



# SASKATCHEWAN CONSERVATION DATA CENTRE



12/12/2011

**SKCDC Status Assessment**

Western Smooth Cliff-brake (*Pellaea glabella* ssp.  
*occidentalis*) in Saskatchewan

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Suggested citation: Enns, A. 2011. SKCDC Status Assessment: Western Smooth Cliff-brake (*Pellaea glabella* ssp. *occidentalis*) in Saskatchewan. Saskatchewan Conservation Data Centre, Fish and Wildlife Branch, 3211 Albert Street, Regina, Saskatchewan, Canada, S4S 5W6.

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## SPECIES DESCRIPTION AND SIGNIFICANCE

### Name and Classification

**PELLAEA GLABELLA SSP. OCCIDENTALIS (E. Nels.) Windham**

[The Nature Serve element code PPAD10H061]

Division: Pteridophyta (Ferns)

Class: Filicopsida

Order: Polypodiales

Family: Pteridaceae or Polypodiaceae (Maidenhair Fern Family; Brake Family)

Genus: *Pellaea*

Species: *Pellaea glabella*

Subspecies: *Pellaea glabella* ssp. *occidentalis*

Western smooth cliff-brake belongs to the Pteridaceae family of plants with diverse habitats with leaves (i.e., fronds) arising from underground stems (i.e., rhizomes) and sori (i.e., reproductive clusters found on the underside of the leaflets of a frond called pinnae) (Moss 1983). In Saskatchewan, there are two genera (i.e., *Cryptogramma* and *Pellaea*) with three species. The genus *Pellaea* includes two species in the province; the other being Gastony's cliff-brake (*Pellaea gastonyi*).

**Common Names:** Western smooth cliff-brake, Western dwarf cliffbrake, Smooth cliffbrake

**Synonymy:** *Pellaea glabella* var. *nana* (L.C. rich) Cody; *Pellaea glabella* var. *occidentalis* (E. Nels.) Butters; *Pellaea occidentalis* (E.Nels.) Rydb.

**Derivation of names:** The generic name derives from the Greek word pellos, meaning "dark," possibly an allusion to the often more-or-less darkish, bluish-gray fronds and/or to the brown or black stipes. Glabella is from the Latin word for 'smooth', possibly referring to the relative lack of hairs and scales (Kershaw *et al.* 2001). The common name, cliff-brake, refers to its occurrence in cliff crevices (Harms and Leighton 2011).

### Morphological description

*Pellaea glabella* ssp. *occidentalis* (Fig. 1) is a low tufted perennial herb with wiry, brown stipes. Rhizomes are short and stout (5-10 mm diameter) covered with thin, brownish scales and fronds growing in low clusters. Fertile and sterile fronds are similar in length [2-15 (28) cm long]. Blades are linear-oblong to lanceolate, 1-2 pinnate with upper pinnae entire or merely lobed. Stipes are shiny, thin, light brown, reddish brown to dark brown. Frond segments are hairless on the underside, with revolute margins that form a false indusium. Sori are in lines along the margins on the underside of pinnae and pinnules, covered by a false indusium. Mature spores are brown or black. [ $2n = 58$ ].



Figure 1. Western smooth cliff-brake (A. Enns 2008).

This species is less hairy than Gastony's cliff-brake (*Pellaea gastonyi*), with the underside of the frond being hairless and the stipe nearly hairless. Fronds of Gastony's cliff-brake are also somewhat dimorphic, with fertile fronds longer than sterile ones (Harms and Leighton 2011).



### Special Significance

This species is considered vulnerable nationally and is apparently secure on a global level. Glacial erratics (i.e., a boulder carried by glacial ice and deposited some distance away from its origin that differs in size and type from rocks native to the area in which it rests) that support this species are important to Cree traditions and culture where the erratics are the setting for sacred ceremonies. These erratics are important indicators of possible tar sands locations and their origins are traced by geologists. Ferns can be used to remediate contaminated soils and have been the subject of research for their ability to remove chemical pollutants from the air.

### DISTRIBUTION

The range for this species appears to be from British Columbia north to the North West Territories, east to Manitoba, and south to Utah, including Montana, North Dakota, South Dakota, and Wyoming (Fig. 2). In Saskatchewan, the range includes widely spaced general localities across northern and southeastern Saskatchewan through the Athabasca Plain, Churchill River Upland, south to the Moist Mixed Grassland and Mixed Grassland ecoregions.

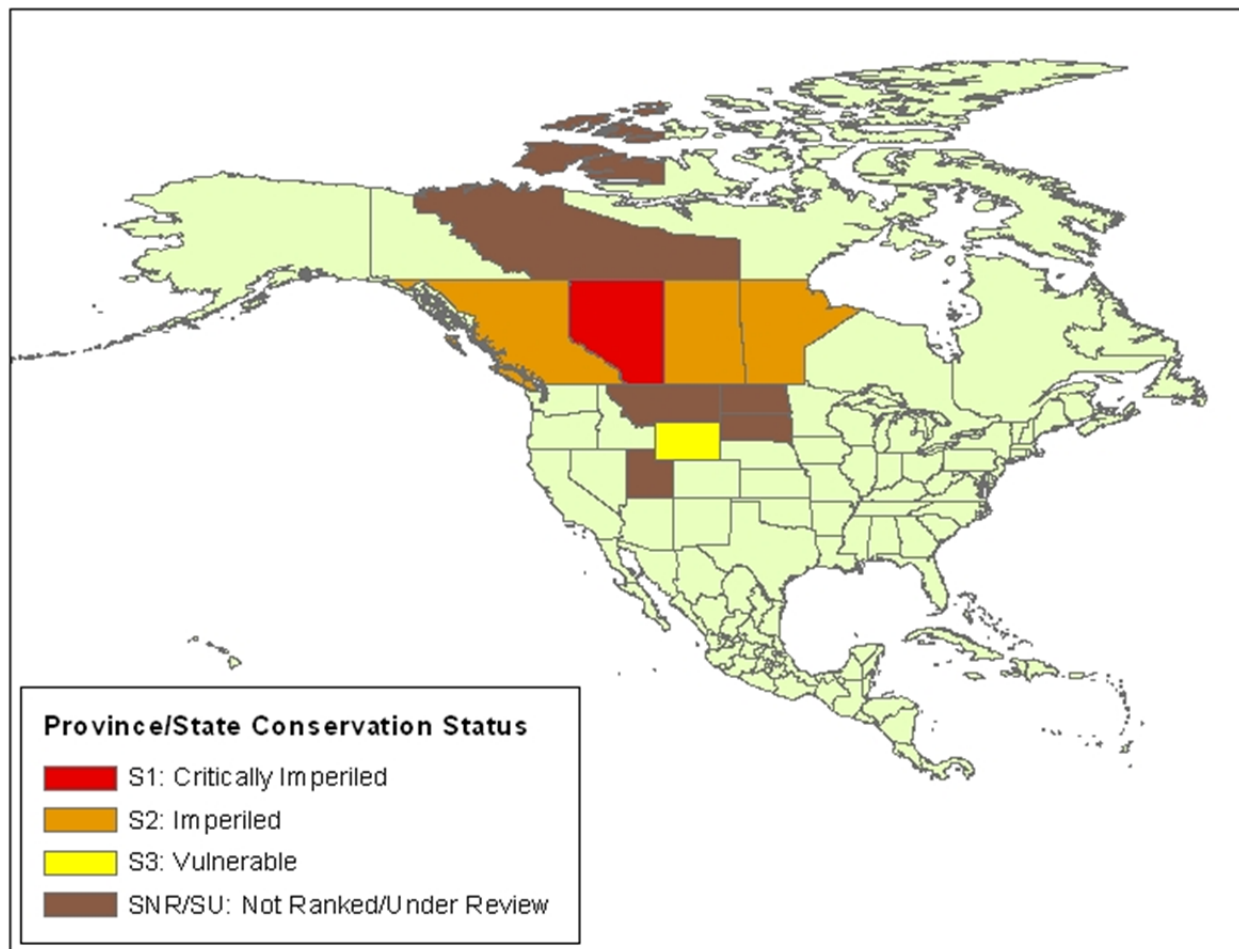


Figure 2. Distribution of western smooth cliff-brake in North America.

Provincially, western smooth cliff-brake can be found at the Big Muddy and Souris River valleys in southernmost Saskatchewan; Amisk Lake, Deschambault Lake, and Sturgeon Landing in east-central Saskatchewan; south of Mildren in southwestern Saskatchewan; and Cluff and Carswell lakes in northwestern Saskatchewan (Fig. 3) (Harms and Leighton 2011).



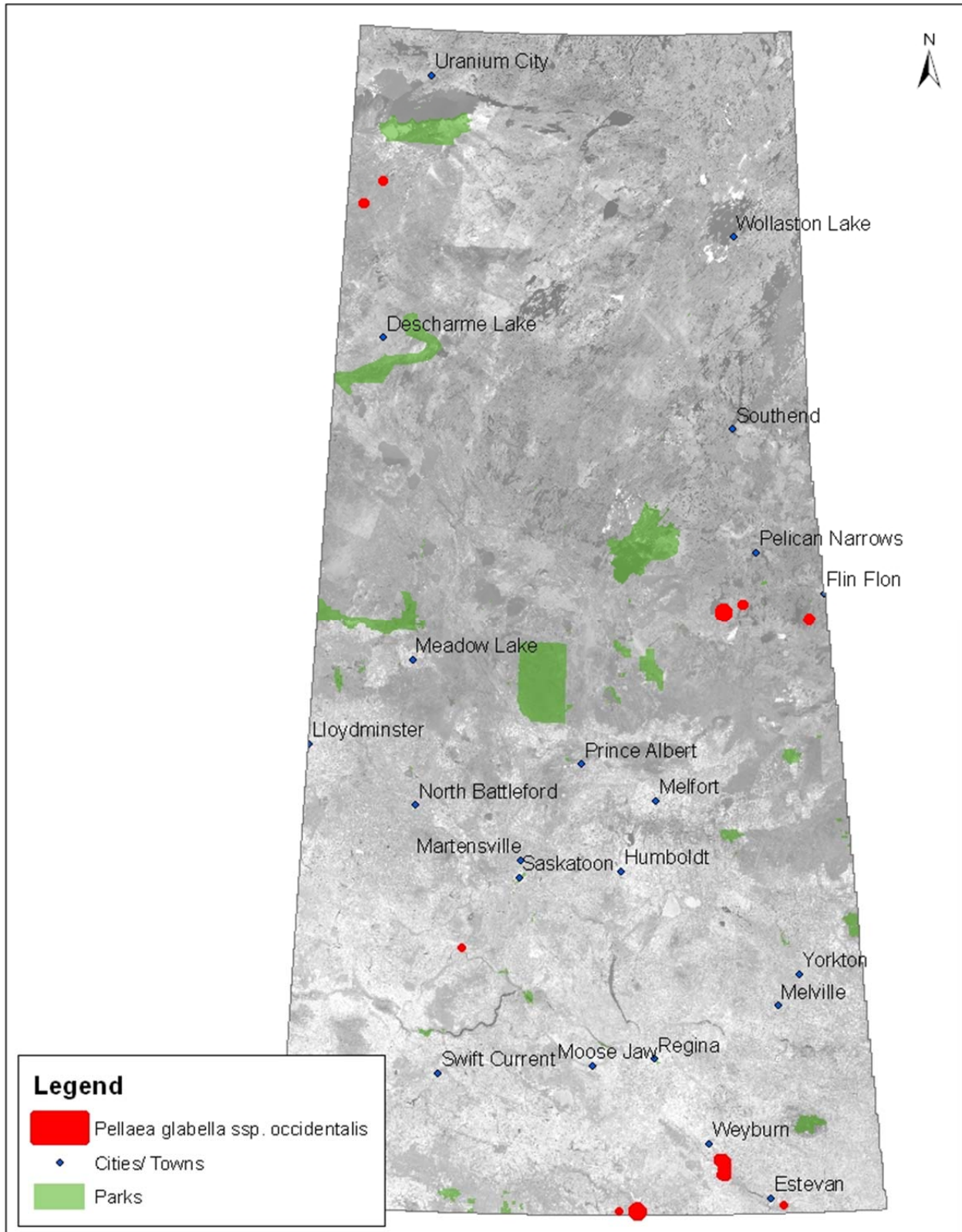


Figure 3. Distribution of western smooth cliff-brake in Saskatchewan (SKCDC 2011).



## Search Effort

No targeted surveys have been conducted for this species. Surveys to revisit historic occurrences, verify identification and locate new occurrences province-wide is needed to advance documentation and conservation efforts. Locations of glacial erratics, and limestone and calcareous outcrop microhabitats need to be identified. Scoured moraine landscape types in proximity to large meltwater and spillway channels are likely to have an abundance of large erratics. Scoured moraines occur at sites such as the North Saskatchewan River north of Borden, the South Saskatchewan River north of Saskatoon, the Souris River, the Arm River, Qu'Appelle River and the meltwater channel around Manitou Lake. Within the agricultural regions, limestone erratics are much more common in eastern Saskatchewan than westwards (Godwin, B., pers. comm. 2011).

Known locations of smooth woodsia (*Woodsia glabella*), an associated species that is provincially imperiled, should also be revisited (Figure 4). Predictive distribution modeling is needed to locate new occurrences.

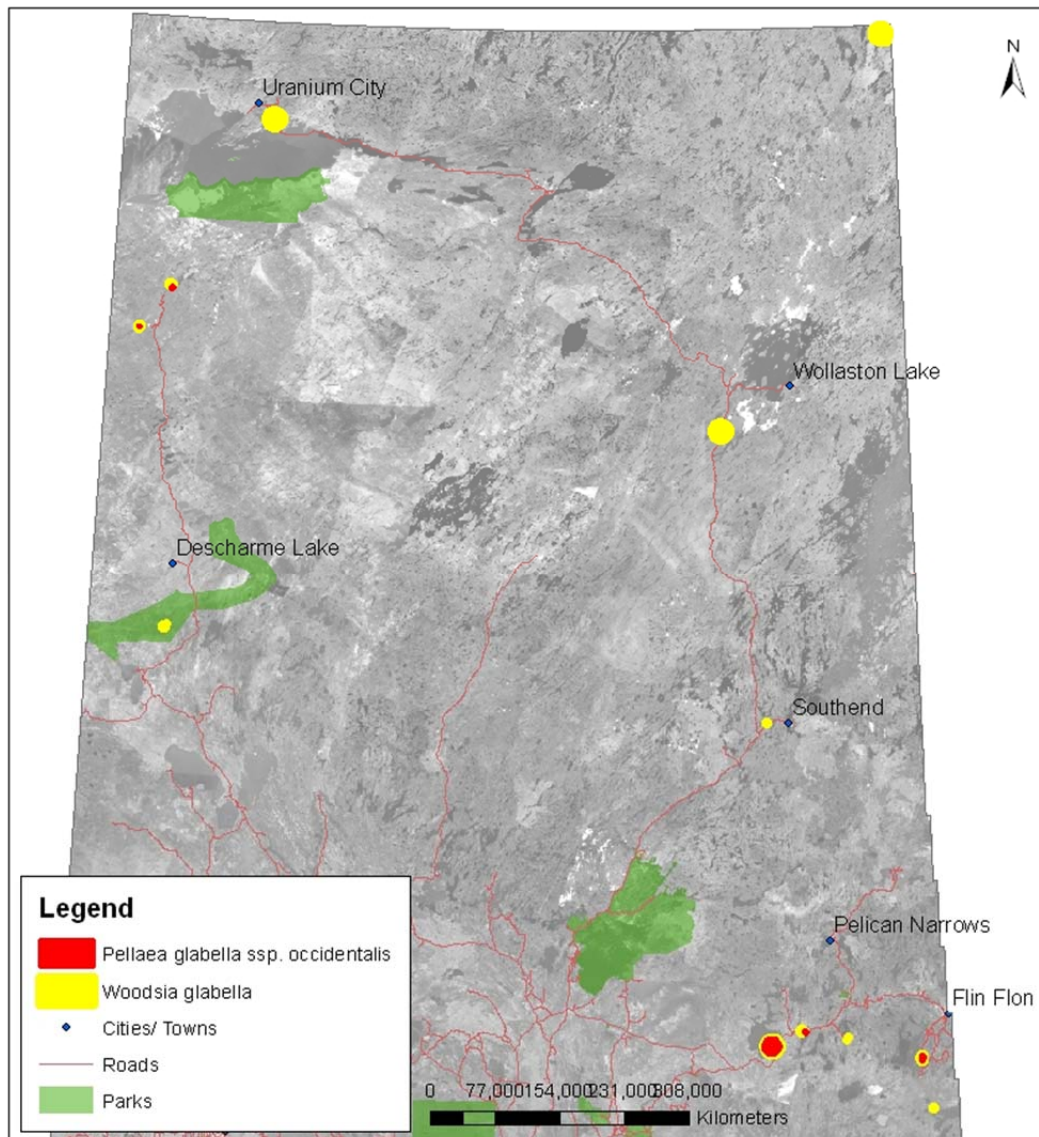


Figure 4. Distribution of *Pellaea glabella* ssp. *occidentalis* and associated *Woodsia glabella*, showing species overlap and future study sites.





## HABITAT

### Habitat Requirements

Habitat is characterized as drier calcareous and limestone outcrops, limestone, sandstone, dolomite cliff edges, boulders, and rocky places (Harms and Leighton 2011). These substrates have higher pH values and greater concentrations and availability of important nutrients like calcium and magnesium (Vermont Agency of Natural Resource 2004). Plants are found at elevations of 300 to 2800 meters. Western smooth cliff-brake has been found on glacial erratics south of Mildred (Fig. 5) and in Lomond pasture. This species has been found on west, south and north facing cliffs and erratics, usually in deep shade in mossy, damp crevices but sometimes in more exposed places (Tryon 1980). These rock habitats support a colonizing vegetation community that includes mosses, lichens and ferns.



Figure 5. Glacial erratic with *Pellaea glabella* ssp. *occidentalis* south of Mildred (A. Enns 2008).

### Habitat Trends

Determining habitat trends is difficult because search effort has been minimal and mapping accuracy is low for many locations. In addition, sites have not been consistently monitored for long enough to accurately determine trends. The most significant habitat trend is habitat destruction due to quarrying for limestone and dolomite (NatureServe 2011). This activity is present in the Amisk Lake area.

## BIOLOGY

### Reproduction and Phenology

Western smooth cliff-brake reproduces sexually with the sperm-producing organ, the antheridium, and the egg-producing organ, the archegonium. Sporangia contain spores and are aggregated into clusters called sori that are naked and covered by a recurved leaf-margin (i.e., false indusium) for protection. Sporangium are long-stalked, opening and discharging the spores through the movements of a special structure called the annulus. Spores are microscopic and all  $\alpha$ -like. Sporulation, whereby spores can be released occurs in the summer and fall (Barkworth 2011). The prothallus (gametophyte) is minute, flat, green, and formed during damp conditions.



This species is identifiable throughout the growing season and can be positively identified even without sori visible. Observation dates from element occurrences in the province show that Western smooth cliff-brake has been observed from June through August.

### Adaptability and Dispersal

Western smooth cliff-brake is not limited by dispersal or establishment due to their small, self-fertilizing spores that are distributed by the wind. Due to its dispersal method and narrow habitat requirements, this species can be thought of as a specialist in marginal or unique habitats where flowering plants cannot thrive. These factors suggest that distribution is mostly dependent on climate and substratum, or microclimate and microhabitat, and that the rarity of suitable habitat or microhabitat is the main cause of rarity for this species and other similar ferns (Wild and Gagnon 2005).

### Interspecific Interactions – Herbivory

Interspecific competition is low for calcareous rock outcroppings and cliff faces that are naturally species-poor habitats. Predation by insects and grazing herbivores is lower than for flowering plants, as ferns generally appear to be unpalatable to herbivores. However, spores are rich in lipids, proteins, and calories, so some herbivores may eat them.

## POPULATION SIZES AND TRENDS

### Element Occurrences and Abundance

Population sizes, ownership, and locations are estimated below, based on current SKCDC information (Table 1). In most cases where plant occurrence was noted without population size, the occurrence contributed zero to the total population size for the site. In all cases, the estimates are lower than the actual population sizes because most sites are mapped but not counted.

Table 1. Known locations for western smooth cliff-brake in Saskatchewan.

Site	Ownership	Year(s) Observed	Present Estimate
<b>South Grassland region</b>			
Big Muddy area	?	1954,1968	Locally abundant
Big Muddy area	Private	1968	Locally abundant
South of Big Beaver	Crown/ private	1968	None
Roche Percée, Souris River valley	Private	1958,1987	5-6
Lomond pasture	Crown	2004	1
<b>West Grassland region</b>			
South of Milden	Crown/ private	2007,2008	400
<b>East Southern Boreal region</b>			
Near Meridian Creek Tower	Crown/ leased	1953,1957,1970,1987	None
Ballantine Bay of Deschambault Lake	Crown	1964	None
Amisk Lake, North of Meridian Creek	Crown	1984	None
East Amisk Lake	Crown/ leased	1987	Common
Limestone Lake	Foran Mining Corp.	1988	None
<b>West Northern Boreal region</b>			
Clearwater River?	?	1887	None
South of Lake Athabasca	Terra Ventures Inc.	1962	None
Cluff Lake area	ESO Uranium Corp.	1977	Uncommon
Cluff Lake area	ESO Uranium Corp.	1978	None
<b>Total population</b>			<b>&gt;407</b>

Targeted surveys have not been conducted for this species. Data from the Saskatchewan Conservation Data Centre (SKCDC) shows 15 Element Occurrences (EOs), although data is insufficient for most. Population counts have only been recorded for 2 EOs and one was noted as locally abundant. Area of occupancy and the number of occurrences or percent area with good viability have not been consistently recorded. Only one site has been revisited in the last decade, first observed in 2007 and revisited the following year, located south of Milden with approximately 400 individuals. Four sites are owned exclusively by mining corporations and two sites owned by the Crown are leased to mining companies (i.e., Mediterranean Marble Ltd. and Bullion Fund Inc.).



Herbarium records accounts for 80% of the occurrences observed. Records show that 1-3 potential populations may occur near the Clearwater Lake area, but records contained incorrect or incomplete coordinate information and could not be mapped (Harms, V. L., pers. comm. 2011).

The Forest Ecosystem Classification (FEC) Program gathered detailed data from 1700 plots in the province's forested ecodistricts between 1999 and 2003. The goal was to survey representative forested areas, so anomalies such as limestone outcrops were not surveyed. No Western smooth cliff-brake was observed.

### Fluctuations and Trends

There has been no long-term monitoring of populations in Saskatchewan and so trends are unknown. At all sites, re-visitation is intended to better delineate the occurrence or estimate the population size of western smooth cliff-brake.

## THREATS AND LIMITING FACTORS

### Mining and Quarrying

Limestone and dolomite quarries are a serious threat that could destroy the specific habitat needs of this species. These rocks are used for building material, as aggregate to form the base of roads, as white pigment or filler, and as chemical feedstock. Currently four eastern locations near Amisk Lake show this type of activity (NatureServe 2010) and all three northwestern sites have mining activities in the area. None of these sites have been revisited since first being observed.

### Development and Industrial Pollution

Calcareous cliff communities are threatened by adjacent upslope development (i.e., residential, agricultural, utility right-of-ways, roads) and its associated run-off. Acid precipitation from industrial pollution can dissolve limestone, reducing habitat. Tar sands development located approximately 50km from the Clearwater River population may be affecting important habitat (Wright, R., pers. comm. 2011).

### Limiting Factors – Climate and Habitat

Western smooth cliff-brake is limited to calcareous limestone and dolomite outcrops, cliff edges and glacial erratics. There is some uncertainty as to whether climate and habitat dictate the dispersal of species, or whether dispersal of spores and establishment are limiting factors. Wild and Gagnon (2005) argue that isolated populations are more controlled by dispersal and establishment factors than populations with nearby micro-sites. Currently, most known populations in Saskatchewan are isolated, except for three occurrences near Amisk Lake.

## PROTECTION, STATUS, AND RANKS

### Status and Ranks

Global rank: G5T4

Canada National rank: N3

Saskatchewan Provincial rank: S2

In 2011, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed western smooth cliff-brake as a Priority 2 candidate wildlife species to be assessed. The priority value indicates that the species is of intermediate and lower priority for COSEWIC assessment and is considered nationally less at risk of extinction or extirpation from Canada than other species (COSEWIC 2011).

Although there have been 15 locations identified in the province, only two have been identified in the last decade and contain population counts. The majority of other occurrences contain limited information and their delimited area is large, meaning exact locations lack precision. Due to microhabitat requirements and the potential for limestone excavation, it is unknown whether previous locations are still intact. The provincial status of *Pellaea glabella* ssp. *occidentalis* was last updated in 2007 and ranked an S2 or imperiled. Using NatureServe's Element Rank Estimator v2. Or2 in 2011, the status was revised to S1S2, based on factors mentioned above, including Number of Occurrences, Population size, Environmental Specificity and Threats (Saskatchewan Conservation Data Centre 2011).



## Habitat Protection and Ownership

Two sites near the Big Muddy may be protected under The Wildlife Protection Act (WHPA 2009) although their mapped uncertainty distances make protection unclear. Another site near Goodwater is protected under the Prairie Farm Rehabilitation Act (PFRA) and WHPA. Lastly, four sites near Amisk Lake may be protected under The Parks Act (The Recreation Sites Regulations 1991), although the mapped locational uncertainty for these sites may move their centroid points out of protective range. All three northwestern sites in the Cluff Lake are owned by private mining companies. The remaining sites are located on private lands, providing no security.

## ACKNOWLEDGEMENTS

Thank you to Bob Godwin from the Saskatchewan Research Council (SRC) for providing location and suitable habitat information. Dr. Vern Harms provided location information from the W.P. Fraser Herbarium at the University of Saskatchewan in Saskatoon. Rob Wright (Ministry of Environment, Parks) provided access to the FEC database and Clearwater Lake population information and threats.

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