

Recovery Strategy for the Drooping Trillium (*Trillium flexipes*) in Canada

Drooping Trillium (*Trillium flexipes*)



2016



Government
of Canada

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For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1)¹.

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

RECOVERY STRATEGY FOR THE DROOPING TRILLIUM (*Trillium flexipes*) IN CANADA

2016

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 Drooping Trillium (Trillium flexipes) in Ontario* (Part 2) under Section 44 of the *Species at Risk Act* (SARA). Environment Canada has included an 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 its own critical habitat and performance indicators and adopting the Government of Ontario's goal and government-led and government-supported actions of the *Drooping Trillium: Ontario Government Response Statement*² (Part 3) as broad strategies and general approaches to meet the population objective.

The federal Recovery Strategy for the Drooping Trillium (*Trillium flexipes*) in Canada consists of three parts:

Part 1 – Federal Addition to the *Recovery Strategy for the Drooping Trillium (Trillium flexipes) in Ontario*, prepared by Environment Canada.

Part 2 - *Recovery Strategy for the Drooping Trillium (Trillium flexipes) in Ontario*, prepared by Jarmo Jalava and John D. Ambrose for the Ontario Ministry of Natural Resources³.

Part 3 – *Drooping Trillium – 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.

TABLE OF CONTENTS

PART 1 - Federal Addition to the *Recovery Strategy for the Drooping Trillium* (*Trillium flexipes*) in Ontario, prepared by Environment Canada

PREFACE	2
ACKNOWLEDGEMENTS	3
ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT	4
1. Species Status Information	4
2. Recovery Feasibility	5
3. Population and Distribution Objectives	8
4. Broad Strategies and General Approaches to Meet Objectives	8
5. Critical Habitat	9
5.1 Identification of Species' Critical Habitat	9
5.1.1. Habitat Occupancy	9
5.1.2. Habitat Suitability	10
5.1.3 Application of the Criteria to Identify Critical Habitat for Drooping	12
Trillium	12
5.2 Activities Likely to Result in the Destruction of Critical Habitat	19
6. Measuring Progress	21
7. Statement on Action Plans	21
8. Effects on the Environment and Other Species	22
References	23

PART 2 - *Recovery Strategy for the Drooping Trillium* (*Trillium flexipes*) in Ontario, prepared by Jarmo Jalava and John D. Ambrose, for the Ontario Ministry of Natural Resources

PART 3 – *Drooping Trillium – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources

PART 1 - Federal Addition to the *Recovery Strategy for the Drooping Trillium* (*Trillium flexipes*) 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 is the competent minister under SARA for the Drooping Trillium 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 (now the Ontario Ministry of Natural Resources and Forestry) led the development of the attached recovery strategy for the Drooping Trillium (Part 2) in cooperation with Environment Canada.

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, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Drooping Trillium and Canadian society as a whole.

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

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 Environment and Climate Change 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 Environment and Climate Change forms the opinion that any portion of critical habitat is not protected by provisions in or measures under

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

SARA or other Acts of 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 Megan Eplett, formerly Environment Canada, Canadian Wildlife Service - Ontario and Ken Tuininga, Krista Holmes, Lauren Strybos and Allison Foran, Environment Canada, Canadian Wildlife Service – Ontario. Lesley Dunn, Elizabeth Rezek and Madeline Austen, Environment Canada, Canadian Wildlife Service – Ontario, reviewed and provided comments and advice during the development of this document.

Acknowledgement and thanks is given to all other parties that provided advice and input used to help inform the development of this recovery strategy including various 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 Drooping Trillium (Trillium flexipes) 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 habitat may not directly correspond to federal requirements, and are not being adopted by Environment Canada as part of the federal recovery strategy. Whether particular measures or actions will result in protection of critical habitat under SARA will be assessed following publication of the federal recovery strategy.

1. Species Status Information

In Canada, Drooping Trillium is ranked as Critically Imperilled both nationally (N1) and provincially (S1) in Ontario (NatureServe 2014). Drooping Trillium is listed as Endangered⁵ on Schedule 1 of the federal *Species at Risk Act* (SARA), and as Endangered in Ontario under the provincial *Endangered Species Act, 2007* (ESA 2007).

Globally, Drooping Trillium (*Trillium flexipes*) is regarded as Secure⁶ (G5) (NatureServe 2014). In the United States, it is ranked nationally as Secure (N5) (NatureServe 2014). It is ranked Critically Imperilled⁷ (S1) in Arkansas, Georgia, Maryland, Mississippi, New York and Virginia; Critically Imperilled to Imperilled⁸ (S2) in Pennsylvania and West Virginia; Imperilled/Vulnerable⁹ (S2S3) in Alabama; Vulnerable in Iowa (S3); and Vulnerable/ Apparently Secure¹⁰ (S3S4) in Illinois. Drooping Trillium has not been ranked (SNR) in Delaware, Indiana, Kentucky, Michigan, Minnesota Missouri, Tennessee, Wisconsin and Ohio.

The percentage of the global range found in Canada is estimated to be less than 1%. The distribution of Drooping Trillium in Canada is very restricted, and five of seven known occurrences appear to have been extirpated from southern Ontario.

⁵ A wildlife species facing imminent extinction or extirpation in Canada

⁶ Common; widespread and abundant

⁷ Extremely rare (often 5 or fewer occurrences) or especially vulnerable to extirpation from the jurisdiction because of some factor(s) such as very steep declines

⁸ Imperilled in the state/province because of rarity due to a 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

⁹ Restricted range, relatively few populations, recent and widespread declines, or other factors vulnerable to extirpation

¹⁰ Uncommon but not rare; some cause for long-term concern due to declines or other factors

2. Recovery Feasibility

Based on the following four criteria outlined in the draft SARA Policies (Government of Canada, 2009), the recovery of the Drooping Trillium is determined to be 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. There are individuals capable of reproduction within the Canadian range that are available to sustain the population or improve its abundance. Continued monitoring of the two extant populations at Strathroy and Dunwich have shown an increase in the number of stems counted since previous surveys were undertaken by McLeod in 1993 (COSEWIC 2009).

The Strathroy site had 1,012 flowering and 105 vegetative stems and the Dunwich site had 453 flowering stems in 2007 (COSEWIC 2009). An increase in counted stems was also seen at both sites from 1993 to 2007 (COSEWIC 2009). However, these increases may be due to differences in survey methods and the maturation of sterile individuals, not actual population growth (COSEWIC 2009).

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

Yes. Several areas that supported Drooping Trillium historically have been significantly altered (COSEWIC 2009) and it is unlikely that they would be suitable without restoration; however, habitat management and restoration is feasible to ensure long-term recovery. Habitat improvement can be achieved through the implementation of best management practices that were developed by Carolinian Canada Coalition in 2011¹¹, such as reducing stream alteration and avoiding logging near Drooping Trillium populations.

Although specific habitat for Drooping Trillium is not abundant in southern Ontario, areas can be created or maintained through stewardship activities, such as the removal of invasive species that would provide ideal habitat conditions.

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

Yes. The primary threats to this species are development and trampling and/or site degradation from recreational activities. Drooping Trillium has only two extant

¹¹ <http://caroliniancanada.ca/bmp/drooping-trillium>

populations, one of which occurs on conservation authority lands; therefore, mitigation of urban and residential development should be achievable.

The second extant population occurs on a private agricultural property; threats to this population can be mitigated or avoided using stewardship activities and best management practices.

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

Yes. Some recovery techniques are clearly understood and demonstrated to be effective. Improvements to riparian habitats along the Sydenham River are underway and effects of these actions on the Strathroy Drooping Trillium population have yet to be studied. Mitigation to reduce the threat of trampling to this population has already been undertaken by St. Clair Conservation Authority by clearly defining trails.

Best management practices have been developed by Carolinian Canada Coalition to mitigate threats such as exotic or invasive species, logging, dumping of litter and consumptive use. Recovery actions should be incorporated within broader ecosystem based strategies such as the Sydenham River (Dextrase et al. 2003) and Thames River recovery strategies (Thames River Recovery Team 2007).

The extent to which the identified threats can be mitigated will require additional research.

In Canada, the species is only found at two locations within the Carolinian Zone, in southwestern Ontario (Figure 1). As such, it will likely always be vulnerable to human-caused stressors and natural, stochastic events.

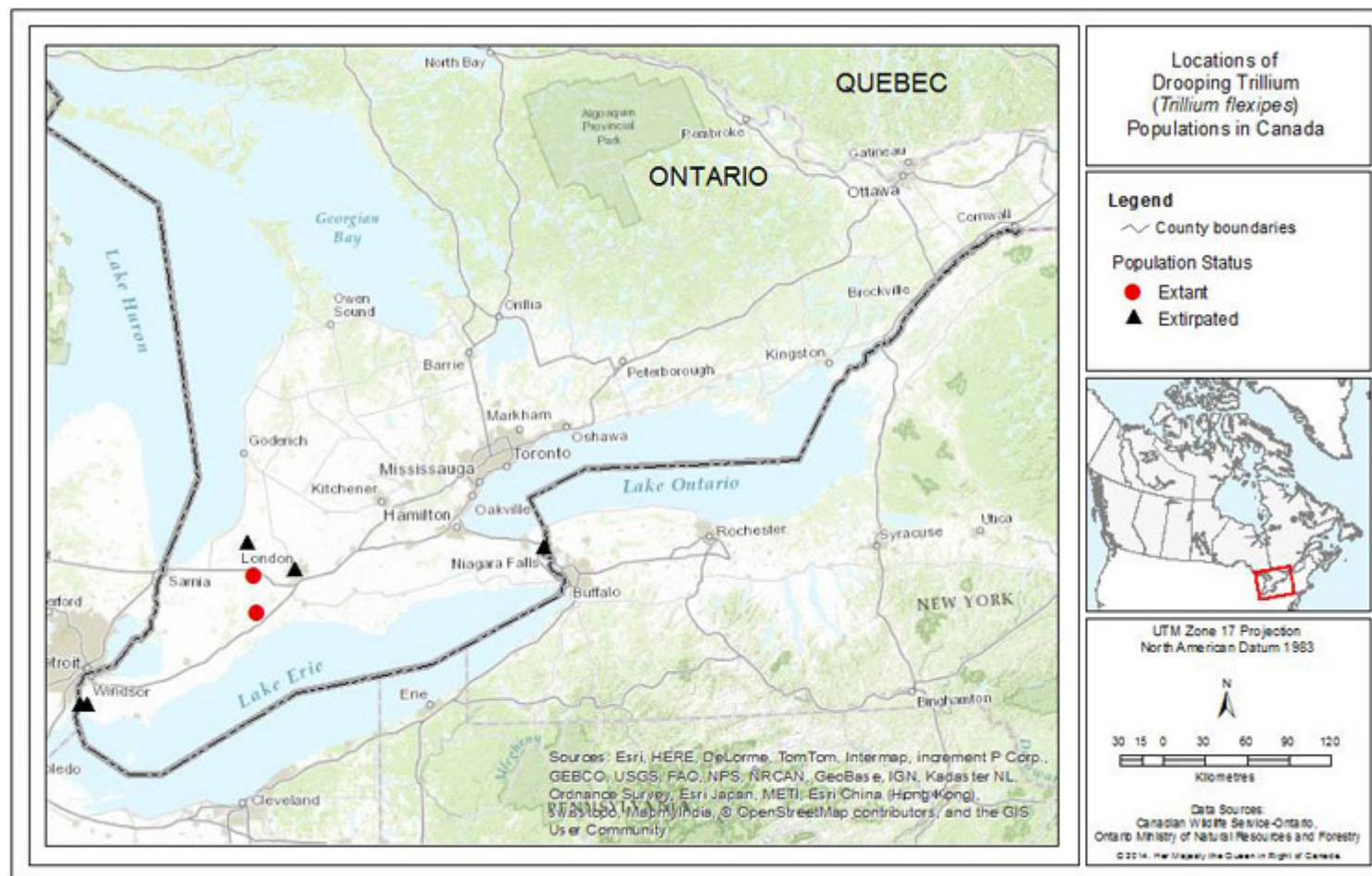


Figure 1. Locations of Drooping Trillium Populations in Canada. There are two extant populations in Strathroy and Dunwich. Extirpated populations are those for which there is documented destruction of habitat or persuasive evidence of the species eradication based on adequate surveys. Five populations are considered extirpated; however, precise locational information does not exist for many of them.

3. Population and Distribution Objectives

The provincial recovery strategy contains the following recovery goal for the recovery of Drooping Trillium (*Trillium flexipes*) in Ontario:

- The recovery goal is to establish and maintain a viable population of Drooping Trillium in its current and historic range in Ontario. This will involve population viability analyses to determine if, and the degree to which, extant populations need to be enhanced as well as the number and size of additional populations that need to be established in the species' historical range in southern Ontario.

The *Government Response Statement* for the province of Ontario lists the following goal for the recovery of the Drooping Trillium in Ontario:

- The government's goal for the recovery of the Drooping Trillium is to maintain self-sustaining populations at existing locations and encourage natural increases in population levels within the species' current range in Ontario.

Under SARA, a population and distribution objective for this species must be established. Environment Canada is adopting the recovery goal in the *Drooping Trillium: Ontario Government Response Statement* (Part 3) as the population and distribution objective for Drooping Trillium under SARA.

The current range of Drooping Trillium is limited to southwestern Ontario and includes two extant occurrences. Both occurrences are believed to be viable (*Drooping Trillium: Ontario Government Response Statement* (Part 3)). Recent counts at the Strathroy site show increased stem counts, however, consistent long-term monitoring protocols are needed to support any conclusions on population abundance (Harris and Foster 2008).

Drooping Trillium is occasionally cultivated for horticulture. Drooping Trillium plants that did not originate from plants native to Ontario, or were planted for purposes other than species recovery, ecological restoration, or habitat creation are not considered as existing populations (or portions thereof) in the above objective.

4. Broad Strategies and General Approaches to Meet Objectives

The government-led and government-supported action tables from the *Drooping Trillium: 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 to Recovery identified in section 2 of the *Recovery Strategy for the Drooping Trillium (Trillium flexipes) in Ontario* (Part 2).

5. Critical Habitat

5.1 Identification of 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. Critical habitat is defined in SARA as "...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 the provincial recovery strategy 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. Drooping Trillium 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 protected¹² as the habitat of the species by the Province of Ontario. A habitat regulation has not been developed for the Drooping Trillium under the ESA, therefore, this federal recovery strategy identifies critical habitat for the Drooping Trillium to the extent possible, based on the best available information as of May 2014. Critical habitat is identified for the two extant populations of Drooping Trillium in Ontario and is sufficient to meet the population and distribution objective; therefore a schedule of studies is not required. More precise boundaries may be mapped, and additional critical habitat may be added in the future if new or additional information supports the inclusion of areas beyond those currently identified (e.g., new sites become colonized downstream or in adjacent areas).

Critical habitat for Drooping Trillium is based on two criteria: habitat occupancy and habitat suitability.

5.1.1. 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 Drooping Trillium individuals have been observed in any single year since 2005

¹² Under the *Species at Risk Act* (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 extant populations from Ontario's Conservation Data Centre (Natural Heritage Information Centre) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). As the plant has the potential for extended dormancy with years where it would not produce flowers (COSEWIC 2009), a ten year window is considered appropriate to evaluate current occupancy. Recent surveys were completed for both the Strathroy and Dunwich populations and the areas currently occupied within these extant populations are believed to be identified. However, peripheral subpopulations may exist. As new observations become available, they will be evaluated for 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.

5.1.2. 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, Drooping Trillium grows in the microhabitats of rich beech-maple, oak-hickory or mixed deciduous swamps, and floodplain forests of the Carolinian Zone, which are usually associated with a watercourse and on well-drained loamy soils (COSEWIC 2009). Forest canopy is also important to maintain woodland ground flora.

The biophysical attributes of critical habitat for Drooping Trillium may include the characteristics described below.

- rich Beech-Maple, Oak-Hickory or mixed deciduous swamps and floodplain forests associated with a watercourse
- well-drained loam and sandy soils that are circumneutral¹³ occurring over calcareous bedrock
- reduced competition with aggressive light-tolerant plant species
- minimum 75% forest canopy cover
- typical vegetation at the occupied Sydenham River site includes: White Ash (*Fraxinus americana*), Silver Maple (*Acer saccharinum*), Sugar Maple (*A. saccharum*), Manitoba Maple (*A. negundo*) and Basswood (*Tilia americana*). Common woody species include Gray Dogwood (*Cornus racemosa*), Witch-hazel (*Hamamelis virginiana*), Chokecherry (*Prunus virginiana*) and introduced honeysuckles (*Lonicera* spp.). The main herbaceous species present are Ostrich Fern (*Matteuccia struthiopteris*), Garlic Mustard (*Alliaria petiolata*), Wild Ginger (*Asarum canadense*), Jack-in-the-Pulpit (*Arisaema triphyllum*) and Skunk Cabbage (*Symplocarpus foetidus*).
- typical vegetation at the occupied Thames River site includes: American Beech (*Fagus americanus*), Hackberry (*Celtis occidentalis*), Black Maple (*Acer nigrum*),

¹³ Nearly neutral; having a pH between 6.5 and 7.5

American Elm (*Ulmus americana*), Slippery Elm (*U. rubra*), White Ash and Blue Ash (*Fraxinus quadrangulata*). The most common ground cover associates were White Baneberry (*Actaea pachypoda*), Trout Lily (*Erythronium canadensis*), Jack-in-the-Pulpit, Spotted Jewelweed (*Impatiens capensis*), False Solomon's-seal, May-apple (*Podophyllum peltatum*), Bluestem Goldenrod (*Solidago caesia*) and Garlic Mustard.

Suitable habitat for the Drooping Trillium is 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 i) provides a basis for describing the ecosystem requirements (e.g., local effects of the associated hydrologic regime, canopy cover) and ii) encompasses the biophysical attributes of suitable habitat for Drooping Trillium. In addition, ELC terminology and methods are familiar to many land managers and conservation practitioners who have adopted this tool as the standard approach for Ontario.

Suitable habitat for Drooping Trillium is defined as:

- the entire ELC ecosite where Drooping Trillium exists AND
- the microhabitat occurring within 50 m of Drooping Trillium

The ELC ecosite will include the surrounding area that provides suitable habitat conditions (e.g., woods and wooded floodplains with closed or semi-closed canopies) to allow the species to carry out essential life process and should allow for natural processes related to population dynamics and reproduction (e.g., dispersal and pollination) to occur. Currently, the ELC ecosites that contain extant Drooping Trillium individuals are not known. Supplementary surveys and monitoring are required to describe the specific ELC ecosites currently occupied by Drooping Trillium in Canada; however, broader habitat information is available to guide recovery planning until more detailed habitat information can be obtained.

Due to the sensitivity of the plant to subtle microclimate and microhabitat characteristics, particularly hydrology and humidity, a distance of 50 m was chosen as a minimum 'critical function zone', or the threshold habitat fragment 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 distances physical and/or biological processes begin to negatively affect Drooping Trillium. 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 Drooping Trillium plant is an appropriate minimum distance to ensure microhabitat properties for rare plant species occurrences are incorporated in the identification of critical habitat. The area within the critical function zone may include both suitable and unsuitable habitat as Drooping Trillium 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, such as hydrology, become available these distances may be refined.

Maintained roadways or built-up features such as buildings do not assist in the maintenance of natural processes; therefore, they are not considered critical habitat.

5.1.3 Application of the Criteria to Identify Critical Habitat for Drooping Trillium

Critical habitat for Drooping Trillium is identified as the entire ELC ecosite polygon (section 5.1.2; to be identified from supplementary surveys and monitoring) and the habitat within a radial distance of up to 50 m from a Drooping Trillium plant that meets the habitat occupancy criterion (section 5.1.1), herein referred to as a critical habitat unit.

Application of the critical habitat criteria to available data identifies 2 units of critical habitat for the Drooping Trillium in Canada, totaling up to 35 ha¹⁴ (Figure 2, See also Table 1). Critical habitat identified for Drooping Trillium is presented within a 1 x 1 km UTM grid. The 1 x 1 km UTM grid is 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. The areas of critical habitat within each grid square are defined by the criteria established in section 5.1. More detailed information on critical 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 a 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 50 m radial distance around the Drooping Trillium. Actual critical habitat occurs only in those areas described in section 5.1 and therefore the actual area could be less than this and would require field verification to determine the precise amount.

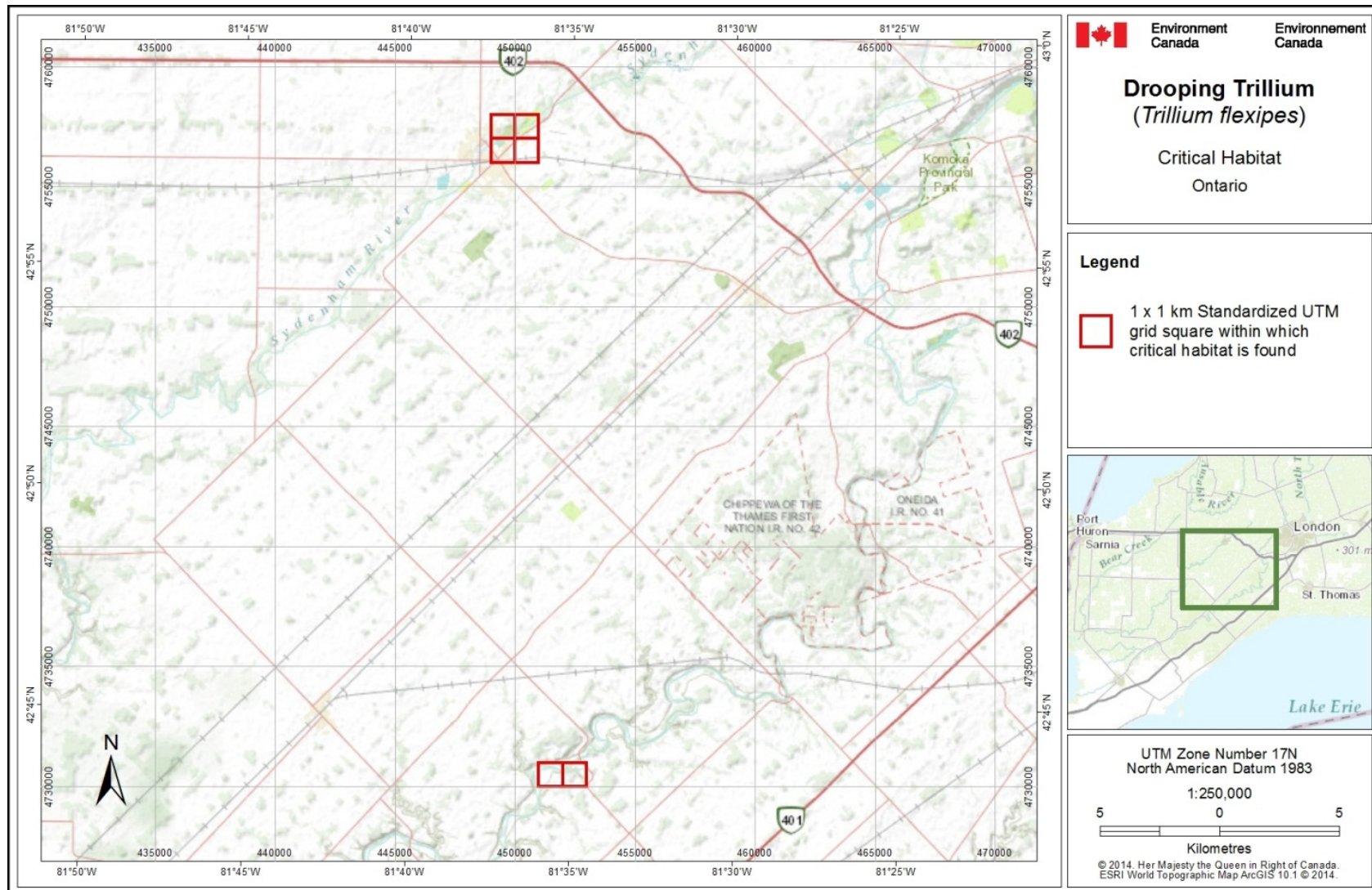


Figure 2. Grid Squares That Contain Critical Habitat for Drooping Trillium (*Trillium flexipes*) in Canada, current to May 2014. Critical habitat for the Drooping Trillium occurs within these 1 x 1 km Standardized UTM grid squares (red outline) where the criteria described in Section 5 are met.

Table 1: Grids That Contain Critical Habitat for Drooping Trillium (*Trillium flexipes*) in Canada, current to May 2014. Critical Habitat for the Drooping Trillium occurs within these 1 x 1 km Standardized UTM grid squares where criteria described in Section 5 are met.

Population	1 x 1 km Standardized UTM grid square ID ¹	Province/Territory	UTM Grid Square Coordinates ²		Estimated area (ha) that contains critical habitat ³	Land tenure ⁴
			Easting	Northing		
Strathroy	17MH45_96	Ontario	449000	4756000	17.70	Non-federal Land
	17MH45_97		449000	4757000		
	17MH55_06		450000	4756000		
	17MH55_07		450000	4757000		
Dunwich	17MH53_10	Ontario	451000	4730000	17.36	Non-federal Land
	17MH53_20		452000	4730000		
Total = 35 ha						

¹Based 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).

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

³The area presented is that of the unit(s) containing all or a portion of critical habitat (rounded to the nearest 1 ha); therefore, the actual area of critical habitat may be significantly less. Refer to Section 5.1 for a description of how critical habitat within these areas is defined.

⁴Land 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.

5.2 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 an element of the critical habitat has permanently or temporarily deteriorated to the point that the habitat can no longer serve its purpose when needed by the species. Destruction may result from one or several activities occurring at a given point in time, or from the cumulative effects of one or more activities over a prolonged period of time (Government of Canada, 2009). Detailed descriptions of activities that threaten the survival and recovery of the Drooping Trillium can be found in *Recovery Strategy for the Drooping Trillium (Trillium flexipes) in Ontario*. Activities described in Table 2 provide examples of activities likely to cause destruction of critical habitat for the species and the component of critical habitat it affects; however, destructive activities are not limited to those listed.

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

Description of Activity	Descriptions of Effect in Relation to Function Loss	Details of Effect
Development and conversion of lands (e.g. agricultural expansion, residential and commercial development, road construction)	<p>Conversion of habitat results in a direct loss of critical habitat which the species relies on for basic survival, successful seed production, development, and establishment.</p> <p>Drooping Trillium is seldom found in small forest patches and is sensitive to habitat fragmentation (Bratton et al. 1994). Reduction in the amount of critical habitat or increased habitat fragmentation would reduce the likelihood of existing populations thriving and establishment of new populations.</p> <p>Results in habitat fragmentation and increased edge effects and/or direct covering up of suitable ground.</p>	<p>If this activity were to occur within critical habitat, the effects would be direct and cumulative at any time of year. These activities would directly remove substrate and/or alter conditions (vegetation cover type and soil type) that allow for the establishment, germination and dispersal of Drooping Trillium. Also the removal of a portion of the critical habitat could hinder the long term persistence of the species.</p> <p>If this activity were to occur outside of critical habitat it may have an indirect impact considering the sensitivity of the plant to subtle microclimate and microhabitat characteristics (such as hydrology and humidity).</p>
Selective Timber Harvesting	<p>May temporarily remove or degrade critical habitat by reducing canopy cover to less than 75%, increasing solar exposure and reducing moisture due to an open canopy, and encouraging the establishment of early successional species or invasive species.</p> <p>Also, this activity can result in direct damage to plants by logging equipment.</p>	<p>Effects are direct and cumulative and may occur at any time of year.</p> <p>If this activity were to occur outside of critical habitat it may have an indirect impact considering the sensitivity of the plant to subtle microclimate and microhabitat characteristics (such as hydrology and humidity).</p>
Operation of all-terrain vehicles (ATVs) and use of recreational trails	<p>If this activity occurs within critical habitat, habitat and individuals may be lost. It also results in ruts and loss of substrate or suitable substrate conditions (e.g. mesic, circumneutral, well-drained soils).</p> <p>These activities can reduce the quality of germinating sites and prevent establishment.</p>	<p>Driving vehicles on existing trails within critical habitat would directly result in the destruction of critical habitat. Repeated habitat degradation will result in the habitat becoming unsuitable for continued existence in these areas and reestablishment.</p> <p>Removal of top soil is a direct effect at all times.</p>
Introduction of exotic and invasive species (e.g. direct seeding or planting or through vectors such as ATV's and recreational users)	<p>Results in increased resource competition through crowding or shading, which may make the critical habitat no longer suitable for Drooping Trillium, leading to a reduction in population size and possibly local extinction.</p>	<p>Effects are direct and cumulative and may occur at any time of the year. This activity must occur within the bounds of the critical habitat to cause destruction.</p>

Alterations to hydrology from land uses (e.g. dam construction, channelization, ditching, water-taking and tile drainage)	Results in the loss of seasonally flooded sites and moist soil conditions that provide suitable conditions for Drooping Trillium growth or establishment.	<p>Changes in the moisture regime could have direct and cumulative effects, depending on the extent of area affected by decreased water levels. However, its effects are mostly likely to be cumulative, with changes over time leading to unsuitable habitat conditions. This activity does not have to occur within the bounds of critical habitat to cause its destruction. It could cause destruction of critical habitat at any time throughout the year.</p> <p>If this activity were to occur outside of critical habitat, it may have an indirect impact considering the sensitivity of the plant to subtle microclimate and microhabitat characteristics (such as hydrology and humidity).</p>
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6. Measuring Progress

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

- Current population abundance and distribution of Drooping Trillium in southern Ontario have been maintained
- Measures have been put in place to encourage natural increases in population levels within the species' current range wherever possible.

7. Statement on Action Plans

One or more action plans will be completed for Drooping Trillium and posted on the Species at Risk Public Registry by 2022

8. 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 directly contributes to the goals and targets of the Federal Sustainability Development Strategy for Canada (FSDS). Specifically, it will help to restore populations of wildlife to healthy levels and maintain productive and resilient ecosystems with the capacity to recover and adapt (Goals 5 and 6 of the FSDS).

Drooping Trillium populations are located within the Carolinian Zone in Ontario's southwest. The Carolinian Zone is one of the richest natural areas in Canada, containing a high diversity of habitat types, such as deciduous forest, prairie, alvar, shoreline and aquatic habitats, which are home for more than 125 at-risk species (Kanter 2005). Development pressures continue to result in habitat loss in this area (Kanter 2005). Therefore, it is expected that the recovery efforts for Drooping Trillium will also benefit many other species that occur in these habitats such as Nodding Pogonia (*Triphora trianthophoros*), Eastern Flowering Dogwood (*Cornus florida*) and Acadian Flycatcher (*Empidonax virescens*), all of which are listed as Endangered under SARA and the ESA; and Blue Ash which is currently listed as Special Concern under SARA and the ESA .

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

¹⁶ www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

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**PART 2 – *Recovery strategy for the Drooping Trillium*
(*Trillium flexipes*) in Ontario prepared by Jarmo Jalava and
John D. Ambrose for the Ontario Ministry of
Natural Resources**

Drooping Trillium

(*Trillium flexipes*) 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

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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.

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DECLARATION

The recovery strategy for the Drooping Trillium has been prepared in accordance with the requirements of the *Endangered Species Act, 2007* (ESA). This recovery strategy represents 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

EXECUTIVE SUMMARY

Drooping Trillium (*Trillium flexipes*) is a perennial herb in the lily family, with the core of its range in the eastern United States. There are only two known extant occurrences of Drooping Trillium in Canada, both in extreme southwestern Ontario. Five historic occurrences were extirpated between 1848 and 1950. Drooping Trillium was designated as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1996 (reassessed in 2000 and 2009) and by the Committee on the Status of Species At Risk in Ontario (COSSARO) in 2008. These designations are due to a highly reduced number of occurrences which are limited by low seed set and lack of habitat for population expansion and which also are threatened by human activities. The species is listed as endangered under Ontario's *Endangered Species Act, 2007* and the federal *Species at Risk Act*.

Drooping Trillium grows in rich beech-maple, oak-hickory or mixed deciduous swamps and floodplain forests which are usually associated with watercourses. The presence of a watercourse may benefit the plant by creating and maintaining a slightly elevated floodplain terrace where soils are a well-drained combination of loam and sand favourable to the species. Forest canopy cover is important to maintain woodland ground flora and to reduce competition with invaders of forest openings, although some light penetration appears to increase plant vigour and population densities of this species.

The main threats to the Canadian populations of Drooping Trillium are considered to be habitat loss or degradation associated with incompatible forestry practices, recreational trail use, invasive species and alterations to soil hydrology. The potential threats of collecting for horticultural uses, diseases, pests, and herbivory by deer have also been noted.

The recovery goal is to establish and maintain a viable population of Drooping Trillium in its current and historic range in Ontario. This will involve population viability analyses to determine if, and the degree to which, extant populations need to be enhanced. Such analyses also will determine the number and size of additional populations that need to be established in the species' historical range in southern Ontario. The objectives to achieve this goal are to:

1. protect and manage habitat to establish and maintain a viable population of Drooping Trillium in Ontario;
2. determine abundance, extent, health and dynamics of Drooping Trillium populations in Ontario through inventory and regular monitoring;
3. address key knowledge gaps relating to the species' biology, ecology, habitat and threats;
4. promote awareness and stewardship of Drooping Trillium with land managers, private landowners, municipalities, horticultural organizations and other key stakeholders; and

5. where it is ecologically and logistically feasible, reintroduce Drooping Trillium to historical or other ecologically suitable sites.

Due to the isolated nature of the extant populations, a strategic management and stewardship approach is recommended. This includes coordination and consultation with a variety of partners including private landowners and the St. Clair Region Conservation Authority.

Given that Drooping Trillium does not occupy all apparently suitable habitat at the extant sites, it is suggested that the area occupied by the plants, as well as adjacent habitat extensive enough to protect the hydrological regime allowing for potential dispersal and population expansion be prescribed as habitat in the regulation. It is recommended that the area prescribed as habitat in a regulation for Drooping Trillium be a composite area delineated by applying the following two criteria: (1) a distance of 120 m from the outer limits of the area occupied by Drooping Trillium in order to protect the hydrological regime, and (2) the full extent of the Ecological Land Classification (ELC) ecosite polygon within which a population occurs. As new information on the species' habitat requirements and site-specific characteristics (such as hydrology) become available, these attributes should be used to refine the habitat definition. It is also recommended that the habitat regulation for Drooping Trillium be flexible enough to include repatriation and/or introduction sites that are necessary or beneficial to recovery. Drooping Trillium is occasionally cultivated for horticulture. Horticultural populations should be excluded from the regulation.

TABLE OF CONTENTS

RECOMMENDED CITATION.....	i
AUTHORS.....	ii
ACKNOWLEDGMENTS.....	ii
DECLARATION.....	iii
RESPONSIBLE JURISDICTIONS	iii
EXECUTIVE SUMMARY.....	iv
1.0 BACKGROUND INFORMATION	1
1.1 Species Assessment and Classification	1
1.2 Species Description and Biology	1
1.3 Distribution, Abundance and Population Trends	2
1.4 Habitat Needs.....	4
1.5 Limiting Factors	5
1.6 Threats to Survival and Recovery	5
1.7 Knowledge Gaps	7
1.8 Recovery Actions Completed or Underway	8
2.0 RECOVERY.....	9
2.1 Recovery Goal.....	9
2.2 Protection and Recovery Objectives.....	9
2.3 Approaches to Recovery	10
2.4 Performance Measures	13
2.5 Area for Consideration in Developing a Habitat Regulation.....	14
GLOSSARY	17
REFERENCES.....	18
RECOVERY STRATEGY DEVELOPMENT TEAM MEMBERS.....	20
LIST OF FIGURES	
Figure 1. Historical and current distribution in Ontario.....	3
LIST OF TABLES	
Table 1. Protection and recovery objectives.....	9
Table 2. Approaches to recovery of the Drooping Trillium in Ontario	10
Table 3. Recovery Strategy Development Team Members.....	20

1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Drooping Trillium

SCIENTIFIC NAME: *Trillium flexipes*

SARO List Classification: Endangered

SARO List History: Endangered (2008), Endangered – Regulated (2004)

COSEWIC Assessment History: Endangered (2009, 2000, 1996)

SARA Schedule 1: Endangered

CONSERVATION STATUS RANKINGS:

GRANK: G5

NRANK: N1

SRANK: S1

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

1.2 Species Description and Biology

Species Description

Drooping Trillium (*Trillium flexipes*), also known as "Bent" or "Nodding" Trillium is a herbaceous perennial with a sturdy, upright stem that stands 15 to 60 cm tall. Its three leaves found at the top of the stem in a whorl are broad, sessile and abruptly pointed and are up to 20 cm long. A single flowering stalk, emerging from the junction of three leaves, sharply curves and grows 3 to 12 cm downward. The majority of plants have their flowers below the level of the leaves. In some plants, the flower stalk can be horizontal or (very rarely) erect. The flower consists of three obtuse petals (each two to five centimetres long) and often has a stale or musty fragrance. The flower is normally white but can be reddish or maroon. Plants with coloured petals are probably hybrids.

Unlike Drooping Trillium which has very short filaments, Nodding Trillium (*T. cernuum*) and Red Trillium (*T. erectum*), two similar species found in southern Ontario, both have filaments almost as long as the anthers. Other distinguishing features of these species are provided in COSEWIC (2009).

Species Biology

Drooping Trillium is a spring ephemeral that takes an average of ten years to reach a reproductive flowering state. It blooms from April to June and reproduces sexually. Although the flowers are usually self-pollinated, the long stamen and drooping peduncle suggest that some bumblebees and butterflies could be potential cross-pollinators. Vegetative reproduction through rhizomes has also been observed, but this mode of

reproduction is not common (Ransom-Hodges 2006). Seeds are the primary source of new plants. Ants are effective short range dispersal agents (McLeod 1996). In Canada, both extant occurrences are thought to be reproducing successfully since both contain many young (non-flowering) plants.

Hybridization between Drooping Trillium and Red Trillium (*T. erectum*) is possible (Ransom-Hodges 2006). It has been shown that the red forms of Drooping Trillium are likely to be hybrids since they occur in places where the ranges of both species coincide (McLeod 1996). Hybridization is also suspected between Drooping Trillium and another related species that occurs only in the United States - Barksdale Trillium (*T. sulcatum*) - with morphological intermediates being produced (Patrick 1984).

Two seasons of cold are required for germination of seeds, known as double dormancy (Ransom-Hodges 2006). Drooping Trillium does not occur in high densities, with densities of 0.02 plants per square metre and 0.075 plants per square metre at the two extant locations in Ontario (Ransom-Hodges 2006). Associations between Drooping Trillium and mycorrhizal fungi have been observed (DeMars and Boerner 1995).

1.3 Distribution, Abundance and Population Trends

Drooping Trillium is found in central United States and adjacent southwestern Ontario, from western New York to southeastern Minnesota, south to northeastern Alabama, with disjunct populations in northern Arkansas, western North Carolina, southeastern Pennsylvania, adjacent Delaware and Maryland (Figure 1). The global rank for Drooping Trillium is G5, or secure. It is ranked S1, S2 or historic in ten states, S3 in two and not ranked in ten (NatureServe 2011). The percentage of global range in Canada is likely less than one percent. It is ranked as N1 or critically imperilled in Canada and as S1 or critically imperilled, in Ontario.

The Canadian range of Drooping Trillium is limited to extreme southwestern Ontario and includes two extant occurrences¹ in Middlesex and Elgin counties and five historical occurrences (Figure 1). An occurrence in the Niagara Glen was last documented in 1950 and other historical occurrences in Middlesex and Essex² counties have not been seen since the late 1800s (NHIC 2011). Data regarding the five historical occurrences are imprecise, but the Niagara Glen occurrence is considered extirpated by NHIC (2011), and given the levels of landscape modification in the area, it seems likely that the Essex occurrences are also no longer extant.

¹ In this recovery strategy, the term “occurrence” is used in the sense of “element occurrence”, which is the standard spatial definition for “an area of land and/or water in which a species...is, or was present” (NatureServe 2010). An occurrence may contain one or more “populations” or sub-populations, as long as landscape features and species biology allow for genetic exchange between the populations. The term “population” is used more generically throughout this recovery strategy (and may thus apply to a local population or the entire provincial population, depending on the context).

² The two historic occurrences in Essex are covered by the same shading in Figure 1.

The extant occurrence on St. Clair Region Conservation Authority land and two adjoining private properties (one of them a golf course, the other undeveloped) along the Sydenham River in Middlesex County had 1,012 flowering and 105 vegetative stems in 2007 covering an area of 7.1 ha (Harris and Foster 2008). The Dunwich occurrence in Elgin County is in the forested valley of the Thames River on a private agricultural property where 453 flowering stems were counted by Harris and Foster (2008) in an area covering 0.9 ha. Another 14 non-flowering plants (97% flowering) were also found. However the surveyors felt that additional plants were probably present but not found due to the density of other herbaceous cover at the site.

The recent counts at the Sydenham River and Thames River sites suggest apparent increases in population size at both when compared to McLeod (1996). According to Harris and Foster (2008), since 1994 the number of flowering plants has apparently more than doubled at the Sydenham site and increased by a factor of six at the Thames site. There was also an apparent increase in area of occupancy at both sites. However, it is possible that the disparity in totals reflects differences in survey methods and extent rather than actual population growth. According to Woodliffe (pers. comm. 2009), regular monitoring of the Sydenham population has found that population numbers are quite variable from year to year, probably due to annual climatic variations.

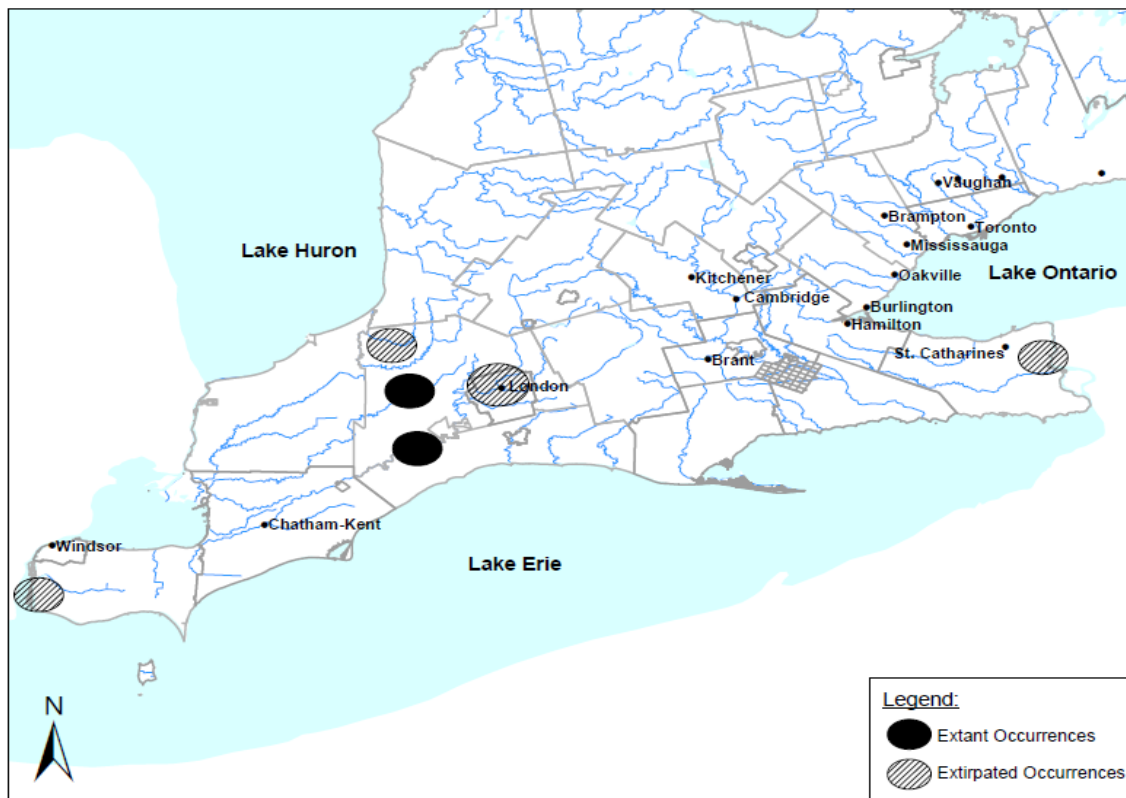


Figure 1. Historical and current distribution of Drooping Trillium in Ontario (based on NHIC data, 2011)

1.4 Habitat Needs

Drooping Trillium grows in rich beech-maple, oak-hickory or mixed deciduous swamps and floodplain forests which are usually associated with watercourses. The presence of a watercourse may benefit the plant by creating and maintaining a slightly elevated floodplain terrace where the soils are a combination of well-drained loam and sand favourable to the species. The species appears to prefer circumneutral soil types (COSEWIC 2009) occurring over calcareous bedrock (Case 2002, Gleason and Cronquist 1991).

A study of forest-floor herbaceous plants along the Susquehanna River riparian corridor in northeastern Maryland and southeastern Pennsylvania found Drooping Trillium to show a strong fidelity to the larger tracts of mature riparian forest with rich mesic soils, with the species seldom being found in smaller forest patches and stands on drier, poorer soils (Bratton et al. 1994). Forest canopy cover is important to maintain woodland ground flora and to reduce competition with aggressive light-tolerant plant species which include a number of introduced and invasive taxa.

At the two extant Ontario occurrences, relatively high population densities and greater plant vigour have been observed along a walking trail and in a selectively logged forest (McLeod 1996, Harris and Foster 2008, NHIC 2011). This suggests that light selective logging has not seriously impacted the habitat of the species and that low levels of pedestrian trail use (to a certain threshold) may in fact benefit the species by maintaining a slightly open canopy. Minimum canopy cover of 75% should be retained however. An optimum level of disturbance may be a requirement of the species.

COSEWIC (2009) and Harris and Foster (2008) provide detailed habitat descriptions for the two extant occurrences in Ontario:

At the Sydenham River occurrence, overstorey vegetation consists mainly of White Ash (*Fraxinus americana*), Silver Maple (*Acer saccharinum*), Sugar Maple (*A. saccharum*), Manitoba Maple (*A. negundo*) and Basswood (*Tilia americana*). Most plants are on the floodplain of the Sydenham River but occur mainly on slightly-raised, drier microhabitats than the surrounding Skunk Cabbage (*Symplocarpus foetidus*). A few plants occur on the banks of the ravine. The shrub layer varies from open with only a few scattered shrubs and saplings, to areas where more densely concentrated patches occur. Common woody species include Gray Dogwood (*Cornus racemosa*), Witch-hazel (*Hamamelis virginiana*), Chokecherry (*Prunus virginiana*) and introduced honeysuckles (*Lonicera* spp.). The main herbaceous species associated with Drooping Trillium at this site are Ostrich Fern (*Matteuccia struthiopteris*), Garlic Mustard (*Alliaria petiolata*), Wild Ginger (*Asarum canadense*) and Jack-in-the-Pulpit (*Arisaema triphyllum*).

At the Thames River site most plants occur on upper terraces above the floodplain. Overstorey vegetation is mainly American Beech (*Fagus americanus*), Hackberry (*Celtis occidentalis*), Black Maple (*Acer nigrum*), American Elm (*Ulmus americana*), Slippery Elm (*U. rubra*), White Ash and Blue Ash (*Fraxinus quadrangulata*). Most of the habitat

was subjected to selective logging in about 2003 when most trees greater than about 25 cm diameter at breast height (1.3 m) were cut. The resultant stand has a fairly open canopy with dense regeneration of False Solomon's-seal (*Maianthemum racemosum*). The most common ground cover associates were White Baneberry (*Actaea pachypoda*), Trout Lily (*Erythronium canadensis*), Jack-in-the-Pulpit, Spotted Jewelweed (*Impatiens capensis*), False Solomon's-seal, May-apple (*Podophyllum peltatum*), Bluestem Goldenrod (*Solidago caesia*) and Garlic Mustard. The site was apparently also logged prior to 1970 (McLeod 1996).

1.5 Limiting Factors

Drooping Trillium is at the northern limit of its range in Ontario and climate likely restricts its ability to expand its populations.

One study found that each Drooping Trillium flower produces more ovules on average than seven other pedicellate-flower species studied in North America. However its seed production was the second lowest among them, indicating a low fertilization rate due to inefficient self- and/or cross-pollination mechanisms (Ransom-Hodges 2006). Population expansion of Drooping Trillium in Ontario may therefore be limited by low seed production rates combined with the species' restricted dispersal ability and pollinating agents.

Drooping Trillium's requirement for closed-canopy forest and the current fragmented configuration of such habitat within its Canadian range also undoubtedly affects its ability to disperse and colonize otherwise suitable sites. Bratton et al. (1994) note that Drooping Trillium may have difficulty reestablishing populations in fragmented woodlots once they have been extirpated.

Other limiting factors may include a dependence on mycorrhizal fungi and soil moisture levels which may to some extent be interrelated (DeMars and Boerner 1995).

1.6 Threats to Survival and Recovery

Urban and Agricultural Development

The greatest historic threat to Drooping Trillium in Ontario has been from habitat loss and degradation. A study of forest-floor herbaceous plants along the Susquehanna River riparian corridor in northeastern Maryland and southeastern Pennsylvania found Drooping Trillium to be one of the most sensitive herbaceous understory plants to forest fragmentation seldom found in small forest patches (Bratton et al. 1994). An historic occurrence at London probably succumbed to habitat loss as a result of urban development. Occurrences along the Detroit River in Essex County, last reported 150 years ago, probably met the same fate as the area is now quite densely populated.

Incompatible Forestry Practices

Bratton et al. (1994) found that Drooping Trillium rarely occurred in younger successional stands that had undergone heavy selective logging. Habitat modification at the Thames River site may have been produced by pre-1970 selective timber harvesting (McLeod 1996). Another selective cut occurred in the early 2000s (Harris and Foster 2008). Excessive exposure to solar radiation along with direct damage to the plants by logging equipment may have been detrimental to this population but the actual impacts cannot be assessed because of the absence of historical data for this site (McLeod 1996).

Trails and Recreational Activities

At the Sydenham River occurrence, habitat degradation has occurred with the construction of trails and the use of off-road vehicles in Drooping Trillium habitat. According to COSEWIC (2009), a trail passes directly through the Drooping Trillium population at the publicly-owned conservation area. Inadvertent damage to trail-side plants has occurred, both from trampling by hikers and from the unauthorized use of all-terrain vehicles (ATVs), which are too wide for the trail and leave a continuous swath of crushed vegetation in their wake along one and sometimes both sides of the trail. The anticipated population growth in the area likely will result in a greater recreational demand. This will increase the pressure on the Drooping Trillium population unless mitigating measures are taken.

Exotic or Invasive Species

Increased competition for ecological resources from alien plant species such as Garlic Mustard has been cited in COSEWIC (2009) as potentially posing a threat to the two extant Drooping Trillium occurrences. At the Sydenham River occurrence, Garlic Mustard and non-native honeysuckles (*Lonicera* spp.) are abundant in the Drooping Trillium habitat. At the Thames River site several invasive species, including Garlic Mustard, are also present but are less abundant (Harris and Foster 2008).

Exotic earthworms also pose a threat to plants of deciduous forests of eastern North America. In a recent study, earthworm invasion resulted in significant changes to the location and nature of nutrient cycling activity in the soil profile (Bohlen et al. 2004). The impacts of earthworms included: altered soil total carbon and phosphorus pools; changes to carbon:nitrogen ratios; and modifications in the distribution and function of roots and microbes (Bohlen et al. 2004.). Implications of such changes on forest understorey species are not well understood currently, but the impacts may be serious.

Alterations to Hydrology

Given that Drooping Trillium is strongly associated with riparian forests in Ontario, changes to soil hydrology resulting from land uses higher in the watershed (such as from dam construction, channelization, ditching, water-taking, tile drainage) may also be a significant threat affecting habitat quality and suitability.

Consumptive Use

The growing native wildflower gardening industry and the particular popularity of trillium species may pose a future threat to both of Ontario's extant occurrences because of the demand by local gardeners for mature plants. Although removal of plants from conservation areas is strictly prohibited, the Sydenham River site is likely to be at greater risk in this respect because of its proximity to an urban population and the ease of access to this site (COSEWIC 2009).

Diseases and Pests

Potential diseases associated with a fungus (*Botrytis*) and a mycoplasma bacterium and infestation by a species of *Clepsis* moth have not been observed in Ontario populations of Drooping Trillium. However, these potential threats, especially if combined with herbivory by White-tailed Deer (Augustine and Frelich 1998) before maturation of seed, could present a threat if effects were widespread and occurred for several successive years in the same population.

Hyperabundant Predator Populations

White-tailed Deer were noted in 2007 as having browsed many of the Drooping Trilliums at the Sydenham River occurrence (Harris and Foster 2008). The relatively low population size and small area occupied by the Thames River population may render it particularly vulnerable to destruction by potential disease, insect infestations and White-tailed Deer herbivory. (COSEWIC 2009)

Dumping of Litter

An additional threat to habitat at the Thames River site is dumping of trash (e.g., bales of fence wire) (Harris and Foster 2008).

1.7 Knowledge Gaps

Addressing the following knowledge gaps will contribute to the successful recovery of the Drooping Trillium in Canada:

- better definition of its specific habitat requirements, including: (a) clarification of the effects of water quality and changes in the hydrologic regime on habitat dynamics; (b) soil preferences; and (c) optimum levels of canopy closure and solar radiation;
- better information on: (a) current status of populations and habitat condition at historical sites; (b) degree of annual fluctuation in population size and flowering numbers at extant occurrences; and (c) whether additional areas of suitable habitat support the species in Ontario³;
- better understanding and prioritization of threats to the species;

³ The habitat at the historical McGillivray Township site still appears to be relatively intact and may hold the most promise for eventual re-discovery of a population last reported over 100 years ago.

- better understanding of the biology of the species (i.e., seed productivity, fertility, pollination and long range dispersal mechanisms);
- knowledge of the degree to which Drooping Trillium hybridizes with other trillium species in Ontario;
- an understanding of minimum viable population levels; And,
- understanding the establishment requirements before introduction into historic sites or new habitats is considered.

1.8 Recovery Actions Completed or Underway

A number of projects to improve water quality has been undertaken upstream of the Sydenham River site under the Sydenham River Aquatic Ecosystem Recovery Strategy. Also, the St. Clair Region Conservation Authority established formal trails through the conservation area. Chips and dust were spread on some of the trails and this may have resulted in some negative effects on trilliums located immediately adjacent to the trails. However, the more formal delineation of the trail encourages people to stay on the path and also discourages the creation of new informal paths.

A comprehensive inventory and evaluation of the status of the two extant Ontario occurrences was undertaken in 2007 as part of the COSEWIC (2009) update status report on the species (Harris and Foster 2008).

Carolinian Canada Coalition developed a draft Best Management Practices (BMP) fact sheet for Drooping Trillium in early 2011 with the support of the Ontario Species at Risk Stewardship Fund. Carolinian Canada Coalition is also preparing broader habitat-based BMP “menus.”

2. RECOVERY

2.0 Recovery Goal

The recovery goal is to establish and maintain a viable population of Drooping Trillium in its current and historic range in Ontario. This will involve population viability analyses to determine if, and the degree to which, extant populations need to be enhanced as well as the number and size of additional populations that need to be established in the species' historical range in southern Ontario.

2.1 Protection and Recovery Objectives

Table 1. Protection and recovery objectives

No.	Protection or Recovery Objective
1	Protect and manage habitat to establish and maintain a viable population of Drooping Trillium in Ontario.
2	Determine abundance, extent, health and dynamics of Drooping Trillium populations in Ontario through inventory and regular monitoring.
3	Address key knowledge gaps relating to the species' biology, ecology, habitat and threats.
4	Promote awareness and stewardship of Drooping Trillium with land managers, private landowners, municipalities, horticultural organizations and other key stakeholders.
5	Where it is ecologically and logistically feasible, reintroduce Drooping Trillium to historical or other ecologically suitable sites.

2.2 Approaches to Recovery

Table 2. Approaches to recovery of the Drooping Trillium in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
1. Protect and manage habitat to establish and maintain a viable population of Drooping Trillium in Ontario.				
Critical	Short-term	Protection, Management	1.1 Develop Best Management Practices (BMPs) to include guidelines for appropriate forest, watershed and trail management as well as a species-specific BMP for Drooping Trillium.	<ul style="list-style-type: none"> Habitat loss and degradation due to incompatible land development, forestry practices, hydrological impacts and trail use.
Critical	Short-term	Protection, Management	1.2 Provide recommendations and BMPs to landowners and land managers.	<ul style="list-style-type: none"> Habitat loss and degradation due to incompatible land development, forestry practices, hydrological impacts and trail use.
Beneficial	Long-term	Protection	1.3 Identify key sites to secure in the context of the overall Carolinian Woodlands Recovery Strategy ⁴ .	<ul style="list-style-type: none"> All threats, except: diseases, pests and off-site impacts, such as alterations to hydrology.
Beneficial	Long-term	Protection	1.4 Secure key sites through easements or purchase.	<ul style="list-style-type: none"> All threats, except: diseases, pests and off-site impacts, such as alterations to hydrology.

⁴ There is only one known extant occurrence that is entirely on private land with the other being partly on private land. However, if additional populations are discovered through inventory or if suitable habitat for reintroduction is found, these might also be priority sites for acquisition or conservation easements.

Recovery Strategy for the Drooping Trillium in Ontario

2. Determine abundance, extent, health and dynamics of Drooping Trillium populations in Ontario through inventory and regular monitoring.				
Critical	Short-term	Inventory, Monitoring and Assessment	2.1 Inventory sites of historic reports.	<ul style="list-style-type: none"> Knowledge gaps relating to current population size and extent.
Critical	Short-term	Inventory, Monitoring and Assessment	2.2 Identify and survey additional sites with suitable habitat.	<ul style="list-style-type: none"> Knowledge gaps relating to current population size and extent.
Beneficial	Short-term	Inventory, Monitoring and Assessment	2.3 Review herbarium specimens of Drooping Trillium and similar species to ensure that all have been identified correctly.	<ul style="list-style-type: none"> Knowledge gaps relating to current population size, extent, and possible hybridization with other trillium species.
Necessary	Short-term	Inventory, Monitoring and Assessment	2.4. Develop monitoring strategy for Drooping Trillium.	<ul style="list-style-type: none"> Knowledge gaps relating to population trends and prioritization of threats.
Necessary	Ongoing	Inventory, Monitoring and Assessment	2.5. Apply monitoring strategy (where appropriate, in association with monitoring of other priority species at risk).	<ul style="list-style-type: none"> Knowledge gaps relating to population trends and prioritization of threats.
3. Address key knowledge gaps relating to the species' biology, ecology, habitat and threats.				
Critical	Short-term	Research	3.1 Assess threats based on field inspections at extant and key historic sites.	<ul style="list-style-type: none"> All threats Better understanding and prioritization of threats
Critical	Short-term	Research	3.2 Conduct hydrological study at extant sites to better understand habitat processes and needs.	<ul style="list-style-type: none"> Clarification of the effects of impacts on hydrological regime.
Critical	Short-term	Research	3.3 Identify the positive and/or negative impacts of land-use and management practices.	<ul style="list-style-type: none"> Habitat loss and degradation Better understanding of habitat requirements

Recovery Strategy for the Drooping Trillium in Ontario

Critical	Short-term	Research	3.4 Conduct population viability analysis.	<ul style="list-style-type: none"> Knowledge gap relating to minimum viable population levels.
Necessary	Long-term	Research	3.5 Engage academic community to: <ul style="list-style-type: none"> research pollination and long range dispersal mechanisms; research impacts of Garlic Mustard, other invasive plants and exotic earthworms on the species and its habitat; investigate causes of extirpation from historic sites. 	<ul style="list-style-type: none"> Knowledge gaps relating to pollination, dispersal and invasive species impacts.
Beneficial	Long-term	Research	3.6 Research seed productivity and fertility in Ontario.	<ul style="list-style-type: none"> Knowledge gaps relating to productivity and fertility.
4. Promote awareness and stewardship of Drooping Trillium with land managers, private landowners, municipalities, horticultural organizations and other key stakeholders.				
Necessary	Short-term	Education and Outreach	4.1. Develop outreach materials that highlight the significance, vulnerability and threats to Drooping Trillium, emphasizing the threat of illegal collecting.	<ul style="list-style-type: none"> Threats associated with incompatible forestry, and horticultural collecting and trading
Necessary	Short-term	Education and Outreach, Communication	4.2. Disseminate these materials to target audiences (horticultural clubs, landscaping companies, plant nurseries) and the general public.	<ul style="list-style-type: none"> Threats associated with incompatible forestry, and horticultural collecting and trading
5. Where it is ecologically and logistically feasible, reintroduce Drooping Trillium to historical or other ecologically suitable sites.				
Beneficial	Long-term	Stewardship	5.1. Based on assessments of threats, studies of the species' biology and ecology, population viability analysis, determine the feasibility and necessity of reintroduction.	<ul style="list-style-type: none"> All threats
Beneficial	Long-term	Stewardship	6.1 Reintroduce species to historical or other suitable sites, if deemed feasible.	<ul style="list-style-type: none"> All threats

Narrative to Support Approaches to Recovery

The specific approaches and studies outlined in Table 2 are needed to reduce the immediate jeopardy of Drooping Trillium. The two historical sites in Middlesex should be surveyed to ascertain whether the species is extant or has been extirpated. Better understanding of minimum viable population size, demographic structure, the essential features and the processes required to maintain suitable habitat are recommended. As well, ongoing assessments of habitat condition and threats are recommended at both extant and key historic sites in order to prioritize recovery activities.

Many of the recovery steps recommended in this strategy should be accomplished in coordination with steps being planned for other Carolinian woodland species at risk in existing and developing parallel strategies. The needs of Drooping Trillium should be incorporated into Best Management Practices (BMPs) for woodlands, municipal natural heritage systems mapping and protection legislation, activities of conservation authorities and stewardship council projects. Recovery actions should be coordinated with efforts being undertaken by the Sydenham River Aquatic Ecosystem Recovery Team (Dextrase et al. 2003), the Thames River Species at Risk Recovery Team (TRRT 2007) and the St. Clair Region Conservation Authority.

Approaches to recovery for Drooping Trillium will be incorporated into the implementation strategies of the Carolinian Woodland Recovery Strategy (Jalava et al. 2008, Jalava and Mansur 2008) and associated action plans. The focus of the Carolinian Woodland Recovery Strategy is to improve the integrity of those portions of the Carolinian woodland landscape in which species at risk occur. This initiative will be undertaken in concert with other broader ecosystem-based strategies such as the Sydenham River (Dextrase et al. 2003) and Thames River (TRRT 2007) recovery strategies, Conservation Action Planning for Carolinian ecosystem recovery, Ontario's Biodiversity Strategy, and the Nature Conservancy of Canada's Conservation Blueprint and Natural Area Conservation Plans⁵.

2.3 Performance Measures

Measures of the success of the recovery effort will form part of the regular monitoring program. Measures will 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 to allow for quantitative comparisons between Drooping Trillium 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 (Bickerton 2003) as follows.

⁵ Additional information on these various strategies and action plans can be found at the following web sites: www.carolinian.org (Carolinian Canada Coalition conservation action plans), <http://sydenhamriver.on.ca/index.htm> (Sydenham River), http://www.thamesriver.on.ca/species_at_risk/species_at_risk.htm (Thames River).

- i. At a minimum, a less-intensive level of monitoring may be undertaken by volunteers or landowners annually or biannually at sites considered to be less critical from the point of view of threats, size and quality. Performance measures would include the presence or absence of Drooping Trillium and an approximate population count, a coarse numerical assessment of threats and qualitative assessment of changes to habitat quality and threats.
- ii. If resources permit, a more intensive level would involve demographic monitoring of the Drooping Trillium population trend based on life stages, seedling-establishment, mortality and other factors. Intensive monitoring may be considered for critical sites with a high-level of threat, public land sites that have qualified staff available to conduct annual monitoring and any re-introduction sites. At present, both extant populations of Drooping Trillium should receive this intensive level of monitoring.

Evaluation of the recovery effort should be measured by the following criteria.

- There is no loss of extant populations. Populations are increasing or stable in size.
- There is no increase in anthropogenic disturbance (as determined from monitoring data), and threats are being addressed by 2014:
 - monitoring program developed and initiated by 2012;
 - key knowledge gaps relating to threats addressed by 2013;
 - threats prioritized and mitigation plans developed by 2014; and,
 - threat abatement measures initiated in 2014.
- Communications products are produced and distributed to landowners and land managers starting in 2013.
- Where feasible, reintroduction is initiated at suitable or restored historical sites by 2016.

Evaluation of specific actions taken to restore Drooping Trillium populations and their Carolinian woodlands habitat should be measured against specific steps and anticipated effects. Evaluation would involve determining whether the action was actually undertaken as prescribed and whether the anticipated effect of the action was realized. Monitoring and evaluation results should be provided in annual reports made publicly accessible by the responsible jurisdictions.

2.4 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 authors will be one of many sources considered by the Minister when developing the habitat regulation for this species.

In establishing the description of habitat to be considered for regulation, several factors were taken into consideration. Drooping Trillium has a very limited distribution in Ontario. The two extant occurrences are found in deciduous forests on well-drained loamy soils along fluvial systems that are believed to have high water tables. Drooping Trillium has likely occupied these sites as long as these conditions have existed and it is unlikely that much change in population sizes or location will occur as long as the environmental variables remain relatively constant. However, regular monitoring of the Sydenham River occurrence has found that population numbers are quite variable from year to year (Woodliffe pers. comm. 2009), probably due to annual climatic variations.

Because of the extremely low number of extant occurrences and the lack of knowledge of the importance of hydrological influence on the maintenance of Drooping Trillium habitat, it is recommended that the precautionary principle be applied in the regulation of the habitat. Given that the species does not occupy all apparently suitable habitat at the extant sites, it is recommended that the area occupied by the plants and the full extent of surrounding habitat required to protect the hydrological regime allowing for potential dispersal and population expansion, be prescribed as habitat in the regulation. Therefore, the area prescribed as habitat in a regulation for Drooping Trillium should be a composite area delineated by applying the following two criteria:

1. A distance of 120 m from the outer limits of the area occupied by Drooping Trillium plants in order to protect the hydrological regime⁶.
2. The full extent of the Ecological Land Classification (ELC) ecosite (Lee et al. 1998, Lee 2009) polygon within which a population occurs.

The precautionary principle is applied here in recommending the 120 m buffer in the absence of site-specific hydrological studies which would provide better delineation of the area required to maintain the hydrological regime of the habitat. As new information on the species' habitat requirements and site-specific characteristics, such as hydrology, become available, these attributes should be used to refine the habitat definition. In particular, if it is demonstrated that a different area (larger, smaller, different shape) is necessary to protect the hydrological regime upon which the species depends, the habitat regulation should be revised to reflect this.

Historic occurrences have been extirpated, probably primarily due to habitat loss, nevertheless there appears to be a considerable amount of suitable unoccupied habitat within this species' range in Ontario. It is therefore recommended that the habitat regulation for Drooping Trillium be flexible enough to include repatriation or introduction sites that are necessary or beneficial for recovery. It should be noted that the species may spread through the dispersal of propagules downstream during flood events in the riparian habitats it occupies. Habitat regulation should therefore be flexible enough to allow for the future inclusion of newly colonized sites.

⁶ The recommended 120 m distance is consistent with policy protecting adjacent lands of provincially significant wetlands (OMNR 2002).

Drooping Trillium is occasionally cultivated for horticulture. It is recommended that horticultural populations be excluded from regulation.

GLOSSARY

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 sub-national (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.

Forb: A broad-leaved, non-woody plant other than a grass, sedge or rush.

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.

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RECOVERY STRATEGY DEVELOPMENT TEAM MEMBERS

Table 3. Recovery Strategy Development Team Members.

NAME	AFFILIATION and LOCATION
The recovery strategy was developed by Jarmo Jalava and John Ambrose under the direction of the following Recovery Team members:	
Roxanne St. Martin (Co-chair)	Ontario Ministry of Natural Resources
Michelle Kanter (Co-chair)	Carolinian Canada Coalition
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
Jarmo Jalava	Carolinian Canada Coalition
Donald Kirk	Ontario Ministry of Natural Resources
Daniel Kraus	Nature Conservancy of Canada
Nikki May	Carolinian Canada
Gordon Nelson	Carolinian Canada Coalition / University of Waterloo
Michael Oldham	Ontario Ministry of Natural Resources
Michael Peppard	Conservation organization (NGO)
Bernie Solymar	Private Consultant
Tara Tchir	Upper Thames River Conservation Authority
Kara Vlasman	Ontario Ministry of Natural Resources
Allen Woodliffe	Ontario Ministry of Natural Resources

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

Drooping Trillium

Ontario Government Response Statement



PROTECTING AND RECOVERING SPECIES AT RISK IN ONTARIO

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

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

Under the ESA, the Ministry of Natural Resources (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 Drooping Trillium (*Trillium flexipes*) was published on June 15, 2012 (http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STDPROD_092938.html).

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.

Drooping Trillium is a perennial herb in the lily family. It has a sturdy upright stem that stands 15 to 60 centimetres tall, and a single flowering stalk at the junction of three leaves that sharply curves and grows 3 to 12 centimetres downward. The flower is normally white but can be reddish or maroon.

MOVING FORWARD TO PROTECT AND RECOVER DROOPING TRILLIUM

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

Drooping Trillium has been assessed as a globally secure species that has not been found to be common in Ontario. The only two known existing occurrences of Drooping Trillium in Canada are in Middlesex and Elgin counties in southwestern Ontario. Five populations are known to have been extirpated from southern Ontario, likely due to habitat alteration and fragmentation. The main threats to these populations are habitat loss or degradation associated with incompatible forestry practices, recreational trail use, invasive species, and alterations in soil hydrology. The species grows in rich beech-maple, oak-hickory or mixed deciduous swamps and floodplain forests. The potential threats of collecting for horticultural uses, diseases, pests, and herbivory by deer have also been noted. Drooping Trillium populations at the two currently occupied sites appear to be viable. Additionally, substantial levels of habitat alteration at many of the species' historical locations make recovery in those areas unlikely. As a result, recovery efforts are focused on retaining and improving the viability of the existing population occurrences in Ontario.

The government's goal for the recovery of Drooping Trillium is to maintain self-sustaining populations at existing locations and encourage natural increases in population levels within the species' current range in Ontario.

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 Drooping Trillium, the government will directly undertake the following actions:

- Develop a survey protocol to be used by proponents and partners to survey for the presence of Drooping Trillium.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.
- Encourage the submission of Drooping Trillium 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 Drooping Trillium and its habitat through the ESA.
- Support conservation, agency, municipal, industry partners and Aboriginal communities to undertake activities to protect and recover Drooping Trillium. Support will be provided where appropriate through funding, agreements, permits (including conditions) and 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 Drooping Trillium. 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 manage Drooping Trillium habitat.

Actions:

1. (HIGH) Develop and promote best management practices to encourage appropriate forest, watershed, and trail management for Drooping Trillium by landowners and land managers.
2. Develop outreach materials that highlight the significance, vulnerability and threats to Drooping Trillium (e.g., illegal collection) and distribute these materials to horticultural clubs, landscaping companies, plant nurseries, Aboriginal communities, municipalities, and other key stakeholders.

Focus Area: Inventory and Monitoring
Objective: Assess the health and abundance of Drooping Trillium populations and habitat.

Actions:

3. (HIGH) Conduct standardized survey and monitoring for Drooping Trillium to:
 - monitor population size and habitat conditions;
 - assess threats at existing and key historic sites; and
 - identify occurrences in suitable or historic habitat.

Focus Area: Research
Objective: Improve knowledge of the species' biology, ecology, habitat, and threats.

Actions:

4. Investigate habitat requirements at existing sites, including water quality, hydrologic regime, soils, and light levels.
5. Research and address impacts of invasive plant species (e.g., Garlic Mustard) and exotic earthworms.
6. Research population dynamics, seed productivity, fertility, pollination and long-range dispersal mechanisms of Drooping Trillium in Ontario.

The focus of recovery efforts is on maintaining the existing viable populations of Drooping Trillium and encouraging natural increases. The relocating of Drooping Trillium from its current locations may have significant adverse effects on the remaining population and its ability to naturally increase.

The planting of a species at risk without appropriate precautions may have potential negative impacts on the target species, the broader ecosystem, or other activities in the surrounding area. To be successful, these projects require long-term financial and technical commitments to monitoring, managing, and evaluating the site. Avoiding and preventing adverse impacts should be the first priority.

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, Species at Risk Farm Incentive Program or Community Fisheries and Wildlife Involvement 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 the Drooping Trillium.

ACKNOWLEDGEMENT

We would like to thank all those who participated in the development of the "Recovery Strategy for the Drooping Trillium (*Trillium flexipes*) 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

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