

# Biocontrol and the Future of Hemlock Forests

Nova Scotia needs a landscape-level solution to restoring the ecological balance that once protected hemlocks.

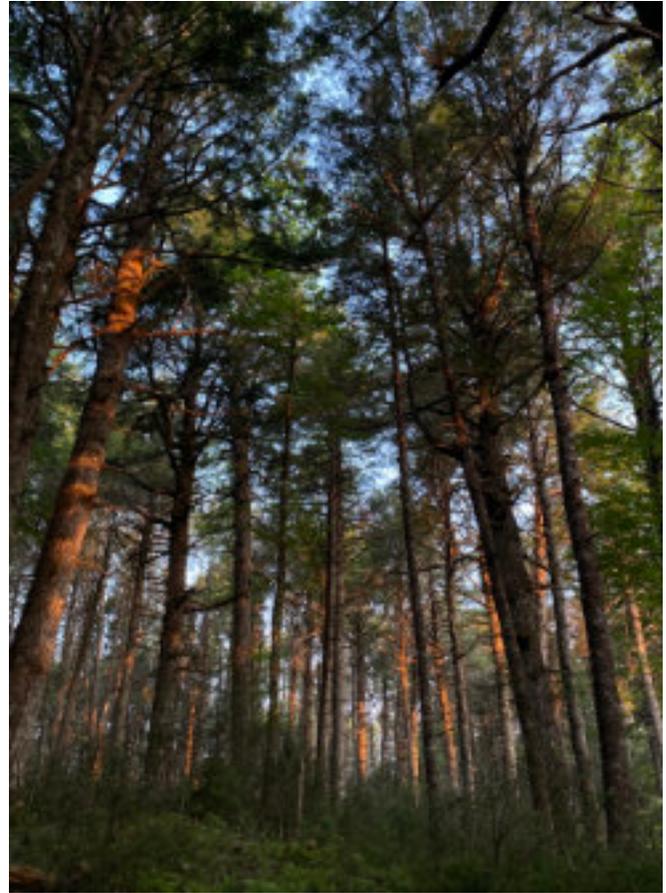
BY N. KIRK HILLIER

Eastern hemlock stands have long shaped the ecological character of Nova Scotia's forests. Their dense, cooling canopies regulate stream temperatures, anchor soils along steep slopes, and provide year-round habitat for birds, amphibians, insects, and mammals. Some trees tower above us after centuries of growth, forming living green vaults across woodland landscapes. These old-growth structures, once common, now survive only in pockets—and face an existential threat.

The hemlock woolly adelgid (HWA), a tiny sap-feeding insect native to parts of Asia and western North America, has recently spread rapidly through southwestern Nova Scotia. Once established on a tree,



Hemlock Woolly Adelgid (HWA) has a devastating impact on hemlock forests, turning them into “grey ghosts”. This photo is from the Appalachian Mountains of North Carolina where HWA has been rampant for many years. PHOTO: STEVE NORMAN, U.S. FOREST SERVICE.



The majesty of hemlock forests.

HWA feeds at the base of hemlock needles, weakening the tree's ability to photosynthesize, store nutrients, and withstand climatic stress. Infestations progress silently at first, but within a few years can transform once-vibrant stands into thinning, pale “ghost forests”. Without intervention, mortality rates can approach 90% in heavily infested regions.

Communities, land managers, and governments across the province have begun protecting selected trees with chemical treatments. While these insecticides can preserve individual or high-value stands, especially in parks or cultural landscapes, they must be reapplied every five to seven years and cannot feasibly be deployed across entire watersheds. Moreover, many stewards prefer options that reduce chemical reliance in the long term. As HWA continues its northward expansion, Nova Scotia needs a landscape-level solution—one that restores the ecological balance that once protected hemlocks in their native range.

## A New Tool for a Long-Term Problem

Biological control—using specialized predators to suppress HWA populations—has emerged as the most promising long-term strategy. For more than twenty years, scientists in the United States have tested and released predators from the adelgid’s native range. The results have been encouraging; although not a quick fix, these natural enemies can reduce HWA densities to levels where trees can recover and new seedlings can establish.

Acadia University is now at the forefront of bringing this approach to Atlantic Canada. A new biocontrol research and rearing facility, developed in partnership with the Canadian Forest Service and provincial collaborators, is nearing full operation on the Acadia campus. This state-of-the-art unit will house controlled-environment chambers, a quarantine-level research facility, and specialized equipment for rearing natural enemies of HWA. It represents the first such facility in Atlantic Canada dedicated to deploying biocontrol agents for forest conservation.

The facility’s purpose is twofold: to establish predators for release, and to generate the scientific knowledge necessary to ensure that every release is ecologically safe, environmentally sound, and biologically effective. Researchers and graduate students will study host specificity, predator life cycles, seasonal timing, winter survival, genetic diversity, and potential dispersal patterns of the predators. These insights will help shape where and how releases occur across the province.



HWA white and woolly egg sacs on hemlock stems.



Inside the Facility—Boxes inside the environmentally controlled space are rearing predatory *Laricobius* beetles.

## The Predators: Beetles and Silver Flies

*Laricobius nigrinus*: This is among the most valuable predators now being used, a small dark beetle native to the Pacific Northwest. Adults feed on HWA during late autumn and winter, precisely when adelgid populations are growing most rapidly. Their larvae consume adelgid eggs inside the woolly ovisacs, offering targeted pressure on the pest.

Acadia researchers, partnering with the Canadian Forest Service in Fredericton, New Brunswick, and colleagues in British Columbia, have now completed several successful collections of these beetles from coastal sites in British Columbia where they occur naturally. In the past three years, more than 21,000 beetles have been collected for release in Nova Scotia. Follow-up monitoring has confirmed good survivorship and establishment.

*Silver Flies*: Complementing the beetles are the *Leucotaraxis* silver flies—two species of shimmering predatory flies whose larvae feed on both generations of HWA. Because HWA produces two reproductive cycles each year, effective control requires predators that are active across both seasons. Silver flies fill this gap.

This spring Acadia and the Canadian Forest Service will begin scouting and collecting founder populations from British Columbia to initiate experimental rearing under controlled conditions. Once the new biocontrol facility is fully operational, we anticipate these flies will be produced in the tens of thousands, enabling targeted releases across multiple forest types.



The tiny but tenacious *Laricobius nigrinus* beetle feeds on HWA during the winter months. Adults and larvae work together to reduce adelgid densities.

## Why Biocontrol Matters for Nova Scotia

Hemlock forests in the province cover more than 216,000 hectares, much of it on private lands. They form cool riparian corridors, stabilize slopes, regulate nutrient cycling, and support diverse communities of organisms—from salamanders to lichens, fungus gnats to warblers. Their decline would ripple through forest ecosystems for decades.

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The two predators work in complementary roles as winter-active beetles and spring-active flies. Multispecies biocontrol is important to prevent HWA populations from rapidly rebounding.

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Biocontrol offers a sustainable, cost-effective path forward. Once released and established, predators disperse naturally, follow HWA populations through changing landscapes, and persist through winter and summer without constant human input. Unlike chemical treatments, which require repeated applications, biological control agents can become self-sustaining components of the forest community.

This approach will not eliminate HWA entirely, nor should it. The goal is to return the adelgid to the low, cyclical densities that exist in its native range, where predators keep populations in check and allow hemlock forests to thrive. Introducing predators from outside a region is not a decision taken lightly, as an introduction of exotic species can sometimes have unintended ecological consequences. For this reason,

extensive research and long-term testing are essential to ensure that any predator released is highly specific to the target pest and unlikely to disrupt native species or food webs. In the case of hemlock woolly adelgid, the predators currently being used have been studied for decades and shown to feed almost exclusively on adelgids. Importantly, these species originate from the West Coast of North America, where hemlock woolly adelgid are also present in a closely-related ecological system. Ongoing research, quarantine rearing, and post-release monitoring remain central to this work, helping ensure that biological control is applied cautiously, transparently, and with ecological safety as the highest priority.

## Research, Partnerships, and Community Involvement

Acadia's biocontrol program is embedded within a broad network of scientific and community partners. Graduate students are examining predator genetics, hybridization risks, climate tolerance, and forest arthropod diversity. Others are developing environmental DNA (eDNA) tools to track predator establishment. Field technicians and collaborators help scout release sites, monitor canopy decline, and collect environmental data. This initiative is supported by



Kirk Hillier and students examining a branch sample for HWA predators.

partnerships with Nova Scotia Department of Natural Resources (NS-DNR), Nova Scotia Environment and Climate Change NS-ECC), Natural Resources Canada – Canadian Forest Service, Parks Canada, and Environmental and Climate Change Canada. Consultation with Indigenous communities has also been paramount in the development of HWA management planning, including biocontrol options. Funds to support research and development of the biocontrol facility and associated risk assessments have been generously provided by NS-DNR, NS-ECC, the Nature Smart Climate Change Fund, the Sustainable Climate Change Communities Fund, Research Nova Scotia Forestry Missions Fund, and Natural Sciences and Engineering Council.

Since the majority of hemlock stands in Nova Scotia occur on private land, community awareness and involvement will remain central to the success of biological control. As releases expand, citizen scientists may play a role in monitoring predators through visual surveys, sampling fallen branches, or collecting environmental data in priority areas.

## Looking Ahead

Nova Scotia stands at a pivotal moment in the future of its hemlock forests and losses already visible on the landscape are sobering. As a keystone species in the Acadian forest, eastern hemlocks shape unique forest ecosystems, and provide irreplaceable habitat valued by both wildlife and people. Nova Scotia faces the prospect of losing up to 90% of these trees, including

## How You Can Help

Report HWA infestations you find on iNaturalist or to [hwa@nshemlock.ca](mailto:hwa@nshemlock.ca). The Nova Scotia Hemlock Initiative website provides great access to resources and upcoming workshops on HWA.

iconic stands in places such as Kejimikujik, the Kentville Ravine, and the Millennium Trail. While there is deep concern and short-term chemical treatments are being applied in a limited number of high-value sites, these approaches are costly and come with significant ecological and logistical challenges. As a result, many hemlocks across the province will inevitably be lost. However, all is not lost—the emergence of a coordinated biocontrol strategy offers genuine reason for optimism. As Acadia University’s new facility comes online and predator releases continue, the province will move from emergency response to long-term ecological restoration.

The work ahead is significant, but hope lies in action. With science, community effort, and time, we may again see young hemlocks rising beneath their elders, streams kept cool under deep green canopies, and forests recovering the resilience they once held.

**Dr. N. Kirk Hillier is an entomologist specializing in how insects use chemical signals to interact with their environment. He directs Acadia University’s new HWA Biocontrol Facility. He contributed the photos.**



Acadia student researchers check blue vane traps to monitor predator numbers in the hemlock forest.