

Recovery Strategy for the Juniper Sedge (*Carex juniperorum*) in Canada

Juniper Sedge



2019



Government
of Canada

Gouvernement
du Canada

Canada

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For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](#)¹.

Cover illustration: Samuel Brinker

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¹ <http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1>

RECOVERY STRATEGY FOR THE JUNIPER SEDGE (*Carex juniperorum*) IN CANADA

2019

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of Ontario has given permission to the Government of Canada to adopt the *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario* (Part 2) and the *Juniper Sedge – Ontario Government Response Statement* (Part 3) under section 44 of the *Species at Risk Act* (SARA). Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this recovery strategy.

The federal recovery strategy for the Juniper Sedge in Canada consists of three parts:

Part 1 – Federal Addition to the *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario*, prepared by Environment and Climate Change Canada

Part 2 – *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario*, prepared for the Ontario Ministry of Natural Resources and Forestry²

Part 3 – *Juniper Sedge – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources and Forestry

² On June 26, 2014, the Ontario Ministry of Natural Resources (OMNR) became the Ontario Ministry of Natural Resources and Forestry (OMNRF).

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Part 2 – *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario*, prepared for the Ontario Ministry of Natural Resources and Forestry

Part 3 – *Juniper Sedge – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources and Forestry

Part 1 – Federal Addition to the *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario*, prepared by Environment and Climate Change Canada

Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)³ agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the Species at Risk Public Registry.

The Minister of Environment and Climate Change is the competent minister under SARA for the Juniper Sedge and has prepared the federal component of this recovery strategy (Part 1), as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Ontario Ministry of Natural Resources and Forestry, as per section 39(1) of SARA. SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). The Ontario Ministry of Natural Resources and Forestry led the development of the attached recovery strategy for the Juniper Sedge (Part 2) in cooperation with Environment and Climate Change Canada. The Province of Ontario also led the development of the attached Government Response Statement (Part 3), which is the Ontario Government's policy response to its provincial recovery strategy and summarizes the prioritized actions that the Ontario government intends to take and support.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Juniper Sedge and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

³ <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6b319869-1#2>

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area⁴ be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

⁴ These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Acknowledgements

The initial draft of this federal addition was prepared by Holly Bickerton, Consulting Ecologist, Ottawa. Additional preparation and review was provided by Ken Tuininga, Angela Darwin, and Krista Holmes (Environment and Climate Change Canada, Canadian Wildlife Service – Ontario) and Lauren Strybos, and Justine Mannion (formerly Environment and Climate Change Canada, Canadian Wildlife Service – Ontario). James Page (Canadian Wildlife Federation), Jennifer Chambers (Ontario Parks) and Ontario Parks' summer staff assisted with fieldwork at Selkirk Provincial Park. Mike Oldham (Ontario Natural Heritage Information Centre (NHIC) provided information and recent field data from Selkirk Provincial Park that significantly assisted surveys. Angela McConnell, Jude Girard, Ken Corcoran, and Elizabeth Rezek (Environment and Climate Change Canada, Canadian Wildlife Service – Ontario), Mike Oldham (NHIC) and Vivian Brownell, Eric Snyder and Mark Hulsman (Ontario Ministry of Natural Resources and Forestry) reviewed and provided comments and advice during the development of this document.

Acknowledgement and thanks is given to all other parties that provided advice and input used to help inform the development of this recovery strategy including various Indigenous organizations and individuals, individual citizens, and stakeholders who provided input and/or participated in consultation meetings.

Additions and Modifications to the Adopted Document

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that are not addressed in the *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario* (Part 2 of this document, referred to henceforth as “the provincial recovery strategy”) and/or to provide updated or additional information.

Environment and Climate Change Canada is adopting the Ontario recovery strategy (Part 2) with the exception of section 2, Recovery. In place of section 2, Environment and Climate Change Canada is adopting the recovery goal from the *Juniper Sedge – Ontario Government Response Statement*⁵ (Part 3) as its population and distribution objective. Environment and Climate Change Canada is also adopting the government-led and government-supported actions set out in the *Juniper Sedge – Ontario Government Response Statement* (Part 3) as the broad strategies and general approaches to meet the population and distribution objectives.

Under SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Therefore, statements in the provincial recovery strategy referring to protection of the species’ habitat may not directly correspond to federal requirements. Recovery measures dealing with the protection of habitat are adopted; however, whether these measures will result in protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.

1. Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Juniper Sedge. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

Yes. Five extant⁶ populations of Juniper Sedge occur in Canada. The most recent comprehensive population estimate is from the 2000 COSEWIC status report (6600 plants). The Ontario recovery strategy provides the sum of the most recent population counts at the time of its development for all extant populations including one

⁵ The Government Response Statement is the Ontario Government’s policy response to the recovery strategy and summarizes the prioritized actions that the Ontario Government intends to take and support.

⁶ Extant: population which is considered to be still in existence, i.e., not destroyed or lost (extirpated).

population (20 plants) that was rediscovered (Brinker 2002) and the new population at Selkirk Provincial Park (50 plants in 2008) (Bickerton et al. 2015). Additional fieldwork in 2015 in Selkirk Provincial Park documented 90 plants at that location (H. Bickerton, pers. obs. 2015). Plants in each population have been observed in fruit, and are believed to be reproductive. Because the species has only been recently described and identification requires a skilled observer, the species may be discovered elsewhere in Ontario. Also, since additional suitable habitat is present within Selkirk Provincial Park, it is possible that more plants may be found in the provincial park. There are also populations in the United States in Ohio, Kentucky and Virginia (NatureServe 2015).

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. The largest populations occur on the Napanee Plain in open Eastern Red Cedar (*Juniperus virginiana*) and oak (*Quercus sp.*) woodlands, a rare habitat type, where there is additional similar and apparently suitable habitat (Crowder et al. 2013). As mentioned above, additional suitable habitat is also present in Selkirk Provincial Park.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Unknown. The primary threats to this species are considered to be habitat loss and degradation, mainly because most plants in Canada occur on private land within a small area of Ontario (COSEWIC 2000). Although sites are not currently known to be at immediate risk, residential and quarry development are common in the area, as is solar and wind farm construction. The risk of habitat loss may be mitigated to some extent by increasing landowner awareness, encouraging landowner stewardship, and by purchasing properties for conservation when opportunities arise. Private land may also be susceptible to habitat degradation, such as overgrazing, garbage dumping and ATV use. Finally, the invasive Common Buckthorn (*Rhamnus cathartica*) is abundant at some sites, and although control methods are well-known, this species has proven difficult and costly to control in similar habitat on the Napanee Plain (T. Trustham, pers. comm. 2014).

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Unknown. Several recovery techniques exist to conserve existing habitat and individuals. Occupied habitat on private property may be conserved through land securement or stewardship programs (e.g., Conservation Land Tax Incentive Program), but some habitats are becoming overgrown, potentially out competing Juniper Sedge plants. Techniques have been developed to control some of the invasive plant species that occur at Juniper Sedge locations (OIPC 2015), but others such as Common Buckthorn are difficult to control. Populations at two locations in Ohio have reportedly responded very well to prescribed burning (NatureServe 2015). Because plants appear to prefer canopy gaps and forest edges, it is possible that canopy thinning may increase

available light and benefit populations; and this has been identified as a research need in the provincial recovery strategy (Bickerton et al. 2015).

2. COSEWIC* Species Assessment Information

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| <p>Date of Assessment: May 2000</p> <p>Common Name (population): Juniper Sedge</p> <p>Scientific Name: <i>Carex juniperorum</i></p> <p>COSEWIC Status: Endangered</p> <p>Reason for Designation: The species is globally rare, occurring within a single, very small area of provincially rare habitat. It is threatened by exotic species and potential land development.</p> <p>Canadian Occurrence: Ontario</p> <p>COSEWIC Status History: Designated Endangered in April 1999. Status re-examined and confirmed Endangered in May 2000.</p> |
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* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

3. Species Status Information

The Juniper Sedge is a perennial sedge that has been recently described (Catling et al. 1993). The species is found at about 35 locations in eastern North America, many of them widely disjunct (NatureServe 2015). Globally and in the United States, Juniper Sedge is considered Vulnerable⁷ (G3/N3)⁸ and in the individual states: in Kentucky it is Critically Imperilled/Imperilled⁹ (S1S2), in Ohio it is Vulnerable (S3) and in Virginia it is Critically Imperilled (S1). In Canada, Juniper Sedge is considered to be Critically Imperilled¹⁰ (N1). It is known only from Ontario where it is considered Critically Imperilled (S1). It occurs at four locations in the Napanee area (Hastings County), and a single location in southwestern Ontario at Selkirk Provincial Park. Juniper Sedge is listed as Endangered¹¹ on Schedule 1 of SARA. In Ontario, the Juniper Sedge is listed as Endangered under the provincial *Endangered Species Act, 2007* (ESA). The

⁷ Vulnerable: At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats or other factors.

⁸ Conservation ranks (Master et al. 2012)

⁹ Imperilled: At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats or other factors.

¹⁰ Critically Imperilled: At a very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats or other factors.

¹¹ Endangered: a species facing imminent extinction or extirpation.

percentage of the global range that occurs in Canada is difficult to estimate from existing range maps (e.g. Kartesz 2015), but it may be as high as 25%, owing to the small number of populations, and limited extent of its specific habitat.

4. Species Information

4.1 Species Population and Distribution

Additional field data was collected in 2014 and 2015 that was not included in the provincial recovery strategy (2015). The population at Selkirk Provincial Park was observed in both 2014 (by Mike Oldham, Sam Brinker, and Mary Gartshore) and 2015 (by Holly Bickerton, James Pagé, and Jennifer Chambers). Observations by Ontario Natural Heritage Information Centre (NHIC) staff in 2014 and previous years were used to conduct a thorough count of Juniper Sedge clumps¹² at Selkirk Provincial Park in June, 2015. Ninety clumps were observed. This is higher than previous estimates for this site (~50 clumps, 2014), although this probably reflects a significant increase in cumulative search effort. Additional suitable habitat is present within the park, and more plants may be present.

4.2 Habitat Needs

The Ecological Land Classification¹³ (ELC) vegetation type in which Juniper Sedge occurs at Selkirk Provincial Park has been identified as Dry-Fresh Oak-Hickory Forest (FODM2-2). While the percentage canopy cover for the surrounding vegetation community as a whole is greater than 60% (i.e. forest), most plants occur along a trail, or within small gaps and canopy openings in the forest, usually in areas of 40-60% canopy cover. The canopy of the surrounding upland forest is dominated by Northern Red Oak (*Quercus rubra*), with Shagbark Hickory (*Carya ovata*) and White Ash (*Fraxinus americana*). The shrub layer, although sparse, contains Downy Arrow-wood (*Viburnum rafinesquianum*) and Hawthorn (*Crataegus* sp.) with Ash saplings. Dominant ground cover species throughout the habitat include Pennsylvania Sedge (*Carex pensylvanica*), Wild Geranium (*Geranium maculatum*) and Oval-leaved Sedge (*Carex cephalophora*).

The following understory species were also found in the immediate vicinity (up to approximately 2 m) of Juniper Sedge at Selkirk Provincial Park: Oval-leaved Sedge, Meadow Sedge (*Carex granularis*), Enchanter's Nightshade (*Circaea canadensis*), Wild Strawberry (*Fragaria virginiana*), American Columbo (*Frasera caroliniensis*), White Avens (*Geum canadense*), Path Rush (*Juncus tenuis*), Many-flowered Wood-rush (*Luzula multiflora*), Common Plantain (*Plantago major*), Mayapple (*Podophyllum peltatum*), White-lettuce (*Nabalus* sp.), Multiflora Rose (*Rosa multiflora*),

¹² To standardize counting of this probably clonal species, a single “clump” was defined as a dense tuft centred at least 5 cm from the centre of a neighbouring clump.

¹³ Ecological Land Classification is a system used to delineate natural regions based on ecological factors.

False Melic Grass (*Schizachne purpurascens*), Early Goldenrod (*Solidago juncea*), Goldenrod sp. (*Solidago* sp.), Early Meadow-rue (*Thalictrum dioicum*), Hooked Buttercup (*Ranunculus recurvatus*), Common Speedwell (*Veronica officinalis*), Highbush Cranberry (*Viburnum trilobum*), and Violet (*Viola* sp.) (H. Bickerton, pers. obs. 2015).

5. Population and Distribution Objectives

Under SARA, a population and distribution objective for the species must be established. Consistent with the recovery goal in the Government of Ontario's Government Response Statement (Part 3) Environment and Climate Change Canada's population and distribution objective for Juniper Sedge is to:

- Maintain the current population levels across the species' distribution in Ontario and support natural increases to improve long-term persistence.

Juniper Sedge is a globally rare species. Despite the existence of other areas of similar and presumably suitable habitat, it has been found at only approximately 35 locations across eastern North America (NatureServe 2015). Maintaining or increasing Juniper Sedge abundance at all five extant Canadian populations is therefore extremely important to the conservation of this species. Because many populations are also highly disjunct and can be separated by many hundreds of kilometres, each location is very important to maintaining the species' current range and area of occupancy. A number of strategies for maintaining or increasing population abundance at current locations have been outlined as government-led and government-supported actions in the *Ontario Government Response Statement*.

It is likely that Juniper Sedge has always been a rare plant in eastern North America. There are no known historical or extirpated occurrences, and recovery will therefore focus on maintaining extant populations. Because it has been relatively recently described, and its identification requires a skilled observer, Juniper Sedge may be overlooked. It is possible that additional populations may be discovered in Canada in the future.

6. Broad Strategies and General Approaches to Meet Objectives

The government-led and government-supported actions tables from *Juniper Sedge – Ontario Government Response Statement* (Part 3) are adopted as the broad strategies and general approaches to meet the population and distribution objective. Environment and Climate Change Canada is not adopting the approaches identified in section 2 of the *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario* (Part 2).

7. Critical Habitat

7.1 Identification of the Species' Critical Habitat

Section 41(1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Under section 2(1) of SARA, critical habitat is "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species".

Identification of critical habitat is not a component of provincial recovery strategies under the Province of Ontario's ESA. Under the ESA, when a species becomes listed as endangered or threatened on the Species at Risk in Ontario List, it automatically receives general habitat protection. Juniper Sedge currently receives general habitat protection under the ESA. In some cases, a habitat regulation may be developed that replaces the general habitat protection. A habitat regulation is a legal instrument that prescribes an area that will be protected¹⁴ as the habitat of the species by the Province of Ontario. A habitat regulation has not been developed for Juniper Sedge under the ESA; however, the provincial recovery strategy (Part 2) contains a recommendation on the area for consideration in developing a habitat regulation.

This federal recovery strategy identifies critical habitat for Juniper Sedge in Canada to the extent possible, based on this recommendation and on the best available information as of December 2015. Critical habitat is identified for the five known extant populations of Juniper Sedge in Ontario (Figures 1 and 2; Table 1). More precise boundaries may be mapped, and additional critical habitat may be added in the future if new or additional information supports the inclusion of areas beyond those currently identified (e.g. new sites are colonized or existing sites expand into adjacent areas).

The identification of critical habitat for Juniper Sedge is based on two criteria: habitat occupancy and habitat suitability.

7.1.1 Habitat Occupancy

The habitat occupancy criterion refers to areas of suitable habitat where there is a reasonable degree of certainty of current use by the species.

Habitat is considered occupied when:

- At least one Juniper Sedge individual has been observed in any year since 1993

¹⁴ Under the federal SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.

Habitat occupancy is based on recent occurrence reports available for extant populations from the NHIC and COSEWIC. Juniper Sedge is a small and inconspicuous plant that is only recognizable by experienced botanists. As Juniper Sedge was first described in 1993, a limited number of systematic surveys have been done in Ontario; this time window allows for the inclusion of all data for the five known extant populations of Juniper Sedge in Canada.

7.1.2 Habitat Suitability

Habitat suitability relates to areas possessing a specific set of biophysical attributes that can support individuals of the species in carrying out essential aspects of their life cycle. Throughout its eastern North American range, Juniper Sedge is generally found within canopy openings or small gaps in open Eastern Red Cedar and oak woodlands. In Ontario, Juniper Sedge is typically found in areas of light shade, on shallow, alkaline clay soils derived from and underlain by limestone bedrock; however, the habitat differs between the two areas in Ontario where Juniper Sedge occurs. In Hastings County, Juniper Sedge is found in alvar woodland habitat typical for the species, while individuals in Selkirk Provincial Park are found in deciduous forest. The predominant habitat of this species, alvar woodland, is very limited in Ontario.

The biophysical attributes of suitable habitat for Juniper Sedge include:

- Areas of light shade (50 to 70% canopy cover); AND
- Well-drained, shallow, alkaline clay soils with a pH range between 7.0 to 7.8; AND
- Alvar woodland;
 - Associated tree species may include but are not limited to Eastern Red Cedar, Bur Oak (*Quercus macrocarpa*), Eastern White Pine (*Pinus strobus*) White Ash, or Basswood (*Tilia americana*)OR
- Deciduous forest
 - Associated tree species may include but are not limited to Northern Red Oak, Shagbark Hickory, Eastern Hop-hornbeam (*Ostrya virginiana*), Ash (*Fraxinus sp.*), or Sugar Maple (*Acer saccharum*)

Based on the best available information, suitable habitat for Juniper Sedge is currently defined as the extent of the biophysical attributes where Juniper Sedge exists in Ontario. In Ontario, suitable habitat for Juniper Sedge can be described using the ELC framework for Southern Ontario (from Lee et al. 1998). The ELC framework provides a standardized approach to the interpretation and delineation of dynamic ecosystem boundaries. The ELC approach classifies habitats not only by vegetation community, but also considers soil moisture conditions and topography, and as such encompasses the biophysical attributes of suitable habitat for Juniper Sedge. In addition, ELC terminology and methods are familiar to many land managers and conservation practitioners who have adopted this tool as the standard approach for Ontario.

Within the ELC system in Ontario, the vegetation type boundary best captures the extent of biophysical attributes required by the species. The vegetation type includes the areas occupied by Juniper Sedge and the surrounding areas that provide suitable habitat conditions to carry out essential life process for the species and should allow for natural processes related to population dynamics and reproduction (e.g., dispersal and pollination) to occur. There is no specific information about seed dispersal, but the occupied ELC vegetation type should provide sufficient opportunity for dispersal and expansion of populations (i.e., increase abundance of extant populations). This larger area around the plant may also promote ecosystem resilience to invasive species while protecting what are typically rare communities in Ontario. It will also generally preserve the local surface water movement that determines the alvar's seasonal water cycle. In cases when the vegetation type cannot be classified using ELC¹⁵, suitable habitat is defined as the extent of biophysical attributes where Juniper Sedge exists in Ontario, up to a maximum distance of 100 m (radial distance) from any plant. As explained in the provincial recovery strategy, the protection of 100 m of suitable habitat ensures that habitat conditions such as canopy cover conditions and hydrological functions are maintained in order to preserve the ecological functions of the area necessary for the persistence of Juniper Sedge.

ELC vegetation types (Lee et al. 1998) containing Juniper Sedge have been described as Eastern Red Cedar – Early Buttercup Treed Alvar (ALT 1-5) in Hastings County, and as Dry – Fresh Oak – Hickory Deciduous Forest (FOD2-2) in Selkirk Provincial Park. Additional habitat assessments are required to map the specific ELC vegetation types currently occupied by Juniper Sedge in Hastings County.

In addition to the suitable habitat, a critical function zone of 50 m (radial distance) is applied when the biophysical attributes around a plant extend for less than 50 m. The 50 m is considered a minimum 'critical function zone', or the threshold habitat fragment size required for maintaining constituent microhabitat properties for a species (e.g., critical light, temperature, litter moisture, humidity levels necessary for survival). At present, it is not clear at what exact distances physical and/or biological processes begin to negatively affect Juniper Sedge. Studies on micro-environmental gradients at habitat edges, including light, temperature, litter moisture (Matlack 1993), and of edge effects on plants in mixed hardwood forests, as evidenced by changes in plant community structure and composition (Fraver 1994), have shown that edge effects could be detected up to 50 m into habitat fragments although other studies show that the magnitude and distance of edge effects will vary depending on the structure and composition of adjacent habitat types (Harper et al. 2005). Forman and Alexander (1998) and Forman et al. (2003) found that most roadside edge effects on plants resulting from construction and repeated traffic have their greatest impact within the first 30 to 50 m. Therefore, a 50 m distance from any Juniper Sedge plant was chosen to ensure that microhabitat properties were maintained as part of the identification of critical habitat. The area within the critical function zone may include both suitable and

¹⁵ As a result of past history of site disturbance in Hastings County, it may not be possible to classify the vegetation types in which Juniper Sedge is found using the ELC framework.

unsuitable habitat as Juniper Sedge may be found near a transition area/zone between suitable and unsuitable habitat. As new information on species' habitat requirements and site-specific characteristics, such as hydrology, become available, these distances may be refined.

Human-made structures (e.g., maintained roadways, buildings) do not possess the biophysical attributes of suitable habitat or assist in the maintenance of natural processes.

7.1.3 Application of Criteria to Identify Critical Habitat for Juniper Sedge

Critical habitat for Juniper Sedge is identified as the extent of suitable habitat (section 7.1.2) where the habitat occupancy criteria is met (section 7.1.1). In Ontario, as noted above, suitable habitat for Juniper Sedge is most appropriately identified at the ELC vegetation type. At the present time, ELC vegetation type descriptions and boundaries are not available to support the identification of critical habitat for all populations in Ontario. When the ELC vegetation type cannot be mapped, suitable habitat for Juniper Sedge is defined as the extent of biophysical attributes where Juniper Sedge exists in Ontario, up to a maximum distance of 100 m (radial distance) from any plant. In addition, in cases where the suitable habitat extends for less than 50 m around a Juniper Sedge, a critical function zone capturing an area within a radial distance of 50 m is also included as critical habitat.

In Ontario, critical habitat is located within these boundaries where the biophysical attributes described in section 7.1.2 are found and where the occupancy criterion is met (section 7.1.1). When ELC vegetation type boundaries are determined, the identification of critical habitat will be updated.

Application of the critical habitat criteria above to the best available information identifies critical habitat for the five known extant populations of Juniper Sedge in Canada (see Figures 1 and 2; Table 1). The critical habitat identified is considered a full identification of critical habitat and is sufficient to meet the population and distribution objective for Juniper Sedge.

Critical habitat identified for Juniper Sedge is presented using 1 x 1 km UTM grid squares. The UTM grid squares presented in Figure 1 and Figure 2 are part of a standardized grid system that indicates the general geographic areas containing critical habitat, which can be used for land use planning and/or environmental assessment purposes. In addition to providing these benefits, the 1 x 1 km UTM grid respects data-sharing agreements with the province of Ontario. Critical habitat within each grid square occurs where the description of habitat occupancy (section 7.1.1) and habitat suitability (section 7.1.2) are met. More detailed information on critical habitat to support protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment and Climate Change Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

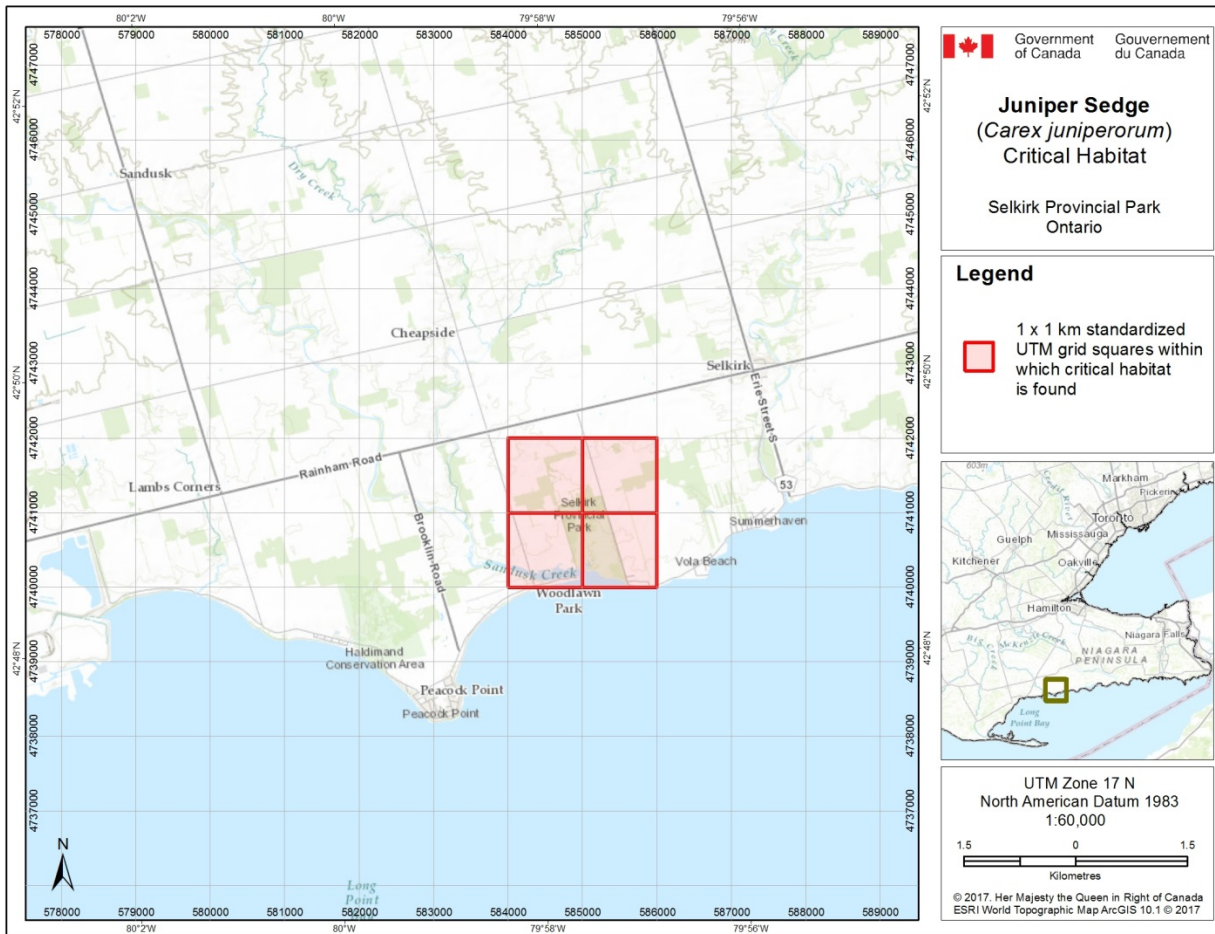


Figure 1. Grid squares that contain critical habitat for the Juniper Sedge in Selkirk Provincial Park. Critical habitat for Juniper Sedge occurs within these 1 x 1 km UTM grid squares (red shaded squares), where the criteria described in section 7.1 are met.

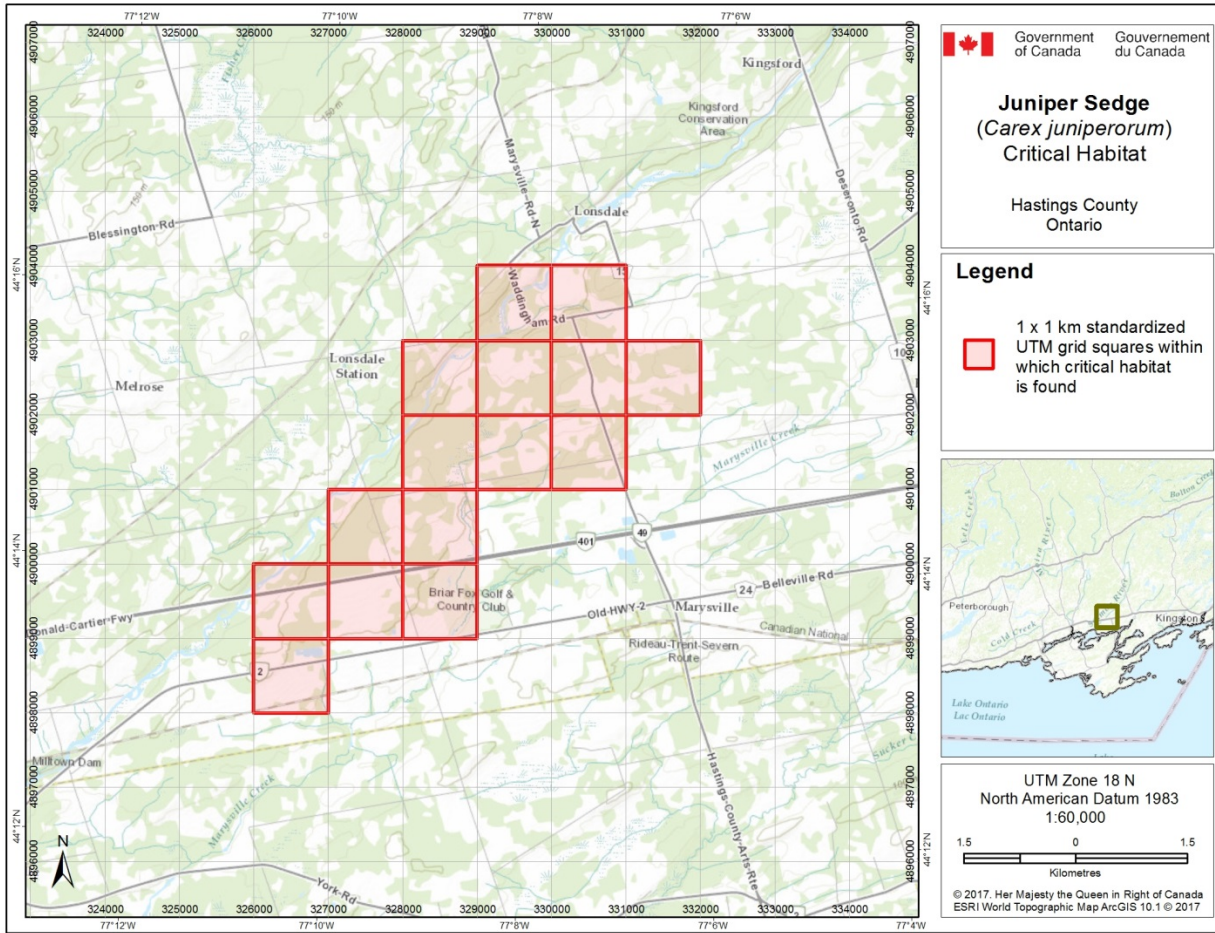


Figure 2. Grid squares that contain critical habitat for the Juniper Sedge in Hastings County. Critical habitat for Juniper Sedge occurs within these 1 x 1 km UTM grid squares (red shaded squares), where the criteria described in section 7.1 are met.

Table 1. Grid squares that contain critical habitat for the Juniper Sedge in Canada. Critical habitat for Juniper Sedge occurs within these 1 x1 km UTM grid squares where the description of habitat suitability (section 7.1.2) and habitat occupancy (section 7.1.1) are met.

| Population | 1 x 1 km Standardized UTM grid square ID ¹ | Province | UTM Grid Square Coordinates ² | | Land Tenure |
|--|---|----------|--|----------|------------------|
| | | | Easting | Northing | |
| Salmon River Alvar: West of the racetrack | 18TUP2968 | Ontario | 326000 | 4898000 | Non-federal Land |
| | 18TUP2969 | | 326000 | 4899000 | |
| Salmon River Alvar: North of Highway 401 (Lonsdale Alvar) | 18TUQ2081 | | 328000 | 4901000 | |
| | 18TUQ2082 | | 328000 | 4902000 | |
| | 18TUQ2091 | | 329000 | 4901000 | |
| | 18TUQ2092 | | 329000 | 4902000 | |
| | 18TUQ2093 | | 329000 | 4903000 | |
| | 18TUQ3001 | | 330000 | 4901000 | |
| | 18TUQ3002 | | 330000 | 4902000 | |
| | 18TUQ3003 | | 330000 | 4903000 | |
| Salmon River Alvar: About 2 km SSW of Lonsdale | 18TUQ2070 | | 331000 | 4902000 | |
| | 18TUQ2080 | | 327000 | 4900000 | |
| Salmon River Alvar: About 2 km SSW of Lonsdale and Salmon River Alvar: East of the racetrack | 18TUP2979 | | 328000 | 4900000 | |
| | 18TUP2989 | | 327000 | 4899000 | |
| Selkirk Provincial Park | 17TNH8440 | | 584000 | 4740000 | |
| | 17TNH8441 | | 584000 | 4741000 | |
| | 17TNH8450 | 585000 | 4740000 | | |
| | 17TNH8451 | 585000 | 4741000 | | |

¹ Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789>), where the first 2 digits and letter represent the UTM Zone, the following 2 letters indicate the 100 x 100 km standardized UTM grid followed by 2 digits to represent the 10 x 10 km standardized UTM grid. The last 2 digits represent the 1 x 1 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See <http://www.bsc-eoc.org/> for more information on breeding bird atlases).

² The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 1 x 1 km standardized UTM grid square containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

7.2 Activities Likely to Result in Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time. It should be noted that not all activities that occur in or near habitat are likely to cause its destruction. Activities described in Table 2 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Table 2. Activities Likely to Result in the Destruction of Critical Habitat

| Description of Activity | Description of effect in relation to function loss | Details of effect |
|---|---|--|
| Any residential, agricultural, or industrial development (e.g. construction of houses, structures, roads, gardens, quarries, utility lines, renewable energy installations, including removal of soils) | Construction within critical habitat converts habitat and results in the direct loss of critical habitat upon which the species relies for basic survival, successful seed germination and seedling establishment. Direct removal of soil/substrate would render the habitat unsuitable for Juniper Sedge by removing the biophysical attributes required by the species. | When this activity occurs within the bounds of critical habitat, at any time of year, the effects will be direct, and is certain to result in the permanent destruction of critical habitat. There are no possible thresholds for this activity. Activities restricted to the surface of existing roadways/access roads and recreational trails would not result in the destruction of critical habitat. |
| Activities that result in the alteration of local surface water flows (i.e. quarrying, extensive tiling or ditching) | Changes to surface water flows on alvars may disrupt the ecological function of critical habitat, which may both reduce habitat suitability for Juniper Sedge while increasing the competitive ability of other species. | When this activity occurs within critical habitat at any time of year, the effects are likely to be direct and/or cumulative. The information available at this time does not allow for the development of thresholds. |
| Covering of habitat by refuse (i.e., creation of refuse dumps) | Garbage dumping may physically cover suitable habitat such that sunlight may not penetrate to soils. Debris may also contain chemicals that can change soil chemistry, or introduce exotic plants or animals that may alter the natural environment such that it is unsuitable for Juniper Sedge. | When this activity occurs within critical habitat at any time of year, the effects are likely to be direct and/or cumulative. The information available at this time does not allow for the development of thresholds. |
| Activities that can introduce exotic plants (e.g. introduction of non-native plant seeds, plants, foreign soil or gravel, composting or dumping of garden waste, ATV use, over grazing by livestock) | Introducing invasive species can result in the species being out competed by the invasive species, and/or physical and chemical changes to habitat such that it is no longer suitable for Juniper Sedge. | When this activity occurs within or adjacent to critical habitat at any time of year, the effect can be cumulative. It can result in introduction of an invasive species that can lead to gradual destruction of critical habitat over time. The information available at this time is insufficient to develop a threshold for this activity. |

8. Statement on Action Plans

One or more action plans will be completed for the Juniper Sedge and posted on the Species at Risk Public Registry by December 31, 2024.

9. Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)¹⁶. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s¹⁷ (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

Protecting and maintaining the habitat of Juniper Sedge in Canada is likely to protect other rare species and habitats. At one site on the Napanee Plain, a provincially rare sedge (*Carex conoidea*, S3) grows in close association with Juniper Sedge, and the diversity of groundcover flora associated with this species is considered high. Several other provincially rare plants are found within suitable habitat at some Napanee sites (COSEWIC 2000). The significance of the alvar flora of the Napanee Plain has been well documented by Catling (1995), Brownell and Riley (2000), and others. Critical Habitat for the Dwarf Hackberry (*Celtis tenuifolia*, THR) has been identified within the Salmon River ANSI. At Selkirk Provincial Park, Juniper Sedge shares an open oak woodland habitat with the American Columbo (END, S2).

The potential for this recovery strategy to inadvertently lead to adverse effects on other species was considered. Currently, recovery actions for the Juniper Sedge focus on identifying, protecting and monitoring populations and habitat, conducting research to better understand the species and its habitat, and managing threats. In general, these activities have little potential to lead to adverse effects on other species that may share the habitat or range of the Juniper Sedge. Only habitat management activities

¹⁶ www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1

¹⁷ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

(e.g. invasive species control, threat management) have the potential to directly affect other native species, and such activities are likely to be beneficial to native species and their habitats.

The SEA concluded that this strategy will clearly benefit the environment and will not entail significant adverse effects.

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Part 2 – *Recovery Strategy for the Juniper Sedge (Carex juniperorum) in Ontario*, prepared for the Ontario Ministry of Natural Resources and Forestry

Photo: Wasyl Bakowsky

Juniper Sedge (*Carex juniperorum*) in Ontario

Ontario Recovery Strategy Series

Recovery strategy prepared under the *Endangered Species Act, 2007*

2015

Natural. Valued. Protected.

About the Ontario Recovery Strategy Series

This series presents the collection of recovery strategies that are prepared or adopted as advice to the Province of Ontario on the recommended approach to recover species at risk. The Province ensures the preparation of recovery strategies to meet its commitments to recover species at risk under the Endangered Species Act (ESA) and the Accord for the Protection of Species at Risk in Canada.

What is recovery?

Recovery of species at risk is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

Under the ESA a recovery strategy provides the best available scientific knowledge on what is required to achieve recovery of a species. A recovery strategy outlines the habitat needs and the threats to the survival and recovery of the species. It also makes recommendations on the objectives for protection and recovery, the approaches to achieve those objectives, and the area that should be considered in the development of a habitat regulation. Sections 11 to 15 of the ESA outline the required content and timelines for developing recovery strategies published in this series.

Recovery strategies are required to be prepared for endangered and threatened species within one or two years respectively of the species being added to the Species at Risk in Ontario list. There was a transition period of five years (until June 30, 2013) to develop recovery strategies for those species listed as endangered or threatened in the schedules of the ESA. Recovery strategies are required to be prepared for extirpated species only if reintroduction is considered feasible.

What's next?

Nine months after the completion of a recovery strategy a government response statement will be published which summarizes the actions that the Government of Ontario intends to take in response to the strategy. The implementation of recovery strategies depends on the continued cooperation and actions of government agencies, individuals, communities, land users, and conservationists.

For more information

To learn more about species at risk recovery in Ontario, please visit the Ministry of Natural Resources and Forestry Species at Risk webpage at:

www.ontario.ca/speciesatrisk

RECOMMENDED CITATION

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AUTHORS

Holly Bickerton, Consulting Ecologist, Ottawa
Adele Crowder, Emeritus Professor, Queen's University, Kingston
Todd Norris, District Ecologist, OMNRF, Peterborough District
Hilary Knack, former Species at Risk Intern, Peterborough District

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DECLARATION

The recovery strategy for the Juniper Sedge was developed in accordance with the requirements of the *Endangered Species Act, 2007* (ESA). This recovery strategy has been prepared as advice to the Government of Ontario, other responsible jurisdictions and the many different constituencies that may be involved in recovering the species.

The recovery strategy does not necessarily represent the views of all of the individuals who provided advice or contributed to its preparation, or the official positions of the organizations with which the individuals are associated.

The goals, objectives and recovery approaches identified in the strategy are based on the best available knowledge and are subject to revision as new information becomes available. Implementation of this strategy is subject to appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy.

RESPONSIBLE JURISDICTIONS

Ontario Ministry of Natural Resources and Forestry
Environment Canada – Canadian Wildlife Service, Ontario

EXECUTIVE SUMMARY

Juniper Sedge (*Carex juniperorum*) is a small, distinctive, and very rare plant in the sedge family (Cyperaceae). The species was recently described in 1993, and it is known only from about 35 sites globally, all of which occur in eastern North America. It is considered globally vulnerable (G3), and critically imperilled (N1) in Canada. In Ontario, Juniper Sedge is designated as endangered under the *Endangered Species Act, 2007*. Five occurrences have been documented in Ontario, and all are thought to be extant. Of these, four are found on private land within the Salmon River Alvar Area of Natural and Scientific Interest (ANSI) of the Napanee Plain in eastern Ontario, and one population exists in a provincial park in southwestern Ontario.

The most recent estimate of the Ontario population was in 2000, when the population was estimated at 6,600 plants in four populations. Since that time, a small population has been discovered, but very little surveying has occurred, and no updated estimate or trends are available.

Very little is known about the biology or ecology of the Juniper Sedge, which is thought to be a species of alvar woodlands, particularly occurring in association with red cedar. On the Napanee Plain, Juniper Sedge occurs in characteristic alvar woodland dominated by Red Cedar, on shallow calcareous soils over limestone. The population in southwestern Ontario occurs in an upland deciduous forest, dominated by Red Oak.

The predominant threat to Juniper Sedge is probably habitat loss due to development. However, sites in the Napanee Plain are also threatened by invasive species such as European Buckthorn and Common Lilac. Other potential threats include habitat degradation, natural succession, and possibly fire suppression. Again, sites have not been visited recently to assess threats.

The recovery goal for Juniper Sedge is to maintain or increase the population abundance and area of occupancy in Ontario, and to ensure the species' long-term persistence within its current range. The recovery objectives are to:

- identify and protect populations and their habitats by working collaboratively with landowners and land managers;
- regularly monitor and report on all populations and habitats;
- address knowledge gaps relating to the ecology and management of Juniper Sedge;
- identify and manage threats through monitoring and habitat management of Juniper Sedge populations and habitat; and
- if feasible and necessary, consider ex-situ conservation of Juniper Sedge through germplasm conservation.

It is recommended that a habitat regulation for Juniper Sedge protect the area within 100 metres of plants. This is a precautionary approach to ensure the habitat conditions directly surrounding Juniper Sedge plants are maintained. In cases where protected

areas are less than 100 metres apart, the intervening area should also be protected if it contains suitable habitat.

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1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Juniper Sedge

SCIENTIFIC NAME: *Carex juniperorum*

SARO List Classification: Endangered

SARO List History: Endangered (2004)

COSEWIC Assessment History: Endangered (2000)

SARA Schedule 1: Endangered (June 5, 2003)

CONSERVATION STATUS RANKINGS:

GRANK: G3

NRANK: N1

SRANK: S1

The glossary provides definitions for the abbreviations above and for other technical terms in this document.

1.2 Species Description and Biology

Species Description

The Juniper Sedge is a small, distinctive, perennial sedge in the *Phyllostachyae* section of the genus *Carex* (Cyperaceae or sedge family). Members of this group occur in tufted clumps, and are most easily distinguished from other groups by leaf-like pistillate scales¹ that cover the perigynia² on the inflorescence³, and greatly reduced staminate scales (Crins 1990).

In Ontario, Juniper Sedge most resembles other members of the *Phyllostachyae* section, including Back's Sedge (*Carex backii*, S4S5), James' Sedge (*Carex jamesii*, S4, Carolinian distribution), and Willdenow's Sedge (*Carex willdenowii*, S1, Niagara area). Juniper Sedge may be distinguished from Back's Sedge by its narrower pistillate scales (1.2 – 2.5 mm wide) that do not entirely conceal the perigynia underneath. Unlike James' and Willdenow's Sedge, Juniper Sedge lacks hyaline (thin and translucent) margins on the pistillate scales, and has generally shorter culms (less than 6.5 cm tall, vs. 8 – 30 cm tall in the related species) (Catling et al. 1993).

¹ Pistillate scales in the genus *Carex* are bracts that subtend female flowers or achenes within the inflorescence. Similarly, staminate scales are bracts that subtend the male flowers on the inflorescence.

² The perigynium is a sac-like bract that subtends the pistillate (female) flower of the genus *Carex*, and that envelops the seed (or achene).

³ The inflorescence refers to the entire flower cluster, including stems and bracts.

However, this short description is provided for general information only. Those wishing to distinguish this species from similar species should refer to the botanical description and technical keys found in Catling et al. (1993). Juniper Sedge is not found in popular reference floras widely used in Ontario because it has a very limited distribution, and has been relatively recently described.

Species Biology

Very little is known about the biology of Juniper Sedge, which was first described in 1993. In Ontario, flowering occurs in May and June (Catling et al. 1993). There is no specific information on pollination, seed set, dispersal, or demographics. The seeds of most plants in the Cyperaceae family are probably dispersed by water or animals (Leck and Schütz 2005). It is possible that Juniper Sedge seeds may be dispersed by water during seasonal flooding, on the hooves of ungulates, by small mammals, birds, or insects (e.g., ants), or by gravity. Like other members of the genus *Carex* (Bernard 1990), this species probably relies significantly on vegetative reproduction. Juniper Sedge occurs in dense patches, and probably reproduces asexually by underground stems called rhizomes. The lifespan of individual plants is not known. The generation time is also unknown, but has been estimated at several years (COSEWIC 2000).

Juniper Sedge appears to be tolerant to fire. Populations at two locations in Ohio have reportedly responded very well to prescribed fire, increasing in abundance and physical vigour, and expanding onto burned lands (NatureServe 2014).

Substantial taxonomic work has been undertaken recently on the *Phyllostachyae* section of the sedge family, including Juniper Sedge (e.g., Ford et al. 1998, Starr et al. 1999, Starr and Ford 2001, Ford et al. 2008, Starr et al. 2009). Genetic studies of 44 North American populations have demonstrated that Juniper Sedge has a very high degree of genetic variability when compared with related species, and despite existing in a small number of geographically separated areas, the species demonstrates unexpectedly high levels of gene flow and little differentiation among populations (Ford et al. 1998). Hybrids between this species and others in the genus *Carex* have not been reported (COSEWIC 2000).

1.3 Distribution, Abundance and Population Trends

Juniper Sedge is a globally rare species (G3), with an unusual disjunct distribution. In addition to five Ontario occurrences⁴, the species has been documented from only about 35 localized sites in Kentucky, Ohio and Virginia. In every jurisdiction where it occurs, Juniper Sedge is ranked as conservation concern (i.e., S1-S3) (NatureServe 2014).

⁴ Occurrence: This term is used throughout to refer to Element Occurrences (EOs) as defined by NatureServe (2014). For plants, EOs or occurrences are defined as populations separated by a minimum of one kilometre.

Four of five Ontario occurrences of Juniper Sedge are in Hastings County, within the Salmon River Alvar of the Napanee Plain (Figure 1, Table 1). In 2005, a fifth occurrence was discovered in Haldimand County at Selkirk Provincial Park, near Lake Erie to the east of Port Dover.



Figure 1. Historical and current distribution of Juniper Sedge in Ontario. The overlapping occurrence records east of Belleville represent four records (see Table 1 for details). Based on data from the Natural Heritage Information Centre (NHIC 2014a).

Table 1. Occurrences of Juniper Sedge in Ontario

| EO ID | Location | Last population count | Population | EO Rank ⁵ | Threats | Owner or Manager |
|-------|---|-----------------------|---|----------------------|---|------------------|
| 22262 | Salmon River Alvar: West of the racetrack | 2000 | 170+ plants (partial count, Veit 2000) | B | Invasive species, Development, Cattle grazing | Private |
| 5872 | Salmon River Alvar: North of Highway 401 (Lonsdale Alvar) | 1995 | 5000 (COSEWIC 2000) | A | Development, Invasive species | Private |
| 22271 | Salmon River Alvar: About 2 km SSW of Lonsdale | 2002 | 20 stems (Brinker 2002) | X ⁶ | Invasive species, Development, Cattle grazing | Private |
| 22263 | Salmon River Alvar: East of the racetrack | 2000 | 400+ plants (partial count, Veit 2000) | AB | Invasive species, Development | Private |
| 92788 | Selkirk Provincial Park | 2008 | Approx. 50 plants but more possible (NHIC 2014a) | AB | No obvious threats | Ontario Parks |

Determining the current Ontario population of Juniper Sedge is difficult for several reasons. Most populations are found on private land, and have not been censused in over a decade (T. Norris, M. Oldham, pers. comm. 2014). Plants grow in dense patches, making separation of individuals difficult; these patches are probably clonal and represent an unknown number of genetic individuals. Over time, population censuses have also used different methods, with some counts referring to “plants,” and other to “stems” (Table 1). When not in fruit, the Juniper Sedge also closely resembles other sedge species, making census difficult.

There is no current, accurate population estimate of Juniper Sedge in Ontario. The sum of the most recent population counts (including partial counts) of all occurrences is 5640+ plants (Table 1). All occurrences are believed to be extant. Three occurrences on the Napanee Plain have been recently observed, although no population counts were made (P. Catling, pers. comm. 2014). Partial counts of individual populations were last undertaken in 2000 and 2002 (Veit 2000; Brinker 2002).

The most recent comprehensive population estimate of Juniper Sedge is found within the 2000 COSEWIC status report, when the population was estimated at 6,600 “plants” in three extant occurrences. Since that time, one occurrence that was thought to be extirpated has been rediscovered (20 plants; Brinker 2002), and a new occurrence has been discovered at Selkirk Provincial Park (50 plants). A larger area of unexplored suitable habitat is present at Selkirk Provincial Park, and more plants may be present

⁵ Element Occurrence (EO) Rank provides an assessment of the estimated viability or probability of persistence of each population (NatureServe 2014). A: excellent; B: good; C: fair; D: poor; E: verified extant (viability not assessed); X: extirpated. Intermediate ranks (e.g., AB) are used in some cases. For further information, see <http://explorer.natureserve.org/eorankguide.htm>.

⁶ This population was rediscovered in 2002; EO rank to be updated.

there. In any case, these estimates of plant abundance probably represent far fewer genetically distinct individuals, due to the clonal habit of this species.

It is not possible to determine population trends for the Juniper Sedge in Ontario, since none of these sites has been systematically or repeatedly censused. Longer-term information is not available since the species was described relatively recently (1993). Despite significant threats range-wide, the species' abundance across its range appears to be stable, with populations in Ohio having responded well to periodic burning (NatureServe 2014).

1.4 Habitat Needs

Throughout its eastern North American range, the Juniper Sedge is generally found within open Eastern Red Cedar⁷ (*Juniperus virginiana*) and Oak (*Quercus* spp.) woodlands. The openings in which Juniper Sedge occurs usually have species assemblages typical of prairies or alvars (Catling et al. 1993). In Ontario, the species is typically found in areas of light shade, with 50 to 70 percent crown closure (Norris 1994), and is absent from areas of dense shade or full sun (COSEWIC 2000). Juniper Sedge is usually found on shallow, alkaline clay soils derived from and underlain by limestone bedrock, with soil pH ranging from 7.0 to 7.8 (Catling et al. 1993).

Juniper Sedge occurs within two areas of Ontario, and its habitat differs between the two areas. The four Hastings County occurrences are found on the Napanee – Prince Edward Plain, and occur in alvar woodland habitat that is typical for the species. Most plants occur within openings between Eastern Red Cedar (*Juniperus virginiana*) or other trees. Norris (1994) broadly described the habitat of Juniper Sedge as very dry treed barrens on limestone, with Red Cedar – Bur Oak (*Quercus macrocarpa*) – Eastern White Pine (*Pinus strobus*) – White Ash (*Fraxinus americana*) – Basswood (*Tilia americana*). Using the Ecological Land Classification (ELC) habitat descriptions of Lee et al. (1998), this community type may be considered Red Cedar – Early Buttercup Treed Alvar (ALT 1-5). Other community types (e.g., treed rock barrens) in more recent versions of the ELC (e.g., Lee et al. 2008) may also apply. It is possible that, as a result of natural succession, some sites would now be considered as coniferous forest using ELC methods.

European Buckthorn (*Rhamnus cathartica*) and Common Juniper (*Juniperus communis*) were associates at three of the Hastings County sites surveyed in 1994 (COSEWIC 2000). Dominant associates in the ground layer at all sites included Poverty Oatgrass (*Danthonia spicata*) and Wild Strawberry (*Fragaria virginiana* var. *virginiana*). Other species commonly occurring in the habitat of Juniper Sedge included Heart-leaved Aster (*Symphyotrichum cordifolium*), Dry-spike Sedge (*Carex siccata*), Pennsylvania Sedge (*Carex pennsylvanica*), Umbellate Sedge (*Carex umbellata*), Bastard Toadflax (*Comandra umbellata*), Tall Hawkweed (*Pilosella piloselloides*) and Canada Bluegrass

⁷ Common and Scientific names of vascular plant species follow VASCAN (Brouillet et al. 2014).

(*Poa compressa*). Associated moss species included *Abietinella abietina* and a *Brachythecium* species (Catling et al. 1993).

A comprehensive list of groundcover associates of Juniper Sedge at three of the Hastings County sites is found in COSEWIC 2000 (pp. 9 – 10). Surveys demonstrated that Juniper Sedge habitat at these three sites is characterized by relatively high species diversity, with 66 species of ground cover associates growing within only one metre of a Juniper Sedge plant (COSEWIC 2000). Soils in this area of Ontario consist of Farmington Loam over Black River Limestone bedrock (Gillespie et al. 1962). Soils are typically less than 30 cm deep, and are well drained (COSEWIC 2000).

Based on the number of years that have passed since habitat descriptions were completed in the 1990s, some areas of habitat may have experienced natural succession such that they now consist of greater than 60 percent forest cover. In this case, they would no longer be considered a treed alvar vegetation type using ELC (Lee et al. 1998). In 2000, the habitat for certain sub-populations on the Salmon River Alvar were described as having 75 percent to 80 percent tree cover (Veit 2000), and these areas would now likely be considered coniferous forest. It is possible that these areas may no longer constitute optimal habitat for Juniper Sedge, and habitat management may be required to maintain the population.

The occurrence at Selkirk Provincial Park in southwestern Ontario occurs in quite different habitat, in an upland deciduous forest. Dominant overstory species include Red Oak (*Quercus rubra*), Shagbark Hickory (*Carya ovata*), Hop-hornbeam (*Ostrya virginiana*), Ash (*Fraxinus* spp.) and Sugar Maple (*Acer saccharum*). Common species in the shrub layer include Hawthorn (*Crataegus* spp.), American Witch-hazel (*Hamamelis virginiana*) and Downy Arrow-wood (*Viburnum rafinesquianum*). Groundcover species recorded within this occurrence include Large Tick-trefoil (*Hylodesmum glutinosum*⁸), Spotted Jewelweed (*Impatiens capensis*), Downy Yellow Violet (*Viola pubescens*⁹), and Fringed Loosestrife (*Lysimachia ciliata*) (NHIC 2014a).

Although vegetation community associates have been thoroughly described for several populations (e.g., Catling et al. 1993; Norris 1994; Veit 2000; Brinker 2002), the extent of occupied habitat for the Ontario occurrences has not been mapped using the standard Ecological Land Classification (ELC) methods for southern Ontario (Lee et al. 1998).

1.5 Limiting Factors

The predominant habitat of this species, alvar woodland, is very limited in Ontario. Most alvar woodland community types in Ontario are considered to be provincially rare (S1–S3) by the Natural Heritage Information Centre (NHIC 2014b), and some may be

⁸ Formerly *Desmodium glutinosum*.

⁹ The original record lists *Viola pennsylvanica*, which is now considered synonymous with *V. pubescens* var. *pubescens* (Brouillet et al. 2014).

globally rare. Consequently, habitat availability has been thought to limit the distribution and abundance of Juniper Sedge throughout its range (Catling et al. 1993; COSEWIC 2000).

However, the recently discovered population of Juniper Sedge at Selkirk Provincial Park occurs within a much more common deciduous forest community type. This suggests that a lack of suitable habitat may not necessarily limit this species to the extent that was previously thought.

1.6 Threats to Survival and Recovery

Habitat loss

Historically, habitat loss has probably been the predominant threat to this species in Ontario. Development is probably the most urgent threat facing sites on the Napanee Plain (P. Catling, pers. comm. 2014). Residential development occurs on alvars in the Napanee Plain region generally, and Crowder et al. (2013) describe how the construction of homes and gardens has resulted in the loss of many small patches of remnant alvars. The construction of major roads probably separated and isolated existing occurrences. Quarry expansion has been considered a threat to one Juniper Sedge occurrence in the past (COSEWIC 2000), although it is not known whether this is still the case. Road widening and quarrying for roadside gravel are generally considered of concern to alvars in the area (Crowder et al. 2013). Norris (1994) noted that power and gas line corridors have resulted in extensive habitat loss and alteration of alvar sites within the Salmon River Alvar Area of Natural and Scientific Interest (ANSI). Solar and wind farms are increasingly common in the area. Of the five extant occurrences of Juniper Sedge in Ontario, four occur on private land and are very vulnerable to habitat loss. Available evidence to date suggests that once lost or seriously damaged, alvar ecosystems cannot be fully restored (Catling 2013).

Habitat degradation

In addition to habitat loss, degradation of occupied habitat probably still threatens this species. Juniper Sedge's alvar habitat in the Napanee Plain has traditionally been used to graze cattle (Norris 1994), although it is not known whether this still occurs at some sites. Overgrazing by cattle is a well-known threat to alvars, usually causing reductions in certain native species and increases in others (Reschke et al. 1999). On the Napanee Plain, overgrazing in the dry season is particularly damaging, and can lead to an overabundance of woody shrubs and more aggressive weeds such as thistles (*Cirsium* sp.) (Crowder et al. 2013). Garbage dumping has been observed at one occurrence, and occurs at many alvar sites in Ontario due to their flat nature, and also by the perception that these sparsely vegetated and agriculturally unproductive areas have no value (Reschke 1999; COSEWIC 2000). The use of all-terrain vehicles (ATVs) is frequent within alvar habitat, and can be very damaging in areas of shallow soils, especially when soils are wet (Reschke et al. 1999; Crowder et al. 2013).

Invasive species

European Buckthorn is a common and sometimes dominant species at all sites in the Napanee Plain, and may be shading the understory so that habitat becomes unsuitable for Juniper Sedge (COSEWIC 2000). During surveys undertaken in 2000, Juniper Sedge was absent from areas where European Buckthorn dominated (Veit 2000). Common Lilac (*Syringa vulgaris*) is also widespread and spreading aggressively in the area (P. Catling, pers. comm. 2014). Other exotic species, including the non-native Canada Bluegrass (*Poa compressa*) and Common St. John's-wort (*Hypericum perforatum*) were considered to be potential threats to Juniper Sedge habitat during 1994 field surveys (COSEWIC 2000). Grazing and the use of contaminated fill and gravel may transport seeds of non-native and invasive species (Crowder et al. 2013).

Natural succession and/or Fire suppression

It is possible that natural succession may be causing open alvar woodland to succeed to closed forest on the Napanee Plain, although sites have not been recently visited to confirm whether this is the case. The role of fire in Great Lakes alvar ecology is complex: certain alvars were almost certainly created by fire, while others show no evidence of past fire (Reschke et al. 1999). The fire history of the Napanee plain is not well understood, although in general, fire suppression is considered a possible threat to alvars in this area (Crowder et al. 2013). At the Burnt Lands alvar in eastern Ontario, fire has been shown to maintain distinctive and diverse plant communities (Catling and Brownell 1998; Catling 2009). Juniper Sedge appears to tolerate and benefit from fire; as a result of prescribed burns, populations at some American sites have increased and expanded. Fire suppression is considered a significant threat to some Ohio populations as habitat becomes overgrown by tall grasses and shrubs (NatureServe 2014).

Other threats

Other possible and demonstrated threats to alvars in the Napanee – Prince Edward Plain have been described including drainage changes, forestry, and development of large solar and wind energy facilities (Crowder et al. 2013). Currently, no projects are known to pose these threats on the Salmon River Alvar (T. Norris, pers. obs. 2014).

No threats were identified during the initial discovery at Selkirk Provincial Park (M. Oldham, pers. comm. 2014). Plants are protected from habitat loss and degradation, although the population is not regularly monitored, and there is no recent information on the presence of invasive species, or natural succession.

1.7 Knowledge Gaps

There is an urgent need for additional information on Juniper Sedge to support its recovery. Key information gaps are outlined below.

Population and habitat status

The most critical knowledge gaps for the recovery of Juniper Sedge in Ontario relate to the current status of extant populations, particularly those on the Napanee Plain. Although some sites have been visited regularly, the total population size, current

extent, and land ownership are not known. The severity of threats at most sites is unknown. Although no immediate threats were identified to the population at Selkirk Provincial Park, this site has not been recently visited. Because standard methods of censusing Juniper Sedge populations have not yet been developed, there is little opportunity to assess population or occupancy trends at any site. Vegetation communities present at each site have been generally described, although habitat mapping of these communities using ELC methods (Lee et al. 1998) would provide useful information for habitat regulation.

Habitat needs and ecology

Virtually all aspects of the biology and ecology of the Juniper Sedge are unknown. Almost nothing is known about the species' demography (including longevity, seed set, recruitment, and population viability), pollination, or seed dispersal. More detailed information on habitat preferences, ecological roles (e.g., shade tolerance, tolerance to grazing and other disturbance), and interactions with other species at Ontario sites would help to better understand the specific habitat requirements of Juniper Sedge. The hydrology of the Salmon River sites and its potential role in achene (i.e. seed) dispersal require investigation. Little is known about the fire history of the Salmon River Alvar, which would help to assess whether fire might be an appropriate management tool. The species' recent discovery in a more closed deciduous forest suggests that it may tolerate other habitat types, and may occur more widely than previously thought.

Habitat management

There is very little information available to help landowners guide the management of this species or its habitat in Ontario. Understanding the response of Juniper Sedge to a variety of management techniques would benefit its conservation. This includes the response of Juniper Sedge and its alvar woodland habitat to techniques including invasive species removal and/or control, tree and shrub thinning, and possibly prescribed burning. The effects of invasive species such as buckthorn (*Rhamnus* spp.) on Juniper Sedge are also not well studied.

1.8 Recovery Actions Completed or Underway

With the involvement of a number of stakeholders in the area, a Multi-species Recovery Strategy for the Alvar Ecosystems of the Napanee – Prince Edward Plain in southeastern Ontario has been developed (Crowder et al. 2013). Juniper Sedge is a focal species of this recovery strategy, which outlines recovery needs and threats to over 50 alvars in the Napanee – Prince Edward Plain. Twelve other rare and at-risk plant species are also identified in this recovery strategy, including the threatened Dwarf Hackberry (*Celtis tenuifolia*). The purpose of this ecosystem recovery strategy was to identify recovery activities necessary to help protect and enhance alvar habitat in the Napanee-Prince Edward Plain area. However, it does not address recovery across the entire range of Juniper Sedge in Ontario.

Surveys for Juniper Sedge at sites in the Napanee Plain were last conducted in 2000 and 2002 (Veit 2000; Brinker 2002; T. Norris pers. comm. 2014). Some sites have been observed recently but no detailed survey information was collected (P. Catling, pers. comm. 2014). To date, there have been no other recovery actions conducted to benefit this species in Ontario.

2.0 RECOVERY

2.1 Recovery Goal

The recovery goal for Juniper Sedge is to maintain or increase the population abundance and area of occupancy in Ontario, and to ensure the species' long-term persistence within its current range.

2.2 Protection and Recovery Objectives

The recovery objectives for Juniper Sedge place greatest emphasis on ensuring that extant populations are protected (Table 2).

Table 2. Protection and recovery objectives

| No. | Protection or Recovery Objectives |
|-----|---|
| 1 | Identify and protect populations and their habitats by working collaboratively with landowners and land managers. |
| 2 | Regularly monitor and report on all populations and habitats. |
| 3 | Address knowledge gaps relating to the ecology and management of Juniper Sedge. |
| 4 | Identify and manage threats through monitoring and management of Juniper Sedge populations and habitat. |
| 5 | If feasible and necessary, consider ex-situ conservation of Juniper Sedge through germplasm conservation |

2.3 Approaches to Recovery

Table 3. Approaches to recovery of the Juniper Sedge in Ontario

| Relative Priority | Relative Timeframe | Recovery Theme | Approach to Recovery | Threats or Knowledge Gaps Addressed |
|---|------------------------|---|---|--|
| 1. Identify and protect populations and their habitats, by working collaboratively with landowners and land managers | | | | |
| Critical | Short-term | Communications, Protection, Stewardship | 1.1 Identify and contact current private landowners to assess interest in the protection and management of Juniper Sedge. Prioritize private sites for protection activities. | Threats: <ul style="list-style-type: none"> • Habitat loss • Habitat degradation Knowledge gaps: <ul style="list-style-type: none"> • Population and habitat status |
| Critical | Long-term and Ongoing | Communications | 1.2 Coordinate and communicate Juniper Sedge recovery efforts among groups including OMNRF, land trusts, stewardship groups, conservation authorities, municipalities, and others as appropriate. | Threats: <ul style="list-style-type: none"> • All threats |
| Critical | Short-term and ongoing | Protection, Stewardship | 1.3 Working with landowners, consider options for long-term protection of populations (e.g., stewardship, easements, securement for private lands; additional designations or zoning on public lands if necessary). <ul style="list-style-type: none"> – Promote the use of Species at Risk stewardship funding, Land Stewardship and Habitat Restoration Program (formerly Community Fisheries and Wildlife Involvement Program), Conservation Land Tax Incentive Program (CLTIP) tax incentives, Ecogifts program, and other funding programs within the agricultural community to support protection and stewardship activities | Threats: <ul style="list-style-type: none"> • Habitat loss • Habitat degradation |

| Relative Priority | Relative Timeframe | Recovery Theme | Approach to Recovery | Threats or Knowledge Gaps Addressed |
|--------------------------|---------------------------|--|---|---|
| Necessary | Short-term | Protection Communications | 1.4 With municipalities, identify locations and zoning of private populations, to ensure that sites and alvar habitat receive adequate protection in the municipal planning context. | Threats: <ul style="list-style-type: none"> • Habitat loss |
| Necessary | Long-term | Protection Stewardship | 1.5 Conduct habitat mapping for Juniper Sedge. <ul style="list-style-type: none"> – Describe and map the extent of Juniper Sedge habitat using ELC methods to assist with habitat regulation. – If identified as an option in 1.3, develop habitat mapping guidelines so that Juniper Sedge habitat is eligible for the CLTIP program. | Threats: <ul style="list-style-type: none"> • Habitat loss • Habitat degradation Knowledge gaps: <ul style="list-style-type: none"> • Population and habitat status • Habitat needs and ecology |
| Necessary | Long-term | Protection, Communications, | 1.6 Ensure that recent occurrence information is maintained in the NHIC database, and available to municipalities, conservation authorities, and consultants. Promote protection of alvar woodland habitat in local Official Plans and through other instruments of the Provincial Policy Statement (PPS). | Threats: <ul style="list-style-type: none"> • Habitat loss |
| Necessary | Long-term | Communications, Education and Outreach | 1.7 Promote awareness, conservation, and stewardship of alvar habitat in the Napanee – Prince Edward Plain through public demonstration site visits, bioblitzes, talks, or other events. | Threats: <ul style="list-style-type: none"> • Habitat loss • Habitat degradation Knowledge gaps: <ul style="list-style-type: none"> • Population and habitat status |
| Necessary | Long-term | Inventory | 1.8 Identify additional areas of potentially suitable habitat and complete surveys. | Threats: <ul style="list-style-type: none"> • Habitat loss Knowledge gaps: <ul style="list-style-type: none"> • Population and habitat status • Habitat needs and ecology |

| Relative Priority | Relative Timeframe | Recovery Theme | Approach to Recovery | Threats or Knowledge Gaps Addressed |
|--|--------------------|--------------------------------------|--|---|
| 2. Regularly monitor and report on all populations and habitats | | | | |
| Critical | Short-term | Inventory, Monitoring and Assessment | <p>2.1 Conduct surveys of all extant populations, including the following.</p> <ul style="list-style-type: none"> – Presence-absence and abundance surveys, using standard methods and terminology (see 2.2.). – GPS mapping of population extent, habitat extent, and ELC vegetation communities. – Analysis of threats and identification of site-specific management needs. | <p>Threats:</p> <ul style="list-style-type: none"> • All threats <p>Knowledge gaps:</p> <ul style="list-style-type: none"> • Population and habitat status • Habitat needs and ecology |
| Critical | Short-term | Inventory, Monitoring and Assessment | <p>2.2 Develop and implement standard monitoring methods to be used at all sites. Ensure that methods are published or widely available for use. Conduct baseline population surveys immediately, and repeat surveys every three to five years at minimum.</p> | <p>Threats:</p> <ul style="list-style-type: none"> • All threats <p>Knowledge gaps:</p> <ul style="list-style-type: none"> • Population and habitat status • Habitat needs and ecology |
| 3. Address knowledge gaps relating to the ecology and management of Juniper Sedge | | | | |
| Critical | Ongoing | Research, Management | <p>3.1 Conduct experimental research on the effects of habitat management activities (e.g. grazing treatments, canopy thinning, invasive species control) on alvar woodland habitat, and/or Juniper Sedge populations.</p> | <p>Threats:</p> <ul style="list-style-type: none"> • Invasive species • Natural succession and/or Fire suppression • Habitat degradation <p>Knowledge gaps:</p> <ul style="list-style-type: none"> • Habitat management |
| Necessary | Ongoing | Research | <p>3.2 Conduct research on the ecology of Juniper Sedge in Ontario (habitat preferences, fire history).</p> | <p>Threats:</p> <ul style="list-style-type: none"> • All threats <p>Knowledge gaps:</p> <ul style="list-style-type: none"> • Habitat needs and ecology |

| Relative Priority | Relative Timeframe | Recovery Theme | Approach to Recovery | Threats or Knowledge Gaps Addressed |
|--|-----------------------|--|---|--|
| Necessary | Long-term | Research | 3.3 Conduct research on aspects of the life history of the Juniper Sedge that are relevant to species recovery (e.g., demographics, reproduction, population viability, pollination, seed dispersal, population genetics). | Knowledge gap: <ul style="list-style-type: none"> • Habitat needs and ecology |
| 4. Identify and manage threats through monitoring and management of Juniper Sedge populations and habitat | | | | |
| Critical | Ongoing | Monitoring and Assessment, Management, Stewardship | 4.1 Identify threats and develop a prioritized action plan for each site. | Threats: <ul style="list-style-type: none"> • All threats |
| Critical | Ongoing | Management, Stewardship | 4.2 Determine and, if necessary, control the threat of invasive species (especially European Buckthorn) as required. <ul style="list-style-type: none"> – With land owners or land managers, assess the threat of invasive species at each site and prioritize control. – Conduct control and restoration efforts in priority order. – Monitor results and continue as necessary, regularly assessing the response of Juniper Sedge. | Threats: <ul style="list-style-type: none"> • Invasive species • Habitat needs and ecology |
| Critical | Long-term and Ongoing | Stewardship, Communication, Management | 4.3 Manage sites to protect populations from ATVs, overgrazing and dumping. <ul style="list-style-type: none"> – Work with landowners and land managers to identify potential threats (e.g., overgrazing, ATV use, garbage dumping) that may affect Juniper Sedge or its habitat – Develop methods to control threats on a site-specific basis (e.g., fencing, changes to grazing practices, signage, communication) – Monitor and share results. | Threats: <ul style="list-style-type: none"> • Habitat degradation Knowledge gaps: <ul style="list-style-type: none"> • Habitat needs and ecology |

| Relative Priority | Relative Timeframe | Recovery Theme | Approach to Recovery | Threats or Knowledge Gaps Addressed |
|--|--------------------|--|--|--|
| Necessary | Long-term | Stewardship, Research, Management, Communication | <p>4.4 Develop a document detailing management practices for alvar communities that:</p> <ul style="list-style-type: none"> – summarizes major threats, in particular woody species succession (fire suppression), grazing, and invasive species; and – describes research and management practices (including those used in other jurisdictions) to successfully manage these threats. | <p>Threats:</p> <ul style="list-style-type: none"> • Habitat degradation • Natural succession and/or Fire suppression • Invasive species |
| Necessary | Long-term | Research, Communication, Stewardship | <p>4.5 Field-test and document the use of management practices within Juniper Sedge habitat.</p> | <p>Threats:</p> <ul style="list-style-type: none"> • Habitat degradation • Natural Succession and/or Fire suppression • Invasive species <p>Knowledge gaps:</p> <ul style="list-style-type: none"> • Habitat needs and ecology |
| 5. If feasible and necessary, consider ex-situ conservation of Juniper Sedge through germplasm conservation | | | | |
| Beneficial | Long-term | Research, Management | <p>5.1 If necessary, consider ex-situ conservation techniques such as:</p> <ul style="list-style-type: none"> – preserving Juniper Sedge germplasm (seed storage) from Ontario populations in a recognized storage facility – population augmentation – plant propagation. | <p>Threats:</p> <ul style="list-style-type: none"> • Habitat loss |

Narrative to Support Approaches to Recovery

To maintain and protect Juniper Sedge in Ontario, it will be critical to build the support of private landowners. Four of five extant populations of this species, including the largest population in Canada, occur on private lands. The success of recovery activities, even inventory and monitoring activities, will depend on the success of stewardship on private lands.

As is the case with many other species at risk, examining and identifying funding sources and other incentives to help protect Juniper Sedge on private lands will be crucial in gaining the support of landowners. A variety of approaches, including the purchase of Juniper Sedge habitat from willing landowners, may be required in order to meet the objectives identified in this recovery strategy.

Private landowner support is also important in order to gain current information on the status and ecology of the species. As stated above, so little is understood about the biology and ecology of Juniper Sedge that long-term research on virtually all aspects of its life history and ecology would provide useful information. Given that a recently discovered population of Juniper Sedge occurs in different habitat, more detailed examination of habitat preferences of the species throughout its range would be beneficial. It is possible that conducting surveys in other areas of suitable habitat may result in new populations being discovered.

Alvars in the Great Lakes region face common threats, such as quarrying, development, ATV use, grazing and browsing, and invasive species (Reschke et al. 1999). Juniper Sedge and other rare and at-risk plants of alvars in Ontario would benefit from a review and synthesis of best practices used to manage common threats.

Recovery for Juniper Sedge will be undertaken together with actions outlined in *A multi-species Recovery Strategy for the Alvar Ecosystems of the Napanee – Prince Edward Plain in southeastern Ontario* (Crowder et al. 2013), as well as supporting conservation documents such as the Nature Conservancy of Canada's Conservation Blueprint and Natural Area Conservation Plans. Local land trusts, including Friends of the Salmon River, the Hastings - Prince Edward Land Trust, and the Kingston Frontenac Lennox and Addington Land Conservancy, may also play a role in species recovery.

2.4 Performance Measures

| Objective | Performance Measures |
|---|---|
| 1. Identify and protect populations and their habitats by working collaboratively with landowners and land managers | <ul style="list-style-type: none"> • There is no loss of extant populations. Populations are stable or increasing in abundance and/or extent. Population abundance is measured using defined standard methods (e.g. stem numbers, area of occupancy). • Landowners identified and contacted starting in 2015. • An increased number of private sites protected through stewardship or other methods. • Populations and habitat extent mapped. |
| 2. Regularly monitor and report on all populations and habitats | <ul style="list-style-type: none"> • Updated surveys undertaken by 2016. • Standard monitoring techniques developed and applied. • Monitoring techniques published in reports or peer-reviewed articles. • Sites monitored every three to five years. |
| 3. Address knowledge gaps relating to the ecology and management of Juniper Sedge | <ul style="list-style-type: none"> • Understanding of the life history and ecology of Juniper Sedge significantly improved (ongoing). |
| 4. Identify and manage threats through monitoring and habitat management | <ul style="list-style-type: none"> • Current threats identified and prioritized list created for all sites by 2016. • Reduction in threats observed at each site. • Increase observed in the number of sites managed for threats. |
| 5. If feasible and necessary, consider ex-situ conservation of Juniper Sedge through germplasm conservation. | <ul style="list-style-type: none"> • Necessity and feasibility of germplasm conservation assessed. • If regarded as both necessary and feasible, appropriate activities undertaken as required. |

2.5 Area for Consideration in Developing a Habitat Regulation

Under the ESA, a recovery strategy must include a recommendation to the Minister of Natural Resources and Forestry on the area that should be considered in developing a habitat regulation. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below by the author will be one of many sources considered by the Minister when developing the habitat regulation for this species.

Juniper Sedge is a very rare plant in Ontario, and in the world. Adequately protecting its habitat is important to the global conservation of this species, for which Ontario bears a significant responsibility.

However, there is little known about this species. The habitat in many areas has not been recently assessed or described, and may have changed (e.g., woodlands succeeded to forest) since thorough habitat descriptions took place in the 1990s. Land classification has not been mapped using ELC or any other method, and nothing is known about the size or extent of vegetation communities surrounding occurrences. On

the Napanee Plain, Juniper Sedge's habitat is patchy and disturbed. The species often occurs in small openings within larger vegetation communities, which in most cases have been affected by anthropogenic disturbance such as grazing, and invasion by non-native species.

It is recommended that the habitat regulation include the contiguous ELC vegetation type polygon (Lee et al. 1998) within which the species is found, up to a maximum distance of 100 metres from any plant. In the event that the vegetation community in which a plant occurs cannot be described using existing ELC vegetation types (Lee et al. 1998), then plants should be protected by a 100 metre radial distance in all directions.

Regulating habitat based on the vegetation community will help to preserve the ecological function of the area, and will help to maintain the ecological conditions required for the persistence of Juniper Sedge. It may also facilitate vegetative reproduction and/or achene dispersal in the local area.

A maximum 100 metre radial protection distance has been selected for several reasons. First, little is known about the current identity or extent of ELC vegetation types surrounding occurrences. It is possible that these may constitute extensive areas of identical but unoccupied vegetation types, and the conditions for site occupancy by this very rare sedge are not clear. It is also possible that vegetation types in which Juniper Sedge is found are not easily mapped using ELC, in part due to a past history of site disturbance. Further study of the habitat conditions and ELC vegetation types required by Juniper Sedge are identified as significant knowledge gaps requiring further study in Table 3.

Given these unknowns, the protection of a maximum of 100 metres of similar and presumably suitable habitat is recommended to ensure that the biotic and abiotic conditions directly surrounding plants are maintained. Plants thrive in partially-shaded conditions, and a 100 metre distance will protect these conditions. Plants may also be negatively affected by disturbance and invasion by non-native species, and this distance will ensure some protection of plants from these potential threats. Studies at another Great Lakes alvar (Reschke et al. 1999) showed that local surface water, rather than regional groundwater flow, was the dominant driver of seasonal alvar flooding. It is thought that protection of 100 m will generally preserve local surface water movement that determines the alvar's seasonal cycle of flooding and drought.

It is recommended that the area to be prescribed as regulated habitat include all sites where Juniper Sedge has been documented, unless the species is known to have been extirpated from the site as a result of thorough searches by experienced botanists. Most sites have not been recently surveyed, and the species is easily overlooked. It cannot be assumed that Juniper Sedge has disappeared from a site, unless this absence is confirmed.

Suitable habitat for Juniper Sedge is described in Section 1.4. It may include treed alvars (possibly including degraded alvars or treed rock barrens), woodlands or forests. It may include vegetation types that are considered to be anthropogenic in origin (e.g., cultural woodland). Areas that are not suitable for this species include wetlands, dense coniferous forests, hayfields and cropped areas, paved and gravel roads, and manicured lawns, and should not be included within regulated habitat.

Juniper Sedge is a small and inconspicuous plant that was relatively recently described, and is only recognizable by experienced botanists. It is possible that new populations will be discovered in Ontario. The habitat regulation should be flexible enough to protect newly discovered occurrences, using a similar process of site-specific habitat delineation.

Juniper Sedge is naturally a very rare plant, and no extirpated sites are known in Canada. Experimental population augmentation and/or introduction is not a recovery objective at this time. However, if recovery objectives were modified at a later date, recovery habitat for new populations may be regulated if desired.

GLOSSARY

Achene: A dry fruit resembling a seed or “nutlet”. For a more detailed botanical definition, please see Voss and Reznicek 2012.

Alvar: Alvars are natural communities centred around areas of glaciated horizontal limestone or dolostone bedrock pavement. They are characterized by distinctive flora and fauna with less than 60 percent tree cover that is maintained by associated geologic, hydrologic and other landscape processes (adapted from Reschke et al. 1999).

Area of Occupancy: This refers to the area that is actually occupied by a species within its range. It recognizes that the entire range of the species may contain unsuitable or unoccupied habitats. For a more detailed definition see http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee established under section 14 of the Species at Risk Act that is responsible for assessing and classifying species at risk in Canada.

Committee on the Status of Species at Risk in Ontario (COSSARO): The committee established under section 3 of the *Endangered Species Act, 2007* that is responsible for assessing and classifying species at risk in Ontario.

Conservation status rank: A rank assigned to a species or ecological community that primarily conveys the degree of rarity of the species or community at the global (G), national (N) or subnational (S) level. These ranks, termed G-rank, N-rank and S-rank, are not legal designations. The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by the letter G, N or S reflecting the appropriate geographic scale of the assessment. The numbers mean the following:

- 1 = critically imperilled
- 2 = imperilled
- 3 = vulnerable
- 4 = apparently secure
- 5 = secure

Culm: The stem of a grass or sedge.

Disjunct: Species with a disjunct distribution occur in areas that are widely separated geographically.

Element Occurrence (EOs): An area of land and/or water on/in which an element is or was present. They may be comprised of one or more observation and it is a location important to the conservation of the species or community. For plants, EOs are defined as populations separated by a minimum of one kilometre.

EO Rank: Element Occurrence (EO) Rank provides an assessment of the estimated viability or probability of persistence of each population (NatureServe 2014). A: excellent; B: good; C: fair; D: poor; E: verified extant (viability not assessed); X: extirpated. Intermediate ranks (e.g., AB) are used in some cases. For further information, see <http://explorer.natureserve.org/eorankguide.htm>.

Endangered Species Act, 2007 (ESA): The provincial legislation that provides protection for species at risk in Ontario.

Germplasm: Germplasm refers to the collection of genetic resources for an organism. For plants, the germplasm may be stored as a seed collection (e.g. a seed bank), or in a nursery.

Hyaline: Thin and translucent.

Inflorescence: The entire flower cluster, including stems and bracts (Voss and Reznicek 2012).

Perigynium: A sac-like bract that subtends the pistillate (female) flower of the genus *Carex*, and that envelops the seed (or achene) (Voss and Reznicek 2012).

Pistillate: Of the pistil, one of the female or seed-producing structures of a flower (Voss and Reznicek 2012).

Pistillate scale: Pistillate scales in the genus *Carex* are bracts that subtend female flowers or achenes within the inflorescence.

Species at Risk Act (SARA): The federal legislation that provides protection to species at risk in Canada. This act establishes Schedule 1 as the legal list of wildlife species at risk. Schedules 2 and 3 contain lists of species that at the time the Act came into force needed to be reassessed. After species on Schedule 2 and 3 are reassessed and found to be at risk, they undergo the SARA listing process to be included in Schedule 1.

Species at Risk in Ontario (SARO) List: The regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008.

Staminate: Of the stamen, one of the male or pollen-producing structures of a flower (Voss and Reznicek 2012).

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**Part 3 – *Juniper Sedge* – Ontario Government Response
Statement, prepared by the Ontario Ministry of
Natural Resources and Forestry**

Natural. Valued. Protected.

Juniper Sedge

Ontario Government Response Statement



PROTECTING AND RECOVERING SPECIES AT RISK IN ONTARIO

Species at risk recovery is a key part of protecting Ontario's biodiversity. Biodiversity – the variety of living organisms on Earth – provides us with clean air and water, food, fibre, medicine and other resources that we need to survive.

The *Endangered Species Act, 2007 (ESA)* is the Government of Ontario's legislative commitment to protecting and recovering species at risk and their habitats. As soon as a species is listed as extirpated, endangered or threatened under the ESA, it is automatically protected from harm or harassment. Also, immediately upon listing, the habitats of endangered and threatened species are protected from damage or destruction.

Under the ESA, the Ministry of Natural Resources and Forestry (the Ministry) must ensure that a recovery strategy is prepared for each species that is listed as endangered or threatened. A recovery strategy provides science-based advice to government on what is required to achieve recovery of a species.

GOVERNMENT RESPONSE STATEMENTS

Within nine months after a recovery strategy is prepared, the ESA requires the Ministry to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The recovery strategy for the Juniper Sedge (*Carex juniperorum*) in Ontario was completed on June 25, 2015 (<http://www.ontario.ca/document/juniper-sedge-recovery-strategy>).

The response statement is the government's policy response to the scientific advice provided in the recovery strategy. All recommendations provided in the recovery strategy were considered and this response statement identifies those that are considered to be appropriate and necessary for the protection and recovery of the species. In addition to the strategy, the response statement is based on input from stakeholders, other jurisdictions, Aboriginal communities and members of the public. It reflects the best available traditional, local and scientific knowledge at this time and may be adapted if new information becomes available. In implementing the actions in the response statement, the ESA allows the Ministry to determine what is feasible, taking into account social and economic factors.

Juniper Sedge is a small, perennial plant in the Sedge family with leaves up to 30 cm long. Juniper Sedge can be found in five locations in Ontario with four of the locations occurring in alvar woodlands.

MOVING FORWARD TO PROTECT AND RECOVER JUNIPER SEDGE

The Juniper Sedge is listed as an endangered species under the ESA, which protects both the plant and its habitat. The ESA prohibits harm or harassment of the species and damage or destruction of its habitat without authorization. Such authorization would require that conditions established by the Ministry be met.

Juniper Sedge is a globally rare plant in the Sedge family and only occurs in eastern North America. The species was first described in 1993 and is known from 35 sites globally. The species' abundance across its range appears to be stable despite the existence of threats across all known sites. In Canada, Juniper Sedge only occurs in Ontario. Within Ontario, there are five occurrences of the species: four on private land within the Salmon River Alvar Area of Natural and Scientific Interest (ANSI), located on the Napanee Plain in Hastings County, and one in Haldimand County in Selkirk Provincial Park.

The most recent estimate of the Ontario population of Juniper Sedge was 6,600 plants from surveys conducted in 2000. The surveys done in 2000 were of four of the five Ontario populations as the fifth population was only discovered in 2008. Determining the current population in Ontario is challenging because most populations are found on private land. Long term records for the species are lacking because Juniper Sedge has only recently been described. As well, Juniper Sedge grows in dense patches making the distinction of individuals during surveying difficult. Previous surveys have been inconsistent in their use of survey methodologies, as both "plants" and "stems" have been used to enumerate populations depending on the survey.

The majority of Juniper Sedge populations in Ontario occur in alvar woodland habitat. Alvar habitat types are rare ecosystems that develop on flat limestone or dolostone bedrock where soils are very shallow. These ecosystems are very sensitive to disturbance and alvars in the Great Lakes region face common threats such as quarrying, development, all-terrain vehicle use, grazing and browsing, dumping of garbage in habitat, and invasive species. In addition to these threats, Juniper Sedge in Ontario is also threatened by fire suppression and natural succession which may alter ecosystem dynamics within alvars. These changes may include succession of woody plants, increased competition for nutrients and moisture, and increased canopy cover resulting in less light available to lower lying plants such as Juniper Sedge.

In general, very little is known about the biology or ecology of Juniper Sedge. Juniper Sedge is thought to be a species dependent on alvar woodland habitat, but the recently discovered population in Selkirk Provincial Park occurs within a much more common upland deciduous forest community. This suggests that a lack of suitable habitat may not limit the species to the extent that was previously thought. Further research is needed to determine the habitat needs and limitations of the species, to establish current population estimates, and to better understand the threats impacting populations in Ontario. Reducing threats to the species at the site-level will support natural increases within the Ontario population. Approaches to recovery for the species will focus on collaboratively working with land managers and landowners to effectively manage habitat and reduce threats, fill knowledge gaps through research, and implement monitoring programs.

The government's goal for the recovery of the Juniper Sedge is to maintain the current population levels across the species' distribution in Ontario and support natural increases to improve long-term persistence.

Protecting and recovering species at risk is a shared responsibility. No single agency or organization has the knowledge, authority or financial resources to protect and recover all of Ontario's species at risk. Successful recovery requires inter-governmental co-operation and the involvement of many individuals, organizations and communities.

In developing the government response statement, the Ministry considered what actions are feasible for the government to lead directly and what actions are feasible for the government to support its conservation partners to undertake.

GOVERNMENT-LED ACTIONS

To help protect and recover the Juniper Sedge, the government will directly undertake the following actions:

- Continue to manage the habitat of Juniper Sedge in provincially protected areas to maintain the ecological integrity of its habitat and to minimize the threat of recreational pressures and impacts.
- Work with local landowners and land managers to continue to implement the Ontario Invasive Species Strategic Plan to address the invasive species (e.g. Common Buckthorn) that threaten Juniper Sedge.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.
- Encourage the submission of Juniper Sedge data to the Ministry's central repository at the Natural Heritage Information Centre.
- Undertake communications and outreach to increase public awareness of species at risk in Ontario.
- Protect the Juniper Sedge and its habitat through the ESA.
- Develop direction to provide greater clarity to proponents and partners on the areas of general habitat protected under the ESA for plant species at risk.
- Support conservation, agency, municipal and industry partners, and Aboriginal communities and organizations to undertake activities to protect and recover the Juniper Sedge. Support will be provided where appropriate through funding, agreements, permits (including conditions) and/or advisory services.
- Encourage collaboration, and establish and communicate annual priority actions for government support in order to reduce duplication of efforts.

GOVERNMENT-SUPPORTED ACTIONS

The government endorses the following actions as being necessary for the protection and recovery of the Juniper Sedge. Actions identified as "high" will be given priority consideration for funding under the ESA. Where reasonable, the government will also consider the priority assigned to these actions when reviewing and issuing authorizations under the Endangered Species Act. Other organizations are encouraged to consider these priorities when developing projects or mitigation plans related to species at risk. The government will focus its support on these high-priority actions over the next five years.

Focus Area: Habitat Protection and Management
Objective: Protect and manage the habitat of Juniper Sedge to reduce threats to the species in collaboration with local land owners and community partners.

Habitat loss and degradation is a significant threat to many species found in alvar habitat, including Juniper Sedge. Because Juniper Sedge populations are found in both alvar Areas of Natural and Scientific Interest (ANSI) and in a provincial park, many organizations are already mobilized and have developed best management practices to assist local species. Prioritizing the implementation of these best management practices will enable municipalities, conservation organizations, protected land managers and private landowners alike to take actions to manage habitat, secure lands with habitat, and act as stewards for the species.

Actions:

1. (HIGH) Manage existing habitat for Juniper Sedge using community and species' expertise in the implementation of best management practices. This may include:
 - conducting mechanical or targeted chemical removal of native or invasive woody vegetation in Juniper Sedge habitat, including Common Buckthorn;
 - protecting populations from all-terrain vehicles, overgrazing and dumping of garbage in habitat areas through the use of signage and fencing, as appropriate; and,
 - evaluating the effectiveness of habitat management techniques such as grazing treatments, increasing canopy openness, prescribed burns and invasive species control.
2. As opportunities arise, work with local land owners and community partners to support the securement of Juniper Sedge habitat through existing land securement and stewardship programs.

Focus Area: Monitoring and Research
Objective: Increase knowledge of the species' abundance, distribution, site-specific threats, habitat requirements, life history processes and response to habitat management.

The current population levels of Juniper Sedge in Ontario are unknown. The combination of inconsistent survey methods and the presence of populations on private land has resulted in a lack of up to date, reliable knowledge. Working in partnership with community organizations to create and implement a standardized monitoring protocol will greatly improve our ability to monitor the species and track its progress. Filling

knowledge gaps related to the life history of Juniper Sedge, its habitat requirements, and its response to habitat management techniques will assist in informing protection and recovery actions for the species in the future.

Actions:

3. (HIGH) Collaborate with local partners and land owners to develop and implement a standardized monitoring protocol to provide a quantitative baseline for future monitoring of all existing populations. This should include:
 - developing a standardized approach to determining presence/absence of the species;
 - developing a standardized approach to enumerating the number of plants present, and clear direction on how to implement that approach when surveying;
 - determining an estimate of the population abundance;
 - monitoring changes in site-specific threats to Juniper Sedge populations;
 - identification of the vegetation community type at occupied sites; and,
 - measurements of water and moisture levels at occupied sites.
4. Identify additional areas with potential suitable habitat for Juniper Sedge and conduct presence/absence surveys in these areas.
5. Research the species' life history characteristics and response to habitat management activities that will inform the implementation of recovery actions for the species. This may include:
 - studying mechanisms of pollination, seed dispersal and conditions for germination;
 - conducting a population viability analysis; and,
 - studying the species' response to changes in hydrology.
6. Study the feasibility and necessity of preserving genetic material from the Ontario populations of Juniper Sedge through seed storage (germplasm) conservation.

IMPLEMENTING ACTIONS

Financial support for the implementation of actions may be available through the Species at Risk Stewardship Fund, Species at Risk Research Fund for Ontario, or the Species at Risk Farm Incentive Program. Conservation partners are encouraged to discuss project proposals related to the actions in this response statement with the Ministry. The Ministry can also advise if any authorizations under the ESA or other legislation may be required to undertake the project.

Implementation of the actions may be subject to changing priorities across the multitude of species at risk, available resources and the capacity of partners to undertake recovery activities. Where appropriate, the implementation of actions for multiple species will be coordinated across government response statements.

REVIEWING PROGRESS

The ESA requires the Ministry to conduct a review of progress towards protecting and recovering a species not later than five years from the publication of this response statement. The review will help identify if adjustments are needed to achieve the protection and recovery of the Juniper Sedge.

ACKNOWLEDGEMENT

We would like to thank all those who participated in the development of the Recovery Strategy for the Juniper Sedge (*Carex juniperorum*) in Ontario for their dedication to protecting and recovering species at risk.

For additional information:

Visit the species at risk website at ontario.ca/speciesatrisk

Contact your MNRF district office

Contact the Natural Resources Information Centre

1-800-667-1940

TTY 1-866-686-6072

mnr.nric.mnr@ontario.ca

ontario.ca/mnrf