

Management Plan for the Frosted Glass-whiskers (*Sclerophora peronella*), Nova Scotia Population, in Canada

Frosted Glass-whiskers



2011



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PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) 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 management plans for listed Special Concern species and are required to report on progress within five years.

The Minister of the Environment is the competent minister for the recovery of this species and has prepared this management plan as per Section 65 of SARA. This plan was developed in cooperation with the provincial agency responsible for this species and associated habitat (Nova Scotia Natural Resources) as well as Nova Scotia Environment, Mersey Tobeatic Research Institute, and the Boreal Felt Lichen (Atlantic population) Recovery Team.

Success in the management 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 management plan and will not be achieved by Environment Canada or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this management plan for the benefit of the Frosted Glass-whiskers, Nova Scotia population, and Canadian society as a whole.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

This management plan was prepared by Tyler Smith with contributions from the Boreal Felt Lichen (Atlantic population) Recovery Team.

EXECUTIVE SUMMARY

Frosted Glass-whiskers is a tiny, cryptic, stubble lichen. Identification, even by experts, requires microscopic examination. It is very rare over much of its global range. In Canada, Frosted Glass-whiskers is known from one occurrence in British Columbia, and two occurrences on Cape Breton Island in Nova Scotia. This management plan deals with only the Nova Scotia population.

Frosted Glass-whiskers is an indicator of old-growth forest habitats, where it occurs on the exposed heartwood of mature trees. It may also be sensitive to air pollution, acid rain and acid fog. Combined with its presumed dependence on specific microhabitat conditions, this makes Frosted Glass-whiskers a sensitive bioindicator of old-growth ecosystem health.

Several limiting factors present challenges to the conservation of the Frosted Glass-whiskers Nova Scotia population. It has very limited capacity to colonize new habitat, and its very specific requirements suggest that suitable habitat is rare. The two known occurrences in Nova Scotia are both composed of a single individual, and so are susceptible to loss from natural disturbances. In addition, very little is known about the biology and ecology of this species, presenting a serious challenge to management planning.

The main threats faced by Frosted Glass-whiskers are deforestation, industrial and recreational activities, tree loss due to natural processes, and pollution. As both Nova Scotia occurrences of Frosted Glass-whiskers are within protected Wilderness Areas, the threat of human-induced habitat degradation is limited. However, pollution still presents a serious threat, and the extremely small population size means that any natural disturbance (e.g. forest fire, hurricane) has the potential to eliminate either or both occurrences.

The management objective of this plan is to maintain the two known Nova Scotia occurrences of Frosted Glass-whiskers, as well as any other populations that are discovered in Nova Scotia. The broad strategies to meet the management objective are to ensure adequate protection of Frosted Glass-whiskers habitat and to determine if there are additional occurrences in Nova Scotia.

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1. SPECIES INFORMATION

1.1. COSEWIC Species Assessment Information⁺

Date of Assessment: May 2005

Common Name (population): Frosted Glass-whiskers (Nova Scotia population)*

Scientific Name: *Sclerophora peronella*

COSEWIC Status: Special Concern

Reason for Designation: This tiny cryptic stubble lichen is very rare or threatened over much of its global range. Two of the three known locations of this species in Canada are in Nova Scotia. Despite considerable efforts to locate this and other rare calicioid lichens in the province, this lichen is known only from the exposed heartwood of red maple trees in mature/old growth hardwood forest. Threats include potential habitat loss and degradation associated with the decline of old growth forest ecosystems. However, in Nova Scotia each of the two populations appear healthy and are situated within large protected areas on Cape Breton Island.

Canadian Occurrence: Nova Scotia

COSEWIC Status History: Designated Special Concern in May 2005. Assessment based on a new status report.

⁺Committee on the Status of Endangered Wildlife in Canada.

* Frosted Glass-whiskers (British Columbia population) considered in May 2005 and placed in the Data Deficient category.

1.2. Description of the Species

Frosted Glass-whiskers (*Sclerophora peronella*) belongs to a group of lichenized fungi known as calicioid or “stubble” lichens because of their tiny stalked spore-bearing structures. These are extremely inconspicuous organisms, and even expert lichenologists have difficulty locating and identifying them. The main body is imbedded in the substrate (in Nova Scotia, the heartwood of living Red Maple trees {*Acer rebrum*}), with only the pale-coloured fruit (spore-bearing apothecia) projecting 0.5 to 0.8 mm above the surface.

1.3. Populations and Distribution

The global distribution of Frosted Glass-whiskers includes Europe, the Russian Caucasus, the United States, and Canada (Figure 1). It is extremely rare throughout its range: fewer than 20 locations are known from the United States (Oregon), and in Eurasia “it is rare—becoming more so particularly in Central Europe” (Tibell, pers. comm. reported in COSEWIC 2005). Due in part to lack of information, it has not been ranked by NatureServe (2009) at the global, national or subnational levels. The only exception is British Columbia, where it is ranked as S1 (critically

imperilled) based on a single known population. Two records from Cape Breton Island, Nova Scotia, are the only other Canadian occurrences. Both of these are found within protected areas designated under Nova Scotia's Wilderness Areas Protection Act.

The British Columbia population was first discovered in 1991, while both Nova Scotia occurrences were discovered in 1998. No data is available prior to these dates, so it is impossible to determine population trends or historical changes in distribution. The three Canadian occurrences are believed to each consist of a single individual, and the total occupied area is less than 1 m² (COSEWIC 2005). This probably represents less than 5% of the global abundance of Frosted Glass-whiskers. This management plan applies only to the two Nova Scotia occurrences, which together are referred to as the Nova Scotia population.

Figure 1. North American distribution of Frosted Glass-whiskers (from COSEWIC 2005)



1.4. Needs of the Frosted Glass-whiskers

1.4.1. Habitat and biological needs

In Eurasia, Frosted Glass-whiskers has been found on bark and lignum of old deciduous trees such as maple, beech, ash, oak, mountain ash, basswood and elm (*Acer*, *Fagus*, *Fraxinus*, *Quercus*, *Sorbus*, *Tilia* and *Ulmus*) in humid and rather shaded situations (Tibell 1999). It usually occurs on exposed heartwood of living trees, and the two individuals in Nova Scotia occur in the hollow trunks of living red maples. Available data indicates that Frosted Glass-whiskers is restricted to mature or old-growth forests with stable humidity and low temperature fluctuations (COSEWIC 2005). In Canada, it occurs only in maritime climates, possibly as a consequence of its frost-sensitive algal partner.

1.4.2. Ecological role

Frosted Glass-whiskers is a lichenized fungus. As such, it receives its energy through a symbiotic relationship with a photosynthetic algal partner. Like all lichens, it passively collects water and nutrients from the air. In addition to its specialized requirement for intact mature forest habitat, it is likely that Frosted Glass-whiskers is limited by microhabitat conditions such as substrate pH, texture and moisture capacity; light levels; and microtopography. As such, it is an indicator species for old-growth forests and a sensitive bioindicator of forest ecosystem health (Selva 1994, 1996).

1.4.3. Limiting factors

Frosted Glass-whiskers suffers from a number of limiting intrinsic biological factors. It has not been observed to reproduce vegetatively. Consequently, successful reproduction depends on fungal spores being passively transported by wind to a location with appropriate micro- and macro-habitat conditions, as well as the presence of a compatible free-living algae with which to form the composite lichen (COSEWIC 2005). These conditions are undoubtedly obtained only very rarely.

In addition, Frosted Glass-whiskers also depends on specific microhabitat conditions that occur only on mature trees within mature or old-growth forests (substrate pH, texture, and moisture capacity; light levels; microtopography etc.). The probability of successful establishment will continue to decline as old-growth forest becomes rarer through tree-harvesting and other anthropogenic disturbances. Indeed, just maintaining the two populations may prove difficult because they occur in an inherently unstable micro-habitat.

The Nova Scotia population of Frosted Glass-whiskers is limited by its small population. As the total known Nova Scotia population of Frosted Glass-whiskers is two individuals, the loss of either individual in the absence of inventory to document other occurrences could be serious. Should either of these trees be destroyed before a new Frosted Glass-whisker individual is established, it is unlikely that management action will enable a population to be re-established.

The inconspicuous nature of Frosted Glass-whiskers, while not in itself a limiting factor, has limited our awareness of this organism. Very little is known about the biology of this cryptic species, which hampers efforts to design appropriate management strategies.

1.5. Threats

1.5.1. Threat classification

Table 1. Threat Classification Table

Threat	Level of Concern ¹	Extent	Occurrence ²	Frequency ³	Severity ⁴	Causal Certainty ⁵
<i>Habitat loss and degradation</i>						
Deforestation of old-growth forest habitat	at known sites: none	not occurring	historic	recurrent	high	high
	at suitable unsurveyed sites: high	widespread	current	recurrent	high	high
Industrial or recreational activities (e.g. constructing roads and buildings or creating hiking and ATV trails)	at known sites: none	not occurring	historic	unknown	high	high
	at suitable unsurveyed sites: low	widespread	current	recurrent	low	unknown
<i>Natural processes</i>						
Natural senescence leading to tree death	high	localized	anticipated	one-time	high	high
Natural disturbance (e.g. hurricanes, forest fires)	medium	localized	unknown	unknown	high	high
<i>Pollution</i>						
Air pollution (acid rain and other atmospheric pollutants)	high	widespread	current	continuous	high	High

¹ *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.*

² *Occurrence: indicates whether the threat is historic (contributed to decline but no longer affecting the species), current (affecting the species now), imminent (is expected to affect the species very soon), anticipated (may affect the species in the future), or unknown.*

³ *Frequency: Indicates whether the threat is a one-time occurrence, seasonal (either because the species is migratory or the threat only occurs at certain times of the year), continuous (on-going), recurrent (reoccurs from time to time but not on an annual or seasonal basis), or unknown.*

⁴ *Severity: reflects the population-level effect (high: very large population-level effect, moderate, low, unknown).*

⁵ *Causal certainty: reflects the degree of evidence that is known for the threat (high: available evidence strongly links the threat to stresses on population viability; medium: there is a correlation between the threat and population viability e.g. expert opinion; low: the threat is assumed or plausible).*

1.5.2. Description of threats

Habitat loss and degradation

In both Provincially protected wilderness areas, the threat of habitat loss and degradation is low. Frosted Glass-whiskers is restricted to relatively intact old-growth forests. Clear-cutting these habitats results in total loss of habitat and thus eliminates any individuals that occur. However, selective cutting within an old-growth forest, or any industrial activities in adjacent areas (e.g. tree harvesting, road or building construction), could potentially alter the conditions within the old-growth such that they are no longer appropriate for Frosted Glass-whiskers. For example, clearing a roadcut adjacent to an old-growth forest could result in increased wind speed, which decreases humidity and increases the probability of windthrow damage. It could also create a pathway for exotic invasive species to enter the old-growth.

On a smaller scale, foot paths or ATV trails could have a negative impact on Frosted Glass-whisker habitat. Foot paths are unlikely to have a serious impact, as long as they don't require the removal of potential host trees, or are not routed close to occupied host trees. ATV trails have greater potential for negative impacts, through disturbance of forest soils, which may alter local drainage patterns and/or provide a pathway for invasive exotics to establish in Frosted Glass-whisker habitat.

Natural processes and activities

Tree death due to natural senescence is completely unavoidable. Natural disturbances such as hurricanes and forest fires are unpredictable and inescapable. With only two known host trees, either of these disturbances may have a large population-level effect in the future.

Pollution

Frosted Glass-whiskers satisfies most of its nutrient and moisture requirements in part by direct absorption from the atmosphere. As a consequence of its efficient absorption, the lichen may be sensitive to air pollution and acid rain (COSEWIC 2005) because it will also absorb any pollutant soluble in atmospheric moisture. The decline of other lichens in Atlantic Canada has been attributed to intolerable acidity levels in rain and fog. While some of this pollution is from local sources, this is a regional problem as the majority of the pollutants falling in Nova Scotia originated in industrial centers further west.

1.6. Actions Already Completed or Underway

At this point, the inventory work reported in the COSEWIC (2005) status report for Frosted Glass-whiskers is the only conservation action that has been initiated for Frosted Glass-whiskers.

1.7. Knowledge Gaps

The number of expert inventories of vascular plants in eastern Canada certainly numbers in the thousands, compared to only 39 surveys by experts capable of identifying calicoid lichens, including only five on Cape Breton Island (COSEWIC 2005). Known occupied sites have not been ecologically described and very little is known about the specific biological requirements of Frosted Glass-whiskers populations. Understanding the lichen's ecological requirements may suggest additional areas to survey. Conducting further inventories in mature and old-growth forest on Cape Breton is the top monitoring priority for this management plan.

Additionally, appropriate management planning requires further monitoring of population dynamics and research into rescue potential through transplantation, genetic diversity, and pollution tolerance of this species. However, due to the extremely low population levels, no research that involves any direct sampling or other disturbance of Frosted Glass-whiskers individuals can be permitted.

Nothing is known about the potential for transplantation of Frosted Glass-whiskers (although transplantation has been successful for other lichens, see Richardson and Cameron 2004). While direct sampling of Frosted Glass-whiskers is not appropriate at this time, it may be helpful to design and implement experimental transplantation of other, more common stubble lichens to assess the potential for using this technique as a management tool with Frosted Glass-whiskers.

2. MANAGEMENT

2.1. Management Objective

With no evidence to suggest that Frosted Glass-whiskers was formerly more widespread, and little potential for artificially expanding its distribution in the province, the most appropriate management objective is to maintain the two extant populations, as well as any additional populations discovered during future inventories.

2.2. Broad Strategies to Meet Objective

1. Ensure adequate protection of Frosted Glass-whiskers habitat

Long-term persistence of the populations depends primarily on the preservation of their required habitat. This is facilitated by the fact that both known individuals occur in provincial Wilderness Areas, thus simplifying outreach and stewardship negotiations.

2. Determine if there are additional occurrences of the species in Nova Scotia

Only five calicoid lichen inventories have been completed on Cape Breton Island, suggesting there is potential for additional populations to be discovered.

2.3. Implementation Schedule

Table 2. Implementation Schedule for Frosted Glass-whiskers

Action	Obj.	Priority	Threats or concerns addressed	Responsibility		Timeline
				Lead	Other	
2.3.1 Protection and Management						
Identify host trees and establish 100 m buffers, including GIS mapping. The 100 m buffer is provided as a preliminary guideline only – further research is necessary to determine how large the buffer should be to preserve the host tree and associated habitat; at a minimum, monitoring protocols will need to assess whether any process or activity outside the buffer zone is having a negative influence within the buffer area.	1	high	deforestation, industrial and recreational activities	NS DNR NS Environment		2011
Incorporate currently known host tree locations in Nova Scotia Wilderness Area management programs. Wilderness Areas managers to restrict activity (trails, wood collecting, etc) and development (trail building, roads, tree harvesting) in proximity to host trees.	1	high	industrial and recreational activities	NS DNR NS Environment		2012
2.3.2 Monitoring						
Technical experts familiar in the identification of Frosted Glass-whiskers and other stubble lichens undertake inventories in high priority habitats.	1&2	medium	knowledge gaps	NS DNR NS Environment		2015
Develop appropriate monitoring protocols for the lichen and its habitat, including quantitative measures of population size (number of fruit bodies and/or area of thallus) and habitat assessment.	1&2	medium	knowledge gaps	NS DNR NS Environment		2013
Monitor host trees and additional trees at least once every five years with the resulting data being curated by the Nova Scotia Department of Natural Resources.	1&2	medium	knowledge gaps	NS DNR NS Environment		Completed 2012, and in intervals determined through monitoring protocols

<p>Prepare ecological descriptions of known locations and use descriptions and data collected to identify additional forests to survey. Descriptions to include canopy cover, stand composition, herbaceous vegetation, topographic position, drainage, and climate data.</p> <p>Ecological conditions may suggest additional areas on Cape Breton Island to survey.</p>	<p>2</p>	<p>medium</p>	<p>knowledge gaps</p>	<p>NS DNR</p>	<p>NS Environment</p>	<p>Complete by 2015</p>
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NS DNR: Nova Scotia Department of Natural Resources
 NS Environment: Nova Scotia Department of the Environment

2.4. Measuring progress

Every five years, implementation of this management plan will be measured against the following performance indicators:

- neither population is lost due to industrial or recreational activities.
- additional, potentially suitable, sites are identified.
- potential sites are inventoried by experts capable of identifying calicoid lichens.

2.5. 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*. 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.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that plans 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 plan itself, but are also summarized below in this statement.

This management plan will clearly benefit the environment by promoting the conservation of the Frosted Glass-whiskers, Nova Scotia population. The potential for the plan to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this plan will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: Habitat and biological needs; Ecological role; Limiting factors; Actions and performance measures; and Effects on other species.

This management plan requires very limited alteration to existing land management practices. The two Frosted Glass-whiskers populations are both within protected areas, and the only change to the management programs at these locations is the restriction of activities in the vicinity of the host trees. If this has any impact on other species, it is likely positive, since it means reducing human disturbance to the area.

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4. CONTACTS

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