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Clearsight

Preparing for Wildfire Season: The Electric Cooperative's Guide

This guide provides comprehensive, actionable insights to help electric cooperatives prepare for and navigate the wildfire season, with a focus on leveraging modern technologies and strategies for effective prevention and management.

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In 2020 alone, **over 10 million acres** were engulfed by wildfires, an area nearly the size of Maryland and Delaware combined.

The State of Wildfires: Understanding the Growing Threat

Wildfires are not a new phenomenon. They are a natural part of many ecosystems and have shaped landscapes and life for millions of years. However, in recent years, their scale, frequency, and intensity have escalated at an alarming rate, causing unprecedented destruction and disruption to communities, wildlife, and infrastructure.

The statistics are sobering. Across the U.S., wildfire seasons are getting longer, and fires are becoming more catastrophic. The five years with the most acres burned by wildfires have all occurred in the last decade. In 2020 alone, over 10 million acres were engulfed by wildfires, an area nearly the size of Maryland and Delaware combined.¹

For those of us in the energy sector, particularly electric cooperatives, these escalating wildfire threats present unique challenges. Electric cooperatives serve communities that are particularly vulnerable to wildfires. Cooperative infrastructure spans vast territories, often passing through dense vegetation and challenging terrain, making them susceptible to wildfires. At the same time, failing or damaged electrical infrastructure can itself spark wildfires.

It's a complex, often fraught relationship, but understanding this is the first step in addressing the issue. Our industry has a vital role to play in reducing the risk and impact of wildfires.

At Constellation ClearSight, we are committed to leading the way, utilizing innovative technologies and developing strategies to help electric cooperatives prepare for the increasing threat of wildfires.

This guide will walk you through the current state of wildfires, the risks they pose to electric cooperatives, and most importantly, the strategies that can be implemented to mitigate these risks. As we navigate this journey together, let's remember that the challenges we face today are opportunities for a safer, more resilient tomorrow.

Thank you for joining us in this important endeavor.



Ron Cardwell

President, Constellation ClearSight

Wildfire in View: A Cooperative's Experience

Our country's 800-plus electric cooperatives, from the rural heartlands to bustling urban centers, know well the devastation mother nature creates, including the devastation wildfires can bring. My tenure across multiple leadership roles and locations in this industry has only underscored the urgency of wildfire preparedness in safeguarding our shared mission – reliable, affordable, and safe power supply to our communities.

In my experience, preparation is the cornerstone of resilience. We all heard the adage “an ounce of prevention is worth a pound of cure.” An informed understanding of risks, the instigation of preventive measures, and a robust response strategy are critical pillars that can mitigate the impacts and costs of wildfires. This guide, expertly assembled by the dedicated team at Constellation Clearsight, aims to streamline this process for cooperatives of all sizes and regions, navigating you through the complexities of wildfire preparedness.

The guide encapsulates valuable insights drawn from research, industry best practices, and practical wisdom from those who work in the electric cooperative arena. It is my hope that this guide will be an invaluable asset to your cooperative as you prepare for the wildfire season, work to fortify the safety and resilience of your grid, and strive to minimize service interruptions to your communities.

I am truly honored to embark on this journey of enhanced wildfire preparedness with you. By working together, we can bolster the resilience of our cooperatives and communities against the looming threat of wildfires, maintain our credibility and reputation, and work toward a safer future for all.



Sincerely,
Roy M. Palk, Esq.



CHAPTER 1:

Understanding Wildfire Risk in Different Regions

Geographic Risk Factors

Understanding the American geographic risk factors associated with wildfires is a crucial first step for electric cooperatives in preparing for wildfire season. These factors can significantly influence the likelihood of a wildfire occurring and its potential impact on electric cooperatives.



Topography:

The physical land features play a significant role in wildfire behavior. Valleys can trap heat and smoke, creating dangerous conditions. Slopes can act as natural chimneys, accelerating the speed and intensity of a wildfire.



Vegetation:

Vegetation type, diversity, and density in an area can fuel wildfires. Dry, dense vegetation can ignite quickly and spread fire rapidly. The presence of certain tree species, such as eucalyptus or pine, can also increase fire risk due to their high oil content.



Climate:

Arid, hot climates are more prone to wildfires. Extended periods of drought dry out vegetation, making it more susceptible to ignition.



Proximity to Fire-Prone Areas:

Regions close to forests, grasslands, or other fire-prone areas are at a higher risk of experiencing wildfires.



Human Activity:

Areas with high human activity, such as construction, outdoor recreation, or agricultural practices, can increase the risk of accidental fire ignition.

Understanding these geographic risk factors is essential – an electric cooperative that knows its landscape can **better prepare for and mitigate the impacts of wildfires.**

By incorporating this knowledge into their planning and operations, cooperatives can enhance their resilience to wildfires and **help to ensure the continued delivery of essential service to their communities.**



Climate Change and Escalating Wildfire Threats

As our parent company, Constellation, discussed in their insightful webcast, “The Past, Present, and Future of Energy,” climate change is a significant driver of several escalating threats to the electric grid.² As global temperatures rise, so does the potential for more frequent and severe natural phenomena – including wildfires. This section will explore how climate change is influencing wildfire risks and what this means for electric cooperatives.



Increased Temperatures:

Rising global temperatures are leading to drier conditions across the U.S., making vegetation more susceptible to burning. This can result in wildfires that start more easily, spread more rapidly, and burn more intensely.



Extended Droughts:

Especially in the west, the U.S. is experiencing longer and more severe droughts. These conditions dry out the vegetation and soil, creating ideal conditions for wildfires.



Longer Fire Seasons:

Traditionally, wildfire season was confined to the hot, dry summer months. In the past decade, these conditions have extended into spring and fall, leading to longer fire seasons and providing wildfires with more opportunities to occur.



Increased Lightning Activity:

Warmer conditions are also leading to more thunderstorms and increased lightning strikes – a common natural cause of wildfires.



Changing Wind Patterns:

Wind patterns across the U.S. have also changed. As they change, the new wind patterns have the potential to drive wildfires towards populated areas or infrastructure, including electric cooperative facilities.

The escalating wildfire threats due to climate change present significant challenges for electric cooperatives. However, by understanding these risks and implementing proactive measures, cooperatives can enhance their resilience and continue to provide reliable service to their communities. This includes investing in fire-resistant infrastructure, implementing robust fire detection and response systems, and engaging in community education about wildfire risks and safety.

In the next chapters, we will delve deeper into these strategies and explore how electric cooperatives can effectively prepare for and respond to the increasing wildfire threats posed by climate change.

A landscape photograph showing a field of tall, dry grass or brush in the foreground. In the middle ground, there are several utility poles with power lines stretching across the scene. The background features a line of trees and a sky filled with large, white, fluffy clouds. The overall lighting suggests a bright, sunny day.

CHAPTER 2:

The Intersection of Electric Infrastructure and Wildfires

Infrastructure Vulnerabilities

In Chapter 2: The Intersection of Electric Infrastructure and Wildfires, we delve into the vulnerabilities of electric infrastructure in the face of wildfires. Understanding these vulnerabilities is crucial for electric cooperatives to develop effective strategies to mitigate wildfire risks.

Infrastructure Vulnerabilities:

- ① Overhead Power Lines and Wooden Poles:**

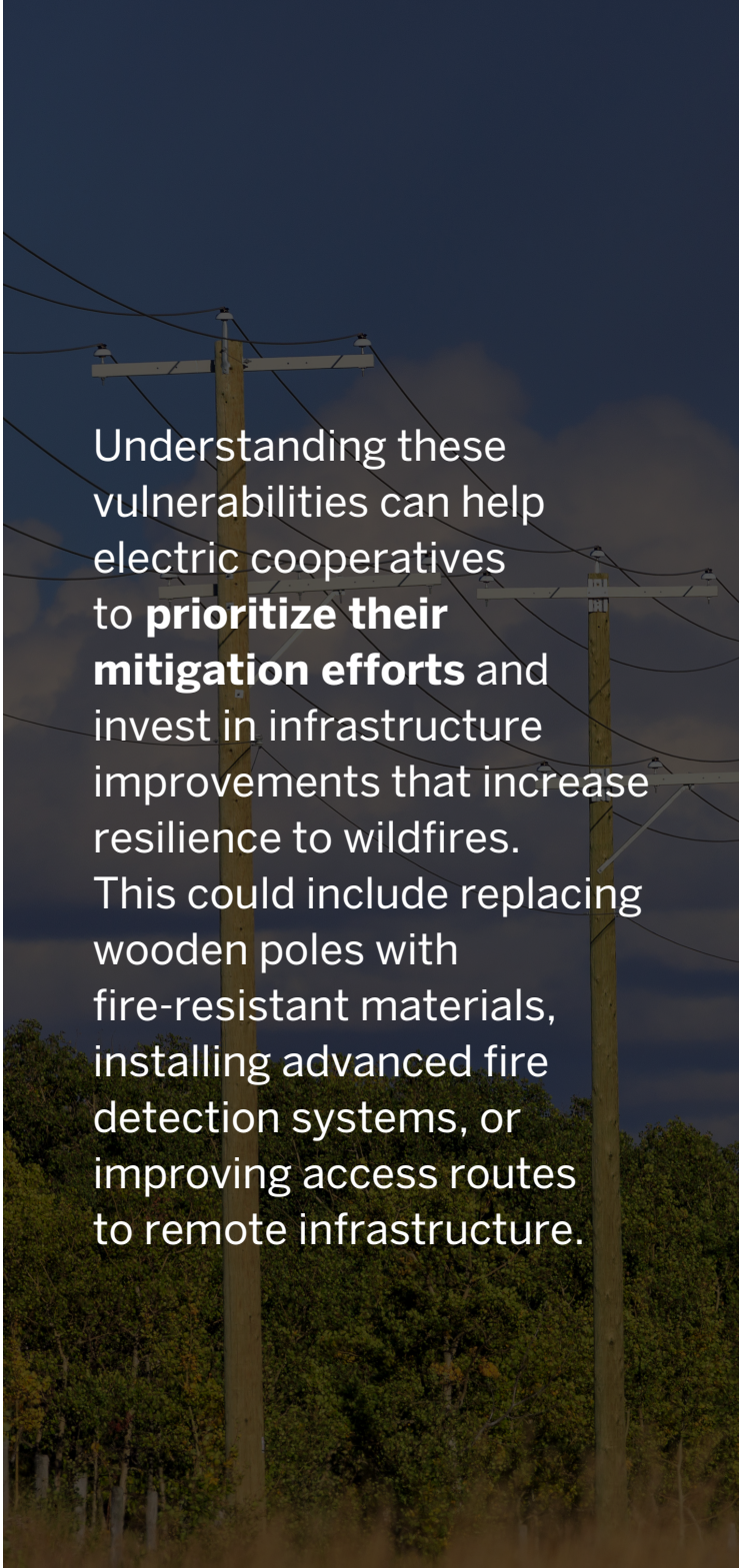
Overhead power lines and wooden poles make up the fabric of America's electric infrastructure. They are also particularly vulnerable to wildfires. Fires can directly damage the lines and poles themselves. Surrounding vegetation caught up in a fire can fall onto the lines. Additionally, sparks from power lines can ignite nearby vegetation and start a fire.
- ② Substations:**

Substations, the critical nodes in the power distribution network, can be severely damaged by wildfires. This can lead to widespread power outages and significant repair costs.
- ③ Transmission Towers:**

Often in remote locations of an electric cooperative, towers can be difficult to protect from wildfires. Damage to transmission towers can disrupt the power supply over large areas.
- ④ Communication Systems:**

Wildfires can disrupt communication systems, making it difficult for utility personnel to coordinate responses to fires or power outages.
- ⑤ Access to Infrastructure:**

Wildfires can make it difficult for repair crews to access damaged infrastructure, delaying restoration efforts, especially in remote areas.



Understanding these vulnerabilities can help electric cooperatives to **prioritize their mitigation efforts** and invest in infrastructure improvements that increase resilience to wildfires. This could include replacing wooden poles with fire-resistant materials, installing advanced fire detection systems, or improving access routes to remote infrastructure.

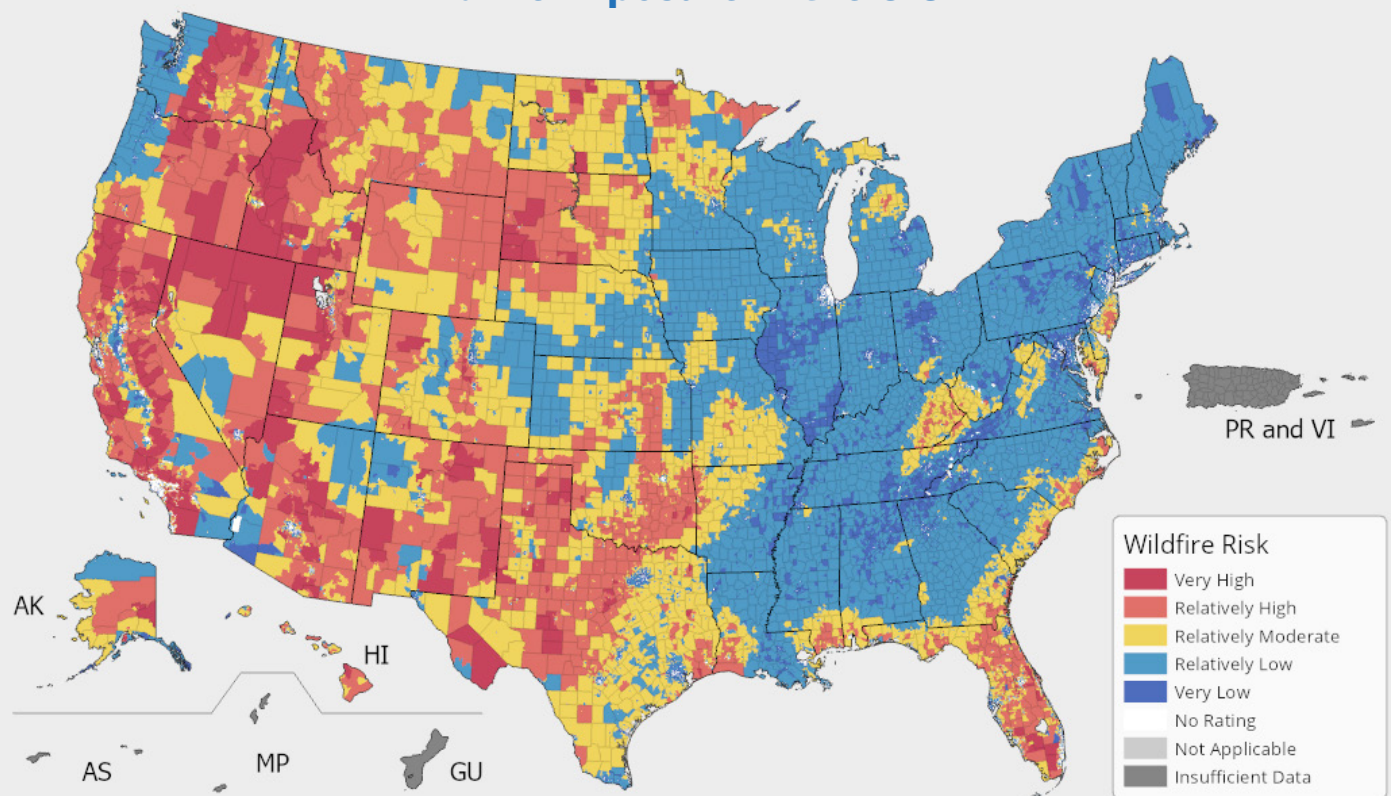
How Infrastructure Can Trigger Wildfires

While infrastructure is vulnerable to wildfires, it can also inadvertently contribute to the ignition of these destructive events. Overhead power lines are one of the most common sources of infrastructure-related wildfires. These fires can be caused by sparks from faulty or damaged equipment, from power lines coming into contact with trees or other vegetation, and from downed power lines. It's important to remember how much of an impact one hazard tree can have: California's second largest wildfire was ignited by a tree coming into contact with a power line, burning almost 1 million acres (about the area of Rhode Island) and costing the utility over \$1 billion dollars.³

Electrical equipment in substations can generate sparks or heat that can ignite nearby vegetation. Additionally, substations often have large amounts of oil for transformers, which can fuel fires if they leak or rupture.

Understanding how infrastructure can trigger wildfires is crucial for electric cooperatives. By identifying and addressing these risks, cooperatives can reduce the likelihood of infrastructure-related wildfires and enhance the safety and reliability of their systems.

Wildfire Exposure in the U.S.





Wildfire Impact on Electric Infrastructure

Damage to Transmission & Distribution:

Wildfires can cause extensive damage to overhead power lines, with heat from the fire potentially melting the lines and causing power outages. Wooden poles supporting power lines can burn in a wildfire, leading to the collapse of the lines and further power outages. Transmission towers can be severely damaged by wildfires, disrupting the power supply over large areas.

Destruction of Substations:

Substations, critical nodes in the power distribution network, can be severely damaged by wildfires, leading to widespread power outages. Wildfires can cause transformer oil in substations to ignite, leading to further damage and potential environmental hazards.

Effects on Underground Infrastructure:

While generally protected from direct impacts, the intense heat of wildfires can damage above-ground components of underground infrastructure. Post-fire conditions such as increased runoff can lead to flooding of underground systems, causing additional damage.

Disruption of Communication Systems:

Wildfires can damage communication infrastructure, impacting coordination of responses to fires or power outages and communication with cooperative members.

Access Challenges for Repair Crews:

Wildfires can make it difficult for repair crews to access damaged infrastructure, delaying restoration efforts.

Increased Risk to Personnel:

Wildfires can increase the risk to personnel, both from the direct dangers of the fire and from hazards associated with damaged infrastructure.



The Broader Impact of Wildfires on Cooperative Members

Wildfires have far-reaching effects that extend beyond the destruction of electric infrastructure. They also significantly impact the lives of the members of electric cooperatives. Here's how:

Direct Threat to Lives and Property:

The most immediate and devastating impact of wildfires is the direct threat they pose to lives and property. Homes may be in the path of wildfires and be destroyed, and residents may be forced to evacuate, often with little notice. In severe cases, wildfires can lead to long-term or even permanent displacement from communities, disrupting social networks and support systems.

Ecological Impact:

Wildfires also threaten the lives of indigenous species of flora and fauna. The impacts of wildfires can result in unpredictable wildlife migration patterns and negative, lasting effects to the natural landscape.

Disruption of Essential Services:

Wildfires can damage electric infrastructure, leading to power outages. This disrupts essential services such as heating, cooling, and refrigeration, and can impact the ability to charge essential devices like medical equipment and communication devices.

Health Risks:

Wildfires produce smoke and particulate matter that pose serious health risks, particularly for individuals with respiratory conditions. The loss of power can also exacerbate health risks and place vulnerable lives in immediate danger for those who depend on electrical medical equipment.

Economic Impact:

Wildfires can lead to job loss and economic instability. Businesses may be destroyed or temporarily closed, and the cost of rebuilding can be significant.

Disruption of Communication:

Damage to communication infrastructure can make it difficult for residents to stay informed about the status of the fire and recovery efforts, or to communicate with family and friends.



Impact on Water Supply:

Wildfires can impact local water supplies, contaminating them with ash and debris. This can affect both drinking water and irrigation for agriculture.

Psychological Impact:

The trauma of experiencing a wildfire can have long-lasting psychological impacts, including stress, anxiety, and depression.

Increased Insurance Costs:

Areas prone to wildfires may see an increase in insurance premiums, adding to the financial burden on residents.

A photograph of a paved road winding through a forested valley. In the background, a large wildfire is visible, with thick black smoke rising into a dark sky. The foreground shows trees with some yellowing leaves, suggesting autumn. A car is visible on the road in the distance.

Understanding these broader impacts of wildfires can help electric cooperatives develop comprehensive response strategies that consider the needs of their members. This includes not only restoring power as quickly and safely as possible, but also **supporting community recovery efforts** and **providing resources and information** to help members navigate the aftermath of a wildfire.

CHAPTER 3:

The Role of Vegetation Management in Wildfire Prevention

The Trendline: What's Happening

U.S. electric cooperatives are taking on increasing challenges related to vegetation management and wildfires. Here are key trends across the cooperative landscape:



Increased Investment in Vegetation Management:

Over the past decade, electric cooperatives have increased their vegetation management budgets with the goal to increase power reliability and mitigate fire risks. The focus has shifted towards preventive measures rather than reactive ones.⁴



Use of Advanced Technologies:

Cooperatives are increasingly incorporating technologies such as drones, LiDAR, and satellite imaging for vegetation management. This allows for early detection and a more efficient response.⁵



Building Relationships Externally:

Cooperatives are collaborating with local government, national organizations such as the NRECA, environmental organizations, and third-party inspection experts for a coordinated, comprehensive approach to vegetation management and fire mitigation.⁶



Community Education and Engagement:

Cooperatives are also working to educate members about the risks associated with vegetation near power lines, providing training, workshops, and literature.⁷

Issues Remain: Barriers to Wildfire Preparedness

However, despite the substantial efforts, there remain key issues that limit overall wildfire prevention effectiveness. Researchers have found the following trends that currently impact electric cooperatives:

Preparedness Gaps:

①

Limited Use of Advanced Technologies:

While some cooperatives are leveraging technology in their wildfire management strategies, adoption isn't widespread.⁸

②

Inadequate Training and Staffing:

There is a significant shortage of skilled personnel trained in wildfire prevention and response strategies, limiting the ability of cooperatives to fully implement their plans.⁹

③

Deficient Infrastructure Maintenance:

Aging infrastructure contributes to wildfire risks, and preventive maintenance is often inadequate due to resource constraints.¹⁰

Barriers to Preparedness:

①

Financial Constraints:

Limited budgets are a reality for cooperatives and contribute to limited wildfire preparedness efforts. This is particularly pronounced in the adoption of costly technologies or in hiring additional skilled personnel.¹¹

②

Regulatory Hurdles:

Complex and varying regulatory landscapes can complicate efforts to manage vegetation and upgrade infrastructure for wildfire preparedness.¹²

③

Access to Resources:

Many cooperatives have limited geographic access to necessary resources, making the logistics of vegetation management more challenging.¹³

Overcoming barriers is crucial for American electric cooperatives to improve power delivery reliability and mitigate risks. Strategic investment in technology, workforce training, infrastructure maintenance, and advocacy for favorable regulation are essential to bridge these gaps. In the following sections, we will discuss both best practices for vegetation management as well as explore the technology landscape and opportunities for cooperatives to improve their wildfire preparedness.

Basics of Vegetation Management for Electric Cooperatives

Vegetation management is a critical aspect of wildfire prevention for electric cooperatives. Overgrown vegetation near power lines can cause power outages, damage equipment, and significantly increase wildfire risk. A robust vegetation management program not only mitigates wildfire risk but also enhances electric infrastructure reliability and efficiency.

The threat of wildfires, including those caused by power lines, necessitates a strong vegetation management program. By reducing the amount of vegetation near power lines, the risk of wildfires caused by electric infrastructure can be significantly reduced. A comprehensive inspection program allows electric cooperatives to be proactive in planning and prevention.

Key components of any vegetation management program include risk assessment, vegetation management planning, monitoring and reporting, compliance management, and training and support.

Through these efforts, a cooperative's vegetation management program can work to reduce the risk of wildfires caused by power lines, improve the safety and reliability of utility infrastructure, and ensure compliance with relevant regulations and standards.



Satellite and LiDAR Technologies in Vegetation Management

LiDAR (Light Detection and Ranging) and satellite technologies have revolutionized the field of vegetation management, offering new tools for identifying and addressing potential issues – including issues that could lead to wildfire.

LiDAR uses light in the form of a pulsed laser to create a detailed 3D map of the environment, allowing electric cooperatives to identify potential issues with vegetation growth near power poles, even in hard-to-reach areas. It can detect overhanging branches or other vegetation that may be too close to the poles, potentially causing damage or outages during storms or high winds. LiDAR provides a comprehensive view of the corridor where electric assets run, enabling the viewer to pinpoint hazards at ground level, at wire level, and from a bird's-eye view.

Satellite vegetation management services complement LiDAR by providing a bird's-eye view of infrastructure and surrounding areas. Satellite assessments can identify tree species, assess their health, and determine their degree of encroachment towards electric lines. By analyzing satellite imagery, potential vegetation issues across wide areas can be identified, helping to prioritize and plan maintenance efforts more effectively.

Over the past decade, the cost of using LiDAR and satellite technologies for vegetation management inspections has decreased dramatically, making these solutions more accessible and cost-effective. As a result, LiDAR and satellite technologies have become attractive options for vegetation management inspections, especially in mitigating wildfires.



Effective Vegetation Management Strategies

Effective vegetation management is a critical component of wildfire mitigation for electric cooperatives. It requires proper planning and scheduling to ensure that maintenance activities are carried out at the right time and in the right way. This involves conducting comprehensive assessments of vegetation risks to electric assets and prioritizing maintenance activities based on the level of risk.

Here are 6 Key Strategies:

①

Comprehensive Risk Assessments:

Conducting comprehensive assessments of vegetation risks to electric assets is crucial. This involves identifying high-risk areas and prioritizing maintenance activities based on the level of risk.

②

Data-Driven Decision Making:

The use of data can significantly enhance the effectiveness of vegetation management activities. Data can be used to analyze the growth rate of different vegetation types, identify potential hazards, and prioritize maintenance activities. Over time, data-driven maintenance plans can help cooperatives manage their budgets more effectively.

③

Integration of Advanced Technologies:

Technologies such as drones, LiDAR sensors, and satellite imagery can provide detailed, large-scale monitoring of vegetation growth and proximity to power lines. By integrating these data sources with AI/ML platforms, cooperatives can identify potential risks, prioritize maintenance activities, and optimize resources.

④

Proper Training and Equipment:

Ensuring that vegetation management workers have the necessary training and equipment is essential for safety and effectiveness. This includes training on proper pruning techniques, the use of equipment, and the identification of potential hazards.

⑤

Stakeholder Engagement:

Engaging with stakeholders, such as property owners, regulatory agencies, and the public, can help build trust and ensure that maintenance activities are carried out in a way that addresses their concerns and is environmentally sustainable.

⑥

Regular Monitoring and Evaluation:

Regular monitoring and evaluation of vegetation management activities can help identify issues early on, enable corrective action to be taken quickly, and identify areas for improvement.

By embracing these strategies, electric cooperatives can enhance their vegetation management programs, reduce wildfire risks, and ensure the safety and reliability of their power systems.



A misty forest scene with tall evergreen trees and a prominent dead tree trunk in the center. The background is hazy, and the foreground shows dense green foliage.

CHAPTER 4:

Proactive Inspection and Maintenance Strategies

Benefits of Regular Infrastructure Inspections

Regular infrastructure inspections need to be an integral part of wildfire preparedness for electric cooperatives. Routine infrastructure inspections offer numerous benefits:



Prevention of Wildfires:

Regular inspections can identify potential fire hazards, such as overgrown vegetation near power lines or faulty equipment that could spark a wildfire. By addressing these issues proactively, cooperatives can significantly reduce the risk of wildfires.



Cost Savings:

While regular inspections require an upfront investment, they can result in significant cost savings in the long run. By identifying and addressing issues early, cooperatives can avoid costly repairs or replacements that might be necessary if problems are left unattended.



Enhanced Safety:

Regular inspections ensure the safety of the cooperative's employees, their members, and their communities. By identifying and addressing potential hazards, cooperatives can prevent issues and enhance overall safety.



Regulatory Compliance:

Regular inspections help cooperatives comply with local and national safety regulations, avoiding potential fines and penalties. They also demonstrate the cooperative's commitment to safety and responsibility, enhancing its reputation among stakeholders.



Improved Service Reliability:

Infrastructure inspections can detect issues that may lead to power outages during a wildfire, such as damaged power lines or transformers. By addressing these issues in advance, cooperatives can increase their chances of continuity of power supply during wildfire events, improving service reliability.



Improve Resilience:

Regular inspections contribute to the resilience of the power grid. By identifying vulnerabilities and implementing necessary upgrades, cooperatives can enhance the grid's ability to withstand and recover from wildfire events.

Regular infrastructure inspections are a proactive measure that electric cooperatives can take to prepare for wildfire season. They not only help prevent wildfires but also **contribute to the safety, reliability, and resilience of the power grid**. In the following sections, we will delve into the best practices for conducting these inspections and how to leverage their findings for effective wildfire preparedness.

Role of Drones in Electric Infrastructure Inspections

In recent years, aerial drone technology has revolutionized the way electric infrastructure inspections are conducted. Uncrewed Aerial Vehicles (UAVs), commonly known as drones, offer a unique blend of capabilities that make them an invaluable tool for electric infrastructure inspections. Here are a few key benefits:

- ① Enhanced Accessibility:** Drones can easily access hard-to-reach areas, such as high voltage lines, towers, and poles, without the need for human intervention. This capability allows for comprehensive inspections that might be challenging or hazardous for human inspectors.
- ② Improved Efficiency:** Drone inspections can cover large areas more quickly than traditional inspections, saving time and reducing labor costs. Drone inspections are able to identify potential issues faster and with greater clarity, enabling proactive maintenance and preventing costly equipment failures and unplanned outages.
- ③ Detailed Inspections:** Equipped with high-resolution cameras, thermal imaging, and LiDAR sensors, drones can capture detailed visual, thermal, and topographical data. This information provides a comprehensive view of the condition of electrical assets, enabling accurate assessments and data-driven decision-making.
- ④ Cost-Effective:** By reducing the need for physical inspections, drones can lead to significant cost savings. They eliminate the need for specialized equipment or personnel to climb poles or towers, saving time and cost of inspections.
- ⑤ Improved Safety:** Drones significantly reduce the need for personnel to work at heights or in close proximity to high-voltage equipment, minimizing the risk of accidents and injuries. Additionally, drones can easily access hard-to-reach or hazardous areas.
- ⑥ Data Collection and Analysis:** The data captured during aerial drone inspections will be processed and analyzed using sophisticated software, providing valuable insights into the health of electrical assets. Detailed reports and visualizations can help electric cooperatives, help electric cooperatives prioritize maintenance activities, and optimize resource allocation.

By providing a **safer, more efficient, and cost-effective** alternative to traditional methods, drone inspections have become an invaluable tool for electric cooperatives.

Embracing Innovation: Shaping the Future of Electric Cooperatives

Innovation is not just about adopting new technologies; it's about fostering a culture of continuous learning, adaptation and improvement. This is particularly crucial in the face of evolving challenges like wildfires, which demand new approaches and solutions.

Here are some ways electric cooperatives can embrace innovation:

① Adopting Advanced Technologies:

From fire detection systems to remote inspection and AI/ML solutions to grid management tools, advanced technologies offer powerful ways to enhance wildfire resilience. Embracing these technologies can help cooperatives protect their infrastructure, manage their systems more effectively, and provide better service to their members.

② Investing in Research and Development:

By investing in research and development, cooperatives can stay at the forefront of new solutions for wildfire mitigation and response. This can involve collaborations with universities, research institutions, or technology companies.

③ Fostering a Culture of Innovation:

As Ron mentioned, embracing innovation means fostering a culture that values learning, experimentation, and adaptation. This can involve training and development programs, innovation challenges, or other initiatives that encourage creative thinking and problem-solving.

④ Engaging with Members and Communities:

Innovation is not just about technology; it's also about finding new ways to engage with members and communities. This can involve education programs, community partnerships, or other initiatives that empower members and enhance community resilience to wildfires.

⑤ Advocating for Supportive Policies and Regulations:

Cooperatives can also play a role in advocating for policies and regulations that support innovation and investment in wildfire resilience.

By embracing innovation, electric cooperatives can not only enhance their wildfire resilience but also position themselves as leaders in the energy sector. They can demonstrate how cooperatives can leverage their unique strengths – their local presence, their member-focused mission, their commitment to community – to meet the challenges of the future and **shape America's more resilient, sustainable, and inclusive energy grid.**

The background of the slide features a series of utility poles and power lines stretching across the frame. The scene is captured in a twilight or dusk setting, with a soft, hazy sky transitioning from light blue to a pale purple. The utility poles are dark silhouettes, and the power lines are thin, dark lines that create a sense of depth and perspective. The overall mood is calm and industrial.

CHAPTER 5:

Enhancing Infrastructure Resilience

Upgrading and Retrofitting Infrastructure: What to Consider

Cooperatives should seriously consider enhancing the resilience of their electric infrastructure in the face of wildfires by either upgrading or retrofitting existing infrastructure. This process involves making modifications to existing infrastructure to improve its performance and resilience. In this section, we will discuss the key factors to consider when planning for infrastructure upgrades and retrofits.



Risk Assessment:

Identify the vulnerabilities in your current infrastructure and understand how these vulnerabilities could impact your cooperative's ability to withstand and recover from a wildfire.

Cost-Benefit Analysis:

Conduct a cost-benefit analysis to ensure that the benefits of the proposed upgrades, such as improved resilience and reduced maintenance costs, outweigh the initial investment.

Regulatory Compliance:

Understand the local and national regulations prior to making a decision. These regulations ensure that your plans are in compliance to avoid potential fines and penalties.

Technological Advancements:

Review the latest technological advancements in electric infrastructure. Innovations such as smart grids, advanced metering infrastructure, and automated fault detection systems can significantly enhance the resilience of your infrastructure.

Environmental Impact:

Understand the environmental impact. Aim for solutions that not only enhance resilience but also contribute to environmental sustainability.

Community Impact:

Consider the impact of the proposed upgrades or retrofits on the communities you serve. Minimize disruptions to service and keep the community informed.

In conclusion, upgrading and retrofitting infrastructure is a complex process that requires careful consideration of a range of factors. By taking these factors into account, electric cooperatives can ensure that their infrastructure is not only resilient to wildfires but also cost-effective, compliant with regulations, technologically advanced, environmentally sustainable, and beneficial to the communities they serve. In the following sections, we will explore specific strategies for upgrading and retrofitting infrastructure to enhance wildfire resilience.

Latest Technologies for Infrastructure Resilience

The latest advancements in technology offer opportunities for electric cooperatives to enhance the resilience of their infrastructure, particularly in the face of wildfires. This section will delve into some of these cutting-edge technologies and their potential applications for infrastructure resilience.

- ① Smart Grids:**
Smart grids leverage digital technology to monitor and manage the flow of electricity from all generation sources to meet the varying electricity demands of end users. They enhance resilience by enabling real-time monitoring, predictive maintenance, and rapid response to disruptions.
- ② Advanced Metering Infrastructure (AMI):**
AMI systems, which consist of smart meters, communication networks, and data management systems, allow for two-way communication between cooperatives and customers. They provide real-time data on power usage and system performance, enabling cooperatives to quickly detect and respond to outages.
- ③ Automated Fault Detection Systems:**
These systems use advanced sensors and algorithms to detect faults in the power grid. They can automatically isolate the affected area, minimizing the impact of the fault and preventing potential wildfires.
- ④ Drones and Technologies:**
As discussed in Chapter 4, drones and technologies play a significant role in infrastructure inspections. They can access hard-to-reach areas, collect detailed data, and significantly improve the efficiency and safety of inspections.
- ⑤ Artificial Intelligence (AI) and Machine Learning (ML):**
AI and ML can analyze vast amounts of data to predict potential infrastructure failures, optimize maintenance schedules, and enhance decision-making processes.
- ⑥ Cybersecurity Technologies:**
As electric infrastructure becomes increasingly digital, it's crucial to protect it from cyber threats. Advanced cybersecurity technologies can help detect and prevent cyber-attacks, ensuring the integrity and reliability of the power grid.

In conclusion, the latest technologies offer exciting opportunities for **enhancing infrastructure resilience**. By adopting these technologies, electric cooperatives can not only improve their preparedness for wildfires but also **enhance the efficiency, reliability, and safety of their operations**. In the following sections, we will delve into each of these technologies in more detail and discuss how to implement them effectively.

Examples of Resilient Electric Cooperative Infrastructure

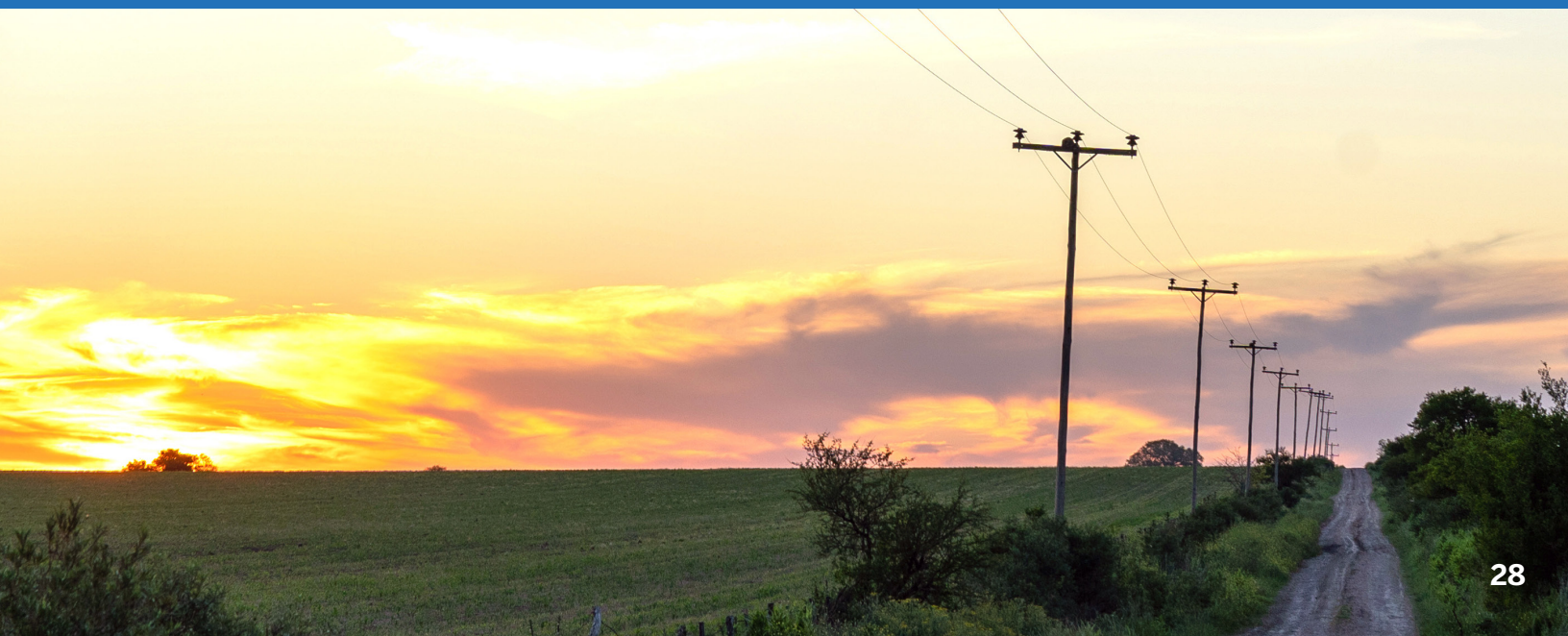
Across the U.S., electric cooperatives have successfully adopted innovative strategies and cutting-edge technologies to bolster their infrastructure resilience. Let's explore a few of these instances to better understand the practical implications of resilient infrastructure in the face of wildfires.

The Electric Power Board (EPB) of Chattanooga in Tennessee has demonstrated the power of smart grid implementation. Their smart grid can autonomously detect and isolate faults, thereby minimizing outage impact and reducing wildfire risks. EPB has reduced their outages by 55%, saving over 161 million outage minutes since its smart grid implementation. Similarly, Pedernales Electric Cooperative in Texas has harnessed the capabilities of Advanced Metering Infrastructure (AMI). This technology offers real-time data on power usage and system performance, empowering the cooperative to swiftly detect and respond to outages.

In California, the Sacramento Municipal Utility District has made strides in resilience by incorporating automated fault detection systems into their infrastructure. These systems can automatically isolate faults, which not only reduces the risk of wildfires but also bolsters service reliability.

Lastly, in response to the escalating threat of cyber-attacks, many cooperatives have implemented advanced cybersecurity measures. The National Rural Electric Cooperative Association (NRECA) offers a cybersecurity program that aids cooperatives in assessing their cyber risks and implementing effective security measures.

These real-world examples underscore the potential of resilient infrastructure in mitigating wildfire risks and enhancing service reliability. They serve as a testament to the fact that with the right strategies and technologies, electric cooperatives can significantly enhance the resilience of their infrastructure.



An aerial photograph of a dense forest with a dirt road running vertically through the center. The trees are mostly evergreens, with some bare trees in the lower-left quadrant. The lighting is natural, suggesting a bright day.

CHAPTER 6:

Crisis Management and Emergency Response Planning

Elements of an Effective Crisis Management Plan

An effective crisis management plan is a crucial tool for any organization, including electric cooperatives. It outlines the procedures and steps to be taken in response to a crisis, ensuring a coordinated and effective response. Here are the key elements of an effective crisis management plan:

① Risk Assessment:

The plan should begin with a comprehensive risk assessment that identifies potential crises that the cooperative could face. This should include natural disasters like wildfires, as well as other types of crises like cyber-attacks or major equipment failures.

② Crisis Response Team:

The plan should designate a crisis response team. This team is responsible for activating and implementing the crisis management plan when a crisis occurs. The team should include representatives from key areas of the cooperative, such as operations, communications, and human resources.

③ Roles and Responsibilities:

The plan should clearly define the roles and responsibilities of the crisis response team and other key personnel during a crisis. This ensures that everyone knows what they need to do and can respond quickly and effectively.

④ Communication Plan:

The plan should include a communication plan that outlines how information will be communicated during a crisis. This includes communication with staff, members, emergency services, and the media.

⑤ Emergency Procedures:

The plan should outline the emergency procedures to be followed in response to different types of crises. This could include evacuation procedures, procedures for shutting down equipment, or procedures for activating backup systems.

⑥ Recovery and Restoration Plan:

The plan should include a recovery and restoration plan that outlines the steps to be taken after the immediate crisis has passed. This includes repairing or replacing damaged infrastructure, restoring services, and supporting community recovery efforts.

⑦ **Training and Exercises:**

The plan should include provisions for regular training and exercises to ensure that all personnel are familiar with the plan and can implement it effectively during a crisis.

⑧ **Review and Update:**

The plan should be regularly reviewed and updated to ensure it remains relevant and effective. This should include reviewing the plan after a crisis to identify any lessons learned and areas for improvement.

By including these elements, electric cooperatives can ensure they have an effective crisis management plan that prepares them to respond quickly and effectively to a crisis, minimizing the impact on their operations and their members.





Communication During Wildfires: Best Practices

Effective communication is a critical component of wildfire response. It ensures that vital information, such as evacuation orders and safety instructions, reaches those affected by the fires in a timely and clear manner. Here are some best practices for communication during wildfires:

Plan for Communication Challenges:

Communication is essential. Expect that, in a wildfire, normal communication channels will be disrupted. Prepare by having reliable backup plans in place, such as satellite phones or ham radios, to ensure that communication can continue even if the power goes out or cell service is disrupted.

Establish Clear Communication Channels:

Emergency responders and local officials should establish clear communication channels that can be used to disseminate information. This could include social media platforms, local news outlets, emergency alert systems, and community meetings.

Provide Regular Updates:

Regular updates should be provided to keep the community informed about the status of the fire, evacuation orders, and where to find help. These updates should be consistent and come from a reliable source to avoid confusion or misinformation.

Use Clear and Simple Language:

Information should be communicated in clear and simple language to ensure it is understood by everyone, including people for whom English may not be their first language. Avoid using jargon or technical terms that may be confusing.

Ensure Accessibility:

Information should be accessible to everyone, including people with disabilities. This could involve providing information in multiple formats (e.g., text, audio, visual) and ensuring that online information is accessible to people using screen readers or other assistive technologies.

Coordinate with Other Agencies:

Coordinate communication efforts with other agencies to ensure a consistent message. This can involve sharing information and resources and collaborating on joint messages or updates.

Provide Resources and Support Information:

In addition to updates about the fire, provide information about resources and support for those affected by the fire. This could include information about emergency shelters, food and water distribution points, and mental health resources.

By following these best practices, emergency responders and local officials can ensure that their communication during wildfires is effective, timely, and accessible, helping to protect the safety and wellbeing of their communities.



Recovery and Restoration: 7 Steps Post-Wildfire

In the aftermath of a wildfire, the focus shifts to recovery and restoration. Here are the 7 key steps that electric cooperatives can take to restore services and support their communities:

- ① Asses the Damage:**
The first step is to assess the extent of the damage to the electric infrastructure and to the cooperative. This involves conducting inspections of power lines, substations, and other assets to identify areas that need repair or replacement.
- ② Prioritize Repairs:**
Based on the damage assessment, repairs should be prioritized. This typically involves restoring power to critical facilities like hospitals and emergency services first, followed by areas with the largest number of affected customers.
- ③ Mobilize Repair Crews:**
Once the repairs have been prioritized, repair crews should be mobilized. This can involve calling in additional crews from other areas to assist with the restoration efforts.
- ④ Communicate with Members:**
Communication with members is crucial during the recovery process. Cooperatives should provide regular updates on the progress of restoration efforts, including estimated times for power restoration.
- ⑤ Coordinate with Emergency Services and Other Utilities:**
Cooperatives should coordinate their recovery efforts with emergency services and other utilities. This can involve sharing information, resources, and expertise to enhance the overall recovery efforts.
- ⑥ Review and Learn from the Event:**
After the immediate recovery efforts are complete, cooperatives should review the event and their response to it. This can involve analyzing what worked well and what could be improved, and updating their emergency response plans accordingly.
- ⑦ Support Community Recovery:**
Cooperatives can also play a role in supporting the broader community recovery efforts. This can involve working with local organizations to provide resources and support to members affected by the wildfire.

By taking these steps, electric cooperatives can **ensure a swift and effective response to wildfires**, minimizing the disruption to their members and supporting the recovery of their communities.



CHAPTER 7:

Collaborating with the Community and Regulatory Bodies

The Role of Community Engagement in Wildfire Preparation

Community engagement is a cornerstone of effective wildfire preparation. It involves educating members about wildfire risks and safety measures, fostering a collaborative environment for planning and response, and building a culture of preparedness. Through workshops, information sessions, and educational materials, cooperatives can raise awareness about wildfires and empower members to protect their homes and communities. Collaborative planning initiatives can ensure that wildfire mitigation and response strategies reflect the needs and concerns of the community, improving their effectiveness. Volunteer programs can also enhance the cooperative's capacity to manage wildfire risks and foster a sense of community ownership and responsibility.

By providing opportunities for engagement, feedback, and input, cooperatives can continuously improve their strategies, respond effectively to member needs, and build trust. Ultimately, by promoting a culture of preparedness, cooperatives can empower members to take proactive steps towards wildfire mitigation and protection. In this way, community engagement not only ensures wildfire preparation but also strengthens the bond between the cooperative and its members.



Navigating Regulatory Requirements in Wildfire Zones

Navigating regulatory requirements in wildfire zones is crucial for electric cooperatives. Here are key steps to ensure compliance and enhance wildfire preparedness:



Stay Informed:

Monitor changes in regulations, understand their implications, and update practices accordingly. Legal counsel or regulatory affairs specialists can facilitate this process.



Ensure Compliance:

Implement systems and processes to comply with regulations. This includes developing internal policies and procedures, conducting regular audits and inspections, and providing training and resources to staff.



Document Activities:

Maintain records of maintenance activities, inspections, and training. Prepare reports for regulatory bodies. Documentation provides evidence of compliance and is a valuable resource in the event of a regulatory review or investigation.



View Compliance as an Opportunity:

Regulatory compliance should be seen not just as a requirement, but as an opportunity to enhance wildfire preparedness and resilience. Aligning practices with regulatory requirements can demonstrate a commitment to safety and reliability to members and the broader community.



Build Relationships That Work:

Regulatory requirements demand a comprehensive strategy – often, a strategy greater than a cooperative’s internal resources allow. Look to cooperative resources and trusted relationships to achieve regulatory compliance.

Conclusion: Building a Future-Ready Electric Cooperative

The Road Ahead: Challenges and Opportunities

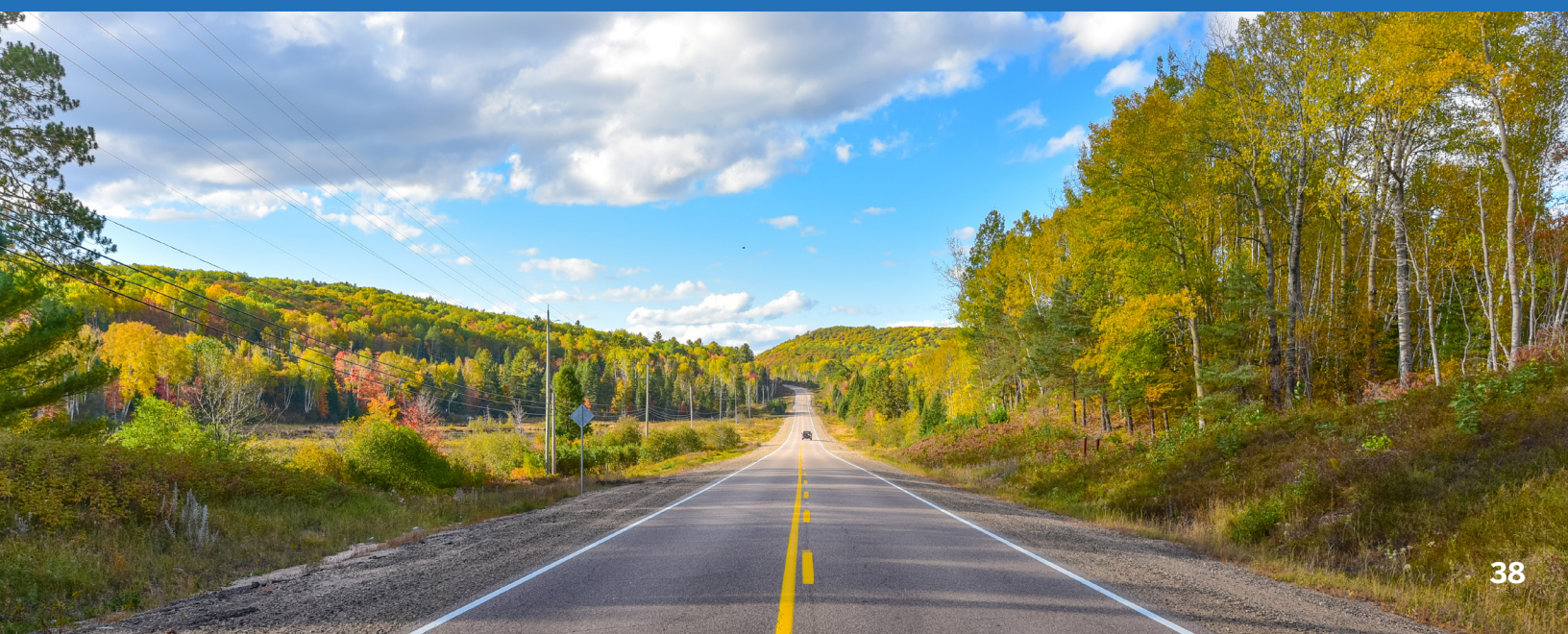
As we conclude our guide, we look towards the future, acknowledging both the challenges and opportunities that lie ahead for electric cooperatives.

The escalating threat of wildfires presents significant challenges for electric cooperatives. These include the need to protect vulnerable infrastructure, manage the direct and indirect impacts of wildfires on cooperative members, and navigate the economic and regulatory complexities associated with wildfire mitigation and response.

Despite these challenges, there are also many opportunities. Advances in technology offer new tools for fire detection, infrastructure protection, and system resilience. Regulatory changes and public awareness of wildfire risks are driving increased investment in wildfire mitigation, creating opportunities for funding and collaboration. And the cooperative model itself – with its emphasis on community engagement and local decision-making – is a powerful asset in managing wildfire risks.

Building a future-ready electric cooperative means understanding the challenges and embracing new opportunities. It means investing in infrastructure, technology, and community education to enhance wildfire resilience. It also means continually learning and adapting to the evolving wildfire landscape.

As we navigate the road ahead, we are confident that electric cooperatives can rise to the challenge of wildfire season, enhancing the safety, reliability, and sustainability of our power systems for the benefit of all members. Together, we can build a future-ready electric cooperative that is prepared for wildfire season and beyond.



Appendices

About the Authors

Ron Cardwell

President and Co-Founder

Ron Cardwell is an accomplished executive with over 25 years of experience leading high-growth software and technology driven services companies. As Co-Founder and President of Constellation Clearsight, Ron is responsible for driving the company's vision, strategy, and financial performance.

Ron is a sought-after speaker and has presented at numerous industry events and conferences, including the Gartner Business Intelligence & Analytics Summit, the Digital Transformation Summit, and the Harvard Business Review's Digital Transformation Forum. He is known for his engaging and inspiring speaking style, and his ability to distill complex ideas into practical insights and strategies that can be applied in real-world situations.

In 2023, Ron is available to speak on the following topics:

- Energy and the AI Future: How AI, Machine Learning, and Automation are Transforming the Business Landscape in the Energy Industry
- Innovations in Energy Management: How Technology is Driving Efficiency and Sustainability
- Digital Transformation: Strategies for Leveraging Technology to Drive Business Value and Growth
- Building a Culture of Innovation: How to Foster Creativity and Drive Disruptive Change
- Leadership in a Changing World: Navigating Complexity and Driving Results in Uncertain Times

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About the Authors

Eddie Aquije

Product Line Manager, Transmission & Distribution (T&D)

Eduardo (Eddie) Aquije is a seasoned utilities energy professional with over 10 years of experience in the industry. He brings expertise in developing successful product lines and driving revenue growth through effective business strategies. As a Product Line Manager of Constellation ClearSight, he owns the Transmission and Distribution product line strategy, positioning, and go-to-market plan.

Eddie is an engaging speaker who has presented at conferences and events around the world and is comfortable speaking to both English and Spanish-speaking audiences.

In addition to wildfire preparation, Eddie is available to speak on the following 2023 topics:

- Data-Driven Inspections: How Analytics and AI are Revolutionizing T&D Operations
- Innovations in Inspection Technology: Improving Safety and Efficiency for Electric Cooperatives
- Data-Driven Asset Management: The Role of Analytics in T&D Infrastructure Optimization
- Innovative Solutions for Safety and Reliability: The Latest Technologies and Strategies

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About the Authors

Alex Brown

Vegetation Product Line Manager

Alexander (Alex) Brown is a seasoned product manager with over 20 years of experience in the energy industry, specifically vegetation management. As the Product Line Manager for the Constellation Clearsight Vegetation Management Product Line, Alex is responsible for leading the development, launch, and growth of the company's vegetation monitoring and management solutions.

Alex is a seasoned speaker who has presented at several industry events and conferences including those hosted by Electric Power Research Institute (EPRI), Electric Utility Consultants Inc. (EUCI), Trees and Utilities, International Society of Arboriculture, and Environmental Concerns in Right-of-Way Management. In addition to these speaking engagements, Alex has also conducted webinars and workshops on various topics related to utility vegetation management and published in T&D World on environmental stewardship in utility vegetation management.

In 2023, Alex is available to speak on the following topics:

- Leveraging Technology to Improve Vegetation Management: The Role Drones, LiDAR, Satellite, and AI Can Play in Your Next Inspection
- Growing Strong: Best Practices for Effective Utility Vegetation Management
- Innovations in Vegetation Monitoring and Management
- How Data Analytics is Revolutionizing Vegetation Management
- Flameproofing Your Utility: Vegetation Management for Wildfire Mitigation
- Tree Risk Assessment for Electric Utilities

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About the Authors

Varun Aditya Mittagunta

Innovation Lead

Varun Aditya Mittagunta is an accomplished engineer who brings deep expertise in LiDAR technology and vegetation management. With over 12 years of experience in the technology industry, Varun has been at the forefront of developing and commercializing cutting-edge LiDAR solutions for various applications.

In his speaking engagements, Varun shares his insights on the latest trends and innovations in LiDAR technology, and how they can be applied to vegetation management. He also provides practical guidance on how utilities and other asset owners can leverage LiDAR technology to optimize their vegetation management programs, improve reliability, and reduce costs.

In 2023, Varun is available to speak on the following topics:

- The Future of Vegetation Management: How LiDAR Technology is Transforming Asset Management
- From Data to Insights: How LiDAR Technology is Enabling Data-Driven Vegetation Management
- Innovations in LiDAR Technology and best practices for Implementing LiDAR-Based Vegetation Management Programs

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Glossary of Key Terms

Aerial Drone Inspection: The process of using uncrewed aerial vehicles (drones) to assess and inspect the condition of physical structures, including power lines and utility poles.

AI (Artificial Intelligence) and ML (Machine Learning): Artificial Intelligence refers to the simulation of human intelligence processes by machines, especially computer systems. Machine Learning is a subset of AI that involves the development of algorithms that allow computers to “learn” from and make decisions or predictions based on data. Instead of being explicitly programmed to perform a task, machine learning algorithms “learn” from experience.

Climate Change: Long-term changes in temperature and typical weather patterns in a place.

Crisis Management Plan: A documented plan outlining the specific actions to be taken in the event of an emergency or disaster to mitigate its impact.

Deforestation: The process of removing or clearing away trees from a forested area, often to make way for agriculture or urban development.

Electric Cooperative (Co-op): An electric utility entity that is owned by the members it serves. It operates on a not-for-profit basis and is governed by a board of directors elected by the membership.

Electric Infrastructure: The foundational services and structures necessary for the generation, transmission, and distribution of electricity.

LiDAR (Light Detection and Ranging): A remote sensing method that uses light in the form of a pulsed laser to measure distances to objects, often used in vegetation management and topographical mapping.

Resilience: The ability to recover quickly from difficulties; in the context of electric infrastructure, resilience often refers to the ability to withstand and recover quickly from damage, including that caused by wildfires.

Satellite Technology: The use of artificial satellites to provide communication, navigation, and weather information.

Urbanization: The process by which towns and cities are formed and grow due to an increasing population shifting from rural to urban areas.

Vegetation Management: The practice of managing and maintaining vegetation growth to ensure safety and reliability of electric infrastructure.

Wildfire: An uncontrolled fire that spreads rapidly, often in rural or forested areas, fueled by vegetation and driven by wind.

List of Useful Resources and Contacts

With this resource list at your fingertips, you are well-equipped to stay informed, proactive, and prepared for the wildfire season.

Academic Articles and Research Cited

1. “Key Technical Challenges for the Electric Power Industry and Climate Change” by Lisa Beard et al. (2010). This paper identifies key technical issues facing the electric power industry related to global climate change. [PDF Link](#)
2. “A comprehensive review of climate adaptation in the United States: more than before, but less than needed” by Rosina Bierbaum et al. (2013). This paper reviews existing and planned adaptation activities of federal, tribal, state, and local governments and the private sector in the U.S. [PDF Link](#)
3. S. Jazebi, F. de León and A. Nelson, “Review of Wildfire Management Techniques—Part 1: Causes, Prevention, Detection, Suppression, and Data Analytics,” in *IEEE Transactions on Power Delivery*, vol. 35, no. 1, pp. 430-439, Feb. 2020, doi: 10.1109/TPWRD.2019.2930055.
4. Farnes A, Weber K, Koerner C, Araújo K, Forsgren C. The Power Grid/Wildfire Nexus: Using GIS and Satellite Remote Sensing to Identify Vulnerabilities. *Fire*. 2023; 6(5):187. <https://doi.org/10.3390/fire6050187>
5. Lynne Holt, Theodore K. Kury. Florida’s Storm Hardening Effort: A New Paradigm for State Utility Regulators, *The Electricity Journal*, Volume 24, Issue 4, 2011, Pages 62-71, ISSN 1040-6190, <https://doi.org/10.1016/j.tej.2011.04.002>. Following several hurricanes in 2004 and 2005, the Florida Public Service Commission initiated a multi-year process that emphasized both collaboration and research and resulted in expanded requirements for utility accountability. An alternative approach was recommended by Joshua Rokach in a recent article in this journal. Regardless of the regulatory process selected, policy questions remain as to the best way to proceed.

Resources

6. National Interagency Fire Center
The Nation's support center for wildland firefighting.
Website: <https://www.nifc.gov/>
7. Firewise USA
A voluntary program that provides a framework to help neighbors get organized, find direction, and take action to increase the fire resistance of their homes and community. Website: <https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA>
8. U.S. Fire Administration
Provides information resources in many formats including books, pamphlets and DVD's - free of charge. Website: <https://www.usfa.fema.gov/>
9. Ready.gov
Wildfires - Provides practical advice on preparing for, preventing and recovering from wildfires. Website: <https://www.ready.gov/wildfires>
10. CAL FIRE
Wildfire Preparedness - California Department of Forestry and Fire Protection's comprehensive information and resources for wildfire preparedness.
Website: <https://www.readyforwildfire.org/>
11. National Fire Protection Association (NFPA)
Wildfire Division - Offers resources and information about safety precautions to take before, during and after wildfires.
Website: <https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire>
12. U.S. Forest Service
Wildland Fire - Provides detailed information about wildfire management and prevention. Website: <https://www.fs.fed.us/managing-land/fire>
13. NOAA - Fire Weather - The National Oceanic and Atmospheric Administration provides accurate and up-to-date fire weather information.
Website: <https://www.weather.gov/fire/>
14. T&D World
"PGE, Pacific Power and Idaho Power Urge Preparing Outage Kit, Staying Informed"
Good reference on how several utilities are preparing their communities for wildfire season. Website: <https://www.tdworld.com/wildfire/article/21266085/pge-pacific-power-and-idaho-power-urge-preparing-outage-kit-staying-informed>

Contacts

National Association of State Foresters

Contact for state-specific resources and guidance.

Website: <https://www.stateforesters.org/>

National Rural Electric Cooperative Association

Provides guidance and resources to electric cooperatives on various issues, including wildfire preparation.

Website: <https://www.cooperative.com/>

National Wildfire Coordinating Group

A collaboration of U.S. federal agencies dedicated to coordinating resources and responses to wildfires.

Website: <https://www.nwccg.gov/>



For questions or assistance related to our wildfire mitigation program, advanced digital infrastructure inspections, vegetation management, or other services, reach out to us at:

www.constellationclearsight.com
clearsight@constellation.com
(800) 794-9537