It is ranked "at risk" in the following states: Florida, Maine and Michigan (S1, critically imperiled); Delaware, New Hampshire and Rhode Island (S2, imperiled); and Vermont (S3, vulnerable). In Canada it is ranked as N1, and both S1 in Ontario and Quebec (NatureServe 2005). Blunt-lobed woodsia is listed as endangered and is in Schedule 1 of the federal *Species at Risk Act* (SARA); a recovery team is in the process of completing a recovery strategy that should indicate necessary steps to be taken to ensure further protection of the species. In Ontario, the species is listed and protected under the *Endangered Species Act*. In March 2003, the Ontario status of blunt-lobed woodsia was upgraded from Threatened to Endangered based on a new assessment using more recent provincial criteria adopted by the province. As a listed species, blunt-lobed woodsia is given consideration under Ontario's Provincial Policy Statement and *Provincial Parks Act*. In Quebec, the species has recently (August 2005) been legally designated threatened under the *Loi sur les espèces menacées ou vulnérables*.

TECHNICAL SUMMARY

Woodsia obtusa
Blunt-lobed woodsia — Woodsie à lobes arrondis
Range of Occurrence in Canada

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* **see Distribution section**	14 000 km²
• *Specify trend in EO*	stable
• *Are there extreme fluctuations in EO?*	no
• *Area of occupancy (AO) (km²)* **see Distribution section**	<20 km²
• *Specify trend in AO*	stable
• *Are there extreme fluctuations in AO?*	no
• *Number of known or inferred current locations*	8 extant
• *Specify trend in #*	decline (1 population likely extirpated; recent finds simply represent previously undiscovered populations and not newly established populations)
• *Are there extreme fluctuations in number of locations?*	no
• *Specify trend in area, extent or quality of habitat*	quality will likely decrease
Population Information	
• *Generation time (average age of parents in the population)*	unknown (possibly decades)
• *Number of mature individuals*	~1400
• *Total population trend:*	uncertain
• *% decline over the last/next 10 years or 3 generations.*	degree of decline uncertain but likely to occur based on the spread of common buckthorn
• *Are there extreme fluctuations in number of mature individuals?*	no
• *Is the total population severely fragmented?*	yes
• *Specify trend in number of populations*	very small increase but this due to intensive surveys
• *Are there extreme fluctuations in number of populations?*	no
Populations 1. Frontenac Park, ON 2. Westport – Sand Lake, ON 3. Westport – Rideau Trail, ON 4. Foley Mtn Cons. Area, ON 5. Gatineau Park (Champlain), QC 6. Gatineau Park (Eardley), QC 7. Saint-Armand, QC 8. Ch. Saint-Armand, QC 9. Frelighsburg, QC	*Abundance* 64 499 82 212 likely extirpated ~300 ~40 120 5-6
Threats (actual or imminent threats to populations or habitats)	
Actual threats: The inferred spread and increase in abundance of the invasive shrub common buckthorn that is likely to occur at the largest site is the most immediate threat; this was probably promoted through human activity.	

Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA:**	secure
• *Is immigration known or possible?*	possible but unlikely
• *Would immigrants be adapted to survive in Canada?*	yes
• *Is there sufficient habitat for immigrants in Canada?*	likely some
• *Is rescue from outside populations likely?*	possible but not likely
Quantitative Analysis	not available
Current Status COSEWIC: Endangered (2000) Threatened (2007) Ontario: Endangered Quebec: menacée (Threatened)	

Status and Reasons for Designation

Status: Threatened	**Alpha-numeric code**: Met criteria for Endangered, B2ab(ii,iii,iv,v), but designated Threatened, C2a(i), because most plants are in protected areas or undisturbed sites where recruitment is occurring.

Reasons for Designation:

A species with a highly fragmented distribution in Canada where it is known only from southeastern Ontario and southwestern Quebec at eight small localized sites. One additional population is now considered to be extirpated. The fern occurs almost exclusively on warm and relatively dry calcareous rocky slopes. The total Canadian population consists of fewer than 1400 mature plants. The primary threat is at the largest population due to the anticipated loss of habitat quality and decline in the fern population as a consequence of the presence and spread of an exotic invasive shrub. Most sites, however, are in protected areas or undisturbed sites where recruitment is occurring.

Applicability of Criteria

Criterion A: (Declining Total Population): Not applicable.

Criterion B: (Small Distribution, and Decline or Fluctuation): Meets Endangered B2ab(ii,iii,iv,v) based on the small area of occupancy, severely fragmented distribution and decline in the area of occupancy with the loss of one population and the inferred additional loss of area of occupancy, quality of habitat, number of populations and number of mature individuals if common buckthorn is allowed to spread at the site of the largest population.

Criterion C: (Small Total Population Size and Decline): Meets Threatened C2a(i) due to the total population size of < 10,000 mature plants, the extinction of one population, and inferred population decline with the spread of common buckthorn at the largest population..

Criterion D: (Very Small Population or Restricted Distribution): Although occurring within a small area of occupancy of < 20 km², most sites are in protected areas or undisturbed sites such that the species does not meet Threatened and is not likely to be become highly endangered within a short period of time.

Criterion E: (Quantitative Analysis): None available.

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