

AMERICAN

WINTER 2013

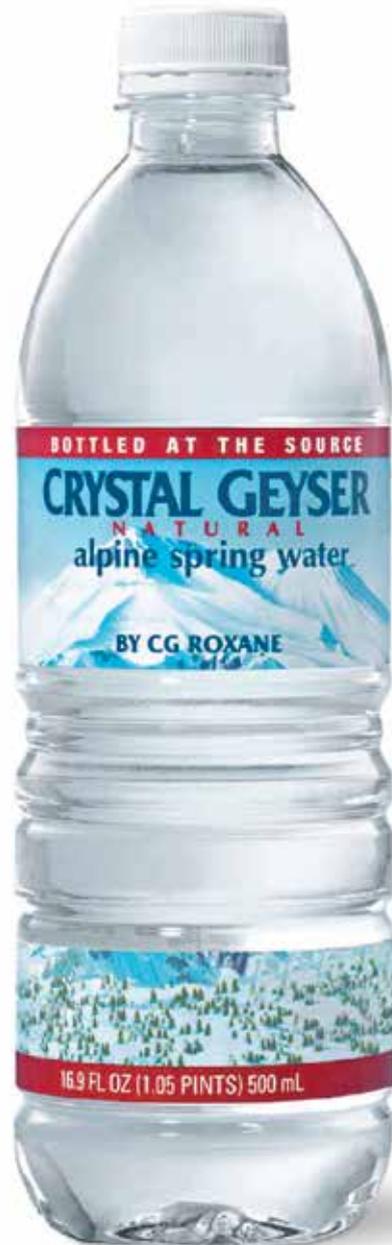
FORESTS



Will We Kiss Our Ash Goodbye?

SCIENTISTS SEARCH FOR WAYS TO STEM
THE DESTRUCTIVE TIDE OF THE EMERALD ASH BORER.

Water and trees. Trees and water.



Trees provide vital environmental benefits like cleaning the water we drink and the air we breathe. They also augment our ground water supply by preventing runoff and erosion. That's why Crystal Geyser alpine spring water is proud to sponsor the reforestation efforts of American Forests. Because bottling all of our alpine spring water directly from the source means that ensuring a clean and fresh water supply is not just part of our job, it's our duty. To learn more about our partnership with American Forests, visit www.crystalgeyserasw.com.



Departments

2 Offshoots

A word from our CEO

4 Tree Doctor

Advice from tree care experts

6 Treelines

20,000 sugar pines for Lake Tahoe, news from both coasts and one big shortleaf pine, plus:

FOREST FRONTIERS:

Dr. Jonathan Kusel recalls his most challenging and rewarding moments as an expert in forest-related policy.

PARTNERS: Our new program, Meeting ReLeaf, gets off to a great start partnering with ASAE in Texas.

WASHINGTON OUTLOOK:

Our 2013 wish list includes increased research and funding for urban forests, better-managed forests and a little help from friends like you.

40 An Ivy League Forest

By Kathiann M. Kowalski

Observe cutting-edge research experiments at the 3,500-acre Harvard Forest.

44 Earthkeepers

SUSTAINABLE FARMING IN HONDURAN COMMUNITIES

By Karim Slifka

Meet two Honduran farmers and the organization helping them achieve sustainability and a greater respect for the environment.

48 Last Look

By Benjamin Zack

CORRECTIONS

Fall 2012, "From Loose Leaf," p. 12: Longleaf pine, a species that is becoming extinct in parts of the Southeast, is incorrectly said to be in the Southwest.



Features

16 Will We Kiss Our Ash Goodbye?

By Dr. Deborah G. McCullough

Discover the latest insect wreaking havoc on the Midwest: the emerald ash borer.

24 Cook vs. Mohawk: Where the Tall Trees Grow

By Robert T. Leverett

Visit two forests as they compete for the title of the Northeast's tallest.

32 The Language of Bark

By Michael Wojtech

Follow one man's quest to create a different kind of field guide.

Growing Forests in Our Own Backyards

BY SCOTT STEEN

WHEN YOU HEAR the word “forest,” what do you think of? The mighty redwood forests of northern California with thousand-year-old trees rising hundreds of feet into the air? The majestic pine forests of the Pacific Northwest and Mountain West? The eastern hardwood forests, filled with an enormous variety of maple, ash, elm, oak, beech, aspen and other tree species?



What you may not think of is your local park, your community garden or

the trees that line your street. Many Americans live in forest ecosystems and don't even know it. But unlike forests in wilderness areas, they require routine — and substantial — human intervention to keep them healthy and growing.

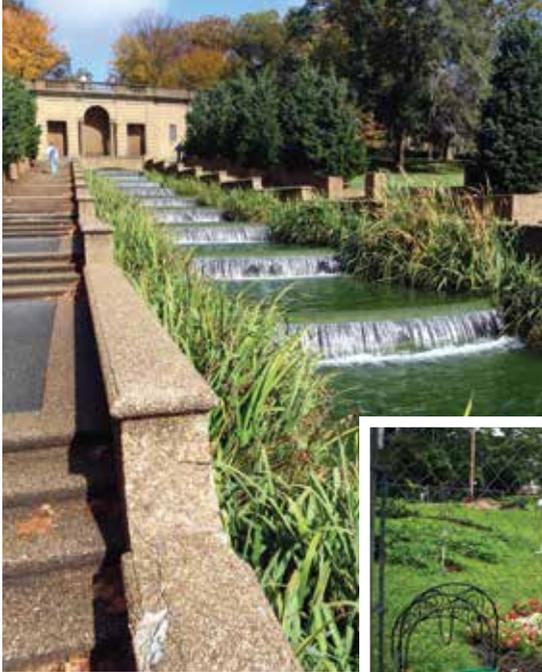
At American Forests, we define urban forests as “ecosystems composed of trees and other vegetation that provide cities and municipalities with environmental, economic and social benefits. They include street and yard trees, vegetation within parks and along public rights of way, water systems, fish and wildlife.”

Urban forests provide many of the same benefits that large, rural forests do. For example, they produce oxygen, remove pollution and greenhouse gases from the atmosphere, clean water and provide animal habitat. But trees and greenspaces in populated areas also produce a number of benefits that might surprise you. Various studies have shown:

- ▶ Residents living in greener surroundings report lower levels of fear and less aggressive and violent behavior.
- ▶ Street trees in urban communities are associated with a lower incidence of childhood asthma.
- ▶ Views of nature reduce the stress response of both body and mind when stressors of urban conditions are present.
- ▶ Shoppers shop more often and longer in well-landscaped, tree-rich business districts and are willing to pay more for parking and up to 12 percent more for goods and services.



PHOTO COURTESY OF LIVE BALTIMORE. BY PHYLICIA GHEE



Top: Meridian Hill Park, Washington, D.C.;
Bottom: Barclay residents in Baltimore work together to create and maintain gardens and greenspaces for children and adults to enjoy.

► The presence of larger trees in yards and as street trees can increase home values throughout neighborhoods by four to 15 percent.

During the past year, American Forests has been working with urban forest advocates and experts around the nation to identify best practices and create new ways to promote the benefits of urban forests. What we have found is truly inspiring — private citizens, nonprofits, corporations and local, state and federal agencies all working together to make cities greener, healthier and more livable. And it is not just happening in the biggest and wealthiest cities. Some of the best work is happening where you might least expect it.

In Milwaukee, city agencies have been working to understand — and map — their tree canopy for decades, using a variety of high-tech tools. Policymakers have also come to see trees as a critical tool in combatting stormwater runoff. Some results of these efforts include reduced maintenance demands, the conversion of a number of previously mowed areas into natural prairies and woodlands and the replacement of ornamental boulevard trees with large shade trees, creating a denser canopy with more environmental benefits.

In Baltimore, partners of all kinds — including city agencies, nonprofit groups, neighborhood associations and local businesses — have joined together to use urban forests to reduce urban blight, connect neighborhoods and create a sustainable, livable city. One initiative

has removed more than 20 acres of asphalt from inner-city schools to create new greenspace. Another is focused on revitalizing vacant lots in some of Baltimore's most blighted areas.

In Detroit, a city famously hard-hit by shifting economic and demographic trends, citizens and nonprofits have come together to do what the city is no longer able to do on its own. Nonprofit The Greening of Detroit has conducted tree plantings, educational programs, urban agriculture, open space reclamation, green infrastructure initiatives, green workforce development, advocacy and community building. One innovative initiative teamed local police officers and community residents to plant trees in their neighborhood, building a greater sense of community and trust by working together.

These communities and dozens like them are showing that forests and trees can make a profound difference in the everyday lives of people. Early this year, American Forests will be launching a new program designed to help cities around the country create healthier urban forests. Keep up to date on this and other urban forest initiatives at www.americanforests.org/urbanforests. 🌱



AMERICAN FORESTS

EDITORIAL STAFF

Publisher
 Scott Steen

Editorial Director
 Lea Sloan

Managing Editor
 Susan Laszewski

Managing Technical & Design Editor
 Sheri Shannon

Contributing Editor
 Michelle Werts

Editorial Assistants
 Alex Cimon / Julia Sullivan

Art Direction and Design
 Eason Associates Inc.
 Brad Latham, Art Director

American Forests (ISSN 0002-8541) is published quarterly by American Forests, 734 15th St. NW, 8th Floor Washington, D.C. 20005. Periodicals postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to *American Forests*, 734 15th St. NW, 8th Floor Washington, D.C. 20005.

American Forests' mission is to protect and restore forests, helping to preserve the health of our planet for the benefit of its inhabitants.

Phone: 202-737-1944
<http://www.americanforests.org>

**AMERICAN FORESTS
 BOARD OF DIRECTORS**

Ann Nichols, Chair
Chevy Chase, MD

Lynda Webster, Immediate Past Chair
The Webster Group, Washington, D.C.

Rod DeArment, Treasurer
Covington & Burling LLP, Washington, D.C.

Scott Steen, CEO (*ex officio*)
American Forests, Washington, D.C.

Zim Boulos
Office Environment Services, Jacksonville, FL

Rob Bourdon
Linkin Park, Sherman Oaks, CA

Michael Chenard
Lowe's, Mooresville, NC

Erin Fuller
Alliance for Women in Media, McLean, VA

Steve Marshall
The Davey Tree Expert Company, Kent, OH

Boyd Matson
National Geographic, McLean, VA

Megan Oxman
Bill & Melinda Gates Foundation, Seattle, WA

Susan Sarfati
High Performance Strategies, Washington, D.C.



tree doctor



Boxelder bug



Sugar maple, *Acer saccharum*

the soil is moist. Plant sugar maple or bur oak toward the top of the slope where the soil is drier. In a couple decades, when the top of the slope is ready for understory, plant ironwood or *Amelanchier* species.

Harmful Growth?

Q: Our red maple has a tumor-like nodule growth the size of a baseball on its trunk. Is this a burl or gall? Should it be removed? Will it hurt the tree?

A: Galls can be caused by fungi and insects. Burls can be caused by stress or injury. On branches and stems, both galls and burls result in modified wood tissue due to excessive cell division and enlargement. Although peculiar, galls and burls will not harm the tree, while removing them could cause a tree wound that could eventually be harmful to tree health. Your best bet is probably to leave the growth alone.

Encouraging Diversity

Q: Quite a few boxelder trees have grown up on our hill that runs down into a wetland. They are the only trees growing there except sumac along the edges of the woods. Should we let the hill remain just boxelder or plant another species of tree? We also want to plant native understory plants to make it a healthy ecosystem. The soil is a clay loam soil. Do you have any recommendations for what we should plant?

A: You want to create a miniature urban forest environment with a variety of trees so that they complement each other and so one single insect or disease doesn't infest a single species.

We would discourage planting additional boxelder because of the brittle nature of the wood and attraction of boxelder bugs. We recommend you retain as much sumac as possible. Try digging and moving some plants to other areas to start new colonies. Boxelder should be cut to a stump. Then, treat the cut stump with herbicide to prevent resprouting. Plant river birch toward the bottom of the slope where



Tree burl



Cedar-apple rust is a fungal disease that causes premature defoliation, distorted and pitted fruit and lesions on apple and flowering crabapple trees.

Bad Year

Q: This year, just about every deciduous tree on my property has some sort of disease. I have identified apple rust on crab trees, blueberry rust on blueberry bushes and even some sort of round ulcer on the more than 100-year-old ivy. I fear losing all the trees and shrubs.

A: Disease activity is dependent on weather — particularly on moisture in the spring during bud break. Every year is different. During a dry spring, fungicide application may be unnecessary. The challenge with diseases is that they cannot be determined in advance. The good news is that most woody plants will recover from the occasional bad year that they may endure many times during their lifespan.

Pipe Predicament

Q: I have a much-loved, old red maple whose roots cause chronic blockage in my sewer line. I have to spend about \$400 a year to have the line cleaned out or use chemicals to keep the roots down to prevent blockage. I've been told I should have a trench dug to pull out the old pipe and replace it with a new, straight pipe, but I'm concerned this will hurt my tree.

A: Visualize the tree root system as a flat pancake that spreads outward from the trunk, potentially in all directions, one and one half times the height of the tree. Place the trunk in the center of the pancake. Now, cut the pancake as close to the trunk as the sewer line. If 40 percent of the pancake is severed, then 40 percent of the canopy will die back in following years as the tree tries to rebalance the root system with the crown. Unfortunately, it is not possible to predict where in the canopy the 40 percent dieback will occur.

Sluggish Seedpods

Q: Our two maple trees did not drop their winged seedpods in the spring this year. Now, they are dark brown. Some are shedding leaves, while others are holding them on the branches. What could be the problem?

A: A number of maples produce fruit that mature or hang on until fall and may persist into winter. They include *Acer ginnala*, *Acer negundo*, *Acer palmatum*, *Acer platanoides*, *Acer pseudoplatanus* and *Acer saccharum*.

The fruit color of Norway maple, *Acer platanoides*, ranges from green to red, becoming tan and brown when mature.



Tree Doctor questions are answered by The Davey Tree Expert Company. Got questions? Visit www.americanforests.org/treedoctor.



Why did you choose to go into natural resource sociology?

I enjoy working with and studying rural communities and how they affect and are affected by resource management. I not only wanted to contribute to learning about rural places and forests, but to translate and share the knowledge I've gained in ways that result in improved resource management and social and economic outcomes.

What was the most difficult moment that you've experienced in pursuit of your work?

Working on President Clinton's Forest Ecosystem Management Assessment Team, which developed the Northwest Forest Plan, there was too little time to do all that was needed to make it as good as I wanted it to be. Knowing that what we were doing was going to affect the lives of tens of thousands of people across the Pacific West and that there was inadequate time to work through disagreement among scientists added to the difficulty.

Do you have a favorite story from your years in the field?

I have a number of favorite stories, and they often involve research that has real-world outcomes. Working on a participatory research project with mushroom harvester groups in south-eastern Oregon, I worked with others to conduct campground meetings in six different languages, including multiple southeast Asian languages, Spanish and English. We reduced violence in the woods and overcame a deep mistrust and fear of U.S. Forest Service officials, resulting in the harvesters themselves mapping and sharing their oftentimes secret mushroom sites with the Forest Service, which then planned timber harvesting and other activities in ways to protect those areas.

SIERRA INSTITUTE

FOREST FRONTIERS

Forest Policy Expert Jonathan Kusel

AMERICAN FORESTS SCIENCE ADVISORY BOARD member Dr. Jonathan Kusel is the founder and executive director of Sierra Institute for Community and Environment. His research focuses on social indicator use and evaluation, community well-being and assessment, and community-based group processes. Some of his accomplishments include leading an assessment of the first federally mandated, natural resource-focused collaboratives — the Resource Advisory Committees associated with the Secure Rural School and Community Self-Determination Act.



Emerald Bay, Lake Tahoe

GLOBAL RELEAF SHOWCASE

Sugar Pine Restoration, Lake Tahoe, Calif. and Nev.

DUE TO THEIR LOCATION IN THE north-central Sierra Nevada, the forests of Lake Tahoe enjoy wet, cool winters and warm, dry summers. These conditions make for some of the most productive timber lands in the United States. Equally impressive are the various river basins that drain the land, supplying water for millions of people and thousands of acres of farmland. These important watersheds are impacted by the health of their surrounding forests, which are comprised of a number of different tree species. One such species, however, is severely threatened by a non-native, invasive fungus, which is why American Forests is helping restoration projects in the area.

Sugar pines once comprised a quarter of Lake Tahoe's forests. These majestic trees are the world's largest species of pine. They boast a uniquely beautiful shape and enormous cones, which are often more than 14 inches long and four to six inches in diameter. Today, however, sugar pines account for less than five percent of the area's forest composition due to white pine blister rust.

Since 2011, American Forests has been working with the Sugar Pine Foundation, a nonprofit organization whose mission is to save Tahoe's sugar pines. American Forests has helped the Sugar Pine Foundation plant 20,000 trees in California and Nevada state parks near Lake Tahoe.

Although blister rust is incurable, roughly three to five percent of sugar pines possess a genetic resistance to the fungus. Every year, the Sugar Pine Foundation collects cones from sugar pines that are known to be resistant to blister rust and uses their seeds to grow seedlings at the CalForest Nursery in Etna, Calif. These young seedlings are then planted throughout the Tahoe Basin, where they will eventually produce their own seeds and spread throughout the forest. Bringing back the sugar pine will not only contribute to watershed health, but will also decrease fire risk and provide wildlife habitat and other scenic and recreation benefits.

Involving the local community in forest stewardship is central to this



SUGAR PINE FOUNDATION



H DRAGON/FLICKR

Sugar pine cone

Above: Kim Jardine (Patagonia Environmental Programs), Maria Mircheva (Sugar Pine Foundation executive director) and Hugh Denno (Sugar Pine Foundation intern) plant a rust-resistant sugar pine seedling.

American Forests Global ReLeaf project. Every year, the Sugar Pine Foundation hosts more than 500 students on outdoor field trips and plantings, giving them the opportunity to learn about forest health and plant thousands of trees in and around the Tahoe Basin. This project also educates and involves hundreds of other community members through its community plantings. 🌱

For more Global ReLeaf projects, visit www.americanforests.org/global-releaf.

If you weren't a scientist, what would you be?

A great horned owl.

Where is your favorite spot to experience nature and why?

In addition to my home in Indian Valley in the northern Sierra, the deserts of Utah. The area has always

held a special place in my heart for the austere beauty and the natural elements that push nature and the soul. That I met my wife there adds a bit as well. 🌱

For an extended interview with Dr. Kusel and other web-exclusive content, visit www.americanforests.org/magazine.

DID YOU KNOW?

Cases of sudden oak death in California increased tenfold last year.



RONALD BILLINGS

BIG TREE SHOWCASE

Shortleaf Pine

SPECIES NAME: Shortleaf pine, *Pinus echinata*

LOCATION: Smith County, Texas

CIRCUMFERENCE: 154 inches

HEIGHT: 91 feet

CROWN SPREAD: 66.5 feet

TOTAL POINTS: 262

NOMINATED: 2007

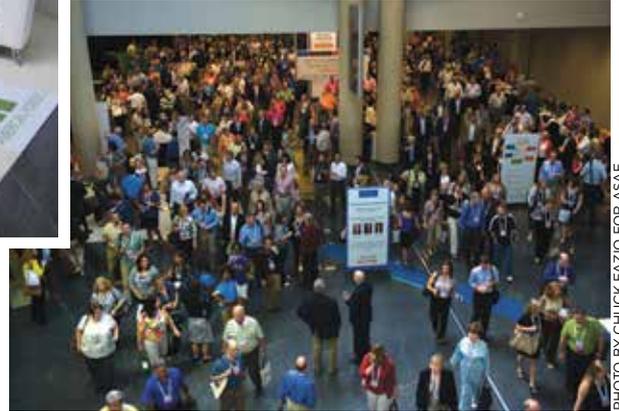
NOMINATED BY: Larry Jones

FUN FACT: This national champion is located at the Lindale Fishing and Hunting Club and is often visited by local tourists. The owners of the shortleaf pine say the tree was around long before the club was built in 1918, making the champ more than 100 years old. 🌲

Discover more champion trees at www.americanforests.org/bigtree.



Left: Green Meetings Lounge at the American Society of Association Executives (ASAE) Annual Meeting;
Below: Opening session of the ASAE Annual Meeting



PARTNERS

American Forests Introduces Meeting ReLeaf

AMERICAN FORESTS HAS ENABLED THE PLANTING OF MORE THAN 42 MILLION TREES through our Global ReLeaf program since 1990. Now, we are excited to have recently introduced a new program to follow in Global ReLeaf’s footsteps: Meeting ReLeaf.

Meeting ReLeaf is a way for organizations to offset the carbon emissions of their meetings and conferences by partnering with American Forests to plant a tree for every attendee. In addition to being a cost-effective way to sequester carbon, organizations get the satisfaction of knowing that the trees planted for their meeting in carefully chosen reforestation projects are helping to clean our air and water, enrich soil and provide habitat for wildlife.

In August, American Forests was proud to implement our first Meeting ReLeaf project in partnership with the American Society of Association Executives (ASAE). ASAE — a source of education and research to more than 21,000 members representing more than 10,000 associations and nonprofits — is no stranger to innovative ways of offsetting its carbon footprint. For its Annual Meeting and Expos, the society partners with host hotels to serve locally grown food and works with a travel agency that offsets travel emissions. Its participation in the Meeting ReLeaf program brings it one step closer to its goal of sustainable meetings.

“It’s great to be able to tell attendees that we offset our carbon footprint by planting trees in honor of every single one of them,” says Amy Ledoux, senior vice president of meetings and exhibitions at ASAE.

Held at the Dallas Convention Center in August, ASAE’s 2012 Annual Meeting and Expo drew more than 6,000 participants — their highest attendance in five years — meaning that together, we will be able to plant more than 6,000 trees in Texas, helping ASAE give back to the land and community that hosted the meeting. 🌱

To learn more about Meeting ReLeaf, visit www.americanforests.org/meetingreleaf.

DID YOU KNOW?

Whitebark pine seeds contain more calories per pound than chocolate.

Leaving a Legacy of Healthy Forests

WHAT BETTER LEGACY IS THERE TO LEAVE behind than one of healthy forests? You may have heard of bequeathing some of your estate to causes you care about in your will, but did you know that you can also name American Forests as a beneficiary of your 401(k), IRA or other qualified retirement plan?

American Forests is happy to have recently learned of a generous planned gift from one of our board members. Lynda Webster, founder and chairman of The Webster Group, has named American Forests as a beneficiary of her retirement plan. Having already given so much of her time and talents to American Forests’ mission, she’s now found yet another way of showing her commitment to helping us protect and restore our nation’s forests.

“A planned gift to American Forests is a wonderful way to contribute to the health of our planet,” says Webster. “I feel glad to know that my contributions will continue to help protect and restore our rural and urban forests for future generations.”

Designating American Forests as a beneficiary of a retirement fund is easy — usually just a matter of filling out one simple form. It will not only ensure your lasting support for our planet’s health, but may have tax benefits for your heirs as well. For more information about how you can include American Forests in your plans, contact our development department at (202) 737-1944. 🌱



Redwood trees line a hiking trail at Hoyt Arboretum.

FRANKENSTOEN/FUCKR

FROM THE FIELD

PORTLAND, ORE.

Amanda Tai, Public Policy Manager

THIS FALL, I TOOK A TRIP TO Portland, Ore., to attend The Wildlife Society's annual conference. I found it interesting that the conference logo combined Portland's city skyline, its major river the Willamette and the wildlife habitat that permeates the city and its surrounding area. Portland is the perfect example of the complex intersection of wildlife habitat and urban environment. Previously, I had only experienced the downtown area of



Portland, so this time, I was curious to learn more about how wildlife habitat incorporates itself into the city.

To start, I paid a visit to Portland's Hoyt Arboretum, just a quick trip from the downtown area. The arboretum's extensive collection of trees provides food and shelter for birds as part of a larger wildlife corridor to the coastal mountains. Hiking around the arboretum's trails, I forgot that I was still in a city. The incorporation of parks and greenspaces, like the Hoyt Arboretum, into a city allows wildlife to have a refuge in an urban environment.

The urban wildlife theme continued at the conference, where several

presenters talked about the growing wildland-urban interface and the conservation challenges that come with urban development. National Science Foundation grant programs like the Urban Long-Term Research Area (ULTRA) and Integrative Graduate Education and Research Traineeship (IGERT) are funding graduate student research on urban ecosystems and wildlife habitat. As we continue to build our Urban Forests program at American Forests, we are committed to addressing the vital role of forests in cities, including the urban wildlife that depends on them. 🌿

COOKSBURG, PA.

Sheri Shannon, Big Tree Program Coordinator

DALE LUTHRINGER, environmental education specialist at Cook Forest State Park, and Bob Leverett of the Native Tree Society invited me to give a presentation about the National Big Tree Program for an advanced tree-measuring workshop this past spring.

Attending the workshop was a great opportunity for me to meet members of the big tree community and network with other tree enthusiasts. As we hiked through the park, I got a chance to chat with Scott Wade, state coordinator for Pennsylvania's Champion Tree Program, and Turner Sharp, volunteer for West Virginia's Big Tree Program, and become more acquainted with some of the people that make the National Big Tree Program possible. I also met Joan Maloof, founder of the Old-Growth Forest Network — a project to educate people about old-growth forests and their preservation — of which Cook Forest State Park was the first forest to become a member.

Later that evening, I gave my presentation at the Sawmill Center for Arts in a big open room that was once part of the old sawmill. In the back of my mind, I kept thinking, "What do you



SHERI SHANNON/AMERICAN FORESTS

Advanced Tree Measuring Workshop attendees at Cook Forest State Park

tell a room full of people who already know and support your program?" The answer? Lots of stories and funny anecdotes about my experience as the program coordinator. Overall, the trip to Pennsylvania was a major success, and American Forests looks forward to partnering with the Native Tree Society for future measuring workshops. 🌿

Read more about Cook Forest State Park on page 24.

SAN DIEGO COUNTY, CALIF.

Kezia Hawkins, Executive Assistant to the CEO

EARLY THIS FALL, I, ALONG WITH several colleagues and members of the American Forests board of directors, had the amazing opportunity to tour one of American Forests' largest

reforestation projects, which is located in Cuyamaca Rancho State Park in San Diego County, Calif. (see *American Forests*, Winter 2012)

In 2003, 95 percent of the 25,000-acre park was charred by the state's largest wildfire in recorded history, the Cedar Fire. The forest could not withstand the severe intensity of the fire and very little natural regeneration has taken place since. The damage has had a drastic effect on the local ecosystem, wiping out wildlife habitat, increasing erosion, decreasing water quality and putting massive amounts of stored carbon back into the atmosphere. American Forests began partnering with California State Parks in 2008, in cooperation with CAL FIRE and Conoco Phillips, to help restore Cuyamaca Rancho State Park.

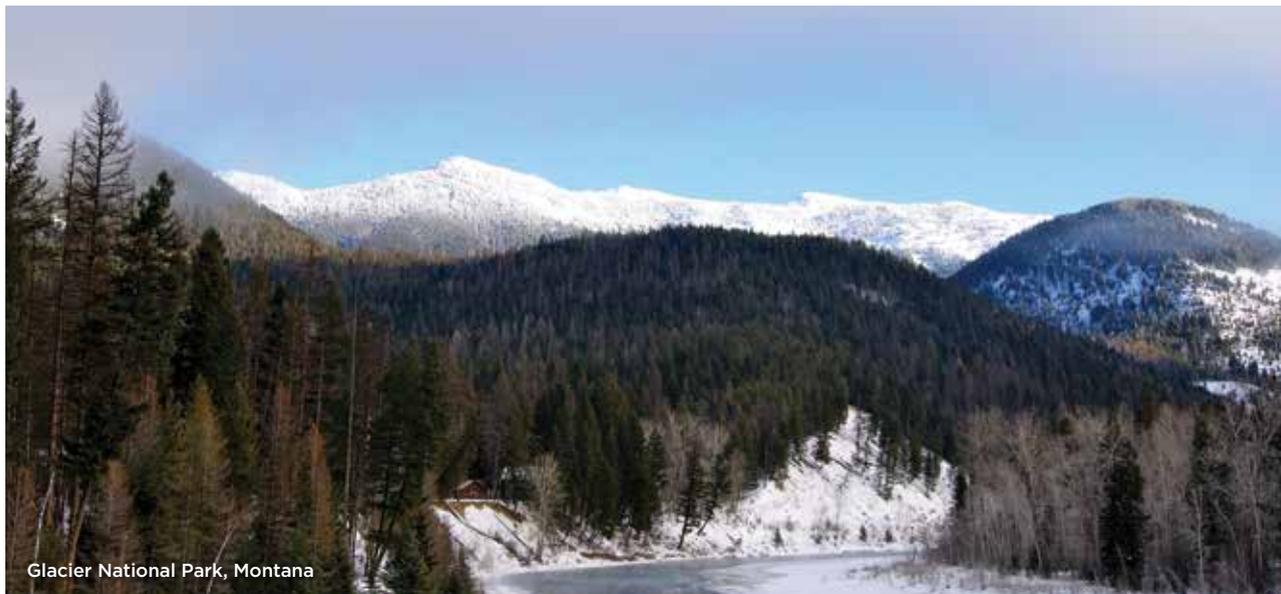
Being a D.C. native, I had never seen anything like the devastation of a major wildfire, other than what I had seen on the news. The tour gave me a real sense of the fire's effect and a greater appreciation for the work that goes into restoring damaged forests and all the volunteers that devote an enormous amount of time to the project. Our board and staff also gained a clearer view of the project's progress and impact. I believe our vice president of development summed up the experience best by saying, "Seeing the Cuyamaca project was a refreshing reminder about why we are all in the conservation business." 🌿

To learn how you can give to reforestation efforts like the Cuyamaca Rancho State Park project, visit www.americanforests.org/donate.



AMERICAN FORESTS

American Forests board and staff members in Cuyamaca Rancho State Park



DR-SCOTT/FLICKR

Glacier National Park, Montana

FROM LOOSE LEAF

Forests, Snow and Floods

After studying four creeks in Colorado, Kim Green and Younes Alia provided new research on how deforestation may be affecting floods. Their findings, published in *Water Resources Research*, show that deforestation at least doubles the number of floods in waterways affected by forested areas. In the area studied, they discovered 10-year floods were occurring every three to five years, 20-year floods were occurring every 10 to 12 years and 50-year floods were occurring every 13 years. And deforestation is just one threat to the forests surrounding these waterways.

The Mountain West is becoming especially susceptible to white pine blister rust and mountain pine beetles. More than 40 million acres of forest across 10 states in the West are thought to be dead or dying. The high-altitude forests affected by these threats protect the area's snow and water supply, which means there could be health and financial consequences. For instance, flood damage costs — which the National Oceanic Atmospheric Administration already reports at \$7.82 billion per year as the 30-year average — will inevitably rise if we continue to lose high-elevation forests.

In order to help mitigate these risks, American Forests has launched its Endangered Western Forests initiative, which you can learn more about by visiting www.americanforests.org/ewf. 🌿



Exercising in the urban forest

ALEX E. PROIMOS/FLICKR

Urban Forests for Healthy Healing

The National Park Service and Institute of the Golden Gate have connected health and urban forestry with “Park Prescriptions.” This new resource provides a compilation of scientific discoveries relating to the positive effects of being exposed to nature. Findings such as “Runners reported lower levels of stress and depression when exercising in nature than when exercising in an urban setting” show how this is especially important for city life. 🌿



Mayan city of Tulum ruins, Yucatán Peninsula, Mexico

A Lesson From the Past

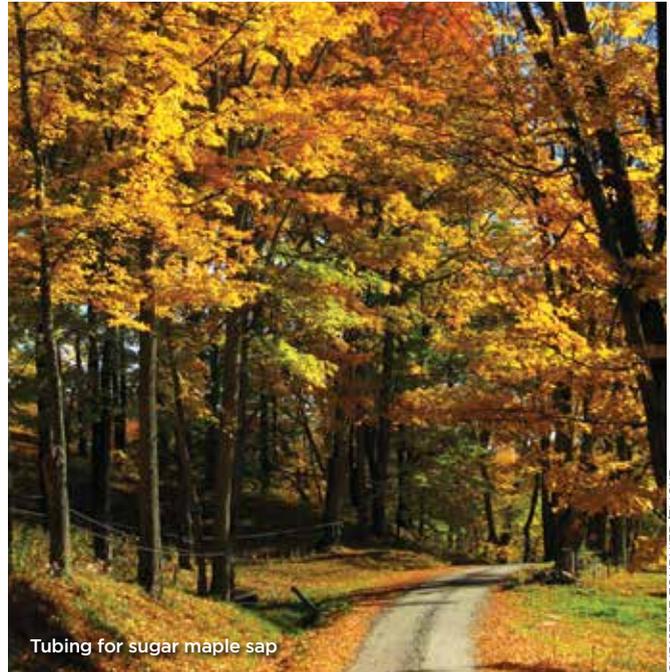
New research is suggesting that agricultural deforestation may have led to the demise of the Mayan people. An article in *Geophysical Research Letters* identifies a five to 15 percent drop in precipitation during the Mayans' time in Mesoamerica. The research also suggests that up to 60 percent of the decline in rainfall can be attributed to deforestation. As this civilization attempted to make room for its growing population, the dense vegetation of Central America suffered. The Mayans exemplify what altering the environment may mean for our future. 🌱

On Time Departures

According to Dr. Bridget Stutchbury and her colleagues at York University, climate change may be posing a direct threat to the wood thrush and other songbirds. Evidence shows that the birds are relying on strict internal clocks rather than changes in the local environment to determine their departure dates for their migration towards North America. But climate change has been causing a shift in the availability of the bird's food sources at their destinations. The rigid migration schedule may cause a discrepancy between the birds' arrival and the seasonal peak of necessary resources. 🌱



Wood thrush



Tubing for sugar maple sap

Bitter Tidings for Sweets

The maple sugar industry is important to the culture of the Northeast, but with changing temperatures due to climate change, new research is predicting a modification to the tradition. The U.S. Forest Service, along with Cornell University, has been observing sugar maples for decades and is noting a shift in the production season. In the sugar maple's southern range, the season is not only starting earlier, but becoming shorter. The Proctor Maple Research Center of the University of Vermont found that the season decreased by an average of 10 percent across northeastern states over the past 40 years. 🌱

For *Loose Leaf* every day, follow our blog at www.americanforests.org/blog.

WASHINGTON OUTLOOK

A New Year for Forest Policy

IT'S A NEW YEAR FLAVORED BY a new session of Congress and the start of a new term for President Obama. Even with the re-election of incumbent members of Congress and the continuation of the same administration, new faces are arriving on the scene. It isn't everyday — or every year for that matter — that such an opportunity arises. That is what it is: an opportunity. Though American Forests finds itself in all-too-familiar battles on ages-old legislation in every session, each year we also win a few new battles and gain some ground — and hopefully some forests, too!

Last year, American Forests reaped several successes benefiting our nation's forests. The Collaborative Forest Landscape Restoration (CFLR) Program received bipartisan support in Congress, ensuring full funding and the addition of 10 new projects, while the Farm Bill passed the Senate with healthy debate on numerous amendments. Our efforts helped pass positive amendments, like the additional permissible purposes for the Community Wood Energy Program grants, and blocked amendments that would have repealed the Forest Legacy Program, Forest Stewardship Program and Conservation Reserve Program.

But we can achieve more. This year, American Forests is continuing to alter our strategy and “upping” our game. We will be focusing our efforts to align more strategically with American Forests' new programmatic goals, increasing our education of new congressional and administration members and staff, and maintaining leadership roles in various collaborations — all while expanding and strengthening our voice.

In alignment with Global ReLeaf and our other forest restoration programs, we will continue our strong

advocacy for increasing efficiency and effectiveness of forest restoration activities: highlighting CFLR project results, increasing transparency and streamlining on-the-ground restoration efforts. With our renewed commitment to urban forests, we will continue the call for increased research efforts and funding, while working with specific cities to help them understand the benefits their urban forest provides and how to leverage that information for increased community awareness. In addition, our Endangered Western Forests initiative provides us an opportunity to have a regional impact that is felt

We have a secret weapon that has not been utilized to its fullest potential: you. Yes, you.

U.S. DEPARTMENT OF AGRICULTURE



Highland Lakes, two unique twin lakes located in Stanislaus National Forest, are the headwaters for two major watersheds in northern California. The 2012 Amador-Calaveras Consensus Group Cornerstone Project focuses on restoring watersheds, streams, forest structure and ecological processes to create more resilient vegetation.



View of Maroon Lake in White River National Forest, the top recreation forest in the nation. The White River National Forest Future Initiative was part of the 2011 Regional Collaborative Forest Landscape Restoration Program to restore species diversity, improve wildlife habitat and reduce fire hazards.

nationally. Working with western policymakers, we can help affect how our forests are managed in order to be more resilient and withstand insect infestations, disease, warming climate and other stresses.

American Forests will continue leading and participating in collaborative efforts with a varied group of organizations and associations, as we believe the best policy answers are found through collaborative processes. It is essential to diversify our partnerships to ensure that only the most comprehensive and effective policy is endorsed. A wide-ranging stakeholder group also guarantees the support of policies that can be implemented on the ground.

Lastly, and maybe most importantly, this year, we are expanding our voice. We have a secret weapon that has not been utilized to its fullest potential: you. Yes, you. For years, American Forests has been sending policy updates and alerts, but we have not requested any action. We believe the way to make the biggest impact on forest policy is to strengthen and expand our voice. To do this, we need you to join our advocacy efforts. Restoring and protecting our forests is not just a job for American Forests; it is a job for the American public.

American Forests is looking forward to the 113th Congress and President Obama's second term. We plan to seize this opportunity to make

a significant difference in our nation's forests. We hope you will join us in our fight. Visit our Action Center at www.americanforests.org/action-center to find out how. 🌿

Jami Westerhold writes from Washington, D.C., and is American Forests' director of strategic initiatives.

DID YOU KNOW?

Urban areas have lost more than 600 million trees to development over the last 30 years.



Will We Kiss Our

Ash trees in a Toledo, Ohio, neighborhood in June 2006

An ecological catastrophe is unfolding across the upper Midwest and is spreading outward, as scientists struggle to find solutions to the latest insect invasion: emerald ash borer.

BY DR. DEBORAH G. MCCULLOUGH

IT'S NOT LIKE WE

haven't seen this sort of thing before. In the early 1900s, people who lived in the eastern U.S. watched chestnut blight, an exotic pathogen, roll through, killing large and small trees and altering

the hardwood forest forever. A few decades later, Dutch elm disease, an exotic pathogen carried by an exotic bark beetle, came through, killing majestic American elms along city streets and in forests. Today, more than

D. HERMS

Ash Goodbye?

BOTTOM: DAVID CAPPAERT; TOP: D. HERMS



Top: Toledo, Ohio, trees after emerald ash borer in August 2009; Bottom: Emerald ash borer

450 species of non-native forest insects and at least 17 significant forest pathogens are established in the U.S. Most go unnoticed, but about 15 percent have had major consequences. And it's starting again.

Emerald ash borer, an Asian insect first identified in Detroit, Mich., in 2002, has become the most destructive forest insect to ever invade the U.S. Tens of millions of ash trees have already been killed in forests and swamps, along waterways and in urban, suburban and rural neighborhoods. Populations of emerald ash borer, commonly known as EAB, have been found in 18 states, along with Ontario and Quebec. And almost



DAVID CAPPAERT

Top: Adult emerald ash borers mating; Bottom: An adult emerald ash borer feeding on a leaf



DAVID CAPPAERT

assuredly, there are more populations, simmering away, that haven't yet been discovered.

BEAUTIFUL KILLERS

Adult EAB beetles are beautiful insects and amazingly good at finding and colonizing ash trees. Unlike many insects, EAB does not appear to produce any long-range pheromones to attract potential mates. Instead, the beetles use their vision and the mix of chemicals emitted by ash leaves, bark and wood to find their host trees and each

other. They are particularly attracted to the blend of compounds given off by stressed or injured ash trees and to specific shades of purple and green. Once beetles find an ash tree, they nibble along the margins of leaves throughout their three- to six-week life span. Leaf feeding is important for the beetles to mature, but it has virtually no effect on the trees. After 15 to 20 days of leaf feeding, the females begin to lay a few eggs at a time, tucking them beneath bark flaps or in bark crevices. Many beetles mean many eggs — bad news for the tree when they hatch.

The tiny, cream-colored EAB larvae hatch from their eggs in mid-summer and chew through the rough outer bark to reach a layer of inner bark, called phloem. Phloem is the tissue used by trees to transport carbohydrates and other nutrients from the canopy down to the roots. The larvae feed in s-shaped tunnels, called galleries, for several weeks in summer and early fall. As the larvae grow, the galleries increase in size. Galleries often etch the outer ring of sapwood, which ash trees use to transport water up from the roots to the canopy. A few larvae feeding in a large branch or on the trunk of an ash tree have little effect on the tree. Over time, however, as the density of larvae builds, the ability of the tree to transport nutrients and water is disrupted by the galleries. The canopy begins to thin, and large branches may die. Eventually, the entire tree succumbs.

Once EAB populations begin to build, nearly all ash trees in the forest, swamp or urban area are likely to become infested and die — often within a time span of only a few years. In southeast Michigan, where EAB was first established, scientists have documented 99 percent mortality in forest stands dominated by green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*) or black ash (*Fraxinus nigra*). More than 60 million ash trees, ranging from one inch to five feet in diameter, have been killed by EAB in this area alone.

We know most adult EAB stay within about a half mile of where they emerge. In any population, however, at least a small proportion of beetles seem to fly farther — for reasons that are as yet unknown. Adult EAB are relatively good fliers; they're much more agile and streamlined than bark beetles, for example. Mature females are probably capable of flying three miles. Unfortunately, EAB has been moved across longer distances by people who unknowingly transported infested ash trees from nurseries or recently cut logs or firewood. Once an ash tree dies or is cut, the phloem dries out, and it will not be re-infested, but any larvae already

under the bark can complete their development and emerge as adults. Federal and state quarantines have been imposed to regulate the transport of ash trees, logs, wood and related materials to reduce the risk of additional EAB introductions.

In fact, accidental transportation of infested ash is probably how EAB got to North America in the first place. The introduction of EAB into the U.S. and Canada almost certainly occurred when infested wood crating or pallets originating in China arrived in the U.S. In its native range in China, EAB functions as a secondary pest, colonizing only severely stressed or dying Asian ash trees. In North America, however, native ash trees have no co-evolutionary history with EAB and have few defenses to resist this pest. While EAB beetles still prefer to colonize stressed ash trees, they will also readily infest — and eventually kill — healthy ash trees.

THE HIGH COSTS OF INFESTATION

The potential economic and ecological impacts of EAB are staggering. National inventory data show more than eight billion ash trees in U.S. forests and woodlands, with a value estimated at more than \$280 billion. Ash trees are especially abundant in eastern forests, but the mother lode of diversity is actually in the southwestern U.S., where at least eight of 16 native ash species occur.

Cultivars of green ash, white ash and velvet ash (*F. velutina*) have also been planted in landscapes and along roadways across the U.S. for decades. Because ash was so commonly propagated, nurseries sustained millions of dollars in losses when the EAB quarantines were imposed. Hundreds of millions of mature urban ash trees are growing on municipal and private land in the U.S. A 2010 analysis in *Ecological Economics* examined the potential costs of either treating or removing 50 percent of landscape ash trees in urban areas affected by EAB. Projected costs would exceed \$10.5 billion by 2019. If suburban ash trees are included, costs nearly double.

Estimating costs of treatment or removal, however, does not do justice to the full economic impacts of losing ash trees, especially large trees, in residential and developed areas. Ash trees comprise up to 50 percent of the municipal trees growing along boulevards and in parks in some cities. Once ash trees die, they begin to decay relatively quickly, posing hazards to homes, vehicles and people. Losing a substantial portion of mature trees dramatically alters the appearance of neighborhoods and diminishes property values. Stormwater run-off increases. Shade decreases, and air conditioners run longer. In southeast Michigan

municipalities, water use soared as a result of widespread ash mortality, resulting in surcharges levied by the regional water authority.

Economic projections, of course, do not address the ecological consequences likely to occur following extensive mortality of ash trees in forests, particularly in areas where ash is a major component of the overstory. Green ash, the most widely distributed ash in the U.S., grows in many types of soils and is often abundant along rivers, streams and other waterways, as well as in forests. White ash is also widely distributed, frequently growing in mixed stands with oaks, maples and other hardwoods.



Larvae feeding on the trunk of an ash tree

DAVID CAPPAERT



ART WAGNER, USDA APHIS PPQ, BUGWOOD.ORG

Larval galleries

Ash trees cut down due to EAB



Many areas — from individual neighborhoods to large cities — are beginning to implement an integrated approach for EAB management.

spent on a major effort to identify, evaluate, rear and release parasitoid wasps that attack EAB in China. Parasitoids are tiny, highly specialized wasps that lay eggs on immature stages of a host insect. After hatching, the immature wasp feeds on the host insect, eventually killing it as it completes its own development. Scientists from the U.S. and China worked together to identify parasitoids that appeared to be important natural enemies of EAB in China. Selected parasitoid species were then screened in quarantine facilities to determine their “host range” and assess whether they might pose any ecological risk in North America. Two species of parasitoids that attack EAB larvae and one tiny wasp that attacks EAB eggs are now being reared in large numbers in a U.S. Department of Agriculture facility and released in states with EAB infestations. Whether these Asian imports will be able to actually control EAB populations and prevent damage to ash trees may take years to determine.

In the meantime, scientists are learning more about native, natural enemies of EAB. In the past, native parasitoid wasps in the U.S. have evolved to find and attack the larvae of native beetles, such as bronze birch borer, that colonize stressed or dying trees. Until recently, however, native parasitoids rarely, if ever, attacked EAB larvae. At least one native parasitoid, *Atanycolus cappaerti*, now seems to be “learning” about EAB. This tiny wasp had never been studied and did not even have a scientific name until 2010. In the last five years, *Atanycolus cappaerti* has become increasingly common, usually in sites characterized by

heavily infested, dying ash trees. Relatively little is yet known about this wasp and whether it will be able to slow the population growth of EAB.

A bright spot in the EAB saga involves blue ash (*F. quadrangulata*), a North American species which ranges from southern Michigan to Kentucky, Tennessee and Missouri. Scientists recently determined that blue ash is relatively resistant to EAB, making it likely that this species will survive the EAB invasion. Understanding more about the chemical and physical traits that underlie blue ash resistance may eventually lead to selective propagation of resistant ash cultivars.

Many areas — from individual neighborhoods to large cities — are beginning to implement an integrated approach for EAB management. Healthy landscape ash trees, for example, can be treated with a systemic insecticide, while urban ash in poor condition can be removed, reducing the amount of ash phloem available for EAB reproduction. Another management option involves using girdled trees as “trap trees.” Once girdled trees have been debarked in fall or winter, the EAB larvae in the trees will be killed before they can complete development. A pilot project called SLAM (SLOW Ash Mortality) was launched in two EAB sites in upper Michigan in 2009 to evaluate different management options. Results to date show the combination of insecticide injections, selective ash removal and trap trees is slowing the growth of the EAB population in the two areas.

On the other hand, there is still plenty of cause for concern. While practical for urban and suburban trees, insecticides are not a solution for the millions of ash trees in forested or riparian settings. While many scientists are optimistic about the potential success of the Asian wasps imported for biological control, others point out that there are few examples of parasitoids controlling any phloem-feeding insect. Moreover, federal funding for activities such as EAB detection, research and outreach is expected to be cut by 75 percent in the next year. It seems inevitable that we will most likely kiss millions more ash trees goodbye before we find a good solution to EAB. ↓

Injecting an ash tree with insecticide to protect it from EAB



DEBORAH G. MCCULLOUGH

Dr. Deborah G. McCullough is member of the American Forests Science Advisory Board, a professor of forest entomology at Michigan State University and a member of a multi-disciplinary working group assigned to identify nonindigenous forest insects and pathogens established in the U.S.



NABB events bring communities together to develop plans for their ash trees.



Large ash trees tagged by NABB in West Lafayette, Ind., raise awareness of what may be lost to EAB.

Taking Action Against EAB

If you are wondering what can be done about this threat to the environment, you are not alone. As emerald ash borer spreads across the United States, concerned communities, experts and policymakers are looking to educate and take action. The most effective and influential protection efforts have been seen at the community level.

One program that targets small communities and neighborhoods is Neighbors Against Bad Bugs (NABB) in Indianapolis. Born out of Purdue University, NABB pairs Purdue Master Gardeners, neighborhood associations, county extension educators and concerned citizens. Together, they work to educate the public and use their cooperation to save trees while keeping communities safe. This program was implemented in Indianapolis' King Park neighborhood during fall 2011. Citizens developed the Ash Borer Action Team (ABATe) and began by surveying ash trees and available planting spaces. Through a combination of treatment, removal and new plantings, the team was able to help preserve the aesthetic

beauty of the King Park neighborhood. The NABB program is only one example of community efforts to address the EAB issue, though.

Through the Cooperative Emerald Ash Borer Program — a cooperative of Midwestern universities — and the United States Department of Agriculture, several resources have been made available to those who want to protect against the spread of EAB. One activity that has been of growing concern for many regions is firewood transportation. For decades, this raw product has been moved throughout the country, with little regard for what may be living inside. The cooperative has compiled maps and policies developed by 15 states, from Minnesota in the west to New York in the east, in order to protect against the spread of EAB.

Individual states are also releasing prescriptive information for proactive community members wanting to get involved. The University of Minnesota Extension and the Minnesota Department of Natural Resources released "Ash Management Guidelines for Private Forest Landowners" to educate the public regarding the history of ash trees and the EAB threat. Faculty from five Midwestern universities developed a

bulletin describing "Insecticide Options for Protecting Ash Trees from Emerald Ash Borer," and Purdue University offers a similar resource with insecticide options for homeowners based on several tree and environmental features.

There are many options for individuals looking to help fight the EAB problem. State and local institutions are becoming increasingly aware of the threat, and with the support of neighborhood programs like NABB, more information is being uncovered. It is the support of concerned citizens that fuels protection efforts.

For details regarding ash trees, EAB and how to get involved, visit the Michigan State University-run website www.emeraldashborer.info. This resource contains a compilation of information from the U.S. Forest Service, Purdue University, Michigan State University and The Ohio State University. These institutions work together to provide information from all states and Canadian provinces currently affected by EAB: Michigan, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Minnesota, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin, Ontario and Quebec.



Cook

vs.

WHERE THE TA

BY ROBERT T. LEVERETT

MIRROR, MIRROR ON THE WALL, which northeastern forest is the tallest of them all? Is it Cook or is it Mohawk? The mirror isn't telling, but the Native Tree Society (NTS) is devoting a lot of time and energy to answering that question.

Since 1997, NTS has measured and monitored the outstanding trees of all native species in Mohawk Trail State Forest in Massachusetts and

FAR LEFT: NICHOLAS A. TONELLI/FLICHR

Facing page: Tom's Run in Cook
Forest State Park; This page:
Mohawk Trail State Forest



Mohawk

ALL TREES GROW

Cook Forest State Park in Pennsylvania. These measurements challenge us to think about great eastern forests of the past and what could be possible in the future. This is what brings me to these forests time after time to measure new giants.

On this particular day, it is beautiful outside, and the white pines of Mohawk Trail State Forest are calling. I park my car at the forest's headquarters and



Will Blozan scales Seneca Hemlock to use the tape-drop method to accurately measure the tree's height. From the top, he drops a weight attached to the end of a tape measure straight down to the base of the tree.

walk up a paved road lined by towering pines. Cutting into the forest, I leave the hard, impersonal asphalt and feel the vitality of the soft duff beneath my feet. I'll first check on the Pocumtuck Pines, one of Mohawk's tall-tree groves. The Cabin Pine — named because it watches over the occupants of rustic cabin number six — lifts its feathery crown 160 feet above roots firmly anchored in the soil. It is the first of the "160s" that I encounter. I pass through a gate and head



ROBERT LEVERETT



TIMOTHY ZELAZO

Top: A 152-foot white pine dedicated by NTS to the memory of Rachel Carson; Bottom: An avenue of pines in Mohawk Trail State Forest

downhill, passing the Trees of Peace. I could happily spend my whole day in this tallest of Mohawk's groves, but the inner voice I have come to trust is telling me my search continues in the Rachel Carson Grove today. I arrive at my work destination and will be occupied for several hours, oblivious to the ticking of the clock. I begin the search by visually scanning the tops of the trees looking for pines that combine long distance and high crown angle, the mark of truly tall trees.

PLACES OF INSPIRATION

Mohawk Trail State Forest covers 7,758 acres and boasts a section of the original Mohawk Indian Trail that connected the waters of the Hudson and Connecticut Rivers and served as both a trade and war-making route from the early 1600s until the end of the Revolutionary War. Being a younger woodland, Mohawk has the beauty and appeal of an athlete in his or her prime. One does not think so much of wisdom, but vitality. It has become an adult that has shed the awkwardness of adolescence and entered into the full flower of its arboreal potency.

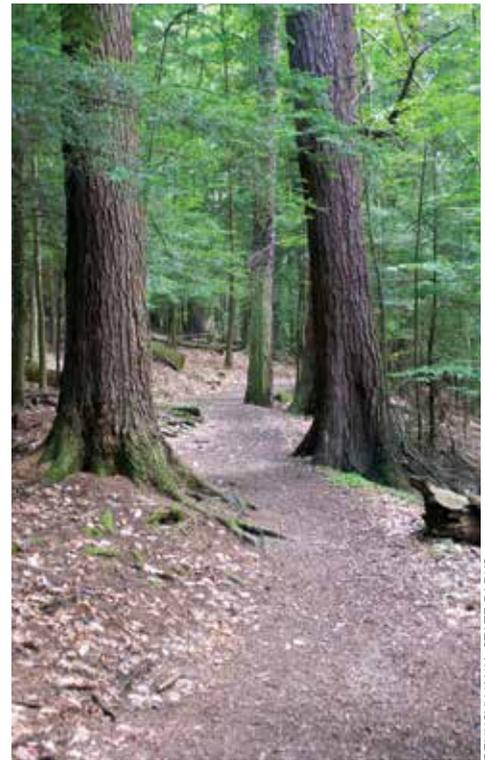
In comparison, Cook Forest State Park, located on the Allegheny Plateau of western

WILL BLOZAN



PHOTO BY D. LUTHRINGER

Old-growth timber along the Seneca Trail in Cook Forest



PENNSYLVANIA STATE PARKS

The towering white pines and hemlocks in Forest Cathedral make it a national natural landmark.

Pennsylvania, is the forest one would expect in a scene from a Tolkien novel: soaring trunks, mossy logs, a timeless appearance, truly a fairytale setting. The old pines, thrusting their lofty crowns skyward, appear wise. One looks upward through a hardwood canopy more than 100 feet high to the gnarled, weather-sculpted crowns of the pines towering above. Borrowing an idea from the Iroquoian and Algonquin peoples, we call these pines the Standing Ones; they connect earth to sky and hold the memories of the cycle of countless seasons.

Among Cook's approximately 11,000 acres are 2,355 acres of old growth — forests that have been shaped by natural processes over several centuries with minimal human intervention. Cook was the first state park in Pennsylvania established specifically to preserve a national natural landmark, the Forest Cathedral. Though Cook's sizable acreage of old growth is sufficient reason to hold it in reverence, there is something more, a little-known fact. Within its forests, the park holds claim to the tallest trees in the Northeast, great white pines between 250 and 350 years old.

Unlike Cook, with its more than 2,000 acres of old growth, Mohawk sports 500 old-growth acres

at most, and instead of 250 to 350-year-old pines, Mohawk's pines are typically between 100 and 200 years old. They are also mostly second growth — forests that have been directly manipulated by humans through logging and other forest-clearing actions. As a consequence, I often think of Mohawk as the godchild of Cook. Although it has old growth, most of Mohawk is younger forest, giving us an opportunity to observe the process of succession as it moves toward Cook's status as an old-growth treasure.

FRIENDLY COMPETITION

In 1997, Cook Forest State Park's then-new nature interpreter and educational specialist Dale Luthringer, a highly disciplined former marine, joined the newly founded NTS. He quickly took to tree measuring and became an invaluable member. He understood the role of numbers in presenting Cook to the public as the outstanding forest that it is. At the time, as the executive director of NTS, I was focusing on both Mohawk and Cook and the role each plays in showcasing the Northeast's tallest trees. A comparison of the two properties seemed logical and could serve both forests well, and thus, a friendly



TIMOTHY ZELAZO

Jake Swamp Pine



PHOTO BY D. LUTHRINGER

Cook Forest lays claim to the tallest known hemlock north of the Great Smoky Mountains, the 147.6-foot Seneca Hemlock.

competition was born to discover which of these forests could claim to be the tallest.

To do the job right, we needed more exacting measuring methods than were commonly employed in commercial forestry or champion tree hunting. We wanted to be able to measure tree height from the ground using state-of-the-art instruments and trigonometry. This became possible with the introduction of the infrared laser rangefinder used in combination with an inclinometer. To be sure that our technique and these instruments were producing accurate results, however, NTS members had to scale some of these massive trees to confirm our ground-based measurements by dropping a tape. We discovered that with this technology, the prevalent source of error that plagues tape and clinometer users — the problem of the top of the tree not being positioned vertically over its base — was eliminated.

As I stand in Rachel Carson Grove, all the measuring challenges are in front of me: trees that

lean, trees that have complicated, nested tops and trees with their highest sprigs obscured. I meet the challenge with forest experience, mathematics, state-of-the-art equipment and a generous dose of intuition.

Spotting a couple of candidates, I take out my LTI TruPulse 200 and start measuring to determine if the trees top 150 feet — the benchmark we're using for the Cook-Mohawk competition. It is my lucky day, as both pines exceed 150 feet in height, and I have just added two more 150-footers to Mohawk's list. Mohawk now has 130 pines that reach 150 feet, and it's time to celebrate — Cook has some catching up to do.

But while Mohawk has more 150 footers than Cook (130 to 122), overall, Cook Forest is slightly taller than Mohawk. Cook has 34 trees more than 160 feet tall. At their individual best, the average height of Cook Forest's tallest 10 pines is around 171 feet. No other property in the Northeast can match this achievement. Mohawk only has 15



NTS members Bart Bouricius (left) and Will Blozan (right) conduct stem analysis of Jake Swamp Pine in Mohawk Trail State Forest during a climb.



Top: Robert Leverett uses the LTI TruPulse 200 laser range finder; Bottom: Leverett measures the circumference of an eastern white pine.

“160s,” but it is a younger forest, and its pines have a lot of growing left to do.

As we include more species, superlatives stack up rapidly for both properties. Cook Forest has four species that reach to heights of 140 feet or more: white pine, tuliptree, black cherry and hemlock. At 147.6 feet, the tallest accurately measured eastern hemlock in the Northeast grows in Cook Forest. Mohawk has two species reaching 140 feet: white pine and white ash. The tallest accurately measured white ash in the Northeast grows there at 152.3 feet.

As impressive as these numbers are, when looking at trees in person, many people relate more to girth than height. Girth is perceived at eye level, and one can interact with it — by hugging a tree, for example. Being the older forest, Cook’s trees are noticeably larger in girth than Mohawk’s. Many of the Cook Forest hemlocks exceed 11 feet around, and a few reach girths of 13 to 14 feet and are visibly larger than their Mohawk counterparts. Still, there are surprises.

Cook’s largest pine measures 13.8 feet in girth while Mohawk’s edges out Cook’s at 14.1. And Mohawk hands-down wins the competition with respect to sugar maple. Mohawk’s largest maple, the current national champion on American Forests’ *National Register of Big Trees*, is close to 19 feet around.

THE TALLEST OF THE TALL

In 2004, NTS president Will Blozan climbed and tape-drop-measured Cook’s tallest tree: Longfellow Pine. Every year since, the tree has been monitored and re-measured by NTS — although with lasers and not a tape measure. It’s a hard tree to measure, but it is at least 183 feet tall with a girth of 11.3 feet. Longfellow Pine derives its name from the Longfellow Trail, which it grows below, but we think the poet would have approved. Timber framer and architect Jack Sobon of Windsor, Mass., discovered Longfellow at an old-growth conference in 1997. Sobon measured the



PHOTO BY D. LUTHRINGER

Dale Luthringer stands at the base of Longfellow Pine.

tree using a surveying transit to a height of 179.1 feet. We calculate the trunk volume of Longfellow to be between 725 and 750 cubic feet, and as best as we can determine, this champion pine added around four cubic feet of trunk volume this past growing season. That is less than some, but still fairly good considering the advanced age of the tree — close to 300 years.

Mohawk's reigning height champion is Jake Swamp Pine at 171.0 feet. Jake is named after the Native American leader, Mohawk Chief Jake Swamp, who visited Mohawk Trail State Forest on at least three occasions before his passing on Oct. 15, 2010.

I last measured Jake in late August 2012. The big pine's trunk volume is between 625 and 635 cubic feet, and the tree is about 160 years old. We began monitoring the Mohawk champion in 1992, when Jake was 9.7 feet in circumference and 155.0 feet tall. Over 20 growing seasons, Jake has averaged a radial growth of one-twelfth of an

inch and a height growth averaging 0.8 feet per year. You wouldn't notice Jake's annual radial growth, but over several years, you can visually discern the tree's thickening limbs and greater height. We calculate that Jake added around eight cubic feet of trunk volume this past season.

With the abundance of data the competition has produced, we can make many comparisons: tree-to-tree and stand-to-stand within and among properties. The fruits of our labors have given us an impressive record of standing large and tall trees, unequaled for any other Pennsylvania and Massachusetts public properties, but it's not just about the size of these trees.

White pines can easily exceed 250 years in age, and we have dated specimens to between 450 and 500 years. These and other maximums can help us recognize when we are reducing forests to shades of their former glory and thereby negatively impacting the species. The bigger, older trees are grand hotels in the forest, nourishing species and ensuring the continuity of forest generations. We should not be eliminating the patriarchs and matriarchs before their missions are complete. To do so is to not only degrade the forest, but also to rob later human generations of the experience of seeing eastern forests in their full glory.

It is not a stretch to say that Pennsylvania's Cook Forest State Park and Massachusetts's Mohawk Trail State Forest are the forest icons of their respective states. These exemplary woodlands present us with glimpses into the past and hope for the future. They have served as the proving grounds for advanced tree-measuring techniques, where each inch matters. But despite the official protections that both enjoy, no forest is safe from invasive pests, storms, drought and other adverse impacts. What we hold dear today in these forests can be lost tomorrow. This awareness reinforces what NTS sees as a critical mission: the thorough measurement and documenting of what we have today for both ourselves and posterity. If we can achieve this, then this will be a competition in which everyone wins. 📌

An engineer by education, Robert T. Leverett is the co-founder and executive director of the Native Tree Society. He writes from Florence, Mass.

Adventures in Tree Measurement

BY AMERICAN FORESTS BIG TREE PROGRAM COORDINATOR SHERI SHANNON

How do you measure the height of a tree when the view of the canopy is obstructed? This is something I immediately had to learn during a Native Tree Society (NTS) advanced tree measuring workshop at Cook Forest State Park in Pennsylvania with Laser Technology Inc. and NTS measuring masters Bob Leverett and Dale Luthringer.

Trees don't always grow vertically in the middle of an open, flat area where you can easily choose a spot to take measurements. But with the proper equipment, NTS is able to calculate the height of a tree even when the tree's base and top are not aligned — a problem that has caused inaccurate measurements with some other methods. So, how does it work?

Let's first define tree height. Tree height is the vertical distance between the base of the tree and the highest point of the crown. NTS uses two key pieces of equipment to accurately measure height: a clinometer, which is a mechanical device that measures the vertical component of the angle between your eye and a targeted object, and a laser rangefinder, which sends a laser pulse in a narrow beam towards the object and measures the time it takes for the pulse to be reflected off the target and returned to the sender.

On my first attempt at measuring a tree with this advanced method, I immediately look up into the crown of a pine and think, "With a push of a button — in seconds — I'll have the number I'm looking for on the screen of my laser rangefinder." Well, there were some numbers, but they definitely weren't what I was looking for. I had to move around for about 10 minutes to find an open area to get the best view of the crown. That's when I realized that even with the best equipment, it takes time to measure a tree.

Before I know it, I'm standing in the presence of the tallest tree north of the Great Smoky Mountains: Longfellow Pine. It's my turn to take the challenge and measure the height of this champion, but how am I supposed to go about doing that when the pine sits on a steep slope? Everyone disperses in different directions while I just focus on not falling and twisting an ankle as I climb over fallen branches and rocks to find the best view of the crown. I hear Bob and Dale shouting out various degrees of angles and calculations from their vantage points. A chorus of voices from 25, 50 and almost 100 feet away are echoing their observations, and I'm thinking, "Let's just give this a shot."

I start at the base and follow the trunk of the tree through the lens until I think I see the topmost branch peering through the sunlight. I'm not sure if it belongs to Longfellow Pine or its neighbor, so I point and shoot, make note of my measurements and move to another location. After 20 minutes of hits and misses, my best result is 178 feet. It's not the same as NTS' most accurate measurement of 183 feet, but at least it's in the ballpark. By the end of the workshop, I am attached to the rangefinder and want to take it home with me.

NTS uses sine-based calculations as opposed to the more conventional tangent-based calculations to measure tree height. The slope distances from the eye to the top of the tree (L_1) and eye to the base of the tree (L_2), shown below, are measured with the infrared laser rangefinder and the corresponding angles (a_1 , a_2) are measured with the clinometer or a tilt sensor. From these measurements, the height can be calculated as follows:

$$H_1 \text{ (the height to the top of the tree)} = L_1 \sin(a_1)$$

$$H_2 \text{ (the height to the base of the tree)} = L_2 \sin(a_2)$$

If top is above and base is below eye level:

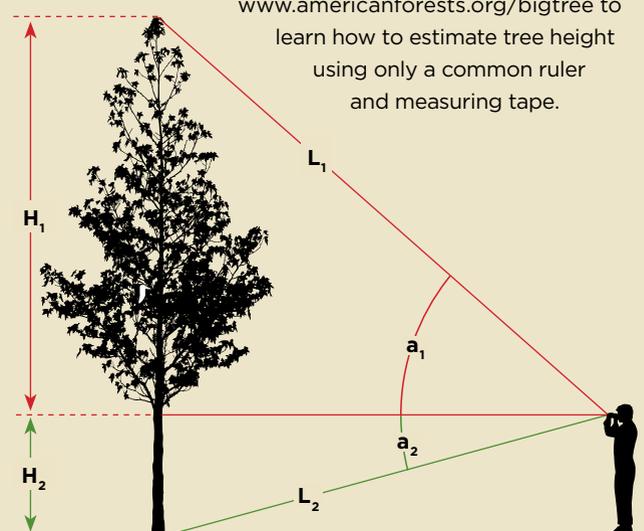
$$\text{Total Height} = H_1 \text{ (height to top)} + H_2 \text{ (height to base)}$$

If both the top and the base are above or below eye level, such as when measuring a tree in a gully below you or on a cliff above:

$$\text{Total Height} = H_1 \text{ (height to top)} - H_2 \text{ (height to base)}$$

The latter calculation assumes the angles are entered in as positive values. If they are entered in as sine values, the formula above works in all cases.

I'm still learning the basics of how to measure trees, but for a more complete explanation, visit www.nativetreesociety.org. If you want to try measuring tall trees, but don't have the equipment necessary, visit www.americanforests.org/bigtree to learn how to estimate tree height using only a common ruler and measuring tape.



Sheri Shannon uses a laser rangefinder.

SHERI SHANNON/AMERICAN FORESTS



THE
Language
OF
Bark



Organizing photos of various bark types

The search for a better all-season field guide inspires a closer look at the unexpected beauty of bark.

STORY AND PHOTOS BY
MICHAEL WOJTECH

I SPOT THE NEON-ORANGE

flag, unmistakable among the more earthly hues of October leaves, and crash through the underbrush to reach it. I quickly begin cataloguing the surrounding trees. On a low-hanging branch, I find familiar looking needles and record eastern hemlock on my data sheet. I peer up through binoculars to recognize the leaves of a broad beauty — an old red maple. The next tree, a tall one, looks like a hickory. Pignut? Bitternut? Mockernut? Its leaves, buds and twigs are too high to see. I write down bitternut, based on the moist, lowland terrain I find myself in, but wish I could be more certain.



Inner bark is a primary food source for beavers, who have stripped it from the base of this American beech.

The flag marks one of 30 plots scattered throughout this western Massachusetts forest in which I have been inventorying trees over the last several weeks. Although it is still morning, a deepening dusk descends along with a steady drizzle; a downpour seems imminent. It is the wind, though, that spurs me on. With each gust, more of the season's last leaves rain down upon me — leaves that provide critical clues to species identification. Today is my last chance. The coming storm will leave behind a canopy of bare branches. By late afternoon, I reach the last plot and document the last tree. I leave the forest drenched, but relieved.

In the following months, as I work toward my master's degree in conservation biology, I yearn for an easier, all-season tree identification guide — one that would have helped me on that October day. Ecologist Tom Wessels, my thesis advisor at Antioch University New England, suggests a solution: bark. I recognize the peeling, gleaming white trunks of paper birch and the smooth, light-gray bark of American beech, but most often, I see bark as a blur of browns and grays. Bark, however, can easily be inspected in any season, and I decide it is the perfect subject for a regional field guide — one I can create for my thesis.

What I learn as I begin field work is how little I know. Bark's diversity, especially within the same species, is far greater than I imagined. It

will take me three years to complete my thesis and another four and a half years for my field guide to be published.

A NEW LANGUAGE

A friend traces the deep furrows of bark with his finger. "That's an eastern white pine," I tell him.

When he asks, "How can you tell?" I am speechless. Over a year into my project, I recognize most tree species by their bark, but still struggle to describe them for others

Hundreds of bark photographs are spread across my office floor. Although I have been sorting through them for months, it has been difficult to explain why some photos are similar and what makes others look so different.

I need a new language, which I find by discovering how bark's multiple layers affect its surface appearance. The growth and function of these layers help provide criteria for separating the photos into categories, which I call bark types — the first level of identification in my bark key. Differentiating the species within each bark type will require a second level of identification, but with this start, I begin to see the forest — and the photos on my floor — through new eyes.

I gather together photos of trees with smooth, unbroken bark, which become my first bark type. These are mostly young trees, with bark that will



Deep furrows separate thick, corky ridges on mature eastern white pine.

developed — is the visible, touchable surface of smooth-barked trees. Cork protects the tree by helping prevent desiccation and keeping insects and pathogens from penetrating to the living tissues beneath it. The dead, mostly air-filled cells also help insulate the tree and account for the light weight of the bark.

Beneath the cork in the periderm are the cork cambium, an area where cell division occurs, and the thin, green cork skin, found by gently scraping away the outer bark on a young twig. The cork skin is capable, to a lesser degree, of the same energy-producing photosynthesis as leaves. Supplemental energy from bark photosynthesis helps trees stay healthy and can boost recovery from defoliation due to insect infestation, disease, storms or severe drought.

Distinctive pores, called lenticels, facilitate the controlled gas exchange — necessary for bark photosynthesis — of carbon dioxide and oxygen through the protective outer bark. Lenticels are readily visible on many species, especially on smooth bark, where you can also feel how they protrude from the surface. They become criteria for another pile of photos and are the distinguishing characteristic of my second bark type. The variety of shapes, sizes and colors of lenticels — from the dark, horizontal lines of yellow birch to the diamond-shaped structures of young bigtooth aspen — will later help me identify the species within this bark type.

Below left: Diagram of the layers of a tree; Below right: Cross section of paper birch trunk showing the orange-brown inner bark, or phloem, surrounded by the white, protective cork layer of the periderm

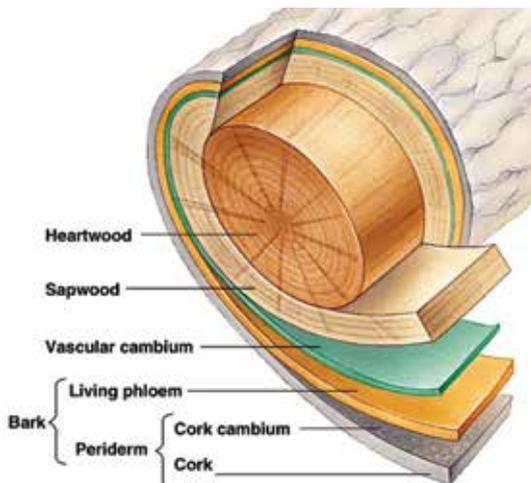
change in appearance as they grow older. Now, to develop my next bark type category, I need to sketch out the multi-layered structure of bark.

The inner bark layer, the phloem, transports sugars produced by photosynthesis throughout the tree. This living layer is the food of beavers, porcupines and other mammals, including humans — the phloem of eastern white pine and other species can be dried and ground into flour.

The layers that are part of the outer bark are collectively referred to as the periderm. The outmost periderm layer — made up of cork cells that die soon after their protective qualities have

TEASING APART THE BROWNS AND GRAYS

A few species, such as American beech, maintain smooth, unbroken bark for their entire lifespan, as their initial periderm continues to grow around the increasing circumference of the trunk and



10 Bark Types



1 Smooth
(American beech, *Fagus grandifolia*)



2 Visible lenticels
(yellow birch, *Betula alleghaniensis*)



3 Peeling horizontal strips
(paper birch, *Betula papyrifera*)



4 Vertical cracks in smooth bark
(northern red oak, *Quercus rubra*)



5 Scales
(black cherry, *Prunus serotina*)



6 Plates
(black birch, *Betula lenta*)



7 Vertical strips
(red maple, *Acer rubrum*)



8 Intersecting ridges
(white ash, *Fraxinus americana*)



9 Ridges broken horizontally
(white oak, *Quercus alba*)



10 Uninterrupted ridges
(northern red oak, *Quercus rubra*)

branches, but many of the uncategorized photos still spread across my floor show bark that has broken apart and grown thicker in a multitude of ways. These trees have all reached a point where their wood is growing faster than — and pushing outward against — the bark that surrounds it. The bark of each species responds differently to this pressure, resulting in specific bark characteristics that provide clues for species identification.

On some species, such as paper birch, this pressure causes thin layers of the outer cork to separate and peel away from the trunk and branches in horizontal, curly strips — creating my third distinctive bark type and a new stack of photos.

More often, pressure exerted by the wood splits the entire periderm, including its protective cork layer. The first visible sign of this process is often vertical cracks in otherwise smooth bark, a feature I noticed long ago on northern red oak. I designate this as my fourth bark type.

Because the periderm protects the tree from outside elements before it breaks apart, a new, active periderm forms beneath the old one, within the active phloem tissue. The cells outside of this new periderm then become isolated and die. This process, which can occur once or multiple times depending on a tree's age and species, results in alternating, non-living layers of old periderm and old phloem tissue called the rhytidome — the Greek word for wrinkle.

My remaining, uncategorized photos all seem, at first, to display the same rough, thick, multi-layered rhytidome — the iconic representation of bark that I held in my mind's eye before starting this project. Slowly, though, as I closely observe my photos and get my hands on living specimens, differences begin to emerge.

On some bark, gaps appear between the outer rhytidome layers, where one could easily catch an edge and pry pieces away from the trunk. Bark with this characteristic can further be divided into three new bark types: scales of bark like on a black cherry; thick, irregular plates like on a black birch; and vertical strips like on a red maple. Other trees have rhytidomes with more tightly adhered layers, creating an additional three bark types: intersecting ridges like on a white ash; ridges broken horizontally like on white oak; and uninterrupted ridges like on northern red oak.

For the first time in months, I now have a clear walking path through my office thanks to 10 neat piles of photos representing each of my 10 bark types, which become the foundation for an identification key. I enjoy months in the woods



The green cork skin found in the interior layer of bark can produce supplementary energy through photosynthesis.

searching for my next set of descriptive clues to differentiate the species within each bark type. At a particular stage in the growth of white pine, for example, I discover fine, horizontal cracks that are evenly spaced, like writing paper. I spend weeks looking at nothing but sugar maple trees before noticing that the surface of their bark is crackled, like old china.

BARK ECOLOGY

After almost three years, I complete the bark key and hand in my thesis. But my field guide is still missing an important piece: I have yet to address the environmental influences behind bark's grand diversity. Drought, fire, temperature extremes, limited growing seasons and interactions with other organisms all have influenced the evolution of different bark characteristics. I begin to research this missing piece by investigating the functions of paper birch's bark features, which I have been wondering about for some time.

The habitat and range of the thin-barked paper birch includes high altitudes and the far northern regions of North America — places where temperate fluctuations are most extreme. Trees can be damaged by sunscald and frost cracks, where abrupt transitions from sun-soaked warmth to cold, or the reverse, can crack or kill sections of bark and open pathways for insects, fungi and other harmful invaders. Yet, this species only maintains a thin outer bark as it matures, even though thick, multi-layered rhytidomes generally provide the best thermal and structural protection.

The white coloring of paper birch bark helps make up for its lack of insulating thickness by reflecting sunlight and reducing the potential for

damage. Its peeling, curly strips keep the outer bark thin, allowing more sunlight to reach the photosynthetic cork skin — even on the trunk. The peeling mechanism also strips mosses, algae and lichens from the surface of paper birch's trunk and branches where, if left to accumulate, they could block sunlight for bark photosynthesis, prevent gas exchange by clogging lenticels and, if dark-colored, contribute to damage from overheating.

Damage to a tree — such as wounds in a tree's outer bark from fire, sunscald, tunneling bark beetles, gnawing rodents or broken branches — are an inevitable part of its lifecycle. Each species has developed a specific set of chemical and structural mechanisms in their bark that help heal wounds and protect the tree, and some of these defenses offer clues for species identification. For instance, betulin, the compound that whitens paper birch bark, also deters against desiccation and bacteria, fungi, insects and gnawing animals, and the

curious, concentric cracks often found on red maple bark result from repeated cycles of fungal infections and attempts by the bark to wall off, or compartmentalize, the intruders.

I also discover olfactory clues to bark identification that result from a bark's defensive mechanisms. A protective chemical in black cherry bark that deters browsing animals yields a bitter, almond scent when the outer bark is scraped away from a twig. But this smell of the chemical doesn't deter humans, as it is used to make cough medicines, expectorants and throat lozenges. Safrole in the bark of sassafras deters insects and other pests, but I find its sweet, licorice-like odor quite pleasing.

Then, there are the beneficial associations between bark and other organisms. Helpful fungi often congregate around lenticels and branch junctions — where invasive organisms are most apt to gain entry — and deter or feed upon other harmful fungi. Slugs often leave trails across the bark of American beech as they glean algae that could otherwise block sunlight for bark photosynthesis.

I've discovered that the environmental influences on bark are even more varied and numerous than the many different bark characteristics that can be used for species identification. Even after finishing a chapter on bark ecology and seeing my field guide published, I know I have only touched the surface of this seemingly infinite web of interactions.

Now, when I walk through a forest, I look at each tree and imagine what is going on beneath the visible surface of its bark — as if, in a way, I have x-ray vision. I have learned to use visual and tactile clues to see and understand what used to leave me feeling lost in a sea of complexity. Instead of a blur of brown and gray trunks, I now see individual trees with species names and a host of ecological relationships.

Beyond the practical reasons for learning to identify bark, I realize that I have been learning and teaching the art of perception. Bark may not seem exotic. It may not, at least initially, leave you in awe like the panoramic view from a hilltop or a glimpse of a crimson morning sky. But learning to see formerly mundane or hidden layers of beauty and function opens up a world of detail and nuance that allow what is local to become spectacular, bringing us closer to home. 📍

Michael Wojtech, a freelance writer, educator, photographer and illustrator, adapted this piece from his book, *Bark: A Field Guide to Trees of the Northeast*. Learn more at www.knowyourtrees.com.



Efforts by red maple bark to combat a fungal infection result in concentric cracks called target canker, which can be used to identify this species.



The white trunk, peeling bark and prominent lenticels make paper birch easy to identify.



An Ivy League Forest

You can't really see the forest without looking closely at the trees.

BY KATHIANN M. KOWALSKI

AFTER SAWING AWAY SURFACE LEAVES AND MOSS with a bread knife, Dr. David Foster presses a Russian corer into the black gum swamp. After a sharp yank, the tool brings up a half-meter core of oozy, gray silt. Extension rods bring up deeper cores, revealing the forest's history.

"In this area, every meter is about 2,000 years," explains Foster. Using similar cores, Foster has traced the area's paleobiological record back more than 11,000 years.

Welcome to Harvard Forest. Headquartered in Peter-sham, Mass., the forest is part of Harvard University, but instead of clusters of ivy-covered buildings, Harvard Forest

is 3,500 acres of living laboratories and classrooms. A sprawling hemlock forest abuts the black gum swamp. Oak, maple and cherry dominate other areas. Still other tracts feature northern hardwoods or mixes of southern and northern trees. Bogs, wetlands and pasture add to the diversity.

Founded in 1907 by Harvard professor Richard Thornton Fisher, Harvard Forest has a long history of forest science. Today, it's one of the National Science Foundation's 27 long-term ecological research sites. Permanent and visiting scholars include biologists and chemists. Historians, sociologists and artists add their perspectives, too.

"When you study forests, you are studying so much more than just trees,"



Harvard Pond located in Harvard Forest

DAVID FOSTER

stresses Foster, the director of Harvard Forest. “We try to do integrated research that will help us understand or address the kinds of changes that are or will occur within our landscape.”

STUDYING FOREST THREATS

Natural disasters and other disturbances can change a landscape dramatically. For example, what will happen after an invasive pest kills massive stands of hemlocks? Researchers are using Harvard Forest to try and find out.

As a foundation species, hemlocks provide habitat for a host of other species: unique mixes of salamanders, fishes and birds, such as the black-throated green warbler and Acadian flycatcher. They also shelter deer, porcupines and

other animals, especially in winter. “There’s no other really long-lived, shade-tolerant conifer in our eastern forests,” says researcher Dr. David Orwig.

Targeting this foundation species is the invasive pest hemlock woolly adelgid, which reproduces asexually and literally sucks the life out of trees. Since arriving in Virginia in the 1950s, the Japanese insect has spread from Maine to Georgia. The pest has already killed huge hemlock stands in the Great Smoky Mountains (see *American Forests*, Spring 2011).

In experimental plots at Harvard Forest, Orwig and his colleagues have girdled trees — that is, cut bark around trunks — to simulate death from hemlock woolly adelgid. Detailed fieldwork catalogs the mix of trees that sprout in the aftermath. The experiment provides insight into what could replace today’s eastern hemlock forests.

Meanwhile, there’s hope for hemlocks in the very long term based on other Harvard Forest research. Foster’s work on core samples shows that something killed most of the area’s hemlocks roughly 5,000 years ago, so perhaps the East Coast’s hemlocks can recover and rebound again — it may just take hundreds or thousands of years.

While invasive pests’ effects can be slow spreading, hurricanes are much more sudden disasters — as last fall’s Hurricane Sandy showed — and have long-lasting effects. To simulate hurricane blowdown in Harvard Forest, workers used winches to pull down selected canopy trees in comparable tracts. Loggers then salvaged lumber from one area, but left another area alone. Surprisingly, many of the mostly uprooted trees lived a few more years, sending up shoots and producing seeds. Two decades later, the left-alone area’s productivity neared pre-“hurricane” levels.

Researcher Audrey Barker-Plotkin concludes that unless there is a compelling reason, people needn’t clean up forests after a natural disaster. “If your goal is to have the lowest forest system impact of a disturbance, then leaving it be is often your best bet.” While slowly



© KATHIANN M. KOWALSKI



NICHOLAS A. TONELLI/FICKR



© KATHIANN M. KOWALSKI

Top: Stand of hemlocks affected by hemlock woolly adelgid; **Middle:** Hemlock woolly adelgid egg sacs; **Bottom:** Species growing within an experimental plot, where girdling was used to simulate death by hemlock woolly adelgid

decaying trees may look messy, they recycle nutrients and provide habitat for wildlife. In contrast, salvage efforts may interfere more with habitat, nutrient recycling and water resources.

HEATING THINGS UP

Climate change could cause big landscape changes in New England and throughout the world. The United States Global Change Research Program reports that “warming of the climate is unequivocal.” By the end of this century, average temperatures could rise as much as 10 degrees Fahrenheit. What roles



DAVID FOSTER

The Environmental Measurements Tower provides the world's longest continuous measurement of carbon exchange between a forest and the atmosphere.



DAVID FOSTER

A 70-foot hemlock canopy access tower used for long-term research on atmospheric carbon exchange

can the forest play in mitigating climate change? And how will climate change impact forests? Researchers hope Harvard Forest can provide insights.

Dr. Jerry Melillo of the Marine Biological Laboratory (MLB) Ecosystems Center at Woods Hole heads a team that studies the forest's response to warmer soils. The experimental treatment area warms the soil by five degrees Celsius with buried electric cables. One control plot has buried but unheated cables. A second control plot has no buried cables.

As heating increased microbial activity, soil gas measurements showed an increase in carbon dioxide emissions. Levels seemed to plateau after a decade, but now, they're going up again. "We may have seen a shift in the microbial community," notes Melillo. If carbon

dioxide emissions keep rising, they could aggravate climate change.

Microbes aren't the only forest organisms that will feel the impact of warmer soils. Dr. Aaron Ellison uses experimental plots at Harvard Forest to see how warmer soils will affect ants at the northern boundary of Mid-Atlantic mixed-deciduous forests. Plots at Duke Forest in North Carolina provided data for the southern limits. "If you're going to see a response to climate change, the first place you look is at the edges," explains Ellison.

Why worry about ants? In areas like New England, which lacks native earthworms, ants bring minerals and nutrients up from beneath the surface and oxygenate the layers. "So no ants, no soil," says Ellison. When ants and other insects eat dead trees, animals and other organisms, they also recycle nutrients.

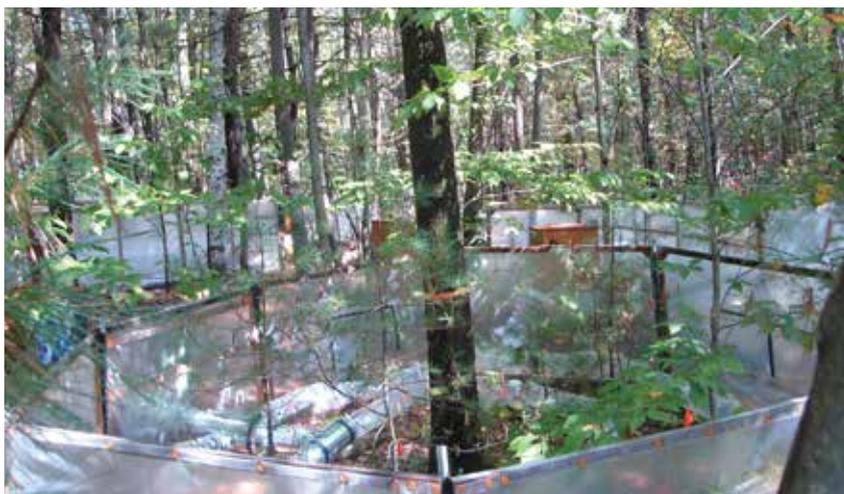
Ellison's data already shows a change in the abundance of certain ant species. Over time, the mix will likely change, too. The study can help scientists better understand how ants contribute to ecosystem services and how that might change in a warmer world.

Of course, not all animals of a heat-intolerant species must move or die. Individuals within the same species naturally vary. Warmer soils should



PHOTOGRAPH © AARON M. ELLISON

Aphaenogaster picea, one of the key ant species used in the warm soils experiment



PHOTOGRAPH © AARON M. ELLISON

View of an ant chamber

give a selective advantage to individuals that can handle more heat. Thus, says Ellison, "We have the opportunity to see evolution in action here."

APPLYING SCIENCE LESSONS

Harvard Forest's interdisciplinary approach, ecosystem diversity and collegial atmosphere make it a unique living laboratory for long-term research. While studies provide specific data about the trees, plants, wildlife and insects of Harvard Forest, their implications reach far beyond the immediate area.

"While we're very much rooted in the place, we try to do our work in a way that it answers basic questions that pertain much more broadly and that make a difference," says Harvard Forest Director Foster. Land use changes, invasive pests and weather disasters pose problems for forests throughout the country, while climate change will impact many areas throughout the world.



DAVID FOSTER

Like the rest of Harvard Forest, the "green garage," made from a solar array and wood from the forest, is operational all year-round.

Meanwhile, work and study continue year-round. "Most field stations close down in the winter or people only go on weekends," notes Foster. "Harvard Forest is a place where we are all there every day studying the place. So, when there's three feet of snow, you put snowshoes on, and you go study the forest. And when trees are crashing down in a violent ice storm, you're out there looking at it."

For more information on Harvard Forest and the research being conducted there, visit harvardforest.fas.harvard.edu.
↓

Kathiann M. Kowalski did field work at Harvard Forest in 2012 as part of the MBL Logan Science Journalism Program's Hands-on Environmental Lab Program. She writes near Cleveland, Ohio.

THINK OF US AS YOUR LOCAL HOMEBUILDERS

Forests are the most diverse terrestrial ecosystems on the planet and countless animals call America's forests home. Help us protect and restore the critical habitats and wild places that nurture and sustain our wildlife.



AMERICAN FORESTS

To learn more, visit our website at www.americanforests.org/donate



Passing the Torch: Sustainable Farming in Honduran Communities

BY KARIM SLIFKA

THE ROADS LEADING TO LA MAJADA AND Brisas del Mar, Santa Barbara, paint a stark contrast to Honduras' large cities. Urban noise and pollution give way to the peace and quiet of rural hillsides. Before long, however, evidence of massive deforestation emerges. Decimated mountain slopes have caused mudslides, soil erosion and water contamination. Flooding and drought are occurring more often. This is the land where Francisco "Chico" Garcia of Brisas del Mar and Noe Garcia of La Majada live and farm.

Chico and Noe have noticed the changes in their environment and climate. Noe says, "The rains do not come when they used to. My father could predict the arrival of rain and knew when to plant our beans and corn to the exact day. Now, it is changing in unpredictable ways. If we plant when our fathers did, we lose all of our beans."

Their needs mirror the needs of most rural farming communities in Central America. Traditional slash-and-burn farming practices have steadily eroded their environment and way of life, creating a destructive cycle that decreases



Left: SHI participant Noe Garcia plants trees on his land in La Majada. Above: Francisco "Chico" Garcia and his wife are among the seven families working with SHI in the small community of Brisas del Mar.

land productivity each year and pushes farmers to clear still more forest. To reverse these trends, local families have sought an alternative method of farming that preserves local habitat, water supplies and livelihoods.

Sustainable Harvest International (SHI) began its work conserving micro-watersheds and reforesting degraded lands in 1997, right here in Honduras. Florence Reed founded SHI after serving as a Peace Corps volunteer in Panama, where she witnessed the devastation that slash-and-burn farming inflicts on families, communities and the planet. Her years of dedication to sustainable agriculture initiatives in Honduras — and later in Panama, Belize and Nicaragua — earned her the National Peace Corps Association 2012 Sargent Shriver Award for Distinguished Humanitarian Service.

SHI has converted 16,000 acres of degraded land to sustainable farms, planted more than 3.2 million trees and helped roughly 2,100 families become self-sufficient stewards of the environment since 1997. SHI also estimates that these families are now teaching 14,700 more families how to replicate their success.

SHI's five-phase program — family selection, orientation and planning; introduction to nutrition, organic farming and crop diversification; advanced crop diversification and introduction to business; identifying markets and strengthening entrepreneurial skills; and family graduation — emphasizes long-term assistance that recognizes the relationship between culturally and ecologically sensitive development. During each of the five phases, SHI evaluates participant families and staff to determine program effectiveness and progress toward achieving environmental sustainability and a decent standard of living. SHI's

“Before working with SHI, we would cut down all the trees and did not understand how important they were for us and our environment. We didn't have this consciousness. Now, I want to take care of the trees and give back what I take so we are all healthy.”

— NOE GARCIA, SHI PARTICIPANT

programs succeed only when participating farmers become committed stewards of their environment.

Amanda Zehner, SHI smaller world and field coordinator, explains, “When asked about the meaning of projects such as improving wood-burning stoves, planting trees, ending slash-and-burn farming or shifting from chemical to organic agriculture, successful SHI participants express a newly found harmonious relationship with their environment and the tie between per-

sonal and environmental health. They also describe the empowerment and community building that comes from families learning and working together to protect and conserve the natural resources on which they all depend.”

SHI received a boost five years ago when American Forests Global ReLeaf began supporting its efforts. Reforestation has been integral to the move toward sustainable agriculture in Santa Barbara, where diverse forest plantations provide food and income while protecting soil, water, habitat and the climate. From July to September 2012, participants in SHI and American Forests' Global ReLeaf projects in Honduras planted nearly 30,000 hardwood and coffee trees, covering more than 50 acres.

Beyond what numbers can show, however, sustainable agriculture has changed the very essence of farming, food and life for these communities. Chico Garcia grew up working as a day laborer on a farm he didn't own. When SHI-Honduras began work in his community, Chico took out a loan to buy some land just so he could participate. Chico learned how to work with the land and developed a relationship with his environment that drives everything he does. As time passed, he bought the forest across the valley to protect a water source vital to his community. Chico also became community president of the SHI group in Brisas del Mar, inspiring others to buy forestland adjoining the piece he bought in order to preserve more of the watershed.

SHI's Impact By the Numbers

SINCE 1997

16,000

acres of degraded land has been converted to sustainable farms.

3.2 million

trees have been planted.

2,100

families have become self-sufficient stewards of the environment.

14,700

more families are now learning from SHI graduates how to replicate their success.

earthkeepers

Now in SHI's Phase 3, Chico is committed to conserving and reforesting the land: "My understanding of my place in the world is different now. I want to live a healthy life and that includes my family and my environment. After working with SHI, I now know and value this important system." Noe Garcia, also in Phase 3, shares a similar revelation: "Before working with SHI, we would cut down all the trees and did not understand how important they were for us and our environment. We didn't have this consciousness. Now, I want to take care of the trees and give back what I take so we are all healthy."



Santa Barbara in Honduras has experienced a renewal, as have the farmers, like Chico and Noe, who live there. As much as the work of SHI is vital to the preservation of our planet's forests, it is these local farmers who carry the message forward and become

enduring community leaders in reforestation and sustainability. 🌱

Karim Slifka is SHI's development and outreach coordinator. She writes from Surry, Maine.

A Sustainable Relationship

Partners since 2007, American Forests and SHI's Global ReLeaf projects include training on how to grow and transplant tree seedlings, manage tree nurseries and plantations, and control insects and disease using organic and local resources. The program also:

- ▶ Meets with teachers, children, parents and organizations to increase awareness around environmental stewardship and reforestation.
- ▶ Works with schools and children to teach the environmental benefits of reforestation and to plant trees around the community.
- ▶ Trains farming families on how to practice sustainable agriculture while preserving forests.
- ▶ Visits reforested areas to monitor tree maintenance, management and health.

SHI and American Forests share the philosophy that nature directly feeds the vitality of local communities. The environmental challenges facing the Honduran departments (equivalent to states in the U.S.) of Santa Barbara and Yoro make this an ideal place for the two organizations to collaborate on reforestation.

"American Forests has been proud to partner with SHI for the past five years in Nicaragua and Honduras where we have planted

243,595 trees," notes Jesse Buff, director of forest restoration for American Forests. "SHI's holistic approach and the level of attention that they bring to helping communities address their challenges truly make their projects sustainable."

Florence Reed, founder and president of SHI, equally values the relationship: "I have always been especially grateful for support from American Forests because they understand the complexity of instituting projects that will keep an area forested for years to come. They are also willing to make the extra investment necessary so programs like SHI's can ensure the long-term success of reforestation projects."

American Forests' work with SHI would not be possible without the generous support of its members and donors. Please consider making a donation today by calling 1-800-545-TREE or visiting www.americanforests.org/donate.



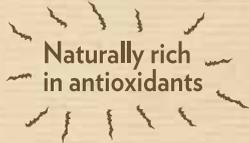
Top: Harvesting cucumbers from a vegetable garden; Bottom: The garden at Midway Primary School provides more than 30 types of fruits and vegetables, including cabbage, string beans, custard apples and mangoes.

All salads aren't created equal.

If your salad isn't Earthbound Farm organic salad,
it's probably missing something.



Delicious, flavorful
salad greens



Naturally rich
in antioxidants



Package made from
recycled bottles



Grown without the
use of toxic synthetic
agricultural chemicals



Pre-washed &
food-safety tested
twice before shipping
to your local store

28

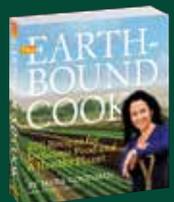
Farmed with 28
years of organic
farming experience



Fresh, delicious Earthbound Farm organic salad greens are grown in ways that protect the environment and help keep toxic chemicals out of our food (and our bodies). It's harder to do, but we believe that *every body* deserves organic.

Earthbound Farm: The *Original* Organic Salad

Search hundreds of delicious recipes at EBFarm.com



Look for our founder's
inspiring new cookbook
wherever books are sold.

last look



BENJAMIN ZACK



Elephant Rocks State Park, Missouri

For the last several years, I've split my time between freelance photojournalism and natural resources work. This combination has allowed me to take a "back-door" look at the natural world with my camera. Last summer, I was camping near Elephant Rocks State Park in the Missouri Ozarks while working on a bat research project. Before work one day, I went out at dawn and captured this image of the granite monoliths. Throughout the vibrant green of the eastern Ozarks, you'll find pockets of these unique pink boulders, which are more than a billion years old and range in size from several inches to larger than a house.

Benjamin Zack is a photojournalist who strives to tell stories that haven't been told. The stories range from those unfolding miles away to issues hidden in plain sight. His photographs help viewers relate to the events and encourage them to learn more about the world around them. With an artistic eye, Zack strives to tell stories about the individual, the community, the environment and the spaces where the three intersect. His photographs and the stories they tell reflect his interests and background in education, natural resources and community development. Zack currently lives in Columbia, Mo., and you can view more of his work at <http://benjaminzack.com/>.

Every cup *makes a difference*

Made with patented flavor-enhancing micro-perforations, Melitta Natural Brown Filters release coffee's full, indulgent flavor. Enjoy all the richness your coffee has to offer with Melitta Premium Coffee Filters.

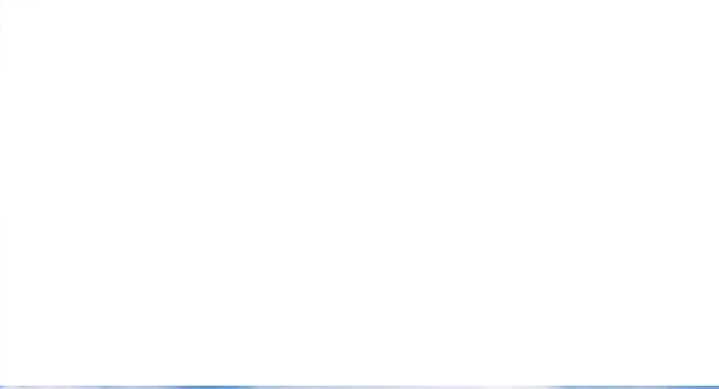
Melitta is a proud sponsor of American Forests and Global ReLeaf, where every dollar donated plants a tree in areas of need across the U.S.



AMERICAN FORESTS

BREWS BETTER TASTING COFFEE... NATURALLY

www.melitta.com



TREES ARE CHAMPIONS OF THE ENVIRONMENT.

Champion trees are the trophy trees of their species. To wear their crown, they survive disease and pests, mistreatment, and the forces of nature.

By nationally recognizing the biggest trees of their species, we draw attention to the key role all trees play in sustaining a healthy environment.

Trees enhance the environment by providing clean air, pure water, shade and shelter, as well as beautiful vistas and landscapes.

Davey's skilled arborists can help to make sure that the trees we live with thrive, and make our communities greener, cleaner places to live, work, play and grow.



The Davey Tree Expert Company

Long-time supporter of American Forests and the premiere sponsor of the National Register of Big Trees

1-800-445-TREE • www.davey.com