Nova Scotia Provincial Status Report

on

Hoary Willow
Salix candida Flűeggé ex Willd.

prepared for

The Nova Scotia Species at Risk Working Group

by

Ruth E. Newell
E.C. Smith Herbarium
K.C. Irving Environmental Science Centre
Acadia University
Wolfville, Nova Scotia
B4P 2R6

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EXECUTIVE SUMMARY

Wildlife Species Description and Significance

Salix candida (Hoary Willow) is a low, deciduous, dioecious shrub, densely white woolly on current season's twigs and lower leaf surfaces. The mature medial leaves are narrowly elliptic or oblanceolate, usually at least 4x as long as wide. Leaf margins are entire and slightly to strongly rolled under. Flowering occurs concurrently with leaf emergence. Female flowers have stalks 0.1 to 1.2 mm long and tomentose pistils. The anthers of male flowers are purple later changing to yellow. The fruit is a tomentose, pear-shaped capsule. Reproduction is both sexual and asexual by layering.

Salix candida is an extremely rare species in Nova Scotia occurring in a rare habitat type i.e., rich, calcareous fens or marshes.

Distribution

In Nova Scotia, Hoary Willow occurs within the Black River system at the northwest end of Lake Ainslie, Inverness County, Cape Breton Island. Here it is known from four rich calcareous fens in close proximity to the river floodplain plus a single plant in a calcareous graminoid marsh. Field work failed to confirm the presence of *Salix candida* in Huntington, Cape Breton County - a record based on a herbarium specimen from Cape Breton University herbarium. The area of occupation (AO) is 14.9 ha. The extent of occurrence (EO) is 198.3 ha. These calculations do not include Huntington, Cape Breton County, Nova Scotia.

Habitat

Across its range, Hoary Willow is known from calcareous river floodplains, bogs, fens, marshes and meadows. In Nova Scotia, it appears to be limited primarily to rich calcareous (alkaline) fens in one river system. These fens have a high, shrub and tree component as well as a unique assemblage of graminoid and forb species many of which are rare.

The underlying geologic strata in the Black River area belong to the Windsor Group which include marine and evaporate deposits. The Huntington area is underlain with strata belonging to the Mabou Group. The lower deposits of the Mabou Group are similar t o the Windsor group deposits.

Biology

Much of the research that has been carried out on willow biology has been conducted on willow species other than *Salix candida*. Willows are known to be mainly insect-pollinated. Seeds of most willows are non-dormant and short-lived. They require moisture and the absence of shade for germination and seedling survival. Seedling cohorts can experience 80-100% mortality if suitable conditions for germination are not found. In spite of the fact that willow seeds are small, light weight and have a coma, long distance dispersal is considered to be the exception rather than the rule (likely more common however in tall shrub and tree willows than in low shrub willows).

Willows are generally dioecious which ensures cross-pollination.

Population Sizes and Trends

Population estimates of mature plants for the four fens where *Salix candida* has been located in the Black River system of Cape Breton Island, Nova Scotia, based on field work by R.E. Newell and R.B. Newell and the Atlantic Canada Conservation Data Centre are as follows: Wetland A: 800-1000 plants; Wetland B: 400-500 plants; Wetland C: ~300 plants; Wetland D: 50-100 plants. One additional plant was observed in a calcareous graminoid marsh. No seedlings were observed in the field. The total population estimate is 1500-2000 mature plants.

There is no historical data on which to base population trends. A railroad (now abandoned and used as a walking trail) was built beside one wetland and through another wetland on the south side of the Black River. One plant was located in the former wetland which is a rich calcareous marsh. This may be a chance occurrence or it may represent the remnants of a once larger population. Water levels in this marsh are artificially maintained by the presence of the railroad. The second wetland which was bisected by the railroad, had no plants of Hoary Willow even though the fen habitat present is similar to the other fens where Hoary Willow willow occurs in the Black River area.

No plants of *Salix candida* were found in the Huntington area of Cape Breton Island where Hoary Willow has been reported in the past.

Threats and Limiting Factors

Threats to *Salix candida* habitat reported elsewhere over its range include hydrologic alteration, grazing, browsing, peat mining, recreational use, alteration of natural fire regime, invasive species and timber harvesting. In the Black River area, forest harvesting appears to be imminent in close proximity to one of the fens where Hoary Willow occurs. This may alter the hydrology of the fen and/or could provide access to the fen for invasive species. The Black River system has been found to have

deposits of fuel grade peat. Any peat mining initiatives would be a serious threat to the Hoary Willow populations. The Black River system is located within a geographic region where oil drilling is scheduled to begin in 2011. The exact location of the drilling is unknown but if conducted within the Black River watershed, could have serious impact on the hydrologic regime of the Hoary Willow wetlands.

Salix candida is limited by its rarity within Nova Scotia and isolation from populations outside of the province. It is also limited by its very specific germination and habitat requirements

Protection, Status, and Ranks

Salix candida is considered to be secure globally with a status rank of G5 (NatureServe conservation status rank). In Canada it is not listed under the national Species at Risk Act (SARA 2003) nor is it protected in Nova Scotia under the Nova Scotia Endangered Species Act (NSESA 1999).

In Nova Scotia, it is listed as an S1 species (= critically imperilled) by NatureServe and as a RED species (= a species that is known to be or that is thought to be at risk) under the Nova Scotia Department of Natural Resources General status of Wild Species program.

The rich calcareous fens in which *Salix candida* occurs in the Black River system are all privately owned.

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Salix candida Flűeggé ex Willd.

Hoary Willow, Sage Willow, Sage-leaf Willow, Sage-leaved Willow, Silver Willow, Saule Tomenteux

Synonyms (from ITIS Canada, 2010):
Salix candidula Nieuwl.
Salix candida var. denudata Anderss.
Salix candida var. tomentosa Anderss.

Family: Salicaceae

Morphological Description

A generally low (0.3-2.5m), deciduous, perennial shrub with current season's branches densely white woolly (hairs crinkled). Older branches are woolly in patches or nearly glabrous. The largest mature leaves are narrowly elliptic or oblanceolate, 50-100 mm long x 5-20 mm wide. Leaf margins are entire or wavy, slightly to strongly rolled under. Lower leaf surface is very densely to sparsely tomentose-woolly; the upper leaf surface dull or shiny, varying from sparsely to moderately tomentose. Flowering occurs simultaneously with leaf emergence. Unisexual, non-showy flowers occur in catkins, with male and female catkins found on separate plants. Bracts subtending the flowers are tawny or brown, 1.2 – 1.8 mm long with the lower surface covered with straight hairs, tip lacking teeth. Female flowers with stalks 0.1 to 1.2 mm. Pistils tomentose, pear-shaped. Male flowers have purple anthers, later becoming yellow, 0.5-0.6 mm long. Fruit a capsule 4-6 mm in length. Colonies are formed by layering.

Figures 1 and 2 illustrate the variation present within Nova Scotia populations of Hoary Willow with respect to the appearance of the upper leaf surface. Figure 1 shows a plant bearing leaves having dull, silvery upper leaf surfaces while Figure 2 shows a plant with shiny, bright green upper leaf surfaces.

Detailed technical descriptions can be found in Gleason & Cronquist (1991) and Argus (2006, 2010).

Salix candida can be distinguished from other Nova Scotian willows by the following combination of characteristics: low to mid-sized shrubs, occurrence of flowers simultaneously with leaf emergence, leaves > 4x as long as wide, largest

leaves densely covered with woolly (crinkled) hairs (or short silky) on lower surface, leaves not toothed and edges slightly to strongly rolled under, ovaries and capsules moderately to densely woolly, female flower stalk 01-1.2 mm.

Willows are notorious for being difficult to identify particularly in the vegetative state. They display a great degree of morphological variability and thus in the absence of flowers and/or fruit can present a significant challenge to the field botanist.

Hybridization of *Salix candida* with a number of other willow species has been reported. Hybrids are easily recognized by the haphazard occurrence of conspicuous woolly hairs on leaves, stems and catkins. Hybrids often have female flowers that are woolly in patches. The second species (parent) is reportedly difficult to determine (Argus, 2006).

Figure 1. Hoary Willow in fen habitat in the Black River system, Cape Breton Island, Nova Scotia. Note the dull, silvery upper surface of the leaves.

Figure 2. An example of a plant of *Salix candida* from fen habitat in Black River with shiny, bright green upper leaf surfaces.

Population Spatial Structure and Variability

The restriction of Hoary Willow to a rare habitat type, i.e., rich calcareous fens, within a few localized areas in northern Nova Scotia may have effectively isolated this species from populations in neighbouring provinces. In spite of the fact that willow seeds seem suitably adapted for wind dispersal being small and bearing a coma (tuft of hairs), Gage and Cooper (2005) recorded a 90% reduction in seed rain density within 200m of parent plants of riparian shrub willows in Rocky Mountain National Park, Colorado, USA.

Lin et al. (2009) in a study on the population genetics of two shrub willows

(*Salix purpurea* and *Salix eriocephala*) in New York, found that the majority of the genetic variation resided within subpopulations rather than among subpopulations. This high degree of interpopulation homogeneity suggests extensive gene flow among populations of both species. They point out that although long-distance gene flow is not common in willow species, if ideal weather conditions such as frequent strong winds, tall stems and open vegetation are present, distribution of seed by wind at a certain scale is possible. *Salix candida* however, being a low shrub species occurring in small fen communities surrounded by forest (Figure 5) may have more restricted seed dispersal or recruitment than tall shrub and tree willows.

Special Significance

Hoary Willow is a rare species in a rare habitat type in Nova Scotia likely isolated from other out of province Hoary Willow populations. The center of its currently known distribution i.e., the Black River system near Lake Ainslie has been described by ACCDC botanist C.S. Blaney (pers. comm., 2010) as one of the most significant and irreplaceable rare plant sites in the whole province….the strongly basic fen communities are as far as is known, unique in Nova Scotia and support a number of species found nowhere else or almost nowhere else in the province.

The Black River Bog was described by Anderson and Broughm (1988) as a peatland type unique to Nova Scotia. The densely treed, “alkaline” bog has some very unusual plant life as well as some unusual cover types. Their sampling data revealed large numbers of bivalves and gastropods in the mineral sediments below the peat.

DISTRIBUTION

Global and Canadian Range

Hoary Willow is a boreal species occurring throughout much of North America with the exception of the southern United States. It also occurs in Saint Pierre and Miquelon (Table 1). Argus (2006) points out that although geographically wide ranging, this willow species is limited to calcareous habitats and for that reason, is quite local or even rare in many parts of its range.

Table 1. Global range of Hoary Willow (*Salix candida*).

Canada	NS, NB. PE, NF, LB, QC, ON, MB, SK, AB, BC, YT, NT, NU
United States	ME, NH, VT, RI, MA,CT, NJ, NY, PA, MI, OH,IN, WI, MN, IA, ND, SD, NE, MT, WY, CO, ID, WA, AK
France	St. Pierre & Miquelon

Nova Scotia Range

Although widely occurring and secure in a number of provinces in Canada, *Salix candida* has a very restricted distribution in Nova Scotia (Figure 3).

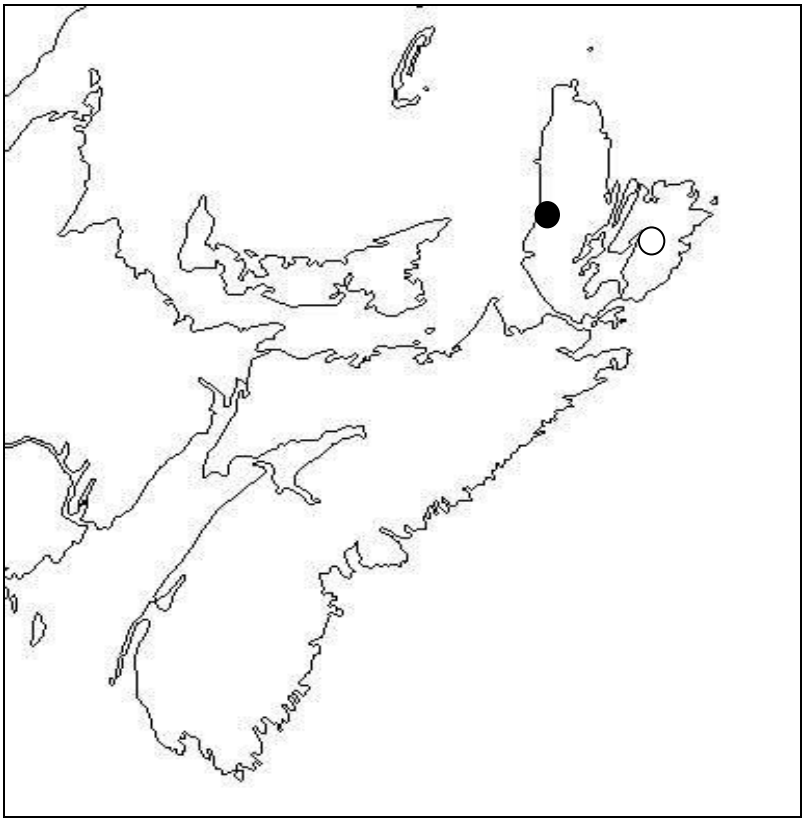

Figure 3. The distribution of Hoary Willow (*Salix candida*) in Nova Scotia. The solid circle represents the Black River system in Inverness County where a limited number of small populations of Hoary Willow occur. The open circle represents the Two Rivers Wildlife Park at Huntington, Cape Breton County. This record is based on a herbarium specimen collected in 1999 by M. Williams and S. Ferguson (Accession No. 3721). No populations of Hoary Willow were located at this site in the summer of 2010 during targeted field work conducted by the author for this report.

Hoary Willow is well documented by herbarium collections (ACAD, NSM, CAN, DAO) and recent field work from the Black River system in Inverness County near the northwest end of Lake Ainslie. At this location, the species occurs in several alkaline fens in forest openings on the west side of the river and along the edge of a graminoid marsh adjacent to the abandoned railroad east of the river floodplain. Detailed locality information is provided in appendices at the end of this document. Species occurrences are also indicated in Figure 4.

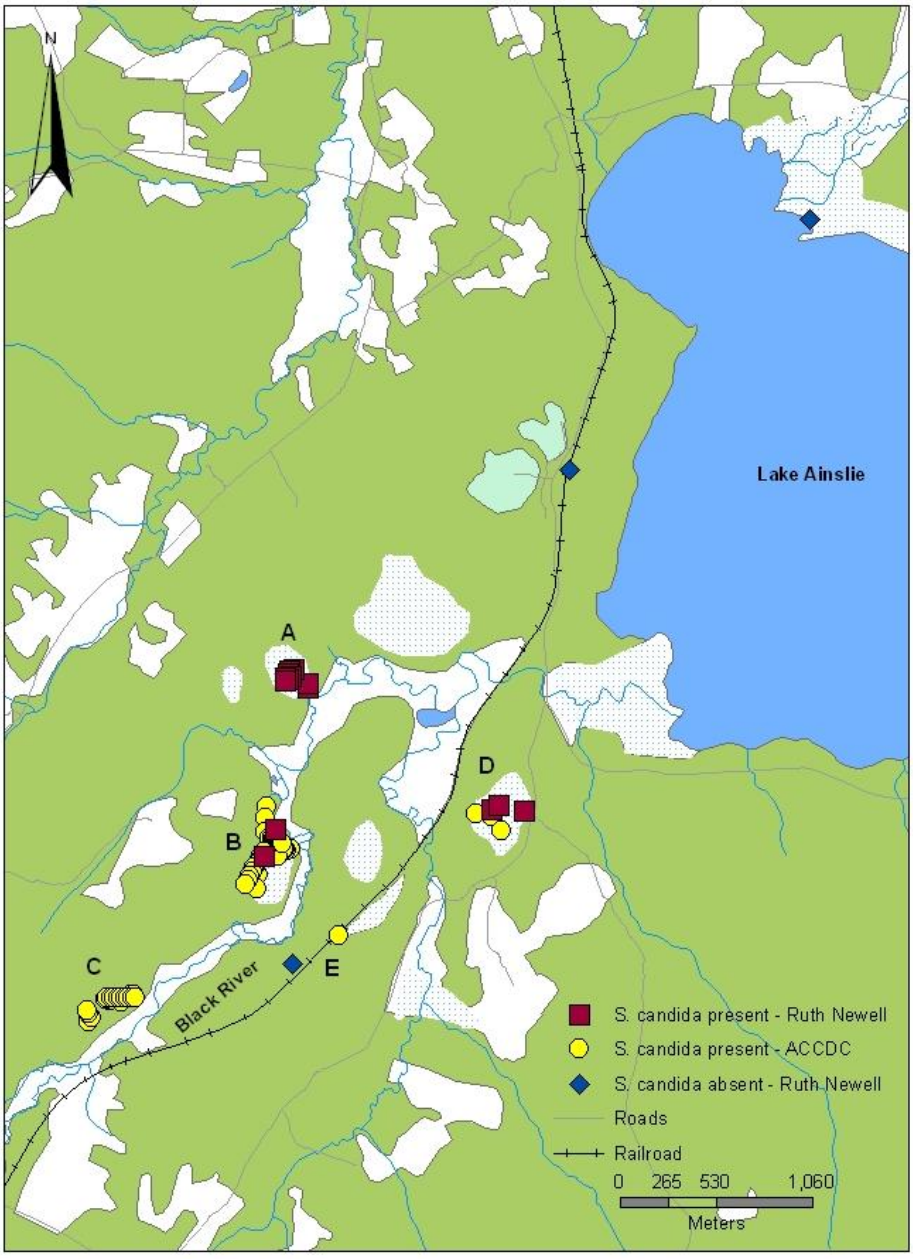

Figure 4. Waypoints marked by R. E. and R.B. Newell (red squares) and C.S. Blaney and D.M. Mazerolle of the Atlantic Canada Conservation Data Centre (ACCDC) (yellow circles) indicating occurrences of *Salix candida* in the Black River system of Inverness County, Cape Breton Island, Nova Scotia. Blue diamonds indicate wetland areas surveyed where no plants of Hoary Willow were found. Not all plants of Hoary Willow within each habitat were geo-referenced.

A collection of *Salix candida* from the Two Rivers Wildlife Park in Huntington, Cape Breton Co. NS, housed at the University of Cape Breton

herbarium (Accession No. 3721) was recently annotated by George W. Argus (2010) as *Salix candida*. The herbarium specimen is vegetative and was collected by M. Williams and S. Ferguson in old field/wooded riparian edge habitat. A recent visit to this area by the author failed to relocate *Salix candida* within the Park. Willows found to be present in these same habitats were all Bebb's Willow (*Salix bebbiana*) (identification based on flowering material). It is felt that the identification of the herbarium specimen as *Salix candida* is doubtful based on morphological features and habitat descriptions.

In spite of the conclusion given above with respect to the occurrence of Salix candida within the Two Rivers Wildlife Park, the author feels that the extensive wetland habitat associated with the Salmon River to the west of the Two Rivers Wildlife Park, should be surveyed for Hoary Willow. This area could potentially have populations of Hoary Willow given the similar geology of this area to that of the Black River area (see description of underlying geological strata in section on **Habitat Requirements**).

A herbarium specimen housed at the Nova Scotia Museum of Natural History collected from Mount Uniacke, Hants County by Charles J. Gossip and identified as *Salix candida* (Accession No. 021572P) has recently been annotated as *Salix humilis* var. *humilis* by George W. Argus (2010). This identification is based on flowering material.

Two collections from ACAD originally identified as *Salix candida* have also been recently examined and annotated by George W. Argus (2010) as willow species other than Hoary Willow. These were from Cape St. Lawrence, Inverness County (Accession No. 20367) and West Dalhousie, Annapolis County (Accession No. ECS014875).

The extent of occurrence (EO) and the area of occupancy (AO) for Nova Scotia's populations of *Salix candida* are 198.3 ha and 14.9 ha respectively. These figures do not include the Huntington area as the author was unable to locate Hoary Willow at this second location.

No data is available on trends or fluctuations in the size of the extent of occurrence and area of occupancy of *Salix candida* in Nova Scotia.

Search Effort

Field Work for this status report was conducted by the author on June 11th-13th and September 11th – 12th, 2010. She was assisted in the field by Reg. B. Newell. B.Sc., M.Sc. A total of fifty-five person hours were spent in the field conducting targeted surveys for this status report.

One day was spent at the Two Rivers Wildlife Park, Huntington, Cape

Breton Co., NS on June 11th, in an effort to relocate the original collection site and/or the species. The remaining field time was spent in the Black River system or in potential habitat nearby.

All known and potential habitat was surveyed by foot. A canoe was used to access most sites along the Black River.

Recent field work was also conducted on the Black River system by S. Blaney and D. Mazerolle, botanists with the Atlantic Canada Conservation Data Centre (ACCDC) on July 21st, 2010. This field work was funded by the Nova Scotia Crown Share Land Legacy Trust.

Location and habitat data gathered by both teams pertaining to *Salix candida* is found in Appendices 1 and 2.

With respect to Nova Scotia collections of *Salix candida*, the following herbaria were contacted by the author: ACAD, NSM, Saint Francis Xavier University herbarium and University of Cape Breton herbarium. Dr. George W. Argus visited DAO and CAN on behalf of the author.

HABITAT

Habitat Requirements

Globally, *Salix candida* has been reported from a variety of wetland types including fens, bogs, and marshes. Particularly those habitats with permanently saturated soils where peat is present plus a high mineral content and alkaline pH (Decker, 2006). Argus (2006) lists river floodplains, marl bogs, fens, and meadows – on calcareous substrate in all cases.

In Nova Scotia, this species is known primarily from four rich alkaline (calcareous) fens in the vicinity of the Black River, Inverness County, Nova Scotia. These fens occur in forest openings in close approximation to each other and to the river floodplain (Figure 5).

The fens at these locations generally have a moderate to high shrub and tree component, plus a variety of graminoid and forb species (Figure 6).

Some of the associated species occurring with *Salix candida* in the alkaline fens at Black River include Shrubby Cinquefoil (D*asiphora fruticosa*), Labrador-tea (*Ledum groenlandicum*), Larch (*Larix laricina*), Witherod (*Viburnum nudum* var. *cassinoides*), Mountain Fly-honeysuckle (*Lonicera villosa*), Black Spruce (Picea *mariana*), Ground Juniper (*Juniperus communis*), Bog Rosemary (*Andromeda glaucophylla*), Alderleaf Buckthorn (*Rhamnus alnifolia*), Red-osier Dogwood (*Cornus sericia*), Arrow-grass (*Triglochin maritima*), Pitcher-plant

(*Sarracenia purpurea*), Meadow-rue (*Thalictrum pubescens*), Bog Goldenrod (*Solidago uliginosa*), Tussock Sedge (*Carex stricta*), Dwarf Raspberry (*Rubus pubescens*), Mitrewort (*Mitella nuda*), Broad-leaved Cattail (*Typha latifolia*), Little Green Sedge (*Carex viridula* var. *elatior*), Lesser Panicled Sedge (*Carex diandra*), Inland Sedge (*Carex interior*), Green Keeled Cottongrass (*Eriophorum viridicarinatum*) and Showy Lady's-slipper (*Cypripedium reginae*).

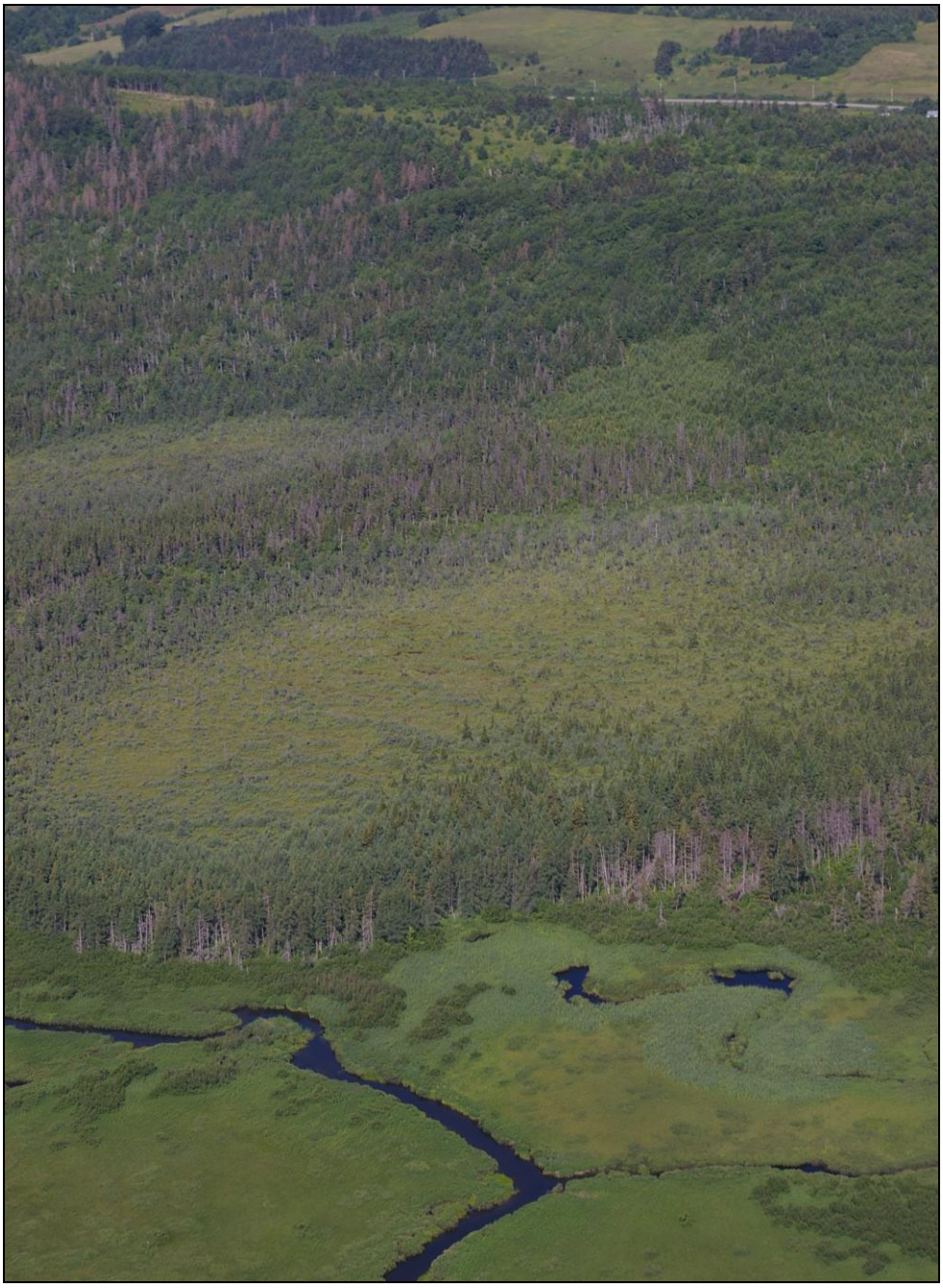

Figure 5. Photo showing one of the fens (mid-photo) (wetland A in Figure 3) where *Salix candida* occurs on the Black River system. The Black River and its associated open floodplain are in the foreground.

In addition to the occurrences in fen habitat in the Black River system, Hoary Willow a single plant was recently reported from the edge of a rich calcareous graminoid marsh adjacent to the abandoned railroad (Wetland E, Figure 4) (pers. comm., C. S. Blaney, 2010) in the same river system. Here the water level is artificially maintained by the railroad bed.

The species occurring along the edge of this marsh with Hoary Willow include: Broad-leaved Cattail (*Typha latifolia*), Speckled Alder (*Alnus incana* ssp. *rugosa*), Bebb's Willow (*Salix bebbiana*), Pussy Willow (*Salix discolor*).

Other rare vascular plant species found within the same wetlands as Hoary Willow at the Black River location, are listed in Table 2. The alkalinity of the habitat may restrict the species able to grow in these fens thus resulting in a unique suite of species reported thus far nowhere else in the province.

Figure. 6. One of the fens where *Salix candida* occurs in the Black River system, Inverness County, Nova Scotia. A plant of Hoary Willow can be seen in the centre foreground at the edge of a small pool.

The only other report for this species in Nova Scotia is from the Two Rivers Wildlife Park, Huntington, Cape Breton County in old field and wooded riparian edge habitat. These habitats are strikingly out of character for this species. The

riparian edge habitat present at this location consists of a high, steep, wooded bank rising above a very narrow cobble river shoreline (Mira River). A search by the author did not locate any plants of Hoary Willow at this specific site and within these reported habitat types. A section of a wetland on the north edge of the park was searched by the author but did not yield any plants of Hoary Willow.

There are wetlands associated with the Salmon River a short distance (~ 1 km) west of the wildlife park. These may provide suitable habitat for Hoary Willow and it is recommended they be surveyed for this species.

Table 2. Rare species occurring within the same fens as *Salix candida* in the Black River system and their Nova Scotia general status rank and Atlantic Canada Conservation Data Centre s-rank. There are no plant species currently listed under the Federal Species at Risk Act (SARA, 2003) or the Nova Scotia Endangered Species Act (NSESA 1999) known to be present.

Latin Name	**Common Name**	**Nova Scotia General Status Rank (2010)**	**Atlantic Canada Conservation Data Centre (ACCDC) Rank (2010)**
Betula pumila	Swamp Birch	YELLOW*	S2S3
Carex gynocrates	Northern bog Sedge	RED**	S1†
Carex viridula var. *elatior*	Little Green Sedge	RED	S1
Cypripedium parviflorum	Small Yellow Lady's-slipper	YELLOW	S2††
Cypripedium reginae	Showy Lady's-slipper	RED	S2
Eleocharis quinqueflora	Few-flowered Spikerush	RED	S2
Galium labradoricum	Bog Bedstraw	YELLOW	S2
Lobelia kalmii	Kalm's Lobelia	YELLOW	S1
Rhamnus alnifolia	Alderleaf Buckthorn	YELLOW	S3†††
Rhynchospora capillacea	Horned Beakrush	RED	S1
Salix pedicellaris	Bog Willow	YELLOW	S2
Triantha glutinosa	Sticky False-asphodel	RED	S1

*YELLOW= a species sensitive to human activities or natural events
**RED= a species known to be or thought to be at risk
†S1= extremely rare; ††S2= rare; †††S3= uncommon

Populations/occurrences of *Salix candida* in Nova Scotia appear associated with Windsor and Mabou Group strata. Windsor group strata include marine and evaporate deposits. These occur at the Black River location and underlie the peat beds of the fens (Davis and Browne, 1996). The Mabou Group deposits succeed the Windsor Group deposits. The lower part of the Mabou Group contains interbeds of gypsum, anhydrite and salt. These are found along the Mira River at and in the vicinity of the Two Rivers Wildlife Park. There are numerous other occurrences of these two strata types on Cape Breton Island but as of this point in time, there are no reports of similar species assemblages from these areas as are found at the Black River location.

Habitat Trends

There may have been a decline in *Salix candida* habitat in the Black River area following the construction of a railroad adjacent to a wetland (wetland E in Figure 4). A single plant of *Salix candida* was recorded from a rich calcareous marsh at this site by C. S. Blaney this past summer. He describes the water levels of the wetland as being artificially maintained by the railroad bed (pers. comm., C.S. Blaney, 2010). This wetland may have previously hosted a larger population of Hoary Willow then it does today as *Salix candida* is sensitive to changes in the hydrology of the habitat in which it occurs (Decker, 2006). There is no historical data however to support this supposition.

No plants of Hoary Willow were observed at another wetland disturbed by the construction of the railroad. The fen habitat at this site appears somewhat similar to the fen habitats to the north of the river where Hoarty Willow occurs.

It would seem that the particular rich alkaline fens associated with the Black River, Inverness County, Nova Scotia are unique in Nova Scotia since the assemblage of rare plant species present has not to date been reported elsewhere within the province.

Further field work in the vicinity of Black River may reveal a few additional populations of *Salix candida*.

Wetlands in the vicinity of the Salmon River near the Two Rivers Wildlife Park should be surveyed for *Salix candida*.

BIOLOGY

Little is known about the specific biology of *Salix candida* but a considerable body of knowledge exists concerning other willow species (Argus, 2006; Decker, 2006; Cremer, 2003, etc.).

Life Cycle and Reproduction

Salix candida has been described as a long-lived perennial that devotes several years to vegetative growth before reproducing (Decker, 2006). Precise age at first flowering is unknown however for *Salix candida*. For some willow species, age at first flowering can be as low as two years or as high as 10 years (Decker, 2006).

The generation time or average age of parents of the current cohort is unknown.

Salix candida reproduces sexually and asexually by layering (Argus, 2006).

Shrub willows are less likely to spread by broken branches than tree willows because shrub willow branches are less fragile than those of tree species (Cremer, 2003).

Willows are dioecious with male and female flowers occurring on separate plants. Dioecism ensures outcrossing.

Flowering in Hoary Willow occurs from mid-April to early July over its range.

Willows are reported to be mainly insect-pollinated although some wind pollination may occur as well (Argus, 1974; Decker, 2006). Both male and female flowers produce nectar (Cremer, 2003).

Willow seeds are wind dispersed or water borne. Wind dispersal is the more common of the two (Cremer, 2003).

Seeds of many willow species are nondormant and will germinate almost immediately upon dispersal. Seeds of some arctic and subarctic species however, have conditional dormancy and are capable of surviving through the winter, germinating in the spring (Densmore & Zasada,1983). Seeds of these species although they mature in the same length of time as nondormant seeds, are held in their capsules and fall-dispersed.

Decker (2006), based on the work done by Densmore and Zasada (1983), suggests that although seed dormancy for *Salix candida* is unknown, its long flowering period may indicate that it produces dormant seeds that germinate the following growing season. This conclusion is based on the fact that *Salix brachycarpa* and *Salix glauca*, willows closely related to *Salix candida*, are fall dispersers (Densmore and Zasada (1983).

Seedling survival is dependent on the presence of adequate moisture and the absence of shading (i.e. competition), conditions often found in disturbed

habitat. Because seeds of willows lack endosperm tissue, they can perish within days for some species if they disperse to unsuitable habitat. Densmore and Zasada (1983) found that most seeds of *Salix alaxensis* and *Salix scouleriana* were nonviable after one week.

The seeds of summer dispersing willows were found to germinate within 24 hours once conditions of moisture and temperature are met. Seeds of summer dispersing willows are green when released containing significant amounts of chlorophyll; photosynthesis begins as soon as the seeds are moistened. Germination rates increase in light (Densmore and Zasada, 1983).

Various researchers have shown that willow seedling co-horts were found to experience mortality rates of 80-100% because of dessication, ice scour, and the fact that landforms suitable for germination occupy a very small portion of study area landscapes (Gage and Cooper, 2005).

Willow seeds have an arillate coma of long silky hairs. These hairs promote wind dispersal. In addition, the coma was shown by Seiwa et al. (2008) to facilitate seed dispersal to microhabitats suitable for germination. Once the hairs become wet upon landing on a moist substrate, the seeds are no longer blown about. The wet, cottony hairs are quickly released from the seeds and germination ensues. Seeds placed on dry habitat were repeatedly blown back into the air.

The coma also appears to play a role in keeping willow seeds afloat thereby increasing the probability of the seeds finding suitable habitat for establishment (Seiwa et al., 2008).

A variety of *Salix candida* hybrids have been reported (Argus, 2006). Hybrids are easily recognized by presence of oddly placed patches of woolly hairs. The second parent is often difficult to determine.

Physiology and Adaptability

Salix candida is restricted to calcium rich wetland habitats (Argus, 2006).

Willows are shade intolerant and will decline as habitats become stabilized and invaded by taller vegetation (Argus, 2006).

Willows growing in a habitat with a closed ground cover such as a fen or bog, cannot easily reproduce by seed in the same place unless there is some disturbance (Argus, 2006).

Seeds of most willows can germinate almost immediately upon dispersal. Seedling survival is dependent upon presence of adequate moisture and the

absence of shade (Argus, 2006).

Willow seed can germinate both on and underwater, The seedlings can survive under water for up to a month. Continued survival however requires exposure to air (Cremer, 2003).

Once established, willows may require protection from biotic factors such as browsing (Argus, 2006).

Salix candida is considered to be a stress tolerator due to growing in water-logged soils and tolerance to low temperatures (Decker, 2006)

Freezing has been found to preserve viability of both summer and fall dispersed willow seeds for up to three years (Densmore and Zasada, 1983),

Willows are reported to have a tolerance to fire. Willows are easily girdled by fire but will re-grow by the production of shoots (Cremer, 2003).

Dispersal and Migration

Willow seed dispersal is by wind and/or water although dispersal by wind is reported to be more common than water dispersal (Cremer, 2003). The seed coma (a ring of fine, silky hairs) facilitates dispersal by wind. When seeds become wet, the hairs collapse and release the seed (Argus, 1986). Decker (2006) suggests that wind dispersal is likely the primary dispersal mechanism for *Salix candida*. Water dispersal is apt to play a bigger role in the dispersal of riparian willow species.

In spite of the fact that willow seeds appear well adapted for wind dispersal, Gage and Cooper (2005) measured an approximately 90% reduction in seed rain density within 200m of parent plants of shrub willows. Some of the tree willows however have been reported to disperse seeds up to a distance of 100 km (Cremer, 2003)

Interspecific Interactions

An association with vesicular-arbuscular mycorrhizae have been reported for a number of Salix species. Ectomycorrhizal associations have also been reported in many willow species. Some species have both types of fungal associations. The presence of mycorrhizal fungi in *Salix candida* remains to be studied (Decker, 2006).

Light to moderate browsing was observed on plants of *Salix candida* in the Black River fens during 2010 surveys conducted for this study. No moose sign

was observed so browsing is likely carried out by deer or rabbits. Browsing did not appear to have had a negative impact on production of flowers or fruit.

Research by Gage and Cooper (2005) found that sustained and intense browsing of riparian shrub willows by elk in Rocky Mountain National Park, Colorado, U.S.A. had a profound effect on the spatial distribution and abundance of seeds, reducing the probability of seeds reaching suitable sites for germination. Browsing removes leaves as well as stems on which aments would be produced thereby reducing or even eliminating flower and seed production.

Trampling by large herbivores may contribute to the formation of sites suitable for seedling establishment however heavy trampling may have a negative impact on habitat but affecting hydrology, microtopography and canopy structure (Decker, 2006).

Most willow species have some degree of susceptibility to infection by fungal rust belonging to the *Melampsora epitea* species complex (Decker, 2006). The degree of resistance of *Salix candida* to this pathogen is unknown.

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

A total of 55 person hours were spent in the field conducting targeted surveys for *Salix candida* for this status report. Surveys were conducted on foot. For most wetlands, meandering transects were conducted by two people within each wetland. A more careful population count was obtained in wetland A (Figs. 4 & 5) where four parallel transects were conducted the length of the wetland. Population estimate for this wetland was 800-1000 mature individuals and is likely somewhat more precise than estimates for the remaining wetlands (Table 3).

Population estimates are given in Table 3.

Distinct clumps of stems were counted as individual plants.

Abundance

The estimate of mature individuals of Hoary Willow in Nova Scotia based on observations by R. E. Newell and R. B. Newell and C.S. Blaney and D.M. Mazerolle for 2010 is approximately 1500 - 2000. No seedlings were observed.

Estimates of population sizes for individual populations are given in Table 3.

There are several wetland habitats in the Black River area which, from air photos, look like they may potentially provide suitable habitat for *Salix candida*. These were not surveyed in 2010. One or two additional populations may therefore be located in future survey initiatives.

Some of the wetland associated with MacQuarries and Ottawa Brooks on the northeast side of Loch Ban (Lake Ainslie) was surveyed as part of the survey work for this report. A major proportion of the wetlands associated with these brooks are alder thickets felt to be unlikely habitat for *Salix candida*. Bog habitat was surveyed on the east side of the West Lake Ainslie Road opposite a waste management facility located about one kilometre north of the Black River. This habitat resembles an acidic bog with no calcareous loving species present.

Table 3. Population size estimates for *Salix candida* within the Black River system, Inverness County, Nova Scotia and at the Two Rivers Wildlife Park, Huntington, Cape Breton County.

Population Name	**Habitat Description**	**Land Ownership**	**Population Size Estimate** (Newell & Newell, June 12-13 & Sept.11-12, 2010)	**Eo count** (Blaney & Mazerolle, July 21, 2010)	**Data source**
Black R wetland A	rich fen	Private	800-1000	not surveyed	Field work
Black R wetland B	rich fen	Private	50-100	400-500	Field work
Black R wetland C	rich fen	Private	not surveyed	~300	Field work
Black R wetland D	rich fen	Private	50-100	~50	Field work
Black R wetland E	rich calcareous marsh (adjacent to rr)	?	not surveyed	1	Field work
Two Rivers Wildlife Park, Huntington	old field/wooded riparian edge	crown	no plants observed within park	not surveyed	based on UCB herbarium specimen

Fluctuations and Trends

No information or data on population trends is available. Targeted surveys and plant counts were only recently (2010) conducted for Hoary Willow.

Being a perennial there are likely no to very little fluctuation in population sizes of *Salix candida* from year to year.

It is likely that *Salix candida* has always been rare in Nova Scotia due to the rarity of its specialized habitat, i.e. calcareous fen.

Rescue Effect

Low due to rarity of habitat and therefore limited probability of propagules finding suitable habitat and the low probablility of long distance dispersal.

THREATS AND LIMITING FACTORS

Salix candida populations and habitat in the Black River system currently show no apparent signs of having been negatively impacted as a result of human activities. Two possible exceptions may be several wetlands in the vicinity of a railroad paralleling the Black River on its southeast side. A calcareous marsh adjacent to the railroad was recently found to harbour one plant of *Salix candida* by ACCDC botanist, C.S. Blaney (Wetland E in Figure 4). The construction of the railroad beside this wetland has altered the habitat by causing changes to the hydrological regime. This could have negatively impacted a population of Hoary Willow if one was present. There is no historic data to support this however. A second wetland slightly southwest of the first appears to have been bisected by the railroad. This wetland was surveyed both by R.E. and R.B. Newell and by C.S. Blaney and D. M. Mazerolle. Neither group located *Salix candida* here even though the habitat resembles fen habitat occurring elsewhere in the Black River system where *Salix candida* occurs.

Survey work conducted by botanists (C.S. Blaney and D.M. Mazerolle) from the Atlantic Canada Conservation Data Centre, under Nova Scotia Crown Share Land Legacy Trust funding, this past summer within the Black River system, discovered signs (survey thread and spray-painted trees), that forest harvesting may be imminent in close proximity to one of the fens where Hoary Willow occurs (Wetland C in Figure 4). It is not known if clear-cutting will negatively impact the *Salix candida* population within this fen. If hydrological alterations are caused by any of the activities associated with the clearcutting, the Hoary Willow could be impacted. Hydrological alterations have been identified as the prime threat to *Salix candida* populations in a number of states in the US (Decker, 2006). Clear

cutting to the wetland edge could also provide an access route for invasive species into the rich fen habitat. Other rare species in this fen, particularly Showy Lady's-slipper (*Cypripedium reginae*), which is more forest associated than Hoary Willow, could be more directly impacted (pers. comm., C.S. Blaney). There is also the potential for heavy machinery damage within the wetland as well.

There has been recent interest in oil drilling in the land surrounding Lake Ainslie. An oil and gas exploration company has obtained 100% exploration and development rights over an area of 155,300h surrounding Lake Ainslie. The Black River system is located within this tract of land. Any drilling carried out within the Black River watershed may have serious negative impact on populations of Hoary Willow as well as the other rare plant species within this system by altering the hydrology and/or by introducing toxic chemicals into the environment.

Research by Gage and Cooper (2005) found that sustained and intense browsing of riparian shrub willows by elk in Rocky Mountain National Park, Colorado, USA had a profound effect on the spatial distribution and abundance of seeds, reducing the probability of seeds reaching suitable sites for germination. Browsing removes leaves as well as stems on which aments would be produced thereby reducing or even eliminating flower and seed production.

Livestock grazing is listed as a threat to *Salix candida* in rich calcareous fen habitat in some states in the USA (Decker, 2006).

Grazing was recently documented by photographs (R.B. Newell) within Nova Scotia's populations of *Salix candida*. It is not known whether the grazing was carried out by moose, deer or rabbits. No moose sign was observed however. The current degree of grazing does not seem to be affecting reproduction. Grazed *Salix candida* shrubs were often observed to be reproductive.

No all terrain vehicle trails were observed during field work conducted for this report. ATV activity however may ioccur in the future. Heavy all terrain vehicle usage would damage or destroy seedlings and mature plants of *Salix candida*.

Anderson and Broughm (1988) found the peat within the Black River system to be fuel grade. Peat mining may prove to be a future potential threat.

No invasive species were observed within *Salix candida* habitat during field work conducted for this status report.

Fire suppression may be having a negative impact on Hoary Willow populations in Nova Scotia. In boreal fen systems, fire is an important mechanism for maintaining non-forested open wetland conditions and preventing

the drying out of fen habitat (Charman, 2002).

Small populations of any wild species are more susceptible to natural rare events such as catastrophic fire, extreme drought, or severe prolonged flooding.

Dioecious plants are vulnerable to chance variation in the sex ratio which could reduce population sizes (Decker, 2006). Any deviation from a sex ratio of 1:1 can have a negative impact by increasing the chance for inbreeding, genetic drift, etc.

The primary threat in South Dakota, Colorado and Wyoming to fens harbouring populations of *Salix candida*, is hydrologic alteration (Decker, 2006). Less imminent threats include: grazing, road construction and maintenance, peat mining, recreational use, alteration of natural fire regime and invasive species.

Threats in Washington state are listed as hydrologic alteration by beaver populations and timber harvesting (http://www1.dnr.wa.gov/nhp/refdesk/fguide/pdf/salcan.pdf).

Threats in Ohio listed as overgrowth by taller woody species as a result of succession (http://www.dnr.state.oh.us/dnap/Abstracts/s/salicand/tabid/1550/Default.aspx).

A prime limiting factor to this species would be the highly specialized habitat requirements. Rich calcareous fens are very uncommon in Nova Scotia. Hoary Willow is extremely limited by the amount of available suitable habitat.

The seeds of willows in general have a very limited window in which to fine suitable habitat for germination and growth. If suitable habitat is not found usually within days, seeds and seedlings will perish (Argus, 2006).

PROTECTION, STATUS, AND RANKS

Legal Protection and Status

Salix candida is not listed nationally in Canada under the federal Species at Risk Act (SARA 2003). It is not listed under Nova Scotia Endangered Species legislation (NSESA 1999). Hoary Willow is not listed in the United States under the U.S. Endangered Species Act (1973).

Non-Legal Status and Ranks

Hoary Willow is ranked as a RED species on the Nova Scotia Department of

Natural Resources General Status Ranks of Wild Species website (http://www.gov.ns.ca/natr/wildlife/genstatus/). A RED-listed species is a species that is known to be or that is thought to be at risk.

NatureServe (2010) status ranks for Hoary Willow are given below (bolded provinces and states have a status rank of S3S4 or lower, indicating some degree of rarity):

Canada: AB (S4), BC (S5), LB (SNR), MB (S5), **NB (S2)**, NF (S4), **NS (S1)**, NT (SNR), ON (S5), **PE (S1)**, SK (S5), **YT (S2)**. NatureServe does not provide status ranks for Quebec and Nunavut although it is reported for both provinces (Argus 2010).

United States: **AK (S3)**, **CO (S2)**, **CT (S3)**, **IA (S3)**, **ID (S2)**, **IL (S2S3)**, IN (SNR), **MA (S3)**, **ME (S1)**, MI (SNR), MN (SNR), **MT (S3S4)**, ND (SNR), NE (SNR), NH (SNR), **NJ (S2)**, NY (S5), **OH (S2)**, **PA (S1)**, **SD (S1)**, **VT (S3)**, **WA (S1)**, WI (SNR), **WY (S2)**.

Table 4. An explanation of NatureServe Ranks.

Status Rank	**Definition**
S1	Critically imperiled
S2	Imperiled
S3	Vulnerable
S4	Apparently secure
S5	Secure
SNR	Not ranked (not yet assessed)

Salix candida has a global conservation status rank of G5 indicating that on a global basis, Hoary Willow is secure to common; widespread and abundant (NatureServe, 2010).

Habitat Protection and Ownership

All Black River properties with *Salix candida* occurrences are privately owned. The province owns a tract of land near the mouth of the river which includes a small section of the river between the railroad bed and the West Lake Ainslie Road. Unfortunately no Salix candida plants were found on this property.

The land where the Two Rivers Wildlife Park is situated belongs to the province. Currently the land is being leased from the province by a not-for-profit community association (The Two Rivers Development Association) which is charged with the management of the Park.

The Black River system was recognized as a significant ecological site under the International Biological Program (IBP-CT, 1974). Unfortunately this designation carried no legal protection.

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

The author would like to thank Sean Blaney and David Mazerolle, botanists with the Atlantic Canada Conservation Data Centre (ACCDC) for sharing their 2010 field data on *Salix candida* from Black River. I am indebted to my husband, Reg. B. Newell, for his invaluable assistance in the field and for reviewing this report. I would like to thank Terry Power, Regional Wildlife Biologist with the Nova Scotia Department of Natural Resources for providing information on the Two Rivers Wildlife Park and known rare plants in the area. I am grateful to Pixie Williams for her recollections on botanizing in the area of the Two Rivers Wildlife Park. Lawrence Benjamin from the Wildlife Division of the Nova Scotia Department of Natural Resources in Kentville, NS kindly provided information on the distribution of Windsor and Mabou deposits on Cape Breton Island and also assisted with the calculation of Area of Occupation (AO) and the Extent of Occurrence (EO) for *Salix candida* in Nova Scotia. Peter Kydd ably created the map of occurrences of Hoary Willow in the Black River area. Dr. George Argus checked on specimens of *Salix candida* at CAN and DAO on my behalf and examined and annotated all *Salix candida* specimens from Nova Scotia herbaria. I am also grateful to the curators of the various Nova Scotia herbaria for loaning their Nova Scotia specimens of *Salix candida* to the E.C. Smith Herbarium.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Ruth E. Newell has worked as a botany technician and curator of the E.C. Smith Herbarium at Acadia University for approximately thirty years. She has authored and co-authored over ten COSEWIC and Nova Scotia provincial status reports, She is a past member of the COSEWIC Vascular Plant and Lichen Species Specialist Sub-Committee and is currently a member of the Nova Scotia Species at Risk Working Group and a member of the Atlantic Coastal Plain Flora Recovery Team. She occasionally works as a botanical consultant conducting rare flora surveys.

COLLECTIONS EXAMINED

Nova Scotia *Salix candida* herbarium specimens were examined from the following herbaria: ACAD (Acadia University), NSM (Nova Scotia Museum), Cape Breton University herbarium and St. Francis Xavier University herbarium. Specimens at CAN (Canadian Museum of Nature) and DAO (Department of Agriculture, Ottawa) were examined on behalf of the author by Dr. George W. Argus.

APPENDICES

Appendix 1. Waypoints marking *Salix candida* plants in the Black River system based on field work conducted by R.E. Newell, and R.B. Newell on June 12th -13th and Sept.11th -12th, 2010). The last three rows indicate wetlands where no plants of Hoary Willow were found.

Location - Black River system (Figure 4)	***Salix candida***	**Waypoint**	**UTM Zone**	**easting**	**northing**	**LATDEC**	**LONGDEC**
FEN A	x	188	20T	631851	5113051	46.15828	61.29232
	x	189	20T	631849	5113074	46.15848	61.29235
	x	192	20T	631771	5113151	46.1592	61.29332
	x	193	20T	631751	5113146	46.15916	61.2936
	x	194	20T	631746	5113130	46.159	61.29366
	x	195	20T	631758	5113112	46.15885	61.29351
	x	196	20T	631745	5113102	46.15876	61.29369
	x	197	20T	631726	5113108	46.15882	61.29393
	x	198	20T	631724	5113091	46.15866	61.29396
	x	end of track line				46.16001	61.29482
FEN B	x	199	20T	631674	5112273	46.15131	61.29483
	x	200	20T	631607	5112122	46.14997	61.29574
FEN C	x		see ACCDC waypoints in Appendix 2				
FEN D (McCormicks Corner)	x	205	20T	633044	5112373	46.15194	61.27707
	x	209	20T	632869	5112384	46.15208	61.27933
	x	210	20T	632903	5112407	46.15228	61.27889
Calcareous marsh (wetland E)	x		see ACCDC waypoint in Appendix 2				
Bog east of Waste Management Facility on east side of West Lake Ainslie Road	absent	203	20T			46.1688	61.27327
MacQuarries Brook - alder thicket	absent	115	20T			46.181	61.25567
Fen habitat on north side of railroad	absent	208	20T			46.14463	61.29385

Appendix 2. *Salix candida* locations and habitat descriptions in the Black River system based on field work conducted by ACCDC botanists C.S. Blaney and D. M. Mazerolle on July 21st, 2010.

NAME	SITE	wpt #	LATDEC	LONDEC	end LATDEC	end LONDEC	Eo COUNT	eoHABITAT	eoASSOCSPP	OBSERV-ER	eoDESC
Salix candida	Black River Fens	339	46.15224	-61.278996			>15	rich calcareous open graminoid/low shrub fen, on wet sphagnum	Typha latifolia; Dasiphora fruticosa; Galium labradoricum; Carex viridula var. elatior; Alnus incana; Picea mariana	Mazerolle, D.M.	
Salix candida	Black River Fens	343	46.151722	-61.279332			~9	rich calcareous open graminoid/low shrub fen, on wet sphagnum	Typha latifolia; Dasiphora fruticosa; Galium labradoricum; Carex viridula var. elatior; Alnus incana; Picea mariana	Mazerolle, D.M.	
Salix candida	Black River Fens	376	46.15033	-61.293799			13	rich calcareous open graminoid/low shrub fen, on wet sphagnum	Dasiphora fruticosa; Carex viridula var. elatior; Ledum groenlandicum; Rhamnus alnifolia; Betula pumila; Alnus incana; Picea mariana	Mazerolle, D.M.	
Salix candida	Black River Fens	378	46.150267	-61.294067			~20	rich calcareous open graminoid/low shrub fen, on wet sphagnum	Typha latifolia; Dasiphora fruticosa; Carex viridula var. elatior; Rhamnus alnifolia; Ledum groenlandicum; Betula pumila; Galium labradoricum	Mazerolle, D.M.	

NAME	SITE	wpt #	LATDEC	LONDEC	end LATDEC	end LONDEC	Eo COUNT	eoHABITAT	eoASSOCSPP	OBSERV-ER	eoDESC
Salix candida	Black River Fens	380	46.150314	-61.29421			3	rich calcareous open graminoid/low shrub fen, on wet sphagnum	Typha latifolia; Dasiphora fruticosa; Carex viridula var. elatior; Rhamnus alnifolia; Ledum groenlandicum; Betula pumila; Galium labradoricum	Mazerolle, D.M.	
Salix candida	Black River Fens	383 to 384	46.150335	-61.294318	46.1505099	-61.294574	10	rich calcareous open graminoid/low shrub fen, on wet sphagnum	Typha latifolia; Dasiphora fruticosa; Carex viridula var. elatior; Rhamnus alnifolia; Ledum groenlandicum; Betula pumila; Galium labradoricum; Cypripedium reginae	Mazerolle, D.M.	
Salix candida	Black River Fens	385 to 386	46.150356	-61.294646	46.14997	-61.294646	~75	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	392	46.149043	-61.296127			6	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	394	46.148392	-61.296221			2	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	406	46.142133	-61.308302			5	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	

NAME	SITE	wpt #	LATDEC	LONDEC	end LATDEC	end LONDEC	Eo COUNT	eoHABITAT	eoASSOCSPP	OBSERV-ER	eoDESC
Salix candida	Black River Fens	408	46.141921	-61.308479			8	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	411	46.142985	-61.306934			15	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	413	46.142931	-61.306123			~6	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	414	46.143107	-61.305832			>10	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	415	46.143223	-61.305446			>25	rich calcareous open graminoid/low shrub fen, on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	416	46.143229	-61.305186			~10	rich calcareous open graminoid/low shrub fen on wet sphagnum		Mazerolle, D.M.	
Salix candida	Black River Fens	231	46.150982	-61.27866			5	rich, open, low shrub fen	Dasiphora fruticosa	Blaney, C.S.	5 crowns
Salix candida	Black River Fens	235	46.151852	-61.280499			2	rich, open, low shrub fen	Dasiphora fruticosa	Blaney, C.S.	2 vigourous clumps
Salix candida	Black River Fens	270 to 272	46.151247	-61.295431	46.15122	-61.295578	8	Dasiphora fruticosa - Morella pensylvanica dominated shrubby fen opening		Blaney, C.S.	

NAME	SITE	wpt #	LATDEC	LONDEC	end LATDEC	end LONDEC	Eo COUNT	eoHABITAT	eoASSOCSPP	OBSERV-ER	eoDESC
Salix candida	Black River Fens	273	46.150904	-61.295308			~10	rich, calcareous, open, graminoid - low shrub fen	Carex lasiocarpa; Schoenoplectus acutus; Carex viridula var. Elatior	Blaney, C.S.	
Salix candida	Black River Fens	274 to 281	46.15086	-61.295075	46.1506341	-61.294412	a few 100	rich, calcareous, open, graminoid - low shrub fen		Blaney, C.S.	population may extend beyond the end waypoint here
Salix candida	Black River Fens	284 to 292	46.15019	-61.295701	46.14862	-61.297046	~200	rich, calcareous, open, graminoid - low shrub fen		Blaney, C.S.	uncommon to fairly common
Salix candida	Black River Fens	305	46.142137	-61.30832			5	rich, calcareous, open, graminoid - low shrub fen		Blaney, C.S.	
Salix candida	Black River Fens	306 to 307	46.142376	-61.308437	46.1425283	-61.308573	~40	rich, calcareous, open, graminoid - low shrub fen		Blaney, C.S.	
Salix candida	Black River Fens	310	46.143075	-61.307283			~20	rich, calcareous, open, graminoid - low shrub fen		Blaney, C.S.	
Salix candida	Black River Fens	311 to 319	46.143138	-61.307093	46.1431184	-61.305108	several 100	rich, calcareous, open, graminoid - low shrub fen		Blaney, C.S.	

NAME	SITE	wpt #	LATDEC	LONDEC	end LATDEC	end LONDEC	Eo COUNT	eoHABITAT	eoASSOCSPP	OBSERV-ER	eoDESC
Salix candida	Black River Fens	327	46.14596	-61.290519			1	rich, calcareous marsh with water level artificially maintained by railway bed	Typha latifolia; Alnus incana ssp. rugosa; Salix bebbiana; Salix discolor	Blaney, C.S.	