PROPOSED

Species at Risk Act
Recovery Strategy Series
Adopted under Section 44 of SARA

Recovery Strategy for the Nodding Pogonia (*Triphora trianthophoros*) in Canada

Nodding Pogonia

2015

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

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RECOVERY STRATEGY FOR THE NODDING POGONIA (*Triphora trianthophoros*) IN CANADA

2015

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

In the spirit of cooperation of the Accord, the Government of Ontario has given permission to the Government of Canada to adopt the *Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora[2]*) in Ontario* (Part 2, the Ontario recovery strategy) and the *Nodding Pogonia: Ontario Government Response Statement* (Part 3) under Section 44 of the *Species at Risk Act* (SARA). Environment Canada has included a federal addition (Part 1) which completes the SARA requirements for this federal recovery strategy.

The federal recovery strategy for the Nodding Pogonia in Canada consists of three parts:

Part 1 – Federal Addition to the *Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora*) in Ontario*, prepared by Environment Canada.

Part 2 - *Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora*) in Ontario* prepared by Judith Jones, Jarmo Jalava and John D. Ambrose for the Ontario Ministry of Natural Resources[3].

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

[2] Please note that the accepted scientific name has recently changed from *Triphora trianthophora* to *Triphora trianthophoros* (Brouillet et al. 2010).

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

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PART 2 - *Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora*) in Ontario* prepared by Judith Jones, Jarmo Jalava and John D. Ambrose for the Ontario Ministry of Natural Resources.

PART 3 – *Nodding Pogonia: Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources.

PART 1 - Federal Addition to the *Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora*) 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 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 Nodding Pogonia 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 Nodding Pogonia (Part 2) in cooperation with Environment Canada. The province of Ontario also led the development of the attached Government Response Statement (Part 3), which is the Ontario Government's policy response to its provincial recovery strategy and summarizes the prioritized actions that the Ontario government intends to take and support.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Nodding Pogonia 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 regulatory implications as SARA sets out a process to evaluate existing protection mechanisms under other Acts of Parliament and provincial and territorial legislation, and if necessary, to put in place additional protection under SARA. For critical habitat located on federal lands outside of federal protected areas the Minister of the Environment must either report on existing legal protection or make an order to provide protection. The Minister of the Environment will assess whether critical habitat is effectively protected on non-federal lands. The discretion to protect critical habitat that is not effectively protected rests with the Governor in Council.

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

Acknowledgements

The initial draft of this recovery strategy addition was developed by Holly Bickerton, with helpful contributions from Judith Jones. Ken Tuininga, Lauren Strybos, Krista Holmes, Christina Rohe, Bruna Peloso, Madeline Austen and Lesley Dunn, Environment Canada, Canadian Wildlife Service – Ontario (EC, CWS-ON), and Megan Eplett, formerly EC, CWS-ON, and Jay Fitzsimmons and Aileen Wheeldon (Ontario Ministry of Natural Resources and Forestry (OMNRF)) and Mike Oldham (Natural Heritage Information Centre, OMNRF) 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 SARA that are not addressed in the Province of Ontario's *Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora*) in Ontario* (Part 2) and to provide updated or additional information.

Environment Canada is adopting the Ontario recovery strategy (Part 2) with the exception of section 2.0, "Recovery". In place of section 2.0 Environment Canada is establishing its own critical habitat and performance indicators, and is adoptiong the Government of Ontario's government led and government support actions of the *Nodding Pogonia: Ontario Government Response Statement* (Part 3) as the broad strategies and general approaches to meet the population and distribution objectives.

Under SARA, there are specific requirements and processes set out regarding the protection of critical habitat. Therefore statements in the provincial recovery strategy referring to protection of the species' habitat may not directly correspond to federal requirements, 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 final federal recovery strategy.

1. Species Status Information

The Nodding Pogonia[5] (*Triphora trianthophoros*) is an orchid endemic to North America, where it is found in Canada, Mexico, Guatemala, Panama and a widespread area of the eastern United States (NatureServe 2014). In Canada it is known only from two locations in southwestern Ontario: the Rondeau Provincial Park population which includes four subpopulations (Municipality of Chatham-Kent) and the Three Birds Woodlot population (Essex County) (COSEWIC 2010; Jones et al. 2013). Both populations are considered extant[6], though the Nodding Pogonia has not been seen since 1987 at the Three Birds Woodlot (Jones et al. 2013). Because this species may remain dormant for many years and there has been little search effort at the Three Birds Woodlot (only 3 surveys have been performed in the eastern portion of the site over the last 30 years) the fact that Nodding Pogonia was not found during these surveys doesn't exclude the possibility that the species may still be present at the site, as it may have flowered in non-survey years or it could be present in unsurveyed areas (Jones et al. 2013).

[5] Nodding Pogonia is also known as the "Three-birds Orchid".
[6] In existence; still existing; not destroyed or lost.

Nodding Pogonia is considered uncommon through much of its large eastern North American range and has a rounded global status rank of G3 - Vulnerable[7] (NatureServe 2014). In Ontario, the conservation status is ranked S1 – Critically Imperiled[8] (NatureServe 2014).
In Canada, the Nodding Pogonia is listed as Endangered[9] on Schedule 1 of the federal *Species at Risk Act* (SARA). In Ontario, it is listed as Endangered[10] under the *Endangered Species Act, 2007* (ESA).This species is at the northern edge of its North American range in Ontario, and it is estimated that less than 1% of its global range occurs in Canada (COSEWIC 2010).

2. Recovery Feasibility

Based on the following four criteria that Environment Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Nodding Pogonia. In keeping with the precautionary principle, a recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery 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 currently two extant populations in Canada. Fieldwork in 2008 confirmed a count of 1357 flowering stems at three of the four known sites (subpopulations) within one of the only two populations in southwestern Ontario (Rondeau Provincial Park) (COSEWIC 2010). The four known sites are in close proximity to one-another and are considered to be a single population consisting of four known sub-populations (COSEWIC 2010). As flowering stems appear in large clumps and may or may not originate from a single tuber, it is not clear how many mature genetic individuals (i.e. genets) this represents. Flowering stem counts at this single Ontario population have fluctuated widely since its discovery in 1966, although available reports indicate there are individuals in Canada with a demonstrated reproductive capability (i.e. flowering and setting seed) (COSEWIC 2010). Nodding Pogonia also occurs broadly across eastern North America, although it is rare and possibly declining in the northern portion of its range (Ramstetter 2001).

[7] At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
[8] Critically imperiled in the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the province.
[9] A wildlife species that is facing imminent extirpation or extinction.
[10] Lives in the wild in Ontario but is facing imminent extinction or extirpation.

It should be noted that the two extant populations in Ontario are isolated and small, and therefore loss of genetic diversity may be a concern if the species does not continue to successfully reproduce for long periods of time. There is also a potential threat from stochastic events in a population with so few locations (COSEWIC 2010).

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

   Unknown. In Canada, Nodding Pogonia is a species of rich, mesic, mixed hardwood forests, especially forests dominated by American Beech (*Fagus grandifolia*) and Sugar Maple (*Acer saccharum*) (COSEWIC 2010; Jones et al. 2013). Although Ontario's Carolinian deciduous forests have been severely fragmented since European settlement, significant areas of apparently suitable habitat are found within the Carolinian zone. Nodding Pogonia has also been found in other habitat types in its U.S. range, including swamps, sphagnum bogs, and on sandy flats (Case 1964; Sheviak 1974; Homoya 1993; COSEWIC 2010). Although there is likely sufficient *apparently* suitable habitat for this species, the range and amount of habitat occupied by its obligate mycorrhizal fungal associate(s)[11] is not known (COSEWIC 2010).

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

   Unknown. Many threats may interact to affect Nodding Pogonia, although it is not clear which constitute a "primary threat". Human-caused changes that disturb this species' delicate mycorrhizal fungal association may be the greatest threat to this orchid (Jones et al. 2013), and some of these are not easily mitigated. For example, invasive plant species are present at both populations, and may disrupt soil fungi and microorganisms. Techniques now exist to control many invasive plant species, but implementation of the techniques can be challenging as it often involves long-term land management (Jones et al. 2013). Non-native earthworms are also considered a potential threat to both populations (COSEWIC 2010). Earthworms reduce the duff[12] and humus[13] layers, have been demonstrated to reduce fungal diversity (Baxter et al. 1999; Muratake 2003; Hale et al. 2005) and may also facilitate invasion by non-native plants (Nuzzo et al. 2009). No techniques are known to control earthworm populations in forests or other habitats where Nodding Pogonia might occur. Browsing by White-tailed Deer (*Odocoileus virginianus*) has been known to threaten orchids, including Nodding Pogonia (COSEWIC 2010), at Rondeau Provincial Park, where high deer

[11] The symbiotic association of the vegetative part of a fungus (mycelium) with the roots of plants. The fungus assists in the absorption of minerals and water from the soil and defends the roots from other fungi and nematodes, while the plant provides carbohydrates to the fungus.
[12] Organic matter in various stages of decomposition on the floor of the forest.
[13] The dark organic material in soils, produced by the decomposition of vegetable or animal matter and essential to the fertility of the earth.

populations are being controlled (Ontario Parks 2001; Jones et al. 2013). Browsing by White-tailed Deer is also a potential threat at the Three Birds Woodlot where the orchid has not been observed for over 20 years (Jones et al. 2013). Given the number and unknown severity of threats, and the fact that Nodding Pogonia occurs in one of the most fragmented and developed areas of Canada, it is not certain that the threats can be completely avoided or mitigated.

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

   Unknown. Although traditional methods of habitat protection (e.g. land securement, easement, or stewardship) could be employed to protect the species and its habitat where it occurs on private land, these may not be sufficient to prevent the species from being extirpated from this site given that several threats pose challenges as mitigation techniques are not known or proven. Finally, most propagation techniques have not been successful when applied to Nodding Pogonia. In Ontario trials, seeds have been successfully germinated in culture, but seedlings did not survive transplant to the wild (Anderson 1990). In propagation trials in Wisconsin, seeds germinated well in culture, but since the delicate corms[14] are very difficult to handle, transplanted corms did not survive (S. Weber pers. comm. 2014). Entire plants from the Three Birds Woodlot were transplanted to Rondeau Provincial Park in 1956, but did not survive (Woodliffe 2011). Direct seeding of mature capsules in suitable habitat is another potential method of propagation for recovery purposes, but little is known about its success.

3. Population and Distribution Objectives

The *Recovery Strategy for the Nodding Pogonia* (Triphora trianthophora) *in Ontario* contains the following recovery goal for the recovery of Nodding Pogonia:

- The recovery goal is to maintain the extant populations of Nodding Pogonia in their current condition or better, to assist these populations over the long-term to become self-sustaining and viable, and to fill knowledge gaps so that recovery activities at other locations may become possible in the future.

The Government Response Statement for the province of Ontario lists the following goal for the recovery of the Nodding Pogonia in Ontario:

- The government's goal for the recovery of Nodding Pogonia is to maintain or improve the viability of existing populations in Ontario.

[14] A fleshy underground stem that is similar to a bulb but stores its food as stem tissue and has fewer and thinner leaflike scales.

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

- To maintain or improve the viability[15] of the two existing populations in Canada.

Due to seasonal conditions, stem counts may vary widely from year to year. Therefore, measuring recovery of Nodding Pogonia based on population abundance, as measured in stem counts, must account for the natural range of variation. Although the 2008 population was estimated at 1400 stems, this was an unusually favourable year and may not represent an average stem count (COSEWIC 2010). This species' ability to remain below ground in unfavourable seasons (Williams 1994) also complicates the use of stem count alone as an abundance measure. Therefore, maintaining or improving the population's viability is considered to be a more appropriate objective.

The Ontario Natural Heritage Information Centre (NHIC) assigns quality ranks to element occurrences based on their estimated viability. The Rondeau population is ranked as C[16] (C: Fair Viability) and the Three Birds Woodlot population is ranked H[17] (H: Historical) (Jones et al. 2013).The Three Birds Woodlot population is treated as an extant population (although technically it is ranked Historical) because the area has not been regularly surveyed, the species can remain dormant in the ground for long periods (COSEWIC 2010) and the site quality remains good.

This population and distribution objective includes maintaining or improving all existing subpopulations previously documented at Rondeau Provincial Park (Woodliffe 2011) as well as maintaining or improving the integrity of habitat occupied by both populations.

4. Broad Strategies and General Approaches to Meet Objectives

The government-led and government-supported actions tables from the *Nodding Pogonia: Ontario Government Response Statement* (Part 3) are adopted as the broad strategies and general approaches to address the threats and meet the population and distribution objectives. Environment Canada is not adopting the approaches identified in

[15] The probability of persistence.
[16] Fair Viability: This rank may be applied to relatively low-quality occurrences with respect to size, condition, and/or landscape context if they still appear to have reasonable prospects for persistence for the foreseeable future (at least 20-30 years).
[17] Historical: In the absence of known disturbance and with the habitat still extant, H is generally recommended for occurrences that have not been reconfirmed for 20 or more years, but for many short-lived insects a shorter interval may be appropriate, and for unusually stable habitats (like undisturbed caves), or for certain plants whose seeds may persist and remain viable in the soil for decades, a longer interval, up to 40 years, may be used.

section 2 of the *Recovery Strategy for the Nodding Pogonia* (Triphora trianthophora) *in Ontario* (Part 2).

5. Critical Habitat

5.1 Identification of the Species' Critical Habitat

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

Identification of critical habitat is not a component of 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. Nodding Pogonia 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 protected[18] as the habitat of the species by the Province of Ontario. A habitat regulation has not been developed for Nodding Pogonia under the ESA.

This federal recovery strategy identifies critical habitat for Nodding Pogonia to the extent possible, based on the best available information as of June 2014. Critical habitat is identified for the two populations of Nodding Pogonia in Ontario (See Figure 1 and Table 1). Additional critical habitat may be added in the future if new or additional information supports the inclusion of areas beyond those currently identified (e.g., new sites are colonized in adjacent areas).

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

5.1.1. Habitat Occupancy

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

Habitat is considered occupied when:

- at least one Nodding Pogonia individual has been observed in any year since 1985

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

Occupancy is based on recent occurrence reports available for extant populations from the Natural Heritage Information Centre (NHIC) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Nodding Pogonia generally appears above ground in the late summer (late July to early August) just before it begins its brief flowering period (between late July and early September), and if conditions in any particular year are not suitable for reproduction, the species can continue to persist and grow under the soil for many years (Jones et al. 2013). The maximum period of dormancy is not well understood for Nodding Pogonia. One occurrence of Nodding Pogonia at a well-surveyed South Carolina site was rediscovered after approximately 20-30 years of going undetected (Porcher 1977, cited in Jones et al. 2013). Orchids in similar habitats to Nodding Pogonia have also been known to persist for many decades, and colonies of orchids may be as old as their surrounding forest environment (Reddoch and Reddoch 1997). It has also been suggested that some *Isotria* species (orchids with similar habitat found in the Great Lakes region) may remain dormant for 15 to 20 years, although this has not been substantiated (Correll 1950, cited in COSEWIC 2011). Habitat occupancy will be presumed for Three Birds Woodlot (ranked Historical) until the population status is reassessed by the Ontario Natural Heritage Information Centre as extirpated[19].

5.1.2. Habitat Suitability

Habitat suitability relates to areas possessing a specific set of biophysical attributes that support individuals of the species carrying out essential aspects of their life cycle.
In Canada, Nodding Pogonia is found in Carolinian deciduous forest areas of Ontario, dominated by mature stands of American Beech and Sugar Maple, often along sandy ridges with acidic soil (Jones et al. 2013), and where there is deep leaf litter, an abundance of humus, and a well-developed tree canopy (COSEWIC 2010). Like other members of the plant family Orchidaceae, Nodding Pogonia depends upon the presence of soil mycorrhizal associates. Mycorrhizal associates have been found for many other species in the same family (Dearnaley 2007). For nutrients and successful seed germination, Nodding Pogonia relies on mycorrhizal fungus (COSEWIC 2010) and this association allows the species to persist underground (for years at a time), and enables stems to appear above-ground for a brief flowering period (Jones et al. 2013).

The biophysical attributes of suitable habitat for Nodding Pogonia include:

- Deciduous forest or swamp (>75% canopy cover); or
    - Dominated by American Beech, Red Maple (*Acer rubrum*), Sugar Maple, Ironwood (*Ostrya virginiana*), Canada Mayflower (*Maianthemum canadense*), Sarsaparilla (*Aralia nudicaulis*),
- Mixed forest or swamp (>75% canopy cover); or

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

    - Dominated by White Pine (*Pinus strobus*) or Eastern Hemlock (*Tsuga canadensis*) with American Beech, Red Maple or Sugar Maple; or
- Treed sand dune (> 25% canopy cover); or
- Tops and sides of sand ridges, floodplain forests, borders of swamps, sphagnum bogs, and on sandy flats; and
    - Presence of a deep leaf litter layer; and
    - Presence of rich soils with an abundance of humus; and
    - Presence of mycorrhizal fungal associate; and
    - A steady supply of moisture throughout the season

Based on the best available information, suitable habitat for Nodding Pogonia is currently defined as the extent of the biophysical attributes where the Nodding Pogonia exists in Ontario. In addition to the suitable habitat, a critical function zone of 50 m (radial distance) is applied when the biophysical attributes around a plant extend for less than 50 m.

In Ontario, suitable habitat for Nodding Pogonia can be described using the Ecological Land Classification (ELC) framework for Southern Ontario (from Lee et al. 1998). The ELC framework provides a standardized approach to the interpretation and delineation of dynamic ecosystem boundaries. The ELC approach classifies habitats not only by vegetation community but also considers soil moisture conditions and topography, and as such encompasses the biophysical attributes of suitable habitat for Nodding Pogonia. In addition, ELC terminology and methods are familiar to many land managers and conservation practitioners who have adopted this tool as the standard approach for Ontario.

Within the ELC system in Ontario, the ecosite boundary best captures the extent of biophysical attributes required by the species. The ecosite includes the areas occupied by Nodding Pogonia and the surrounding areas that provide suitable habitat conditions to carry out essential life process for the species and should allow for natural processes related to population dynamics and reproduction (e.g., dispersal and pollination) to occur. Nodding Pogonia is a colonizing orchid that is likely restricted by the presence of a specific mycorrhizal fungus that supplies nutrients to the orchid. With the exception of the immediate area where Nodding Pogonia plants are growing, it is not possible to ensure the ELC ecosite captures the fungus, about which very little is known regarding its distribution and ecology in Canada. Therefore, using ecosite boundaries to delineate critical habitat boundaries, would be a precautionary approach as studies have found that germination of orchid seeds decreases with increasing distance from adult plants, which suggests mycorrhizae exist in proximity to adult plants (McKendrick et al. 2002; Diez 2007). It is believed the immediate area surrounding Nodding Pogonia populations is more likely to contain the appropriate soil mycorrhizal fungus. It is possible that Nodding Pogonia populations may increase locally, and colonize or recolonize areas of nearby suitable habitat within the ecosite This larger area around the plant may also promote ecosystem resilience to invasive species and their subsequent impacts on mycorrhizal fungal associations.

Ecosites containing Nodding Pogonia have been described in Ontario as Fresh-Moist Sugar Maple Deciduous Forest for subpopulations at Rondeau Provincial Park but are unknown for the Three-Birds Woodlot popualtion (Jones et al. 2013). Additional habitat assessments are required to describe and map the specific ELC ecosites currently occupied by the Nodding Pogonia.

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

5.1.3 Application of the Criteria to Identify Critical Habitat for Nodding Pogonia

Critical habitat for Nodding Pogonia is identified as the extent of suitable habitat (section 5.1.2) where the occupancy criterion (section 5.1.1) is met. In cases where the suitable habitat extends for less than 50 m around a Nodding Pogonia, a critical function zone capturing an area within a radial distance of 50 m is also included as critical habitat.
In Ontario, as noted above, suitable habitat for Nodding Pogonia is most appropriately identified as the ELC ecosite. At the present time, the ecosite descriptions and boundaries are not available to support the identification of critical habitat for all populations in Ontario. In the interim, where ELC ecosite boundaries are not available, ELC community series level is identified as the area within which critical habitat is found. In Ontario, critical habitat is located within these boundaries where the biophysical attributes described in section 5.1.2 are found and where the occupancy criterion is met (section 5.1.1). When ecosite boundaries are determined, the identification of critical habitat will be updated.

Application of the critical habitat criteria to the best available data identifies critical habitat for the two known extant populations of Nodding Pogonia in Canada (Figure 1, see also Table 1, totaling up to ~534 ha[20]. The critical habitat identified is considered a partial identification of critical habitat, insufficient to meet the population and distribution objectives. Although some critical habitat is currently identified at the Three Birds Woodlot, population status and viability needs to be assessed, as well as an evaluation completed to determine whether the current amount of critical habitat identified for the population is sufficient to maintain it.

Critical habitat for Nodding Pogonia is presented using 1 x 1 km UTM grid squares. The UTM grid squares presented in Figure 1 are part of a standardized grid system that indicates the general geographic areas containing critical habitat for land use planning and/or environmental assessment purposes. In addition to providing these benefits, the 1 km x 1 km UTM grid respects provincial data-sharing agreements in Ontario. Critical habitat within each grid square occurs where the description of habitat occupancy (section 5.1.1) and habitat suitability (section 5.1.2) are met. Human-made structures (e.g., maintained roadways, buildings) do not assist in the maintenance of natural processes and therefore are not considered critical habitat. More detailed information on critical habitat may be requested on a need-to-know basis by contacting Environment Canada – Canadian Wildlife Service at Recovery_Planning_pl@ec.gc.ca.

[20] This is the maximum extent of critical habitat based on suitable habitat boundaries that can be delineated from high resolution aerial photography (comparable to ELC Community Series and/or a 50m radial distance around Nodding Pogonia. 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.

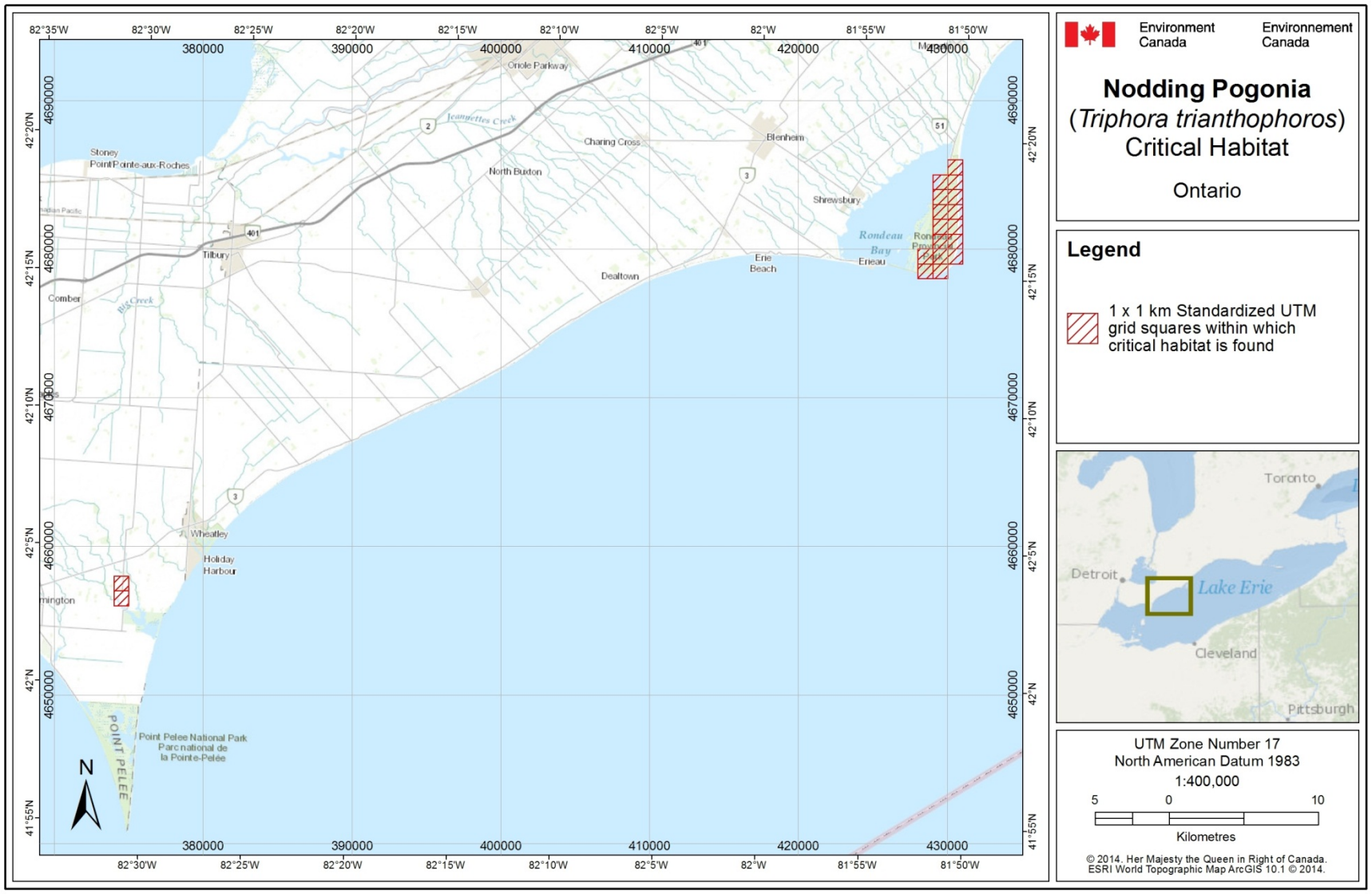

Figure 1: Grid squares that contain critical habitat for the Nodding Pogonia in Canada. Critical habitat for the Nodding Pogonia occurs within these 1 x 1 km Standardized UTM grid squares (red hatched squares) where the description of habitat occupancy (section 5.1.1) and habitat suitability (section 5.1.2) are met.

Table 1: Grid squares that contain critical habitat for the Nodding Pogonia in Canada. Critical habitat for the Nodding Pogonia occurs within these 1 x 1 km Standardized UTM grid squares where the description of habitat occupancy (section 5.1.1) and habitat suitability (section 5.1.2) are met.

Population	1 x 1 km Standardized UTM grid square ID[a]	UTM Grid Square Coordinates[b]		Land tenure[c]
		Easting	Northing	
Three Birds Woodlot	17LG7546	374000	4656000	Non-federal
	17LG7547	374000	4657000	
Rondeau Provincial Park	17MG2788	428000	4678000	Non-federal
	17MG2789	428000	4679000	
	17MG2798	429000	4678000	
	17MG2799	429000	4679000	
	17MG2890	429000	4680000	
	17MG2891	429000	4681000	
	17MG2892	429000	4682000	
	17MG2893	429000	4683000	
	17MG2994	429000	4684000	
	17MG3709	430000	4679000	
	17MG3800	430000	4680000	
	17MG3801	430000	4681000	
	17MG3802	430000	4682000	
	17MG3803	430000	4683000	
	17MG3804	430000	4684000	
	17MG3805	430000	4685000	
Total = 18 grid squares				

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

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

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

5.2 Schedule of Studies to Identify Critical Habitat

Table 2. Schedule of Studies

Description of Activity	Rationale	Timeline
Conduct surveys of the species and habitat at Three Birds Woodlot and identify additional critical habitat, if required.	To assess the current status and quality of the occurrence (viability); complete habitat mapping (e.g., ELC ecosite mapping).	2015-2022

5.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Government of Canada 2009). It should be noted that not all activities that occur in or near critical habitat are likely to cause its destruction. Activities described in Table 3 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

.

Table 3. **Activities Likely to Result in the Destruction of Critical Habitat**

Description of Activity	Descriptions of Effect in Relation to Function Loss	Details of Effect
Activities that damage mycorrhizal fungal associations, especially those that introduce exotic plants or invertebrates (e.g. introduction of non-native plant seeds, plants, foreign soil or gravel, composting or dumping of garden waste, ATV use, livestock grazing).	The introduction of invasive species can result in chemical changes in the soil that inhibit the growth of mycorrhizal fungi or physical changes to the soil that reduce fungal diversity which is essential for the reproduction of Nodding Pogonia. Invasive plants can also increase competition and both increased competition and presence of earthworms can cause physical changes to habitat such that it is no longer suitable for the species.	When these activities occur within or immediately adjacent to the critical habitat at any time of year, the effects may be cumulative. They can result in introduction of invasive species that can cause gradual destruction of critical habitat over time. The information available at this time is insufficient to develop a threshold for this activity.
Conversion of forested areas to agriculture or residential development, directly altering the physical and biological properties of the landscape.	The loss of habitat results in the direct loss of critical habitat upon which the species relies for basic survival, successful seed germination and seedling establishment.	When this activity occurs within the critical habitat at any time of year, the effects will be direct. This activity will result in habitat destruction because Nodding Pogonia requires a mature forest environment. The occurrence of this activity adjacent to critical habitat at any time of year could cause detrimental indirect effects on Nodding Pogonia habitat, due to the risk of edge effects resulting from land conversion practices.
Alteration of natural drainage patterns and moisture levels causing changes to local surface or groundwater levels (e.g. tile or channel drainage, installation of	Results in alterations to the available soil moisture and potentially humidity within forested areas.	When this activity occurs within, or adjacent to critical habitat at any time of year, the effects may be direct and/or cumulative. The likelihood of habitat destruction is dependent upon the degree of change to

Description of Activity	Descriptions of Effect in Relation to Function Loss	Details of Effect
dams, road construction).		existing drainage patterns, and the distance from the Nodding Pogonia occurrence. The information available at this time is insufficient to develop a threshold for this activity.
Removal of native vegetation component of critical habitat, including clear-cut and selective forest harvesting.	Forest management involving the opening of the well-developed canopy layer required by Nodding Pogonia can cause an increase in light penetration within the mature forest, reduction in soil moisture, reduction in summer air humidity, and an increase in the probability of invasive species being introduced on forestry equipment, and ultimately results in habitat no longer being suitable for the species.	When this activity occurs within the critical habitat at any time of year, the effects may be direct or cumulative. This activity is very likely to result in habitat destruction because Nodding Pogonia requires a mature forest environment with deep shade and high soil moisture. The information available at this time is insufficient to develop a threshold for this activity. The occurrence of this activity adjacent to critical habitat at any time of year could cause detrimental indirect effects on Nodding Pogonia habitat, due to the risk of edge effects resulting from removal of native vegetation.
Application of herbicides or fungicides.	Herbicides and fungicides may potentially destroy or deplete the mycorrhizal fungi upon which the species depends for germination and growth throughout its life cycle.	When this activity occurs within or immediately adjacent to critical habitat at any time of year, its effects may be direct or cumulative. The critical habitat will be destroyed if the soil fungi required by Nodding Pogonia are significantly depleted or destroyed. The information available at this time is insufficient to develop a threshold for this activity.

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:

- The integrity of the Rondeau population's habitat is maintained and the population persists, including all sub-populations, with no significant change to its previously documented range or population viability;
- The Three Birds Woodlot is monitored for the presence of Nodding Pogonia where possible, and the habitat integrity of the natural forest is maintained;

- In the event that Nodding Pogonia is re-discovered at the Three Birds Woodlot, the population is fully documented, and threats identified.

7. Statement on Action Plans

One or more action plans will be completed for the Nodding Pogonia and posted on the Species at Risk Public Registry by December 31, 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*[21]. 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's[22] 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.

In general, protecting the forested habitat of this species in Canada will benefit other species and ecosystem functions within the heavily altered Carolinian life zone. The species is highly localized and occurs at only two locations. American Chestnut (*Castanea dentata*) was documented in the western portion of the Three Birds Woodlot (Zavitz and Gaiser 1956, cited in Woodliffe 1988), but is it not known if it persists given its widespread population decline. Eastern Mole (*Scalopus aquaticus*) has also been documented at the Three Birds Woodlot (Oldham 1983), however the current status of that population is unknown. No other currently listed species are known from the Rondeau sites where Nodding Pogonia is found (M. Cairns pers. comm. 2014). It is possible, however, that species such as Eastern Foxsnake (*Elaphe gloydi*) or Milksnake (*Lampropeltis triangulum*) may use the habitat (M. Cairns pers. comm. 2014).

The potential for this recovery strategy to inadvertently lead to adverse effects on other species was considered. Because no management activities are proposed for the stable mature forest habitat of Nodding Pogonia in Canada, and the orchid is highly localized with no known co-occurring species at risk, the SEA concluded that this strategy will clearly benefit the environment and will not entail significant adverse effects.

[21] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[22] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

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PART 2 - *Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora*) in Ontario*, prepared by Judith Jones, Jarmo Jalava and John D. Ambrose for the Ontario Ministry of Natural Resources

Photo: Allen Woodliffe

Nodding Pogonia
(Triphora trianthophora) in Ontario

Ontario Recovery Strategy Series

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

Natural. Valued. Protected.

Ministry of Natural Resources

Ontario

About the Ontario Recovery Strategy Series

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

What is recovery?

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

What is a recovery strategy?

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

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

What's next?

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

For more information

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

RECOMMENDED CITATION

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DECLARATION

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

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

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

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

RESPONSIBLE JURISDICTIONS

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

EXECUTIVE SUMMARY

Nodding Pogonia (*Triphora trianthophora)* is designated as endangered under Ontario's *Endangered Species Act, 2007* (ESA) and the federal *Species at Risk Act* (SARA). This species is a small orchid with a 5 to 31 cm purplish-green stalk, round leaves clasping the upper stem, and usually three greenish-white flowers. The plants acquire nutrients from a symbiotic fungus associated with its roots, and thus only appear above ground when conditions are favourable for flowering. They may be completely absent for a number of years, appearing dormant. However, the plants can be growing underground. The maximum period without flowering is not known.

In Canada, Nodding Pogonia is restricted to two locations in Ontario: Rondeau Provincial Park and Three Birds Woodlot (Essex County). At Rondeau more than 96 plants were present in 2011. Plants have not been seen at Three Birds Woodlot since 1987, but there have only been three partial surveys there in 26 years. The population is considered extant. Trend analysis is difficult due to large fluctuations in numbers of above-ground stems from year to year. In Ontario, the species grows in shady, moist beech-maple woods in small depressions with deep leaf litter and humus.

Current threats to Nodding Pogonia include: (1) disruptions of the mycorrhizal fungal association by earthworms, other invasive species such as Japanese Barberry (*Berberis thunbergii*) or Garlic Mustard (*Alliaria petiolata*), or potentially from air pollution; (2) degradation or loss of habitat from beech bark disease, forest management, or changes in drainage; and (3) grazing by White-tailed Deer, slugs or other animals. Potential threats and natural limitations are also discussed in the text.

The recovery goal is to maintain the extant populations of Nodding Pogonia in their current condition or better and to assist these populations over the long-term to become self-sustaining and viable. The recovery objectives are to:

- determine the current distribution and abundance of Nodding Pogonia populations in Ontario by 2022;
- assess threats to the species and its habitat by 2017 and address threats by 2019;
- fill knowledge gaps relating to the biology, ecology, habitat, and threats of Nodding Pogonia in Ontario by 2017;
- develop and implement a monitoring strategy to be used to help fulfill objectives 1 to 3 by 2015; and
- use a variety of tools to protect and maintain habitat of known populations by 2017.

It is recommended that the area to be considered for habitat regulation include:

1) all areas known to be occupied or formerly occupied by the species since 1950 unless they meet the criteria for lack of occupancy;
2) previously unknown areas where the species becomes discovered from 2012 onward; and

3) In deciduous forest habitat, a radial distance of 200 m around patches of Nodding Pogonia. If non-forested vegetation falls within the 200 m radius circle, it is recommended all of the forested area be included plus up to 30 m of unforested vegetation to a maximum distance of 200 m from the plants.

It is recommended that pre-existing human infrastructure such as roads, railway tracks, parking lots, agricultural crops, etc. should not be included in regulated habitat.

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1. BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Nodding Pogonia
SCIENTIFIC NAME: *Triphora trianthophora*
SARO List Classification: Endangered
SARO List History: Endangered (2004)
COSEWIC Assessment History: Endangered (2010, 2000, 1999), Threatened (1988)
SARA Schedule 1: Endangered
CONSERVATION STATUS RANKINGS: GRANK: G3G4 NRANK: N1 SRANK: S1

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

1.2 Species Description and Biology

Species Description

Nodding Pogonia (*Triphora trianthophora*) is a small orchid that exists primarily underground and only produces flowering stems in favourable years. The roots of Nodding Pogonia are fleshy, and some have tuber-like swellings (called tuberoids or corms) used for nutrient storage. When present, the purplish-green above-ground stems range from 7 to 20 (30 maximum) cm in height (Romero-González et al 2002). Round leaves clasp the upper half of the stem, up to the base of the inflorescence (flower cluster). The number of leaves per plant may be one or several. Often the plant produces three flowers that are subtended by a leafy bract, but there may be as few as one or as many as seven flowers. The inner perianth (flower) consists of two top petals and a lower lip bearing three greenish crests. The three outer sepals are white and petal-like. The flowers sometimes have a distinctive magenta coloration. The fruit is an erect green capsule.

Species Biology

Nodding Pogonia is an inconspicuous species that only appears above ground in late summer just before it begins its brief flowering period. The plants are heterotrophic, meaning they require nitrogen and carbon for growth from a source other than photosynthesis. In Nodding Pogonia, nutrients are supplied by a mycorrhizal fungus in the cortex, or outer layer, of the roots (Carlsward and Stern 2009). This allows the species to survive underground and only occasionally appear above ground to flower and accomplish sexual reproduction.

If conditions in any particular year are not suitable for reproduction, few or no above ground stems may be produced, and the species may appear dormant. However, dormant does not mean an entirely inactive state since the plants are still able to grow and spread underground and to store nutrients in tuberoid corms, or swellings on the underground stem (Williams 1994). Periods of dormancy occur in a wide variety of plant species and have been shown to correspond to increased survival in periods of environmental stress and fluctuating resources (Shefferson et al. 2001, Gremer et al. 2012).

The maximum period this species may remain alive without appearing above ground (e.g., the dormancy period) is not known, but mark and recapture studies (which monitor the presence or absence of specific individuals) have shown a variety of dormancy periods for other orchid species. These range from 1 or 2 years for *Cypripedium* species (Shefferson et al. 2001, Kery and Gregg 2004), to up to 18 years in Helleborine (*Epipactis helleborine)* (Light and MacConaill 2006), to possibly as much as 20 years in some *Isotria* species (Correll 1950). However, Holsinger et al. (1996 cited in COSEWIC 2011) showed that after five years or more there is a 90% chance that plants of Small Whorled Pogonia (*Isotria medeoloides*) will not re-emerge.

A report from South Carolina (Porcher 1977) reported a recurrence of Nodding Pogonia after an apparent absence of 125 years. However, this referred to an absence of reports on the South Carolina coastal plain, rather than from one particular site that had been consistently observed during that span of years. Thus, this report does not conclusively show that an individual Nodding Pogonia plant can reemerge after being dormant for that length of time. Still, the author noted that the orchids emerged in an area he had frequented for many years in which he had never seen them before. This would seem to indicate that the plants may have been dormant for at least the period of his use of the area, which could conceivably be 20 to 30 years or more.

The numbers of above ground stalks produced (if any) may vary greatly from one year to the next. In New Hampshire, an area of approximately one square mile (2.6 km^2) was found to contain 20,000 stems of Nodding Pogonia during one year, less than 500 stems the next year, only 2 stems the third year, and none the fourth year. However, two years later, there were again about 20,000 stems present (Lownes 1926).

The conditions needed for flowering to occur in Nodding Pogonia are not known, but it has been observed that more flowering stems have appeared at Rondeau Provincial Park in cool, damp summers and that dry conditions may inhibit flowering (Woodliffe 1988, COSEWIC 2010). In addition, it is possible that other factors, such as corm size and amount of nutrient storage may also be involved (Williams 1994).

Some more visible Nodding Pogonia populations in Michigan have been known to persist for long periods of time (more than 30 years) in the same location (Case 1987) and may survive within suitable microhabitat even in semi-disturbed surroundings (Case 1987, Swink and Wilhelm 1994, Dister 2006).

In Ontario, flowers have been observed as early as July 30 and as late as September 27 (Woodliffe 1988). In favourable years, up to three stalks may grow, each with between one and seven flowers. An individual flower usually lasts only one day (Case 1987), during which time it is dependent on insect pollinators for seed set. Individual flowers develop to a specific stage and then remain at a stand-still until certain temperature requirements are met. Usually on the second morning after a significant drop in overnight temperature, all developed flowers open synchronously, a process which may increase the potential for cross-pollination. This process repeats itself with subsequent buds. Successful germination of the fine wind-dispersed seeds depends on contact with the correct associated fungus to nourish the developing embryo.

Pollinators of Nodding Pogonia are observed to be mainly Halictid bees. At Rondeau Provincial Park, sweat bees in the genus *Dialictus* were observed as pollinators (P.A. Woodliffe pers. comm. 2012). Medley (1979) reported nine species of bees, mainly in the family Halictidae, pollinating Nodding Pogonia in Michigan.

Artificial propagation of this species has had limited success. Anderson (1990) successfully germinated seeds of this species on an artificial medium and produced small corms in the laboratory, but attempts at reintroducing them in the wild were not successful. Material from Three Birds Woodlot was introduced to Rondeau Provincial Park in 1956, but the introduced plants apparently survived for only four years, and a similar attempt at John E. Pearce Provincial Park was apparently without success (Woodliffe 1988).

The corms of Nodding Pogonia are sometimes collected and cached by squirrels (Case 1987, P.A. Woodliffe pers. comm. 2009), and squirrels may inadvertently help Nodding Pogonia disperse to new locations since translocated corms are capable of producing above ground flowering stems or below ground growth. No specific work has been done on dispersal distances in Nodding Pogonia. However, a study of seed dispersal by Fox Squirrels (*Sciurus niger*) showed an inverse relationship between size of propagule and distance carried (Stapanian and Smith 1978). This study found that Black Walnut (*Juglans nigra*) seeds were carried a maximum distance of 108 m. In Illinois, Dow and Ashley (1996) found acorns of Bur Oak (*Quercus macrocarpa*) were dispersed a maximum of 165 m from parent trees, primarily by squirrels, although the mean distance was 22 m.

However, corms of Nodding Pogonia are smaller and lighter than walnuts or acorns and so might be carried farther, but they are probably not as valuable a food source and might be dropped sooner. These are generalizations that are not specific to orchid corms or to a particular species of squirrel. However, they serve to show that dispersal distances for Nodding Pogonia corms could be as much as 165 m or potentially greater.

Dispersal distances for Nodding Pogonia seeds are much larger than for the corms or for walnuts or acorns. While no specific distances are known for Nodding Pogonia, orchid seeds in general are tiny and dust-like and can remain airborne for long periods. Depending on the speed of the wind and other factors, they are capable of traveling

hundreds of metres from the parent plant (Murren and Ellison 1998, Arditti and Ghani 2000).

1.3 Distribution, Abundance and Population Trends

In Canada, Nodding Pogonia is restricted to two locations in Ontario: Rondeau Provincial Park in the Municipality of Chatham-Kent and Three Birds Woodlot, near Leamington in Essex County (Figure 1). Nodding Pogonia occurs throughout eastern North America (Figure 2) from New England to Texas, and south through Mexico, Guatemala, and Panama (NatureServe 2012). The species is globally ranked G3G4 or vulnerable to uncommon throughout its range, and the species is not ranked secure anywhere in North America (NatureServe 2012). Table 1 shows the conservation status of Nodding Pogonia in North America by state or province. In Canada and in Ontario, Nodding Pogonia is designated endangered. It is ranked N1 and S1 or critically imperiled both nationally and provincially.

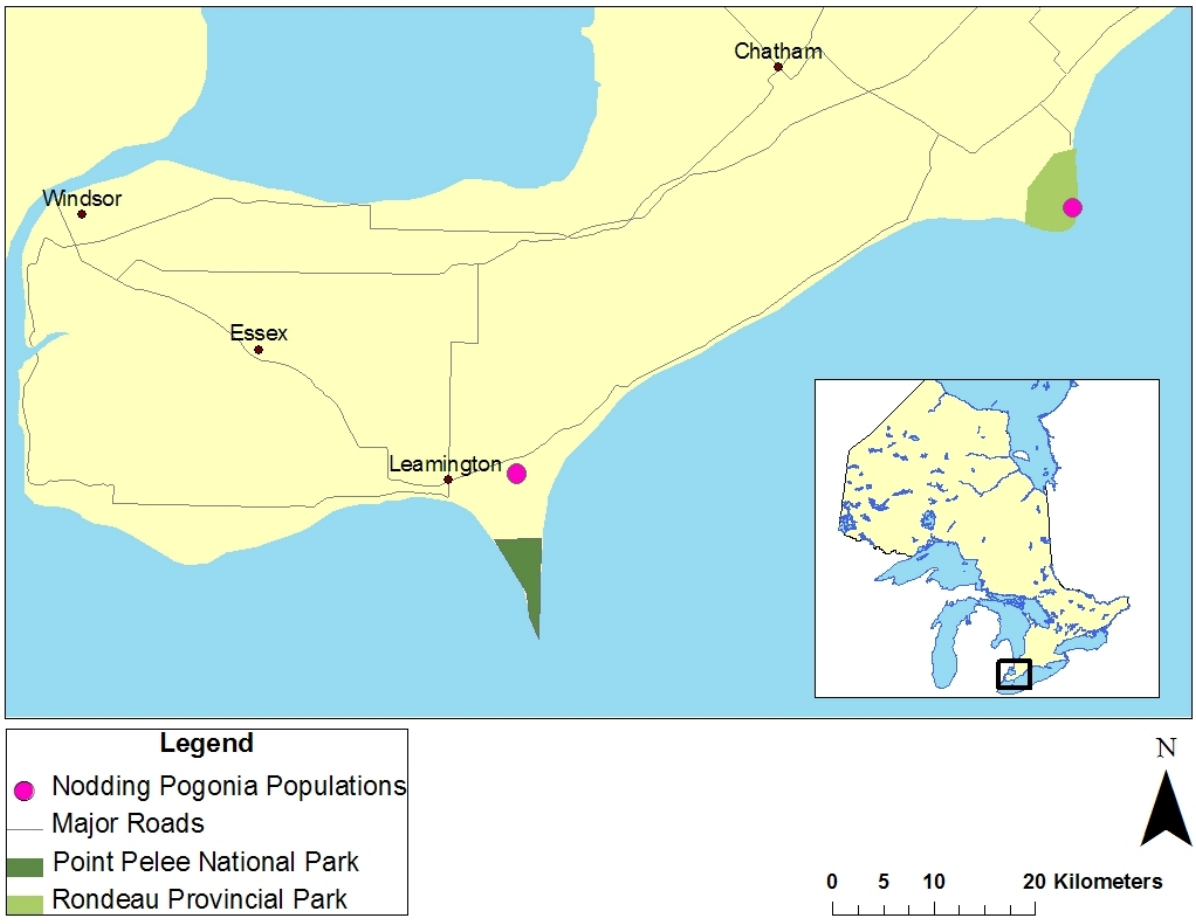

Figure 1. Current distribution of Nodding Pogonia in Ontario.

Figure 2. **North American distribution of Nodding Pogonia (Flora North America 2005). Red dot shows general location of Ontario populations. Distribution in Mexico, Guatemala, and Panama not shown**.

Table 1. Conservation status of Nodding Pogonia in North America by state or province (NatureServe 2012).

Historic (SH)	Critically Imperiled (S1)	Imperiled (S2)	Imperiled to Vulnerable (S2S3)	Vulnerable (S3)	Not Ranked (SNR)
District of Columbia Pennsylvania	Connecticut Delaware Maine Maryland Massachusetts Michigan Nebraska New Jersey **Ontario** Vermont Virginia	Georgia Louisiana New Hampshire New York North Carolina Ohio South Carolina West Virginia Wisconsin	Mississippi Oklahoma	Florida Illinois Iowa	Alabama Arkansas Indiana Kansas, Kentucky Missouri Tennessee Texas

<u>Rondeau Provincial Park</u>

At Rondeau Provincial Park a colony with several clusters of 10 to 15 plants each was discovered in 1966. Annual monitoring of the Rondeau Provincial Park populations using permanent plots was begun in 1986. Numbers of above ground stems in both plot data and rough subpopulation counts vary greatly from year to year. For example, the plots contained 40 stems in 2005 but only 4 stems in 2007, and then 69 stems were

present in 2008 and 126 stems in 2009. Actual numbers for the total population are higher than plot totals because many plants occur outside of plots, but annual counts have not always been done for non-plot areas. Thus, it is impossible to determine what the annual total population maximums may have been in the past. In 2008, 1357 stems were counted in regular plots covering only a portion of the habitat and of the potential population (COSEWIC 2010). In 2011, 96 stems were counted: 13 in study plots and 83 in other areas, but only a portion of the total habitat was surveyed. The Rondeau population consists of four subpopulations within an area of approximately nine hectares (COSEWIC 2010).

It is possible that the Rondeau population originated from plants that were introduced into the park in 1956 from Three Birds Woodlot (Woodliffe 1988). By 1960, the introduced population had disappeared, but in 1966 the species was discovered at another location approximately one kilometre from the introduction site. It is not known whether the species was at the second location all along or whether these plants were the result of seed or corm dispersal from the introduced population. Still, regardless of the origin, the Rondeau population qualifies for recovery because it is within the natural range of the species, and because the propagules introduced came from a known native source (COSEWIC 2010).

Three Birds Woodlot

At Three Birds Woodlot, 12 Nodding Pogonia plants were discovered in 1950. Annual counts have only been done sporadically and only for parts of the population, but numbers have ranged from 188 in 1967 to 22 in 1985. No plants have been seen at Three Birds Woodlot since 1985, but the habitat has not been surveyed on a regular basis. The eastern part of the woodlot (where permission for access was granted) was searched in 1998, 2000 and 2008, but no Nodding Pogonia was found. With searches made in only 3 of the last 26 years and covering only part of the habitat, it remains possible that Nodding Pogonia may be present in the unsurveyed area or may have flowered in a year when no survey work was done. Three Birds Woodlot is approximately eight hectares (COSEWIC 2010).

It is impossible to determine trends for either population from abundance data due to inherent year to year fluctuations in numbers and due to inconsistent survey coverage. The Natural Heritage Information Centre (NHIC) assigns quality ranks to occurrences of natural features based on their predicted viability. Occurrences may be ranked as follows: A – Excellent, B – Good, C – Fair, D – Probably not viable; E – Verified extant, F – Failed to find, H – Historical, X – Extirpated. NHIC has ranked the Rondeau occurrence of Nodding Pogonia as C, while the Three Birds Woodlot occurrence is ranked H (NHIC 2012).

According to NatureServe (2012), a ranking of H is used to indicate that an occurrence has not been confirmed for 20 or more years although there may still be extant suitable habitat. It is also used for plant species with long-lived seed banks that may remain viable in the soil but absent for long periods of time. In such cases, an occurrence can be ranked H for up to 40 years without being considered extirpated. Often the H rank may indicate a lack of field work (M.J. Oldham pers. comm. 2012). COSEWIC

guidelines state that a population may be considered extirpated when (1) there is no remaining habitat for the species and the species has not been found in recent surveys; (2) 50 years have passed since the last credible record of the species despite surveys; or (3) there is information demonstrating that no individuals of the species remain alive (COSEWIC 2012). Therefore, the Three Birds Woodlot population is considered extant.

Nodding Pogonia was reported in 1960 from John Pearce Provincial Park as an introduced species (introduction date unknown), but a 1982 park inventory did not list the species as present (Woodliffe 1988). Morris and Eames (1929) mention Nodding Pogonia as formerly occurring at Komoka (Middlesex County), Ontario, but long extirpated. However, the location may have been reported incorrectly, and it is believed that the collection the report is based on probably came from somewhere in the Niagara region (Woodliffe 1988).

1.4 Habitat Needs

Nodding Pogonia grows in rich, moist deciduous beech-maple woodlands where there is deep leaf litter, an abundance of humus, and a well developed tree canopy. It is also sometimes found on rotten logs. Literature consulted from different time periods and from many different American states (c.f. Lownes 1920, Porcher 1977, Brackley 1985, Case 1987, Maine Dept. of Conservation 1998, Zika 2001) reported the species as growing in stands of pure American Beech (*Fagus grandifolia*) or where the canopy is predominantly beech with a component of Eastern Hemlock (*Tsuga canadensis*). In the United States, the species is known from rich woods along streams and on the edge of swamps and floodplain forests (Correll 1950), as well as on old beach ridges and in *Sphagnum* communities at the edges of bogs (Case 1987). In its broader North American range, Nodding Pogonia may occur in other habitats as well, such as sandy oak-mixed hardwood forests, seasonally wet, sandy flatwoods, Great Lakes dune forests, coniferous forests, tamarack swamps, rhododendron thickets, floodplain forests, wet muck in glacial lake bed forest, and in seasonally flooded sinkhole swamps (Romero-González et al. 2002).

According to P.A. Woodliffe (pers. comm. 2012), at Rondeau Provincial Park Nodding Pogonia is found in rich beech-maple forest with a few White Pine (*Pinus strobus*) in the canopy, along sandy ridges with acidic soil. The vegetation type has been classified as Fresh-Moist Sugar Maple-Hardwood Deciduous Forest (M. Cairns pers. comm. 2012) based on Lee et al.1998. In drier years, the plants appear near the bottom of the low ridges (presumably the moist spots during dry years), but in wetter years, the plants appear a little higher up the side of the ridges, or even atop the ridges. At some Nodding Pogonia sites at Rondeau, the humus layer above the underlying sand is 10 to 15 cm deep, with leaf litter on top of that. In northern Michigan, it is reported that the tuberoid roots grow in contact with sand below a 7.5 to 10 cm layer of leaf mould (Van Arsdale 1982). However, many authors (see above) also reported the species growing in leaf-lined depressions and in leaf-mould without soil or sand.

Some typical associated species present in the habitat of Nodding Pogonia may include: Red Maple (*Acer rubrum*), Sugar Maple (*Acer saccharum*), Ironwood (*Ostrya virginiana*), Mayflower (*Maianthemum canadense*), Sarsaparilla (*Aralia nudicaulis*), among others, as well as other heterotrophic species such as Beechdrops (*Epifagus virginiana*), Indian Pipe (*Monotropa uniflora*) and Spotted Coral Root (*Corallorhiza maculata*) (Brackley 1985, Swink and Wilhelm 1997, Zika 2001).

1.5 Limiting Factors

Nodding Pogonia only grows above ground when conditions are favourable for the production of flowers and seeds. The species' reproductive biology is highly specialized and requires coinciding factors for successful reproduction. If one factor is lacking, successful reproduction will not occur because any of the links in the chain of events may be limiting. These include: suitable climatic and moisture conditions for the plant to produce flowers; insect pollinators to produce seed set; dispersal of seeds to suitable habitat; and contact of the seeds with a specific fungus species for successful germination and establishment.

A lack of pollinators may or may not be a limitation for Nodding Pogonia. The flowers of Nodding Pogonia bloom synchronously and are only fertile for one day, so if no pollinator is present on that day, reproduction is not possible. In a six-year study of Nodding Pogonia, Williams (1994) observed pollinators on only two occasions and reports that the short flowering period and lack of pollinators cause low capsule production. However, other workers have not had difficulty observing pollination in Nodding Pogonia (Medley 1979, Woodliffe 1988, Catling and Catling 1991). Furthermore, even low capsule production as a result of few pollinators may not be a limitation since each capsule contains thousands of seeds, which is more than in many species.

Because the two extant populations of Nodding Pogonia are isolated and small, loss of genetic diversity may be a concern especially if sexual reproduction is not successful for extremely long periods of times. The loss of genetic diversity could make the species incapable of responding to long-term changes in its habitat such as increased temperature or reduced moisture.

1.6 Threats to Survival and Recovery

Threats and factors that may be potential threats to Nodding Pogonia are presented in Table 2.

Table 2. Current, potential, and historical threats to Nodding Pogonia (Sources: COSEWIC 2010; Woodliffe 2011; H. Bickerton pers. comm. 2012).

Threat	THREE BIRDS WOODLOT	RONDEAU
1. Damage to mycorrhizal fungal association due to:		
Japanese Barberry		Current
Garlic Mustard	Current	
Earthworms	Current?	Current?
Air pollution	Potential	Potential
2. Habitat degradation or loss from:		
Beech bark disease	Current	
Forest clearing or forest management	Potential	
Changes in drainage	Potential	
Livestock grazing	Historical	
3. Herbivory		
White-tailed Deer	Potential	Current
Chipmunks, slugs	Potential	Potential
4. Other threats:		
Catastrophic events (floods, windstorms)	Potential	Potential

Disruption of or Damage to the Mycorrhizal Fungal Association

Anything that disrupts the connection of Nodding Pogonia plants with their fungal associates, or that reduces the presence of these fungi in the soil, could seriously impact the ability of the Nodding Pogonia to survive. Disruption of mycorrhizae is likely the most serious current threat to this species, but direct scientific proof of this still needs to be confirmed through field studies. However, indirect evidence of the seriousness of this threat is shown by studies of the effects of several invasive species on soil fungi and microorganisms.

At Rondeau Provincial Park, Nodding Pogonia is threatened by shrubs of the invasive Japanese Barberry (*Berberis thunbergii*). Japanese Barberry roots secrete the toxin berberidine (Schmeller et al. 1997) which is highly damaging to surrounding plants and soil microorganisms, resulting in changes in the structure and function of the soil (Ehrenfeld et al. 2001). In 2010 a successful effort was made to greatly reduce Japanese Barberry in the vicinity of the main Nodding Pogonia population, resulting in fewer barberry shrubs than have been present for at least two decades (P.A. Woodliffe pers. comm. 2012). The effort is not yet complete, and park staff are continuing to monitor and reduce barberry throughout the eastern half of the park, where it has been most problematic. Still, it remains a current threat to other Rondeau subpopulations and could recur as a threat to the main population if control activities are discontinued (COSEWIC 2010).

Garlic Mustard (*Alliaria petiolata*) is another exotic, invasive species that secretes chemicals into the soil, inhibiting the growth of nearby plants and mycorrhizal fungi. Garlic Mustard seedlings were observed at Three Birds Woodlot in 2008 (COSEWIC

2010). The species is present but not widespread in Rondeau Provincial Park (S. Taylor pers. comm. 2012).

Earthworms may be a current threat to Nodding Pogonia. Historically, earthworms were not naturally present in the forests of eastern North America and may be the cause of serious and widespread impacts to these ecosystems (Hale et al. 2006). It has been demonstrated that earthworms reduce duff and humus layers as well as fungal diversity (Baxter et al. 1999, Muratake 2003, Bohlen et al. 2004, Hale et al. 2006), all of which are necessary for the survival of Nodding Pogonia. Although earthworms have not been surveyed at either population, observations of the habitat at both populations in 2008 show shallow leaf litter and several patches of exposed bare soil at the location where the orchids have been seen in the past (Woodliffe 2011, H. Bickerton pers. comm. 2012). It is possible these changes in duff conditions are due to earthworms (COSEWIC 2010).

Nodding Pogonia occurs in a region with high levels of airborne pollutants. Air- and precipitation-borne nutrient loading (increases in available nitrogen) have been shown to reduce fungal diversity in Europe (Arnolds 1991), and are therefore possibly a threat to the mycorrhizal association required by Nodding Pogonia.

Habitat Loss or Degradation

Beech bark disease, which leads to mortality of American Beech trees, may threaten Nodding Pogonia by causing changes to soil moisture levels and affecting habitat conditions. American Beech is a significant component of the forest canopy in the Ontario habitat of Nodding Pogonia, and the loss of beech trees creates openings in the canopy which allow greater amounts of sunlight to reach the ground. This results in drier soil conditions which may be unsuitable for Nodding Pogonia. In addition, the roots of American Beech and large trees of other species bring moisture into the upper soil strata through hydraulic lift (Light and MacConaill 2006), so the loss of American Beech may affect soil moisture levels through this mechanism as well. It has also been speculated that Nodding Pogonia may receive nutrients from Beech trees via the mycorrhizal fungal association (Williams 1994). Beech bark disease was observed at Three Birds Woodlot in 2008 (COSEWIC 2010) but is not present at Rondeau Provincial Park (S. Taylor pers. comm. 2012).

Historically, clearing of land for agriculture and forest products may have been the primary cause of loss of Nodding Pogonia populations in Ontario, but the absence of historic data makes this purely speculative. Forest management creates gaps in the tree canopy (as discussed above), and the use of skidders and large machinery can damage soils, trample plants, or dislodge the underground corms. Changing drainage through irrigation or channeling of streams may also result in excessive drying of soils. Forest clearing and changing drainage are not current threats but could possibly occur on private land at Three Birds Woodlot although neither landowner has plans for these activities (H. Bickerton pers. comm. 2012).

In the past, portions of the Three Birds Woodlot were grazed by horses, but the population persisted and flowered for many years apparently unaffected by this. A population in Michigan is known to have persisted for more than 30 years despite grazing (Case 1987). Still, in the past grazing may have been involved in a decline in numbers of plants at Three Birds Woodlot. Livestock grazing can cause soil compaction, directly damage plants, and introduce exotic or invasive plant species. Grazing has been absent from Three Birds Woodlot now for more than 10 years and is not a current threat (COSEWIC 2010).

Herbivory

Browsing by White-tailed Deer continues to be a threat to Nodding Pogonia at Rondeau Provincial Park (M. Cairns pers. comm. 2012) and is a potential threat at Three Birds Woodlot. A herd reduction program at Rondeau Provincial Park in the 1990s reduced the severity of the threat for that population, but browsing continues to be observed. Browsing by deer, chipmunks, or slugs could damage plants during the critical, above-ground reproductive period.

In Massachusetts (Williams 1994), slugs are reported to be the most destructive herbivores of Nodding Pogonia, chewing into corms, stem, buds, and flowers. Slugs were also responsible for loss of capsules before ripening. It is not known whether slugs are a problem for Nodding Pogonia in Ontario. Plants of Nodding Pogonia are reportedly also eaten by Eastern Chipmunk (*Tamius striatus*) (Williams 1994).

Other Threats

With only two small, isolated, extant populations of Nodding Pogonia in Ontario, the species is at risk of extirpation due to catastrophic events such as storms or drought (COSEWIC 2010). Flooding could rot underground corms and damage mycorrhizae, and windstorms may cause an opening of the forest canopy and drying of the critical humus layer.

Many orchid species are threatened by trampling from visiting naturalists, and collecting of wild, native orchids by orchid enthusiasts is also a widespread practice that damages and removes plants. However, neither trampling nor collecting are serious threats at Rondeau Provincial Park as the species occurs in quite inaccessible areas away from trails. These problems are also not significant threats at Three Birds Woodlot, as the population is on private property and not accessible to the public (COSEWIC 2010).

1.7 Knowledge Gaps

Knowledge gaps may limit the successful recovery of the Nodding Pogonia. Further studies and a better understanding of the following are required:

- the current distribution and abundance of the Three Birds Woodlot population, and annual changes in trends at the Rondeau Provincial Park populations;

- whether other potential habitat areas support additional populations or are suitable as potential reintroduction sites;
- detailed, standardized Ecological Land Classification (ELC) documentation and mapping of the forest communities of the Three Birds Woodlot population;
- impacts of earthworms, slugs, and invasive plants on the species and its habitat.
- Specific mycorrhizal associations of Nodding Pogonia;
- conditions required for plants to produce above ground stems and other biological requirements for growth;
- impacts of air and water-borne nutrient loading on Nodding Pogonia;
- whether in fact there is an association with American Beech or mature trees of other deciduous species;
- details of species' biological and ecological needs relating to site management, stewardship;
- demographic studies to understand emergence periodicity, age structure of populations, and recruitment rates; and
- methods of propagation to be used in potential reintroduction efforts.

1.8 Recovery Actions Completed or Underway

The following recovery actions have been done and the following protective measures are already in place.

- Annual monitoring of plots at Rondeau Provincial Park tracks numbers and locations of plants as well as good bloom years.
- A significant amount of Japanese Barberry was removed from around the main population of Nodding Pogonia at Rondeau Provincial Park in 2010, and more removal work is planned.
- Deer reduction at Rondeau has had a beneficial effect on many features of the park and has somewhat reduced this potential threat to Nodding Pogonia.
- The privately owned Three Birds Woodlot is designated as an Environmentally Significant Area by the Essex Region Conservation Authority (ERCA 2012). As a result of this designation, an application to change the existing agricultural zoning to another land use or to sever part of the property would require an environmental impact assessment demonstrating no negative impact (D. Lebedyk pers. comm. 2012). As well, after June 30, 2012, the *Provincial Policy Statement* of the *Planning Act* (PPS) will prohibit development and site alteration in the habitat of Nodding Pogonia in applications for a change of land use.
- Nodding Pogonia is listed as endangered on the Species at Risk in Ontario (SARO) List of Ontario's *Endangered Species Act, 2007* (ESA). Under the Act, plants of Nodding Pogonia may not be harmed or killed. The habitat will be legally protected as of June 30, 2013.
- At Rondeau Provincial Park, Nodding Pogonia is protected by the *Provincial Parks and Conservation Reserve Act* (2007) under which it is illegal to disturb, cut, kill, remove or harm any plant in a provincial park without written authorization of the park superintendent. As well, the species occurs within a

nature reserve zone within the park in which some recreational activities are restricted.

- Nodding Pogonia is included in the Carolinian Woodlands Ecosystem Recovery Strategy (Jalava, et al. 2009). Ecosystem-based recovery work is underway, coordinated by Carolinian Canada Coalition, a consortium of more than 40 governmental agencies and non-governmental organizations. Several conservation action plans (CAPs) have been developed, and a pilot project is now underway to implement the Essex Forests and Wetlands Natural Areas CAP (Carolinian Canada 2012) which covers the county where Three Birds Woodlot is located. A CAP will be developed for the Rondeau area in 2012, and Nodding Pogonia will be one of the target species.

2. RECOVERY

2.1 Recovery Goal

The recovery goal is to maintain the extant populations of Nodding Pogonia in their current condition or better, to assist these populations over the long-term to become self-sustaining and viable, and to fill knowledge gaps so that recovery activities at other locations may become possible in the future.

Rationale for Recovery Goal

The historical status of Nodding Pogonia in Ontario is unknown, raising questions as to what would constitute "recovery". It is unclear whether Nodding Pogonia was once more common and widespread in the province or whether it has always been extremely rare, or whether the two current populations were recent establishments in the province at the time they first became known in the 1950s and 1960s. Therefore, it is suggested that restoration of a historic range or a historic population not be included in the recovery goal at this time.

In addition, successful propagation and reintroduction of Nodding Pogonia into the wild, which would allow establishment of new populations to be part of recovery, has not yet been achieved. Furthermore, very little interior, moist forest habitat remains in extreme southwestern Ontario where potential reintroductions could take place. Therefore, the focus of recovery should be on maintaining the existing populations and assisting them to become self-sustaining and viable by reducing threats and ensuring suitable growing conditions are maintained. Due to the lack of information about Nodding Pogonia, knowledge gaps must be filled before any broader goals can be defined.

2.2 Protection and Recovery Objectives

Table 3. Protection and recovery objectives

No.	Protection or Recovery Objective
1	Determine the current distribution and abundance of Nodding Pogonia populations in Ontario by 2022.
2	Assess threats to the species and its habitat by 2017 and address threats by 2019.
3	Fill knowledge gaps relating to the biology, ecology, habitat, and threats of Nodding Pogonia in Ontario by 2017.
4	Develop and implement a monitoring strategy to be used to help fulfill objectives 1 to 3 by 2015.
5	Use a variety of tools to protect and maintain habitat of known populations by 2017.

2.3 Approaches to Recovery

Specific approaches to address threats and accomplish recovery of Nodding Pogonia are presented in Table 4.

Table 4. Approaches to recovery of Nodding Pogonia in Ontario.

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
1. Determine the current distribution and abundance of Nodding Pogonia populations in Ontario by 2022.				
Critical	Short-term	Stewardship	**1.1** Begin a respectful discussion with landowners of Three Birds Woodlot to see what recovery work can be planned with their collaboration.	• Required before addressing threats and knowledge gaps will be possible at this site
Critical	Short-term	Inventory, Monitoring and Assessment	**1.2** With permission of landowners, set up annual surveys of Three Birds Woodlot to determine the status of the population.	• Gaps: distribution and abundance of Three Birds Woodlot population and biological requirements or threats
Critical	Short-term	Inventory, Monitoring and Assessment	**1.3** Continue population counts at Rondeau Provincial Park, and expand monitoring area to include more habitat outside plots.	• Gaps: distribution and abundance of Rondeau population and biological requirements or threats
Necessary	Short-term	Inventory, Monitoring and Assessment	**1.4** Document ELC vegetation type for Three Birds Woodlot.	• Gaps: biological requirements including suitable habitat conditions
2. Assess threats to the species and its habitat by 2017 and address threats by 2019.				
Critical	Short-term	Inventory, Monitoring and Assessment	**2.1** Assess and document presence and severity of all threats at both populations	• All threats
Critical	On-going	Management and Stewardship	**2.2** Plan and implement actions to reduce presence of invasive species and address other threats from both populations.	• All threats

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Necessary	Short-term	Management	**2.3** Working with the landowners, discuss potential for recovery work at Three Birds Woodlot.	• All threats
Necessary	Long-term	Management	**2.4** Continue deer population controls at Rondeau Provincial Park to keep threat from browsing low	• Threat: herbivory by deer
Beneficial	Long-term	Management	**2.5** After 3.5, evaluate the usefulness of augmenting the existing populations or establishing other populations of Nodding Pogonia within Rondeau Provincial Park and Three-Birds Woodlot.	• Threats: catastrophic events; loss of genetic diversity
Beneficial	Long-term	Management	**2.6** After 3.5, evaluate the feasibility of reintroducing the species to other suitable sites. Reintroduce if deemed feasible.	• Threats: catastrophic events; enables withstanding other threats
3. Fill knowledge gaps relating to the biology, ecology, habitat, and threats of Nodding Pogonia in Ontario by 2017.				
Critical	Short-term	Research	**3.1** Engage the academic community to participate in researching knowledge gaps.	• Any or all threats
Critical	On-going	Research	**3.2** Research impacts of earthworms and other invasive species on Nodding Pogonia and its habitat.	• Threats: disruption of mycorrhizae by invasive species; habitat degradation.
Critical	On-going	Research	**3.3** Research mycorrhizal relationships of the species.	• Threat: disruption of mycorrhizae
Necessary	On-going	Research	**3.4** Research the conditions required for producing above ground plants, and for flowering and fruiting.	• Gaps: growing conditions and biological requirements
Necessary	On-going	Management	**3.5** Investigate propagation and reintroduction protocols.	• Gaps: propagation and biological requirements

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Beneficial	On-going	Research	**3.6** Investigate possible causes of suspected extirpation from sites where plants are presumed absent (e.g., Rondeau subpopulation 2).	• Gap: biological requirements
Beneficial	On-going	Research	**3.7** Discuss Nodding Pogonia with adjacent jurisdictions where the species occurs to share information and coordinate activities if possible.	• Gaps: biological requirements; Threats: catastrophic events
Beneficial	Long-term	Management; Threats reduction	**3.8** Investigate the appropriateness and feasibility of augmenting populations or reintroducing Nodding Pogonia to other suitable habitat.	• Threats: catastrophic events; enables withstanding other threats
Beneficial	On-going	Inventory, Monitoring and Assessment	**3.9** Identify and survey sites with potentially suitable habitat to search for new populations and to determine suitability for potential reintroductions if deemed feasible in 3.8.	• Threat: loss or degradation of habitat by finding other less-impacted sites
Beneficial	Long-term	Research	**3.10** Research the impacts of air pollution (e.g., NO_2) on the species.	• Gap: effects of air pollution
4. Develop and implement a monitoring strategy to be used to help fulfill objectives 1 to 3 by 2015.				
Critical	Short-term	Inventory, Monitoring and Assessment	**4.1** Develop and apply monitoring protocol for Nodding Pogonia: - expand existing monitoring at Rondeau Provincial Park to include habitat outside plots; - apply protocol at Three Birds Woodlot after 1.1 and 2.3).	• Gaps: distribution and abundance; impacts of invasive species and other threats.
Necessary	On-going	Inventory, Monitoring, Assessment	**4.2** Periodically check suitable habitat at John E. Pearce Provincial Park to see if Nodding Pogonia is still present from 1960s introductions.	• Gaps: distribution and abundance.
5. Use a variety of tools to protect and maintain habitat of known populations by 2017.				

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
Critical	On-going	Management	**5.1** Work with landowners on stewardship measures to ensure growing conditions are maintained.	• Threats; forest management, changes in drainage, grazing, and others
Necessary	On-going	Management	**5.2** Review existing management plans for Rondeau Provincial Park to see if any changes or additions are needed for the protection and recovery of Nodding Pogonia.	• Any or all threats

Narrative to Support Approaches to Recovery

The first steps toward recovery are to ensure the two known populations persist at their current locations. Up-to-date information on population size and demographic structure, descriptions of habitat, and assessments of habitat condition and threats, is required for both populations in order to prioritize recovery activities.

On-going management measures to keep deer populations in check at Rondeau Provincial Park will continue to be needed to reduce or prevent any negative impacts to Nodding Pogonia. Currently, only one population is on private land. However, if additional populations are discovered at other locations, these may be priority sites for securement or conservation easements.

Recovery planning for Nodding Pogonia may be coordinated with implementation of a number of other initiatives: for example, the conservation action plans mentioned in Section 1.8 and the ecosystem approaches in the Recovery Strategy for Carolinian Woodlands and Associated Species at Risk (Jalava et al. 2009). As well, recovery activities may be coordinated with those for other species at risk that share the same habitat, such as American Chestnut (*Castanea dentata)*.

This species produces copious, minute, wind-dispersed seeds, so natural colonization of new sites could be possible where suitable habitat conditions, including appropriate fungal species, are present. However, very little interior, moist forest habitat remains in extreme southwestern Ontario, and opportunities for natural establishment of new populations may be extremely limited.

Therefore, this recovery strategy recommends reintroduction be considered as a component of recovery of Nodding Pogonia. However, propagation of Nodding Pogonia has not been successful so far. Furthermore, research on propagation will need to take into consideration the feasibility of removing material from a source population, since Nodding Pogonia is critically imperiled or imperiled in Michigan, New York, and Ohio, the closest sources to Ontario. Periodic checks at John E. Pearce Provincial Park would be worthwhile. Given the extent of land conversion in the region of Ontario in which Nodding Pogonia occurs, opportunities for re-establishment of populations may be extremely limited.

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 area to be considered for regulation, it is recommended that several factors be taken into consideration.

1) Nodding Pogonia requires habitat that includes mesic forest dominated by deciduous trees, especially Sugar Maple and American Beech. A few scattered coniferous trees as well as some medium-sized to mature trees (DBH ≥ 20 cm) of any species may also be present. Preferred ground conditions have deep leaf litter and humus layers. Therefore, the size of the protected habitat must be large enough to allow the functioning of ecological processes that produce and maintain required soil moisture, duff, and humus conditions. This means that the size of the area must be large enough to include sufficient trees to keep the ground well-shaded and moist and to provide the quantity of leaves needed to produce suitable leaf litter and humus. There is currently no scientific research on minimum sizes for these ecological functions as required by Nodding Pogonia, so it is recommended that specific sizes and distances to be considered be based on other parameters.

2) As a natural process in this ecosystem, squirrels sometimes move corms of Nodding Pogonia to new locations, and distances squirrels carry propagules may be large. Also, the dust-like seed may disperse a great distance (sometimes hundreds of metres or more) on the wind. Sufficient suitable habitat will be needed to allow space for dispersal of seeds and corms for establishment of new patches of Nodding Pogonia. As well, much of the suitable habitat at Rondeau Provincial Park has not been searched, and it is possible there are unknown colonies at some distance from known subpopulations. Therefore, to allow for dispersal and to protect potentially undetected dormant plants, a radial distance of at least 200 m is suggested around known locations of Nodding Pogonia, provided the area inside the circle is deciduous forest.

3) If the species is situated at a location near the edge of suitable deciduous forest habitat, it is recommended that a certain amount of vegetation outside the forest be included to protect the plants and the overall habitat conditions from negative impacts. For example, Nodding Pogonia requires moist, shaded ground with a rich humus component, so changes to drainage even in non-forested adjacent vegetation could negatively affect soil moisture at the location of Nodding Pogonia. A distance of 30 m was derived in the field as sufficient to protect Hill's Thistle (*Cirsium hillii*) from such impacts (Parks Canada Agency 2010). Therefore, it is recommended that a minimum distance of 30 m of non-forest vegetation, measured from the edge of the forest cover, be considered part of the habitat for regulation where necessary.

4) A maximum dormancy period has not been conclusively proven for this species, but 18 to 20 year periods have been shown to be possible for two other Canadian orchid species although it happens only infrequently. Even if only a few Nodding Pogonia plants actually achieve this length of dormancy, there is no way of knowing which dormant plants may be in the process of achieving it. Therefore, given anecdotal descriptions of long dormancy periods for Nodding Pogonia, it is recommended that the maximum dormancy period proven for other orchids in Canada (18 to 20 years at least) be assumed possible for Nodding Pogonia until further studies are done.

5) In order to adhere to the precautionary principle, habitat may need to be regulated even though occupancy by the species is not yet definitively known, either due to dormancy or because habitat has not been searched (e.g., parts of Rondeau Provincial Park) or not searched on a consistent basis (e.g., Three Birds Woodlot). Due to knowledge gaps with Nodding Pogonia, it may be necessary to prove a lack of occupancy rather than to prove occupancy. Therefore, criteria to define a lack of occupancy are needed. It is recommended that a lack of occupancy may be presumed when:

> The entire area in question has been surveyed every year for 20 consecutive years, and in each year, brief surveys to determine presence/absence have been conducted once a week from August 1 to September 30. In none of these surveys has Nodding Pogonia been detected.

Therefore, it is recommended that the area to be considered for habitat regulation include:

- all areas known to be occupied or formerly occupied by the species since 1950 unless they meet the criteria for lack of occupancy (above);
- previously unknown areas where the species is discovered from 2012 onward;
- in suitable deciduous forest habitat as discussed above, a minimum radial distance of 200 m around recorded patches of Nodding Pogonia (even if the plants are not currently above ground). If non-forested vegetation falls within the 200 m radius circle, it is recommended all of the forested area be included plus up to 30 m of the non-forested vegetation (measured from the forest edge) to a maximum distance of 200 m from the Nodding Pogonia plants (Figure 3); and
- it is recommended that pre-existing human infrastructure such as roads, railway tracks, parking lots, buildings, septic beds, and active agricultural areas (e.g. crops) should not be included in regulated habitat.

Based on these criteria, it is expected that at Rondeau Provincial Park several large polygons will be formed of conjoined circles and that these polygons should be the areas to be considered for regulation. At Three Birds Woodlot, it is expected that the 200 m circles formed around the two subpopulation locations will cover most of the woodlot. Should any new populations be discovered, the above criteria may need to be applied to other sites. Figure 3 shows an example of how these criteria might be applied.

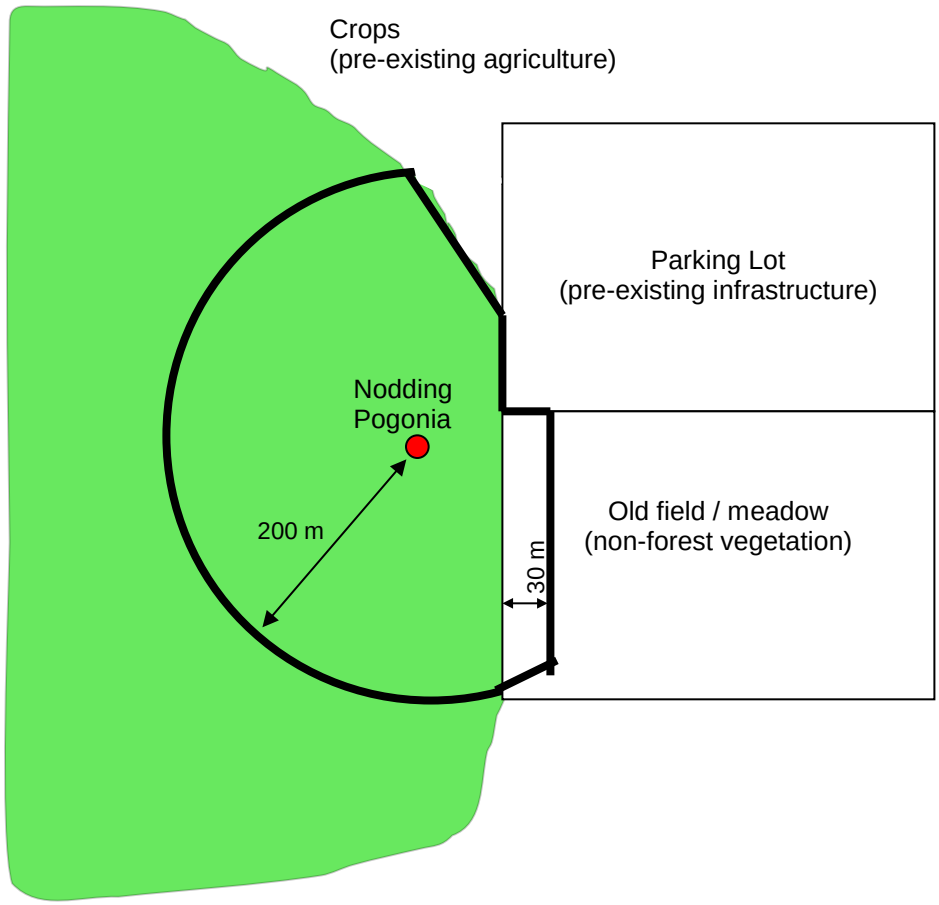

Figure 3. An example of an area to be considered for a habitat regulation for Nodding Pogonia using the parameters outlined above. Red dot is a patch of Nodding Pogonia. Left side of diagram shows 200 m radius circle in deciduous forest habitat. Right side shows up to 30 m of non-forested vegetation to be included (measured from the edge of the forest) and no area considered for regulation in the pre-existing parking lot or cropland.

GLOSSARY

Bract: A modified leaf that performs a function other than that of a typical leaf. For example, a small modified leaf is found below the flowers of Nodding Pogonia.

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

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

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

1 = critically imperiled
2 = imperiled
3 = vulnerable
4 = apparently secure
5 = secure

Corm: A short, vertical, underground stem that is thickened as a food storage organ.

Cortex: The outer layer of tissue just inside the outer skin of a root or stem.

Duff: The top layers of material on the ground. It is mostly made up of un-decomposed leaves, needles, twigs, and woody material.

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

Heterotrophic: Gaining nutrition from alternate sources such as from parasitism or decomposition. Many orchids receive nutrition through a relationship with fungi in their roots and in the soil rather than from photosynthesis.

Humus: The organic layer above the mineral soil that results from decomposition of duff and other organic material.

Mesic: Moist; neither very wet nor very dry.

Mycorrhiza: a mutually beneficial relationship between a fungus and the roots of a plant.

Perianth: The structures that are found around the outside of the reproductive organs in a flower. Petals and sepals usually form the perianth.

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

Ministry of Natural Resources

Natural. Valued. Protected.

Nodding Pogonia

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 Nodding Pogonia (*Triphora trianthophora*) was completed on January 11, 2013 (http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@species/documents/document/stdprod_099157.pdf).

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

Nodding Pogonia is a small orchid that produces one to seven (often three) greenish-white or magenta flowers on a purplish-green stalk about five to 30 cm in size. It lives in rich, moist maple-beech forests and obtains nutrients through fungi associated with its roots.

Ontario

MOVING FORWARD TO PROTECT AND RECOVER NODDING POGONIA

Nodding Pogonia 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.

Nodding Pogonia is uncommon throughout its global range, which extends throughout eastern North America, through Mexico to Panama. The species' conservation status is not considered secure anywhere in North America. In Canada, Nodding Pogonia is known only to occur in two locations in southwestern Ontario, at Rondeau Provincial Park and a private woodlot in Essex County. Some historical records indicate that Nodding Pogonia was previously found in the Niagara region; however, it is not known whether the species was once common in the Carolinian forests of Ontario, or if it was always rare in the province. In addition, Nodding Pogonia can grow or remain dormant underground for many years, only appearing above ground when conditions are right for flowering. This makes the species difficult to detect or reliably infer its absence without consistent surveys. Annual monitoring of Nodding Pogonia at Rondeau Provincial Park has been ongoing since 1986 and in 2008, 1,357 stems were counted in a portion of the suitable habitat. Additional stems may have also occurred in other areas of the habitat, but these areas were not surveyed. No plants have been observed at the second location in Essex County since 1987, but only occasional and incomplete surveys have been undertaken at this location since the late 1980s.

Nodding Pogonia has highly specialized requirements for successful reproduction to occur, which may be a limiting factor for this species. Requirements include suitable climate and moisture conditions to produce flowers, pollinators to pollinate the flowers (which all bloom at the same time for one day), dispersal of seeds to suitable habitat, and contact with a specific fungus for successful germination and establishment. Information about the species' population size in Ontario, the specific conditions required for growth and flowering, and the impacts of threats represent major knowledge gaps that create challenges for the species' recovery. Important threats likely include the disruption of fungal associations by invasive species (e.g. Japanese Barberry (*Berberis thunbergii*), Garlic Mustard (*Allaria petiolata*) and earthworms), and grazing by White-tailed Deer (*Odocoileus virginianus*) and slugs. Other potential threats include degradation or loss of habitat from Beech bark disease, loss of forest cover and changes in drainage.

Suitable habitat that meets the complex reproductive requirements of Nodding Pogonia is likely limited, and past attempts to artificially propagate or re-introduce the species in the wild have not proven successful. For these reasons, recovery efforts should focus on retaining and improving the viability of the existing populations. If future research provides additional information on methods for successful propagation and conditions for growth, the GRS goal may be re-evaluated.

The government's goal for the recovery of Nodding Pogonia is to maintain or improve the viability of existing populations 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 Nodding Pogonia, the government will directly undertake the following actions:

- Continue deer population monitoring and management at Rondeau Provincial Park to minimize the threat of overgrazing on Nodding Pogonia.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.
- Encourage the submission of Nodding Pogonia 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 Nodding Pogonia and its habitat through the ESA.
- Support conservation, agency, municipal and industry partners, and Aboriginal communities and organizations to undertake activities to protect and recover Nodding Pogonia. Support will be provided through funding, agreements, permits (including conditions) and/or advisory services.
- Establish and communicate annual priority actions for government support in order to encourage collaboration and reduce duplication of efforts.

GOVERNMENT-SUPPORTED ACTIONS

The government endorses the following actions as being necessary for the protection and recovery of Nodding Pogonia. 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 existing Nodding Pogonia populations and reduce or remove threats.

Actions:

1. **(HIGH)** Collaborate with landowners to implement best management practices (BMPs) that promote the recovery of Nodding Pogonia. BMPs may include woodlot management to improve habitat, invasive species removal or mitigation of other threats.

Focus Area:	**Monitoring and Research**
Objective:	Expand knowledge of Nodding Pogonia population size, condition, and threats.

Actions:

2. Develop and implement a standardized monitoring protocol for all existing populations. The protocol may include gathering information on:
   - population numbers and health;
   - reproductive success;
   - habitat characteristics such as vegetation type; and
   - the presence of threats.
3. Implement standardized surveys of suitable habitat to look for new populations, including known historic locations. Surveys should be conducted over several years to increase the likelihood of detection.
4. Evaluate the impact and severity of threats to Nodding Pogonia which may include:
   - invasive plants impacting the critical fungi associated with the roots of Nodding Pogonia;
   - earthworms altering the soil characteristics;
   - habitat degradation from loss of forest cover due to clearing or Beech bark disease; and
   - grazing by deer or other animals.
5. Research the conditions necessary for successful reproduction to occur, including length of dormancy, flowering, pollination, and dispersal distances to inform an adaptive management approach to recovery. Collaborate with other jurisdictions to share knowledge as appropriate.

IMPLEMENTING ACTIONS

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

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

REVIEWING PROGRESS

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

ACKNOWLEDGEMENT

We would like to thank all those who participated in the development of the "Recovery Strategy for the Nodding Pogonia (*Triphora trianthophora*) in Ontario" for their dedication to protecting and recovering species at risk.

For additional information:
Visit the species at risk website at ontario.ca/speciesatrisk
Contact your MNR district office
Contact the Natural Resources Information Centre
1-800-667-1940
TTY 1-866-686-6072
mnr.nric.mnr@ontario.ca
ontario.ca/mnr