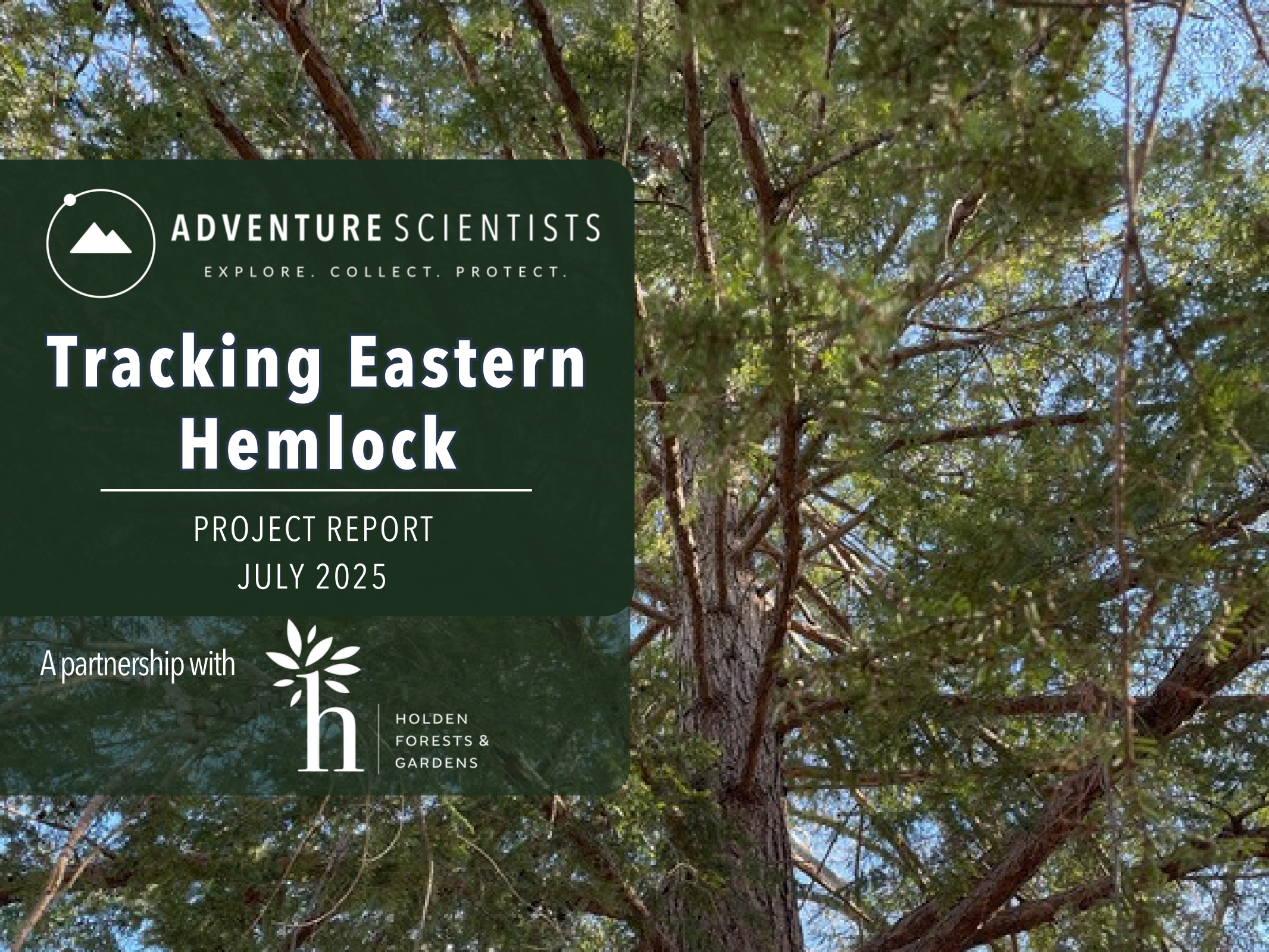


ADVENTURE SCIENTISTS

EXPLORE. COLLECT. PROTECT.

Tracking Eastern Hemlock

PROJECT REPORT

JULY 2025

A partnership with

HOLDEN FORESTS & GARDENS



Acacia, Tracking Eastern Hemlock volunteer, inspecting eastern hemlock needles.

Photo Credit: Volunteer / Acacia F.

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Tracking Eastern Hemlock

1521
Observations Submitted





4.6
Average Number of Active Volunteers Per Day

32.7
Average Number of Observations Per Day





7
National Forests Surveyed

312
Trails Surveyed





126
Most Observations in One Day
Feb. 8 and March 1



Photo Credit: The Pisgah Conservancy / Nina A.

SUMMARY

Winter 2025 brought a new kind of adventure: the search for eastern hemlock *(Tsuga canadensis)*! Bundled up and ready for anything, Adventure Scientists' volunteers turned snowy trails, frozen forests, and frosty climbs into a giant, real-world scavenger hunt–one that made a real impact for science.

With the leaves down and snow on the ground, winter was the perfect time to spot eastern hemlock standing proud against the landscape, and to catch sight of the tiny, fuzzy signs of the invasive hemlock woolly adelgid *(Adelges tsugae)*. The challenge? Find and assess the health of as many eastern hemlock trees as possible across seven national forests in Kentucky, New York, North Carolina, Tennessee, Virginia, and West Virginia.

The project window was short with just three cold, snowy months making every outing count. Volunteers jumped in, knowing that winter conditions gave them the best shot at spotting eastern hemlock trees easily against the bare landscape and finding signs of the invasive woolly adelgid. It was a race against the season, and a team effort every step of the way.

Eastern hemlock trees are true forest superheroes as they provide wildlife habitat, stabilize soil, filter water, and store carbon. But they're under serious threat.

Every hemlock located helps scientists get closer to saving this keystone species and the ecosystems that depend on it.

For many volunteers, this project was not just about science; it was personal.

"I really love eastern hemlock. They're a tree that I feel a connection to and see in many of the places I love to hike," shared volunteer Sophie A. "I've been distressed about the declining hemlocks in many of my favorite places under the onslaught of the hemlock woolly adelgids and have felt sad and hopeless about it. It felt great to get out in the field and feel like I could contribute something to the preservation of this tree I love."

Armed with GPS apps, field guides, and a shared mission, volunteers braved the cold, cheered each other on, and built a community around their winter adventures. Their data is now helping partners like Holden Forests and Gardens and Forest Restoration Alliance pinpoint the strongest trees to breed and protect for the future.

This wasn't just science. It was a team effort to protect something big, and have a blast doing it. When you combine community science with outdoor adventure, everyone wins.



Photo Credit: The Pisgah Conservancy / Nina A.

PROJECT CONTEXT

Eastern hemlock is a keystone species in eastern North American forests, playing a critical ecological role in regulating stream temperatures, stabilizing soils, supporting wildlife habitat, and maintaining water quality, nutrient cycling, and carbon sequestration. However, this foundational species has been in steep decline since the mid-20th century due to infestation by the invasive hemlock woolly adelgid *(Adelges tsugae)*, an aphid-like insect introduced from Asia.





This project focused on identifying candidate lingering hemlocks–trees that have survived woolly adelgid infestation and may harbor natural genetic resistance. These individuals represent a crucial opportunity for forest restoration efforts, as they could form the basis for breeding programs and long-term conservation strategies.

By locating and studying these survivors, we support collaborative research into resistance mechanisms, contribute to adaptive forest management approaches, and ultimately enable the recovery of eastern hemlock populations. Continued investment in this work is essential not only for preserving biodiversity, but also for maintaining the ecological services on which downstream communities and ecosystems depend.



WHAT IS HEMLOCK WOOLLY ADELGID?

The hemlock woolly adelgid is a tiny insect that infests eastern hemlock trees and feeds on their newest needles, causing needle loss. The insect's cotton-like egg sacs are found on the underside of hemlock branches before hatching and infesting the tree.

The insect reproduces asexually, and with no current natural predators in North America, it spreads rapidly and devastates hemlock forests.

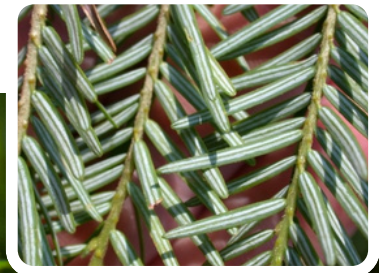


IDENTIFYING EASTERN HEMLOCK

Eastern hemlock bark can range from a cinnamon brown to ash gray color.



Hemlocks have flat, short needles, usually under one inch long, and often occur near creeks. All of the needles occur on the same plane.



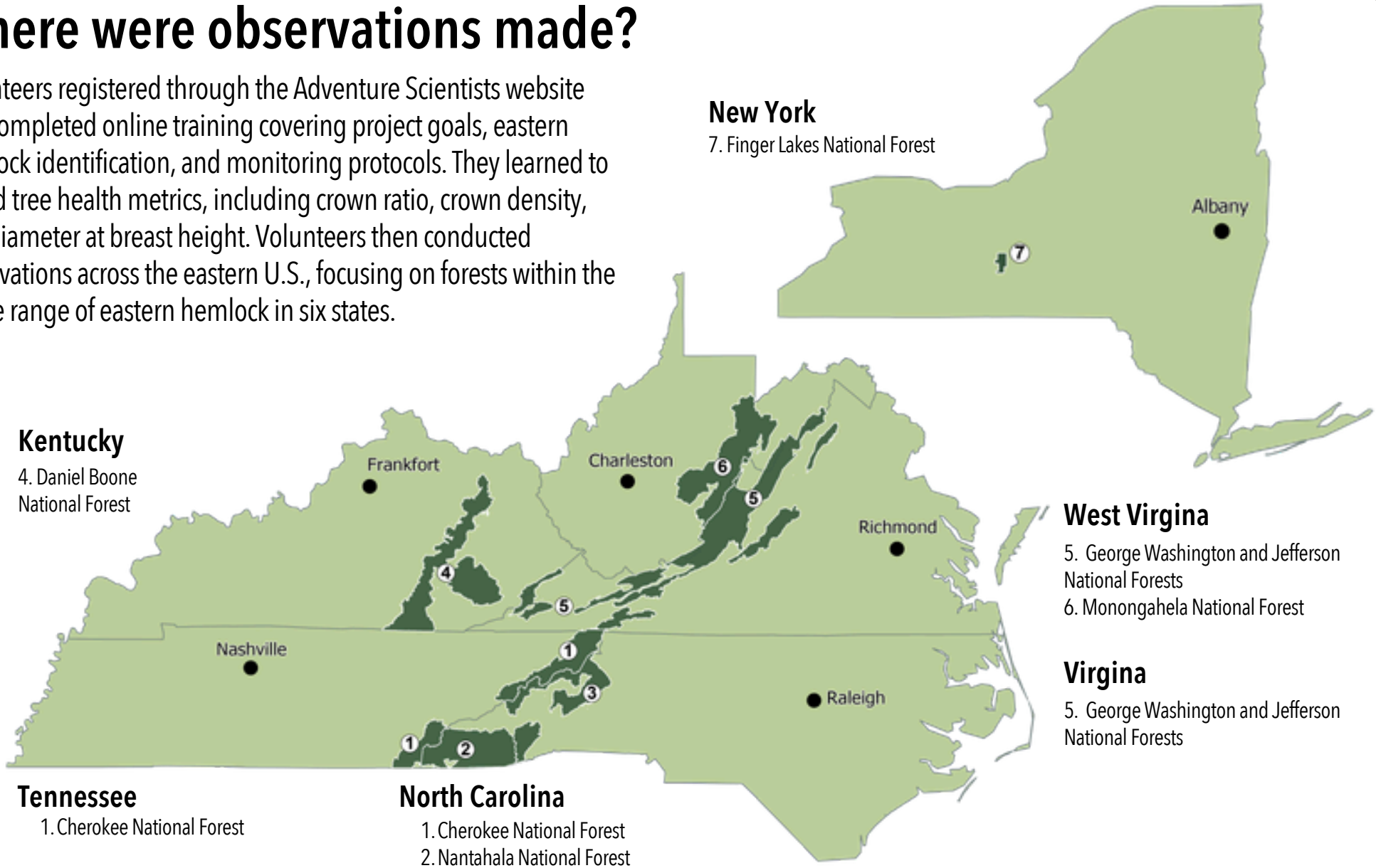
The cones of the eastern hemlock are about the size of a penny.



PROJECT DESIGN

Where were observations made?

Volunteers registered through the Adventure Scientists website and completed online training covering project goals, eastern hemlock identification, and monitoring protocols. They learned to record tree health metrics, including crown ratio, crown density, and diameter at breast height. Volunteers then conducted observations across the eastern U.S., focusing on forests within the native range of eastern hemlock in six states.



New York
7. Finger Lakes National Forest

Kentucky
4. Daniel Boone National Forest

West Virgina
5. George Washington and Jefferson National Forests
6. Monongahela National Forest

Virgina
5. George Washington and Jefferson National Forests

Tennessee
1. Cherokee National Forest

North Carolina
1. Cherokee National Forest
2. Nantahala National Forest
3. Pisgah National Forest

PROJECT DESIGN

How were observations made?

While using the TreeSnap app to record eastern hemlock observations, volunteers followed a standardized protocol to ensure consistent, high-quality data collection. Trees were identified based on distinctive characteristics such as bark texture and color and needle arrangement. Volunteers were asked to assess whether each tree or group of trees was a living "lingering" individual–appearing to be surviving a hemlock woolly adelgid infestation–or a non-living tree showing no signs of healthy foliage.

To evaluate infestation severity, volunteers categorized the presence of hemlock woolly adelgid into one of three levels: light, moderate, or heavy. Additionally, using a flexible measuring tape, they recorded tree circumference at breast height to support ongoing monitoring of tree growth and health over time.

How were surveys analyzed?

As volunteers submitted observations in TreeSnap, the data populated a live project map on the Adventure Scientists' website. Project partners have access to the TreeSnap data and will analyze all data submissions for best candidate lingering hemlocks for future seed collection.

DATA COLLECTION & RESULTS

To support this project, Adventure Scientists partnered with TreeSnap, a citizen science smartphone application designed to help identify and record the locations of many different tree species. TreeSnap enables users–including concerned citizens, landowners, and foresters–to record data on tree health for use in scientific research. The Adventure Scientists Team collaborated with the application developers to create a special designation for the Tracking Eastern Hemlock Project. This unique designation allowed for the observations collected by Adventure Scientists volunteers to be stored and visualized separately from other observations recorded by general TreeSnap users.

By utilizing an established, trusted platform already recognized within the citizen science community, Adventure Scientists was able to significantly streamline the data collection process and engage a broader volunteer network.

Our partnership with TreeSnap resulted in a 267% increase in registered users and a 120% increase in recorded tree observations over the course of the project.







DATA COLLECTION & RESULTS

From January through March 2025, Adventure Scientists' volunteers submitted 1,521 eastern hemlock observations across all seven national forests in our study area. Notable highlights from this season include:

195 observations were recorded along the Appalachian Trail

The longest volunteer observation streak lasted 28 consecutive days

Pisgah National Forest had for the highest number of observations.

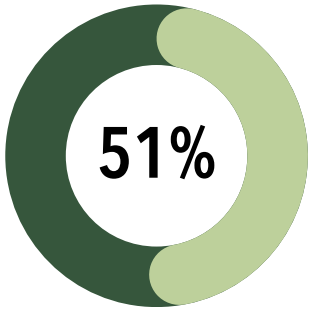
During the Tracking Eastern Hemlock project, Adventure Scientists successfully built a geographically distributed dataset of eastern hemlock locations across National Forests in Kentucky, New York, North Carolina, Tennessee, Virginia, and West Virginia. Volunteers identified candidate lingering hemlocks–trees that have survived infestations of the invasive hemlock woolly adelgid. These surviving trees may possess genetic resistance to the pest and will help inform conservation strategies, predict future changes in hemlock populations, and guide management decisions to protect these ecologically critical trees.

This collaboration not only expanded TreeSnap's dataset but also provided critical data to advance conservation genetics research and strengthen future tree breeding programs.

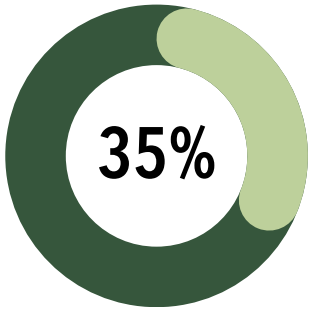
VOLUNTEER EXPERIENCE

Following project completion in March 2025, Adventure Scientists surveyed Tracking Eastern Hemlock project volunteers through an online form.

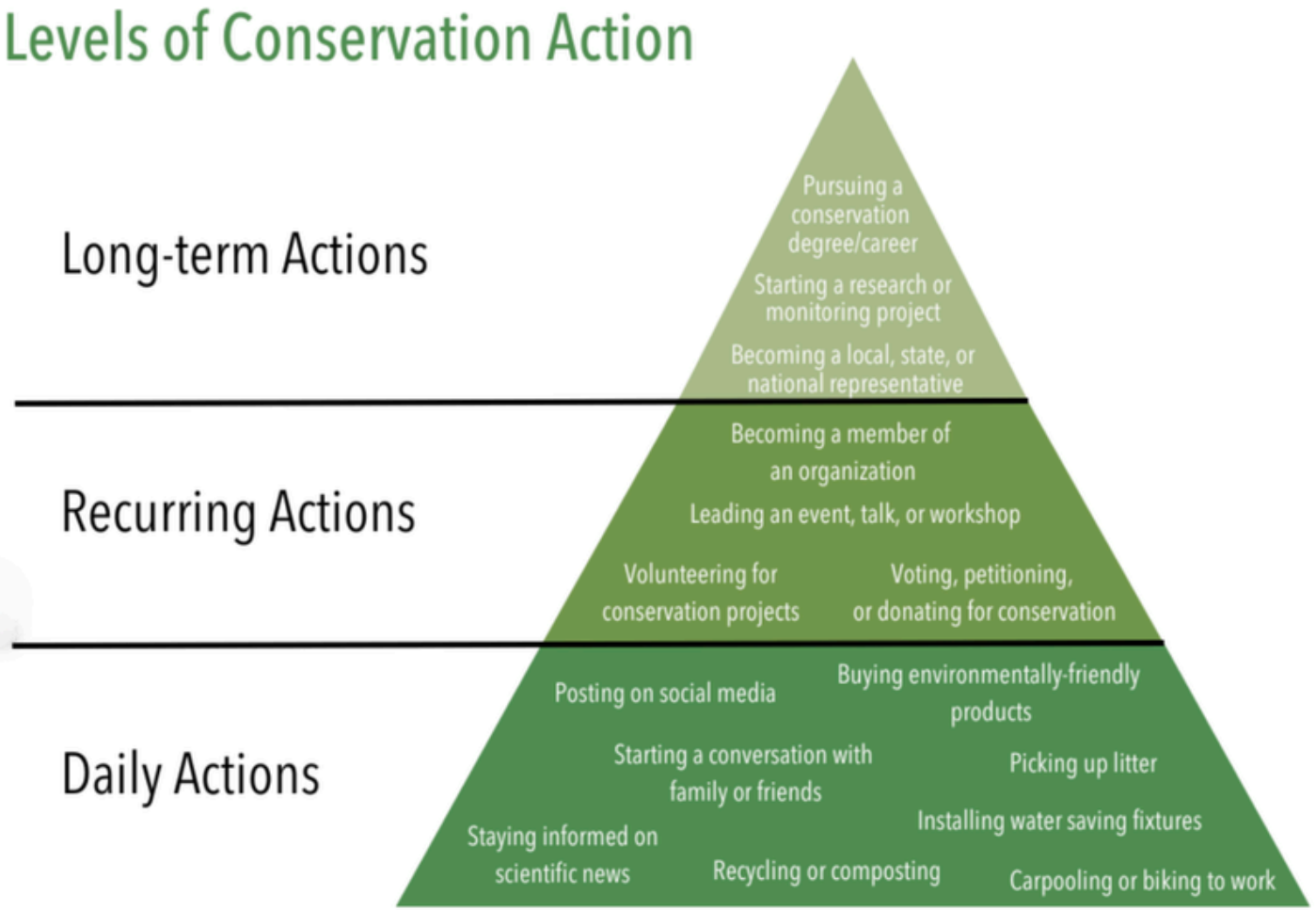
Highlights include:



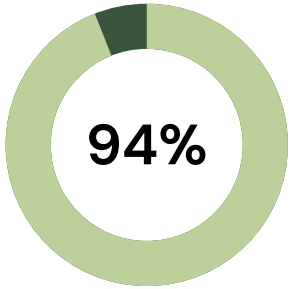
of volunteers are taking greater recurring action in their lives



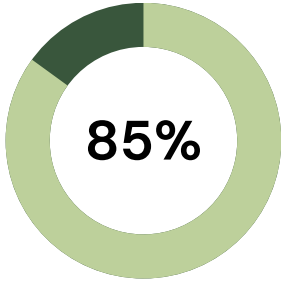
of volunteers are taking greater action in their daily lives



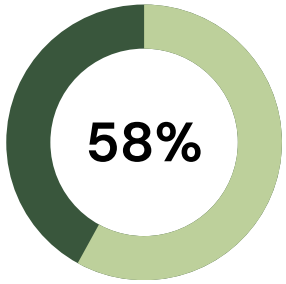
VOLUNTEER EXPERIENCE



of volunteers cared about the project's conservation themes.



of volunteers were new to Adventure Scientists volunteering expanding our volunteer base immensely.



learned a new skill through project participation.

"It helped me deepen my knowledge of and connection with the forests in WNC and the ongoing conservation efforts in the community. I learned new data collection skills that were a gateway to more volunteer opportunities and was able to network with like-minded nature lovers." - Kimberly C.

"It gave me hope. There are so many stories about threatened species but I don't feel like what I'm doing makes that much of a difference. This project made me feel that something could actually change for the better. I had no idea Adventure Scientists existed and just stumbled upon this project. I'm excited about all the work AS is involved in, all things I'm interested in. Plus, I'm adventurous!"

– Tracking Eastern Hemlock Volunteer

2025 VOLUNTEER EVENTS

The Pisgah Conservancy Field Day

On January 22, 2025, over 30 volunteers joined Adventure Scientists' Alison Ormsby, The Pisgah Conservancy, and the Hemlock Restoration Initiative in Pisgah National Forest's Shining Rock Wilderness for a citizen science event supporting the Tracking Eastern Hemlock project. Volunteers hiked trails to identify resilient eastern hemlock trees that have survived the invasive hemlock woolly adelgid, using the TreeSnap app to record tree health, habitat data, and pest presence. The data collected will inform future breeding and restoration efforts for this keystone species. This event highlighted the power of community collaboration in conservation, combining scientific guidance with public engagement to protect imperiled forest ecosystems.



Photo Credit: The Pisgah Conservancy / Nina A.



Photo Credit: Adventure Scientists / Alison O.



Photo Credit: The Pisgah Conservancy / Nina A.

2025 VOLUNTEER EVENTS

Brevard College Field Day

On January 28th, Alison Ormsby, Adventure Scientists, led a class visit and field day in Pisgah National Forest with students from Brevard College as part of the Tracking Eastern Hemlock project. She was joined by Dr. Erasme Uyizeye, Assistant Professor of Environmental Studies at Brevard College, whose students participated in hands-on learning and data collection in the field. The outing provided an opportunity for students to engage directly with conservation research, deepen their understanding of forest health, and contribute to efforts monitoring the status of eastern hemlock trees in the region.



Photo Credit: Brevard College/ Erasme U.

OUR SCIENTIFIC PARTNERS



Ben Smith

Research Scholar, Department of Entomology & Plant Pathology, NC State University

"Through the Tracking Eastern Hemlock project, volunteers have submitted a wealth of information that far exceeds what we could have collected without this assistance. The Forest Restoration Alliance at NC State University is currently using the data submitted to identify lingering hemlocks to propagate for HWA resistance screening and prioritize areas to search in the future as HWA-driven mortality continues. In just a few months, citizen scientists through Adventure Scientists surveyed areas that would have taken us years to cover, and we are grateful to the volunteers and staff of Adventure Scientists for their participation in this effort."

Rachel Kappler

Great Lakes Basin Forest Health Collaborative Coordinator, Holden Forests and Gardens

"The Tracking Eastern Hemlock project has made a great difference in our ability to find important eastern hemlock individuals. This data will allow for prioritization of areas for further investigation and selection, for continuing research and breeding program beginnings."



VOLUNTEER QUOTES

"My sincerest thanks to you and the entire Adventure Scientists team for the opportunity to contribute to some great science, while I play in the outdoors and get healthy / see & explore my home state of KY. It was and is great fun to look at the observations map, knowing that we started with no pins, and over a couple months, covered the East Coast Forests! Always wish we could have done more, but very happy with what everyone accomplished. Congrats to all!" - Emil S

"I loved this project. On our last hike, we discovered so many hemlock trees it was amazing; I named this spot "Hemlock Haven." One of those trees did not have any infestation. We had to hike through a lot of forest to document some of these trees!" - Kathy A.

"I really enjoyed participating. I love participating in citizen science field data collection and intend to again." - Kim C.



Photo Credit: The Pisgah Conservancy / Nina A.

VOLUNTEER QUOTES

"I had hiked on all of the trails I surveyed for this project before, but it was a very satisfying experience to hike them with a specific purpose in mind. Searching for hemlocks added a different dimension to the hike and gave me a different way of looking at the environment."
-Wesley S.

"I enjoyed it so much, data collection was so much fun and I felt a part of something important!"
- Melissa G.



Photo Credit: The Pisgah Conservancy / Nina A.

PROJECT PRESS

Attention Tennessee hikers! Here's how you can help save the eastern hemlock tree



knox news.

January 28, 2025

A Tennessee-based news organization highlights the importance of the hemlock trees to local ecosystems and provides readers with information on how to sign up for the Track Eastern Hemlock project.

Turning Outdoor Enthusiasts into Community Scientists



SCI AM

January 24, 2025

In the episode, Gregg Treinish of Adventure Scientists explains how outdoor enthusiasts can support conservation by gathering data–such as tracking the health of eastern hemlock trees–while spending time in nature.

New Adventure Scientists: Project aims to uncover genetic resistance in eastern hemlock trees



Cleveland Daily Banner

January 21, 2025

The Cleveland Banner article details the Tracking Eastern Hemlock project. The initiative seeks to protect and restore this key tree species across affected regions.

ACKNOWLEDGMENTS



Photo Credit: The Pisgah Conservancy / Daniel J.

Thank you to the donors and supporters whose generosity made this work possible. Your commitment to our mission and your investment in science-driven conservation were essential to the success of the Tracking Eastern Hemlock project.

We would also like to thank our partners at Peak Skis, AllTrails, MiiR, and Mystery Ranch for helping us increase accessibility to the outdoors and express appreciation to our volunteers with great incentives throughout the field season.

Special thanks to our scientific partners, Holden Forests and Gardens, as well as project collaborators TreeSnap, the Forest Restoration Alliance, North Carolina State University, the Hemlock Restoration Initiative, Brevard College, the Pisgah Conservancy, and the US Forest Service.

THANK YOU, VOLUNTEERS!

We want to extend our appreciation to our incredible volunteers. We couldn't have gathered this critical data without their time and effort, and we are thankful for their passion, enthusiasm, and dedication to our mission!

> I really love eastern hemlocks. They're a tree that I feel a connection to and see in many of the places I love to hike. I've been distressed about the declining hemlocks in many of my favorite places under the onslaught of the hemlock woolly adelgids and have felt sad and hopeless about it. It felt great to get out in the field and feel like I could contribute something to the preservation of this tree I love.
>
> -Sophie A.

> I can't not notice hemlocks any more, I'm always looking at them and appraising them. I enjoyed feeling like I had a good reason to be out in the woods, and feel more urgency about saving the Hemlocks that are left
>
> -Tracking Eastern Hemlock Volunteer.



PC: Volunteer / Gavin S.



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