# COSEWIC
# Assessment and Status Report

on the

# Rough Agalinis
## *Agalinis aspera*

**in Canada**

**ENDANGERED**
**2006**

**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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Rough agalinis — Photograph by M. Hughes.


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# COSEWIC
# Assessment Summary

**Assessment Summary – April 2006**

**Common name**
Rough agalinis

**Scientific name**
*Agalinis aspera*

**Status**
Endangered

**Reason for designation**
An herbaceous annual having a restricted geographical range and occupying small prairie remnants mainly along roadsides in southern Manitoba. The few small populations are at risk from such impacts as late season mowing, burning, overgrazing and road expansion.

**Occurrence**
Manitoba

**Status history**
Designated Endangered in April 2006. Assessment based on a new status report.

# COSEWIC
# Executive Summary

## Rough Agalinis
*Agalinis aspera*

### Species information

Rough agalinis (*Agalinis aspera*) is a dicotyledonous (having two embryonic leaves) flowering plant that is currently considered a member of the broomrape family (Orobanchaceae). It is a slender annual herb with narrow linear roughened leaves that are opposite to sub-opposite. Manitoba plants grow up to 35 cm tall and exhibit very little branching. Flowers are borne in a short raceme on stalks that are slender but nearly erect. Only one or two of the showy pink flowers are seen at a time because they only last for a day. The fruit is a dark brown oval-shaped capsule containing numerous tiny diamond-shaped seeds.

### Distribution

The species ranges through the central plains from Manitoba to Texas. It is probably most common in Iowa and Nebraska, where it is listed as S4 (subnational rank indicating apparently secure). It is also recorded in Illinois, Kansas, Arkansas, Louisiana, Missouri, Oklahoma, northern Texas, southwestern Minnesota and Wisconsin and eastern parts of North Dakota and South Dakota. The Canadian range is restricted to 11 known sites from five rural municipalities in southern Manitoba.

### Habitat

This is a prairie species found in low wet meadows that are often at risk due to drainage or heavy grazing. The plants occur where vegetation is sparse and the soil is alkaline. The Canadian sites represent remnant prairie habitats found primarily along roadsides.

### Biology

Rough agalinis is an annual herb that relies, in part, on other flowering plants for part of its nutrients (hemiparasitic). Host preference is not currently known.

### Population sizes and trends

The population size was very small in 2004, although it may fluctuate from year to year. Only 209 – 229 plants were found at 11 sites within an area of occupancy of less than 5 $km^2$. Previous studies are not available to establish trends.

## Limiting factors and threats

All prairie habitat has been reduced by the expansion of agricultural activity in the province of Manitoba. Most of the Manitoba sites are in road allowances.

## Special significance of the species

*Agalinis aspera* is specially adapted to prairie habitat and may represent a unique evolutionary line.

## Existing protection

This species currently does not have any protection in Canada.

## COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5th 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

## COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

## COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

## DEFINITIONS (2006)

| | |
|---|---|
| Wildlife Species | A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. |
| Extinct (X) | A wildlife species that no longer exists. |
| Extirpated (XT) | A wildlife species no longer existing in the wild in Canada, but occurring elsewhere. |
| Endangered (E) | A wildlife species facing imminent extirpation or extinction. |
| Threatened (T) | A wildlife species likely to become endangered if limiting factors are not reversed. |
| Special Concern (SC)* | A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. |
| Not at Risk (NAR)** | A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. |
| Data Deficient (DD)*** | A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction. |

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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# COSEWIC Status Report

on the

# Rough Agalinis
*Agalinis aspera*

**in Canada**

2006

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## SPECIES INFORMATION

### Name and classification

| | |
|---|---|
| Scientific name: | *Agalinis aspera* (Dougl.) Britton |
| Synonyms: | *Agalinis greenei* Lunell |
| | *Gerardia aspera* Dougl. ex Benth. |
| Common name: | Rough agalinis; gérardie rude |
| Family: | Orobanchaceae (broomrape family) |
| Major plant group: | Eudicot flowering plant |

*Agalinis* Raf. is a New World genus with about 60 species in North and South America. Pennell (1929) originally recognized 38 species from North America but later reduced that to 35 (Pennell 1935). Current studies (Canne-Hilliker and Kampney 1991) accept 32 North American species. Pennell (1929) divided the genus *Agalinis* into six sections with *Agalinis aspera* alone in the Section *Asperae* based on vegetative anatomy. Like those species in the section *Heterophyllae*, *A. aspera* has an elongated seed capsule but unlike them it also has sepals united to form calyx lobes which are only half the length of the tube. Pennell also considered the narrow elongated leaves to be distinctive. Canne-Hilliker and Kampney (1991) also divide the genus into six sections but with several changes including moving *A. aspera* into Section *Purpurea* Subsection *Pedunculares*. Thus under this reclassification of the sectional and sub-sectional ranks *A. aspera* is no longer in its own unique section. *Agalinis* is a taxonomically complex genus that has generated much study of the phylogenetic relationships among the different sections.

This species was first described as *Gerardia aspera* by Douglas, who collected the type specimens in 1827 in the present province of Manitoba (Pennell 1929). It was first recorded as *Agalinis aspera* (Dougl.) Britt. in Britton and Brown's "Illustrated Flora of the Northern United States and Canada ed. II" (1913). The previous *Agalinis greenei* Lunell is included in *A. aspera* (Pennell 1929). The Manitoba plants seem to fit the type described as *A. greenei* (the type specimen of which was collected at Leeds, ND, 80 km south of the MB border) because they are short and have few branches. This type may be a form of genetic diversity adapting the species to the periphery of its range.

*Agalinis* was considered part of the family Scrophulariaceae until recent work determined that all parasitic Scrophulariaceae should be separated into the family Orobanchaceae (Olmstead *et al*., 2001).

This species does not have a widely accepted common name; it is also known as: rough purple agalinis (Britton and Brown 1970), rough gerardia (NPWRC 2005), and rough false foxglove (USDA, NRCS 2004 The Plant Database).

In Manitoba, two other taxa have been described in addition to *A. aspera*. *Agalinis tenuifolia* Vahl var. *parviflora* Nutt., which has been found in several southern Manitoba locations: Giroux, Pinawa, Marchand, Vita, Tolstoi, Gardenton. It is characteristically

east of the Red River, while *Agalinis aspera* is found west of the Red River. Scoggan (1957) also lists *A. paupercula* (Gray) Britton. Budd's Flora (Looman and Best 1979) records *Agalinis purpurea* (L.) Pennell var. *parviflora* (Benth.) Boiv. from "moist grassland in southeastern Parklands". The Manitoba Conservation Data Centre lists three species: *A. aspera*, *A. tenuifolia var. parviflora* and *A. paupercula var. borealis*, which is considered synonymous with *A. purpurea var. parviflora*. The Herbarium at the University of Manitoba, Winnipeg (WIN) also has records of only two species (*A. aspera* and *A. tenuifolia*). Obviously, great care must be taken in identification of *A. aspera* in the field to ensure that the correct species is being studied. Budd's A. purpurea and Scoggan's *A. paupercula* can be distinguished by the pedicels that are shorter than the calyx or capsule. *Agalinis tenuifolia* has very slender pedicels that are generally longer than those of *A. aspera*. The capsules of *A. tenuifolia* are globose compared with *A. aspera's* ellipsoid to ellipsoid-ovoid capsules, and the corolla of the flower is much smaller. Agalinis aspera is always rough to touch owing to its scabrous or hispidulous-scabrous leaves.

Other species of *Agalinis* are considered rare, including the following: *Agalinis acuta* is federally listed as endangered in the USA; *Agalinis gattingeri* is listed as endangered in Canada.

**Morphological description**

This description is based on Pennell (1929), Pennell (1935), Britton and Brown (1970) and personal observations on fresh and herbarium specimens from Manitoba.

*Agalinis aspera* is an annual hemiparasitic herb with a slender erect stem. In its more southern range in the United States this species is known to be 20 – 80 cm in height but Manitoba specimens are only 8 – 35 cm (Table 1). Plants may have many ascending branches in the southern range, but in Manitoba stems are simple or with one or two small branches. The narrow linear leaves are opposite to sub-opposite 1 – 4 cm long, 0.8 – 1.5 mm wide. They are scabrous on the upper surfaces. (This gives the plant its rough feel, hence the common name). The elongate racemes are 4 –18 flowered. The slender, nearly erect flower-bearing pedicels are 4 – 13 mm long, equal to or two times as long as the calyx, while capsule-bearing pedicels lengthen slightly to 5 – 20 mm. The puberulent calyx is made up of five united sepals with acute calyx teeth one-third as long as the 4 – 7 mm tube. The corolla of five united petals is 15 – 25 mm long. The lobed campanulate tube is purple-pink in colour, evanescent, falling the first day (Figure 1). The dark brown seed capsules are oval and oblong, extending well beyond the calyx. They are 7 – 11 mm long. The seeds are 1.2 – 1.4 mm long, oval-angulate, somewhat diamond-shaped.

Figure 1. *Agalinis aspera* in bloom at Grosse Isle, MB, Aug. 16, 2004 (photograph by M. Hughes).

**Table 1. Data summary of populations, their size and average height of plants.**

| Population | Description of Site | # of Plants | Average ht (cm) |
|---|---|---|---|
| 1 | Grosse Isle | 8 | 19.5 |
| 2 | Warren | 20 | 20.0 |
| 3 | Woodlands | 27 | 15.4 |
| 4 | St. Laurent | 30-50 | 20.0 |
| 5 | Poplar Point | 13 | 19.5 |
| 6 | Poplar Point | 7 | 17.6 |
| 7-1 | Poplar Point | 10 | 9.9 |
| 7-2 | Poplar Point | 15 | 20.0 |
| 7-3 | Poplar Point | 23 | 10.1 |
| 8 | Poplar Point | 1 | 10.0 |
| 9 | Poplar Point | 18 | 11.5 |
| 10 | Poplar Point | 28 | 16.5 |
| 11 | Brandon | 7 | 15.1 |
| Totals of plant number and average height of plants | | 207-227 | Av. 15.8 |

## Genetic description

Chromosome numbers have been studied in 19 species of the genus *Agalinis*, but unfortunately no counts are available for *A. aspera.* Other species were found to have meiotic counts of n=13 or n=14 and mitotic counts of 2n=26 or 2n=28 (Canne 1984).

## DISTRIBUTION

### Global range

*Agalinis aspera* ranges throughout the central plains of North America from Manitoba to Texas. State records with NatureServe (2004) ranks, in brackets, include: Illinois (SNR), Iowa (S4), Kansas (SNR), Louisiana (SNR), Minnesota (SNR), Missouri (SNR), Nebraska (S4), North Dakota (SNR), Oklahoma (SNR), South Dakota (SNR), Texas (SNR) and Wisconsin (SNR). The designation SNR represents not ranked/under review and S4 is secure. The USDA PLANT Database (2004) records *A. aspera* from seven counties in Arkansas; NatureServe (2004) does not record *A. aspera* from Arkansas. As no other records were found besides those on NatureServe to confirm the presence of *A. aspera* in Louisiana, Louisiana was not included in the map in Figure 2.

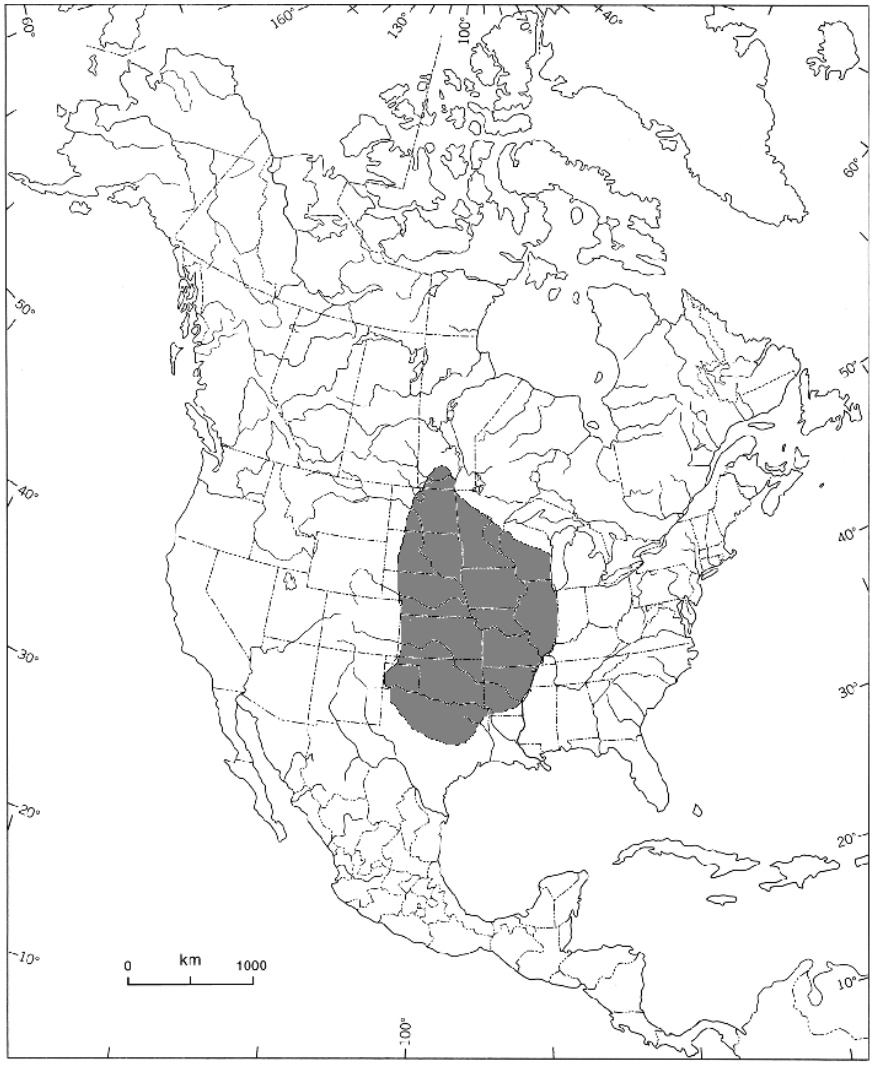


Figure 2. Global range of *Agalinis aspera* within central North America based on NatureServe (2004), USDA's The PLANTS Database (2004) and field observations for this study.

Pennell (1929) writes that *A. aspera* is “occasional on prairies and bluffs in Illinois; more frequent through southwestern Minnesota, western Iowa, through the Central Lowland from the western lake section to the Osage Plains, from eastern North Dakota to central Oklahoma; penetrating the Plains Border in Kansas and the eastern High Plains in Nebraska.” More recent records (Ownbey and Morley 1991) record *A. aspera* in several counties across southern Minnesota and in western areas of central and northern MN.

*Agalinis aspera*, being typical of the Great Plains, occurs west of most of the other members of the genus *Agalinis*. Pennell (1929) considered *Asperae*, a section of *Agalinis* consisting of the single species *A. aspera*, to be a “unique western line of evolutionary progress,” based on the vegetative anatomical features described above.

## Canadian range

The Canadian range is limited to five rural municipalities in southern Manitoba: Brandon, Portage la Prairie, Woodlands, St. Laurent and Rockwood. Eleven populations, found within an area of occupancy of 4.7 km$^2$, are located at 1) Grosse Isle, 2) Warren, 3) Woodlands, 4) St. Laurent, 5) Poplar Point (six distinct populations in this area) and 6) Brandon. Specific locations are discussed below and shown on the map in Figure 3.

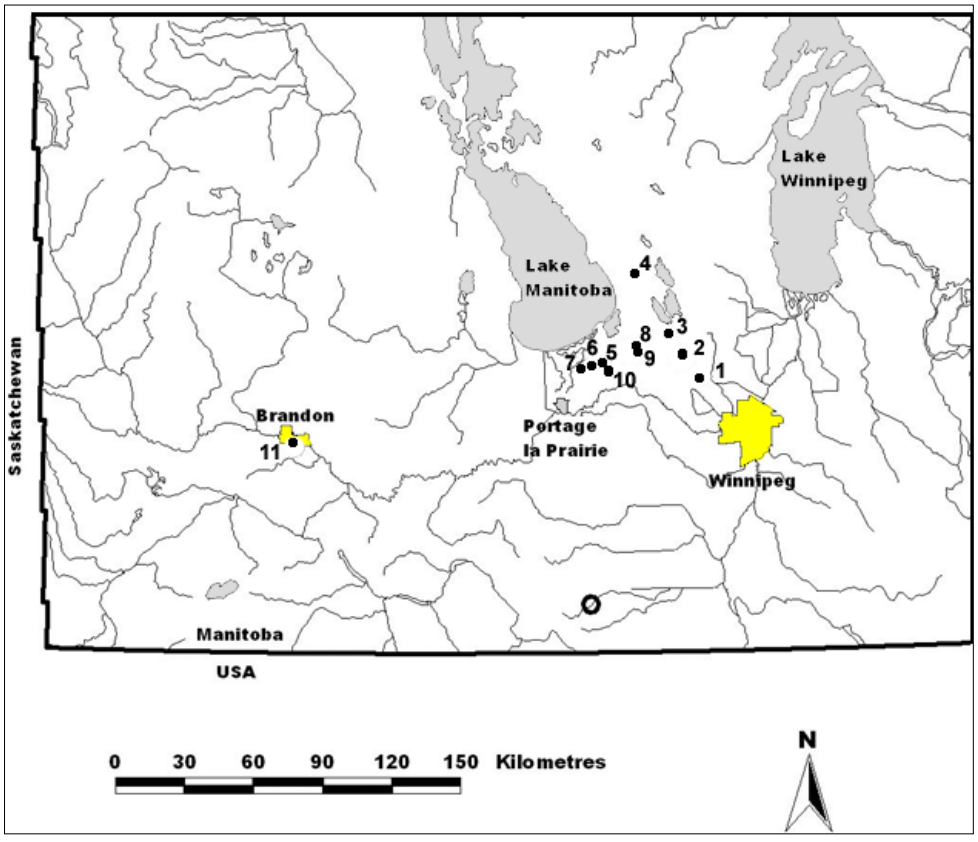


Figure 3. Distribution of *Agalinis aspera* in Manitoba. Populations are numbered as in Table 1. The historic population near Morden (hollow circle) is now considered to be extirpated.

# HABITAT

## Habitat requirements

The USDA database (2004) defines the habitat for this species as “basic soils, dry rocky or sandy prairies on limestone or limestone-capped bluffs, steep sandy hillsides and sandy-gravelly moraines.” This may be the preferred habitat found further south in the species range.

Although Pennell (1929) considers *A. aspera* habitat to be dry prairie hills, observations made in this study would indicate that the habitat of preference is low prairie meadows that are somewhat wet. The soil is basic, with exposed patches of bare stony soil and limestone gravel. Soil disturbance is tolerated. The vegetation is sparse and open where the plants occur, allowing full exposure to the sun. The Canadian sites represent remnant prairie habitats found primarily along roadsides.

## Habitat trends

All prairie habitat has been reduced by the expansion of agricultural activity in the province of Manitoba. Wet meadows have been subject to drainage and may be affected by heavy grazing as they are often used for pasture.

## Habitat protection/ownership

All but three of the populations and sub-populations found in Manitoba in 2004 were in road allowances. Warren and Grosse Isle are along a Provincial Trunk Highway (PTH #6) while the remaining road allowance sites are on smaller roads. The maintenance of the highway road allowance is the responsibility of Manitoba Transportation and Government Service (Roberts, pers. comm. 2004) while smaller roads are usually the responsibility of the local municipalities.

The Woodlands site (#3) is owned and maintained by the Public Works Department of the Rural Municipality of Woodlands. The Woodlands prairie remnant may be completely eliminated if Manitoba Highways proceeds with plans to alter the course of PTH #6 (Roberts, pers. comm. 2004). This highway currently forms a curve as it passes through the town because there was once a railway station adjacent to it.

The St. Laurent site (#4) is a privately owned hay field. The owners are aware that there are rare species on their property.

The other meadow site at Poplar Point (sub-population 5C-2) is part of the Prairie Farm Rehabilitation Administration (PFRA) Community Pasture. It currently has a small amount of grazing from a herd of horses, but the pasture is managed by the PFRA range managers. They have been made aware of the presence of this rare plant on the property.

## BIOLOGY

All information on the biology of this species is contained within studies of the genus as a whole, especially Pennell's 1929 and 1935 monographs. No publications have been found that are written specifically about this species.

### Life cycle and reproduction

This is an annual species that blooms from late July / early August until the end of August / early September and produces seeds in September. The flowers are perfect, occurring in indeterminate racemes in the axils of opposite bracts.

The large flower corolla is attractive to pollinating insects such as bumblebees (Pennell 1935). The spreading lobes of the corolla are specifically adapted to pollination by bees as are the stamens, which have short filaments thereby positioning the anthers within the corolla. In a study of *Agalinis acuta* (Neel 2002), it and other species of *Agalinis* were found to be self-compatible. Thus even a very isolated plant may still be capable of producing seed. Although this feature has not yet been studied in *A. aspera,* the placement of anthers and stigma within the flower make it possible that it could be autogamous (self-fertilized; Canne-Hilliker, pers. comm. 2004). This is a significant feature considering the small size of the Manitoba populations.

The leaf blades are narrow and structurally reduced. This may represent an adaptation to the dry prairie environment, i.e., a xerophytic modification.

### Herbivory/predation

No information available under this subheading.

### Physiology

No information available under this subheading.

### Dispersal/migration

The 1.2 to 1.4 mm seeds are oval-angulate, somewhat diamond shaped (Pennell 1929). Numerous small light seeds are produced per capsule (Figure 4). They probably disperse locally by being blown in the wind when the mature capsules open, although some may be picked up on the feet of birds (Pennell 1935) and other animals.

### Interspecific interactions

*Agalinis* is a hemiparasitic genus. The roots of the *Agalinis* connect to the host xylem via specialized roots called haustoria, by which they are able to obtain water and dissolved nutrients. The size and vigour of the hemiparasite depends on the availability of host roots and the host type (Musselman and Mann 1978).

*Agalinis tenuifolia* has been recorded to parasitize a variety of Angiosperm hosts including: *Paspalum pubescens, Panicum dichotomum, Agrostis perennans, Juncoides campestre, Anemone virginiana, Rubus villosus, Fragaria virginiana, Potentilla pumila, Viola triloba, Mitchella repens, Solidago bicolor, S. caesia, S. nemoralis, Aster undulatus, Antennaria plantaganifolia and Achillea millefolium* (Pennel 1929). Musselman and Mann (1978) found *Agalinis* to have "the broadest host range of any root parasite in the South". Although they found no definite host preference by any species of *Agalinis*, they did note that *Agalinis purpurea* is never abundant in areas without woody plants. Host preference in *A. aspera* is not currently known, but one of the most vigorous plants observed in this study was close to a small snowberry bush (*Symphoricarpos albus*). The two field populations were not far from clumps of aspen (*Populus tremuloides*).

### Adaptability

No information available under this subheading.

## POPULATION SIZES AND TRENDS

Before the commencement of this study *Agalinis aspera* was known from only two recent locations: Grosse Isle (population #1) and Poplar Point (population #5).There were two records from Morden, the most recent of which was 1943. Scoggan (1957) lists further records from Stony Mountain near Winnipeg (Macoun 1896, rocky ground; Fowler 1953) and Portage la Prairie (McMorine 1891, 1897). Pennell (1929) records specimens from Emerson and Stony Mountain. There were no population assessments included with any of these records.

Population sizes and vigour of plants located in 2004 are summarized in Table 1.

### Search effort

Search efforts began by locating all herbarium specimens and records and by contacting knowledgeable individuals. All these leads were followed up. When it became obvious what kind of habitat and plant community were appropriate, further examinations of similar habitats were done. Fieldwork was carried out by the author on 16 days (between July 20 and Sept. 28, 2004), on three of which she had additional companions for assistance. The first *A. aspera* plants were found at Grosse Isle August 11, 2004. The highway (PTH #6) and the railway parallel each other in a northwest direction for about 42 km from Grosse Isle to St. Laurent, although the railway tracks have been removed north of Warren. This wide (up to 35 m) road allowance appears to support a healthy community of prairie species in many locations. *Agalinis aspera* populations were found at Warren and Woodlands, but more study of this road allowance might be worthwhile.

Although three days were spent in the area of the PFRA Portage and Woodlands community pastures and all roadsides were examined, the author does not feel that

she was able to completely inventory this area. These pastures consist of over 10,000 hectares of land and further studies would have to be carried out on horseback or all-terrain vehicle.

Several Manitoba locations known to contain small white lady's-slipper were visited because the habitat requirements appeared to be similar. This led to the discovery of the St. Laurent site. Several other potential areas were visited including Lake Francis Wildlife Management area, Pembina Hills Provincial Park, Bird's Hill Provincial Park and the St. Charles Rifle Range. Plants of *Agalinis aspera* are very inconspicuous when not in bloom; therefore future search efforts must be carried out during the bloom period, which in 2004 was between August 10 and September 10.

**Summary of extant populations**

**1. Grosse Isle**: There are three voucher specimens from this location at the University of Manitoba herbarium (WIN # 43190, #43478, # 44346). They were all collected by D. Punter in 1986 and 1987.

A small population of eight *Agalinis aspera* plants was found on August 16, 2004. The plants were spread out in a 60 m line along the southwest facing side of a 24-m-wide road allowance between the highway and the railway track. The plants were found on moist gravelly soil on the mid-slope of this low ditch. The associated plant community is tall-grass prairie. Species found in the immediate area around the plants were: *Andropogon gerardii*, *Schizachyrium scoparium*, *Poa sp, Psoralea argophylla, Allium stellatum, Lobelia spicata, Solidago missouriensis, Elaeagnus commutata and Aster ptarmicoides.* Other plants found nearby include *Solidago* sp., *Salix* sp., *Helianthus maximiliani*, *Zizia aptera* and *Aster ericoides*. To the north, the ditch becomes deeper and supports marsh species such as *Typha latifolia*. On August 16 *A. aspera* was in bud and blooming. The plants were from 16 to 30 cm in height and capsules were just beginning to develop after flower drop. When the site was revisited September 10, the plants appeared to be still in good condition. No blooms were observed but capsules were developing well. Nearby there is a 3-hectare area of tall-grass prairie that has remained in the triangular or Y-shaped area between three railway tracks. This area was examined carefully on five occasions for this survey (July 20 and 30, August 11 and 16 and Sept. 10, 2004), but *A. aspera* was not found there. This prairie is burned regularly (Hamel pers. comm. 2004) and otherwise maintained as a prairie habitat by the Prime Meridian Trail Association.

**2. Warren**: *Agalinis aspera* was located August 22, 2004, and revisited September 10, in a 35-m-wide area of the road allowance near the town of Warren. This shallow ditch contains a tall-grass prairie remnant. There was an alkaline crust on the soil and gravelly stones were found near the plants. The plant community included *Andropogon gerardii*, *Aster ptarmicoides, Liatris* sp., *Melilotus alba*, *Dalea purpurea, Gentiana puberulenta, G. linearis, Lobelia spicata, Rosa* sp*., Psoralea agrophylla,* and *Solidago missouriensis*.

A population of about 20 plants was found, spread out thinly along a 10 m stretch of ditch. They were between 15 and 25 cm tall on August 22, blooming, in bud and beginning to form capsules. Two plants were still blooming when visited on September 10 and capsules were developing well on some plants (Figure 4). One plant showed degeneration of capsules with no seed development, which may have been due to a frost which occurred in southern Manitoba on August 19-20, 2004.

Figure 4. Capsules forming on *Agalinis aspera* plants at Warren, MB, Sept. 10, 2004 (photograph by M. Hughes).

**3. Woodlands**: At this location the tracks and buildings have been removed from what was once a small railway station. Although part of this space is mowed as town lawn, part has remained native prairie. On August 28, 2004 this prairie showed a healthy community of tall-grass prairie species including *Andropogon gerardii*, *Schizachyrium scoparium, Parnassia palustris, Gentiana crinita, Gentiana puberulenta, Dalea purpurea, Aster ptarmicoides, Solidago missouriensis.* By September 10, the whole area had been mowed, cutting all plants down to about 15 cm.

The *Agalinis aspera* population at this site consisted of 27 plants spread out along a 16-m line. The grasses are thin in the area of the *A. aspera* with patches of bare soil, pebbles crusted with calcareous deposits and chunks of limestone gravel. It is not clear whether this gravel was original in the area or part of the railway grade.

**4. St. Laurent**: A population of 30 – 50 plants of *Agalinis aspera* was found August 22, 2004, in a wet meadow on this property. The plants were found 60 m east of a small dirt

road with water-filled ditch and 2 – 6 m north of a stand of *Populus tremuloides*. The population was contained within a 28 m by 7 m area. The other vegetation in the area was open and sparse consisting mainly of young green stems of *Andropogon gerardii*, also *Parnassia palustris*, *Eleagnus commutata*, *Populus tremuloides* seedlings, *Cypripedium* sp., *Castilleja* sp., *Juncus* sp., *Calamagrostis* sp., *Bromus ciliatus* and *Solidago missouriensis*.

This population is of special interest because it is one of only two populations that were found in fields rather than road allowances.

**Poplar Point Sites**: A small dirt road cuts through the PFRA Portage Community Pasture, and its 11-m -wide road-allowance supports some tall-grass prairie remnants. Three populations and two sub-populations of *Agalinis aspera* were found on the north side of this road (Table 1). Intermixed with *A. aspera* were the following taxa: *Andropogon gerardii, Schizachyrium scoparium, Poa* sp., *Carex* sp., *Dalea purpurea, Dalea candida, Allium stellatum, Lobelia spicata, Meliotus alba, Symphoricarpos albus, Gentiana puberulenta, Monarda fistulosa, Rosa* sp*., Cypripedium* ***sp****.* The following populations were recorded within the Poplar Point area:

**5. Poplar Point**: At this site, 13 healthy plants were spread over a 3-m length of the road allowance. Plants were found on the south-facing side of the shallow rise of the ditch where the soil is gravelly and moist. There were footprints of cattle in the ditch. North of the fence the pasture is heavily grazed by cattle, so it was not inspected for this study.

**6. Poplar Point**: Some 2.4 km west of site 5, seven plants were found on wet gravelly soil marked with cow footprints. While some of these plants were small (9 – 11 cm) and feeble, one vigorous plant, near a snowberry bush (*Symphoricarpos albus*), was 29 cm tall.

**7. Poplar Point**: This population was found 1.4 km west of population 6 along the same road. The population consisted of three sub-populations: ***Sub-population 7-1*** consisted of 10 tiny plants spread out over 5 m of almost bare ditch. *Schizachyrium scoparium* formed grassy hummocks above the bare ground and *Agalinis aspera* was found beside *S. scoparium* and *Lobelia spicata* on the hummocks. ***Sub-population 7-2*** was found north of the fence in the adjacent pasture that was not heavily grazed. It consisted of 15 plants located about 60 m north of the road in a wet meadow. Other plants found near the *A. aspera* were: *Andropogon gerardii, Poa* sp., *Carex* sp., Juncus sp., *Allium stellatum, Campanula rotundifolia, Dalea purpurea, Achillea millefolium, Grindelia squarrosa* and *Ambrosia artemisiifolia var. elatior.* The *A*. *aspera* plants were found 10 m east of a grove of aspen*, Populus tremuloides*. The pasture population was quite vigorous compared to the plants in the road allowance as they were taller, with more blooms and small branches (Table 1). ***Sub-population 7-3*** was found about 800 m south and consisted of 23 plants growing in a dry bare gravelly ditch. They were mostly quite small and feeble with the tallest plants being 16 cm high.

**8. Poplar Point**: On August 20, 2004, all of the roads adjacent to or bisecting the Portage and Woodlands pastures were driven and their roadsides examined from the road. If suitable areas were observed they were examined more closely. Adjacent pasture areas were examined, if they looked promising. The only other site found was on the east side of the Woodlands pasture. At this site, only one tiny 10-cm plant was found. The grass around it was low and hummocky. Associated plants were: *Andropogon gerardii*, *Poa* sp. *Dalea purpurea*, small *Potentill*a sp. shrubs and *Eleagnus commutata.*

**9. Poplar Point**: South of the Woodlands pasture, but along the same road, a population of 18 tiny plants of *A. aspera* was found spread out over 11 m of the west road allowance. The plants were 8 – 16 cm tall with only one tiny flower or bud and showed little evidence of capsule development. This ditch has sandy gravelly soil. Associated plants were *Andropogon gerardii*, *Aster ptarmicoides*, *Solidago missouriensis, Liatris* sp., *Campanula rotundifolia*, small *Potentilla* shrubs and *Eleagnus commutata*. This site is 11.32 km east of population 5.

**10. Poplar Point**: This population was found in the road allowance east of PR 430. About 28 plants were spread out sparsely along a 160-m stretch of the east side (west facing) of the ditch. These plants ranged from 8 to 25 cm in height with very little branching (Table 1). The associated plant community was made up of*: Andropogon gerardii, Poa sp., Aster ptarmicoides, Solidago missouriensis*, *Liatris* sp. *Rosa* sp*. Oxytropis splendens*, *Gentiana crinita,*and *Rudbeckia serotina.* This site is 3.14 km southeast of site 5A.

**11. Brandon**: This site was discovered by M. Hughes on August 14, 2001, during a study of small white lady's-slipper. A voucher specimen was collected in 2001 and deposited at the Manitoba Conservation Data Centre. When the site was visited August 24, 2004, only seven plants were found in a 1 – 2 $m^2$ area. The potential habitat in this road allowance would be about 400 $m^2$. The plants were budding and flowering, with some small capsules beginning to develop. The soil in the road allowance is a sandy, gravelly loam. There are some gravel-pit operations in this section indicating the presence of a gravelly moraine ridge. The plant community is a mixed-grass prairie remnant which includes *Andropogon gerardii, Schizachyrium scoparium, Poa* sp., *Fragaria virginiana*, *Aster ptarmicoides, Gentiana puberulenta, Gentiana crinita, Eleagnus commutata*, *Populus tremuloides* (seedlings), and *Equisetum* sp. The plants in this population were between 10 and 20 cm in height. They were feeble and thin with very little branching. The survival of this population appears to be very precarious.

All the known sites of small white lady's-slipper in the Brandon and Brandon Hills areas were checked August 24 – 25, 2004 but no further populations of Agalinis aspera were found.

## Historic extirpated populations

**Morden.** There are two collections of *A. aspera* in the herbarium at the Morden Agricultural Research Station (Enns, pers. comm. 2004) collected August 4, 1939, three miles west of Morden in “sterile sand, acid sand”. Although there is no name associated with this specimen it may be the record referred to in Scoggan (1957) as collected by “Marshall 1939.”

There is also a specimen of *A. aspera* in the University of Manitoba herbarium (WIN # 48846) collected August 20, 1943, by G. De Ruyck at “Morden, Man. prairie, grassy, rather low meadow.”

An extensive survey of the Pembina Hills flora was undertaken in the 1970s and 1980s by H.H. Marshall (Marshall 1989), but no additional records of *A. aspera* were recorded. It would be logical to assume that Marshall, being familiar with this species and the area, would have found it, if it were still present. The species is listed in this book associated with wet meadows and woods. The book makes the following comment on wet habitats:

> “Several large wet areas were associated with lake beaches but most have been drained or heavily grazed. The draining process has provided new homes along ditches. This habitat has been greatly reduced and changed.”

While this survey identified some very suitable potential habitat in the Morden-Thornhill area, no populations of *A. aspera* were found.

**Poplar Point.** This record, from the University Herbarium (WIN #44121) was collected August 16, 1982, by D. Punter (determined by G.M. Keleher) from “provincial road 227 between Highways 240 and 430. Roadside flat, open”. This 19 km stretch of Prov. road 227 was studied August 17, 2004. It is a very wide gravel road which was realigned and upgraded in the late 1980s and early 1990s because of the hydro power line on the north side (McKay, pers. comm. 2005). The ditches no longer support a remnant prairie community; they are mowed or overgrown with weeds. It appears that the population of *A. aspera* which may have occurred along this road has been extirpated.

## Abundance

Numbers of plants were very small at all locations in 2004, ranging from 1 to perhaps a maximum of 50 plants with a total likely not exceeding 230 plants.

## Fluctuations and trends

It is impossible at this time to be sure of the population trends because so few previous records are available. Studies of *Agalinis gattingeri* (Canne-Hilliker 1988) found enormous fluctuation in the size of populations from year to year because *Agalinis* plants are delicate annuals dependant on the germination and production of seed from

year to year. Assuming this is the case for *A. aspera* as well, further studies are warranted to assess the population numbers.

### Rescue effect

The nearest known population of *A. aspera* in the U.S.A. is from Stutsman County, ND (186 km south of the U.S.A./Canada border and 200 km south of the extant Canadian populations). This record from the Northern Prairie Wildlife Research Center was passed on by Bruce Hanson, who has done extensive plant studies in North Dakota but has not encountered *A. aspera*. He concludes that it is not common in the state of ND (Hanson, pers. comm. 2004). *Agalinis aspera* is considered to be fairly common in southern and western Minnesota (Smith, pers. comm. 2004). While the seed capsules do produce large numbers of seeds, their distribution over such a great distance would appear to be unlikely. Based on county distributions for North Dakota (USDA, NRCS 2004), the nearest occurrences in the United States are well over 200 km south of the extant Canadian populations. There is likely little or no rescue potential considering that the species has no adaptations for long-distance dispersal.

## LIMITING FACTORS AND THREATS

*Agalinis aspera* requires habitats that are open and sunny, where competing plants are sparse. The plants seem to survive well along roadsides where the right combination of soil and sparse vegetation is present. They seem to be able to tolerate soil disturbance; in fact such disturbance may increase the chance of successful germination.

In Manitoba, human impact poses the greatest threat to these populations because most of them are in road allowance areas. Any major disturbance of the road allowance undertaken for road expansion, road straightening, etc., would put these populations at risk. Slight disturbance due to cattle tracks and moderate erosion is probably not a problem. Mowing may be useful to control competing species but should not be done during late summer when flowers and capsules are present. Extensive damage to the seed capsules was observed at Woodlands due to late-season mowing. The *A. aspera* plants were between 11 and 24 cm tall on August 28. The mowed specimens were still alive on September 10 but, although some capsules were still developing safely, many seed capsules had been destroyed by the mowing.

The impact of burning on this species is presently unknown, but it appears that the extensive burning undertaken at the Grosse Isle prairie has reduced the population of *A. aspera* there. Canne-Hilliker (2000) noted that “short plants that produce small seeds, such as Skinner’s agalinis, are known to be particularly susceptible to loss in fire-suppressed prairies.”

The impact of grazing is significant at the Poplar Point sites, and cooperation with range management personnel will be important in the prevention of overgrazing.

The population may be reaching a critical level below which the genetic diversity would be too low to ensure survival.

## SPECIAL SIGNIFICANCE OF THE SPECIES

*Agalinis* is a hemiparasitic plant that, because of its unusual lifestyle, has been placed in a separate family, the broomrape family (Orobanchaceae), with other species of similar biology. The generic name in Latin means “remarkable flax”. The basis for this name is uncertain. The plant does not appear to have any specific economic uses nor does there appear to be any recorded Aboriginal traditional knowledge regarding this species. In spite of the showy flowers, all species in this genus turn black when dried for plant collections and so have no special value for hobbyists wishing to use the plants for decorative arrangements (NPWRC 2005). *Agalinis aspera* is specially adapted to prairie habitat and may represent a unique evolutionary line.

## EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

There is no current protection for this species in Manitoba. It is not on any list of rare or protected plants in Minnesota or North Dakota (Smith, pers. comm. 2004).

# TECHNICAL SUMMARY

***Agalinis aspera***
rough agalinis gérardie rude
Range of Occurrence in Canada: southern Manitoba

| | |
|---|---|
| **Extent and Area Information** | |
| • *Extent of occurrence (EO)(km²)*<br>**The area of a polygon connecting Brandon, St. Laurent and Grosse Isle was measured, excluding the area which is lake.** | 3725 km² |
| • *Specify trend in EO* | unknown |
| • *Are there extreme fluctuations in EO?* | unknown |
| • *Area of occupancy (AO) (km²)*<br>**Length and width of sites was measured in the field by pacing or using the GPS unit.** | <5 km² |
| • *Specify trend in AO* | unknown |
| • *Are there extreme fluctuations in AO?* | unknown |
| • *Number of known or inferred current locations* | 11 |
| • *Specify trend in #* | unknown |
| • *Are there extreme fluctuations in number of locations?* | no |
| • *Specify trend in area, extent or quality of habitat* | inferred decline |
| **Population Information** | |
| • *Generation time (average age of parents in the population)* | Annual species |
| • *Number of mature individuals* | < 250 |
| • *Total population trend:* | decline |
| • *% decline over the last/next 10 years or 3 generations.* | unknown |
| • *Are there extreme fluctuations in number of mature individuals?* | Possibly but unknown |
| • *Is the total population severely fragmented?* | yes |
| • *Specify trend in number of populations* | uncertain if any recent losses |
| • *Are there extreme fluctuations in number of populations?* | no |
| • List populations with number of mature individuals in each:<br>see Table 1 | |
| **Threats** | |
| Habitat impact due to mowing, prairie burning, and overgrazing. Alteration of roadsides has already eliminated 1 population. | |
| **Rescue Effect** | |
| • *Status of outside population(s)?*<br>**USA**: mainly not ranked or under review in adjoining states | |
| • *Is immigration known or possible?* | Unlikely; nearest US population is 200 km to the south in North Dakota |
| • *Would immigrants be adapted to survive in Canada?* | Yes |
| • *Is there sufficient habitat for immigrants in Canada?* | Limited, yes |
| • *Is rescue from outside populations likely?* | No |
| **Quantitative Analysis** | not available |
| **Current Status**<br>COSEWIC: Endangered (2006) | |

**Status and Reasons for Designation**

| | |
|---|---|
| **Status**: Endangered | **Alpha-numeric code**: B1ab(ii, iii, iv, v) + 2ab(ii, iii, iv, v); C2a(i) |

**Reasons for Designation**:
An herbaceous annual having a restricted geographical range and occupying small prairie remnants mainly along roadsides in southern Manitoba. The few small populations are at risk from such impacts as late season mowing, burning, overgrazing and road expansion.

**Applicability of Criteria**

**Criterion A**: (Declining Total Population): n/a No data available

**Criterion B**: (Small Distribution, and Decline or Fluctuation): Met Endangered under B1 ab(ii, iii, iv, v) + 2ab(ii, iii, iv, v) based on extent of occurrence and area of occupancy below critical values with the 11 populations being highly fragmented and impacted by declining quality of habitat due to a number of documented impacts. A population loss along provincial road 227 due to road improvements in the last 15 years indicates a decline in area of occupancy and loss of mature individuals.

**Criterion C**: (Small Total Population Size and Decline): Met Endangered C2a(i) due to its total population being much less than 2,500 plants with inferred decline in numbers of mature plants due to various threats and no population having >250 mature plants.

**Criterion D**: (Very Small Population or Restricted Distribution): Likely more than 250 mature plants but maximum number unknown.

**Criterion E**: (Quantitative Analysis): Not available.

**Uncertainty**: There potentially may be more than 250 mature individuals. A large area of PFRA prairie exists (>10,000 ha) at the Portage and Woodlands community pastures with only the roadsides surveyed along these pastures.

## ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

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John P. Morgan, Prairie Habitats, P.O. Box 1, Argyle, Manitoba R0C 0B0
Elizabeth Punter, assistant curator, University of Manitoba Herbarium
Al Rogosin, retired professor of botany, University of Brandon, Brandon, Manitoba

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### Authorities contacted

Dean Nernberg, Grassland Ecologist, Environment Canada, Canadian Wildlife Service, Saskatoon, SK.
Peter Achuff, National Botanist, Ecological Integrity Branch, Parks Canada, Waterton Lakes, AB.
James Duncan, Manager, Biodiversity Conservation Section, Wildlife and Ecosystem Protection Branch, Manitoba Conservation, Winnipeg, MB.
Gloria Goulet, Aboriginal Traditional Knowledge Coordinator, Environment Canada, Ottawa, ON.

## INFORMATION SOURCES

Britton, L.B. and A. Brown. 1970. An Illustrated Flora of the Northern United States and Canada. Vol 111. Dover Publ. Inc. New York.
Canne, J.M. 1984.Chromosome numbers and the taxonomy of North American *Agalinis* (Scrophulariaceae) Can. J. Bot. 62:454-456.
Canne-Hilliker, J.M. 1988. Status report on Gattinger's Agalinis, *Agalinis gattingeri* in Canada. Unpublished report prepared for the Committee on the Status of Endangered Wildlife in Canada, Canadian Wildlife Service, Environment Canada, Ottawa K1A 0H3.
Canne-Hilliker, J.M. 2000. Update COSEWIC status report on the Skinner's Agalinis*, Agalinis skinneriana* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa.
Canne-Hilliker, J.M., pers. comm. 2004. Email correspondence to M. Hughes. August 2004. Department of Botany, University of Guelph, Guelph, Ontario.

Canne-Hilliker, J.M. and C.M. Kampny.1991. Taxonomic significance of leaf and stem anatomy of *Agalinis* (Scrophulariaceae) from U.S.A. and Canada. Can. J. Bot. 69:1935-1950.

Enns, Suzanne, pers. comm. 2004. Email correspondence to M. Hughes. October 2004. Morden Research Station, Morden, MB.

Hamel, C., pers. comm. 2004. Email correspondence to M. Hughes. August 2004. Assistant Biologist, Wildlife and Ecosystem Protection Branch, Manitoba Conservation, Box 24-200 Saulteaux Crescent, Winnipeg, MB.

Hanson, B., pers. comm. 2004. Email correspondence to M. Hughes. July 2004. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, North Dakota.

Marshall, Henry H. 1989. Pembina Hills Flora. Morden and District Museum Inc., Morden, Manitoba.

McKay, R. pers. comm. 2005. Telephone conversation with M. Hughes. Sept. 2005. Director of Regional Operations, Dept. Transportation and Govt. Services. Portage la Prairie, Manitoba.

Musselman, Lytton J. and William F. Mann. 1978. Root Parasites of Southern Forests. Southern Forest Experimental Station Southeastern Area, State and Private Forestry Service, U.S. Department of Agriculture.

NatureServe. 2004. NatureServe Explorer. An online encyclopedia of life (web application). Version 4.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/exlorer. (Accessed October 4, 2004)

NPWRC. 2005. Native wildflowers of the North Dakota Grasslands. USGS Northern Prairie Wildlife Research Center web site (Accessed January 30, 2005): http://www.npwrc.usgs.gov/resource/plants/wildflwr/species/agalaspe.htm

Neel, Maile C. 2002. Conservation Implications of the Reproductive Ecology of *Agalinis acuta* (Scrophulariaceae). Amer. J. Bot. 89(6): 972-980.

Olmstead, R.C., C.W. Depamphilis, A.D. Wolfe, N.D. Young, W.J. Elisens, and P.J. Reeves. 2001. Disintegration of the Scrophulariaceae. American Journal of Botany 88: 348-361.

Ownbey, G.B. and T. Morley 1991. Vascular Plants of Minnesota, A Checklist and Atlas. University of Minnesota, Minneapolis, Oxford.

Pennell, F.W. 1929. *Agalinis* and allies in North America. 11. Proc. Acad. Nat. Sci. Philadelphia 81: 111-249.

Pennell, F.W. 1935. The Scrophulariaceae of eastern temperate North America. 441. *Gerardia*. Acad. Nat. Sci. Philadelphia Monogr. 1: 419-476.

Roberts, D., pers. comm. 2004. Email correspondence to M. Hughes. September 2004. Manitoba Conservation, Interlake Office, Gimli, Manitoba.

Scoggan, H.J. 1957. Flora of Manitoba. Bull. No. 140. Biological Series No. 47. National Museum of Canada.

Smith, W., pers. comm. 2004. E-mail correspondence to M. Hughes (via Diane Larson). July 2004. Natural Heritage Program, Minnesota Dept. Natr. Res., St. Paul, MN.

USDA, NRCS. 2004. The PLANTS Database Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA70874-4490 USA (accessed May 2004).

## BIOGRAPHICAL SUMMARY OF REPORT WRITER

Marjorie Hughes received a B.Sc. Hons. degree in 1971 from the University of Manitoba. She has been employed by the University of Manitoba Botany and Zoology Departments; Canadian Dept. of Fisheries and Oceans (Freshwater Institute); and Manitoba Dept. of Mines, Natural Resources and Environmental Management. She has taken part in ecological studies of biological communities in Manitoba and on Devon Island, Nunavut. In 2001 she completed a contract with Environment Canada and Manitoba Conservation to assess three rare plant species in Manitoba (small white lady's-slipper, hairy prairie clover and western spiderwort). She has also taken part in a Manitoba survey of dragonflies undertaken by Manitoba's Conservation Data Centre and worked on the general status assessment of dragonflies in Canada.

## COLLECTIONS EXAMINED

University of Manitoba Herbarium (WIN)
Manitoba Museum Herbarium
Morden Agricultural Research Station Herbarium