

Recovery Strategy for the Wild Hyacinth (*Camassia scilloides*) in Canada

Wild Hyacinth



2015



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

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¹ <http://www.registrelep-sararegistry.gc.ca>

RECOVERY STRATEGY FOR THE WILD HYACINTH (*CAMMASSIA SCILLOIDES*) IN CANADA

2015

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

In the spirit of cooperation of the Accord, the Government of Ontario has given permission to the Government of Canada to adopt the *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario* (Part 2) under Section 44 of the *Species at Risk Act* (SARA). Environment Canada has included a federal addition (Part 1) which completes the SARA requirements for this recovery strategy.

Environment Canada is adopting the provincial recovery strategy with the exception of section 2, Recovery. In place of section 2, Environment Canada is establishing a population and distribution objective and performance indicators, and is adopting the Government of Ontario's government-led and government-supported actions of the *Wild Hyacinth: Ontario Government Response Statement*² (Part 3) as the broad strategies and general approaches to meet the population and distribution objective.

The federal recovery strategy for the Wild Hyacinth in Canada consists of three parts:

Part 1 – Federal Addition to the *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario*, prepared by Environment Canada.

Part 2 – *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario*, prepared by J.V. Jalava for the Ontario Ministry of Natural Resources³.

Part 3 – *Wild Hyacinth: Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources.

² The Government Response Statement is the Ontario Government's policy response to the recovery strategy and summarizes the prioritized actions that the Ontario Government intends to take and support.

³ On June 26, 2014, the Ontario Ministry of Natural Resources became the Ontario Ministry of Natural Resources and Forestry.

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PART 2 – *Recovery Strategy for the Wild Hyacinth (Camassia scilloides)* in Ontario prepared by J.V. Jalava for the Ontario Ministry of Natural Resources.

PART 3 – *Wild Hyacinth: Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources

PART 1 – Federal Addition to the *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario*, prepared by Environment Canada

Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)⁴ agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Wild Hyacinth and has prepared the federal component of this recovery strategy (Part 1), as per section 37 of SARA. SARA section 44 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for content (sub-sections 41(1) or (2)). The Ontario Ministry of Natural Resources and Forestry led the development of the attached recovery strategy for the Wild Hyacinth (Part 2) in cooperation with Environment Canada and the Parks Canada Agency.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada and the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Wild Hyacinth 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 the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When the recovery strategy identifies critical habitat, there may be future regulatory implications, depending on where the critical habitat is identified. SARA requires that critical habitat identified within federal protected areas be described in the *Canada Gazette*, after which prohibitions against its destruction will apply. For critical habitat located on federal lands outside of federal protected areas, the Minister of the Environment must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies. For critical habitat located on non-federal lands, if the Minister of the Environment forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of

⁴ <http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2>

Parliament, and not effectively protected by the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to extend the prohibition against destruction of critical habitat to that portion. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

Acknowledgements

The initial draft of the federal addition was prepared by Jennie Pearce (Pearce and Associates Ecological Research). Additional preparation and review of the document was completed by Rachel deCatanzaro, Angela Darwin, and Christina Rohe (Environment Canada, Canadian Wildlife Service – Ontario). This federal addition benefited from input, review, and suggestions from the following individuals and organizations: Krista Holmes, Madeline Austen, and Lesley Dunn (Environment Canada, Canadian Wildlife Service – Ontario), Paul Johanson (Environment Canada, Canadian Wildlife Service – National Capital Region), Tammy Dobbie and Gary Allen (Parks Canada Agency), and Aileen Wheeldon (Ontario Ministry of Natural Resources and Forestry). Updated information on the Middle Island population was provided by Tammy Dobbie (Parks Canada Agency).

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

Additions and Modifications to the Adopted Document

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that are not addressed in the Province of Ontario's *Recovery Strategy for the Wild Hyacinth (Camassia Scilloides) in Ontario* (Part 2) and to provide updated or additional information.

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

1. Species Status Information

The Wild Hyacinth is found in the southeastern and midwestern United States, from northwestern Georgia to eastern Texas, to southern Wisconsin, and east to western Lake Erie. Globally, the Wild Hyacinth is ranked Apparently Secure⁵ - Secure⁶ (G4G5). The conservation status of the Wild Hyacinth nationally in the United States, as well as subnationally in many states in which it occurs has not been assessed (NNR) (Appendix A). In Canada, the Wild Hyacinth has a national and subnational (Ontario) rank of Imperiled⁷ (N2 and S2, respectively) (NatureServe 2013). The species is listed as Threatened⁸ under the Ontario *Endangered Species Act, 2007* (ESA), and as Threatened⁹ on Schedule 1 of the federal SARA.

In Canada, the species reaches the northernmost part of its range on islands in Lake Erie, Ontario (COSEWIC 2002). The Canadian population of the Wild Hyacinth is estimated to constitute less than one percent of the species' global distribution, with an area of occupancy¹⁰ of 1.1km² (COSEWIC 2002).

2. Recovery Feasibility Summary

⁵ Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences but with possible cause for some concern as a results of local recent declines, threats or other factors.

⁶ Secure: Common, widespread and abundant.

⁷ Imperiled: At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats or other factors.

⁸ A species that lives in the wild in Ontario and is likely to become endangered if steps are not taken to address factors threatening to lead to its extinction or extirpation.

⁹ A wildlife species likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

¹⁰ A biological measure of the occupied habitat within a wildlife species' range, determined by COSEWIC using an Index of Area of Occupancy (IAO).

Based on the following four criteria that Environment Canada uses to establish recovery feasibility, the recovery of the Wild Hyacinth has been deemed feasible.

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

Yes. Five relatively large, reproducing populations are present on Hen Island (one population), Middle Island (one population) and Pelee Island (three populations), and these colonies appear to be stable over recent decades (Jalava 2013; NHIC 2014). Two additional, small populations have been recently re-discovered on East Sister Island and Middle Sister Island (NHIC 2014), although the stability of these populations and the potential for availability of mature reproducing individuals in a given year is unknown. In 2001, COSEWIC (2002) estimated a total population size of 21,212 flowering Wild Hyacinth plants in Canada. Even though several sites have been more recently visited (see Table 1), no formal population survey has been undertaken since 2001 and a more recent estimate of total population size in Canada is not available.

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

Yes. Sufficient suitable habitat is available to sustain the five extant (currently existing) populations occurring on Hen Island, Middle Island and Pelee Island. However, ongoing management of the colonial nesting Double-crested Cormorant (*Phalacrocorax auritus*) (hereafter referred to as “cormorant”) and Canada Goose (*Branta canadensis*) populations is likely needed to maintain habitat for the Wild Hyacinth on Middle Island. Habitat restoration and control of hyper-abundant cormorant populations is also likely to be required on East Sister Island and Middle Sister Island to maintain or increase the abundance of the Wild Hyacinth and sustain the two populations on these islands.

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

Yes. The primary threats to populations of the Wild Hyacinth in Canada are mortality of individuals and habitat degradation caused by cormorants (which form large nesting colonies) and to a lesser extent by Canada Geese. The expansion in cormorant populations since the 1980s has substantially damaged vegetation and poses a threat to the Wild Hyacinth at Middle Island, Middle Sister Island, and East Sister Island (Jalava 2013). Trampling of vegetation by expanding Canada Goose populations has also caused vegetation damage on Middle Island (PCA 2012). An improvement in habitat quality and an increase in abundance of the Wild Hyacinth has been observed on Middle Island since management actions were implemented in 2008 by Point Pelee National Park to control cormorant populations and deter nesting geese and cormorants.

(Dobbie pers. comm. 2014), suggesting that these threats can be effectively mitigated. Other known threats, including habitat loss from land development and invasion of habitat by exotic or invasive species, could be reduced through habitat protection and management actions.

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

Yes. The primary threats to the Wild Hyacinth are mortality of individuals and destruction of habitat by large nesting colonies of cormorants and geese. Techniques exist to manage cormorant populations, and may be implemented where necessary through site management and stewardship actions, along with the protection of local Wild Hyacinth populations. Successful management of cormorants has been demonstrated on Middle Island; the Wild Hyacinth population was reduced from approximately 5,000 individuals in 1988 to 500 individuals in 2003 as a result of impacts from cormorants and geese, and then recovered to over 8,000 plants in 2012 after cormorant and goose population management began (Dobbie pers. comm. 2014; PCA 2014).

In Canada, the Wild Hyacinth has a very restricted distribution and is at the northern edge of the species' range. As a result of this, and considering the lack of evidence to suggest that the Wild Hyacinth was ever common in Ontario (Jalava 2013), the species will likely continue to be considered 'at risk' in Canada despite applying available recovery techniques and maintaining existing populations.

3. Population and Distribution

The *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario* (Part 2; Jalava 2013) provided a summary of the status of extant, historical¹¹, and extirpated¹² occurrences of the Wild Hyacinth in Ontario based on observations up to 2011. Since this time, the Parks Canada Agency has undertaken management actions and monitoring of the population on Middle Island. Surveys in 2012 resulted in a count of 8,411 Wild Hyacinth individuals on Middle Island, roughly double the 2008 population estimate (PCA 2014). However, high nesting densities of cormorants and occasional browsing by geese are still having impacts, which can be seen in the lack of flowering and the re-distribution of plants away from areas of high cormorant nest densities (PCA 2014; Dobbie pers. comm. 2015). In addition, in 2013, the Wild Hyacinth was confirmed at two locations (Middle Sister Island and East Sister Island) where no individuals had been found in 2001 (NHIC 2014). Currently, there are believed to be

¹¹ Recent field information verifying the continued existence of the occurrence is lacking (NatureServe 2014).

¹² Adequate surveys by one or more experienced observers at times and under conditions appropriate for the species at the occurrence location, or other persuasive evidence, indicate that the species no longer exists there or that the habitat or environment of the occurrence has been destroyed to such an extent that it can no longer support the species (NatureServe 2014).

seven extant populations of Wild Hyacinth in Canada, all on islands in Lake Erie. Two other populations are presumed to be extirpated (see Table 1).

Table 1: Most recent information on the status of populations of the Wild Hyacinth in Canada (Jalava 2013; NHIC 2014; PCA 2014).

County or Region	Population	Most recent known status
Essex	Hen Island	2001: 5,680 plants
Essex	Middle Point (Pelee Island)	2013: Thousands of plants ^a
Essex	Stone Road Alvar (Pelee Island)	2001: 4,485 plants
Essex	Fish Point (Pelee Island)	2001: 2,090 plants
Essex	Middle Island	2012: 8,411 plants ^a
Essex	Middle Sister Island	2013: 230+ plants ^a
Essex	East Sister Island	2013: 50-100 plants ^a
Essex	North Harbour Island	presumed extirpated
Essex	Bois-blanc Island (Detroit River)	presumed extirpated

^a Updated data since the publication of the provincial recovery strategy.

4. Threats

In addition to the known and potential threats outlined in Part 2 - *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario*, another potential threat to the Wild Hyacinth is a decline in pollinator populations. The Wild Hyacinth is pollinated by insects including butterflies (superfamily *Papilionoidea*), bumblebees (*Bombus* spp.), metallic green/bronze bees (*Agapostemon* spp.), small solitary bees (*Megachilidae*), bee flies (*Bombiliidae*) and hover flies (*Syrphidae*) (COSEWIC 2002). A number of factors are suspected to be contributing to the decline in insect pollinator populations globally and in Canada, including loss of habitat and food sources, diseases, viruses, pests, and pesticide exposure (Health Canada 2014). Notably, there is growing evidence to suggest that pesticides, including neonicotinoids, may be having negative effects on pollinator populations due to their toxic properties and persistence in soil and water (van der Sluijs et al. 2013; Cutler et al. 2014). Currently, the extent to which the decline in pollinator populations may impact the Wild Hyacinth is not known.

5. Population and Distribution Objectives

The provincial *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario* (Part 2) contains the following recovery goal:

- To maintain and, where necessary, establish self-sustaining and viable populations of Wild Hyacinth at extant sites and at suitable historical sites in southern Ontario.

The Government Response Statement for the Province of Ontario (Part 3) lists the following goal for the recovery of the Wild Hyacinth in Ontario:

- To maintain self-sustaining populations at all existing sites and, where recolonization may be feasible, restore degraded habitat at historic locations.

Environment Canada supports the provincial recovery goal outlined in the Government Response Statement for the Province of Ontario. To meet the requirements and processes set out in SARA, and to account for more recent information on the species' distribution, Environment Canada has refined this recovery goal into a population and distribution objective for the species that reflects current information on populations. The population and distribution objective established by Environment Canada for the Wild Hyacinth is to:

- Maintain, or where necessary and biologically and technically feasible, increase the species' current abundance and distribution at existing populations in Canada.

At the time of the provincial recovery strategy (Part 2), five extant populations were known, and it was suggested that maintenance of these five populations at current levels plus the re-establishment of populations on East Sister Island and Middle Sister Island (if restoration of habitat at those sites was feasible) would probably constitute viability of the Wild Hyacinth in Canada. Since the publication of the provincial recovery strategy, the Wild Hyacinth has been re-discovered in small numbers at both East Sister Island and Middle Sister Island (see Table 1). As a result, seven Wild Hyacinth populations are currently known to exist in Canada. In order to maintain or increase the abundance and distribution of Wild Hyacinth populations on East Sister Island and Middle Sister Island, where abundance of the species is currently low and cormorants have had significant impacts, threats posed by cormorants will likely need to be addressed. Similarly, ongoing management of cormorant and Canada Goose populations is likely to be required on Middle Island in order to maintain the abundance and distribution of the Wild Hyacinth at that location. A population viability analysis for the Wild Hyacinth would be beneficial to determine if and where increases in population abundance are necessary to promote self-sustaining populations and long-term persistence of the species.

6. Broad Strategies and General Approaches to Meet Objectives

The government-led and government-supported action tables from the *Wild Hyacinth Ontario Government Response Statement* (Part 3) are adopted as the broad strategies and general approaches to meet the population and distribution objective. Environment Canada is not adopting the approaches identified in section 2 of the *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario* (Part 2).

7. Critical Habitat

7.1 Identification of the Species' Critical Habitat

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

Identification of critical habitat is not a component of provincial recovery strategies under the Province of Ontario's ESA. Under the ESA, when a species becomes listed as endangered or threatened on the Species at Risk in Ontario List, it automatically receives general habitat protection. The Wild Hyacinth currently receives general habitat protection under the ESA; however, a description of the general habitat has not yet been developed. In some cases, a habitat regulation may be developed that replaces the general habitat protection. A habitat regulation is a legal instrument that prescribes an area that will be protected¹³ as the habitat of the species by the Province of Ontario. A habitat regulation has not been developed for the Wild Hyacinth under the ESA; however, the provincial recovery strategy (Part 2) contains a recommendation on the area for consideration in developing a habitat regulation. This federal recovery strategy identifies critical habitat for the Wild Hyacinth in Canada to the extent possible, based on this recommendation and on the best available information as of October 2014.

Critical habitat is identified for the seven extant populations of Wild Hyacinth in Ontario and is sufficient to meet the population and distribution objective; therefore a schedule of studies is not required. Additional critical habitat may be added in the future if new or additional information supports the inclusion of areas beyond those currently identified (e.g., new sites become colonized or existing sites expand into adjacent areas).

The identification of critical habitat for the Wild Hyacinth is based on two criteria: habitat occupancy and habitat suitability.

7.1.1 Habitat Occupancy

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

Habitat is considered occupied when:

- One or more native Wild Hyacinth individuals have been observed in any single year since 1994.

¹³ Under the federal SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Protection of critical habitat under SARA will be assessed following publication of the final federal recovery strategy.

Occupancy is based on recent occurrence reports available for all known populations from Ontario's Conservation Data Centre (Natural Heritage Information Centre) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Individual Wild Hyacinth plants are believed to be long-lived, given that a closely related species, the Common Camas (*Camassia quamash*), lives for 15 to 20 years (Stevens et al. 2001 in Jalava 2013), and observations of the Wild Hyacinth in Ontario suggest that the species often persists at a location for decades (COSEWIC 2002). Recently, the species has been re-discovered at two locations (East Sister Island and Middle Sister Island on Lake Erie) where it was thought to have disappeared (NHIC 2014). The period starting in 1994 corresponds to the threshold beyond which a record is considered historical in conservation data centres (i.e. 20 years for the Ontario Natural Heritage Information Centre (NHIC)) and allows for the inclusion of data for all seven populations known to be extant. If new observations become available, they will be considered for the identification of additional critical habitat.

Plants that are considered horticultural specimens, and those clearly planted in landscaped settings such as urban gardens, are not considered to be occupying habitat for the purposes of identifying critical habitat.

7.1.2. Habitat Suitability

Habitat suitability relates to areas possessing a specific set of biophysical attributes that can support individuals of the species carrying out essential aspects of their life cycle. At extant locations in Canada, the Wild Hyacinth grows in partial to moderate shade of open to semi-open wooded areas, most commonly in deciduous woodlands and hawthorn scrub (COSEWIC 2002; Jalava 2013).

The biophysical attributes of suitable habitat for the Wild Hyacinth typically include the characteristics below, although each may not be present at all locations:

- open to semi-open wooded areas with partial to moderate shade;
- limestone bedrock occurring near the ground surface; and
- rich clay to organic soils.

Based on the best available information, suitable habitat for the Wild Hyacinth is currently defined as the extent of the biophysical attributes where the Wild Hyacinth exists in Ontario. In addition to the suitable habitat, a critical function zone of 50 m (radial distance) is applied when the biophysical attributes around a plant extend for less than 50 m. In Ontario, suitable habitat for the Wild Hyacinth can be described using the Ecological Land Classification (ELC) framework for Southern Ontario (from Lee et al. 1998). The ELC framework provides a standardized approach to the interpretation and delineation of dynamic ecosystem boundaries. The ELC approach classifies habitats not only by vegetation community but also considers soil moisture conditions and topography, and as such provides a basis for describing the ecosystem requirements (e.g., local effects of the associated hydrologic regime, canopy cover) and encompasses the biophysical attributes of suitable habitat for the Wild Hyacinth.

In Ontario, ELC terminology and methods are familiar to many land managers and conservation practitioners who have adopted this tool as the standard approach for Ontario.

Within the ELC system in Ontario, the ecosite boundary best captures the extent of biophysical attributes required by the species. The ecosite includes the areas occupied by the Wild Hyacinth and the surrounding areas that provide suitable habitat conditions (e.g., partial to moderate shade of open to semi-open wooded areas) to carry out essential life process for the species and should allow for natural processes related to population dynamics and reproduction (e.g., dispersal and pollination) to occur. The dense clustering of Wild Hyacinth plants in colonies suggests the species does not disperse over long distances (Jalava 2013) and that the occupied ELC ecosite should provide sufficient opportunity for dispersal and expansion of populations. In addition, use of the ELC ecosite is considered precautionary, as there is insufficient information on habitat requirements of the Wild Hyacinth to determine whether the more refined boundaries of ELC vegetation type would provide sufficient habitat to meet its needs. Currently, the ELC ecosites that contain existing Wild Hyacinth plants are not known. Additional habitat assessments are required to describe and map the specific ELC ecosites currently occupied by the Wild Hyacinth in Canada.

Because the Wild Hyacinth may be sensitive to changes in microclimate and microhabitat characteristics, a distance of 50 m was chosen as a minimum 'critical function zone', or the minimum size required for maintaining constituent microhabitat properties for a species (e.g., light, temperature, litter moisture, humidity levels necessary for survival) and which allows natural processes to occur (e.g., hydrological, dispersal). At present, it is not clear at what exact distances physical and/or biological processes begin to negatively affect the Wild Hyacinth. Studies on micro-environmental gradients at habitat edges, i.e., light, temperature, litter moisture (Matlack 1993), and of edge effects on plants in mixed hardwood forests, as evidenced by changes in plant community structure and composition (Fraver 1994), have shown that edge effects could be detected up to 50 m into habitat fragments, although other studies show that the magnitude and distance of edge effects will vary depending on the structure and composition of adjacent habitat types (Harper et al. 2005). Forman and Alexander (1998) and Forman et al. (2003) found that most roadside edge effects on plants resulting from construction and repeated traffic have their greatest impact within the first 30 to 50 m. Therefore, a 50 m distance from any Wild Hyacinth plant was chosen as a precautionary distance to ensure that microhabitat properties were maintained as part of the identification of critical habitat. The area within the critical function zone may include both suitable and unsuitable habitat as the Wild Hyacinth may be found near the transition area/zone between suitable and unsuitable habitat (e.g. within small forest openings, or along woodland edges). As new information on species' habitat requirements and site-specific characteristics, become available, these distances may be refined.

Maintained roadways or built-up features such as buildings do not possess the biophysical attributes of suitable habitat or assist in the maintenance of natural processes and are therefore not considered critical habitat.

7.1.3 Application of the Criteria to Identify Critical Habitat for the Wild Hyacinth

Critical habitat for the Wild Hyacinth is identified as the extent of suitable habitat (section 7.1.2) where the occupancy criterion (section 7.1.1) is met. In cases where the suitable habitat extends for less than 50 m around a Wild Hyacinth plant, a critical function zone capturing an area within a radial distance of 50 m is also included as critical habitat.

In Ontario, as noted above, suitable habitat for the Wild Hyacinth is most appropriately identified as the ELC ecosite. At the present time, the ecosite descriptions and boundaries are not available to support the identification of critical habitat for populations in Ontario. In the interim, ELC community series level is identified as the area within which critical habitat is found. In Ontario, critical habitat is located within these boundaries where the biophysical attributes described in section 7.1.2 are found and where the occupancy criterion is met (section 7.1.1). When ecosite boundaries are determined, the identification of critical habitat will be updated.

Application of the critical habitat criteria to best available information identifies critical habitat for the seven known extant populations of Wild Hyacinth in Canada (Figure 1, See also Table 2), totaling up to 139 ha¹⁴.

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

¹⁴ This is the maximum extent of critical habitat based on habitat boundaries that can be delineated from high resolution aerial photography (comparable to ELC, Community Series) and/or a 50m radial distance around the Wild Hyacinth. Actual critical habitat occurs only in those areas described in section 7.1 and therefore the actual area could be less than this and would require field verification to determine the precise amount.

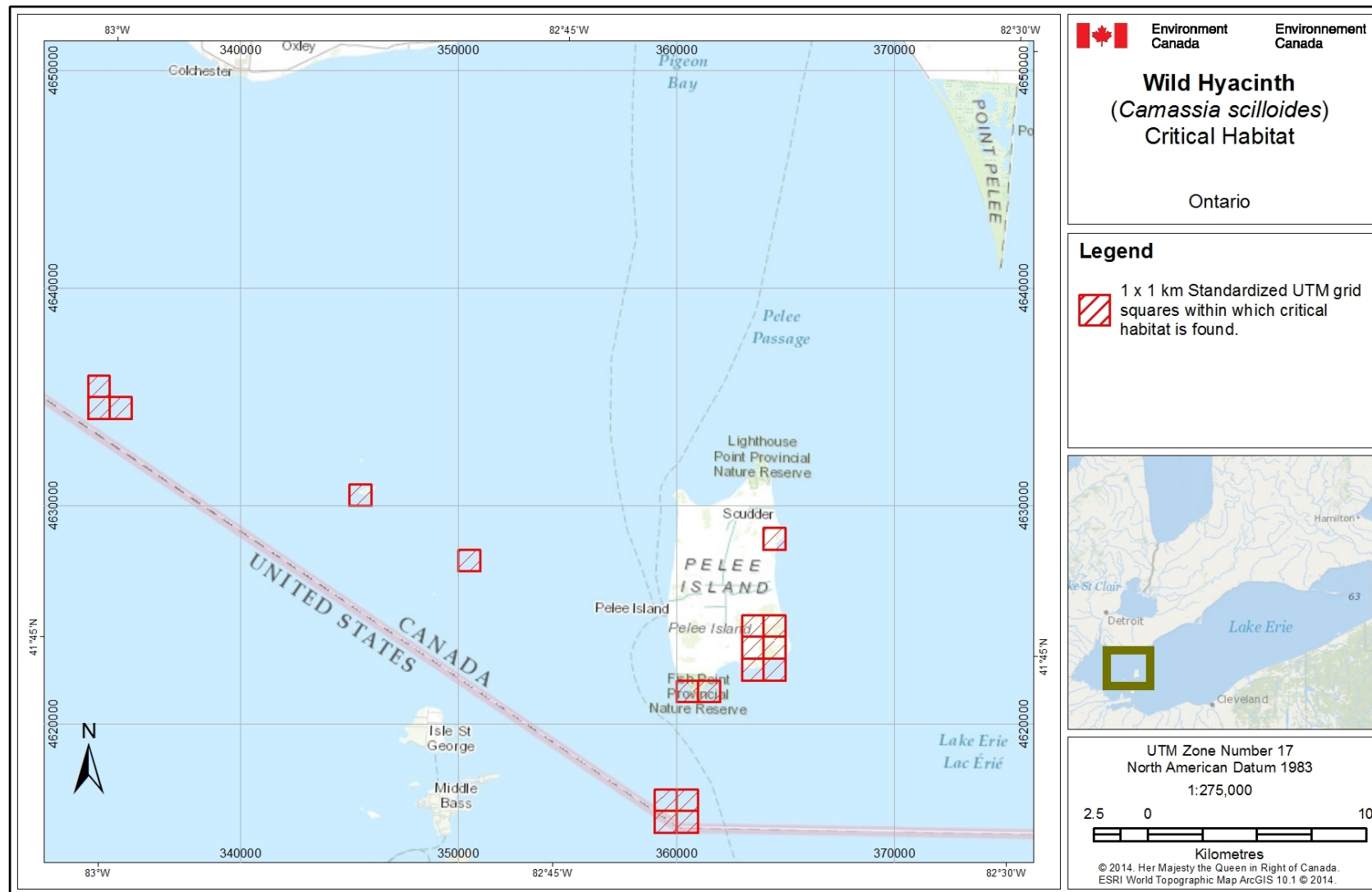


Figure 1. Grid squares that contain critical habitat for the Wild Hyacinth in Canada. Critical habitat for the Wild Hyacinth occurs within these 1 x 1 km standardized UTM grid squares (red hatched squares), where the description of habitat occupancy (section 7.1.1) and habitat suitability (section 7.1.2) are met.

Table 2. Grid squares that contain critical habitat for the Wild Hyacinth in Canada. Critical habitat for the Wild Hyacinth occurs within these 1 x 1 km standardized UTM grid squares where the description of habitat occupancy (section 7.1.1) and habitat suitability (section 7.1.2) are met.

Population	1 x 1 km standardized UTM grid square ID ^b	UTM Grid Square Coordinates ^c		Land Tenure ^d
		Easting	Northing	
East Sister Island	17LG4350	345000	4630000	Non-federal Land
Hen Island	17LG5207	350000	4627000	Non-federal Land
Middle Island	17LG5195	359000	4615000	Federal Protected Area (Point Pelee National Park)
	17LG5196	359000	4616000	Federal Protected Area (Point Pelee National Park)
	17LG6105	360000	4615000	Federal Protected Area (Point Pelee National Park)
	17LG6106	360000	4616000	Federal Protected Area (Point Pelee National Park)
Middle Sister Island	17LG3334	333000	4634000	Non-federal Land
	17LG3335	333000	4635000	Non-federal Land
	17LG3344	334000	4634000	Non-federal Land
Fish Point (Pelee Island)	17LG6201	360000	4621000	Non-federal Land
	17LG6211	361000	4621000	Non-federal Land
Middle Point (Pelee Island)	17LG6248	364000	4628000	Non-federal Land
Stone Rd Alvar (Pelee Island)	17LG6232	363000	4622000	Non-federal Land
	17LG6233	363000	4623000	Non-federal Land
	17LG6234	363000	4624000	Non-federal Land
	17LG6242	364000	4622000	Non-federal Land
	17LG6243	364000	4623000	Non-federal Land
	17LG6244	364000	4624000	Non-federal Land
Total = 18 grid squares				

^b Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098>), where the first 2 digits represent the UTM Zone, the following 2 letters indicate the 100 x 100 km Standardized UTM grid followed by 2 digits to represent the 10 x 10 km Standardized UTM grid. The last 2 digits represent the 1 x 1 km Standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See <http://www.bsc-eoc.org/> for more information on breeding bird atlases).

^c The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 1 x 1 km Standardized UTM grid square containing all or a portion of the critical habitat unit. The coordinates are provided as a general location only.

^d Land tenure is provided as an approximation of the types of land ownership that exist at the critical habitat units and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

7.2. Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in

time or from the cumulative effects of one or more activities over time (Government of Canada 2009). It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction. Activities described in Table 3 are examples of those activities likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Table 3. Activities likely to destroy the critical habitat of the Wild Hyacinth.

Description of Activity	Description of effect in relation to function loss	Details of effect (including related threat, scope, and thresholds)
Activities that compact the soil, or disturb or trample vegetation (e.g., use of all-terrain vehicles or heavy machinery)	<p>Because the Wild Hyacinth is believed to be dependent on loose soils for seed germination, alteration of the physical properties of the soil through soil compaction may render it unsuitable for germination.</p> <p>Disturbing native ground cover can also increase ability of invasive plants to colonize areas – see below.</p>	<p>Compaction of soils and disturbance of vegetation could occur as a result of a single activity (of significant magnitude), or through repeated smaller disturbances within critical habitat.</p> <p>The activity is most likely to cause destruction if it is undertaken at any time when the ground is not completely frozen.</p>
Development and conversion of lands (e.g., agricultural expansion, residential and commercial development, road construction)	<p>Development and conversion of lands can result in direct physical removal of the habitat (e.g., through building of structures) required by the species to carry out its life processes.</p> <p>Development and conversion of lands can result in clearing of native vegetation and/or disturbance of soils, thereby altering shade levels and/or other biophysical conditions (e.g., soil and moisture properties), rendering the habitat unsuitable for the Wild Hyacinth to carry out its life processes (i.e., dispersal, reproduction, and growth).</p>	<p>A single occurrence of this activity within critical habitat, regardless of what time of year it is conducted, is likely to result in the destruction of critical habitat. It also has the potential to cause destruction if it occurs outside the bounds of critical habitat, if it alters shading and/or hydrology of the site.</p>
Introduction of exotic invasive species, especially plants or invertebrates (e.g., through introduction of non-native plant seeds, plants, foreign soil or gravel, composting or dumping of garden waste, ATV use, livestock grazing)	<p>The introduction of invasive plant species can result in increased competition with the Wild Hyacinth for limited resources. Invasive species can also alter the ecological dynamics and/or cause physical and chemical changes to habitat (e.g., altered shade or soil moisture) and render it no longer suitable for the Wild Hyacinth.</p>	<p>Introduction of an invasive species in or adjacent to critical habitat can lead to gradual destruction of critical habitat over time. Thresholds are not applicable to this activity, as introduction of even a single individual could lead to further spread of the species.</p>

8. Measuring Progress

The performance indicator presented below provides a way to define and measure progress toward achieving the population and distribution objective. Every five years, success of recovery strategy implementation will be measured against the following performance indicator:

- Abundance and distribution of the Wild Hyacinth at existing populations in Canada have been maintained, or increased where necessary and biologically and technically feasible.

9. Statement on Action Plans

One or more action plans will be completed and posted on the Species at Risk Public Registry for the Wild Hyacinth by December 31, 2022.

10. 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](#)¹⁵. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s¹⁶ (FSDS) goals and targets.

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

This recovery strategy will clearly benefit the environment by promoting the recovery of the Wild Hyacinth. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. Other species at risk on islands in Lake Erie, Ontario include the Prothonotary Warbler (*Protonotaria citrea*), Least Bittern (*Ixobrychus exilis*), Blanchard's Cricket Frog (*Acris blanchardi*), Small-mouthed Salamander (*Ambystoma texanum*), Blue Racer (*Coluber constrictor foxii*), Eastern Foxsnake (*Elaphe gloydi*) Carolinian population, Lake Erie Watersnake (*Nerodia sipedon insularum*),

¹⁵ <http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1>

¹⁶ <http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1>

Chimney Swift (*Chaetura pelagica*), Eastern Prickly Pear (*Opuntia humifusa*), Grey Fox (*Urocyon cinereoargenteus*), Blue Ash (*Fraxinus quadrangulata*), Common Hop-tree (*Ptelea trifoliata*), Kentucky Coffee-tree (*Gymnocladus dioicus*), Red Mulberry (*Morus rubra*), Acadian Flycatcher (*Empidonax virescens*), Monarch (*Danaus plexippus*) and the Eastern Spiny Softshell Turtle (*Apalone spinifera spinifera*). Recovery approaches for the Wild Hyacinth are not anticipated to have adverse effects on these species. Management of cormorants is anticipated to also benefit several species, including Kentucky Coffee-tree, Common Hop-tree, Blue Ash, and Red Mullberry, all of which are threatened by the colonial nesting of cormorants.

The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects that cannot be avoided or mitigated.

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Appendix A: Subnational Conservation Ranks of the Wild Hyacinth (*Camassia scilloides*) in Canada and the United States

Wild Hyacinth (<i>Camassia scilloides</i>)	
S-rank	State/Province
S1 (Critically Imperiled)	North Carolina, Pennsylvania
S2 (Imperiled)	Ontario, Georgia, Iowa, Michigan, South Carolina, Virginia, Wisconsin
S2S3 (Imperiled-Vulnerable)	Mississippi
S3 (Vulnerable)	Louisiana
S3S4 (Vulnerable-Apparently Secure)	Illinois
S4 (Apparently Secure)	Kentucky, West Virginia
SNR (Unranked)	Alabama, Arkansas, District of Columbia, Indiana, Kansas, Maryland, Missouri, Ohio, Oklahoma, Tennessee, Texas

Rank Definitions (NatureServe 2015)

S1: Critically Imperiled – Critically imperiled in the state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2: Imperiled – Imperiled in the state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3: Vulnerable – Vulnerable in the state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4: Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors.

SNR: Unranked – State/province conservation status not yet assessed.

PART 2 – *Recovery Strategy for the Wild Hyacinth (Camassia scilloides) in Ontario*, prepared by the J.V. Jalava for the Ontario Ministry of Natural Resources



Wild Hyacinth (*Camassia scilloides*) in Ontario

Ontario Recovery Strategy Series

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

Natural. Valued. Protected.

About the Ontario Recovery Strategy Series

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

What is recovery?

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

What is a recovery strategy?

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

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

What's next?

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

For more information

To learn more about species at risk recovery in Ontario, please visit the Ministry of Natural Resources Species at Risk webpage at: www.ontario.ca/speciesatrisk

RECOMMENDED CITATION

Jalava, J.V. 2013. Recovery Strategy for the Wild Hyacinth (*Camassia scilloides*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. v + 26 pp + appendix.

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Cette publication hautement spécialisée Recovery strategies prepared under the Endangered Species Act, 2007, n'est disponible qu'en Anglais en vertu du Règlement 411/97 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec Pamela Wesley au ministère des Richesses naturelles au 705-755-5217.

AUTHORS

Jarmo V. Jalava, Consulting Ecologist, Carolinian Canada Coalition

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This recovery strategy was prepared by Jarmo Jalava in consultation with the Carolinian Woodlands Plants Technical Committee and with input from: Allen Woodliffe (Ontario Ministry of Natural Resources, Aylmer District); Michael Oldham and Sam Brinker (Ontario Natural Heritage Information Centre); John Ambrose (Botanical Consultant); Chris Risley, Amelia Argue, Vivian Brownell, Carolyn Seburn, Eric Snyder and Bree Walpole (Ontario Ministry of Natural Resources, Species At Risk Branch); Kate Hayes, Graham Bryan, Angela Darwin and Barbara Slezak (Canadian Wildlife Service, Environment Canada); Mhairi McFarlane (Nature Conservancy of Canada); Judith Jones (ecological consultant); Melody Cairns and Sandy Dobbyn (Ontario Parks); Dan Lebedyk (Essex Region Conservation Authority); and Kim Borg and Valerie Minelga (Parks Canada Agency).

DECLARATION

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

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

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

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

RESPONSIBLE JURISDICTIONS

Ontario Ministry of Natural Resources
Environment Canada – Canadian Wildlife Service, Ontario
Parks Canada Agency

EXECUTIVE SUMMARY

Wild Hyacinth (*Camassia scilloides*) is a showy, perennial, spring-flowering plant of the lily family (Liliaceae) that develops from a bulb. It has linear leaves and a stalk that supports up to 100 pale blue to white star-shaped flowers. Within its Canadian range, it grows in partial to moderate shade in low, moist woods on clay soil, as well as in drier, scrubrier hawthorn thickets and hackberry woodlands on shallow, rocky soil over limestone bedrock. In the United States the species also occurs in deeper-soiled floodplain forests, prairies, and a variety of other semi-open habitats.

Wild Hyacinth is designated Threatened under the *Endangered Species Act (ESA)*. It was designated as threatened in Canada by COSEWIC in 2002, and this status was adopted federally under the *Species at Risk Act*. It is of conservation concern or very rare (S1 or S2) in 8 of the 25 states of the United States within its range. However, it is common in its core distribution area, the Mississippi basin.

All extant and historic Ontario occurrences are from islands in western Lake Erie and the Detroit River in southwestern Essex County. Based on targeted surveys in 2001 and subsequent site visits, five extant occurrences are large (2,000 to >5,000 plants) and are believed to be stable. Habitat damage from colonial-nesting Double-crested Cormorants is believed to have destroyed two occurrences within the past two decades, and another was seriously impacted but has recovered since cormorant management was initiated at the site. One sub-population on Pelee Island has also disappeared within the past 15 years due to land clearing. The two extirpated historic populations were also lost to land development.

The recovery goal is to maintain and, where necessary, establish self-sustaining and viable populations of Wild Hyacinth at extant sites and at suitable historical sites in southern Ontario. Although extant occurrences appear to have stable populations, intervention may be necessary to prevent population declines due to cormorant impacts or possible future private land development.

The recovery objectives are to:

1. protect and manage habitat to maintain extant populations in Ontario;
2. determine current distribution and abundance of Wild Hyacinth populations in Ontario through inventory and monitoring in association with other Carolinian woodland plant species at risk;
3. address knowledge gaps relating to their biology, ecology, habitat and threats;
4. determine feasibility of reintroduction, and reintroduce Wild Hyacinth populations to suitable historical sites and recovery habitat; and
5. prepare and disseminate information on best management practices for Wild Hyacinth.

It is recommended that an occupancy-based approach be used to define the area to be regulated as habitat under the ESA. Given that Wild Hyacinth does not occupy all

apparently suitable habitat at the few extant Ontario sites, it is recommended that the area occupied by the plants, as well as surrounding habitat required for dispersal and population expansion, be prescribed as habitat in the regulation. The area prescribed should be delineated as the full extent of the Ecological Land Classification (ELC) ecosite polygon (as mapped by a qualified biologist, ecologist, or equivalent) within which a population occurs.

Wild Hyacinth is occasionally cultivated. It is recommended that horticultural populations be excluded from the habitat regulation.

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1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Wild Hyacinth

SCIENTIFIC NAME: *Camassia scilloides*

SARO List Classification: Threatened

SARO List History: Threatened (2004)

COSEWIC Assessment History: Threatened (2002), Special Concern (1990)

SARA Schedule 1: Threatened

CONSERVATION STATUS RANKINGS:

GRANK: G4G5

NRANK: N2

SRANK: S2

The glossary provides definitions for technical terms, including the abbreviations above.

1.2 Species Description and Biology

Species Description

Wild Hyacinth (*Camassia scilloides*) is a showy, perennial, spring-flowering plant of the lily family (Liliaceae) (Gould 1942). It develops from a bulb and has basal, keeled, linear leaves. It has a stalk up to 70 cm tall that supports up to 100 star-shaped flowers, pale blue to white in colour, with six petals and yellow anthers (Gould 1942, Gleason and Cronquist 1991).

Species Biology

In Canada, Wild Hyacinth blooms in mid to late May when pollinating insects are abundant. Insect visitors that have been observed on sunny days include butterflies (superfamily Papilionoidea), bumblebees (*Bombus* spp.), metallic green/bronze bees (*Agapostemon* spp.), small solitary bees (Megachilidae), bee flies (Bombiliidae) and hover flies (Syrphidae), but little or no insect visitation occurred during cloudy or rainy weather (COSEWIC 2002). As with many other spring ephemerals, leaves and fruiting stalks die down by mid-summer.

Germination occurs the following spring. Seeds are produced copiously from dry capsules, some of which fall over before opening, suggesting that seeds are not dispersed very far. The dry, hard seeds do not seem to be attractive to woodland dispersal agents, such as ants. Within a habitat patch there may be several densely-clustered Wild Hyacinth colonies. It is uncertain what dispersal mechanisms are at play in creating a new colony (COSEWIC 2002).

It appears that vegetative reproduction from bulb offsets does not occur frequently in Canadian populations (Oldham 1990, COSEWIC 2002). During field work for COSEWIC (2002), a group of Wild Hyacinths was dug up to determine if there were indications of vegetative growth of populations. No evidence of offshoots or bulblets was seen. However, numerous small bulbs were among (but clearly separate from) the mature bulbs, suggesting seedlings of different ages. The occurrence of mixed flower colours within colonies (white to very pale blue to pale blue) is further indication of genetic variation that would not be expected in populations that have developed by vegetative means (COSEWIC 2002).

Individual plants are likely long-lived, since the closely related Common Camas (*Camassia quamash*) of western North America has a lifespan of 15 to 20 years (Stevens et al. 2001). There has been little change in location from different observations of Wild Hyacinth in Ontario over the decades (COSEWIC 2002).

Wild Hyacinth has an observed interaction with a variety of pollinating insects, a relationship that undoubtedly is symbiotic, providing food energy to the pollinators and an exchange of genetic material for the plants. As a staple native food plant of North American Aboriginal people, hyacinths (*Camassia* spp.) played a significant socio-ecological role in functioning ecosystems prior to European settlement (e.g., see Garibaldi and Turner 2004).

1.3 Distribution, Abundance and Population Trends

Wild Hyacinth occurs naturally in the southeastern and midwestern United States, with its distribution centred on the Mississippi drainage basin. It is found from northwestern Georgia to eastern Texas and north to its extremely limited range in Canada, on the Lake Erie Islands of Ontario. Western Lake Erie and southern Wisconsin mark the northeastern and northwestern limits of its range, respectively.

Wild Hyacinth is of conservation concern in nearly all the state and provincial jurisdictions within which its status has been assessed. It is designated endangered in Pennsylvania and Wisconsin and threatened in Michigan and North Carolina (USDA 2012). It is also classified as threatened in Canada under the *Species at Risk Act* and in Ontario under the *Endangered Species Act, 2007*. According to NatureServe (2012), it is ranked “critically imperilled” (S1) in North Carolina and Pennsylvania, “imperilled” (S2) in Ontario, Georgia, Iowa, Michigan, South Carolina, Virginia and Wisconsin, “imperilled to vulnerable” (S2S3) in Mississippi, “vulnerable” (S3) in Louisiana and “vulnerable to apparently secure” (S3S4) in Illinois. It is considered “apparently secure” (S4) in two states, Kentucky and West Virginia (NatureServe 2012). Its conservation status has not been ranked in Missouri, Kansas, Tennessee, Texas and Alabama, according to NatureServe (2012)¹.

¹ Other sources provide the following: Wild Hyacinth is described as: “common” in Missouri (CCM 2006), and it occurs in 22 counties in Kansas, 26 counties in Tennessee, 30 counties in eastern Texas and 5

All extant and historic Ontario occurrences of Wild Hyacinth are from islands in Lake Erie and the Detroit River in Essex County (COSEWIC 2002, NHIC 2006). One historic record of Wild Hyacinth on the mainland of Point Pelee National Park is believed to have been planted (PCA 2011a). Based on detailed surveys for the species between 2001 (COSEWIC 2002) and 2012 (PCA 2011b, McFarlane (pers. comm. 2012), five extant occurrences are relatively large (2,000 to >5,000 plants). Due to impacts from colonial-nesting Double-crested Cormorants (*Phalacrocorax auritus*), the East Sister Island and Middle Sister Island populations appear to no longer be extant. The Middle Island population was reduced from ~5,000 individuals in 1988 to less than 865 plants (700 of them vegetative) in 2001, and no more than 500 in 2003 (North-South Environmental 2004), before recovering to approximately 4,000 plants in 2008, the year cormorant population management was begun at the site.

There is no evidence that Wild Hyacinth was ever common in Ontario. In the late 1980s, the total estimated population for the province was between 14,000 to 16,000 plants (Oldham 1990), not including a large population on Hen Island for which no count was available. A 2001 survey of all known sites, undertaken with a crew of knowledgeable volunteers, yielded a total count of 21,212 flowering plants (COSEWIC 2002), suggesting relatively stable populations in recent decades at most extant sites. However, the loss of the East Sister Island population apparently to cormorant impacts (COSEWIC 2002), combined with the loss of two historical populations and a Fish Point sub-population to land development, suggests a long term overall decline of the species in the province.

Hyacinth (*Camassia* spp.) bulbs are starchy and edible, and the western North American species (*C. leichtlinii* and *C. quamash*) was consumed as a staple food by native people and by early European explorers. Wild Hyacinth bulbs were probably similarly used by eastern Aboriginal people in the Lake Erie region. It is possible that the species was deliberately or accidentally introduced to the Erie Islands by them (COSEWIC 2002), which may offer clues as to the species' ability to persist and/or expand its populations in Ontario. Hyacinth bulbs, usually of the western species, are commonly available in the specialty horticultural trade (COSEWIC 2002), which could affect the "purity" of the native populations should exchange of genetic material occur.

counties in Alabama (USDA 2012). MacGregor (1966) considered it "common" in eastern Kansas, and it is not included in the Tennessee Natural Heritage Program Rare Plant list (Crabtree 2008). BONAP (2012) mapping suggests that at the county level it is only sporadically rare along the southern, eastern and northern edges of its range in North America. This suggests that, with the exception perhaps of Alabama, it is not of conservation concern in the states where its conservation status has not been ranked.

Table 1. Extant and Historic Occurrences of Wild Hyacinth in Ontario (based on COSEWIC 2002, PCA 2011b, NHIC 2012, McFarlane pers. comm. 2012)

Ontario Population		Quality rank*	Last Obs.	Status	Notes
County or Region	Site				
Essex	Hen Island, Lake Erie	A**	2001	One population; 5680 plants	Private land; invasive species a threat.
Essex	Middle Point	A	2011	Two sub-populations; 4862 plants in 2001; population considered similar or slightly larger in 2011.	Owned by Nature Conservancy of Canada (NCC); population appears thriving, no immediate threats noted. Previously undocumented population of 10-15 plants on private land east of East Shore Road may be threatened by Periwinkle (<i>Vinca minor</i>) (McFarlane pers. comm. 2012).
Essex	Stone Road Alvar	A	2001	Five or six sub-populations (Woodliffe pers. comm. 2011); 4485 plants	Most of site protected as nature reserve by various agencies; populations on private land possibly threatened by development.
Essex	Fish Point Provincial Nature Reserve	A	2001	Two sub-populations; 2090 plants	One private-land sub-population extirpated by housing development; others protected within Fish Point Provincial Nature Reserve.
Essex	Middle Island	B	2008	~4000 plants (PCA 2011b)	Acquired by NCC in 2001, now managed by Point Pelee National Park; Double-crested Cormorant being managed to reduce impacts.
Essex	Middle Sister Island	F***	2001, 2011	One sub-population; 3230 plants in 2001. None observed in 2011.	Private land; possibly threatened by development. Incidental observations in 2011 indicate that population is likely gone; island covered in coromorant guano with only remaining herbaceous vegetation being a stand of Pokeweed (<i>Phytolacca americana</i>) (PCA 2011b).
Essex	East Sister Island	H****	1985	No plants found in 2001, presumed extirpated	Provincial Nature Reserve; habitats heavily impacted by Double-crested Cormorant nesting colony.
Essex	North Harbour Island	X	1948	Presumed extirpated	Private land. Most of the island is now an extensive lawn; detailed searches in 1987 failed to locate the species.
Essex	Bois-blanc Island, Detroit River ("White Island, west of Amherstberg)	X	1882	Presumed extirpated	Private land. All recent (to 1999 at least) searches have been unsuccessful; most of the island is now an amusement park (COSEWIC 2002).

*Quality Rank refers to Natural Heritage Information Centre (NHIC) ranks based on predicted viability of the occurrence: A – Excellent, B – Good, C – Fair, D – Probably not viable; E – Verified extant, F – Failed to find, H – Historic, X – Extirpated; ** - status assigned as "E" by NHIC (2006) requires update to "A"; *** - status assigned as "A" by NHIC (2006) requires update to "F"; **** - status assigned as "C" by NHIC (2006) requires update to "H".

Recovery Strategy for the Wild Hyacinth in Ontario

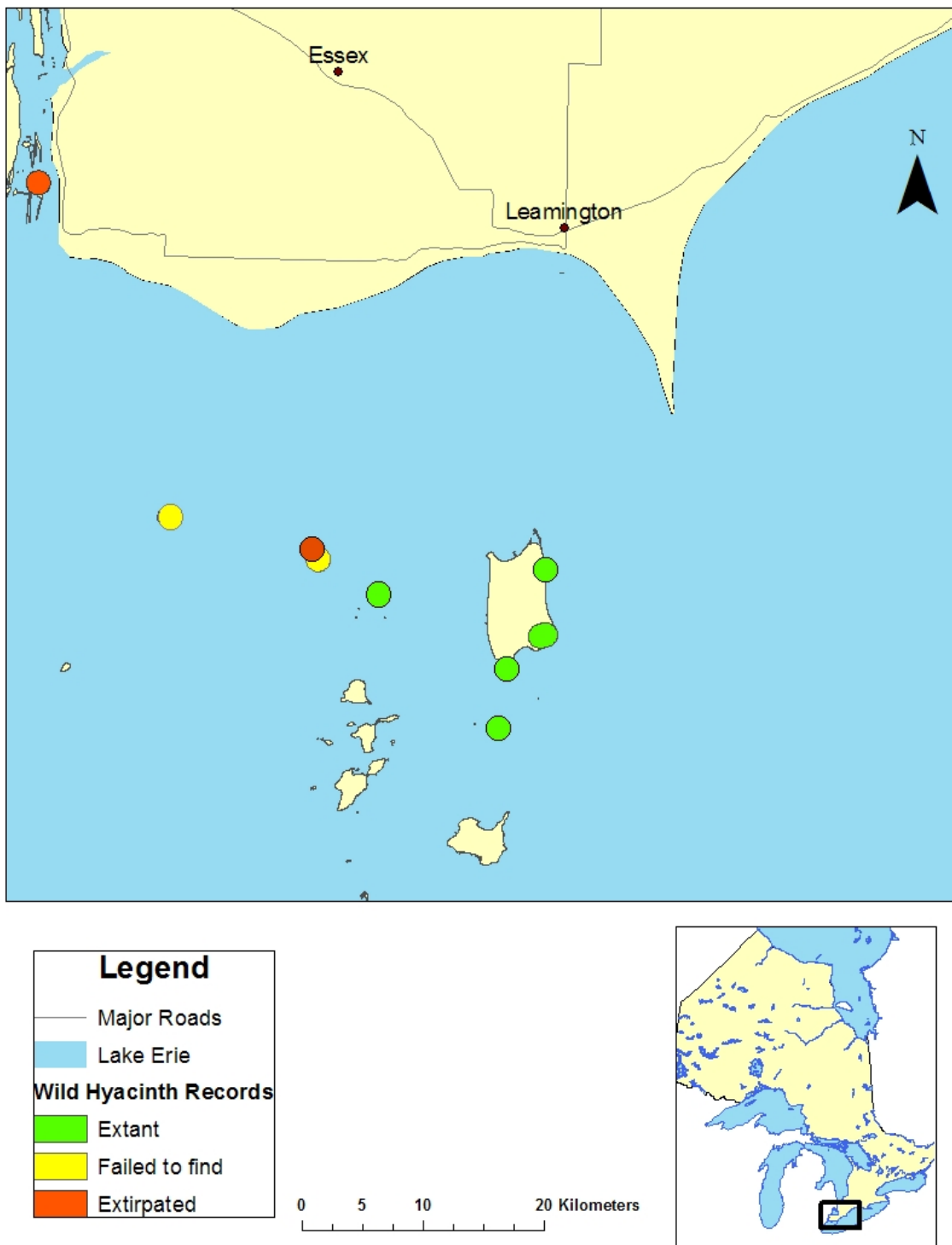


Figure 1. Historical and current distribution of Wild Hyacinth in Ontario

1.4 Habitat Needs

Wild Hyacinth is restricted in Canada to islands at the west end of Lake Erie, an area with a climate moderated by this large body of water. This region has one of the longest growing seasons in Ontario and the highest heat units in Canada, as well as relatively dry summers compared to other parts of southern Ontario. Within this restricted range, Wild Hyacinth grows in the partial to moderate shade of open deciduous woodlands and hawthorn scrub. The rich clayey Farmington loam (Richards et al. 1949) ranging to organic soils in these habitats is shallow, with limestone bedrock occurring close to the surface (COSEWIC 2002).

In Ontario, the extant occurrences of Wild Hyacinth are in low, moist woods on clay soil as well as drier scrubby woodland on shallow, rocky soil over limestone bedrock (Oldham 1990). The Stone Road Alvar occurrences are found in shrubby alvar, Blue Ash – Chiquapin Oak – Hackberry savannah, Red Ash – Swamp Oak forest, Shagbark Hickory forest, and Hackberry – Hawthorn savannah. At Middle Point, habitats in which the species occurs are described as Hackberry – Maple forest, Hackberry forest, rich Hackberry forest, moist woods and rocky woods. Tree and shrub dominants at other occurrences include Red Ash (*Fraxinus pennsylvanica*), Downy Hawthorn (*Crataegus mollis*) and Common Hackberry (*Celtis occidentalis*), with overstorey associates such as Shagbark Hickory (*Carya ovata*), Bur Oak (*Quercus macrocarpa*) and Sugar Maple (*Acer saccharum*) (Oldham 1990). Herbaceous associates at these sites include False Mermaid (*Floerkea proserpinacoides*), Canada Avena (*Geum canadense*), Spring Avena (*Geum vernum*), Garlic Mustard (*Alliaria petiolata*), Kidney-leaved Buttercup (*Ranunculus abortivus*), Virginia Creeper (*Parthenocissus* sp.), Spotted Jewelweed (*Impatiens capensis*), Long-styled Sweet-cicely (*Osmorhiza longistylis*), Cleavers (*Galium aparine*), Blue Phlox (*Phlox divaricatus*), Short's Aster (*Aster shortii*), Canada Onion (*Allium canadense*), White Trout-lily (*Erythronium albidum*) and Virginia Waterleaf (*Hydrophyllum virginianum*) (Oldham 1990). The habitat of the historic Bois Blanc Island occurrence on the Detroit River was described as “wet meadows”.

In the United States, the species also occurs in deeper-soiled floodplain forests, and in Wisconsin it is considered a species of “damp prairie soils, roadsides and railroad right-of-ways” (WDNR 2006), while in Missouri it is a plant of “prairies, glades and open woods” (CCM 2006). Oldham (1990) lists the following habitat types for United States occurrences, based on various literature sources and herbarium data: prairie meadow; slightly dry to wet prairies; open woods; calcareous glades or outcrops in rocky forests; moist woods or meadows; hill prairies and railroad prairie; edges of woods, particularly in calcareous areas; floodplain woods and along streams; steep, rocky calcareous wooded slopes; hackberry woods; river-bottom flats and banks; roadside wet-mesic prairie remnant; wet meadows; grassy road bank; oak woods on steep slope; limestone hillside; low oak – red cedar – hackberry woods; lowest and wettest spots in prairie; low granite ridges, prairie; rich, moist woods.

In horticultural settings, *Camassia* are also tolerant of a wide range of habitats and moisture levels, and do well in any fertile soil that is moist but not saturated in spring

(Oldham 1990). Plants of this genus do not appear to be negatively impacted by droughty conditions in summer, and appear to do best in full sun (Oldham 1990), although preference for “part shade” or “shade” is cited as the light requirement in UTLBJWC (2012).

1.5 Limiting Factors

Wild Hyacinth is at the extreme northern limit of its range on the Lake Erie Islands, where temperature extremes are reduced and growing season extended because of the moderating effect of the adjacent waters. This suggests the possibility that climate may be a factor limiting its expansion in Ontario. Since a native population has never been confirmed on the mainland², it would appear that the waters of Lake Erie may also have restricted population expansion (with Aboriginal peoples possibly having been the vector that introduced the species to the islands, as noted above). The demographic structure of populations discussed above and the clustering of plants in colonies suggest that the species has limited ability to disperse over long distances.

Macior (1978) suggests that Wild Hyacinth is completely dependent on insects for pollination. This would be a serious limiting factor should its pollinator populations be in decline.

Although it has a widespread geographic distribution, the fact that Wild Hyacinth is considered rare in many jurisdictions (NatureServe 2012) within its range suggests that it may have certain as yet unknown biological or habitat limitations. At the same time, the fact that it can thrive along roadsides and railway lines in some portions of its range (WDNR 2006) suggests that Wild Hyacinth can benefit from moderate levels of certain types of disturbance if other ecological factors are favourable.

1.6 Threats to Survival and Recovery

Known Threats

Hyperabundant Native Species

One of the main threats to the survival of Wild Hyacinth in Canada involves the explosion of Double-crested Cormorant populations on the Lake Erie since the early 1980s. Canada Goose populations have also increased dramatically in southern Ontario during this period (CWS 2012). Cormorants nest in large colonies (more than 5,000 individuals), severely impacting both the trees and the ground flora in their vicinity. Trampling by Canada Geese has been noted as a significant recent impact at the Middle Island population (PCA 2011b). Browsing by geese has also been observed (Woodliffe pers. comm. 2009), although the severity of impact is unknown. Compounding the goose-impacts, ammonia-rich excrement produced by cormorants

² A population at Point Pelee National Park is believed to have originated from planted stock (NHIC 2006).

has destroyed much of the native understorey, creating conditions suitable for rapid colonization by highly-competitive plant species such as Pokeweed (*Phytolacca americana*) and European Stinging-nettle (*Urtica dioica* ssp. *dioica*) (Jalava et al. 2008b). However, recent efforts to control cormorants and deter Canada Geese at Middle Island appear to have resulted in a significant recovery of Wild Hyacinth at the site (PCA 2011b). Cormorants prefer to nest on small, isolated islands with fewer predators, so presumably the Hen Island population would be much more likely to be impacted than the occurrences on Pelee Island.

The increase in Double-crested Cormorants is a recent phenomenon with underlying anthropogenic causal factors. Their expansion into the Great Lakes region from the west in the early 1900's was probably related to an increase in food supply (prey fish species) associated with declines in predatory fish species caused by commercial over-fishing, as well as the introduction of Sea Lamprey, and other factors (Environment Canada 2006). A dramatic population decline of cormorants occurred between the 1950s and 1970s due to bio-accumulating toxic chemicals combined with direct persecution by fishermen who believed cormorants were preying on juveniles of desirable commercial and sport fish species. A gradual recovery of populations began in the 1970s after regulations were put in place to control the production and use of DDT and related chemicals in North America, with rapid increases starting in the late 1980s. The United States federal protection under the Migratory Bird Treaty Act in 1972, combined with the expansion of the aquaculture industry and construction of reservoirs in the southeast United States are considered important factors in the resurgence (USFWS 2012). The introduction of Round Goby and other exotic prey species to the lower Great Lakes may also have benefitted cormorants in recent decades. Also, the reduced turbidity of lakes due to the effects introduced mussels has likely made their prey easier to see.

Land Development

Two historic Wild Hyacinth occurrences (Bois Blanc and North Harbour islands) were extirpated by clearing for housing and other development (COSEWIC 2002). The habitat of one population at Fish Point (Mosquito Point) on Pelee Island on land zoned as cottage residential was cleared for development prior to Wild Hyacinth's designation as threatened. Occurrences on private land at Stone Road and Middle Point are not situated near the shoreline where cottage development is more likely, are almost entirely now on private or public conservation lands, and are therefore not likely to be impacted by this threat.

Exotic or Invasive Species

Invasion of Wild Hyacinth habitat by exotic species is often linked to other threats, such as cormorant colonies, land clearing for development, forestry practices, nearby trails and roads, and other disturbances. Invasive exotic plant species compete for limited resources with native taxa. Their presence alters the overall composition of ecological communities, potentially affecting other taxa, including pollinating insects. Invasive species have been observed as being a problem at both the Middle Island and the (probably extirpated) East Sister Island occurrences (COSEWIC 2002,

Jalava et al. 2008b). Garlic Mustard and Norway Maple have been noted as invading woodlands near the Middle Point population (COSEWIC 2002), although not at the occurrence itself, and invasive species control is one of the management priorities at this site (McFarlane pers. comm. 2012). The western *Camassia* species have been “severely impacted” by introduced species in the Garry Oak ecosystems of Vancouver Island (Garibaldi and Turner 2004).

Emerald Ash Borer has recently arrived on Pelee Island, and the resulting die-back of various ash species has been significant. Ash is one of the most dominant species on Pelee Island, but with the die-back forest canopies are opening up and shrub and vine (especially *Parthenocissus* spp., *Rubus* spp., *Rhus* spp., *Smilax* spp.) populations have increased greatly. Impacts on the light levels in the understorey may be detrimental to Wild Hyacinth at affected sites (Anonymous 2011).

Potential Threats

Trampling

Trampling of plants by humans has not been cited as a threat to Wild Hyacinth in Canada. However, the potential exists at any accessible site on Pelee Island, even though venturing off trails may be prohibited at Fish Point Provincial Nature Reserve and other protected sites. The amount of visitation by boaters to outlying smaller Erie Island sites is not known, but it is probably relatively infrequent. Trampling may cause direct damage to plants and disturb the habitat, creating conditions suitable for invasion by exotic species. At present this should be considered a relatively minor threat. As noted above, trampling by Canada Geese was damaging Middle Island populations until goose deterrents were put in place (Anonymous 2011, PCA 2011b).

Collecting for Horticulture

Wild Hyacinth is a showy, attractive, spring-flowering plant; and the potential for its collection by horticultural enthusiasts is considerable. Hyacinth (*Camassia* spp.) are widely available in the specialty horticultural trade, although the western species and related cultivars are most frequently sold commercially in North America (COSEWIC 2002). Given that there are no documented instances of Wild Hyacinth collecting in Ontario, at present this is also considered a relatively minor threat.

Natural Succession

Given that all Ontario populations of Wild Hyacinth occur in open or semi-open woodland habitats, near openings, or along edges, probably due to light requirements, natural succession to closed-canopy conditions could render habitat unsuitable for the species. However, some of the larger Ontario populations occur away from forest edges, and have quite extensive canopy cover by late spring and throughout the summer. A dominant tree species at these sites is Common Hackberry (*Celtis occidentalis*), one of the last of the tree species to leaf out, thereby allowing sunlight to reach the forest floor throughout the peak flowering period. By the time heavy shade takes over, flowering is complete, and seed set is largely established (Woodliffe pers. comm. 2011).

1.7 Knowledge Gaps

Additional study required to better understand the status and ecology of Wild Hyacinth in Ontario includes:

- determining what constitutes a viable, self-sustaining population in Ontario;
- determining through field surveys and monitoring the most current distribution and population sizes of extant populations, particularly at heavily impacted sites;
- better understanding of population trends province-wide and at individual sites;
- determining if current recommended management practices for Double-crested Cormorant colonies are appropriately addressing the recovery needs of Wild Hyacinth populations at impacted sites;
- better definition of the habitat requirements for this species in Ontario;
- determining the degree of threat by adjacent land development and forest management on remaining private land sites;
- better understanding of the relative severity and importance of potential and poorly-understood threats such as invasive species, trampling and collection for horticulture;
- better understanding of Wild Hyacinth reproductive biology (seed dormancy, viability and germination; seed bank structure; pollination methods and pollinators), dispersal (mechanisms and distances) and establishment (ecological conditions, minimum propagule pressure) would be beneficial;
- best management practices are largely undocumented (e.g., see Franken et al. 2009, on potential effects of prescribed burns); and
- understanding establishment requirements and feasibility (prior to reintroduction to historic sites).

1.8 Recovery Actions Completed or Underway

A comprehensive survey of known extant and historic Wild Hyacinth populations was undertaken in 2001 by a team of volunteers (COSEWIC 2002).

Passive management is the standard practice at Provincial Nature Reserves (East Sister Island and Fish Point), although specific management for Wild Hyacinth is not noted in the management plan for Fish Point (Ontario Parks 2005), in which the species is erroneously indicated as being designated Special Concern. Stone Road Alvar is a nature reserve with portions owned by the Federation of Ontario Naturalists, the Nature Conservancy of Canada (NCC) and the Essex Region Conservation Authority (ERCA); on both the Ontario Nature and ERCA properties, management efforts have included prescribed burning to prevent the natural succession of shrubs from closing in on the savannah communities (Ontario Nature 2006).

Middle Island is managed for natural heritage protection by Point Pelee National Park. A control program for the Double-crested Cormorant was initiated in 2008 with the aim

of reducing impacts of the nesting colony on the site's vegetation and associate species at risk.

The NCC's Natural Area Conservation Plan for the Western Erie Islands includes Wild Hyacinth habitat as one of its top priority conservation targets. NCC recently acquired the property with the major population at Middle Point, as well as one of the sub-populations at Stone Road Alvar, and is undertaking surveys, monitoring and management for Wild Hyacinth at these sites (McFarlane pers. comm. 2012).

In 2007, Waldron (pers. comm. 2012) conducted an inventory of the Bois-blanc Island's flora and fauna. No Wild Hyacinth was observed during that season's fieldwork. However, areas in the south portion of the island would likely support a population of Wild Hyacinth. Some of these areas are under Federal control although Essex Region Conservation Authority is responsible for their management. According to Waldron (pers. comm. 2012) this area may be a suitable repatriation site.

2.0 RECOVERY

2.1 Recovery Goal

The recovery goal is to maintain and, where necessary, establish self-sustaining and viable populations of Wild Hyacinth at extant sites and at suitable historical sites in southern Ontario.

At a minimum, several robust, reproducing populations are needed to ensure long-term viability in Ontario. Maintenance of extant populations at their current levels, with no further habitat loss, along with re-establishment of the East Sister Island and Middle Sister Island populations, if restoration of recovery habitat³ at these cormorant-impacted sites is feasible, would probably constitute viability of the species in Ontario. A population viability analysis is recommended to confirm this assumption. Given the extent of land conversion within the historic range of Wild Hyacinth in Ontario, opportunities for re-establishment of populations are limited.

2.2 Protection and Recovery Objectives

Table 2. Protection and recovery objectives

No.	Protection or Recovery Objective
1	Protect and manage habitat to maintain extant populations in Ontario.
2	Determine current distribution and abundance of Wild Hyacinth populations in Ontario through inventory and monitoring in association with other Carolinian woodland plant species at risk.
3	Address knowledge gaps relating to the biology, ecology, habitat and threats.
4	Determine feasibility of reintroduction, and reintroduce Wild Hyacinth populations to suitable historical sites and recovery habitat.
5	Prepare and disseminate information on best management practices for Wild Hyacinth.

³ For the purpose of this recovery strategy, recovery habitat is considered historical but unoccupied habitat of Wild Hyacinth.

2.3 Approaches to Recovery

Table 3. Approaches to recovery of the Wild Hyacinth in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
1. Protect and manage habitat to maintain extant populations in Ontario.				
Critical	Short term	Management	1.1 Apply, and adapt as necessary, appropriate management practices to reduce cormorant impacts.	<ul style="list-style-type: none"> • Double-crested Cormorant impacts.
Necessary	Short term	Protection	1.2 Identify the positive and/or negative impacts of land-use and management practices.	<ul style="list-style-type: none"> • All threats relating to on-site and adjacent land uses.
Necessary	Short term	Protection	1.3 Identify sites that may be affected by future land development, and ensure that habitat is appropriately mapped and protected through regulation, stewardship and/or securement.	<ul style="list-style-type: none"> • All threats relating to on-site and adjacent land uses.
Necessary	Short term	Protection	1.4 Develop Best Management Practices (BMPs) for maintaining Wild Hyacinth habitat.	<ul style="list-style-type: none"> • All threats relating to on-site and adjacent land uses.
Necessary	Short term	Protection	1.5 Encourage and support private land stewards and public land managers to implement BMPs.	<ul style="list-style-type: none"> • All threats relating to on-site and adjacent land uses.
Beneficial	Short term	Management	1.6 Clarify land ownership of some populations in order to determine stewardship and/or securement options.	<ul style="list-style-type: none"> • All threats relating to on-site and adjacent land uses.
Beneficial	Long term	Stewardship	1.7 Determine feasibility of restoration or rehabilitation of habitat at historic occurrences and recovery habitat.	<ul style="list-style-type: none"> • Vulnerability due to low population levels and low number of occurrences.
Beneficial	Long term	Stewardship	1.8 Determine and apply best methods for exotic and invasive species control at impacted sites.	<ul style="list-style-type: none"> • Double-crested Cormorant nesting colonies; exotic or invasive species; trampling.

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Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Beneficial	Long term	Stewardship	1.9 Integrate restoration planning and recovery actions with NCC's Natural Area Conservation Plan initiative and other programs of partner agencies and groups.	<ul style="list-style-type: none"> Double-crested Cormorant nesting colonies; exotic or invasive species; trampling.
Beneficial	Long term	Protection	1.10 Identify key sites for securement in the context of the overall Carolinian Woodlands Recovery Strategy (Jalava et al. 2008a, 2009).	<ul style="list-style-type: none"> Land development; forestry.
Beneficial	Long term	Protection	1.11 Secure key sites through easements or purchase.	<ul style="list-style-type: none"> Land development; forestry.
2. Determine current distribution and abundance of Wild Hyacinth populations in Ontario through inventory and monitoring in association with other Carolinian woodland plant species at risk.				
Critical	Short term	Inventory, Monitoring and Assessment	2.1 Conduct population counts of extant populations every 3 to 5 years, characterize habitat, and assess threats.	<ul style="list-style-type: none"> Knowledge gaps relating to status.
Necessary	Short term	Inventory, Monitoring and Assessment	2.2 Identify and survey any additional sites with potentially suitable habitat.	<ul style="list-style-type: none"> Knowledge gaps relating to status.
Necessary	Short term	Inventory, Monitoring and Assessment	2.3 Develop monitoring strategy for Wild Hyacinth (Appendix 1).	<ul style="list-style-type: none"> All threats. Knowledge gaps: better understanding of current status.
Necessary	Ongoing	Inventory, Monitoring and Assessment	2.4 Apply the monitoring protocol every 3 to 5 years in association with monitoring for other priority species of the overall Carolinian Woodlands Recovery Strategy (Jalava et al. 2008a, 2009).	<ul style="list-style-type: none"> All threats. Knowledge gaps: better understanding of current status.

Recovery Strategy for the Wild Hyacinth in Ontario

3. Address knowledge gaps relating to the biology, ecology, habitat and threats.				
Critical	Short term	Research	3.1 Determine the degree to which Double-crested Cormorant colonies must be managed in order to ensure Wild Hyacinth viability.	<ul style="list-style-type: none"> Double-crested Cormorant impacts
Necessary	Short term	Research	3.2 Assess whether natural succession is impacting populations.	<ul style="list-style-type: none"> Natural succession
Necessary	Long term	Research	3.3 Engage the academic community to investigate Wild Hyacinth reproductive biology (seed dormancy, viability and germination; seed bank structure; pollination methods and pollinators), dispersal (mechanisms and distances) and establishment (ecological conditions, minimum propagule pressure) ⁴ .	<ul style="list-style-type: none"> Knowledge gaps relating to reproductive biology, dispersal and establishment.
Necessary	Short term	Inventory, Monitoring and Assessment	3.4 Conduct population viability analysis.	<ul style="list-style-type: none"> Knowledge gap relating to minimum viable population level.
Necessary	Short term	Research, Stewardship	3.5 Research and identify best management practices for Wild Hyacinth and its habitat.	<ul style="list-style-type: none"> All anthropogenic threats; knowledge gaps relating to site management.
Beneficial	Long term	Research	3.5 Determine if Wild Hyacinth is at risk from collecting by horticulturalists.	<ul style="list-style-type: none"> Collecting for horticulture.
Beneficial	Long term	Education and Outreach	3.6 Develop educational and outreach materials if necessary, and provide to horticultural clubs and native plant nurseries.	<ul style="list-style-type: none"> Collecting for horticulture.

⁴ Ambrose (2012), former curator of the University of Guelph Arboretum, has grown abundant seedlings in a woodland nursery from fall planted seeds and suggests that establishment, at least under controlled conditions, can be undertaken with no apparent difficulty. As a plant of horticultural and reintroduction interest, establishment information is quite widely available (e.g., Horvath et al. 2001, UTLBJWC 2012)

Recovery Strategy for the Wild Hyacinth in Ontario

4. Determine feasibility of reintroduction, and reintroduce Wild Hyacinth populations to suitable historical sites and recovery habitat.				
Beneficial or necessary	Long term	Stewardship	4.1 Based on assessments of threats, studies of the species' biology and ecology, population viability analysis, determine the need and feasibility of reintroduction.	<ul style="list-style-type: none"> • Vulnerability due to low number of occurrences.
Beneficial or necessary	Long term	Stewardship	4.2. Reintroduce Wild Hyacinth to historic sites where feasible.	<ul style="list-style-type: none"> • Vulnerability due to recent losses of populations and low number of extant occurrences.
5. Prepare and disseminate information on best management practices for Wild Hyacinth.				
Necessary	Long term	Stewardship	5.1 Prepare "best management practices" (BMP) fact sheets and provide to landowners and land managers with Wild Hyacinth habitat, as well as to horticultural clubs and garden centres.	<ul style="list-style-type: none"> • Inadvertent damage to habitat; introduction of invasive species; contamination of gene pool with non-native varieties.

Narrative to Support Approaches to Recovery

Up-to-date information on population size, fruiting and seedling counts, longevity, descriptions of habitat, and assessments of habitat condition and threats, is required at all extant sites in order to prioritize recovery activities. The current status of all populations should be systematically verified.

To maximize efficiency and reduce costs, inventory and recovery actions should be planned and, where appropriate, undertaken in concert with those for other priority species of the overall Carolinian Woodlands Recovery Strategy (Jalava 2008a, 2009). For example, inventory and monitoring for several species occurring at nearby sites would most effectively be undertaken by the same surveyor(s) as part of the same project. Approaches to site management, stewardship and threat mitigation should be developed in association with other Carolinian woodland species at risk that have similar habitat requirements or face similar threats. Similarly, identification of priority sites for restoration or securement should be made using a gap analysis approach that considers the full suite of priority species of the Carolinian Woodlands Recovery Strategy (Jalava 2008a, 2009).

2.4 Performance Measures

Evaluation of the overall recovery effort will be measured by the following criteria.

- No loss of extant populations. Populations are increasing or stable (i.e., within an acceptable range of annual fluctuation).
- Habitat is identified and mapped.
- Communications products produced and distributed to landowners and land managers.
- Historic reports and other potential habitat comprehensively surveyed.
- Potential restoration sites identified.
- No further population declines due to cormorant impacts or anthropogenic disturbance (as determined from monitoring data), and threats are being appropriately addressed.
- Habitat restoration initiated where feasible.
- Reintroduction, if feasible, initiated at suitable or restored historic sites.

Evaluation of specific actions taken to recover Wild Hyacinth populations and their Carolinian woodlands habitat will be measured against specific steps and anticipated effects. Evaluation will involve determining whether the action was actually undertaken as prescribed and whether the anticipated effect of the action was realized.

2.5 Area for Consideration in Developing a Habitat Regulation

Under the ESA, a recovery strategy must include a recommendation to the Minister of Natural Resources on the area that should be considered in developing a habitat

regulation. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below by the author will be one of many sources considered by the Minister when developing the habitat regulation for this species.

Wild Hyacinth has a very limited distribution in Ontario, with only six or fewer known extant occurrences, all of them on the islands of western Lake Erie. Because of the extremely low number of occurrences, it is recommended that a precautionary approach be applied in defining habitat for Wild Hyacinth.

Given that the species uses a wide variety of habitats both in Ontario and throughout its range, it is recommended that an occupancy-based approach rather than a generic habitat definition be used to define the area to be regulated. Because Wild Hyacinth does not occupy all apparently suitable habitat and it is extant at fewer than six sites, it is recommended that the regulated area include enough suitable habitat to allow for dispersal and population expansion. It should also be large enough to ensure that direct impacts and adjacent human activities do not negatively affect populations.

The area occupied by Wild Hyacinth plants, as well as surrounding habitat required for dispersal and population expansion, should be prescribed as habitat in the regulation. The area prescribed should be delineated by full extent of the Ecological Land Classification (ELC) ecosite (Lee et al. 1998, Lee 2012) polygon (as mapped by a qualified biologist, ecologist, or equivalent) within which a population occurs.

Defining habitat at the ecosite rather than the more refined ecotype level is precautionary in that it recognizes the need to better understand the habitat requirements of the species. As new information on habitat requirements and site-specific characteristics become available, these attributes should be used to refine the habitat definition, perhaps to the ecotype level. Population viability analysis and new information on reproductive biology and dispersal requirements may also improve the understanding and definition of habitat requirements. In particular, if it is demonstrated that a different areal extent is necessary to allow for dispersal and population expansion, the habitat regulation should be revised to reflect this.

Historic sites have been extirpated primarily due to habitat loss, but there nevertheless appears to be suitable unoccupied habitat within the range of Wild Hyacinth in Ontario. It is therefore recommended that the area described as habitat under the ESA for Wild Hyacinth be flexible enough to allow for repatriation sites, where feasible, should repatriation be deemed necessary or beneficial to recovery.

Wild Hyacinth is occasionally cultivated. It is recommended that horticultural populations be excluded from the habitat regulation.

GLOSSARY

Anthropogenic: Caused or produced by humans.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee responsible for assessing and classifying species at risk in Canada.

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

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

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

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

Occurrence: An area of land and/or water where a species is, or was, present and has practical conservation value.

Propagule: Any plant material used for the purpose of plant propagation. In asexual reproduction, a propagule may be a woody, semi-hardwood, or softwood cutting, leaf section, or any number of other plant parts. In sexual reproduction, a propagule is a seed or spore.

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

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

Symbiotic: A close, prolonged association between two or more different organisms of different species that may, but does not necessarily, benefit each member.

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RECOVERY STRATEGY DEVELOPMENT TEAM MEMBERS

NAME	AFFILIATION and LOCATION
Earlier drafts of this recovery strategy were developed by Jarmo Jalava in 2007 and 2009, with the assistance of the following Recovery Team members:	
Roxanne St. Martin (Co-chair)	Ontario Ministry of Natural Resources
Michelle Kanter (Co-chair)	Carolinian Canada Coalition
John Ambrose	Botanical Consultant
Dawn Bazely	York University
Jane Bowles	University of Western Ontario
Barb Boysen	Ontario Ministry of Natural Resources
Dawn Burke	Ontario Ministry of Natural Resources
Peter Carson	Private Consultant / Ontario Nature
Ken Elliott	Ontario Ministry of Natural Resources
Mary Gartshore	Private Consultant
Ron Gould	Ontario Ministry of Natural Resources
Karen Hartley	Ontario Ministry of Natural Resources
Steve Hounsell	Ontario Power Generation
Donald Kirk	Ontario Ministry of Natural Resources
Daniel Kraus	Nature Conservancy of Canada
Nikki May	Carolinian Canada Coalition
Gordon Nelson	Carolinian Canada Coalition / University of Waterloo
Michael Oldham	Ontario Ministry of Natural Resources
Bernie Solymar	Private Consultant
Tara Tchir	Upper Thames River Conservation Authority
Allen Woodliffe	Ontario Ministry of Natural Resources (formerly)

APPENDIX 1: CONSIDERATIONS FOR MONITORING WILD HYACINTH

Measures of the success of the recovery effort will form part of the regular monitoring program. Measures should include long-term trends in the size and number of extant sites (area of occupancy and area of extent), site quality (measured through a habitat suitability index) and population trends and projections determined through regular population counts. A scoring system should be developed that will allow for quantitative comparisons between Wild Hyacinth populations and factors affecting the quality and extent of its woodland habitat.

Monitoring may be undertaken at varying levels of intensity in the future depending on the current threat level, size and quality of each site. The following criteria are based in part on monitoring methods recommended in Bickerton (2003) and NatureServe (2006):

- i. A less-intensive level may be undertaken by volunteers or landowners annually or biannually. Performance measures will include the presence or absence of Wild Hyacinth and an approximate population count, a coarse numerical assessment of threats, and qualitative assessment of changes to habitat quality and threats.
- ii. A more intensive level will involve demographic monitoring of Wild Hyacinth population trends based on life stages, seedling-establishment, mortality and other factors. Intensive monitoring may be considered for critical sites with a high-level of threat, sites for which qualified staff are available to conduct annual monitoring, and any re-introduction sites. Populations should be monitored to assess stability, note recruitment, document longevity of individuals and the yearly reproductive output of individual plants, as well as the nature and extent of impact on populations by threats (e.g., cormorant colonies, invasive species).

**PART 3 – *Wild Hyacinth: Ontario Government Response*
Statement, prepared by the Ontario Ministry of
Natural Resources**

Wild Hyacinth

Ontario Government Response Statement



Photo: Allen Woodlife

PROTECTING AND RECOVERING SPECIES AT RISK IN ONTARIO

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

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

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

GOVERNMENT RESPONSE STATEMENTS

Within nine months after a recovery strategy is prepared, the ESA requires the Ministry to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The recovery strategy for Wild Hyacinth (*Camassia scilloides*) was completed on January 11, 2013 (http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@species/documents/document/stdprod_099160.pdf).

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

Wild Hyacinth is a perennial plant that grows up to 70 cm tall and can support up to 100 pale blue to white star-shaped flowers. It grows in partial shade in moist, open or semi-open woodlands or in drier hawthorn scrub. Wild Hyacinth bulbs are edible and were a staple food plant of North American Aboriginal peoples.

MOVING FORWARD TO PROTECT AND RECOVER WILD HYACINTH

Wild Hyacinth is listed as a threatened species under the ESA. The ESA prohibits harm or harassment of the species and damage or destruction of its habitat without authorization. Authorization would require that conditions established by the Ministry be met.

Wild Hyacinth occurs naturally in the southern United States from South Carolina to Texas and in the north to southern Michigan and northeast Wisconsin. In Ontario it is only found on islands in western Lake Erie. It is most common in its core range within the Mississippi drainage basin, but is of conservation concern in nearly every jurisdiction where it has been ranked. It is unknown whether Wild Hyacinth was ever more common in Ontario or what factors (such as climate or an inability to disperse to the mainland) have kept the species in its restricted range. It is also possible that the species was originally introduced to the islands by the Aboriginal peoples that used them as a food source.

One of the main threats to Wild Hyacinth recovery in Ontario is hyper-abundant Double-crested Cormorants (*Phalacrocorax auritus*), whose large breeding colonies on islands in Lake Erie destroy vegetation. Other important threats include browsing and trampling by Canada Geese (*Branta canadensis*), loss of habitat to development, and invasive species such as Garlic Mustard (*Alliaria petiolata*). In southern Ontario, there are five remaining populations believed to have good viability based on surveys completed in 2001. Two historic Wild Hyacinth populations and a sub-population have been extirpated as a result of land development, and two more located on East Sister Island and Middle Sister Island may have been recently extirpated due to the impacts from cormorants. Monitoring of cormorant impacts is ongoing at East Sister Island Provincial Park to determine if management actions are feasible or appropriate. Management of cormorants by Parks Canada at one of the five existing sites, Middle Island, has been shown to result in an increase in Wild Hyacinth population numbers. Ongoing cormorant management is likely required to retain these results. Without addressing the threats caused by cormorants, it is unlikely that Wild Hyacinth can be recovered at the East Sister Island and Middle Sister Island locations, where cormorants have had the greatest impact. If suitable habitat conditions can be restored at historic locations in the future, the GRS goal may be re-evaluated.

The government's goal for the recovery of Wild Hyacinth is to maintain self-sustaining populations at all existing sites and, where recolonization may be feasible, restore degraded habitat at historic locations.

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

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

GOVERNMENT-LED ACTIONS

To help protect and recover Wild Hyacinth, the government will directly undertake the following actions:

- Continue to monitor the impacts of Double-crested Cormorants in East Sister Island Provincial Park to determine whether habitat restoration and reintroduction of Wild Hyacinth to formerly occupied habitat is feasible.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.
- Encourage the submission of Wild Hyacinth data to the Ministry's central repository at the Natural Heritage Information Centre.
- Undertake communications and outreach to increase public awareness of species at risk in Ontario.
- Protect Wild Hyacinth and its habitat through the ESA.
- Support conservation, agency, municipal and industry partners, and Aboriginal communities and organizations to undertake activities to protect and recover Wild Hyacinth. Support will be provided through funding, agreements, permits (including conditions) and/or advisory services.
- Establish and communicate annual priority actions for government support in order to encourage collaboration and reduce duplication of efforts.

GOVERNMENT-SUPPORTED ACTIONS

The government endorses the following actions as being necessary for the protection and recovery of Wild Hyacinth. Actions identified as "high" will be given priority consideration for funding or for authorizations under the ESA. The government will focus its support on these high-priority actions over the next five years.

Focus Area: Protection and Management

Objective: Protect and enhance existing Wild Hyacinth habitat and address major threats.

Actions:

1. **(HIGH)** Develop and implement best management practices for maintaining or improving Wild Hyacinth habitat by removing invasive species, maintaining semi-open forest conditions during flowering, and preventing inadvertent trampling.
2. Identify and protect key sites through land securement in connection with existing initiatives and partners.

Focus Area: Monitoring and Research

Objective: Increase knowledge of Wild Hyacinth population trends, biology, habitat, and threats.

Actions:

3. **(HIGH)** Develop and implement a standardized monitoring strategy for Wild Hyacinth to document Wild Hyacinth population size and dynamics, reproductive success, characterization of habitat, and assessment of threats.
4. Research the conditions for successful Wild Hyacinth establishment, including pollination and dispersal mechanisms and distances.
5. Undertake research into Wild Hyacinth population viability that takes into account its reproductive biology, dispersal and establishment conditions.

Focus Area: Awareness

Objective: Educate local groups to promote the protection of Wild Hyacinth.

Actions:

6. Develop educational and outreach materials on the sensitivity of Wild Hyacinth to inadvertent collection, trampling, or interbreeding with horticultural hyacinth varieties, and distribute to local stewardship organizations, horticultural clubs, and native plant nurseries.
7. Collaborate with First Nations to incorporate Aboriginal traditional knowledge, where available, into outreach initiatives.
8. Work with conservation groups and initiatives in the Lake Erie islands area to coordinate the strategic implementation of actions with broader ecosystem recovery efforts.

IMPLEMENTING ACTIONS

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

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

REVIEWING PROGRESS

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

ACKNOWLEDGEMENT

We would like to thank all those who participated in the development of the "Recovery Strategy for the Wild Hyacinth (*Camassia scilloides*) in Ontario" for their dedication to protecting and recovering species at risk.

For additional information:

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

Contact your MNR district office

Contact the Natural Resources Information Centre

1-800-667-1940

TTY 1-866-686-6072

mnr.nric.mnr@ontario.ca

ontario.ca/mnr