Vegetation Management Best Practices 2021

Reimagine. Replace. Reduce.

AIDASH

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Introduction

Power companies are in business to provide safe, reliable and affordable electric service to their customers 24/7. But this wasn't so easy in 2020, after all. 2020 proved to be one of the most devastating and challenging years in history for power utilities – with disasters and large-scale weather events tearing through utility infrastructure, causing massive outages and impacting resiliency.

Can we do more to improve system reliability and resiliency? As we step into the new year, this is a vital question that needs to be discussed at the boardroom level in every utility company and acted upon urgently.

Weather events and vegetation are the leading contributors to utility outages. Adopting the right technology to fight the right challenges can go a long way in adding value to business continuity plans, improving reliability, and reducing costs.

It is now possible to predict the extent of damage to weather events or disasters or even having complete information of tree height, health, species, growth patterns, and distance from feeders along T&D networks. With all this information at your disposal, it will be easier to make informed decisions by putting risk analysis and business continuity planning in conjunction with an overall efficiency of carrying out operations and maintenance activities all year-round.

This eBook talks about the emerging technologies that bring a revolution in utility O&M activities, particularly vegetation management. Get introduced to the 3Rs – Reimagine, Replace, Reduce - to kick start your Vegetation Management Best Practices in 2021.

Vegetation Management Today

Power utilities have been managing vegetation along power lines for several decades now. There's nothing new in it for them. Naturally, the techniques have been improvised over the years to make the process more effective, efficient, and technologically advanced. But the million-dollar question is - have they yielded results as expected?

Vegetation management is frequently the single largest line item of annual operational budgets, exceeding $100 million annually in most large utilities with distribution line networks spanning thousands of miles and more. The costs may be justified, but can they be reduced?

The Root-Cause Analysis

Understanding the present scenario and identifying the challenges is pertinent to plan intelligently for the future. As a matter of fact, existing vegetation management systems are not being optimized to reduce costs, improve reliability and resilience. Let's understand how:

MANUAL MODES OF DATA COLLECTION

Vegetation management is often a manual process, consisting of manual patrol for inspection of hazard trees, trim decisions, and post-work audits. If we talk about service-level contracts, there are often many repeat work orders along with the same feeders for activities such as trimming, herbicides, asset maintenance, and the like. From data collection to data analysis, everything was being done on an ad-hoc basis.

CYCLICAL AND REPETITIVE APPROACH

Most power utilities find themselves relying on traditional fixed trim cycles, which usually vary between 4 and 8 years. These cyclic and repetitive, fixed trims are essentially an unoptimized method of vegetation management. There are instances where there is excessive maintenance along feeders that have slow vegetation growth and vice versa. The whole system is, therefore, inefficient and unscientific.

LACK OF VISIBILITY AND RISK ANALYSIS

In line with the above point, most power utilities perform vegetation management manually, making it extremely difficult to monitor and inspect vegetation growth along distribution lines spanning thousands of line miles. This impacts risk analysis capabilities, putting reliability at stake. It also implies a lack of predictive capabilities to prevent outages and hazards.

LAGGARD TECH USAGE

When we are stepping into Industry 4.0, which is enabling a transformation of traditional manufacturing and industrial practices combined with the latest smart technology, power utilities are hesitant and late to adopt new and emerging technologies like Artificial Intelligence, Machine Learning, and more.

COSTLY

As mentioned above, Vegetation Management often exceeds $100 million annually in many larger utilities. The lack of visibility concerning urgent situations and hazards, inability to identify the exact point of failure, or even prioritize tasks optimally results in reactive and ad-hoc maintenance that is primarily expensive. Is the money spent being capitalized?

INCREASING LOSSES AND RISKS OF LIABILITIES

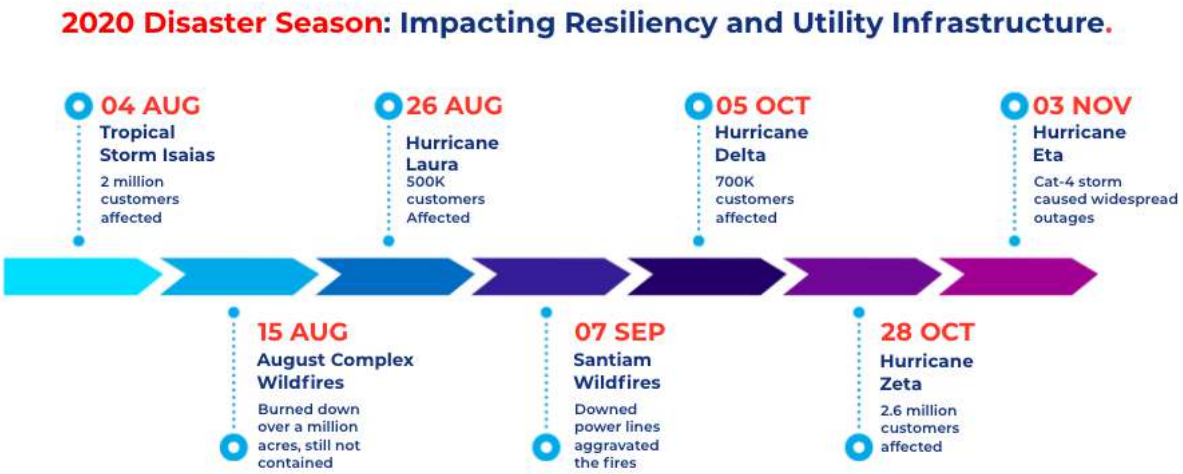
As assets age and are impacted by weather and surroundings, power outages are a significant risk for power utilities. Outages cost an average of about $33 billion per year in the United States alone. In addition to this, increasing scrutiny from regulators, legislators, activists, media, and customers has caused utilities to understand the increasing risks of liabilities.

Identifying these challenges is the first step towards finding solutions to a more efficient vegetation management ecosystem. While vegetation management has not been effective enough, utilities face increased costs, dissatisfied customers, and reputations damaged beyond measure.

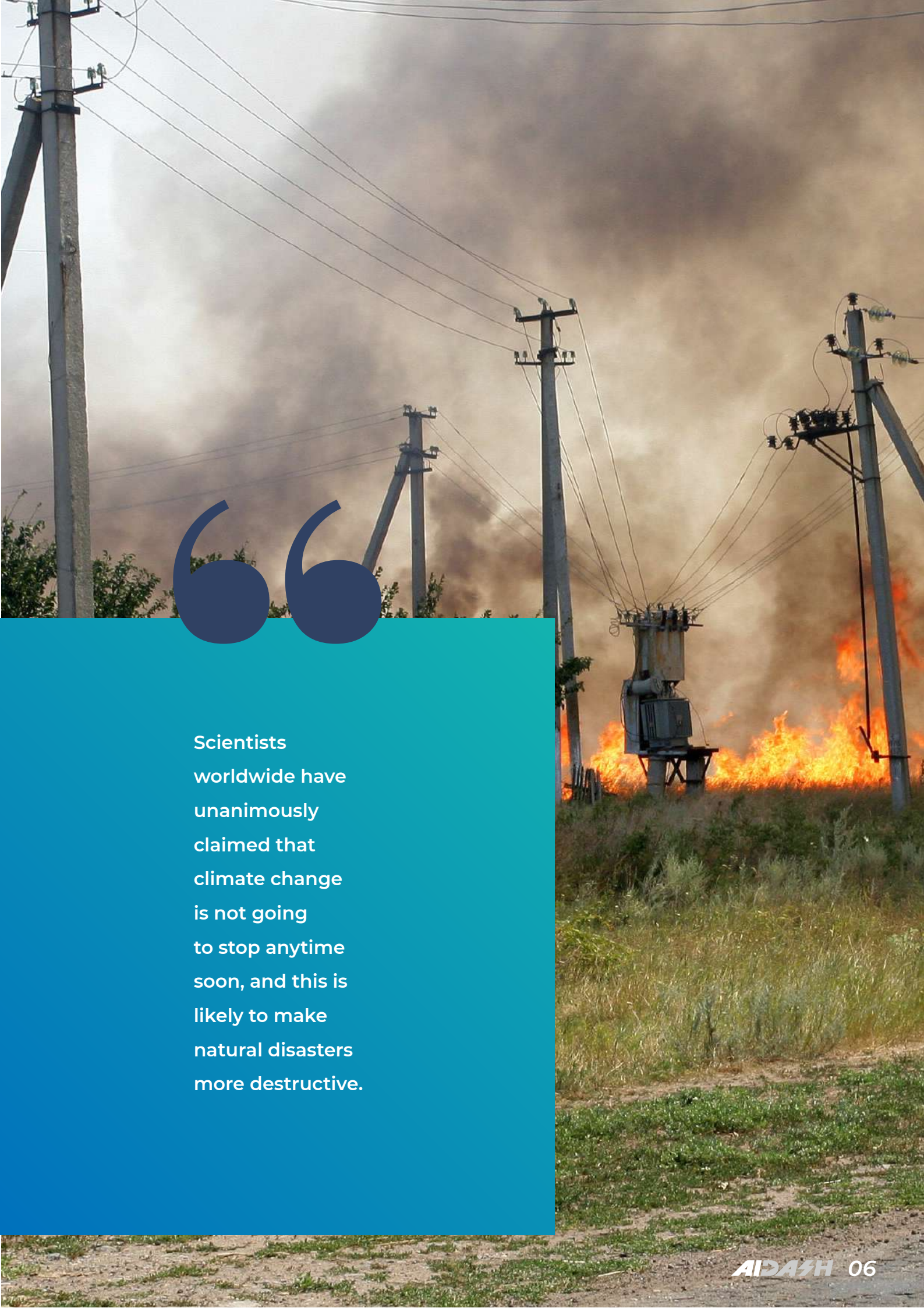
The Worse for Wear: How Utilities Fared in 2020

We felt it would be best to validate that power utilities struggle to deal with risk analysis and business continuity concerning being on top of the vegetation management game.

2020 was indeed the year of destruction and agony beyond COVID-19. Large-scale weather events and disasters tore through several states in the US. Among the many hard-hitting impacts, it is pertinent to note that such disasters have underscored our electricity system infrastructure's vulnerability and raised questions on the way utilities conduct their operations and maintenance - including vegetation management, grid resilience, power restoration, and more.



> **Over the last few years, storms have been particularly unkind to US utilities, causing widespread power outages resulting in customer dissatisfaction, fallen trees, and damages to utility infrastructure, eventually leading to losses worth billions of dollars and innumerable days of restoration work.**



Scientists worldwide have unanimously claimed that climate change is not going to stop anytime soon, and this is likely to make natural disasters more destructive.

Remote Sensing Technology: The Rise of Satellites

Remote sensing is a crucial geospatial technology that helps acquire information about an object or phenomenon without making any form of physical contact, typically using satellites or air-bound devices. Adopting cutting-edge technology like remote sensing to monitor and manage vegetation around power lines will be considered a paradigm shift for power utilities. But, why and how? Let's find out.

Popular Remote Sensing Tools

SATELLITES make remote sensing the most accessible technology globally. Being the most reliable data source worldwide, they have been used in the geospatial space for almost six decades now. They are used widely in environmental monitoring forecast and research, mapping, aircraft monitoring, military intelligence, predicting forest fires, optimizing solar panel energy, and so much more.

AERIAL PHOTOGRAPHY is all about taking photographs from an aircraft or any airborne flying object. In airborne remote sensing, downward or sideward looking sensors are mounted on an airplane to obtain images of the Earth's surface. It is now used for cartography, power line inspection, movie production, surveillance, vegetation, and ocean mapping. Aerial Photography can be conducted in various ways by airplanes, helicopters, unarmed aerial vehicles (UAVs), and other airborne objects.

LiDAR, a portmanteau of light and radar, is used to measure distances by illuminating the target with a laser and measuring the reflection with a sensor. First introduced in the 1960s, its first applications came in meteorology, although now used in agriculture, archaeology, geology, conservation, etc.

A Quick Comparison: Satellites, Drones & LiDAR

Satellites offer 100% geographic coverage and range from airplanes and drones, and have explicit regulatory approvals for data collection. Simultaneously, aircraft can also cover a decent range; most drones, whether due to battery life or regulatory restrictions on beyond-line-of-sight operations, have a comparatively short range.

Drones and LiDAR, on the other hand, offer an excellent resolution. However, they're costly, extremely slow, and require high maintenance. The complexities in managing them add to the costs and overall efficiency.



Features	Satellite	Drones w/ LiDAR	Helicopter w/ LiDAR
Resolution	12-inch High Resolution	VHR	VHR
Perspective	Overhead	Overhead	Overhead
Bands	MultiSpectral, Mono, TriStereo, SAR, Hyperspectral	Visual, LiDAR, additional bands can be added	Visual, LiDAR, additional bands can be added
Speed of Data Acquisition	Instant	Very Slow	Fast
Geographic Coverage	Entire Planet	Localized	Regional
Regulatory Approval Needed	None	Required	Required
Historic Data	Available	Not Available	Not Available
Clearance Detection	Yes	Yes	Yes
Change Detection	Yes	No	No
Costs	**$**	**$$$$**	**$$$$**

How can Satellites Transform Vegetation Management for Power Utilities?

Having a 360° visibility of their distribution lines is probably the most underrated and obscure functionality for power utilities. So what if they have thousands of line miles of assets! There should be a way to view, access, monitor, or inspect any feeder at any point in time – REMOTELY. Satellites can make this possible.

HIGH-RESOLUTION IMAGERY – Satellites today offer 30-cm Very High-Resolution multispectral imagery as well as Synthetic Aperture Radar (SAR) Imaging.

SAR – SAR is unique in its imaging capability. It can "see" through the darkness, clouds, and rain, detecting changes in habitat, levels of water and moisture, effects of natural or human disturbance, and changes in the Earth's surface after events such as earthquakes or sinkhole openings

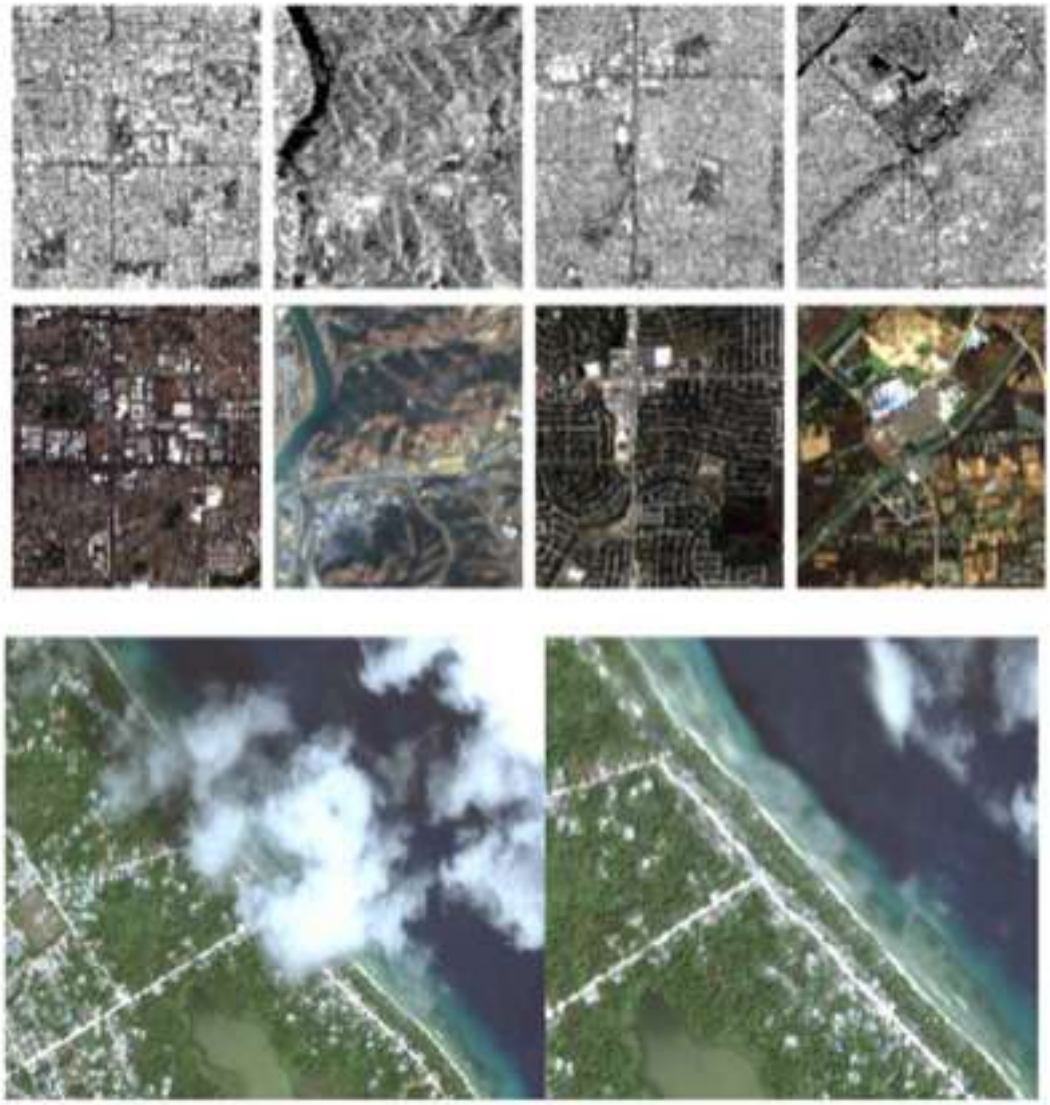
SPEED – Almost instant and non-stop inflow of data is available via satellites

PERSISTENT SURVEILLANCE CAPABILITIES – The ability to revisit the same place repeatedly and get the same image quality regardless of weather and day or night is only possible via satellites.

CHANGE DETECTION – Long term datasets allow experts to examine an area over time, see what changes (if any) are indicated, and determine the cause. Not only are the data of use in studying the past, but they can be used to forecast future changes based on past trends.

1/10TH CHEAPER THAN DRONES - As far as costs are concerned, large-area mapping is most affordable with the help of satellites, whereas drones and aircraft-based data collection have very high operational costs.

COMPLIANCE - No regulatory compliance or approvals needed.



Before and After: Synthetic Aperture Radar and its unique imaging capabilities, as it can "see" through the darkness, clouds and rain.

Combining Satellite Data with Artificial Intelligence

Now you know how satellites can revolutionize the way utilities manage vegetation. The traditional approach to vegetation management has so far been expensive and labor-intensive, relying primarily on manual inspections and static records of the last time an area was trimmed. But cutting-edge technology can make this process more data-driven and intelligent.

But we're talking double the power and double the efficiency. To enhance satellite data processing, it is pertinent to combine it with the next-gen emerging technologies in the world today – Artificial Intelligence.

Given the growing prevalence of AI across industries and verticals, it is now the right time to adopt AI-driven, satellite-powered vegetation management to solve one of the significant problems facing core industries. With the successful utilization of AI, there is a much lower dependence on the ground-level workers to take reactive actions to minimize damage, as AI will enable a more proactive and predictive approach to vegetation management.

How do AI Models Work?

Combining high-resolution multispectral satellite images with Artificial Intelligence offers increased visibility on vegetation growth around transmission and distribution grids. This can help predict tree growth, plan cycle trims, and prioritize risk-based maintenance before anything else.

AI models can use the data to quickly and accurately process vast and complex inputs from geospatial and time-based datasets, helping utilities monitor the entire service territory for vegetation overgrowth and identify power line infringement.

These AI models can identify vegetation management activities, assess risk, and measure task completion for compliance and reliability.

With satellite data, the AI models use location, weather, soil, and tree species to identify and classify vegetation management tasks. These tasks are then prioritized as routine, preventive, or on-demand tasks.

A mobile app and a web dashboard are user access points that help stakeholders assign and execute tasks on the ground. This model optimizes future decision-making by combining field inputs, vegetation data, and pre-trained models for growth rate, trim cycles, and labor hours.

Satellite Analytics and AI Models that are Instrumental in Vegetation Management

DIGITAL ELEVATION MODEL

A digital elevation model (DEM) is a 3D computer graphics representation of elevation data representing terrain. There are several ways to create digital elevation models, but mappers and experts frequently use remote sensing rather than direct survey data. Here are a few use cases for the DEM with regards to Vegetation Management:

- Object height computation & 3D point cloud generation using stereoscopic satellite imagery
- Helps in detecting vertical clearance between power lines and trees
- Analytics on horizontal distances between hazard and distribution line computed against actual hazard tree height

Watch Video

SUPER RESOLUTION MODEL

In easy terms, Super Resolution is the process of obtaining a High Resolution (HR) image from a Low Resolution (LR) image. Deep learning and AI can estimate the High Resolution (HR) image from a small size, degraded image. This is particularly useful in improving satellite imagery to view power lines and trees with better clarity. Let's understand the functionalities of the Super-Resolution Model:

- The supervised satellite super-resolution model helps in generating high-resolution imagery from low-resolution satellite imagery
- Significantly improves AI model performance for attribute detection (tree, grass, buildings, etc.) via low- resolution satellite imagery
- Reduces error margin in computing & geo-encoding distances of hazards (e.g., tree encroachment) from power lines

Watch Video

The Super Resolution Model is a supervised AI model that can generate high-resolution images from low-resolution images.

Reimagine, Replace, Reduce

While 2020 was a bad year for utilities, let's ensure we have a Vegetation Management Action Plan 2021 already in place that puts all the above knowledge to practical use. Let's face it, technology is running the show for most industries of the world and power utilities also need to keep up with the times.

To summarize the action plan, we've devised a 3R policy that promises to transform vegetation management for your utility company. Read on to know what the 3Rs stand for:

REIMAGINE

As we bid goodbye to a catastrophic year, let's get thinking on how we re-evaluate the situation and ensure better preparedness, risk analysis, predictive capabilities and business continuity during a pandemic or disaster. Vegetation Management right now is in dire need of a new approach.

Hence, the first thing to do is Reimagine the way we perform this task. The need of the hour is to find novelty in a routine task, incrementally. Can it be made more intelligent? How can we achieve more by doing less manual work?

REPLACE

Statistics say that vegetation management has not been an efficient exercise for most companies, despite all efforts. What is the one common thing that utilities can avoid in order to solve this problem?

The 2nd R talks about replacing old and outdated technologies, thus paving the way for the adoption of new and emerging technologies. Several companies have been using drones and LiDAR to map and monitor their T&D network; however, they have constantly failed to yield results. From limitations in speed and coverage to scalability and lack of availability in past data, drones and LiDAR need to be replaced with a more robust technology platform. Satellite analytics and AI are breaking new ground in the vegetation management space. So, NOW is the time to adopt new technology and improve resilience and reliability.

REDUCE (COSTS)

The last R is all about saving big bucks - Millions of dollar of them! Why is no one talking about it? We need to opt for methods that are cheaper and more efficient. Did you know large-area mapping is cheapest with the help of satellites?

What's worse is that drones and aircraft-based data collection have very high operational costs and most of it can't even be capitalized. And that's one of the biggest reasons why we need to replace them!

To empower utilities with state-of-the-art AI and Satellite technology for Vegetation Management, AiDash has designed the Intelligent Vegetation Management System (IVMS). While it offers a gamut of solutions to make vegetation management more efficient, it promises two important things:

Reduce Cost by 20%

Improve Reliability by 15%

Intrigued? Please drop us an email at sales@aidash.com and one of our executives will reach out to you soon.

Conclusion

Technology-led business model innovation has been the secret sauce to success for most modern-age digital startups. On the other hand, core industries are taking the slow and steady approach, adopting technology in a piecemeal manner while keeping their core business model or processes unchanged.

However, with Industry 4.0 knocking at the door and competition getting fierce by the day, it is best to adopt new technologies and keep up with the times. We hope this ebook could validate why power utilities must adopt satellite analytics and AI-powered operations and maintenance activities, with a significant focus on vegetation management.

From going remote during COVID times to monitoring pre-and post-disaster damage, these emerging technologies are proving beneficial in preparedness, planning, risk analysis, and business continuity.

About AiDash

AiDash is an AI-first vertical SaaS company enabling satellite-powered operations and maintenance for utility, energy, and other core industries with geographically distributed assets. AiDash uses high-resolution, multispectral and SAR data from the world's leading satellite constellations that are fed into its proprietary AI models to make timely predictions for O&M activities. These AI models empower AiDash's full-stack applications and enable efficient planning, prioritization, execution, review and audit of O&M activities using satellite analytics.

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