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SKCDC Status Assessment

Long beech-fern (*Phegopteris connectilis*) in Saskatchewan

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SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

***PHEGOPTERIS CONNECTILIS* (Michx.) Watt**

[The Nature Serve element code PPTHE02010]

Division: Pteridophyta (Ferns)

Class: Pteridopsida

Order: Athyriales

Family: Thelypteridaceae; Polypodiaceae (Marsh-fern Family)

Genus: *Phegopteris*

Species: *Phegopteris connectilis*

Long beech-fern belongs to the Thelypteridaceae family with plants of diverse habitats with leaves (fronds) arising from underground stems (rhizomes) and sori (reproductive clusters found on the underside of the leaflets of a frond, called pinnae) (Moss 1983). In Saskatchewan, there are 2 genera (*Thelypteris* and *Phegopteris*), each with 1 species (*Thelypteris palustris* var. *pubescens* and *Phegopteris connectilis*).

Common Names: Long beech-fern, Northern beech-fern, Narrow beech-fern

Synonymy: *Phegopteris polypodioides* Fée; *Dryopteris phegopteris* (L.) Christ.; *Thelypteris phegopteris* (L.) Sloss.

Derivation of names: The generic name is based on the Greek words *phegos*, meaning “beech”, and *ptēris*, referring to “fern”, which translates to its common name, beech-fern, perhaps in reference to the habitats of some species (Harms and Leighton 2011; Kershaw et al. 2001) *Connectilis* is from the Latin word *conecto*, meaning “to fasten together”, referring to the pinnae.

Morphological description

Phegopteris connectilis (Fig. 1) is a small but coarse, single-leafed fern. Fronds are spaced singly along slender, creeping rhizomes. Fronds are all-alike and 15-60 cm long. Blades are 1-2 pinnate, broadly triangular and blade rachis are not grooved on the upper (adaxial) surface. Frond segments are on the underside of the pinnae with needle-like, transparent unicellular hairs on the midribs and veins. The lowest pair of pinnae are longer than the others and drooping. Pinnae toward the tip of the frond are mostly joined at the base by wings that form semi-circular lobes between the pinnae. Stalks are hairy, straw-coloured above, dark and slightly scaly near the base, 5-30 cm long, and 1-2 times as long as the blade. Sori (Fig. 2) are round or oblong and located near the ends of veins without protective membranes (indusial). Sporangia often have stalked glands or hairs on capsules. [$2n = 60, 90^*$]. (Harms and Leighton 2011; Kershaw et al. 2001; Moss 1983).



Figure 1. Long beech-fern leaflet.





Figure 2. Sori of long beech-fern.

The fronds of this species are broader than eastern marsh-fern (*Thelypteris palustris* var. *pubescens*). The lowest pair of pinnae are shorter than those above for marsh beech-fern, and the upper pinnae are not joined along the blade rachis. Sporangial capsules are glabrous and sori are round, located alongside veins. The indusial is present for eastern marsh-fern, tan and hairy (Harms and Leighton 2011).

Special Significance

This species is considered vulnerable nationally, and is apparently secure on a global level. This fern is an indicator of nitrogen-rich soils and friable forest floors with Moder and Mulls humus forms (Rook 2004; Klinka et al. 1989). Soils are retained by this plant's deep root systems, reducing erosion (Jones 1998). Ferns, in general, 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 distribution for this species is circumboreal, characterized as wet temperate and in cool climates. Populations stretch from Alaska to Newfoundland and Greenland, south to northern Oregon, North Carolina, Michigan, and Iowa in North America (Fig 3). It is also found in Europe from Iceland, east to Finland, south to the Ukraine and west to Spain, and Asia.

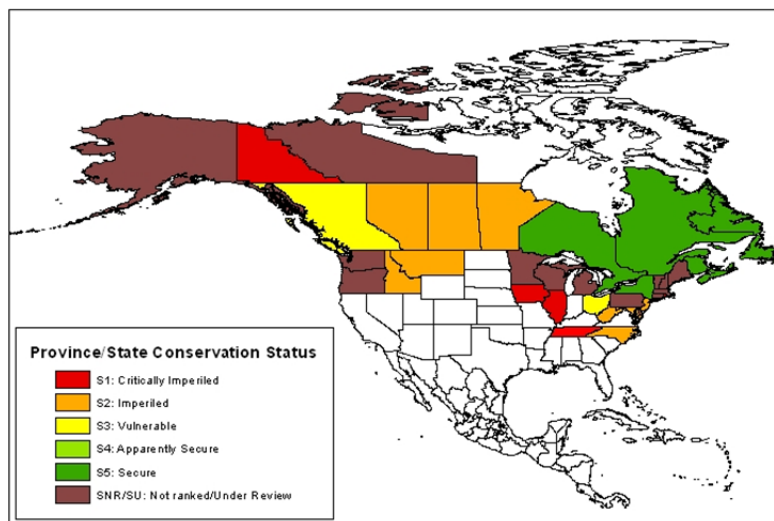


Figure 3. Distribution of long beech-fern in North America.



In Saskatchewan, long beech-fern is mainly found in the northeastern quadrant, ranging from Axis Lake at the east end of Lake Athabasca to the northeastern Pasquia Hills. The north eastern quadrant of the province is relatively unknown (SKCDC 2011) (Fig 4).

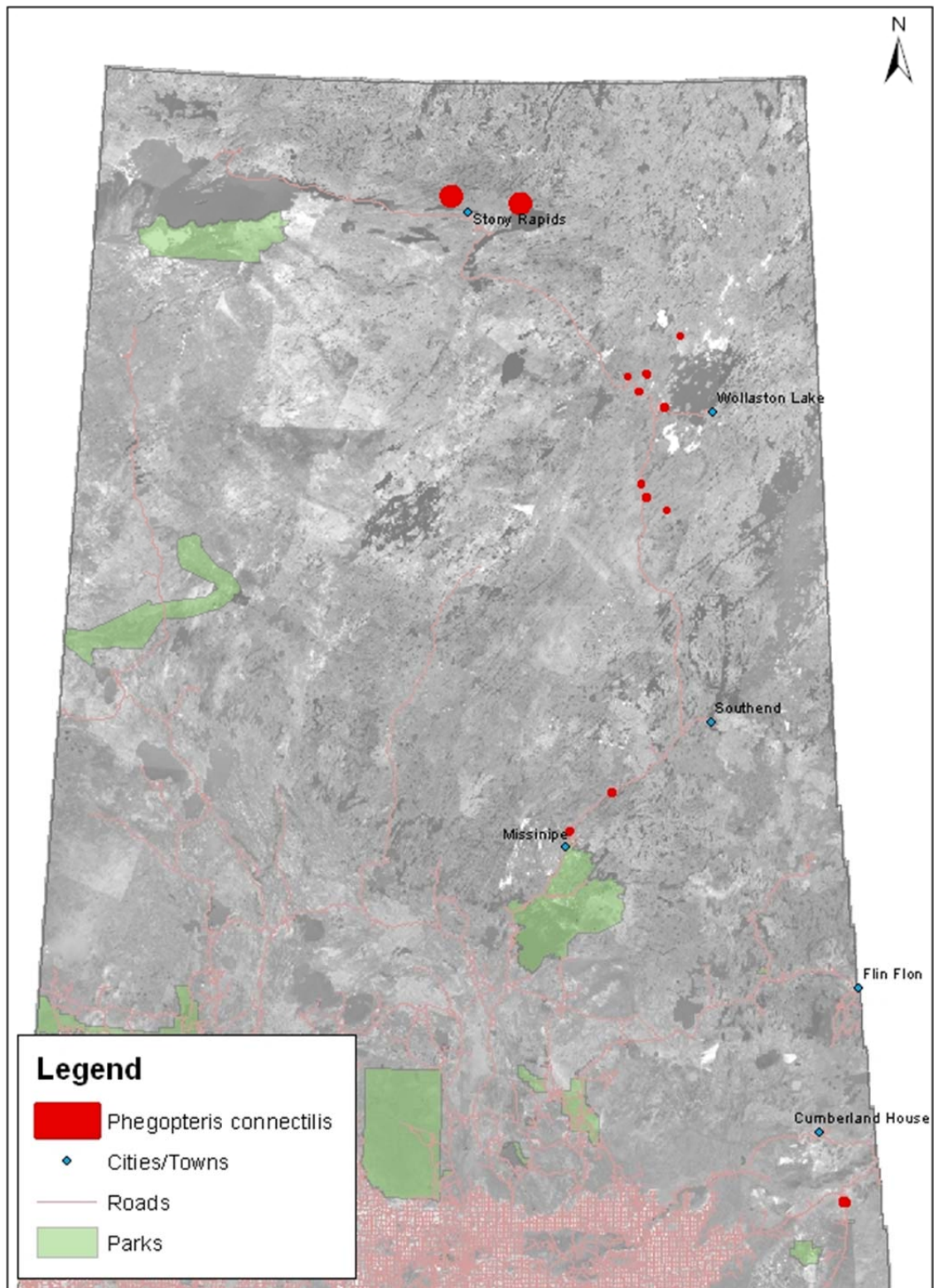


Figure 4. Distribution of long beech-fern in Saskatchewan (SKCDC 2011).



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.

HABITAT

Habitat Requirements

Habitat is characterized as a lush moist riparian wood with mossy substrate in boreal regions. This species has been found in low areas, open slopes, moist rocky hillsides, ledges and along creeks and streams (SKCDC 2011). The parent material is mainly glacial till with colluvium (i.e., loose deposits of rock debris accumulated at the bottom of slopes) with coarse soils that are strongly to moderately acidic (Province of Nova Scotia 2011).

The riparian woods that support this species are dominated by a treed canopy of black spruce (*Picea mariana*), white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), balsam poplar (*Populus balsamifera*), trembling aspen (*Populus tremuloides*) and white birch (*Betula papyrifera* var. *papyrifera*). The shrub layer can include river alder (*Alnus rugosa*), wild red raspberry (*Rubus idaeus*), bracted honeysuckle (*Lonicera involucrata*). Forbs and herbs can include lady fern (*Athyrium filix-femina*), oak fern (*Gymnocarpium dryopteris*), wild sarsaparilla (*Aralia nudicaulis*), bunchberry (*Cornus canadensis*), meadow horsetail (*Equisetum pratense*), star-flowered Solomon's seal (*Maianthemum stellatum*), marsh reed grass (*Calamagrostis canadensis*) and bishop's cap (*Mitella nuda*). Mosses, like knight's plume (*Ptilium crista-castrensis*) and club-mosses like stiff club-moss (*Lycopodium annotinum*) cover the forest floor. Long beech-fern can be epipetric (i.e., growing on rocks) as well as terrestrial.



A. Enns 2008

Figure 5. Moist riparian habitat of *Phegopteris connectilis*.



Habitat Trends

Determining habitat trends is difficult because search effort has been minimal and mapping accuracy is low for some locations. In addition, sites have not been consistently monitored for long enough to accurately determine trends. Habitat for this species includes moist wooded streamsides not suited for other uses (SKCDC 2011) so habitat may be relatively intact.

BIOLOGY

Reproduction and Phenology

Long beech-fern reproduces sexually by spores and vegetatively by rhizomes. Sexual reproduction occurs 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 not covered by an 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, all α -like and produced in August. 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 long beech-fern has been observed from June through August (SKCDC 2011).

Adaptability and Dispersal

Temperature, soil moisture and pH are the dominant factors influencing fern distribution (Karst 2001; Lellinger 1985). *Phegopteris connectilis* is well adapted to moist acidic soil but can be adaptable to other soil types and be drought tolerant (Olsen 2007). This species is extremely cold tolerant but does not adapt to heat (Hoshizak and Moran 2001) and is adapted to shaded areas or climates where the weather is frequently overcast. Shaded areas where long beech-fern has been found usually contain a late-successional tree canopy and multiple vegetation layers.

Long beech-fern spores are dispersed by the annulus that acts like a slingshot to catapult spores the location where they will germinate and give rise to the gametophyte. Transport of spores occurs mainly via wind and is more frequent at short distances (Flinn 2007).

Interspecific Interactions – Herbivory

Interspecific competition between fern species is low since they are separated primarily by distinct environmental preferences (i.e., niche-assembly rules) and to a lesser extent by dispersal processes (i.e., dispersal-assembly rules). In species-rich communities such as that which supports long beech-fern, the presence of trade-offs in the ability to partition for resources in space and time allow species to avoid competition and co-exist. The abundance of species present in these sites may also attest to dispersal factors which do not limit the number of species present; only being restricted by the local pool of species available to colonize a site (Karst 2001).

Phegopteris connectilis tends to be more abundant and healthy in ungrazed woods where areas are not trampled. Ferns generally appear to be unpalatable to herbivores (Ratcliffe 1977), 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 many sites are mapped but not given proper estimates.



Table 1. Known locations for long beech-fern in Saskatchewan.

Site	Ownership	Year(s) Observed	Estimate
Hudson Bay area			
Pasquia Hills	Crown	1987	None
Pasquia Hills	Crown	1988	12-20
La Ronge area			
McLennan Lake; N of La Ronge	Wescan Goldfields Inc.	1972	None
North of Missinipe (Lower Pond and Pond Lakes)	Golden Band Resources Inc.	2004	1000's
Southend area			
Wollaston Lake Road	Crown	1973	None
Wollaston Lake Road, Geikie River	Crown	1973	Common
Hidden Bay of Wollaston Lake	UEX Corporation	1975, 1976	Common
Wollaston Lake area	AREVA Resources Canada Inc.	1992	Fairly common, but localized
Scrim Lake	Purepoint Uranium Group Inc.	1998	250+
South McMahon Lake	AREVA Resources Canada Inc.	1998	200+
Wollaston Lake Road	Crown	2005	Locally abundant
Treed riparian	Cameco Corporation	2008	Locally abundant
Stony Rapids area			
E end Lake Athabasca, Axis Lake	Pure Nickel Inc.	1935	None
Chipman River, Black Lake	Santoy Resources Ltd.	1987	None
Total population			>2000

Targeted surveys have not been conducted for this species. Data from the Saskatchewan Conservation Data Centre (SKCDC) shows 13 Element Occurrences (EOs) and 14 sites (Source Features) in four general locations. Population counts have only been recorded for four EOs and five were noted as common or locally abundant. The majority of occurrences (i.e., seven) were observed in the Southend area and most sites were located 1.5 km from any road (min. 68 meters; max. 42 km). Occurrences with good viability were only recorded for two sites, both in the Southend area. Two uranium mines (i.e., Midwest Mine and McClean Lake Uranium Mine) owned by AREVA Resource Canada Inc. are located in close proximity (i.e., 1.7 km to 9.8 km) to three sites in the Southend area. Two sites have been revisited; one in the Southend area and the other in the Hudson Bay area. Herbarium records accounts for 65% of the occurrences observed with voucher specimens collected.

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 long beech-fern was observed.

Fluctuations and Trends

There has been no long-term monitoring of populations in Saskatchewan and so trends are unknown. At all sites, revisitation is intended to better delineate the occurrence or estimate the population size of long beech-fern.

THREATS AND LIMITING FACTORS

Modification of Natural Processes – Mining

Developments that affect the drainage and thereby alter the moisture conditions will disrupt populations of this fern. Resource extraction alters moisture regimes as water is extensively used in mining operations such as extracting uranium ore from the ground. These activities can also contaminate surface and ground water by in situ leaching and mill tailing effluents. Currently eight sites are owned exclusively by mining companies; most of which are owned by uranium mining companies.



Forest Management Practices and Human Disturbance

This species is threatened to a lesser degree by timber harvest, site preparation and prescribed fires. Riparian areas support the highest diversity and abundance of species because of their diversity of natural features. Timber harvest in riparian areas removes the forest canopy, reduces the viability of shade-tolerant species, increases stream temperatures and increases runoff and erosion. Past timber harvesting in Montana likely led to declines in abundance and distribution for long beech-fern (Montana Natural Heritage Program). Site preparation such as precommercial thinning has been shown to have little effect on species richness, except for in sub-canopy layers (i.e., shrubs) (Cole et al. 2008). Timing since thinning and the consequences of natural recovery to plant diversity need to be researched. Prescribed fires consume both coarse woody debris and the organic O horizon which affects soil chemistry and composition down through deeper soil horizons.

This species is threatened to a lesser degree by picking and trampling (i.e., grazing or site preparation). The single stalks of this species are fragile and trampling can lead to soil compaction (SKCDC 2011).

Limiting Factors

Long beech-fern is limited mainly by microhabitat and microclimate conditions that impact establishment rates (Wild and Gagnon 2005). Flinn (2007) found that the availability of suitable sites for establishment, created by small-scale heterogeneity on forest floors limits both the growth of fern populations and the colonization of new habitats.

PROTECTION, STATUS, AND RANKS

Status and Ranks

Global rank: G5

Canada National rank: N5

Saskatchewan Provincial rank: S2

Phegopteris connectilis is not listed under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Although there have been 13 locations identified in the province, only 3 have been identified in the last decade and only 2 sites have been revisited. It is unknown whether previous locations are still intact.

The provincial status of *Phegopteris connectilis* was last updated in 2000 and ranked an S2 or imperiled. Dr. Harms (2003) listed this species as threatened (S2). Using NatureServe's Element Rank Estimator v2. Or2 in 2011, the status remained an S2, based on factors mentioned above, including Number of Occurrences, Population size, Viability and Threats (Saskatchewan Conservation Data Centre 2011).

Habitat Protection and Ownership

None of the sites occur on protected lands. Eight of the 14 sites are owned exclusively by mining companies, providing no security. Four sites occur on Crown lands in the Hudson Bay and Southend areas.

ACKNOWLEDGEMENTS

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INFORMATION SOURCES

- Barkworth M.E. 2011. Spore-bearing vascular plants: identification keys for use in the intermountain region of western North America. <<http://herbarium.usu.edu/IMRkeys/SporebearingIMR2.pdf>>. Accessed 2 Dec 2011.
- Cole H.A., S.G. Newmaster, L. Lanteigne, D. Pitt. 2008. Long-term outcome of precommercial thinning on floristic diversity in north western New Brunswick, Canada. <<http://www.sisef.it/iforest/contents/?id=470>>. Accessed 21 Dec 2011.
- Flinn, K.M. 2007. Microsite-limited recruitment controls fern colonization of port-agricultural forests. *Ecology* 88: 3103-3144. <<http://www.esajournals.org/doi/abs/10.1890/06-2124.1>>. Accessed 15 Dec 2011.
- Harms, V.L. 2003. Checklist of the vascular plants of Saskatchewan and the provincially and nationally rare native plants in Saskatchewan. University Extension Press. Saskatoon, Saskatchewan. 328 pp. (222)
- Harms, V and Leighton, A. 2011. Ferns & fern allies of Saskatchewan. Flora of Saskatchewan Association and Nature Saskatchewan. Nature Saskatchewan Special Publication No. 30.
- Hoshizaki, B.J., and R.C. Moran. 2001. Fern grower's manual. Portland, Oregon: Timber, 92-94.
- Jones, D.L. 1998. Encyclopaedia of ferns: an introduction to ferns, their structure, biology, economic importance, cultivation and propagation. Port Melbourne, Vic: Lothian, 15-382.
- Karst, J. 2001. Ecological separation among fern species in an old-growth forest. Thesis, McGill University, Montreal, Canada.
- Kershaw, L, J Gould, D Johnson, J Lancaster. 2001. Rare vascular plants of Alberta. University of Alberta Press. Edmonton, Alberta. 484 pp. (366)
- Klinka, K., V.J. Krajina, A. Ceska, A.M. Scagel. 1989. Indicator plants of coastal British Columbia. University of British Columbia Press. 288 pp. (36)
- Lellinger, D.B. 1985. A field manual of the ferns and fern-allies of the United States and Canada. Smithsonian Institution Press. Washington, D.C. 389 pp.
- Montana Natural Heritage Program. Northern beechfern – *Phegopteris connectilis*. Montana Field Guide. <<http://www.ec.gc.ca/inre-nwri/default.asp?lang=En&n=235D11EB-1&offset=14&toc=show>>. Accessed 21 Dec 2011.
- Moss, E.H., Second edition revised by J.G. PACKER. 1983. Flora of Alberta. A manual of flowering plants, conifers, ferns and fern allies found growing without cultivation in the province of Alberta, Canada. University of Toronto Press, Toronto, ON. 687 pp. (41)
- Olsen, S. 2007. Encyclopedia of garden ferns. Portland: Timber, 296. Print.
- Province of Nova Scotia. 2011. Forest vegetation types – TH2. <<http://www.gov.ns.ca/natr/forestry/veg-types/th/th2.asp>>. Accessed 15 Dec 2011.
- Ratcliffe, D.A. 1977. A nature conservation review: volume 1. Cambridge University Press, Cambridge, UK. 401 pp. (76).
- Rook, E.J.S. 2004. *Phegopteris connectilis* – long beech-fern. <<http://www.rook.org/earl/bwca/nature/ferns/phegopteriscon.html>>. Accessed 13 Dec 2011.
- Saskatchewan Conservation Data Centre. November 2011. Element Subnational Ranking Species. Regina, Saskatchewan.
- Wild, M. and Gagnon, D. 2005. Does the lack of available suitable habitat explain the patchy distributions of rare calcicole fern species? *Ecography* 28: 191-196.

