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PREVENTING UTILITY-RELATED WILDFIRES

A Prevention-First Framework for Modern Grid Safety

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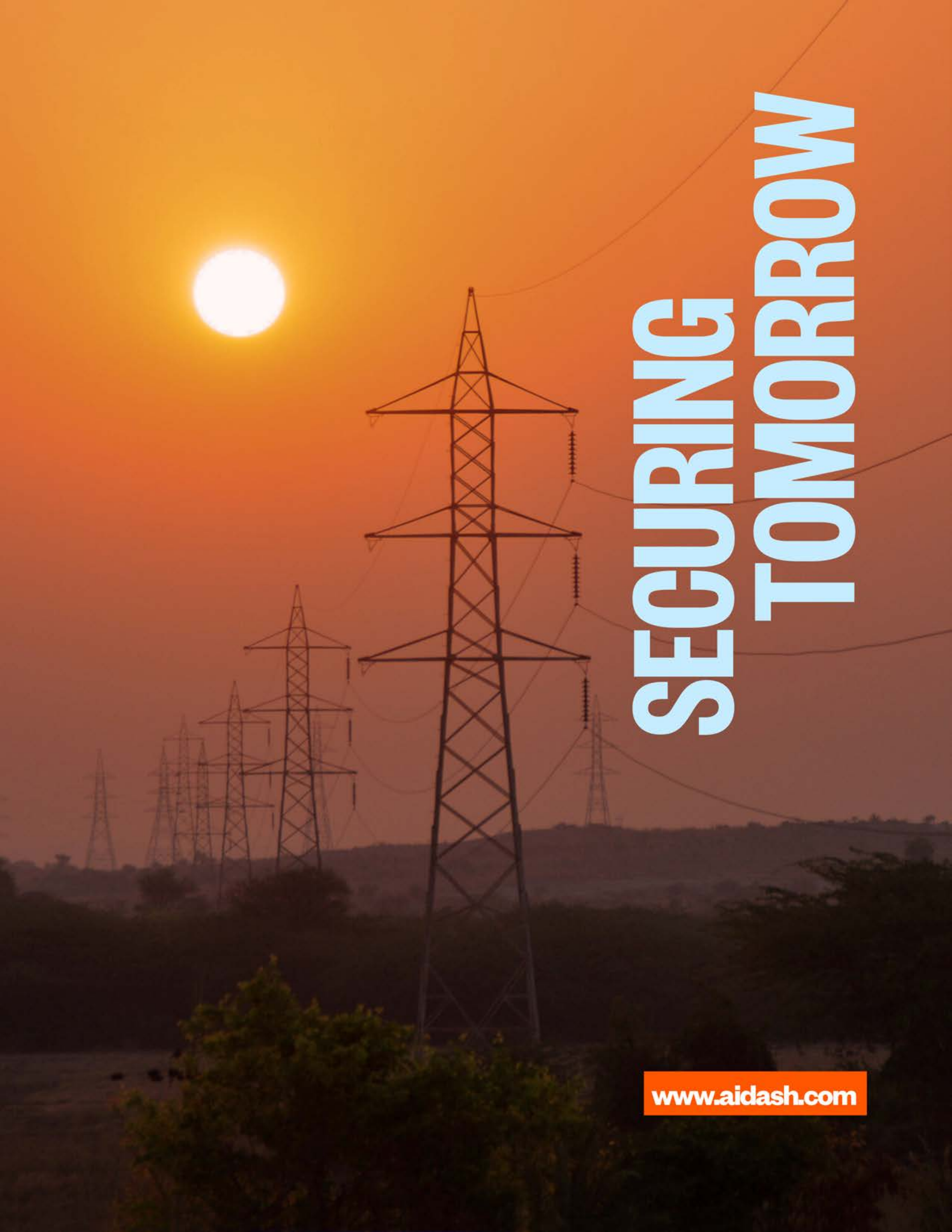
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The United States faces an immediate national emergency that demands urgent action: utility-related wildfires. Recent catastrophic events demonstrate that traditional utility approaches focused on calendar-based maintenance and broad geographic power shutoffs are proving dangerously inadequate as climate change creates more extreme and unpredictable conditions. Although electrical power only ignited 9% of wildfires between 2014 and 2017, these fires were responsible for 42% of the total area burned and over half of the fatalities from the most destructive fires.[1]

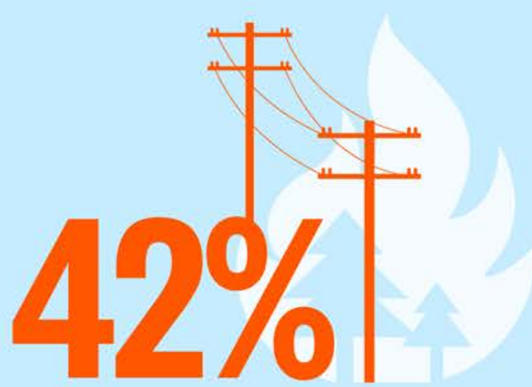
While the sophistication of wildfire mitigation will vary based on risk levels and resources, every utility—investor-owned, cooperative, or municipal—must develop and maintain appropriate wildfire mitigation capabilities. This document presents a transformative framework that emphasizes proactive prevention, data-driven decision making, and surgical response capabilities.

The Evolution Beyond Traditional Models

Historically, utilities have relied on standardized approaches: fixed maintenance cycles, broad geographic power shutoffs, and reactive responses to deteriorating conditions.

While these methods provided predictable operations, they fail to address the complex reality of modern wildfire risks. With much of the U.S. electric grid built in the 1960s and 1970s, utilities face unprecedented challenges in managing aging infrastructure while adapting to rapidly changing environmental conditions.

The traditional mindset of treating wildfire safety as a separate program must evolve. We should begin to view it as an integral component of every utility decision and investment.



of the total area burned in wildfires was caused by electrical power ignition.[1]

[1] California Public Utilities Commission, "Reducing Utility Related Wildfire Risk", 2020

A New Prevention-First Framework

This playbook establishes a comprehensive prevention-first framework built on five core principles:

1. Risk Understanding Must Drive Action:

Modern utilities must maintain sophisticated awareness of landscape risks, vegetation conditions, and asset health across their entire service territory.

Advanced technologies, including satellite monitoring, AI-powered analytics, and predictive modeling, now make this possible at scale. This awareness requires moving beyond simple geographic risk maps to a dynamic understanding of evolving conditions.

2. Prevention Eliminates the Need for Reaction:

Rather than accepting regular power shutoffs as inevitable, utilities should strive to reduce conditions that necessitate them. They can do so through aggressive vegetation management, strategic system hardening, and proactive operational protocols. Success requires the integration of this prevention mindset into every aspect of utility operations.

3. Surgical Response Over Broad Reactions:

When intervention becomes necessary, utilities should implement precisely targeted actions based on specific asset risks rather than broad geographic shutoffs. This requires sophisticated situational awareness and network hardware that enables utilities to isolate truly threatened infrastructure while maintaining service to other areas.

4. Data Must Drive Decisions:

Modern wildfire mitigation demands moving beyond calendar-based maintenance to true risk-based decision-making powered by continuous monitoring and predictive analytics. Every major investment and operational decision should be evaluated through the lens of wildfire risk reduction and prevention effectiveness.

5. Technology Enables Transformation:

The technology exists today to transform how utilities assess and manage wildfire risks. High-resolution monitoring, AI-powered analytics, and sophisticated decision support tools should become standard capabilities. Utilities must accelerate the adoption of these technologies to enable proactive risk management.

Implementation Framework

Effective implementation requires coordinated action across multiple dimensions:

- **Landscape Risk Assessment**: Utilities must maintain continuous awareness of wildfire risk factors across their service territories, combining satellite monitoring, weather data, and vegetation analytics to identify and track evolving threats.

- **Vegetation Management**: Programs must evolve from fixed maintenance cycles to risk-based approaches that identify and address threats before they materialize. This includes expanding focus beyond traditional right-of-way (RoW) boundaries to manage risk across the landscape.

- **System Hardening**: Infrastructure investments should be prioritized based on risk reduction potential and speed of implementation rather than simple age-based replacement. This means pursuing quick wins through targeted hardening activities while planning longer-term resilience improvements.

- **Operational Integration**: Wildfire safety considerations must be embedded in daily operations through enhanced situational awareness, dynamic protection settings, and sophisticated de-energization protocols.

The Role of Regulators

Regulators play a crucial role in enabling this transformation by:

- Establishing clear requirements while providing flexibility in implementation approaches
- Supporting investment in analytical capabilities needed for data-driven decision-making
- Evaluating success through metrics that address achieved risk reduction rather than program completion
- Encouraging innovation in prevention and mitigation strategies
- Facilitating coordination between utilities and other stakeholders

The Path Forward

Success requires a sustained commitment to drive cultural transformation throughout organizations; evolving utilities to better mitigate wildfire risk is no exception.

For utilities of all sizes, this transformation demands clear executive accountability for wildfire safety, integrated into organizational goals and performance metrics. Leaders must drive a shift from reactive maintenance to proactive risk management throughout their organizations. This means equipping every worker—from field crews identifying hazards to engineers incorporating safety into designs—with the training and tools to contribute to wildfire prevention.

The transformation extends to core utility operations, where traditional reliability metrics and fixed maintenance cycles must evolve into dynamic, risk-based approaches that respond to changing environmental conditions. Success requires ongoing reinforcement through clear communication channels and recognition of proactive risk identification at every level.

From regulators, success requires a multifaceted approach centered on establishing clear requirements while providing flexibility in implementation. Regulators must support investment in analytical capabilities needed for data-driven decision-making while evaluating success through metrics that address achieved risk reduction rather than simple program completion.

Utility regulatory commissions play a crucial role in encouraging innovation in prevention and mitigation strategies and facilitating coordination between energy providers and other stakeholders. Oversight should include developing rate structures that incentivize proactive risk management, while streamlining approval processes for critical safety improvements without compromising rigorous oversight.

Most importantly, both utilities and regulators must collaborate to embrace available technology to enable proactive risk management. This means deploying advanced monitoring systems that combine **satellite imagery**, **weather data**, and **asset health information**.

It requires implementing AI-powered analytics to identify emerging risks before they materialize, while utilizing sophisticated decision support tools that enable data-driven resource allocation. Continuous awareness of changing conditions through remote sensing capabilities becomes essential for maintaining comprehensive risk awareness.

The end objective is clear: a resilient grid where infrastructure design, maintenance practices, and operational protocols work together to prevent catastrophic wildfires while ensuring reliable power delivery.

This means creating a system where infrastructure is engineered to minimize ignition risks, and vegetation management programs anticipate and address threats before they materialize. In this transformed system, operational decisions are guided by sophisticated risk assessment, emergency responses are precise and targeted, and customer impacts are minimized through strategic planning and advanced technologies.

While achieving this vision requires significant investment and operational changes, it represents the only sustainable path forward for modern utilities.

The costs of implementation, while substantial, pale in comparison to the potential liabilities and societal impacts of catastrophic wildfires. This document provides regulators and utilities with a clear framework for this essential transformation, offering both strategic guidance and practical implementation steps toward a safer, more resilient electric grid.

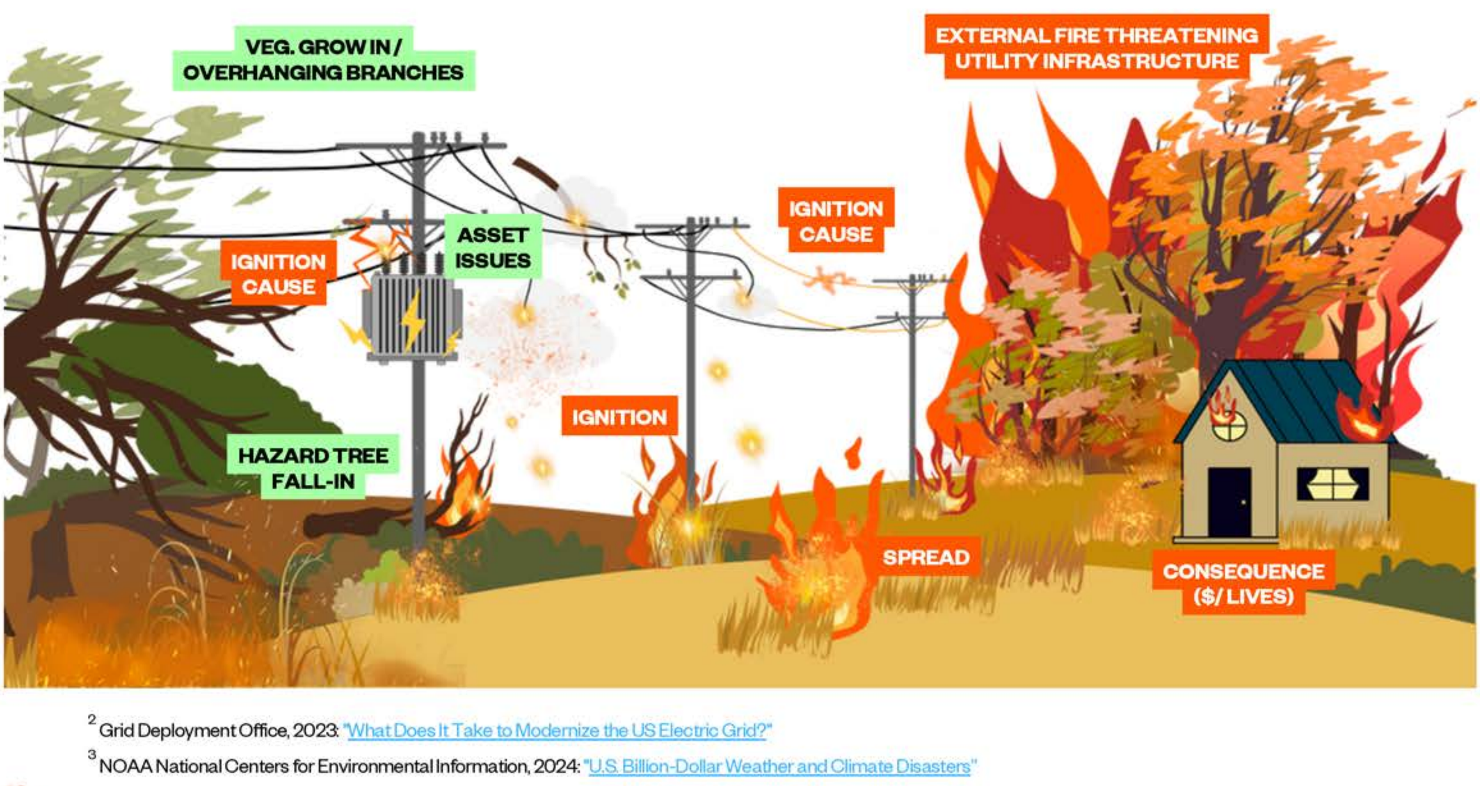
INTRODUCTION

Utility-caused wildfires have emerged as a critical threat to public safety and grid reliability. They're driven by aging infrastructure and complex interactions between utility assets and their surrounding environment.

With much of the U.S. electric infrastructure built in the 1960s and 70s,[2] utilities face unprecedented challenges in managing landscape risks and maintaining situational awareness across their service territories. A significant portion of the electric grid is nearing the end of its intended lifespan, making it increasingly vulnerable to failure and ignition risk.

Equipment failures, such as downed power lines and faulty insulators, can ignite dry vegetation and spark catastrophic wildfires, particularly in areas with high fire risk. Climate change is exacerbating wildfire risk by increasing the frequency and intensity of droughts, heat waves, and extreme weather events.[3]

These conditions create a tinderbox-like environment, where even small sparks can quickly escalate into raging infernos. Utilities should proactively assess their infrastructure and vegetation and adapt their wildfire mitigation strategies to account for the changing climate and the increased risk of ignitions.



[2] Grid Deployment Office, 2023: "What Does It Take to Modernize the US Electric Grid?"

[3] NOAA National Centers for Environmental Information, 2024: "U.S. Billion-Dollar Weather and Climate Disasters"

Technological advancements, such as artificial intelligence (AI), remote sensing, sophisticated situational awareness, and advanced grid technologies offer new opportunities for improving wildfire mitigation efforts.

These technologies can enhance situational awareness, enable data-driven decision-making, and improve the efficiency and effectiveness of vegetation management and system hardening.

A New Approach to Wildfire Mitigation

The evolution of utility wildfire risk models traces back to San Diego Gas & Electric's Wildfire Risk Reduction Model (WRRM), developed to prioritize grid hardening investments for maximum risk reduction per dollar spent. Since then, the industry has seen significant advancement in wildfire risk modeling capabilities.

Many of the current wildfire risk models have emerged from the fire management sector, offering sophisticated fire behavior simulations that have proven valuable for fire departments in assessing and managing wildfire risk. These solutions provide utilities with important characteristics for understanding fire behavior such as fire spread and intensity and risk.

However, utilities face unique challenges around their infrastructure and operational needs that require a nuanced approach, particularly around:

- **Preventative approaches** to eliminate utility-caused ignitions
- **Bolstering situational awareness** by confirming potential fuel sources using artificial intelligence
- **Addressing liability risks** from outside-origin fires by projecting inbound fire paths to utility equipment
- **Incorporating real-time weather and vegetation conditions** into operational decision-making
- **Optimizing the balance** between public safety and continuity of service

This playbook presents a holistic perspective on emerging utility-specific approaches, highlighting how proactive measures and advanced technologies can be leveraged to prevent utility-caused wildfires while also managing risks from external fire threats. By combining established fire science with utility-specific insights, the industry can develop more effective and efficient wildfire mitigation strategies.

Modern Multi-Layered Prevention Strategy: To effectively prevent utility-related wildfires, utilities should adopt a multi-layered approach powered by modern technology and advanced analytics.

This starts with a comprehensive landscape risk assessment, including using satellite monitoring to evaluate vegetation health and environmental factors across the service territory. AI-enabled systems help detect dangerous conditions while driving risk-based vegetation management to identify hazards before they pose ignition threats. By integrating these preventative capabilities with strategic system hardening, utilities can identify and address potential ignition risks at scale.

extreme conditions should utilities consider Public Safety Power Shutoffs (PSPS) or emergency line de-energization.

Public Safety Power Shutoffs (PSPS): While PSPS is a useful tool for wildfire risk mitigation, it should be viewed as a surgical approach as utilities build towards a more sophisticated risk-mitigation system. Current PSPS implementations often demonstrate minimum precision and maximum disruption—the opposite of what utilities should strive to achieve.

The goal should be a "perfect PSPS" that is extremely precise and minimally disruptive—one enabled by robust risk analysis, situational awareness, and the strategic placement of SCADA devices and advanced network controls to precisely identify and isolate only the highest-risk areas for the minimum necessary duration.

The true north star is developing a grid so resilient and intelligent that preventive shutoffs become necessary only in extreme cases. The ultimate focus should shift to proactive wildfire prevention, where advanced technologies identify and eliminate potential causes of ignitions before they emerge, creating a future where utilities can maintain public safety while rarely needing to disconnect power.

Emergency Line De-energization: Given changing climatic conditions, and regardless of their efforts to eliminate risk, utilities will continue to face an increasing incidence of wildfires in the future that threaten their assets.

Henceforth, they should also invest in advanced remote sensing technologies to maintain continuous awareness of active fires to respond to those that could impact their networks. They should develop the capability of targeted emergency de-energization when fires approach infrastructure, which is distinct from broader PSPS events.

Through satellite monitoring and AI-powered analytics, utilities can implement surgical de-energization only where necessary, minimizing customer impacts while ensuring safety.

This playbook provides regulators with a comprehensive framework for evaluating and guiding the development of modern wildfire mitigation programs. Through seven carefully structured chapters, it establishes both foundational principles and practical guidance for implementation:

Chapter 1 introduces the critical need for wildfire mitigation plans (WMPs) in our changing climate, establishing why every utility must develop appropriate capabilities regardless of their historical risk profile. It provides regulators with clear criteria for evaluating the necessity and scope of mitigation programs within their jurisdictions.

Chapter 2 explores modern landscape risk assessment as the essential foundation for effective wildfire prevention. It details how advanced technologies and sophisticated analytics enable utilities to understand and monitor risk factors across their entire service territories —

a capability that underlies all other mitigation efforts.

Chapter 3 examines ignition management as the cornerstone of prevention, providing a structured framework for understanding and interrupting the chain of events that leads to utility-related fires. This chapter establishes how utilities can move beyond reactive responses to proactive risk elimination.

Chapter 4 delves into comprehensive situational awareness, demonstrating how modern utilities can integrate multiple data streams—from weather to vegetation health to asset conditions—into actionable intelligence that enables informed decision-making.

Chapter 5 transforms traditional vegetation management from a calendar-based maintenance activity into a sophisticated risk management program. It provides regulators with specific guidelines for evaluating program effectiveness and driving continuous improvement.

Chapter 6 reframes system hardening through the lens of risk-based decision making, establishing clear frameworks for evaluating and prioritizing infrastructure investments based on their ability to deliver timely risk reduction.

Chapter 7 presents a prevention-first approach to PSPS and emergency de-energization, demonstrating how utilities can minimize customer impacts through sophisticated risk assessment and targeted response capabilities.

This systematic progression—from understanding risk to implementing prevention to enabling targeted response — provides regulators with both strategic perspective and tactical guidance. Each chapter builds upon previous concepts while introducing new tools and frameworks for evaluation.

For regulators, this playbook serves multiple essential functions:

- **Establishes clear standards** for evaluating utility wildfire mitigation programs
- **Provides structured frameworks** for assessing specific capabilities and initiatives
- **Enables risk-appropriate scaling** of requirements across different jurisdictions
- **Supports the development** of effective oversight and compliance programs
- **Facilitates alignment** between utilities, regulators, and other stakeholders

Most importantly, this playbook recognizes that wildfire mitigation requirements must be both rigorous and flexible.

While the most sophisticated approaches may be necessary in the highest-risk areas, every jurisdiction needs an appropriate framework for understanding and managing utility wildfire risk. The guidance provided here can be scaled and adapted based on local conditions while maintaining focus on essential capabilities and outcomes.

In the chapters that follow, we examine each component in detail—providing regulators and utility leaders with specific criteria, evaluation frameworks, and implementation guidance.

This comprehensive approach enables the development of effective oversight programs that drive meaningful risk reduction while ensuring reliable electric service.

A Call for Collaboration and Continuous Evolution

This playbook represents the beginning of a critical journey to transform how utilities and regulators approach wildfire risk mitigation. While it establishes essential frameworks and best practices, we recognize that effective solutions must be shaped by diverse perspectives and experiences across the industry. The challenges we face demand unprecedented collaboration between utilities, regulators, technology providers, fire agencies, and communities.

As we move forward, we will engage in deeper dialogue with utilities and regulators across multiple states to further refine and evolve these frameworks. Each utility faces unique combinations of risk factors, resource constraints, and operational challenges. Through broader engagement, we can develop more nuanced guidance that addresses the specific needs of utilities of every size and risk profile—from major investor-owned utilities in high-risk regions to smaller municipal utilities in emerging risk areas.

We invite all stakeholders to join us in this crucial endeavor. By sharing experiences, challenging assumptions, and collaboratively developing solutions, we can build more resilient and adaptable frameworks that serve our common goal: preventing catastrophic wildfires while maintaining reliable electric service. Together, we can transform these guidelines from a static document into a living framework that evolves with our growing understanding and changing conditions.

CHAPTER 1

Understanding the Need for Wildfire Mitigation Plans

The electrical grid that powered the United States into the 21st Century is increasingly vulnerable to wildfire risks. Most of the U.S. electric grid was built in the 1960s and 1970s during the post-World War II population and electricity demand boom.[4] According to the U.S. Department of Energy's (DoE) Grid Deployment Office, 70% of utility transmission infrastructure is more than 25 years old and approaching the end of its lifespan.[5] This aging infrastructure faces unprecedented challenges from increasing electricity demand and severe climate events:

- The U.S. Energy Information Administration (EIA) found that in 2021, U.S. electricity customers experienced over seven hours of power interruptions on average, a significant increase from three to four hours in 2013 when the EIA began its survey.[6] More than five of those seven hours were during extreme weather events.
- According to the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI), in 2023 alone, the United States experienced 28 billion-dollar disasters, more than any year on record and over three times higher than the 1980-2023 annual average.[7]

Among these climate-driven challenges, wildfire risk has become particularly acute. Alaska has suffered eight billion-dollar disasters between 1980-2024, all of which were wildfires. During the same period, California experienced 46 confirmed billion-dollar disasters, with wildfires accounting for the largest share (19 events). The National Risk Index identifies a significant portion of the United States as being at high risk of wildfires.

Several states have recognized this growing threat and implemented mandatory wildfire mitigation plan (WMP) requirements. California led this effort through Senate Bill 901 in 2018,[8] followed by Washington's House Bill 1032[9] and Oregon's ORS 757.963.[10]

These regulatory frameworks provide valuable models for other state energy policymakers developing their own WMP requirements and utilities looking for guidance on WMP development.

4 Clifford, Catherine. "Why America's Outdated Energy Grid Is a Climate Problem." CNBC, February 17, 2023.

5 Department of Energy. (2023, October 19). What does it take to modernize the U.S. electric grid? [Blog post]. Retrieved from https://www.energy.gov/articles/reimagining-and-rebuilding-americas-energy-grid

6 Berry, Rosalyn. "U.S. Electricity Customers Averaged Seven Hours of Power Interruptions in 2021." U.S. Energy Information Administration, November 14, 2022.

7 Smith, Adam B. "U.S. Billion-Dollar Weather and Climate Disasters, 1980 - Present (NCEI Accession 0209268)." NOAA National Centers for Environmental Information, 2024.

8 California Legislature. "SB 901- CHAPTERED."

9 Washington Legislature. "SB 1032."

10 Oregon Legislature. "ORS 757.963 - Pub. Utility Required to Develop Wildfire Protection Plan."

WMPs serve seven essential purposes:

1

They provide a structured framework for utilities to systematically **identify, assess, and mitigate wildfire risks**. Without such a framework, utilities often address wildfire risks reactively and inconsistently, leading to gaps in protection and inefficient resource allocation.

2

They establish **clear accountability** metrics for utility performance in wildfire prevention. This accountability is essential for ensuring **public safety** and maintaining **public trust** in both utilities and regulatory bodies.

3

They create a **standardized approach** for evaluating utility **wildfire preparedness**, allowing regulators to make informed decisions about resource allocation and risk mitigation strategies.

4

They **structure operational criteria** for how utilities act in the face of wildfire risk, thereby identifying the value of early situational awareness.

5

The activities prescribed by the WMP result in **significant improvements** to **public safety** and **service reliability**, whether any environmental risks appear or not.

6

The outlined strategy informs the long-term **grid infrastructure improvement** plans to increase **grid resiliency**, which is a key focus area for regulators. These improvements can lead to **lower insurance premiums** for utilities in high-risk areas.

7

A well-crafted WMP helps insurers verify the effectiveness of a utility's risk reduction strategies, potentially leading to **better insurance coverage terms** and improved insurability of the organization.

The development of an effective WMP requires a comprehensive understanding of multiple interconnected components. In the following chapters, we will examine each of these critical elements in detail. By understanding these components, utilities can construct mitigation programs and regulators can effectively evaluate and guide utilities' wildfire mitigation efforts.

Each chapter provides specific requirements, evaluation criteria, and implementation guidance based on proven practices and emerging technologies.

Let us begin with the fundamental task of understanding and mapping wildfire risk across utility service territories.

CHAPTER 2

Modern Landscape Risk Assessment: Establishing the Foundation

A comprehensive landscape risk assessment forms the foundation of any effective WMP. Over the last five years, we have witnessed a transformation in how utilities can assess and monitor wildfire risks, driven by remarkable advances in satellite technology, artificial intelligence, and machine learning. This chapter provides regulators with detailed guidance on evaluating utilities' risk assessment methodologies and prescribes minimum standards for modern landscape risk assessment programs.

Understanding the Risk Framework

Modern landscape risk assessment is built upon a three-dimensional understanding of wildfire risk: the likelihood of ignition, the potential for fire spread, and the consequences of a fire event.

This framework, pioneered by San Diego Gas & Electric and now adopted by leading utilities across the country, provides a structured approach to quantifying and managing wildfire risk. The approach also provides insight as to which proposed projects provide the best use of the utility funds for the greatest reduction in wildfire risk.[11] Regulators should require utilities to explicitly address each of these dimensions in their assessment methodology.

The identification of high-risk areas serves as the starting point for any assessment. While different jurisdictions use varying terminology — High Fire Threat Districts (HFTD) in California and High Fire Risk Zones (HFRZ) in Oregon, for example — the underlying principle remains constant: identify areas within or near a utility's service territory where the confluence of environmental conditions, asset proximity, and potential consequences creates elevated wildfire risks in relation to their facilities.

According to the California Public Utilities Commission's (CPUC) analysis, properly identified high-risk areas have demonstrated a very high correlation with actual wildfire events over the past decade.[12] The Fix Our Forests Act establishes critical infrastructure supporting modern risk assessment through its creation of an interagency Fireshed Center and public Fireshed Registry. These resources provide utilities

[11] Southern California Edison. "2024 Wildfire Mitigation Plan." California Public Utilities Commission, 2024.

[12] https://www.cpuc.ca.gov/industries-and-topics/wildfires/fire-threat-maps-and-fire-safety-rulemaking

with comprehensive geospatial data on wildfire exposure, historical management activities, and community risk factors. This integration of data and analysis capabilities enables utilities to build more sophisticated risk assessment approaches that consider both immediate infrastructure risks and broader landscape contexts.[13]

Core Components of Risk Assessment

In order for utilities to understand risk within and near their territory, they should deploy the following core components:

1. Geographic Information Systems (GIS):

Utilities should maintain detailed GIS mapping of their entire service territory, with particular attention to areas where infrastructure intersects with high-risk vegetation or topography.

This mapping should achieve resolution of at least 10 meters per pixel for broad areas and 30 centimeters per pixel within utility corridors, enabling precise risk assessment and mitigation planning.

Modern GIS systems should integrate real-time data layers from multiple sources including weather, vegetation, and asset details (e.g., type, age, location, etc.) to provide a comprehensive view of risk conditions and enable sophisticated analysis of potential threats.

2. Historical Fire Pattern Analysis:

Risk assessment should incorporate historical fire occurrence data to identify areas prone to ignition and spread. This analysis should examine not just where fires have occurred, but also how they spread under various conditions and what natural or man-made barriers proved effective at containing them. Understanding the frequency, severity, and cause of past fires helps anticipate High-Fire Areas (HFAs) and improves predictive accuracy for future events. This historical perspective provides crucial insights for identifying high-risk zones and developing effective mitigation strategies.

3. Asset Performance and Health Tracking:

Infrastructure condition and performance history form a critical component of wildfire risk assessment. Utilities should maintain comprehensive records of asset age, condition, maintenance history, and performance patterns to identify potential failure points before they create ignition risks. This includes tracking repair histories, known vulnerabilities, environmental exposure factors, outages, and expected lifespans.

Historical outage data (with cause codes) and component failure analysis should also be critical aspects of utility asset management practices to uncover risks.

[13] H.R. 471, Fix Our Forests Act §102-103 (2025)

4. Weather and Climate Data Integration:

Weather conditions fundamentally drive wildfire risk and should be continuously monitored and analyzed. Modern utilities should maintain comprehensive weather intelligence systems that combine data from multiple sources to create high-resolution forecasts customized to their service territory. These systems should integrate real-time observations, satellite data, and numerical weather models to enable both immediate situational awareness and longer-term risk forecasting. Effective weather monitoring captures local variations in conditions that could affect fire risk, particularly in high-risk areas.

Advanced weather intelligence systems should provide detailed insights into wind patterns, temperature variations, and humidity levels across the service territory. This local-scale understanding proves particularly crucial during extreme weather events when conditions can vary significantly over short distances.

5. Topography and Fire Behavior Modeling:

Understanding how terrain influences fire behavior is essential for accurate risk assessment. Modern risk analysis should incorporate detailed topographical data, including elevation, slope, aspect, and terrain roughness. These factors significantly influence fire spread patterns and pose unique challenges for utility infrastructure.

Advanced fire behavior modeling should simulate how fires might spread under various weather conditions across different terrain types, accounting for factors like wind channeling through canyons and upslope fire acceleration. This modeling helps identify areas where topography could amplify fire risk or complicate suppression efforts.

6. Vegetation Risk Management:

Vegetation management requires sophisticated monitoring and analysis capabilities given its dynamic nature and critical role in fire risk mitigation.

Remote sensing technologies should be deployed for frequent, comprehensive monitoring of utility right-of-way (and outside the right-of-way), moving beyond traditional cyclical inspections to at least annual assessments with increased frequency in high-risk areas during fire seasons.

Modern analysis should assess both vegetation encroachment risks and overall vegetation health, using multi-spectral analysis to detect moisture content, growth patterns, and early signs of deterioration.

This technology-enabled approach allows utilities to detect potential risks much earlier than traditional methods and shift from reactive to proactive vegetation management. The monitoring system should provide actionable insights through automated risk prioritization, clear visualization of threats, and integration with work management systems to ensure prompt risk mitigation before issues develop.

The Revolution in Remote Sensing

The landscape of utility infrastructure monitoring has been fundamentally transformed by advances in satellite technology. Modern satellite constellations now offer unprecedented capabilities that make continuous, high-resolution monitoring of utility corridors not just possible, but economically viable. Multiple utility programs have demonstrated that satellite-based vegetation monitoring could reduce inspection costs by 60% while being far more accurate than drive-through surveys and about 95% accurate when compared against thorough manual inspection.[14]

AI-Powered Data Fusion and Risk Analytics

A transformation in utility risk assessment has arrived. For the first time in history, we have the capability to process and analyze massive amounts of diverse data in real time to understand evolving wildfire risks. This represents a dramatic departure from traditional approaches that relied primarily on manual inspections and historical records.

The New Era of Data-Driven Risk Assessment: Today's utility executives navigate an entirely new world of data-driven risk assessment. Modern utilities receive continuous streams of high-resolution satellite imagery, real-time weather data, wind measurements, vegetation health metrics, and asset performance information. They maintain extensive databases of historical outages, equipment failures, fire perimeters, and climate patterns. The volume of this data is staggering — often exceeding several terabytes per day for a large utility. This would have been incomprehensible just a decade ago, but it now represents a powerful opportunity for enhanced risk management.

This wealth of data also presents a fundamental challenge: how can utilities effectively synthesize all of this information to understand actual conditions on the ground and predict emerging risks? This is where modern artificial intelligence systems become essential. Today's AI systems can process these diverse data streams in real-time, identifying subtle patterns and correlations that would be impossible for human analysts to detect. By leveraging the enormous computational power now available, these systems can perform complex multivariate analysis incorporating dozens of risk factors simultaneously.

Before analysis, data quality procedures and governance are important to define. This includes rigorous validation protocols, clear operational definitions for each data stream, documented policies and procedures for data collection and management, and structured data architectures that enable systematic auditing. All data inputs should have established quality control thresholds, standardized formats, and clear chains of custody to ensure reliability.

[14] Tulane University, Remote Sensing Technology and Artificial Intelligence for Utility Vegetation Management: A Regulatory Perspective Sprouting from a Pilot Study, 2023

Learning from History

AI-Powered Pattern Recognition:

The historical pattern analysis enabled by advanced computational systems represents another leap forward in risk assessment capabilities. Modern AI can analyze decades of fire history, weather patterns, and infrastructure performance to identify crucial patterns.

Areas that have repeatedly burned, natural barriers that have consistently stopped fires, and landscapes that are particularly vulnerable to extreme conditions can all be mapped and understood. This historical perspective becomes even more valuable as climate change alters traditional risk patterns.

Consider how risk patterns shift with changing environmental conditions: An area that historically presented low risk might become high risk during drought conditions or after changes in vegetation density. Traditional static risk assessment methods simply cannot capture these dynamic changes.

However, modern AI systems can continuously update risk assessments based on changing ground conditions. For example, when high-rainfall years create abundant vegetation that later dries during drought conditions, advanced AI models that are capable of predicting vegetation growth can rapidly identify the elevated risk and adjust mitigation priorities accordingly.

The Path Forward: Technology and Regulation

The computational power available today enables analysis that would have been impossible even a decade ago. We can now process and fuse multiple real-time data streams, detect subtle patterns across vast datasets, generate sophisticated predictive risk scores, and automatically adjust assessments as conditions change.

AI-powered monitoring systems can identify potential vegetation-related risks (fall-in, grow-in, etc.) much earlier than traditional inspection methods. This early warning capability is absolutely critical for preventing catastrophic wildfires.

Given these capabilities, it would be both irrational and irresponsible not to leverage modern AI and computing power for utility risk assessment. Regulators have a critical role to play in driving this technological transition. They should mandate that utilities leverage these powerful new capabilities to protect public safety and critical infrastructure. The stakes are simply too high to rely on outdated methods when far more sophisticated tools are available.

As climate change continues to create more extreme and unpredictable conditions, the importance of sophisticated AI-powered risk assessment will only grow.

The technology exists today to dramatically improve wildfire risk assessment. We should ensure it is deployed effectively across the utility industry.

Bringing It All Together: The Future of WMPs in the Age of Advanced Risk Assessment

The advanced capabilities described in this chapter represent more than just technological progress; they offer a fundamental opportunity to transform how utilities develop and execute their wildfire mitigation plans. Traditional WMPs often relied on static assessments and fixed maintenance schedules, leaving utilities struggling to adapt to rapidly changing conditions. Modern landscape risk assessment changes this paradigm entirely.

By incorporating AI-powered risk assessment into their WMPs, utilities can move from reactive to proactive wildfire prevention. Rather than waiting for annual inspections or responding to outages, utilities can continuously monitor their entire system for emerging risks. This allows for dynamic adjustment of vegetation management schedules, targeted infrastructure hardening, and optimization of resource allocation based on actual risk conditions rather than predetermined schedules.

The impact on WMP effectiveness can be transformative. Consider a utility that traditionally divided its service territory into fixed maintenance zones with predetermined inspection and trimming schedules. With modern risk assessment capabilities, that same utility can now continuously evaluate every segment of their system, identifying the highest-risk areas that require immediate attention while safely deferring work in lower-risk zones. This not only improves safety but also maximizes the impact of limited resources.

> **!** The question is no longer **whether to adopt** these capabilities, but **how quickly we can implement** them across the utility industry

More importantly, these capabilities enable utilities to demonstrate to regulators and stakeholders that their WMPs are based on sophisticated, data-driven analysis rather than general guidelines or historical practices. When a utility proposes specific mitigation actions in their WMP, they can now support those decisions with detailed risk analytics that show exactly why those actions are necessary and how they will reduce wildfire risk.

Looking ahead, the integration of modern landscape risk assessment into WMPs will become increasingly critical as climate change continues to alter traditional risk patterns. Utilities that strategically deploy these capabilities can maximize their infrastructure investments through data-driven prioritization, enhance grid resilience in vulnerable communities, and build adaptive capacity to address emerging climate risks. The technology exists today to create more effective, dynamic, and responsive WMPs. The question is no longer whether to adopt these capabilities, but how quickly we can implement them across the utility industry.

Ignition Management: Breaking the Wildfire Chain

The evidence is clear and compelling: Utility infrastructure presents a disproportionate wildfire risk that demands immediate regulatory attention. Analysis of California's experience reveals that while electrical power caused only 9% of wildfire ignitions from 2014-2017, these events accounted for 42% of acreage burned on state responsibility lands.[15] Even more concerning, utility-related ignitions were responsible for more than 50% of fatalities from California's twenty deadliest fires.[16]

The serious threat extends beyond California. Texas experienced over 4,000 power line-related ignitions in just three-and-a-half years, burning more than 640,000 acres.[17] In Victoria, Australia, utility infrastructure was responsible for most fatalities during the devastating "Black Saturday" fires of 2009.[18]

Regulators should therefore establish comprehensive ignition risk management requirements as the foundation of any effective wildfire mitigation strategy.

Today, many utilities rely primarily on fairly broad PSPS to prevent catastrophic wildfires. While this approach has gained significant momentum with western states, it provides incomplete protection while creating significant societal impacts. PSPS decisions depend on accurate risk predictions and timing; if predictions are wrong or implementation is delayed, catastrophic fires can still occur. Furthermore, widespread power shutoffs create their own public safety risks and economic damages.

A more comprehensive approach to ignition management moves utility operations towards the objective of eliminating utility-related wildfires.

[15] California Public Utilities Commission, "Reducing Utility Related Wildfire Risk", 2020

[16] CAL FIRE, "Top 20 Deadliest California Wildfires", 2024 Update.

[17] Texas Wildfire Mitigation Project. "How do power lines cause wildfires?" 2014.

[18] Fairley, Peter. "How an Australian State Fought Back Against Grid-Sparked Wildfires." IEEE Spectrum, November 2019.

Consider three illustrative scenarios:

1

A utility maintains completely cleared RoW brushes, maintains wide clearances, continuously monitors for vegetation encroachment, and creates containment zones in high-risk areas. While obtaining easements for such a corridor could be difficult for distribution facilities, the benefit is that even if equipment failure creates a spark, the absence of fuel prevents fire development. Such a utility has a low risk of igniting a catastrophic wildfire.

2

Another utility proactively monitors for vegetation encroachments, pruning them in a timely manner; removes all hazard trees that could fall into power lines; regularly applies fire retardants in high-risk zones; and maintains strategic fuel breaks. This multi-layered approach prevents both ignition sources and fire spread, effectively eliminating wildfire risk.

3

A third utility has fully undergrounded its power lines in risk areas and/or installed covered conductors. Though this approach is cost-prohibitive across entire systems, it physically eliminates the possibility of ignitions caused by overhead lines in critical areas (though some risks remain in the form of underground systems faults).

While extensive undergrounding may not be necessary or practical, the first two scenarios demonstrate that with proactive monitoring and preventative actions, ignition management can achieve comparable risk reduction through more cost-effective means.

This chapter presents a comprehensive framework for preventing utility-related wildfires by understanding and interrupting the chain of events that leads to catastrophic fires.

Understanding the Wildfire Chain

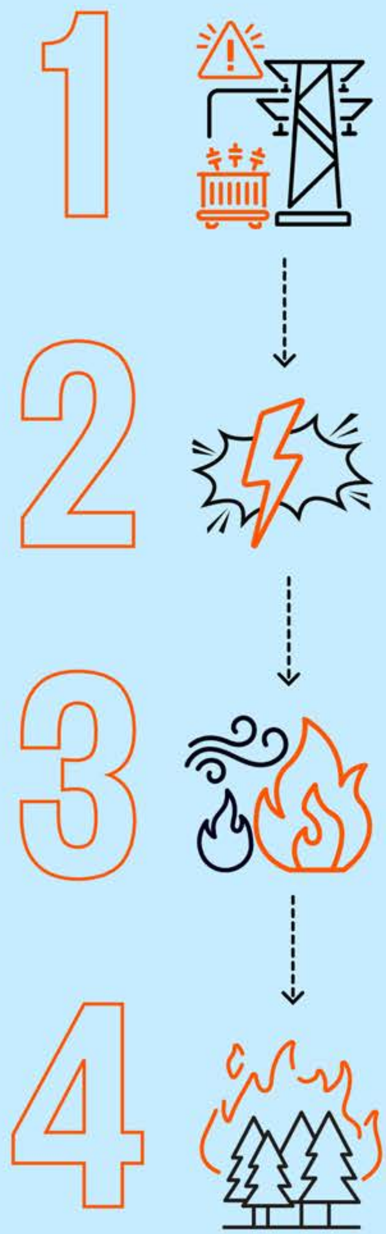
For a utility-related wildfire to occur, three critical conditions align in a devastating chain of events.

First, utility infrastructure creates an **ignition source**, typically through equipment failure, vegetation contact, vehicle/object contact, or wildlife interaction.

Second, receptive fuels are present to convert that initial spark or heat source into an **active ignition**.

Third, conditions support **fire spread**, including both environmental factors, like wind, and continuous fuel pathways that allow the fire to grow and propagate.

Understanding this chain provides regulators with multiple intervention points for prevention. By breaking any link in this chain, catastrophic wildfire development can be prevented. This understanding forms the foundation for a comprehensive two-dimensional strategy that addresses both ignition sources and the conditions that enable fire development.



Mandatory Documentation Framework

To effectively manage ignition risks, regulators should first establish standardized reporting requirements that create accountability and enable systematic improvement. California's Fire Ignition reporting requirement, implemented in 2014,[19] provides an effective model that regulators should adapt for their jurisdictions.

At a minimum, utilities should document any incident where electrical infrastructure creates ignition that spreads beyond the immediate source or damages non-utility property.

Regulators should consider additional criteria to capture events like pole fires that may not spread but indicate serious system vulnerabilities. The documentation requirements should encompass four critical phases:

1. Initial Documentation:

Field personnel should record basic information soon after discovering an ignition or related outage. This includes evidence of heat (such as burning, charring, or arcing), preliminary cause assessment, and immediate environmental conditions.

Speed of documentation is essential to capture perishable evidence and enable rapid response.

2. Technical Analysis:

Qualified staff should conduct detailed investigation of each event, examining specific failure modes, weather correlations, and asset histories. This analysis should seek to identify both immediate causes and potential systemic issues that could indicate broader vulnerabilities.

3. Management Review:

Leadership should evaluate analysis findings and implement appropriate corrective measures. The level of response should scale with risk. High-risk findings demand immediate corrective action and system-wide review, while lower-risk issues may be addressed through scheduled maintenance programs.

4. Inform CapEx investments and system upgrades:

These findings, especially pertaining to asset health and conditions, should inform and enable prioritization for regular maintenance, upgrades, and improvements in the infrastructure at risk for ignition.

[19] CPUC Decision 14-02-015 February 5, 2014

A Two-Dimensional Strategy for Prevention

Regulators should require utilities to implement comprehensive ignition management programs that simultaneously address both the sources of ignition and the conditions that enable fire development and spread. This dual focus provides multiple opportunities to interrupt the wildfire chain while making efficient use of limited resources.

Dimension 1: Eliminating Ignition Sources

The first dimension focuses on preventing the initial spark or heat source that could start a fire as a result of utility equipment. This requires a systematic approach to managing all potential ignition sources, with efforts prioritized based on territory risk levels.

Analysis of utility data reveals the critical importance of this dimension. In California, contact with foreign objects accounts for 53% of utility-related ignitions that burned more than ten acres, with vegetation specifically responsible for 35% of these incidents.[20] Equipment failures represent the second major category at 32% of significant ignitions, with connection points and conductor failures being the predominant issues. These statistics demonstrate that focusing on ignition sources can address over 85% of catastrophic utility-related fires. Regulators should require utilities to implement comprehensive equipment management programs and vegetation management programs that go beyond routine maintenance.

Equipment management forms the foundation of this dimension. Utilities should implement comprehensive inspection, mitigation, and (wherever necessary) audit programs that identify and address potential failure points before they create ignition risks. With equipment failures responsible for nearly one-third of significant ignitions, these programs should leverage advanced diagnostic technologies that enable early detection of deteriorating conditions. Connection points and conductors require particular attention, given their prevalence in ignition events.

Vegetation management represents another critical component of ignition source elimination. The fact that vegetation contact alone accounts for over one-third of significant ignitions demonstrates that standard clearance requirements and current trimming practices that do not adjust on-basis of situation often prove insufficient, particularly during extreme weather conditions. Regulators should therefore seek enhanced vegetation management standards that do not leave any blindspots and increase clearances with territory fire risk.

These requirements should be accompanied by proactive removal of hazard trees that could contact lines during storms or high winds. (Chapter 5 provides detailed guidance on comprehensive vegetation management strategies.)

[20] California Public Utilities Commission, "Reducing Utility Related Wildfire Risk", 2020

Wildlife protection measures form the third key element of ignition source control and are an often-overlooked risk.

Utilities should install protective equipment in high-risk and high-activity areas and modify infrastructure designs to reduce wildlife contact opportunities. These measures can dramatically reduce animal-caused faults while also providing additional protection against other contact sources.

Dimension 2: Preventing Fire Ignition/Development

The second dimension focuses on preventing any sparks that do occur from developing into spreading fires. This requires aggressive fuel management within and adjacent to utility corridors that goes beyond traditional vegetation management practices.

Regulators should require utilities to implement comprehensive fuel management strategies that include reduction of ground fuels in highest-risk areas, creation of strategic fuel breaks, and application of fire retardants in appropriate locations.

System hardening plays a crucial role in this dimension by creating infrastructure that is less likely to fail catastrophically even when faults occur. However, complete system undergrounding is cost-prohibitive: California's regulators report that undergrounding costs varied across the state from$1.85 million and $6.1 million per mile.[21]

$1.85-$6.1 MILLION

per mile of undergrounding costs reported by[2] California's regulators

Given these costs, strategic undergrounding should only be targeted by utilities at the highest-risk areas, where potential liability costs outweigh the capital outlay.

Other hardening measures, like insulated conductors, wider cross-arms, fuse and lightning arrestor replacements, lower emission switches, and enhanced pole materials, can provide significant risk reduction at lower cost.

(Chapter 6 provides detailed guidance on system hardening strategies and prioritization.)

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[21] California Public Utilities Commission. (n.d.). California Public Utilities Commission. Retrieved [February 15, 2025] from https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/electric-reliability/undergrounding-program-description

Risk Assessment and Monitoring Framework

Modern ignition management demands integration of sophisticated risk assessment and monitoring capabilities across both dimensions of prevention. Regulators should require utilities to implement frameworks that enable both strategic planning and real-time operational decisions by combining multiple data streams into actionable intelligence.

The assessment framework should begin with a clear understanding of territory risk levels. This requires detailed mapping of historical ignition patterns, vegetation density and type, population exposure, and critical infrastructure locations. However, static risk mapping alone is insufficient; utilities should maintain dynamic awareness of changing conditions that could affect either ignition probability or fire spread potential.

For the first dimension of ignition source control, monitoring should focus on asset health and vegetation conditions. Utilities should implement remote sensing capabilities that provide continuous assessment of vegetation encroachment and condition. These systems should be supplemented by targeted deployment of advanced inspection technologies in highest-risk areas. Asset health monitoring should combine real-time diagnostic data with predictive analytics to identify potential failures before they create ignition risks.

The second dimension requires sophisticated monitoring of fuel and weather conditions. Weather monitoring systems play a particularly crucial role, as conditions can change rapidly from low-risk to extreme danger. These systems should track wind speed, temperature, humidity, and other factors that influence both ignition probability and spread potential.

Modern monitoring capabilities should combine wide-area satellite observation for continuous coverage with targeted deployment of advanced technologies like LiDAR in highest-risk areas. This risk-based approach to technology deployment optimizes cost-effectiveness while maintaining appropriate surveillance levels across the service territory.

Building Utility Capabilities: A Strategic Roadmap

Regulators should guide utilities toward comprehensive ignition management capabilities while recognizing that this transformation requires sustained effort. A structured, multi-year approach allows utilities to build capabilities progressively while delivering measurable risk reduction at each stage.

The strategic roadmap (outlined below) consists of a series of four phases spanning approximately four to five years: **Foundation** (12-18 months), **Integration** (18-24 months), **Analytics** (12-18 months), and ultimately ongoing **Maturity**.

12-18 MO

The Foundation Phase establishes the essential building blocks for data-driven decision-making. To start, utilities should implement standardized ignition documentation processes and begin collecting structured data about ignition events and conditions. Systematically collecting and verifying this information helps identify which urgent risks should be addressed first.

18-24 MO

The Integration Phase connects key systems and enhances data collection capabilities. Utilities establish unified data architecture connecting key systems while deploying advanced monitoring technologies in high-risk areas.

This 18-24 month phase marks the transition from reactive to proactive risk management, as integration of data sources enables more sophisticated risk assessment and targeted prevention efforts.

12-18 MO

The Analytics Phase introduces sophisticated pattern recognition and predictive capabilities. During this 12-18 month period, utilities implement advanced analytics across integrated datasets while expanding monitoring technology deployment. The combination of historical analysis and real-time monitoring supports both strategic planning and operational decision-making.

ONGOING

The Maturity Phase achieves full deployment of sophisticated capabilities including real-time risk assessment and mitigation, automated pattern detection, and integrated decision support tools.

This ongoing phase represents the desired end state where utilities maintain comprehensive awareness and control of ignition risks across their service territories.

Charting the Path Forward

Success in preventing utility-related wildfires requires clear focus on breaking the wildfire chain through multiple complementary measures. The comprehensive approach outlined in this chapter provides regulators with a framework for guiding utilities toward effective ignition management while ensuring reliable electric service.

While the technological capabilities and analytical sophistication described may seem daunting, California's experience demonstrates both their necessity and achievability.

Recent catastrophic wildfires have shown that traditional approaches no longer suffice in our changing climate. The costs of implementation pale in comparison to the potential liabilities from catastrophic fires. For example, California utilities alone faced over $30 billion in wildfire liabilities during 2017-2018.

Regulators should therefore establish clear requirements while providing utilities the flexibility to develop capabilities matched to their specific risk profiles and operational realities. The path forward demands commitment from both regulators and utilities. Regulators should maintain a clear focus on the ultimate objective while ensuring transformation proceeds at a sustainable pace. Utilities should embrace technological innovation while building the organizational capabilities needed to translate data into effective risk mitigation.

Support from the government and regulations like the Fix Our Forests Act that allow utilities to remove trees within 150 feet of power lines and/or allow wider tree clearances and brush removals inside or outside RoW will accelerate the journey of making a wildfire-resistant grid.[22]

Together, these efforts can dramatically reduce the threat of utility-related wildfires. By implementing the comprehensive two-dimensional strategy outlined in this chapter, utilities can move beyond reactive response to achieve proactive risk management. This represents a crucial step toward the ultimate goal of preventing catastrophic utility-related wildfires while ensuring communities maintain access to safe, reliable power.

[22] H.R.471 - Fix Our Forests Act

CHAPTER 4

Comprehensive Situational Awareness for Wildfire Prevention

The preceding chapters have established the critical components of wildfire risk assessment, ignition management, and infrastructure resilience. This chapter examines how these elements are woven together through comprehensive situational awareness to create truly effective wildfire prevention programs.

For regulators, understanding situational awareness is crucial. It represents not just monitoring capabilities, but a utility's holistic ability to understand and act upon wildfire risk factors in real time.

Defining Modern Situational Awareness

Traditional definitions of utility situational awareness have focused primarily on weather monitoring and fire detection. However, as demonstrated by recent catastrophic wildfires, this narrow view is no longer sufficient. Modern situational awareness integrates multiple risk streams that we have discussed in previous chapters — from vegetation conditions to equipment health to weather patterns — into a comprehensive understanding of wildfire risk. The need for a more comprehensive approach is clear.

When utilities monitor and assess risk factors in isolation, they miss critical interactions that can lead to catastrophic events. Only by integrating multiple data streams can utilities develop a complete picture of wildfire risk and take appropriately targeted prevention measures.

This integrated approach enables utilities to move beyond reactive responses to proactive risk management based on a thorough understanding of conditions on the ground.

Moving Beyond Siloed Approaches

Historically, utilities have managed key risk factors in isolation. Vegetation management programs operated on fixed cycles without real-time risk data.

Equipment inspections followed predetermined schedules regardless of conditions. Weather monitoring focused on simple thresholds rather than complex risk interactions. This siloed approach helps explain why electrical power caused only **9% of wildfire ignitions** but accounted for **42% of acreage burned** in recent data from 2014 through 2017.[23]

[23] California Public Utilities Commission, "Reducing Utility Related Wildfire Risk", 2020

Modern technology, particularly advances in artificial intelligence and remote sensing, now enables utilities to break down these silos.

Machine learning algorithms can process vast amounts of data from multiple sources to identify risk patterns that human analysts might miss. Satellite and aerial monitoring can track vegetation health and infrastructure conditions across entire service territories. Weather modeling can predict dangerous conditions days in advance with unprecedented accuracy.

The Risk Integration Challenge

The most significant challenge in modern situational awareness lies not in collecting data, but in its validation, meaningful integration and interpretation for decision-making. One of the most significant insights to emerge from recent research is that catastrophic wildfires often arise not from extreme values of any single parameter, but from the complex interaction of multiple factors operating at the margins of their typical ranges.

Central to this understanding is the concept of percentile-based risk assessment.[24] Rather than using fixed thresholds or absolute values, leading utilities now evaluate conditions based on their statistical rarity for a given location. For example, while 40 mph winds might be unremarkable in a coastal community where they frequently occur, they could pose severe risks in areas that rarely experience such conditions.

The 90th percentile - representing conditions that occur only 10% of the time historically - has traditionally been used as a key risk indicator. However, recent experience shows that the most dangerous conditions often arise from the combination of multiple factors that individually may not reach extreme levels. A location might face elevated risk when experiencing 85th-percentile winds combined with 88th-percentile low humidity and 82nd-percentile high temperatures. While none of these conditions alone might trigger concern, their combination creates circumstances that could enable rapid fire spread and overwhelm both infrastructure and vegetation that hasn't adapted to such conditions.

The challenge extends beyond weather conditions. Equipment that performs adequately under typical loads might fail during moderate stress if maintenance is overdue. Vegetation that normally maintains adequate clearance might pose contact risks under unusual wind patterns or after abnormally wet winters. Understanding these complex interactions requires sophisticated analytics and risk modeling capabilities that can process multiple data streams in real-time while accounting for local conditions and historical patterns.

[24] Texas Forest Service. (2004). Firefighter's Guide to Percentiles and Thresholds. Texas Interagency Coordination Center. http://ticc.tamu.edu/Documents/guides/Firefighters_Guide_to_Percentiles_and_Thresholds.pdf

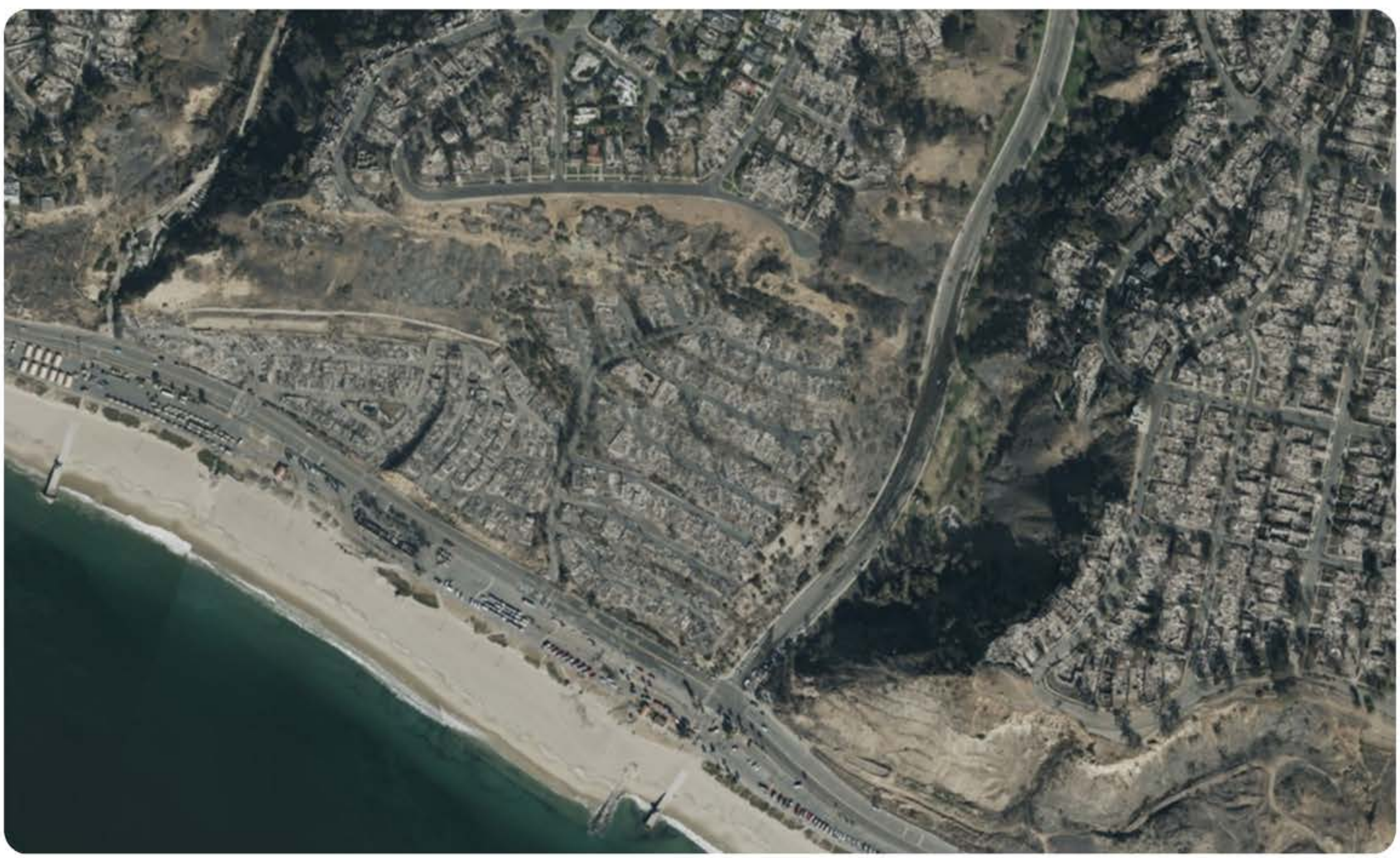
Technology as the Enabler

Recent advances in artificial intelligence and remote sensing have transformed what's possible in utility situational awareness.

Technologies that were experimental just a few years ago are now proven and commercially available:

- **High-resolution satellite** and **aerial monitoring** can track vegetation health and infrastructure conditions across entire service territories
- **Machine learning algorithms** can process vast amounts of sensor data to identify potential failures before they occur
- **Advanced weather modeling** can predict dangerous conditions with unprecedented accuracy
- **Integration platforms** can combine multiple data streams into actionable intelligence

These capabilities make it possible to move from cyclic to risk-based approaches across all aspects of wildfire prevention. Instead of fixed maintenance schedules, utilities can prioritize work based on actual risk conditions. Rather than calendar-based vegetation management, they can target areas where vegetation poses the greatest threat.



The New Role of Human Judgment

While previous approaches to situational awareness relied heavily on human observation and judgment, modern technology enables a more systematic approach. Artificial intelligence can process more data, identify more patterns, and make more consistent assessments than human analysts.

However, human judgment remains valuable as a final validation layer, particularly in critical high-risk areas where multiple risk factors converge.

The key is finding the right balance: using technology for comprehensive monitoring and initial risk assessment while preserving human oversight for critical decisions and unusual situations. This represents a shift from humans as primary observers to humans as informed decision-makers supported by sophisticated analytics.

Building Comprehensive Awareness

Modern situational awareness demands the seamless integration of multiple monitoring and assessment capabilities, each contributing to a complete understanding of wildfire risk.

These capabilities build upon the foundational elements discussed in previous chapters while enabling the dynamic risk assessment necessary for effective wildfire prevention.

Weather Intelligence Systems:

Weather monitoring forms the foundation of situational awareness but goes beyond simple data collection. Modern utilities require sophisticated weather intelligence systems that combine data from multiple sources—ground stations, satellite observations, and numerical weather models —to create high-resolution forecasts customized to their service territory. These systems should account for local microclimates and terrain effects while maintaining the ability to detect and forecast extreme conditions that could lead to catastrophic fires.

While meteorological expertise remains valuable for complex weather pattern interpretation, modern AI-powered systems can now process vast amounts of weather data to provide actionable insights in near real time. These advanced systems combine the best of human knowledge and machine intelligence: using AI to continuously analyze data streams and identify potential risks, while enabling meteorologists to focus on validating critical decisions and handling complex edge cases. The most effective programs leverage machine learning algorithms that improve forecast accuracy by learning from historical patterns and outcomes, while maintaining expert oversight for high-stakes decisions.

This hybrid approach—where advanced technology augments rather than replaces meteorological expertise—enables utilities to maintain comprehensive weather awareness while optimizing their resources. The AI systems can handle routine monitoring and pattern recognition across vast service territories, automatically flagging conditions that warrant closer expert attention. Meanwhile, meteorological staff can focus on analyzing complex weather scenarios, validating system recommendations, and providing strategic guidance for critical operational decisions.

Advanced Vegetation Management Intelligence:

As discussed briefly in Chapter 2, vegetation management represents one of the most critical yet traditionally overlooked aspects of wildfire prevention. Modern situational awareness requires moving beyond periodic ground inspections to continuous monitoring through satellite and aerial technologies. .

Leading utilities now employ multispectral imaging to assess vegetation health and detect signs of stress before they become visible to ground observers

Machine learning algorithms can process this data to identify high-risk vegetation conditions, predict growth patterns, and optimize trimming schedules based on actual risk rather than calendar-based cycles.

Infrastructure Health Monitoring:

The integration of real-time infrastructure monitoring represents a considerable advance in modern situational awareness capabilities.

Some modern utilities have deployed networks of sensors across their infrastructure to detect early warning signs of potential failures; these systems monitor everything from conductor temperatures to pole stability.

Advanced analytics can process this data to identify patterns indicating potential failures, allowing for preventive action before conditions become critical. This capability proves particularly valuable during high-risk weather conditions when equipment might be operating near its limits.

Operational Risk Integration and Resource Awareness:

Bringing these elements together requires sophisticated operational risk integration systems that can process multiple data streams in real-time while accounting for changing conditions and resource availability. These systems should track not only the status of utility assets and systems but also the availability of response resources—from utility crews to firefighting capabilities. The most advanced systems now incorporate artificial intelligence to help operators understand complex risk interactions and make informed decisions about system operations, especially during high-risk conditions.

Modern systems empower utilities to make precise, targeted shutoff decisions—minimizing customer impact while maximizing safety.

This integration capability proves particularly crucial during PSPS events, where operators balance multiple risk factors against the impacts of de-energization. Modern systems can provide operators with clear visualizations of risk factors and potential consequences, enabling more precise and targeted shutoff decisions (when coupled with sectionalizing devices) that minimize customer impact while maintaining safety.

The Fix Our Forests Act strengthens utilities' ability to maintain sophisticated situational awareness through new institutional frameworks and data-sharing mechanisms. The Act's establishment of the Fireshed Center creates a foundation for enhanced data integration and analysis capabilities that directly support utility decision-making.

By breaking down traditional barriers between agencies and standardizing risk assessment approaches, this legislation enables utilities to develop more comprehensive awareness of conditions across their service territories. The mandated sharing of critical data streams—from weather patterns to vegetation conditions to fire behavior modeling—provides utilities with essential inputs for maintaining real-time understanding of evolving risks.[25]

[25] H.R. 471, Fix Our Forests Act §102 (2025)

Recommendations for Regulators

As regulators evaluate utility situational awareness capabilities, they should:

1. Assess how utilities **integrate different risk factors** into a cohesive monitoring program, rather than using isolated monitoring programs, to track and evaluate risk throughout their service area.

2. Assess how utilities use modern technology to **enable risk-based** rather than calendar-based **approaches**.

3. Evaluate the sophistication of **risk assessment models** and their ability to capture complex interactions.

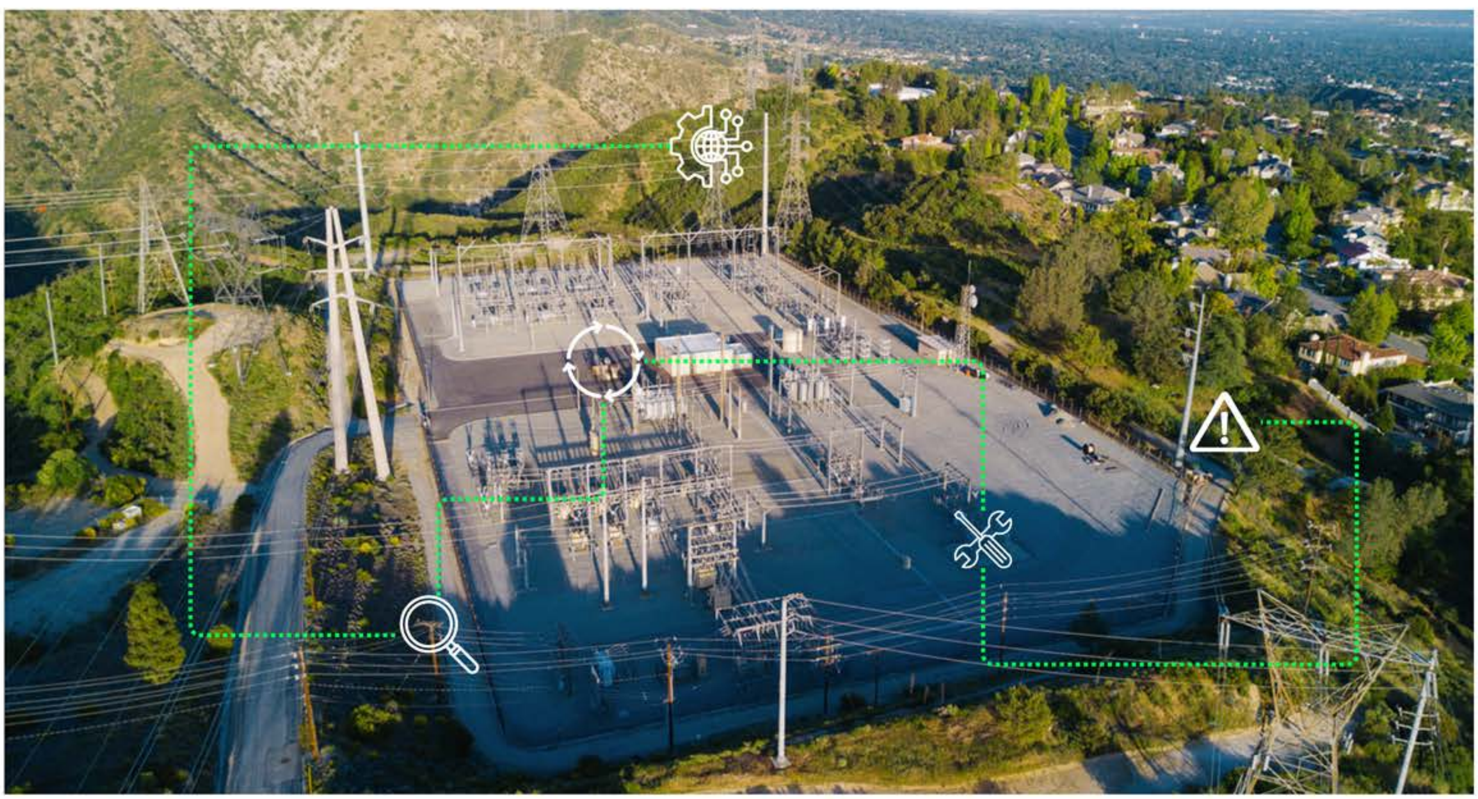
4. Examine how **situational awareness information** drives operational decisions.

5. Verify that utilities **maintain appropriate human oversight** while leveraging technology for comprehensive monitoring.

6. Examine how the utility is **prioritizing hardening and re-work projects**; require utilities to track and analyze verified data to quantify risk reduction achieved through programs and initiatives.

7. Ensure **good coordination** between the utility and its stakeholders and customers.

8. Examine the utility for **inspection, repair**, and **patrol** programs and how they are measured and tracked.



[20] California Public Utilities Commission, "Reducing Utility Related Wildfire Risk", 2020

CHAPTER 5

Vegetation Management: Critical Foundation for Wildfire Prevention

Vegetation contact with electrical infrastructure remains one of the leading causes of utility-related wildfires.

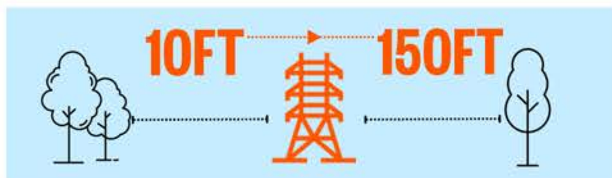
Despite this clear connection, many utilities continue to rely on traditional fixed-cycle vegetation management practices that fail to account for rapidly changing environmental conditions and varying risk levels across their service territories. This disconnect between risk and response leaves utilities exposed to potentially catastrophic outcomes.

The 2015 Butte Fire in California provides a stark example of these consequences. A single gray pine tree, weakened by drought conditions and disease, fell into a power line and ignited a catastrophic fire that burned over 70,000 acres, killed two people, and destroyed 965 structures.[26]

Although the utility had conducted its scheduled maintenance in the area, the fixed-cycle approach failed to identify and address this specific threat before it materialized.

This event, like many others, demonstrates that traditional vegetation management practices are increasingly inadequate in today's changing climate conditions.

The landscape of vegetation management is evolving, as new potential federal legislation provides expanded authority for utilities to address vegetation risks within their service territory. The Fix Our Forests Act of 2025 recognizes the critical need for more comprehensive vegetation management by expanding utilities' hazard tree removal authority from 10 to 150 feet around power lines.



This proposed legislation enables utilities to address the full scope of vegetation risks that could impact their infrastructure during extreme weather conditions, moving beyond traditional narrow RoW boundaries to implement truly effective wildfire prevention. The Act also streamlines the approval process for vegetation management plans while ensuring appropriate stakeholder engagement through mandated consultation with private landowners regarding hazard tree removal. This legislative framework supports the transition toward more dynamic, risk-based vegetation management approaches that better align with today's wildfire challenges.[27]

[26] "Butte Fire". CAL FIRE. Retrieved September 16, 2015.

[27] H.R. 471, Fix Our Forests Act §203-204 (2025)

These developments–from the stark lessons of past wildfires to emerging legislation–highlight the urgent need for utilities to transition from rigid, time and boundary-limited vegetation management to more comprehensive, risk-based approaches that can effectively prevent utility-related wildfires in today's changing climate conditions.

Vegetation Management as a Cornerstone of Wildfire Prevention

Vegetation management cannot operate in isolation. As discussed in previous chapters, effective wildfire prevention requires the integration of multiple components, including landscape risk assessment, situational awareness, and ignition management. Vegetation management plays a crucial role in this ecosystem by directly addressing one of the primary ignition sources while also influencing the potential spread and intensity of any fires that do occur.

When examining landscape risk, as detailed in Chapter 2, areas with well-maintained vegetation present fundamentally different risk profiles than those with overgrown or unhealthy vegetation. A power line running through cleared space or properly maintained RoW presents minimal ignition risk regardless of weather conditions. Conversely, lines with nearby dead, diseased, or overgrown vegetation become high-risk assets during adverse weather conditions.

This relationship between vegetation condition and wildfire risk demands that vegetation management insights directly inform operational decisions.

For example, PSPS decisions, as discussed in Chapter 7 ahead, should be preceded by vegetation analysis and management, alongside weather forecasts and other risk factors in order to help utilities limit PSPS scope.

Areas with well-maintained vegetation may be able to safely operate during conditions that would require de-energization in areas with higher vegetation risks.

Enhancing Situational Awareness Through Vegetation Monitoring

Modern vegetation management requires continuous awareness of changing conditions that could lead to ignition risks.

Traditional infrequent and manual inspections cannot capture the rapid changes in vegetation health and fuel conditions that occur due to weather patterns, disease, or other environmental stressors. The 2015 Butte Fire in California was caused by a diseased tree that had deteriorated significantly between inspection cycles.[28]

Effective vegetation monitoring should focus on trees both inside and outside the utility RoW (with strike risk) and track multiple indicators that together provide early warning of developing risks.

[28] "Butte Fire". CAL FIRE. Retrieved September 16, 2015.

Key indicators include:

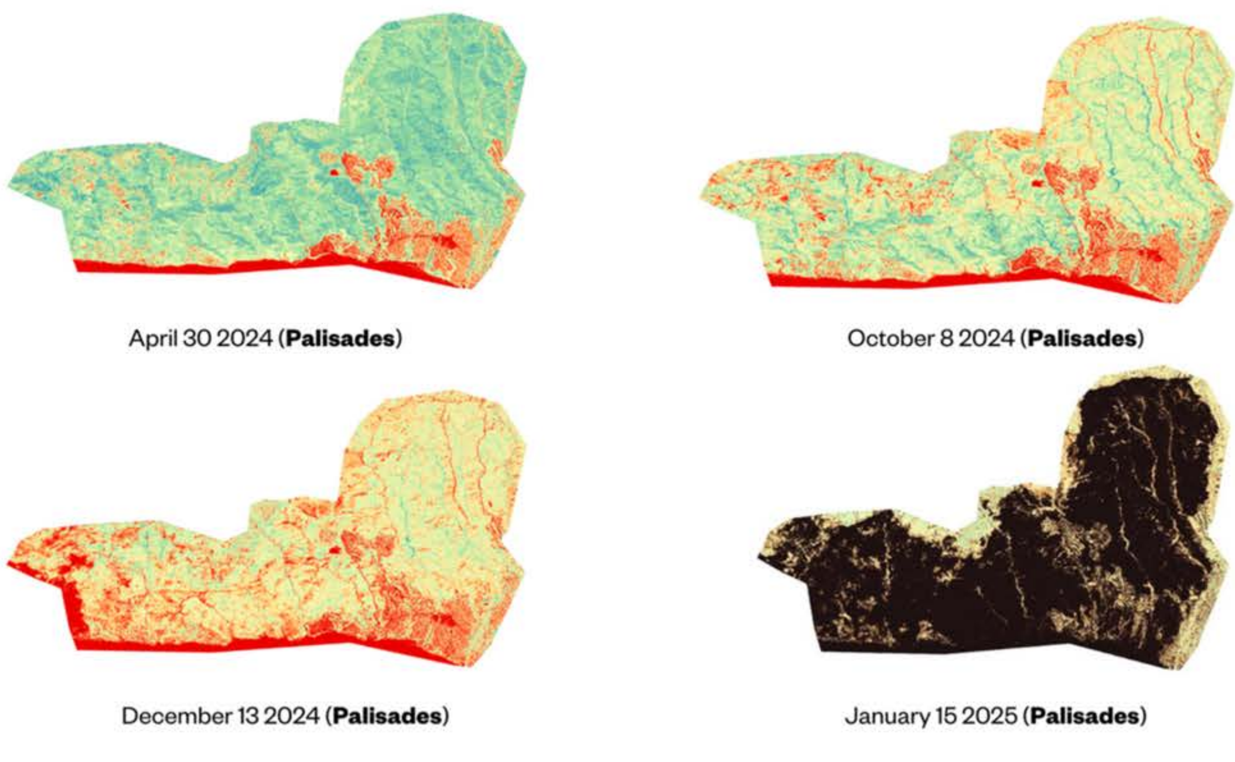
1. **Vegetation health**, measured through the Normalized Difference Vegetation Index (NDVI), provides critical insight into plant stress and mortality risk. NDVI uses specific bands of satellite imagery to detect subtle changes in vegetation health weeks before they become visible to the human eye. When NDVI values drop below 0.5, they indicate dangerous levels of vegetation stress that could lead to tree failure or increased ignition risk.

2. **Fuel load and moisture content** directly influence both ignition probability and potential fire intensity. Modern monitoring systems can assess these factors continuously across the utility's entire service territory, identifying areas where dry or dead vegetation creates elevated risk conditions.

3. **The Energy Release Component (ERC)** helps predict potential fire intensity based on fuel conditions. When combined with vegetation health data, ERC provides crucial insight into areas where ignition could lead to catastrophic outcomes.

These indicators should be monitored dynamically, with increased frequency during high-risk weather conditions or in areas with deteriorating vegetation health.

This enhanced situational awareness enables utilities to identify and address emerging risks before they result in ignitions.



April 30 2024 (**Palisades**)

October 8 2024 (**Palisades**)

December 13 2024 (**Palisades**)

January 15 2025 (**Palisades**)

Figure 1: NDVI spot values for Palisades from April 30, 2024 to January 15, 2025.

Source: Airbus Imagery, 3km × 3km resolution.

Moving Beyond Fixed-Cycle Management

Most utilities today, particularly for distribution networks, rely on fixed maintenance cycles, typically trimming vegetation along each circuit within the RoW once every 3-5 years regardless of growth rates, health conditions, or risk levels. While this approach provides predictable resource allocation, it fails to address the dynamic nature of vegetation risks and risks outside the traditional easement.

Regulators should work with utilities to move toward risk-based vegetation management, while recognizing operational constraints. Utilities can maintain cycle-based programs for baseline maintenance and balancing resources (tree trimmers), but these cycles should be supplemented with dynamic risk assessment and targeted interventions —especially for trees that have a high likelihood of contacting utility equipment. This hybrid approach should include:

- **Continuous monitoring** of vegetation health and risk conditions
- **Risk-based adjustment** of maintenance cycles
- Proactive **hazard tree identification** and removal (inside and outside of the RoW)
- Targeted **"hot spot" maintenance** between cycles, with a focus on areas of concern prior to a high-fire-risk event
- Enhanced **brush management** in high-risk areas
- Integration of **vegetation risk data** with operational systems

Leveraging Modern Technology Cost-Effectively

Recent advances in remote sensing and artificial intelligence have made comprehensive vegetation monitoring both technically and economically feasible. These technologies enable utilities to monitor their entire network frequently enough to detect changing conditions while remaining cost-effective.

A strategic combination of monitoring technologies can provide comprehensive coverage while optimizing costs. Wide-area satellite monitoring can provide frequent system-wide assessment to identify areas of concern, while targeted aerial surveys using LiDAR or high-resolution imagery can provide detailed analysis in high-risk areas of vegetation and fuel load. This multi-layered approach ensures there are no blind spots while focusing the most intensive monitoring where it's most needed.

Artificial intelligence has matured to reliably analyze this data at scale, automatically identifying hazard trees, measuring clearances, assessing vegetation health, and predicting growth rates. These capabilities enable utilities to shift from reactive to predictive vegetation management, addressing risks before they lead to ignitions.

Focus on Ignition Prevention

While vegetation management serves multiple objectives, including system reliability and compliance, its primary goal in the context of wildfire mitigation is the prevention of utility-related ignitions.

Traditional vegetation management programs often prioritize reliability metrics like reducing tree-caused outages. However, in high fire-risk areas, the potential consequences of ignition demand a more focused approach. Effective ignition prevention through vegetation management requires:

- **Early identification of hazard trees** and at-risk vegetation before they can cause ignition events
- Creation and maintenance of **defensible space around critical infrastructure**
- Enhanced **management of ground-level vegetation** that could facilitate fire spread
- Integration of **vegetation risk data** with operational decision-making systems
- **Documentation and analysis** of prevented ignition events

This focus on ignition prevention complements rather than replaces traditional reliability objectives. Many of the same activities that reduce ignition risk also improve system reliability.

However, in high-risk areas, decisions about prioritization and resource allocation should be driven primarily by ignition prevention goals.

Risk-Driven Program Requirements

Modern vegetation management programs should demonstrate a clear connection between activities and risk reduction outcomes. The program should maintain continuous awareness of vegetation conditions across the service territory, with more frequent monitoring in high-risk areas and during adverse conditions. Risk assessment should incorporate vegetation health, proximity to assets, and potential fire spread impacts alongside traditional measurements like tree height and clearance distances.

Performance should be measured primarily through a reduction in vegetation-related ignition risk and improvement in system reliability. Programs should document both identification of emerging risks and verification that mitigation actions effectively addressed those risks. Regular assessment of these outcomes should drive continuous program improvement.

Regulatory Oversight and Path Forward

Effective vegetation management represents one of the most direct and impactful ways utilities can reduce catastrophic wildfire risks. As demonstrated by events like the 2015 Butte Fire, traditional fixed-cycle approaches are increasingly inadequate in the face of changing climate conditions and heightened wildfire risks. Regulators should work with utilities to drive the evolution of vegetation management beyond simple compliance activities towards outcome-focused programs that demonstrably reduce wildfire risks.

This evolution requires regulators to shift their oversight approach. Rather than focusing primarily on compliance with fixed maintenance cycles, regulators should evaluate vegetation management as an integral component of utilities' overall wildfire mitigation strategies.

This means ensuring that:

- Vegetation management programs demonstrate clear risk reduction outcomes rather than just maintenance completion metrics
- Programs integrate effectively with other wildfire mitigation components, including situational awareness and operational decision-making (e.g., targeted vegetation risk mitigation should be performed in identified areas prior to a high-risk weather event).
- Utilities leverage available technologies appropriately to enable comprehensive, risk-based approaches
- Resources are allocated based on risk assessment rather than fixed inspection cycles alone
- Programs maintain focus on ignition prevention while balancing system reliability needs

This evolution takes time and resources. The goal should be continuous improvement toward more effective practices rather than immediate wholesale changes that could disrupt essential maintenance activities. The technology and knowledge exist today to dramatically improve vegetation management effectiveness. By driving evolution toward risk-based approaches supported by modern monitoring capabilities, regulators can help prevent future catastrophic wildfires while improving overall system reliability.

The choice is not between traditional practices and new approaches, but rather how to effectively combine both in programs that deliver measurable risk reduction outcomes.

CHAPTER 6

Transforming System Hardening Through Risk-Based Decision Making

A New Paradigm for Grid Investment

The United States faces an immediate national emergency in utility-related wildfires that demands urgent action. While the traditional approach to system hardening has focused primarily on long-term infrastructure replacement programs, today's reality requires a more sophisticated strategy that balances immediate risk reduction with long-term grid resilience.

The north star for all system hardening programs should be maximizing risk reduction per dollar invested, with particular emphasis on the time horizon for achieving these safety improvements.

A dollar spent on risk reduction today is far more valuable than a dollar spent on equivalent risk reduction five years from now. This temporal aspect of risk reduction has been largely overlooked in traditional system hardening programs but is central to how regulators should evaluate and approve utility investments.

We are in a race against time to prevent the next catastrophic wildfire.

The Limitations of Traditional System Hardening

Historically, utilities have relied on straightforward but overly simplistic approaches to system hardening and asset replacement. These programs typically prioritize assets based primarily on age—for example, replacing all transformers that are more than 30 years old before addressing newer equipment. While this time-based approach is easy to implement and explain to regulators, it fails to account for the complex reality of wildfire risk in our changing climate.

Consider two transformers in a utility's service territory: one 28 years old located in a low-risk urban area with minimal vegetation, the other 21 years old positioned in a high-fire-threat district surrounded by dense, drought-stressed vegetation.

Under traditional maintenance schedules, the older transformer would receive priority for replacement. However, this approach ignores the fact that a failure of the newer transformer poses a far greater risk of igniting a catastrophic wildfire.

Understanding Risk Through a Two-Pronged Approach

The complexity of modern wildfire risk demands that utilities look at their assets through entirely new lenses, instead of simply tracking the age of equipment. Before utilities can effectively prioritize hardening investments, they should develop a sophisticated understanding of their risk landscape. This requires examining each asset through two critical lenses that together reveal where investments will deliver the greatest and most timely risk reduction.

The first prong requires utilities to understand the geographic context in which each asset operates—what we call the "Asset Geo-Profile." This profile should consider historical fire patterns, population density, evacuation routes, weather exposure, and vegetation risks. A transformer might be relatively new, but if it sits in an area of extreme fire risk, surrounded by dense vegetation and subject to severe wind conditions, it may demand immediate attention.

The second prong examines the specific health, condition, and outage/failure data of each asset. Like a detailed medical history, this assessment looks at patterns of stress, maintenance history, known vulnerabilities, and signs of deterioration. A piece of equipment might be located in a moderate-risk area but exhibit concerning patterns that suggest elevated probability of failure during high-risk conditions.

Modern technology enables utilities to build these detailed risk profiles at scale. Satellite imagery reveals vegetation patterns, weather stations, and weather modeling providers document wind exposure, and advanced inspection techniques uncover early warning signs of potential failures.

When fused together through sophisticated analytics, these data sources enable utilities to identify where hardening investments will deliver the fastest and most significant risk reduction.

Strategic Investment Prioritization

With this two-pronged risk understanding as a foundation, utilities should evaluate potential hardening investments through the lens of both risk reduction potential and speed of implementation. This evaluation reveals three distinct categories of opportunity:

Implementation Time	Hardening Initiatives
Near Term(a few months) These initiatives are "low-hanging fruit" that can be deployed immediately.	**Vegetation Management** • Vegetation management (aggressive tree trimming and clearance • Firebreaks around power infrastructure • Enhanced monitoring with drones and LiDAR) **Infrastructure Hardening** • Fire-resistant grid components (fire-resistant coatings and wraps, wildfire-proof equipment enclosures, etc.)
Mid Term (1-3 years) These initiatives require moderate investments and grid reconfigurations but can be deployed relatively quickly.	**Infrastructure Hardening** • Covered conductors • Stronger poles and structures (e.g., composite, steel, or concrete replacements) • Separation and spacing of power lines **Grid Modernization** • Fast-acting circuit breakers and fault detection • Sectionalizing devices (remotely controlled breakers and fuses)
Long term (3+ years) These initiatives require significant capital investments, infrastructure upgrades, and regulatory approvals but offer high-impact, long-term resilience.	**Infrastructure Hardening** • Undergrounding power lines (most expensive but highly effective) **Grid Modernization** • Grid-scale battery storage integration • Decentralized renewable energy infrastructure

Strategic Undergrounding: A Case Study in Risk-Based Decision Making

The question of power line undergrounding perfectly illustrates how this risk-based, time-sensitive approach challenges traditional utility investment decisions. While undergrounding provides almost complete reduction of ignition risk, its massive costs ($2 to 6 million per mile)[29] and lengthy implementation timelines often make it a suboptimal choice for immediate wildfire risk mitigation. Undergrounded equipment can still have faults, which result in residual risks and new challenges for the utility.

Consider a utility with a limited budget for hardening and two high-risk circuits.

- Circuit A serves 5,000 homes through forested terrain. Undergrounding would cost $12m and take 30 months, while covered conductors plus enhanced vegetation management would cost $3m and take 8 months.
- Circuit B serves 3,000 homes in a high-wind area with similar options at proportionally lower costs given the smaller territory.

Rather than undergrounding Circuit A alone, implementing enhanced vegetation management and covered conductors on both circuits would protect more customers sooner and cost less overall. After these improvements, Circuit B's persistent wind exposure might warrant targeted undergrounding, while Circuit A's risk may be adequately managed through the initial measures.

This does not mean strategic undergrounding has no place in a utility's modern hardening strategy. Rather, it should be pursued surgically in locations where:

- Other measures cannot achieve sufficient risk reduction.
- Construction can be completed relatively quickly.
- Costs are justified by exceptional risk factors.
- Long-term grid modernization creates compelling synergies.

A targeted approach to undergrounding, combined with other risk reduction measures that are faster and less expensive to implement, can often achieve better overall wildfire risk reduction than a blanket undergrounding program.

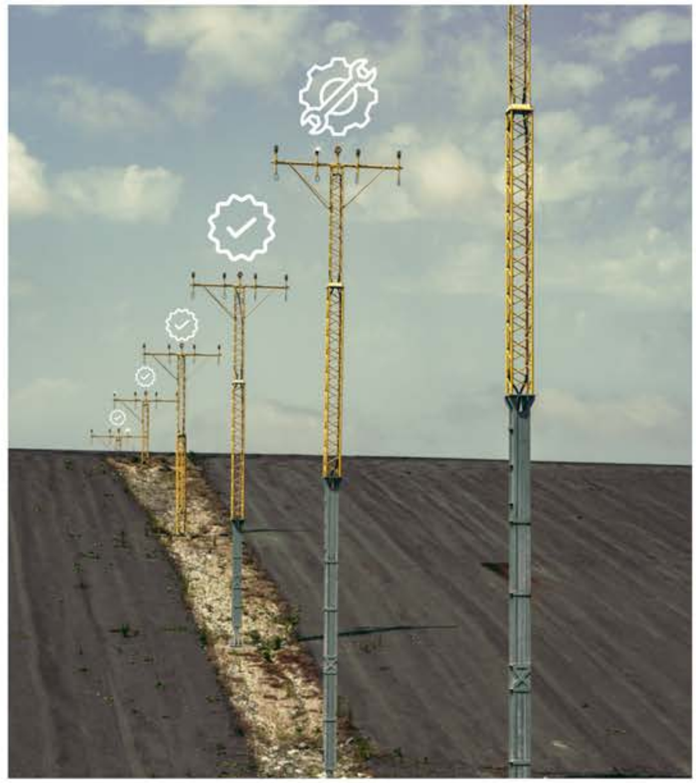
[29] California Public Utilities Commission. (n.d.). California Public Utilities Commission. Retrieved [February 15, 2025] from https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/electric-reliability/undergrounding-program-description

The Annual Cycle of Strategic Hardening

Regulators should work with utilities to implement an annual cycle of strategic planning and investment in system hardening. This begins with a comprehensive assessment of risk reduction opportunities across the utility's service territory, leveraging the aforementioned two-pronged approach of evaluating both geographic risk profiles and asset-specific health factors discussed earlier in this chapter.

Utilities should then categorize potential hardening initiatives based on both their implementation timeline and level of effort required. Most importantly, this prioritization should be completely refreshed each year based on current conditions and the impact of work already completed.

Areas initially identified as candidates for expensive hardening measures like undergrounding may no longer require such intensive approaches after other improvements reduce their risk profiles. Conversely, changing conditions may make certain initiatives more urgent than previously understood.



Measuring Success Through Risk Reduction

This strategic approach to system hardening demands sophisticated measurement of results. Regulators should require utilities to quantify the actual risk reduction achieved through each investment and compare these results to projections. This creates accountability while informing future investment decisions.

Traditional reliability metrics like SAIDI and SAIFI remain relevant but are insufficient. Utilities should develop and track metrics specifically focused on wildfire risk reduction, measuring both the magnitude of improvement, cost of implementation, and the speed with which it was achieved. These metrics should inform future prioritization by helping regulators evaluate the effectiveness of different approaches.

A Call for Strategic Action

The transformation of system hardening from a standardized infrastructure replacement program to a dynamic, risk-focused strategic initiative represents a fundamental shift in how utilities approach grid safety. While this new framework demands more sophisticated analysis and frequent reevaluation, it enables utilities to achieve dramatically greater risk reduction from limited safety dollars.

Regulators play a crucial role in enabling this transformation by:

- Demanding clear analysis of risk reduction potential per dollar for all proposed investments
- Emphasizing the temporal value of risk reduction in program evaluation
- Requiring annual reevaluation of priorities based on changing conditions
- Supporting investment in analytical capabilities needed for optimal decision-making
- Evaluating success through achieved risk reduction and end customer value rather than program completion

Through this strategic approach to system hardening, we can maximize the impact of every safety dollar while building a more resilient grid for the future.

CHAPTER 7

Public Safety Power Shutoffs (PSPS) and Emergency De-Energization:

A Prevention-First Approach

This chapter introduces a transformative perspective on utility wildfire mitigation that demonstrates opportunities to enhance current Public Safety Power Shutoff (PSPS) practices. While PSPS has become an increasingly common industry practice, this framework demonstrates how utilities can and should adjust their thinking about PSPS through comprehensive prevention and targeted emergency response.

This shift in perspective is necessary because utilities face fundamentally different operational realities and responsibilities than other stakeholders in wildfire prevention and response. They require solutions specifically designed to prevent utility-related ignitions.

Aligned with the north star goals of safety, resiliency, and 'keeping the lights on', rather than accepting PSPS as a primary tool, utilities should strive to improve their approach to PSPS through systematic risk reduction while maintaining it strictly as a measure reserved for extreme conditions such as those beyond the design standards of grid infrastructure.

Prevention First: The Path to Grid Resilience

The fundamental premise of this framework is that a properly maintained and hardened electrical grid should rarely require preemptive de-energization and leverage advanced capabilities to limit PSPS utilization. As demonstrated in previous chapters, comprehensive prevention measures including risk-based vegetation management, proactive ignition control, and systematic grid hardening can eliminate many conditions that traditionally trigger PSPS events.

Let's examine how this prevention-first approach manifests in hypothetical scenarios and enables utilities to maintain service even during challenging weather conditions.

- Consider a circuit where the utility maintained wide RoW clearances, removed hazard trees, installed covered conductors, and implemented enhanced inspection protocols. When 55 mph winds hit during Red Flag conditions, the circuit would remain safely energized because all potential ignition sources have been eliminated through prevention.
- In another circuit, remote monitoring identified declining vegetation health in a high-risk corridor weeks before fire season. The utility prudently removed hazard trees and dry vegetation inside and outside RoW before the season began, initiated enhanced protection settings, and changed the recloser settings to a highly-sensitive 'one shot' mode, to avoid the likelihood of sparking. These preventive measures enabled them to avoid PSPS during situations that would historically have required de-energization.

These examples highlight how utilities can reduce the usage of PSPS through comprehensive risk elimination and detailed situational awareness. By focusing on the fundamental causes of utility-ignited fires—including vegetation contact, equipment failures, and declining asset health—utilities can maintain safe operations even in severe conditions.

This prevention-first approach enables the achievement of an ideal state where infrastructure resilience makes PSPS events necessary only in extreme cases and helps utilities fulfill their core mission of providing safe, affordable, and reliable power service.

Emergency De-energization: The True Priority

While utilities work to reduce PSPS through prevention, they should maintain robust capabilities for emergency de-energization in response to active fires. This represents a critical distinction: rather than de-energizing based on theoretical risk conditions, focus on responding to actual fire threats when they materialize. This approach ensures power remains available until genuine threats emerge while maintaining public safety through rapid response capabilities.

Modern emergency de-energization requires sophisticated fire detection systems that integrate high-resolution satellite monitoring, ground-based sensors, weather station networks, and field observer reports. When fires are detected, utilities should rapidly assess their growth patterns, trajectory, and potential impacts to specific assets. This analysis should consider not just the fire's location and movement, but also the effectiveness of existing prevention measures, network sectionalization, and presence of natural or artificial barriers that might prevent fire impacts.

Based on this comprehensive analysis, utilities can implement truly targeted de-energization, shutting off power only to specifically threatened assets while maintaining service to other areas. This surgical approach to emergency de-energization serves as a model for how any de-energization decisions should be made—based on specific threats to identified assets rather than broad geographic risk factors.

Surgical PSPS: A Bridge to the Prevention-First Future

While utilities work toward the prevention-first ideal state, broader PSPS capabilities may still be required as a bridge measure. However, PSPS programs should be transformed from broad geographic shutoffs to surgical interventions guided by rigorous risk assessment and targeted implementation. This surgical approach focuses on specific asset risks rather than theoretical fire-spread scenarios across broad areas.

The decision to implement PSPS should be based on a detailed understanding of actual asset conditions and risks, including vegetation contact potential, equipment health concerns, and historical performance issues. Weather monitoring should focus on conditions that could trigger ignitions from these specific risks, like high winds that could cause vegetation contact or hot, dry conditions that increase fire spread potential.

Most importantly, de-energization should only be implemented for targeted segments (enabled by sectionalizing devices) where all of the following are true:

- Known risks exist
- Weather conditions exceed safety thresholds
- System stability is compromised despite operational mitigations

When PSPS becomes necessary, implementation should follow equally precise protocols. Utilities should deploy field observers to monitor actual conditions, maintain detailed documentation of decision rationale, and establish clear criteria for restoration (e.g., before re-energizing the electric system, patrols should be conducted to check for vegetation concerns and other issues). Customer impacts should be minimized through targeted sectionalizing, support for critical facilities, and clear communication protocols. Each PSPS event should be followed by thorough analysis to identify additional prevention measures that could eliminate the need for future shutoffs.

Performance Monitoring and Continuous Improvement

Moving toward the prevention-first ideal requires rigorous tracking of both prevention measure implementation and PSPS reduction. Utilities should demonstrate steady progress in hardening their systems and eliminating conditions that necessitate PSPS. This includes documenting specific risk reduction achievements, tracking customer impact reductions, and continuously refining emergency response capabilities.

Regulators should evaluate utilities not just on their PSPS preparation, execution, and associated communications, but primarily on their progress toward significantly reducing PSPS necessity through prevention. This includes assessing the effectiveness of vegetation management programs, grid hardening investments, and operational improvements in reducing both PSPS frequency and scope.

Transforming Utility Culture: From PSPS Reliance to Integrated Wildfire Prevention

Increasing usage of Public Safety Power Shutoffs (PSPS) does not solve the underlying problems that cause utility-related wildfire risk. A transformative shift in mindset is required—one that views wildfire risk mitigation not as a separate program, but as an integral component of every utility decision and investment. This means incorporating wildfire considerations into asset replacement strategies, maintenance planning, grid modernization efforts, and daily operational decisions.

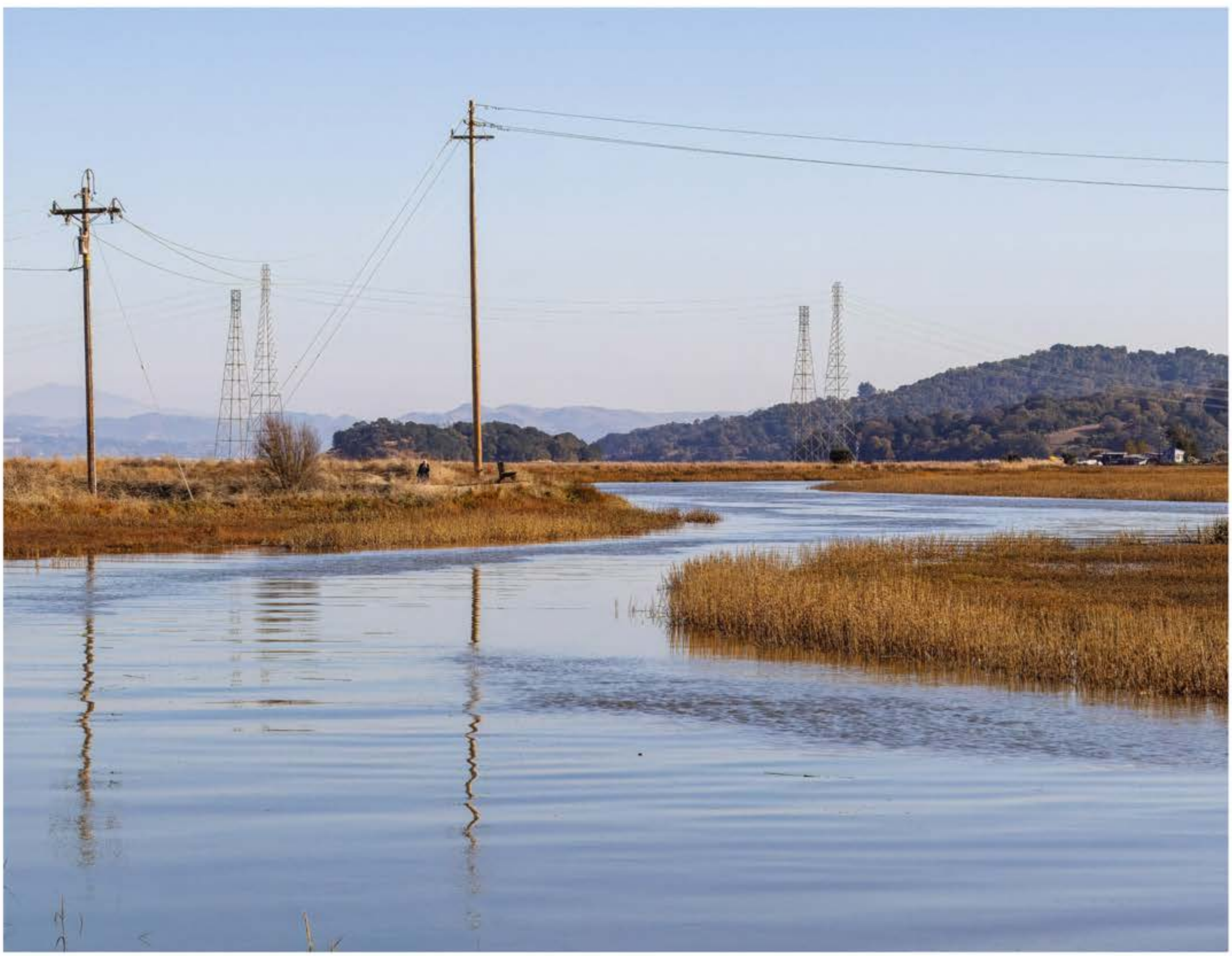
When a utility replaces a transformer, they should consider not just its electrical specifications but its potential contribution to wildfire risk. When planning vegetation management cycles, they should assess not just compliance clearances inside the RoW but comprehensive risk reduction potential of vegetation within their service territory. When designing protection schemes, they should evaluate not just system reliability but ignition prevention capability. This holistic integration of wildfire mitigation into all aspects of utility operations is essential for achieving true grid resilience.

Success requires sustained commitment from utility leadership to drive this cultural transformation throughout their organizations. It means training every field worker, engineer, and planner to understand their role in wildfire prevention.

It requires updating procurement specifications, maintenance procedures, and design standards to prioritize fire safety alongside traditional utility metrics. Most importantly, it demands leveraging available data and advanced capabilities to improve PSPS targeting and truly embracing prevention as the path forward.

By shifting focus to comprehensive prevention and targeted emergency response, utilities can better fulfill their mission of providing reliable, affordable power while protecting public safety. While this transition requires significant investment, operational changes, and cultural transformation, it represents the best path forward for utility wildfire risk management.

The end state is clear: a resilient grid where infrastructure design, maintenance practices, and operational protocols significantly reduce the need for PSPS while ensuring public safety.



A Call to Action for Modern Wildfire Mitigation

The devastating impact of utility-related wildfires demands immediate and decisive action across our industry. Throughout this playbook, we have established a comprehensive framework for modern wildfire mitigation that challenges traditional assumptions while providing practical paths forward.

Yet we recognize that no single approach can address the diverse needs across different states and regions. Instead, the guidelines and best practices outlined here should serve as a foundation that regulators and utilities can adapt and scale based on their specific risk profiles, resources, and priorities.

States like California, facing extreme wildfire risks, require the most comprehensive and sophisticated approaches. Other regions may appropriately implement more basic programs. However, the key principle remains constant: every jurisdiction must develop a thoughtful, risk-based approach aligned with their unique circumstances while maintaining essential capabilities in landscape risk assessment, vegetation management, system hardening, and operational practices.

The increasing frequency and severity of utility-related wildfires demands we move beyond traditional operational models where utilities work in isolation, focused narrowly on their own assets and RoW. Today's challenges require unprecedented collaboration between utilities, regulators, fire agencies, land management agencies, and communities. Only through shared understanding of the complex interactions between utility infrastructure, vegetation, weather, and human factors can we effectively prevent catastrophic fires. This means developing joint planning between utilities and fire agencies, coordinated fuel reduction programs, shared data and risk assessment capabilities, and unified community education efforts. The barriers between organizations must give way to true partnership in service of public safety. Technology stands ready to transform how utilities assess and manage wildfire risks. High-resolution satellite monitoring, advanced remote sensing, artificial intelligence, and sophisticated data analytics provide capabilities that were impossible just a few years ago.

Yet many utilities lag far behind other industries in adopting these powerful new tools. We must accelerate the deployment of multi-modal remote sensing, combining satellites, LiDAR, and other sensors; AI-powered vegetation and asset health monitoring; and predictive analytics for risk assessment.

Advanced weather monitoring and forecasting, automated work planning and resource optimization, and real-time situational awareness systems are no longer optional extras; they're essential capabilities for modern utilities.

These technologies enable a fundamental transformation in how utilities understand and manage risk across their territories. Traditional approaches that focus on fixed clearances and maintenance cycles are no longer sufficient. Modern utilities must implement comprehensive landscape risk assessment capabilities that enable them to monitor vegetation health and fuel conditions across broad areas and identify hazard trees and at-risk vegetation before failures occur. The ability to track changes in risk factors over time, enable data-driven work prioritization, and support proactive risk mitigation represents a crucial evolution in protecting our communities from catastrophic wildfires.

This evolution must extend to every utility, regardless of size or type. Whether investor-owned, cooperative, or municipal, every utility should develop and maintain an appropriate wildfire mitigation plan.

These plans must be living documents, reviewed and updated at least annually to incorporate new technologies and lessons learned. While the sophistication and scope will vary based on risk levels and resources, having a structured approach to identifying and managing wildfire risk is no longer optional. Climate change and evolving environmental conditions mean that areas historically considered low risk may face increasing wildfire threats.

A basic plan that can be enhanced over time is far better than no plan at all.

Success requires sustained commitment from all stakeholders. Regulators must establish clear requirements while enabling flexible implementation approaches. Utilities must invest in foundational technologies and capabilities while transforming their operational practices and culture. Technology providers must accelerate innovation while ensuring solutions are accessible to utilities of varying sizes and resources. Communities must engage in mitigation planning and support necessary prevention activities. This shared responsibility demands ongoing collaboration, knowledge sharing, and mutual support.

While the challenges we face are significant, the cost of inaction is far greater. Through collaborative effort and sustained commitment, we can build a more resilient grid that protects our communities while providing reliable power. The framework established in this playbook provides a foundation, but it represents just the beginning of our shared journey toward truly effective wildfire mitigation.

This playbook marks the start of an ongoing dialogue that must expand to include diverse perspectives from across our industry.

The authors commit to engaging in deeper conversations with utilities and regulators across multiple states, learning from their experiences and challenges to further refine these frameworks. Every utility's situation is unique, shaped by their geography, infrastructure, resources, and risk profile. Only by understanding these diverse needs can we develop guidance that serves utilities of every size and circumstance.

We invite all stakeholders to join us in evolving this framework. Share your experiences by contacting AiDASH, challenge our assumptions, and help us develop more nuanced and effective solutions.

This document should not remain static; it must grow and adapt through our collective wisdom and learning. Through broader engagement and collaboration, we can transform these guidelines into living best practices that serve our entire industry.

The time for incremental changes has passed. We must act decisively to implement comprehensive wildfire mitigation programs that match the scale of risk we face.

Yet we must also remain humble enough to learn and adapt as we progress. The roadmap outlined in this playbook shows the way forward. Now we must work together to refine it, enhance it, and ultimately make its vision reality.

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Randy Lyle is Principal of Wildfire Mitigation Strategies and a 45-year veteran of the fire industry, bringing extensive experience in fire suppression, prevention, and mitigation to his consulting work. His career began with 32 years at the California Department of Forestry and Fire Protection (CAL FIRE), where he rose to the rank of Division Chief in San Diego and became a recognized leader in the application of GIS technology to wildfire management. Following his retirement from CAL FIRE in 2007, Randy served as Fire Program Manager and helicopter specialist with San Diego Gas & Electric (SDG&E), where he played a critical role in developing the utility's response to the devastating 2007 fires.

His contributions at SDG&E include the development of an Ignition Management Program, a fuel treatment program, and a contract fire resource program. He also significantly contributed to the California Public Utilities Commission's fire safety rulemaking process, influencing the creation of the statewide High Fire Threat District map. Since establishing Wildfire Mitigation Strategies, Randy has worked with electric utilities across the Western U.S., including authoring wildfire mitigation and public safety power shutoff plans in Oregon, New Mexico, Colorado, Wyoming, and South Dakota. He has received numerous awards for his work in developing situational awareness tools and enhancing public safety around wildfires and is a respected speaker at industry conferences.

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Joe brings over 16 years of specialized experience in wildfire mitigation and climate adaptation to his role as Principal of Wildfire Risk & Mitigation Solutions, LLC. Previously serving as Wildfire Mitigation Metrics & Measures Manager at San Diego Gas & Electric (SDG&E), he pioneered several groundbreaking initiatives in utility wildfire safety, including developing one of the first utility Fire Prevention Plans that evolved into today's wildfire mitigation plans. His expertise spans vegetation management, fire risk assessment, regulatory affairs, and program development. Throughout his career, Joe has successfully led cross-functional teams and worked extensively with utilities, regulators, and stakeholders to implement effective wildfire mitigation strategies. Drawing on his engineering background and passion for innovation, he continues to develop cutting-edge solutions that help utilities adapt to evolving wildfire risks while ensuring regulatory compliance and operational excellence.

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A visionary partnerships and strategy leader, Amit spearheads AiDASH's mission-critical initiatives in climate resilience and critical infrastructure protection. As VP of Global Partnerships & Strategy, he orchestrates groundbreaking collaborations between industry leaders, technology pioneers, and regulatory bodies to tackle humanity's most pressing infrastructure and sustainability challenges. Leveraging his extensive experience leading transformative partnerships at Google, Amit is architecting an ecosystem where innovation meets impact, positioning AiDASH at the forefront of safeguarding tomorrow's critical infrastructure. His strategic vision and ability to transform complex challenges into collaborative opportunities is reshaping how industries approach climate resilience and infrastructure protection.

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Nick is a veteran utility industry strategist who bridges the gap between innovative AI solutions and critical infrastructure operations. As Strategic Partnerships Manager at AiDASH, he orchestrates collaborations that help utilities revolutionize their vegetation management, risk mitigation, and infrastructure inspection processes. Drawing from his decade of experience with industry leaders like Copperleaf Technologies and EnergySavvy (now part of IFS and Uplight respectively), Nick has consistently helped utilities transform their operations through technology adoption. His unique blend of utility domain expertise and deep understanding of AI applications positions him as a trusted advisor in the utility infrastructure modernization space. Nick is dedicated to helping utilities leverage cutting-edge technology to enhance grid reliability, improve operational efficiency, and accelerate their transition to more resilient infrastructure.

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Eshaan is a first-year student studying Government at Harvard University with a passion for all things energy. Growing up in Houston, Eshaan's passion developed as he saw the immense toll hurricanes and other severe climate events (which are only worsening year-by-year) took on his city's infrastructure. Eshaan has worked previously for a consulting firm on wildfire resilience and community solar development, consulted for the EPA on energy equity, contributed to publications like the Harvard Tech Review on climate resilience, analyzed utility regulatory policies for early stage companies.

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