COSEWIC
Assessment and Update Status Report

on the

Western Spiderwort
Tradescantia occidentalis

in Canada

THREATENED
2002

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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Western Spiderwort — Illustration courtesy of Manitoba Conservation, Wildlife and Ecosystem Protection Branch.

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COSEWIC
Assessment Summary

Assessment Summary – November 2002

Common name
Western Spiderwort

Scientific name
Tradescantia occidentalis

Status
Threatened

Reason for designation
A perennial restricted to four disjunct sand dune habitats where the species is at risk from invading leafy spurge, cattle grazing and dune stabilization.

Occurrence
Alberta, Saskatchewan and Manitoba

Status history
Designated Threatened in April 1992. Status re-examined and confirmed in November 2002. Last assessment based on an update status report.

COSEWIC
Executive Summary

Western Spiderwort
Tradescantia occidentalis

Species information

Western spiderwort (*Tradescantia occidentalis* (Britt.) Smyth), a perennial species, is a member of the Commelinaceae (spiderwort family). Only one other geographically separate species of this genus occurs in Canada, namely, *Tradescantia ohiensis* Raf. This species is restricted to southwestern Ontario.

Distribution

Western spiderwort is confined in the wild to western North America. In Canada, the species is restricted to disjunct sites in the southern prairie provinces. Western spiderwort is known from one site in southeastern Alberta, one site in southcentral Saskatchewan, and three sites in southwestern Manitoba.

Habitat

Western spiderwort sites are located on partly stabilized sand dune ridges, usually on south-facing steeper slopes but also on blow-out areas. There is usually some degree of active drifting sand associated with the sites. In Manitoba, the sand dune ridge systems can be fairly extensive. In Alberta and Saskatchewan, western spiderwort is restricted to small areas within larger partly stabilized dune complexes. Common species associated with western spiderwort sites are as follows: sand grass (*Calamovilfa longifolia*), chokecherry (*Prunus virginiana*), poison ivy (*Rhus radicans*), rose (*Rosa woodsii*), pasture sagewort (*Artemisia frigida*), prairie sagebrush (*Artemisia cana*), ground juniper (*Juniperus horizontalis*), bluebell (*Campanula rotundifolia*), buckbrush (*Symphoricarpos occidentalis*), silverberry (*Elaeagnus commutata*), June grass (*Koeleria macrantha*), Indian rice grass (*Oryzopsis hymenoides*), needle-and-thread (*Stipa comata*), golden bean (*Thermopsis rhombifolia*), cushion cactus (*Coryphantha vivipara*), spear grass (*Stipa viridula*), sand bluestem (*Andropogon scoparius*), blue grama (*Bouteloua gracilis*), and brittle prickly-pear (*Opuntia fragilis*).

Biology

Western spiderwort flowers from May to July and sets seed from early-August to the first snowfall. Each flower lasts only one day. The plant produces above ground

shoot buds in the fall, and overwinters in this vegetative state. Flower color ranges from white to pink to the most common form, deep purple. The most common pollinator is the sweat bee. The plant has both fleshy and slender roots, an adaptation for survival in low moisture sand dune habitat.

Population sizes and trends

The total Canadian population is estimated to be currently about 22,000 plants. The majority of plants are found at two of the three Manitoba sites; namely, the Hellman site (9,422 plants) and the Loutit site (4,321 plants). The third Manitoba site has a population estimate of 619 plants. The Saskatchewan site has approximately 100 plants. The population at the Pakowki Sand Hills in Alberta had a population of 7 plants during 2002, a drought year, but rebounded to 7,450 plants during 2002 when ample precipitation was available.

Limiting factors and threats

Limiting factors have been noted to be cattle grazing, invasion by leafy spurge, shading/dune stabilization and human disturbance. Low to moderate cattle grazing has limited impact and may even serve to offset the effects of dune stabilization. Overgrazing is harmful but is not a concern at the present. Leafy spurge has invaded three of the five Canadian sites but western spiderwort is holding its own at present. Human disturbance of the fragile sand dune habitat through use of off-road vehicles, sand removal and oil exploration is problematic. The Alberta population is in danger of extirpation due to the effects of dune stabilization.

Special significance of the species

Western spiderwort is one of several important species of the fragile sand dune habitat of the southern Canadian prairie provinces. Species of spiderwort are grown horticulturally.

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.

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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.

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Update
COSEWIC Status Report

on the

Western Spiderwort
Tradescantia occidentalis

in Canada

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2002

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SPECIES INFORMATION

Name and classification

Scientific Name: *Tradescantia occidentalis* (Britt.) Smyth
Common Name: Western Spiderwort
Family: Commelinaceae; spiderwort family
Major Plant Group:Monocot flowering plant

Description

Western spiderwort (*Tradescantia occidentalis* (Britt.) Smyth) is an erect perennial with slender stems, 5-61 cm in height (Figure 1). The leaves are linear, with conspicuously ribbed, curved sheaths, swollen at the juncture with the node. The roots are stout and fleshy with slender fibrous roots. The flowers are in terminal few- to many-flowered cymes which are subtended by elongated bracts that are similar in appearance to the foliage leaves. Petals are 10-15 mm long, rose to dark blue in colour, arranged in threes, slightly pointed at the tips. There are six stamens, hairy, with bright yellow anthers. The fruiting structure is a dry papery capsule, 0.4-1.0 cm in length, containing 2-6 seeds. *Tradescantia* is the only genus in the family Commelinaceae that is native to Canada. There is only one other native Canadian species of *Tradescantia*, namely*, Tradescantia ohiensis* Raf., a species restricted to southwestern Ontario in distribution. *Tradescantia virginiana* L. is known from Ontario only as a garden escape.

Figure 1. Illustration of western spiderwort (courtesy of Manitoba Conservation, Wildlife and Ecosystem Protection Branch).

DISTRIBUTION

Global range

Western spiderwort is distributed in the central United States, from Texas, New Mexico and Arizona in the south to Montana and the Dakotas in the north (Figure 2). Western spiderwort probably occurs in northern Mexico, but no records are available. The species occurs in Canada in four disjunct areas, with the Manitoba sites being more contiguous with the main range of the species to the south (Smith 2001).

Figure 2. North American distribution of western spiderwort.

Canadian range

Western spiderwort occurs in the provinces of Alberta, Saskatchewan and Manitoba (Figure 3). It is considered rare in all three provinces. The species occurs at only four sites in these three prairie provinces, with the sand dune habitats subjected to disturbance from grazing and invasive weeds. Substantial populations of the species occur at two of the three Manitoba locations and at one Alberta site.

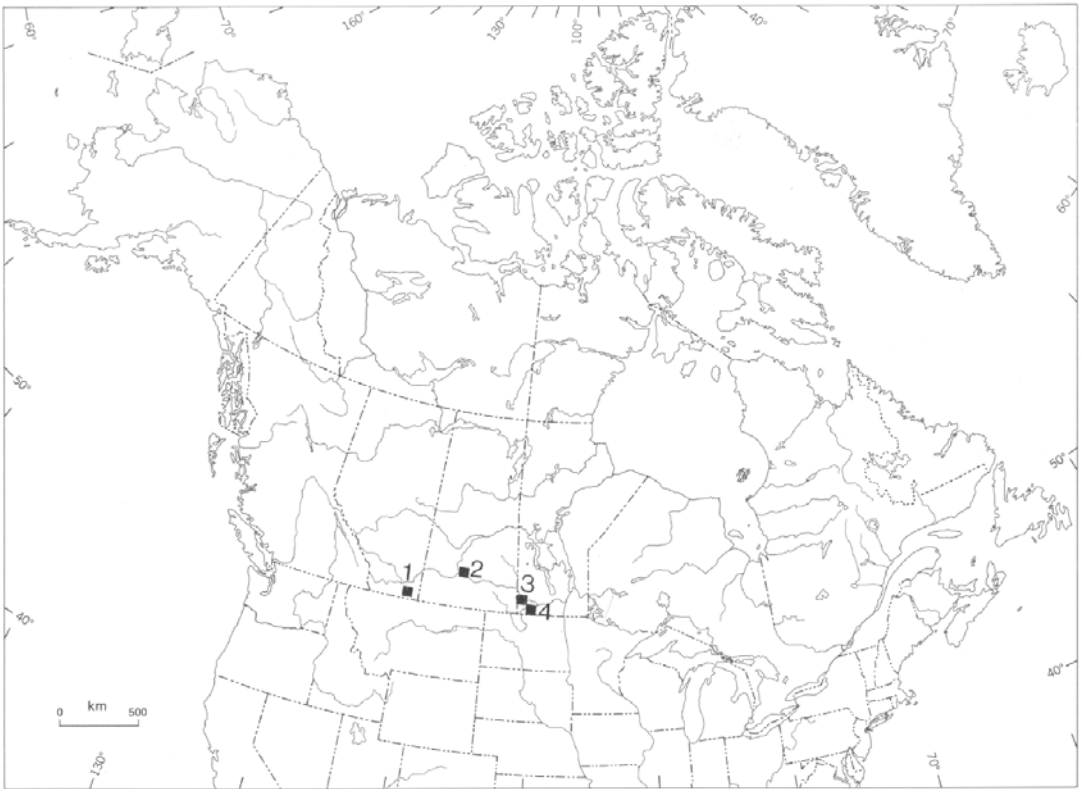

Figure 3. Canadian distribution of western spiderwort.

Legend: 1. Pakowki Lake Sand Hills (Manyberries site), Alberta. 2. Elbow Sand Hills (Douglas Provincial Park site), Saskatchewan. 3. Lauder Sand Hills (includes Western and Eastern populations), Manitoba. 4. Routledge Sand Hills (includes the ESA and surrounding lands) Manitoba.

Alberta

Western spiderwort occurs only at the Pakowki Lake Sand Hills near Manyberries in southeastern Alberta.

Saskatchewan

Western spiderwort occurs at only one site in south-central Saskatchewan in the Elbow Sand Hills, east of Diefenbaker Lake in Douglas Provincial Park.

Manitoba

Western spiderwort occurs at the Routledge Sand Hills and at two locations in the Lauder Sand Hills (western population, including Manitoba Habitat Heritage Corporation (MHHC) site and an eastern population) in southwestern Manitoba. The eastern population, first discovered by Ken DeSmet in 1995, is approximately 1.5 kilometres northeast of the MHHC site. The three Manitoba sites have a total coverage of 12 quarter-sections of land. The Manitoba populations are isolated from those in the adjacent United States, and represent a northern extension of the species' distribution.

Several additional sand hill regions in southwestern Manitoba have been searched without success (Hohn 1994, DeSmet 1995, Goulet and Kenkel 1997).

HABITAT

Habitat Requirements

Western spiderwort sites are located on partly stabilized sand dune ridges, usually on steepsouth-facing slopes but also on blow-out areas (Figures 4 and 5). There is usually some degree of active drifting sand associated with the sites. In Manitoba, the sand dune ridge systems can be fairly extensive. In Alberta and Saskatchewan, western spiderwort is restricted to small areas within larger partly stabilized dune complexes. Common species associated with western spiderwort sites include: sand grass (*Calamovilfa longifolia*), chokecherry (*Prunus virginiana*), poison ivy (*Rhus radicans*), rose (*Rosa woodsii*), pasture sagewort (*Artemisia frigida*), prairie sagebrush (*Artemisia cana*), ground juniper (*Juniperus horizontalis*), bluebell (*Campanula rotundifolia*), buckbrush (*Symphoricarpos occidentalis*), silverberry (*Elaeagnus commutata*), June grass (*Koeleria macrantha*), Indian rice grass (*Oryzopsis hymenoides*), needle-and-thread (*Stipa comata*), golden bean (*Thermopsis rhombifolia*), cushion cactus (*Coryphantha vivipara*), spear grass (*Stipa viridula*), sand bluestem (*Andropogon scoparius*), blue grama (*Bouteloua gracilis*), and brittle prickly-pear (*Opuntia fragilis*). Leafy spurge (*Euphorbia esula*) can be a problem introduced species as it flourishes on sandy habitat restricting native vegetation (Smith 2001, Goulet and Kenkel 1997).

Figure 4. Dune ridge habitat at Routledge Sand Hills, Manitoba (photo by B. Smith, July 1990).

Figure 5. Sand hills habitat at Routledge Sand Hills, Manitoba (photo by B. Smith, July 1990).

In Manitoba, species that were found mainly in the spring include June grass, hairy golden-aster (*Heterotheca villosa*), yellow flax (*Linum rigidum*) and low townsendia (*Townsendia exscapa*). Dead grass cover was high in the spring. Species that were more abundant in the late summer include sand bluestem, spear grass and sand dropseed (*Sporobolus cryptandrus*). Typical species of sand dune habitat in Manitoba include the following: spear grass, sand bluestem, blue grama, chokecherry, roses, and bearberry (*Arctostaphylos uva-ursi*). Skeltonweed (*Lygodesmia juncea*) is characteristic of more open dune areas. Creeping or ground juniper can cover extensive dune areas. Open, stabilized and ungrazed dunes (Hellman ESA site) are characterized by high cover of the moss *Tortula ruralis*, which form a stabilizing 'crust' on sand. The moss is uncommon on grazed areas since trampling by cattle easily breaks up the moss 'crust'. Other characteristic species of Manitoba sand dunes include wolf willow, purple prairie clover (*Petalostemon purpureum*) and goldenrod (*Solidago missouriensis*). Manitoba populations of western spiderwort are found on coarse, sandy soils containing very little silt and clay (Goulet and Kenkel 1997).

Vegetation composition at the Loutit site in the Lauder Sand Hills differs from the other two Manitoba sites. Grass cover is lower, and tree-shrub encroachment onto the dunes is widespread. Destabilized open sand 'bowls' are common in the northern and southern sections of the property (Goulet and Kenkel1997).

The dune habitat differs among the three Manitoba sites. The Hellman site, in the Routledge Sand Hills, is divided by natural shrub and forest breaks between the sand dunes, and by property boundaries. The main dune ridge on the Hellman property runs southeast to northwest. The sand dunes at the MHHC site in the Lauder Sand Hills are generally smaller and broader than those of the Hellman site. The dunes run from north to south, curving at both ends to form an enclosed circle. The sand dunes at the Loutit

site, also in the Lauder Sand Hills, run continuously from north to south on the property, over two quarter sections. Many of these dunes are high (12 m or more) and steep (60% slopes) (Goulet and Kenkel 1997).

Climatic factors are probably critical to the distribution of western spiderwort at the northern limit of its distribution. Above average moisture availability in the summer months increases both population size and length of the flowering period. Plants in moist, well-drained sites are generally more robust than those found in excessively drained habitats (Smith and Bradley 1990, Hohn 1994, Goulet and Kenkel 1997).

Field observations indicate that western spiderwort is most commonly encountered in areas where there is considerable snow accumulation in winter, and where warm and sunny conditions prevail in summer (Goulet and Kenkel 1997).Sufficient and continuous winter snow cover is probably essential to the survival of western spiderwort populations. The overwintering of above-ground shoots undoubtedly require a protective layer of snow to survive the severe Manitoba winters. Since the prevailing winter winds in Manitoba are from the north, the south-facing dune slopes collect and accumulate a considerable amount of blowing snow in winter. This deep snow layer is a particularly effective insulator. In the spring, snow on the south-facing slopes melts earlier and more quickly than that on north-facing slopes, thus extending the microenvironmental 'growing season' for western spiderwort

Trends

Alberta habitat appears to be disappearing or substantially diminishing as a result of dune stabilization by shrubby vegetation (Smith 2001B). Saskatchewan habitat is stable as is Manitoba habitat due to the continued formation of blow-out areas required for colonization.

Protection/ownership

The Alberta population occurs on Crown land that is presently under a grazing lease (Smith and Bradley 1990). The Saskatchewan population occurs on a managed community pasture near the boundaries of Douglas Provincial Park. Douglas Provincial Park allows cattle grazing (Godwin and Thorpe 1991).

The Ecologically Significant Area (ESA) at the Routledge Sand Hills affords a degree of protection to Manitoba western spiderwort populations and habitats. The ESA is fenced off, and permission is required to enter the area. Unfortunately, enforcement is difficult as the owners do not reside on the property. Most of the rest of the Routledge Sand Hills population is subject to cattle grazing and/or human disturbance (mainly motorized vehicles). The MHHC (Manitoba Habitat Heritage Corporation) (Lauder Sand Hills) is managed by an absentee landowner. Permission is required to gain access to the land, but this regulation is not enforced. The site is very accessible as it is adjacent to Provincial Road 345. The eastern population in the Lauder Sand Hills is used as pasture land for cattle (Goulet and Kenkel 1997).

BIOLOGY

General

Western spiderwort flowers from May to July. Each flower lasts only one day. In 1996, the western spiderwort flowered from June to mid-August, and released seed from early August until the first snowfall in October. The species produces aboveground shoot buds in the fall, and overwinters in this vegetative state. Flower color ranges from white to pink to the most common form, deep purple. The rare pink variety occurs at only two of the five sites and is distributed in patches within these sites (Goulet and Kenkel 1997, Smith 2001B).

Reproduction

While self-sterility is common within the genus *Tradescantia*, previous reports have speculated that selfing may occur in western spiderwort. The plant reproduces by seed and by vegetative propagation. Moist stratification is required for seed propagation. The species may propagate vegetatively by producing root buds from stem portions (Smith and Bradley 1990).

In Manitoba, a comparison of flowering plants in 1996 (Goulet and Kenkel 1997) and 1993 (Hohn 1994) found the proportion of plants flowering in 1996 was much lower than in 1993 (Hellman pasture, 72% in 1993 vs. 30% in 1996; MHHC, 52% in 1993 vs. 27.5% in 1996). These results may reflect differences in the definition of an 'individual'. In 1996, about half of all plants flowered in the ungrazed ESA (Routledge Sand Hills) and the eastern population in the Lauder Sand Hills. The lower level of flowering at the grazed portion of the Routledge Sand Hills (30%) was attributable to cattle grazing. Results from both the 1993 and 1996 surveys indicate that flowering is lowest at the MHHC site (Lauder Sand Hills), which may indicate suboptimal conditions at this site (Goulet and Kenkel 1997, Hohn 1994).

Life History

The following account is based on Goulet and Kenkel (1997). On average, most plants produce one or two stems (mean = 1.5). The species invariably produces a single, multi-stemmed shoot. In fact, only one plant with two shoots was found, about half the typical size, in a highly trampled area in the pastures at the Routledge Sand Hills. The root systems are slender and somewhat fleshy. These fleshy roots extend 20-100 cm into the soil, the finer roots extend deeper still.

Plants located in early May of 1996 were already 5-15 cm in height, and consisted of two or four leaves branching at the ground. Flowering buds first appeared on June 12, 1996 in a tight cyme. Each day, a single pedicled bud is raised and forms a flower the following morning. The first flower was seen on June 28, 1996 about a week later than in 1993 and 1994 (Hohn 1994). Each flower lasts a single day, and usually closes by mid-day. At the same time, a second flowering bud is raised to flower the following

day. This process continues until all the buds of the cyme have flowered. The closing of a pollinated flower results in the production of a fleshy structure hanging out from the closed sepals. This structure hardens the following day. Flowering peaked in mid-July, but continued into mid-August of 1996. Some flowering shoots continued to produce new floral buds even after the first capsule in the cyme had dehisced. Following initiation of the first cyme, many plants produced one or more additional cymes.

Plants occurring in small clumps were often at the same stage of floral development. By contrast, some plants in larger clumps failed to flower, and those that did were often at different stages of floral development. Like many perennial species, western spiderwort may not flower until it is sufficiently large and/or old enough.

After flowering, the developing capsules hang in a loose cluster. About 22% of flowers failed to set seed, either because they were sterile or because they were not pollinated. Non-fertilized flowers produce small and cylindrical shaped capsules, whereas fertilized flowers form an ovoid-shaped fruiting capsule.

About three weeks after flowering, the dry, papery capsule dehisces to release 1-6 seeds, averaging 4 seeds. Values were highest at the Routledge Sand Hills and at the eastern population of the Lauder Sand Hills. They were lowest at the MHHC site (Lauder Sand Hills). Seed release was first observed on July 22, 1996 and continued into late September.

After flowering, the above-ground parts of the plant become chlorotic and dry up. At the same time, new shoots are initiated from buds at the root-shoot interface. This fall 'regrowth' occurs as early as late July and continues well into late fall. By late September, plants are very similar in appearance to those seen in early spring. It is apparent that western spiderwort overwinters in this form. Such a strategy has the apparent advantage of allowing the species to resume growth in early spring, prior to being shaded by potential competitors, but may also be a limiting factor in the northward expansion of the species. Some plants were observed to produce two or even three 'regrowth' shoots in the fall. Since only single-shoot plants were found during the summer survey, it appears that only one of the multiple shoots survives the winter. Alternatively, multiple shoot development may be a method of vegetative propagation, if each of the shoots produces an independent 'daughter' plant the following spring.

Pollinators and other insects

Various pollinators have been observed on western spiderwort. A species of halictid or 'sweat' bee (order Hymenoptera, family Halictidae) is the most common pollinator that has been seen on western spiderwort (Goulet and Kenkel 1997). These are solitary bees that nest in the ground and consequently prefer light sandy soils.

Another species inhabiting western spiderwort is a mesh web-spider (family Dictynidae). It builds a web on a portion of a leaf and lives within a curled section of the leaf. Less commonly seen was a species of crab spider (family Thomisidae). An aphid

(order Homoptera) that appears to mimic the floral buds was occasionally noted within the 'mature' cyme (Goulet and Kenkel 1997).

Survival

Western spiderwort possesses both fleshy and slender roots, which is unique within the genus. Succulent root and shoot systems are adaptation to habitats of low soil moisture, such as sand dunes (Goulet and Kenkel 1997).

Physiology

Over all survey years, the MHHC site had the greatest proportion of pink-flowering plants. Despite an extensive search, no pink-flowered plants were observed at the Loutit site in 1996. A new large population of pink-flowered plants was discovered at the north end (Crowfoot dunes) of the Routledge Sand Hills ESA in 1996, substantially increasing the number of pink-flowered plants reported from that area (Goulet and Kenkel 1997).

Manitoba populations of western spiderwort show a continuous gradation in flower color, from almost pure white through to pink and various shades of blue and purple. This observation suggests that flower color is determined by the amount of pigmentation present. Only two white-flowered individuals were observed in 1996, both in the Crowfoot dunes at the north end of the ESA. Other oddities were noticed in the 1996 survey including a single plant that produced two cymes, one with pink-colored flowers and the second with purple flowers and another plant that produced pink, purple and striped pink-purple flowers from the same cyme (Goulet and Kenkel 1997).

The comparative rarity of pink flowers suggests that 'loss of pigmentation' is a recessive trait, and/or that is selected against by pollinators. The discovery of uniquely coloured plants indicate that variation in flower color may be attributable to a mutation in the floral meristem, or a chimeric mutation. However, the fact that all of the uniquely coloured plants occur in a localized region within the Lauder Sand Hills at the MHHC (western population), and no pink flowering plants occur in the eastern population suggests that the mutation is not random in the populations in Manitoba (Goulet and Kenkel 1997).

The strongly clumped spatial distribution of pink-flowered plants suggests that seed dispersal and pollination in western spiderwort populations is limited. Observations in 1996 indicated that pollinators tend to move between adjacent plants within a dune region. This suggests that gene flow in western spiderwort populations is highly localized, which could account for the spatial distribution of pink-flowered plants (Goulet and Kenkel 1997).

Higher leaf damage in unshaded sites suggests that such micro-environments may be stressful to the plants. Higher transpiration rates under full light conditions may result in water and nutrient stress, leading to leaf chlorosis and/or necrosis (Goulet and Kenkel 1997).

The largest plants were found in shaded, lightly-grazed areas where leafy spurge was present. The robust growth of these plants may be attributable to interspecific competition for light. To survive, plants must grow higher than the leafy spurge (Goulet and Kenkel 1997).

Movements/dispersal

Western spiderwort plants show a strongly clumped spatial pattern. Such a pattern likely reflects the limited seed dispersal of the species. Vegetative propagation (from lateral buds), if it occurs, could also account for the observed clumped spatial patterns (Goulet and Kenkel 1997).

Seeds usually fall to the ground directly below the parent plant. Indeed, several seeds were observed trapped between the leaves and the stem node of the parent plants. The relatively large size of the western spiderwort seeds probably limits their dispersal. In many sites, inidividual plants were observed to form linear patterns down a dune face, suggesting that seeds may be dispersed downslope through the action of wind, rain, and/or snowmelt. Strong winds may disperse seeds upslope. Herbivores may also contribute to dispersal by consuming seeds, as they often graze flowering/fruiting plants. If western spiderwort seeds remain viable after passing through the herbivore rumen and gut, this could be an important method of long-distance dispersal (Goulet and Kenkel 1997).

Behaviour/adaptability

It may be possible to transplant greenhouse-grown western spiderwort plants into suitable habitat. However, Hohn (1994) noted that transplanted populations may be difficult to establish and maintain. Sites would have to be prepared by removing leafy spurge, thinning shrubby vegetation, and/or partially destabilizing the sand dunes. Suggested potential transplant sites in Manitoba include the Oak Lake Sand Hills, the Lauder Sand Hills Wildlife Management Area, the Carberry Sand Hills, and the Portage Sand Hills.

POPULATION SIZES AND TRENDS

There are a total of 5 populations located within four sand dune deposits in three provinces in Canada.

Alberta
Pakowki Lake Sand Hills

Manyberries site

Western spiderwort is known to occur in southeastern Alberta at one location near Pakowki Lake. This site was first located in 1986 and has been revisited in 1986, 1987, 1990, 1999, and 2001 by various investigators.

On June 29, 1999, Gould and Cotterill noted 27 plants in the population that were dispersed within a small area in three subpopulations of 3, 19 and 5. Of the 27 plants observed 24 were in bud, 3 were in flower (ANHIC 2001).

The site was investigated by the author (Smith 2001B) on July 14 and again on August 6, 2001. 7 plants were found. The plants were in poor shape. They were less than 15 cm in height and had curled, deformed leaves and were not flowering. All occurred together in a small patch. By the time of the return visit on August 6, no plants were visible.

The population, was apparently always small, varies considerably from year-to-year from a low of 7 to a high of 210 plants (1986 - 50; 1987 - 30; 1990 - 210; 1999 - 27; 2001 - 7). Variation is probably dependent on climatic factors.

Information based on surveys in July 2002, after a spring of high precipitation, resulted in a partial count of 1255 clumps (multi-stemmed plants) and an estimate over the entire area of about 7450 plants (pers. com. Sue Peters, Alberta Conservation Association, Edmonton). Clearly the species fluctuates greatly from season to season depending on climatic conditions.

Saskatchewan
Elbow Sand Hills

Douglas Provincial Park site

Western spiderwort occurs in southcentral Saskatchewan at only one location. Population work done at this site occurred in 1991 at which time 42 plants were counted. The site was reinvestigated in 2001 by Douglas Provincial Park staff. Plants were found in 15 locations ranging from one to several plants at each location yielding a total population of less than one hundred. The final report on the occurrence of western spiderwort was not available at the time of writing (Douglas Provincial Park, 2001).

Manitoba
Lauder Sand Hills

Western population (including the MHHC)

This, the first of two Lauder Sand Hills sites was surveyed in 1990, 1992, 1994, 1996 and 2001. In 1990, 66 plants were counted. During the 1992 and 1994 surveys numbers remained constant at 380. The estimated population in 1996 was 783 plants (Goulet and Kenkel 1997) and in 2001 the count was 619 (pers. com., Elizabeth Reimer, Manitoba Cons. Data Centre).

This site supports comparatively small populations of western spiderwort. Two localized populations have previously been described; both occur in protected 'pockets'

of the sand dune (Smith and Bradley 1990, Hohn 1994). In 1996, a small new population was found on a gently rolling meadow west of the main chain of sand dunes. This population occurs in a low-lying area that is sheltered by clumps of low shrubs (Goulet and Kenkel 1997).

Eastern population

This population was first discovered in 1995. A complete search of the area was undertaken in 1996 including areas identified by DeSmet (1995) and the northern portions of the property that had not been previously explored. Western spiderwort was most abundant on the high dunes in the central portion of this private property, where cattle grazing is minimal. Less dense populations also occur at the north end of the property, and on high sand dunes in the southern portion (Goulet and Kenkel 1997). The estimated population in 1996 was 19,540 plants (Goulet and Kenkel 1997). A survey in 2001 by Marjorie Hughes yielded a count of 4,321 (pers. com., Elizabeth Reimer, Manitoba Cons. Data Centre).

Routledge Sand Hills

This population represents the largest Canadian population of western spiderwort. It was examined in 1990, 1992, 1994, 1996 and 2001. The partially stabilized sand dune ridges were found to contain 3278 plants in 1990 (Smith and Bradley 1990). Approximately 7800 plants were counted in the 1992 and 1994 surveys (Hohn 1992, 1994). The estimated population in 1996 was 26,550 plants, 75% of which occur in the ESA (Goulet and Kenkel 1997). Again, climatic factors apparently greatly influence population levels from year-to-year.

The majority of western spiderwort plants at this site are found in the ESA, which is on private property. Adjacent Crown land supports a dense growth of western spiderwort, but these plants only occupy a small area extending about 5-20 m beyond the fence line of the private property. In 1996, additional plants were discovered on two other private properties adjacent to the ESA. The extension into the one property continues only about 100 m past the fence line, even though the sand dunes extend much further. The second property was not fully explored as permission to search the land was not obtained (Goulet and Kenkel 1997).

In 1996, two new sub-populations of western spiderwort were discovered in the ESA. A small sub-population was found in a grass-shrub meadow on stabilized, gently rolling sand hills. The plants at this site were most abundant in low-lying, protected areas. A second, larger sub-population was found on the Crowfoot sand dunes that extended into adjoining private lands. This second sub-population contains a large number of pink-flowered plants (Goulet and Kenkel 1997).

Western spiderwort at the Routledge Sand Hills site were reported to have remained stable to the present day (Hellman, pers. com 2001). Actual counts, however, made by Marjorie Hughes in 2001 (pers. com., Elizabeth Reimer, Manitoba Cons. Data

Centre) give a total of 9,422 plants, a considerable drop in numbers from the 1996 high of 26, 550.

Overview

Western spiderwort is limited in distribution in Canada to one moderately large population in Alberta (Pakowki Lake Sand Hills) that appears to fluctuate considerably with seasonal rainfall, two small populations, with one in Saskatchewan (Douglas Provincial Park) and one in Manitoba (Western Lauder Sand Hills) and two fairly substantial populations in Manitoba (Eastern Lauder Sand Hills and Routledge Sand Hills). Population sizes are summarized in Table 1.

Table 1. Summary of population data on western spiderwort. with new data from Alberta (for 2002) and Manitoba (2001) provided in September, 2002 by the respective jurisdictions.
[E. Haber, COSEWIC].

Province Sand Hills Sites	AB Pakowki Lake Sand Hills Manyberries site	SK Elbow Sand Hills Douglas Prov. Pk.	MB Lauder Sand Hills W. Pop. incl. MHHC	MB Lauder Sand Hills E. Pop.	MB Routledge Sand Hills incl. ESA and other private lands	Total Canadian Population*
1986	50					50
1987	30					30
1990	210		66		3,278	3,554
1991		42				42
1992			380		7,800	8,180
1994			380		7,800	8,180
1996			783	19,540	26,550	46,873
1999	27					27
2001	7	100	619	4,321	9,422	14,469
2002	7,450 est.					7,450
Most Recent Count	7,450	100	619	4,321	9,422	21,912

* Total population count based on incomplete data for most years.

The two largest populations of western spiderwort both occur in southwestern Manitoba. The Routledge Sand Hills likely contains the largest Canadian population consisting of a high of over 26,000 plants as estimated in 1996. This population, like others, fluctuates considerably in size, with the most recent count representing a drop in numbers to just over 9,400. This site also supports a large number of the pink-flowered form of the plant. Over the past twelve years, total population numbers, in Canada, have remained in the thousands of plants with considerable fluctuations in numbers. Minimal human disturbance and limited presence of leafy spurge may account for the relatively large numbers of western spiderwort at the Routledge Sand Hills. It seems likely that favourable site conditions also play a role. The Eastern Population in the Lauder Sand Hills contains the second largest Canadian population with the most recent count being in 2001 at 4,321 plants, a considerable drop from the 1996 count of 19,540.

This population, first discovered in 1995 covers both high and low relief dunes (Goulet and Kenkel 1997).

Population estimates in 1996 are much higher than previous estimates. A number of factors, including the following, likely have contributed to these higher values: 1 The Eastern Population at the Lauder Sand Hills, which includes over 40% of the known Manitoba population, was not included in earlier surveys. 2. In the 1996 survey, the number of non-flowering plants was included in the estimate of total population size. 3. The 1996 census was more complete than previous surveys. It included areas in both the Routledge Sand Hills and MHHC site that were not previously enumerated (e.g., Crowfoot dunes, and two other private properties). 4. The observed increase in western spiderwort population size between 1990 and 1992 may have been attributable to increased levels of precipitation over the same period (Goulet and Kenkel 1997, Hohn 1994).

Information based on fieldwork in July of 2002 commissioned by Alberta Sustainable Resource Development, Fish and Wildlife Division, has provided new insights into population fluctuations at the single site in Alberta. About 7,450 plants are estimated to have been present in the summer of 2002 after a spring of high rainfall. Similarly, new data from the province of Manitoba for its three sites provided by the Manitoba Conservation Data Centre were particularly informative. The Manitoba data (Table 1) indicates a considerable drop in population sizes during 2001 from a previous high in 1996 for all three sites. These low values were also reflected in the extremely low number documented for the single Alberta population for the same year. For the current year of 2002, the ample rainfall in southern Alberta provided good growing conditions for the resurgence of the Alberta population at the Pakowki Lake Sand Hills to high numbers. Clearly population sizes fluctuate considerably in this species.

The total Canadian population is estimated to fluctuate in size in recent years (see table 1) from a low of about 7,714 (low values from all of the known sites) to 54,423 plants (high values at all the sites).

LIMITING FACTORS AND THREATS

The original status report indicated that threats to the survival of western spiderwort in Canada were: conversion of tame pasture to cropland, dune stabilization, grazing and fire control, invasive weeds, and petroleum production and extraction (Smith and Bradley 1990). Any loss of habitat within the known locations of the species would adversely affect the species' survival in Canada. Loss of habitat is most likely as a result of agricultural practices such as grazing and introduction of weedy species such as the leafy spurge.

Goulet and Kenkel (1997) list the following as limiting factors: cattle grazing, invasion by leafy spurge, shading and human disturbance.

Cattle grazing

Overgrazing is highly detrimental to western spiderwort habitat and should be discouraged. Low to moderate grazing levels may help prevent vegetation encroachment in sand dune habitats. Shoot regeneration was observed in plants damaged by cattle grazing and trampling. If the plant is not grazed to the ground, regeneration can occur from the remaining stem tissue (Goulet and Kenkel 1997). The lower level of flowering (30% as opposed to 50% in ungrazed sites) was attributable to cattle grazing. Cattle appear to be attracted to the colourful flowers, as many flowering shoots are nipped off (Goulet and Kenkel 1997).

All Canadian western spiderwort sites, except the MHHC site in Manitoba, have been subject to grazing. Grazing of western spiderwort by both cattle and native herbivores (mainly white-tail deer) has previously been reported (Hohn 1994). The majority of the grazing pressure appears to be attributable to cattle. The effects of grazing pressure on western spiderwort may be both positive and negative. Grazing-trampling of plants may reduce population size and fecundity. However, cattle may prevent dune stabilization by their movements, and by their browsing of woody plant species and dune-stabilizing grasses (Goulet and Kenkel 1997). In areas where grazing pressure is light to moderate (Hellman pasture, Loutit sites),light to moderate cattle grazing does not appear to be a serious threat to the long-term persistence of western spiderwort populations. However, cattle grazing is known to decrease the relative diversity of communities. Heavy grazing is highly detrimental to western spiderwort populations (and sand dune habitats generally) and should be actively discouraged (Goulet and Kenkel 1997).

The ESA in the Routledge Sand Hills is now protected from cattle grazing. The area south of the ESA is grazed by about 25 head of cattle. Grazing by cattle was particularly common in the southern portion of the main Routledge site. All the areas surrounding the ESA, with the exception of the Crown land area, were subjected to cattle grazing (Goulet and Kenkel 1997). Cattle no longer graze the main Routledge site found on private property (pers. com., Elizabeth Reimer, Manitoba Cons. Data Centre).

Although the MHHC site is protected from grazing the site is surrounded on all sides by pasture land and the area is used as a winter feeding station for white-tail deer. Hohn (1994) noted heavy grazing damage to western spiderwort populations at this site indicating the species is grazed by native herbivores. Since the area is used as a winter feeding station the populations of white-tail deer may be artificially high.

About 168 head of cattle graze in the area of the Eastern Population on the Lauder Sand Hills property site during the summer months, affecting mainly the north and south portions of the property. The less accessible steeper slopes in the central region remain relatively undisturbed thus affording some protection to the western spiderwort populations. Cattle grazing and trampling have destabilized these sand dunes, resulting in open areas dominated by the cactus Opuntia fragilis (Goulet and Kenkel 1997).

Ungrazed sand dunes have a 'typical' profile of tall grasses on the south-facing slope, where the majority of western spiderwort plants are found. In grazed areas, south-facing slopes are used by cattle as 'pathways', resulting in open sand 'bowls' and shrub-dominated areas. On grazed sand dunes, western spiderwort is largely restricted to shrubby areas and to the northern dune face. Shrub cover may provide protection from herbivory and adverse microenvironmental conditions (Goulet and Kenkel 1997).

At the Routledge Sand Hills, western spiderwort is most abundant in the ungrazed areas (ESA), and is less abundant in the grazed pasture lands. At the Eastern Population site (Lauder Sand Hills), western spiderwort is most abundant on the high, steep dunes (inaccessible to cattle) in the central portion of the property. These observations suggest that long-term grazing by cattle may reduce western spiderwort population sizes. It is important to note, however, that western spiderwort has persisted in these habitats despite many years of light to moderate cattle grazing (Goulet and Kenkel 1997).

The Manyberries site in Alberta is held under a grazing lease. No indications of active grazing of the site were noted during fieldwork (Smith 2001B).

The Douglas Provincial Park site in Saskatchewan has had yearly grazing for the past several decades with apparently little impact although direct grazing of plants has been noted to occur (Godwin and Thorpe 1991).

Invasion by leafy spurge

Western spiderwort habitat in Manitoba has been colonized by leafy spurge (Euphorbia esula), a Eurasian invasive plant. This species is particularly common in the Lauder Sand Hills (Western and Eastern Populations) where it occurs at high cover (Goulet and Kenkel 1997). The introduction of leafy spurge to North America (sometime in the 1900's) has resulted in extensive loss of habitat and biodiversity in the western United States and southern Canadian provinces. Once established, leafy spurge is difficult if not impossible to eradicate (Harris 1988). Chemical and natural tillage cannot be used to control the invasion of leafy spurge in natural communities. Biological control, using European spurge beetles, was undertaken at the Lauder Sand Hills (Western Population) and at the Routledge Sand Hills in 1993. Results, to date, are unknown (Hohn 1994). The transport of hay bales containing leafy spurge seed is thought to be a major contributing factor to the spread of the species in the Canadian provinces (Schmidt 1989).

The species is locally abundant at the Routledge Sand Hills, particularly in areas grazed by cattle. In the ESA, leafy spurge is only occasionally encountered (three small populations), and it usually occurs at relatively low cover. Leafy spurge covers almost 75% of the sand dunes at the MHHC site in the in the Lauder Sand Hills. There is some uncertainty as to whether spurge beetles have been released at this site. Leafy spurge has completely covered large sections of the dunes within the Eastern Population in the Lauder Sand Hills. The land owner has plans to release spurge beetles on the property (Goulet and Kenkel 1997).

Leafy spurge did not appear to adversely affect fecundity, abundance, or phenology of the western spiderwort in the summer of 1996 (Goulet and Kenkel 1997). It is important to note that information on community composition and structure prior to the invasion of leafy spurge is not available. It is also possible that leafy spurge might be capable of strongly competing with western spiderwort if adverse climatic conditions occur (Goulet and Kenkel 1997).

Leafy spurge has invaded several thousand acres of land in the Elbow Sand Hills. The leafy spurge within the sand hills is currently concentrated in the eastern half of the area. The location where the western spiderwort is found lies just west of the extensive leafy spurge invasion (Godwin and Thorpe 1991). In 2001, leafy spurge now occurs to a limited extent amongst the western spiderwort populations at the Saskatchewan site (Douglas Lake Provincial Park, 2001).

Leafy spurge does not occur at the Manyberries site at the Pakowki Lake Sand Hills in Alberta (Smith 2001B).

Shading/dune stabilization

Fire suppression policies implemented in the early 1900's may have promoted woody shrub-tree encroachment into sand-dune communities resulting in dune stabilization and loss of western spiderwort habitat. The full effects of dune stabilization on western spiderwort populations are unknown. The presence of shrubs may have a positive effect, since shrub cover protects the species from herbivores and creates a more favorable microclimate (Goulet and Kenkel 1997). Plants growing in semi-shaded habitats (amongst shrubs or under a canopy of bur oak) often appeared healthier and had high levels of seed production. Low shrub cover may be critical to the survival of western spiderwort in more exposed habitats (Goulet and Kenkel 1997).

An examination of a time-series of aerial photographs of the Routledge Sand Hills (1940's-present) indicate that minimal shrub-tree encroachment has occurred. The south-facing dune slopes are very hot and dry in summer, and this may preclude the establishment of long-lived woody species. In addition, low to moderate browsing by cattle and native ungulates may be important in keeping woody vegetation 'in check'. The species will grow also in meadows and shaded habitat as well as open, partially stabilized dunes.

Dune stabilization and cover by shrubby species has resulted in a negative impact on the Alberta population in the Pakowki Sand Hills (Manyberries site). There has been a substantial loss of more open grassy/sandy habitat in favour of shrubby habitat (Smith 2001B).

Human disturbance

Western spiderwort is restricted to ecologically-sensitive sand dune habitats that are easily destroyed by human activity. Human disturbance to the fragile sand dune

communities may take many forms. Pedestrian and motorized vehicles are a major problem on the ESA and MHHC sites. At MHHC, a sign on the highway encourages exploration on foot (pers. com., Elizabeth Reimer, Manitoba Cons. Data Centre). Motorized vehicles are particularly destructive to the dune habitats. Sand-gravel excavation and oil exploration are potential threats to western spiderwort habitats. Removal of plants from their natural habitat for transplanting into gardens is also a problem (Goulet and Kenkel1997).

The Routledge Sand Hills is relatively undisturbed, although trespassers on motorized dune bikes and snowmobiles occasionally disturb the ecological integrity of the area (Goulet and Kenkel 1997).

There is little impact from human disturbance in the Manyberries site in Alberta. The Saskatchewan site lies in Douglas Provincial Park and is subjected to typical park usage such as campground operations, hiking and picnicing. The population is apparently stable at present (Douglas Provincial Park 2001, Smith 2001B).

SPECIAL SIGNIFICANCE OF THE SPECIES

Western spiderwort is one of several species found exclusively in the fragile sand dune habitat of the southern Canadian prairie provinces. The very recognizable western spiderwort may serve as an indicator species for the well-being of the sand dunes it inhabits. Although the particular horticultural use of western spiderwort is unknown, several other species of spiderwort are grown horticulturally.

EVALUATION AND PROPOSED STATUS

Existing protection or other status

COSEWIC designated western spiderwort as "threatened" based on the status report by Smith and Bradley (1990). The province of Manitoba designated the species as threatened in 1994 (Goulet 1997). Western spiderwort is listed by Alberta and Saskatchewan as a species of concern (ANHIC 2001, Harms, Ryan and Haraldson 2001).

Assessment of status and author's recommendation

There are five known populations of western spiderwort within Canada. All populations are disjunct from their American counterparts and, for the most part, from each other. Three of the five populations are in Manitoba on two dune fields; namely, the Lauder Sand Hills (two populations, 1.5 km apart) and Routledge Sand Hills (1 population). The Alberta and Saskatchewan sites contain smaller disjunct populations. Two of the Manitoba sites contain a substantial population base, namely, the relatively newly discovered (1995) Eastern Population (Lauder Sand Hills) and the

Routledge Sand Hills population. The total Canadian population is estimated to contain in 2001/2002 about 22,000 plants.

Threats to the survival of the species in Canada include: cattle grazing, invasion of habitat by leafy spurge, shading/dune stabilization, and human disturbance. The fragile sand dune habitat is particularly susceptible to damage as a result of human disturbance (off road vehicles, sand removal and oil operations). In most cases the species is holding its own against the invasion of its habitat by leafy spurge in Saskatchewan and in Manitoba at the Western Population (MHHC) in the Lauder Sand Hills and at the Routledge Sand Hills. Cattle grazing has appears to have an impact on the species but in moderation does not apparently pose a severe threat and may be somewhat beneficial in negating the effects of dune stabilization.

A recommendation of 'threatened' is tendered based upon the low number of Canadian sites, the considerable fluctuation in population sizes and the ongoing concerns regarding the sensitivity of the sand dune habitat to varied disturbances.

TECHNICAL SUMMARY

Tradescantia occidentalis *(Britt.) Smyth*
Western Spiderwort] Tradescantie de l'Ouest
Canada, Alberta, Saskatchewan, Manitoba

Extent and Area information	
• *extent of occurrence (EO)(km²)*	Approximately 500 sq. km
• *specify trend (decline, stable, increasing, unknown)*	stable
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	no
• *area of occupancy (AO) (km²)*	Approximately 10 sq. km.
• *specify trend (decline, stable, increasing, unknown)*	perhaps a decline due to leafy spurge in MB and SK
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	no
• *number of extant locations*	4 areas but 5 pops.
• *specify trend in # locations (decline, stable, increasing, unknown)*	stable
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	no
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	a loss of habitat in MB and SK due to leafy spurge infestation
Population information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	Unknown, perennial
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	about 7,700-54,500 recent number about 22,000 plants
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	no clear trend; pops. fluctuate
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	census data not adequate
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	yes
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	yes
• *list each population and the number of mature individuals in each*	AB - Manyberries -7450 SK - Douglas - 100 MB - MHHC - 619 MB - Loutit – 4,321 MB - Hellman – 9,422 [values in 2001]
• *specify trend in number of populations (decline, stable, increasing, unknown)*	stable
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	no
Threats (actual or imminent threats to populations or habitats)	
- cattle grazing, invasion of leafy spurge, dune stabilization, human disturbance	

Rescue Effect (immigration from an outside source)	
• *does species exist elsewhere (in Canada or outside)?*	yes
• *status of the outside population(s)?*	Not at risk
• *is immigration known or possible?*	Not possible
• *would immigrants be adapted to survive here?*	probably
• *is there sufficient habitat for immigrants here?*	yes
Quantitative Analysis	

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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.

COLLECTIONS EXAMINED

University of Calgary Herbarium, Calgary, AB.
Alberta Natural Heritage Information Center, Edmonton, AB.
W.P. Fraser Herbarium rare plants of Saskatchewan database, Saskatoon, SK.

Fieldwork

The author visited the Alberta site twice in 2001, once in July and again in August. As well, the author visited the Saskatchewan site in August, 2001 but did not conduct extensive fieldwork at this time upon learning that the park wardens of Douglas Provincial Park had just completed an extensive survey for western spiderwort over the course of the summer. The author did not visit the Manitoba sites during 2001 as other investigators had conducted very extensive and detailed surveys of these populations during recent years. The author contacted the Hellmans in July, 2001.