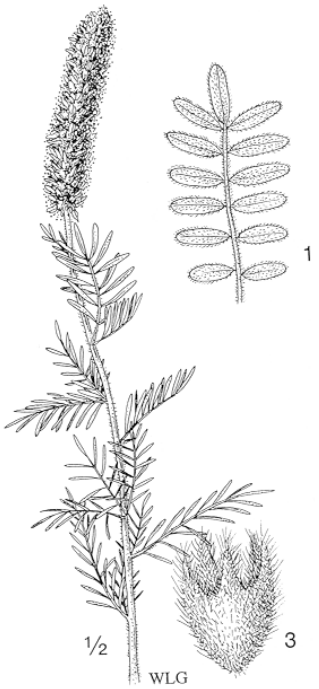
COSEWIC
Assessment and Status Report

on the

Hairy Prairie-clover
Dalea villosa var. *villosa*

in Canada



THREATENED
2000

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:

Please note: Persons wishing to cite data in the report should refer to the report (and cite the author(s)); persons wishing to cite the COSEWIC status will refer to the assessment (and cite COSEWIC). A production note will be provided if additional information on the status report history is required.

COSEWIC 2000. COSEWIC assessment and status report on the hairy prairie-clover *Dalea villosa* var. *villosa* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 22 pp.

Smith, B. 1998. COSEWIC status report on the hairy prairie-clover *Dalea villosa* var. *villosa* in Canada, *in* COSEWIC assessment and status report on the hairy prairie-clover *Dalea villosa* var. *villosa* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-22 pp.

Production note:
The report originally prepared by the author has been modified by Erich Haber, Co-chair, Species Specialist Group for Plants and Lichens, to more closely conform to the new standardized format. New information has been incorporated in the 2000 report.

For additional copies contact:

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

Tel.: (819) 997-4991 / (819) 953-3215
Fax: (819) 994-3684
E-mail: COSEWIC/COSEPAC@ec.gc.ca
http://www.cosewic.gc.ca

Également disponible en français sous le titre Rapport du COSEPAC sur la situation de la dalée velue (*Dalea villosa* var. *villosa*) au Canada

Cover illustration:
Hairy prairie-clover — Illustration by Walter Linclon Graham. Reprinted with permission from N.H. Holgren, the Illustrated Companion to Gleason and Cronquist's Manual: Illustrations of the Vascular Plants of Northeastern United States and Adjacent Canada, page 282, copyright 1998, The New York Botanical Garden.

Catalogue No. CW69-14/163-2002E-IN
ISBN 0-662-32339-4

COSEWIC
Assessment Summary

Assessment Summary – May 2000

Common name
Hairy prairie-clover

Scientific name
Dalea villosa var. villosa

Status
Threatened

Reason for designation
Perennial herb known presently from three dune fields in Saskatchewan and Manitoba. It is impacted by habitat alteration and threats from the spread of invasive plants.

Occurrence
Saskatchewan and Manitoba

Status history
Designated Threatened in April 1998. Status re-examined and confirmed Threatened in May 2000. May 2000 assessment based on new quantitative criteria applied to information from the existing April 1998 status report.

COSEWIC
Executive Summary

Hairy Prairie-clover
Dalea villosa var. *villosa*

Species Information

Dalea villosa (Nutt.) Spreng. var. *villosa*, or hairy prairie-clover, is a member of the Fabaceae or Pea Family. It is a perennial with a woody taproot and caudex. Stems are ascending or decumbent, 3-6 dm tall and densely villose. Leaves are very numerous and crowded, 3-5 cm long. Leaflets, numbering 9-17, are densely villose. Dense subsessile spikes, 2-10 cm long, terminate the branches. The calyx is 4-5 mm long, 10-ribbed, and densely villose. Corollas are pale-rose-purple, rarely white. Flowers are pea-like. There are 5 stamens and 4 staminodes and one style. The pod is obovate, 3 mm long and villous.

Distribution

Dalea villosa is restricted to North America and distributed from southcentral Saskatchewan (Dundurn, south of Saskatoon and formerly, Mortlach/Caron, 65 miles west of Regina) to southwestern Manitoba (north to Shilo, about 15 miles east of Brandon) in Canada and extends southward in the United States to New Mexico, Texas and Michigan.

Habitat

Interestingly, existing hairy prairie-clover sites provide markers for the positions of old deltas of glacial lakes formed 10,000 to 17,000 years ago. During this time, all of the modern sites of hairy prairie-clover were connected by a series of glacial lakes and their spillways. *Dalea villosa* is found locally on active sand or sandhill blowouts although it also tolerates partially stabilized sandy sites. Habitat always includes some element of active sand. Commonly associated species include the following: *Stipa comata, Calamovilfa longifolia, Andropogon hallii, Artemisia frigida, Artemisia ludoviciana, Artemisia campestris, Mamillaria vivipara, Euphorbia esula, Koeleria macrantha, Lygodesmia juncea*. Shrub cover often includes the following species: *Prunus virginiana, Rhus radicans,Ulmus americana*, and *Rosa woodsii*.

Biology

Dalea villosa is a sexually reproducing perennial species with a stout taproot. It produces fruit and sets seed at most sites. Little is known about the role the species plays in the ecosystem.

Population Sizes and Trends

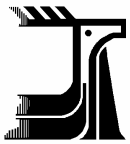
The species is very localized within its restricted range in Saskatchewan and Manitoba, occurring only on sandy sites with an element of active sand. The total Saskatchewn population is estimated to be in the low to mid-hundreds. The total Manitoba population is estimated to be in the mid-thousands. There are few sites in Saskatchewan and Manitoba with good local populations, the best of which are the sites at the Lauder Sand Hills and Spruce Woods Provincial Park in Manitoba. One of the two Saskatchewan sites has been extirpated (Mortlach/Caron). At least two sites have been lost in Manitoba - Boissevain and Treesbank, near Spruce Woods Provincial Park. This leaves only 1 Saskatchewan site and 5 Manitoba sites in Canada. The population trend is downward as a result of process of stabilization of the sandhills in these two provinces.

Limiting Factors and Threats

Survival of the species is primarily threatened by the processes of dune stabilization and the affects of grazing and fire control on these processes. There has been considerable loss of habitat as dunes continue to become vegetated throughout the range of the species. The leafy spurge, an invasive weed, assists this process and has invaded most sites. Tourism practices within Spruce Woods Provincial Park should be closely monitored at the Spirit Sands site. Agricultural practices such as mowing road margins in the Lauder Sand Hills should be curtailed. Any threat to the existing habitat of this species, especially at the Lauder Sand Hills and Spruce Woods Provincial Park sites, could be catastrophic. Several sites have already been lost.

Special Significance of the Species

A few species of *Dalea* are useful in horticulture, among them *D. villosa* which has potential for garden use. Daleas best adapted for native plant gardens and naturalistic and informal areas, are occasionally accommodated in flower beds.



COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* 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.

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.

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.

COSEWIC Status Report

on the

Hairy Prairie-clover

Dalea villosa var. *villosa*

in Canada

Bonnie Smith[1]

1998

[1]7203 Hunterview Drive NW
Calgary, AB
T2K 4P7

TABLE OF CONTENTS

SPECIES INFORMATION 3
Classification and nomenclature 3
Description 3
DISTRIBUTION 4
Global Range 4
Canadian Range 6
HABITAT 6
Habitat Requirements 6
Climate 6
Physiography, Hydrology, and Edaphic Factors 9
Dependence on Dynamic Factors 10
Land Ownership and Management Responsibility 10
Management Practices and Experience 10
BIOLOGY 3
POPULATION SIZES AND TRENDS 3
Population Summary 6
LIMITING FACTORS AND THREATS 7
Dune Stabilization/Grazing and Fire Control 7
Tourism and Recreation 8
Invasive Weeds 8
SPECIAL SIGNIFICANCE OF THE SPECIES 9
EVALUATION AND PROPOSED STATUS 9
Existing Protection or Other Status 9
Assessment of Status and Author's Recommendation 10
ACKNOWLEDGEMENTS 10
LITERATURE CITED 10
THE AUTHOR 12
AUTHORITIES CONSULTED 12
Collections Consulted 12
Fieldwork 3

List of figures

Figure 1. Hairy prairie-clover photographed at Spirit Sands, Spruce Woods Provincial Park, Manitoba. 4
Figure 2. Global distribution of *Dalea villosa* var. *villosa*. 5
Figure 3. Distribution of *Dalea villosa* var. *villosa* in Canada. 7
Figure 4. Dundurn Sand Hills, Site 1, Saskatchewan. 8
Figure 5. Hairy prairie-clover and habitat at Southern Lauder Sand Hills, Manitoba. 4
Figure 6. Roadside population of hairy prairie-clover at Northern Lauder Sand Hills, Manitoba. 5
Figure 7. Hairy prairie-clover habitat (grassy, semi-stabilized knoll at top left) at Devil's Punch Bowl, Spirit Sands, Spruce Woods Provincial Park, Manitoba. 6

SPECIES INFORMATION

Classification and nomenclature

Dalea villosa (Nutt.) Spreng. var. *villosa* is commonly referred to as hairy or silky prairie-clover. This species is also known under the synonyms with the variant spellings of *Petalostemon villosus* Nutt. and *Petalostemum villosum* Nutt. Hairy prairie-clover is a member of the family Fabaceae (or Leguminosae). The Fabaceae is a large family consisting of 440 genera with 12,000 species. The genus *Dalea* has 160+ species worldwide. (Cronquist 1981).

Scoggan (1978) recognized three species of *Petalostemum* in Canada, one of which is *Petalostemum villosum*. He did not recognize the genus *Dalea*. All North American species of *Petalostemon* are usually now included within the genus *Dalea*.

The Gray Herbarium Index (1968) lists the species as *Dalea villosa* Spreng. and the synonym *Kuhniastera villosa* O. Ktze. *Dalea* is named after Samuel Dale, 1659-1739, an English botanist and author on pharmacology (Bailey 1942). The descriptive epithet *villosa* refers to the hairy herbage of the species.

Description

Dalea villosa is a perennial with woody taproot and caudex, branched at the base and bushy (Figure 1). Stems are ascending or decumbent, 3-6 dm tall, densely villose. Leaves are very numerous and crowded, 3-5 cm long, often with fasciculate ones in their axiles. Stipules are subulate. Leaflets number 9 to 17, are close and oblong or oblanceolate, acute or obtuse, 5-10 mm long, 2-4 mm broad, densely villose. Spikes terminating the branches are usually subsessile, sometimes clustered, cylindric, in fruit 8 mm thick and 2-10 cm long, dense. Bracts are lanceolate, caudate-attenuate, longer than the calyxes, deciduous, villous. The calyx (including lobes) is 4-5 mm long, densely villose, 10-ribbed, the lanceolate lobes acute and shorter than the tube. Corollas are pale-rose-purple, rarely white. The blade of the banner is cordate, 2 mm long and broad, the claw 2.5 mm long. Blades of the other petals are elliptic, 2.5 mm long, the claws 0.5 mm long. There are 5 stamens and 4 staminodes, united at least part way from their bases into a tube, and one style. The pod is enclosed within the persistent calyx, obliquely obovate, somewhat lunate, 3 mm long, villous (Correll and Johnston 1970, Everett 1981). The corolla is a light purple or pinkish purple and is often faded in the strong light from the sun and the sand (Lommasson 1973).

No other species of *Dalea* are known to occur in Canada. Two species of the closely related genus *Petalostemon* occur within the range of the species in Canada; namely, *P. candidus* (Willd.) Michx. (white prairie-clover) and *P. purpureus* (Vent.) Rydb. (purple prairie-clover), (Scoggan 1978). *Petalostemon* has only 5 stamens whereas *Dalea* has 9-10 (Bailey 1942). *Dalea* may be distinguished from other genera within the Fabaceae based upon the following characteristics: plants not climbing, fruit a

Figure 1. Hairy prairie-clover photographed at Spirit Sands, Spruce Woods Provincial Park, Manitoba (B. Smith).

legume, keel not truncate, leaves pinnately divided, flowers in dense, cylindrical spikes, fruit not prickly, stamens more than 5 (Moss 1983).

Hairy prairie-clover superficially resembles the white and purple prairie-clovers. The white petals and glabrous herbage of the former quickly separate the species. The purple prairie-clover has fewer leaflets, at most 7, that are linear not elliptic or oblong. Flowering spikes are denser and shorter, to about 5 cm long, and the plant is glabrous to sparingly hairy not silky-hairy throughout as in the hairy prairie-clover (Scoggan 1978). Within a head of the hairy prairie-clover, flowering progresses from the base to the tip; but the spread of flowers, which are in blossom at one time, covers more than half the length of the head. This gives an appearance of the whole head's being in flower at once in contrast to the blooming of the purple prairie-clover which appears to be restricted to the base of the head (Lommasson 1973).

DISTRIBUTION

Global Range

Dalea villosa ranges from its northernmost disjunct sites in southcentral Saskatchewan and southwestern Manitoba southward throughout the central plains of the United States to New Mexico, Texas and Michigan (Scoggan 1978, Maher et al. 1979; see Figure 2).

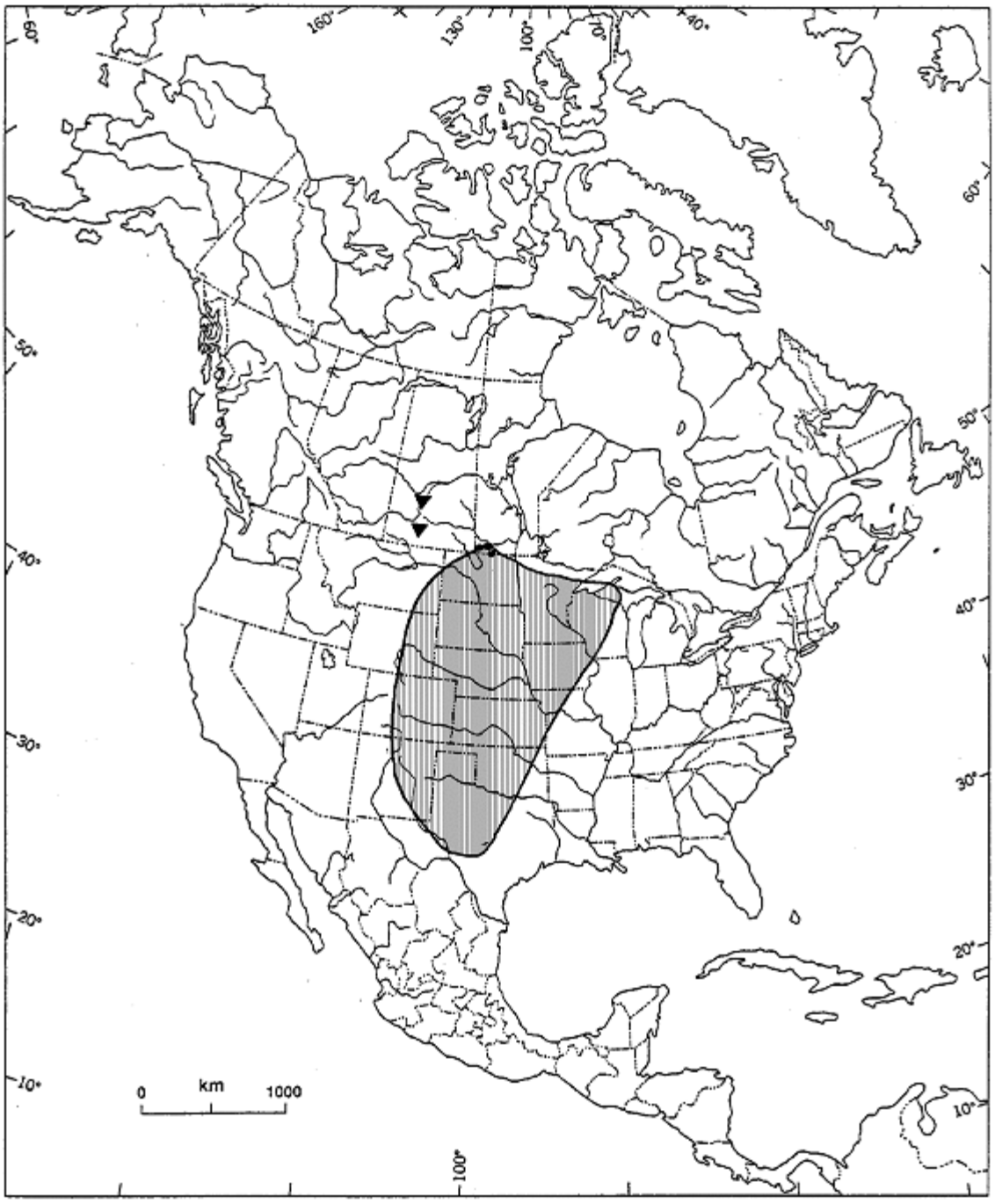


Figure 2. Global distribution of *Dalea villosa* var. *villosa*.

Canadian Range

In Canada the species is found near Dundurn, south of Saskatoon and near Mortlach/Caron, 65 miles w of Regina in Saskatchewan and at several sites in southwestern Manitoba, namely Treesbank, Camp Shilo, Spruce Woods Provincial Park at Spirit Sands, Boissevain and the Lauder Sandhills (Figures 3, 4).

During the summer of 1996 many other potential sites were examined in southwestern Saskatchewan and Manitoba but no other populations were located (Smith 1996). Precise locality data and land ownership, if known, are on file with COSEWIC and the appropriate provincial - territorial jurisdictions. This information is generally available unless the localities are considered to be publicity-sensitive.

HABITAT

Habitat Requirements

Populations occur in the mixed grassland (prairie) natural region in Saskatchewan and Manitoba. Hairy prairie-clover occupies an azonal vegetation complex, the sandhill complex, characterized by active complexes, stabilized blowouts, stabilized dunes, dune depressions and sand flats (Richards 1969). The species appears to be best adapted to active sand or sandhill blowouts (Harms 1990), although it is also found growing on partially stabilized sand in dune slack areas (Smith 1996). Hudson (1982) noted that the plant seems to be confined to at least semi-moving sand blowouts.

Species commonly associated with hairy prairie-clover include the following: *Stipa comata, Calamovilfa longifolia, Andropogon hallii, Artemisia frigida, Artemisia ludoviciana, Artemisia campestris, Mamillaria vivipara, Euphorbia esula, Koeleria cristata, Lygodesmia juncea*. Shrub cover included the following species: *Prunus virginiana, Rhus radicans, Ulmus americana, Rosa woodsii*.

Climate

The Prairies Climatic Region, encompassing both the Saskatchewan and Manitoba populations, lies in the northern cool-temperate zone characterized by low annual precipitation, high evaporation rates and fast runoff. These factors lead to chronic water deficits with severe shortages in the short-grass prairie area. Soil moisture is not always restored to capacity in an average year and water surplus averages only 7 mm. Southern Saskatchewan has a very high average annual water deficiency - among the highest in Canada (Stamp 1988), greater than the average annual water deficiency in southwestern Manitoba (Sanderson 1988).

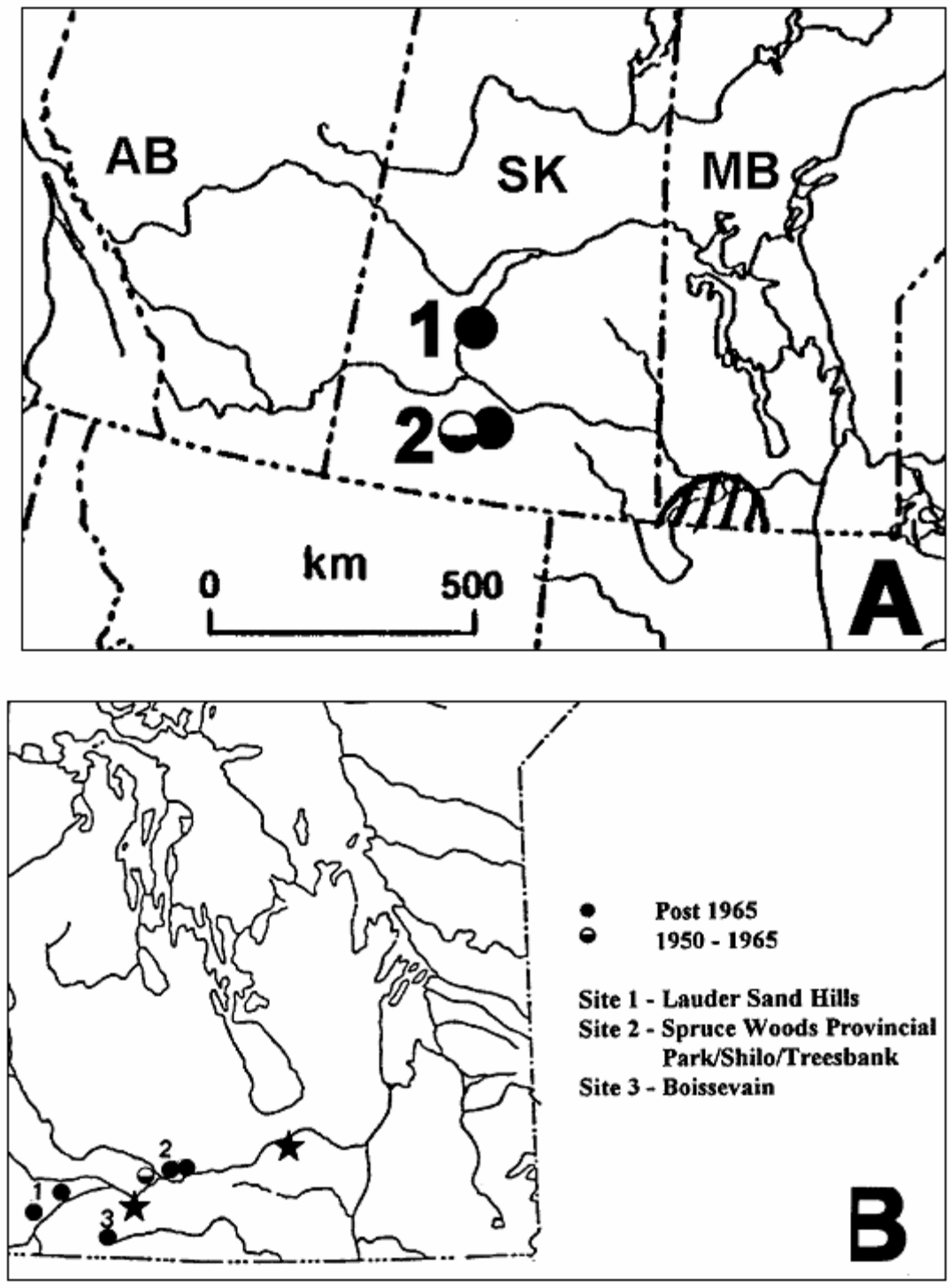


Figure 3. Distribution of *Dalea villosa* var. *villosa* in Canada. A) sites in Saskatchewan (Dundurn Sand Hills, Site 1; Mortlach/Caron area, Site 2; and region of sites in Manitoba (hatched); B) sites in Manitoba [stars indicate localities for two small populations not documented at time of report completion (left Glenboro, right Portage Sandhills)].

Figure 4. Dundurn Sand Hills, Site 1, Saskatchewan (photo, B. Smith).

The climate of the mixed grassland natural region is continental, characterized by extremes in temperatures with warm summers and cold winters. The mean temperature ranges from 6°C in the hotter parts to 0°C in the cooler areas. The growing season is relatively short, with an average of 105 to 130 frost-free days. The growing average frost-free period around Diefenbaker Lake is about 100 days. There is comparatively low annual precipitation, ranging from about 30 cm. in extreme southwestern Saskatchewan to 40 cm. along the western and northern fringes. Dry summers and winters are typical. Spring is the wettest season with about two-thirds of the annual precipitation falling as rain, the peak occurring in June. Because of the warm temperatures and high average wind speed, the rate of evaporation is high through the summer months (Wallis 1982).

The Dundurn area has a mean annual temperature of 1°C, the May to September mean is 15°C. Mean annual precipitation is 34-35 cm. Evaporation from a free water surface in the frost-free season approximates 65 cm (Hulett *et al*. 1966).

Nearly two thirds of the precipitation falling on the Manitoba sites occurs during the six summer months, the remainder appearing mostly as snow. The southwestern area of Manitoba has an average 100-day frost-free period (Weir 1988). The site at Spruce Woods Provincial Park receives 300-500 mm of moisture per year - twice the amount received in a true desert region (Spruce Woods Provincial Park, Spirit Sands, Devil's Punch Bowl Hiking Trails 1995).

Physiography, Hydrology, and Edaphic Factors

The Saskatchewan and Manitoba populations occur in the Interior Plains physiographic region (Acton 1988). In Manitoba the Lauder Sand Hills site lies in the Souris Plains physiographic subdivision, the Spruce Woods site in the Upper Assiniboine Delta physiographic subdivision, both characterized by lacustrine deposits and sand dunes. The Boissevain site lies in the Boissevain Till Plain physiographic subdivision characterized by alluvial deposits and moraines (Barto and Vogel 1978).

The sand dune areas occurring in southern Saskatchewan (and Manitoba) are aeolian deposits derived from glacial alluvial and lacustrine sediments. Glacial ice retreated from the region 10,000 to 13,000 B.P. Since the general inclination of the land surface was to the north and east and the ice obstructed water flow to the northeast, the melt water moved southeastward along the ice front until it was impounded in one of several glacial lakes. When it flowed into a lake the load capacity of the water decreased. The larger particles (sand) were deposited first in deltas, the finer materials being carried farther to be deposited lakeward. Subsequent exposure of the sand in extensive deltas has permitted modification of the surface by wind to form parabolic dunes. These are characteristic of semiarid climates where a partial cover of vegetation is present during dune formation. Since the effective wind direction in southwestern Saskatchewan is from the northwest, most of the present dunes tend to be oriented in a northwest to southeast direction. Rates of movement of partially denuded dunes reported in other areas vary from 2 to 22 ft. (0.6 to 6.6 m) per year (Hulett *et al*. 1966).

As the last glacial ice retreated across Saskatchewan some 17,000 to 10,000 years ago, a number of glacial lakes formed along the ice front. Sandy deltas originated where water flowed into these lakes. After the lakes disappeared, wind action modified the deltas into dune fields such as the Dundurn Sand Hills that originated along the southern shore of glacial Lake Saskatchewan that existed in the Saskatoon area 14,000 to 11,000 years ago (Pylypec 1989).

During the period of deglaciation, 15,500 to 12,000 years ago, a series of glacial lakes connected by their deltas to spillways formed an interconnected link between the Saskatchewan and Manitoba sites. All present day sites for the hairy prairie-clover were at one time connected. The Blackstrap Spillway and glacial Lake Saskatchewan (Dundurn site), the Thunder Spillway and glacial Lake Regina (Mortlach/Caron site) and the Souris Channel and Spillway and glacial Lake Agassiz (Lauder, Spruce Woods and Boissevain sites) all contributed to the deposition of sand at various locations throughout the prairies upon which the present day hairy prairie-clover relies (Christiansen 1979).

At Spruce Woods Provincial Park, the hairy-prairie clover site lies on the past delta of glacial Lake Agassiz. More than 15,000 years ago, the Assiniboine River, much larger than it is today, created an enormous delta as it brought glacial meltwater into ancient Lake Agassiz. Of the original 6,500 square kilometres of deltaic sand, only 4 square kilometres remains open; the rest is now covered with a rich variety of plants

and wildlife (Spruce Woods Provincial Park, Spirit Sands, Devil's Punch Bowl Hiking Trails 1995).

Saskatchewan and Manitoba sites occur on Cretaceous bedrock geology. Saskatchewan's is of the Bearpaw Formation. Saskatchewan and Manitoba sites lie in the Hudson Bay Drainage Basin (Richards 1969).

All Manitoba and Saskatchewan sites occur in brown soil zones. Saskatchewan sites occur on undifferentiated regosol and chernozemic dark brown (Dundurn) and brown (Mortlach) soils (Richards 1969). Manitoba sites (Lauder and Spruce Woods) occur on chernozemic soils characterized by coarse textured sandy, sands, wind and wind-sorted deposits. The Boissevain site is characterized by loam till deposits (Barto and Vogel 1978).

Dependence on Dynamic Factors

Hairy prairie-clover is restricted to sand dune areas. It appears to require some element of active (drifting) sand. Annual water deficiency and wind erosion cause considerable soil drifting in sand areas. Areas may be partially stabilized by vegetation but plants are found only where there is some drifting sand. Large areas of once active sand have become stabilized over the last forty years (Wallis 1988).

Land Ownership and Management Responsibility

A. Saskatchewan

The Dundurn site lies on crown land and partly within the Camp Dundurn Military Reserve. Land south of the military reserve is part of the P.F.R.A. Dundurn Community Pasture. The Mortlach/Caron site lies within a community pasture managed by the Mortlach Sheep Provincial Community Pasture. Owners of the Besant Campground control part of the Mortlach/Caron sandhill site.

B. Manitoba

The southern Lauder Sand Hills site lies within area purchased for Wildlife Habitat by the Manitoba Habitat Heritage Corporation and is managed by the Wildlife Branch under the Critical Wildlife Habitat Program. The western section of the northern Lauder Sand Hills site is on crown land posted as Lauder Sandhills Wildlife Management Area while the eastern section is under private control. The Spruce Woods site lies within Spruce Woods Provincial Park. The Shilo area (Bald Head Hills) lies within Camp Shilo Military Reserve. The Boissevain site is probably extirpated.

Management Practices and Experience

Mixed prairie is the most extensive grassland region found in North America. The majority of short-grass and mixed-grass prairie has been lost or converted in Alberta

(Wallis and Wershler 1988). Much of the remaining rangelands exists in areas unsuitable for cultivation. Hairy prairie-clover prefers marginal sandy areas. At the same time, greatly increased grazing pressure on the remaining rangelands has changed the plant composition in all types of habitats. About 24% of the original mixed prairie remains in its native state. One provincial park, Spruce Woods Provincial Park, in Manitoba offers some protection but the park is heavily used for recreational purposes. Loss of primary habitat as well as destruction of specific habitats is a serious concern regarding survival of endangered species (World Wildlife Fund 1988).

The extreme conditions existing within sandy habitats protects these areas, to a degree, from many kinds of exploitation but damage to habitat may still result from certain uses such as tourism, oil and gas exploration and other site-specific types of disturbance. Sand dune areas are exposed to increasingly greater use for consumptive and non-consumptive recreational purposes, cattle grazing and resource extraction, e.g., minerals, oil and gas. Heavy grazing by cattle has a dramatic effect on the plant species composition leading to decreases in grasses such as Needle-and-thread and increases in Blue Grama, sedges and Prairie Selaginella. Activities such as trampling, all-terrain vehicle use and grazing can quickly reduce these diverse environments to a simple surface of drifting sand. The preservation and careful management of these areas often regarded as wastelands by the general public needs to be recognized (Pylypec 1989).

BIOLOGY

Hairy prairie-clover is a perennial species with a stout taproot that reproduces primarily by seeds. From a study of herbarium labels the species apparently flowers from late July to late August, setting seed in September. Only 1 plant out of 1000 was found in flower at the Spruce Woods Provincial Park site in Manitoba on July 23, 1996 (Smith 1996). No plants were in flower at the Dundurn site on July 25, 1996.

At the southern Lauder Sand Hills site, in Saskatchewan, 15-20% of plants were in flower on July 25, 1996. At the northern Lauder site on the same date none of the specimens of hairy prairie-clover were in flower. On June 26, 1990 the plants were barely in bud at the southern Lauder site. By July 28, 1990, 50-60% were flowering (Smith and Lewis 1990).

Little specific information on the biology is available for this species.

POPULATION SIZES AND TRENDS

Populations always occur as discrete units within a larger area of seemingly similar habitat. The largest populations occur at the Manitoba sites in the Lauder Sand Hills and in Spruce Woods Provincial Park at Spirit Sands. The following is an overview of populations in the two provinces of occurrence.

Saskatchewan Populations

Site 1 - Dundurn (Figure 4)

Hudson found 40-50 plants at the Dundurn location in 1981 and a further 100-200 plants a month later at the more southern Proctor Lake location in the Dundurn area (herbarium labels). In 1975, the species was collected twice by other collectors. No population information was given.

Smith (1996) found a small, discreet population of 15-20 plants on a semi-stabilized blowout at the Dundurn site. The area requires more intensive exploration. It would be expected that the entire area might contain a population in the low to mid-hundreds of specimens. Suitable habitat containing active sandy areas is very infrequent within the dune field.

Site 2 - Mortlach/Caron

Historically, hairy prairie-clover was last collected from this site in 1966 (site collections made from 1956 to 1966). At this time small populations were confined to the bottoms and sides of sand blowouts. During an examination of this site by the author in 1996 no specimens were found. Populations have never been large at this site and the species may be extirpated from this location. There is very little active sand now existing within the site or surrounding area. This small dune field is mostly stabilized. Also, the abundant leafy spurge may have displaced the species from its preferred habitat. An intensive search may turn up a few specimens.

Manitoba Populations

Site 1 - Lauder Sand Hills

This site contains the best Canadian populations of the species. Hairy prairie-clover was found at two sites within the sandhills, Site 1A in the southwest (west of Lauder, east of Bernice), and Site 1B in the northeast (west of Hartney, southeast of Grande-Clairière). Both sites occur in the Lauder Sand Hills lying west of the Souris River valley (Smith 1996).

Site 1A (Figure 5)

Plants counted included 300 on the south side of the road and 800 on the north side of the road on a relatively short, 1.5 km, partly stabilized dune ridge system. They are found on the open stabilized top and southwest to south facing dune slopes. Total population is estimated in the low thousands (Smith 1996). A farm and overgrazed cattle pasture is present next to the site. The open eroded sand at this site is too bare and devoid of vegetation to support even the hairy prairie-clover.

Figure 5. Hairy prairie-clover and habitat at Southern Lauder Sand Hills, Manitoba, Site 1A, (photo, B. Smith).

Site 1B (Figure 6)

Various stabilized ridge and dune areas were checked proceeding east towards Hartney through the northern dune area. Although several dune ridges were examined no specimens were found until progress had been made halfway across the northern dune field. Four plants were counted over two dune ridges, all on marginal, atypical habitat associated with juniper beds. The plants were very sparse as the dunes were very stabilized on this Lauder Sandhills Wildlife Management Area. Hairy prairie-clover was discovered in higher numbers on private land held by J. Martin & Sons. The plant was found to grow fairly commonly along the roadside of a 1 km stretch at the eastern edge of the Lauder Sand Hills. Of the 73 plants counted along the road edges, about 20% had been severely damaged as a consequence of mowing. Plants can only grow to 6 inches in height before they are again mown. A further 177 plants were counted in the fenced pasture enclosing overgrazed lower dune slopes. The overgrazing has led to soil erosion resulting in exposed sand subject to blowing. Of these 177, 30 had been badly damaged by trampling of cattle. Hairy prairie-clover is far more common at this disturbed location than it is on the undisturbed, stabilized dune areas. A total population for the northern Lauder Sand Hills site would be in the low-hundreds (Smith 1996).

Hairy prairie-clover becomes much less common as one proceeds northeast through the Lauder Sand Hills (Smith 1996).

Figure 6. Roadside population of hairy prairie-clover at Northern Lauder Sand Hills, Manitoba, Site 1B (photo, B. Smith).

Site 2 - Spruce Woods Provincial Park, Spirit Sands, Devil's Punch Bowl (Figure 7)

A closely confined area of open high relief dunes (4 square kilometres) provides extremely suitable habitat for the species. The total population for this site is estimated to be between 1000-1500 plants. Hairy prairie-clover prefers 50-60% stabilized south to west facing dune slopes. Small discreet populations of 62 and 60 plants were found on the dune slopes and tops as the leading edge of the major dune was approached. The species became more common near the dune face occurring in populations of 200+ at a few nearby locations in grassy areas near the open sand. Populations preferred at least partly stabilized sand surfaces near the edge of active blowouts and blowing sand (Smith 1996).

The nearby areas to the west within the Camp Shilo Military Reserve (the Bald Head Hills) may contain suitable habitat. This area was inaccessible but should be surveyed when possible (Smith 1996).

Figure 7. Hairy prairie-clover habitat (grassy, semi-stabilized knoll at top left) at Devil's Punch Bowl, Spirit Sands, Spruce Woods Provincial Park, Manitoba, Site 2 (photo, B. Smith).

Site 3 - Boissevain

No specimens were found and no suitable habitat exists as former sandy roadsides are now either covered by weeds or mown for hay (Smith 1996). The population is likely extirpated.

Population Summary

Saskatchewan:
Dundurn - low to mid-hundreds
Mortlach/Caron - extirpated or very small population

Manitoba:
Lauder - southern site - low thousands
northern site - low hundreds
Spruce Woods - 1000-1500
Camp Shilo - probably low hundreds
Treesbank - extirpated
Boissevain - extirpated

LIMITING FACTORS AND THREATS

Dune Stabilization/Grazing and Fire Control

The Dundurn Sand Hills near Saskatoon, Saskatchewan have mostly been stabilized by vegetation. Small areas still exist where wind erosion and deposition are altering landform particularly under disturbed conditions such as those incurred under heavy grazing in times of drought. Earlier aerial photographs (1944) reveal areas of active dune complexes more extensive in the past (Pylypec 1989). Hudson (1977) noted that the survival of the species at Mortlach/Caron was threatened by the natural regeneration of grasses of the blowouts there. Similar trends have been noted in the surrounding dune fields at the Harris and Great Sand Hills (Epp 1980, 1982) and in Alberta dune fields at the Middle Sand Hills, Pakowki Lake and Dune Point (Wallis 1988). This has been the pattern throughout the prairie provinces. Areas of potential habitat have been dramatically reduced and now exist as islands among the surrounding cultivated fields. Small areas of active sand exist at Dundurn, Mortlach/Caron, and Spruce Woods Provincial Park. The Lauder Sand Hills contain more extensive habitat, by comparison, although still only small areas within the larger dune field are suitable habitat. The abundant rainfall, nearly twice that of a true desert, enables plants to colonize or cover the dunes, decreasing the open sand areas (Spruce Woods Provincial Park, Spirit Sands, Devil's Punch Bowl Hiking Trails 1995).

Hairy prairie-clover has not been found on what is apparently suitable habitat in the nearby dune fields at the Harris and Great Sand Hills in Saskatchewan, the Oak Lake and Routledge Sand Hills in Manitoba, or any of the similar sand hills of Alberta.

Although the dynamics of dune stabilization are poorly understood, a consensus is emerging that it is a combination of fire and grazing during appropriate seasons that keeps blowouts active. Dunes have been stabilizing where there have been repeated fires but little grazing and in other areas where there has been grazing but few fires (Wallis 1988).

The positive or negative impacts of grazing at various seasons are unknown (Wallis and Wershler 1988). A current theory is that late summer or fall fires formerly created lush green areas the following spring. These green patches attracted large herds of grazing animals like bison and resulted in reactivation of the sand dunes due to the disturbance caused by the animals. The sandhills were also apparently used as sheltering areas by bison during the winter and this could have been significant in keeping dunes active. Fire control and changes in grazing patterns have completely changed the factors that shape sand dune environments (Wallis 1988).

The Mortlach/Caron site in Saskatchewan is located within a community pasture actively grazed by sheep. Overgrazing is indicated by the presence of *Artemisia frigida* and *Mamillaria vivipara*. Further data is required for a full understanding of the affects of the absence of grazing, grazing and overgrazing cycles on the growth and frequency of hairy prairie-clover.

The Dundurn site is fenced for grazing. Most of the disturbed roadside localities containing active blowing sand were found along cattle trails (Smith 1996).

Manitoba sites are potentially threatened by grazing practices. Part of the Lauder Sand Hills site is protected from grazing under the Manitoba government's Wildlife Habitat Management Program. There is a heavily eroded feedlot next to the site. An electric fence separates this property from the protected land. Other areas closer to Hartney are not protected and are actively grazed by cattle and in some roadside areas mown for hay.

Tourism and Recreation

Spruce Woods Provincial Park encloses one of the best Manitoba sites at Spirit Sands. The open dune field is interlaced with hiking trails. Hiking is not restricted to the trails (Spruce Woods Provincial Park, Spirit Sands, Devil's Punch Bowl Hiking Trails 1995, Enclosure 1). The hairy prairie-clover site lies within one of the park's heavily used recreational sites. Tours by horse-drawn wagon are offered from mid-May to early September. Hairy prairie-clover is found within the popular Devil's Punch Bowl at Spirit Sands. Although, the park lends the species a degree of protection from resource extraction and agricultural use, the pressures of tourism should be closely monitored. Use of trails and all-terrain vehicles in the Dundurn Sand Hills needs to be closely monitored (Pylypec 1989). The Lauder Sand Hills are intersected by numerous roads and trails and requires close monitoring. Manitoba Habitat Heritage Corporation forbids use of off road vehicles within the Wildlife Management Area which encloses most of the suitable habitat in the Lauder Sand Hills.

At the Mortlach/Caron site in Saskatchewan the Besant Campground lies within the small sand hills area upon which the hairy prairie-clover was known to occur. Given the small area of appropriate habitat at this site any intrusion would likely have a substantial impact (Smith 1996).

Invasive Weeds

Habitat of the Lauder Sand Hills site in Manitoba is persistently threatened by the leafy spurge, *Euphorbia esula*. The valleys between the dune ridges at the Lauder site are filled with leafy spurge. *Dalea villosa* grows mixed with the leafy spurge in some areas. Leafy spurge could potentially invade and overtake the habitat of the hairy prairie-clover at this location (Smith 1990, 1996). Leafy spurge is also very common and ranges over large areas of the sand hills at the Mortlach/Caron site in Saskatchewan. At this site the leafy spurge colonizes the open sand areas as well (Smith 1996).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Fabaceae ranks second only to the Poaceae in agricultural importance (Cronquist 1981 A few species of *Dalea* are useful in horticulture, among them *D. villosa* which has potential for garden use (Everett 1981). Daleas best adapted for native plant gardens and naturalistic and informal areas, are occasionally accommodated in flower beds. They are likely to respond best to conditions approximating those under which they grow in the wild. Good soil drainage and exposure to sun are essentials. Transplanting is likely to be difficult, therefore it is recommended that plants raised from seeds be grown in pots until they are set in their permanent positions. The species is also at the periphery of its range in Manitoba and disjunct from the core range in the USA in Saskatchewan.

EVALUATION AND PROPOSED STATUS

Existing Protection or Other Status

No specific legal status is accorded *Dalea villosa* in any part of Canada.

In Canada, hairy prairie-clover occurs naturally only in southcentral Saskatchewan and southwestern Manitoba. As a result of this limited distribution the species is considered rare from a national perspective. Maher *et al*. (1979) identified hairy prairie-clover as rare in Saskatchewan. Argus and Pryer (1990) identified the species as rare in Canada (Saskatchewan and Manitoba), Iowa, Montana and Wisconsin.

The Nature Conservancy global Heritage Status is G5T?; the provincial ranks are Manitoba, S2 and Saskatchewan S1. In USA border states this species has the following status: Montana S1; North Dakota SR; Minnesota SR.

All the lists of rare species for the prairie provinces are relatively long. Kershaw (1987) acknowledges three major groups of distribution patterns of rare species in the prairie provinces. Over 80% of the "rare" species in the prairie provinces appear to belong to a group composed of species extending into the provinces from nearby (non-disjunct) widespread populations. Such populations add considerably to the species diversity of the provinces, probably accounting for more than 20% of the total floras. The Canadian populations of *Dalea villosa* probably fall into this category. A second group is composed of species extending into the province as small disjunct populations and is composed of less than 10% of the number of total rare species in the prairie provinces. A third group, composed of endemic species, is limited to a local area and is restricted geographically (Kershaw 1987).

Assessment of Status and Author's Recommendation

The following criteria have been used to assess the status of *Dalea villosa* in Canada:

abundance - known from only 1 location in Saskatchewan, with limited local population, and from 5 sites in Manitoba. Total Canadian population in the mid-thousands.

distribution - restricted in Canada to the Dundurn area of southcentral Saskatchewan and south of Brandon, Manitoba from 5 locations. Several sites extirpated; namely, Mortlach/Caron in Saskatchewan, Treesbank near Spruce Woods Provincial Park and Boissevain, both in Manitoba .

habitat stability - unstable due to loss of habitat to agricultural practices and dune stabilization.

protective status - low, no formal designation, uncertainty about future landowners, management of grazing leases, and potential development on sites.

All preceding criteria are items of concern in assessing the status of this species. In Canada, *Dalea villosa* is known only from scattered sites. Continuity of populations may be affected by many factors including changes in land use, ongoing habitat destruction, and possible development in the remaining known and potential habitat placing the future survival of the species in question. The lack of formal protection for most sites with a viable management plan is a critical problem for the species' survival in Canada.

Hairy prairie-clover is proposed for listing as a threatened species in Canada.

ACKNOWLEDGEMENTS

Funding was provided by the Canadian Wildlife Service, Environment Canada.

LITERATURE CITED

Acton, D.F. 1988. "Physiographic regions" in The Canadian Encyclopedia. Vol. 4. 2d ed. Hurtig Publishers, Edmonton.

Argus, George W. and K. Pryer. 1991. Rare vascular plants in Canada. National Museum of Natural Sciences. National Museums of Canada, Ottawa.

Bailey, L.H. 1942. The Standard Cyclopedia of horticulture. Vol. 1. MacMillan Company, New York.

Barto, W.P. and C.G. Vogel. 1978. Agro-Manitoba information package. Department of Mines, Natural Resources and Environment, Winnipeg.

Beaty, Chester B. 1975. The Landscapes of southern Alberta. Department of Geography, University of Lethbridge, Lethbridge, Alberta.
Bird, C.J. 1988. "Vegetation regions" in The Canadian Encyclopedia. Vol. 4. 2d ed. Hurtig Publishers, Edmonton.
Booth, W.E. and J.C. Wright. 1959. Flora of Montana. Montana State University, Bozeman, Montana.
Cronquist, Arthur. 1981. An Integrated system of classification of flowering plants. Columbia University Press, New York.
Everett, Thomas H. 1981. The New York Botanical Garden illustrated encyclopedia of horticulture. Vol. 8. Garland Publishing, New York.
Harms, V.L. 1990. Rare native vascular plants in the Saskatoon area. Blue Jay 48(2):65-78.
Harms, V.L., Peggy Ann Ryan and Judy A. Haraldson. 1992. The Rare and endangered native vascular plants of Saskatchewan. Prepared for the Saskatchewan Natural History Society. The W.P. Fraser Herbarium, University of Saskatchewan, Saskatoon.
Hudson, John H. 1977. Rare and endangered native plant species in Saskatchewan south of lat. 55^{O}. Blue Jay 35(3):126-137.
Hudson, John H. 1982. Plant finds in Saskatchewan 1980 and 1981. Blue Jay 40(3):136-138.
Hulett, G.K., R.T. Coupland and R.L. Dix. 1966. The Vegetation of dune sand areas within the grassland region of Saskatchewan. Can. J. Bot. 44:1307-1331.
Hummel, Monte. 1987. Prairie conservation, pp. 21-26 in "Proceedings of the workshop on endangered species in the prairie provinces" by Geoffrey L. Holroyd *et al*. Provincial Museum of Alberta Natural History Occasional Paper No. 9, Edmonton, Alberta.
Kershaw, Linda. 1987. Rare plants in the prairie provinces: a discussion of terms and distribution characteristics, pp. 103-107, in "Proceedings of the workshop on endangered species in the prairie provinces" by Geoffrey L. Holroyd *et al*. Provincial Museum of Alberta Natural History Occasional Paper No. 9, Edmonton, Alberta.
Looman, J. and K.F. Best. 1979. Budd's flora of the Canadian prairie provinces. Publication 1662. Agriculture Canada, Ottawa.
Maher, Robert V., George W. Argus, Vernon L. Harms and John H. Hudson. 1979. The Rare vascular plants of Saskatchewan. National Museum of Natural Sciences Syllogeus 20. National Museums of Canada, Ottawa.
Moss, E. 1983. Flora of Alberta. 2d ed. (revised by J.G. Packer) University of Toronto Press, Toronto.
Packer, John G. and Cheryl E. Bradley. 1984. A Checklist of the rare vascular plants in Alberta. Natural History Occasional Paper No. 5. Provincial Museum of Alberta and Alberta Culture, Historical Resources Division, Edmonton, Alberta.
Paterson, D.F. 1973. Maps of the geological systems in Saskatchewan. Department of Mineral Resources, Saskatchewan Geological Survey, Regina.
Richards, J. Howard, ed. 1969. Atlas of Saskatchewan. University of Saskatchewan, Saskatoon.

Scoggan, H.J. 1978. Flora of Canada. Part 3. Publications in Botany, No. 7. National Museum of Natural Sciences. National Museums of Canada, Ottawa.
Smith, Bonnie. 1996. Field observations, Alberta and Saskatchewan on *Dalea villosa* (Nutt.) Spreng.
Stamp, Robert M. 1988. "Alberta" in The Canadian Encyclopedia. Vol. 1. 2d ed. Hurtig Publishers, Edmonton, Alberta.
Spirit Sands Tour. n.d. Pamphlet. Spruce Woods Provincial Park, Manitoba.
Spruce Woods Provincial Park, Spirit Sands, Devil's Punch Bowl Hiking Trails. 1995. Manitoba Natural Resources, Winnipeg.
Wallis, Clifford A. and Cleve Wershler. 1988. Rare wildlife and plant conservation habitats of southern Alberta. Alberta Forestry, Lands and Wildlife; Alberta Recreation and Parks; World Wildlife Fund Canada, Edmonton, Alberta.

THE AUTHOR

The author received her B.Sc. (Botany) from Mount Allison University, Sackville, N.B. in 1977. She has been employed at the University of Calgary, Department of Biological Sciences Herbarium as Technician from 1981 to 1992. Since 1992, she has been greenhouse/herbarium technician at the University of Calgary. Ms. Smith has authored or co-authored twelve COSEWIC status reports on rare plants and is employed as a botanical consultant and rare plant specialist on an on-going basis

AUTHORITIES CONSULTED

1. John H. Hudson, University of Saskatchewan, Saskatoon, SK (conducted fieldwork at the Saskatchewan sites).
2. K.L. Johnson, Manitoba Museum of Man and Nature, Winnipeg, MN (conducted fieldwork at the Lauder Sand Hills site in 1982).

Collections Consulted

The following botanical collections have been consulted:

University of Calgary, Calgary, AB
University of Alberta, Edmonton, AB
University of Regina, Regina, SK
University of Saskatchewan, Saskatoon, SK
Manitoba Museum of Man and Nature, Winnipeg, MN
University of Winnipeg, MN
Canadian Museum of Nature and Agriculture Canada, Ottawa, ON

Fieldwork

John H. Hudson conducted fieldwork in Dundurn area in 1981 and in the Mortlach/Caron area in 1955/1966 in Saskatchewan. As well, G.F. Ledingham and B. Boivin conducted fieldwork in the Mortlach/Caron area during 1956/1960. The author revisited most known Saskatchewan sites in 1996.

Various botanists have conducted fieldwork in southern Manitoba, most recently K.L. Johnson in 1982 and H. McColl in 1985. As well, the author revisited all known sites within Manitoba in 1996.