

Carolina Mantleslug

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 Carolina Mantleslug (*Philomycus carolinianus*) in Ontario was completed on July 12, 2023.

Carolina Mantleslug is a terrestrial slug with an adult size of 6 to 10 cm, and an ash-coloured mantle (the protective cover on the top of a slug) covering the entire body. It has a fragmented range in southwestern Ontario.

Protecting and Recovering Carolina Mantleslug

Carolina Mantleslug is listed as a threatened species under the ESA, which protects both the animal 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.

Carolina Mantleslug is native to eastern North America. Its east-west distribution ranges from Maine to Minnesota in the north and Florida to Texas in the south. The species is secure in most of its U.S. range, except Michigan, where it is a species of special concern under state legislation. In Canada, the species has a highly fragmented distribution and is found only in southwestern Ontario.

The Ontario distribution of Carolina Mantleslug includes seven known subpopulations across Pelee Island (three subpopulations), Grape Fern Woods (in the County of Lambton), Wheatley Provincial Park, Rondeau Provincial Park and Sinclair's Bush (in the Municipality of Chatham-Kent). The species also historically occurred at a site near Leamington (in the County of Essex), but its status has not been confirmed since 1994 due to lack of access. Current population trends or viability of the extant subpopulations is unknown.

In Ontario, Carolina Mantleslug is mostly found in riparian areas or in low, wet, older-growth forests with sandy or rocky soil and abundant well-decayed wood. Similar to other slug species, Carolina Mantleslug likely requires specific moist microhabitat conditions, such as those found beneath decaying logs or in leaf litter. A diverse mushroom and lichen community is present at all known occupied sites and is believed to be an important habitat requirement.

Carolina Mantleslug is an air-breathing, egg-laying terrestrial slug that can be difficult to differentiate from related slugs without genetic analysis. The species is believed to reach sexual maturity within one year, and each individual slug has both male and female reproductive organs. Both members of a mating pair may exchange sperm and produce eggs. The generation time is estimated to be two years, and the species' maximum lifespan is believed to be three to four years based on other similarly sized slugs. From laboratory studies, it is believed that Carolina Mantleslug hibernates in the winter and mates in the spring, with eggs usually hatching in the summer (though eggs laid in the fall may overwinter and hatch the following spring). The species generally lays one to two clutches of 65 to 75 eggs, with hatching success ranging from 40 to 75 percent.

The species is mostly inactive and likely has very limited dispersal capability. In dry summers it is only found in or under logs, but in moist conditions it can also be found in leaf litter. Carolina Mantleslug is most active at dawn, dusk, or at night. Its diet is uncertain, but it likely eats fungi and lichen. It may also feed on decaying wood or other decaying plant material, and therefore serve a role in local nutrient cycling. Carolina Mantleslug may be a host to a number of parasitic mites and nematodes, and may serve as prey to a variety of taxa, including reptiles, amphibians, birds, insects and small mammals.

Additional research is required to better understand the current threats to Carolina Mantleslug. Habitat loss and fragmentation were historical threats that contributed to population declines,

but the ongoing impacts are likely negligible where Carolina Mantleslug is known to occur in Ontario. Due to its low dispersal ability and dependence on specific microhabitats, Carolina Mantleslug may be particularly vulnerable to climate change and associated severe weather events such as droughts, floods and extreme temperatures. Prescribed burns are an important habitat management tool for many species and ecosystems, but fires can affect survival of ground-dwelling animals such as slugs by altering or destroying microhabitat.

Carolina Mantleslug habitat may also be degraded by invasive species, such as various types of non-native earthworms and plants (e.g. Garlic Mustard [*Alliaria petiolata*] and European Common Reed, also known as invasive Phragmites [*Phragmites australis* ssp. *australis*]). Several invasive snails and slugs (e.g. Draparnaud's Glass Snail [*Oxychilus draparnaudi*] and Leopard Slug [*Limax maximus*]) may also threaten Carolina Mantleslug through direct competition for food or shelter, but the interactions between the species are poorly understood. Ring-necked Pheasant (*Phasianus colchicus*) and Wild Turkey (*Meleagris gallopavo*) in Ontario may also impact Carolina Mantleslug as both bird species are known to include gastropods (slugs and snails) in their diet, but there is currently no evidence of these birds feeding on Carolina Mantleslug.

Significant knowledge gaps remain about Carolina Mantleslug in Ontario, including its distribution, status and viability of subpopulations, habitat requirements, ecological interactions and threats. Current and historical occurrences of Carolina Mantleslug are limited to small patches of highly fragmented habitat, and the species requires specific microhabitat conditions while having limited dispersal ability. Recovery of Carolina Mantleslug will require research to better understand threats to the species and appropriate mitigative actions, monitoring to confirm where the species is present, and protection and maintenance of existing habitat to ensure the persistence of existing subpopulations.

Government's Recovery Goal

The government's goal for the recovery of Carolina Mantleslug is to maintain or restore self-sustaining subpopulations, where feasible, where the species currently exists 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 Carolina Mantleslug, the government will directly undertake the following actions:

- Continue to protect Carolina Mantleslug 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 Carolina Mantleslug data to 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 Carolina Mantleslug. 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 implement *Ontario’s Invasive Species Act, 2015* to prevent the introduction and spread of invasive species (e.g. invasive Phragmites) that threaten Carolina Mantleslug and its habitat by applying the prohibitions set out in the Act and as prescribed through the associated Regulations.
- Continue to implement the Ontario Invasive Species Strategic Plan (2012) to address the invasive species (e.g. Garlic Mustard [*Alliaria petiolata*], invasive Phragmites) that threaten Carolina Mantleslug and its habitat.
- Conduct a review of progress toward the protection and recovery of Carolina Mantleslug 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 Carolina Mantleslug. 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: Research

Objective: Fill knowledge gaps related to Carolina Mantleslug biology, threats and management techniques.

To support effective protection and recovery efforts of Carolina Mantleslug, further information is needed regarding the causes of the species’ decline. Investigating the species’ response to various known and potential threats will help focus recovery efforts on actions that will have the most benefit for the species. Further understanding of Carolina Mantleslug’s biology, such as life history, food requirements and dispersal ability, is required to support management of the species and its habitat. Development of genetic tools to confidently identify the species will be important to facilitate monitoring efforts. Given the rarity of Carolina Mantleslug and its limited distribution, work is also required to determine whether active population management may be necessary, and, if so, the feasibility of implementing such measures. Any research activities undertaken should consider potential impacts on the Ontario population if they may impact wild individuals.

Actions:

1. **(High)** Investigate the effects and severity of known and potential threats to Carolina Mantleslug and its habitat, and identify potential mitigation measures as appropriate. Targeted areas of research may include:
 - i. impacts of invasive, native and introduced species, such as exotic slugs, non-native earthworms, invasive plants, Wild Turkey and Ring-necked Pheasant
 - ii. feasibility of reducing or controlling invasive and problematic native species
 - iii. effects of climate change and severe weather on the species and its habitat, and the extent of the species' ability to adapt to climate variation
2. **(High)** Research and develop genetic analysis tools, such as barcoding and environmental DNA assessment methods, to reliably distinguish presence of Carolina Mantleslug from similar looking slugs (e.g. *Philomycus*, *Pallifera* and *Megapallifera* species).
3. Conduct research to improve knowledge on Carolina Mantleslug biology and ecology, such as life history traits, population size fluctuations, minimum viable population size, genetic diversity, diet, dispersal ability and home range territory size.
4. Investigate the necessity, feasibility and outcomes of population augmentation measures (e.g. captive breeding, assisted reproduction, head-starting).

Focus Area: Monitoring

Objective: Investigate Carolina Mantleslug distribution in Ontario, and monitor existing subpopulations, their habitat and site-specific threats.

In order to better focus actions to support protection and recovery of Carolina Mantleslug, it is important to understand where this species is present in the province. The use of standard survey methods and undertaking surveys in areas where the species has previously been found or where suitable habitat exists will help address knowledge gaps about the species' distribution and status of subpopulations. Continued monitoring of extant sites, habitat conditions and site-specific threats will aid in understanding appropriate management actions required for each site. It will also be important to monitor effectiveness of management activities and adjust recovery approaches as appropriate.

Actions:

5. **(High)** Develop and implement a standardized survey and monitoring protocol for Carolina Mantleslug in Ontario. The survey and monitoring protocol should document and monitor:
 - i. presence or absence at a site, including sites that are currently considered occupied, sites that were historically occupied but still have suitable habitat, and potential new sites within the species' historical range that have not yet been surveyed but may be occupied based on the presence of suitable habitat
 - ii. subpopulation characteristics (e.g. abundance, demographics, viability)
 - iii. site-specific threats
 - iv. effectiveness of management activities at occupied sites
 - v. genetic verification of species presence at new sites

Focus Area: Management

Objective: Maintain or improve Carolina Mantleslug habitat and mitigate threats to extant subpopulations in Ontario .

Carolina Mantleslug may be impacted by several threats, including climate change and severe weather, pollutants, and invasive and problematic native species. Management efforts should be focused on maintaining or enhancing habitat and minimizing threats to support the protection and recovery of the species where it is known to exist. Where appropriate to support natural dispersal, efforts should also be taken to improve connectivity and enhance suitable habitat immediately surrounding existing occurrences. If research determines that population augmentation is necessary to achieve the recovery goal, and feasible methods are available that are likely to result in self-sustaining subpopulations, augmentation measures should be considered.

Successful recovery depends on continued collaboration across multiple levels of government, landowners and other stakeholders. Much of Carolina Mantleslug's known distribution is on land publicly or privately managed for conservation. Conservation organizations and local partners have been actively involved in the ongoing maintenance and restoration of these areas (e.g. prescribed burns) to support the protection and recovery of multiple species at risk. As certain management activities may impact Carolina Mantleslug, working collaboratively on these efforts will enhance the protection and recovery of all species at risk present .

Actions:

6. **(High)** Work collaboratively with municipalities, conservation partners, landowners and land managers to undertake habitat restoration and/or enhancement to mitigate threats and improve habitat quality and availability for Carolina Mantleslug, including:
 - i. identifying, protecting, and/or creating suitable microhabitat (e.g. increasing the abundance and diversity of native advanced stage decaying logs, leaf litter and fungi)
 - ii. improving connectivity between occupied habitats (e.g. planting hedgerows, wild grass strips and poly-cultures [multiple plant species])
 - iii. mitigating effects of invasive species and problematic native species using evidence-based approaches (e.g. Best Management Practices that minimize risks to species at risk) whenever possible
 - iv. limiting chemical inputs (e.g. pesticides, heavy metals) into occupied and connecting habitat
7. Develop and implement site-specific management plans that identify and mitigate threats to Carolina Mantleslug and its habitat, or update existing management plans where appropriate. Plans should consider impacts of ongoing management strategies for other species (e.g. pesticide application, prescribed burns) .
8. If determined necessary and feasible, implement, monitor and adapt augmentation actions for local subpopulations, with a focus on those at high risk of extirpation and high likelihood of becoming self-sustaining.

Focus Area: Awareness and Outreach

Objective: Increase the level of public awareness and engagement in protecting and recovering Carolina Mantleslug.

Increasing public awareness of this species and encouraging participation in monitoring will contribute towards recovery efforts by determining where Carolina Mantleslug exists in the province, including where the species may occur on private lands. It is also important to improve awareness of the species and its threats among conservation partners who may be interested in undertaking stewardship efforts or are involved in developing property management plans.

Actions:

9. Develop an identification tool to illustrate differences between Carolina Mantleslug and similar looking species, and distribute the tool to land managers, naturalist groups and citizen scientists.
10. Engage volunteers (e.g. naturalists, land managers, experts) to participate in surveys, monitoring and stewardship efforts for Carolina Mantleslug.

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 Carolina Mantleslug will be measured against the following performance measure:

- By 2034, the total number of subpopulations in Ontario is equal to or greater than seven.

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 5 years. The review will help identify if adjustments are needed to achieve the protection and recovery of Carolina Mantleslug.

Acknowledgement

We would like to thank all those who participated in the development of the Recovery Strategies and Government Response Statement for the Carolina Mantleslug (*Philomycus carolinianus*) in Ontario for their dedication to protecting and recovering species at risk.

For Additional Information:

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

Contact the Ministry of the Environment, Conservation and Parks

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