

White-rimmed Shingle Lichen

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. The *Endangered Species Act, 2007* (ESA) is the Ontario government's legislative commitment to protecting and recovering species at risk and their habitats.

Under the ESA, the government 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.

Generally, within nine months after a recovery strategy is prepared, the ESA requires the government to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The response statement is the government's policy response to the scientific advice provided in the recovery strategy. In addition to the strategy, the government response statement considers (where available) input from Indigenous communities and organizations, stakeholders, other jurisdictions, and members of the public. It reflects the best available local and scientific knowledge, including Indigenous Knowledge where it has been shared by communities and Knowledge Holders, as appropriate, and may be adapted if new information becomes available. In implementing the actions in the response statement, the ESA allows the government to determine what is feasible, taking into account social, cultural and economic factors.

The Recovery Strategy for the White-rimmed Shingle Lichen (*Fuscopannaria leucosticta*) in Ontario was completed on January 25, 2023.

White-rimmed Shingle Lichen is composed of many small densely overlapping lobes, which create a shingle-like appearance. The lobes are generally 2 to 3 mm in size and are dark grey to chestnut brown with white edges. The lichen can be found almost exclusively on the bark of trees in wet old-growth forests and swamps.

Protecting and Recovering White-rimmed Shingle Lichen

White-rimmed Shingle Lichen 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 or complying with the requirements of a regulatory exemption.

White-rimmed Shingle Lichen has a disjointed global distribution that spans most continents as it can be found in North America, Central America, South America, Europe, Africa and Asia. It is thought that the species was once present throughout its global distribution, but that it has been lost from many areas, resulting in sparse relict populations. These remaining populations are most common in North America and Northern Pacific Asia.

Within Canada there are four distinct sub-populations – one in Nova Scotia, one in New Brunswick and two in Ontario. The two Ontario subpopulations are found at sites scattered across the southern regions of the Thunder Bay and Rainy River Districts. In Ontario, there are currently seven known sites where White-rimmed Shingle Lichen is extant (currently exists) and one historical site where the species was previously found. Each site contains about 13 thalli (individuals) on average. The viability of the lichen colonies at these sites is unknown since the critical population threshold is also unknown. All of these sites were identified by a single expert which signals that there are likely additional undiscovered occupied sites. Based on a 2020 evaluation report by the Committee on the Status of Species at Risk in Ontario, although there are 77 known thalli in Ontario, the total provincial population of White-rimmed Shingle Lichen is estimated at 639 thalli. Results from additional surveys may inform future re-assessments of the status of this species in Ontario.

Lichens are organisms that are composed of a fungus and a type of alga or a cyanobacterium (a phylum of photosynthetic bacteria). The alga or cyanobacterium produces food for the lichen through photosynthesis while the fungus provides structure to the lichen, absorbs nutrients from the host structure, and plays an important role in the lichen's reproduction. In White-rimmed Shingle Lichen, the fungal element is in the Pannariaceae family and the cyanobacterial element is believed to be in the *Nostoc* genus.

White-rimmed Shingle Lichen reproduces sexually via ascospores (spores capable of developing into a new lichen) that are carried by the wind to a new location. Dispersal distances and survival rates of ascospores are unknown. There is some evidence to suggest that vegetative (asexual) reproduction may also be occurring based on observations of fragmented pieces of vegetation in Nova Scotia. This is likely to be rare since this species lacks the vegetative structures typically needed for this type of reproduction. Asexual reproduction in White-rimmed Shingle Lichen should be further investigated to confirm its reproductive contribution.

Ontario's White-rimmed Shingle Lichen appear to be limited to nutrient-rich, high-moisture ecosystems as the plant has been found exclusively in old-growth wet forests and undisturbed treed-swamps. The extant sites in Ontario typically feature raised hummocks and scattered pools and do not contain an excessive amount of standing water.

White-rimmed Shingle Lichen's wet forested habitat is usually dominated by the plant's host species, Eastern White Cedar (*Thuja occidentalis*). Eastern White Cedar is the only known host to White-rimmed Shingle Lichen in Ontario. Outside of Ontario, the lichen has been recorded a few times on Red Maple (*Acer rubrum*) bark, Black Ash (*Fraxinus nigra*) bark and on rock. It is possible these types of substrates are also used by the species in Ontario but this remains a knowledge gap due to limited number of known occurrences in the province. Eastern White Cedar trees provide a uniquely suitable substrate for White-rimmed Shingle Lichen due to the tree's soft and spongy bark, neutral pH level (White-rimmed Shingle Lichen prefer non-acidic substrates) and structural attributes that increase its water retention. Water retention tends to be high in Eastern White Cedar trees due to their ability to grow after being blown over and their twisted growth habit that causes the trunk to lean. Leaning trees provide an ideal environment for White-rimmed Shingle Lichen colonies to grow on the upper side of the tree. The microhabitat created by these characteristics provides a unique light regime, prevents desiccation (drying out) and increases access to rainwater.

While the type of habitat the species occupies is generally understood, there are several knowledge gaps related to specific habitat characteristics and preferences. It is important to further clarify the species' preferred soil type and hydrological regime as, to date, no studies have been conducted to investigate factors such as soil texture, organic material depth, water table variability, water transfer mechanisms and surface water depth at occupied sites. White-rimmed Shingle Lichen also has several knowledge gaps related to the age, size and lean angle of the host tree, tree stand age as well as the species' preferred location on the host tree. Some of these knowledge gaps regarding habitat preference may be the key to understanding which factors limit White-rimmed Shingle Lichen's ability to colonise a new area and influence distribution pattern. Currently it is unclear why thalli occur in such low densities and why there are significant distances between occurrences even when the habitat is considered suitable.

Additional knowledge gaps surrounding White-rimmed Shingle Lichen include the genetic diversity between occupied sites, the feasibility of propagation and transfer, generation time (average age of reproductively active individuals), the effects of browsing and grazing by wildlife like White-tailed Deer (*Odocoileus virginianus*) and Porcupine (*Erethizon dorsatum*) and the extent of the effects of air quality on the species.

There are five primary threats to White-rimmed Shingle Lichen that contribute to the loss of host trees, loss of habitat or changes to the species' preferred microhabitat conditions. These threats include habitat loss, habitat degradation, changes to the hydrological regime, climate change and air pollution. White-rimmed Shingle Lichen is particularly vulnerable to these threats in part due to its habitat: old growth swamp and wet forested habitat are highly sensitive to disturbance.

Changes to the hydrological regime can dramatically increase or decrease the water level in an ecosystem. These changes can produce periods of excessive flooding or drying of habitat, leading to a decline in host trees. Climate change is also projected to have considerable impacts on White-rimmed Shingle Lichen through alterations to temperature and moisture. White-rimmed Shingle Lichen are likely to experience an increased risk of desiccation and heat stress

as the mean annual temperature increases and summer precipitation decreases in northern Ontario. Regional changes in temperature and precipitation regimes may result in alterations to the composition of the vegetation communities and increases in wildfires.

Air pollution can result in direct effects to White-rimmed Shingle Lichen when particulate matter (tiny particles in the air) dissolves and is absorbed into the lichen. These chemicals can cause physical damage and interrupt photosynthesis. Air pollution may also have indirect effects on White-rimmed Shingle Lichen through habitat degradation. Acidification, which often results from air pollution, can lead to acid rain. Acid rain degrades White-rimmed Shingle Lichen habitat by leaching calcium from tree bark or soil, altering the pH level of the host substrate. Coniferous trees like White-rimmed Shingle Lichen's host plant are particularly vulnerable to acidification due to their thin bark.

Due to the low number of known occurrences in Ontario, the risk of extirpation remains relatively high for White-rimmed Shingle Lichen. The recovery of this species requires the maintenance of existing and newly discovered occupied sites and increasing its abundance and distribution, where possible. To achieve this goal, additional information is needed about what factors might be limiting the species so recovery efforts can be better focused to address them. Raising awareness about White-rimmed Shingle Lichen to both local land managers and users will help to identify new colonies, promote protection and aid in filling knowledge gaps.

Government's Recovery Goal

The government's goal for the recovery of White-rimmed Shingle Lichen is to maintain or increase the species' distribution and abundance in Ontario.

Actions

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 government 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 White-rimmed Shingle Lichen, the government will directly undertake the following actions:

- Continue to protect White-rimmed Shingle Lichen and its habitat through the ESA.
- Undertake communications and outreach to increase public awareness of species at risk in Ontario (e.g., through Ontario Parks Discovery Program, where appropriate).
- Continue to monitor populations and mitigate threats to the species and its habitat in provincially protected areas, where feasible and appropriate.
- Educate other agencies and authorities involved in planning and environmental assessment processes on the protection requirements under the ESA.

- Encourage the submission of White-rimmed Shingle Lichen data to the Ontario’s central repository through the NHIC (Rare species of Ontario) project in iNaturalist or directly through the Natural Heritage Information Centre.
- Continue to support conservation, agency, municipal and industry partners, and Indigenous communities and organizations to undertake activities to protect and recover White-rimmed Shingle Lichen. Support will be provided where appropriate through funding, agreements, permits and/or advisory services.
- Work with all levels of government, communities and sectors to take action on climate change, and to report on progress in reducing greenhouse gas emissions.
- Continue to manage Crown forests in a manner that minimizes adverse impacts to species at risk and their habitats.
- Conduct a review of progress toward the protection and recovery of White-rimmed Shingle Lichen within five years of the publication of this document.

Government-supported Actions

The government endorses the following actions as being necessary for the protection and recovery of White-rimmed Shingle Lichen. Actions identified as “high” may be given priority consideration for funding under the Species at Risk Stewardship Program. Where reasonable, the government will also consider the priority assigned to these actions when reviewing and issuing authorizations under the ESA. Other organizations are encouraged to consider these priorities when developing projects or mitigation plans related to species at risk.

Focus Area: Monitoring

Objective: Increase knowledge of the distribution, limiting factors and habitat preferences of White-rimmed Shingle Lichen.

There are several knowledge gaps concerning White-rimmed Shingle Lichen in Ontario including the extent of species distribution, their specific habitat preferences, and colony viability. Filling these knowledge gaps may help determine the factors influencing the species’ ability to recover, where protection and recovery efforts should be focused.

Actions:

1. **(High)** Conduct intensive surveys of apparently suitable habitat, including across the southern regions of the Thunder Bay and Rainy River Districts, to determine whether additional colonies are present, and document site conditions as well as the characteristics of any new colonies including:
 - i. information about the substrate (e.g. host tree species, size, age, lean angle, tree stand age and the lichen’s location on the host tree etc.)
 - ii. hydrological regime (e.g. variability in water table, surface water depth of occupied sites etc.)
 - iii. habitat conditions (e.g. dominant vegetation, soil texture, organic material depth)
 - iv. colony characteristics (number of thalli, thalli area (i.e. max length/width) and potential threats)
2. **(High)** Conduct long-term monitoring at all existing and newly identified White-rimmed Shingle Lichen subpopulations. Monitoring information collected should include site conditions and the characteristics of colonies (as identified in Action 1).

Focus Area: Research

Objective: Improve understanding of aspects of the species' biology, ecology and threats within Ontario.

Very little is known about the effects of genetic, reproductive and environmental factors, such as air pollution, on White-rimmed Shingle Lichen and its populations dynamics. Understanding the interaction between these factors and the species will help to reveal additional barriers the species may be facing, the extent of existing threats and uncover additional recovery measures that can be implemented to aid the species' recovery.

Actions:

3. **(High)** Develop habitat suitability and population viability models to direct future surveys and further assess species' vulnerability.
4. Conduct research on the biology and ecology of White-rimmed Shingle Lichen including:
 - i. genetic relatedness of subpopulations within Ontario and of Ontario population relative to the Eastern Canada and U.S. populations
 - ii. dispersal distance
 - iii. optimal techniques and feasibility of propagating (including propagation from vegetative fragmentation) or transplanting White-rimmed Shingle Lichen
 - iv. air pollution impacts on White-rimmed Shingle Lichen
 - v. generation time
5. Investigate the effects and severity of known and potential threats to White-rimmed Shingle Lichen and its habitat, and identify potential mitigation measures as appropriate.

Focus Area: Awareness

Objective: Increase awareness of White-rimmed Shingle Lichen including its identification, distribution and habitat requirements to promote protection and recovery.

White-rimmed Shingle Lichen is known to occur in Thunder Bay District and Rainy River District. There are limited known occurrences of the White-rimmed Shingle Lichen and it is reasonable to assume there may be additional occurrences which have not been found due to limited awareness of the species. Increasing awareness of White-rimmed Shingle Lichen, its habitat requirements, distribution and threats, to those managing or using the land will increase the likelihood of unknown occurrences being found and protected.

Actions:

6. **(High)** Promote awareness of White-rimmed Shingle Lichen among Indigenous organizations and communities, forest industry partners, environmental professionals, naturalists, land managers and by sharing information regarding:
 - i. the identification of the species
 - ii. the species' distribution and habitat associations
 - iii. protection afforded to the species and its habitat under the ESA
 - iv. actions that can be taken to reduce threats to the species and its habitat
 - v. how the observations can be reported to NHIC

Implementing Actions

Financial support for the implementation of actions may be available through the Species at Risk Stewardship Program. Conservation partners are encouraged to discuss project proposals related to the actions in this response statement with Ministry of the Environment, Conservation and Parks staff. The Ontario government can also provide guidance about the requirements of the ESA, whether an authorization or regulatory exemption may be required for the project and, if so, the authorization types and/or conditional exemptions for which the activity may be eligible. 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 coordinated across government response statements.

Performance Measures

Progress towards achieving the government's goal for the recovery of White-rimmed Shingle Lichen will be measured against the following performance measures:

- By 2028, the total number of thalli in Ontario is equal to or greater than 639.
- By 2028, 100% of the occupied sites in Ontario have the same, or an increased number of thalli observed.
- By 2028, there are seven or more occupied sites in Ontario.

Reviewing Progress

The ESA requires the Ontario government to conduct a review of progress towards protecting and recovering a species no later than the time specified in the species' government response statement, which has been identified as five years. The review will help identify if adjustments are needed to achieve the protection and recovery of White-rimmed Shingle Lichen.

Acknowledgement

We would like to thank all those who participated in the development of the Recovery Strategies and Government Response Statement for the White-rimmed Shingle Lichen (*Fuscopannaria leucosticte*) 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 the Ministry of the Environment, Conservation and Parks

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