COSEWIC
Assessment and Status Report

on the

False Hop Sedge
Carex lupuliformis

in Canada

ENDANGERED
2011

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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COSEWIC
Assessment Summary

Assessment Summary – November 2011

Common name
False Hop Sedge

Scientific name
Carex lupuliformis

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 reintroduction at three sites in Quebec.

Occurrence
Ontario, Quebec

Status history
Designated Threatened in April 1997. Status re-examined and designated Endangered in May 2000 and November 2011.

COSEWIC
Executive Summary

False Hop Sedge
Carex lupuliformis

Wildlife species description and significance

False Hop Sedge (*Carex lupuliformis*) is a perennial sedge that can grow 50 to 130 cm tall. It grows in tufts of 5 to 30 stems from a scaly rhizome. Plants have both male and female flowers. Its small dried fruit (achenes) are three-angled with the angles thickened and bearing prominent knobs. These knobs are the only characteristic that reliably distinguishes False Hop Sedge from Hop Sedge (*Carex lupulina*), which occupies the same habitat.

The species is of no particular horticultural interest and has no known traditional uses. Canadian populations are at the northern limit of the species' range. These peripheral populations may exhibit genetic and morphological divergences from more central populations.

Distribution

False Hop Sedge occurs sporadically throughout eastern North America. In the United States, it occurs from Vermont to Wisconsin, Iowa, Missouri and Oklahoma and south to Florida, Louisiana and Texas. In Canada, it currently occurs only in extreme southern Quebec along the Richelieu and Ottawa rivers and within two counties of southwestern Ontario. Less than 1% of its total range is in Canada. The actual area of habitat occupied by the species is less than 0.01 km^2.

Habitat

False Hop Sedge is associated with a variety of relatively open wetland habitats subject to periodic flooding. In Ontario, known habitats consist mostly of small temporary forest ponds or marshes isolated in swamps. In Quebec, False Hop Sedge occurs exclusively in openings in riverine Silver Maple swamps or at the edges of these swamps. Populations in Quebec are found less than 15 m from streams. In all Canadian populations, the species occurs primarily on sites where there is relatively little competition from other herbaceous species.

Biology

False Hop Sedge generally emerges in May, flowers from June to August and fruits from July to October. The fruits reach maturity between early September and mid-October in Quebec, and as early as late August in Ontario. Seeds are dispersed primarily by water and gravity. The species appears to be shade-intolerant, with light being a limiting factor for both seed germination and plant vigour.

Population sizes and trends

There are currently 10 known natural populations of False Hop Sedge in Canada: seven in Ontario and three in Quebec. Re-establishment work has also been carried out at three historical populations in Quebec. Since the last status report in 1998, four populations have become extirpated, one population which was extirpated has been re-established and four new populations have been discovered. The populations range in size from one to 39 individuals, for a total of 166 mature individuals. Population sizes vary from year to year, but the entire Canadian population has declined since 2005.

Threats and limiting factors

The main threats to False Hop Sedge and its habitat are late or long-term flooding, agricultural drainage (particularly in Ontario), invasion of sites by invasive alien species, such as Reed Canary Grass and Common Buckthorn, the presence of an alien aphid, recreational activities, pollution, residential development (particularly in Ontario), shoreline erosion and the regulation of the water regime. However, the latter two threats only affect Quebec populations. Canopy closure is also a significant limiting factor for the species.

Protection, status, and ranks

False Hop Sedge has a NatureServe global conservation status rank of apparently secure (G4) and national ranks of apparently secure (N4) in the United States and imperilled (N2) in Canada. In Ontario and Quebec, the only two provinces in which the species occurs, it has a rank of critically imperilled (S1). The species was assessed as Endangered in 2000 by COSEWIC and was added to Schedule 1 of Canada's *Species at Risk Act* in 2003. However, no extant Canadian populations are located on federal lands. A recovery strategy is being prepared. The species is designated Threatened in Quebec and Endangered in Ontario. All the Ontario populations receive both species and habitat protection under the *Endangered Species Act*, 2007, of Ontario. In Quebec, a single extant population in an ecological reserve is legally protected.

TECHNICAL SUMMARY

Carex lupuliformis
False Hop Sedge Carex faux-lupulina
Range of occurrence in Canada: Quebec and Ontario

Demographic Information

Generation time *Can sometimes reproduce sexually in the first year and survive for at least seven years. The longevity of the seed bank is unknown*.	7+ years
Is there an observed continuing decline in number of mature individuals? *The number of mature individuals has declined since 2005. Widespread continuing decline in habitat quality is likely to cause future declines*.	Yes
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations	Unknown
Observed percent reduction or increase in total number of mature individuals over the last 10 years, or 3 generations.	Unknown
Projected percent increase in total number of mature individuals over the next 10 years.	N/A
Inferred percent increase in total number of mature individuals over any 10 years, or 3 generations period, over a time period including both the past and the future.	N/A
Are the causes of the decline clearly reversible and understood and ceased?	No
Are there extreme fluctuations in number of mature individuals? *Though the number of mature individuals fluctuates, it is not by more than one order of magnitude*.	No

Extent and Occupancy Information

Estimated extent of occurrence *36,810 km^2 including the three re-established sites.*	20,280 km²
Index of area of occupancy (IAO) *52 km^2 (2x2 km UTM grid) including the three re-established sites. Current area of occupancy < 0.01 km^2.*	40 km^2 (2x2 km)
Is the total population severely fragmented? *Naturally small isolated populations, the majority likely not viable.*	Yes
Number of "locations∗" *8 excluding re-established populations.*	9
Is there an observed continuing decline in extent of occurrence? *The EO decrease was due to the extirpation of the Carillon Island population.*	No
Is there an observed and projected continuing decline in index of area of occupancy? *The index of area of occupancy had decreased during the last 10 years due to the loss of the Amherstburg population. We can assume that this decrease will continue because three populations have five or fewer mature individuals*.	Yes

∗ See definition of location.

Is there an observed continuing decline in number of populations? *Four populations have been extirpated during the last 10 years, four have been discovered and one extirpated site has been successfully reintroduced. There is no reason to believe that these are newly established populations because it is easy to overlook this species. They were likely present but undiscovered at the time of the previous status report*.	Yes
Is there an observed continuing decline in number of locations?	No
Is there an observed continuing decline in quality of habitat?	Yes
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations∗?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	**Number of Mature Individuals**
London	5
Mount Brydges	29
Rodney	1
West Lorne	20
West Elgin	39 (63)
Ailsa Craig	19
Lambeth	Unknown
Lacolle	2
Marcel-Raymond Ecological Reserve	8
McGillivray Bay	9
Saint-Blaise-sur-Richelieu (restoration site)	34
Grande Baie d'Oka (restoration site)	(22)
Sainte-Anne-de-Sabrevois (restoration site)	(9)
Total: brackets indicate transplants that are not considered mature individuals. > 260 including transplants	>166

Quantitative Analysis

Probability of extinction in the wild	Not done

Threats (actual or imminent, to populations or habitats)

Anthropogenic drainage, invasive alien species, recreational and landowner activities, garbage deposition, water regime regulation, and residential and urban development. It is limited by late or long-term flooding, closure of vegetation, and bank erosion.

Rescue Effect (immigration from outside Canada)

Status of outside population(s) *It is apparently secure globally (G4) and apparently secure (N4) in the United States. It is ranked critically imperilled (S1) in Massachusetts, New Jersey, North Carolina, Pennsylvania, Texas and Wisconsin; imperilled (S2) in Delaware, Indiana, Maryland, Michigan, New York, Ohio, Vermont, Virginia and West Virginia; critically imperilled to imperilled (S1S2) in Arkansas; vulnerable (S3) in Connecticut and Illinois; imperilled to vulnerable (S2S3) in Tennessee; apparently secure (S4) in Mississippi; apparently secure to secure (S4S5) in Kentucky and historical (SH) in Iowa. It is not ranked (SNR) in Florida, Louisiana, Maine, Minnesota, Missouri, Oklahoma, Georgia or South Carolina.*

∗ See definition of location.

Is immigration known or possible?	Possible but unknown
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely? *False Hop Sedge is scarce in neighbouring states, making immigration less likely.*	Yes, but low probability

Current Status

COSEWIC: Endangered (November 2011)

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Endangered	B2ab(ii,iii,iv,v); C2a(i); D1
Reasons 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 reintroduction at three sites in Quebec.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. The degree of declines is not documented. Several sites do not have trend data.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Endangered B2ab(ii,iii,iv,v) as the IAO is <500 km², the populations are considered to be severely fragmented, as the persistence of more than half the sites is in doubt, and there is a continuing decline in the IAO, area and quality of habitat, the number of populations and the number of mature individuals.
Criterion C (Small and Declining Number of Mature Individuals): Meets Endangered C2a(i) as there are <2500 mature individuals, the populations continue to decline and no population is known to have >250 mature individuals.
Criterion D (Very Small or Restricted Total Population): Meets Endangered D1 as there are fewer than 250 mature individuals when one excludes transplants that haven't produced viable progeny.
Criterion E (Quantitative Analysis): Not done.

PREFACE

Since the 2000 assessment of False Hop Sedge (COSEWIC 2000), four populations that were considered to be extant have apparently been extirpated, one extirpated population has been successfully introduced and four new populations have been discovered. There is no reason to believe that these are newly established populations. They were likely present but undiscovered at the time of the previous status report. Population sizes fluctuate from year to year, but the entire Canadian population size has recorded a decline since 2005. The species' extent of occurrence has declined by about 10,000 km^2 since the last report, primarily owing to the extirpation of the populations in the Ottawa River in Quebec. However, three populations have been re-established in Quebec (from seeds of Canadian populations). When these three re-established sites are factored in, the extent has increased by about 6,190 km^2. The species' index of area of occupancy has also declined during the last ten years. The area of potential habitats has remained relatively stable in both provinces since 1998. However, the quality of the habitats is in constant decline due mainly to the spread of exotic species. Finally, the presence of an alien aphid has emerged as a possible threat to all populations.

COSEWIC HISTORY

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

COSEWIC MANDATE

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

COSEWIC MEMBERSHIP

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

DEFINITIONS
(2011)

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

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

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

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

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and classification

Scientific name:	*Carex lupuliformis* Sartwell ex Dewey
Basionym:	*Carex lupulina* Muhlenberg ex Willdenow var. *polystachia* Schweinitz & Torrey
English common names:	False Hop Sedge, Hop-like Sedge, Knobbed Hop Sedge
French common names:	Carex faux-lupulina, Carex lupuliforme
Family:	Cyperaceae
Major plant group:	Monocot flowering plant

False Hop Sedge is a member of section Lupulinae Tuckerman ex J. Carey of the genus *Carex* (Reznicek 2002). This section also includes Hop Sedge (*C. lupulina* Willdenow), Bladder Sedge (*C. intumescens* Rudge), Gray's Sedge (*C. grayi* J. Carey), Louisiana Sedge (*C. louisianica* L. H. Bailey), and Giant Sedge (*C. gigantea* Rudge). The last two species do not occur in Canada. No infraspecific taxa have been described for False Hop Sedge in Canada.

False Hop Sedge and Hop Sedge are thought to be closely related, and it is possible that False Hop Sedge is an aneuploid derivative of Hop Sedge (Ostlie 1990). However, there is insufficient research on these species to support strong phylogenetic relationships. Despite the resemblance between the two species, almost all botanists agree on the species' status of False Hop Sedge (Reznicek and Ball 1974; Ostlie 1990; Reznicek 2002). Among recent publications, only Boivin (1992) expresses a preference for varietal status due to the strong morphological resemblance with *C. lupulina*.

Some specimens appear to be hybrids between *C. lupuliformis* and *C. retrorsa* or with other members of the Lupulinae section and especially *C. lupulina* (Reznicek and Ford 2002; Hill 2006). However, it is not clear whether the specimens are truly hybrids or an artifact of a dipteran parasite (see **Herbivory and Interspecific interactions** section) that cause a distortion of the form and the colour of the achene (Reznicek and Ball 1974; Ostlie 1990; Thompson and Paris 2004; Hill 2006). Nevertheless, intermediates between *C. lupuliformis* and *C. retrorsa* are likely rare (B.A. Ford. pers. comm. 2010).

Morphological description

False Hop Sedge is a cespitose perennial that can grow 50 to 130 cm tall (Figures 1 and 2). It grows in tufts, typically consisting of 5 to 30 erect stems arising from a dark, scaly sympodial rhizome. The inflorescence is 6 to 40 cm long and consists of male (staminate) and female (pistillate) flowers (Figures 1 and 3). The one or two staminate spikes per stem are on a 1- to 12-cm peduncle. Fruits are achenes (small, dry, seed-like fruits with a thin wall that do not open at maturity), which are more or less stipitate, with concave faces, and are trigonous, with angles that are thickened internally and bear prominent nipple-like knobs (Figures 1 and 4).

Figure 1. Morphology of *Carex lupuliformis*. Illustration by R. Roy, reproduced with permission of the Ministère du Développement durable, de l'Environnement et des Parcs du Québec; fruiting stem; pistillate spike (left) and achene (right).

Figure 2. One clump of *Carex lupuliformis*. Photo: Jacinthe Letendre.

Figure 3. *Carex lupuliformis* inflorescence. Photo: Jacinthe Letendre.

Additional morphological descriptions can be found in Reznicek and Ball (1974), COSEWIC (2000), and Reznicek (2002).

False Hop Sedge and Hop Sedge are frequently misidentified, because the two species are virtually identical during the vegetative stage and often occupy the same habitats. A number of characters have been used to differentiate these two species; however, with one exception, they tend to be variable depending on environmental conditions. False Hop Sedge tends to be somewhat larger than Hop Sedge where they co-occur and False Hop Sedge often has larger, darker leaves (Figure 5). These distinctions may, however, be due to Hop Sedge growing in shadier micro-habitats than False Hop Sedge. In greenhouses, these differences have not been observed (Letendre and Pellerin pers. obs.). It is impossible to distinguish between the two species solely on the basis of vegetative characters. Two main features can be used to distinguish mature specimens: False Hop Sedge has visibly prominent knobs on the angles of its achenes (Figure 4), and its spikes are longer and less crowded than those of Hop Sedge. However, the latter feature only applies to healthy specimens and seems to be associated with the fact that in Hop Sedge, the perigynia are often more or less appressed to the axis of the inflorescence, forming an angle of 45° or less with it, whereas in False Hop Sedge, the perigynia are more divergent, forming an angle greater than 45°. It is therefore essential to examine the achenes in order to reliably differentiate these two species.

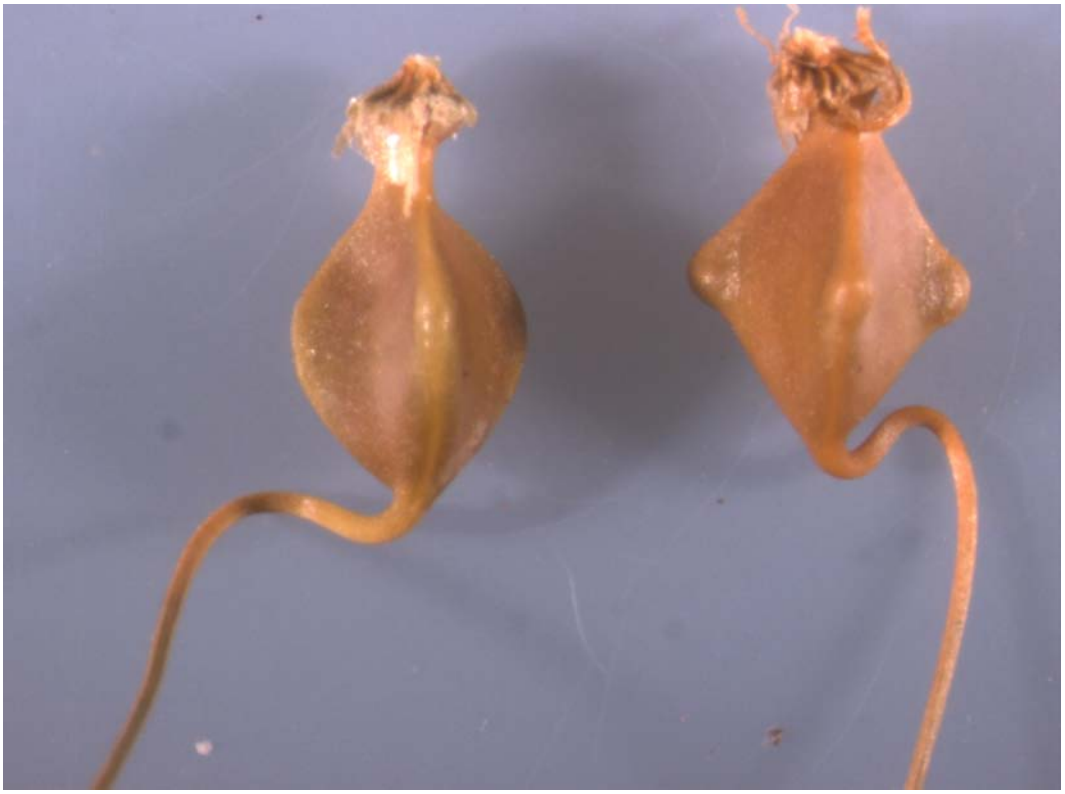

Figure 4. *Carex lupulina* (left) and *Carex lupuliformis* (right) achene. Photo: Stéphanie Pellerin.

Figure 5. Leaves of *Carex lupuliformis* (top) and *Carex lupulina* (bottom). Photo: Courtesy of Jacques Labrecque, with permission.

Population spatial structure and variability

The genetic structure of False Hop Sedge populations has not been studied in Canada or the United States. Only one chromosome count is available, 2*n* = 60, for a specimen collected in Saint-Paul-de-l'île-aux-Noix in 1972 (Reznicek and Ball 1974). The same article reported a chromosome number of 2*n* = 56 for Hop Sedge, whereas Wahl (1940) obtained a count of 2*n* = 60 for that species.

Genetic exchange between the Ontario and Quebec populations is unlikely. Habitats suitable for the establishment of the species exist between the two regions, but False Hop Sedge seeds disperse mainly in water, and there is no direct hydrological link between the populations in the two provinces. Although some populations are located in the same watershed in Ontario, there is also no direct hydrological link among the habitats of the Ontario populations (Environment Canada 2009). However, genetic exchange may occur among the Richelieu River populations in Quebec, because they are all located on a segment of the river less than 20 km long. Genetic exchange may also be possible between the Quebec and United Status populations. The Lacolle

population is located only a few metres from the U.S. border and the adjacent U.S. habitats are suitable for the species (Pellerin and Letendre pers. obs.). The species is also present near Lake Champlain (in the states of New York and Vermont) upstream of the Richelieu River (Thompson and Paris 2004; New York Natural Heritage Program 2009). However, False Hop Sedge is scarce in neighbouring states, making immigration less likely. There are no data to suggest that exchange between the U.S. and Ontario populations is possible.

Designatable units

There is only one designatable unit of False Hop Sedge in Canada as all populations are located in the COSEWIC Great Lakes Plains Ecological Area. There are no known morphological or genetic differences between the Quebec and Ontario populations, although genetic exchange between the two regions is unlikely.

Special significance

False Hop Sedge is of no horticultural interest and has no known Aboriginal or traditional uses (G. Goulet pers. comm. 2009). Canadian populations are at the northern limit of the species' range and might therefore be expected to exhibit genetic and morphological divergences from more central populations, particularly the Ontario populations, which appear to be genetically isolated.

DISTRIBUTION

Global range

False Hop Sedge occurs sporadically throughout eastern North America (Figure 6; Ball and White 1982; Argus and Pryer 1990; Reznicek 2002; NatureServe 2009). In the United States, it is present from Vermont to Wisconsin, Iowa, Missouri and Oklahoma, and south to Florida, Louisiana and Texas (Reznicek 2002). It has been reported in 1912 from Maine (Norton 1912), but the specimen has never been reviewed (Thompson and Paris 2004). Erroneous reports exist for Kansas (NatureServe 2009), while Georgia reports a potential presence of the species (R.F.C. Naczi pers. comm. 2010). In Canada, False Hop Sedge occurs only in southernmost Quebec and Ontario (Figures 7 and 8). The species is considered rare or uncommon throughout its range, particularly northward (Reznicek 2002; NatureServe 2009).

Figure 6. Global range of *Carex lupuliformis*. Map by Y. Lachance, reproduced with permission of the Ministère du Développement durable, de l'Environnement et des Parcs du Québec.

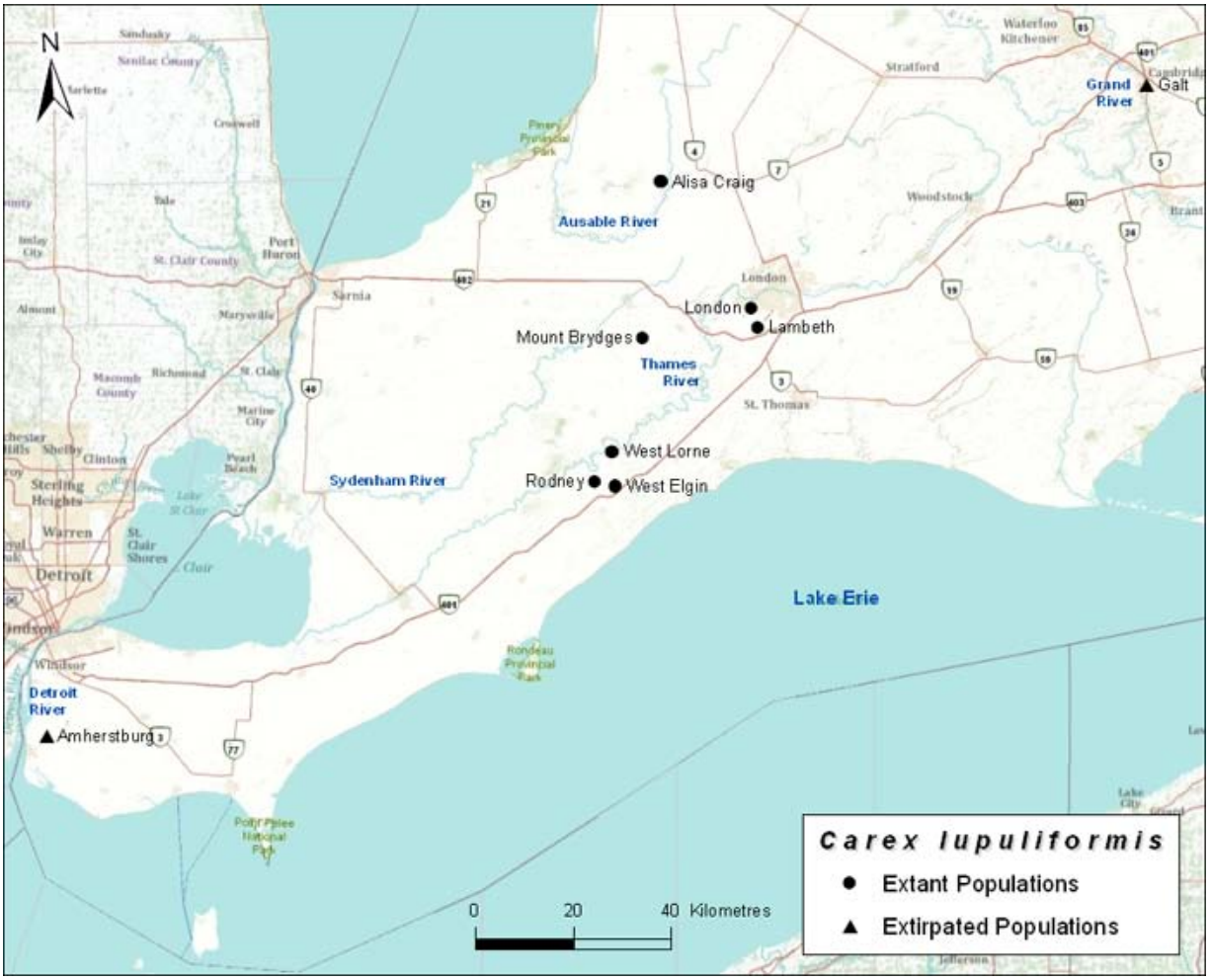

Figure 7. Range of *Carex lupuliformis* in Ontario.

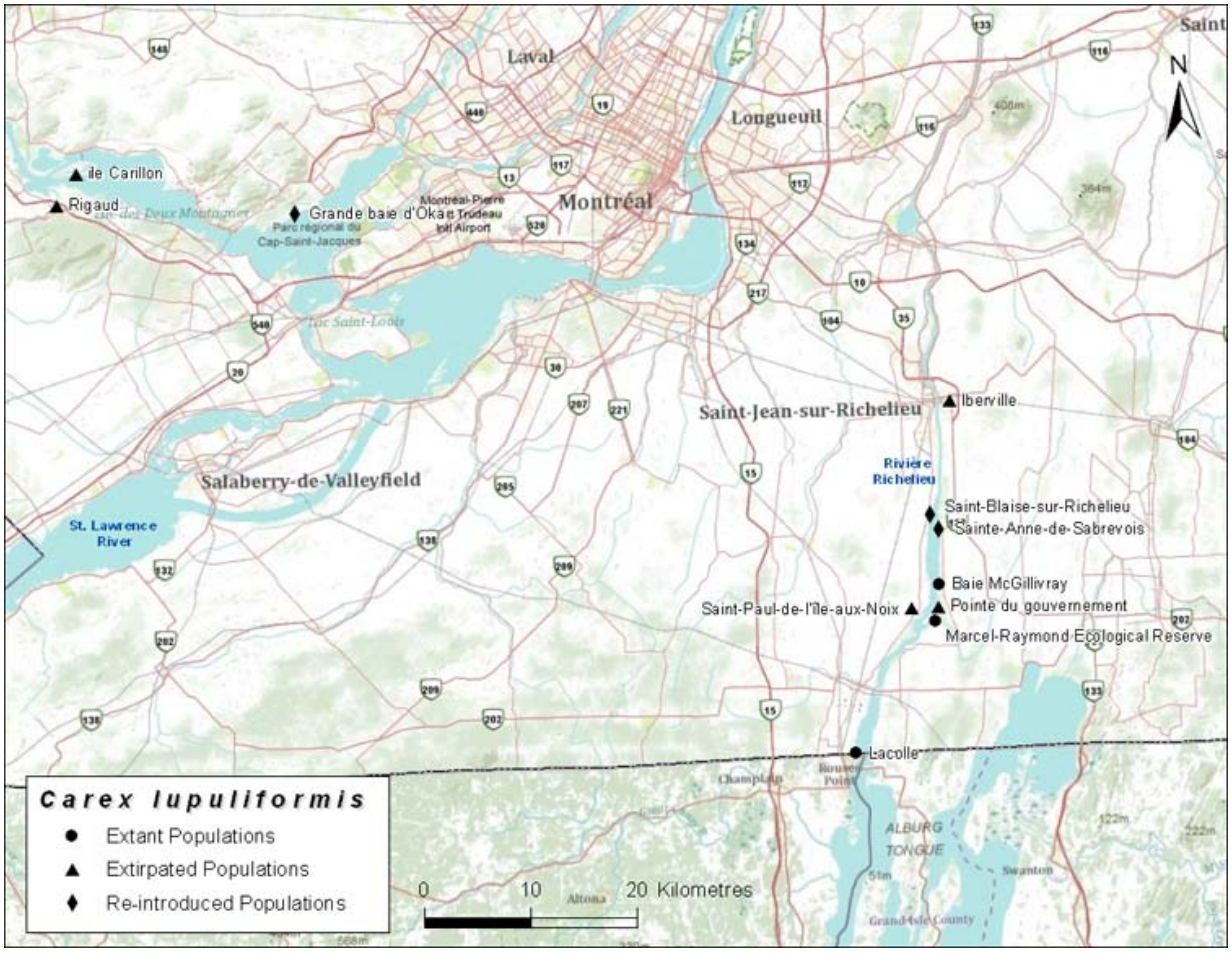

Figure 8. Range of *Carex lupuliformis* in Quebec.

Canadian range

A total of 20 natural populations (separation distance of >1 km) have been documented in Canada (Table 1). Since the last status report, (COSEWIC 2000), four populations considered to be extant have become extirpated, one extirpated population has been reintroduced and four new populations have been discovered. In 2009, there were ten populations considered naturally extant (seven in Ontario and three in Quebec) as well as three populations re-established, all in Quebec (see **Physiology and adaptability** for details on the re-establishment). False Hop Sedge populations in southernmost Quebec and Ontario represent the northern extent of its range (Figures 7 and 8). The Canadian range of False Hop Sedge accounts for less than 1% of its global range. From the 13 extant populations in Canada, 9 locations are recognized using the COSEWIC / IUCN location concept (see **THREATS AND LIMITING FACTORS** for details).

Table 1. Status of natural Canadian populations of False Hop Sedge (*Carex lupuliformis*).

ID[1]	Populations	Province	County or RCM[2]	Status	First record / Last record
5805	Rodney	Ontario	Elgin	Extant	1993 / 2009
92901	West Elgin	Ontario	Elgin	Extant	2005 / 2009
5802	West Lorne	Ontario	Elgin	Extant	1993 / 2009
2938	Amherstburg	Ontario	Essex	Extirpated	1985 / 1985
	Lambeth	Ontario	Middlesex	Extant	2009 / 2009
5804	London	Ontario	Middlesex	Extant	1992 / 2009
5803	Mount Brydges	Ontario	Middlesex	Extant	1994 / 2009
	Ailsa Craig	Ontario	Middlesex	Extant	2009 / 2009
2937	Galt	Ontario	Waterloo	Extirpated	1902 / 1902
6875	Carillon Island	Quebec	Argenteuil	Extirpated	1992 / 1992
6867	Grande Baie d'Oka	Quebec	Deux-Montagnes	In restoration[3]	1935 / 1992
6876	McGillivray Bay	Quebec	Haut-Richelieu	Extant	1994 / 2010
6869	Iberville	Quebec	Haut-Richelieu	Extirpated	1938 / 1938
15349	Lacolle	Quebec	Haut-Richelieu	Extant	2005 / 2009
10119	Pointe du Gouvernement	Quebec	Haut-Richelieu	Extirpated	1992 / 1992
6874	Marcel-Raymond Ecological Reserve	Quebec	Haut-Richelieu	Extant	1992 / 2011
6872	Sainte-Anne-de-Sabrevois(extirpated)	Quebec	Haut-Richelieu	In restoration[3]	1938 / 1938
6873	Saint-Blaise-sur-Richelieu	Quebec	Haut-Richelieu	In restoration[3]	1992 / 2011
6871	Saint-Paul-de-l'île-aux-Noix	Quebec	Haut-Richelieu	Extirpated	1950s / 1972
6868	Rigaud	Quebec	Vaudreuil-Soulanges	Extirpated	1934 / 1934

[1]Occurrence number according to the Ontario and Quebec Nature Heritage Centre; [2]Regional county municipality; [3]Original natural populations are considered extirpated.

Extent of occurrence and index of area of occupancy

The species' extent of occurrence (EO) in Canada is about 20,280 km^2 (~36,810 km^2 including the three re-established sites). This area has declined by about 10,240 km^2 since the last report, primarily owing to the extirpation of the populations in the Ottawa River sector in Quebec. When the three re-established sites are factored in, the EO has increased by 6,190 km^2.

The index of area of occupancy (IAO) for False Hop Sedge is 40 km^2 based on a 2 km x 2 km UTM grid (52 km^2 including the three re-established sites). The species' current area of occupancy is less than 0.01 km^2. Since the last status report, the species' IAO has declined by 4 km^2 based on a 2 km x 2 km UTM grid. When the three restoration sites are factored in, the IAO has increased by 8 km^2.

Search effort

False Hop Sedge was first reported in 1902 in the area of Galt, Ontario. It was not until 1985 that a second Ontario population was discovered, near Amherstburg (Essex County). These two populations were never reconfirmed, although botanists familiar with the species (e.g., Anton Reznicek, Craig Campbell, Michael Oldham, Nicole Lavoie) searched suitable habitats in the areas of those populations on several occasions. Note that the Galt area is now largely encompassed within the City of Cambridge and that the entire area has been considerably developed and altered since 1902. Four new populations were discovered in the 1990s: two in Middlesex County (London and Mount Brydges) and two in Elgin County (West Lorne and Rodney) (COSEWIC 2000). Since the last status report COSEWIC (2000) one population (West Elgin) was discovered in 2005 in Elgin County (Nault 2006), and two more (Ailsa Craig

and Lambeth) were discovered in Middlesex County in 2009 (MacIntyre and Oldham pers. comm. 2009). However, because the two recent discoveries occur on private land, the size of the populations could not be verified for this report. Specimens of both populations were, however, confirmed by M. Oldham from the Ontario Natural Heritage Information Centre.

In Quebec, the first specimens were collected in the 1930s along the Ottawa River (Rigaud), the Lac des Deux-Montagnes (Grande Baie d'Oka) and the Richelieu River (Iberville and Sainte-Anne-de-Sabrevois). These four populations are now considered extirpated, as is the population discovered in 1970 in Saint-Paul-de-l'Île-aux-Noix on the Richelieu River. During the 1990s and 2000s, six new populations were discovered. Three of them—Carillon Island (Ottawa River), Saint-Blaise-sur-Richelieu (Richelieu River) and Pointe du Gouvernement (Richelieu River)—could not be reconfirmed in recent years, despite intensive search efforts. The three remaining populations are located along a 20 km segment of the Richelieu River, in the municipalities of Henryville (McGillivray Bay and Marcel Raymond Ecological Reserve) and Lacolle. There are three other records for Quebec (Perrot Island and Huntington near Montréal, and Grondines near Quebec City), but the reference specimens were later identified as Hop Sedge. Conversely, a specimen identified as Hop Sedge that was collected in 1992 in Oka Provincial Park (near the Grande Baie d'Oka population, last reported in 1935) was recently re-identified as False Hop Sedge by S. Pellerin, with confirmation by A.A. Reznicek and J. Labrecque. For more information on the historical search effort see COSEWIC (2000).

HABITAT

Habitat requirements

Throughout its range, False Hop Sedge is associated with a variety of relatively open wetlands subject to periodic flooding (COSEWIC 2000; Thompson and Paris 2004; Hill 2006). In Quebec, it occurs in maple–hickory forest (Upper St. Lawrence Plain), while in Ontario, it occurs in the Carolinian forest zone (Great Lakes Plain). Because the species is relatively shade-intolerant, it is primarily found at the edges of riverine swamps or in openings around small temporary forest ponds (Reznicek 2002; Thompson and Paris 2004). The species grows mainly in high-pH, poorly drained, loamy soils, although the substrate at certain U.S. sites is clearly acidic (Searcy *et al.* 2003; Thompson and Paris 2004).

The Ontario populations of False Hop Sedge are found primarily in vernal pools that flood in the spring or in small ponds and also in marshes isolated in swamps (COSEWIC 2000; Nault 2006). These pools are primarily located in stands of Red Ash (*Fraxinus pennsylvanica*), Red Maple (*Acer rubrum*) or Silver Maple (*Acer saccharinum*). These sites are not near natural flowing watercourses. The species is usually found in areas with little competition from herbaceous vegetation. The soil is generally a clay loam (COSEWIC 2000). The main associated herbaceous species are

False Nettle (*Boehmeria cylindrica*), Rice Cutgrass (*Leersia oryzoides*), Hop Sedge, Dwarf Clearweed (*Pilea pumila*), beggarticks (*Biden*s spp.), smartweed (*Polygonum* spp.), Rough Cocklebur (*Xanthium strumarium*) and Reed Canary Grass (*Phalaris arundinacea*).

In Quebec, False Hop Sedge occurs exclusively in openings of riverine Silver Maple swamps or at the edges of these swamps (Jolicoeur and Couillard 2006). All three Quebec natural populations occur near water (within 15 m) during low water and in small bays sheltered from currents, where the land is flat or gently sloping. False Hop Sedge grows mainly in areas of open herbaceous and shrubby vegetation. The substrate for the Quebec populations consists of recent alluvium, ranging from sandy loam to clay loam (COSEWIC 2000). The pH of the surface soils around the plants ranges from 5 to 6.1, and the organic matter content ranges from 5% to 11% (Pichon 2009). The main associated herbaceous species are Reed Canary Grass, False Nettle, Rice Cutgrass, Water-parsnip (*Sium suave*), Prairie Cordgrass (*Spartina pectinata*) and Hop Sedge (Jolicoeur and Couillard 2006).

The role of disturbance in habitat maintenance has yet to be determined. COSEWIC (2000) suggests that bank erosion caused by ice is indispensable at the Quebec sites for maintaining a transition zone in which vegetation remains sparse. Fire, logging and even insect infestations also seem to have a temporary positive effect on the species, because they help open the tree canopy (COSEWIC 2000; Thompson and Paris 2004; Hill 2006).

Habitat trends

The area of potential habitat has remained relatively stable in both provinces since the last status report in 1998. In Quebec, Bill 28, a bill that defines the boundaries of the waters in the domain of the State and protecting wetlands along part of the Richelieu River, should ensure that the area and, to a certain degree, the quality of habitats in the region remain stable in the future. In both provinces, the quality of the habitats is in constant decline due to invasion by exotic species, such as Common Buckthorn (*Rhamnus cathartica*) and Reed Canary Grass. Urban and mostly agricultural drainage at Ontario sites and the pollution of the Richelieu River by garbage and trash in Quebec also continuously degrade the quality of False Hop Sedge habitats.

BIOLOGY

There are few published data on the biology of False Hop Sedge. Most of the information presented in the following sections comes from Bachand-Lavallée and Pellerin (2006), Letendre *et al.* (2007, 2008), Dupin (2008), Pichon (2009) and Genest (2009), which were published as part of a Quebec project aimed at restoring historical populations, increasing population sizes and monitoring extant populations. This project is supervised by S. Pellerin from the Montréal Botanical Garden. Unless otherwise specified, the information presented below comes from these sources. The other main sources of information are the previous status report (COSEWIC 2000), publications on other species of *Carex* and communications with botanists familiar with the species.

Life cycle and reproduction

False Hop Sedge can reproduce by either seed or rhizome. However, vegetative reproduction appears to be relatively uncommon in Quebec (Jolicoeur and Couillard 2006). The germination period in nature is unknown, but is likely in the spring. Little is known of the species' specific germination requirements, but as with most species of the genus, the achenes have difficulty germinating in the shade (Schütz 2000). In greenhouses, burying the achenes with more than 2–3 mm of soil prevents germination. Disturbance of the upper soil layers therefore appears to be essential to recruitment from the seed bank (Thompson and Paris 2004). In Quebec, plants begin to emerge in late May before all water has drained from the sites. Throughout its range, flowering occurs from late June to late October (Ostlie 1990). In Quebec, flowering occurs from mid-June to early August. As with most species of this genus, the flowers are probably wind-pollinated. Fruiting occurs shortly after flowering and in Canada takes place from July to October (COSEWIC 2000). The fruits reach maturity between early September and mid-October in Quebec, and in late August in Ontario (MacIntyre pers. comm. 2009). In Quebec, fruit dispersal begins in mid-September (COSEWIC 2000; Heiniger 2007).

It is not known how long the achenes of False Hop Sedge remain viable, but in some species of the genus *Carex*, they can persist in soil for very long periods of time (Schütz 2000; Nariyasu *et al.* 2001). The viability of the achenes is apparently high throughout the species' range, and is in no way a limiting factor for recruitment (Hill 2006).

Because False Hop Sedge reproduces sexually and vegetatively, it is difficult to establish the generation time. Individuals can reproduce in their first year and can persist for several years. In Quebec populations, where each individual is permanently marked using a metal stake, a number of individuals have been established for at least six years.

Physiology and adaptability

False Hop Sedge is the most aquatic species of the section Lupulinae (Reznicek and Ball 1974) and periodic flooding of its habitat appears to be essential to its survival (COSEWIC 2000; Thompson and Paris 2004; Hill 2006). However, flooding that occurs during flowering or at the start of fruiting and that extends over a long period can cause the flowering and fruiting stems to rot (Letendre pers. obs.). The species shows a dependency on open or semi-open areas (COSEWIC 2000; Thompson and Paris 2004; Hill 2006) and light appears to be a limiting factor for both achene germination and plant vigour. In this respect, False Hop Sedge differs from Hop Sedge in that the latter appears to be much more shade tolerant and is often found in the understory (COSEWIC 2000). The opposite phenomenon has been observed in a number of sites occurring in more southern parts of its range, where False Hop Sedge occupies more shaded habitats than Hop Sedge (Cusick 1996). The requirements relating to light and flooding suggest that periodic, short-duration flooding is a critical factor in reducing competing vegetation (COSEWIC 2000; Thompson and Paris 2004). According to some authors, False Hop Sedge tends to be a calciphile, although the substrates of a number of U.S. sites are clearly acidic (Ostlie 1990; Searcy *et al.* 2003; Thompson and Paris 2004).

False Hop Sedge appears to be sensitive to habitat alteration, particularly canopy opening or closure (COSEWIC 2000). Openings created by logging or fire are believed to promote the establishment of large populations (COSEWIC 2000; Thompson and Paris 2004; Schimp 2005; Hill 2006; NatureServe 2009). This phenomenon is undoubtedly of short duration, disappearing with the regrowth of the vegetation. In Quebec, several individuals were observed to colonize a former lighthouse easement (COSEWIC 2000) and to then disappear completely following invasion of the site by herbaceous plants (Letendre *et al.* 2008). The phenomenon was also observed in the Mount Brydges population, where logging in 2002 created openings in the environment, resulting in a huge increase in the population size (from 25-30 plants in 1992 to 1,075 in 2003). The canopy at Mount Brydges is currently closing, which could partly explain the decline in numbers between 2005 and 2009 (back down to 29 plants). False Hop Sedge is well adapted to periodic flooding and to water saturation of the substrate. Alteration of the normal flood cycle through the modification or regulation of water levels following drainage or dam construction could therefore adversely affect the species (COSEWIC 2000; Jolicoeur and Couillard 2006). So False Hop Sedge has some ability to naturally disappear from some areas and colonize habitats newly made available through disturbance.

False Hop Sedge is believed to be relatively unaffected by organic pollution (Ostlie 1990), but sensitive to chemical fertilizers from runoff from adjacent cropland (Schimp 2005).

In the fall of 2005, 400 achenes from all known Canadian populations were cultivated in the greenhouses of the Montréal Biodome by Andrée Nault. The germination rates obtained at the end of spring 2006 ranged from 6% (London) to 54% (West Elgin, Lacolle). In a number of subsequent trials carried out using seeds collected from Quebec populations or from plants cultivated at the Montréal Botanical Garden, germination rates were generally above 70%. Achene viability does therefore not appear to be a limiting factor for this species. Since 2006, several reintroductions have been carried out in Quebec and Ontario (Table 2). Ontario-sourced plants were used to supplement Ontario populations while Quebec sourced plants were used to re-establish and supplement Quebec populations. In Ontario, reintroduced plants have not been systematically marked due to difficulty in obtaining permission to access the land. As a result, it is very difficult to differentiate natural plants from reintroduced plants. In Quebec, all reintroduced plants have been permanently marked using a metal stake and identification number. In 2010, the survival rates of transplants in Quebec ranged from 17 to 82% depending on the site, and the percentage of transplants producing seeds ranged from 15 to 60%. A number of transplants produced seeds the year following their introduction. It is thus impossible to know whether the new plants that were found come from the seeds of natural plants or reintroduced plants. Some populations have reintroduced individuals that have produced viable offspring and thus were considered in the calculation of mature individuals (Table 3).

Table 2. Number of reintroduced plants per year in Canadian populations of *Carex lupuliformis,* and number of living transplants in 2010 for Quebec populations (data unavailable for Ontario).

Populations	Year of introduction	Number of reintroduced plants	Number of living transplants in 2010
Rodney	2006	96	
Rodney	2007	4	
West Elgin	2006	112	
West Lorne	2006	106	
London	2006	17	
London	2009	10	
Mount Brydges	2006	24	
Mount Brydges	2009	1	
Grande Baie d'Oka	2008	27	22
Grande Baie d'Oka	2010[1]	60	
McGillivray Bay	2006	64	9
McGillivray Bay	2008	81	15
Marcel-Raymond Ecological Reserve	2006	64	8
Marcel-Raymond Ecological Reserve	2007	60	17
Sainte-Anne-de-Sabrevois	2006	64	13
Saint-Blaise-sur-Richelieu	2006	65	4
Saint-Blaise-sur-Richelieu	2007	55	7
Saint-Blaise-sur-Richelieu	2009	60	60

[1] Reintroduced plants are not counted until the year following planting

Table 3. Size of Canadian populations of *Carex lupuliformis*.

Populations	Year	Natural plants (fruiting stems)	Transplants[1] (fruiting stems)
Ontario Populations			
Rodney	1993	±93	
	2002	2	
	2005	26	
	2009	1 (2)	
West Elgin	2005	? (±150)	
	2009	39 (132)	63 (91)
West Lorne	1993	±100	
	2005	63	
	2009	20 (59)	
Amherstburg	1985	±100	
	2002-5-9	0	
Lambeth	2009	unknown	
London	1992	12 (±150)	
	2002	>12	
	2005	28	
	2009	5 (4)	
Mount Brydges	1992	25–30	
	2005	1075	
	2009	29 (43)	
Ailsa Craig	2009	19	
Galt	1902	Herbarium (CAN)	
Quebec Populations			
Carillon Island (Ottawa River)	1992	2–10	
	2001-2-6-7	0	
Grande Baie d'Oka	1935	Herbarium (MT)	
(Lac des Deux-Montagnes)	1992	Herbarium (MT)	
	2006-7-8	0	
	2009	0	22 (1)
	2010	0	22 (121)
McGillivray Bay (both natural and	1994	5	
introduced plants are considered to	2001	25	
be mature individuals by definition)	2003	18	
(Richelieu River)	2005	>10	
	2007	9 (?)	50 (16)
	2008	12 (41)	16 (21)
	2009	6 (22)	26 (66)
	2010	4 (3)	24 (7)
	2011	1 (3)	8 (0)
Iberville (Richelieu River)	1938	Herbarium	
	1992	0	
Lacolle (Richelieu River)	2005-7	7	
	2007	1	
	2008	1 (2)	
	2009	2 (1)	
Pointe du Gouvernement (Richelieu	1992	3	
River)	2004-5-7-9	0	

Populations	Year	Natural plants (fruiting stems)	Transplants[1] (fruiting stems)
Marcel-Raymond Ecological Reserve (both natural and introduced plants are considered to be mature individuals by definition) (Richelieu River)	1991	?	
	1992	±10	
	1997	19	
	2000	19	
	2004	3	
	2005	24	
	2006	18 (27)	
	2007	17 (33)	25 (1)
	2008	20 (178)	54 (1)
	2009	26 (175)	46 (44)
	2010	22 (148)	26 (55)
	2011	3 (0)	5 (0)
Sainte-Anne-de-Sabrevois (Richelieu River)	1938	Herbarium (MT)	
	1992	0	
	2007		61 (120)
	2008		19 (6)
	2009		15 (17)
	2010		13 (20)
	2011		9
Saint-Blaise-sur-Richelieu (both natural and introduced plants are considered to be mature individuals by definition) (Richelieu River)	1950s	-	
	1978	-	
	1992	5	
	2004-5	0	
	2007	0	10 (24)
	2008	0	33 (99)
	2009	0	18 (88)
	2010	1 (2)	71 (102)
	2011	1 (1)	33 (0)
Saint-Paul-de-l'Île-aux-Noix (Richelieu River)	1972	Herbarium (MICH)	
	1992	0	
Rigaud (Ottawa River)	1934	Herbarium (MT)	
	2007	0	

[1] Reintroduced plants are not counted until the year following planting. Only clearly identified transplants are indicated in this column.

Dispersal and migration

Dispersal of False Hop Sedge seeds is by gravity, water and, to a lesser extent birds, particularly waterfowl (COSEWIC 2000; Thompson and Paris 2004). The perigynia are persistent, which enables the fruits to float and to be dispersed over relatively large distances during flooding (Reznicek and Ball 1974; COSEWIC 2000; Heiniger 2007).

The potential for a rescue effect between extant Quebec and Ontario populations and between various Ontario populations is very low (see **Population spatial structure and variability**). Conversely, exchanges likely occur between Quebec populations and between Quebec and U.S. populations (see **Population spatial structure and variability**). Most localities are small and isolated from one another with little probability of exchanges, particularly in Ontario. The Canadian population as a whole is likely severely fragmented as defined by COSEWIC, because the sizes of most of the habitat patches are not large enough to sustain viable populations (fewer than 10 mature individuals).

Herbivory and interspecific interactions

Several species of *Carex* are eaten by animals, which could be a significant cause of mortality in some species (Bernard 1989). In Quebec, signs of grazing, probably by waterfowl, have been sporadically observed. The seeds of several species of *Carex* are rich in nutrients and are occasionally eaten by waterfowl (Mueller and van der Valk 2002). The effect of predation on the population dynamics of False Hop Sedge is unknown, but is likely insignificant.

False Hop Sedge, like other members of the section Lupulinae, is a host of a dipteran parasite. The larvae of this parasite develop inside the achenes, distorting their shape to a longer, more ovoid configuration. The shape and position of the perigynia are also altered. These distortions are believed to have resulted in misidentifications, the specimens in question being considered hybrids of False Hop Sedge and Hop Sedge or other species (Reznicek and Ball 1974; Ostlie 1990; Thompson and Paris 2004). The presence of distorted achenes has been observed at all Canadian sites (COSEWIC 2000; Nault 2006), but it is unknown how common this phenomenon is. The effect of parasitism on the long-term reproduction of False Hop Sedge is also unknown.

A sawfly of the family Tenthredinidae, subfamily Nematinae, genus *Pachynematus* (*Pachynematus corniger* Norton complex; identification H. Goulet, Agriculture and Agri-Food Canada) has been observed feeding on the leaves of False Hop Sedge in Quebec. This sawfly feeds on the tips of the leaves, cutting them on an angle. When it feeds on both sides of leaves, they form a point. The sawfly was identified after it was reared *ex situ* (Montréal Insectarium) to the adult stage. 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.

An exotic aphid (*Ceruraphis eriophori* Walker; identification R.G. Footit, Agriculture and Agri-Food Canada) has been observed on several individuals of the species in Quebec and possibly Ontario (identification of the specimen in progress). This aphid often hides between the leaves at the base of the stems. It is believed to have been introduced to North America from the European portion of the Palearctic region. Its life cycle involves a winter host (*Viburnum*) and a summer host (primarily *Carex*, *Cyperus*, *Eriophorum*, *Luzula*, *Typha*). It is not considered to be a rare species in nature (Footit pers. comm. 2008), although few records have been reported. This aphid could have a significant impact on the long-term survival of False Hop Sedge. The observation of its presence appears to coincide with the premature drying and mortality in 2007 of a large proportion of the plants reintroduced in 2006 in Quebec. Infestations of this aphid vary considerably from year to year depending on climate and hydrological conditions, which is very common in aphid infestations (Brodeur pers. comm. 2008). To date, this species has not been observed in U.S. populations; however, there have been no search efforts there (Reznicek pers. comm. 2009).

POPULATION SIZES AND TRENDS

Sampling effort and methods

False Hop Sedge can easily be confused with other species of the same genus, particularly Hop Sedge, which occupies the same habitats. Searches were therefore made during the period when the two species are fully mature, facilitating the observation of projections on the achenes of False Hop Sedge. Botanists familiar with both species can reliably separate mature plants in the field. Data prior to 2010 presented in this report come from botanists familiar with the species, including Jacques Labrecque, Guy Jolicoeur, Frédéric Coursol, Nicole Lavoie, Michael Oldham, Kate MacIntyre, Stéphanie Pellerin and Jacinthe Letendre.

In Ontario, roughly 20 person-days were spent in 2005 on searches for False Hop Sedge on the sites of the five populations known at the time and in 16 potential habitats in the former townships of Dunwich (Dutton/Dunwich, Elgin county), Adelaide (Adelaide-Metcalfe, Middlesex county), Mosa (Southwest Middlesex, Middlesex county), Aldborough (West Elgin, Elgin county) and Caradoc (Strathroy-Caradoc, Middlesex county) (Nault 2006). In 2009, eight person-days were spent on the searches and inventory of the species in five extant populations, and at the site of the historical population of Amherstburg. The Ailsa Craig and Lambeth populations and a part of the West Lorne population, which occur on private property, could not be revisited.

In Quebec, approximately 100 person-days were spent between 1998 and 2008 (most intensively since 2005) on searches for False Hop Sedge at the sites of extant and historical populations and in some 20 potential habitats along the Richelieu and Ottawa rivers and Lac des Deux Montagnes. The searches focused essentially on riverine wetland habitats (Bachand-Lavallée and Pellerin 2006; Letendre *et al.* 2007; Letendre *et al.* 2008). Particular attention was paid to the edges of Silver Maple stands and openings in such stands. In 2009, eight person-days were spent on searches and inventory of the species in three extant populations, as well as at the sites of the historical populations of Grande Baie d'Oka, Saint-Blaise-sur-Richelieu and Pointe du Gouvernement. In 2010 and 2011, four person-days were spent on searches and inventory of the species along the Richelieu River.

In addition to the three Quebec populations where each individual was permanently marked in 2005 (ecological reserve and Lacolle) or 2008 (McGillivray Bay), only those individuals producing fruiting stems were counted, as it is impossible to identify with certainty individuals in the vegetative state or during flowering. Only the number of plants producing fruiting stems is indicated in Table 3, even though the information sources sometimes also contained the number of vegetative plants. Furthermore, because False Hop Sedge can reproduce both sexually and vegetatively, it is impossible to evaluate the true number of individuals. For the needs of this report, each individual tuft was considered an individual (see discussion under **Abundance**, below). This method can be easily applied in Quebec, where the plants are spaced apart from each other. In Ontario, at the Mount Brydges, West Elgin and West Lorne

sites some tufts were difficult to distinguish from one another. Where necessary, each group of stems occupying an area of 0.4 m^2 was considered one individual. This method is the same as that used in 2005 (Nault 2006). At several Ontario sites, plants reintroduced to supplement the populations in 2006 were not marked. As a result, it was often impossible to differentiate supplemented from natural plants. As mentioned above, a large proportion of plants re-established in Quebec produced fruit the year following their introduction. Because these plants can participate in recruitment (as seen in the Saint-Blaise-sur-Richelieu re-established site where "newly" (i.e. not planted) established plants were observed in 2010), all reintroduced plants (except those reintroduced in the summer of 2010) were also counted. All fruiting stems were individually counted. This number could potentially be used to estimate the vigour of individual plants or the total population, given that it is a clonal species.

More than 2500 seeds from nearly all Canadian populations are kept at the Millennium Seed Bank at Kew, England, as well as in Agriculture and Agri-Food Canada's Plant Gene Resources national seed bank in Saskatoon.

Abundance

For densely tufted sedges such as False Hop Sedge in which the tufts are unlikely to fragment under natural conditions, COSEWIC has considered the tuft or clump to represent a single individual rather than a collection of multiple individuals (e.g. COSEWIC 2008). Vegetative offshoots are only counted as separate individuals in such species if they are distinctly separated from the parent tuft. Thus the tuft is the unit counted as an individual in this report. According to the 2009-2011 surveys, there are at least 166 mature individuals in Canada considering both natural and reintroduced plants that are considered mature individuals by definition (Table 3). However, the number could be slightly higher given the likely presence of mature individuals that did not produce fruit.

Fluctuations and trends

With the available data, it is difficult to assess short- and long-term trends in the number of mature individuals of False Hop Sedge, although an overall decline is likely to have occurred since 2005. Pre-2005 data are often imprecise and most counts only include fruiting individuals even though the fruiting rate varies annually as a function of the hydrological conditions of the habitat (Letendre *et al.* 2008; Genest 2009). Such counts can suggest fluctuations which did not actually occur because, as previously mentioned, it is impossible to identify vegetative individuals with certainty. Permanent marking of plants is therefore essential to assessing actual population trends, as is the case for the three Quebec populations. The Lacolle and McGillivray populations have declined since 2005, whereas the population in the ecological reserve was stable until 2010 and may have declined in 2011 (Table 3). Nevertheless, only eight of the 24 tufts marked at the ecological reserve in 2005 remained in 2010 and only one in 2011. Because it is impossible to know whether new plants identified since 2006 were already established at the sites in 2005 but were in a vegetative stage at the time, it is

impossible to say that this population is declining. In Ontario, the size of all populations has fluctuated. This is particularly notable at Mount Brydges, where population fluctuations of a magnitude greater than the entire current Canadian population have been documented between 1992 (25-30 plants), 2005 (1075 plants) and 2009 (29 plants), probably as a function of canopy opening and closure cycles or of exotic aphid infestation (see **THREATS AND LIMITING FACTORS** section). However, it is unclear if this fluctuation was largely caused by recruitment and loss of new individuals or by an increase in flowering of otherwise infertile (and therefore uncountable) individuals.

Rescue Effect

Because the perigynia of False Hop Sedge are persistent, the fruits can float for some time and be dispersed over a relatively large distance by flood waters. It appears, therefore, that the seeds produced by a U.S. population upstream from the Richelieu River sites in Quebec could rescue the Canadian population in that area. The likelihood of such a phenomenon is undoubtedly low given the rarity of False Hop Sedge in Vermont and New York, where it has a NatureServe rank of imperilled (S2). The species could no doubt be successfully reintroduced from U.S. seeds should all Canadian populations become extirpated.

THREATS AND LIMITING FACTORS

The description of the current threats to False Hop Sedge and its habitat and the key limiting factors is based on Nault (2006), Jolicoeur and Couillard (2006), Bachand-Lavallée and Pellerin (2006), Letendre *et al.* (2008) and Genest (2009) and on observations made as part of the work done in connection with this status report. False Hop Sedge is generally affected by the same threats as those that influence the wetlands in which it occurs. These threats and limiting factors are presented below in descending order of severity.

1. *Late or long-term flood:* Flooding that occurs during flowering or at the start of fruiting and that extends over a long period can cause the flowering and fruiting stems to rot (Letendre pers. obs.). In Quebec, such flooding seems to occur every 4-5 years (Pellerin pers. obs.). Long-term and extreme flooding seems also detrimental to the survival of the species. For instance, the 2011 extreme and long-term flooding in the Richelieu Valley caused a 60% mortality of the mature individuals in this area (Table 3).

2. *Anthropogenic drainage*: False Hop Sedge requires that its habitat be periodically flooded. Anthropogenic drainage of the sites is therefore a real threat to the species' survival. It is mostly a threat to the Ontario populations, where municipal and private drains (surface and subsurface) exist near most populations. At Rodney, the False Hop Sedge individuals are located near a constructed agricultural drain. At West Elgin, the woodlot where the population occurs is bisected and surrounded by municipal drains (both surface and subsurface). At Mount Brydges, the population is located near agricultural drains. The London site seems mainly affected by constructed drainage for urban development. Agricultural and municipal ditches also surround the Ailsa Craig woodlot while surface and subsurface agricultural drains surround the West Lorne site. No hydrological study has been done on those sites to evaluate the real impacts of those drains. However, the West Lorne and London site appears to have dried up dramatically in recent years (MacIntyre pers. comm. 2009).

3. *Closure of vegetation*: False Hop Sedge is shade-intolerant, and the closure of vegetation—by trees, shrubs or other herbaceous species—is a significant limiting factor (COSEWIC 2000). Canopy closure is believed to be partially responsible for the extirpation of the Grande Baie d'Oka, Rigaud and Amherstburg populations (COSEWIC 2000). It may also have contributed to the significant decline observed in the Mount Brydges population (see **Adaptability**). The increase in density in the shrub and herbaceous layers is believed to have caused the loss of plants of the Marcel-Raymond Ecological Reserve population that were located in a former lighthouse easement (see **Adaptability**). This limiting factor is also present on the West Lorne, Saint-Blaise-sur-Richelieu and McGillivray Bay sites. In some sites the closure of the vegetation may be a result of anthropogenic drainage.

4. *Invasive alien plant species*: The invasion of the sites by invasive alien plant species is a growing threat for False Hop Sedge. Since the last status report, a dense Reed Canary Grass stand has become established at the site of the Pointe du Gouvernement population and is believed to be the likely cause of its extirpation. The presence of Reed Canary Grass and, more importantly, the abundance of Tall Manna Grass (*Glyceria maxima*) are believed to be partly responsible for the loss of the Carillon Island population (Labrecque pers. comm. 2009). This threat is also present in the London (Common Buckthorn), West Lorne (Reed Canary Grass), Marcel-Raymond Ecological Reserve (Reed Canary Grass) and Lacolle (Common Buckthorn) populations. These species compete with False Hop Sedge for light, and in Quebec they also likely act as a barrier to seed dispersal during seasonal flooding because they form a dense band of vegetation between populations and the open water.

5. *Recreational and landowner activities*: Walking and all-terrain vehicle (ATV) trails have been observed near the Rodney, West Lorne, West Elgin, Ailsa Craig and London populations. However, this threat appears to be relatively low. Tree harvesting is a potential threat to the Rodney population. At the Ailsa Craig, the landowner keeps cattle adjacent to the site, and the population may thus be trampled. The McGillivray Bay population is used for waterfowl hunting and receives disturbance from ATVs. In recent years, awareness efforts have been directed at the main users of the site and appear to have reduced the threat. The Saint-Anne-de-Sabrevois reintroduction site is less than 100 m from homes and a marina. The owners' desire to keep the site well groomed (cutting shrubs, removing dead branches, etc.) could lead to harmful measures. The intensive recreational use of Oka Provincial Park, the most heavily visited park in Quebec, poses a serious threat to the reintroduction site in the park. For instance, in 2008, transplants were pulled out by park visitors (Letendre, pers. obs.).

6. *Alien animal species*: The presence of an exotic aphid seems to pose a threat to the species' survival (see **Herbivory and interspecific interactions**). During an infestation, the aphids cause the plants to dry out prematurely and most of the infested plants do not reappear the following year. This aphid has been observed in Quebec populations and likely in Ontario populations (identification of specimens under way).

7. *Erosion*: Although shoreline erosion can favour the species by creating openings in the environment (COSEWIC 2000), it poses a serious threat to the populations along the Richelieu River, causing the loss of a few plants each year. This phenomenon has likely been more significant since the early 2000s with the persistence of high water levels on the river (Letendre *et al.* 2008). The populations of the Marcel-Raymond Ecological Reserve and McGillivray Bay and the reintroduced population of Sainte-Anne-de-Sabrevois are particularly affected by erosion. At Sainte-Anne-the-Sabrevois and McGillivray Bay sites, erosion also induces habitat loss because those sites are a narrow band of riparian vegetation with developed land behind it, and thus habitat lost to erosion is not necessarily replaced by new habitat.

8. *Garbage deposition:* The presence of large amounts of garbage has been observed at the London site and at all sites along the Richelieu River. At Quebec sites, garbage is deposited by flood waters and sometimes covers False Hop Sedge plants.

9. *Water regime regulation*: The regulation of the water regime of Lac des Deux Montagnes and the Ottawa River by the Carillon dam could be the partial cause of the extirpation of the Grande Baie d'Oka and Rigaud populations (COSEWIC 2000). The actual impact of this threat has not been studied, but it could also be partly responsible for the extirpation of the Carillon Island population. That population, which was very small in 1992, was located in a very dense Reed Canary Grass stand. This type of stand is difficult to control unless there is a relatively long period of high water. Because the levels have been regulated, it is likely that they fluctuate less than they would under natural conditions, which could benefit Reed Canary Grass to the detriment of False Hop Sedge (Labrecque pers. comm. 2009). In the future, this phenomenon could also pose a threat to the potential habitats still present in the area.

10. *Residential and urban development*: Although residential and urban development was a significant threat in the past and was likely the cause of the extirpation of the Sainte-Anne-de-Sabrevois, Saint-Paul-de-l'île-aux-Noix, Iberville and Saint-Blaise-sur-Richelieu populations (COSEWIC 2000), this threat is now less severe. Only the London population, which is an isolated population surrounded by urban development, seems to be affected by these threats, with plants located less than 500 m from residential neighbourhoods. However, because the site is owned by the city of London, no more development will occur.

All extant populations in Quebec except Grande Baie d'Oka are likely to be affected by a single extreme flooding event, as experienced in 2011. Because this flooding induced 60% mortality, it is likely the most important threat for these populations. Thus each of the seven Ontario populations should be considered individual locations as well as the Grande-Baie population in Quebec. All populations along the Richelieu River should be considered as one location reflecting a total of 9 locations (or 8 if we exclude re-established populations).

At the Lacolle, Saint-Blaise-sur-Richelieu, Grande-Baie d'Oka, Sainte-Anne-de-Sabrevois, London, and Rodney populations, all the mature individuals are located in one small patch. Thus, the most important threat at these populations is expected to affect all mature individuals. The individuals at the McGillivray Bay, West Lorne and West Elgin populations are located in two distinct patches, while the individuals at the Marcel-Raymond Ecological Reserve site are spread in clumps of two or three individuals along a ~500 m segment. Only one patch was visited in 2009 at the West Lorne population, but in 2005 the same threats (drainage, invasion by Reed Canary Grass and closure of the vegetation) affected both patches (Nault 2006). At the three other sites, the same threats affected all individuals (drainage in West Elgin; recreational activities, pollution and erosion in McGillivray Bay; Reed Canary Grass, pollution and erosion in Marcel-Raymond Ecological Reserve). The Ailsa Craig and Lambeth populations were not visited.

PROTECTION, STATUS, AND RANKS

Legal protection and status

False Hop Sedge is not covered under the Convention on International Trade in Endangered Species (CITES) or the U.S. *Endangered Species Act*. False Hop Sedge was assessed as Threatened in Canada by COSEWIC in 1997. In May 2000, its status was reassessed by COSEWIC as Endangered. False Hop Sedge was added to Schedule 1 of the Canadian *Species at Risk Act* in June 2003. However, no extant Canadian populations are located on federal lands, to which the Act applies. A draft recovery strategy is currently in progress (Environment Canada 2009).

In the United States, the species is designated Endangered in Connecticut, Wisconsin, New Jersey and Massachusetts, Threatened in Michigan and in Ohio, State Rare in Indiana and New York and has a proposed rank of Endangered in Pennsylvania (USDA, NRCS 2011).

In Ontario, it is designated Endangered under Ontario's *Endangered Species Act, 2007*. In Quebec, it is designated Threatened under the Quebec *Act Respecting Threatened or Vulnerable Species*. The two acts prohibit, among other things, harming or killing the species or damaging or destroying the habitat upon which it depends. The largest Quebec population is located in the Marcel-Raymond Ecological Reserve.

In Quebec, a conservation plan for the species was prepared in 2006 (Jolicoeur and Couillard 2006). The response strategies are 1) to undertake efforts to increase the size of populations; 2) to conduct a detailed inventory of all populations and implement a monitoring system; 3) to ensure *ex situ* conservation of the species; and 4) to ensure legal protection of its current habitats. Points 1 and 2 have already been implemented, as described in the **Adaptability** section. The results of these efforts are described in detail in Bachand-Lavallée and Pellerin (2006), Letendre *et al.* (2007), Letendre *et al.* (2008) and Genest (2009). With respect to point 3, over 100 plants are currently maintained in cultivation at the Montréal Botanical Garden, and seeds of all extant Ontario and Quebec populations (except Ailsa Craig and Lambeth) have been sent to national (Saskatoon) or international (Kew) seed banks. Lastly, point 4 has been partially addressed through the Quebec government's drafting of a bill aimed at protecting the banks of the Richelieu River (see **Habitat protection and ownership**).

Non-legal status and ranks

False Hop Sedge is not on the IUCN Red List. It is apparently secure globally (G4, NatureServe 2009). Nationally, the species is ranked as apparently secure (N4) in the United States and imperilled (N2) in Canada and critically imperilled (S1) in Ontario and Quebec. In the United States, it is ranked critically imperilled (S1) in Massachusetts, New Jersey, North Carolina, Pennsylvania, Texas and Wisconsin; imperilled (S2) in Delaware, Indiana, Maryland, Michigan, New York, Ohio, Vermont, Virginia and West Virginia; critically imperilled to imperilled (S1S2) in Arkansas; vulnerable (S3) in Connecticut and Illinois; imperilled to vulnerable (S2S3) in Tennessee; apparently secure (S4) in Mississippi; apparently secure to secure (S4S5) in Kentucky and historical (SH) in Iowa. It is not ranked in Florida, Louisiana, Maine, Minnesota, Missouri, Oklahoma, Georgia or South Carolina.

Habitat protection and ownership

In Ontario, the London population is located on land owned by the City of London, and some individuals of the West Elgin population are located on land owned by the municipality of West Elgin and managed by the West Elgin Nature Club. However, according to the city ecologist of London and the clerk of the West Elgin Nature Reserve these sites are not afforded any particular protection (Bergsma pers. comm. 2009; Bryant pers. comm. 2009). All of the other Ontario populations are on private property.

One Quebec population is located entirely within an ecological reserve (Marcel Raymond Ecological Reserve) that is owned by the Quebec government and managed by Quebec's Ministère du Développement durable, de l'Environnement et des Parcs (Department of Sustainable Development, Environment and Parks). The status of ecological reserve is the highest level of protection afforded to Quebec lands, protecting resident species from any exploration, construction or development of the natural resources occurring within the reserve and from any activities that may directly affect the ecosystem. The Lacolle and McGillivray Bay populations (which are on private property), as well as the habitats of all of the extirpated populations along the Richelieu River (except the Iberville population), occur within the boundaries of the Samuel-de-Champlain proposed biodiversity reserve (Bill 28). This status affords the habitats some protection, because it prohibits certain activities such as logging and resource development on the land in question. In addition, the habitat of the extirpated Pointe du Gouvernement population is on land owned by the Société de conservation des milieux humides du Québec, a not-for-profit organization whose goal is to protect and enhance wetlands. The habitat of the extirpated Grande Baie d'Oka population occurs within the conservation zone of Oka Provincial Park, which is owned by the Quebec government; the habitat is therefore theoretically protected from all recreational and development activities. Finally, part of the habitat of the extirpated Carillon Island population is located on a migratory bird sanctuary (Carillon Island Bird Sanctuary) managed by the federal government, where general prohibitions under the *Species at Risk Act* apply.

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Jacinthe Letendre completed graduate studies in plant biology at Université Laval and has been working in the field of wetland conservation and biodiversity since 2006. She worked for two years at the Université de Montréal's Institut de recherche en biologie végétale on the Quebec False Hop Sedge conservation and recovery project. She is currently a project manager at Nature-Action Québec, an organization engaged in environmental project management.

COLLECTIONS EXAMINED

The Marie-Victorin Herbarium (MT) and the Louis-Marie Herbarium (QFA) were the only collections examined for this update status report. Furthermore, several herbarium collections (CAN, DAO, MT, MTMG, QFA, QUE, TRTE and UWO) were examined for the first status report (COSEWIC 2000). Herbaria with major Ontario collections were examined in 1981-82 for False Hop Sedge specimens in association with the publication of Ball and White (1982).