

Recovery Strategy for the False Hop Sedge (*Carex lupuliformis*) in Canada

False Hop Sedge



2013

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PREFACE

The federal, provincial and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (SARA) (S.C. 2002, c. 29), 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.

The Minister of the Environment is the competent minister for the recovery of the False Hop Sedge and has developed this strategy, as per section 37 of SARA. It has been prepared in cooperation with the governments of Ontario (Ministry of Natural Resources) and Quebec (Ministère du Développement durable, de l'Environnement et des Parcs du Québec).

Success in the recovery of this species depends on the commitment and cooperation of the many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the False Hop 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 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.

ACKNOWLEDGMENTS

This recovery strategy was revised by Vincent Carignan and Matthew Wild (Environment Canada, Canadian Wildlife Service - Quebec Region) based on a draft version by Nicole Lavoie (consulting botanist) and advice from members of the advisory committee for the recovery of False Hop Sedge in Canada [Vincent Carignan, Patricia Désilets (Ministère du Développement durable, de l'Environnement et des Parcs du Québec), Kate MacIntyre and Allen Woodliffe (Ontario Ministry of Natural Resources) and Andrée Nault (Scientific Research Division of the Montréal Biodôme)].

This recovery strategy also benefited from comments by Alain Branchaud and Karine Picard (Environment Canada, Canadian Wildlife Service - Quebec Region); Kate Hayes (formerly with Environment Canada, Canadian Wildlife Service - Ontario Region), Kathy St. Laurent, Angela Darwin, Madeline Austen, Graham Bryan, Lesley Dunn and Dalia Al-Ali (Environment Canada, Canadian Wildlife Service - Ontario Region), Marie-José Ribeyron and Tanys Uhmman (Environment Canada, Canadian Wildlife Service - National Capital Region); Jacques Labrecque, Nadia Cavallin, Jacques Cayouette, Guy Jolicoeur, and Line Couillard (Ministère du Développement durable, de l'Environnement et des Parcs du Québec); Jacinthe Letendre, Bree Walpole, Eric Snyder, and Michael J. Oldham (Ontario Ministry of Natural Resources), Stéphanie Pellerin (Institut de recherche en biologie végétale) as well as Diane Amirault-Langlais and Marjorie Mercure (formerly with Environment Canada, Canadian Wildlife Service - Quebec Region).

EXECUTIVE SUMMARY

False Hop Sedge (*Carex lupuliformis*) is an herbaceous perennial in the sedge family that grows in tufts on the margins of wetlands, including swamps, marshes, floodplains and vernal pools. The species was evaluated as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2000, and listed as endangered on Schedule 1 of the *Species at Risk Act* (SARA) in 2003.

The species has a sporadic distribution in eastern North America and is at the northern limit of its range in Canada, occurring solely in the southernmost part of Ontario and Quebec. There are 20 known populations, including 12 in which naturally-occurring individuals have been detected since 2009. Transplantations have been conducted at four populations and reintroductions have taken place in two formerly extirpated populations. In 2009–2010, there were approximately 361 tufts of False Hop Sedge in Canada, half of which were the result of reintroduction or transplantation efforts. Following a severe flooding event in Quebec during the spring of 2011, only two naturally-occurring tufts remained in that province.

The main threats to False Hop Sedge have been identified as alteration of the water regime, closure of the vegetation, invasive alien plant species, recreational and landowner activities, parasites, garbage deposition and residential development. It should also be noted that a limited number of extant populations with low abundance distributed within a restricted geographic region poses a significant challenge for the long-term persistence of the species in Canada.

The recovery of False Hop Sedge is considered technically and biologically feasible. The population and distribution objective is to maintain or, where feasible, increase the population size and the area of occupancy of False Hop Sedge in Canada. The broad strategies to be taken to address the threats to the survival and recovery of the species are presented in the section on Strategic Direction for Recovery.

The critical habitat of False Hop Sedge in Canada is partially identified in this recovery strategy. It corresponds to the suitable habitat at 13 of the 20 locations where populations of the species are found and described, including all of the populations that have benefitted from reintroduction or transplantation efforts or within which the existence of suitable habitat has been recently confirmed. A schedule of studies is proposed to complete the identification of the critical habitat at the Lambeth, Amherstburg and Galt locations in Ontario as well as at the Oka location in Quebec.

One or more action plans will be developed for False Hop Sedge within five years after the recovery strategy is posted on the Species at Risk Public Registry.

SUMMARY OF RECOVERY FEASIBILITY

Under section 41(1) of SARA, the competent minister must determine whether the recovery of the listed wildlife species is technically and biologically feasible. On the basis of the criteria established in the draft SARA Policies (Government of Canada, 2009), recovery of False Hop Sedge is considered biologically and technically feasible, since the responses to the following statements are “yes” or “unknown”:

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. Inventories conducted since 2005 have located new False Hop Sedge populations and seed and seedling production has recently been observed at twelve extant populations in Canada. Seedlings are currently being produced *ex situ* in Quebec and Ontario.

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

Yes. In Ontario, suitable habitat is found at least at 7 of the 9 locations that are currently occupied by populations and more than 35 wetlands showing similarities to habitats supporting extant populations have been identified elsewhere in the province. In Quebec, nine potential wetlands have been identified along the Ottawa River and three along the Richelieu River (Bachand-Lavallée and Pellerin, 2006). These wetlands are located near extant or historical populations along a 10-km stretch of the Ottawa River and a 20-km stretch of the Richelieu River.

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

Yes. The threats with the highest level of concern (e.g. canopy closure, alteration of water regime) can be avoided or mitigated through recovery activities such as habitat protection and stewardship. It should also be noted that a limited number of populations (14) with low abundance (<400 individuals total) distributed within a restricted geographic region poses a significant challenge for the long-term persistence of the species.

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

Yes. Although habitat restoration (e.g. clearing competing vegetation) and reintroduction or transplantation of False Hop Sedge individuals have been successfully carried out in the field (Bachand-Lavallée and Pellerin, 2006, Letendre et al., 2007), the outcome of such efforts can be moderated by the fact that the species is at the northern limit of its range in Canada. In 2010, the survival of transplanted individuals ranged from 17 to 82% depending on the population, and the survival of seed-producing individuals ranged from 15 to 60% (COSEWIC, 2011).

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1. COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: November 2011

Common Name: False Hop Sedge

Scientific Name: *Carex lupuliformis*

COSEWIC Status: Endangered

Reason for Designation: In Canada, this rare sedge is found in southern Ontario and Quebec where fewer than 250 mature plants have been found. There have been substantial historical population losses attributed to residential development and other forms of land use. Continued declines are attributed to late season flooding, land drainage, invasive alien species, recreation, erosion, garbage deposition, water regime regulation, and residential and urban development. Recovery efforts have included re-introduction at three sites in Quebec.

Canadian Occurrence: Ontario, Quebec

COSEWIC Status History: Designated threatened in April 1997. Status re-examined and designated endangered in May 2000 and November 2011.

* Committee on the Status of Endangered Wildlife in Canada

2. SPECIES STATUS INFORMATION

Less than 1% of the global False Hop Sedge (*Carex lupuliformis*) population is found in Canada (Labrecque, 1998). The species is listed as endangered¹ on Schedule 1 of SARA (S.C. 2002, c. 29). It is listed as threatened² in Quebec under the *Act respecting threatened or vulnerable species* (R.S.Q. c. E-12.01) and as endangered in Ontario under the *Endangered Species Act, 2007* (S.O. 2007, c. 6).

In the most recent NatureServe assessment (dating from 2000), the species was assigned a global conservation status rank of G4 (apparently secure), a national rank of N4 (apparently secure) in the United States and N2 (imperilled) in Canada, and a subnational rank of S1 (critically imperilled) in Ontario and Quebec (NatureServe, 2010; see Appendix A for definitions of ranks).

¹ Endangered : A species facing imminent extirpation or extinction in Canada

² Threatened : A species for which extinction is imminent.

3. SPECIES INFORMATION

3.1 Species Description

Based on COSEWIC (2011) and references cited therein, False Hop Sedge is a perennial herbaceous plant in the Cyperaceae family. This sedge reaches a height between 50 and 130 cm. It grows in tufts comprising 5 to 30 stems arising from a sympodial rhizome³. The leaves (i.e., blade) are smooth, erect and 30 to 80 cm long. Flowering begins in late June with an inflorescence⁴ 6 to 40 cm across, bearing 1 to 6 elongated spikes. Fruiting occurs from mid-July to late October in Canada. The perigynium (fruit casing) is glossy. The plant's achenes (one-seeded fruits) are trigonous (have a triangular cross-section). The achenes bear prominent nipple-like knobs, a characteristic that can be used to distinguish False Hop Sedge from Hop Sedge (*Carex lupulina*), which are otherwise virtually identical during the vegetative stage.

3.2 Population and Distribution

False Hop Sedge is a species with a sporadic distribution in eastern North America and is at the northern limit of its distribution in Canada. Its range in the United States includes all states from Wisconsin, Iowa, Kansas, Oklahoma and Texas eastward to New York. In Canada, it occurs solely in the southernmost part of Ontario and Quebec (Figure 1).



Figure 1: Distribution of False Hop Sedge in North America. Map by Y. Lachance, reproduced with permission of the Ministère du Développement durable, de l'Environnement et des Parcs du Québec (in COSEWIC, 2011).

³ Refers to the way the stems develop successively and are joined together along the root.

⁴ The flowering part of a plant.

According to COSEWIC (2011), the species' extent of occurrence in Canada is about 23 900 km² (~41 800 km² when including reintroduction sites). This area has declined by about 21 550 km² since the last report (Labrecque, 1998), primarily owing to the extirpation of the populations in the Ottawa River sector in Quebec. When the reintroduction sites are factored in, the reduction is 3 540 km². The species' current area of occupancy in Canada is less than 0.01 km².

There are 20 populations documented in Canada, 12 of which had naturally-occurring individuals in 2009 or after (Appendix B). In Ontario, all populations are concentrated in Middlesex and Elgin counties. In Quebec, they are located along a 20-km stretch of the Richelieu River, near Saint-Jean-sur-Richelieu, and along a 10-km stretch of the Ottawa River.

In order to increase the resilience of the species, individuals have been transplanted in four of the extant populations (three in Quebec, one in Ontario) and reintroduced in two of the extirpated populations (both in Quebec). The necessity of such measures became evident following the severe flooding of the Richelieu River in Quebec during spring 2011 after which only two naturally-occurring individuals were found (Stéphanie Pellerin, personal communication). Had this species not benefited from reintroduction efforts and augmentation of its numbers by transplantations since 2006, it would have been nearly extirpated in the Province of Quebec today.

In 2009–2010, there were 361 mature individuals (142, if transplants are excluded) in the extant population. Population size can fluctuate from year to year, and despite recent monitoring of populations, no clear trend is discernable. A number of factors explain this situation. First, the data available prior to 2005 were primarily estimates and based solely on fruiting individuals which vary as a function of hydrological conditions (Letendre et al., 2007). Second, it is almost impossible to identify vegetative (seedless) individuals of the species. Hence, permanent marking of plants is essential for tracking population trends. This approach has been used since 2005 for individuals in Quebec's populations where more than 180 individuals have been marked⁵, and the fluctuations observed indicate a downward trend (see Appendix B).

3.3 Needs of False Hop Sedge

The False Hop Sedge colonizes a transition zone along the natural shorelines of various types of wetland where the vegetation remains sparse due to periodic short-term flooding or ice scouring (COSEWIC, 2011). These types of habitat favour species that prefer high light and, indeed, the vigour of the False Hop Sedge decreases as the canopy becomes more closed (Letendre et al., 2007). According to COSEWIC (2011), False Hop Sedge appears to be less adaptable to different habitats than most riparian species, which could partly account for its rarity.

In Ontario, wetlands that are currently colonized by False Hop Sedge are vernal pools as well as isolated marshes within wooded swamps that are unconnected to any major streams (Labrecque, 1998; COSEWIC, 2011). The wooded swamps within which these habitats are imbedded likely provide dispersal habitat and support the hydrological processes that maintain them (Eric Snyder,

⁵ In Quebec, all naturally-occurring and transplanted individuals are currently marked. For transplanted individuals, stakes are removed after three years of absence whereas stakes are never removed for naturally-occurring individuals (Stéphanie Pellerin, personal communication).

OMNR, personal communication). Although False Hop Sedge is found at locations with limited competition from herbaceous and shrubby plants, the most frequently observed companion species are : Bog Hemp (*Boehmeria cylindrica*), Rice Cutgrass (*Leersia oryzoides*), Hop Sedge (*Carex lupulina*), Clearweed (*Pilea pumila*), Beggarticks (*Bidens spp.*), Knotweed (*Polygonum persicaria*), Cocklebur (*Xanthium strumarium*) as well as Red Ash (*Fraxinus pennsylvanica*), Red Maple (*Acer rubrum*) or Silver Maple (*Acer saccharinum*) (Labrecque, 1998). The soil is composed of a clay loam (Labrecque, 1998).

In Quebec, False Hop Sedge has only been observed in Silver Maple swamps or shrub swamps in small isolated bays that are sheltered from currents but near a natural shoreline subjected to periodic flooding of short duration. Companion species include Red Ash, Black Willow (*Salix nigra*), Reed Canary Grass (*Phalaris arundinacea*), Bog Hemp, Rice Cutgrass, Water Parsnip (*Sium suave*), Prairie Cordgrass (*Spartina pectinata*) and Hop Sedge. Except in the case of the Lacolle population, which is located 50 m from a river, the tufts are very close to water (10-15 m) during low flow periods. The soil is composed of a gleysol⁶ of recent alluvia ranging from sandy loam to clay loam (Labrecque, 1998) and is poorly drained (COSEWIC, 2011).

The preceding habitat descriptors and species associations are based on a subset of sites occupied by the species and may not necessarily represent conditions that are optimal for this species that has a very limited distribution in Canada and is at the northern limit of its distribution. The actual distribution of the species could, in certain instances, be the result of historical artifacts related to landscape development.

A persistent seed bank (Templeton and Levin, 1979) plays a crucial role in maintaining False Hop Sedge populations. Aside from the fact that the seeds are dispersed primarily by water, little is known about seed dispersal dynamics. It is nonetheless likely that mature seeds fall into the water and are carried over long distances during flooding, thereby ensuring local dispersal (Labrecque, 1998) and colonization of suitable habitats that become available (COSEWIC, 2011). Despite this, it is assumed that no genetic exchange takes place between the Ontario and Quebec populations since they are hydrologically isolated (COSEWIC, 2011).

⁶ <http://www.soilsofcanada.ca/orders/index.php>

4. THREATS

4.1 Threat Assessment

Table 1. Threat Assessment Table.

Threat	Level of Concern ¹	Extent	Population	Frequency	Severity ²	Causal Certainty ³
Habitat loss or degradation						
Alteration of water regime	High	Widespread	Current	Continuous	High/Moderate ⁴	High
Recreational and landowner activities	Medium	Widespread	Current	Continuous	Moderate	Medium
Residential development	Low	Localized	Historical	Continuous	High/Moderate	High
Changes in ecological dynamics or natural processes						
Closure of vegetation	High	Localized	Current	Continuous	High/Moderate	High
Alien, invasive or introduced species/genome						
Invasive alien plant species	Medium	Widespread	Current	Continuous	Unknown	High
Parasites	Low	Widespread	Current	Continuous	Unknown	Low
Pollution						
Garbage deposition	Low	Localized	Current	Continuous	Low	Low

¹ Level of Concern: signifies that managing the threat is of high, medium or low concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table. Threats with a low Level of Concern are listed and described but may not be specifically addressed in the recovery approaches.

² Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).

³ Causal Certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability, e.g. expert opinion; Low: the threat is assumed or plausible).

⁴ Each threat assessment criterion is assessed for each population and for the entire range. When two qualifiers are indicated in a box, it means the identified threat does not have the same impact at both levels (scale of populations/entire range).

4.2 Description of Threats

The threats listed below are presented in decreasing order of the level of concern. It should also be noted, however, that a limited number of extant populations (14) with low abundance (<400 individuals total) distributed within a restricted geographic region poses a significant challenge for the long-term persistence of the False Hop Sedge.

Alteration of the water regime

Natural fluctuations in water levels as well as drought periods appear to play a crucial role in the establishment and maintenance of False Hop Sedge and its habitat. Indeed, episodic high-water levels can provide suitable habitat by removing competing plant species and by eroding more forested riparian habitats thereby creating openings that are suitable for the establishment of new individuals (Labrecque, 1998; Bachand-Lavallée and Pellerin, 2006; Jolicoeur and Couillard, 2006; COSEWIC, 2011). However, excessive water saturation of the substrate does not favour the expansion of Silver Maple swamps (Jean Morin, personal communication) and appears to impede the emergence of seeds and reduce the vigour of individuals (Letendre et al., 2007). Indeed, it has been shown that high water levels such as those observed on the Richelieu River since the 2000s (and particularly during the spring 2011 floods), cause the loss of False Hop Sedge plants (Letendre et al., 2007; Stephanie Pellerin, personal communication). Locations where the suitable habitat consists solely of a narrow strip of vegetation hemmed in along the river by private residences (e.g., Sainte-Anne-de-Sabrevois, McGillivray Bay) are more at risk from this threat.

Dam construction can exacerbate the negative effects of high water levels. In Quebec, construction of the Carillon Dam in the 1950s altered the hydrological regime of the Ottawa River, leading to shoreline erosion in areas upstream of the dam which may have caused the extirpation of the populations in the Lac des Deux-Montagnes region (Jolicoeur and Couillard, 2006). The threat of dam construction remains along the Richelieu River in Quebec but is unlikely in Ontario since most populations are found in vernal pools.

In several Ontario populations, surface or subsurface drains (agricultural and/or municipal) are situated right next to most extant populations and appear to have dried the soils at the West Lorne and London locations. In Quebec, the location of extant populations within 10-15 m of large watercourses suggests that drainage is not a threat. However, some extirpated populations where reintroductions are being considered are more vulnerable as they are further away from these watercourses. Changes in the hydrological conditions of the habitat can promote the growth of competing plant species in the shrub and herb layers, which can be detrimental to False Hop Sedge. The decline observed in several populations in Ontario and Quebec appears to be related to this factor (COSEWIC, 2011).

Closure of vegetation

False Hop Sedge is a shade-intolerant species and as such, the vigour of individual plants appears to be positively correlated with the openness of the surrounding vegetation (Labrecque, 1998; Letendre et al., 2007). Furthermore, germination does not occur in habitats with a low light intensity (Schütz, 2000). Shading through vegetation succession therefore presents a threat to this species (COSEWIC, 2011). This appears to have been the cause of the extirpation of the Grande Baie d'Oka and Rigaud (Quebec) populations as well as the Amherstburg (Ontario) population (Labrecque, 1998). As found in many other species of *Carex*, the seeds may nonetheless remain viable in the soil for more than 10 years (Leck and Shutz, 2005) and germinate following disturbance of the soil or opening of the canopy. This situation was observed at the Mount Brydges (Ontario) population where forest harvesting created openings in the canopy, promoting a dramatic increase in the number of individuals at this location (from 25–30 in 1992 to 1075 in

2003). However, competition by herbaceous vegetation and closing of the canopy in subsequent years reduced the number of individuals to 29 in 2009.

Invasive alien plant species

Invasive alien plants can affect the survival of False Hop Sedge by competing with it for sunlight and nutrients as well as by acting as a barrier to seed dispersal (COSEWIC, 2011). The absence of water level fluctuations or low water levels is conducive to the establishment of invasive plants (Hudon et al., 2005). Species that may be more problematic are Purple Loosestrife (*Lythrum salicaria*), Reed Canary Grass, Reed Manna Grass (*Glyceria maxima*) and Common Buckthorn (*Rhamnus cathartica*). All the individuals at the Pointe du Gouvernement sector of the Henryville (Quebec) population appear to have disappeared due to the establishment of a dense stand of Reed Canary Grass (COSEWIC, 2011). European Water-chestnut (*Trapa natans*), although not currently present at False Hop Sedge populations, occur in some areas along a tributary of the Richelieu River (Quebec) as well as upstream of the Carillon dam on the Ottawa River on the Ontario side. This species forms a dense carpet on the water surface which could eventually invade False Hop Sedge populations and inhibit their growth and dispersal ability.

Recreational and landowner activities

A number of populations are located in areas where mortality through trampling of the plants may be a threat because of public access or landowner activities (e.g., grazing, hunting, clearing of underbrush and tree harvesting). All-terrain vehicle (ATV) use has been observed near two populations in Quebec (Carillon Island and Henryville (Labrecque, 1998)). Proximity of False Hop Sedge to residences or recreational areas also increases the risk of vandalism, as was observed in the Parc national d'Oka, where a number of transplanted tufts were pulled up by park users.

Parasites

False Hop Sedge and other members of this plant family are hosts of a dipteran⁷ parasite. The larvae of this parasite develop inside the achenes, causing a deformity that affects the position of the fruit casing. This phenomenon affects all extant Canadian populations, but more so the one at Saint-Blaise-sur-Richelieu (COSEWIC, 2011). The effect this parasite has on the species is unknown (Labrecque, 1998). In addition, an alien aphid (*Ceruraphis eriophori*) has been observed on several plants in Quebec and may be present in Ontario. The presence of the aphids appears to be linked to premature drying of plants (Letendre et al., 2007) and appears to be correlated with the drying and mortality of a number of individuals transplanted in Quebec in 2006. It is possible the aphid could have a significant impact on the species' long-term survival (COSEWIC, 2011). A sawfly (*Pachynematus corniger*) has also been observed feeding on the leaves of False Hop Sedge in Quebec. The impact of sawfly feeding on the survival of False Hop Sedge plants has not been studied, but it appears to reduce the plants' vigour (COSEWIC, 2011).

⁷ Insects of the Order Diptera, also known as the true flies, characterized by a single pair of wings; includes houseflies, mosquitoes and gnats.

Garbage deposition

Garbage or other waste/debris can impede the growth of False Hop Sedge. This has been observed around the population in London (Ontario) and the populations along the Richelieu River. In Quebec, debris consist of floating materials deposited along the shoreline by flood waters and waves (COSEWIC, 2011).

Residential development

Residential development affects populations through habitat loss and degradation. Nearly two thirds of the shoreline of the Richelieu River have been altered, mainly as a result of residential development and the construction of marinas. Shoreline development likely explains the extirpation of the Sainte-Anne-de-Sabrevois, Saint-Paul-de-l'Île-aux-Noix, Iberville and Saint-Blaise-sur-Richelieu populations (Labrecque, 1998). This threat is more limited now because of various legislative measures that protect wetlands. The COSEWIC status report (COSEWIC, 2011) mentions residential development near the London population; however, this does not appear to be a major threat at present because the city owns the site and is not likely to develop it.

5. POPULATION AND DISTRIBUTION OBJECTIVE

The population and distribution objective is to maintain or, where biologically and technically feasible, increase the abundance and area of occupancy of the False Hop Sedge in Canada. At the present time, it is not possible to establish a quantifiable objective regarding the appropriate abundance of individual populations or the overall population in Canada but this may become possible once viability analyses are conducted.

In the southernmost part of Ontario and Quebec, a high rate of wetland loss was observed during the last century along with significant alteration of riparian habitats colonized by False Hop Sedge. This has resulted in the persistence of very few individuals within a limited number of populations, therefore increasing the vulnerability of the species to catastrophic events. For example, during the spring of 2011, a severe flooding took place along the Richelieu River wiping out all but two of the naturally-occurring individuals. Had reintroduction or transplantation efforts not been undertaken in previous years, the species would be nearly extirpated from the Province of Quebec today. At the same time, such events can generate suitable habitats that can be colonized by the species if sufficient seed-producing individuals survive. Extant sites may also bounce back from such events if the seedbanks are not flooded for an extended period.

The objective of the federal recovery strategy corresponds to those set out in the Government of Quebec's conservation plan for the False Hop Sedge (Jolicoeur and Couillard, 2006) which are to : 1) protect and ensure the long-term maintenance of all extant populations; and 2) introduce or reintroduce the species, if feasible, in the physiographic units⁸ where it has become extirpated. A similar conservation plan has not been prepared by the Province of Ontario.

⁸ According to the Cadre écologique de référence of the Quebec Ministère du Développement durable, de l'Environnement et des Parcs (Li et al.1994), physiographic units correspond to landscapes elements measuring in the order of 1 000 km².

6. BROAD STRATEGIES AND APPROACHES FOR MEETING RECOVERY OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Conservation and stewardship

- Seeds were sent to Agriculture and Agri-Food Canada's seed bank in Saskatoon. More than 2500 achenes obtained from nearly all the populations in Canada (except Ailsa Craig and Lambeth in Ontario) were also sent to the Millennium Seed Bank of the Royal Botanic Gardens in Kew (England) for long-term conservation. Seeds were collected in Quebec and Ontario and seedlings were grown to reintroduce individuals in certain populations.
- Habitats have been restored and individuals were reintroduced in two extirpated populations in Quebec (Sainte-Anne-de-Sabrevois and Grande Baie d'Oka) and transplanted in two populations in Quebec (Saint-Blaise-sur-Richelieu and McGillivray Bay) and one population in Ontario (West Elgin). In 2010, the survival of transplanted individuals ranged from 17 to 82%, and the survival of seed-producing individuals ranged from 15 to 60% (COSEWIC, 2011).
- A portion of the Marcel-Raymond Ecological reserve has been legally designated as a plant habitat⁹ (Baie-des-Anglais) under the Quebec *Act Respecting Threatened and Vulnerable Species*.
- In revising their regional development plan, the Haut-Richelieu, Deux-Montagnes and Argenteuil regional county municipalities designated False Hop Sedge habitats as ecologically significant areas. In these areas, only developments devoted to education, such as interpretive trails, can be authorized.
- The projected Samuel-de-Champlain biodiversity reserve in Quebec (*Natural Heritage Conservation Act*; R.S.Q. c. C-61.01) was designated in 2011 to protect 487 ha of wetlands in the Richelieu River (Quebec) sector between Saint-Jean-sur-Richelieu and the United States border.
- In Ontario, the habitat of the False Hop Sedge is protected under the *Endangered Species Act, 2007*.

⁹ According to section 17 of the Act "No person may, in the habitat of a threatened or vulnerable plant species, carry on an activity that may alter the existing ecosystem, the present biological diversity or the physical or chemical components peculiar to that habitat. »

Surveys and monitoring

- Since 2005, the extant populations of Quebec have been surveyed and mapped every year or two and a management approach has been recommended for each (Jolicoeur and Couillard, 2006).
- Nine new locations suitable for the reintroduction of the species have been identified along the Ottawa River (Bachand-Lavallée and Pellerin, 2006; Letendre et al., 2007).
- In 2009, surveys were conducted at all the extant populations in Ontario as well as the extirpated Amherstburg site.

Outreach and communication

- Outreach activities directed at the general public as well as owners of properties located near False Hop Sedge populations of the Richelieu River were carried out in 2006 and 2007 (Bachand-Lavallée and Pellerin, 2006; Letendre et al., 2007).

6.2 Strategic Direction for Recovery

Table 2. Recovery Planning Table.

Threat or Limitation	Broad Strategy to Recovery	Priority	General Description of Research and Management Approaches
All	Conservation of the species, its suitable habitat and the adjacent riparian zone	High	<ul style="list-style-type: none"> • Apply legal and stewardship measures within the localities hosting populations and in the adjacent areas in order to reduce the impacts of the main threats. • Continue or implement management approaches to increase the abundance of the species and the area of suitable habitat, where feasible: <ul style="list-style-type: none"> ○ <i>ex situ</i> cultivation of the species using artificial propagation techniques; ○ restoration of habitats; ○ reintroductions in extirpated populations; ○ transplantations in extant populations.
Gaps in knowledge related to demographics and biology	Survey and monitoring	High	<ul style="list-style-type: none"> • Develop and implement a standard inventory and monitoring protocol for collection of comparable data in Ontario and Quebec including: <ul style="list-style-type: none"> ○ Marking of all naturally-occurring individuals at extant populations as well as reintroduced or transplanted individuals in order to better monitor population dynamics and trends. ○ Gather georeferenced data on individual tufts as well as on the area of occupancy for the tufts, particularly in the Ontario populations. • Conduct an inventory of suitable habitat outside of known localities at regular intervals.
All; Gaps in knowledge related to demographics and biology	Research	High	<ul style="list-style-type: none"> • Develop techniques to increase the vigour and persistence of transplants: <ul style="list-style-type: none"> ○ Study the species' capacities to adapt to ecological conditions (ex. availability of light, frequency and length of flooding events) at the northern edge of its distribution • Study the species' population dynamics <ul style="list-style-type: none"> ○ Investigate the viability of seeds in the soil ○ Determine how seed dispersal influences population dynamics ○ Conduct a population viability analysis • Study genetic aspects that could limit our abilities to recover the species (ex. hybridization)
All	Communication and outreach	Medium	<ul style="list-style-type: none"> • Develop and implementation of a communication strategy for partner agencies, interest groups, private landowners and the general public.

7. CRITICAL HABITAT

7.1 Identification of the Species' Critical Habitat

The False Hop Sedge colonizes natural shorelines of various types of wetlands. In Canada, biophysical attributes of suitable habitat for this species include:

For all populations:

- Sufficient light to ensure the germination of seeds as well as the vigour and survival of the plants;
- Reduced competition from other species (herbaceous or shrubs) that impede the growth of individual plants
- Adequate water table so as not to encourage competition from other species or impede growth.

For populations in Ontario:

- Wooded swamps and wooded swamp edges, including the vernal pools and isolated marshes within them.
- Associated species such as Bog Hemp, Rice Cutgrass, Hop Sedge, Clearweed, Beggarticks, Knotweed, Common Burdock as well as Red Ash, Red Maple or Silver Maple.
- A soil composed of a clay loam.

For populations in Quebec :

- Silver Maple swamps or shrub swamp in small isolated bays that are sheltered from currents but near a natural shoreline subjected to periodic flooding of short duration.
- Associated species such as Reed Canary Grass, Bog Hemp, Rice Cutgrass, Water Parsnip, Prairie Cordgrass, Hop Sedge.
- A soil composed of a gleysol with recent alluvia ranging from sandy loam to clay loam.

The critical habitat of False Hop Sedge in Canada is partially identified in this recovery strategy. It corresponds to the suitable habitat at 13 of the 20 locations where populations of the species are found and described, including all of the populations that have benefitted from reintroduction or transplantation efforts or within which the existence of suitable habitat has been recently confirmed. Of the seven remaining locations, four need further investigations to determine if the species or suitable habitat is still present or to establish their area of occupancy (quality ranking codes E and H) and a schedule of studies is proposed to that effect in section 7.2. Three locations no longer provide suitable habitat (code X) and will not be designated as critical habitat unless restoration efforts are undertaken. In Quebec, critical habitat is identified at seven locations (six with extant populations, three of which have benefitted from transplantations efforts and two that have benefitted from reintroductions; and one in which the population is extirpated but suitable habitat is still available). Six of these populations are identified as conservation targets in the Government of Quebec's conservation plan for the False Hop Sedge plus the Sainte-Anne-de-

Sabrevois population which is included in the federal recovery strategy because successful reintroduction efforts started after the publication of the provincial conservation plan in 2006. In Ontario, critical habitat is identified at six of the seven locations hosting extant False Hop Sedge populations. More precision for the boundaries of the Lambeth location are necessary to identify it as critical habitat.

The boundaries of locations containing critical habitat correspond to the extent of the woodlot and associated wetlands containing suitable False Hop Sedge habitat. Any element contained within the boundaries that does not correspond to the biophysical attributes of suitable habitat (ex. agricultural field, road) is not considered critical habitat. Appendix D lists the 13 critical habitat parcels identified for Quebec and Ontario, their status (extant, have benefited from reintroduction or transplantation efforts or not) as well as general localisation coordinates (1 x 1 km resolution). No maps or specific coordinates are provided for this species' critical habitat as the data is considered to be sensitive in Ontario.

7.2 Schedule of Studies to Identify Critical Habitat

Table 3. Schedule of Studies.

Description of Activity	Outcome/Rationale	Timeline
Determine if individuals and/or suitable habitat are still present at the Galt and Amherstburg (Ontario) populations; establish the boundaries of the Lambeth (Ontario) population and characterize the Oka (Quebec) population	Identification of additional critical habitat	2013-2018

7.3 Examples of Activities Likely to Result in Destruction 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 (Government of Canada, 2009).

The critical habitat of False Hop Sedge may be destroyed through two main mechanisms associated with human activities:

Changes in the water regime

- Changes in water levels due to drainage, dam construction/regulation or similar activities can cause shoreline erosion, excessive saturation or drying of the substrate as well as indirectly affect the level of canopy closure. This can make a site unfavourable for the germination of seeds or the growth of individuals that require a suitable level of soil water saturation. In addition, plants may experience a reduction in vigour due to increased

competition from other plant species. Drier sites are also more easily colonized by competing plants, especially invasive species, which can lead to closure of the vegetation and increased shading.

Habitat loss or degradation

- Infrastructure (e.g. roads, trails, houses, wharves, bank stabilisation structures) and land use changes (e.g. wood harvesting, mowing, haying) can cause the direct destruction and/or fragmentation of habitat leading to a reduction in the availability of suitable habitat and of the connectivity between populations.
- Tree harvesting and recreational activities can alter the soil structure through compaction caused by the passage of machinery or by trampling which can negatively affect the growth of individuals or lead to difficulties with seed germination.
- Garbage or waste deposition can prevent the production of seeds or affect the vigour of the plants.

These examples do not represent an exhaustive list of the activities likely to destroy the critical habitat of False Hop Sedge.

8. MEASURING PROGRESS

The performance indicators presented below propose an approach for defining and measuring progress towards the achievement of the population and distribution objectives. The success of the recovery strategy will be evaluated every five years on the basis of the following performance indicators:

- the population size of False Hop Sedge and the area of occupancy are maintained or, where feasible, increased in Canada.

9. STATEMENT ON ACTION PLANS

One or more action plans for False Hop Sedge will be posted on the Species at Risk Public Registry within five years after the final recovery strategy is published.

10 REFERENCES

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APPENDIX A: DEFINITION OF NATURESERVE RANKS

G4 and N4 (Apparently Secure) —Uncommon but not rare; some cause for long-term concern due to declines or other factors.

N2 (Imperilled) —Imperilled in the jurisdiction because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from jurisdiction.

S1 (Critically Imperilled) —Critically imperilled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.

APPENDIX B. FALSE HOP SEDGE POPULATIONS IN CANADA

Table B-1: False Hop Sedge populations in Canada.

Name of population (ID)	Province	County	Status of population and Quality Rank ¹	Inventory Year	Number of Natural plants (fruiting stems)	Number of transplants (fruiting stems)
Mount Brydges (5803)	Ontario	Middlesex	Extant (A)	1992	25–30	
				2005	1075	
				2009	29 (43)	
West Lorne (5802)	Ontario	Elgin	Extant (A)	1993	~ 100	
				2005	63	
				2009	20 (59)	
West Elgin (92901)	Ontario	Elgin	Extant (A)	2005	? (~ 150)	
				2009	39 (132)	63 (91)
Ailsa Craig (NA)	Ontario	Middlesex	Extant (B)	2009	19	
London (5804)	Ontario	Middlesex	Extant (D)	1992	12 (~ 150)	
				2002	> 12	
				2005	28	
				2009	5 (4)	
Rodney (5805)	Ontario	Elgin	Extant (D)	2002	2	
				2005	26	
				2009	1 (2)	
Lambeth (NA)	Ontario	Middlesex	Extant (E)	2009	?	
Amherstburg (2938)	Ontario	Essex	Historical (H)	1985	~ 100	
				2002	0	
				2005	0	
				2009	0	
Galt (2937)	Ontario	Waterloo	Historical (H)	1902	Herbarium	
Grande Baie d'Oka (6867)	Quebec	Deux-Montagnes	Extant - reintroduction (Cr)	1935	Herbarium	
				1992	Herbarium	
				2006	0	
				2007	0	
				2008	0	
				2009	0	22 (1)
				2010	0	22 (121)
2011	0	51				
Sainte-Anne-de-Sabrevois (6872)	Quebec	Haut-Richelieu	Extant - reintroduction (Cr)	1936	?	
				1992	0	
				2007	0	61 (12)
				2008	0	19 (6)
				2009	0	15 (17)
				2010	0	13 (20)
2011	0	10				

McGillivray Bay (6876)	Quebec	Haut-Richelieu	Extant (C)	1994	5	
				2001	25	
				2003	18	
				2005	> 10	
				2007	9 (?)	50 (16)
				2008	12(41)	16 (21)
				2009	6 (22)	26 (66)
				2010	4 (3)	24 (7)
				2011	2	8
Henryville ² (6874)	Quebec	Haut-Richelieu	Extant (C)	1991	?	
				1992	~ 13	
				1997	19	
				2000	19	
				2004	3	
				2005	24	
				2006	18 (27)	25 (1)
				2007	17 (33)	54 (1)
				2008	20 (178)	46 (44)
				2009	26 (175)	26 (55)
				2010	22 (148)	
Saint-Blaise-sur-Richelieu (6873)	Quebec	Haut-Richelieu	Extant (D)	1992	5	
				2004	0	
				2005	0	
				2007	0	10 (24)
				2008	0	33 (99)
				2009	0	18 (88)
				2010	1 (2)	71 (102)
				2011	1	33
Lacolle (15349)	Quebec	Haut-Richelieu	Extant (D)	2005	7	
				2006	7	
				2007	1	
				2008	1 (2)	
				2009	2 (1)	
Oka (18675)	Quebec	Deux-Montagnes	Extant (E)	2008	?	
Carillon Island (6875)	Quebec	Argenteuil	Extirpated (X)	1992	2-10	
				2001	0	
				2002	0	
				2006	0	
				2007	0	
Rigaud (6868)	Quebec	Vaudreuil-Soulanges	Extirpated (X)	1934	Herbarium	
				2007	0	
Iberville (6869)	Quebec	Haut-Richelieu	Extirpated (X)	1938	Herbarium	
				1992	0	
Saint-Paul-de-l'Île-aux-Noix (6871)	Quebec	Haut-Richelieu	Extirpated (X)	1972	Herbarium	
				1992	0	

Sources: Bachand-Lavallée and Pellerin (2006), Letendre et al. (2007), CDPNQ (2011), COSEWIC (2011)

¹ Provides an assessment of the estimated viability or probability of persistence of the population (see Appendix C).

² Following a review of the data by the CDPNQ in 2011, individuals from the Pointe du Gouvernement and Marcel-Raymond Ecological Reserve are considered to be part of the same population. No individuals have been detected in the Pointe du Gouvernement sector since 1992 and no individuals have been transplanted there.

APPENDIX C: DEFINITION OF QUALITY RANKS OF FALSE HOP SEDGE POPULATIONS

Quality Rank	Definition
A (Excellent)	More than 25 tufts in a floodplain forest covering at least 400 ha that is not affected by artificial regulation of water levels and that is subject to only minimal disturbance from human activities.
B (Good)	From 12 to 25 tufts in a floodplain forest covering at least 400 ha that is subject to moderate disturbance from human activities, or a smaller habitat (more than 200 ha with little or no disturbance).
C (Fair)	From 6 to 11 tufts in a 200-ha habitat that is significantly disturbed by human activities and has an intact natural flooding regime.
D (Low)	From 1 to 5 tufts in a heavily degraded habitat of any size; major disturbances caused by erosion, forest clearing, marina construction or altered natural flooding regime, drainage.
E (Recent)	Recent population; the observation of the population dates back less than 25 years, but no information on its demographics is available.
F (Not relocated)	Population not relocated during inventories conducted in the past 20 years (fail to find).
H (Historical)	The observation (inventories) of the population dates back more than 20 years.
X (Extirpated)	Extirpated population. No individuals of the species have been found for more than 20 years. The habitat may no longer be suitable. After three subsequent failures to find the population, it is classified as extirpated even if suitable habitat is still present.
r (reintroduction)	Formally extirpated population in which plants have been reintroduced.

APPENDIX D. CRITICAL HABITAT OF FALSE HOP SEDGE IN CANADA

Table D-1: Locations containing False Hop Sedge critical habitat in Quebec.

Location / population name	Reason for selection	Coordinates of location*	Land tenure
Henryville (Quebec)	Extant population where transplantation efforts have been undertaken (Marcel-Raymond ecological reserve sector); location is identified as a conservation target in the provincial plan	45.080 ; -73.150	Non federal (provincial Plant habitat and ecological reserve + protected by an NGO)
McGillivray Bay (Quebec)	Extant population where transplantation efforts have been undertaken ; location is identified as a conservation target in the provincial plan	45.091 ; -73.145	Non federal (provincial)
Saint-Blaise-sur-Richelieu (Quebec)	Extant population where transplantation efforts have been undertaken ; location is identified as a conservation target in the provincial plan	45.125 ; -73.152	Non federal (provincial)
La Grande Baie d'Oka (Quebec)	Extant population with suitable habitat where reintroduction efforts have been undertaken ; location is identified as a conservation target in the provincial plan	45.290 ; -73.591	Non federal (provincial park)
Sainte-Anne-de-Sabrevois (Quebec)	Extant population with suitable habitat where reintroduction efforts have been undertaken	45.115 ; -73.150	Non federal (provincial)
Lacolle (Quebec)	Extant population; location is identified as a conservation target in the provincial plan	45.004 ; -73.212	Non federal (provincial)
Carillon Island (Quebec)	Extirpated population with suitable habitat ; location is identified as a conservation target in the provincial plan	45.303 ; -74.163	Non federal (private; Migratory Bird Sanctuary)

* The listed coordinates represent the southwest corner of the 1 km Universal Transverse Mercator (UTM) Military Grid Reference System square containing the critical habitat site centroid (for more information on the reference system see http://maps.nrcan.gc.ca/topo101/mil_ref_e.php). The coordinates may not fall within critical habitat and are provided as a general location only.

Table D-2: Locations containing False Hop Sedge critical habitat in Ontario.

Location / population name	Reason for selection	Coordinates of location*	Land tenure
Mount Brydges (Ontario)	Extant population	42.883 ; -81.588	Non federal (private)
West Lorne (Ontario)	Extant population	42.676 ; -81.671	Non federal (private)
West Elgin (Ontario)	Extant population where transplantation efforts have been undertaken	42.604 ; -81.658	Non federal (private)
Ailsa Craig (Ontario)	Extant population	43.171 ; -81.541	Non federal (private)
London (Ontario)	Extant population	42.938 ; -81.319	Non federal (municipal)
Rodney (Ontario)	Extant population	42.621 ; -81.707	Non federal (private)

* The listed coordinates represent the southwest corner of the 1 km Universal Transverse Mercator (UTM) Military Grid Reference System square containing the critical habitat site centroid (for more information on the reference system see http://maps.nrcan.gc.ca/topo101/mil_ref_e.php). The coordinates may not fall within critical habitat and are provided as a general location only.

APPENDIX E: 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. 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.

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 on non-target species or habitats. The results of the SEA are incorporated directly in the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of False Hop Sedge. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects.

The recovery activities recommended in this document should not have any negative impacts on other non-target indigenous species, natural communities and/or ecological processes. They may actually prove to be beneficial for the other species at risk that share False Hop Sedge's habitat. These include four fish species: the Eastern Sand Darter (*Ammocrypta pellucida*) (COSEWIC status: Threatened), the Channel Darter (*Percina copelandi*) (COSEWIC status: Threatened), the River Redhorse (*Moxostoma carinatum*) (COSEWIC status: Special Concern), and the Grass Pickerel (*Esox americanus vermiculatus*) (COSEWIC status: Special Concern); two turtles: the Spiny Softshell (*Apalone spinifera*) (COSEWIC status: Threatened) and the Northern Map Turtle (*Graptemys geographica*) (COSEWIC status: Special Concern); and one bird: the Least Bittern (*Ixobrychus exilis*) (COSEWIC status: Threatened). Other threatened or vulnerable plant species as designated by the *Endangered Species Act*, 2007 (Ontario) and the *Act respecting Threatened or Vulnerable Species* (Quebec) are likewise associated with False Hop Sedge habitats in Canada. The list for Ontario includes Palm Sedge (*Carex muskingumensis*), Frank's Sedge (*Carex frankii*), Narrow-leaved Cattail Sedge (*Carex squarrosa*), Ribbed Sedge (*Carex virescens*), Pumpkin Ash (*Fraxinus profunda*), and Short's Sedge (*Carex shortiana*). The list for Quebec is as follows: Swamp White Oak (*Quercus bicolor*); Lowland Yellow Loosestrife (*Lysimachia hybrida*); Yellow Water Buttercup (*Ranunculus flabellaris*), Small Beggarticks (*Bidens cf. discoidea*), Palegreen Orchid (*Platanthera flava* var. *herbiola*), and Golden Hedgehyssop (*Gratiola aurea*).