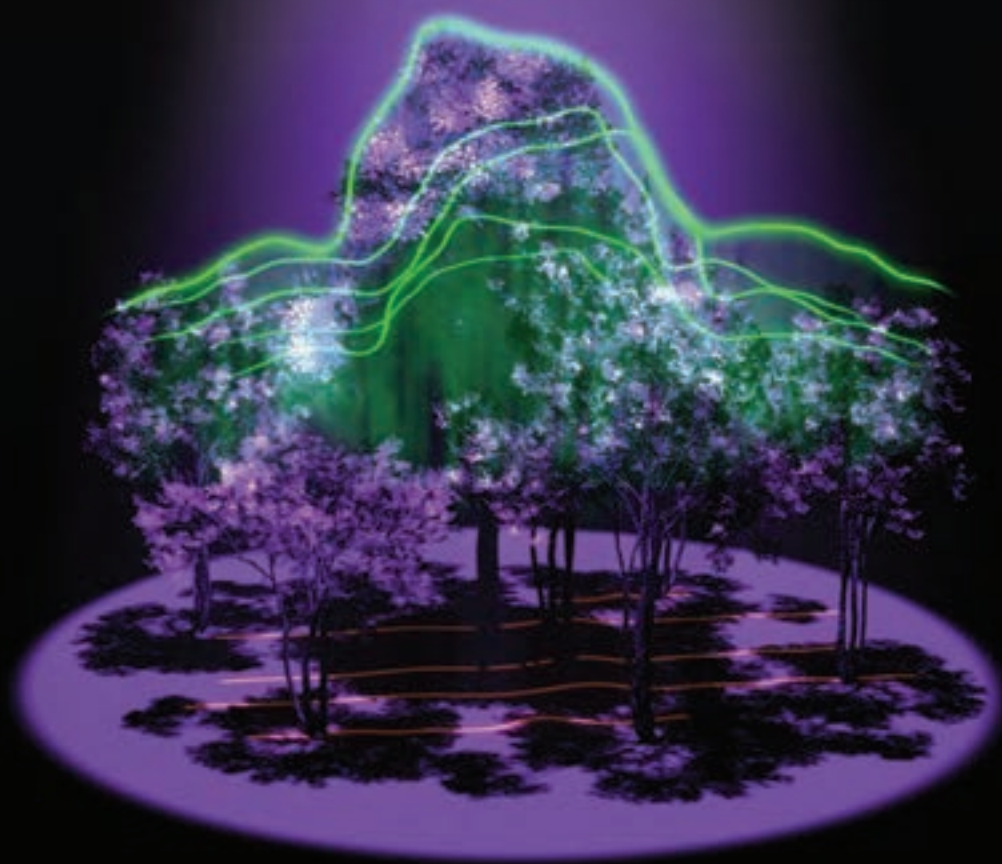


AMERICAN

FALL 2018

FORESTS



Eyes in the Sky

HOW LIDAR MAPS FORESTS' ROLE IN SLOWING CLIMATE CHANGE

PUT STOCK IN FORESTS: A LIVING, GROWING INVESTMENT

And find a wealth
of benefits for the
short and long term

Your gift of stocks, bonds or mutual funds can plant a living investment of trees, to ensure forests thrive far into the future and provide the benefits of clean air and water to future generations.

With an outright gift of appreciated securities to American Forests, you may save on capital gains and income taxes, while protecting and restoring critical forest ecosystems.

In 2018, the IRS declared that charitable donations from your tax-deferred IRA or 401(k) will be exempt from taxation up to \$100,000. Speak to your financial advisor about how you can generously support forest restoration, while minimizing or avoiding tax on distributions from those accounts.

Questions? Contact Jennifer Broome, VP, Philanthropy, jbroome@americanforests.org, 202-370-4513.

American Forests cannot offer legal or tax advice. Please consult your lawyer or tax advisor about the advantages of making a charitable gift of appreciated assets.



AMERICAN FORESTS

A tree you plant today may outlive your grandchildren's grandchildren's grandchildren. This Great Basin bristlecone pine is 5,067 years old, the oldest-known living, non-clonal organism on Earth.



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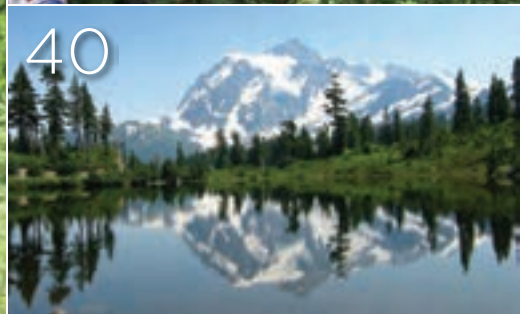
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Taking American Forests Back to the Future

BY JAD DALEY

IT IS AWE-INSPIRING to take the helm of America's first forestry organization that was founded before the federal government even had an agency solely dedicated to America's forests. For more than 140 years, American Forests has stood at the center of the forest movement.

The weight of this fully hit me when I learned that from 1905-1908 James Wilson simultaneously served as the President of American Forests (then the American Forestry Association) and also as the Secretary of Agriculture. During that same period, the second American Forest Congress, led by our organization, passed a resolution calling for creation of the U.S. Forest Service. The U.S. Congress complied by passing legislation to establish the Forest Service literally within weeks.

So, why am I launching my first Offshoots as president & CEO of American Forests by looking backward at our history? Shouldn't the new president be starting with our vision for the future?

My backward look will make sense as you understand that my vision for

American Forests' future is grounded more strongly in our full history than just our recent past.

You see, American Forests has always planted trees, but we were not always

considered a tree planting organization as some see us today. The first tree planting that American Forests organized in 1882 drew 50,000 people by foot, horseback, carriage and rail to Cincinnati, Ohio.

But it was not really an event just about planting trees. It was a leadership event, part of the first American Forest Congress, and intended to launch a comprehensive forest movement.

We clearly led the forest movement that we launched back then and in differing ways have ever since. Many of our organization's greatest gifts to America's forests have been achieved with our vision, expertise and voice — not just our shovels.

While it's easier to count trees, I can assure you American Forests has had extraordinary impact through less-visible actions like organizing and leading coalitions of forest organizations to pass major legislation, inventing new ways

to map urban tree canopy, and teaching "right tree, right place" forestry principles to people caring for forests across the country.

Each of these actions is one step removed from actually planting a tree or taking another on-the-ground action to protect, restore and steward America's forests. But done right, these breakthroughs can improve America's forests far beyond just what American Forests can do alone — these are the actions of a true movement leader.

Why is leadership needed now? It starts with climate change. Climate change is simply the greatest threat to our forests and our planet that we have ever faced. From rapidly dying western forests to the subtler yet equally serious erosion of forest health occurring in other regions, our forests are in trouble and need a lot of help from people to withstand the climate change we have fostered.

But there is a big payoff if we get this right — healthy and resilient forests can capture carbon emissions from the atmosphere and play a huge role in slowing climate change. Today, America's forests capture 14 percent of our emissions. They could do even more to slow climate change — or become a source of carbon emissions, depending on our actions.

Tree planting can really help meet this challenge by creating new forests and replacing forests as they are lost to the growing impacts of climate change.

We are doing just this at American Forests, challenging ourselves to plant more trees than ever in stressed areas like California's Southern Sierra Nevada. We are making these efforts climate-smart by partnering with scientists from the U.S. Forest Service to replant the right tree species in the right places to create forests that can withstand future climate stress.

We are leading tree planting in urban areas, like Miami-Dade County, where we are using computer mapping technology





AMERICAN FORESTS

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and cutting-edge science to help local officials plant urban trees that can withstand future hurricanes while cooling homes and businesses from rapidly increasing extreme heat. These energy-saving trees offer a double bonus to slow climate change, directly absorbing carbon from the air and reducing the amount of energy used by people for cooling.

But our own place-based work will not be nearly enough given the scale of the climate challenge to forests and our country. That's why American Forests has launched a comprehensive new Climate Leadership Strategy to empower government agencies, private landowners, forest-products companies, communities, and other nonprofits to also take action.

The centerpiece of this strategy is our leadership of the Forest-Climate Working Group, a powerful coalition I was proud to co-found in 2007. American Forests has taken the reins of this coalition, and we are now engaging policymakers and forestry professionals at an unprecedented scale. This includes the Learning Lab that American Forests hosted in July for delegations from the 16 states of the U.S. Climate Alliance.

American Forests organized a multi-day workshop staffed by more than 60 volunteer technical experts from across the country. This innovative, hands-on training led each state team through a dynamic curriculum that enabled them to build strategies for prioritizing and investing in forest-climate solutions, including planting more forests.

This dramatic demonstration of our leadership abilities has led to a long-term partnership with the U.S. Climate Alliance and new grants that will help us continue to empower these states in taking action. This kind of leadership,

when combined with American Forests' own on-the-ground efforts in places like the Sierra Nevada and Miami-Dade, represents the full potential of our organization to create change on an issue of this magnitude.

While we see climate change as the threshold leadership issue for American Forests, it is not the only one. America

faces other pressing challenges that demand the same kind of movement leadership combined with place-based action to deliver forest solutions.

In particular, you will hear much more about our major push to use urban forests as an equity lever to create opportunities and improve quality of life for

underserved urban neighborhoods and people. This includes our exciting new partnership with tree care companies to engage thousands of people who urgently need career opportunities into the fast-growing field of urban forestry.

You will also hear much more about our new leadership strategies on the long-standing forest priorities of water and wildlife, in both cases bringing new scientific rigor, partnerships and scale to our work restoring forests for these important outcomes.

America's forests need more from us now in every way — more trees planted, yes, but also leadership that can help different public and private organizations come together to overcome seemingly insurmountable threats like climate change.

American Forests is ready to provide the servant leadership that can build an unstoppable movement to better our forests and our country. Thank you very much for being part of it. ♦

— A. Daley III

Many of our organization's greatest gifts to America's forests have been achieved with our vision, expertise and voice — not just our shovels.

PROJECT SHOWCASE

Managing Our Forests for Soil Carbon

BY DOROTHY HASTINGS

WHEN STANDING in a beautiful forest, it can be easy to forget you are standing in the largest carbon storage unit in the U.S., and that the soil beneath your feet is responsible for most of it. Protecting our forests means protecting our soil, and American Forests, The Northern Institute of Applied Climate Science (NIACS), the University of Michigan and State of Maryland are partnering on a project that will protect and enhance soil carbon storage and sequestration in forests across North America.

The project focuses on forest restoration as a means to hold more

carbon, identification of the best forest management practices for soil carbon, and building an understanding of the contribution each managed forest makes to climate change mitigation.

“When you think about conservation at large, virtually any issue is too large for a single organization,” says Chris Swanston, director of NIACS. “American Forests has a core mission around forest restoration and supporting working forests, and NIACS has a core mission around helping land managers pursue climate-informed forest stewardship.”

The project is partly funded by the Sustainable Forestry Initiative (SFI), which has the largest forest-managed footprint of any forest management standard world-wide.

“It’s our belief that managed forests have an important role to play in ensuring that as much carbon is captured from the atmosphere as possible in an effort to combat greenhouse gases,” says Paul Trianosky, chief conservation officer at SFI. “With that in mind, the work of American Forests is going to be really important to help us identify what practices help promote those outcomes that we care about.”

Seventy-five percent of carbon in forests is stored in the soil, and the carbon sequestration process that occurs in forests is fundamental to greenhouse gas mitigation. Therefore, ensuring that forest management practices prioritize protecting and increasing soil carbon is imperative in climate change adaptation. Yet, past climate mitigation efforts and incentives have generally focused on impacting limbs, tree trunks and other components of aboveground live biomass. This lack of attention to soils has been generally due to limited data on forest soil carbon and lack of clarity regarding what actions landowners can take to positively or negatively impact this carbon pool.



More than 75 percent of Maryland’s forests are owned by families and individuals. The forest soil carbon analysis could lead to new incentives for woodland owners to sustainably manage their land.



Tree tubes are used to grow trees on marginal agricultural land, a soil carbon enhancement strategy.

American Forests is working with partners to synthesize national and regional datasets to broadly assess the differential impact of forest practices. Work to date by NIACS and others shows that practices like tree planting can build soil carbon stocks, while thinning and prescribed burns can help avoid future carbon losses. These larger datasets will then be combined with local data to develop forest soil carbon practices for specific forest types and geographies in Maryland and surrounding states. The approach will result in detailed tools and guidance that will be accessible and usable by SFI, as well as landowners, land managers and policymakers to meet forest health and climate goals.

“Soil carbon sequestration is a hard thing to foster,” says Swanston. “I hope that we can continue to learn how to do that in a way that helps store

carbon for long periods of time in soils which have very strong feedback into supporting healthy forests.”

American Forests has already begun working with the Maryland Department of Natural Resources Forest Service to gather data on forest management practices that benefit soil carbon storage in the state, and to determine how these practices can be applied to different forest types across North America.

Prioritizing soil carbon not only protects against climate change, it benefits biodiversity, water quality, species conservation and other ecosystem services that contribute to forest health and maintenance. 🌿

Dorothy Hastings was an American Forests summer editorial intern and is a senior at American University studying journalism with a minor in American studies.

Seventy-five percent of carbon in forests is stored in the soil, and the carbon sequestration process that occurs in forests is fundamental to greenhouse gas mitigation.



PROJECT SHOWCASE

A River's Forward Progress in Indiana

BY NICHOLAS DEL GIUDICE

THE PATOKA RIVER MEANDERS through the hills of southwest Indiana. It should be lined by rare Midwestern bottomland and oak savannas. But, as so often happens, the wildlands around the river were left unmanaged, leading to an unhealthy overgrowth of regionally invasive pear trees and autumn olive. With the Patoka River National Wildlife Refuge being an intersection between critically

depleted oak savannas and bottomland, restoring this land properly is a priority.

Since its creation in 1990, refuge officials estimate they have reforested approximately 1,200 acres of land, planting 500 seedlings per acre, for a total of nearly 600,000 trees. With funding from American Forests and Alcoa Foundation, the refuge planted 35,000 seedlings to restore 70 acres.

“The reason this refuge exists and is thriving is because of all the partnerships we have here.”

tion, invasive trees were cleared on the Columbia Mine Tract. Once a strip-mining operation, the tract was converted to a savanna about 16 years ago but has been left unmanaged since. The removed trees were either ground into mulch to enrich the soil or logged and used to augment shoreline habitat along nearby Lake Laura Hare for native species of fish, such as large and smallmouth bass. Tree tops that stick out of the water are used by reptiles and amphibians to sun themselves. After removing the offending invasives, desirable, native species were left, and others are being replanted, primarily oaks, which are fire tolerant. Controlled burns are used every year to keep the oak savanna healthy and native.

Success stories in conservation don't happen every day. Building coalitions and partnerships is crucial.

“The reason this refuge exists and is thriving is because of all the

partnerships we have here,” Hamilton said. “They range from multi-national corps to local conservation groups. I think with every group, we can find common ground, and agree on many things we're trying to do to protect the environment. We just happen to be the group on the ground restoring this land.”

With American Forests — and other stakeholders such as Alcoa Foundation, Friends of the Patoka, and all the southwest Indiana residents who stand to gain from a healthier refuge — helping restore the Patoka River National Wildlife Refuge, things will only continue to get better. 🌱

Nicholas Del Giudice was an American Forests summer editorial intern and is a senior at American University, studying public relations and strategic communications with a minor in sustainability studies.

Patoka River National Wildlife Refuge interns with some of the trees logged from the site.

“The grant has allowed us to restore these sites to the optimal level of biodiversity,” said U.S. Fish and Wildlife Service Specialist and project lead, Heath Hamilton. “We wouldn't have been able to do five acres on our own.”

The long-term goal is to provide one-third of a mile of buffer on either side of the Patoka River to provide uninterrupted breeding and rearing habitat for interior nesting birds, such as the cerulean warbler (*Setophaga cerulea*), endangered Indiana bat (*Myotis sodalis*) and the threatened northern long-eared bat (*Myotis septentrionalis*).

In 2017, with funding from American Forests and Alcoa Founda-



The long-term goal is to provide a 500-meter buffer on either side of the Patoka River to provide uninterrupted breeding and rearing habitat for interior nesting birds, such as the cerulean warbler.

ANDY REAGO & CHRIS MCCLAREN

ABOVE: HEATH HAMILTON, PATOKA RIVER NATIONAL WILDLIFE REFUGE, USFWS

FROM THE FIELD

VANCOUVER, BRITISH COLUMBIA, CANADA

Jennifer Broome, Vice President of Philanthropy

IN JUNE, American Forests was honored to join some of the most innovative, progressive and socially conscious companies and organizations across North America at the Sustainable Brands Conference in Vancouver, British Columbia, where companies shared the latest innovations, recent challenges and emerging opportunities in environmental stewardship to improve their sustainability practices.

So, why, do you ask, does a conservation organization participate in business conferences? Well, because American Forests is proud to help companies improve their sustainability practices, making every aspect of their business — from the supply

chain to their products, and everything in between — greener, by helping them off-set their carbon emissions, water or paper usage, or simply augment their customers' awareness of their sustainability efforts through shared marketing initiatives.

We do this for two primary reasons.

First, it's good for our forests. The more awareness-raising we do about the need for companies to keep forests top of mind when sourcing their products, and off-set their use of non-renewable energy by planting trees and restoring forests, the better the long-term health of our forests will be.

Secondly, it's good for our friends and partners. We're happy to highlight

the good work our corporate partners are doing with us so that other brands can see healthy, mutually beneficial partnerships in action — and be inspired. And, this helps raise our profile and attract new potential partners who are looking for a nonprofit that can help them achieve their sustainability goals.

While there is a lot to be concerned about — from deforestation to forest conversion, and forest products waste — conferences like these provide encouragement and hope to those of us working on the front lines of forest conservation. They are a much-needed reminder that there are indeed many companies from all industries that are actively improving their sustainability efforts and making significant strides to be better stewards of our shared environment. 🌱



People were drawn in by the trees, park bench and oak barrel in front of our American Forests backdrop, and the chance to learn more about American Forests' critical forest restoration work. The booth was clearly a big hit!

LEFT: JENNIFER BROOME; FACING PAGE: LINDSEY PUTZ



Volunteers at American Forests' planting.

LOS ANGELES

Lindsey Putz, Director of Corporate Giving

IN JUNE, I HAD THE PRIVILEGE of representing American Forests at a planting with Reyes Coca-Cola Bottling, the local southern California bottler for The Coca-Cola Company. The planting is part of a larger partnership with the Coca-Cola Foundation focused on water replenishment in critical watersheds across the United States. More than 30 employees and their families joined me on a toasty Saturday morning to plant 20 coast live oaks and western sycamores in Los Angeles State Historic Park.

Historic is a perfect way to describe this park. Los Angeles River State Park Partners shared with our group that prior to being a beautiful outdoor space, the park acted as a Zanja Madre (or irrigation ditch) for Pueblo Indians in the 1700s, a train station in the late

1800s, and a cornfield as part of an art movement in the early 2000s. It is now considered the Central Park of LA.

After an introduction to the park and a safety demonstration, our group put in some major sweat equity digging, planting, mulching and watering. One of my favorite things to see at plantings is families volunteering together, getting younger generations involved early on in giving back, especially in their own community. Most of the families in attendance were locals from the neighborhood — a park-poor area very much in need of greenspace.

One of the younger tree planters asked me, “Did you know trees provide oxygen so we can breathe?” I let her know I had heard that before, but I was glad she confirmed it for me.

Throughout the morning we had several community members come up and thank us for what we were

doing. They shared a bit of their history, being from the area and not having a space like this before, and how much they appreciate having an outdoor area to come together, meet their neighbors, be active and play with their kids. While positive affirmation is not a necessity for volunteering, it definitely doesn't hurt.

My fellow planters made promises to come back and visit their trees, a living testament to their hard work and the impact a small team can make by giving up just one Saturday morning. 🌱

One of my favorite things to see at plantings is families volunteering together, getting younger generations involved early on in giving back, especially in their own community.



Eddie Bauer Guides David Morton (left) and Jake Norton (right) hiking in the North Cascades in Washington.

PARTNER PROFILE

Eddie Bauer

FOR 23 YEARS, American Forests and Eddie Bauer have nurtured a partnership, starting with the seedling “give a dollar, plant a tree” campaign, all the way to the now-flourishing #WhyIHike campaign, where thousands from around the globe are sharing their outdoor experiences.

Eddie Bauer created #WhyIHike to unite the company, conservation nonprofits and the outdoor enthusiasts that are the lifeblood of both organizations.

“Together, we are able to bring greater awareness to causes we believe in, open the conversation with customers, and connect the idea of conservation to the consumer’s enjoyment of forests

and outdoor spaces,” says Eddie Bauer President Damien Huang.

#WhyIHike was a photography competition on Instagram and Twitter in which outdoor enthusiasts around the globe are invited to post a picture from the wild spaces they adventure in and share their inspiration. The initiative launched in April 2018 and ran through the end of September 2018.

“Whether it’s on a weeklong backpacking trip or hiking in their own backyard,” Huang says, “some hike to clear their minds or to challenge themselves. Others hike to honor a loved one or to bond with family and friends.”

Competition entrants had a chance to win a once-in-a-lifetime hiking adventure to either Kauai, Hawaii, Whistler, British Columbia or Yosemite National Park, in addition to other

smaller prize offerings. Additionally, Eddie Bauer created a special American Forests t-shirt for the campaign, with 10 percent of the proceeds going directly to American Forests.

“Conservation and preservation has been in our DNA since our founder, Eddie Bauer, was alive,” Huang says. “Eddie Bauer, the man himself, spent his entire life encouraging people to get outside, and reminding them to assume personal responsibility for preserving the beauty of nature.”

That brand DNA of environmental conservation and stewardship is alive and well today, with Eddie Bauer helping American Forests plant more than 7 million trees during our 23-year partnership, with many millions more to take root as this partnership further flourishes. 🌱

Eddie Bauer EST. 1920

DONOR PROFILE

Daniel Hochman

GROWING UP IN BROOKLYN, N.Y., most of Daniel Hochman's interactions with nature were in New York City parks. It wasn't until he attended Dartmouth College, and joined the Outing Club, that he experienced the boundless beauty of New England's forests and lakes through camping, hiking and kayaking.

"Over the course of four years, I went from definitely a city kid to someone who was much more interested in the outdoors," Hochman says.

From there, his passion only grew. For the past seven years, Hochman has worked as a senior researcher at Bridgewater Associates, an investment management firm. Hochman says he relates his work as a researcher to how he views trees.

"[In macroeconomics], it's about seeing everything as a part of a whole," Hochman says. "I think that led me to reflect on the role trees play in the landscape around us."

One day, Hochman ran across American Forests' National Register of Champion Trees. As he learned more about the organization, he felt that donating to American Forests was a concrete way he could help protect our forests and our Earth.

"I try to think about what I feel responsible for," he says, "and one of them is helping steward the natural environment, and this seems like a good way to begin."

Hochman joined American Forests' Sequoia Circle in December 2017, believing that nonprofits play a vital role in conservation by providing the opportunity to get involved and stay educated.

Hochman keeps nature in his personal life, too. He recently began taking a woodworking class taught by Mark Andreas and also goes for walks or hikes. Through reading books and articles, Hochman is constantly learning new facts about conservation and trees.

One of his favorite tree facts is that unlike most living entities, as trees grow older they grow faster. This means that older trees store more carbon, making them crucial to fighting climate change.

"It's such a cool fact where you're like 'wait a second, you mean that if you just leave the tree alone, it will just get increasingly big and effective?'" Hochman says. "Yeah, just don't chop it down. Leave the trees to do what trees do." 🌲



JOIN THE SEQUOIA CIRCLE

Your annual leadership gift of \$1000 or more helps American Forests plant keystone species — like the giant sequoia — and protect and restore native forest ecosystems.

Learn about the exclusive benefits for Sequoia Circle members at americanforests.org/sequoiacircle or by contacting **Emily Russell**, Director of Major Gifts, at erussell@americanforests.org or 202-370-4522.

ACTION CENTER

Keeping the Endangered Species Act Strong

EARLIER THIS YEAR, the U.S. Fish and Wildlife Service proposed the removal of the Kirtland's warbler from the endangered species list due to its remarkable recovery.

For nearly 30 years, American Forests has been restoring the Michigan jack pine forests the Kirtland's warbler depends on for habitat. We've planted more than 4.6 million young jack pines across 4,200 acres in Michigan. It is through this dedication, and our partnership with Michigan's Department of Natural Resources, along with other dedicated conservationists, that this rare bird's population has recovered to this point. And it is because of the Endangered Species Act (ESA) that we can celebrate this victory. Of course, this proposed delisting does not mean our work stops. American Forests is committed to continue our jack pine restoration to ensure the Kirtland's warbler continues to thrive.



However, now the ESA that was instrumental in protecting Kirtland's warbler is also at risk. Congress has introduced a "modernization package" made up of nine bills that would alter the ESA and make it more difficult to

add species to the endangered species list, make it easier to delist species, and remove the responsibility for conservation practices from involved parties.

While critics of the ESA focus on the statistic that 3 percent of species have been delisted, they ignore the fact that more than 99 percent of the species covered by the Act are saved from extinction — a clear indication of the effectiveness of the ESA. The Act protects those species by protecting their habitats and keeping them listed as endangered until their population is stable.

The fate of endangered wildlife and plant species is an issue that deserves the attention provided by the ESA as it currently stands. Weakening the ESA will only hurt our ability to protect endangered species. Help us voice our opposition to the ESA reformation package by letting Congress know that we expect them to follow through on the commitment made by the original ESA to protect our endangered species!

Visit our Action Center at americanforests.org/TakeAction and let your Congressional members know you want a strong, effective Endangered Species Act. 🌿



Whitebark pine is a keystone species in the high-elevation regions of the Northern Rockies and Cascades and is a candidate species under the U.S Endangered Species Act.

CHAMPION TREE SHOWCASE

Sugar Maple

SCIENTIFIC NAME: *Acer saccharum*

LOCATION: Charlemont, Mass.

NOMINATED: 2007

NOMINATED BY: MA Dept. of Conservation & Recreation

HEIGHT: 112 feet

CIRCUMFERENCE: 233 inches

CROWN SPREAD: 91 feet

TOTAL POINTS: 368

DID YOU KNOW?

The sugar maple is the official state tree in four states — New York, Vermont, West Virginia and Wisconsin — more than any other single species.



PLANT A SEED FOR FUTURE GENERATIONS

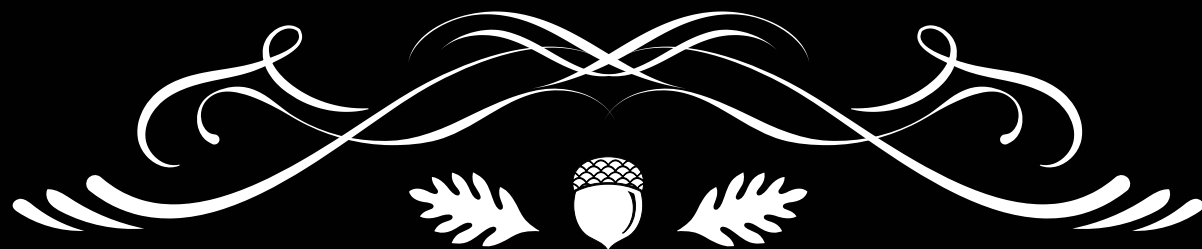
AND INCLUDE **AMERICAN FORESTS** IN YOUR ESTATE PLANS.

Our Evergreen Society members are lifelong friends who, through their wills, trusts, retirement plans or life insurance, help American Forests plant legacies, one tree at a time.

Learn more about the Evergreen Society by visiting americanforests.org/EvergreenSociety or by contacting Jennifer Broome, Vice President of Philanthropy, at jbroome@americanforests.org or 202.370.4522.



AMERICAN FORESTS



NOTES

of

OAK

**THE JOURNEY OF WHITE OAK
FROM ACORN TO CASK**

BY CHRISTOPHER HORN





THE CURVATURE OF A WOOD BARREL JUXTAPOSES THE USUAL FORMS

associated with trees and lumber: straight, flat, solid. And while industry creates the barrel itself, nature is the true builder here. The genetic make-up of barrel wood — typically that of a white oak tree — is tailor-made for use as a forest product.

From the floors you walk on to the water you drink, the impact of white oak is widely felt — or tasted — and to many, it is the most important tree species in the United States.

The ecological, economic and cultural significance of white oak makes its sustainability an even more pressing issue as the species and the forests it thrives in face tremendous challenges for future viability.

“From a mast production and habitat perspective, it’s probably the most ecologically important species in the eastern United States.”

ECOLOGICAL HEAVYWEIGHT

One of the most widespread species in the eastern U.S., white oak (*Quercus alba*) provides a variety of ecosystem services: wildlife habitat and food sources, watershed health and climate mitigation.

White oaks are bountiful mast producers — some trees can produce between 2,000-7,000 acorns per year — serving as a substantial food source for wildlife such as blue jay, black bear and wild turkey. The tree’s bark is very flaky and has a lot of surface area. In fact, a study of the species in the Mid-Atlantic found that white oaks provide habitat for more than 500 species of moths and butterflies — more than any other woody plant in the region.

“From a mast production and habitat perspective, it’s probably the most ecologically important species in the eastern United States,” says Eric Sprague, director of forest conservation at American Forests.

White oak trees can reach more than 100 feet tall and 4 feet in diameter, an impressive size that helps sequester large amounts of carbon. The abundance, deep roots and broad canopies of white oak also mean the species plays an important role in producing clean and steady streams of water and providing aquatic wildlife habitat.

Factor in that some white oaks can live for many centuries, thus offering benefits for generations of people and wildlife. Yet, one often misunderstood and under-recognized, but profoundly important, benefit to people is the use of white oak as a forest product.

VOLUME = VALUE

American white oak has a broad range of uses, from construction-grade products, like railroad ties or wood pallets, to high-quality materials such as flooring and veneer for cabinets and furniture. According to the American Hardwood Export Council (AHEC), all of the sub-species that are classified as American white oak together account for roughly one-third of the American hardwood resource.

The wood properties of white oak made it commercially successful over the centuries, and it is still one of the most exported hardwood species in the U.S. today. But the status of white oak is beginning to change, and the focus on sustainable management and harvesting is more integral than ever in the production of white oak wood products.

“It’s been a species that has been maintained in the forest system up until now,” says Jeff



Some white oaks can produce 2,000 to 7,000 digestible acorns annually, making the species a mainstay in the diet of many wildlife.



American white oak wood is strong and pliable, with an attractive grain, making it an attractive material for high-quality furniture and flooring. The heartwood, or interior wood, is not porous — a primary reason it’s the best species for making wine and spirit barrels.



Stringer, Ph.D., professor and chair of the Department of Forestry and Natural Resources at the University of Kentucky.

Working in the forestry field since 1981, Stringer has spent most of his career researching management techniques that increase the volume, and ultimately value, of white oak. His first project began in 1983, and he and his team are still monitoring progress today.

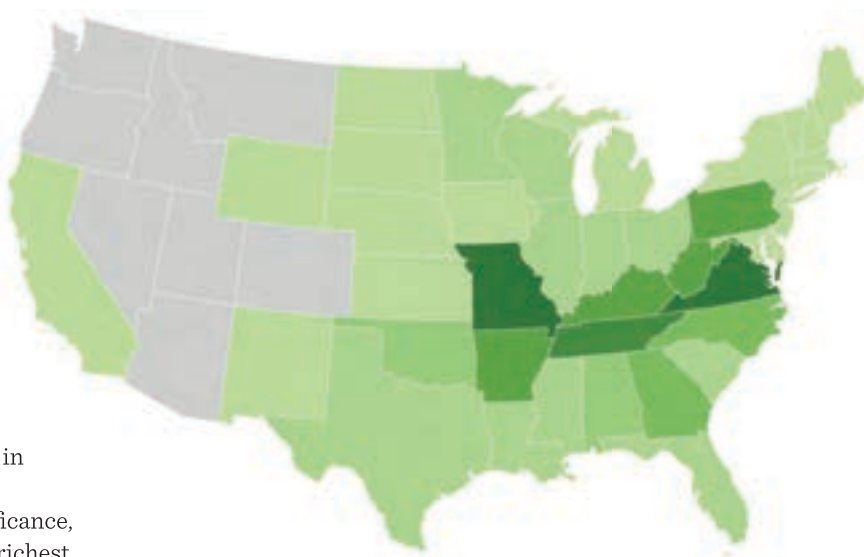
Stringer and other researchers are experimenting with different thinning treatments, such as removing small trees from competition, to determine if they could accelerate white oak growth and ultimate value. They have found they could significantly increase the growth and quality of white oak trees, resulting in price increases.

While white oak has historical significance, Stringer's testing sites are in one of the richest parts of the central hardwoods region, spanning from Missouri to Pennsylvania, where white oak is the largest species by volume.

Volume and value go hand-in-hand in Kentucky, where white oak is the leading species exported out of the state. The 2017 numbers for

Above: Purchasers from Independent Stave Company evaluate the quality of logs brought in from local loggers, and purchase high-quality logs that will be processed into barrel staves. Independent Stave Company wastes nothing — the scraps are turned into other wood products.

Below: White oak has the largest volume of any hardwood species in the United States, and it's concentrated in the central hardwoods region.



**VOLUME OF LIVE TREES
ON FOREST LAND, 1000 m³**





Once the staves are processed in the sawmill, they naturally season in 18 to 36 months. Seasoning removes unwanted green characters, bitterness and astringency from the wood.

Kentucky are on par with national figures from AHEC, with the state boasting \$347 million in wood-related exports, nearly one-third (or roughly \$100 million) of which are the most exported product of them all: barrels.

A COOPER'S CRAFT

Humans have used wood barrels for millennia. From storing and processing food items to transporting goods over long distances, a barrel's utility is ultimately driven by its sturdiness

and durability. White oak in particular also has tyloses, bubble-like structures in the heartwood that make the wood and products made from it impenetrable to liquid and decay.

Yet, in the advent of cardboard and steel in a world of mass production, barrels have become much rarer, except for in a few industries that would be entirely different, if not out of business, without white oak barrels.

Independent State Company (ISCO) was founded in 1912 by T.W. Boswell, who had some

AMERICAN RELEAF PRIORITY ECOSYSTEMS



OZARKS AND APPALACHIANS



White Oak



People/Jobs



American Forests is partnering with Independent Stave Company to sustain **white oaks in eastern forests to support local jobs, water and wildlife.**



In Missouri, **we planted 36 acres of oak forests** on the Lead Mine Natural Area in partnership with the Missouri Department of Conservation and **restored 175 acres on the Mark Twain National Forest.**



In Kentucky, American Forests partnered with Green Forest Works to **restore 20 acres of native oak forest** on abandoned mine land in the Daniel Boone National Forest.



Above: While a large part of the barrel-making process is automated, people handle every piece of wood throughout the process.

forest land in southern Missouri near the Mark Twain National Forest and decided to harvest the white oak on his land as staves to build barrels. Now in its fourth generation (the fifth

has begun working in the cooperage, too) as a family-owned business, ISCO has an illustrious history, from the woes of Prohibition to being at the forefront of the burgeoning American wine industry in the 1970s and 1980s. Through it all, ISCO has become a world-renowned cooperage, with facilities on four continents and a booming business to show for it.

When it comes to casks that will hold precious contents like wine or spirits, even the smallest margin of error can create major problems. While automation is certainly a factor in crafting barrels, it's actually the combination of machinery, technology and, most importantly, the skills and craftsmanship of ISCO employees that ensures barrels meet the company's high product standards.

"It's very hard to automate what we do," says Brad Boswell, great-grandson of T.W. Boswell and current CEO of ISCO, "there is still an enormous human element to it."

At both the sawmills and the cooperages, every piece is handled by a human being. Defects in white oak are very random and hard to inspect, so it takes a lot of skilled people.

"Because white oak has such a great amount of variability," Boswell says, "we like to say that our number one job as coopers is to take a very inconsistent raw material and make a very consistent barrel that distillers and winemakers can count on barrel after barrel, year after year."

ISCO employs the philosophy of providing the best products to its clients, and in the end, employees incorporate time-tested, traditional techniques in their work, harking back to the era when the company was founded.

CHEERS TO THAT!

The fruits of that labor find their way into a glass. But before the alcohol hits the bottle, winemakers and distillers are constantly figuring out how to enhance and adjust the taste of their product, which oftentimes puts the barrel front and center.

Below: The law requires bourbon — here, a batch of Knob Creek — to be aged in new, charred oak barrels.





Eric Aafedt, the director of winemaking at Bogle Vineyards, uses a wine thief to test wine that has been aging in the barrel.

“Winemaking is a wonderful mixture of art, science, craft and imagination,” says Eric Aafedt, the director of winemaking at Bogle Vineyards in Clarksburg, Calif. “A lot of it is blending and tasting. A lot of that comes with barrel types.”

Bogle ages nearly all of its wine portfolio in barrels, for a year on average. Barrel-aging concentrates the flavors and colors and creates a softening and complexity out of the wine, and a fruit-forward driven style from esterification. Common flavors that are derived from the toasting profiles Aafedt creates with the cooper are vanillin and eugenol.

“The actual aging of the wine in a barrel does create a much more complex wine,” he says. “It’s a real

belief that I hold that barrel-aging makes a big difference in quality.”

The process is similar for distillers, like those at Michter’s, a Louisville, Ky.-based, American whiskey distillery that traces its roots back to 1753.

Michter’s products average about six years of maturation, a process managed by Andrea Wilson, the company’s master of maturation. Wilson’s grandfather was a known moonshiner in Kentucky, so it was inevitable she’d end up in the business — and good thing, she knows her stuff, and knows how important white oak is to the process.

Like Aafedt, Wilson works with coopers to create flavor profiles. She and her team look for vanillin, which is extracted from the wood’s lignin layer, and caramelized sugars that derive from the breaking down of the hemicellulose layer. For bourbon specifically, the type of wood is

Want to learn how barrel flavor profiles are created? Read our web exclusive featuring ISCO’s director of spirit research and innovation at americanforests.org/Fall2018



essential. Congress passed a law in 1964 that designated bourbon the national spirit of the United States, and also outlined criteria that bourbon must adhere to, among which is requiring aging in new, charred oak barrels.

“Even though the law only requires new charred oak,” Wilson says, “there’s tremendous value in using American white oak.”

CAUSE FOR CONCERN

White oak’s popularity around the world is such that white oak lumber export values increased by 24 percent, up from \$410 million in 2016 to \$509 million in 2017, according to the American Hardwood Export Council. Using U.S. Forest Service data, the council has also found that American white oak growth exceeds harvest in all major supplying states.

That said, folks like the University of Kentucky’s Jeff Stringer forecast long-term loss of white oak dominance in the central hardwoods region.

“The actual aging of the wine in a barrel does create a much more complex wine. It’s a real belief that I hold that barrel-aging makes a big difference in quality.”



Michter’s Master of Maturation Andrea Wilson routinely samples the company’s products to evaluate color, flavor and aroma.



American Forests is working with partners on the ground, like the U.S. Forest Service, to implement sustainable management and restoration activities to ensure future success for white oak across the central hardwoods region.

The clock is ticking to maintain the immense benefits white oak forests are providing today, while simultaneously planning for the future.

“All the data points to a fact that there’s going to be a diminished amount of white oak in the system over time,” Stringer says. “That’s a long-term sustainability issue.”

Potential threats include usual suspects like land use patterns, forest fragmentation and pests and disease, but the real challenge facing white oak is difficulty naturally regenerating.

While white oaks are one of the most abundant tree species by volume, when looking at the forest floor, white oak seedlings are becoming rarer and rarer, or absent in some cases. White oak abundance can be attributed to past land use disturbances, from logging to severe wildfire, that created conditions where white oak thrived.

Natural, low-intensity fires that would eliminate other tree species like maple, which are more susceptible to fire, have been so rare that the forests are becoming more favorable to other species than white oak. When shade-growing species, such as red and sugar maple, become the dominant canopy species,

white oak seedlings are locked out of the next forest.

Improper forest management plays a part, too. For example, when loggers select the biggest and

tallest trees, the genetic diversity and quality of the trees within the stand is reduced, leading to degradation of tree quality over time. The possibility of the reduction of white oak supply and quality isn’t just being felt by the forest products industry, but also the winemakers and distillers who rely on barrels for their livelihoods.

For the folks at Michter’s, the thought of white oak production declining is of serious concern.

“Both as Michter’s and as an industry, it’s not something we brush off and take lightly,” Andrea Wilson says. “It’s something very important for the sustainability of our business. It’s a very important raw material for us. We can’t make Kentucky bourbon without it.”

Michter’s Master Distiller Pam Heilmann believes that conservation and reforestation are important for future generations to enjoy the benefits white oak forests provide. But with two decades of industry experience, she also understands that business depends on a reliable supply of white oak.

“You’ve got to ask yourself ‘OK, this industry is booming, and that’s wonderful, but is that sustainable for the future?’,” she says. “Who’s thinking about that?”

A WAY FORWARD

Because American white oak is such a slow-growing species, it is really important to ensure



there's not a large gap in timber supply or ecological benefits. That said, without disturbance, we won't have white oak forests in the future.

In other parts of the United States, prescribed fire is a useful disturbance technique to ensure forest health. However, in the eastern U.S., prescribed burns aren't necessarily the answer. These areas have more adjacent population centers, face cultural challenges to wildfire, and lack the infrastructure needed to contain a burn. Prescribed fire could be one of those tools used where it's appropriate, but sustainably managing and harvesting white oak forests is the best way to create ideal conditions — in both an ecological and economic sense.

"It's a perfect marriage of sustainable forest management and creating conditions that sustain all the benefits of white oak for the future," says American Forests' Eric Sprague.

To help landowners adapt forest management practices to sustainably grow and harvest white oak, with natural regeneration in mind, the White Oak Initiative was created. The group — comprised of nonprofits, government agencies, academic institutions, the wood products industry, and wine and spirit companies — is leveraging resources, exchanging research and implementing initiatives to ensure white oak remains the viable resource it is today.

For Sprague and American Forests, white

oak restoration is a top priority, not just for the aforementioned ecological services the species provides, but also the impact it has on people and communities. To meet this objective, American Forests has identified the Ozarks and Appalachians — essentially all of the central hardwoods region — as a priority American ReLeaf landscape and has already been hard at work participating in restoration activities across the region.

"We're excited about how we can use restoration to create those ecological benefits in combination with the people benefits," Sprague says.

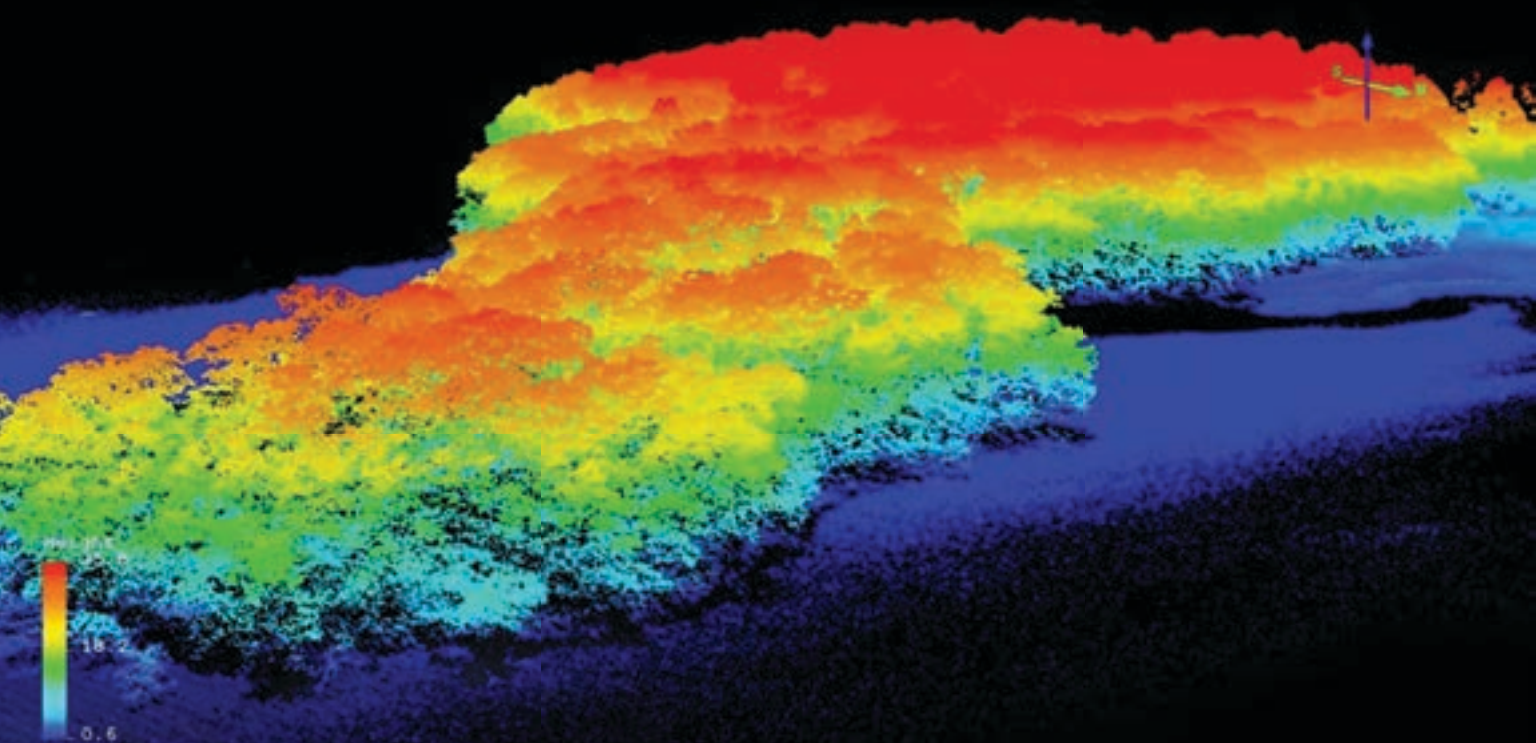
White oak is such an important economic resource across the eastern U.S., particularly in rural areas, where jobs are important. The clock is ticking to maintain the immense benefits white oak forests are providing today, while simultaneously planning for the future.

"We have some time to figure this out because white oak isn't going away any year now," Sprague says. "But if we don't start now, there will be challenges in the future." ↓

White oak conservation starts with good forestry practices, and members of the White Oak Initiative, including American Forests and Independent Stave Company, are helping private forest landowners and loggers sustainably manage and harvest their white oak stands.

Learn why sustainability and white oak conservation are important to Jim Beam and Beam Suntory at americanforests.org/Fall2018

Christopher Horn writes from Washington, D.C., and is the director of communications at American Forests.



A visualization of data from LiDAR (light detection and ranging) measurement over a patch of deciduous forest. Red indicates taller trees; blue, shorter trees.

Eyes in the SKY

How LiDAR maps forests' role in slowing climate change

BY GABRIEL POPKIN

MARYLAND'S MOSTLY SECOND-GROWTH FORESTS

don't receive the attention of the California redwoods' soaring heights, the Olympic rainforest's lush grandeur or the Great Smokies' exceptional biodiversity. But in an

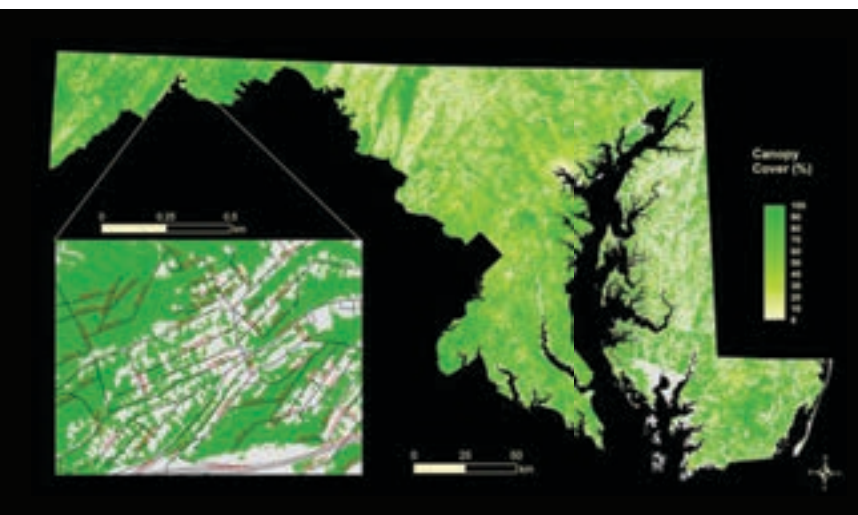
important way, the forests of the mid-Atlantic state just south of the Mason-Dixon line best their more famous counterparts — and all others out there.

"We know more about Maryland forests — at the state scale — than any place in the world," says George Hurtt, a geographer at the University of Maryland in College Park.



Scientist Jess Parker and volunteers measuring a tree at the Smithsonian Environmental Research Center in Maryland.

Forests, however, also sop huge amounts of carbon dioxide out of the atmosphere — almost 25 percent of global emissions...



A map showing percent forest canopy cover over the state of Maryland. Thanks to NASA-funded research, Maryland has some of the world's best-measured forests — and the state is a test case for a system that could measure and verify how much carbon is stored in forests around the world.

Going back centuries, governments and private companies have sought to quantify forests. The classic field forester slings a measuring tape around a trunk to quantify tree volumes. Stock estimates generated in this manner were of obvious interest to an industry that makes its money by selling wood by the board-foot and to policymakers hoping to maximize the industry's profitability.

As scientists and others have become aware of the multiple values of trees and forests, however, it's no longer just loggers who need good forest numbers. Growing trees pull vast amounts of carbon dioxide out of the air and use it as food. Because wood, once dried, is about half carbon by mass, forests can play a key role in reducing greenhouse gas levels and slowing climate change. But for anyone to have confidence in such a climate solution, scientists need an accurate, precise and transparent measurement system for forest carbon.

That's where Hurtt and his colleagues come in. They have used Maryland's forests as a proving ground for airborne technologies that could revolutionize how forest carbon is measured worldwide. This year, the state of Maryland may formally adopt Hurtt's methods to support its greenhouse gas reduction program. Other states are watching closely.

With a federal administration showing little interest in climate change, Hurtt hopes to enable other actors — from states to nonprofits to companies to other countries — to generate robust, reliable forest carbon numbers. Such a system is not enough to win the fight against climate change. But without it, a major piece of that battle likely can't be won.

A GOLD STANDARD

Efforts to systematically measure and quantify forests date to the 1700s, a time when European countries were struggling with wood shortages. The concept got a major boost in 1928, when the U.S. Congress directed the nascent U.S. Forest Service (USFS) to produce comprehensive estimates of the country's standing timber. To implement what evolved into the Forest Inventory and Analysis (FIA) program, field crews fanned out to wood-production forests in the 48 states, staked out plots and measured the trees within each. Combined with studies of wood density and width-height relationships that are specific to individual species, the data enabled scientists to generate estimates of the volume of standing trees in forests spread across the country.

Over time, the USFS standardized and improved the methodology and expanded it to all forest land in the continental U.S. The program now includes four plots within one randomly selected 1-acre area for roughly every 6,000 acres of forest, adding up to hundreds of thousands of plots. In addition to standing timber, the inventory includes information on dead wood, soil and other forest attributes. Countries that could afford to do so, such as Mexico, have emulated the FIA program, says Grant Domke, a scientist based in Saint Paul, Minn., who leads the USFS's carbon research.

"It really is seen as the gold standard of international inventories," Domke says.

Two developments in the second half of the 20th century began to make even the U.S.'s world-class inventory look a bit slow and creaky for modern needs. One was the recognition of global warming as a major problem facing humanity. Though climate change is primarily caused by burning of fossil fuels, burning and dying forests also make a sizable contribution: about 10 percent of the global total. Forests, however, also sop huge amounts of carbon dioxide out of the atmosphere — almost 25 percent of global emissions, according to scientists' best estimates.

Those estimates, however, are hamstrung by massive uncertainties. When the United Nations'

Framework Convention on Climate Change went into force in 1994, USFS researchers realized they needed better estimates of how much carbon American forests were storing and releasing.

Christopher Woodall, a USFS researcher who managed the FIA's carbon program until 2016, Domke and other researchers worked to generate carbon figures from annual forest inventories. They used what is known as the "stock difference" method, by which they compared estimates from inventories taken at different times, rather than use computer modeling to estimate how forest carbon will evolve from one point in time. Just before the 2015 conference that produced the Paris Agreement, the team reported that U.S. forests offset some 15 percent of the country's carbon emissions. Though still an estimate that needs refining, the USFS's result gave the U.S. negotiating team enough certainty to include forests in its climate change mitigation plan, Woodall says.

Growing trees pull vast amounts of carbon dioxide out of the air and use it as food.





Maryland's suburbs contain many Bradford pears — a tree developed at a USDA facility in the state. Though now unpopular, the trees contribute to the state's forest carbon.

VIEW FROM ABOVE

Periodic inventories may be too slow and not transparent enough to keep an eye on whether countries are meeting their forest carbon targets, however. That's where a second development — remote sensing — comes in.

A vast forest can be surveyed from the air in the time it takes a ground crew to stake out a few plots. And unlike with forest inventories, which are controlled by individual governments or companies, anybody can, in principle, monitor a forest from the sky.

Despite these advantages, going airborne is hardly a quick and easy fix to the forest measurement problem. Remote sensing measures properties of light, not trees. Information about trees must be derived — a process that inevitably introduces uncertainty. Photography can provide information on forest extent, but says little about tree size, which is crucial for carbon estimates. In the 1960s, forest scientists gained a new and powerful tool: lasers. Laser light bouncing off trees from a plane or satellite returns a bit faster

than light bouncing off the ground, potentially yielding data on forest height and structure. With a nod to the related radio-wave technology used to measure speeds of cars on the highway, the laser-based version was called LiDAR.

In 2010, Congress directed the National Aeronautics and Space Administration (NASA) to launch a Carbon Monitoring System to, among other things, develop capabilities for conducting remotely sensed forest inventories. Hurtt, who became the program's science team leader, assembled a team with colleagues at the University of Maryland, the nearby NASA Goddard Space Flight Center in Greenbelt, Md, and elsewhere.

Given his location, it was natural to use Maryland's forests — mostly mixed-deciduous, with some pine-dominated areas in the south — as a test bed. The decision was timely for another reason: Legislation passed in 2009 called for a 25 percent cut in the state's greenhouse gas emissions by 2020, with planting and management of forests providing around 10 percent of the



A vast forest can be surveyed from the air in the time it takes a ground crew to stake out a few plots.

reductions. Suddenly the need for an accurate accounting of forest carbon was not just a scientific curiosity; it was a political necessity.

Hurtt's team gathered LiDAR data collected by individual counties and by the U.S. Geological Survey, and high-resolution imagery from the U.S. Department of Agriculture. They measured individual trees in those forests using similar methods to the FIA; they also used existing FIA plot data. This allowed them to correlate LiDAR measurements from specific forest types with direct measurements of trees. Hurtt's team then pieced together what he calls a "wall-to-wall" map of forest carbon, first for two Maryland counties, then for every square meter in the state.

"Our model has millions of points; that's unheard of in forestry," Hurtt says. "Usually in forestry you have tens of points."

Hurtt says his Maryland carbon estimates match USFS numbers in forests. But his method measures 15 to 20 percent more trees throughout the state, he says, because it includes suburbs, cities and other sparsely treed areas, which the service is only beginning to incorporate into their inventory. The service's "Urban FIA" program has, since 2014, placed measurement plots in around 100 cities across the country.

"We're seeing trees that the Forest Service doesn't see," he says.

Hurtt then ran his data through a computer model to peer into the future. Maryland's 2.5 million acres of forests range from young ones recolonizing abandoned farmland to a few patches of remnant old-growth, and each forest type packs on carbon at a different rate. An additional 3.7 million acres may contain trees but are not classified as forest. At a recent conference, Hurtt simulated what would happen if Maryland's forests were

Old-growth hemlocks are among the trees storing the most carbon in Maryland, but are imperiled by the hemlock woolly adelgid.

allowed to grow unfettered for three centuries. Above-ground stored carbon roughly doubled in 75 years and tripled in 300 years.

While forests are never again going to carpet 95 percent of Maryland, Hurtt's model could help determine where the state will get the most carbon bang for its buck when planning conservation, reforestation or afforestation, says Rachel Marks, an ecologist at Maryland's Department of Natural Resources in Annapolis, who works on incorporating the new

methods into the state's climate plan. The model the state currently uses makes a lot of unrealistic assumptions, Marks says, such as that forests add carbon at a constant rate independent of age.

For Hurtt, the next prize is the Regional Greenhouse Gas Initiative — a pact between Maryland, Delaware, New York and the six New England states to jointly reduce emissions. Because of the uncertain measurement science, the initiative currently limits how much

of states' claimed emissions reductions can come from forests. If Maryland shows it can generate solid numbers, he hopes to get that limit raised for the other eight states.

AN UNCERTAIN FUTURE

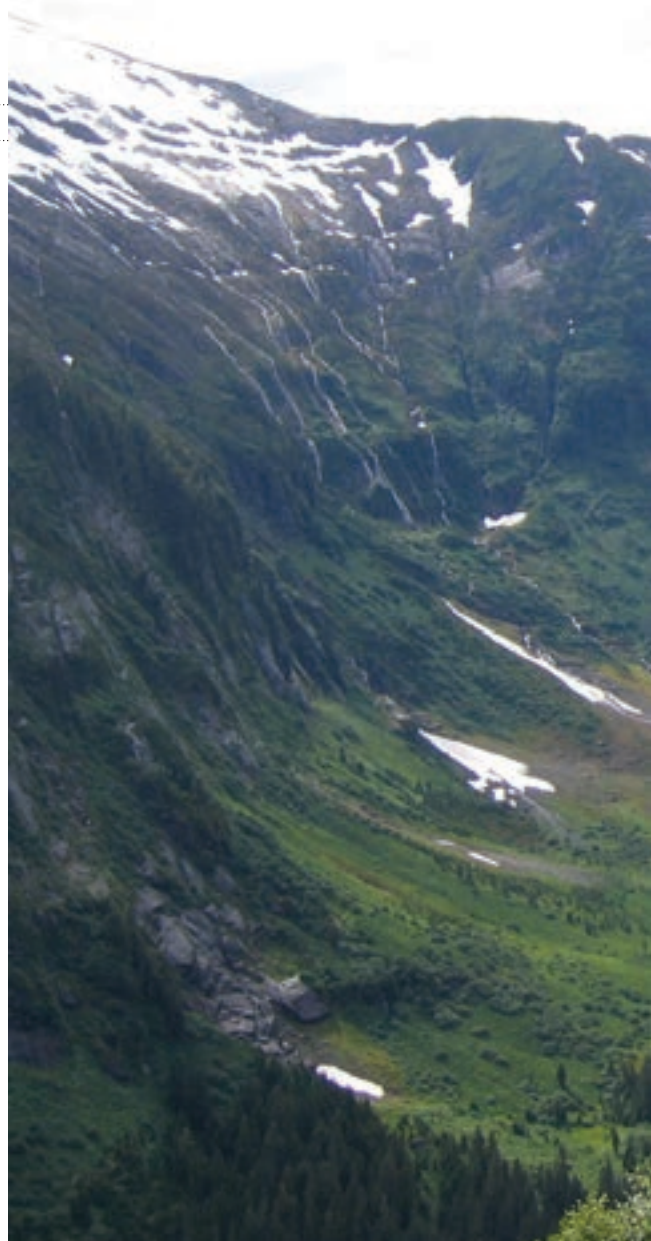
Not everyone is convinced that remote sensing is a panacea for forest measurement. Even today's sophisticated methods have difficulty detecting small but important changes in tree growth, some researchers point out.

The USFS, for its part, has for years studied how to incorporate remote sensing into its inventories, and the agency is a partner in Hurtt's project. But the team remains committed, for now, to the time-intensive but time-tested tape measures.

"That's the way FIA works and the way our team works," Domke says. "We're talking about monitoring 300 million hectares that we're responsible for. We want to make sure we're doing things in a measured sort of way."

Domke and Woodall are, however, especially excited about LiDAR's potential in Alaska. The mammoth state, which accounts for more than one-sixth of the country's total area, contains millions of acres of spruce-aspen forest in its vast and mostly

Alaska, which accounts for more than one-sixth of the country's total area, contains millions of acres of spruce-aspen forest in its vast and mostly roadless interior. Some estimate the area could hold as much as a third of the country's total forest carbon...



Gabriel Popkin standing in front of Maryland's largest tree.

roadless interior. Some estimate the area could hold as much as a third of the country's total forest carbon, but those estimates are wildly uncertain, because the state is so poorly surveyed (including by FIA) — and because much of the carbon resides underground, in the soil, which Woodall calls the "final frontier" of forest carbon measurement.



FIA field workers taking measurements in Alaska.

Putting crews on the ground requires expensive and treacherous trips by helicopter or bush plane; grizzly bears and other dangerous animals roam, and then there's the infamous "state bird" — mosquitoes large and numerous enough to threaten a field worker's sanity. While USFS is slowly installing FIA plots, a way to gather data from the sky would be very helpful for measuring the above-ground carbon, Woodall says. A NASA grant has allowed the service to start mapping the state using methods similar to what Hurtt has pioneered in Maryland.

The effort's ultimate success will depend on a lot of things — including politics. A news report in May revealed a plan to end the carbon monitoring program. Congress members have since written into spending bills language to continue funding the program, and the recently confirmed NASA administrator James Bridenstine has also expressed support for it, but the future remains uncertain.

Ending the program would be especially poor timing because NASA is about to put the first dedicated forest-measuring laser into space. This fall, the Global Ecosystems Dynamics Investigation will take up a perch on the International Space Station, which flies above most of the planet's surface. The instrument will sample forest carbon over the entire tropics and most of the temperate zone. For scientists such as Hurtt, a globally consistent forest measurement tool will be a dream come true. But, how much impact it has on the world's forests and the carbon stored within will depend entirely on what happens on the ground. 📍

Gabriel Popkin is a science and environmental writer who has written for *The New York Times*, *The Washington Post*, and more than 30 other publications. In his spare time, he serves on Mount Rainier, Maryland's tree commission and leads tree walks in and around Washington, D.C.



CLEARWATER *Country*

BY TYLER WILLIAMS

WE DROVE A ONE-LANE LOGGING ROAD, looking for a gap in the trees that would reveal some of the canyon below. Ahead, a man sat quietly on an ATV, waiting for us to pull alongside, a graying black lab perched on the seat behind him. Up front were two sealed plastic jugs, “for baiting bear,” he would tell us. His pants were greasy and his shoes tattered. On one hip he wore a large handgun, on the other, a smart phone. When I asked about a ridge we planned to bushwhack out of the canyon, he grinned. “You could do it,” he said, “but you wouldn’t want to.” Moments later we were at an overlook, blurry Google Earth images in hand, getting a geography lesson from our new friend, Roger, the local mountain man.



ALL PHOTOGRAPHY BY TYLER WILLIAMS

Larkins Lake
offers a tranquil
spot for fishing.

Their sweeping limbs called me deeper into the empire, reaching outward like gothic angels' wings.

I'd come to this obscure corner of northern Idaho because it was the heart of the Clearwater Mountains, which is the center of a rich forest region that carries a variety of descriptive monikers: The Inland Empire Forest, The Coastal Dis-

junct Zone of the Northern Rockies, The Interior Montane Region. None of these are official titles, just as there are no hard boundaries to this forest land, but a rough geographic description would have it covering northwest-ern Montana, northern Idaho, northeastern Wash-ington and southeastern British Columbia. Despite

the region's nebulous definitions, any tree lover will know when they've arrived there.

Two hours out of Missoula, it was obvious that Montana's big skies were behind me when the highway I drove ran beneath walls of green 100 feet high, sheared back by the road crew to form a shaved strip through a carpet of forest. First there were stately grand firs and lacy western white pines, and

then the trademark species of the region — western red cedar. Their sweeping limbs called me deeper into the empire, reaching outward like gothic angels' wings. Finally, the hemlocks sneaked in, adding a dark, haunting element that was felt more than seen.



I spent summers as a kid amidst this forest, bringing stories of the wild woods back to the arid Southwest and my hiking companion, Bret. When he chose to live in the Pacific Northwest as an adult, I was quick to claim credit for the move, and eager to make annual visits. We've been adventuring in the dankest forests we can find ever since. This year, we met along the banks of Idaho's big boisterous North Fork of the Clearwater River.

The North Fork is the centerpiece for the Clearwater Refugium, one of several theories that attempt to explain how this West Coast environment got here, 375 miles from the coast. The refugium theory hypothesizes that mesic species, like hemlock and sword fern, migrated inland prior to the ice ages, then survived in the low-elevation canyons of the Clearwater River while the moun-



Williams traverses through western red cedar and bracken fern, essential elements of the Inland Empire forests.



En route to Little North Fork canyon, hikers experience dramatic changes in forest composition.

tains above were mantled in ice. When the pleistocene ended, the moisture-loving plants climbed the slopes to new terrain and dispersed to wherever moisture would allow.

The refugium theory works for some of the inland habitat, but there is contradicting evidence. Red cedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) pollens have been found in lake sediments of the area up to 3,500 years ago, but no earlier. The ice ages came to a close more than 10,000 years ago. This leaves a 6,500-year gap, suggesting

that these trademark species took hold through bird dispersal as the climate moistened just 35 centuries ago. Whatever the botanical evolution might be, today we are left with an uncommonly diverse mosaic of flora: three pines, three firs, two hemlocks, a spruce, a cedar, a larch, plus a handful of broadleaf trees and shrubs including birch, alder and maple. It's a rich forest plopped between arid landscapes of the Intermountain West.



Our avenue through this cloaked country would lead down the Little North Fork of the Clearwater, a hidden drainage that promised extensive stands of old-growth forest, located one ridge north of the main North Fork. Mountain hemlock was the dominant species at 6,000 feet, as we hiked a high divide above the river canyon. Their dark trunks were dappled with moss, supporting feathery foliage that dangled over a hazy blue gap below. Looking west, there was a brightness indicating unbroken sunshine over eastern Washington, but our ridgeline was kissed by a mantle of cloud, producing a fine cool mist. It was June 23rd, and piles of snow still covered the trail.

Pacific air masses are wrung nearly dry by the Cascade Range, leaving some downwind locations with annual precipitation totals under 10 inches. But the storms regather to create another wet belt in the Clearwater Mountains. Most valley locations here receive about 40 inches of annual precipitation, roughly the same as Seattle. The mountains are even wetter.

The Clearwater cloud hovered as we pitched our tent beside a crystalline creek, lakeside. By morning I was sitting in emerging sunshine while Bret fished the mirror lake, a perfect reflection of hemlock and snow. We walked across open mountainsides of mountain ash and Rocky Mountain maple, gazing at lower slopes where a lime green carpet of cedar



Reminiscent of a giant sequoia cluster, western red cedars soar over hiker Bret Simmons.



Devil's club lines a tributary stream.

It could've been any number of sprucey places from northern Canada to a Colorado mountainside, but when a steep bluff revealed a new grove of trees below, the scene was pure north Idaho. We were in the cedars.

canopy was punctuated by soaring grand firs, dark and eminent. Soon our trail entered the woods — a pure stand of Englemann spruce. Their flaky trunks rose evenly from a carpet of green. It could've been any number of sprucey places from northern Canada to a Colorado mountainside, but when a steep bluff revealed a new grove of trees below, the scene was pure North Idaho. We were in the cedars.



The largest tree in North America east of the Cascade Range is a western red cedar. It grows over a cold spring-fed creek, among other giants,

here in the Clearwaters. Although the species attains its greatest size in coastal rainforests and is revered by native peoples there for its many uses — house planks, canoe hulls, rope strands — the trees can be overlooked in the context of so many other big trees. In these interior forests, however, the cedars are king. No other tree besides California's redwoods has the rot resistance of red cedar, which allows the trees to exceed 1,000 years of age and grow massive basal trunks in the process. These big cedars helped fuel the logging industry during the late 1800s, when northern Idaho led the nation in wood production. Even so, the girthy cedars weren't the most favored timber tree in these woods, it was the white pine.

Western white pines (*Pinus monticola*) once dominated this landscape, an endless grove of tall perfectly straight trees, and to a logger's eyes, perfectly suited for harvest. But, before these fields of conifers could be completely chopped down, most fell to the appetite of a parasite.

White pine blister rust (*Cronartium ribicola*), a Siberian fungus, landed in the port of Vancouver in 1910, and a decade later it was thriving in the pine forests of northern Idaho. By 1926, an eradication effort was commenced that focused on removing the rust's host plant — currant bush — from the entire landscape. Largely ineffective, the eradication program was finally abandoned in 1968, and by then most of the white pines were either dead from the rust or logged, or both.



Spotting a mature white pine these days is reason for excitement, so I was giddy when we arrived at the river. Several old pines rocketed skyward, arrow straight and hundreds of years old, survivors of the blister rust and escapees from the saw, elder trees that quietly lived in this natural canyon refuge, unreachable and unspoiled. The river glowed golden from yellow boulders beneath transparent flowing water. Happy to be unburdened of our packs, Bret and I blew up our pack rafts and started downstream. Around the first bend, a cow elk stood on

shore, head down eating streamside grasses. We watched her for several seconds before she shot up with a startled look, then trotted along the river cobbles before crashing into the woods.

When a sandy beach backed by mature cedars appeared on the left, we knew we'd found camp. A huge log offered a drying rack for our wet gear, and an old fire ring sat a few feet from the water. We had a stove, but we cooked over a driftwood fire that night, burning our fingers and ingesting some ash, because it just felt like the appropriate thing to do,

Above: A view down the canyon of the Little North Fork of the Clearwater. **Below:** Williams and Simmons paddle through a lush zone to find their campsite.





Above: The old-growth forests of North Idaho make for appealing hikes. Below: Williams sets up camp on the Little North Fork.

there among the 500-year-old trees. I wandered upstream to measure a big white pine. At two-and-a-half lengths of my encircling arms — 165 inches of circumference — it was a good healthy tree trunk, but hardly an adequate thickness to be supporting a tree that was 206 feet tall. The pine seemed almost delicate, a giant weed sprouting for the sky with child-like exuberance.



This old-growth forest is enduring, not just from blister rust and logging, but also fire. Low-intensity understory fires come through this habitat every 20 years on average. Big, hot, stand-replacing fires occur every 200 years. The most infamous of these was The Great Fire of 1910. Forests burned that year from New Mexico's Gila to the Sierra Nevada and Cascades, and even the upper Midwest, but the epicenter of it all was northern Idaho. Two-and-a-half million acres burned here, much of it in a crown firestorm fueled by gale force winds. The town of Wallace, Idaho went down in flames while firefighter Ed Pulaski famously took refuge in a nearby tunnel with 50 of his troops, 46 of whom successfully escaped the disaster. Shocking news of "The Big Burn" (as coined in author Timothy Egan's bestseller) helped generate public support for Teddy Roosevelt's and Gifford Pinchot's fledgling national forest service at a time when timber barons were gobbling up the land. Our national forest system of today owes much to these lush Inland Empire woods.

The Little North Fork is just south of the big burn, and just inside the boundaries of what





became U.S. Forest Service land, only miles away from the stripped mountainsides belonging to the Potlatch Corporation. It is a canyon lost in time, a relict of unmolested forest and a throwback wildland, lacking official wilderness designation but a de-facto wilderness nonetheless. Hunters, horse packers and the occasional backpacker or paddler like us comes here, but the

place is principally the home of elk, moose, bear and trees. There are indications of man's passing, but rarely a man to be found.



We got out of the river and picked up Roger's horse trail, right where he said it was, beside his favorite fishing hole. Dodging through prickly head-high Devil's club, we crossed a creek and started uphill, careful not to veer onto one of the beaten moose trails that led off the route. Up and up we went, past fresh bear scat and along a spine ridge with occasional views of the river far below, happily bouncing along in splashy runs beneath leaning cedar snags and drooping hemlocks.

I was lost in reverie when I noticed something was different. Direct sunlight shone on shrubby alders ahead of me and nearby fir trees were just 30 feet tall, forming an impenetrably thick hedge. We had entered a clear-cut. Just like that, wild nature was behind us, left below in its nurturing canyon. When we popped out on the logging road, the sun was setting over the rim of the canyon, illuminating blue humps of Clearwater country behind silhouettes of hemlock, hanging like a veil over the forgotten coast forests of the interior. 🌿

The pine seemed almost delicate, a giant weed sprouting for the sky with child-like exuberance.

Above: The sunset creates majestic silhouettes of hemlock.

Left: The forests of northern Idaho were the epicenter of The Great Fire of 1910, where 2.5 million acres burned, much of it in a crown firestorm fueled by gale force winds.



Tyler Williams is the author of "Big Tree Hikes of Sequoia Country—A Guide to the Giants." To learn more, visit his website www.funhogspress.com.



RESILIENCY NOW

BY ERIC SPRAGUE



IN 2014, CALIFORNIA'S KING FIRE BURNED nearly 100,000 acres of ponderosa pine, sugar pine and Douglas-fir in and around Eldorado National Forest in the Sierra Nevada. The fire was one of the most ecologically damaging wildfires in California history. In the northern portion of the fire, more than 30,000 acres burned so intensely that no trees survived.

Top left: American Forests' planting site at Pilot Creek, which flows into Stumpy Meadows Lake and serves as a source drinking water for Georgetown, Calif. Right: The Rubicon River Overlook faces the ridge of the Sierra Nevada.

American Forests has worked with partners in situations just like this for more than 30 years. In fact, our partnerships have led to the planting of nearly 60 million trees since then.

These tree plantings have undoubtedly provided the public benefits by jump-starting the development of

wildlife habitat, protection of water quality, and sequestration of carbon.

Yet, the effects of climate change — rising temperatures, prolonged drought and more and larger fires — are testing this strategy and forcing agencies and conservation groups to play catch-up across the country. Severe wildfires, pest outbreaks and other impacts can lead to declines in the capacity of America's forests to sequester carbon and loss of stored carbon in next few decades. Higher temperatures and prolonged drought, as well as more severe fires, will also hinder our ability to reforest landscapes and mitigate carbon emissions.

To protect forests as our existing carbon sink and to mitigate additional carbon emissions require both an offensive and defensive climate-smart restoration strategy. This model focuses on adding to the existing forest land base and strengthening its forest sequestration power (offense) while preventing forest conversion and reducing the impact of stressors with actions, such as adaptation-focused restoration and management practices on high-risk lands (defense).

American Forests is deploying this strategy in our priority American ReLeaf landscapes, including the Sierra Nevada and Southern California Ranges, Northern Rockies and Cascades, and Lower Rio Grande Valley.

SIERRA NEVADA AND SOUTHERN CALIFORNIA RANGES

The iconic mixed conifer forests of the Sierra Nevada, including Eldorado National Forest, Sierra National Forest and Yosemite National Park, are facing unprecedented threats from drought, pest outbreaks and massive wildfires. The combined effects of these changes and extreme events have real potential to create a permanent conversion of the region's forests to shrublands and grasslands. These shifts will in turn diminish the natural benefits that the Sierra's forests provide, including carbon sequestration, water supply and quality, wildlife habitat, recreation, and timber production.





A growing body of science has made clear that a proactive strategy is needed now to sustain these forests given rapidly changing conditions. Since 2010, 129 million trees have died across the state of California, with a majority of those deaths occurring in the Sierra Nevada. Recent research has shown that, as these standing dead trees fall over the next 10 years, they will produce large amounts of fuel and lead to mega-fires that are massive in area and intensity.

American Forests is working with Eldorado National Forest and other partners to test new climate-smart restoration designs to meet these challenges. These include actions that:

- Reduce fuel loads to lower the risk of severe wildfire;
- Limit competition to newly planted seedlings from shrubs and grasses;
- Plant tree species that may be more resilient to drought and other climate impacts;
- Plant trees in ways that mimic natural and post-fire regeneration forest conditions; and
- Restore forests that result in a mix of forest conditions at regional scales to improve resilience to fire, pests and other stressors.

LOWER RIO GRANDE VALLEY

The Lower Rio Grande Valley (LRGV) in South Texas is one North America's most important biodiversity hotspots. The local Tamaulipan (Texas) thornscrub forests and other habitats support a stunning array of wildlife species, including 11 federally listed threatened or endangered wildlife species, such as the ocelot, 530 bird species (58 percent of all species in North America can be found here), 300 butterfly species (40 percent of all species in North America) and 1,200 plant species.

Climate change projections for the landscape include more persistent and extreme drought. These conditions will stress the ability of existing thornscrub forests to sequester carbon and hinder our ability to add to the carbon sink by making reforestation efforts more difficult.

Top left: The Lower Rio Grande Valley (LRGV) in South Texas has been a priority area for American Forests for more than 20 years. Bottom left: The LRGV is, surprisingly to many, one of the most biologically diverse areas in North America.

In addition, climate change is projected to stress the region's unique biodiversity by causing a northward shift of forest and transition to near-desert in the driest areas of the LRGV. Many wildlife species, like the ocelot, have the potential to migrate as habitats shift, but a lack of

suitable core habitat and connecting corridors will limit their success.

American Forests and U.S. Fish and Wildlife Service, South Texas Refuge Complex are partnering to build a drought resilience strategy for restoration actions in the LRGV that will facilitate adaptation of the area's rich biodiversity while also protecting future mitigation opportunities. Our strategy includes planting a diversity of species, shifting species selection to favor drought tolerant species, using tree shelters to better retain soil moisture, and planting in locations that will serve as corridors for migrating wildlife species.

NORTHERN ROCKIES AND CASCADES

Whitebark pine is a keystone species in the high-elevation regions of the Northern Rockies and Cascades. Their large and nutritious seeds are an



A limber pine seedling growing in the Rocky Mountains in Glacier National Park.



Whitebark pine is a keystone species in the high-elevation regions of the Northern Rockies and Cascades.

important source of food for wildlife in these rugged landscapes for a host of species, including grizzly bears, small mammals and Clark's nutcracker. When cones are abundant, grizzly bears in the Greater Yellowstone Ecosystem can feed almost exclusively on whitebark pine seeds. Whitebark pine is adept at quickly establishing in open areas, providing the opportunity for trees and vegetation to colonize the area. This ability to establish in remote, alpine areas helps to stabilize soil and accumulate snow, which retards spring runoff, reduces flooding and improves water quality.

Yet, these functions are threatened by climate change as longer periods of warmer, drier weather are fueling unprecedented native pest outbreaks and shifts in the ecosystem's elevational and latitudinal distribution. The ecosystem is also suffering major declines due to the spread of an exotic disease, white pine blister rust, and the effects of long-term fire suppression policies. Given these threats, whitebark pine is a candidate species under the U.S Endangered Species Act.

The latest research shows that whitebark pine may be able to respond to fire and drought and

adapt to climate change. The catch is that the ecosystem's ability to adapt in the future is dependent on current conditions and restoration actions we take now. American Forests and the Whitebark Pine Ecosystem Foundation are partnering with the U.S. Forest Service, and collaborating with other federal agencies and tribes across the region, to develop a consensus-based, core-area restoration plan for the U.S.

distribution of whitebark pine. This strategic plan will identify selected areas within the U.S. range of whitebark pine for priority restoration, including those areas important for climate adaptation. We will also include our efforts to replant whitebark pine seedlings that show resistance to blister rust in priority locations.



Implementing climate-informed restoration will be key to each of these regions and for meeting our local and national climate goals. America's forests are powerful natural climate solutions as they sequester approximately 855 million metric tons of CO₂ each year, or 15 percent of U.S. annual emissions at current levels. Furthermore, reforestation is one of the most promising strategies for making gains in carbon storage. American Forests' restoration efforts provide demonstrations for how these forest-provided benefits can be sustained. ▼

Eric Sprague writes from Washington, D.C., and is American Forests' director of forest conservation.

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Uniting for the Land

BY DOROTHY HASTINGS

Robert Bonnie

"THERE IS A COMMON LINE that runs through all the work I've been involved in, whether we're trying to protect the climate, water, the Chesapeake Bay, longleaf pine, National Forest lands, or make lands more resilient to fire," Robert Bonnie says. "It's all a collaborative, incentive-based approach that recognizes it's not just about lands, it's about people."

Bonnie has spent more than 20 years partnering with farmers, ranchers and foresters on conservation and land management solutions, and he tackles climate goals with a steadfast dedication to land and to people.

"Aldo Leopold said that he cared about two things," he says, "the relationship with people to the land and the relationship with people to each other. That was true then and it's still true today."

Bonnie grew up surrounded by forests and wildlife on a farm in Kentucky, where he found outdoor interests and hobbies that laid the groundwork for his long career in conservation. Bonnie's family has owned and managed forest area in South Carolina for more than a

century, which exposed him early on to the issues farmers and foresters face on working lands.

Bonnie graduated from the Nicholas School of the Environment at Duke University with a joint master's degree in forestry and environmental management and, in 1995, began working at the Environmental Defense Fund (EDF), where he later became vice president for land conservation. He was specifically interested in creating incentives for wildlife conservation for private landowners. By collaborating with rural stakeholders on conservation solutions that did not involve the usual regulations and restrictions imposed on their land, he saw ways to empower landowners instead of deterring them.

In his work at the EDF, Bonnie helped develop the Safe Harbor Agreements that now encompass more than 4 million acres across the U.S. The Safe Harbor program revolutionized approaches in conservation, restoration, and land and wildlife management by giving government incentives to private landowners who conserve rare species on their land.

Bonnie and a team of conservationists focused on restoring the red-cockaded woodpecker in North Carolina by rewarding private landowners who protected and improved the habitat of the endangered bird.

In 2009, Bonnie joined the U.S. Department of Agriculture (USDA) as a senior advisor to Secretary of Agriculture Tom Vilsack. From 2013 to 2017, he served as under-secretary for natural resources and the environment at USDA, where he continued to engage rural constituencies with conservationists to develop environmental policies that benefit everyone. He worked on projects covering watershed protection, climate change legislation, fire management, endangered species conservation, and forest restoration in our national forests.

In 2015, Bonnie collaborated with public and private landowners to incentivize conserving sage-grouse habitat in the Western U.S. The combined efforts of ranchers and state agencies resulted in a rebounding of the sage-grouse population that avoided their listing under the Endangered Species Act.



Bonnie's family has owned and managed forest land in South Carolina for more than a century.

"You can't regulate anybody into restoring habitat for an endangered species," Bonnie says. "You can't regulate them into planting trees to protect climate, and you can't regulate them into protecting longleaf pine in the Southeastern U.S."

Bonnie adds that while regulation can help in a few instances, we ultimately need landowners to make voluntary choices when it comes to protecting the environment. He believes the way we achieve that is by working collaboratively with landowners.

"We have more work to do to get the environmental community to understand what actually works in those rural communities."

Since three-quarters of the land in the U.S. is privately owned, it seems obvious that solutions to species and habitat conservation must involve farmers, ranchers and private landowners. But until recently, many environmentalists did not invite stakeholders in the forest and timber industries, or local communities, to be a part of the conversation.

"If we're going to have resilient lands, we need to have resilient communities and resilient economies and resilient people working on all of this."

Bonnie has continued to fight for collaboration and partnership with rural stakeholders through his work at the EDF, the USDA and now as a Duke University Rubenstein Fellow.

"We have to recognize that if farmers, ranchers and forest landowners are going to stay on the land, they're going to need to get economic returns, and they're going to need to make money for doing conservation, farming, ranching and practicing forestry," Bonnie says. "One piece is that we need to have viable markets for wood, for farm products, for agricultural products...we need to figure out how we reward landowners for doing good conservation."

Bonnie is confident that better managing our natural resources and our forests requires a serious investment in conservation on both private and public

lands, an investment that is inexpensive and will mean large dividends in the future. Forests and agricultural lands are critical for solving climate change, for providing us with clean air and water, and mitigating greenhouse gas emissions. At the core of Bonnie's work is the belief that all our livelihoods depend on how public and private lands are managed, and we will accomplish nothing working against each other.

"If we're going to have resilient lands," Bonnie says, "we need to have resilient communities and resilient economies and resilient people working on all of this." 🌱

Dorothy Hastings was an American Forests summer editorial intern and is a senior at American University studying journalism with a minor in American studies.

last look



NAOMI FORTINO



ABOUT THE PHOTOGRAPHER

Naomi Fortino is an amateur photographer from the Chicago suburbs. Surrounded by forests while growing up, she has always had a passion for nature and wildlife. Capturing and sharing her love through her photos has become her life's path, believing that no matter where you are, there is nature and beauty. Naomi's photo "Sunshine Makes My Soul Shine" was the Forest Close-Ups category winner in American Forests' 2017 Forests in Focus photo contest. Find more of Naomi's work on Facebook @photosbynaomi140.

Maple Lake, in Willow Springs, Ill., is one of Fortino's favorite places thanks to its beautiful views and diverse wildlife. Sunrises there, such as this one captured in June 2018, are a favorite way to start her day.



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