The comeback The American Chestnut Foundation and UMaine join forces to help the ‘redwood of the East’ battle back from the brink by Elyse Kahl | Photography by Adam Küykendall

Dalton Herrick-Wagman was a man on a mission. On a sunny June afternoon, the second-year forestry major at the University of Maine rode his bike through Orono to the location of one of the largest American chestnut trees in the state. The sight of the majestic rare hardwood got him wondering whether there might be others in the neighborhood.

He biked along the Stillwater River, searching for glimpses of the tree’s canoe-shaped leaves with small hooks along the scalloped edges. He headed toward a recently developed area and walked into the adjacent woods, looking for the tree that was a mainstay in the Appalachian states before a deadly fungus began wiping out the species nationwide in the early 1900s.

Before the blight decimated the American chestnut tree population, the trees accounted for a quarter of the hardwoods from Maine to Florida, and west to Ohio. UMaine forestry major Dalton Herrick-Wagman is involved with the Maine Chapter of The American Chestnut Foundation's effort to restore the tree to its native range. He manages the foundation's breeding orchard in Bradley, Maine.

No luck. He started to pedal away when something caught his eye. On the ground was a brown, prickly husk a little larger than a golf ball. He recognized it instantly — the remains of last year's green American chestnut bur that protected three edible seeds.

That's when he took another look. He walked the property line of the new housing development and found what he hoped for — a previously undocumented native American chestnut tree. He ventured deeper into the woods and found another, then another, ultimately discovering eight trees of various sizes, the tallest standing more than 40 feet high.

"I believe I was meant to discover those trees," says Herrick-Wagman, of Torrington, Connecticut. "Finding surviving, pure American chestnut trees that still produce chestnuts is incredibly rare. I didn't think I'd ever find one."

That's because locating an American chestnut — the "redwood of the East" — is akin to finding a needle in a haystack. In Maine, there are about 200 documented, large native trees in 136 municipalities, says the Maine chapter of The American Chestnut Foundation (TACF).

It was much easier in 1900, when there were more than 4 billion American chestnut trees from Maine to Florida, and west to Ohio, accounting for a quarter of the hardwood trees in the region. In 1904, Cryphonectria parasitica arrived in North America, most likely on blight-resistant Asian nursery stock. It proceeded to decimate the U.S. population of American chestnuts.

The blight is a fungus that kills the aboveground portion of chestnut trees, according to Brian Roth, associate director of UMaine's Cooperative Forestry Research Unit. The roots remain viable, and while the tree often sprouts new shoots from the stump, it rarely gets big enough to reproduce — making the species functionally extinct.

In 1983, a group of plant scientists founded the nonprofit TACF with the goal of breeding a blight-resistant American chestnut tree and restoring the species to its native forests to benefit the environment, wildlife and society. The group also aims to create a template for restoration of other species.

"It is about restoring an element of our cultural heritage as Americans. It is about restoring balance to nature," says Herrick-Wagman, one of a dozen dedicated undergraduate forestry students who have volunteered for the restoration effort through planting, plotting, mapping and research.

Stephen Shaler, director of the UMaine School of Forest Resources, says undergraduates get the chance every semester to take outdoors what they learn in the classroom.

"The opportunity for students to take the skills they have learned in class in different contexts, such as the reintroduction of chestnut trees, really helps to cement the information in the students' brains," Shaler says.

The American chestnut, which can grow up to 100 feet tall, has been characterized as “the perfect tree,” according to Glen Rea, emeritus chair of TACF and board member of the national organization, as well as the Maine chapter of TACF.

Chestnut wood has straight grain and is highly rot-resistant, making it ideal for barns, flooring, utility poles, railroad ties and furniture, Rea says. Chestnuts are sweet and nutritious, a source of food for deer, bears, birds and squirrels. Unlike other nuts, such as acorns, chestnuts are produced abundantly every year, he says.

“It’s everything you want in a tree,” says Rea, who earned a forest management degree from UMaine in 1981. He said early settlers depended on the trees — using the seeds to feed livestock and make flour, and the wood to build homes, furniture and caskets.
Of the 200 mature trees in Maine, Rea says around 50 are part of the foundation’s breeding program, which includes hand pollination with pollen from the foundation’s research farm in Virginia, as well as seed collecting.

In the 1980s, TACF began a breeding program to cross Chinese chestnut trees with American chestnut trees to introduce genes resistant to the blight. To end up with a tree with American characteristics — straighter, stronger and taller than Chinese trees — the new trees are then backcrossed to pure American trees for two more generations.

At each stage, young trees are tested for resistance, as well as similarity to American trees, with only the best trees retained for the next generation of breeding. Two more generations of interbreeding produces trees that are fifteen-sixteenths American. Each generation of breeding takes as long as a decade to complete, according to Roth.

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Dalton Herrick-Wagman

Rea approached UMaine in 2005, asking for land to plant, grow and pollinate the hybrids in a breeding orchard to introduce genes from the state population of native trees. The Maine chapter of TACF doesn't own any land, and with all of its money going to the breeding effort, these types of partnerships are critical to the restoration effort's success, Rea says.

TACF manages breeding orchards, where volunteers, including UMaine students, inject the trees with blight to determine which are most resistant. TACF also has seed orchards, where the group will produce seeds with the desired genes to be reintroduced into Maine's forests.

The Maine chapter of TACF maintains breeding and seed orchards at UMaine's Highmoor Farm in Monmouth and on university property in Hartland. UMaine students and other TACF volunteers also helped establish a seed orchard in Stetson on land donated by the Penobscot County Conservation Association, and manage a breeding orchard in the Penobscot Experimental Forest in Bradley.

"The University of Maine has been so good to us. They have gone out of their way to help us out," says Rea, noting that UMaine is the only university in the state working with the foundation.

The blight, which is dispersed by animals or spores in the air or on raindrops, enters a tree through a bark wound. The pathogen spreads through the tree, killing tissues until the flow of nutrients closes and the tree dies, according to TACF. Trees with aggressive strains can die within a year, Rea says, while those with mild forms can fight for years — surviving but not producing viable chestnuts.

Producing seeds and testing them for blight resistance requires about six years for each backcross generation and five years for intercross generations, according to TACF. The Maine chapter is growing fifth-generation hybrids that will produce sixth-generation seeds to be strategically planted in the wild by TACF volunteers starting in 2020.

Roth, A board member of the Maine chapter of TACF, introduced forestry students — particularly members of the UMaine Mapping and GIS Student Club — to the restoration effort. The club, which began in 2013, was formed to familiarize students with geographic information systems (GIS), according to member Danae Shurn, a second-year forestry major from Machias, Maine. Another focus, she says, is reaching out to organizations and connecting students with volunteer opportunities, as well as others in the industry.

The TACF project was the club's first and continues to be a major effort. In fall 2013, club members, including Shurn and Herrick-Wagman, visited TACF orchards to create maps, returning in the spring to plant seedlings.

"When you map the orchard it helps predict how many more plots of trees you can put in the area. If you did that all with footwork, it's a lot more expensive and time-consuming, versus, if you use ground-plotted GPS markings and satellite imagery, you do it a lot more efficiently and accurately," says Dimitrje Howe-Poteet of Glenburn, Maine, one of 22 active club members.

Using technology available in the School of Forest Resources' Barbara Wheatland Geospatial and Remote Sensing Analysis Laboratory, students show TACF members how to use global positioning systems (GPS) and Google Earth to monitor trees and map plots, says William "Carter" Stone, Barbara Wheatland Geospatial and Remote Sensing manager.

In July 2014, commercial pilots David Sandilands, a forestry graduate student, and Louis Morin, a forest resources instructor, completed a flyover using information from TACF and maps created by the UMaine Mapping and GIS Student Club. Along with William “Carter” Stone, Barbara Wheatland Geospatial and Remote Sensing manager, they captured images of documented chestnut trees around the state.

In July, Stone; Louis Morin, a forest resources instructor and pilot; and David Sandilands, a forestry graduate student and commercial pilot, completed a flyover using information from the mapping club and TACF. They rented the university’s donated Cessna 172S Skyhawk to capture images of documented chestnut trees in Maine to serve as a reference for the discovery of undocumented native American chestnut trees.

The aircraft had a camera pod — a box with a window — strapped underneath that held a digital camera that was automatically triggered by Garmin GPS.

“We program where we want photos to be taken, and once we fly over that point, it triggers the camera and everything is sent right to our tablet so we can view it in real time,” Sandilands says.

A modified infrared camera differentiates between hardwoods and softwoods, which isn’t easily done with the naked eye, Sandilands says. A digital aerial camera takes photos that may be processed in stereo using software to create 3-D images, allowing researchers to measure the dimensions of trees and other objects.

The American chestnut is one of a few trees in Maine to bloom in July, producing a canopy of white catkins that make the tree easy to spot from the air. By capturing images when the trees are flowering, the researchers can compare the photos to Google Earth images taken at another time of year to help determine if a tree is a chestnut and document its precise location, Sandilands says.

The team plans to conduct annual flyovers to monitor the health of trees, as well as find new trees. If the researchers think they have discovered a tree, software in the lab can determine latitude and longitude based on the photo, making it easier to find and verify the trees on the ground, Roth says.

Stone says the mapping club and aerial team aim to create a Maine database for TACF, and update it through monitoring efforts on the ground and in the air.

“The interaction forestry students have with The American Chestnut Foundation is a great example of the learning continuum that exists from the classroom, to the laboratory, and finally on the ground — or in the air,” Shaler says.

“Activities such as this also benefit the educational experience by bringing those ‘real world’ experiences back to the classroom in the form of questions and a bigger context,” he says.

Rea says he’s impressed by the enthusiasm and energy of the first- and second-year students doing the fieldwork.

Members of the UMaine Mapping and GIS Student Club plotted trees that were discovered by member Dalton Herrick-Wagman in Orono during the summer using tools in the Barbara Wheatland Geospatial and Remote Sensing Analysis Laboratory.

“They’re learning a lot and it’s going to be good for them, but it’s especially going to be good for us. We’re going to find more large native trees that are hidden away and no one knows about,” he says.

Knowing where these trees are will provide information about conditions, such as soil and climate, in which the species grows best — valuable information for the upcoming restoration plantings, Roth says.

“We all stopped and agreed we were going to put some energy into this project,” Stone says. “It’s good for the university, it’s good for TACF. We’re showcasing our new technology, we’re using a new mapping club. Everything came together at the right time.”

The Maine chapter of TACF formed after the 1998 ice storm when trees were wounded and susceptible to blight, Rea says.

“We started with people with pieces of paper writing stuff down. Now we have planes flying over — just tremendous technology. For us, this is just fascinating,” Rea says of the resources available through UMaine. “They didn’t have this technology when I was in college, I’m learning this from the students and professors now.”

He says the work being done at UMaine is unique.

“Various chapters have tried this technology of using an airplane and camera, and have not been successful. They try and then just sort of back away from it. The University of Maine is the first one to put it all together,” he says. “Maine is putting it together first and the best.”

During the summer, Herrick-Wagman became the manager of the foundation’s Bradley orchard, where he maintains the property and tends to the trees. This fall he is completing an orchard inventory.

He also is working on an independent study with his adviser Michael Day, an associate research professor of tree physiology and physiological ecology, to document variation in the time of leaf flushing among lines of American chestnut tree hybrids in the Hartland orchard.

“The ideal chestnut tree will break bud after the frost, and then proceed to develop all of its leaves quickly so it can compete with surrounding vegetative species,” he says, adding his study could be vital to successfully reintroducing the tree to its native range.

Other students have participated in a stock comparison field trial, planting trees of different sizes — seeds, potted seedlings and bare-root whips — to determine how best to deploy the soon-to-be available sixth-generation restoration trees in the wild, where they will face competing vegetation and browsing deer.

“There are still many mysteries about the trees. We are learning more every year,” says Herrick-Wagman, who plans to continue restoration efforts after he graduates. He says it’s important to share the often forgotten story of the American chestnut tree with the next generation.

“They call it chestnut fever,” he says. “Once you get involved, you have to continue.

“It is my dream to one day go out into the forest with my children in autumn, and harvest chestnuts together as our great-grandparents once did,” says Herrick-Wagman. “It is also my dream to reinvigorate an economy which once thrived off of the renewable resources that came from the mighty chestnut trees.”

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