

Utility Arborist Newsline

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Key Technology Initiatives That Should Be on Everyone's Radar in 2019

By Michlen Robinson, Manager of Information Security, Lewis Tree Service

What would you do differently if you knew you were going to be robbed?

Michael Sentonas, Chief Technology and Strategy Officer, APAC for Intel Security, famously asked that cyber security question in 2015—and responded with high-level advice on prevention, protection, detection, and rapid response (e.g., surveillance techniques, sensors, indicators, alerts).

In today's ever-shifting landscape, a dedicated focus on cyber security is more critical than ever. In the past few years, many of us in the vegetation management (VM) industry have been encrypting laptops, implementing laptop security tools to protect confidential and personally identifiable information, completing cyber security awareness training, sending weekly cyber security tips, and ensuring compliance with customer cybersecurity breach insurance requirements.

So what's on the docket for 2019? Continuous adherence to our Cyber Security program with heightened focus on the following items.

FOCUS ON TECHNOLOGY

Third-Party Vendor Compliance

When examining the recent, high-profile security breaches at companies like Under Armour, Delta Airlines, Best Buy, and so on (companies perceived to have significant technology investments), what comes most heavily under scrutiny is third-party breaches. Clearly, this is an issue for companies in all industries. At Lewis, we are working diligently to ensure our vendors are meeting industry standards to protect our data—and then some. We're validating current processes, designing stronger procedures, incorporating more tools, and educating vendors and employees accordingly. Our utility customers and our team members are depending on us and our partners to be at our best when managing third-party interactions and this is a critical focus area for us.



Employee Education

The phrase "You are the Weakest Link; Good-bye" makes for great television, yet it's the last thing anyone wants to hear at work. For the past few years, as part of our standard educational offering, we have



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Key Technology Initiatives *(Continued)*

been working with all team members—including those most at-risk—on the dangers of sharing passwords, opening bogus e-mails, clicking on unknown links, using public Wi-Fi, leaving devices unsecured, copying company data to USB drives and personal e-mail, and downloading unknown or untested apps. This year, we are encouraging all employees to share this information with their family members to improve their cyber behaviors as well. We all need to take ownership, secure our data and devices, and report any cyber incidents as mission-critical events to ensure the company has full transparency and the ability to act quickly.



teams, we also imagine that teams like the Patriots have much stronger back-up plans in place. They also seem to have the right player for the right moment. At Lewis, we're working diligently to make sure we're prepared and have a solid business continuity plan in place for all of our unexpected twists and turns. We're deep diving into various scenarios and possible catastrophic events while asking questions like: Who can work? From where? How does this impact our employees and customers? What critical steps must be taken? Are we tested in particular scenarios? What is required to ensure continuity of services and our business?

Disaster Recovery and Business Continuity

Residents of Buffalo Bills country live with a constant reminder of the value of disaster recovery. In 2018, with one of the highest percentages of career interceptions in the NFL (9.2 percent), Nathan Peterman was benched. Who took his place? A 35-year-old quarterback recently brought back into the NFL, who arguably should not have been on the field. While some fans scratch their heads in regards to some personnel decisions with our favorite sports

As Tom Rogers, President and CEO of Lewis, has repeatedly emphasized, "Our effective use of technology has become a crucial part of delivering great value for our customers, protecting the interests of our employees, and our business assets. We must use technology responsibly at all times, and vigilantly safeguard the confidential information of our customers and team members."

We look forward to meeting the continued technology challenges of 2019 and pushing our company to be more resilient and responsive—and hope that you are as well.

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Executive Director Comments

By Phil Charlton



If you were to research the definition for technology, you may be frustrated with the rather broad simplicity of the answer. According to Merriam-Webster, it is "the practical application of knowledge." You may not consider all the tools used for your daily tasks "technology," but at one point, that tool was a groundbreaking discovery.

This issue of the *Newsline* gives a great look at the variety of ways industry leaders and early adopters are applying our ever-growing knowledge base into practical processes, methods, and tools for managing vegetation. Technology is helping our members as they work to create safer and more reliable energy delivery while giving greater care to our

environmental, social, and cultural resources.

Considering how far technology has come and how it continues to improve, many agree that this is an exciting time to be involved in the utility vegetation management (UVM)

industry. It is too bad so few of our schools are preparing students—or even making them aware of—UVM. To this end, the UAA executive team would like to develop a task force (a short-term, focused working group) specifically to build student awareness. If the UAA can get the message to graduating students and entry-level professionals, everyone will benefit.

We need the next generation to prepare for the future, to bring new ideas, and new energy. Students that find their careers in UVM will be well rewarded too. Students today are motivated by the impact they can make in a career field. Those interests align

well with what we do—managing more than 14 million acres of rights-of-way (ROWs), and caring for more than 500 million trees in the urban forest. Students looking at a career in the natural resource field will not find opportunity like that elsewhere. Our members are shaping the urban forest, creating wildlife habitat, and yes, working with emerging technologies. We just need to get the word out.

I will admit that we have been talking about this task force for some time. It is time to quit talking about it and start doing something! We are looking for a few committed members to offer just a little bit of time. If you are interested, just contact us through the UAA website. In the meantime, reach out to your alma mater and put in a good word with today's students.

As always, thanks are in order for the Editorial Committee and to the many contributors to this issue on technology and UVM.



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President's Message

By Bob Richens

Greetings! You are in store for another informative issue of the UAA *Newsline*.

As I reviewed the articles in this technology issue, I couldn't help but reflect on the technological advances I have personally used in the utility vegetation management (UVM) industry in the last 25 years and how far we have come.

In the early 1990s, I was introduced to an IBM desktop computer equipped with internal company e-mail and a program called "dbase" to track budgets and contractor invoicing. It was quite an improvement from the paper systems it replaced. At that time, we still had big two-way radios in our utility company vehicles for communications; cell phones were not standard issue. We looked up easement documents stored in metal filing cabinets.

Then, a few years later, we were introduced to the laptop personal computer and the internet. By the late 1990s, we started using geographic information system (GIS) software in the field to collect vegetation information and plan work. It was extraordinary.

Since then, technological advances have often moved faster than many companies who try to build their business case in justifying total cost of ownership (TCO) or the return on investment (ROI) needed to purchase and deploy new, hi-tech advances. Today, it is exciting to see all the innovation still evolving with new ways to get our work done better, faster, safer, and most of the time, with the value required in calculating ROI.

One of the most exciting technology accomplishments I am seeing now is related to mobile devices and applications with planning prescriptions for the crews who perform VM work. The ability to assign work to a crew remotely, and for them to close the work out as completed, has arrived.

From a safety improvement aspect, current equipment technology is enabling the removal of dead and decayed trees at much lower risk to workers with the use of crane-mounted grapple saws. Climbing equipment technology has improved as well, reducing the number of injuries ascending, working, and descending the trees that must be climbed.

On the VM front, new herbicides and application techniques, coupled with closed chain-of-custody management, has improved the precision and efficacy of integrated vegetation management (IVM); It has the potential to turn millions of acres of rights-of-way (ROWS) into improved habitat for pollinators and other wildlife.

The point of all of this is to improve the safety, efficiency, and effectiveness of our operations, while also improving environmental sustainability and stewardship and providing the public with a higher level of service.

When you attend the upcoming UAA conferences this year, you will hear speakers, meet vendors, and network with your peers willing to share how all the evolving technologies can help you achieve your personal goals as well as the company's.

Where Technology and Sustainability Connect

The benefits of the Right-of-Way Stewardship Council reach beyond the practitioner's sphere; it has the potential to positively impact the industry, communities, stakeholders, and agencies. Clearion technology was informed by the standards established by ROWSC.



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- 3 Landowner notifications and ability to obtain electronic signatures.
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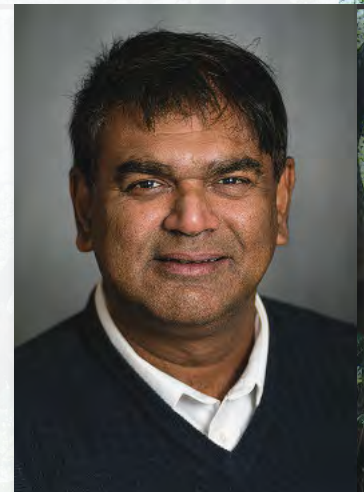
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Anand Persad, PhD; BCE

Manager Arboriculture and Plant Sciences/ Entomologist, The Davey Institute



By Jenna Paul, Davey Resource Group

Anand Persad, Ph.D., BCE has been a research scientist with the Davey Institute for more than 15 years, applying his expertise in entomology and the biomechanics of trees to combat the effects of invasive pests, improve safety, and develop pollinator friendly rights-of-way (ROWS) in the utility vegetation management (UVM) industry.

Dr. Persad recalled a Saman tree (*Samanea saman*)—one of his favorites—as inspiration for his career. He found this tree while growing up in the beautiful Caribbean islands of Trinidad and Tobago. The Samaan soon fell victim to the pink hibiscus mealybug (*Maconellicoccus hirsutus*), a pest that affects many plants in tropical and subtropical regions. When that tree died, he acquired an interest in the growing concern around such destructive pests.

He later received a Bachelor's of science degree, followed by a Master's degree, and then his Doctorate from the University of West Indies, employing additional knowledge gained at the Slimbridge Wetland Centre in Gloucestershire, England. He was later recruited by the United States Department of Agriculture (USDA) Research Service in Orlando, Florida to aid in researching the pink hibiscus mealybug and conducting research jointly with the University of Florida, Gainesville. Dr. Persad then transitioned to work with the Davey Tree Expert Company as a technical advisor, intrigued by how he could apply his knowledge in a commercial environment.

At Davey, Dr. Persad said that he found his niche in "listening to the field." When pest treatment predictions using the old calendar system became an issue, he began to work on a daily temperature and phenology-based system, colloquially known as the "Nature Clock," which he would develop and patent. Dr. Persad said, "With new and emerging trends and variable weather patterns, more dynamic systems need to be employed in managing trees and green spaces."

Dr. Persad was also involved in the research on the Emerald Ash Borer (EAB) (*Agrilus planipennis*) and this grew into an interest in tree biomechanics and safety. When the threat of the EAB came into the spotlight, most scientists were focusing on eradication and management. Dr. Persad decided to look at the situation from a different angle. He thought, "Let's assume we can't manage the pest—what's next?" Instead, he began to research how they could manage the effects this insect caused.

The research around EAB led Dr. Persad into a deeper interest of tree biomechanics and finding ways to relate science to issues in the field in meaningful, impactful ways. He was surprised that there were so many incidents, and, in some cases, hospitalizations, of utility workers associated with EAB, as the pests' impact led to ash tree failure on job sites.

This led to further studies centered on how and why trees break and the formulation of the first safety guidelines for the industry. He presented his data to the Tree Care Industry Association (TCIA) national conferences in Baltimore and Pittsburgh, as well as several International Society of Arboriculture (ISA) and utility meetings and was well received. His work continues to have emphasis on improving safety protocols and applied solutions to issues in the field around tree failure and worker safety.

With the emergence of a greater appreciation for utility corridors as a habitat, Dr. Persad has focused his expertise on research that compares the pollinator values of vegetation in ROWs. This includes weighing the effects of different management tactics and accounting for changing weather patterns. These pollinator habitat quality (PHQ) evaluations, coupled with compatibility ratios of plant material, will ultimately contribute to advancing integrated vegetation management (IVM) standards in our industry. Dr. Persad said, "As we advance IVM and plan ahead, one must consider what the utility ROWs will look like in the future. As fuel reduction efforts, habitat quality needs, regulatory compliance, etc. all emerge in greater importance, our research efforts often provide innovations and may guide the implementation of new processes."

As a chair of the UAA Research Committee, Dr. Persad acknowledges the importance of collaboration and dynamic change in an ever-growing industry. To him, the UAA is an important resource for growing the communication and collaboration needed in an industry that is anything but static. Moving forward, Dr. Persad said, "I believe that utility science needs, more than ever, to strive to be more of a behavior-based entity." He continues to be interested in holistic approaches to current UVM issues and applying his findings to further train those in the industry.



Research Committee Update

Research Leads from Our Members: Technology and Innovation

By Dr. Anand Persad, Manager of Arboriculture and Entomology, The Davey Institute, and Chuck Anderson, Executive Vice President and Chief Strategy Officer, ECI Consulting

Technological advancements and innovation work closely with scientific progress and in the utility industry. They help guide our continuous efforts for safer and more efficient work practices. The UAA Research Committee understands that as we advance right-of-way (ROW) and utility sciences, both technological advances and innovation should center upon relevancy and successful implementation within the industry.

Our membership consists of experts with many years of in-depth knowledge about what works and what does not in the “real world.” We thus have access to one of the best sounding boards for what is relevant and what more is needed to enhance our research efforts and advance ROW science. In this light, the Research Committee initiated a survey poll conducted in late 2018 that focused on ranking several tenets of our industry, including Employee, Contractor, and Public Safety; Service Reliability; and Regulatory Compliance.

The objective of the exercise was to help us prioritize our research focus and introduce various subcategories that our members prioritize. Analyzing the results from 89 member responses, we identified the following categories and subcategories (ranked 1-5) as member priorities:

Employee, Contractor, and Public Safety:

- (1) Training Relevance and Quality
- (2) Training Frequency

Service Reliability:

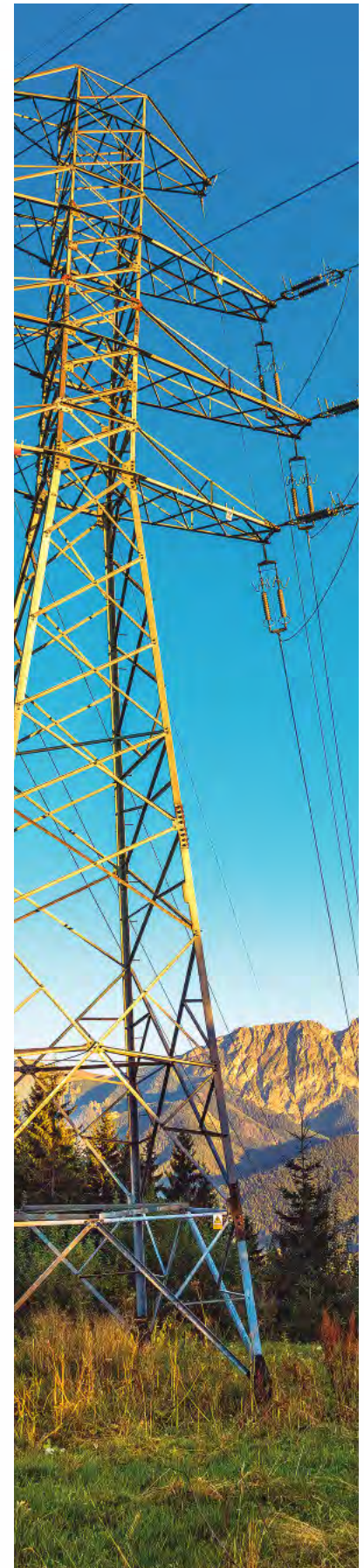
- (3) Tree Failure
- (4) Tree Worker Experience

Regulatory Compliance:

- (5) Training and Process Improvement



While this data from our membership is revealing of our times today and important to ROW science overall, we also recognize that social, exploratory, and other research questions may arise from time to time and provide additional scope for evaluation. We remain dynamic as a result of the emerging trends and many detailed questions on implementation; our partnerships and funding opportunities must reflect this. Through our main internal funding source, the utility arborists research fund (UARF), in partnership with the TREE Fund, seeks quality proposals annually. This allows for some level of work to get done on the science, technology, and innovation fronts—not through a static set of questioning, but through a living, breathing assemblage representing an evolving industry. We cannot do it alone, however. Our membership, the industry at large, as well as new alliances and collaborations between us and like-minded organizations will continue to drive innovative thinking and help us realize our implementation goals to meet the needs of a growing, dynamic industry.





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SPOTLIGHT on the Environment



Winning with WOW Program

By Jason Grossman, Manager of Transmission and Distribution, Liberty Utilities

Vegetation management (VM) is essential for maintaining the electric system's reliability. Conventional means of managing vegetation can upset some customers, especially those who are environmentally minded. Due to urban sprawl and fragmentation of land, finding a compromise between VM and property owners has led Liberty Utilities' Empire District to think outside of conventional means and implement a Wires Over Wildlife (WOW) Program.

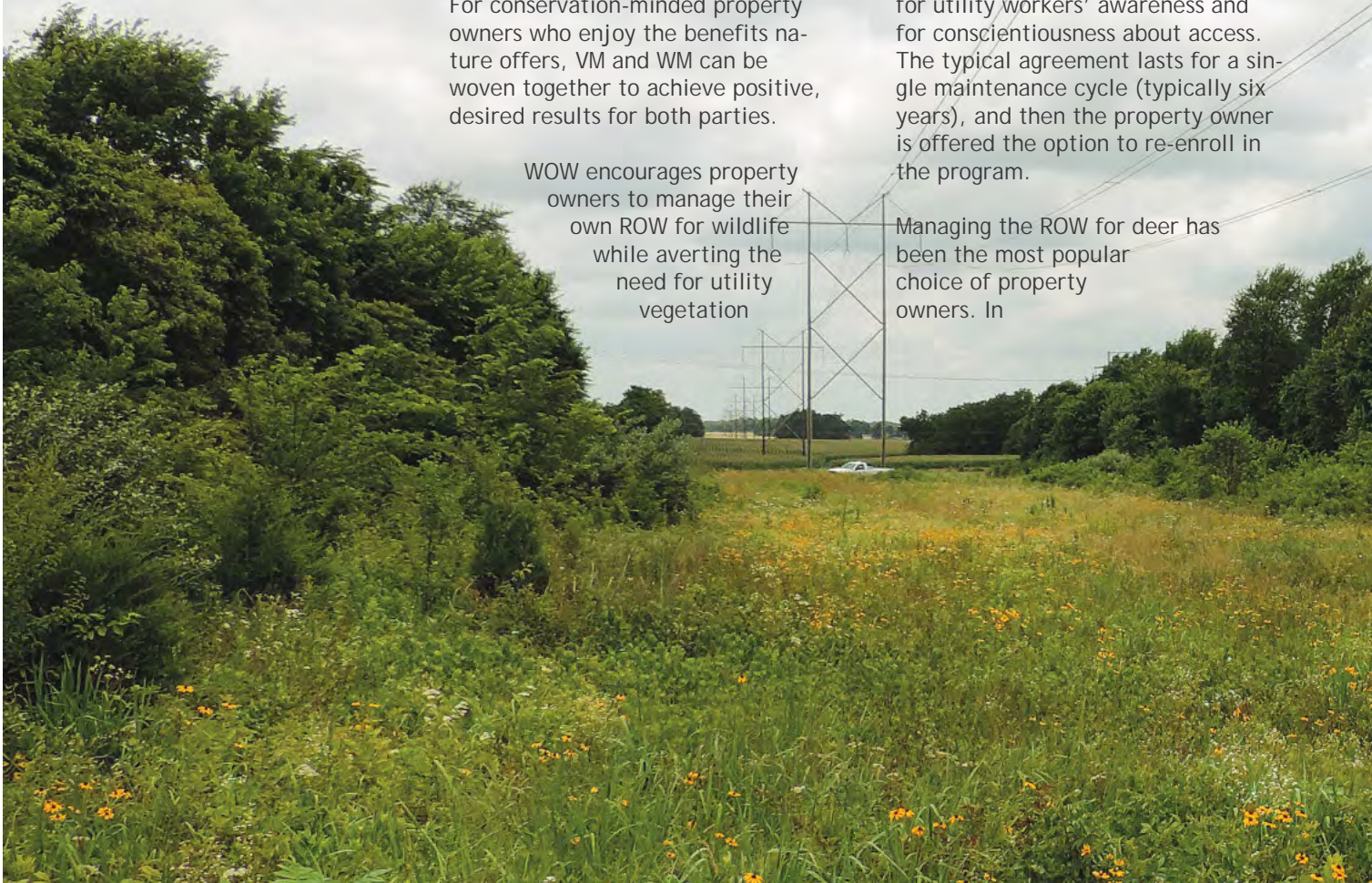
Partnering with the Missouri Department of Conservation (MDC) and landowners, WOW offers a solution that protects, restores, and enhances wildlife habitat while maintaining the utility's functionality of the right-of-way (ROW). Wildlife management (WM) and VM complement each other, so it should be no surprise that the two practices have overlapping management principles. For conservation-minded property owners who enjoy the benefits nature offers, VM and WM can be woven together to achieve positive, desired results for both parties.

WOW encourages property owners to manage their own ROW for wildlife while averting the need for utility vegetation

management (UVM) maintenance. The solution is a cost-sharing program that re-allocates maintenance funds directly to property owners for the purpose of investing in their specific wildlife goals. The goals for each project are unique and typically staggered throughout several years, with Liberty Utilities' only caveat being the removal of tall-growing, woody vegetation from the ROW.

Once the property owner has registered for the program, a plan is created, which includes target dates. In some cases, Liberty Utilities helps with the initial clearing; however, most of the property owners are left to complete the work on their schedule. The cost-sharing funds can be used for any part of the project (e.g., seeds, equipment purchase, fuel, etc.). WOW signs are posted at the ROW entrances on the property for utility workers' awareness and for conscientiousness about access. The typical agreement lasts for a single maintenance cycle (typically six years), and then the property owner is offered the option to re-enroll in the program.

Managing the ROW for deer has been the most popular choice of property owners. In



southwest Missouri, deer hunting is not just a hobby—it is a lifestyle. Monday mornings at the office are spent telling stories of close encounters with them the previous weekend or sharing pictures of the harvest. Aerial patrol reports ROW lined with deer stands and blinds as coworkers and neighbors vie for the year's trophy. Several WOW participants are enticed to participate in the program with the hope that this year, their story will be the one that is retold by others.

Pollinator plots are another popular function of WOW resources. They are quite appealing to sensitive property owners. Pollinators have been a hot topic of discussion in the VM industry with the emergence of Colony Collapse Disorder and the potential federal listing of the monarch butterfly extinction. Wildflowers offer beauty and functionality to a ROW that may otherwise be underutilized. If biological control is the ultimate goal for integrated vegetation management (IVM) programs, then seeding ROW with wildflowers pushes the program closer to that goal.

Some property owners prefer the utilitarian approach to maintaining their ROW by trying to attract as many species as possible. One of Liberty Utilities' WOW program participants elected to plant a food plot of buckwheat on the ROW. She was impressed with the number of pollinators that were drawn to the site, as well as the deer and turkey. Having lived on the property the majority of her life, she was also surprised at the potential to hunt dove in the fall, an activity which she had never done prior to her enrollment in the WOW Program due to lack of fowl to hunt.

When WOW projects become complex—to the point that it may be beyond Liberty Utilities' expertise—MDC is consulted. MDC has a staff of private land consultants who specialize in WM, and who have a wealth of knowledge that adds multiple benefits to the WOW program. The validation and credibility built with the organization helps develop a synergistic

relationship and another advocate for Liberty Utilities' VM program.

The property owner likewise becomes an advocate. When value can be added to someone's property and the utility can agree to assist them with a project about which they are passionate, all can benefit. Sharing positive experiences with friends and neighbors is more powerful than advertising with a thousand commercials. The relationships Liberty Utilities builds with its customers, the positive impact the company has on the surrounding wildlife, and the overall reduction in VM maintenance makes the WOW Program a win-win-win.

If you would like to share environmental stewardship projects taking place on your ROW, send an e-mail to branchout@growwithtrees.com.



The Case for Data Integration

By Joe Purohit, President, EcoLayers, LLC; Justin Stratton, Production Manager of Software Development, and Vince Mikulanic, Market Manager, Davey Resource Group, Inc.

Utilities have traditionally used some combination of technologies, tools, and processes for utility vegetation management (UVM). This includes manual, paper-based approaches, basic desktop or online data and mapping tools, and high-end, custom-developed systems which cost millions of dollars. While it's rare to find two utilities with identical VM programs, they are all but guaranteed to share one common characteristic. They are driven primarily by the current state of utility technology adoption. Almost every aspect of UVM is being forced to function in highly fragmented silos of

data. This isolates analysis, organizations, decision-making, and workflows. The issue is that these are not typically integrated holistically into one system. The pervasiveness of these silos has severely affected the efficiency and effectiveness of practically every UVM program.

The solution is to break down the silos through the "integration" of existing applications and systems. Integration, as defined in this context, means bringing together the separate applications and systems to perform a more complex task that cannot be done by any individual application or system. There are many factors in UVM which drive the need for integration as UVM shifts away from routine line clearance towards tailored approaches focused on reliability and condition-based maintenance strategies. One factor is the need for large, more diverse data sets from different sources like micro weather stations and remote

sensing data. Another factor is the increasing demand on the functionality and capabilities of what UVM should deliver, as in the case of the fires in California.

The proper integration of existing technologies and business processes will benefit utilities and improve UVM in many ways. It will improve data sharing, collaboration, and work hand-offs between departments and contractors, reducing the need for the manual handling of data. A sharable knowledge base with a single point of access also leads to greater efficiency in processes for individual UVM programs, including herbicide and pruning.

An interesting case study of integration in action is the collaboration of Davey Resource Group (DRG) and EcoLayers to develop unique solutions for integrated UVM. One of the early implementations will be at the

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City of Palo Alto, California, which owns and operates its own power distribution network. The City's Urban Forestry Section of the Public Works Department is responsible for both utility vegetation and urban forestry management.

The dilemma for them is that these two areas, which already struggle to find an appropriate middle ground on disparate goals, have been managed as separate programs. Their data was kept entirely in "silos" using paper-based processes and other legacy systems. For many years, the city used DRG's TreeKeeper platform to manage the urban forestry and track work on street and park trees. Utility line clearance used a variety of systems, including pen and paper, to document and manage the work performed.

The city has recently adopted Eco-Layer's Tree Asset Manager (TreeAM) for its UVM. TreeAM is a software platform for the systemic management of vegetation as environmental assets. Its key capabilities include content aggregation from diverse sources, data and process integration, stakeholder collaboration, sophisticated modeling and analytics, customizable workflows, and an

enterprise-grade asset management system. This aids in the integration of UVM with urban forestry, which is an important objective. Now and in the foreseeable future, urban forestry programs will continue to be managed in TreeKeeper, with utility programs managed in TreeAM.

From the City's perspective, both street trees and utility trees are part of the same urban forest, which suggests the need for the integrated management of these two programs. This scenario makes a compelling case for the integration of TreeAM and TreeKeeper, as conceptually illustrated in the figure below.

The primary integration objective is to enable the exchange and sharing of data between TreeKeeper and TreeAM through the use of application programming interfaces (APIs). The integration will also address the frequency of data transfers, compatibility between the data structures and organization, and data security, among other issues.

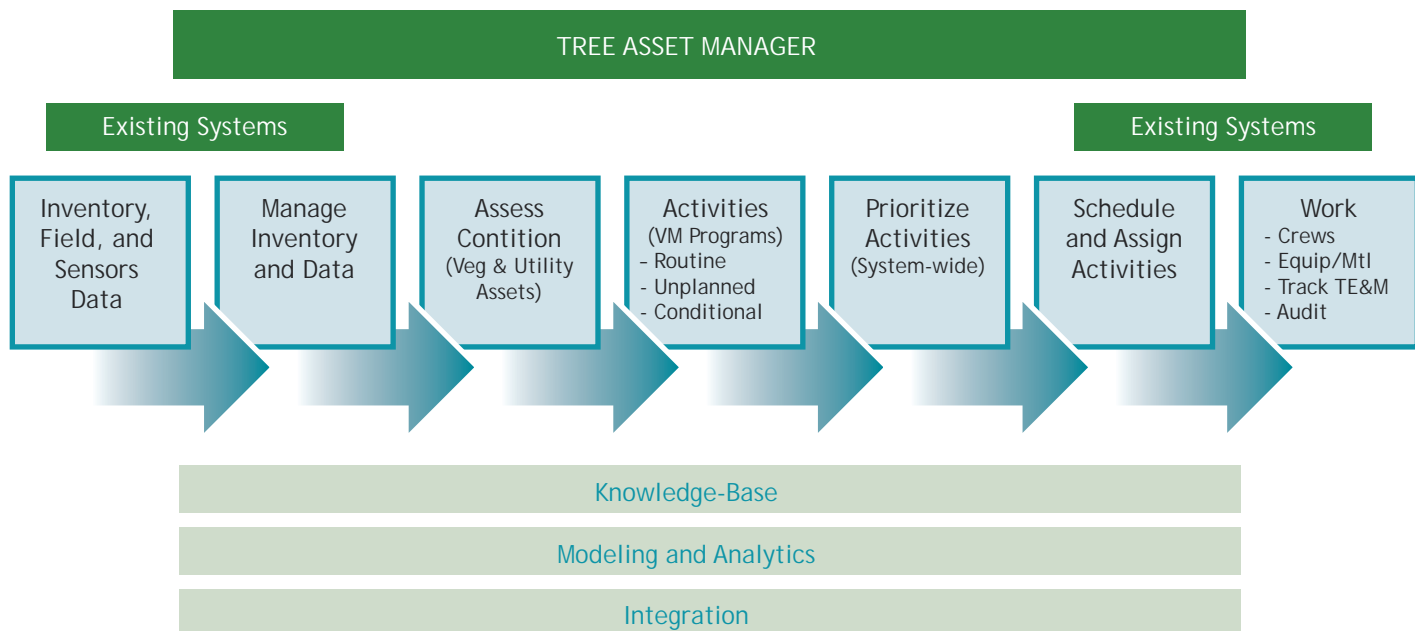
This one-time integration effort will provide recurring, long-term benefits to the city from the combined capabilities of both systems. Urban forest programs can continue to be managed

using TreeKeeper. TreeAM will enable the integration between UVM and urban forestry based on the most current data, with the ability to bring in new data sets in the future (e.g., LiDAR, weather), improve data sharing and collaboration across the organization, and apply a new class of analytical and decision support tools.

As Peter Bollinger, Program Manager at the City of Palo Alto, said, "The integration of TreeKeeper and TreeAM is something we here in the City of Palo Alto Urban Forestry Section are very excited about. Our city staff and field crews are very comfortable working in the TreeKeeper framework. Adding the modeling and analysis capabilities of TreeAM to the TreeKeeper user interface brings us the best of both systems without having to train users on a new program. This increase in functionality, along with a reduction in data silos, will play an important part in our transition from a cycle-based UVM program to a more risk-focused UVM program."

Integration of existing data and systems can be one of the most cost-effective strategies for many utilities to improve their UVM programs.

Technology Integration: Working with Existing Systems





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How Necessity Transformed an Outdated VM Platform into a New Goal-Breaking Software Solution

By Lori Jones, Maintenance Services Manager, Salt River Project (SRP)

Two Decades, Two Challenges, One Solution

For years, the vegetation management (VM) department at Salt River Project (SRP) dispatched work to our contracted tree crews by handing them a folder with one or more maps. The tree company pre-planner would identify required VM work and tree crews from the same company would execute the prescribed tree pruning and removal. Once complete, the tree crews would turn in the completed folder.

VM staff would record the work completed in our SmallWorld mapped environment in a layer called "Arbor." Between work assignment and completion, VM had little visibility into what was happening in the field and, except for weekly verbal reports, little knowledge of where crews were working. Additionally, the amount of work required to map the completed work orders into the Arbor layer was simply too inefficient and costly.

Even with the addition of a third party to assist with pre-planning and permitting, our VM team knew automation and streamlining were needed. We also knew that if we had

an inventory of vegetation across our service territory, it would be easier to plan work. These were serious needs because, as of that time, the VM team had yet to complete a distribution cycle on time. Transmission cycles always finished on time due to regulatory requirements, but that often meant our teams and contractors focused exclusively on transmission lines between November and February—while distribution lines waited. In a two-year cycle, that meant VM was typically six months behind.

This was one part of the challenge we were facing at SRP. The need for

a new solution became urgent when our VM team learned that the Arbor layer was no longer going to be supported by Smallworld (and that we had less than a year to identify a replacement). A number of outside vendors and their platforms were considered with respect to our timeline and budget, but after careful evaluation, we determined the most cost-effective solution with the shortest time to implement could, in fact, be built by our own geographic information system (GIS) team working closely with our VM team.

We successfully configured an app that allowed the VM team to automate the influx of information, better capture tree inventory, and affect a significant change in role-based work dispatch and completion. We were also able to integrate our contracted partners into the new solution. But what would we name our new automated solution?

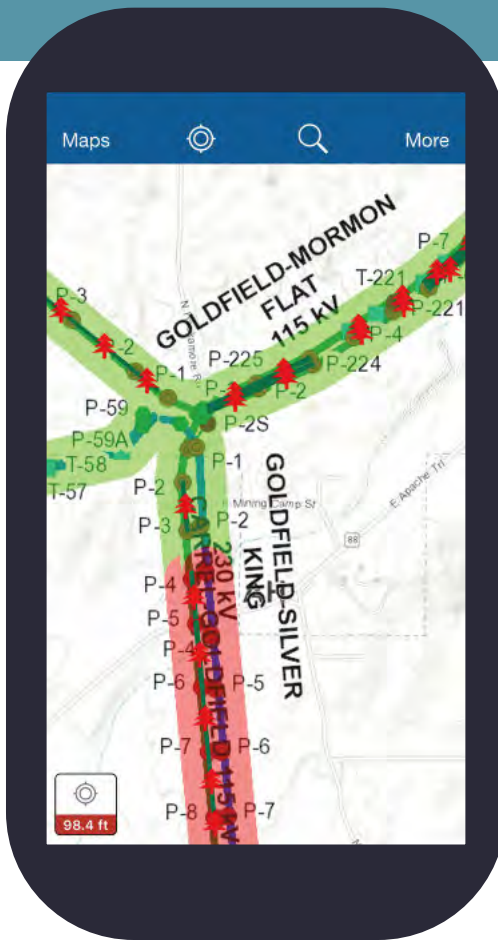
Introducing Arbor II

Arbor II was created as a way for the VM team to catch up to and eradicate the consistent distribution lag. Using our in-house development team, we successfully completed the Arbor II work management application in 2016. In keeping with our current work cycles and processes, SRP identifies a specific region of our service territory requiring VM work. This area is mapped out in Arbor II and released to our third party VM consultant, ACRT, to assess numerous aspects of the area, make tree prescriptions, and input all data into Arbor II.

ACRT pre-planners are equipped with a pictorial representation of our overhead 12kV and 69kV distribution lines. As vegetation is inspected along rights-of-way and in customer neighborhoods, trees are marked, quantities and species are identified, potentially aggressive dogs or homeowners are indicated, and dates of when a neighborhood or lot was entered are collected. Some information is captured by ACRT personnel in the field while other data, such as dates and line voltage, are captured automatically by the tool.

This new process has significantly increased and enhanced our overall productivity and the accuracy of our information. We are now able to capture data remotely and view it immediately using WiFi and cellular data sync.

Once the assessment of the mapped region is completed, the required tree prescriptions and any other vegetation-



SRP Arbor IIT - 115 and 230 kV - green shading is the ROW and red shading indicates a sensitive area where only hand cutting is allowed.

related work are released to tree crews in their respective layer within Arbor II. Work is identified as lift (L) or manual (M), so the type of work crew needed can be viewed and dispatched up front.

As an aside, the collaborative efforts between our pre-planners and tree crews have paid dividends. Thanks to a system of benchmarking, prescription testing, and comparison, both parties jointly identified the best path forward toward achieving SRP VM goals and are on the same page at all times. An immediate result of this collaboration is efficient completion of work for each region.

Long-Term Benefits of Arbor II

Arbor II brought many immediate and post-implementation benefits, such as faster data capture and cataloging, better visibility into the vegetation and customers throughout our service territory, better decision-making via data, and increased productivity due to collaboration between our consultants

and work crews. These were a boon to our operations, but the true value rests in what Arbor II has allowed us to accomplish with time.

Simply by launching Arbor II and eliminating the need to map out the different areas on our system that require vegetation work and customer notifications, we were able to realize a quantifiable savings of five percent in a single year. Another long-term benefit with a significant impact on our bottom line rests in the customer satisfaction realm. There are two components to this, the first being the launch of Arbor II and the second being an internal decision to transition to a 100 percent customer notification model.

Prior to the development of Arbor II, work required on customer streets and alleys was performed without necessarily informing residents. This was not a sustainable model, as it led to complaints and pressure on our Consumer Affairs Ombudsman Office. With the launch of Arbor II and the decision to notify all customers near where our teams would be working, customer complaints have dropped significantly. All customers are now notified of work to be performed in advance, and little intervention is needed from the Ombudsman Office.

Another benefit tied to the ease of data capture is the manner in which different lines were being worked on. Prior to Arbor II, SRP worked 12kV and 69kV lines in

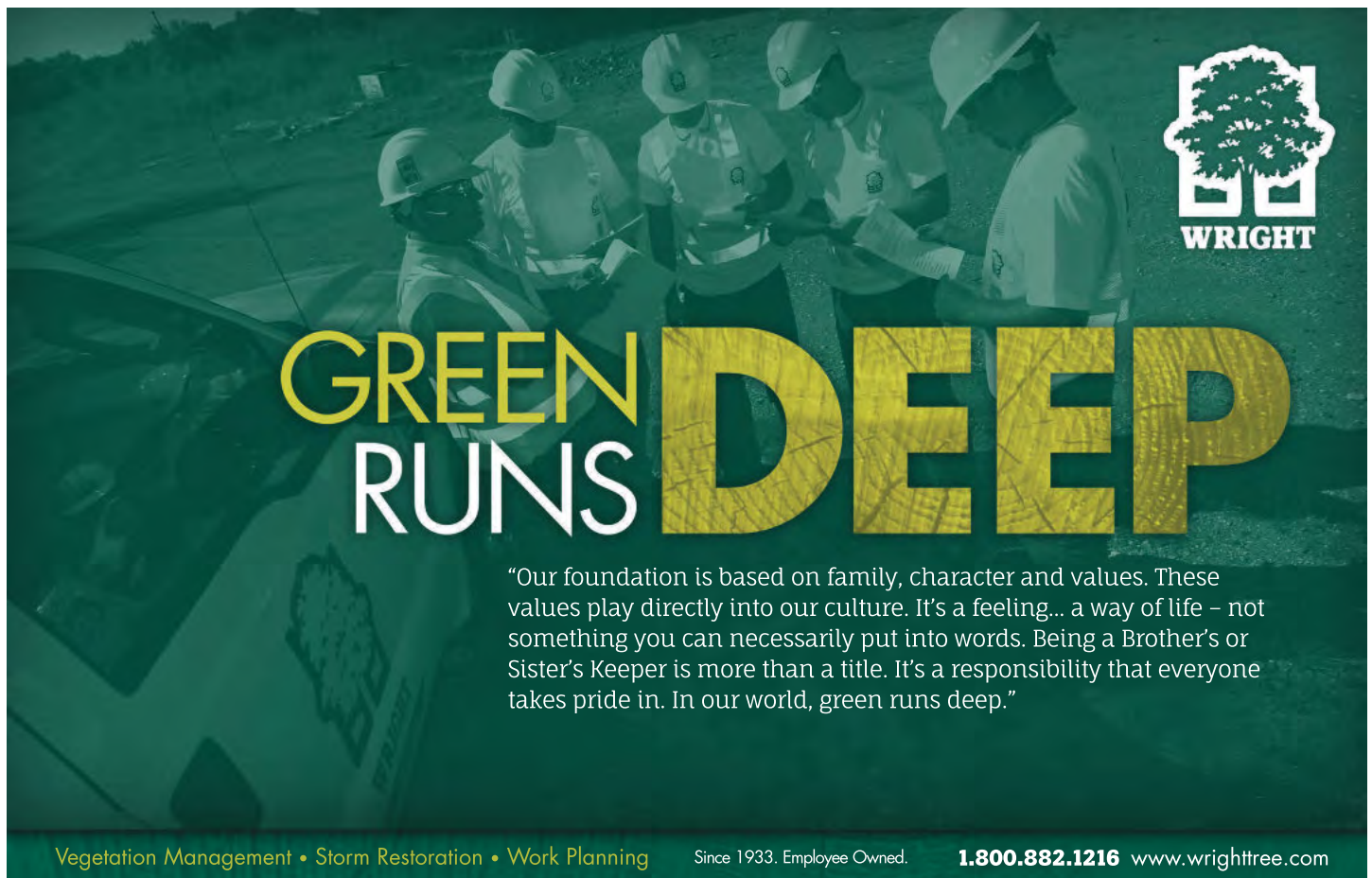
separate cycles, even though 12kV lines are often underbuilt below 69kV lines. Crews would pass through the same areas twice—treating the two voltages separately as each having a separate budget tied to them. The same was being done for higher voltage transmission lines. This is no longer the case. Now, we are working lines at the same time and all year long, so as not to end up months behind on cycles that were already short in duration. As a result, SRP is tracking ahead of schedule for both distribution and transmission lines at the midyear mark for the first time. While SRP is at midyear, our work isn't standing still at 50 percent complete. In fact, we have completed 84 percent of our transmission work for the year, with the remainder slated for early Q1 of 2019. Completing our two-year distribution cycle on time will afford an additional savings of nearly 25 percent by shaving six months of operational labor from our cycle expenditures.

The Future of Arbor II

While Arbor II has been up and running for nearly two years, the platform won't stop with distribution and low-voltage transmission. Work is already underway on Arbor II-T—a transmission-specific version of Arbor II focusing on 115kV, 230kV, and 500kV transmission lines.

Beyond that, enhanced reporting features are being developed to indicate lead time. This past year, weekly production metrics were put in place for tree crews and pre-planners. Rather than having crews focus on completing geographical regions as their production targets, SRP is now asking for crews to complete unit-based, weekly production targets for trees and brush pruning and removal. To ensure crews are able to fulfill that goal, ACRT pre-planners must identify sufficient required work in advance of the tree crews completing the required VM. This has led to a lag-time metric of 8-10 weeks between work identification and completion. We have achieved this goal in some areas, while others are closing in. Once realized system wide, a system of robocalls and other advanced customer notifications can be implemented as an additional touchpoint for our customers.

Additional plans are in the works, but for now, our focus is on fine-tuning and further developing Arbor II and Arbor II-T to continue our goal of improving operational efficiency, lowering tree-related outages (currently two percent of all outages at SRP), and improving our service to our valued customers throughout our service territory.




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A Layered Look at Land Management—Technology Offers a Clear View

*Opinion Editorial by Chris Kelly,
CEO, Clearion*

Back in the “olden days” (i.e., the 1960s and ‘70s), when people proudly displayed sets of encyclopedias on their shelves, curious young students would spend hours flipping through the pages of information. Most interesting were the layers of transparent pages that combined to reveal different views of the human body—the outer skin, tissues, muscles, organs, and bones—each page adding a level of detail and specificity. The printed tomes are a thing of the past, but the concept of those layered pages is as relevant as ever in the digital world, and utility vegetation management (UVM) is no exception.

Today, vegetation managers and crews at major utility companies and other agencies can use this powerful, digital, layered approach to give them an unparalleled level of information and allow them to control the way their assets and lands are managed.

In the past few years, the team at Clearion has been working with utility partners on a number of user-friendly technical solutions to layer readily available, third-party data across the vast data sets in their geographic information systems (GIS). This data can reveal targeted views at the touch of a screen rather than the flip of a page—and we’re happy to share some key examples to kick off the New Year.

Property-Level Insights and Location-Based Natural Hazards

How many of you have ever received a call that your VM crews “butchered” a property owner’s 100-year-old family heirloom trees?

In today’s world, where customer satisfaction and crew soft skills are increasingly more important, it is critical to access granular property information prior to engaging with customers and accessing properties. These insights help prevent avoidable disputes with valued customers.

Enter CoreLogic. For many of you, CoreLogic is already fairly well known. Utilities have partnered with CoreLogic for years, using their parcel-level information for infrastructure planning, engineering, emergency preparedness, and more. Yet, for nearly a decade, VM has become an increased area of focus for CoreLogic and its utility customers due to the depth, accuracy, and currency of their property data.

In addition to key geospatial information, such as current property owner and contact information, CoreLogic offers acreage, valuation, how the properties is viewed (e.g., residence, farm, warehouse, commercial, restaurant), land use, water sources, and more. All of this is tied together by property boundaries or lots. CoreLogic also offers nine natural hazard data sets (i.e., flooding, storm surge, hurricane winds, wildfire, earthquakes, hail, tornados, straight-line winds, and sinkholes) to heighten decision making.

When this data is overlaid with the utility infrastructure, VM teams have the right information at their fingertips to best plan and manage customers on a property-by-property basis.

Did a prior crew have a negative interaction with a homeowner or an aggressive dog? With parcel-level layered information, current crews would know if the property has changed owners since the last interaction or to be on high alert if the contentious homeowner remains.

As any utility that has one or more full-time employees who focus on property-level data can tell you, keeping it up-to-date can be a time-consuming and expensive ordeal. In some utilities, GIS professionals spend a lot of time hunting down data which may not be current. Instead of working on vital projects, they are up to their ears in cleansing and triaging data instead of simply accessing and consuming third-party

data that is current (i.e., updated on a quarterly basis), accurate, and readily usable.

Sensitive/Specialty Crops and Beehive Layers

How many of you have ever received a call that your VM crews sprayed downwind of an apiary and killed their bees? Or harmed their organic crops?

This January, *CropLife* magazine named the FieldCheck app, from FieldWatch, one of the “15 Best New Agriculture Apps for 2019.” This app allows pesticide applicators to locate specialty crop and beehive locations easily from their mobile device or tablet by providing access to the DriftWatch Specialty Crop and BeeCheck Apiary Registry data. Users in the field simply click on the pins to see the detailed contact and location information they need. FieldWatch registries are free and voluntary for crop producers, beekeepers, and pesticide applicators to utilize and can be layered into any of Clearion’s applications.

These tools were originally developed by a team at Purdue for the agriculture industry, but now serve many non-agriculture industries, including right-of-way (ROW) stewards, vegetation managers, mosquito sprayers, and state departments of transportation. At this time, the data includes specific fields for 46 chemical-sensitive crops including those found at vineyards, orchards, fish hatcheries, organic corn and tomato farms, apiaries, and more.

Importantly, the data is crowd-sourced with significant growth in the last few years. Picture the app “Waze” for growers of sensitive and specialty crops. Users drop pins to identify their sites and an easy-to-use drawing tool enables them to draw polygons around their sites. The tool currently has 21 states on board with more states and maps coming online in 2019.



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When scheduling utility spray work, planners may note pins on the map. By clicking to the next layer, they can zoom in to find further information, such as contact information and type of crop (e.g., conventional or organic). This enables planners or users in the field to contact the owner and ask, "When is a good time to spray?" Beekeepers can close their hives and organic farmers may opt-out of spraying. Imagine all this crucial operational information at the fingertips of managers and work planners at every phase of the work process. This allows customer notification to become more collaborative, decreases customer complaints, and heightens satisfaction.

Right Tree, Right Place with LiDAR

As we all know, when fewer trees need pruning, utilities can deliver their service more reliably, at a lower cost, with fewer VM safety concerns, and less customer hassles.

Enter "right tree, right place" or RTRP.

With LiDAR tree detection and species identification, you can identify and mark RTRP trees in your ROW that you will not have to maintain for at least three years. When effective at the span level, you can eliminate RTRP spans from your maintenance cycle—with biannual checks to ensure accuracy. With this layer of information available to VM planning teams and crews, they just need to mark and update any new information on trees/spans for immediate or future action. This includes logging tree growth regulator locations, which hold for a three-year cycle.

Layered Information for a Comprehensive View

More data equips decision-makers to make better decisions. What's even better is when all teams are collaborating, sharing, and modifying the same information in a single, layered

view as opposed to compiling information from multiple data sources.

If you are one of those utilities who is utilizing a robust GIS system, but still find yourselves pushing a lot of paper or working from disparate systems, this may be the year when you commit to saving time, money, and resources by moving beyond the old encyclopedic way of working and fully embracing the digital space.

At any given moment, a layered approach to data management can offer a clear view of all information that is available and needed in order to plan the work, notify property owners for permissions, execute and audit the work, and issue reports in real time.

In 2019, let's commit to using all the tools and available data to know how to be good stewards—and be better, smarter, and more customer-centric. Your team will thank you.

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How a new device will dramatically reduce tree-related outages, fires, and accidents in the very near future.

Aware Devices for Monitoring as a Service for Built Environment and Infrastructure

By Stephen Cieslewicz, CRO, and Tero Heinonen, CEO, Aware

It would probably be a safe bet that the average citizen is much more susceptible to tree growth or trees falling into an overhead powerline than a homeowner who is also a utility arborist by training and vocation. As a population, members of the UAA are less likely to have a tree-related outage, fire, or accident result from their own tree. One would further expect that, as utility arborists, we would not plant trees genetically pre-disposed to grow to 100 feet directly underneath powerlines. That should all make intuitive sense, right?

As utility arborists, we routinely inspect our own landscaping and ask ourselves the following questions:

- Are our trees growing near the high-voltage lines?
- Could they become a climbing hazard due to their proximity to

- the lines?
- Are they overhanging or leaning towards the electric facilities?
- Are they pressing heavy on our service drop or secondary lines?
- Are they displaying any new evidence of decline or disease?

As a utility arborist, it could and should be embarrassing to have an avoidable outage caused by one of our own trees. It's our job to pre-identify those conditions and prevent those issues from happening. If we do encounter an issue, we would likely get it fixed *before* it causes a problem.

So, if we know how to identify and prevent most of the tree-related outages, fires, and accidents, why can't we do that for all the trees we manage? Why are tree-related outages still the number one cause of

the lights going out? Why are we experiencing more tree and power line-related fires? And why is electrocution still a major killer in the green industry?

While the most common answer to those questions is that we don't have the money or resources (at least based on industry benchmarking), we would offer up a different twist on the actual problem. We believe that the more often tree and power line inspections are done, the less likely we will have problems. Let's unpack that statement.

Utility arborists probably examine their own trees every day as they walk by them. However, they likely do not pay much attention to their neighbors' apart from once or twice during a typical three- to seven-year distribution cycle (note: NERC trees



are inspected once a year by mandate and California utilities do these inspections at least once a year for every foot of their transmission and distribution lines).

Lack of money and resources aside, how much of an impact on reliability and public safety could you make if you could inspect everyone's trees every day?

That one critical question is what lead to the development of Aware devices for Monitoring-as-a-Service for Built Environment and Infrastructure.

An Aware network is a scalable end-to-end sensor system for infrastructure monitoring. It incorporates 3D imaging, secure mesh networking, cloud processing, and machine learning to enable real-time situational awareness across an entire electric system. In layman's terms, that means we can actually inspect every tree condition every day.

Aware devices are mounted on poles, towers, or others structures and they provide daily information that will be effective in preventing a good portion of our tree-related outages, fires, and accidents. One mounted device can provide real-time imagery, take a daily LiDAR scan, monitor real-time wind speed and wind

direction, and of course, reliably measure ambient temperature and conditions. When these proprietary devices are connected via a secure mesh network, the accumulated data is processed and the utility is "automatically" notified of changing or changed conditions. The utility can then remotely view the conditions and, when necessary, send appropriate resources to fix the threats before they manifest into actual accidents.

While only a short list of actual capabilities, here is what they can do:

- Aware sensors automatically measure actual distances between vegetation and powerlines, and when a pre-determined clearance is breached, the utility is notified.
- Aware sensors can detect new leans of trees adjacent to power lines, and when a pre-determined tolerance is violated, the utility is automatically notified.
- Aware sensors can detect newly planted trees adjacent to power lines, and automatically notify the utility.
- Aware sensors can continually track wind speeds and wind directions and then automatically notify the utility when a breach of tolerances is imminent. (For example, we know, based on the Beaufort Scale, that trees start to break apart at 39 miles per hour.)
- Aware sensors can monitor and alert the utility of a change in localized fire conditions. (For example, high winds, low humidity, and high temperatures have been contributors to many of the major tree- and power line-related fires in the west.)

Aware sensors track real-time environmental conditions on a daily basis and then utilize a robust back-end, cloud-based processing system to perform automatic change detection to identify irregularities. These anomalies could include newly broken overhanging limbs, trees starting to lean towards the lines, fast growing trees encroaching into established clearances, and of course,

newly planted trees under or near the electric facilities.

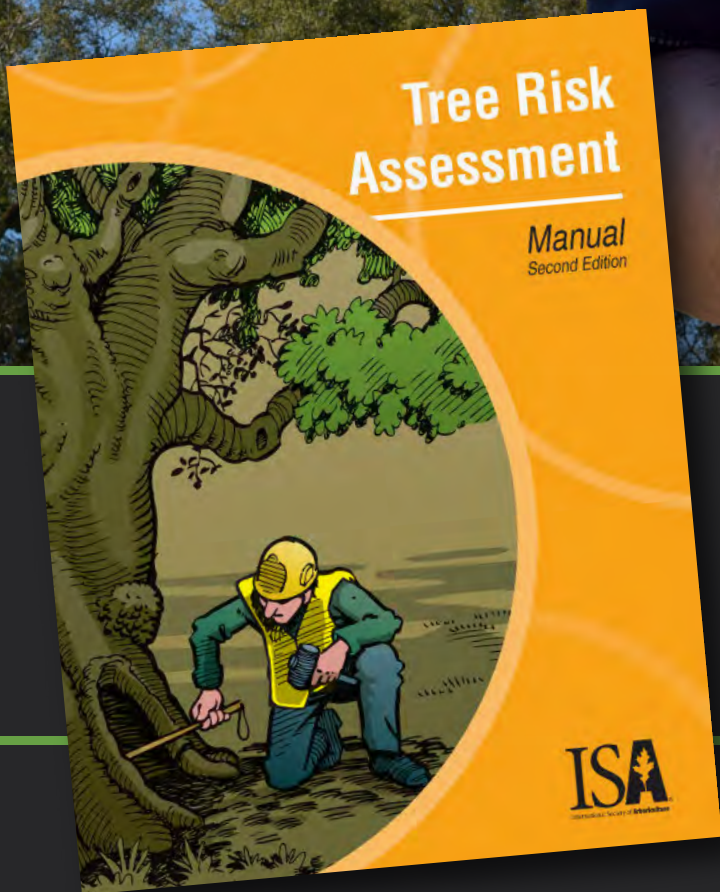
A couple other features include:

- The devices can be powered by a solar panel or hard-wired like a typical street light.
- They have back-up battery power that will be functional for five days without power, and they also work in areas that do not have reliable cellular networks.

This is all possible because Aware was founded by experienced and successful technologists who are experts in remote sensing, UAV/UAS, and in the development of cost-effective miniaturized sensors for autonomous vehicles. Aware founders also have an extensive background in utility vegetation management (UVM) and in critical infrastructure protection.

Other potential UVM programs probably come to mind too. Aware provides the ability to accurately measure distances between vegetation and powerlines along a complete electric system, which means it could be used to identify and quantify all of the actual UVM work that needs to be done in the field—remotely. That also means it could quantify and audit completed work remotely and automatically. If Aware can provide remote visual access to real-time conditions on your system, couldn't it also significantly reduce the time it takes to restore power after a major event? For example, Aware can provide real time visual access to what is on the ground, or still up in the air.

We should also be clear on what Aware devices *will not* do. Aware does not replace the arborist experts in assessing a specific situation. Instead, it provides an alarm to look at the situation at the right time, and the tools and information to analyze the matter quickly, efficiently and, in many cases, entirely remotely. This will better inform what work needs to be done and where, but someone still has to notify customers and agencies and, of course, fix the



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problem. Aware will give us a better ability to schedule and complete our UVM work in record time. That may be important to those interested in SAIDI.

So, how much will it cost? That's a question that is currently being evaluated with the pilot projects. Right now, we can say it will be a lot less expensive than simply increasing foot, LiDAR, or aerial patrols to a more frequent basis during the year. We recognize this wouldn't work if we had to pay the cost of performing daily inspections on our lines. It has to be cost effective in relation to its value. Current estimates suggest the device and installation cost will be similar to installing a new street light, with about the same installation costs.

This is not a "pie-in-the-sky" proposition. These devices are currently being evaluated and piloted at two major utility companies in the West. We expect to complete our pilots this year and be fully prepared to scale and deploy circuit- and grid-wide solutions for other utilities beginning in 2020.

Given the implications of this new technology, we will be updating the UVM community as we progress through our pilots. Until then, feel free to contact us or track our progress at www.aware.us.



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Acquiring and Deploying Software Technology Solutions Using a Project Management Framework *By Tim Rowell, IT Program Manager, ArborMetrics Solutions, Inc.*

Deploying software to assist in your vegetation management (VM) operations can be a challenging endeavor, but there are a few tools you can use from the project management world that will allow you to ensure a quality end product delivered on time, in budget, and within scope.

Project management is a science and discipline developed in the 1950s to codify the process of managing projects across all disciplines. It can be defined as the application of processes, methods, knowledge, skills, and experience to achieve project objectives (association for project management).

You may have staff within your organization that help manage software acquisition and deployment projects; however, you—as the primary stakeholder—have a responsibility to understand and guide their efforts to achieve the best outcome. You are the subject matter expert on the processes and operational goals you would like the software to address, and the more input you have in the process, the better the outcome will be.

The Software Acquisition and Deployment Project

While every organization follows different steps and may use differing terminology, in general, a software acquisition and deployment project will have the following steps:

STEP 1 Needs Assessment and Joint Application Design (JAD)

Ideally, this takes place before acquiring any software. This is the time to sit down and map out the processes and operations you would like the software to address in detail, and be sure to include all the operational roles that will have a stake in using the software or its outputs. This can include planning staff, line clearance contractors, foresters, and management. These meetings can be conducted in face-to-face meetings (ideal), or via electronic communication, like video web conference. What is important is that all stakeholders have an opportunity to provide input on what they would like to see out of the proposed deployment. Two primary documents can be created from a thorough needs assessment:

1. **Functional Requirements Document (FRD).** A good FRD will list in detail the things you want the software to accomplish, and require potential vendors to list exceptions to meeting any of the requirements. The more

Figure 1: A completed FRD can be as simple as a list of expected program functionality.

Requirement Number	Description	Notes
WORK PLANNING REQUIREMENTS		
Functional Requirement 1.1	Ability to collect tree removal agreements in approved format	Provide vendor with current paper tree removal agreement
Functional Requirement 1.2	Ability to modify planning work types	Provide vendor with XLS of current work types
TREE CREW REQUIREMENTS		
Functional Requirement 2.1	Ability to enter hours worked and crew complement at each work location	
Functional Requirement 2.2	Routing of crew from current work location to next work location	
MANAGEMENT CONSOLE		
Functional Requirement 3.1	Ability to create reports on circuit status	
Functional Requirement 3.2	Map-based views depicting circuit work completion status	Provide GIS infrastructure data

specific you can be in these requirements, the better. Be sure to include any requirements around technical support, hardware, application documentation, and any application outputs (printed or electronic) like removal forms, work manifests, maps, etc. (Figure 1).

Applying these concepts from project management can help to ensure the software acquisition and deployment tasks run as smoothly as possible and result in a focused and quality product that meet all organizational requirements, and are deployed in budget, in scope, and on time.

Don't worry about this list being too long. The more detailed you are, the fewer questions about desired functionality you are likely to receive from the vendor, the fewer changes down the road in the deployment phase, and the more likely you will be to get the quality-end product you are seeking.

2. **Project Scope Document.** "Scope" refers to a projects (or products) boundaries, what will be completed (and maybe what won't be completed), what the project or product will deliver, what happens when the inevitable changes occur, project deadlines—in short, everything required to ensure a project comes in on time, in budget, with the appropriate deliverables.

If you have project managers on staff, the creation of a comprehensive scope document will most likely be their task to complete. Again though, you are the stakeholder with the most "skin in the game," and the more information you can provide regarding desired functioning, operational deadlines, budgetary constraints, etc., the better outcome you can expect.

This document provides your input into the completed project scope document. This is vital to insure that your interests, as a primary project stakeholder, are addressed.

STEP 2 Request for Proposals (RFP)

Creating the RFP will likely fall to someone in your procurement department, but you will need to provide the critical information about what organizational needs you have determined are related to the software functioning. If you conducted a thorough needs assessment, you have this information ready to go in the form of your FRD and scope input documents.

(Continued on page 32)

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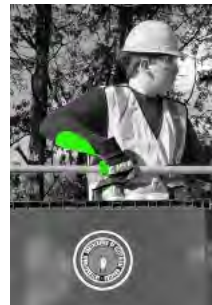
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It probably goes without saying, but you need to be an integral part of the RFP review process. One of your most critical tasks will be to review how closely each RFP submittal meets the functional requirements you created in your needs assessment.

STEP 3 Software or Vendor Assessment

Part of the decision-making process should be an opportunity for select software vendors to demonstrate software functioning in person or via a web meeting. This is the time to ask any questions you may have had after the RFP review, and to get a feel not only for the software, but the vendor themselves. Some aspects to consider during demos and vendor assessments from the project management level:

- How well does the software meet your desired functional requirements? Have your requirements document in front of you, and check off each requirement as it is addressed. Realize as well that some customization and configuration may be necessary by the vendor to meet all of your requirements, so you can ask how a particular requirement will be met in the completed software.
- How will changes be handled? In a software deployment project, a change can be defined as any desired functionality outside of the currently defined project or product scope. This may be addressed in your RFP already, but it's never too early to start the discussion about how the inevitable change requests will be handled, and you can prepare for a potential vendor's ability to handle these changes by directly asking the question.
- Change often comes with additional cost or impacts to project timeline. We'll talk a little more about change management in the next section.

STEP 4 Managing the Software Deployment

Once you have awarded the contract to a vendor, the testing and deployment phase of the project begins. There are a few tools here in the project management toolbox that can help you in this testing and deployment period. If you have a comprehensive project scope document, these concepts will already be defined and in place, but it's a good idea for you to be familiar with the terms and your role in guiding the project to a successful completion.

In general, a software deployment will go through one or more rounds of on-site testing in your operational environment in order to work out any issues with the software or integrations with your current systems. While not in the scope of this document, it is helpful to understand and discuss with your vendor the potential interruptions to your ongoing operations and contingency plans for minimizing impact to daily operations during this period.

The following are steps you can look for to assist in the testing and deployment process:

1. **Project milestones.** Project milestones can give you pausing places within testing and deployment to take stock of project metrics. How is the project proceeding along the established timeline? Is the project still on track to meet budget goals? Some of the established milestones in a software deployment project can include: commencement of a testing phase, delivery of a release version of software, and a scheduled project progress review.
2. **Change Tracking.** The only sure thing about almost any project is that changes will occur, and many of them will come in the testing phases, as each end-user role puts the software through its paces. These changes may take the form of additional requirements from end-users, corrections to program functioning that may have been misunderstood by the vendor or your organization, etc. It is important to designate someone to compile all change requests coming from the end-users, and submit them to the change request process. Your scope document will have defined the process for change management, and it will most likely take the form of a formal request from you to have a change considered and accepted or rejected. It is critical to understand the impact of any approved changes on timeline and budget, and these impacts should be quantified in the change request process.
3. **Deliverables.** During testing and deployment, you will be provided with project deliverables. These may be testing instances of the software, draft version of documentation, etc. It is important to have defined "acceptance criteria" for deliverables—most critically, the production release. Ideally, acceptance criteria for the production release would be that it meets all of the criteria in your functional requirements document and project scope, along with any approved changes at an acceptable level of quality, defined as the degree to which a product complies with the requirements.
4. **Project Closeout.** Project closeout is the process of finalizing all project activities, and is an often overlooked step in a project. During this project phase, you will want review your FRD to ensure all requirements have been met to your satisfaction. You may also want to review how the project went, and derive any lessons learned. This closeout also serves to create a firm ending to the project for both your organization and the vendor, and prevents those "never-ending" projects from occurring.

Applying these concepts from project management can help to ensure the software acquisition and deployment tasks run as smoothly as possible and result in a focused and quality product that meet all organizational requirements, and are deployed in budget, in scope, and on time.

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The Value of LiDAR Acquired by Drone Versus Conventional Methods

By Deborah Sheeler, Production Manager of GIS services, Davey Resource Group, Inc. and Thomas Barracca, U.S. Business Development Manager, ULC Robotics

Aerial mapping and acquiring remotely sensed data such as light detection and ranging (LiDAR) has become much more common in today's utility vegetation management (UVM) and environmental consulting practices. There are several key benefits for using small unmanned aerial vehicles (UAV), or drones, as opposed to conventional methods such as manned aerial acquisitions:

- Decreased cost. Unmanned aircraft can be deployed rapidly and gather data in a matter of hours.
- Faster data delivery. Current data acquired can be processed and delivered in a matter of days.
- Improved safety. Small UAVs supplement the ground, vehicle, and manned aerials inspections while removing workers from risks of hazardous terrain and other challenging environments.

The Challenge

Energy companies face many realities for system disruptions, including equipment failures, vegetation, weather, and wildlife as the most common examples. One of the leading causes of power outages are due to vegetation encroachment, wherein vegetation comes into contact with electric conductors. Traditionally, manned aerial acquisitions have been used to acquire LiDAR data system wide to accurately map utility features and the surrounding vegetation within the utility corridors. Although manned acquisitions are great for capturing system-wide information for large regions, the sheer amount of data takes weeks or months to schedule, weeks to acquire, months to process, and becomes outdated in certain locations by the time the data is delivered.

Since ground conditions require constant monitoring when it comes to vegetation health and growth, as well as weather- and human-related disturbances, manned acquisition cannot account for all environmental changes within the timeframe of each acquisition. The use of a drone, on the other hand, provides a wealth of benefits to energy companies. It is more cost efficient to deploy,

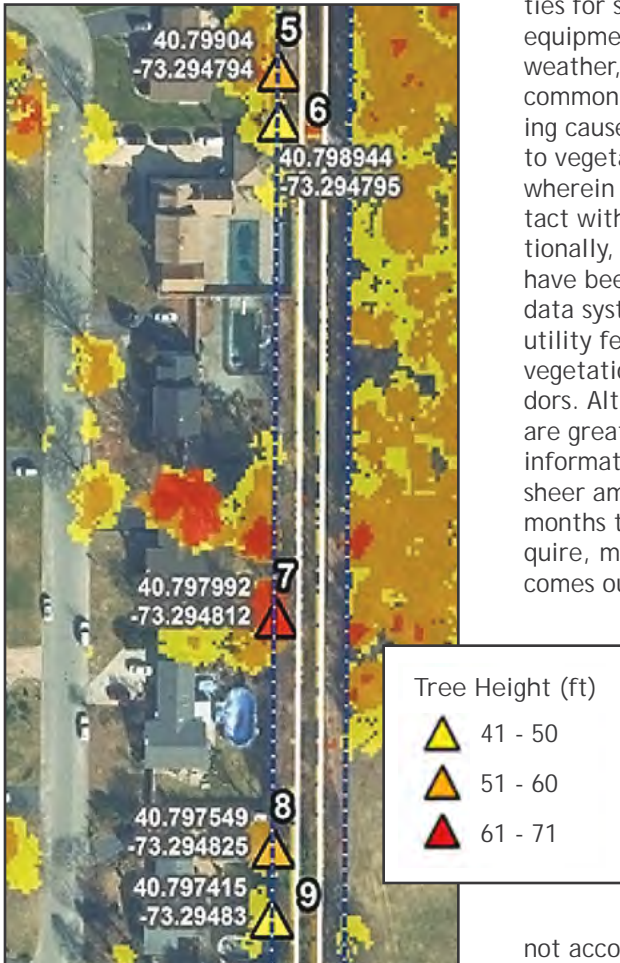
In an industry where mitigating risks is a top priority, remote sensing technology not only provides an important analysis tool, but can help lead the way to solving challenging problems.

acquire, process, and deliver data within hours/days in comparison to the conventional methods of weeks/months. It also supplements traditional ground inspections to help decrease inspection costs by determining areas that are clear and do not require foot patrols, improve worker safety due to avoidance of challenging terrain and heights, and enhance system reliability with the ability to quickly deploy a drone to capture current ground conditions.

The Solution

Davey Resource Group, Inc. and ULC Robotics had an opportunity to partner on a pilot project for a utility company in the state of New York. Using LiDAR and high-resolution camera sensors mounted on a custom-developed small UAV platform, ULC Robotics conducted an aerial inspection on multiple sections of a utility right-of-way (ROW) approximately 2.5 miles, acquiring remotely sensed datasets. FAA-Certified commercial drone pilots captured LiDAR point cloud data, current high-resolution images, and ground control points (GCP) with multiple flights along both sides of the corridor and a substation at a specified elevation and distance. All LiDAR and imagery data captured were provided to Davey Resource Group, Inc. for processing and analysis.

Derived from the point cloud data, vegetation elevations were transformed



Sample result of tree canopy layer classified by height from processed LiDAR data and possible infraction locations identified within a specified buffer distance of the conductors.

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into raster grids through geoprocessing operations by a certified geospatial analyst. Elevation models were generated from the processed LiDAR data to associate heights to the current ground features. Further geospatial, imagery analysis, and automated feature extraction processes were conducted to generate the final vegetation layer that determines possible infraction locations where canopy encroachment was identified to be within a specified buffer distance of the conductors. Supplemental three-inch resolution imagery was also utilized as a visual reference for the quality assurance and quality control (QA/QC) process of the vegetation layer.

Maps were generated to provide a visual representation of the data and also aided in routing to specific locations for further ground inspections

to be completed (Figure 1). These data were classified by height and all final deliverables were provided to the client in a GIS format compatible with their existing software program, along with a report describing the results of the detailed findings.

The Results

Key results from this pilot project highlighted a more cost-effective approach when utilizing a small UAV to capture current LiDAR and high-resolution imagery to monitor utility ROWs in a much shorter time frame. Data was acquired in a few hours, and can be processed and delivered within a few days when automated scripts and processes are generated. This data acquisition was focused on improving operational efficiencies, safety, and reliability. The results from this assessment provided important information using an innovative

solution that allows managers to make informed decisions quickly for budgeting and prioritizing line inspections using the most current data available. Because land cover is constantly changing due to vegetation growth, weather conditions, and human activities, the ability to quickly deploy a drone is crucial in order to accurately acquire, process, and deliver the most current LiDAR and imagery data while providing a much more cost-effective approach for monitoring change.

Further analysis can be completed by capturing multispectral and hyperspectral imagery to determine vegetation health and species identification. In an industry where mitigating risks is a top priority, remote sensing technology not only provides an important analysis tool, but can help lead the way to solving challenging problems.

Best Practices for Selecting and Implementing Vegetation Technology Solutions

By Scott Rogers, Senior Vice President, Technology Integration, Environmental Consultants

In the past few years, a number of utilities have implemented various technology solutions to assist with their vegetation management (VM) planning, execution, and reporting. The value that these software applications have brought has convinced many other utilities that are currently considering similar projects.

The implementation of any new technology requires careful planning and thought. Technology can bring enormous benefits to the organization, but the intended benefits are minimized if the technology is implemented without consideration of how the applications will be incorporated and supported by the business. Likewise, great technology with a well-designed business process will only produce less-than-adequate results when it is poorly adopted throughout the organization.

Therefore, when organizing technology implementation, it's important to consider all aspects of the project from start to finish. To do this, many utilities—and the consultants that support them—have adopted implementation methodologies to help guide the project to a successful completion. I've found this four-step process to be effective:

1. Understand your current processes.
2. Design your future processes with the impact of technology in mind.
3. Choose the right solution
4. Implement the solution.

Obviously, this is a simplified model and there are a number of

subcomponents to each step. Refer to Figure 1 to examine this in more detail.

Understand Your Current Processes

You cannot solve a problem unless you understand what the problem is. This statement definitely applies to technology implementation. When starting a project, it's important to understand your current business process. Areas for consideration include, but are not limited to:

- How will work keep moving through your process?
- What is the volume of work to be completed?
- Who will be responsible for each process step?
- What will be the inputs for each step and what is the expected output?
- How long will it take to complete each step?
- What data is needed to support your process and what is the source of that data?
- How often will that data updated?

In general, prioritize how work will flow, the volume of work in the flow, and how long it takes in the projected timeline. Each of these considerations will be helpful in understanding where potential bottlenecks might arise. Also, analyzing these factors can help spot where process gaps or weaknesses need to be addressed. Finally, this kind of foresight can assist in establishing a baseline of the cost, in terms of time and dollars, which can then be used as a foundation for the development of both an initial business case and to determine a post-implementation return on investment (ROI).

The determinations for each of these considerations act as inputs into the next project phase, which is designing future processes.

Designing Future Processes

It's important to be aware of your destination before starting a trip. This is equally true for technology implementations. As in the first phase, there are a number of points that must be considered in advance. For example, what are the current, and—if possible—future key business objectives that need to be supported? How will the effectiveness or success of those processes be measured? How long will it take to complete each process step? And, most importantly, how will technology support or improve these processes?

In some cases, there's a tendency to adapt technology to "automate" existing business processes. Unless the current process is functioning at a high level and is designed to meet current and future business needs, merely adding technology will not return maximum benefits. When ready to take advantage of the newly developed business process, make sure you identify key provisions of the technology.

To do this effectively, consider the benefits of the technology that you are installing, including what benefits peers have achieved, how the various technology providers have provided successful solutions, and what the "art of the possible" of the use of the technology is. This doesn't mean that you have to implement every function that a solution provides, but it is

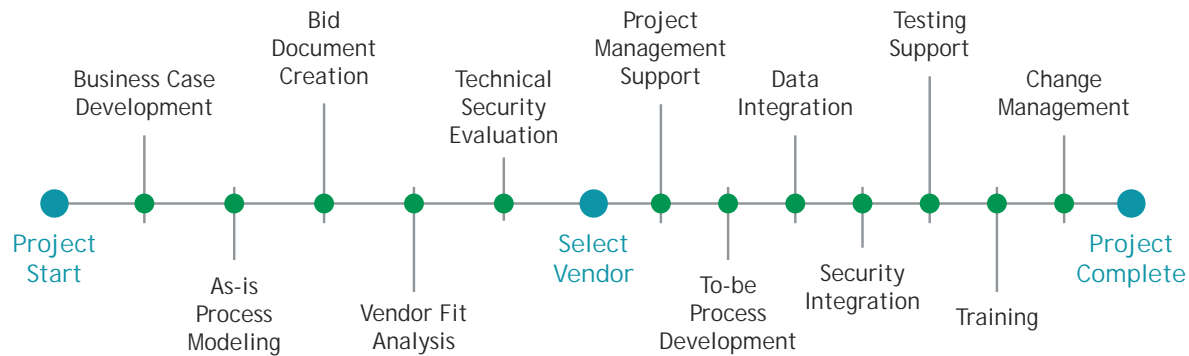


Figure 1 - Lifecycle of a Technology Implementation Project

important to realize what's possible so you can have a full view into the benefits that can be achieved through an optimized implementation of new business processes supported by new technology.

Often, this phase can also include the development of a formal business case and ROI model. By comparing metrics gathered from Phase 1 to metrics from this later phase—in addition to gathering estimates of the cost of the technology solution—a business case can be developed, an implementation budget formulated, and approvals gained.

Once a new process is designed, the next step is to take an in-depth look at the technology solutions.

Choosing the Right Solution

This is the fun part! With the future process in hand, it's now time to find a solution that best fits your business objectives. There are many solutions available and each have their own benefits and drawbacks. Consider each solution and spend time with the provider. Understand what their current application provides, what it does not, what's in the future development roadmap, what functionality others use, and what functionality others want. Understanding how the application is supported and how requests for new functionality

is funneled into future product releases is also key.

Build a relationship with your solution provider. This relationship will be critically important through the implementation phase of the project and for long-term support of the application. The bottom line is that their success AND your success is dependent on your successful implementation of the solution.

To evaluate the solutions effectively, it's often helpful to develop a list of solution requirements. This matrix of requirements can be used to objectively evaluate each solution, which can help lead to the best technical fit.

Consider other requirements, like cyber security, procurement, IT governance, and others. Engage the appropriate stakeholders early in the evaluation process to ensure that any concerns are addressed.

Implement the Solution

The last phase is to finalize the solution. This is where the rubber meets the road. Throughout this phase, focus on those that will use the technology. Incorporate a group of end users into your project team throughout this phase. Gain their input and acceptance early by making sure their voices are heard.

Implement the solution in small increments, aligned with the business process. Ensure each set of functionality considerations are properly tested and that an appropriate training and change management program is instituted. Change management in particular is often the key to a successful implementation. In most cases, users will be transitioning from a largely paper-driven process, depending on their years of experience and familiarity with the process. The implementation of technology is a big modification and can take some adjustment. Address this project risk through the adoption of a formal change management program.

Summary

Implementing technology to support your VM business can provide tremendous benefits to your organization. To achieve the maximum business benefit, it must be done using a thoughtful, methodical process. This four-step process is a methodology that has been successfully used. Pick the methodology that best matches your business needs. Consultants with deep VM domain experience can help ensure a successful business process design, solution selection, and solution implementation to deliver the benefit that you expect.

Southwest Region

By Eric Brown; Special Response by Krassimir Piperkov, Co-founder & COO, Enview

A Special Message from Enview: Industry Leaders Look to Technology to Prevent Wildfires

As record-breaking wildfires rage, utilities and regulators alike are looking to technology to assist with utility vegetation management (UVM) and wildfire prevention. At the 2018 CEATI VM Conference in December, attendees saw first-hand that remote sensing and advanced analytics technologies have reached a tipping point. Utilities can now leverage automated and accurate analytics—at scale. Several major technology players were testing their capabilities and the promise of preventing threats before they become incidents. Many of the established sensor and data collection companies were present: Dielmo 3D, EagleView, Fugro, Geodigital, Harris, Leading Edge Geomatics, Leidos, Quantum Spatial, and Terra Remote.



Krassimir Piperkov



Aware is a new venture offering real-time monitoring for infrastructure by using sensors that utilize 3D imaging, mesh networking, and weather data to provide real-time information on asset health, VM, and wildfire threats. On the data analytics side, Enview demonstrated their recently released artificial intelligence solution to automatically detect encroaching vegetation that threatens power. While experts at the conference agreed that technology can't replace humans, it can transform UVM programs, enable risk-based UVM approach, and ultimately help prevent wildfires.

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