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THE BUCKEYE Arborist

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Ohio Chapter International Society of Arboriculture
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Pioneer Profile

Where are they Now?

Bruce Roberts was born in 1933 in Leonia, New Jersey; right across the Hudson River from New York City. He currently resides in Delaware, OH.

Bruce has always loved trees and the out-of-doors, even though born and raised in an urban environment. After graduating from college and while serving in the Army at Ft. Bragg, NC, he happened to spend a day in Durham visiting the campus at Duke University. As luck would have it, the first person he met was a faculty member from the Department of Forestry. Five years later the die had been cast. He started out in arboriculture as a research scientist with the U.S. Department of Agriculture in Delaware, OH. His last job was an adjunct professorship in the Department of Botany & Microbiology at Ohio Wesleyan University. During his tenure at OWU, he taught a class in plant physiology and directed undergraduate students who were involved in independent research studies.

We asked Bruce what he felt his greatest legacy was to the Ohio Chapter. That was easy for him to answer. "The Ohio Chapter became my home away from home during the late 1970's and early 1980's. I developed many lasting friendships during those years, serving on the Chapter board, as Chapter newsletter editor, as Chapter president and as an international board member. But those were tough times, including one year when each of the Board members put in $100 each to keep the Chapter afloat. But from adversity often comes success, and that's certainly what happened in this instance."

Bruce knows that there are so many names that could be included in the list of his greatest inspirations. His short list includes these three: Alan Cook (former Ohio Chapter executive director), Bill Lanphear (one of Ohio's premier arborists) and L.C. Chadwick (although

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President's Branch

By David S. Bienemann

It's amazing how history repeats over the years in arboriculture when it comes to invasive pests and diseases across the US. Gone are the days of planting all callery pear or Autumn Purple ash in downtowns or whole subdivisions. Let's take a step back in time and look how arboriculture and urban forestry have evolved over the past 100 years.

Chestnut blight was first identified in 1900 to 1908. Chestnut lumber was imported from China and/or Japan. By 1940, most native American chestnuts across the natural range were gone. Chestnut blight destroyed about 4 billion American chestnut trees. The American Chestnut Foundation (ACF) was founded in 1983 to create a blight resistant chestnut tree. The crossed hybrid American Chestnut is 15/16th American and 1/16th Chinese. The first American Chestnut blight resistant trees were planted in Wayne National Forest in 2009. The Ohio Chapter ACF has been planting American chestnut blight resistant trees across their natural range in Ohio. We have planted 75 American chestnut blight resistant trees in Hamilton, Ohio.

Dutch Elm Disease (DED) native to Asia was discovered in 1930 on furniture imported from the Netherlands to Cleveland, Ohio. There was an initial loss of 77 million American elm trees by 1970. Loss continues today across the native range of American elm especially in Minnesota. A total of 4 billion elms were impacted. American elm research created the following new DED resistant trees: Princeton, Valley Forge, Lewis & Clark, Liberty and New Harmony.

The gypsy moth was brought to North America in 1869 by an artist named Mr. L. Trouvelot in a misguided attempt to breed a hardy silkworm. Some escaped and the first recorded defoliation by gypsy moth was in 1889 of the street trees in Trouvelot's

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Ohio Chapter ISA

The **Mission** of the Ohio Chapter International Society of Arboriculture is to advance responsible tree care practices through research, technology and education, while promoting the benefits of trees.

The Ohio Chapter **Values** investing in the future of professional arboriculture through education, research, safety and communication, while maintaining integrity and credibility.

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By purchasing a *Trees4Ohio* specialized interest license plate for your vehicle, you help underwrite educational programs and services that directly benefit the trees of Ohio.

The plate provides one of the best **member benefits**; it directs readers to Trees4Ohio.org. This site is designed for consumer's looking for everything from proper pruning and mulching to how to find and hire an Ohio tree care professional. **Chapter members must login to OhioChapterISA.org and update their profile. You must check "available for hire" and each of the services you provide.** Your email address associated with your membership record is your user name. If you forgot your password or have not logged in before, use the "forgot my password" and an email will be sent to you with instructions. If you have questions or problems logging in, please contact the Chapter office.

The new specialized interest plate is available under Organizational ***Plates at https://www.bmv.ohio.gov/vr-sp-organization.aspx.***

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Pioneer Profile Cont. from page 1

never a student of Chad's, his mentorship during Bruce's early years in arboricultural research was invaluable.

For those just starting in the industry, Bruce's advice is to "keep your eyes and ears open to the practically endless possibilities that exist in arboriculture. New technology will undoubtedly bring great change to the industry. Be a participant, not an observer."

The transition to retirement for Bruce after working for 55 years has not been easy. In fact, he's actually working on his third retirement attempt right now, having returned to work after the previous two tries. But he's finally found a hobby that he enjoys (woodworking) so things are going smoother this time around. Taking care of his 10-acre property here in Delaware and owning an additional 75-acre woodlot in upstate New York go a long way in keeping him busy and out of trouble. Bruce and his wife also own a small cabin on a remote lake in the Adirondack mountains of NY which can be a relaxing venue (fishing, canoeing, etc.), but also requires a lot of work.

Bruce is both pleased and proud of the growth and progress made by the Ohio Chapter. Compared to where we were and how far we've come, it represents an impressive journey. For all those members who have volunteered to serve over the years as committee chairs, board members and Chapter officers, and for our executive director(s), Bruce extends a strong thank you all for a job well done.

President's Branch Cont. from page 1

own neighborhood of Medford, Massachusetts. Lacking many natural enemies, the gypsy moth has escalated into one of the most important insect pests of forest and shade trees in the eastern United States. The first outbreak in Ohio was in Ashtabula County in 1971. Eradication efforts began in 1973 to 1989. In 1989, the US Forest Service and the Ohio Department of Agriculture began the Suppression Program. The Slow the Spread Program began in 1999 and continues today.

Emerald ash borer (EAB) was discovered in northwest Ohio in 2003. EAB probably arrived via infested pallets, crates and/or dunnage in Michigan. It has spread across most of Ohio today and can be found in 34 states. EAB has the potential to impact 4 billion ash trees. Native North American ash research has started to create future EAB resistant ash trees.

History teaches that large plantings of one species and/or a genus can result in a loss of billions of trees which impacts ecosystems and urban areas. Towns across the US started planting American elms to replace the American chestnuts when the Chestnut blight hit the US. Earth Day and Arbor Day programs began planting native ash trees to replace American elms. Emerald ash borer finally made us look at diversifying the urban forest to reduce the impacts of invasive pests and diseases that are now common due to global trade. The recent discovery of Asian Longhorn Beetle in the US and Ohio has once again proved we have to be diligent in efforts to plant diversity.

Now is a great time to impact the history of the urban forests and arboriculture. Ohio has great university researchers and extension staff, ODNR Division of Forestry Urban Foresters, outstanding commercial, utility, and municipal arborists watching over our urban forests. I encourage all Ohio ISA members to be on the lookout for the Spotted Lanternfly as it marches toward Ohio from our friends to the east!

Certification Corner

By Carrie Paulus, Education Committee and Tyler Stevenson, ODNR Urban Forestry Coordinator

ISA Certified Arborists Assist Urban Forest Strike Team (UFST) Initiative

Assessing Damage to Urban Forests after Natural Disasters

Ever wonder how the certified arborist's skill set is put to valuable use? Clearly in the daily activities of the professional arborist—but are you aware of their presence in the Urban Forest Strike Team initiative? The UFST initiative was developed in 2007 by state forestry agencies and the U.S. Forest Service (USFS) in the Southeastern U.S. following a series of devastating hurricanes. They observed in the aftermath of these events that proper tree risk assessment was not guiding decisions for storm damaged trees, resulting in unnecessary tree removals and high-risk trees left standing, furthering public safety issues associated with the disaster. The UFST initiative involves recruiting, training, and deploying professional urban foresters and arborists—required to possess experience and specific certification, such as the ISA Certified Arborist and Tree Risk Assessment Qualification (TRAQ)—to assess urban tree storm damage using ISA and Federal Emergency Management Agency (FEMA) standards. The goals of UFST assessments are to assist communities in need, provide increased public safety, reduce loss of the urban tree canopy, document disaster recovery needs and costs for possible FEMA reimbursement, and provide for more efficient recovery.

Introduced to the USFS northeastern area in 2009, the two regions, including 33 states and the District of Columbia, continue to partner on the project. Natural disasters in both regions continue to cause severe and significant damage every year in our urban forests, resulting in assessment and cleanup responsibilities which can be very challenging for many communities. State forestry agencies and the USFS continue to develop resources like the UFST to aid communities in the wake of these disasters.

The Ohio Department of Natural Resources (ODNR) Division of Forestry established Ohio's UFST in 2015 and today the team consists of 30 urban foresters and certified arborists from Ohio municipalities, universities, and state agencies that have completed the Task Specialist and Incident Command System training. The team also partnered with the USFS and Michigan DNR for a mock disaster exercise in Toledo in 2016. The UFST's network, trainings, exercises, and partnerships proved to be critical in 2019 when a record tornado outbreak on Memorial Day evening ripped through western Ohio communities causing substantial damage to the urban forest.

The City of Dayton, Wright Patterson Air Force Base, and the City of Beavercreek experienced devastating EF3 and EF4 tornadoes that tore through the heart of this region. In the following months the ODNR Urban Forestry Program worked closely with these communities and the USFS to deploy Ohio's UFST as part of the area's recovery effort. The deployment team included seven, two-person crews, GIS specialists, team leaders, and other support staff and observers. The generous response, coordination, and support from Ohio and beyond included the communities of Cincinnati, Columbus, Dayton, Hamilton, Hudson, Stow, Strongsville, Upper Arlington, and Worthington, as well as ODNR's state urban foresters, Ohio State University, the Massachusetts Tree Wardens and Foresters Association, and the USFT's Morgantown, WV and Durham, NH field offices. The team's primary objective was to help these communities

2019 Dayton Urban Forest Strike Team

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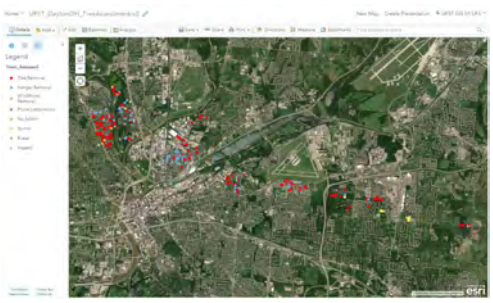
retain as much viable, low risk tree canopy as possible following the tornados. The team also collected data to support FEMA Public Assistance applications and help the communities increase public safety. Ohio's first UFST deployment was successful due to the training, partnership, and support from the USFS and Ohio's communities. The deployment also generated interest from other arborists and urban foresters around the state to become part of the team.

If you're interested in joining Ohio's UFST, training sessions are held twice each year throughout the mid-west and eastern U.S. Presently over 500 professionals have participated in the basic task specialist training while over 50 have attended the advanced team leader training. Since 2007, UFST teams have engaged in 5 deployments in the northeastern states and 9 deployments in southeastern states.



ODNR plans to conduct future task specialist trainings and mock disaster exercises in Ohio over the next several years to keep up to date on the tree risk assessment process and GIS and data collection technology and further grow our team to ensure an effective response for the next natural disaster. For more information regarding our Ohio UFST and future task specialist training opportunities, contact Tyler Stevenson, Urban Forestry Program Manager, ODNR Division of Forestry: tyler.stevenson@dnr.state.oh.us. You can also view a short video of the 2019 Dayton Deployment at: youtu.be/jCiStBtl3ts.

We are honored to recognize the following individuals who recently received new credentials. Congratulations to all!

ISA BOARD CERTIFIED MASTER ARBORIST

Barry Kendall, Cincinnati

ISA MUNICIPAL SPECIALIST

Steve M. Grimm, Cincinnati

Philip Olsen, Wooster

ISA UTILITY SPECIALIST

Steven Holton, Gratis

Kasey Joel Miller, Zanesville

ISA TREE RISK ASSESSMENT QUALIFICATION (TRAQ)

Patrick Costello, Vermilion
Lewis Elter, Dundee, MI
Matthew Haire, Nanty Glo, PA
Nathaniel Hamel, Cloverdale
Chris Henkel, Cincinnati
Josh Horst, Wooster
Aaron James Hoskins, Shelby
William Hunt, Riverside
Michael Johnson, Eastlake
Kody Kappes, Morehead, KY
Kevin Lewis, Northfield
Nicholas Moses, Bellevue
Grai Oleksy, Cleveland
Holdan Oyster, Columbus
Nathanael D. Richards, Grove City, PA
ERICK G RICO, North Ridgeville
Joshua Rohrbaugh , Chippewa Lake, OH
Chad Stewart, Richfield
Neil Trares, Atwater
Nicholas Wilson, Canal Winchester
Robert Yoder, Girard

Free Member Benefit

By Mark A. Webber BCMA, CPH, LTE, MArborA, OCMNT, TPAQ, TRAQ

The Ohio Chapter ISA wants to connect you to the consumers and buyers of arboricultural services. Your membership in the Ohio Chapter can increase your exposure to potential consumers of your services and improve your financial bottom line. However, before new clients can find you, YOU need to be signed up to be seen and found by potential Ohio tree care clients.

Potential Buyers Are Looking For YOU… But How Will They FIND You?

In 2018, the Ohio Chapter adopted and initiated a marketing plan that successfully completed a difficult task by getting legislation passed in the Ohio General Assembly that our Chapter had its very own specialty license plate. That license plate is now being sold and placed on vehicles all over Ohio. The "Trees4Ohio.org" license plates are mobile billboards and are now being seen along Ohio roadways 24 hours a day, 7 days a week. Consumers also hear and see the Trees4Ohio.org message daily on radio stations all across the state, as well as on social media outlets. Your Ohio Chapter ISA is telling the story that proper tree care matters and that the best choice is an ISA Certified Arborist.

Increase Your Exposure To Potential Clients By Being Part of the Trees4ohio.org Message

If you are an ISA Certified Arborist, you have achieved and have exceeded the International Organization for Standardization (ISO 17024).

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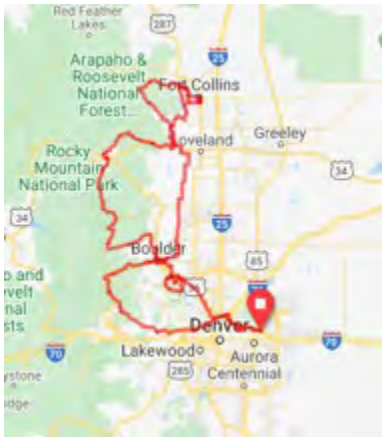
TREE Fund Update

By Kevin Jones

Greetings Ohio Chapter ISA! As usual, late winter is a time when the TREE Fund is currently busy reviewing proposals for urban forestry research. We will soon find out how they will award grant dollars to proposals for the Utility Arborist Research Fund Grant, Hyland John's Grant, and the Ohio Chapter ISA Educational Grant. We look forward to announcements later this year to find out the details of the exciting research that is being supported in our industry with TREE Fund dollars.

In addition to research, the TREE Fund is all about disseminating the latest in urban forestry science. One of the ways that they do this is with a series of webinars that are FREE to us all. I encourage everyone to head over to treefund.org to find out more about the 2020 webinar series. Each webinar is also good for 1.0 CEU at the ISA. Upcoming topics include experts discussing topics like branch failure, tree health and the role of mycorrhizae, and more. Webinars can be viewed after the initial recording, so you can find the resources as your schedule allows. Again, head over to treefund.org to find out more.



As we all know, a lot of TREE Fund dollars are generated with the annual Tour des Trees. Registration and fundraising are now open for this years' Colorado based tour, Rollin' the Rockies! Team Ohio is taking shape and is currently 7 riders strong. The 2020 Tour will depart Denver on Aug. 30 for five days of riding, engagement and comradery. Feel free to reach out to yours truly if you have any questions or feel the urge for a great adventure supporting the TREE Fund.

In this edition of our TREE Fund Update, I would like to introduce our membership to the TREE Fund's new CEO, Russell King. J. Eric Smith retired from leading the TREE Fund last year. The TREE Fund leadership performed and extensive search for his replacement and is very excited to have Russell leading the organization. By the time this edition hits your mailbox, many of you may have had the chance to meet Russell in Dayton at the OTCC. From the TREE Fund:

TREE Fund is pleased to welcome its new president and CEO, Russell King, who began service at the end of October 2019. Russell's hire followed an extensive national search to replace J. Eric Smith, who has retired as president and CEO after four years' service to the organization.

Russell is a seasoned nonprofit executive with more than 25 years of experience in the public sector, including multiple chief executive roles. He is the author of four books, a long-time contributor to numerous traditional print and online media outlets, including Huffington Post, and has an extensive community service resume, including election to the Verona (Wisconsin) Area Board of Education.

After earning his Bachelor of Science degree in journalism, Russell worked as a freelance writer. Part of that freelance life was a weekly outdoor column—he's an avid angler and hiker—that eventually morphed into his first book.

He entered the nonprofit world as a writer and editor, spending eight years as editor of a peer-reviewed scientific journal. During that time, he attended the Institute of Organization Management, earned certification from the American Society of Association Executives, and received an MBA. Nonprofit management is a specific discipline requiring certain skill sets, and these programs provided those skills.

Russell's experience gave him the chance to work with an operating budget as large as $5 million and a staff as large as 120, negotiate with a union, build fund-development programs from the ground up, teach the roles of boards and their members, create organizational print, online and broadcast voices, and more.

"Technical skills are essential," Russell said, "but the heart of the work is the mission. Trees have always been a big part of who I am, so TREE Fund's mission resonates powerfully with me. As I told the search committee during the interview process, this is about what we love."

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Safety Corner

By Brian Goodall and Evan Beck

For this article, we wanted to go back to the basics a little bit and discuss the importance of personal protective equipment (PPE) as it relates to chainsaw use.

It is not uncommon to find someone running a chainsaw without proper PPE as much as it may seem to be common sense to most of us these days. Whether it is the homeowner who just went out and bought a chainsaw after a branch or tree fell in his or her yard or a professional tree care provider that uses a chainsaw every day, PPE is oftentimes lacking.

It has been reported by the Centers for Disease Control and Prevention (CDC) that each year over 35,000 chainsaw related injuries occur in the US. Most of these incidents are severe enough to cause for emergency room treatment. It could be argued that in some cases the incident could have been prevented, but due to lack of PPE and or improper training and use of the chainsaw it was not. Chainsaws are considered to be one of the most dangerous tools available to the common consumer right up there with ladders which average about 140,000 injuries a year. Ironically, these two tools are often used together and the end result in not usually pretty.

A major issue that we feel leads to this is the ease of access to chainsaws. Chainsaws are sold worldwide with little to no regulation, meaning that you don't need to have any form of credential or training to purchase one. The price point can deter a lot of people, but unfortunately it is not enough to stop everyone; especially when "affordable" chainsaw brands are available to the consumer that may be less safe than the "big" brands like Husqvarna or Stihl. There is also a lack of emphasis on safety and training when someone purchases a saw. The purchase of a chainsaw feels much like purchasing any other tool from your local hardware store. You feel sicker about the money you just spent than you do about the potential hazards that await you from said tool.

This point not only applies to the general homeowner but the "professionals" we know in the field as well. There have been countless instances in which a landscape company or even a tree care company is providing services to a client and the employees are not wearing proper PPE when using chainsaws. The chainsaw is oftentimes treated just like any other tools on the trailer or in the truck. What makes this section of people that get injured worse is that if they are truly "professionals" then they should know better. Oftentimes the attitude of "that won't happen to me" or the emphasis of production over safety is the modus operandi amongst these groups.

The first step in addressing this issue is education. There is a wealth of statistics and articles out there for everyone to view about chainsaw safety; people need to be made aware of them and be encouraged to take them seriously. More emphasis at the point of sale should be given to provide people with a safety warning. People need to feel compelled to actually read the safety instructions and follow them. A potential opportunity would be to increase chainsaw training opportunities for the common homeowner that may not have access to training otherwise. An emphasis on safety in chainsaw use is a must for everyone, not just the professionals who need to acquire continuing education credits.

With that being said, what is the proper PPE for chainsaw use? According to ANSI Z133-2017 Section 3.3, proper PPE shall be required when there is a reasonable probability of injury or illness that can be prevented by such protection. All workers engaged in arboricultural operations shall wear head protection that conforms to ANSI Z89.1. Eye protection shall be worn when engaged in arboricultural operations. Hearing protection shall be worn. Cut resistant leg protection that meets or exceeds ASTM F1414 and ASTM F1897 shall be worn while operating a chainsaw during ground operations.

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Make note of the use of the word shall. For those of you unfamiliar, shall, when used in this standard is a term signifying a mandatory requirement. This means you must wear the PPE listed above, no exceptions. Now, the language in the ANSI Z133 does mostly apply to those that work in the tree care industry, but the same standards should be advised to and required for the general public.

In review and to make sure we are clear on what is required PPE: Helmets that meet the appropriate safety standards must be worn at all times. Safety glasses must be worn at all times. Ear plugs or muffs must be worn at all times. Chainsaw chaps or pants with the appropriate rating must be worn at all times when operating a chainsaw.

Helmets not only help prevent injuries from falling objects or bumping your head on something but can help reduce the impact of a potential kick back of the chainsaw that is headed towards your dome. Safety glasses are important to help keep your eyes clear of debris and injurious projectiles in order for you to be able to see what you are doing with the chainsaw and see your family later that day. Ear plugs or muffs will help protect your ears from irreparable damage from the noise exposure and will help prevent that incessant ringing that you can't figure out where it is coming from. Chaps or pants rated for chainsaw protection will help prevent you from cutting your own leg off or having to let the doctor take it the rest of the way off for you.

One further PPE item that I would recommend but is not required by the ANSI standard would be gloves. Gloves can aid in the protection of cuts or scrapes. Certain types of gloves can also provide better grip for the chainsaw user, making the situation safer as well.

Proper use of PPE can help save your life while operating a chainsaw. Educate yourself on what you are supposed to be wearing and make sure you wear it. Furthermore, learn how to properly use your PPE as well as properly use the chainsaw before you do any work with one. You can wear all of the PPE in the world and still hurt yourself or others because you are using it (the chainsaw or your PPE) improperly.

One final note to make is this, one of the most important components of chainsaw safety that is not often followed and should be a part of any situation involving a saw including your PPE is having someone there to help. It is not part of the ANSI standard for chainsaw use, but it very well could be. Again, you can have all of the required PPE and be trained effectively in chainsaw use, but if you don't have someone there to help you when an accident occurs, it could be your last. Cut with friends.

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Be Safe on the Road

By Keith Pancake, ACRT and Bermex Safety Manager

Driving is a routine task that many take for granted. Yet traffic accidents are a leading cause of death and injury in the United States, with an average of about 33,000 fatalities in the last five years, according to the National Highway Traffic Safety Administration (NHTSA).

The bad news: Many of these incidents occur during the workday or on the commute to and from work. Thus, companies and utilities, especially those with large fleets, must keep this in consideration and work to protect their No. 1 asset—their employees.

The good news: Most accidents are preventable. With some simple safety measures and tips to follow, you can help ensure your team members make it home to their families each night.

A Prevention State of Mind

While the NHTSA reports that the number of roadway fatalities has decreased by 25 percent over the past decade, one cannot ignore that most accidents are preventable.

The National Safety Council defines a preventable vehicle accident as one in which the driver failed to do everything reasonable to avoid the accident. In other words, when a driver commits errors or fails to react reasonably to the errors of others, an accident is preventable. Actions that lead to such accidents include:

- Speeding
- Unsafe driving in bad conditions (fog, ice, snow, heavy rain, etc.)
- Fatigued driving
- Aggressive driving
- Improperly maintained vehicles
- Neglecting to ensure space is clear before moving, especially when backing up
- Distracted driving

Distraction-affected crashes, or those in which drivers lost focus on the safe control of their vehicles due to manual, visual, or cognitive distraction, cause at least 3,000 deaths each year, according to the NHTSA. Such behaviors include using a cellphone, eating and drinking, talking to passengers, reading (including maps), using a navigation system, and adjusting a radio.

Studies show that texting involves simultaneous manual, visual, and mental interferences and is among the worst of all driver distractions. To put it in perspective, sending or receiving a text takes a driver's eyes from the road for an average of 4.6 seconds, the equivalent of driving the length of a football field, blindfolded and at a speed of 55 mph. Observational surveys show that more than 100,000 drivers are texting at any given daylight moment.

There are ways to help your employees avoid these mistakes—and avoid preventable accidents.

Set Up a Program, Enact a Policy

According to a recent Virginia Tech Transportation Institute study, engaging in visual-manual subtasks (such as reaching for a phone, dialing, and texting) associated with phones and other portable devices increased the risk of getting into a crash by three times.

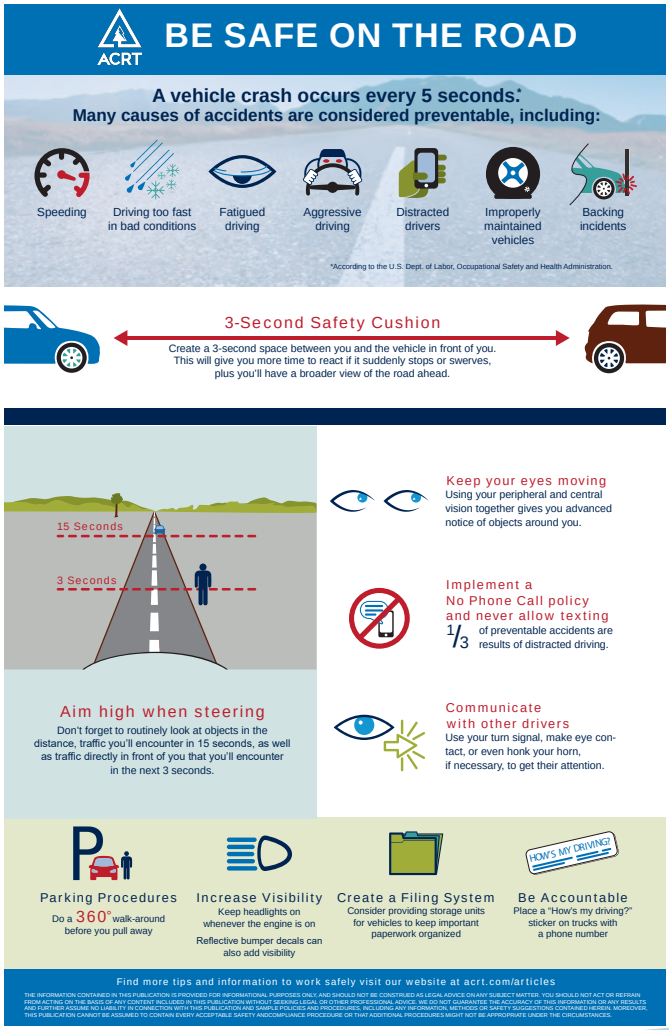
Utilities and other companies can help reduce the number of such traffic crashes and subsequent injuries that impact their workforces and their families. By sharing safe driving tips and educating workers, U.S. employers can directly reach more than half of the driving population—even more when information is extended to employees' family and community members, according to the Network of Employers for Traffic Safety (NETS).

Communicating simple, actionable steps is key in helping employees be at their best behind the wheel. Companies can tap into a number of resources such as NETS and the Occupational Safety and Health Administration, which provide toolkits for launching a safety campaign at work. OSHA's "Guidelines for Employers to Reduce Motor Vehicle Crashes," available online, provides tips and a worksheet that can help calculate how much motor vehicle crashes cost your organization.

Going a step further, developing or expanding a fleet safety program that includes zero-tolerance on distracted driving can help prevent injuries and save lives. To make an impact, collect pledge forms from employees or enact enforceable policies to combat distracted driving.

Fleet safety programs should be communicated through all available channels, including newsletters, vehicle magnets and team meetings. Training should also be mandatory, not just when an employee starts but as part of any ongoing training program offered by the company.

About the author: Keith Pancake is a safety manager serving ACRT and Bermex. He has been involved in the UVM industry for 10 years. He is an ISA Certified Arborist and Utility Specialist with a Bachelor of Arts in Geography/GIS from Keene State College and a Bachelor of Science in Wildlife, Fish and Wildlands Science and Management from Tennessee Technological University.



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Spotted Lanternflies Could be Coming Your Way

By Don Grosman, Technology Advancement Manager and Entomologist, Arborjet Inc.

Uh oh! The scourge of Pennsylvania, the spotted lanternfly (SLF), has been sighted within 15 miles of Ohio's border. The SLF, an invasive planthopper native to parts of China, India, Vietnam, and eastern Asia, was discovered in Berks County, Pennsylvania in 2014. It has since become established in 13 additional counties in southeast Pennsylvania, as well as in Delaware, Maryland, New Jersey, Virginia and West Virginia, and sighted in Connecticut, Massachusetts, and New York. A USDA Agricultural Research Service map identifying the areas suitable for establishment of the SLF in the United States shows that several Midwest states, including Ohio, have high suitability for this insect (https://www.eurekalert.org/pub_releases/2019-10/esoa-sfl092519.php).

Adult Spotted Lanternflies *(photo by Don Grosman)*

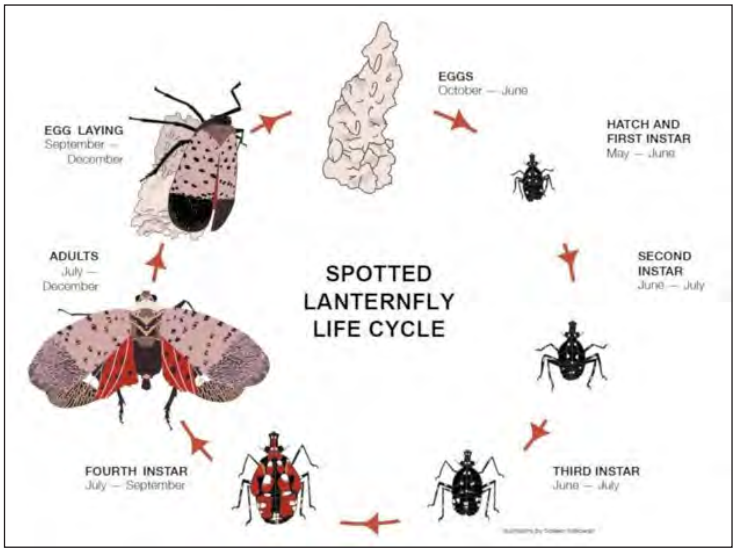
SLF pose a significant threat to Ohio's agricultural and forest health. SLF nymphs and adults feed on over 70 plant species. The insect will change hosts as it goes through its developmental stages. Early instar nymphs feed on a wide range of plant species (annuals and perennials), while late instar nymphs and adults are a serious pest of grapes (both cultivated and wild), hops, apples, peaches and other tree fruits. Ohio's annual yield of apples and grapes, with a combined value of more than $25 million, could be impacted if SLF enters Ohio. The full extent of economic damage this insect could cause is unknown at this time.

Besides agricultural crops, SLF are moving into wooded and residential areas to feed on Tree of Heaven (*Ailanthus*), black walnut, red and silver maples, tulip poplar, paper and river birch, and willows. Because of the copious amount of honeydew, and subsequent sooty mold they produce, SLF has become a significant nuisance in residential areas. An added nuisance is the wasps, ants, and flies attracted to the honeydew.

Hornets attracted to tree sap flowing from SLF feeding sites. (*Photo by Don Grosman)*

Nymphs are black with white spots and turn red before transitioning into adults. They can be seen as early as April. Adults begin to appear in July and are approximately 1 inch long and ½ inch wide at rest, with eye-catching wings. Their forewings are grayish with black spots. The lower portions of their hindwings are red with black spots, while upper portions are dark with a white stripe. Although it has two pairs of wings, it jumps more than it flies. In the fall, adults lay 1 to 2-inch-long egg masses on nearly anything from tree trunks and rocks to vehicles and firewood. They are smooth and white with a shiny, waxy coating when first laid, but turn brownish gray after a few hours.

The SLF causes damage when nymphs and adults feed, sucking sap from the trunk, branches, twigs, and leaves. You will often see hundreds, if not thousands of SLF feeding on plants, resulting in plant stress and increased vulnerability to disease and other insect attacks. They often create oozing wounds, leaving a greyish or black trail along the bark of the plant. This feeding can weaken the plant and eventually contribute to plant and tree death. In addition, the insect excretes large amounts of honeydew. These fluids promote growth of black sooty mold which can reduce photosynthesis leading to further weakening of the host.



Spotted Lanternfly Life Cycle
Source: https://extension.psu.edu/spotted-lanternfly

Eggs are laid on trees that tend to retain their leaves into late October/early November, such as red maple and tulip poplar. Other favored hosts, such as walnut and Tree of Heaven, frequently drop their leaves by early October; before females are ready to lay eggs.

SLF has few natural enemies. They are very distasteful, so birds and mammals avoid eating them after just one taste. Mantids, spiders, and stink bugs will prey on a few SLF, but not enough to stop the spread and increase in populations. Recently, however, two native fungal pathogens have been found infecting nymphs and adults in southeast Pennsylvania.

Current management options for ornamental trees had been limited to scraping egg masses, sticky bands, and spray applications of contact insecticides and bole spray of one systemic insecticide, dinotefuran. However, recent research has shown that systemic trunk injections of

Spotted Lanternfly Cont. from page 14

imidacloprid (IMA-jet) and/or acephate (ACE-jet) were effective in killing nymphs and adults that feed on treated trees as well as reducing numbers of live insects on the trunk, amount of honeydew and sooty mold production, and the number of egg masses laid in the fall.

What can you do? SLF is a hitchhiker. Be sure to inspect for the pest. Egg masses, juveniles, and adults can be on trees and plants and are also found on bricks, stone, metal, and other smooth surfaces. Also thoroughly check your vehicles, trailers, and even the clothes you're wearing because you can accidently move SLF. Inspect your trees and plants for signs of this pest, particularly at dusk and at night when the insects tend to gather in large groups on the trunks or stems of plants. Look for plants that ooze or weep and have a fermented odor. Look for a buildup of sticky fluid (honeydew) and/or sooty mold on plants and on the ground underneath infested plants. If you find an insect or egg mass that you suspect is the spotted lanternfly, contact your local Extension office (http://npic.orst.edu/pest/countyext.htm) or State Plant Regulatory Official (http://pest.ceris.purdue.edu/services/napisquery/query.php?code=spro) to report it.

About the Author: *Don Grosman is the Technology Advancement Manager and Entomologist with Arborjet Inc. (a tree healthcare company out of Woburn, MA). He has spent the past two years becoming well acquainted with spotted lanternfly, honeydew, and sooty mold in southeast Pennsylvania as well as conducting research on the effectiveness of different control options to protect residential trees.*

Free Member Benefit Cont. from page 5

To have earned an ISA Certified Arborist credential, you have been trained and are knowledgeable in all aspects of arboriculture. Your Ohio Chapter ISA marketing committee is spreading the word about the value of Ohio ISA Certified Arborists, and consumers are looking to find you. But, how do consumers of tree services find and choose you and your business over others who claim to be the so-called tree experts or qualified that are not members of the Ohio Chapter?

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But to grow your business and connect you with potential customers, you need to enroll at the Ohio Chapters website *(https://www.ohiochapterisa.org)* so that potential clients can compare and find you by the click on an electronic device. Take advantage of your yearly $45 Chapter membership benefit that costs you just a mere 12 cents per day for YOU to be put forth as an industry leader and a "True" Ohio Tree Expert by being part of Trees4Ohio.org.

A record 546 tree care professionals attended the conference last month. Not only were there a record number of attendees, the exhibit hall also sold out. We are sincerely grateful for the support of the following companies:

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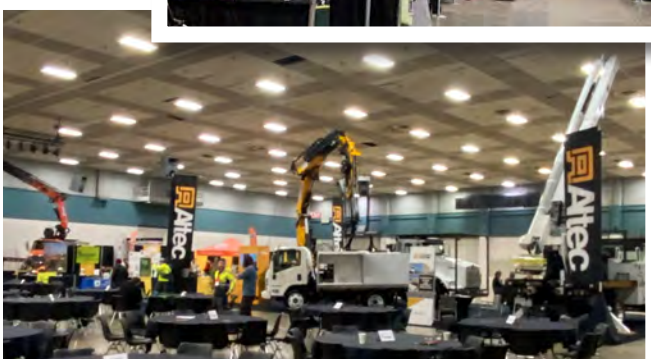
Mark your calendar for the 2021 conference, February 23-25 in Cleveland, Ohio.



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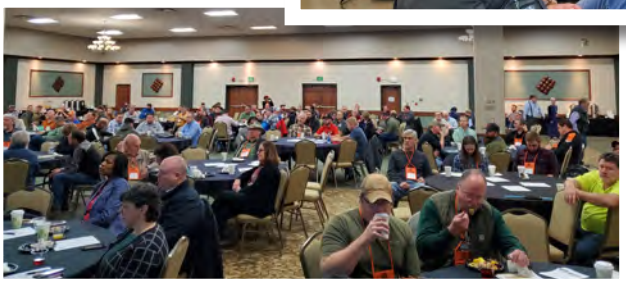
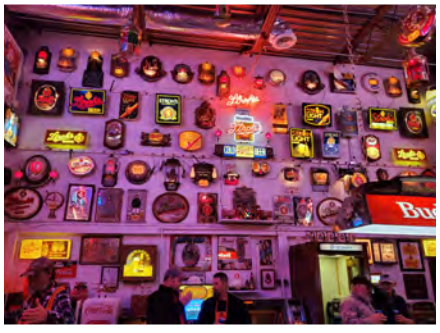
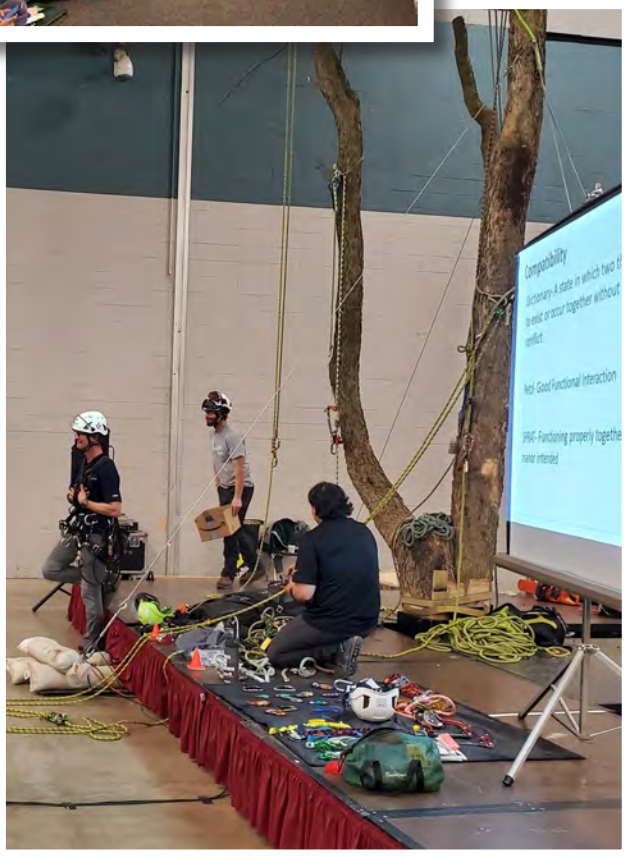






Awards Presented

The annual meeting was held in Dayton as part of the Ohio Tree Care Conference. We are honored to recognize the following award recipients.

The **Award of Merit** is the highest honor the Chapter can bestow. It recognizes outstanding meritorious service in advancing the principles, ideals, and practices of arboriculture, and to one who has contributed materially to the promotion of the Chapter. The recipient of this award has also been nominated for an ISA award of distinction. This individual has a reputation that precedes him. His many articles in industry publications display extensive knowledge and witty humor we all enjoy so much. And his deeply rooted involvement in professional organizations, committees, boards, and other volunteer opportunities have ensured not only that he is well known throughout our profession but also that he will be asked again and again to join this or teach that. Many of us have witnessed his selfless character and endless dedication to and influence on our profession and the people that work to make our urban environment a better place to live. This year's Award of Merit went to **Steve Cothrel** for lending his knowledge and time to anyone who asks and for his work with the Ohio Chapter.

The **Award of Achievement** is granted to an individual who has through specific programs, contributed to the advancement of the use and maintenance of shade trees and other landscape plants in Ohio. This year's Award of Achievement goes to **Dr. Carolyn Keiffer** with the American Chestnut Foundation for her continued work in promoting responsible care of public trees. Dr. Keiffer is a professor of botany in the Department of Biological Sciences at Miami University. A plant ecologist primarily interested in restoration ecology and forest biodiversity, she also has done extensive restoration work with The American Chestnut Foundation over the past 20 years serving as Ohio president and a national board member. Dr. Keiffer cultivates other kinds of seedlings as well, the minds of students. Dr. Keiffer is passionate about involving students in community service projects and many of her students are active in local parks, arboretums and nature sanctuary projects. With further interests and involvement in the maintenance and improvement of the urban tree canopy, Dr. Keiffer has also been a member of the Tree City USA program for more than a decade.

Honorary Life Membership is granted only to Chapter members who have contributed materially and have given unselfishly of their efforts in supporting and promoting the objectives of the Chapter. This year's award goes to an individual we all know and appreciate for his unique brand of edutainment. Just provide him a topic and audience and he will be there with bells on. This individual always makes himself available to teach our youth, adults, and seniors; the uninformed, apathetic, and yes, even the incarcerated. This year's award was presented to **Jim Chatfield** for his continued support and volunteer training especially with our certified arborist preparation courses.

The **Gold Leaf Award** traditionally recognizes individuals, groups, or businesses for outstanding Arbor Day recognition activities or

community beautification projects. The Gold Leaf Award is a nationally recognized ISA award and this year we are honored to present it to **Keep Ohio Beautiful** for their 2019 Arbor Day event at Deer Creek State Park as well as spending the past three years planting trees at our state parks.

The **Safety Award** recognizes an individual or crew's heroic reaction to an emergency. When natural disasters hit our communities, the safety and well-being of our citizens is priority number one and high-risk trees pose a significant threat. The staff and leadership of this organization exemplified what a safe and efficient response to natural disasters should be. Beyond their initial response, this organization continues to work with state and federal agencies, neighboring communities, and private contractors to reduce risk associated with the aftermath this 2019 natural disaster. If you haven't figured it out already, the award goes to the City of Dayton for their response to the Memorial Day tornadoes that swept across Western Ohio.

Chapter president Tyler Stevenson presented one more special award. And it's so special that he decided to rename it the **Heartwood Award**. As members are aware, the heartwood of a tree provides structure and support for the branches of a tree. This person is a major component of our Chapters heartwood. This award goes to someone we all have come to know over the last few years. Although mostly behind the scenes, you'll find her at every event, often with her family, making sure everything is running smoothly. She is Dixie's sidekick and an integral part of our Chapter. We are grateful to have her on our team. The 2020 Heartwood Award was presented to **Jennifer Clegg**

And last, but not least, the 2020 **President's Award** was presented to **Eric Davis**. When we were in need, Eric graciously stepped up and filled the treasurer's role, all while keeping up with past president duties, the leadership development committee, and co-chairing this OTCC. As you may recall, the treasurer role had big shoes to fill after Tom Munn's retirement. But Eric jumped right in and kicked butt all year. We decided that he likes it so much that he's going to drop the "acting" role and just become our treasurer. Eric has dedicated many years to this chapter and the profession, giving back the support, advice, and wisdom he received from other Chapter members through his early career.

Congratulations to all recipients!

Meet the Board of Directors

Membership in an organization is a powerful tool in so many ways. One of your Chapter's membership tools is the ability to vote to elect new members to the board of directors, because there is power in numbers! The board acts as your voice at the table. If you work in the municipal arena, for example, then you had three representatives "at the table" last year who hopefully carried your mission, challenges, and goals to discussions and strategic planning. In February, the membership voiced their opinions in electing the 2020-2021 board members. During the Ohio Tree Care Conference, the new board was recognized.

President, **David Bienemann**, is a municipal arborist/utility forester with the City of Hamilton. Dave is active on the Ohio Tree Care Conference committee and excited to lead the Chapter as president.

Through the power of membership, **Virginia Bowman** was elected as the new vice president. Virginia is manager of forestry services for The Illuminating Company, a FirstEnergy utility, and works in the Brecksville office. **Jay Butcher** is joining the board as a director. Jay is co-owner of Madison Tree Care & Landscaping in Cincinnati and is a third-generation arborist. **Sue Mottl**, City of Stow, and **Steve Schneider** with The Ohio State University, were both re-elected for a second 3-year term on the board.

The board also includes these individuals whose terms will expire next year: **Scott Conover**, City of Upper Arlington; **Dale Hopkins** with AEP Ohio in Steubenville; and **Kevin Jones** who works for ACRT.

Eric Davis has agreed to stay on the board as treasurer and **Tyler Stevenson** will remain on the board for one more year as past president.

If you are interested in a leadership or volunteer position, please contact any member of the board or the Chapter office; you will definitely benefit from the experience.

CEUs at Home

Spectral Reflectance & Tree Risk Analysis and Management

By Mark A. Webber BCMA, CPH, LTE, MArborA, OCMNT, TPAQ, TRAQ

K. N. Au, Geocarto International Centre Limited

When professionals inspect trees with preexisting defects for the potential of failure, one question an arborist should consider is if the tree is adequately healthy to produce carbohydrates necessary for its essential functions plus the needs for the management of decay through compartmentalization (Smith, 2015). Plants, including trees, face an existential dilemma in the allocation of internal resources for the individual tree's survival and reproductive effort. Trees must grow fast enough to compete for light, water, and essential mineral elements while providing defense against pests, decay, pathogens, and episodically or chronically adverse environments (Smith, 2015). Plants, including trees, depend upon radiant energy (sun) to carry on photosynthesis and other physiological processes (Gates et al., 1965).

When trees capture light and generate sugar, it becomes photosynthate and it is usually transported by the phloem from the foliage to where the energy is to be stored or used. In trees in the temperate zones (Ohio), energy is stored in the sapwood parenchyma, particularly in the wood rays (Savage et al., 2017). The other starch that is created by the tree after photosynthesis is then stored in the branches and roots to provide reserves for important life processes, including the compartmentalization of decay (CODIT) (Pallardy et al., 1991; Smith & Downer, 2019).

The energy stored in the parenchyma cells is critical for compartmentalization to be successful (Smith & Downer, 2019). Additionally, the newly formed wood for wall four in CODIT and other defense materials in trees need energy (Smith, 1997). The energy generated to produce cellulose, hemicellulose, and lignin is a direct biological product of photosynthesis (Smith & Downer, 2019). However, a key part of decay management in trees is if the trees will have the reserves to accomplish this successfully (Hirons & Thomas, 2015). Although trees can potentially produce large volumes of carbohydrates, research has shown that tree defense (managing decay) is the last priority in energy resource allocation for most trees (Hirons & Thomas, 2015; Smith & Downer, 2019).

How do we know if photosynthesis has accumulated enough carbohydrates for the defense of decay in trees?

As previously discussed, the sum of photosynthesis that is used in tree defense is the last priority in energy resource allocation for most trees (Hirons & Thomas, 2015; Pallardy, 2007). So as practicing arborists, how do we measure if a tree is producing carbohydrates at a high enough capacity to have enough energy for the management of decay and defend the plant? The starch test using iodine solutions has been used with some reliability as a measure of carbohydrates in trees (Webber, 2016). However, starch testing only shows what has accumulated and does not reflect if the photosynthetic process of the tree is fully functional. Trees have two-stage priorities of energy needs that are known as metabolisms (Hirons & Thomas, 2015). A fully functioning tree has both primary and secondary metabolisms (Hirons & Thomas, 2015). The first metabolism is the production of energy for primary metabolites for the basic functions of normal growth, reproduction, and energy storage for the trees primary needs but not for the defense of decay (Hirons & Thomas, 2015). The secondary accumulation of energy metabolism in trees provides the vital defenses to compartmentalize decay and defend the tree (Hirons & Thomas, 2015; Pallardy et al., 1991; Smith & Downer, 2019). However, unless the primary energy needs are not met, then the secondary energy reserves will be limited and or non-existent (Hirons & Thomas, 2015).

Spectral Reflectance in Plants

Green plants, including trees, have unique spectral features, mainly because of the chlorophyll, carotenoid, other pigments, and water content together constitute the spectral features of a plant (Chen, 2008) The leaf of a tree is the primary photosynthesizing organ with photosynthesis occurring in the chloroplasts where the chlorophyll pigment is located (Gates et al., 1965). The radiant energy (sun) interacts with the leaf structure by absorption and by scattering. The energy absorbed selectively at certain wavelengths by chlorophyll will be converted into heat or fluorescence and converted photochemically into stored energy in the form of organic compounds through photosynthesis (Gates et al., 1965).

Electromagnetic radiation (EMR) produced by the sun has different wavelengths that make up the electromagnetic spectrum. Important wavelengths of the spectrum are ultraviolet, visible (VIBGYOR), which is violet, indigo, blue, green, yellow, orange, and red, and other types (Roy, 1989). The research results confirmed by Horler et al., (1983) show a direct correlation between spectral reflectance color and chlorophyll content in plants. The spectral reflectance color can be used to estimate the chlorophyll content of a plants leaves. Plants with less chlorophyll will generate fewer leaves, less carbohydrate accumulation, and less spectral reflectance color (Humbolt.edu, 2020). Wavelength is a measure known by the symbol of μm. Chlorophyll strongly absorbs light at wavelengths around 0.45 μm (blue) and 0.67 μm (red) and reflects strongly in the green light; thus, our eyes perceive healthy vegetation as green. Healthy plants have a high reflectance in the near infrared between 0.7 μm and 1.3 μm. This is primarily due to the healthy internal structure of plant leaves, and there is an internal structure that varies amongst different plant species (Roy, 1989).

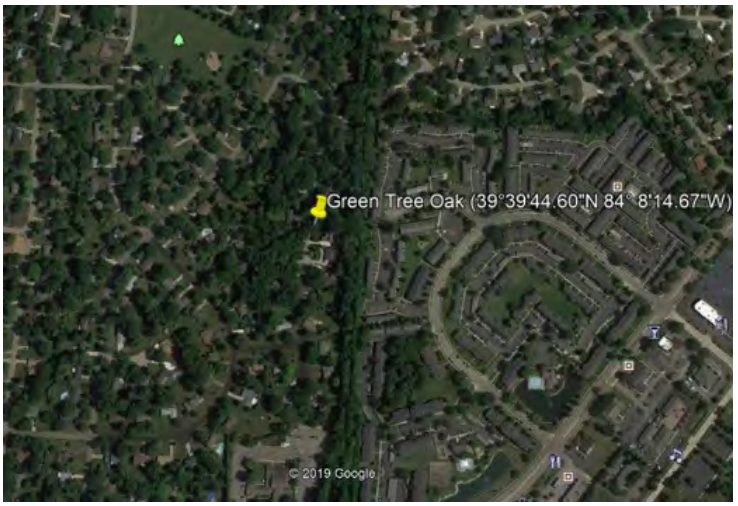
Methods and Means

Geocarto International Centre Ltd. and Mark A. Webber worked in collaboration in this exercise. Neither party knew of each other's work or methods as well as each other's independent findings until the final report was compiled and written collaboratively. The purpose of this experiment was to determine if there was any correlation between tree structural condition concerns and management of trees inspected utilizing an ANSI A300 Part 9 level two tree risk assessment. Mark Webber's data would then be compared and analyzed to the Geocarto spectral reflectance data collected from the same trees. Also, if the spectral reflectance data provided by Geocarto can provide information as to if structurally troubled trees are indeed functioning inadequately in the production of carbohydrates to manage decay. More so, if the data provided by spectral reflectance analysis would provide additional information on how to better advise the trees owner on how to manage the tree in the long-term.

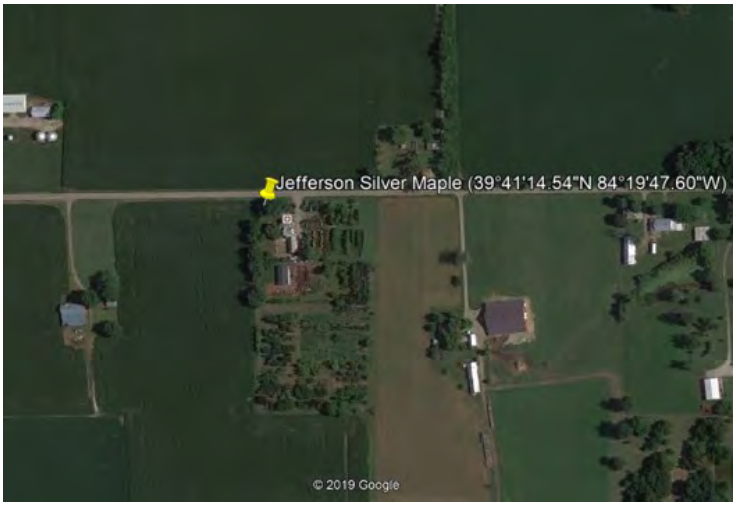
CEUs at Home Cont. from page 20

Four deciduous trees were chosen by Mr. Webber for this study and were designated as the Woodland swamp white oak (Quercus bicolor), Green Tree chestnut oak (Quercus montana), Jefferson silver maple (Acer saccharinum), and the School Yard sycamore (Platanus occidentalis). (See Photographs 1-4)

Photograph 1. Woodland swamp white oak
(Source Google Earth)



Photograph 2. Green Tree chestnut oak
(Source Google Earth)



Photograph 3. Jefferson silver maple
(Source Google Earth)

Photograph 4. School Yard sycamore
(Source Google Earth)

The GPS (Global Positioning System) location of each tree was collected during site inspection by Mark Webber, and that data was reconfirmed via Google Earth Pro GPS tools. Geocarto was supplied the GPS location, and the Google Earth photographs by Mr. Webber as shown in **Photographs 1-4.** Geocarto procedures then precisely selected a few pixels (each of about 30cm x 30cm to 50cm x 50cm, depending on the resolution used) from the foliage at the top canopy of the subject trees to compute the spectral reflectance value. The pixels are selected from the adaxial (upper) surface of the leaves. The spectral reflectance value provided information of leaf cellular structure and chlorophyll content of each of the subject trees. The Geocarto procedure for this analysis precludes the air space and ground data. Geocarto's spectral reflectance technology for tree health monitoring is based on subtle changes in chlorophyll content and leaf cellular structure generated from the three spectral bands of (1) near-infrared, (2) red edge and (3) red, collected by high-resolution WorldView-2 and WorldView-3 satellites. Global case studies have verified this new approach. It is an early detecting approach revealing internal warning indicators before the emergence of discernible external symptoms. Details are presented in two articles in Arborist News, April 2017 and August 2018 issues published by the International Society of Arboriculture and in a white paper published by DigitalGlobe in June 2017. All are available online at www.geocarto.hk.

Geocarto's interpretation is based on a comparison of the spectral reflectance of the same tree on different dates in the same season and sensor azimuth. According to Geocarto, it can be performed for different trees regardless of the species. Interference of light reflection from nearby buildings will not affect the result, because such reflection will occur in all the images for that tree. With data collected on at least three dates, this technology can identify four categories of tree health, namely, (a) improving, (b) stable, (c) fluctuating, and (d) declining.

Geocarto research has found that biotic (living) and abiotic (non-living) factors affecting chlorophyll content and leaf cellular structure will be

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CEUs at Home Cont. from page 21

revealed in spectral reflectance changes. It is similar or analogous to the use of X-ray, CT scan (CATSCAN), and MRI (magnetic resonance imaging) in medical examinations that reveal hidden warning indicators not observable externally. Geocarto states that this technology provides objective and early information to assist arborists and tree management teams in carrying out remedial measures expeditiously. This monitoring technology can be undertaken remotely without a field visit. Being computer-based, it is non-invasive, time-saving, and cost-effective.

In fact, the technology of monitoring urban tree health from space is very new. Prior to the launch of the two satellites, WorldView-2 on October 8, 2009 and WorldView-3 on August 13, 2014, it was not feasible to implement this technique, because the data provided by other commercial satellites only included four multispectral bands of blue, green, red, and near-infrared, without the red edge band which is a good indicator of chlorophyll content. Moreover, the resolution of the data collected by other satellites is not high enough for monitoring an individual tree. For analysis, Geocarto uses AComp (atmospheric compensation) data, which is then pan-sharpened with a "lossless" program to retain the spectral information content from each pixel.

Mark Webber Level 2 Inspection Data

In the autumn of 2019 Mark Webber inspected the four subject trees. A level two risk assessment was conducted by following the protocols of the ANSI A300 Part 9. That inspection included tree identification, measurement of trunk diameter at 4.5 feet above the ground, possible targets, a complete 360-degree ground based visual inspection of the roots, root flare, trunk, large scaffold limbs, secondary limbs, and overall canopy for defects. Mr. Webber also performed an analysis of the most likely parts of each tree to fail and the likelihood of failure of those known defects. The other portions of this risk assessment were precluded in this study. The time period for the assessment was 18-months before the next inspection. Mark Webber's findings are listed below in Table A for each of the four subject trees.

Table A. Mark Webber Level 2 Inspection Data (Fall of 2019)

Tree Name	Species	DBH	Targets	Defects	Likelihood of failure
Woodland swamp white oak	Quercus bicolor	55"	Gravestones Infrequent pedestrian occupancy	The tree has a corrected lean. The lower trunk has three pockets of decay with no visible fungal bodies. At 25 feet from the ground, a 36" long by 6.0" wide opening with 8.0" outer wall and the upper trunk is hollow. Numerous old dead branches with proper wound closure around dead branches. A full canopy of leaves.	Probable failure of dead branches and possible failure of the upper trunk.
Green Tree chestnut oak	Quercus montana	42"	Dwelling, roadway, and frequent pedestrians	The lower trunk has a 40" long by 10" wide opening. The outer shell of the cavity is 15-18" with no visible buckling cracks. In 2017 a level three assessment found one (1) dried fungal body of Ganoderma species. The upper canopy is full, and the client was concerned about its leaf color in the summer of 2018.	Possible lower trunk failure.
Jefferson silver maple	Acer saccharinum	38"	Dwelling, roadway, passing vehicles, and occasional pedestrians.	Large tree branch (14") was removed 8 years ago after a storm. Wound wood has formed around the wound and is closing. The tree had little to no visible defects. The tree was affected by an herbicide drift event in 2016.	Possible failure of smaller scaffold limbs during an intense thunderstorm event.
School Yard sycamore	Platanus occidentalis	32"	School yard sidewalk is connecting the entrance of a school and a public sidewalk.	2 of 6 anchorage roots are decayed. The trunk is open and hollow. Wall of sound wood is approximately 3-6" thick. Opposite the large opening on the trunk, there is an open longitudinal crack that likely occurred due to partial trunk collapse. 2 of 9 large scaffold limbs are dead, and the canopy is in overall decline.	The probable – imminent failure of the trunk. Probable – imminent failure of two large dead scaffold limbs and or small branches.

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Geocarto Data Analysis

The Geocarto spectral reflective data analysis of the four subject trees can be found in Table B.

Table B. Geocarto Spectral Reflective Data Analysis

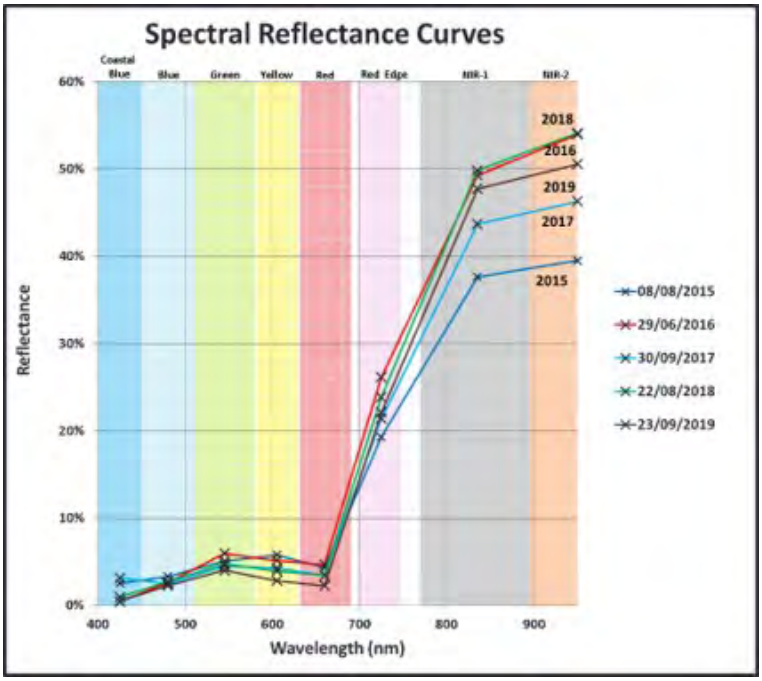
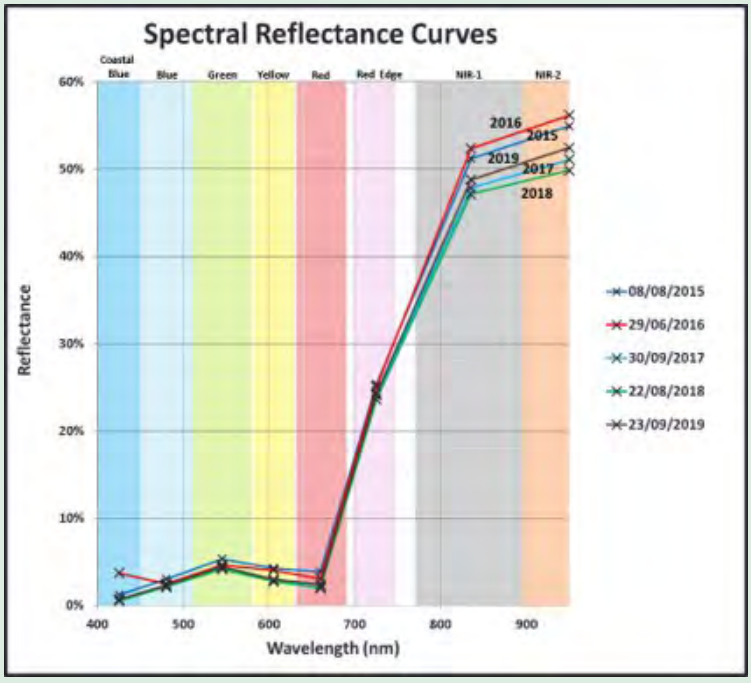
Woodland swamp white oak	 Tree Location (39°44'35.89"N, 84°10'40.80"W)	The spectral reflectance analysis shows that this tree showed much fluctuation over the period from 2015 to 2019. It revealed marked improvement from 2015 to 2016 and then declined significantly from 2016 to 2017, but improved again from 2017 to 2018. Then it became quite stable from 2018 to 2019. Over the 5-year period, the spectral reflectance was highest in 2016 but lowest in 2015, with the minor difference between 2018 and 2019. Such major changes imply marked fluctuation in health conditions.
Green Tree chestnut oak	 Tree Location (39°39'44.39"N, 84°8'14.57"W)	The spectral reflectance analysis shows that this tree indicated a quite stable condition over the period from 2015 to 2019. The spectral reflectance from 2015 to 2016 differed mildly, and from 2016 to 2017, it varied slightly more, but from 2017 to 2018, the difference was reduced, and then from 2018 to 2019, it showed a minor difference. These small changes in spectral reflectance imply a fairly stable health condition

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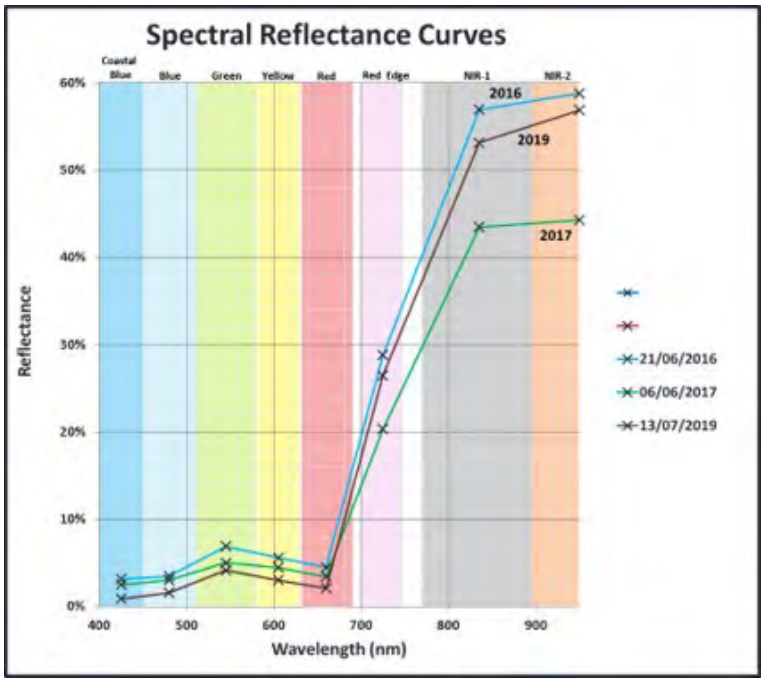
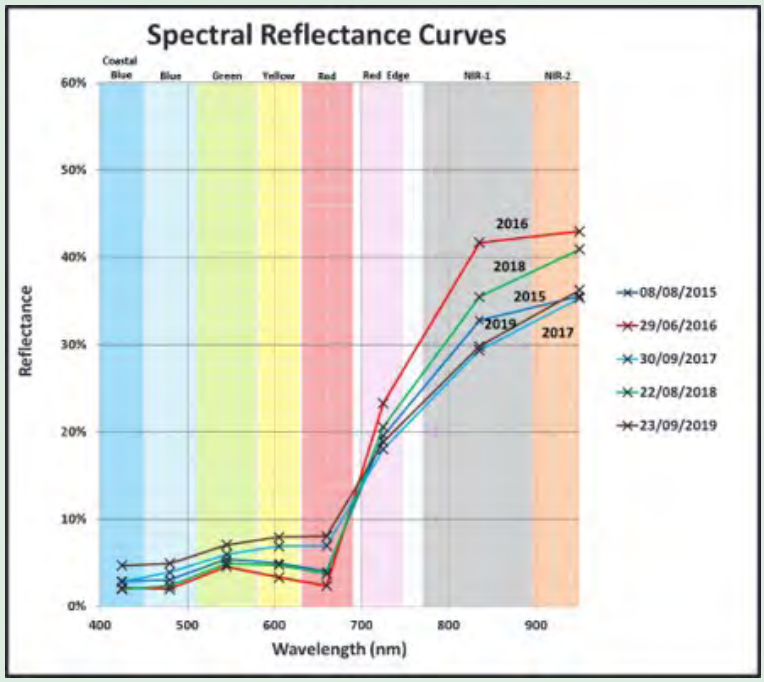
Table B. Geocarto Spectral Reflective Data Analysis Cont.

Jefferson silver maple	 Tree Location (39°41'14.39"N, 84°19'47.59"W)	The spectral reflectance analysis shows significant declining condition from 2016 to 2017 and then marked improvement from 2017 to 2019. It, therefore, indicates fluctuating conditions over the period from 2016 to 2019. For this tree, we only have satellite data for three dates for our analysis and interpretation.
School Yard sycamore	 Tree Location (39°39'58.22"N, 84°14'56.18"W)	The Spectral reflectance analysis shows a highly fluctuating condition from 2015 to 2019. There was a marked improvement from 2015 to 2016 and significant deterioration from 2016 to 2017, followed by amelioration from 2017 to 2018, but declining condition from 2018 to 2019. Therefore, the health condition over that period was fluctuating and unstable.

Discussion and Analysis

A review of the data and visual evidence showed that the use of spectral reflectance data of trees can provide arborists, tree managers, and owners important objective and quantitative information regarding photosynthetic production capacity of individual trees and the carbohydrates available for decay management. Spectral reflectance data combined with visual ground inspection data from a trained arborist can provide meaningful information to the tree owner on how to best manage a tree long-term. However, the spectral reflectance interpretation of the data alone may produce a finding that masks the structural deficiency of the tree and create findings not rooted in reliable facts and data. Another important consideration is if spectral reflectance data is plentiful enough (number of years) to produce a valid finding that can be relied upon. The spectral reflectance data of the four subject trees in this case study underpins this analysis and findings.

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Woodland Swamp White Oak

The Woodland swamp white oak in this study is an example of a tree with structural defects that may cause the owner or arborist to remove it, however the spectral reflectance data demonstrates that it is still functioning at a very-high photosynthetic capacity (Pallardy, 2007). Trees can be structurally sound, but not green and healthy. Conversely, a tree can be structurally deficient but green and healthy (Dunster, 2013). It has been published that oaks (Quercus) can manage decay well (Gilman, 2002). The Woodland swamp white oak, in this case, contains a large pocket of decay. The spectral reflectance data, in this case, does provide an adequate factual indicator of the structural defects by the fluctuation in health condition as the tree is likely attempting to manage decay (Smith & Downer, 2019). The inspection by Mr. Webber of the location and severity of the defect determined it is not likely to fail under normal weather conditions. The low likelihood of failure from the visual inspection combined with the spectral reflectance data shows that the tree can likely be retained if the trees owner accepts the risk. Thus, the Woodland swamp white oak is likely producing enough extra carbohydrates for secondary tree needs for the defense of decay (Smith & Downer, 2019; Dunster, 2013).

Green Tree Chestnut Oak

The Green Tree chestnut oak, another example of a tree with structural defects, where the spectral reflectance data demonstrates that it is still functioning at a very-high photosynthetic capacity and is likely managing decay. The visual inspection found that the Green Tree chestnut oak's lower trunk cavity has no visible buckling cracks and in 2017 a level three assessment found one (1) dried fungal body of Ganoderma. The visual inspections found that the upper canopy was full of leaves, and the client was concerned about its leaf color in the summer of 2018. The spectral reflectance data from 2018 to 2019 showed a minor difference in photosynthesis in the same period as the tree's owner had concerns about the subject tree. These small changes in spectral reflectance imply a relatively stable health condition whereas Mr. Webber's long-term prognosis after inspection found the Green Tree chestnut oak in a stable condition (Dunster, 2013; Smith & Downer, 2019). The combinations of the arborist inspections and the spectral reflectance data show the Green Tree chestnut oak has decay, but it is likely being managed well by the tree (Dunster, 2013 & Smith & Downer, 2019). Thus, the Green Tree chestnut oak is likely producing enough extra carbohydrates for secondary tree needs for the defense of decay.

Jefferson Silver Maple

In the case of the Jefferson silver maple, fluctuating spectral reflectance data revealed a drop in its photosynthetic values correlated to when it was exposed to an herbicide drift event in 2016, but the data shows that the tree then quickly recovered and is still functioning at a high capacity. Mr. Webber's visual inspection found very few defects with the tree and when combined with the spectral reflectance data shows that the tree is likely producing enough extra carbohydrates for secondary tree needs in managing decay (Dunster, 2013; Smith & Downer, 2019).

School Yard Sycamore

In the case of the School Yard sycamore, the spectral reflectance data showed that the photosynthetic values over that period were fluctuating and unstable. Mr. Webber's visual inspection determined that the sycamore was a probable – imminent candidate for trunk failure and likely probable – imminent failure of two large dead scaffold limbs and or small branches. The fluctuating and unstable spectral reflectance data is likely showing the trees struggles and attempts to generate enough photosynthetic capacity to take care of its primary needs and little to no allocation for defense against decay. The spectral reflectance data combined with Mr. Webber's assessment underpins the probable – imminent likelihood of failure and the risk to targets below in the next 18-months.

Other Research

Research conducted by Hovi et al., (2017) has shown that tree species and leaf side (adaxial (lower) vs. abaxial (upper)) were important factors in explaining spectral variation, whereas canopy position had a minor role. These findings were consistent in both broadleaved and coniferous trees, which suggests that the results can be generalized to a large variety of species, and also confirms that the measurements were carefully conducted. Other studies show high near-infrared (NIR) and particularly the high short-wave infrared (SWIR) light transmission in broadleaved tree species across genera and species. However, other research shows that conifer tree species differ dramatically in readings between genera and species. The differences in conifer species may be related to needle age and density as well as seasonal influences.

Research by (Möttus et al., 2014) found that seasonal trends in broadleaved tree species were similar as observed by other research and reflect changes in biochemical composition and thickness of the leaves. These changes in biochemical composition and thickness of the leaves can produce findings that are not reliable. This research demonstrates that arborists should work with spectral reflectance data that produces a mean average of several years of a tree's photosynthetic capacity. Research conducted by (AU, 2018) shows that trees that have had a prolonged period of decline, as seen in spectral reflectance data analysis, are likely candidates for imminent failure. Conversely, this same research by (AU, 2018) shows that trees that were in decline but were treated by arboricultural services reflected improvements in spectral reflectance data.

The following two case studies demonstrate positively the practical application of spectral reflectance technology to detect declining or improving health conditions of trees. The first example was a heritage Tembusu tree (Fagraea fragrans), of more than 270 years old, collapsed on February 11, 2017 causing the death of one person and injuring four others. According to the press report, this tree was inspected twice a year and was found to be healthy in September 2016. However, spectral reflectance analysis has detected progressive deterioration since 2010.

The second was a Chinese banyan tree (Ficus microcarpa), that is approximately 400 years old, diagnosed with brown root rot disease (Phellinus noxius) in 2009 and was marked for removal by September 2013. As that tree was regarded as an old and valuable tree of high historical value, the removal decision was later withdrawn, and that tree was treated with a new method of applying Trichoderma to the soil around the root zone to suppress the fungus that caused the disease. This tree recovered markedly, and the improvement was indicated by the consistent rise of spectral reflectance in recent years.

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Apart from the application of this technology in monitoring a single tree to identify the four categories of tree health, a new procedure has now been developed by Geocarto to provide preliminary screening of a large number of trees to detect declining health. Utilizing this new procedure, Geocarto was able to identify 20,884 trees in an AOI (Area of Interest) of 3km x 3km with WorldView -2 satellite data for the period from 2014-02-17 to 2018-02-28. This AOI falls in the termite belt area of tree decline. The trees in this study have been weakened due to termite infestation. The preliminary screening result reveals that there are 3,148 trees with declining values for all the three internal warning indicators from 2016 to 2018. This number represents about 15% of all the 20,884 trees identified.

Research by (AU, 2019) found that 25 trees out of the top 500 in the list of the 3,148 declining trees from the preliminary screening were removed during the period from 2018-02-28 to 2019-07-15. This was confirmed through the latest date of satellite data for study by the use of Google Earth images available on the internet.

Conclusions

Spectral reflectance technology constitutes a likely breakthrough in tree health monitoring because it will reveal internal warnings before external symptoms are discernible. Spectral reflectance curves indicate the change in tree health. A rise in near-infrared and red edge, and a drop in red band reflectance imply amelioration; while a drop in the former two bands and a rise in the red band indicate deterioration. Minimal variation denotes stable conditions. Fluctuation signifies unstable conditions.

When this technology is integrated with onsite professional arborist inspections, diagnosis, and treatment, it will significantly enhance tree management, maintenance, and reduce the likelihood of risk to nearby targets.

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1. The energy stored in the trees _____is critical for compartmentalization to be successful.
   a. Parenchyma
   b. Phloem
   c. Xylem
   d. Cambium

2. This study found that spectral reflectance data combined with visual ground based inspections from a trained arborist can provide meaningful information to the trees owner on how to best manage it long-term.
   a. True
   b. False

3. The spectral reflectance values provided information about the leaf cellular structure and chlorophyll content.
   a. True
   b. False

4. The research results confirmed that there is a _____ between spectral reflectance color and chlorophyll content in plants.
   a. in direct correlation
   b. direct correlation
   c. non-conclusive

5. Trees can be structurally sound, but not green and healthy.
   a. True
   b. False

6. A tree can be structurally deficient, but green and healthy
   a. True
   b. False

7. Trees that have prolonged periods of decline, as seen in spectral reflectance data analysis, are likely candidates for imminent failure?
   a. True
   b. False

8. A rise in near-infrared and red edge, and a drop in red band reflectance imply _____?
   a. Deterioration
   b. Amelioration
   c. Poor data

9. What were the four tree species that were the scope of this study?
   a. Quercus alba, Acer saccharinum, Platanus occidentalis, Quercus montana
   b. White oak, red maple, red oak, silver maple
   c. Quercus bicolor, Quercus montana, Acer saccharinum, Platanus occidentalis

10. Research has shown that tree species and leaf side _____ were important factors in explaining spectral variation, whereas canopy position had a minor role.
    a. adaxial vs. abaxial
    b. lateral
    c. horizontal

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March 15
Chapter $5000 Education Grant Application Deadline

March 21
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March 26
Why do Tree Branches Fail?
TREE Fund Free Webinar

March 27-29
Society for Ecological Restoration Annual Meeting
Cleveland, OH

March 31
What's Killing Beech Trees in Ohio?
Canfield, OH

April 7
Proper Tree Care and Pruning
Hamilton, OH

April 7
Herbicide Applicator Re-certification Program
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April 22
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ISA Tree Worker Climber Specialist Exam
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