

HUBBARD BROOK RESEARCH FOUNDATION

Annual Report

DECEMBER 2019



“We were not intent on discovering acid rain, and I think that’s what science does. You don’t set out to discover something. It’s something that happens, and you need to be aware of the unusual and try to understand it. Keep your mind open, and always find time to think deeply and critically. I like the idea of serendipity; when you see, or hear, or taste something unusual, jump on it. Run with it.”

– Dr. Gene E. Likens,
Co-Founder of the Hubbard
Brook Ecosystem Study,
October 2019

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On the cover: Artist Nikki Lindt in the Hubbard Brook
Experimental Forest

THE HUBBARD BROOK COMMUNITY

For more than half a century, long-term studies of air, water, soils, plants, and animals at the 7,800-acre Hubbard Brook Experimental Forest have led to landmark discoveries including acid rain; the effects of lead, salt, and nitrogen pollution in streams and lakes; and the factors affecting migratory songbird abundance. Hubbard Brook is a network of environmental thinkers, including scientists, communicators, educators, stakeholders, and engaged citizens.

Hubbard Brook Research Foundation

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Hubbard Brook Experimental Forest

Robert S. Pierce Laboratory

234 Mirror Lake Road

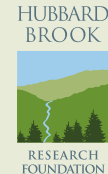
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Operated by the USDA Forest Service

Ian Halm, Site Manager

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From Our Executive Director

We All Have Something to Contribute in This Community



I'm not a practicing scientist. I'm more comfortable expressing myself in words and pictures than with charts and graphs. Working every day in a setting that is chockablock with leading scientific experts, you might think I'd feel like an oddball. The truth is, I've never felt more professionally "at home" than I do at Hubbard Brook.

Among the silos and echo chambers, Hubbard Brook is an oasis of openness, inclusion, and optimism. To work here is to have room to stretch and explore, making creative links and leaps among institutions, disciplines, and sectors. At Hubbard Brook, success is collective and it depends on our ability to listen and share with curiosity and respect across a wide variety of perspectives and styles, within and beyond academic research.

This openness means there is a place at Hubbard Brook for science communicators like me, and for artists like Xavier Cortada (*pg. 4*), and new voices like Tristan Keller (*pg. 5*).

At Hubbard Brook, we all have something to contribute in a community of knowledge-seekers. However you appreciate the natural world, we are grateful for your participation.

A handwritten signature in cursive script that reads "Anthea Lavalley". The ink is dark and the signature is fluid and elegant.

Anthea Lavalley
HBRF Executive Director



WORDS

TO DESCRIBE HUBBARD BROOK

Gene:
discovery
multidisciplinary
longevity
fun

“When something interesting comes along, jump on it—try to figure out what it means.”

Dr. Gene E. Likens

Co-Founder of the Hubbard Brook Ecosystem Study

Imagine a curious boy, more than six decades ago, gazing up at the clouds over his family’s small farm in Indiana, shaping questions about nature as he walked barefoot along streams and lakes. Dr. Gene E. Likens humbly attributes his achievements in life and in his scientific career to curiosity and to embracing serendipity, which he defines as keeping your mind open. When something interesting comes along, jump on it—try to figure out what it means.

When Gene took an early water sample at Hubbard Brook in the summer of 1963, he and Hubbard Brook Ecosystem Study Co-Founders, Dr. F. Herbert Bormann, Dr. Noye Johnson, and Dr. Robert S. Pierce, were surprised by its acidity, and their minds filled with questions. They wondered how long the water had been that way. What was the source of the acidity? What effect was it having on the ecosystem?

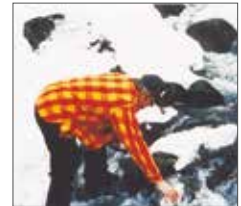
It was also a socially experimental time in U.S. history. A curious youth counterculture was exploring the effects of psychedelic drug-use and, after Gene shared early findings in a public lecture, a related news headline read:

“Prof says rain on acid trip.”

Serendipity and long-term ecosystem monitoring at Hubbard Brook ultimately led to one of the most significant science-to-policy success stories of our time. Likens said, “it shocked me that we ever got to the point where the 1990 Clean Air Act Amendments were signed into law. There have been very few examples of scientific discovery of a major environmental problem that led to political action, and I was on both ends. That is exceedingly rare, to be at the discovery end and still alive at the federal action end.”



Dr. Gene Likens



Gene taking a water sample during his early research at Hubbard Brook.

Jenny Bower

Ph.D. Candidate at the University of Vermont

Jenny studies mineral weathering—the interactions among soil, water, and rock—at Hubbard Brook. One of her favorite aspects of the work is simply walking in the woods with researchers, talking and sharing ideas. “It’s been really cool during the field season to get to work with people who are not involved in my project at all but have really useful ideas about what’s happening biologically.”

Jenny’s boundless curiosity is well-suited to Hubbard Brook’s collaborative culture. “Don’t be afraid to ask for what you need, ask for what you want, and send a billion emails. It was really Hubbard Brook that taught me how not to be afraid to reach out to people who are working in totally different areas of science. It adds so much if you get a perspective from a totally different field to inform your own work.”

As a young researcher facing an uncertain environmental future, Jenny has faith in the science-to-policy approach that achieved acid rain recovery. Jenny believes in science as an essential tool for understanding and addressing climate change, biodiversity, and other pressing environmental issues.



“It was really Hubbard Brook that taught me how not to be afraid to reach out to people who are working in totally different areas of science.”

Jenny Bower using a concrete saw on Rangely schist to test a bedrock sampling method. ►



WORDS

TO DESCRIBE HUBBARD BROOK

Jenny:
collaboration
change
fruitful

(inspired by summer
mushroom-foraging)

Xavier Cortada

Science Artist

At Hubbard Brook, Xavier finds artistic inspiration in science, nature, and data.

His work includes *Wind Words*, a visual art piece incorporating the vocabulary of water properties, and *Waterviz*, a near-real-time animation and sonification of the hydrologic cycle, fed by sensor data from the Hubbard Brook Experimental Forest (<https://waterviz.org/>).

For Xavier, art and science are both expressions of creativity and curiosity. As a member of Hubbard Brook's Committee of Scientists, Xavier breaks through the perceived barrier between science and art, taking a seat at the table among scientific visionaries and trailblazers.

Xavier believes that art can be a gateway to science. Now more than ever, the work of scientists at Hubbard Brook is vitally important. Art can tell the story of their discoveries, drawing more people into the conversation. Experience his Hubbard Brook work at <https://cortada.com/event/2018/waterPaintings>.

"I hope that, through my art, I can help New England and the world around us to understand the incredible value of the scientists at Hubbard Brook."



WORDS

TO DESCRIBE HUBBARD BROOK

Xavier:
chemicals flowing
through the forest
canvas
water

Tristan Keller

Summer Intern for the U.S. Forest Service

Tristan Keller was a 2019 summer intern for the Forest Service at Hubbard Brook. Memorable summer experiences include learning to take measurements at the weirs, carrying fire hoses into the middle of the woods for irrigation plots, setting up experiments, not to mention earning her chainsaw certification. Now back at Plymouth State University, Tristan is studying watersheds in her geology class, and the experiences of physically painting watershed boundaries at Hubbard Brook and observing how water moves through the forest system give her a deeper understanding of how it all works.

“I didn’t have to look at pictures, I was there,” she says. “It’s a very dynamic place. There are all of these different ways to understand water and the forest. There are people counting salamanders under wooden planks in the woods and people spraying ice on trees in the middle of the winter. Hubbard Brook is also conducting studies that are focused on the future of the environment and, as the climate continues to change, this research is incredibly important in understanding how we might be able to alter those changes.”

“It’s a very dynamic place. There are all of these different ways to understand water and the forest.”

WORDS

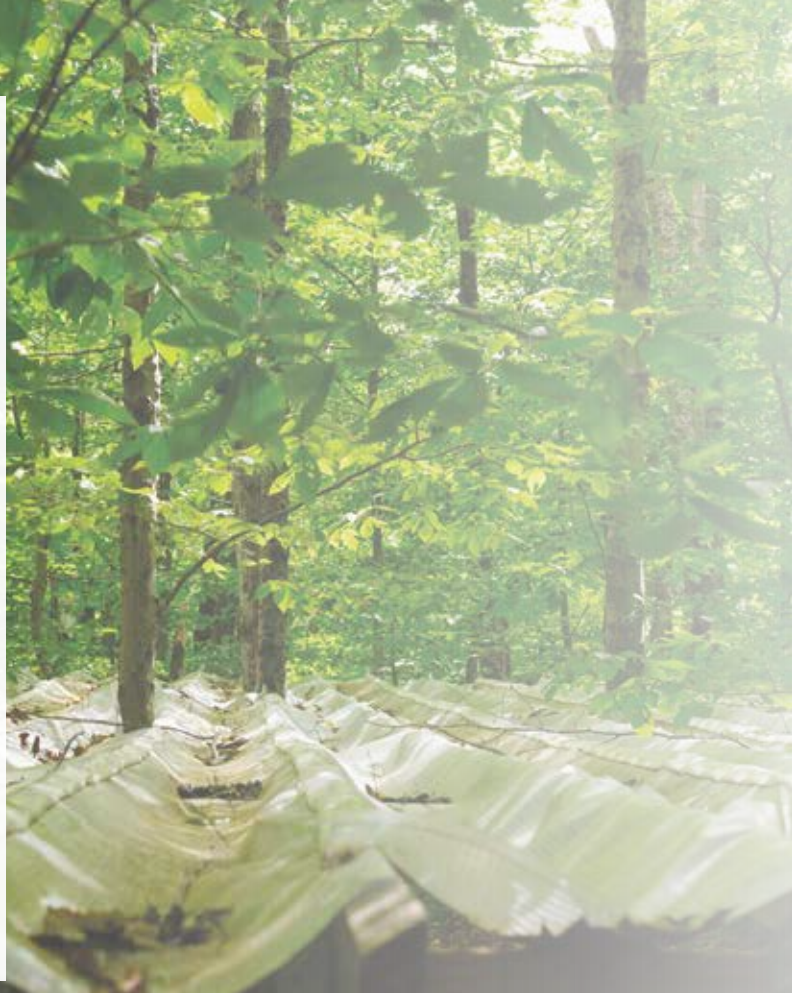
TO DESCRIBE HUBBARD BROOK

**Tristan:
amazing
teachable
a lot of hard-
working people**



HUBBARD BROOK SCIENCE AND PROGRAM UPDATES

- 🌿 In response to the federal shutdown last winter, HBRF raised \$9,440 from more than 40 donors for technical support in the Experimental Forest. More than \$7,000 remains available for future federal staff support, in the event of another shutdown.
- 🌿 HBRF staff and Hubbard Brook investigator, Gary Lovett, hosted a **round table dialogue** in February on the topic of invasive forest pests and the forest products industry in New England.
- 🌿 Sarah Thorne conducted a workshop on May 4 based on the acid rain curriculum for the **NH Science Teachers' Association** conference.
- 🌿 Over the summer and fall, Sarah Thorne and our U.S. Forest Service partner, Amey Bailey, launched a **Citizen Science Forest Monitoring Collaboration with Squam Lakes Conservation Society**. They established three monitoring plots at Doublehead Preserve in Sandwich, NH.
- 🌿 In July, HBRF coordinated Hubbard Brook's first-ever **public storytelling event, "The Moss,"** kicking off the 56th Annual Meeting of Cooperators. The theme of the night was "Unexpected Encounters."





- 🌿 The lead article for HBRF's **Winter Climate Change Science Links** project was published in July in the journal *Ecological Applications*. This project, led by Alix Contosta from UNH, synthesized the state of knowledge of how winters are changing across northeastern North America and the impacts of those changes on the northern forest. HBRF will be releasing a public report based on this scientific synthesis this winter.
- 🌿 **U.S. Congresswoman Ann Kuster (NH-02)** and her team visited Hubbard Brook for a science briefing in August. Presenters shared what they know on the topics of winter climate, snowmaking at Loon Mountain, forest health and pests, and Hubbard Brook as a training ground for future ecologists.
- 🌿 Sarah Garlick and U.S. Forest Service Research Ecologist, John Campbell, represented Hubbard Brook at **U.S. Congresswoman Ann Kuster's August climate change and outdoor recreation round table** in Lancaster, NH. Sarah presented results from the Winter Climate Change Science Links report.
- 🌿 Sarah Garlick and Clara Claisson attended the **Tribal Climate Resilience Summit** at the Turning Stone Resort Casino in Verona, NY.
- 🌿 In September, Lindsey Rustad was selected as an **IF/THEN**® Ambassador by the American Association for the Advancement of Science and Lyda Hill Philanthropies as an innovator and high-profile role model for middle-school girls. Sarah Garlick and Clara Chaisson assisted with the application and public announcement.
- 🌿 In October, Anthea Lavallee, HBRF staff, and Hubbard Brook researchers prepared a customized climate fact sheet for U.S. Congresswoman Ann Kuster. The fact sheet provides context for the Congresswoman's new clean energy and climate initiative.

Top: At “The Moss,” Amey Bailey, U.S. Forest Service Forestry Technician, shares memories of her professional colleague and tennis adversary, Herb Bormann. **Bottom:** David Patrick, TNC NH Director of Conservation, and John Battles, Hubbard Brook Investigator from UC Berkeley, discuss ecological and community resilience in the White Mountains at Hubbard Brook in July.

More Bitter Than Sweet Future for Maple?

A Hubbard Brook approach for understanding the future of sugar maples in New England

Sugar maple is an iconic species in our region, highly valued for timber, fall foliage, and maple sugar products. But sugar maple is contending with calcium poor soils in the wake of acid rain, beech competition, and climate change, among other environmental stressors.

Dr. Natalie Cleavitt, Research Associate with **Cornell University**, is leading an investigation that extends Hubbard Brook science beyond the Experimental Forest. After years of studying sugar maples at Hubbard Brook, Nat wondered, “Are sugar maples experiencing the same type of regeneration failure in other parts of the state?”

The Society for the Protection of NH Forests (SPNHF) is hosting researchers at four of its reservations with similar northern hardwood compositions to help answer this question. Nat and HBRF Educator, Sarah Thorne, are leading teams of 14 SPNHF **volunteer citizen scientists** to collect data on sugar maple regeneration at these sites over a multi-year period. HBRF’s Sarah Garlick is evaluating the project. Cornell undergraduate students who are participating in the fieldwork also organized tours with foresters and syrup producers for an exchange of information and concerns among forest stakeholders. The citizen scientists have completed their first field season, working on 48 forest plots from Mt. Monadnock in Jaffrey, NH, to Stark, NH, in the Great North Woods region. The second field season will include partnerships with high schools near each of the study sites. Project support has been contributed by **Cornell University, the Society for the Protection of New Hampshire Forests, the National Science Foundation, and the USDA Northeast Climate Hub.**



Photo: SPNHF



Photo: Sarah Thorne

Top: Dr. Natalie Cleavitt, leader of the investigation

Bottom: Monadnock Crew crew standing by large, wolf maple on one of their plots.



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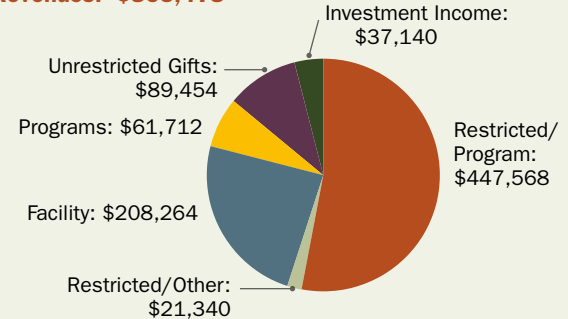


Photo: Joe Klementovich

Hubbard Brook Research Foundation

October 1, 2018 – September 30, 2019

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