



Mystery, Migration, Mushrooms: Flying Squirrels in the Huron Mountains

By Jill Riddell

In the Huron Mountains, there are two thousand five hundred fifty-three animal species documented to date. Some are conspicuous—deer, bald eagles—while others aren't, like pine sawyer beetles and pygmy Fossaria pondsnail; and one other category consists of fascinating species big enough for us to easily see and yet we rarely do. One good example in that group is flying squirrels.

Unlike most other squirrels, flying squirrels are practically invisible to us. They're nocturnal and spend almost all their time where we aren't looking: up in the tree canopy. They're the subject of a four-year study sponsored by the Huron Mountain Wildlife Foundation and undertaken by Cody Thompson, a collection manager for mammals at the University of Michigan Museum of Zoology and an assistant research scientist in the Department of Ecology and Evolutionary Biology. "My study is of the two species of North American flying squirrels: northern and southern," says Thompson. "I'm looking at the relationship between them."

Northern flying squirrels (*Glaucomys sabrinus*) reside in heavy dense forests of pine and hemlock in the northern reaches of the United States, in high alpine areas in the Rockies, and at high altitudes in the Appalachian Mountains. They extend into Canada, where they're more widespread and abundant than in the U.S. The southern flying squirrels (*G. volans*) are found from Mexico, to the Great Lakes region. They are particularly concentrated in the southeast.



Northern flying squirrels mostly eat nuts, fruits, and fungi. They're omnivores, though, and also predate on birds' nests, eating eggs and baby birds. According to Thompson, one researcher found mushrooms dried out near a northern flying squirrel nest, and is wondering if it's possible the squirrel was preserving them for later, in the same way we might.

"The Upper Peninsula is a contact zone where the two species converge," says Thompson. While the northern and southern squirrels are considered separate species, they're capable of hybridizing, the relationships Thompson studies are both ecological and genetic.

Inspiring, endearing, and possessed with the power of flight

With sleek fur and large eyes, it's hard not to succumb to "charming" when describing flying squirrels. Adding to their charisma, they really do live up to their name by sailing through thin air.

Flying squirrels were the bio-inspiration for human wingsuits, also called "squirrel suits." Developed in the late 1990s, wingsuits utilize synthetic materials to recreate the type of membrane that flying squirrels possess naturally. They use this like a sail or an airplane wing. As is true for squirrels, wingsuit jumpers can't take off from the ground but instead start from a high point, sometimes from a mountainous ledge but more often, from the fuselage of a plane.

"Tree squirrels spend a lot of time climbing down to the forest floor, sprinting over to another tree, then climbing back up its trunk. They do this over and over again," says Thompson. "Flying squirrels, on the other hand, conserve a lot of that energy by gliding. It has the added advantage of keeping them away from the risks of going to the ground. By day, they avoid foxes by night, coyotes and other terrestrial predators."

Globally, gliding is uncommon. "There's a type of flying lemur in southeast Asia that's the size of a large terrier," says Thompson. "But worldwide, only a handful of species exist that have evolved an ability to glide."

Details on 2016-2019 Huron Mountain studies

The Huron Mountains are an excellent study location because decades of documentation for small mammal populations, including flying squirrels, exist already. "Using the data that predates this study, it's possible to document changes over time,"

Right: Cody Thompson from University of Michigan studies flying squirrels. His Foundation supported project is in its fourth year.



says Thompson. “Bill Harris [a member of the Huron Mountain Club and Associate Curator of Mammals at the University of Michigan Museum of Zoology in the 1960s] did some work on squirrels. He collected specimens that now reside in the collections the University of Michigan’s Museum of Zoology and the Huron Mountain Club’s museum.”

All the flying squirrels Harris found then were the northern species. Subsequent studies by HMWF researchers documented the continued presence of northern flying squirrels, and showed that southern flying squirrels were beginning to make an appearance by the 1980s. That study was done by a former HMWF researcher, Nancy Wells-Gosling. Another University of Michigan researcher and a long-term HMWF researcher, Philip Myers, confirmed the presence of southern flying squirrels in 2003 while surveying the Huron Mountains for small mammals. (Myers’s work received the Foundation’s Manierre Award in 2009.)

Where the only species of flying squirrel in the Huron Mountains was once the northern flying squirrel in Harris’s time and the predominant species in Myers’s time, the numbers now have flipped. The majority of

WHEN AND WHERE TO SEE A FLYING SQUIRREL

Southern flying squirrels are found all over the Huron Mountain Club property. “The northern ones are pretty limited,” says Thompson. “The only places I found them was around the Stone House, in the rocky area behind the buildings, and where the Club cabins are, at the McClelland cabin on the side facing Pine River.”

During the day, flying squirrels typically are curled up inside their nests in tree cavities. The main way to increase your odds of success is to be outdoors at night. Time your observation period for the time of day when it’s still possible to see without artificial light but before it gets so completely dark that you can see nothing. Squirrels are active then. Since our vision at night isn’t the greatest in the animal kingdom by quite a long shot, use your other senses. Sit quietly and listen for sounds above you.

the animals Thompson has successfully captured and released are the southern species of flying squirrel (*Glaucomys volans*).

“Out of the 36 total individual flying squirrels I’ve captured, only 10 are northern flying squirrels. The Club grounds are great, but its perimeter is surrounded by logging,” says Thompson. “No matter how large a property is, what’s on the outside can have huge implications. That’s true for National Parks, Forest Service properties. Any type of protected land is very affected by how the land around it is used.”

Forces underlying change

A warming Upper Peninsula is the overarching reason why the populations of the southern flying squirrel are outpacing the northern species. Slightly warmer winters allow them to survive, when in the past, fearsome cold might have done them in. “In the northern part of the Michigan mitten, northern populations appear to be extirpated,” says Thompson.

Another reason is habitat. Northern flying squirrels prefer dense hemlocks and dense old growth. Southern flying squirrels do much better in places that were disturbed than northern flying squirrels do—and obviously, there’s a lot of logged or otherwise disturbed land.

Male flying squirrels wander far from their natal home range in search of opportunities. Females stay more local, nearer their mothers. The theory is that dispersing southern males compete for the northern females, the same ones counted upon by the northern males who already occupied the territory.

“The southern flying squirrel males are thought to be more competitive for resources,” says Thompson, “And that includes mating opportunities. They end up being more aggressive. The recently arrived southern squirrels succeed in having more mating events with females than the resident flying squirrels do; and gradually, genetics of the southern flying squirrels become more prolific in the population.”



Annual Meeting Report

Phyllis Green, Superintendent of Isle Royale National Park, was featured speaker at the Foundation's annual meeting on August 6. Green retired this fall after 18 years across Lake Superior at Isle Royale. At the Playhouse meeting, she spoke about one of the most recent and important projects she implemented at Isle Royale: the reintroduction of wolves after their decline and loss over the last few decades.

In her talk, Green acknowledged the importance of the earlier attempted reintroduction of wolves in the Huron Mountains. Though that effort failed, only to see successful "self-introduction" a couple of decades later, it was critical in helping wildlife managers devise better approaches; some of the scientists involved in the very successful reintroduction of wolves in Yellowstone and recently at Isle Royale were either part of the Huron Mountain reintroduction attempt or were influenced by its findings. Research following wolf establishment at Yellowstone has been critical in better understanding how "top predators" can restructure whole ecosystems through what ecologists call "top-down" effects; which can maintain a more desirable vegetation structure and community of other wildlife species.

At Isle Royale, after several years of planning, the first "new" wolves were relocated to the island last winter, with more planned for this coming winter. These first wolves came from three populations on the north shore of Lake Superior and from Michipicoten Island. (Ontario wildlife officials were essential collaborators in the effort.) Further introductions are planned from "mainland" Upper Peninsula populations.

This diversity of sources is designed to avoid the problems with inbreeding and low genetic diversity that drove the recent decline of the wolves on Isle Royale. Green noted the ability to take this powerful approach is critically dependent on the network of large areas of protected natural habitats in the Lake Superior basin – another recognition of the regional importance of the Huron Mountains.

Green's talk was grounded in the scientific bases of wildlife conservation and provided fascinating insights into the complex issues and decisions involved in management of large natural areas and National Parks. In addition, the large audience at the Playhouse enjoyed some dramatic video of the wolves before and after release, and of the winter helicopter flights required for their transport. So far, the wolves introduced in 2018-19 are doing well on the island, and researchers are monitoring them with great interest, hoping to use their observations to better understand how wolf societies and pack structures evolve.

Manierre Award

Presentation of the endowment-supported William and Anne Manierre Award at the Foundation's annual meeting recognizes a recent publication in the peer-reviewed scientific literature of research sponsored by the Foundation. This is a celebration of both the contributions of the Manierre family and the publications that are one of the most lasting products of the work of the Foundation. The first Manierre Award was made in 2000, and it has been presented annually since 2007.

This year, the 15th presentation of the award went to Drs. John Willis and Michael Walters for their 2018 paper, "Nutrition and mycorrhizae affect interspecific patterns of seedling growth on coarse wood and mineral soil substrates," in the open-access journal *Ecosphere*. The paper is freely available at <https://doi.org/10.1002/ecs2.2350>. The paper presents part of Willis's Ph.D. Dissertation research, conducted under the advisorship of Walters. (One of Walters' earlier Ph.D. students, Dr. Laura Marx, worked at the Huron Mountains over a decade ago, and her work was an important stimulus for the work conducted by Willis.)

Willis and Walters combined intensive field work and greenhouse experiments to gain better understanding of tree seedling establishment and how early growth of important tree species is affected by interactions among substrate (rotting wood of "nurse logs" vs. mineral soil), presence of mycorrhizal fungi, and nutrient availability. Despite the importance of seedling survival and growth in shaping forest dynamics, these influences have been poorly understood because of the absence of rigorous experimentation and research. Willis and Walters rose to the challenge and found complex interactions among these factors. Their findings are helping forest ecologists and land managers better understand how influences in the earliest life stages of trees affects the composition of entire forests.

Information on past Manierre Awards, with links to the winning papers, is posted at the Foundation's website: <http://www.hmwf.org/news/manierre-award/>.



From top: Members of the Manierre family (from left, Anne Sheret and Bill Manierre) with the winner of this year's Manierre Award (John Willis) and HMWF's research director, (Kerry Woods). Seedlings of trees getting their first burst of growth from a "nurse log," a decomposing fallen log that helps generate nutrients for seeds of trees to get started growing.



2018-2019 Donors

The Board of Directors would like to extend our gratitude to all those who donate to the Huron Mountain Wildlife Foundation. Because this newsletter goes to print near the end of 2019, we don't yet have contributions for November and December; rest assured, your gifts made during these upcoming weeks will be acknowledged in the next newsletter! This list includes those who made a donation anytime in 2018 and those who donated from January to early November of 2019. Thank you all!

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PRODUCTS

The Foundation's program maintains a substantial profile in the world of scientific research. Here I've listed recent Foundation-driven additions to the classic "currency" of scientific results: peer-reviewed journal publications, books, and presentations at technical conferences. (Past publications are listed at www.hmwf.org under "reports.")

In recent years, these traditional venues have been supplemented by new ways of utilizing the capacities of web-based communication; this has been particularly important in opening the door to increased participation by a broader community in the work of research science, also known as "citizen science." Our current program includes two good examples of this trend. Studies of mammal/predator communities by Dr. Nyeema Harris at University of Michigan are supported by "citizen-science" contributions to identification of animals in "game-camera" photos collected over the last several years (<https://www.zooniverse.org/projects/michiganzoomin/michigan-zoomin>). Dr. Karen Murchie leads a citizen-science-driven project at Shedd Aquarium to study fish migrations in the Great Lakes (<https://www.sheddaquarium.org/about-shedd/press-releases/shedd-launches-regional-research-project-with-citizen-scientists>).

In both of these studies, the Huron Mountains constitute one of a network of sites. In fact, several of the publications listed here are similarly based on geographically extensive collections of research sites (often with many authors!) with the reference ecosystems of the Huron Mountains serving as a critical "anchor." The increasing frequency and prominence of such integrative research emphasizes one of the special values offered to researchers by the Foundation: access to a large, unique and well-protected near-pristine landscape and ecosystem to which other sites may be contrasted.

PEER-REVIEWED PUBLICATIONS AND BOOKS

- Anderson, C. J. 2019. Comparing the slope–area threshold for stream initiation in primeval and managed forests of Northern Michigan. *Forest Science*. doi: 10.1093/forsci/fxz065
- Colas, F., . . . , and S.D. Tiegs. 2019. Towards a simple global-standard bioassay for a key ecosystem process: organic-matter decomposition using cotton strips. *Ecological Indicators* 106: 105466
- Dye, A., M. Ross Alexander, D. Bishop, D. Druckenbrod, N. Pederson, and A. Hessel. 2019. Size–growth asymmetry is not consistently related to productivity across an eastern US temperate forest network. *Oecologia* 189:515–528.
- Lambrech, N., C. Wittkop, S. Katsev, M. Fakhraee, and E. D. Swanner. 2018. Geochemical Characterization of Two Ferruginous Meromictic Lakes in the Upper Midwest, USA. *Journal of Geophysical Research: Biogeosciences* 123:3403–3422.
- Lambrech, N., S. Katsev, C. Wittkop, S. J. Hall, C. S. Sheik, A. Picard, M. Fakhraee, and E. D. Swanner. 2019. Biogeochemical and physical controls on methane fluxes from two ferruginous meromictic lakes. *Geobiology* <https://doi.org/10.1111/gbi.12365>
- Lennox R.J., . . . , K.J. Murchie, et al. 2019. 100 pressing questions on the future of global fish migration science, conservation, and policy. *Frontiers in Ecology and Evolution*. 7:1-16
- Tiegs, S. D., D. M. Costello, et al.. 2019. Global patterns and drivers of ecosystem functioning in rivers and riparian zones. *Science Advances* 5:eav0486.
- Voelker, S. L., S.-Y. S. Wang, T. E. Dawson, J. S. Roden, C. J. Still, F. J. Longstaffe, and A. Ayalon. 2019. Tree-ring isotopes adjacent to Lake Superior reveal cold winter anomalies for the Great Lakes region of North America. *Scientific Reports* 9:1–10.
- Werner, Thomas. 2017. The *Drosophilids* of a pristine old-growth northern hardwood forest. *Great lakes Entomologist* 50: 8-78
- Werner, Thomas; Steenwinkel, Tessa; and Jaenike, John. 2018. *Drosophilids of the Midwest and Northeast (Version 2)*. Open Access Books. 1. <https://digitalcommons.mtu.edu/oabooks/1>

CONFERENCE PRESENTATIONS

- Kailing, Chris D., Diana J.R. Lafferty. Using local knowledge to optimize live-capture of American marten. Annual meeting The Wildlife Society, Reno, NV, USA. 2019
- Lambrech N, and ED Swanner. "Bio-physical controls on the methane flux from ferruginous meromictic lakes in the Midwest." Association for the Sciences of Limnology & Oceanography Aquatic Sciences Meeting, San Juan, PR. February 23-March 2, 2019.
- Murchie, K.J. and P.B. McIntyre. Gathering phenological data on sucker migrations via citizen scientists. Wisconsin Chapter of the American Fisheries Society, Annual General Meeting, Green Bay, WI. February 2019
- Murchie, K.J. and P.B. McIntyre. Combining telemetry and citizen science to understand sucker migrations in Laurentian Great Lakes tributaries. 5th International Conference on Fish Telemetry. Arendal, Norway. June 2019.
- Sterman, J., A.C. Leeper & J.M. LaMontagne. Synchrony of mast seeding patterns in a boreal forest community. Joint meeting of the Canadian Society for Ecology and Evolution, the Canadian Entomological Society, and the Acadian Society of Entomologists. Fredericton, New Brunswick, Canada. August 2019.
- Swanner ED, Lambrech N, Wittkop C, Katsev S, Fakhraee M, and C Sheik. "The biogeochemistry of ferruginous lakes and past ferruginous oceans. Keynote presented at Geological Society of America Meeting, Indianapolis, IN. November 4-7, 2018.
- Tiegs, S.D., D. Costello, M. Isken, G. Woodward, P.B., McIntyre, E. Chauvet, A. Flecker, M.O. Gessner, N. Griffiths and the OUCELLEX Consortium. 2019. Global Patterns of Organic-Matter Decomposition in Riverine Ecosystems Demonstrated Through Peer Sourcing. Symposium for European Freshwater Science, Zagreb, Croatia. July 2019.
- Woods, K.D. Permanent plots and heritage data-sets offer our best insights into dynamics of primeval forests in the face of global change. Keynote delivered at conference on "Temperate and boreal primeval forests in the face of global change." Lviv, Ukraine, September 2019.



Memorials and Gifts of Celebration

Each year, the Foundation receives both memorial gifts and donations made to commemorate births in the family, important birthdays, weddings, and other milestones. We are grateful to all our donors. In 2018 to early November of 2019.

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