THE FORESTRY SOURCE

Special Edition: Urban & Community Forestry

News for forest resource professionals published by the Society of American Foresters

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forests. resources. communities.

IN THIS ISSUE

DEPARTMENTS

Leaning into Urban and Community Forestry

To set the stage for this special edition on urban and community forestry, let's look at the two terms. The first is the most common—many SAF members identify themselves as urban foresters. But urban denotes cities, and not all urban foresters work in metropolitan areas. Some work in suburbs, exurbs, and small towns and villages far from city centers. Thus, community forestry may be a better term, as it encompasses everything from rural areas to densely populated inner-city neighborhoods. All communities have one thing in common: a love of and appreciation for trees, parks, and green spaces.

Our coverage of urban and community forestry begins with an interview with Janette Davis, US Forest Service assistant director for cooperative forestry and leader of the agency's national Urban and Community Forestry Program (see page 6). "We like to use the term 'community forest' instead of 'urban forest,' because people relate to the word community a little bit better," she said.

In "When Diversity is Not Diversity" (page 7), SAF member John Ball, CF, notes that, "If there's anything we've learned from Dutch elm disease and emerald ash borer, it is that the threat is not at the species level, but at the genus." Ball offers guidelines for urban forest diversity. On page 8, you'll read about efforts to help urban and community forests in Texas and Puerto Rico recover from the widespread destruction wrought by Hurricanes Harvey, Maria, and Irma in 2017.

A wilderness in a city? Read about Tennessee's Radnor Lake State Park, near Nashville, on page 10, followed by articles on the importance of urban planning and Missouri's Healthy Yards for Clear Streams program on page 11; "Greening the City: Are We Bringing Foresters to the Table?" on page 12; how the Forest Service's i-Tree Eco tool helps with urban tree assessment, page 14; and "A New Tool for Urban Foresters: Urban Site Index," on page 16.

Fayetteville, Arkansas, is recognized as a Tree City USA Community by the Arbor Day Foundation. Photo: City of Fayetteville.

A Conversation with Interim Forest Service Chief Christiansen

By Steve Wilent

Vicki Christiansen was named interim chief of the US Forest Service in March, following the resignation of Tony Tooke (see "USFS: Tooke Resigns, Agency Shaken by PBS Report," The Forestry Source, April 2018). She stepped into the chief's office at a difficult time for the agency and its employees, amidst public allegations of sexual harassment. See, for example the March 1 article by the Public Broadcasting System, "They Reported Sexual Harassment. Then the Retaliation Began" (tinyurl.com/yct9x5ez). At the same time, the agency scored important wins this spring when Congress passed legislation reforming the mechanisms for funding wildfire suppression and ending the need for disruptive "fire borrowing" from other agency accounts.

Before becoming interim chief, Christiansen was deputy chief for state and private forestry, where she oversaw fire and aviation management, tribal relations, forest health protection, cooperative forestry, Gifford Pinchot's home Grey Towers, and conservation education; she joined the Forest Service in 2010 as deputy director of fire and aviation management. Prior to joining the Forest Service, she served as Arizona state forester and Washington state forester.

"With seven years at the Forest Service and 30 with the states of Arizona and Washington, Vicki knows what is needed to restore our forests and put them back to work for the taxpayers," wrote Agriculture Secretary Sonny Perdue in a letter to agency employees about Christiansen's appointment. "As a former wildland firefighter and fire manager, she knows firsthand that failure to properly maintain forests leads to longer and more severe fire seasons. And as a former State Forester, she knows the benefits of Good Neighbor Authority and how best to partner with our state and local colleagues."

Christiansen, an SAF member for nearly 35 years, earned a bachelor's degree in forest management from the University of Washington in 1983. I spoke with her in late April about the challenges she faces in leading the US Forest Service. What follows is a portion of our conversation.

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The fire funding provisions Consolidated Appropriations Act of 2018 are "a milestone," said Vicki Christiansen, interim chief of the US Forest Service. Photo: US Forest Service.

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COMMENTARY

The Forest Service Faces a Familiar Call for Reform

By James G. Lewis

The third applicant was "no gentleman," the US Forest Service ranger wrote to his boss, but would still make a first-class fire lookout on the remote Klamath National Forest. He thought little of the first applicant's abilities, and the second had poor eyesight, though that didn't prevent him from frequently violating the local game laws. Yet the third candidate was so unusual, ranger M.H. McCarthy cautioned, "I hope your heart is strong enough to stand the shock."

For the shocking third applicant was a woman, Hallie Morse Daggett, though McCarthy added that she "is absolutely devoid of the timidity which is ordinarily associated with her sex."

McCarthy told his supervisor not to worry about being overrun by female applicants in the future, "since we can hardly expect these positions to ever become very popular with the Fair Sex." What is telling in light of recent news about the systemic problem of discrimination throughout the Forest Service is that this was written 105 years ago.

Women—and minorities, too—have long struggled to be accepted as equals in the Forest Service, an agency traditionally led by white males at all management levels. Thirteen years ago, I wrote *The Greatest Good and The Forest Service: A Centennial History,* which included a chapter about what women working in the Forest Service had achieved and what obstacles they continued to face in the agency. If I were writing that chapter today, what I then called "New Faces, Changing Values" would now be titled "New Faces, Same Old Values." It seems that all that has changed is the names of those involved in incidents, and not the misogynistic behavior.

There have always been notable exceptions, of course, women who made their way with the help of their male colleagues, as in the cases of the first female smokejumper, Deanne Shulman, and of Geraldine Bergen Larson, the first female forest supervisor.

Hallie Morse Daggett, the first woman fire lookout, served for 15 years, starting in 1913. She was one of the most effective lookouts on the Klamath National Forest, typically reporting fires before others did. Of the approximately 40 fires she reported her first season, fewer than five acres burned. Photo: US Forest Service, courtesy of the Forest History Society.

Too often, though, it's been like what their contemporary, Gene Bernardi, a research sociologist in the California region, encountered in 1973. When a hiring manager preferred to wait for a male applicant to be available rather than hire her, she complained, garnering compensation but not the job. Fed up, she and other women then filed a class-action lawsuit in California over sexual discrimination. In the end, after years of litigation and negotiation, the Forest Service consented to hire more women and minorities in the region.

Fifty years before that agreement in California, a group of female Forest Service employees met with agency leaders, including Chief William Greeley, to discuss how the agency could "make working conditions pleasant" for women. In 1924, they told leaders how to do so in no uncertain terms. According to the meeting minutes, a "Miss Peyton" observed:

The first summer after I came to the Service a group of freshly-graduated students arrived from one of the forest schools, painfully young, immature looking, and inexperienced, to such an extent indeed, as to cause quite a number of facetious remarks at their expense, one young forester going so far as to remark that they looked too young to be out without their mothers. That's the way their fellow workers viewed them and gibed them. Then suddenly something else caught and held my attention. The heads of the Service evidently saw those boys from some different angle. The Service didn't see mere boys. It saw potentialities. It was not looking at the present. It visioned the future.

In other words, don't denigrate new employees for their lack of experience. Let them work to gain experience and judge them on ability. Asking that women be afforded the same treatment, Miss Peyton went on:

Their history might in fact be written to a large extent in four words: No responsibilities, no experience. And the result? … What has happened to them might easily be indicated in three fateful words: Unused faculties atrophy. Think of it—(they're) retrograding instead of developing! … Now, reverse the picture, and thereby get a glimpse of these same women as an army of well-developed trained workers.

Female smokejumpers: (L-R) Jennifer Martynuik, Mara Kendrick, Lori Messenger, and Jeanine Faulkner, photographed in 2000 on the Toiyabe National Forest. Lori was married to a smokejumper. She and her husband alternated being on the jump list so one of them could be home with their child. Her boss accommodated them to keep retention rates high. Photo: US Forest Service, courtesy of the Forest History Society.

Job opportunities for women were limited largely to office and clerical tasks until passage of the Civil Rights Act of 1964. Several more years would pass before women began working in field positions. Photo: US Forest Service, courtesy of the Forest History Society.

How great the gain!

Ten years after Gene Bernardi filed suit, a Forest Service employee noted, "Given the Forest Service's traditional values, it's a big step to open up the organization to women and minorities. It'll take time, but we're getting there."

Today, 35 years later, after Forest Service chief Tony Tooke resigned amid charges of sexual misconduct, and with the agency's employment practices once again deservedly under scrutiny, the agency appears far from "there."

It's time to heed the advice offered nearly a century ago by Miss Peyton: Look at people for their potentialities, not their gender or skin color. Vision this future.

James G. Lewis is the staff historian at the Forest History Society (foresthistory.org), in Durham, North Carolina.

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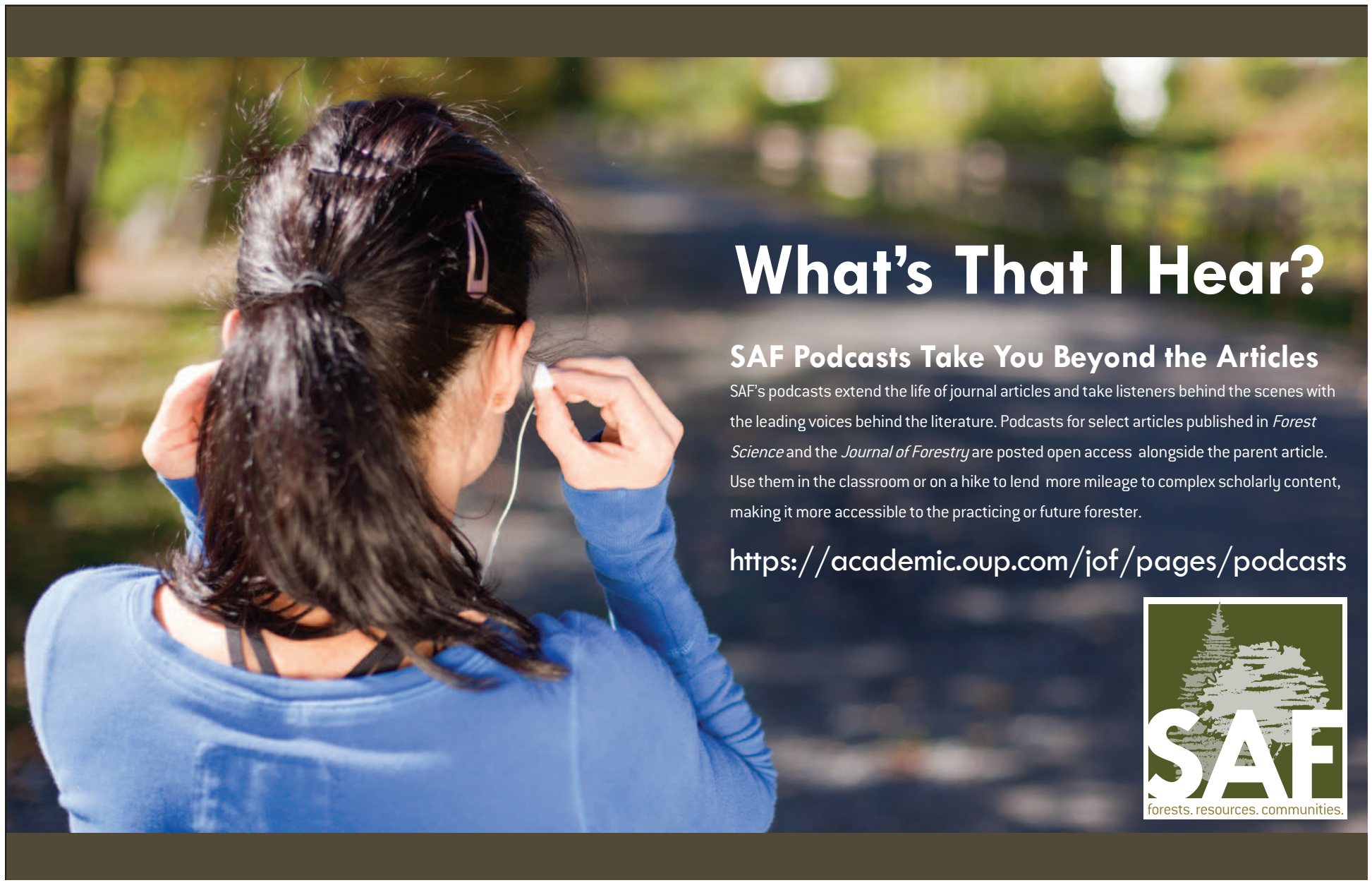

■ From Page 1

What are your top objectives for the agency in the short term?
First, let me say thank you for the opportunity to talk with the members of the Society of American Foresters. It's an organization that's important to me—I've been a member since 1984.

Among the many issues in front of us here at the USDA Forest Service, right now I'm really focused on three things: improving the condition of America's forests, improving agency effectiveness through internal reforms, and improving the work environment. I'll describe the steps we're taking to move forward on these issues, but first I want to start by recognizing the importance of the fire funding solution enacted as part of the fiscal year 2018 omnibus bill. It's really a milestone. In fiscal year 2020, this comprehensive fire funding fix will stabilize our operating environment by addressing the rising wildfire suppression budget and treating catastrophic wildfires as disasters.

The fire funding fix does two things to stop the erosion of funding available for our investments in forest health and vegetation management. First, it stops the rise of the 10-year rolling average of the wildfire suppression budget, and second, it reduces the likelihood of fire transfers, the disruptive practice of transferring funds from our nonfire programs to cover firefighting costs. This is the product of more than a decade of really hard work—a bipartisan solution that came about with the help of so many of our diverse partners—and we greatly appreciate all of their efforts.

Interim Chief Christiansen: "Right now I'm really focused on three things: improving the condition of America's forests, improving agency effectiveness through internal reforms, and improving the work environment." Photo: US Forest Service.

That fire funding fix doesn't fully kick in until 2020. Will any provisions of the omnibus bill help the agency this year and in 2019?
Absolutely. Effective immediately, Congress also gave us several new authorities that will help us get more work done to improve America's forests. These provisions really enhance how we plan and implement active management. Much of the nation's forest, including the 193,000,000 acres of land that we directly manage, are under threats from wildfire, insects, disease, overstocking, and other extreme events. We need to reset and fundamentally change how we do work and with whom we do it. We need to reform our processes and fully utilize our new authorities.

About 80 million acres of National Forest System lands are at risk from insects, disease, and wildfire, and about one-third of those lands are at very high risk, and they endanger adjacent state, private, and tribal lands.

[The new authorities] signal a significant change for us, and it will not be business as usual. One of them is the expansion of the existing Good Neighbor Authority, which enables the Forest Service to enter into cooperative agreement contracts with states to perform watershed restoration and forest management on National Forest System lands. We currently have 127 Good Neighbor Authority agreements in 33 states on 56 national forests. The omnibus expanded the list of permitted activities to include road reconstruction, repair, and maintenance, which makes it easier for us to rebuild and repair National Forest System infrastructure. This had been holding us back on some important projects.

Another provision of the omnibus bill is the authority to enter into 20-year stewardship contracts, which is crucial to businesses in planning for building mills and other facilities.
Extending the length of stewardship agreements from a maximum of 10 years to a maximum of 20 years will better enable us to work with the private sector to restore and maintain healthy forests, and this is critically needed work in areas at risk of wildfire. It also provides support for local economies. For businesses, the added assurance of supply is critical for tracking investment, and a 20-year contract agreement is very helpful. We believe this will allow us to create additional markets for wood products in areas where mills are scarce or even nonexistent, and that means creating jobs in rural communities, which is a high priority for us.

I'd like to shift gears now to talk about the allegations of sexual harassment within the agency, a topic you mentioned in your testimony during a budget hearing before the Senate Committee on Energy and Natural Resources in April—allegations that have been covered prominently by the news media. You stated before the committee that such "unacceptable behavior … must—and will—end in this agency," and that you "see strong, courageous, and forward-thinking people willing to stand up for their colleagues and themselves." How is morale within the agency, from the Washington office on down to the ranger districts?
We're at a watershed moment within the Forest Service. We cannot achieve our mission without the safe and respectful work environment that our colleagues and the American people require and deserve. We are committed to getting at the root causes of our work-environment challenges. I really believe that the purpose of the Forest Service has always been about something bigger than any one individual, and we cannot support anyone who erodes trust in our agency's mission.

These recent hard truths that we are facing about allegations of harassment and retaliation are significant. I hear, I see, I feel a resounding commitment across our agency that this is our time to step up. Some of our people are angry; some are sad; some have had some old wounds open up; some are apathetic. But there are many others who see this as an important catalytic moment to improve the future of our work environment.

As you know, the Forest Service has been combating these problems for years. The recent news reports make it painfully clear that the significant policies and practices that we have already put in place to prohibit such behavior still aren't enough. So we are going to match the urgency of the situation with focused action and a sustained commitment. I have committed to hold everyone accountable for their behavior, and I've asked everyone to think about how they can stand up for each other, to help change the culture, finally, within our agency.

In a memo you recently sent to all agency employees, you announced a new initiative called Stand Up for Each Other. What can you tell me about that?
It's a starting point, not an ending point. We are going to listen, learn, and adapt as we move forward to ensure that we have a workplace where everyone in the agency is safe, respected, and valued. One of my first actions as chief was to announce this focus on our workplace as a top priority. I have a strong belief that only strong, unambiguous actions will get us to where we want to be. So we have amended and broadened our antiharassment policy; we've added misconduct investigation capacity; we've opened a harassment reporting center; we've launched an antiharassment program Internet page; we've created a senior adviser for work environment who will work here in the chief's office. [Among other measures,] we're also working on a contract for an independent, agency-wide assessment of our work environment.

Additionally, in March we launched several initiatives to help produce a safe, harassment-free, resilient work environment. In the first step, agency leaders are conducting "listen and learn" sessions with all employees to understand, from their perspective, how we can better support and protect them. The next step is that in June we're going to hold a full day of "Stand Up For Each Other" sessions for all employees, oriented toward preventing harassment, assault, bullying, and retaliation, but it's also about naming what it's going to take to get to that safe, harassment-free, resilient work environment.

We need to have humility, empathy, and a lot of straight talk. I put humility and empathy ahead of straight talk, because we can't really fix what we don't understand or acknowledge.

Are you interested in continuing as chief without interim than your title?
Well, let me put it this way: I'm not one that has to be the one at the top. Serving in a leadership role as a deputy or at whatever level is what's most important. I'm focused on the outcomes that we need to achieve. So I'll just say that I'll serve in the way that I'm needed to serve.

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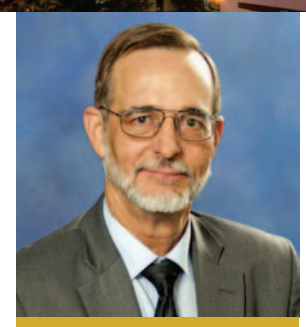

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Why Is the US Forest Service Interested in Urban Forests?

A Conversation with Janette Davis, National Urban and Community Forestry Program Leader

By Steve Wilent

Most people usually associate the US Forest Service with the national forests, firefighting, and Smokey Bear. However, explains Janette Davis, US Forest Service assistant director for cooperative forestry, the agency's mission is to sustain the health, diversity, and productivity of *all* of the nation's forests, including those in cities and towns far from any national forest.

Davis leads the agency's national Urban and Community Forestry Program, which was allocated about $28 million in fiscal year 2017. She has worked for the US Forest Service for about eight years; she previously worked for the Texas Forest Service for 17 years. Davis also served as an SAF Council (Board of Directors) member representing District 11 (Louisiana, Mississippi, and Texas) from 2007 to 2010.

I interviewed Davis in May. What follows is a portion of the conversation.

Is there a difference between an urban forest and a community forest?
The agreed-upon definition of an urban forest is the aggregate of all vegetation and green spaces with trees—or the potential to grow trees—that provide environmental health and economic benefits to a community. If you combine all of those places within a community—parks, rights-of-way, street trees, trees in people's yards, trees around schools, and so on—that would be considered a community forest. We like to use the term "community forest" instead of "urban forest," because people relate to the word *community* a little bit better.

And not all community forests are in urban areas. They may be in suburban or rural areas, small towns as well as urban metropolises.
Right, and I often think that our program benefits rural communities the most, because they may not have the access to some of the resources and expertise that the larger cities have.

Why is the US Forest Service interested in urban forests?
The Forest Service is concerned with the health of the nation's forests. We recognize that having trees in communities isn't just for beauty. We have the science to prove that they actually contribute to better human health, increased property values, energy conservation, [reduced] storm water runoff, and job creation. Taken together, the arboriculture, landscape maintenance and design, horticulture, and so on is a $147 billion industry [see "Economic Impacts of the Green Industry in the United States," tinyurl.com/y7epnmhn].

Also, the actual planting of trees in communities sometimes can bring a community together around a certain cause. For example, the Arbor Day Foundation has a program called Tree City USA, and as a requirement to obtain the Tree City USA designation, a city has to have a tree board or department, a tree maintenance ordinance, a community forestry program with a certain level of funding, and an annual Arbor Day ceremony and proclamation by the mayor. Many times I've seen these Arbor Day celebrations bring local organizations and groups together, whether it's on a small scale, such as a school group, or a large-scale tree-planting event that's associated with a festival or some other occasion that might involve 10,000 people.

Tell me about the Forest Service's Urban and Community Forestry Program. What are its main goals?
The 1990 Farm Bill outlined our key goals: We work with state forestry agencies and encourage tree planting in communities and research into the value of forests in communities. We also provide a lot of technical assistance to the state forestry agencies, to teach people not just how to plant trees, but to care for them. It's important for trees to be healthy, so that they don't become problems in the community. When a storm comes through, for example, healthy trees are less likely to have limbs fall on houses and cars. We help teach communities and arborists how to care for their trees. And we try to help the public understand that there are professionals who know how to care for trees.

The Arbor Day Foundation is an Urban and Community Forestry Program partner, and I've read about your work with American Forests and the National Association of Regional Councils on the Vibrant Cities Lab (vibrantcitieslab.com). What other organizations do you partner with?
We work not only with the state forestry agencies, but also with a broad network of national partners, most of which belong to an organization called the Sustainable Urban Forestry Coalition. The members of the coalition all have an interest in trees in communities. For example, the Arbor Day Foundation and the International Society of Arboriculture clearly have an interest not only in community forests, but in our program as well. And there are other organizations that may focus primarily on water or wildlife, but also have an interest in community forests.

What kinds of projects has the Urban and Community Forestry Program supported recently?
Each state forestry agency has a state urban forestry coordinator, as well as a volunteer or technical-assistance coordinator. Each state also has a State Forest Action Plan that talks about all of their forestry priorities, including urban and community forests. The priorities of the states and the local communities guide the kind of projects that are undertaken. One example is the Green Heart Project, where the University of Louisville is studying the impact of trees and green space on cardiovascular health [see tinyurl.com/y974za2h]. And the Los Angeles Center for Urban Natural Resources Sustainability is working with us and its other partners on studying the tree species that are best suited for Southern California's future climate conditions [laurbanresearchcenter.org].

Janette Davis, US Forest Service assistant director, Cooperative Forestry, and national Urban and Community Forestry Program leader, received the Jeff Jahnke Current Achievement Award for Leadership from the National Association of State Foresters in 2016.

The state forestry agencies reported last year that they worked with about 8,500 communities, more than one-third of which are in rural areas, and each one of those communities has a sustainable urban forestry program. And the population of those 8,500 communities totals about 204 million people who are benefiting from those programs.

Forests in the US, whether they are community forests or otherwise, face numerous threats. The emerald ash borer is notable example. How does the program help communities deal with these threats?
One of the threats is invasive species, including the emerald ash borer and others. A lot of times, invasive species come into the country through ports in our larger cities on the coasts and then work their way inland, and sometimes even onto national forests. Having a well-diversified tree canopy in communities small

Q & A ■ Page 13

When Diversity Is Not Diversity

By Andrea Watts

SAF member John Ball, CF, will be the first to admit that his recommendation for reducing the economic impact of exotic pests upon the urban forest has its detractors. "Native plant societies have a price on my head," said the professor of forestry at South Dakota State University (SDSU), who is also an extension forestry specialist and forest health specialist with the state's Department of Agriculture. And fellow urban foresters have said outright that implementing Ball's recommendation can't be done. He takes these criticisms in stride, however: "Twenty years from now, after some insignificant pest from China starts eliminating our maples [or another species], I don't think someone wants to say, 'Why didn't we learn to diversify?' We've been hit twice; we should learn our lesson now."

So, what in Ball's guideline prompts such a reaction? He proposes planting no more than 5 percent of any genus. Since it was proposed in the late 1980s by Dr. Frank Santamour Jr., a research geneticist with the US National Arboretum, the 10-20-30 guideline (plant no more than 10 percent of any species, no more than 20 percent of any genus, and no more than 30 percent of any family), has become a widely utilized and unofficial planting guideline. Ball still has notes from the lecture when Santamour discussed the need for diversity within the urban forest, and he thinks that the guideline has been misinterpreted (Santamour himself shared this sentiment), with too much emphasis placed on species selection when deciding which trees to plant.

> **The lesson we learned was not to plant elm. What we should have learned was to diversify.**

"If there's anything we've learned from Dutch elm disease and emerald ash borer is that the threat is not at the species level, but at the genus," Ball said.

This realization came to Ball around 10 years ago while conducting tree inventories in South Dakota. With ash no longer the preferred tree to plant because of the threat posed by the emerald ash borer, he noticed an increased prevalence of maple, such as red, silver, and freeman (a hybrid of red and silver maple), in South Dakota's urban forests, and that these forests were considered diverse in spite of their being comprised largely of the same genus of tree. "I realized we learned the wrong lesson," Ball said. "The lesson we learned was not to plant elm. What we should have learned was to diversify."

There are two reasons why Ball suspects that diversity ought to be focused at genus rather than species level. "Not a lot of people have made the obvious connection that these exotic threats aim at the genera level," he explained. "We do not have exotic threats focused on an individual species."

And the second reason: a reluctance to do the research necessary to identify which species are best suited for a site.

There is also the perception that maintaining a healthy forest can increase its resilience in the face of disturbances and pests; however, Ball cautions that resilience shouldn't be confused with resistance when the threat is exotic pest species. Resistance is only possible when the tree has natural defenses, and these natural defenses only evolve in response to the presence of the pest. This is why Ball advises urban foresters to pay attention to whether genera are found in other temperate climates when selecting trees to plant. "This raises the possibility of an exotic threat arriving there and recognizing our trees as suitable hosts, but our trees do not have any natural defenses against them," he explained.

These ash trees, killed by the emerald ash borer, are marked for removal. Photo: Ryan Armbrust, Kansas Forest Service, Bugwood.org.

And it's in the reduced economic fallout that occurs when these pests do arrive that the 5 percent genus guideline will make a difference. "My reasoning [for focusing on genera] is not that Dutch elm disease or emerald ash borer would not affect your community, but it means you've limited your exposure, and it's a more manageable problem than if you have 20–30 percent ash or elm," he explained.

In South Dakota, his 5 percent genera rule is gradually being adopted. The South Dakota Department of Agriculture's planting recommendations no longer include maple, because forest inventories revealed the species was already found in too many communities across the state. When communities have more than 5 percent of one genera, Ball recommends utilizing open planting spaces for new trees to bring the percentage down. He does, however, acknowledge the importance of a sense of place, which means that, in some cases, native species will be the dominant overstory species.

Ball said that working with nurseries is an important component of diversification. It's important to work with the nursery industry "so they know what we're recommending to communities," he explained. And when cities begin planting new varieties, the public will notice and, in turn, ask for these trees as well.

Looking ahead, Ball acknowledges that it's going to take a lot of work to make urban forests truly diverse. This is where urban foresters can prove their worth: The urban forest will require more-active management to match trees to site and soil conditions. "That's why [the cities] need us," Ball said. "You need people with the expertise to surgically insert trees in the community, rather than saying 'on these five blocks we're planting maple.'" (Interested in learning more about the matching trees to site and soil conditions? See "A New Tool for Urban Foresters: Urban Site Index" on page 16.)

And whatever the amount of work needed, diversity will be more cost-effective in the long run, he said, "because it's also a lot of work taking down 50 million ash trees."

After a Devastating Hurricane 2017 Season, Urban Forests Are Recovering

By Andrea Watts

Of the top five costliest US hurricanes to date, three occurred in 2017: Harvey ($125 billion), Maria ($90 billion), and Irma ($50 billion), according to the National Oceanic and Atmospheric Administration (NOAA). The three storms caused devastation in the southern and southeastern US and Puerto Rico. As part of our coverage on urban and community forestry in this edition of The Forestry Source, we set out to learn how state agencies, local governments, and the public responded to the destruction of the urban forests in Texas and Puerto Rico and how these urban forests are progressing in their recovery.

Texas

On August 25, 2017, Hurricane Harvey made landfall in the middle of the Texas coastline as a Category-4 storm. The communities of Rockport, Victoria, and Refugio, which were in the path of the hurricane, requested that the Texas A&M Forest Service (TFS) send an urban forest strike team to assess the damage to their urban-forest canopy. SAF member Paul Johnson, the urban and community forestry program leader for TFS, has been a member of the agency's urban forest strike team for nearly 15 years. Seeing the destruction in Rockport was heartbreaking, he said. Thirty percent of the buildings were completely destroyed, and another 30 percent would likely not be salvageable due to extensive damage. In addition, the wind had been so strong that it blew nearly every leaf off most trees and shrubs.

"I had a pretty extensive experience working with the community [as a regional urban forester]," he said. "It just looked like a bomb blast. However, by our second day of inventory, you could start to see baby leaves pop out. It was a great sign of the resilience and the coming recovery, not only for the community forest but also the community itself."

With the community of Rockport having an active community forestry program and a long history of working with TFS, Johnson said that the urban forest strike team was in the community earlier than usual. The electricity hadn't even been restored yet, and the team worked out of a library powered by a generator.

"We were there less than two weeks after the storm," he explained. "We don't want to be there too early, to cause additional distractions…. But as soon as things begin to settle after that initial response, the chainsaws start to come out, and we want to get there as quickly as possible so we can save the trees that can be saved."

Although you might think that the greatest risk to the urban trees was Hurricane Harvey itself, in fact, people can be even more destructive. "The second storm is when unqualified individuals come out and start doing things to trees that shouldn't be done," said Johnson. "There can be just as much devastation from the fear that people have after a storm as there is during the storm itself."

Following the team's assessment of the damage, Johnson estimated that the Rockport community lost 10–20 percent of its public trees, and that 1,300 needed to be removed or required pruning or other care. Because the urban strike team focuses only on public trees, Johnson said that they arranged for the local chapter of the International Society of Arboriculture (ISA) to conduct visits with private landowners in Rockport.

"Coordinating [a] service day [with the ISA] is really an important role that the state can serve in connecting people with qualified, certified professionals who can help, not just somebody who saw a need and happened to have a pickup and chainsaw," he said.

Once the assessments were completed, the recovery efforts of cleaning up the debris began, which prompts the question of how communities are dealing with the large volume of woody debris. "It's been a real issue," Johnson admits. "[Some communities] have actually turned to incineration to deal with these huge volumes."

The community of Rockport, Texas, lost an estimated 10–20 percent of its public trees according to Paul Johnson, an SAF member and member of the urban forest strike team. Photography courtesy of Texas A&M Forest Service.

In Aransas County, an estimated 72,000 cubic yards of vegetative debris was burned, and 10,300 cubic yards were burned in Refugio County. To give a sense of the volume of debris that needed to be disposed of, during a four-month period, 106 days were devoted to debris-burning operations. TFS partnered with the Texas A&M Engineering Extension Service and the Texas Department of Transportation to complete these vegetative debris–mitigation efforts.

TFS communications manager Linda Moon shared via e-mail that "most of the debris was along state highways and part of the highway system. A percentage of the debris did come from urban areas, but we do not have a good estimate of how much of it originated in urban areas."

In June, the city of Houston will receive its first urban forest strike team assessment as part of a nationwide strike team training program. "We're going to be able to go out and actually gather information from trees that were impacted," Johnson said. "Because [Houston experienced flooding], the damage will be different than some of the other wind damage that we've worked with before. It will be a very interesting training,"

The reason for delaying the visit to Houston, he explained is because "with flooding, it damages the root system of the tree. Now that the trees are beginning to leaf out, they will start to show signs of damage, so we can tell which trees were victims of Hurricane Harvey."

Replanting efforts began at the end of 2017 and are expected to resume later this year. Through its TreeCovery Program, TFS provides funding to communities to restore their urban forests, and the Arbor Day Foundation will conduct a series of tree adoptions for the public in the fall. Johnson expects that next year TFS will offer training sessions on the recovery and restoration pruning, since these will be ongoing activities for the foreseeable future.

Puerto Rico

On September 20, 2017, Hurricane Maria made landfall in Yabucoa as a Category-4 storm. Every region of Puerto Rico experienced some combination of wind, flooding, beach erosion, or landslide damage; the entire 3,515-square-mile island was declared a disaster area on October 2, 2017.

As for how the urban forest fared, "it wasn't so much the direct mortality but what happened afterwards," explained Elvia Melendez-Ackerman, a professor in the College of Natural Sciences at the University of Puerto Rico. "It was the cutting of the trees during the cleanup of the debris. If trees were considered hazards, they were cut, and there is the possibility that a lot of people didn't want certain trees and took advantage of that time."

Although there are laws in place in Puerto Rico to prevent the unlawful cutting of trees, in the aftermath of the hurricane, they were ignored. Melendez-Ackerman sees the irony in that: "There we were, trying to lift our power poles up, and we're cutting our trees [down]."

Because some of her undergraduate and graduate students had collected pre-hurricane tree inventory data of several San Juan neighborhoods (San Juan is the capital of Puerto Rico), it was possible to quantify the number of trees lost during Hurricane Maria. In two different

Tabebuia trees damaged by Hurricane Maria in Puerto Rico. These brittle trees lined the Media Luna Boulevard outside the building complex that is home to Elvia Melendez-Ackerman, a professor in the College of Natural Sciences at the University of Puerto Rico.

Hurricane Irma hit the Florida Keys in September 2017. Photo: Cayobo, Wikimedia Commons.

neighborhoods, an undergraduate student found that one-third of the trees had been cut, while the other had a 16 percent loss. And using data from 60 iTree plots on the Santurce Peninsula, where San Juan is located, students estimated that this sector lost 26 percent of its trees.

In Melendez-Ackerman's condo complex, she described the destruction of the huge, yet fragile eucalyptus trees as "bittersweet." They broke apart in the hurricane-strength winds, and since they couldn't be salvaged, were legally cut down. The trees lining the boulevard outside the complex were also damaged and uprooted, but Melendez-Ackerman said she was surprised that a number of these trees weren't cut.

Although you might think that the greatest risk to the urban trees was Hurricane Harvey itself, in fact, people can be even more destructive.

When asked how the woody debris was disposed of, she said, "A lot of it has gone to landfill, which is a shame." Although burning of organic waste is prohibited, "we know it happened [illegal burning] because the accumulation was so massive," she added.

In May 2018, a post-hurricane assessment drafted with input from multiple agencies was released, and this report will inform future recovery efforts. Because her research focus is on the ecosystems services that trees provide, Melendez-Ackerman contributed to the sections on ecosystem services and endangered species in riparian areas.

For her, it's the impacts upon these ecosystem services that is troubling. "Yes, the trees are coming back, but they're struggling," she said. "They're not providing the same ecosystem services [as before]." Because residents assumed the bulk of responsibility for cleaning up the debris, Melendez-Ackerman wonders if people's pre-hurricane perceptions of trees as being beneficial have changed and whether this could affect replanting efforts. "Green infrastructure is not as valued as the grey infrastructure [roads, sewer, etc.], yet it can bring just as many benefits with less resources," she explained. "I wish people would realize that. I would rather have a tree than an air conditioner."

However, even if residents are interested in replanting, the availability of seedlings is limited, because very few nurseries sell native trees. For the past 10 years, the nonprofit Para La Naturaleza has distributed free trees and educated the public on their benefits. The organization recently launched an ecological restoration program called Through Habitat to "reforest the most impacted areas by the hurricanes and continue supporting the sustainable development of communities."

What the aftermath of Hurricane Maria also revealed was the extent that San Juan's urban-forest canopy hadn't been cared for. There are few arborists or foresters on the island, and there's little government support to develop and maintain an urban forest. "There's not a culture of maintaining and planning the green infrastructure in a way that is science-based," Melendez-Ackerman explained. "[When designing the urban forest] it's just not very well thought out. I think the current government is trying, but there's so many things happening at the same time."

Which means, if there is anything positive that can come out of Hurricane Maria, it's the opportunity to design a new urban forest for San Juan. "The trees are so damaged, we might as well imagine what trees we want," she explained. "Trees offer a lot of services. What services do we want?" She cited the example of trees that serve as a food source, since that is an ecosystem service most people can readily identify and the fruit is used by people.

And there is another intangible ecosystem service that trees provide that currently isn't being measured. "Just a few days after the hurricane, [our native] palm trees were just doing well," Melendez-Ackerman said. "They gave everybody hope. If they can recover, we can recover, too."

If you are interested in learning more about Para La Naturaleza, visit http://www.paralanaturaleza.org/. For more information about the ecosystem research being conducted at Melendez-Ackerman's lab, visit https://experiment.com/projects/ecosystem-services-loss-due-to-impacts-of-hurricanes-irma-and-maria-in-san-juan-residential-trees.

Radnor Lake State Park: "Wilderness" in a City

By Steve Wilent

A wilderness in a city? Tennessee's Radnor Lake State Park (RLSP) is about as close as you can get. Compared to designated wilderness areas in national forests and parks, RLSP is far from pristine, but for many of Nashville's 700,000 residents, the park is highly valued as a place to get as close to nature as possible.

"Stroll through Radnor Lake State Park and it's easy to forget you're within city limits," reads a travel tip in *USA Today*. "The 1,200-acre oasis is in the Oak Hill neighborhood just south of downtown Nashville. The nature preserve, the largest pocket of wilderness in close proximity to a major US city, supports a variety of wild animals including otters, raccoons, and bobcats."

The park, also known as Radnor Lake State Natural Area, is actually 1,332 acres, according to Tennessee State Parks, a division of the state's Department of Environment and Conservation. And you'll also see beaver, mink, white-tailed deer, and a variety of other creatures.

RLSP is designated as a Class II–Natural Scientific Area under the Tennessee Natural Areas Preservation Act of 1971, which states that activities in such areas "shall not be inconsistent with the purpose of perpetual preservation." Tennessee State Parks notes that the day-use-only park's six miles of trails "are strictly used for hiking, photography and wildlife observation. Pets, jogging, and bicycles are only allowed on the Otter Creek Road Trail. The Lake Trail is accessible to people with all-terrain wheelchairs."

Robert Loeb, a professor of biology and forestry at Pennsylvania State University, has conducted research at the park for more than 10 years, but his interest in urban forests started even earlier. In 1971, at 16 years old, he became a research assistant at the New York Botanical Garden, where he helped conduct research on urban forests. Since then, his work has taken him to urban forests across the eastern US to examine long-term ecological changes. He was drawn to RLSP in part because other researchers had documented conditions in the park in the 1970s, giving him an opportunity to look at the changes that have occurred since then. He's now the collaborative lead scientist at RLSP.

The forest in what is now the park was completely harvested during the Civil War and has regrown naturally since then.

"This is what I refer to as an old-growth urban forest," Loeb said. "My first interest was to take a look at what the long-term ecological changes were and see what influences were causing what I saw back in 2007, when I first started my research there. There were data plots in the forest types that were identified at the time. As far as I could see, the vast majority of the changes were in relation to the introduction of white-tailed deer into the area."

Since the 1940s the range of white-tailed deer in Tennessee has expanded from a few counties in east Tennessee to the entire state, according to the Tennessee Wildlife Resources Agency. White-tails were first seen in RLSP in 1980.

A grassland restoration site in Tennessee's Radnor Lake State Natural Area. Photo courtesy of Steve Ward.

"The studies in the 1970s show a very healthy forest, with large numbers of seedlings and saplings and a well-developing older forest. When I went back to the plots that were laid out in the early 1970s, it was amazing to see virtually no seedlings and a significant decline in the number of saplings," said Loeb.

Despite hosting more than one million visitors a year, human influences since the 1970s are minor, compared to those of the deer.

"One of the interesting things about Radnor Lake is that off-trail walking or hiking isn't allowed, so those million visitors are all concentrated on the trails," said Loeb. "The rangers will give out tickets to park visitors who go off the trail. But the public is very accepting of this—they are very enamored of the forest, and they are very protective of it. If they see someone going off a trail, often they will call the rangers. When I do my research close to the trails, the rangers regularly get telephone calls about 'this guy out in the woods.'"

In other parks that Loeb has studied, damage caused by people recreating off designated trails is much more apparent.

"This is a forest that has developed without the influence of human trampling," he said. "Most other parks that I go to are open and accessible. Even where we have deer exclosures, people can walk around in those at will. With regard to tree reproduction at Radnor, human trampling has not been a factor."

People vs. Plant Pests

A number of non-native, invasive plants are present in RLSP, and the worst of these is Amur honeysuckle, also known as bush honeysuckle, which was found about 35 years ago. According to Loeb, Amur honeysuckle has invaded virtually every area of the park, with the exception of some ridge tops, and it shades out many of the tree seedlings that somehow escape the deer.

"This is where the public gets very involved with the management of the park," said Loeb. "Volunteers come in and do treatments, along with the rangers doing treatments, and my research has shown that these treatments are effective—they do knock down the population of bush honeysuckle."

Robert Loeb, a professor of biology and forestry at Penn State, talks with visitors at Radnor Lake State Natural Area in Tennessee about the need to remove invasive Amur honeysuckle. Photo courtesy of Wade Punch.

Loeb gave a presentation on these treatments at the 2017 SAF National Convention in Albuquerque. For a look at this and other research projects, see the website of the Friends of Radnor Lake, a nonprofit group that supports research by Loeb and others in order to provide a scientific basis for the management of the park.

Residents of the Nashville area have many outdoor recreation opportunities, but RLSP's qualities are highly valued by local residents.

"When I talk with people in Nashville and I say that I do research at Radnor, their faces light up. It's a prime spot for experiencing nature—it's a preferred park, to say the least," Loeb said. "Nashville residents certainly take advantage of the alternative recreation sites, alternatives that have other amenities besides nature. People who come to Radnor really want to experience nature—they're not interested in anything else."

Urban Planning Is Key to Healthy Urban Forests

By Steve Wilent

One of the first jobs in William Elmendorf's 35-year career in urban forestry was with the Department of Community Planning and Development in Thousand Oaks, California, which is now a city of about 130,000 people northwest of Los Angeles.

"I was the city forester, working for the Planning Department as an assistant planner. I administered one of the first tree-preservation ordinances in the state of California. It protected oaks and other native trees during development—the trees couldn't be removed without a permit," he said. "I started to see the importance of planning and regulatory policies and conserving natural resources, because many municipalities in the United States have a lot of authority to use zoning and other tools to preserve riparian areas, steep slopes, wood lots, and other areas."

Elmendorf, an SAF member, is now a professor and extension specialist in urban forestry in the College of Agricultural Sciences at Pennsylvania State University. In October 2017, he was named the first holder of the Joseph E. Ibberson Chair in Urban and Community Forestry, a position made possible by a gift from the late Ibberson, a 1947 forestry graduate of Penn State who retired in 1977 from the Pennsylvania Bureau of Forestry as chief of forest advisory services.

Urban planning lays the foundation for managing urban forests, says William Elmendorf, professor and extension specialist in urban forestry in the College of Agricultural Sciences at Pennsylvania State University. Photo: Penn State.

Several years ago, Elmendorf and two US Forest Service colleagues, Phillip Rodbell, program leader for urban and community forestry, and Donna Murphy, coordinator of the Mid-Atlantic Center for Urban & Community Forestry, saw a need to provide more information about land-use planning to participants in the planning process.

"How can people participate [in land-use planning]—whether they are service foresters, state park staff, or concerned citizens—if they don't understand the lingo? If they don't understand what an overlay district is, [what] one of variance is, what a subdivision land-development ordinance is, how can they really participate in the planning process in a nonemotional way?" Elmendorf said.

To provide such information, Elmendorf and two contractors wrote a series of 21 detailed articles "intended to help urban foresters, service foresters, fire specialists, and other natural-resource professionals become more familiar with land-use planning—what it is, the policies that direct it, and the tools used to carry it out." The articles, called fact sheets, are available on the Landscape Conservation website, www.landscapestewardship.org. Elmendorf wrote or coauthored several papers in the series, including "An American History of Planning," "Principles of Ecosystem Services," and "Developing a Natural Resource Assessment."

The website is a partnership between the Northeastern Area Association of State Foresters and the US Forest Service, Northeastern Area, State and Private Forestry.

"The fact sheets are also aimed toward planning commissioners, the people appointed by elected officials to review plans and administer land-development ordinances. But a lot of them aren't well-versed in environmental planning, so we're trying to reach that audience, too."

For all participants in planning, having an understanding of the topics covered by the fact sheets early in the process is crucial.

"People often don't get involved early enough," Elmendorf said. "They react when they see bulldozers in the forest, but that's way too late.

"Many people have a deep emotional attachment to the place where they live, and it hurts them deeply to see those places change drastically," he added. "That doesn't necessarily have to happen. You can have development and growth, and still preserve the nature and flavor of the place. We're just trying to give people some tools to help them with that."

Healthy Yards = Clear Streams

By Steve Wilent

Most homeowners don't realize that, collectively, they use more chemicals per acre on their lawns and landscapes than farmers use on crops or foresters use in site prep and stand maintenance. A new educational program in Missouri, Healthy Yards for Clear Streams, is designed to help homeowners learn how to be environmentally responsible with yard-care and landscaping practices, and thus improve water quality in the state's streams and lakes.

The Healthy Yards program has its roots in efforts to reduce pollution in the James River watershed; the river is a source of drinking water for Springfield, the third-largest city in the state. In the early 2000s, efforts to reduce urban sources of pollution focused on educating commercial applicators of pesticides and fertilizers, such as tree and lawn-care services. Subsequent educational programs in Springfield and Jefferson City, called Healthy Neighborhoods and Healthy Yards, respectively, were aimed primarily at people enrolled in master gardener programs. When the global economic recession occurred beginning in 2007, however, funding for these programs fell by the wayside.

But the State of Missouri and cities large and small still needed to comply with Environmental Protection Agency (EPA) water-quality regulations. In 1999, the EPA had published stormwater-management rules that required communities to implement public education programs for homeowners and communities about the impacts of stormwater discharges on local waterbodies and the steps that can be taken to reduce pollution.

As they recovered from the recession, the state, cities, and their partners resurrected the Healthy Neighborhoods and Healthy Yards programs and reshaped them into Healthy Yards for Clear Streams, an educational program that includes private property owners and focuses on maintaining healthy plants and soils, conserving water, and reducing stormwater runoff from lawns and gardens. This endeavor entailed packaging a number of educational modules into programs suited to ordinary citizens, in addition to urban foresters, arborists, horticulturists, and other professionals.

"In this day and age, everybody wants lots of information, but they want it in an hour or less," said Hank Stelzer, a University of Missouri Extension forestry specialist who helped design and deliver the program.

Stelzer and his colleagues, including numerous foresters, identified three broad communities for outreach: homeowners, commercial chemical applicators, and municipal workers who manage and maintain parks, green spaces, and other areas. They began by focusing on homeowners.

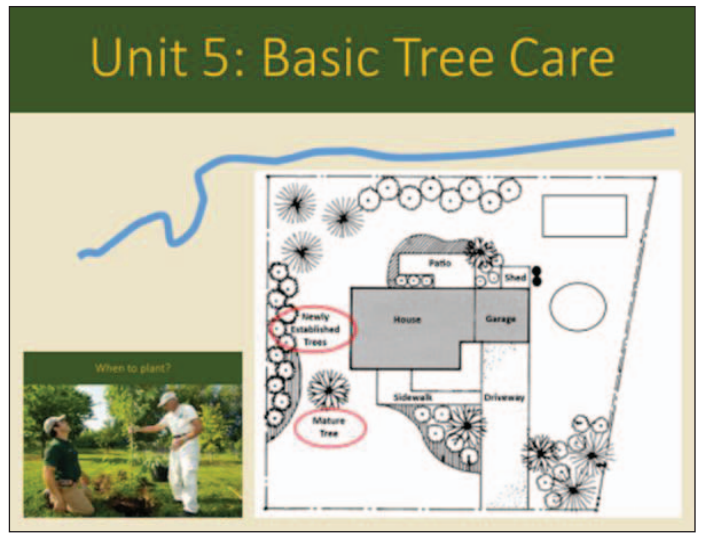
"We wanted to start with the homeowners because we could get that material online and fine-tune it, and then, later, take that same material and reach out to the green industry and municipal workers," he said.

The first stage of the Healthy Yards for Clear Streams has two main goals:

- Educate individual homeowners and homeowner associations and help them reduce the amounts of pesticides and fertilizers and help lower what chemicals they do apply on their landscapes.
- Encourage homeowners to talk about best management practices with their friends and neighbors.

The program includes seven educational modules:

1. Healthy Soils, Healthy Plants
2. Right Plant, Right Place
3. Basic Lawn Care
4. Vegetable Gardens, Flower Beds, and Groundcovers
5. Basic Tree Care
6. Integrated Pest Management
7. Sustainable Landscaping



In "Basic Tree Care," one of seven education units in the Healthy Yards for Clear Streams program, participants learn how to properly plant a tree, care for young and mature trees, and prune trees, and an arborist visits to identify hazard trees.

So far this year, these training modules have been presented in workshops around the state. Online training materials will be available this month, and this summer, Stelzer and his colleagues plan to hold more live workshops to supplement the online material. Workshops may be presented by University Extension specialists or by nonprofit groups, such as Forest ReLeaf of Missouri.

Feedback from program participants and communities has been positive, Stelzer said.

"We're beginning to work with the Metropolitan Sewer District in St. Louis. They see the value of [the program]—it's a lot cheaper to put in trees and maintain green riparian corridors than it is to lay pipe and concrete to mitigate stormwater," said Stelzer. "Simple things that a lot of homeowners have in place, such as rainwater collection barrels and rain gardens, really do make a difference. But we also want these folks and the homeowners associations to look at the riparian corridors that exist in a lot of their communities."

The "Sustainable Landscaping" module includes information about the benefits of healthy riparian buffers.

Stelzer and his colleagues are considering the addition of another module to the program.

"The eighth module would be a walk around a community, to see what practices are being used," he said. "We'll also have online discussion forums that will be open to program participants, so they can ask questions and share information. We're trying to make this program as versatile as we can," he said.

Greening the City. Are We Bringing Foresters to the Table?

By Eric Wiseman and Susan Day

Not a week goes by without a major news story describing trends in urban population growth and their consequences for people and the environment. Urban areas are growing, and cities are seeking to minimize the environmental impacts of urbanization and create hospitable habitats for people. City managers and officials are asking themselves, "How do we do this, and which professionals will be entrusted to make it happen?" Scientists and policymakers are busy tackling the first half of that question; the second half is largely up to the professions to stake their claim.

Managing urban environments is no easy endeavor, and no single profession could or should take sole ownership. In the past, the natural-resources component of cities (think trees, soils, and other vegetation) received sporadic attention from planners, architects, and park managers. Today, cities are using increasingly complex green infrastructure systems to harness the ecosystem services provided by our urban natural resources. This degree of intertwinement of natural-resource systems with the built environment requires a new and thoroughly interdisciplinary approach to management and design. With respect to green infrastructure, an array of professionals have expertise to contribute to the management of these plant-based, ecological systems: landscape architects, urban planners, horticulturalists, ecologists, engineers—*and* urban foresters. Yet, as the future of cities is examined, which of these professional groups will be viewed as the subject-matter experts on managing urban forests—arguably the most significant portion of green infrastructure? It might be presumed that cities will turn to urban foresters for expertise. However, both anecdotal evidence and scientific data suggest that urban foresters are, at best, inconsistently recognized as a critical knowledge resource and may not always be at the decisionmaking table when urban forests are planned and managed. Now is an important time for urban foresters of all stripes to recognize the opportunity—indeed, the imperative—to lead the way in urban-forest management and ensure the best knowledge and expertise are being deployed to manage our urban-forest resource.

Four years ago, a team of researchers from four Mid-Atlantic universities (Virginia Tech, West Virginia University, University of Maryland, and Virginia State University) was selected by the National Urban and Community Forestry Advisory Council to undertake a project funded by the US Forest Service. The charge was to investigate university programs in urban forestry and devise recommendations to enhance enrollment and bolster the future ranks of urban-forestry practitioners. The backstory on this charge was the perception that university programs in urban forestry are scarce, undersubscribed, and shrinking. With an eye toward the future, our research team dubbed the project "Urban Forestry 2020" and embarked on an in-depth series of studies, interviews, focus groups, and conference meetings.

An early move of our research team was to create a steering committee comprised of representatives from diverse public and private urban-forestry enterprises around the country. As the team and the steering committee unpacked their mandate, we discovered that looking solely at the status of university programs would be inadequate for devising well-informed recommendations. Therefore, we expanded the research scope to include aspects of urban-forestry employment and professional practice. This resulted in the four discrete studies of national scope summarized below.

Employment Opportunities

How do you make a career in urban forestry? Naturally, students and early-career professionals are interested in this question, but it also sheds light on how the profession is viewed and structured by employers. Thus, we had a two-fold purpose for looking at urban-forestry employment opportunities. First, we were interested in describing the opportunities in terms of qualifications, duties, salary, and sector. Second, we were interested in constructing a career ladder based on degree requirements and supervisory duties. This information has relevance to university curricula, student recruitment, and mentoring. Over an 18-month period, we gathered 151 urban-forester job postings from across the US and performed a detailed document analysis. Results have recently been published in the *Journal of Forestry* (doi.org/10.1093/jofore/fvx006), but we include some highlights here.

Because we used a strict definition for urban forestry in our search criteria, 62 percent of job postings were with local governments; jobs with commercial or nongovernmental organizations comprised less than 20 percent. Of the preferred degrees described in postings, just over half listed "forestry" as a preferred degree. Interestingly, "urban forestry" only appeared in 35 percent of postings—slightly below "horticulture" at 40 percent. Further, only a quarter of postings included "urban forestry" or "urban forester" in the job title—although this may be partly due to the slow pace of change in government job classifications. The ISA Certified Arborist credential (International Society of Arboriculture) was the most frequently listed credential, either as preferred (14%) or required (45%). Neither the SAF Certified Forester credential nor SAF-accredited degrees were mentioned in any posting. Nearly all postings would be best described as mid- or late-career positions. Only 7 percent of postings were considered truly entry level, requiring one year or less of experience after receiving a degree.

One implication of this study is that urban forestry is not widely recognized as a distinct discipline necessitating a specialized degree or credential (urban forestry is often conflated with arboriculture, with ISA credentials serving as surrogates for urban foresters). This makes it difficult to communicate with prospective students the value of a specialized urban-forestry degree. Even if they get the degree, student prospects for getting an entry-level urban-forestry job are not good, necessitating that many of them start their careers in commercial tree care, which may not be a desirable path for many aspiring urban foresters.

From Urban Forestry 2020, uf2020.frec.vt.edu.

Employer Expectations

Where entry-level positions do exist, what are employers looking for in a new hire? In a separate survey, we asked government and private-sector employers about the skills they seek in new hires and whether their recent hires have met these expectations. This survey targeted a different population than the job posting analysis above, but it revealed some similar trends. By far, the most valued credential by employers was the ISA Certified Arborist. Unlike the job postings, however, a clear preference was expressed for employees with an urban-forestry degree, slightly more so than a degree in arboriculture, forestry, or horticulture. The most valued skills were a cross-section of basic technical skills (tree identification, pruning, planting, species selection) and professional skills (public relations, customer service, communication, ethics). Interestingly, although urban-forestry curricula provide students with a broad array of geospatial analytical skills and an understanding of policy, planning, and decisionmaking, employers did not identify these as most-valued skills. Employer expectations were commonly not being met by new hires in the areas of conflict resolution, employee supervision, and advanced technical skills (tree root management, risk assessment, and disorder diagnosis). All told, collegiate urban-forestry curricula appear well-aligned with employers' expectations, but continuing efforts must be made to provide students with practical experiences to polish their nontechnical skills, either within the curriculum or through internships.

Employee Experiences

Who practices urban forestry and how they arrived at the occupation can be telling about how decisionmakers approach marketing and creating support mechanisms to advance the profession. We conducted a nationwide survey of individuals working in local governments whose primary responsibilities revolve around managing urban trees and greenspaces. The most surprising finding was the self-described professional identify of respondents: Only 33 percent identified themselves as an urban forester. In contrast, 21 percent identified themselves as a public administrator and 12 percent as an arborist. A full 34 percent of the respondents identified with an "other" professional identity.

While it's reassuring that managing our urban forests is predominantly entrusted to arborists and urban foresters, it's also daunting that more than half of the trustees may have limited professional preparation for the task. Although many of these situations might be small localities that hire well-qualified consultants or utilize the expertise of extension agents or state agency foresters, undoubtedly, many of our nation's urban forests have minimal professional management. The survey also revealed that the urban-forestry workforce is not very diverse: Of the 524 respondents, 91 percent were white, 78 percent were male, and the median age was 52. Racial and gender diversity is not a new challenge for forestry and natural resources, and it appears to pervade urban forestry as well. It seems logical that urban forestry would be a sector to make inroads on racial and gender diversity, and that these be imperatives for resource professionals serving an urban clientele. Encouraging diversity is not just good for the clientele, it also brings a diversity of ideas and perspectives to resource management and ensures that students from underrepresented groups have role models and mentors with similar life experiences.

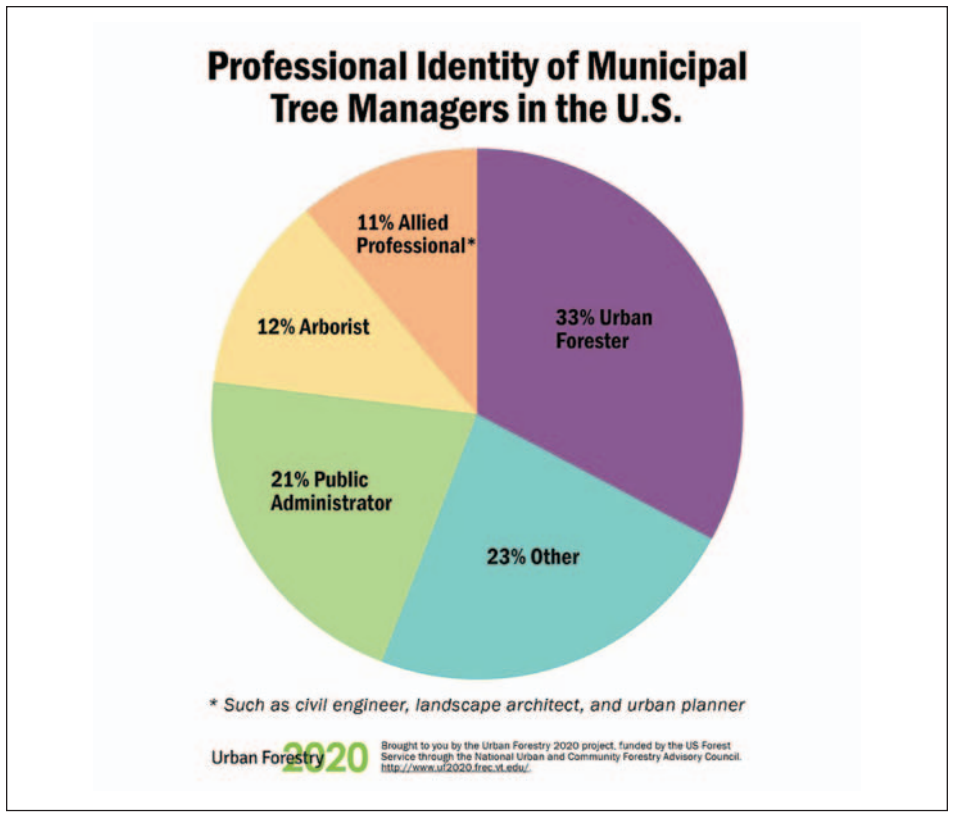
With the caveat that their demographic profile was narrow, the survey respondents expressed favorable perceptions of their workplace and satisfaction with their career choice. As an example, 88 percent somewhat or strongly agreed that their

opinion was considered on urban trees or greenspace issues, and 77 percent likewise indicated that their coworkers understood what they do in their urban-forestry jobs. Similarly, 94 percent somewhat or strongly agreed they were satisfied with their career thus far, 84 percent felt there were opportunities for career advancement in the profession, and 76 percent indicated that they were well paid. What we cannot ascertain from the survey is where individuals who do not fit the demographic profile might land with their perceptions. Are there individuals whose careers in urban forestry have faltered because of their race or gender? What are the implications for how decisionmakers market and recruit to a decidedly much more diverse college-age populace? How to ensure that underrepresented groups get the proper mentoring and early-career support they need for success? All told, the survey suggests that urban forestry is a well-regarded natural-resources profession with promise of a well-paying job and meaningful work. This information needs to be widely leveraged for student recruitment and coupled with continuing development of a professional structure that will create broad career access.

Student Perceptions

The future of the profession comes down to the eagerness of talented young people to devote themselves to a career in urban forestry. So, what do college students think about career choice and urban forestry as a career path? We explored these questions with a nationwide survey of 1,000 college students enrolled in environmental and natural-resources courses. Personal interest and job satisfaction were the most important factors for these students when considering a career path, even more important than pay or prestige. Family opinions influenced personal motivations, and their family's disposition toward nature and the environment positively influenced personal motivations about personal interest and job satisfaction.

Students had little exposure to urban forestry: 33 percent were not aware of it at all, and 29 percent were only slightly aware. After showing students a brief video describing the urban-forestry profession, the overall impression of students toward the profession scored slightly favorable (statistically different from a neutral impression), and students did not differ based on race/ethnicity, gender, or residential setting growing up, though students from a very wealthy socioeconomic background did have a less-favorable impression. Further analysis suggested that recruitment messages may only be reaching those students pre-filtered by their attraction to traditional forestry and natural-resources programs, and that there are no significant intrinsic barriers to student interest in urban forestry based solely on their demographics. Simply put, decisionmakers need to do a better job of exposing young people to urban forestry and do so in an inclusive manner that does not pre-suppose who may or may not be interested in it as a career path.



From Urban Forestry 2020, uf2020.frec.vt.edu.

Conclusion

The research conducted in Urban Forestry 2020 is in various stages of publication. In the meantime, resources and data summaries are available at uf2020.frec.vt.edu. A set of strategic recommendations resulting from Urban Forestry 2020 is currently being vetted with our steering committee and will be available on our project website this summer. It is our hope that urban-forestry educators and practitioners can leverage this information to advance the profession and bring urban foresters to the table as citizens green our cities.

Eric Wiseman and Susan Day are associate professors in Virginia Tech's Department of Forest Resources and Environmental Conservation.

Q & A

■ From Page 6

and large helps prevent the rapid spread of these invasive species. When an invasive species becomes a problem, we try to communicate to these communities the importance of replanting with a diversified tree stock, so that they don't experience the same thing again.

What other issues are of concern these days?

A lot of times communities have big tree-planting campaigns—you've probably heard of "million tree" campaigns and the like. But the communities also need to build in the funding for the care and maintenance of those trees. They have to understand that it's not just a one-time investment.

Another issue is having a trained workforce that is interested in jobs and careers in arboriculture. The Forest Service is working with several universities and national partners on this. What are the best entry points for arboriculture careers? Is it apprentice programs? Two- or four-year college programs? What are the educational tracks that colleges provide? Arboriculture and tree care? Or are they more in line with urban planning?

We are also looking at new markets for urban wood—urban trees that are affected by the emerald ash borer or other invasive species, or by storms like we had last year with Hurricanes Harvey and Irma. The storms blew down a lot of wood that was in urban neighborhoods that had the potential to be turned into wood products. We've seen a rise in the market for urban wood of this kind in communities across the country.

Does the Forest Service provide funding directly to communities or to its community forestry partners?

It depends on how the states have structured their programs. Some states have competitive grant processes so that communities can compete for funds, while some states mainly provide technical assistance. And other states work with other partners that work in their communities. In general, state forestry agencies match federal funds at least 50-50, and often more in some cases.

I recently read about the Forest Service's national Urban and Community Forestry Challenge Cost-Share Grants. Tell me about that program.

The 1990 Farm Bill directed us to assemble the National Urban and Community Forestry Advisory Council to advise the secretary of agriculture on what they see as the up-and-coming issues in urban and community forestry and to offer solutions to problems that their constituents may be experiencing. The Farm Bill also authorized the Cost-Share Grant Program. Over the past few years, the grant program has been able to fund quite a bit of the research that's been done in urban and community forestry, and also has been used to promote innovation in the field.

What key lesson have you learned in your work for the Forest Service in urban and community forestry?

When I decided to pursue forestry as a career, I knew that forests at the most basic level provide products—including clean water, clean air, places to recreate. But bringing that understanding to where people live, work, play, and learn, which is part of our program's mission, not only influences their decisions about the management of the national forests, but it also shows them that their community forests offer the same benefits in their communities. We have a lot of great urban forestry data and we have a lot of great projects, and sharing those nationwide has been incredibly beneficial in supporting urban and community forestry.

Each of the nine Forest Service regions has an urban forestry program manager, and they all work together on what we call a technology, science, and delivery team that we put together about four years ago. They exchange ideas, what their states' priorities are, and what their local projects are about. For me, one of the highlights of managing this program has been creating and supporting what is truly a national information exchange network.

Because we work with each of the state forestry agencies, we also work very closely with the National Association of State Foresters, which has an urban and community forestry committee. Having the National Association of State Foresters, our program managers, the members of the sustainable urban forestry coalition, and the states themselves all in alignment is what has made the National Urban and Community Forestry Program successful.

How might SAF play a bigger role in supporting urban and community forestry?

SAF has had an interest in urban and community forestry for a long time, but just recently, I've been working with SAF's national leadership to look at how we can add more urban and community forestry articles to the *Journal of Forestry* and how we can make the urban and community forestry track of the SAF National Convention more robust. I look forward to continuing that work with SAF.

What's your favorite part of your job?

Working with all of our national partners. They make me proud, proud to know that trees are getting planted and cared for every day in communities across the nation. And I like seeing the sense of accomplishment shown by the people our program serves. It might be something like a tree planting in a small community, or it might be something big, like an urban tree canopy assessment that tells the city what its actual needs are. Maybe it's something really small, like a Saturday morning tree giveaway. But those kinds of things show me that the program is really making a difference in people's lives.

i-Tree Eco: Urban Park Tree Assessment

By Zhu Hua Ning and RaHarold D. Lawson

City parks improve the physical and psychological health of citizens, strengthen communities, and make cities and neighborhoods more attractive places to live and work. They are valuable urban green spaces that provide substantial environmental benefits. Trees in these parks provide direct and indirect social, ecological, and economic benefits, such as filtering pollution from the air, sequestering carbon dioxide, regulating floodwater and controlling runoff, and regulating climate. Assessments of park trees help the policymakers, city managers, and the general public aware of these ecological benefits.

Independence Park in Baton Rouge, Louisiana, is operated by the Baton Rouge Recreation and Park Commission (BREC). Being in the center of the city, this park serves a large geographic area of the city and is designed to engage families and visitors for recreational, educational, and physical activities.

Communicating the park's benefits only with intangible values would not be convincing, unless these values are expressed in monetary terms. The application of the i-Tree model in park tree assessment can better demonstrate the need for investment in the parks. Developed by the US Forest Service, the i-Tree Eco model is an urban forest–ecosystem analysis, as well as an ecological-benefit and economic-value assessment tool. i-Tree Eco is designed to use standardized field data from randomly located plots and local hourly air pollution and meteorological data to quantify urban-forest structure and ecological functions, as well as associated monetary values (Nowak & Crane, 2002). Some of the attributes that i-Tree Eco can quantify are: species composition, tree health, and leaf area; amount of pollution removed hourly by the urban forest, and the associated percentage of air quality improvement throughout a year; total carbon stored and net carbon annually sequestered by the urban forest; effects of trees on building energy use and consequent effects on carbon dioxide emissions from power plants; stormwater-runoff reduction; and structural value of the forest, as well as the monetary value for the ecological functions (Abd-Elrahman et al. 2010; Hirabayashi et al. 2011; Martin 2013; McPherson 2010; and Nowak et al. 2008, 2010, 2013).

Using the i-Tree Eco v6 model and its complete inventory protocol (www.itree.org), an assessment of the trees in Independence Park was conducted. Field data were collected from each individual tree located throughout Independence Park and recorded using a handheld GPS unit, Trimble Geo6000 XH. The data collected included tree species, diameter at breast height (DBH), total tree height, height to live top, height to crown base, crown width, crown dieback, crown light exposure, percent impervious surface under the tree, and direction and distance to building. The data were then entered into the i-Tree Eco v6 model and analyzed using a series of scientific equations or algorithms to compute the results. The detailed computation methodologies can be found at www.itree.org.

Structure, Function, Value

The i-Tree Eco v6 model estimated that the tree canopy cover makes up 30.6 percent of Independence Park (Table 1). There are a total of 607 trees and 16 different tree species in the park, the most common tree species being live oak, loblolly pine, and crape myrtle. Live oaks, which constitute 48 percent of the total park trees population, define the landscape of the Gulf Coast region. The species should be carefully managed and maintained. The crape myrtle ranks third among the top three most common species, mainly because of the crape myrtle garden/grove in the park, which consists of 56 varieties that were installed and are carefully managed by the BREC Botanical Garden. As large shrubs to small-size trees, crape myrtles do not just add beauty to the park, but also diversify its tree height composition.

It is a positive aspect for species richness when among the top six most important species, three are evergreen broadleaf species (live oak, crape myrtle, and southern red oak) and three are conifers (loblolly pine, bald cypress, and shortleaf pine). However, these top six species made up 93 percent of the park's total tree population, which can be considered negative because it resulted in a low species evenness in the park.

Among the total 607 trees in the park, no trees were less than six inches in DBH (Figure 1). To diversify the DBH and age class of the tree population, we recommend planting new tree saplings in the park. When planting new trees, species diversity should be addressed by considering current tree species composition. New tree planting would also help to increase the tree canopy cover from the current 30.6 percent to a higher level in the future. It is fortunate that the park cur-

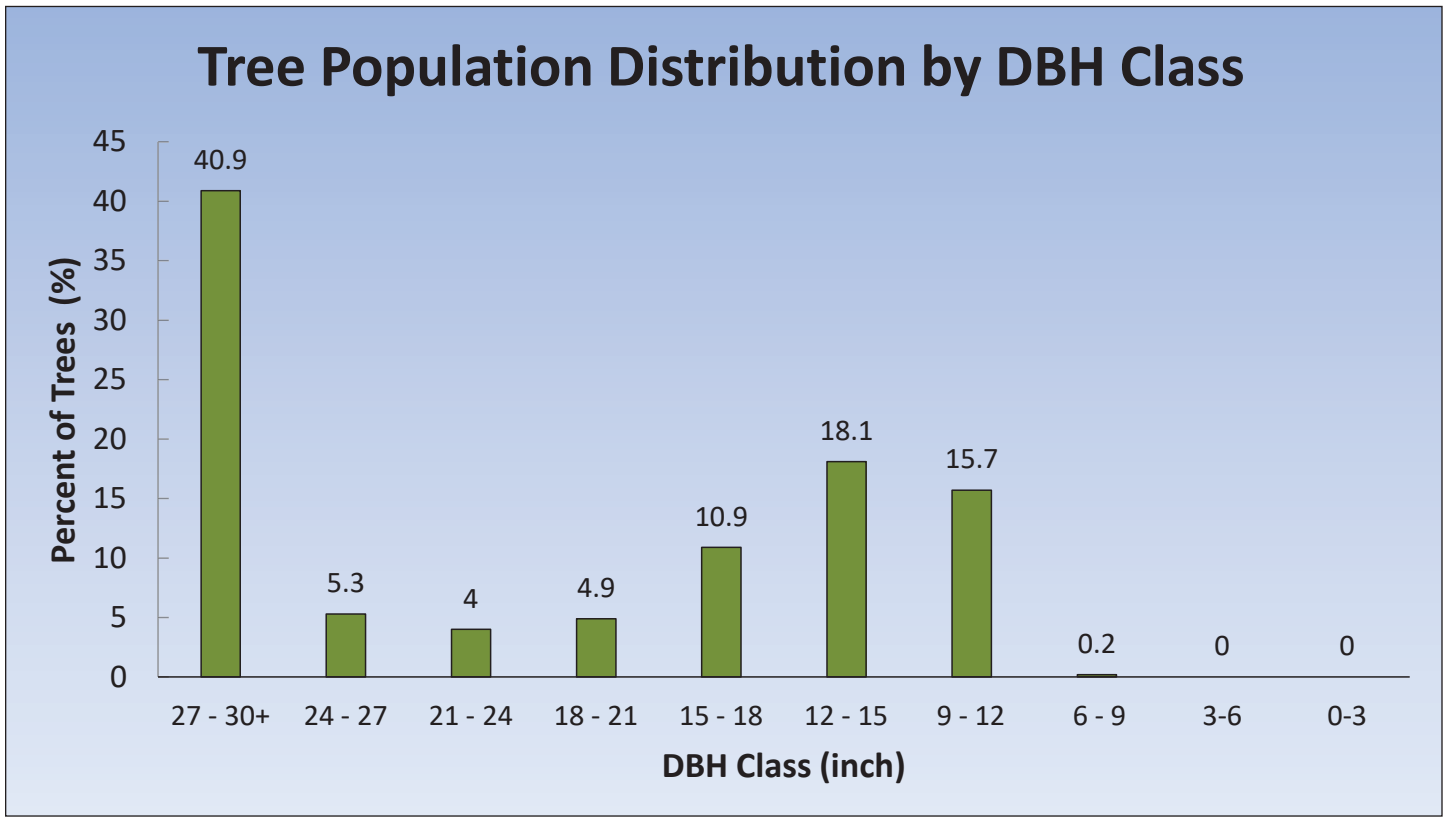


Figure 1. Tree Population Distribution by DBH Class

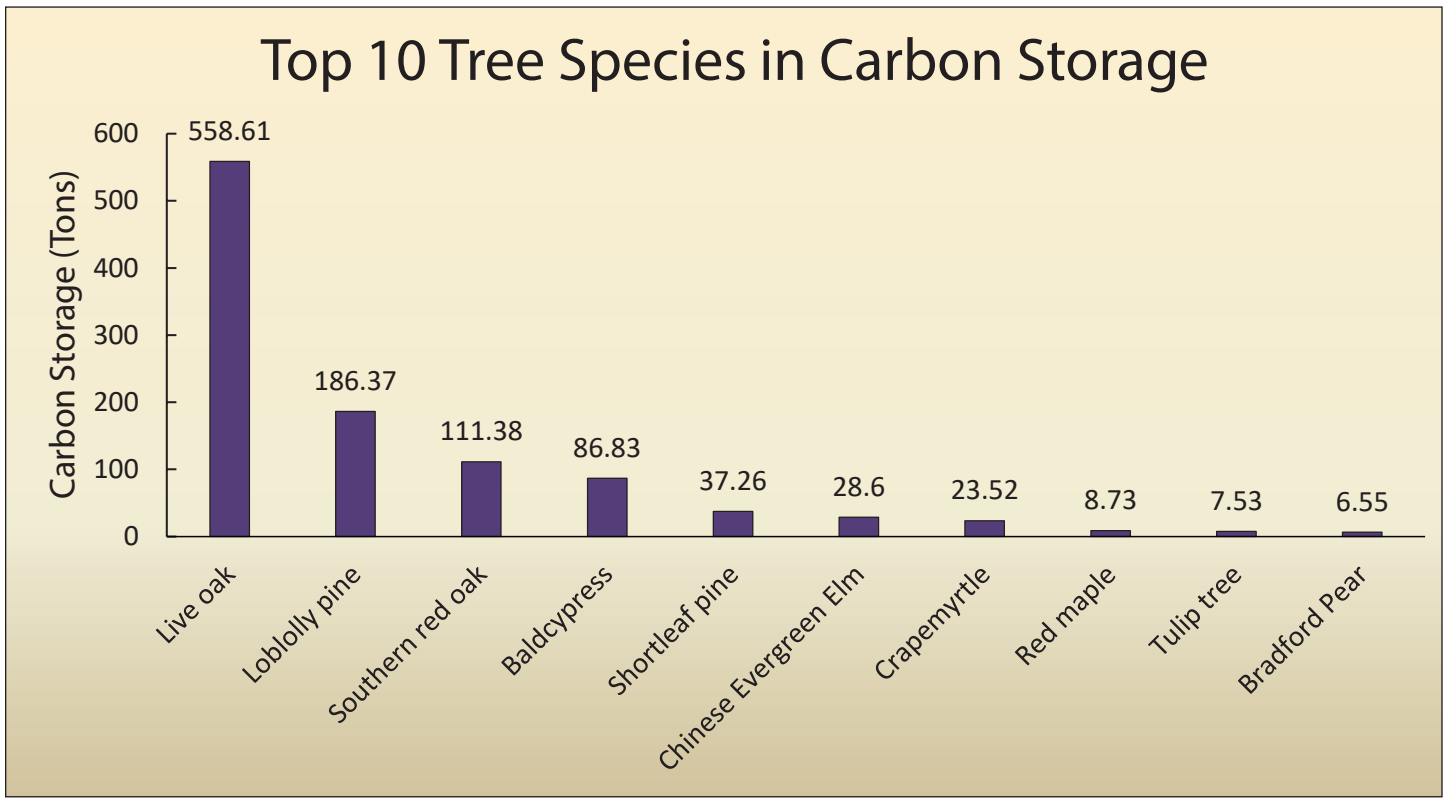


Figure 2. Top 10 Tree Species in Carbon Storage

The Value of Trees in Independence Park	
Number of trees	607
Tree canopy cover	30.6%
Most common	Live oak, loblolly pine, crape myrtle
Trees <6 inches DBH	0%
Pollution removal	877.9 pounds/year ($433,000/year)
Carbon storage	1,079 tons ($140,000)
Carbon sequestration	13.7 tons/year (1780,000/year)
Oxygen production	36.54 tons/year
Avoided runoff	35,110 cubic feet/year ($235,000/year)
Structural values	$3.32 million

Table 1. I-Tree Eco Model Application Result Summary

rently does not have any invasive species; to maintain this positive attribute, species selection guidelines should be developed for the park to avoid any invasive species introduction.

At present, 50.2 percent of the tree population are large trees. The management objectives and implementation strategies for these large trees should place emphasis on large-tree maintenance, such as pruning weak, dead, or dying branches; cabling large branches; checking for and preventing trunk and root cavities, and assess the risk of damage to people and property from falling trees or limbs.

Air pollution is an issue of global concern. Urban trees can help mitigating this problem by sequestering pollution (Abdollahi et al., 2000). Pollution removal by trees in Independence Park was assessed by the i-Tree Eco model using field data and recent local pollution and weather data. It is estimated that trees in the park remove 878 pounds of air pollution per year, with an associated value/avoided cost of $433,000 (Table 1). The pollutants removed include ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter smaller than 2.5 microns (PM2.5), and sulfur dioxide (SO_2).

Carbon storage by trees is a cost-effective way to mitigate global climate change. Trees' ability to store carbon is determined by tree species, size, and health condition. As illustrated in Figure 2, in Independence Park, live oaks store the highest amount of carbon, at 559 tons, followed by loblolly pine at 186 tons, southern red oaks at 111.38 tons, and bald cypress at 111 tons. All 607 park trees together store 1,079 tons of carbon, with an associated economic value/avoided cost of $140,000.

The trees in Independence Park enable the park to provide ecological services to surrounding communities and the city. These ecological services added economic benefits to these communities and the city (Table 1). In addition to pollution removal and carbon storage, on an annual basis, the trees in the park sequestrated 14 tons of CO_2, with an associated economic value/avoided cost of $178,000; contributed to stormwater-runoff prevention by 35,113 cubic feet, with an avoided cost valued at $235,000; and produced 37 tons of oxygen. In addition to these benefits, trees in the park also have a structural value of $3.32 million.

The complete i-Tree Eco inventory and analysis help in better understanding the structure, function, and value of the trees in Independence Park, therefore promoting management decisions that will improve human health and environmental quality. Such results can serve as a baseline for evaluating changes in urban parks over time so that their social and ecological benefits can be maximized. They also can be used for better management of trees and parks that contribute to the sustainable development of the surrounding urban areas and can be used in city development planning and best management practices toward reducing the impacts of urbanization.

Zhu H. Ning is an endowed professor at Southern University. RaHarond Lawson is the assistant director of park operations at the BREC. Both institutions are located in Baton Rouge, Louisiana.

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A New Tool for Urban Foresters: Urban Site Index

By Andrea Watts

Alan Siewert recalled that it was a Thursday afternoon in August 2009 when Stephanie Foster Miller called to discuss what they, as regional urban foresters with the Ohio Department of Forestry (ODoF), could do better when explaining a fundamental principle of urban forestry: what constitutes a good or poor planting site. The concept is covered in the eight-day Tree Commission Academy that the ODoF launched in 2008 and offers to tree commission volunteers and city staff interested in learning more about urban forestry. Although the class includes discussion of why it's important to choose the right tree for the right site, Siewert said that once he delved deeper into the concept, explaining that it's also important to select the least hardy tree for the site, the participants "stared at us, and you could hear them blink," he said.

As Siewert and Miller hashed out over the phone how they could better describe the least-hardy tree concept and help communities assess planting sites, the first-ever urban site index (USI) was born.

Link between Soils and Diversity

"[The Ohio urban site index] grew out of a real desperation—how can communities, at the large scale, quickly identify soils and site conditions and then develop some long-range planting designs," explained Miller, who is also an SAF Fellow.

The importance of long-range planting designs became apparent with the appearance of the emerald ash borer: A lack of species diversity has allowed them to devastate ash trees, which dominate—or once did—the tree canopies of many communities. Miller was on the front lines when emerald ash borer swept through the region, and as communities rebuilt their urban canopies, she saw the same few species being used, which would make the communities vulnerable when the next invasive pest species came through. The lack of diversity often resulted, Miller said, because "historically, in urban forestry, communities have played it really safe and they planted a handful of species."

Because soil quality is a key factor in planting-site quality, and by extension, tree growth and survival, Miller and Siewert reached back to their traditional forestry roots to create their USI, comparable to the site indexes used in natural settings.

"We worked it backwards," explained Siewert. "We looked at our experience and said, 'These factors are important. Let's put a scale to [them].'"

They identified eight factors—four for soil and four for street conditions—that determined whether a planting site is good or poor. The four soil factors are vegetation, surface, probe, and layer. Each factor is then assigned a score of 0 to 3 based upon its condition. For example, vegetation is scored by these criteria:

- 3 points for good (unwatered) lush grass; some weeds are ok
- 2 points for patchy grass and weeds
- 1 point for sparse weeds with dirt showing through
- 0 points for bare dirt, gravel, or pavement

Waterville, Ohio, was one of the communities that went through the process of using the Urban Site Index to develop a master planting design. Photograph courtesy of Stephanie Miller.

Street factors were identified based upon the "wind's ability to carry things like salt and pollution [off the road] up onto the trees," Siewert explained. "The faster the cars go, the more of that slurry ends up around the trees." The four factors are speed, lanes, parking, and length between traffic stops. Each street score has a range of 0 to 2; the lanes factor, for example, is scored by these criteria:

- 2 points for a street with 2 lanes of traffic
- 1 point for 3 or 4 lanes
- 0 points for 5 lanes or more

After a score is assigned to each of the eight factors, the scores are added to yield an overall score for the site; total scores fall a within a range of 0 to 20. A score of 16 and above is a good site; 12 to 15 is an intermediate site; and 9 to 11 is a difficult site.

To determine a tree species' USI score, Foster and Siewert assessed trees in numerous communities as to their respective health in relation to the site's USI score. Using that data, Miller compiled tree lists for good, intermediate, and poor sites.

"We've never found a tree growing at a site 8 or less," said Siewert. "It's just too harsh; trees are planted and they die."

"We overestimated how well a lot of trees would perform on the low end of the scale," added Miller. "We thought that we could have trees growing in a score of 5, but the lowest score is a 9."

When communities conduct a USI inventory, it's at the block level rather than each individual property. "For most communities, from one block to the next, you're going to have fairly consistent site conditions," she explained.

After all the USI scores are collected, the community volunteers can create their master planting design. This is accomplished by taking a map of the city and labeling each block with its USI score. From there, trees are placed in locations that match their USI score. The process can be worked through fairly easily and quickly. Miller said that after a couple hours in a coffee shop, she and the community members leave with a finished plan. "When we're done, we have this colorful map that's really attractive, and people see how they fit into it," she explained. "It gives our tree commissions and staff something they can show their decision makers."

The rationale behind having communities create their master planting design right after taking an inventory of their USI, Siewert said, is because "the only way that Stephanie and I know that we can engineer a sustainable urban forest with good quality diversity is to do it all at once."

To create diversity, there are stipulations as to where trees can be placed. The same species cannot be used within six segments (or blocks), and those within the same genus have to have a separation of four segments. At the family level, two blocks have to be skipped. For example, if one block has red maple, the tree cannot be planted within six adjacent blocks.

"This forces us into spatial diversity, so that if some insect comes in and takes those out, we won't blow a big hole in our canopy—just a block here and a block there," said Siewert.

In subsequent years, Siewert and Miller have reevaluated the USI scores assigned to tree species. One such species is the red maple, which has a different score in northwest Ohio compared to its score for northeast Ohio. In the northwest, they can be found on sites as low as 16, but in the northeast, they are "happy as pigs on 12 sites," said Siewert.

A benefit of the USI is that its scores can be adapted to the soil types within a specific region, which is what Siewert and Miller had to do for Ohio. For example, the red maple has two different scores: 12 in northeast Ohio and 16 in northwest Ohio because of the limestone found in the soil in the northwest.

What Siewert and Miller find exciting about the USI is that it expanded the palette of trees they recommend planting. "What's beautiful about this is we never recommended things like tulip poplar or sugar maple, because we thought they were too sensitive to live in the urban forest, and that's wrong," Siewert said. "If you have a good spot, they do fine. But how can you identify the beautiful sites? Ah ha! Now we [have] found them."

And the USI also helps alleviate the confusion that the class participants had regarding what Siewert meant about selecting the least-hardy tree for a site.

Because good sites with great soil and little street use are limited, tough trees shouldn't be planted on good sites, explained Miller, adding that "with the USI, we can now select the least-resilient species that will survive and thrive on the site. We've historically played it safe, which is why we've had narrow species pallets."

Miller estimates that well over a hundred communities in Ohio have adopted the USI through the Ohio Tree Commission Academy experience.

Other Uses for USI

In 2011, Miller and Siewert presented the Ohio USI at the International Society of Arboriculture's Urban Tree Growth and Longevity Conference at Chicago's Morton Arboretum, and they received immediate, positive feedback. "This been something the urban forestry community has been seeking," said Miller.

Other researchers have tested the USI outside Ohio and found that it works. Oleksandre Dramova, a master's student at the University of Toronto, applied the USI to Toronto's urban forest and found the USI scores accurately reflected tree growth. Dr. Bryant Scharenbroch of the Morton Arboretum conducted an analysis of the USI in eight Midwest and Northeast cities in the US. In a paper titled "A Rapid Urban Site Index for Assessing the Quality of Street Tree Planting Sides," published in the October 2017 *Urban Forestry & Urban Greening,* Scharenbroch reported that "The RUSI model accurately predicted urban tree health and growth metrics," and "Field assessments in the RUSI model were significantly correlated with similar laboratory analyses. Other users may be able to use the RUSI model to assess urban tree planting sites (<5 min per site and no laboratory analyses fee), but training will be required to accurately utilize the model."

Dr. Burnell Fischer, CF, a professor emeritus at Indiana University, is looking into whether the urban site index can be equated with canopy expression, not only to extrapolate volume but also for ecosystem services.

Both Miller and Siewert agree that there are many applications in which the USI can be used, and that the research is just beginning.

"When we look at site index in the forestry industry, it's a century-old concept that's had extensive research on it," said Siewert. "The urban site index is just a few years old."

Interested in learning more about the urban site index? Visit http://forestry.ohiodnr.gov/urbanforestrytoolbox. Miller and Siewert will also be presenting the USI and doing a Master Planting Design Workshop at the upcoming 2018 International Society of Arboriculture conference, to be held August 5–8 in Columbus, Ohio (see tinyurl.com/y6vdtgy3).

Sources of Error in Forest Inventory

By Zack Parisa

I remember a time in forestry school at Mississippi State when the professor had each student try to count every single tree in a 10-acre stand. We were all surprised that we had as many different numbers as we had students. The professor wasn't.

Error is a given in forest inventories, but not all errors are created equal. This is particularly true now that many foresters are integrating remote sensing and other technologies into their inventories. Traditional cruising and remote sensing-assisted methods contribute to the potential for error in different ways. By understanding the different sources of error in various inventory designs, you can make an informed decision about when and where it makes sense to include remote sensing in your inventory process.

In this article, I consider error in three broad categories of inventory designs: traditional cruises, model-assisted remote sensing, and model-based remote sensing. All foresters are familiar with traditional cruising, in which one lays a grid of plots out across a stand or strata. The other two categories both use remote-sensing data (satellite images, aerial photos, lidar, and so on) and statistical models that relate plot data to the remote-sensing imagery. Model-assisted methods still rely on a grid of plots and use imagery to "fill in the gaps" between the plots in a traditional cruise. Model-based methods, on the other hand, are not backed by a traditional (design-based) cruise.

Measurement Error

Measurement error is the simplest type of error to understand. It occurs when your measurement instrument does not correctly register a measurement. This can happen for many different reasons, from the distance-measuring equipment (DME) not being properly calibrated to misreading a diameter tape because of fatigue. This is what happened in the story above, when the students miscounted the total number of trees. We didn't measure perfectly—some of us overcounted and some undercounted.

Unfortunately, measurement error can frequently be directional—that is, systematically biased toward undercounting or overcounting. For example, a careless cruiser might consistently call borderline trees "out" of a plot, artificially undercounting the number of stems in each sample.

To account for these types of errors, one can turn to a familiar practice: check cruising. By revisiting plots and re-measuring the stems, it is possible to check for measurement error against a second (perhaps more careful) measurement.

In remote sensing, poorly calibrated sensors or errors in post-processing can both contribute to measurement error.

Sampling Error

Sampling error occurs when a sample (hence the name) is taken rather than a census. When only a fraction of a population is measured, the areas not measured contribute to sampling error. This is less of a problem in very homogenous plantation stands, because the unmeasured areas are likely very similar to the measured areas. All else being equal, more-variable mixed-structure and mixed-species stands usually end up with more sampling error, because there's a greater chance that the area measured is not representative of the area not measured. The standard error calculation is used to estimate how much sampling error to expect in a given cruise. The equation for and description of the standard error for a cruise was recently covered by the good Dr. DBH in the March 2018 edition of *The Forestry Source* ("Estimating a Proportion, and a Quick Note about the Importance of the Confidence Interval").

Note that sampling error occurs only in traditional cruises. Remote-sensing approaches typically do not have sampling error, because they have wall-to-wall imagery for each stand. The imagery is a true census; because it covers the whole area, there's no sampling error. But there's no free lunch! Remote-sensing methods trade sampling error for a different type of error: modeling error.

Modeling Error

Many foresters have encountered modeling error in the context of subsampling tree heights. Rather than measuring the height on every tree in a plot, a few heights are measured and then a model is built to predict height from DBH. Because DBH relates well—but not perfectly—to height, there will be some modeling error in the predicted heights.

Modeling error also occurs in remote-sensing forest inventories. Remote-sensing data are rarely direct measurements of the tree attributes foresters actually care about (DBH, species, etc.). Instead, it's necessary to build a model to translate the raw remote-sensing data into useful forest inventory information. For example, several studies have shown that radar measurements of forests are correlated with timber volume. By cruising a few plots, one could build a mathematical model that relates the volumes measured on the ground to the radar signature measured by the European Space Agency Sentinel-1 satellite (a US radar satellite is going up in 2020). However, this model won't be perfect. Sometimes it will predict more volume than is actually there, and sometimes it will underpredict. The expected difference between the actual and predicted value is the modeling error.

A quantitative metric for the model performance can be developed by looking at the difference between the actual and predicted values—this is known as the "residual." If the residuals are highly variable, that means the model has inconsistent quality—a troubling sign. However, if the variability in the residuals is low, and they don't show any directional bias, it means that the model is fairly reliable and the modeling error is low.

Note that traditional cruising is not susceptible to modeling error. Cruisers measure DBH directly on each plot—there's no model involved. However, modeling error can sneak into traditional cruises through height and volume models. These are attributes that are not often measured on every tree and rely on models to predict them.

Error Type	Traditional Cruising Design-Based	Remote Sensing Model-Assisted	Remote Sensing Model-Based
Measurement	✓	✓	✓
Sampling	✓		
Modeling		✓	✓
Coverage	*	*	✓

Table 1. * no coverage error assuming an unbiased plot layout.

Coverage Error

Coverage error is perhaps the most insidious type of error in a forest inventory because it's often impossible to quantify or correct. One can avoid coverage error in a well-designed traditional cruise and in a model-assisted remote-sensing inventory (because it is underpinned by a traditional cruise), but when it comes to model-based remote-sensing approaches, there's no guarantee.

To understand coverage error, let's examine a common practice that you've probably seen. A forester lays out a grid of 50 plots across a stand and starts cruising at the northern end. So far, so good. But as the forester measures plots, he's also keeping a rolling calculation of the coefficient of variation of the DBHs in his sample. After he's worked his way through 30 plots on the stand, the CV falls below 10 percent, he declares, "Mission accomplished!" and heads for the truck, leaving the remaining 20 southern plots unmeasured.

This cruise suffers from coverage error. The problem is that those 30 plots are not a valid sample of the full stand. The southern part of the stand could be significantly different, and he wouldn't know—and without going back out to the woods, there's no way to fix this problem or even understand how big of a problem it is. Coverage error occurs when a cruise is not a statistically valid sample of the whole population.

Luckily, it's straightforward to avoid coverage error in traditional cruises and in model-assisted remote-sensing approaches. Ask the simple question, "Do all areas this inventory is meant to describe have a known probability of being sampled?" If the answer is yes, no problem. If the answer is no, then one might want to rethink a design.

Coverage error can be a big problem in model-based remote-sensing approaches. The plot data used to train the remote-sensing model are often selected to build a good model, but perhaps fail to cover the full range of oddities in the target population. The plots (or individual trees, in the case of single-tree lidar methods) may not be a statistically valid subsample of the population being measured.

To see why this could be a major problem, consider building a model for an individual-tree lidar segmentation project. If the data used to train this model only come from nice, straight trees, how will the model perform on the messy, forked, twisted trees that surely exist in the targeted forest? Will the model split a forked tree into two trees? Will it clump two adjacent trees into a single tree? If the training data aren't drawn from a statistically valid sample, there's nothing to guarantee that the "splitting" will balance out the "clumping." Like measurement error, coverage error like this can frequently be directional, biasing estimates either high or low. See Table 1.

Parting Thoughts

So, how can all of this help you make better decisions about your inventory strategy? All inventories are subject to error, but understanding the tradeoffs among different types of error can save you a lot of grief later on.

Measurement error exists in all types of inventories, but a good check-cruising program can help minimize that problem.

A big difference between traditional cruising and remote-sensing approaches is that sampling error is traded for modeling error. If the modeling error is less than the sampling error, this can be a good trade and can save a lot of fieldwork. The appropriate choice of training plot data, imagery inputs, and modeling approaches can significantly reduce modeling error.

Of the four, coverage error is perhaps the most pernicious, because it leaves you with no knowledge of the magnitude of the error—you have no idea what you're missing. As Donald Rumsfeld famously said, it's an "unknown unknown." Fortunately, you can avoid this type of error by using statistically valid sampling design and by not relying solely on a model-based remote-sensing method. Having a design-based cruise underpinning your

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Scenes from SAF's Forest Technology Workshop

More than 150 foresters attended SAF's Forest Technology Workshop in Colombia, South Carolina, in May, which featured two dozen presentations at the Columbia Metropolitan Convention Center and product demonstrations held on the grounds of the South Carolina Forestry Commission headquarters. Sponsors and exhibitors included American Forest Management, the Davis-Garvin Agency, Dynamic UAV Solutions, Esri, F&W Forestry Services, F4 Tech, Forest Metrix, Haglöf Sweden AB, Landmark Spatial Solutions, Laser Technology, Leading Edge Geomatics, Lim Geomatics, Mason Bruce and Girard, North Point Geographic Solutions, Orbis, Remsoft, SilviaTerra, Tract, Trimble Forestry, and Voss Signs. Photos by Steve Wilent, editor, *The Forestry Source*.

Britt Townsend, of Landmark Spatial Solutions (landmarkspatialsolutions.com), explains how to use Haglof MD II electronic calipers

Jonas Wikner, of Haglöf Sweden AB (haglofcg.com), explains the functions of the company's VL5 Vertex laser hypsometer.

Kerry Halligan, of Mason Bruce, & Girard (masonbruce.com), gives a demonstration of the company's MobileMap software on a Juniper Systems Mesa 2 tablet. (Pictured above)

Everyone at the outdoor sessions of the SAF Forest Technology Workshop had a chance to try out a handful of measurement instruments.

Darian Yawn, of Landmark Spatial Solutions (landmarkspatialsolutions.com), demonstrates Laser Technology's Criterion RD 1000 electronic basal area factor scope and dendrometer.

Donn Downey, of Forest Metrix (forestmetrix.com), answers questions about the company's Forest Metrix PRO forest inventory app on an iPad Mini.

Kelly Bellar, of Laser Technology Inc. (lasertech.com), demonstrates the use of the company's TruPulse 360/B laser rangefinder/hypsometer. Horizontals

Matt Lehman, of Dynamic UAV Solutions (dynamicuav.com), just before a demonstration flight of a DJI M200 unmanned aerial vehicle (UAV).

Mark Milligan, president of F4 Tech (thinkf4), talks about the company's SilvAssist Suite of forest inventory, data management, and decision support tools.

Jesse Adams, of North Point Geographic Solutions (northpointgis.com), gives a presentation entitled "Working in the ArcGIS Platform."

Peter Eredics, Director of Forestry at Esri, talks about the use of ArcGIS software and services in forest management.

Take Action to Help Your Chapter Succeed

By Joe Glover

Editor's note: Joe Glover, chair of the SAF Pennsylvania Division, sent this letter to division members in May. I asked him for permission to publish it in The Forestry Source*, as other chapters and divisions may benefit from the actions he describes. He agreed. If you wish to share success stories from your chapter and division about increasing meeting attendance and member involvement, contact me by e-mail at wilents@safnet.org.—Steve Wilent*

I would like to thank those members of the Pennsylvania Division who were able to attend the Wednesday, April 25, 2018, meeting in State College. With only 45 minutes twice a year at the Allegheny SAF Section Meeting, we frankly need more time to see where we are. At the previous meeting in February, several members voiced concerns with the following items:

- Low member attendance at chapter meetings
- Difficulty attracting new leadership within chapters
- Difficulty organizing and finding help in hosting the Allegheny Section meetings
- Low participation among students and new members at the chapter level

There was a great deal discussion around each of these areas at our April 25 gathering. We have come up with several action steps to help your chapters succeed. We feel strongly that our chapters are the grassroots incubators of the needs of our natural-resources professionals. With a drive across the commonwealth taking six hours or more east to west, travel for a dinner or half-day meeting is difficult for members and the employers who give us the opportunity to develop professionally. If chapters are struggling, perhaps the Pennsylvania Division will also look to ways of helping to strengthen chapters. Toward that end, the PA Division approved a proposal to offer matching funds up to $1,000 to any chapter that presents a funding-request proposal designed to increase member participation/attendance at a chapter meeting. The chapter will be required to submit a written post-meeting evaluation indicating whether the increased participation/attendance goal was achieved.

Member Attendance. Chapters with low attendance/participation need to poll members as to what their needs are for training. What are their barriers to participation? If a local gathering is not meeting the needs within the chapter, then does the chapter need a central PA location with divisional support?

Leadership. When chapters are not meeting regularly, it is hard to know who the chapter leaders are or to develop new ones. If there is no one willing to step up, sometimes we need to just step aside. That may be enough for new leadership to emerge. Nature abhors a vacuum. Look no further than the current division chair. Thank goodness there is qualified leadership and help behind him to make the organization go. Don't be afraid to ask for help. One of those distinctive traits of foresters is an independent, rugged individualistic attitude. Let it go, just a bit. We are the Society of American Foresters. A society is more than you are. A society works together and finds our common needs.

Several ideas are in the works to address this lack of leadership both in the near term for our Society and our members as a whole. Allegheny, New England, and New York SAF are planning a leadership academy to be held this fall at Grey Towers. The purpose is to help identify young professionals who will be leaders in our profession and society. The tuition, room, and board costs for this training are approximately $1,500. The PA Division is also looking to host a professional development workshop; this is early in the planning stages.

Meeting Planning and Organization. Planning the Allegheny Section meeting is a large task. Like eating an elephant, it is best done one bite at a time. If you take a couple of bites and I take a couple bites, then soon there is only the tail. We are all busy. When you want something done, you normally don't look for someone with nothing going on to do a job. It is a poor excuse for a professional. I'm busy too. I have work that will still get done today, but improving our profession is just as important to the future of forestry. Is your profession's future important to you? I believe it is, because you paid your dues.

The Allegheny Society has an excellent "Guidelines for Hosting Meetings" document to help chapters plan the winter and summer Allegheny Section meetings. For more information, see tinyurl.com/y946b5n9.

The Division is exploring how to find an easier way to collect money and generate an attendance list to help address that part of the elephant. I have not attended a meeting in the Allegheny over the last several years that was not well run by rank amateurs. Don't beat yourselves up. You are detail-oriented professionals. Stop and see the forest, not the individual trees.

Participation/Attendance. Students and young professionals make up 19 percent of the PA Division membership. After graduation, we seem to lose about half of this cohort as they transition from student members to entry-level employees. To help reduce this attrition rate, we are working on an effort to engage the students during their first monthly meetings on campus. The division also proposes to set up a booth at the Penn State Career Fair, held in February. Penn State also has a mentoring program between alumni and students. If you are interested in this program, the link is: ecosystems.psu.edu/alumni/mentoring. By going onto campus and meeting students there, you will become a known face when they show up at your chapter meeting. Make a connection and help build the future of your profession.

Well, that is enough of a high stump speech. If you have any further questions, please contact me. I look forward to seeing you outstanding in the field of forestry!

IN MEMORIAM

Royce Gordon Cox died on January 30, 2018, at age 102. He graduated from Iowa State University in 1939 with a degree in forest management. Cox was a passionate forester and devoted advocate of proper forest management. He was one of the first graduate foresters to work for Potlatch Forests Inc., and for 40 years he helped pioneer sustained-yield forestry practices and improved forest-management techniques. He provided a strong voice for improved logging procedures and regeneration of private forestland. He continued to be involved in forestry issues and his community long after he retired. For more information, see tinyurl.com/y8e26w32.

Ralph Edward Duddles, 78, died on February 23, 2018, in Coos Bay, Oregon. He began his forestry studies at Michigan Technical University, and in 1962 moved to Seattle, Washington, to continue his studies at the University of Washington. His career as a forest practices forester led to assignments up and down the West Coast, with stops in California, Washington, and Oregon. He and his family moved in 1985 to Coos Bay, where Duddles was the extension forester for Oregon State University. He retired in 2002. For more information, see tinyurl.com/y8l9ha4u.

Ralph Edward Duddles

William Otto (Bill) Kleinhans, 88, died on Saturday, April 21, in Marianna, Florida. Kleinhans graduated from New York State Ranger School in 1951 and then began a 44-year career as a forester with International Paper. He retired in 1995, but remained active writing land management plans. Kleinhans was a member and chair of the Marianna City Tree Board and served on the Project Learning Tree Steering Committee for 17 years. In 1948, he began his 70-year career as a Scout master with the Boy Scouts of America. For more information, see tinyurl.com/ybcw95cz.

George Croney Kiefer Jr., 96, of Salisbury, Connecticut, died on February 10, 2018. Before he received his master's degree in forestry from Duke University, Kiefer joined the US Navy in 1942 and served as a second lieutenant in the Pacific Theater. After his service, he returned to Duke to finish his degree. He was a forester by trade and a true naturalist with a passion for agriculture and the land. He was well-versed in the use and history of early farm and forestry hand tools. He loved trees above all. He believed in simplicity, environmental sustainability, and community—from the New England Society of American Foresters' *News Quarterly*, April 2018.

Warren Slater Thompson, 88, of Starkville, Mississippi, died on March 26, 2018. Thompson was a veteran of the US Army. He completed his BS and MS degrees in forestry at Alabama Polytechnic Institute (Auburn University), and his PhD at the University of North Carolina. He served as dean (1964 to 1994) and dean emeritus of the College of Forest Resources at Mississippi State University (MSU). He also served as a wood science professor and director of the Forest Products Lab, through which he helped build an internationally acclaimed forest products research program. He was an authority on wood preservation and served as a consultant for the US Justice Department and the Environmental Protection Agency. In 1996 the university named its forestry building in his honor. Before joining MSU, Thompson worked for the Masonite Corp. and taught at Louisiana State University. Thompson was a Fellow of the Society of American Foresters. For more information, see tinyurl.com/ycmxechm.

TinyURL: Short Links

Ever wonder why The Forestry Source often prints so many website addresses that begin with tinyurl.com? In short, TinyURL LLC offers a service that lets you turn long website addresses into short (tiny) ones. Although other companies offer web-address shortening services for a small fee, TinyURL is free. The Forestry Source has made a small donation to TinyURL to help support the service.

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inventory (as in traditional cruising and model-assisted remote sensing) is a safety net that prevents you from being blindsided by unexpected coverage errors.

It's an exciting time to be a forester, because there are lots of new data sources, imagery platforms, and modeling methods becoming available all the time. For most tree attributes, low-cost remote-sensing data are available to help improve estimates. By being aware of the sources of error in different remote sensing approaches, you can take advantage of these new technologies while avoiding some common pitfalls.

Zack Parisa is the president of SilviaTerra.

Science & Tech

The Forestry Source welcomes contributions for the Science & Technology section, which focuses on recent research, technologies, and techniques for forestry and natural resources management. Information: Steve Wilent, 503-622-3033, wilents@safnet.org.

SAF MEMBERS IN THE NEWS

Zhu Ning Receives ISA Award
Zhu H. Ning, an endowed professor in the Urban Forestry and Natural Resources Department of the Southern University and A&M College System, in Baton Rouge, Louisiana, is the 2017 recipient of the International Society of Arboriculture's (ISA) prestigious Alex L. Shigo Award for Excellence in Arboricultural Education. The award was made in recognition of Ning's "dedication to enhancing the quality and professionalism of arboriculture through sustained excellence in education," according to the ISA. The award was presented at the ISA Annual International Conference and Trade Show in July 2017 in Washington, DC.

Through her professional services to ISA, Dr. Ning has made significant impacts on arboricultural education at the national and international level. She was elected as a member of the ISA Board of Directors and contributed to the ISA strategic direction including education and research policy development that ensures the educators, scientists, practitioners, and students receive advanced and best available arboricultural and urban forestry knowledge. Ning, an SAF member, has been an associate editor and an editorial board member of the *Journal of Arboriculture and Urban Forestry*.

Ning's dedication and impact on urban forestry education extends beyond the borders. She has influenced the development of scientific exchange in urban forestry between the US and China. She chaired and organized the first Urban Forest Sustainability International Symposium. Her efforts provided education and scientific exchange platform for international educators, scientists, practitioners, and students from four continents.

"Dr. Ning's work with the international symposium not only helped promote arboriculture in China, but also introduced the world's most populous country to ISA," says Michelle Mitchell, ISA board president. "Ning also led a team in translating ISA's Arboriculture Dictionary into Chinese, which helped advance arboriculture education in China."

The ISA, headquartered in Champaign, Illinois, USA, is a professional organization supporting urban forestry and arboricultural research, education, and outreach around the world. It has more than 30,000 members and credential holders worldwide.

Gallagher Receives FRA Award
The Forest Resources Association's South-central Region recently honored Auburn University's Tom Gallagher and Marissa Jo Daniel with its First Place Technical Writing Award for 2018. This annual award recognizes the best Technical Releases published and posted on FRA's website.

Daniel is a PhD grad student of Gallagher, an SAF member. Daniel and Gallagher co-authored Technical Release 17-R-16, Utilization of Phone App Technology to Record Log Truck Movements in the Southeastern US. Their project, funded by the Wood Supply Research Institute, aimed to gather data on the log truck driver's wait time at the log landing and at the mill, and to analyze other delays a driver may encounter while traveling from one location to another. Auburn University created an app for drivers' phones. The app prompts the driver to select the reason for any stop or delay. Initial findings from a small number of drivers and mills in the states of Alabama, Ohio, and South Carolina showed that there clearly are opportunities to improve both loading and unloading time efficiencies. Redelsheimer Receives NESAF Award

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FOREST PRODUCTS INDUSTRY NEWS

Conifex Looks to the South…
Conifex Timber Inc., which is based in Vancouver, British Columbia, recently announced an agreement with BW SLC Holdings LLC, an affiliate of Blue Wolf Capital Partners LLC, and the minority shareholders of Caddo River Forest Products LLC to purchase all of the outstanding membership interests of Suwannee Lumber Holding Company LLC, Suwannee Timber Management LLC, and Caddo River Forest Products LLC (collectively, the BW Group). The BW Group owns the Suwannee sawmill in Cross City, Florida, and the Caddo River sawmill in Glenwood, Arkansas, both of which primarily produce southern yellow pine (SYP) lumber and specialty products such as decking. The Suwannee mill and Caddo River mill each have an annual dimension lumber capacity of approximately 185 million board feet (mmbf) on a two-shift basis.

As a result of the transaction, Conifex's annual lumber production capacity in the southern US will increase by 200 percent to about 550 million board feet. After the acquisition of the BW Group mills, the company's total annual lumber production capacity will increase by about 50 percent to 1.1 billion board feet.

"This is a highly strategic and transformative transaction for Conifex. It brings together two successful growth-oriented companies to create a leading SYP lumber producer," said Ken Shields, Conifex president and CEO.

And So Does Canfor
Canfor, another Vancouver-based company, has invested $8.8 million in upgrades at its Urbana, Arkansas, mill, primarily the addition of a third continuous dry kiln that will increase the mill's annual lumber production by 45 mmbf to nearly 200 mmbf. According to the company, the impact of the new kiln translates into 36 new jobs in a second shift at the mill and an increased demand on harvesting operations.

A new dry continuous kiln at Canfor's Urbana, Arkansas, mill will lead to the addition of 36 new jobs. Photo: Canfor.

Canfor has had a presence in the southern US since 2006 and has since grown to include 14 manufacturing facilities. After the company's recent investments in new kilns at three of its South Carolina locations (Camden, Conway, and Darlington), each of these operations added second shifts.

BBF Club 2017
The International Wood Markets Group (www.woodmarkets.com) recently released its annual "Billion Board Foot Club" list of the top global lumber companies, in terms of total production. The top five companies are based in North America: West Frasier (Canada), 6.2 bbf; Canfor (Canada), 5.2 bbf; Weyerhaeuser (US) 4.5 bbf; Georgia-Pacific (US), 2.6 bbf; and Interfor (Canada), 2.6 bbf. Number 6 on the list is Stora Enso (Finland), 2.3 bbf.

Wood Markets noted that "several companies—Weyerhaeuser, Canfor, Georgia-Pacific, Interfor, and Tolko—have announced expansions or new sawmill projects to be implemented over the next few years, so the big companies will continue to get bigger."

Stora Enso Makes DuraSense
Stora Enso may be one of the world's top lumber producers, but the Finnish company also aims to be a major producer of wood-based biocomposites that can be used as a substitute for petroleum-based plastics. Earlier this year, the company began producing DuraSense granules, which it says are "suitable for a wide range of applications from consumer goods to industrial applications. Typical applications include, for example, furniture, pallets, hand tools, automotive parts, beauty and lifestyle products, toys and items, such as kitchen utensils and bottle caps, among other uses."

DuraSense granules, which are made from a combination of wood fibers, polymers, and additives, have the moldability of plastic with the sustainability and workability of wood, according to Stora Enso.

"Reducing the amount of plastic and replacing it with renewable and traceable materials is a gradual process. With DuraSense, we can offer customers a wood fiber–based alternative which improves sustainability performance and, depending on the product, significantly reduces the carbon footprint—all the way up to 80%," sais Jari Suominen, head of wood products at Stora Enso, in a press release.

DuraSense granules are produced at Stora Enso's mill in Hyltebruk, Sweden, which has an annual production capacity is 15,000 metric tonnes. The company says this is the largest capacity of any mill in Europe dedicated to wood-fiber composites.

CONTINUING EDUCATION CALENDAR

More Events at tinyurl.com/gnd78jh (www.eforester.org)

*Continuing education events for **June and July 2018**. SAF Continuing Forestry Education (CFE) credits are available at all events. Visit SAF's Continuing Education Calendar at tinyurl.com/gnd78jh for more information on these events and others that may have been recently added to the list. Note the webinars at the top of the listings.*

***CFE Providers:** To obtain pre-approval of Continuing Forestry Education credits for an event, complete and submit the CFE Provider Application Form on the Certification & Education/Continuing Education page at eforester.org (or tinyurl.com/z2zqc3o). Submittal instructions are included on the form.*

***CFE Post Approval for Individuals:** If an event was not preapproved for CFE credit, SAF will evaluate the meeting on an individual basis. This service is available to members and SAF-certified professionals at no cost; non-members are assessed an annual fee of $30. To apply, complete and submit the CFE Post Approval Form on the Certification & Education/Continuing Education page at eforester.org (or tinyurl.com/z2zqc3o). Submittal instructions are included on the form.*

INTERNATIONAL

6/6–8/2018, International Forest Business Conference, Sulęczyno, Poland

WEBINARS

6/8/2018, Hazard Tree Assessment Training
6/12/2018, Promoting Urban and Community Forestry
6/12/2018, Truths and Myths About Chronic Wasting Disease
6/26/2018, Have you Checked Your Trees Lately?
7/10/2018, Trees for Bees: Pollinators Habitats in Urban Forests
7/24/2018, Transitioning from Gray to Green Infrastructure Using Urban Forestry

ALABAMA

7/10–11/2018, JCJC's 20th Annual CE's by the Sea, Orange Beach

ARKANSAS

6/5/2018, Forestry Training Day, Hope

FLORIDA

6/7/2018, Best Management Practices for Forestry in Florida, Gainesville
6/11–13/2018, Trees Florida 2018 Conference, Fort Myers
6/27–28/2018, Florida Master Logger 2-Day Workshop, Lake City
7/10/2018, American Tree Farm Inspector Training, Gainesville
7/17/2018, Best Management Practices for Forestry in Florida, Live Oak

GEORGIA

6/5/2018, Conservation of At-risk Species on Working Forests, Atlanta
6/7–8/2018, Prescribe Fire Certification, Thomasville
6/19/2018, Timber Market Analysis, Atlanta
7/24–25/2018, Wildlife Management, Athens

IDAHO

6/12–14/2018, 2018 Forest Insect & Disease Identification and Management Training, Orofino
7/13/2018, Root Disease: the Hidden Menace, Coeur d'Alene
7/27/2018, Forest Insects & Disease Field Day, Sandpoint

KENTUCKY

6/13–15/2018, Kentucky/Tennessee Summer Meeting, Slade

LOUISIANA

7/19/2018, Deer Steward: Antlered Assets, New Orleans

MAINE

6/1/2018, Intro to Avenza Maps, Orono
6/7/2018, Long-Term Site Productivity Research: Lessons from Other Regions and Maine, Orono
6/8/2018, Long-Term Site Productivity Research: Lessons from Other Regions and Maine, Orono
6/21/2018, Forest Management on Maine's Coastal Islands Restrictions and Possibilities, Nautilus Island
7/27/2018, White Pine Silviculture and Forest Health, Bethel

MINNESOTA

6/1/2018, Intro/Refresher to Ecological Classification, Pennington
6/15/2018, Intro/Refresher to Ecological Classification, Baudette
6/22/2018, Intro/Refresher to Ecological Classification, Wannaska
7/25/2018, Native Plant Community Field Guide Training, Northfield/Fairbault

MISSISSIPPI

6/2/2018, Business Management, Raymon
7/13/2018, Urban Forestry Summer School. Diagnosis and Treatment of Tree Pests and Diseases, Starkville

NEW HAMPSHIRE

6/1/2018, Bat Conservation & Forestry for Northeast Foresters, Sugar Hill
6/1/2018, Bird Mist Netting, Sugar Hill
6/1/2018, US Army Corps wetland delineator methods (day 5), Portsmouth
6/8/2018, Soil genesis, Rindge
6/13/2018, Northeast Silviculture Institute Spruce-Fir Module (day 1), Orono
6/13/2018, Soil morphology/Describing soils, Portsmouth
6/14/2018, Northeast Silviculture Institute Spruce-Fir Module (day 2), Orono
7/14/2018, Where the Wild Things Are, Jefferson

NEW JERSEY

6/7–8/2018, Vegetation Identification for Wetland Delineation: North, Basking Ridge
6/12–15/2018, Methodology for Delineating Wetlands, Basking Ridge
6/13/2018, Introduction to Wetland Identification, Basking Ridge

NORTH CAROLINA

6/1/2018, Region 1 NCFS Consulting Foresters Meeting, Kinston
6/6/2018, NC Retired Foresters Meeting, Garner
6/7/2018, NCSAF Summer Meeting, New Bern
6/7/2018, Foresters for the Birds North Carolina, Elizabethtown
6/8–10/2018, Association of Consulting Foresters Day 1 of 3, Asheville
6/8–10/2018, Association of Consulting Foresters Day 2 of 3, Asheville
6/8–10/2018, Association of Consulting Foresters Day 3 of 3, Asheville
6/8/2018, NCSAF - Field Tour Stream Mitigation/Solar Farm, New Bern
6/8/2018, NCSAF - Field Tour Wind Farm, New Bern
6/9/2018, NCACF - TSP in a Day, Asheville
6/9/2018, NCACF - Leadership Training, Asheville
6/10/2018, NCACF - Technology and Software, Asheville
6/10/2018, NCACF - Forestry Equipment Technology Updates, Asheville
6/11/2018, NCACF - Technical Session, Asheville
6/12/2018, Logging Cost Analysis, Kinston
6/12/2018, NCACF - Field Tour(s), Asheville
6/13/2018, "NCACF - Planning, Preserving, Protecting", Asheville

OHO

6/18–21/2018, SILVAH: Oak Ecology and Silviculture Workshop, Dundas

7/20/2018, The Tree Course, Worthington

OREGON

6/2/2018, 2018 Tree School Lane, Pleasant Hill
6/5/2018, Forest Products Industry Symposium, Portland
6/5/2018, Forest Products Symposium, Portland
6/7/2018, 2018 Oregon Urban & Community Forestry Conference, Portland
6/14/2018, Log On 2018 Forestry Advocacy Training Conference, Salem

PENNSYLVANIA

6/22–24/2018, Deer Steward: Habitat Enhancement, Knoxville

TENNESSEE

6/6/2018, 2018 SRS-FIA P2+ Training - Knoxville, Knoxville
6/14/2018, TFA West TN Regional Meeting, Shiloh
6/20/2018, Conservation Professionals Training: Protect Riparian Zones Duck/Elk Watersheds, Fayetteville

TEXAS

6/25–29/2018, Urban Forest Strike Team Training, Houston area

VERMONT

6/1/2018, Succession Planning for Foresters, White River Junction
6/9/2018, An Archaeological Tour of the Old Job Historic Logging Village, Mt Tabor

WASHINGTON

6/14/2018, Washington Hardwoods Commission Annual Symposium, Puyallup

WEST VIRGINIA

6/4–27/2018, Best Management Practices/ Recertification, Multiple dates and locations

WISCONSIN

6/6–7/2018, Woodland Plant Identification, Amherst Junction
6/16–17/2018, Aquatic Plant Identification, Hatley
6/29–30/2018, Wetland Plant Identification, Stevens Point
7/29–30/2018, Prairie Plant Identification, Amherst Junction

WYOMING

6/2/2018, Fuels Mitigation Workshop, Sheridan
6/4–7/2018, 2018 PLT International Coordinators' Conference, Cody

From the SAF Career Center

For the complete listing of these and other ads, visit http://careercenter.eforester.org

Log Yard Manager
Employer: Keweenaw Land Association Ltd.
Location: Ironwood, Michigan
Job ID: 41167232
Posted: May 18, 2018
Min Education: BA/BS/Undergraduate
Min Experience: 0-1 Year

Forestry Crew Lead – Stanislaus/ Eldorado NFs
Employer: Great Basin Institute
Location: Sonora/Placerville, California
Job ID: 40984257
Posted: May 11, 2018
Job Type: Full-Time
Job Duration: 3-6 Months
Min Education: BA/BS/Undergraduate
Min Experience: 1-2 Years
Required Travel: 50-75%

Forester
Employer: Hampton Lumber
Location: Chehalis, Washington
Job ID: 40960631
Posted: May 10, 2018
Job Type: Full-Time
Job Duration: Indefinite
Min Education: Associates Degree
Min Experience: 0-1 Year
Required Travel: 50-75%

Seasonal Forestry Intern
Employer: Campbell Global LLC
Location: Flagstaff, Arizona
Job ID: 40960550
Posted: May 10, 2018
Job Type: Internship
Job Duration: 3-6 Months
Min Education: None
Min Experience: None

Project Manager
Employer: Campbell Global LLC
Location: Flagstaff, Arizona
Job ID: 40960418
Posted: May 10, 2018
Job Type: Full-Time
Job Duration: Indefinite
Min Education: BA/BS/Undergraduate
Min Experience: 3-5 Years

State Forester/Assistant Commissioner
Employer: Tennessee Division of Forestry
Location: Nashville, Tennessee
Job ID: 40959986
Posted: May 10, 2018
Min Education: BA/BS/Undergraduate
Min Experience: 5-7 Years

Operations Forester
Employer: Seven Islands Land Company
Location: Maine
Job ID: 40959860
Posted: May 10, 2018
Job Type: Full-Time

Forester (6 positions)
Employer: Colorado State Forest Service, CSU
Location: Colorado
Job ID: 40906686
Posted: May 7, 2018
Job Type: Full-Time
Job Duration: Indefinite
Min Education: BA/BS/Undergraduate
Min Experience: 2-3 Years

Senior Forester
Employer: Northwest Management, Inc
Location: Deer Park, Washington
Job ID: 40826587
Posted: May 3, 2018
Min Education: BA/BS/Undergraduate
Min Experience: 5-7 Years

Timber Procurement Forester/TimberBuyer
Employer: Madison County Wood Products Inc
Location: Fredericktown, Missouri
Job ID: 40789105
Posted: May 1, 2018
Job Type: Full-Time

Forester
Employer: Weyerhaeuser
Location: L' Anse, Michigan
Job ID: 40722678
Posted: April 27, 2018
Job Type: Full-Time
Job Duration: Indefinite
Min Education: BA/BS/Undergraduate

Graduate Research Assistantship in Forest Operations and Biomass Utilization
Employer: Northern Arizona University - Ecological Restoration Institute
Location: Flagstaff, Arizona
Job ID: 40700365
Posted: April 26, 2018

Log Scaler/Operations Forester
Employer: Straight Fork Forest Management LLC
Location: Huntsville, Tennessee
Job ID: 40668473
Posted: April 24, 2018
Industry: Forestry
Min Education: BA/BS/Undergraduate

Assistant Professor of Game Ecology and Management
Employer: Stephen F. Austin State University
Location: Nacogdoches, Texas
Job ID: 40668151
Posted: April 24, 2018
Job Type: Full-Time
Min Education: Ph.D.

Operations Forester
Employer: SDS Lumber Co
Location: Bingen, Washington
Job ID: 40403160
Posted: April 11, 2018

Assistant Professor - Outreach/Extension Silviculture
Employer: University of Georgia, Warnell School of Forestry & Natural Resources
Location: Tifton, Georgia
Job ID: 40080751
Posted: March 23, 2018

Manager, Renewable Thermal Collaborative
Employer: WWF Washington, DC
Location: Washington, D.C.
Job ID: 41118214
Posted: May 16, 2018
Job Function: Other
Job Type: Full-Time

Assistant Professor of Forestry
Employer: School of Forestry, Northern Arizona University
Location: Flagstaff, Arizona
Job ID: 40960408
Posted: May 10, 2018
Min Education: Ph.D.

Forester I or II
Employer: Olympic Resource Mgmt
Location: Wilsonville, Oregon
Job ID: 40922781
Posted: May 8, 2018
Job Type: Full-Time
Min Education: BA/BS/Undergraduate

Forester/Forest Technician
Employer: American Forest Management LLC
Location: Alachua, Florida
Job ID: 40684675
Posted: April 25, 2018
Job Type: Full-Time
Job Duration: Indefinite
Min Education: BA/BS/Undergraduate
Min Experience: 2-3 Years

North Carolina State Parks Chainsaw Crew Leader
Employer: North Carolina Youth Conservation Corps
Location: North Carolina
Job ID: 40668009
Posted: April 24, 2018
Job Function: Other
Job Type: Temporary

NEWS BRIEFS

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fire-prevention activities into landscape forest-restoration efforts in and near wildland-urban interface areas.

To implement this executive order and the Forest Carbon Plan, a Forest Management Task Force will be convened. The full order is available at https://tinyurl.com/ybkypxmk.

SAF MEMBERS IN THE NEWS ■

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Redelsheimer Receives NESAF Award

Carol Redelsheimer, SAF's director of science and education, recently received the James W. Toumey Outstanding Service Award, which is given for outstanding achievement in service to the New England Society of American Foresters. Redelsheimer served as Maine SAF co-chair/chair in 1992-1993, general chair for the 1993 NESAF annual meeting, was a 1994-1995 member of the Forest Practices Task Force, and was the program chair for the 2017 NESAF annual meeting. For 1997-1998 she was the Maine SAF state representative to the NESAF Executive Committee. Her service extended to the national level, where she was a member and chair of the SAF Certification Review Board (CRB) committee, co-chair of the 2000 SAF National and Centennial Convention, and a District 6 Council representative.

Her professional accomplishments and reputation for strong personal ethics and sound stewardship have been recognized with a variety of awards and honors, including 1993 Maine Project Learning Tree Stewardship Award, 1995 NESAF Mollie Beattie Young Forester Award, and the 2011 NESAF Austin Cary Practicing Forester Award. She was named an SAF Fellow in 2008.

Forestry News from around the Nation

$40M for Delaware River Watershed
The Delaware River Watershed Initiative (DRWI) will receive more than $40 million from the William Penn Foundation to continue protecting and restoring the Delaware River watershed, a source of drinking water for 15 million people. A collaboration of 65 nongovernmental organizations, DRWI was launched in 2014 and is one of the largest nonregulatory conversation efforts in the United States.

"When we led the creation of the DRWI, our intent was to serve as a catalyst for accelerated watershed protection in our region," said Janet Haas, board chair of the William Penn Foundation. "We wanted to build a framework that would harness the enormous capacity of conservation organizations to work together on a shared approach, and to see whether that critical mass could affect greater change."

DRWI's accomplishments include protecting nearly 20,000 acres and restoring 8,331 acres. With this new infusion of funding, an additional 43,484 acres will be protected and restored.

EAB in South Dakota
In early May, the South Dakota Department of Agriculture confirmed an infestation of emerald ash borer (EAB) in Sioux Falls. This makes South Dakota the 33rd state where this invasive pest has been found. In response, the state's agriculture secretary, Mike Jaspers, implemented an emergency quarantine that restricts the movement of ash materials in Minnehaha County and portions of Lincoln and Turners Counties unless authorized by the Department of Agriculture. The state created a website with information regarding the emerald ash borer: emeraldashborerinsouthdakota.sd.gov/index.aspx. See also tinyurl.com/ydblz2gz.

In other EAB news, the US Department of Agriculture is considering abandoning its quarantine because the insect continues to be found beyond the quarantine boundaries. The EAB quarantine area encompasses Massachusetts to Indiana, south to Georgia, and parts of Colorado. The insect is spreading beyond the quarantine area primarily because of the transportation of infected firewood by the public; the beetles can move several miles a year on their own.

A final regulation regarding the quarantine will likely come later this summer.

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Ohio Boasts Most Tree Cities
For the 37th consecutive year, Ohio claims the title as the state with the most Tree City USA communities. Last year, residents across the state volunteered more than 48,000 hours, planted more than 27,000 trees, and invested more than $40 million in urban-forestry projects.

"We are proud to have so many Ohio communities that consistently promote the care of their trees through the Tree City USA program," said Robert Boyles, CF, state forester for Ohio. "Ohio communities continue to enjoy the environmental benefits and visual aesthetic that being a participant in the Tree City USA program provides."

Created in 1976, the Tree City USA program is sponsored by the Arbor Day Foundation, US Forest Service, US Conference of Mayors, National League of Cities, and National Association of State Foresters.

California to Combat Tree Mortality
California's governor, Edmund G. Brown Jr., recently issued an executive order in an effort to combat widespread tree mortality, improve forest health, and increase forests' ability to sequester carbon. Of the state's 20 most destructive wildfires, eight have occurred in the past four years; the largest in record-keeping history was the Thomas Fire in 2017.

"Devastating forest fires are a profound challenge to California," said Governor Brown. "I intend to mobilize the resources of the state to protect our forests and ensure they absorb carbon to the maximum degree."

Among the orders issued are:

- The Natural Resources Agency shall take all necessary steps to double the total statewide rate of forest treatments within five years to at least 500,000 acres per year.
- The Department of Forestry and Fire Protect shall increase new landowner agreements and memoranda of understanding, such as Good Neighbor Authority agreements, to accelerate forest-restoration thinning and prescribed-fire projects across jurisdictions, and shall integrate

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