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JUNE 2023

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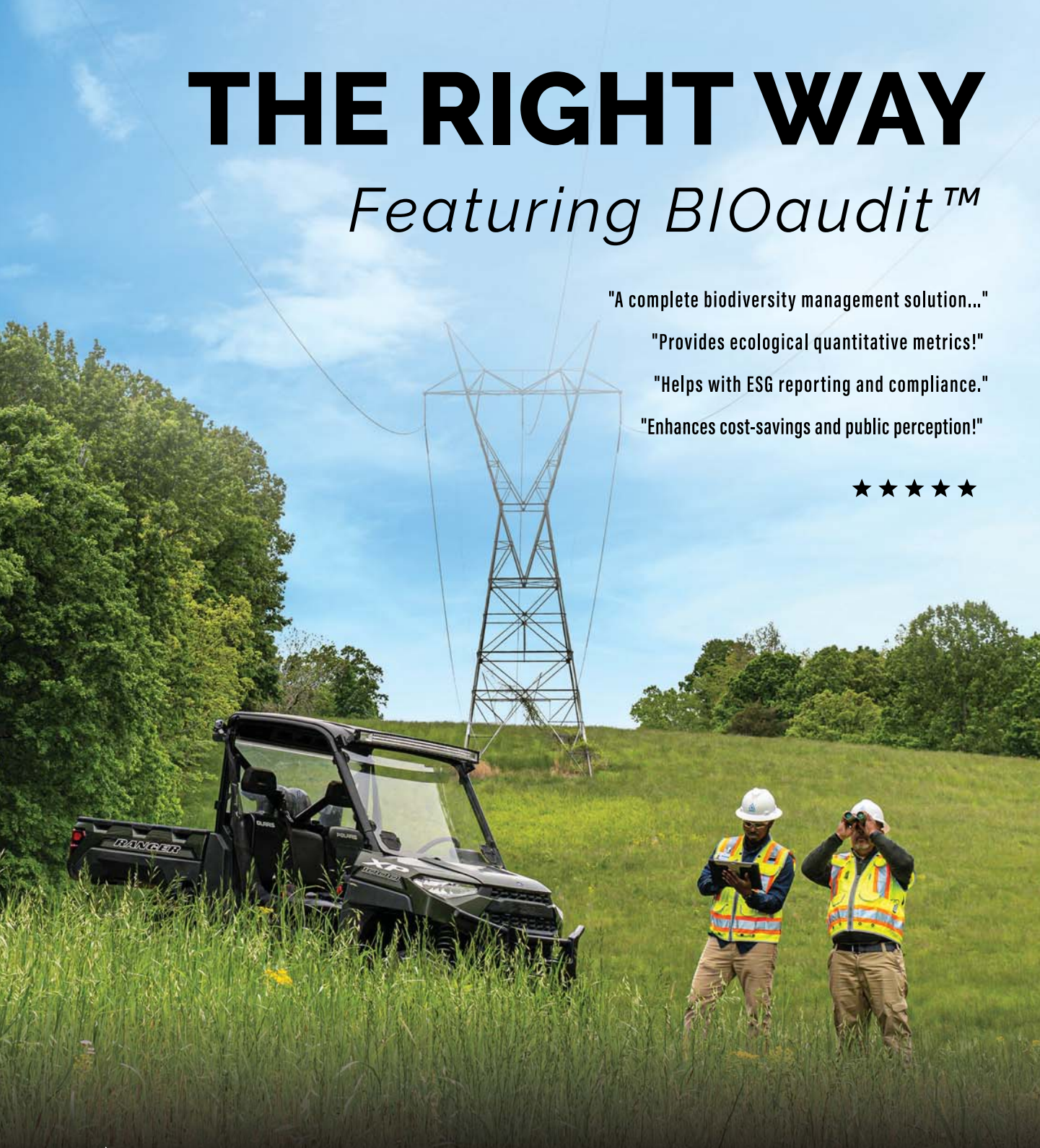

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The Past and Future of Safety in UVM

The science of safety has changed much since the early 1900s, and yet, we still see some of the old practices used in our profession. What started with Frederick Taylor's T*he Principles of Scientific Management* was somewhat furthered by the work of Herbert Heinrich's classic work in 1931, *Industrial Accident Prevention: A Scientific Approach*, which drove most of the safety world for the greater part of a century.

Although "Taylorism" brought forth some good ideas from the production aspect of work, it created or at least strengthened, the divide between the worker and management. An extreme simplification of the Taylor view was that the worker wasn't smart enough and, therefore, should play no role in the planning of the work. Heinrich's work added to this by, in essence, blaming workers for their "behavior" and creating an oversimplification of the relationship between behaviors and outcomes. This led to the graphic of the safety pyramid, or triangle, which attempted to explain the relationship between behaviors, low-severity, and high-severity incidents.

The fundamental flaw with the safety pyramid concept is that it assumes that the same underlying behaviors cause low-, medium- and high-severity injuries or fatalities. This faulty thinking led to a connection between the severity of incidents; that is, the more lower severity incidents occurred, the greater likelihood of a severe one or fatality. The data just didn't support this connection.

Reflecting on the History of Safety

As we moved forward, other research continued to shape our view of safety. For example, B.F. Skinner's scientific view of human behavior showed how employees' actions are shaped by being rewarded for wanted behavior and punished in some capacity for unwanted actions. In the 1970s, we began to target the behavior of the employee. It made sense at some level — if we can change the behavior of the individual employee, we can reduce the incidents. Change the shape of the triangle at the bottom, and then change the shape at the top. Focus on the employee, and all incidents can be prevented. We all believed it to be true, and it seemed to reduce incidents as we tracked and recorded them. The logic error proven through testing this theory was that "behaviors" are not "beliefs." Behaviors are learned because of specific conditions. If a worker's conditions change, so do their behaviors.

Tom Krause and others began to tackle the inconsistency with the safety pyramid. They found that the safety triangle is not predictive. One of the key things they found relates to a topic many of us in the UVM space are spending many resources on — reducing serious injuries and fatalities (SIFs). Their research indicated that reducing the number of lower severity incidents (the bottom of the triangle) does not correlate to reducing SIFs (the top of the triangle). There is no relationship between the bottom of the triangle and the top.

Taking a New View

Next, we come to cognitive dissonance around the key concepts of how we practice safety in the field. We see an overall reduction in recordable incidents, but we're not noticing a similar reduction in SIFs. At this point we start to look at things differently. We also start hearing from different researchers and thought leaders who changed the shape of safety including David Woods, Erik Hollnagel, Sydney Dekker, Todd Conklin and Shane Bush. We begin talking about capacity and resilience instead of just compliance and OSHA recordability.

When we speak of resiliency, we speak of the ability to fail safely. When we focus on capacity, we focus on adding meaningful defenses to the work environment to create safer processes — not safer people. Workers want to be safe. In the "new view" of safety, we find ways to create conditions in which they can use their expertise to achieve this goal. Workers will make mistakes — all humans do. However, a mistake should never cost someone their life. A resilient system with capacity for error allows workers to be human and still go home safely at the end of the day.

For successful application of this approach, it is vital to remember workers are the experts in their tasks and conditions. If we only focus on reprimanding the workers when something doesn't go to plan, we lose the opportunity to learn from the experts, and ultimately improve the system. If we develop systems separated from those diligently working within them, we create safety on an island, and our solutions prove fruitless. Safety is a support function of operations. Safer work environments will be created only with a thorough understanding of the conditions surrounding the work, and the interconnected relationship between those conditions, worker behaviors and outcomes. TDW

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Moving From Compliance to ROW Stewardship

Environmental protection isn't just good for compliance — it's good for business, too.

By **JILL GOLDEN**, The Davey Tree Expert Company

As one of the most highly regulated industries, utilities have a track record of upping their utility vegetation management (UVM) game and proving their willingness to become good environmental stewards. A growing list of endangered and threatened species coupled with encouragement from various wildlife programs is providing the impetus for utilities to move toward even greater participation in conservation efforts.

Utility corridors are shown to provide suitable habitat for insects, birds, plants, mammals and species of conservation concern. As such, utilities have a unique opportunity to help preserve the natural ecosystem by promoting the health of pollinators and wildlife habitats.

Cultivating biodiverse habitats is not only beneficial for the environment, but it's also in the best interest of utilities. In fact, this is a chance for utilities to push their environmental protection efforts beyond just a "feel-good" effort or a compliance initiative. By integrating ROW habitat conservation best practices and new protocols into their management plans, utilities can make a real impact in helping thwart the decline of rare and endangered species, including several pollinator species.

Pollinator species need habitats to help sustain their population — and people need pollinators. That's because, according to the U.S. Department of Agriculture, 90 percent of fruits and vegetables depend on pollinators. Protecting pollinators means protecting the ecosystem and ensuring a global food supply.

"It's no secret that pollinator populations have declined dramatically in the past 25 years, and their continued decline could impact the function of native ecosystems and pollination of our food production systems," says Adam Baker, Ph.D., technical advisor and pollinator ecologist at The Davey Tree Expert Company's Davey Institute. "All land use sectors — including utilities — are desperately needed to play a role in helping restore food and habitat resources for butterflies, bees and other pollinators."

For some utilities, putting a stop to a decline in pollinators might require re-thinking traditional ways of managing vegetation in the ROW. Instead, utilities might want to consider implementing

A monarch butterfly nectars on teasel.

A hummingbird moth nectars on monarda.

scientifically defensible, long-term vegetation management strategies supporting biodiversity and encouraging healthy pollinator habitats.

Butterflies and Biodiversity

With an estimated 10 million acres of utility corridors, utility vegetation managers are well positioned to cultivate ROW habitats that support biodiversity, as well as provide flyways for migratory birds, monarch butterflies and other imperiled species.

IVM's Environmental and Economic Benefits

- Reducing vegetation management maintenance and utility customer costs over time
- Improving worker safety, compliance, and transmission reliability
- Building community partnerships and engaging surrounding communities
- Establishing better habitat quality
- Combating the decline of species important to the ecosystem
- Eradicating invasive, non-native species that suppress biodiversity
- Increasing the abundance of floral and host resources that pollinators need
- Reducing runoff and preserving geological features, such as wetlands and agricultural areas
- Creating connectivity to contiguous landscapes
- Cultivating positive public perception while inspiring future generations
- Boosting and strengthening employee engagement

Not only will cultivating biodiverse ROW habitats support botanical and pollinator communities, but it is also likely to benefit utilities, too. This is especially important with respect to potentially qualifying for participation in certain wildlife programs.

Programs like the Monarch Conservation Candidate Agreement with Assurances (CCAA), Wildlife Habitat Council and Million Pollinator Garden Challenge among others, encourage utilities and others to participate in conservation and monitoring of managed lands in support of the health and proliferation of adult and larval insects, including the monarch butterfly (Danaus plexippus).

As an example, utility lands qualified and enrolled in the Monarch CCAA program are exempt from certain limitations and regulatory restrictions surrounding the monarch's population status — now and in the foreseeable future. That's good news, of course, for utilities. Equally good, says Baker, is that utilities that opt to diversify ROW vegetation can improve habitat quality and build upon their sustainability initiatives.

"Not only is there the benefit of possibly becoming certified by various wildlife organizations like Monarch CCAA," explains Baker, "but when utilities create a diverse landscape next to public areas, they can enhance the proverbial bang for their conservation buck by creating tangible evidence of goodwill for and within the community. The public can appreciate when a utility has cultivated a place where monarch butterflies, warblers and other wildlife are thriving. They may also enjoy other amenities, such as bike paths and walking trails that meander through ROW habitats."

But that's not all. Here are two other ways that are proven to support successful operation:

- Long-term reduction in maintenance costs: Over time, establishing and maintaining a stable community of appropriate plants requires less maintenance than traditional cyclical approaches.

An azure butterfly nectars on honeyvine.

A leaf-cutter bee lands on a flower.

- Increased employee engagement: When employees understand and appreciate that a habitat program benefits their community, the environment, and their company's bottom line, they have a greater sense of pride that, in turn, causes them to become very engaged with both the process and the outcome.

Preserving the Natural Ecosystem

Utilities can facilitate this level of participation in conservation and monitoring of their managed lands by taking a multifaceted approach using both UVM and integrated vegetation management (IVM).

Traditional approaches to UVM typically involve reliability-

Common milkweed is shown in in the fall. Milkweed is the sole host plant to the monarch butterfly's caterpillar, but keeping milkweed as part of the landscape is important to more than just monarch butterflies.

focused controls and cost-effective vegetation removals to meet short-term compliance needs. IVM is a specialized component of UVM focused on using site-specific approaches to achieve multiple objectives — like diversifying vegetation to preserve the natural ecosystem while also achieving reliability, compliance and cost control requirements.

The U.S. Environmental Protection Agency (EPA) defines IVM as "… the practice of promoting desirable, stable, low-growing plant communities — that will resist invasion by tall-growing tree species — through the use of appropriate, environmentally sound and cost-effective control methods. These methods can include a combination of chemical, biological, cultural, mechanical and/or manual treatments."

Benefits of IVM

If a utility's only goal is compliance, it would manage its lands differently than a utility that's committed to both environmental stewardship and playing an active role within the communities they serve, Baker says.

"By taking a more holistic approach that combines UVM with IVM, our customers are creating more diverse habitat landscapes that naturally support imperiled species while also combating invasive species to improve reliability and sustainability," he says.

IVM is proving to have significant and far-reaching benefits. Not only does an IVM program on a ROW promote safe, reliable and cost-effective electric power, according to the EPA, it also helps "reduce wildlife habitat fragmentation and allow species to be geographically diverse, remaining in areas they might otherwise be excluded."

The Science of ROW Conservation

Author Stephen Covey said to "begin with the end in mind," and that concept can apply to improving ROW stewardship.

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Butterfly weed appears in an actively managed IVM site located in Maryland.

"Practicing environmental stewardship by transforming ROWs into conservation areas is simple, not easy — but it is worth it," says Scott Eikenbary, project manager for the Davey Resource Group (DRG), a subsidiary of The Davey Tree Expert Company. "You can't simply eradicate non-desirable plants and put in a bunch of host plants. It takes a lot of commitment, monitoring and patience to understand what exists in the ROW before transforming it, to assess the biodiversity and to track changes over time. It also takes an upfront investment to develop long-lasting strategies that support the goal of creating environmental and ecological sustainability. We recommend a cost-benefit analysis that shows how costs are reduced over time. But keep in mind that IVM is not just a monetary investment; it's also an investment and commitment to society and the environment."

"Practicing environmental stewardship by transforming ROWs into conservation areas is simple, not easy — but it is worth it."

When it comes to stewardship, the more diverse the plant community, the better. That's why assessing biodiversity and tracking it over time in relation to IVM practices is so important.

Pollinators and host plants are often used as indicator species to assess environmental health, Baker added.

"At Davey, we employ scientifically defensible methodologies to monitor, track and assess the health of the ecosystem and its response to IVM practices," he says. "We also developed technology-based solutions that enable reliable and consistent collection of key data points."

Methods for baseline data and continuous monitoring for changes in ecosystem function and potential disturbances to habitat include, but are not limited to, these nondestructive sampling and quantifying methods:

- Surveys to track the number and species and abundance of butterflies, bees and other pollinators
- Vegetation surveys that assess the number and type of floral (nectar and pollen) resources
- Counts of keystone plants that may be indicators of habitat health and quality
- Visual assessment of habitat features, such as snags, brush piles, bare ground and wetlands

Coreopsis grows in a meadow restoration site along a gas line right-of-way recently enhanced with pollinator-friendly native plant species.

- Scorecards to measure habitat quality and composition
- Invasive species presence

By employing a robust protocol like IVM, utilities can go beyond meeting compliance standards, and, instead, develop a science-based action plan in support of environmental, social and corporate governance goals. They can also better engage the public in their environmental initiatives, as well as verify and report results for participation in ecological certification programs like Monarch CCAA, Habitat Wildlife Council and others.

The benefits of establishing habitat on ROWs far outweigh any potential drawbacks. This opportunity for utilities to assess biodiversity, track changes over time, evaluate successes and promote sustainability can transform a ROW from a parcel of land into something far more valuable: a true asset that benefits the utility and the customers and communities it serves. TDW

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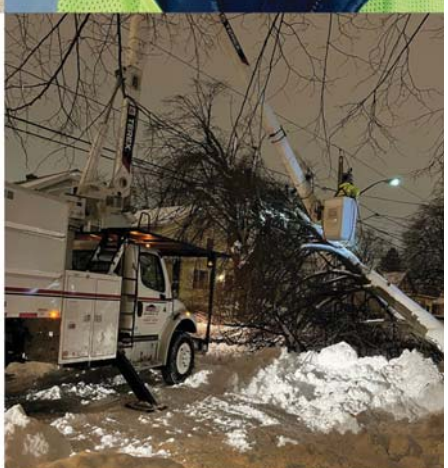


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The planting of a golden shower tree (*Cassia fistula*) is an example of successful trees (four years of growth originated from a bagged seedling) in Port of Spain, the capital of Trinidad and Tobago. (Inset) The vibrant blooms of golden shower trees are important for pollinators.

Lessons from Tropical Frontline Regions

U.S. utilities can better understand tree biomechanics and climate change through international research.

By **DR. ANAND PERSAD**, ACRT Services

Today's fast-paced world requires an understanding of not only the relationship between green assets, biodiversity and mental/social health, but also the need to implement dynamic strategies in a changing climate. The utility, urban forestry resources and management programs are of growing importance to the communities they serve. The readiness of the arbor-resiliency programs is tested during more extreme and frequent weather events.

In the United States, the strategies are evolving as utilities gather data and employ newer technologies, ranging from advanced plant health-care detection tools to mapping and the use of satellite data. Companies are using this data to better inform and guide work planning and deliver arboricultural, ecological and economic return on investment. Globally, the urban tree canopy cover and tree resources are now of special concern due to the interconnectedness of climate effects.

In this light, the nation is now paying attention to and becoming appreciative of the lessons learned from frontline regions of the world. These areas tend to have longer growing seasons and sometimes more heightened and apparent climate effects. In addition, they have experienced, or are experiencing, even more challenges and changes in vegetation and a higher frequency of erratic weather systems.

Plants respond to change and evolve with sites as conditions change, resulting in more rapidly occurring plant dynamics and/or plant migration. As climate effects are not always apparent, research narratives in these frontline areas, such as island nations and the global south, can help Americans understand the relatable challenges that may come their way.

Exploring International Regions

For several years, researchers have looked at changing plant populations and plant dynamics in utility and urban areas through several international frontline regions. Sea level rise is a global phenomenon. Apart from water levels rising, the secondary effects of salinity intrusion and loss of biodiversity to more salt-tolerant plant communities are very telling. A drought's primary effects of stunting, defoliation and branch dieback may cause loss of structural integrity. Secondary effects may include the rise of tree pests and pathogens. Conversely, in many cases, heavy rainfall and flooding lead to whole tree failure, broken branches and pathogens associated with earlier tree mortality.

Under these dynamic conditions, the management of urban trees regularly pruned for sight, safety and reliability will rely on real-time data and analytics. In past decades, cycle- or time-based programs not only sufficed but were effective. To continue building upon this foundation, more effective and dynamic programs and integrated approaches are needed. With site conditions changing rapidly, programs must be effective at the tree species level with system-wide efficiency.

Considering Tree Resources as a System

In agriculture, it's easier to consider a systems approach. As in many cases, it may be a monoculture of plants or a limited mixed crop situation. These agro-ecosystems can be monitored and

Yohann Govia of Trinidad and Tobago's Ministry of Agriculture Land and Fisheries, points to an endemic double (*Warszewiczia Coccinea*) Chaconia tree, the national tree of Trinidad and Tobago, that is biomechanically suited for urban environments.

Outplants of nursery-raised trees (Serianthes nelsonii) with officials of the Guam Plant Extinction Prevention Program (GPEPP).

managed. Although cropping in climate resiliency efforts has considerable challenges, its core objective is to raise plants from seeds to seedlings to the whole plant, then yield. This process may be relatively short-term in nature, but still wholly-related to the arboricultural process.

The similar, longer-term objective in the exploration of tree systems is to realize the near-full or full potential of trees. The current estimates in the urban and utility space for tree survivorship to maximum age potential are much lower than ideal (45 to 60 percent longevity or yield of tree ecosystem benefits on average by some estimates). To improve these statistics, we can start by upping our acceptability levels as agriculture demands a higher success level.

In terms of limitations, apart from site, care of seedlings, and plant establishment, seed stock has often been touted as a limiting factor. To build tree resources globally, this must be addressed. In several tropical frontline areas, seed stock is derived from naturally occurring and other local plantings and reintroduced to the landscapes via area nurseries as seedlings grown in bags. These smaller seedlings take off with relative ease and can adapt to sites with sometimes higher survivorship compared to planting larger trees. Notably, trees in the tropics are often planted in areas where similar species are already doing well in adjacent locations.

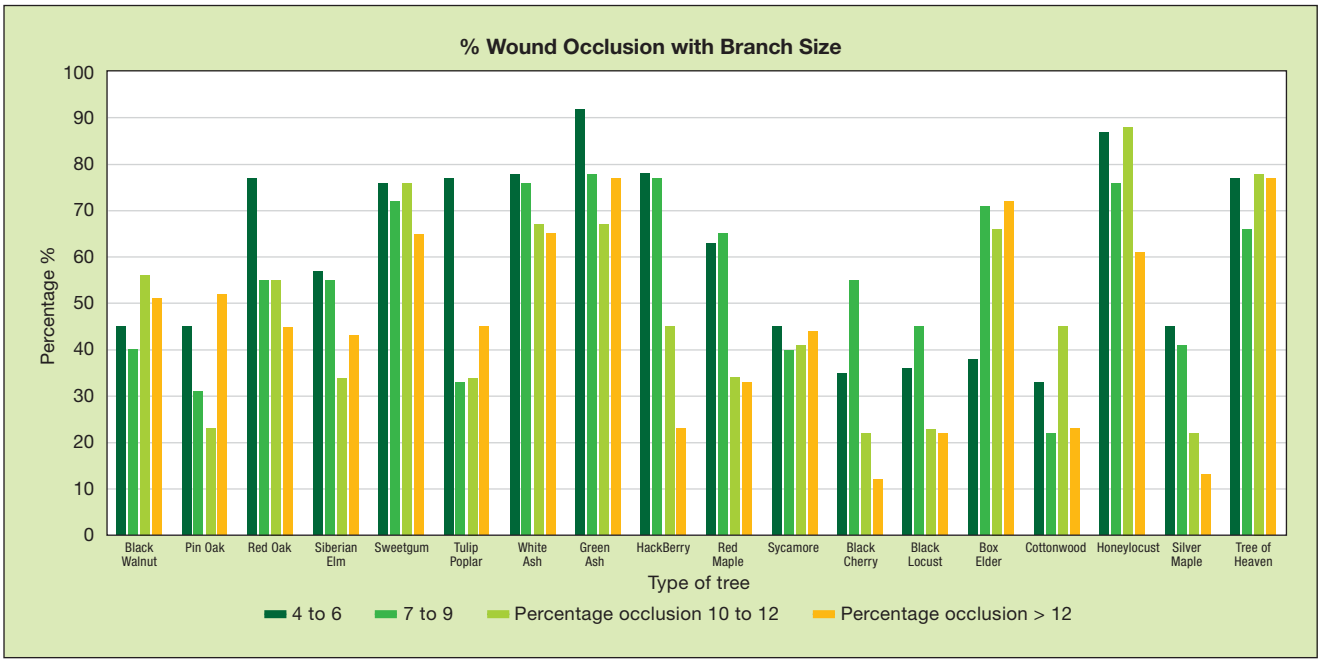
In the United States, seed stocks, planting systems and care for the establishment are very important and need to be continuously addressed while building capacity for future tree canopies in cities. Nurseries can propagate superior plants and while plant quality can be improved, attention to plant species and microsite conditions is now of additional concern and should accompany the "right tree right place" philosophy to give better survivorship and maximize overall tree lifespans.

Pioneer species, such as ironwood (*Casuarina equitsifolia*) in Micronesia, are strong trees individually and are stable in stands with the ability to tolerate high wind loads.

Tree Structural Assets as a Factor of Stability

Tree-inherent properties, including growth rates, branch aspect ratios and percentage branches with included bark are all indicators of tree potential for strength or failure. By assembling a database of recently planted trees, attaching inherent properties and comparing them to more established trees, it's possible to begin to understand biodiversity and its relationship to tree species and structural tree integrity assets as trees grow in a particular geography. Trees planted in ecosystems or in stands generally fare better in high wind-loading environments,

To capture this data globally, Tree Biomechanics International (TBI) was formed and is a growing series of



Pruning cuts with percentage eclosion three years after pruning treatments. In most species, larger branches had less ability to heal. The exceptions were sweetgum, boxelder and tree of heaven species.

sites that come together for tropical tree structural research. TBI sites are found in Belize, the Caribbean, Micronesia, Mexico, Columbia and other countries including the global south.

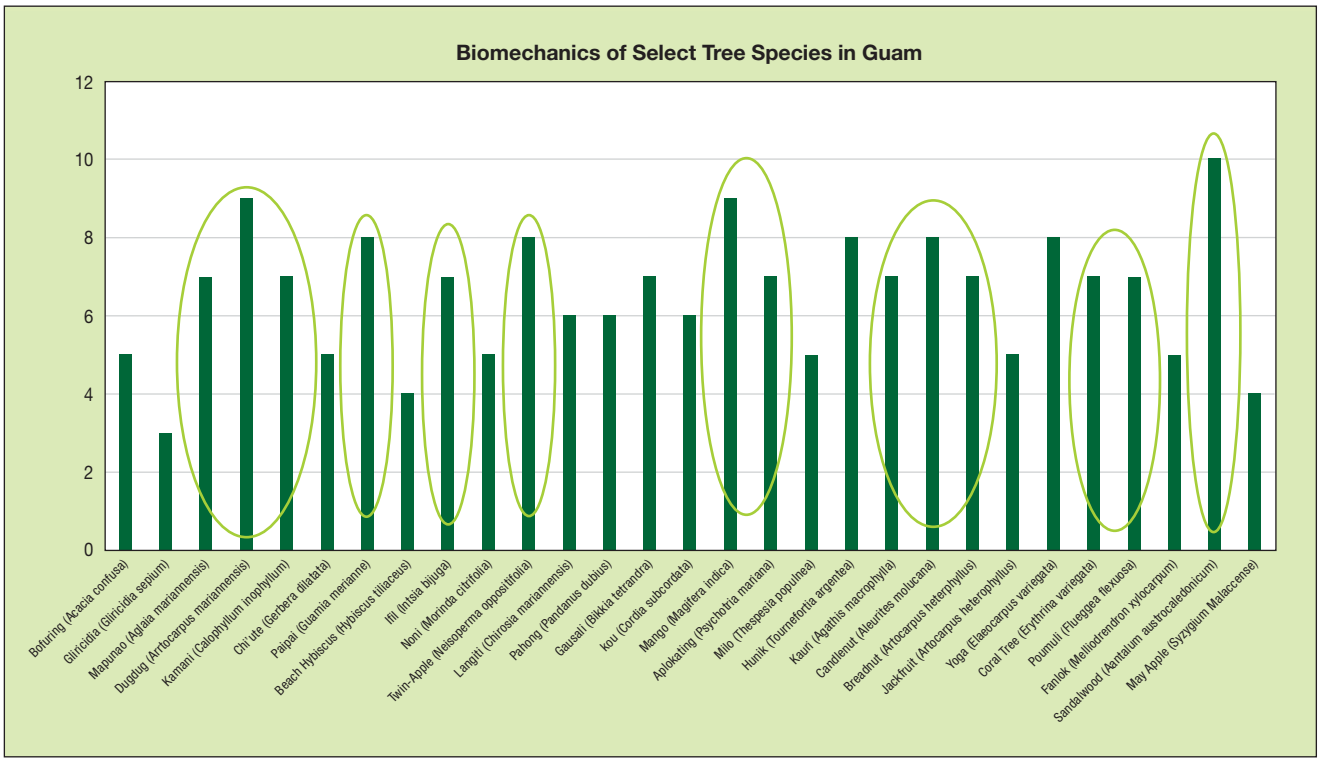
TBI's aim is to gather data on tree structural characteristics in these tropical species and better understand the survivability of trees based on structure. With that data, researchers knit together the successes and challenges of trees in these areas that are historically subjected to heavy loading, high moisture, drought and other climate impacts.

Are there lessons that can be applied here in the United States? As the country experiences warmer winters and longer, hotter summers, for many species, the impact is already occurring. The fall season in temperate areas allows for trees to regroup energy and heal wounds such as accidental branch breaks, stem wounds and pruning cuts.

With reduced fall seasonal times, will this be a factor for tree survival and future tree structural integrity? Wound eclosion (healing in pruning cuts) is being measured across several sites in the United States, and several species of trees are beginning to demonstrate higher eclosion rates compared to others. This may be a more cohesive parameter to figure out what species are becoming more successful at surviving climate change

Zoning in on Tree Biomechanics

Conventional edge-hardening efforts often rely on visual tools and management cycles based on system analytics over time. However, dynamic climate readiness and programs dictate a need for adaptability, additional metrics and overall system-level solutions and can borrow from national and international case studies on tree biomechanics.



Attaching a biomechanical stability score to tropical trees, coupled with structural integrity and tree inherent assets, can pinpoint the species that may impart more tolerance to loading.

At a tree biomechanics workshop in Guadalajara, Mexico in August 2022, the group observes a fractometer, a mechanical measurement device determining characteristic values of bending and compression strength of wood evaluating samples taken from tropical ash (*Fraxinus uhdei*) trees.

This tool can assist in mapping efforts on the stability of edge and corridor trees and its implementation can be an additional layer to better understanding trees in rights of way (ROWs). These data also capture stability in relation to flooding, wind, rain, snow and ice loading, or the relationship of the tree structure to drought effects and insect and disease impacts.

The inclusion of tree biomechanics considerations in ROW forestry programs means that system foresters can better engage climate readiness at a level that provides greater emphasis on tree structure and stability. The lessons learned from frontline regions can inform processes in the United States. For example, the biomechanical scoring systems in tropical areas based on survivorship, coupled with plant inherent characteristics, can be adapted for temperate trees.

Collaborating with government agencies both within the United States and internationally allows the Research, Science, and Innovation (RSI) department through ACRT Services to draw inspiration. Participating in global collaborative initiatives, as opposed to limiting research domestically, allows the team to produce better products, be better informed analytically and ultimately, better understand climate readiness. Climate is a global issue, which must be kept in mind with the continued work toward climate resilience. TDW

DR. ANAND PERSAD (*apersad@acrtinc.com*) is the director of the Research, Science and Innovation (RSI) team at ACRT Services. He is the research committee chair for the Utility Arborist Association, chair of the International Society of Arboriculture Science and Research Committee and actively works with city, state and federal organizations. He earned his Ph.D. in invertebrate ecology/entomology from the University of the West Indies.

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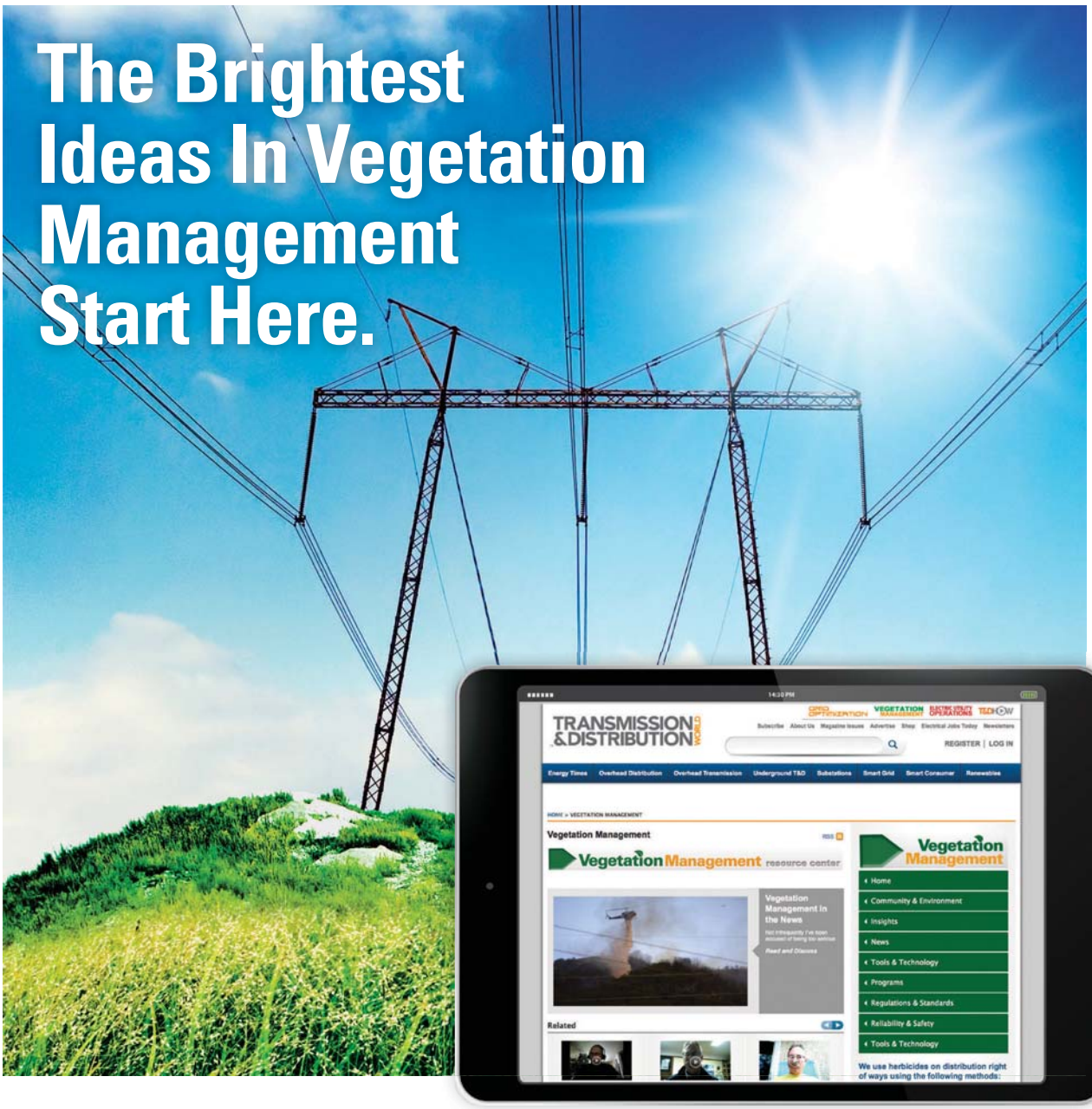

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This drone shot depicts property and utility line damage in Fort Myers, Florida, after Hurricane Ian.

A New View of Safety in Storm Restoration

When severe weather rolls in, vegetation management crews must prepare to respond in a safe manner.

By **STEVEN POWELL**, Lewis Tree Service

Severe storms of all types — from wildfires to hurricanes and derechos to Nor'easters — are seemingly becoming more frequent, more intense and causing more damage to utility power systems than ever before. Despite the significant work being done by utilities and their contractors to harden systems and reduce the impact of weather-related outages, one destructive storm after another appears to have become a nearly year-round phenomenon. Storm is the new norm. With every storm, the first responders are called upon to work together to clear roads, remove trees, repair infrastructure and restore power for sometimes millions of customers. Crews face perilous conditions as they travel to job sites to perform their heroic work. Every move is in a dynamic, high-risk environment, so new tools for creating safety while performing restoration work are critical.

According to Deloitte's 2022 Power and Utilities Industry Outlook, more than 3,100 extreme weather events occurred globally during the 2010s and more than 3,500 events happened between 2000 and 2009 — compared to just 711 in the 1970s. Deloitte's 2022 Power and Utilities Industry Outlook reports that these unprecedented and unpredictable extreme weather events can badly disrupt the utility supply chain, challenging the grid's reliability and resiliency and affecting utility business operations across the globe.

Spotlight on Safety Tools for Storm Response

In the wake of severe weather, line crews and vegetation management teams must focus on safety in the field. Here are just a few ways that Lewis has kept a focus on safety during storm work.

After-Action Reviews. Despite 16-hour workdays in 90-degree heat, Lewis crews and their utility partners on line and vegetation management teams conducted AARs at the end of each workday to share close calls, learnings and tips to prepare for the next day. Within Lewis, the AARs were submitted to the safety team each night to be reviewed and shared across all corporate and operations teams on daily storm calls. These AARs are also stored in a repository for reference and sharing on future storms. A common theme in AARs submitted by several crews was managing the pressure building due to rising tensions in the general public and adverse encounters with homeowners stressed by the storm.

Peer Check. A Lewis crew member working in the Florida area approached contractors providing fuel services to ask them how they were doing and discovered they had been working all day without eating. The Lewis worker went to the staging area and brought back lunch and water for the fuel crews.

Team Building. Recognizing the potential emotional impact of Lewis workers missing Christmas Eve and Christmas Day with their families while responding to Winter Storm Elliott in Buffalo, New York, a Lewis general foreman opened his home to out-of-town crews to spend Christmas eve together.

Situational Awareness, Forecasting and Reframing. After a 20-hour day that included two-hour trips on both ends of moving from a staging area to the assigned work zone, Lewis team leaders voiced a concern about starting the following day at the 6 a.m. time requested by their assigned utility forester. Escalating the request to Lewis management and eventually to a decision-maker in the utility, the crews were given permission to prioritize their rest, allowing them to start fresh at noon the following day.

Another example of situational awareness is when utility and Lewis crews discuss a gameplan and stop many times in the process of installing grounds, testing lines and performing tree removal and line restoration work before giving the okay to work.

The problem seems to be getting worse. A U.S. interagency report projected that due to climate change, future extreme events causing power outages will be more frequent and last longer. Responding to the Deloitte survey, the majority of power and utility industry respondents have already noticed an impact. Fifty-one percent said extreme weather has affected the reliability of electricity delivery in their territory more than usual in the past year. More recent data backs up the claim. Florida Power & Light Company (FPL), America's largest electric utility serving more than 12 million people, experienced damage impacting more than 2.1 million customers from Hurricane Ian in October 2022. A month later, Tropical Storm Nicole hit the east coast of Florida, affecting more than 480,000 customers. The economic impact to FPL's system from just these two storms exceeded $1 billion.

Ratcheting Up Safety

When storms hit and the power goes out, oftentimes, line crews and vegetation management crews are the very first responders to move into an impacted area. Tree crews remove branches, fallen trees and other debris from roads, power lines and structures so police, fire and medical responders can move in, and utility workers can begin to restore essential power to homes and businesses.

This drone photo shows Lewis crews conducting pre-job safety briefing in Fort Myers, Florida, before starting a day of restoration work following Hurricane Ian.

A Lewis crew works to remove trees from power lines after Hurricane Ian.

"It's often a chaotic situation filled with a great deal of uncertainty and hidden hazards," says Leslie Kass, CEO of Lewis Tree Service. "What was once a pristine tree-lined street with solid utility infrastructure can become a scene of twisted branches, downed wires, broken poles and flooded roads in no time. While safety is always a top priority at Lewis, in these situations, the safety methods utilized by our restoration crews are of utmost importance."

In supporting utilities in Florida impacted by Hurricane Ian in 2022, Lewis assembled an on-the-fly workforce of more than 1,200 craftworkers, safety specialists and field leaders from across the company's 27 state service territory.

Three Phases of Restoration

Like many companies, Lewis leaders have a list of key performance indicators (KPIs) guiding their actions and tracked to measure success. When called upon to support their utility partners in response to an impending storm, the Lewis team quickly builds an ad hoc organization led by an operations vice president who uses a unique set of "Storm KPIs" for the duration of the event. The action often starts days before a predicted weather event is due to strike and doesn't end "until the last crew safely returns home," Kass says. Central to the Lewis KPIs are safety objectives including special attention to three distinct phases of action by every crew — mobilization, working and demobilization.

"We realize that keeping people safe throughout a storm response involves sometimes different areas of focus depending upon which phase of a storm our crews are in," Kass says. "During the mobilization and demobilization phases, we emphasize things like the importance of 360-degree inspections of our vehicles, the roles of driver and co-driver, situational awareness of road conditions and careful navigating in staging areas, fueling stations and parking lots. We also recognize that workers have unique and different physical and emotional conditions when traveling into a storm, moving to or from a work site or after being released to head home. Our safety team does a great job of providing tailgates and information appropriate to each phase to help our crews stay sharp and prepared."

Heightened safety actions in route to the staging areas and going home are critical, especially when crews are relocating to an impact zone different from their normal work location. Having and using tools and techniques to work safely during storm response can create safety issues in a situation where typical methods and procedures have their limits. Dennis Brown, president and COO of Lewis, has seen his share of storm scenes in his more than 30 years in the industry.

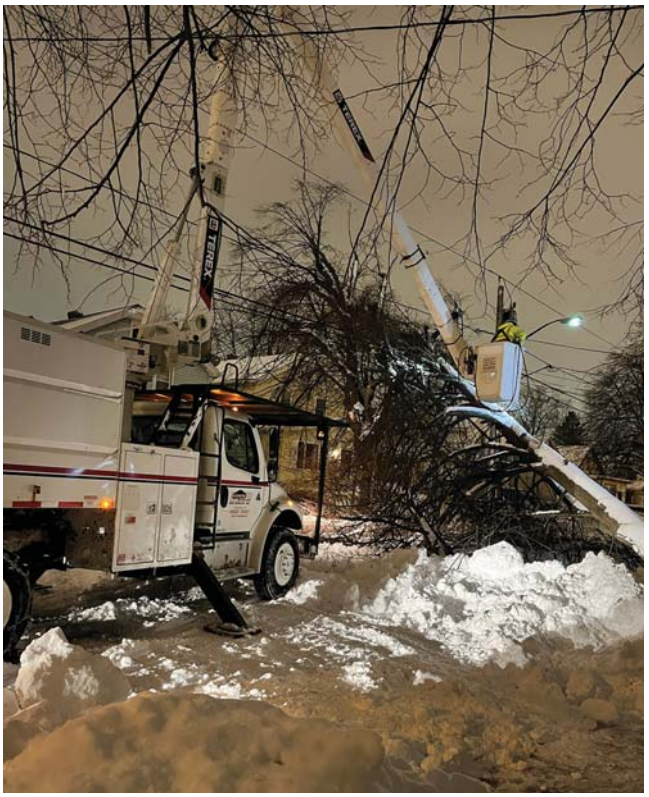
"Just because the power may be out in a neighborhood or business doesn't mean lines on the ground aren't energized," Brown says. "And trees laying across lines and poles can shift with the wind or flooding, so approaching the work from the perspective of 'safety first, safety always' is imperative."

Sometimes, the downed lines aren't even accessible via roadways due to flooding, so crews need to wade into these areas hand-carrying their tools.

"In places like Florida and Louisiana, the risks in these situations can even include displaced alligators, snakes and sharks,"

Lewis workers, carrying equipment to the work site, wade through a flooded area in Florida.

Lewis crews conduct after-action reviews in a staging area after a work day during the Hurricane Ian restoration.



A Lewis crew works in single-digit temperatures at night after Winter Storm Elliott.

Brown says. "In addition to the tools needed to perform their work, special safety methods and techniques help to de-risk these difficult situations."

Human Performance in Action

Beth Lay, director of resilience and reliability, has been equipping crews with special safety tools since she came to Lewis in 2018. Following a fatality that occurred the week before she started, Lay began laying the foundation for a culture change. This shifted the focus from safety audits, incident investigations and blame-and-punish responses to accidents. This would allow leaders to learn from work done right and respond to failures with curiosity. They could also pose questions designed to drive learning rather than inhibit it.

Deploying tools with names like, "Uncertainty Gauge," "Press Pause," "Peer Checks" and "After-Action Reviews (AARs)", Lewis crews, field leaders and safety personnel work together to identify hidden risks and potential surprises and provide input to refine and improve processes and methods. They're empowered to call in others, including peers, field leaders and utility partners, without retribution anytime their uncertainty exceeds their comfort level continuing the work at hand. Risk hides in the differences, so Lewis pairs travel crews with local leaders to help them navigate local conditions and customer specific needs. For example, if an out-of-town crew is bringing its convoy into an unfamiliar area, a local leader will meet them and guide them into the work location.

Nowhere are these tools more important than in the ambiguity and stress incumbent in weather disasters. Lewis crews employed these human performance tools in storm response efforts throughout 2022 — both formally and informally — resulting in more than 500,000 hrs of work without incident.

Learning for Storms and Blue-Sky Days

It's not the known risks that lead to injuries and fatalities, but rather the situations with the greatest uncertainty, according to Todd Conklin, author, safety speaker and human and organizational performance consultant. The aftermath of severe weather creates circumstances of almost infinite uncertainty for the utility and tree workers called upon to restore power, and with it, calm and order.

The Safety-II/human performance principles and tools used by Lewis crews not only help to bring order to the chaos of storm work, but also apply equally to the blue-sky work. It often seems routine and ordinary, but can be highly variable and fraught with risks, surprises and uncertainties. Beyond elevating worker safety, these new safety tools of the trade also boost the productivity and performance of the crews.

To help utility customers ride out the next storm with less damage and safer restoration, it's imperative to listen, learn and stay curious, Lay says. For example, they must discover what crews are concerned about, what challenges they are facing and where they need help.

"This is the way to make discoveries, find opportunities and improve performance," she says. "That's how to create a human-centered safety and human performance culture." TDW

STEVEN POWELL (*steven.powell@lewistree.com*) is the director of marketing and business development for Lewis Services.

Filling a Need

Tulane University launched an educational initiative to identify challenges and drive change in the UVM industry.

By **LAWRENCE J. KAHN**, Tulane University Law School

In the United States, utility vegetation management (UVM) is a multi-billion-dollar-a-year industry. Case in point: California utilities alone spend between $3 billion and $5 billion annually performing this work.

Utilities invest in UVM for many key reasons. For example, they trim and remove vegetation to prevent wildfires and outages. In addition, the law requires utilities to take certain measures to ensure the safe and reliable delivery of utility services. This includes mandatory or required vegetation management to avoid violation of such laws and regulations and to minimize legal risks.

As anyone involved in UVM can attest, however, the industry's laws, regulations, ordinances, rules and practices vary significantly. What may be true on one side of an invisible line may differ from what is true on the other side of that line. The laws and regulations pertaining to this practice can conflict with one another and are often unclear. Importantly, certain violations carry along with them not only fines and penalties, but also potential criminal violation as well.

In 2020, the law school created UVMI with the mission to serve as a center for the understanding, development and improvement of law, policy and practice of UVM. (Inset) Lawrence Kahn is the director of Tulane University Law School Utility Vegetation Management Initiative.

When UVM is not performed as needed, disaster is not far behind. For example, many of the most damaging wildfires have resulted from tree and power line conflicts in not only California and the West, but also in Texas, Georgia and Florida. The 2003 Northeast Blackout also resulted from this same issue.

Nationwide, the U.S. Department of Energy has estimated a total of $100 billion or more in annual lost business productivity alone from power outages. This doesn't include damages, insurance, tax revenue, household losses or other losses due to power outages caused by tree and power line conflicts – the primary cause of as much as 70-80% of all outages.

Tragic loss of life and severe injury is also directly attributable to the failure to maintain vegetation away from utilities' infrastructure. On average, one arborist or line worker dies in this country each week because of utility line clearance or related work, according to the U.S. Bureau of Labor Statistics. Additionally, hundreds of deaths — many of them children — result each year from tree climbing too close to utility power lines.

Mission, Vision and Values

For years, government, industry and advocacy groups have sought guidance on addressing these challenges. Tulane University Law School, through the Utility Vegetation Management Initiative (UVMI), has now answered this call.

In 2020, the law school created UVMI with the mission to serve as a center for the understanding, development and improvement of law, policy and practice of UVM. The goal of the program is to promote the creation of safe and environmentally sound co-existence among people, infrastructure and the natural environment while also ensuring safe and reliable delivery of energy and other utility services.

The UVMI's vision is to earn its role as the unquestioned center for excellence in every aspect of law, policy, and

practice impacting the intersection between utilities and the environment by studying, educating and advocating the fair, well-reasoned and science-based understanding of global, national and local factors influencing proper decision-making in all aspects of UVM. In doing so, it aims to aid and assist government, courts, industry, NGOs and the public-at-large.

The UVMI's core values serve to focus all decisions and actions, and no decision or action is taken without reference to these core values:

- **Intellectual honesty.** All positions taken shall be supported by intellectually honest, fair, well-reasoned and science-based information developed by unbiased research free from undue influence aimed at any particular result.
- **Security.** People and the natural world have the right to safe and peaceful co-existence that includes reliable delivery of utility services (including energy and the infrastructure that supports it) without endangering human life, property or the environment.
- **Dignity, Fairness and Compassion.** The highest purpose of public policy, and the laws, regulations, ordinances and rules that flow from such public policy, is the establishment of fair and proportionate plans for the allocation of risk and expense in society without the undue sacrifice of community values, and for the provision of compassionate, fair and dignified justice to resolve inequities.
- **Tireless Dedication to Purpose.** A continually urgent moral imperative exists to prevent conflicts between utility (including energy) delivery systems and vegetation to avoid tragic losses of life, property, infrastructure and the natural environment, and the key to enduring successful prevention is the wise adherence to core values.

Tulane Law School UVMI students attend a demonstration of utility line clearance work presented by Entergy Louisiana and ABC Professional Tree Services.

Making a Difference

To further its mission and vision, the UVMI has engaged in several projects to expand knowledge and serve as a valuable resource. For example, the students have taken on research projects and have prepared papers for publication. Other projects include:

Compendium of UVM Laws. The UVMI is compiling all the laws, regulations and ordinances relating to UVM. It has completed an initial North American survey, which is now being compiled and updated. For the first survey, it involved Mexico, Canada and the United States, but it is looking to add more countries to this compendium.

Third Party Verification of Remote Sensing Technology. The UVMI conducted an independent, unbiased pilot field study on the use of satellite technology to determine the effectiveness of satellite technology in improving data accuracy and decision-making for UVM. The results of this pilot, proof-of-principle field study are presented in a report that is now ready for publication.

In the study, the UVMI identified a test plot within the southeastern United States covering about 70 square miles and containing 54.3 line miles of distribution line made up of 1076 spans. AiDash, Inc. provided analysis as to the threat level at each span, as well as a factor relating to efficient work.

This predictive analysis was turned over to a team of arborists from Plank Road Forestry, who were tasked with determining the accuracy of the predictive analysis and, when the prediction was correct, to determine whether it would have been discovered during a standard inspection.

The findings on the pilot study with respect to many of the most critical factors was that the predictive analysis was accurate more than 95% of the time. More importantly, though, in 55 cases, a standard Level 1 inspection would not have revealed the existence of the tree and power line conflict, and in one of those cases, even a Level 3 inspection would not have revealed the conflict. This meant that the satellite technology was able to find a potential power outage, wildfire or electrocution risk that would not have been found with a standard inspection about once every mile of distribution line.

Model Municipal Tree Ordinance. The UVMI is working together with the Arbor Day Foundation to attempt to develop a model municipal tree ordinance that will promote the planting and protection of public trees and encourage tree planting while simultaneously meeting the needs of utilities to trim and/or remove incompatible trees (or find engineering solutions) to avoid tree and power line conflicts.

California Office of Energy Infrastructure Safety Scoping Meeting. California's newly formed Office of Energy Infrastructure Safety had a public scoping meeting in early 2023 to initiate a discussion to organize all the state's electric utilities in a unified effort to combat California's wildfire risk. The UVMI was invited to help lead the scoping meeting and to serve as a resource for the state and the utilities.

Through research, education and outreach, the UVMI is striving to identify challenges and help utilities and stakeholders to proactively work toward a brighter future for the UVM industry. TDW

LAWRENCE J. KAHN, ESQ. (*LKahn4@Tulane.edu*) is the director of the Tulane University Law School Utility Vegetation Management Initiative.

Utility Technology Investments: Point-Counterpoint

To find the right technology to manage their vegetation management programs, utilities must keep several key points in mind.

By **CHRIS KELLY**, Clearion

Today's utility environments are operating under increasing complexity. Once-distant innovations are rapidly coming to the forefront and ushering in an era of unprecedented collaboration among formerly siloed organizational disciplines.

With a shifting regulatory environment, increased community engagement, emerging ESG goals and a heightened focus on operational safety, effectiveness and efficiency, electric utilities are embracing tools like artificial intelligence (AI) and remote sensing more than ever before. While even the most forward-thinking utility professionals cannot accurately predict future technology requirements, key considerations — unique to each utility — can help pave a clearer path forward.

Understanding the Technology Landscape

While affordability is always a principal concern, today's utility customers are investing in solutions that are scalable, interoperable and offer the most value to their internal and external stakeholders.

Taking the steps to ensure your utility is moving in the best-in-breed direction, you also are helping to save the environment one tree at a time. Birdlkportfolio/Getty Images

Before diving into the pros and cons of differing technology investment strategies, it's important to provide a high-level overview of solution alternatives.

- Best-of-breed often refers to the leading technology solution in a particular niche. Best-of-breed software solves a nuanced problem or serves a specific purpose. Think of tax preparation. Businesses, like consumers, often mix and match specialized technology offerings to ensure they are using the best tools to get the job done.
- Best-in-class solutions typically optimize a function or series of related functions. For example, online banking or human resources information systems manage onboarding, payroll, benefits and more. Best-in-class solutions within a department or business function are highly integrated, efficient and provide a single-view of information for business intelligence.
- All-in-one solutions are unified, large-scale platforms encompassing all the critical data and functionality across an organization. Examples include enterprise resource planning systems for financial management, supply chain management, inventory management and more. All-in-one solutions offer bolt-on modules for additional functionality under a single platform.

When it comes to vegetation management technology, it can be useful to frame considerations across these broad alternatives.

- Best-of-breed: dedicated work planning or arborist tools or LiDAR/satellite data processing and analytics.
- Best-in-class: vegetation work management solutions with field operations maps and workflows spanning supervisors, field crews and leadership.
- All-in-one: enterprise work management systems.

But which alternative is right for you? Will you lose flexibility if you build a wide range of functions into a single vendor platform? Will you lose speed and efficiency or add complexity by integrating different software platforms?

Evaluating Technology Investments

It can be daunting for functional managers, who may not be technology experts, to evaluate solutions in today's fast-moving and highly competitive environment.

To determine what is right for your organization and avoid

The latest technology stacks are available now in all formats, including the desktop, mobile and hand-held devices.

Loaded data, courtesy of Overstory, is used to analyze all vegetation on Earth to prevent wildfires and power outages, enabling smarter infrastructure management and safer communities.

avoid a costly pilot or risk a failed implementation, you must first explore how work is done, who is impacted and how key decisions are made. Here are some key factors to consider during this process.

Identify the critical challenge you are trying to solve. A counterpart at a nationwide healthcare organization once joked, "We get more accomplished in one year than others can in a week." Unfortunately, many of us can relate. When it comes to large-scale technology implementations, unending change requests can lead to scope creep and missed completion dates. Much of this can be circumvented through stronger front-end planning and prioritization.

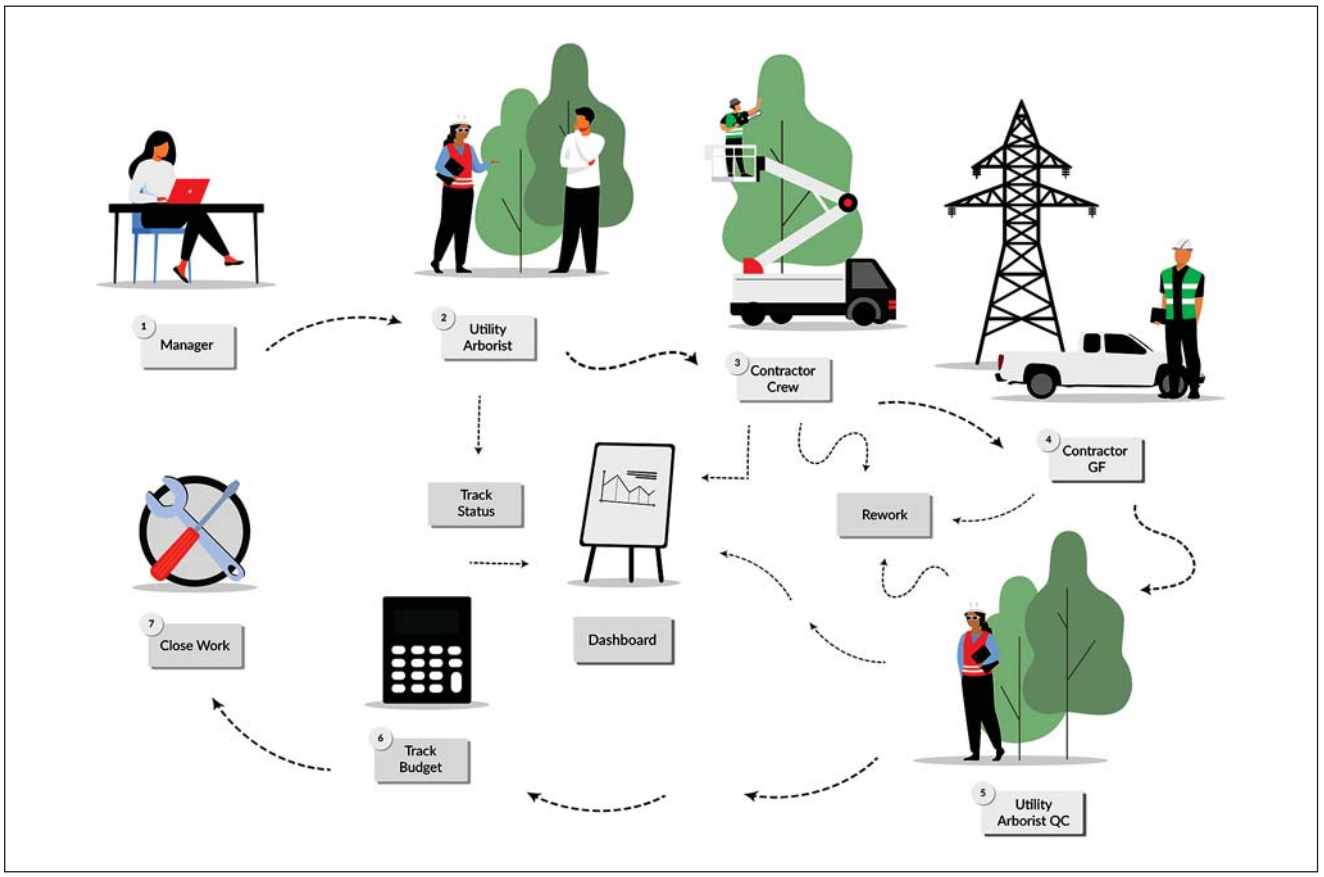
Agreeing that we need to increase operational or field efficiency is not enough. In vegetation management, that may mean shortening the cycle time between audit and close or streamlining crew workflows to reduce customer response times.

It is important for the solution to be designed and built for how a utility will be using it (i.e., not adapted from another use case). Accordingly, when gathering user requirements, it's wise to determine how well versed a potential partner is in understanding similar work environments from a variety of vantage points and solving related challenges.

Determine how broad the use cases are. Gone are the days when vegetation management departments were a stand-alone function. From investor-owned utilities to smaller cooperatives and municipalities, many departments within an organization must exchange data.

Beyond vegetation management, one of the first steps in scoping technology requirements is to gather input from each of the relevant user groups within an organization.

- Vegetation management may need solutions for work planning, scheduling, dispatching and auditing.
- Customer care may seek solutions for processing customer tickets or managing different notification requirements across operating regions or companies.
- Billing and contractor management teams may need production data by vendor.
- Finance may need a record of expenses.
- Environmental management and legal teams may seek compliance with endangered species management and habitat preservation.



Seek out technology solutions that solve your workflow challenges throughout the work cycle.

- Fleet and ESG teams may want quantifiable emissions reduction data.
- Investor relations may be looking for proven data on how the utility is achieving sustainability goals and serving as good corporate citizens.

Asking the Right Questions

Gathering broad-based requirements allows utilities to begin asking incremental questions of the users and their processes to determine what elements can and should be managed in the same system. Deeper dive questions may look like the following:

- Does it make sense to use field operations software to capture environmental data or denote pollinator habitats?
- Would a single platform make sense for work planners, crews and auditors or for rapid dispatch of customer ticketing and notification of rework from auditing?
- Are contractor timesheets needed in the system? Why or why not? If yes, do they need to tie to work completion?

- Is your utility embracing remote sensing/AI solutions but still needing to support manual field processes?

Because every environment is unique, these questions don't have one right answer. Framing and answering these types of questions with work groups allows utilities to design a solution that supports not only the necessary requirements but also other important data elements when and where they make sense. This also enables companies to determine where to draw the line.

Identify the key functional users. When weighing the pros and cons of implementing best-of-breed solutions versus best-in-class or all-in-one technology, it's important to consider the key functional users of each element of the solution set. If shared, a consistent user experience is a worthwhile investment. Utilities can lose millions per year in lost field productivity due to poor usability at the additional cost of employee and contractor morale.

Diagramming the collaborative processes across the organization is recommended to provide a unified view, remove fragmentation and silos and ensure critical data flows freely across teams.

Figure out what decisions will be made with the data and how quickly they will be made. In general, day-to-day work management processes require more granularity of data than, for example, the data rollup required for a monthly financial close. During your discovery process, it's critical to determine the level of detail required by each decision maker, and associated timing, and use that as a guide to design the optimal system.

Onsite team meeting includes technology training the field workforce.

Stay Updated on Technological Advances

Before building a complex, real-time, front-end system for native integration to your enterprise work management system, determine if a simple integration of relevant information, without custom coding, is doable, effective and efficient. You must also understand the maturity or fast-moving nature of the technology. Innovation is driving the world, and utility technologies are no exception. For example, consider the impact of cybersecurity, mobile operating systems and mobile device management in the industry.

Technology built years ago is no longer supported and/or needs to be rewritten. Pay attention to how well any commercial vendor is staying current with the underlying technology and how much custom code for your organization is being built upon it. Staying up-to-date and maintaining compliance with custom solutions in fast-moving technologies can become a challenge.

In addition, some technologies such as AI, machine learning and even remote sensing are in their infancy. Tying your company to a specific technology at an early stage while another model may prove to be superior longer term may be detrimental.

Consider how rapidly data acquisition is changing with LiDAR and satellites. Also think about how quickly remote sensing and machine learning models are extracting intelligence regarding clearance, tree species, tree health and more. Also ask yourself how quickly, if ever, these will become the primary tools for planned maintenance work or managing customer tickets, notifications and capturing customer interactions. An important balance is in play today with sky-based programmatic innovations and ground-based customer experience strategies that should not be overlooked.

The best companies in the field are innovating rapidly. The key to success is parsing out what elements of the proposed solution are already becoming commoditized (such as data acquisition) versus those that are continuing to innovate (such as image processing and data intelligence). Next you must ensure you establish clarity around what that means to your organization's ability to manage the technology over time.

Finding the Best Fit

When doing research, you must also consider a vendor's area of expertise. While many solution providers are building the business of tomorrow today and technology convergence is on the rise, their foundational strengths and depth of industry knowledge are likely to differ (e.g., remote sensing, satellite imaging, data analytics and technology integration).

Odds are in your favor that each provider will readily maintain its areas of expertise. But what innovative approaches or new frontiers might your vendor miss if it is looking through a single lens? Take the time to analyze each vendor and discuss, with your larger discovery team, what foundational strengths are critical to your success longer term. Center your approach upon these strengths. In addition, investigate each potential partner's pilot success rates and longer-term technology adoption. These are critical inputs to help you assess technology sustainability and potential maintenance requirements over time.

For example, placing a best-in-breed remote sensing bet may pave the way for innovation with a partner of choice for some utilities. For others, a configurable, best-in-class vegetation management platform incorporating remote sensing data from a range of providers provides the longer-term flexibility they need.

You must also evaluate the level of burden on your utility's IT resources. In today's utility environment, a heavy emphasis is placed on data- and cybersecurity. Couple that with system integrations, upgrades, optimizing for interoperability and managing too many tools in a tech stack can lead to administrative nightmares and skyrocketing costs.

At many utilities, changes to large enterprise systems are frowned upon due not only to expense considerations but also potential adverse impacts on other key functions these systems support (e.g., inventory and financial reporting). Building custom, front-end applications for enterprise asset/work management systems may tie the hands of a vegetation management department looking to innovate its business processes. Reducing complexity by thinking through the long-term administrative burden upfront is mandatory.

Implementing the right technology solution to meet your specific needs requires a host of in-depth considerations and planning — especially since the range of options has grown substantially in the past few years with no signs of slowing down. It takes significant effort to answer these fundamental questions and discover the ideal boundaries for the range of systems and software that can deliver value to your utility vegetation management programs. TDW

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Screen captures from the app in the actual Area of Interest show four vegetation layers in LiveEO's Vegetation Management Insights program.

Satellite Data for Managing Vegetation Risk

Liberty Utilities launched a pilot project to identify high-risk vegetation near power lines with satellite imagery.

By **JASON GROSSMAN**, Liberty Utilities, and **NICK FERGUSON**, LiveEO

On a crisp, clear day in November 2020, a team gathered in Joplin, Missouri, to confirm what everybody hoped: that by using specially trained artificial intelligence (AI) to analyze satellite imagery, it would be possible to overcome the problems of scale confronting every utility vegetation manager: too many trees located over too many miles too far away.

At that point in time, LiveEO had already done many field validations. Its Vegetation Management Insights program locates and measures individual trees, and its vitality monitoring module assesses tree health on three continents. During this project, however, the company was testing a new species identification technology to track seasonal changes in foliage and identify the genus. While this AI technology had yielded positive results in Europe, the data-hungry algorithm required extensive training when applied to a new environment. Rural Missouri, with its dense, high-variety forests, was a new playground.

Missouri woodlands in the fall include a low vitality area.

For Liberty, the pilot represented the company's second foray into the world of satellite imagery. The first satellite project had failed to meet the needs of its already well-established integrated vegetation management program, but the utility was determined to give it another shot.

Launching the Pilot Project

By using AI to analyze satellite imagery, the utility could infuse technological innovation into its vegetation management program. Liberty aimed to improve processes and gain efficiencies by

Risk analysis is performed on Liberty's distribution lines in LiveEO's vegetation management software.

taking a quick, reliable snapshot of vegetation conditions along the entire grid. In addition, the utility was also searching for a tool capable of prioritizing risks and generating work orders to tackle them.

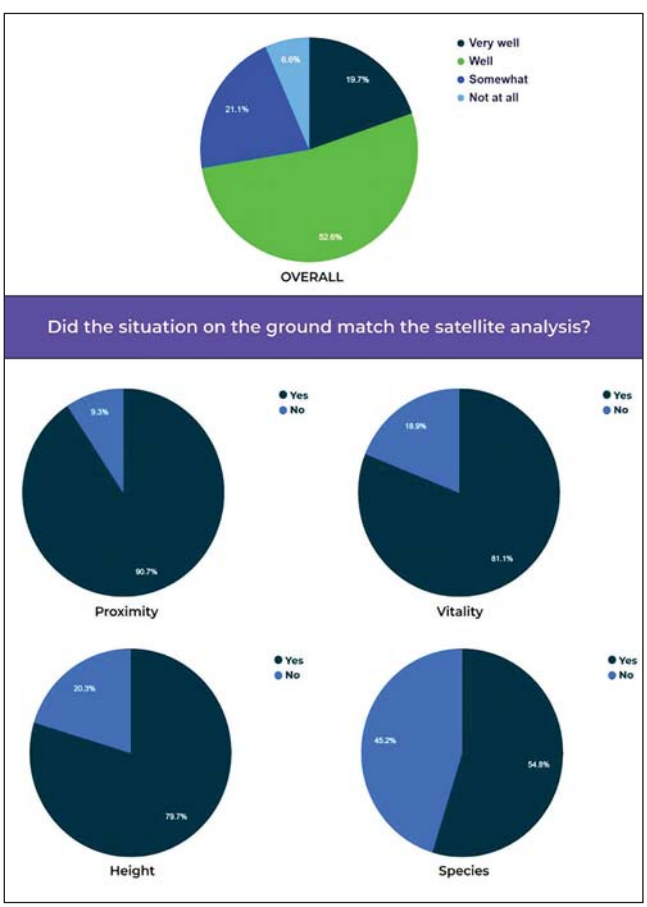
At the start of the pilot project, the team traveled to several areas of interest to inspect specific locations and validate the assessments made by the company's Vegetation Management Insights solution. For example, they checked the information available in the app against what is known as the "ground truth," or the reality on the ground.

The inspections zoned in on three key factors—tree location and height, essential to measuring vegetation-conductor distance and fall-in or grow-in potential; tree vitality, which singles out potential fall-ins most likely to fail; and tree species, a determining factor in growth rate. The species is also a critical piece of work order information in the event of a cutback.

During the project, the utility's employees tested the mobile app in the field. For added reassurance, the app includes a feedback function by default, not just for validations, but also to allow contractors in the field to flag inaccuracies or errors. As the mechanism by which AIs improve themselves, feedback is critical to machine learning. Making it as easy as possible for users to provide feedback to the algorithms ensures the machine analysis gets increasingly more accurate every time it is used.

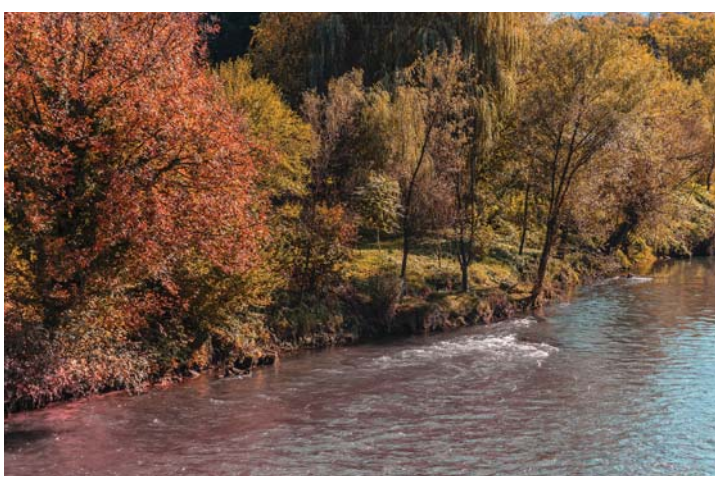
Evaluating Trees in Decline

Height and location proved highly reliable for the most part. A few miscalculations occurred near steep embankments, but they were quickly rectified. The most challenging aspect was getting everyone to agree on the height of the trees. To provide



This shows the results of Liberty's 2022 LiveEO pilot project and the ground truth validation.

Missouri's forests feature high tree density and species variety.



Steep embankments can pose a challenge for height measurement.

Larin McCulley, Tom Waddington, Jason Grossman and Todd Lushinsky were on site during the pilot project.

guidance, an experienced field validator volunteered to step in as a human yardstick.

Traveling across the service territory, the team began evaluating trees flagged by the app as "in decline." In several cases, the trees' low vitality was obvious. These trees clearly needed some attention to eliminate the risk of an outage, and even an inexperienced ground patrol would have spotted them straight away.

This was not the case with all the trees in decline. With a satellite resolution of 50 cm, even minor limb dieback showed up. The team required a more in-depth visual inspection to confirm the vitality decrease picked up by the AI. Even so, it was beneficial to highlight these declines before the process began. The accuracy of the plant vitality and change detection highlighted changes that weren't readily identifiable with the naked eye.

While walking away from the ailing tree, it occurred to the team that their vision of the environment was almost magically augmented, allowing them to see things that human sight alone could not. As that first day wrapped up and they made their way back to their vehicles, they reviewed the events of the day.

They may not have achieved perfect results, but they targeted areas for improvement. Because the model had performed so well on species it recognized from previous projects, it suggested it was a matter of calibration and training. LiveEO's project manager defined the steps to improve the AI's training on dense/high-variety woodlands like in Joplin, Missouri. For a start, they knew they had to double the length of their local species list.

Meanwhile, the team from Liberty talked numbers: would the day's results hold up their projections? With the time and money they'd save cutting overflights, how many more of those critical fall risks could they get to — all of them? It felt like the conversation was only starting.

Over the following months and a series of reruns, species identification accuracy improved in large steps. Seeing how fast the AI technology evolved and improved felt more exciting than the high accuracy the established modules had displayed. This was no regular tool Liberty was adding to its tool kit. This tool was self-improving, and it was a fast learner too. TDW

JASON GROSSMAN (*jason.grossman@libertyutilities.com*) is the vegetation control coordinator for transmission for Liberty. He started working in utility forestry in 2006 as a contractor with Environmental Consultants Inc. and joined Empire District Electric in 2008 as the distribution coordinator. Grossman earned his degree in agricultural science and natural resource management from Oklahoma State University. He is a founding member of the City of Joplin Tree Board, for which he served as chairman from 2009-2013.

NICK FERGUSON (*nick.ferguson@live-eo.com*) is vice president infrastructure at LiveEO GmbH, a company specializing in using AI to analyze data from earth observation satellites. He is also the co-host of the CEU-accredited UVM Podcast which won the UAA's Education Award in 2022. With bachelor's and MBA degrees, he has an academic background and interest in the application of innovative spatial technologies to generate value for electrical utilities. He has worked alongside utilities with global exposure to best practices in the United States, Canada, Australia, the U.K., the Middle East, Africa and India.

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Utility Arboriculture and Technology Transform VM

When I started my utility arboriculture career in the early 1990s, many North American utilities had decentralized vegetation management programs run by operations managers, light-duty lineworkers or others without arboricultural training. The predominant perception was that it wasn't "rocket science," and anybody could do it without training. In those early days, I was informed many times that money spent on foresters or arborists was better spent "trimming trees."

That perception was wrong then, and even more so now. Vegetation management is essential to utility operations. Failure in vegetation management has been an existential threat to utilities. Conflicts between trees and power lines have resulted in catastrophic fires, ruinous blackouts, public electric contacts, enforcement action from regulators and tarnished corporate reputations. Utilities have fallen into bankruptcy and chief executives have lost their jobs as a result. Now, vegetation management is often the largest utility operations and maintenance budgetary line item, and the contribution provided by utility arborists is indispensable.

Gaining Knowledge

The knowledge required for an effective vegetation management program is formidable. In addition to demanding command of dynamic natural systems, this work requires an understanding of program management, budgeting — often for tens of millions or hundreds of millions of dollars — remote sensing, communication, safety and the fundamentals of electrical systems, according to the *Utility Arboriculture: The Utility Specialist Certification Study Guide* published by the International Society of Arboriculture.

The criticality of VM is evident from the articles presented in this *T&D World* Vegetation Management Supplement, which is published in partnership with the Utility Arborist Association. This issue features articles about environmental stewardship, biodiversity, the cost-effectiveness of integrated vegetation management (IVM) and chemically facilitated biological control. Alongside this content is collaboration with and leadership for utility tree workers to promote safety and professionalism. This supplement also includes articles featuring technological innovations from satellite imagery to artificial intelligence.

Investing in Technology

Technological developments are transforming vegetation management. A premise of IVM best practices is to base prescriptions on data, according to "Utilities & Vegetation Management in North America: Results from a 2019 Utility Forestry Census of Tree Activates & Operations," a 2021 University of Wisconsin-Stevens Point publication. Vegetation managers can apply this principle by taking information supplied through remote sensing to deploy resources to areas of greatest risk. Moreover, technology can a help overcome the constraints imposed by insufficient human resource pressure. Technology drives efficiencies that can bridge the gap between need and resource limitations.

As essential as these technological advances are, they cannot replace competent field professionals. Practitioners on the ground are necessary to augment remote sensing, ensure quality control and deliver optimal programs. For example, remote sensing is unable determine tree flaws that can be identified through tree risk assessments.

Misuse of technology may drive vegetation management programs into a detrimental hotspot paradigm. The articles in this supplement by Jill Golden and Dr. Anand Persad provide insight into the importance of developing diverse, compatible plant communities through IVM. The method is not only cost effective, but it also has an added benefit for creating early successional habitat that benefits pollinators, ground nesting birds and other species for which habitat has been dwindling in recent decades due to development, agriculture and human preference for trees and forests. Technology by itself can't deliver that result.

Focusing on Training

State-of-the-art IVM requires training. Credentials such certification and tree risk assessment from the International Society of Arboriculture are crucial. University of Wisconsin-Stevens Point, the Utility Vegetation Management Association, and the Utility Arborist Association have collaborated on a two-year Utility Vegetation Management Program. This program should be promoted by progressive utilities and contractors for their employees wishing to advance their vegetation management careers, according to Tomaszewski and Miller in the "2022 UVM Professional Development Program" article in the *UAA Arborist Newsline*.

It's clear that money spent on arborists is not better spent "trimming trees." Professional vegetation management is central to enabling utilities to deliver safe, flawlessly reliable electricity while advancing environmental stewardship, all of which are core values of progressive utilities. *T&D World* recognizes the importance of vegetation management and has wisely selected articles for this supplement. They offer a blend of topics that provide information on the skills necessary to transform utility arboriculture to the benefit of arborists, utilities and the public. TDW

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