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Wildfire Mitigation in the Bonneville Power Administration Service Territory

André Coleman (PNNL)
Chief Scientist

Kelly Miller (BPA)
Wildfire Mitigation Program Manager

WSU-PNNL Advanced Grid Institute
Richland, Washington
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Background

- Over the past decade, utility-caused wildfires have evolved from a regional operational hazard to a national and international crisis
- On average, utility-caused fires only represent ~3% of wildfire starts;
- However, those starts represent 50-500k burned acres/year at a cost of $394-893 billion/year

  - *2018 Camp Fire (CA)* – 153k ac – 18,804 structures – $16.5 billion
    - Caused by a single faulty hook on a transmission tower + extreme weather
  - *2023 Maui Fires (HI)* – 6k ac – 2,200 structures – $6 billion
    - Caused by downed distribution lines + extreme weather
  - *2024 Smokehouse Creek (TX Panhandle)* – 1.1M ac – ~500 structures – 12k cattle - ~$1B – High threat to the Texas Pantex Plant (nuclear)
    - Caused by a decayed wood pole + extreme weather

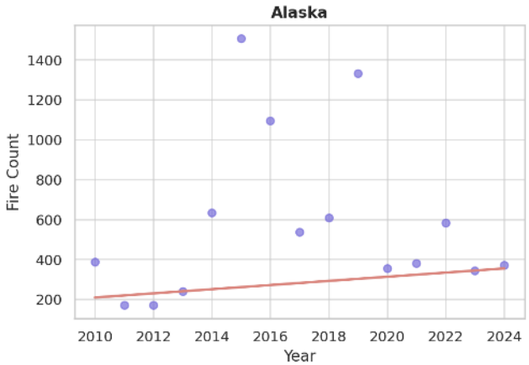

Worn hook

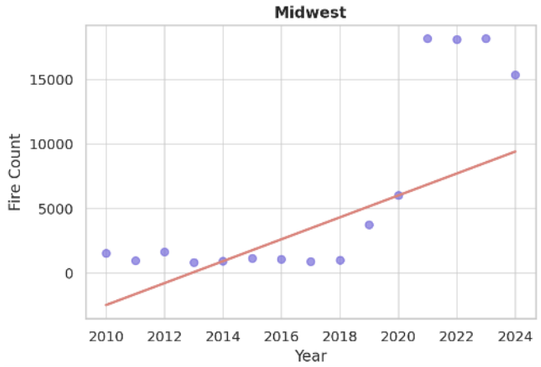

Downed lines

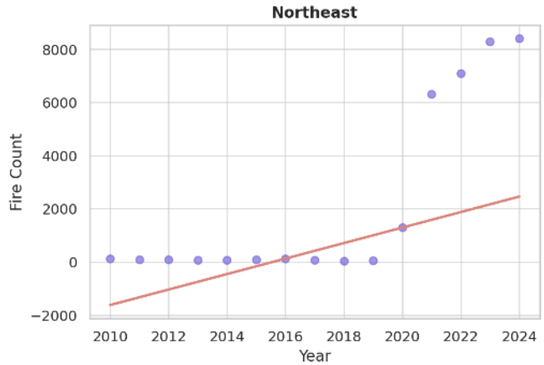

Decayed pole

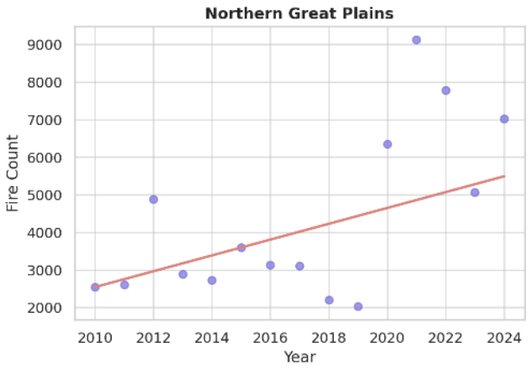

Vegetation Contact

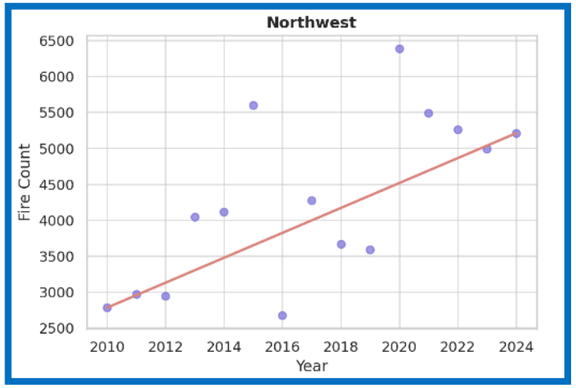
Long-Term Regional Wildfire Trends
-Annual Total Fire Occurrence

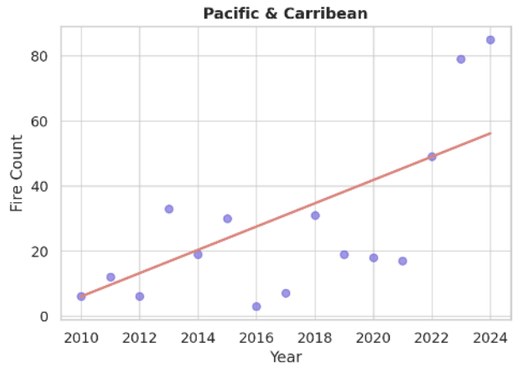


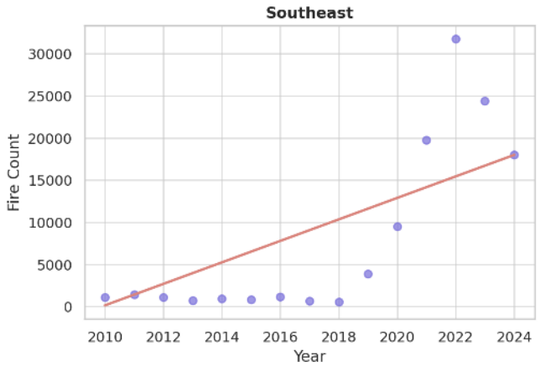


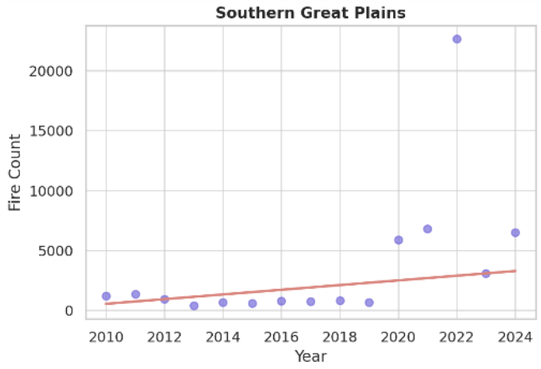


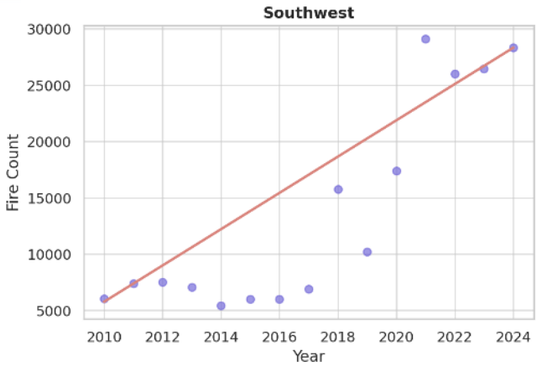


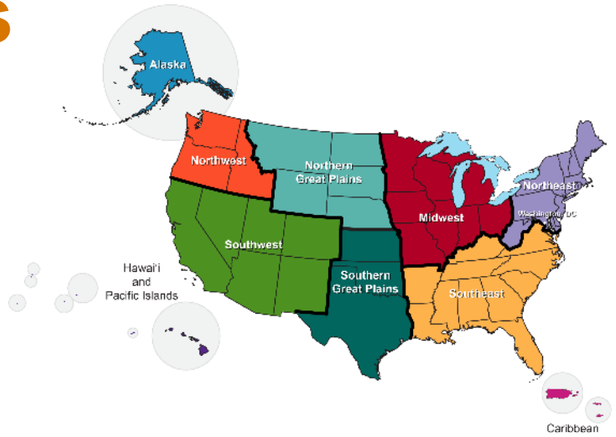








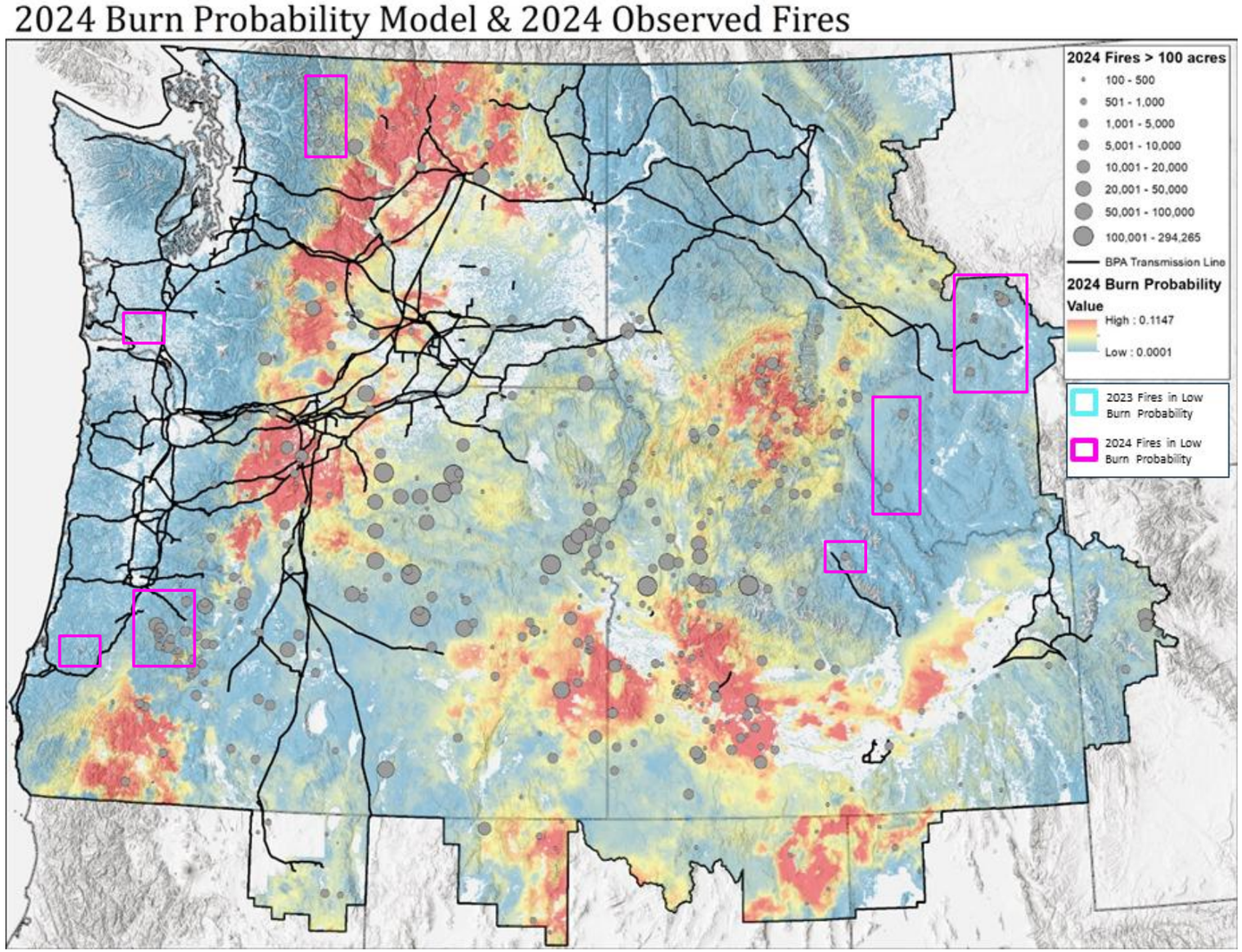


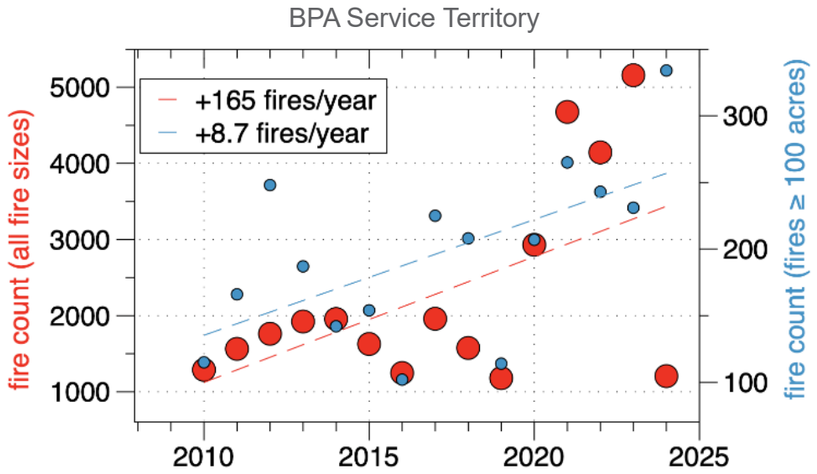


All regions except Alaska are exhibiting statistical non-stationarity

PNW had the 2nd largest burn area in the U.S. in 2024

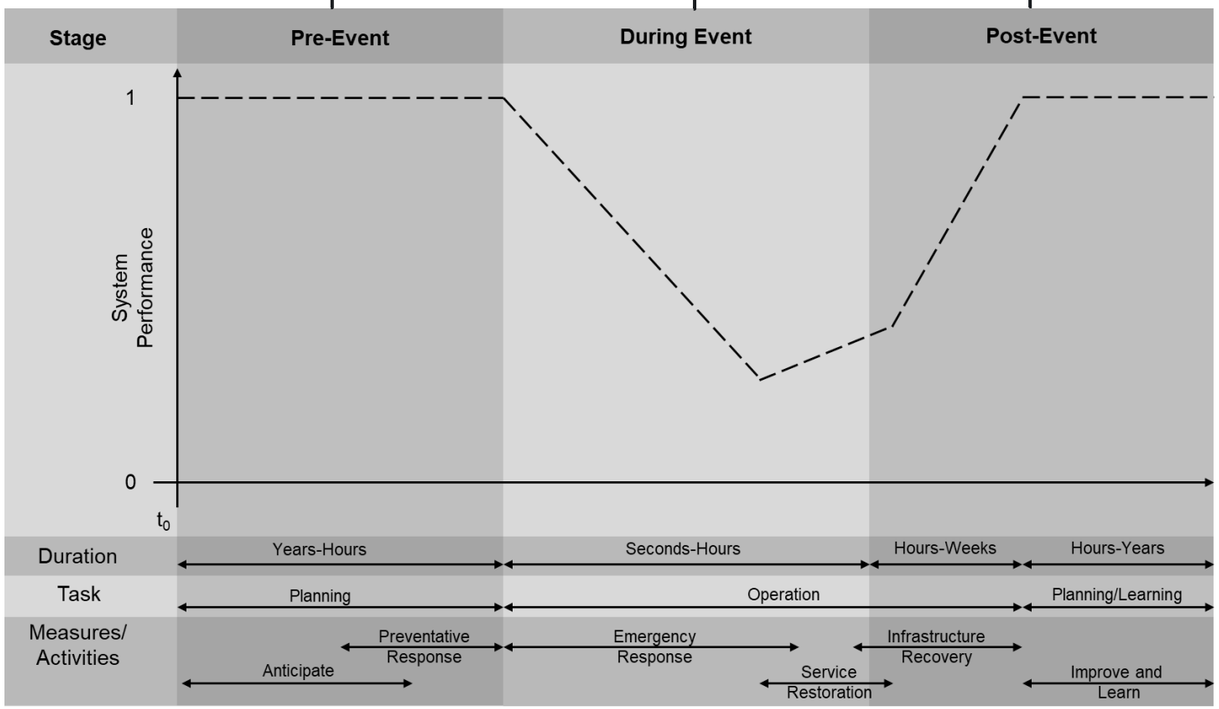
Wildfire Risk in the BPA Service Territory



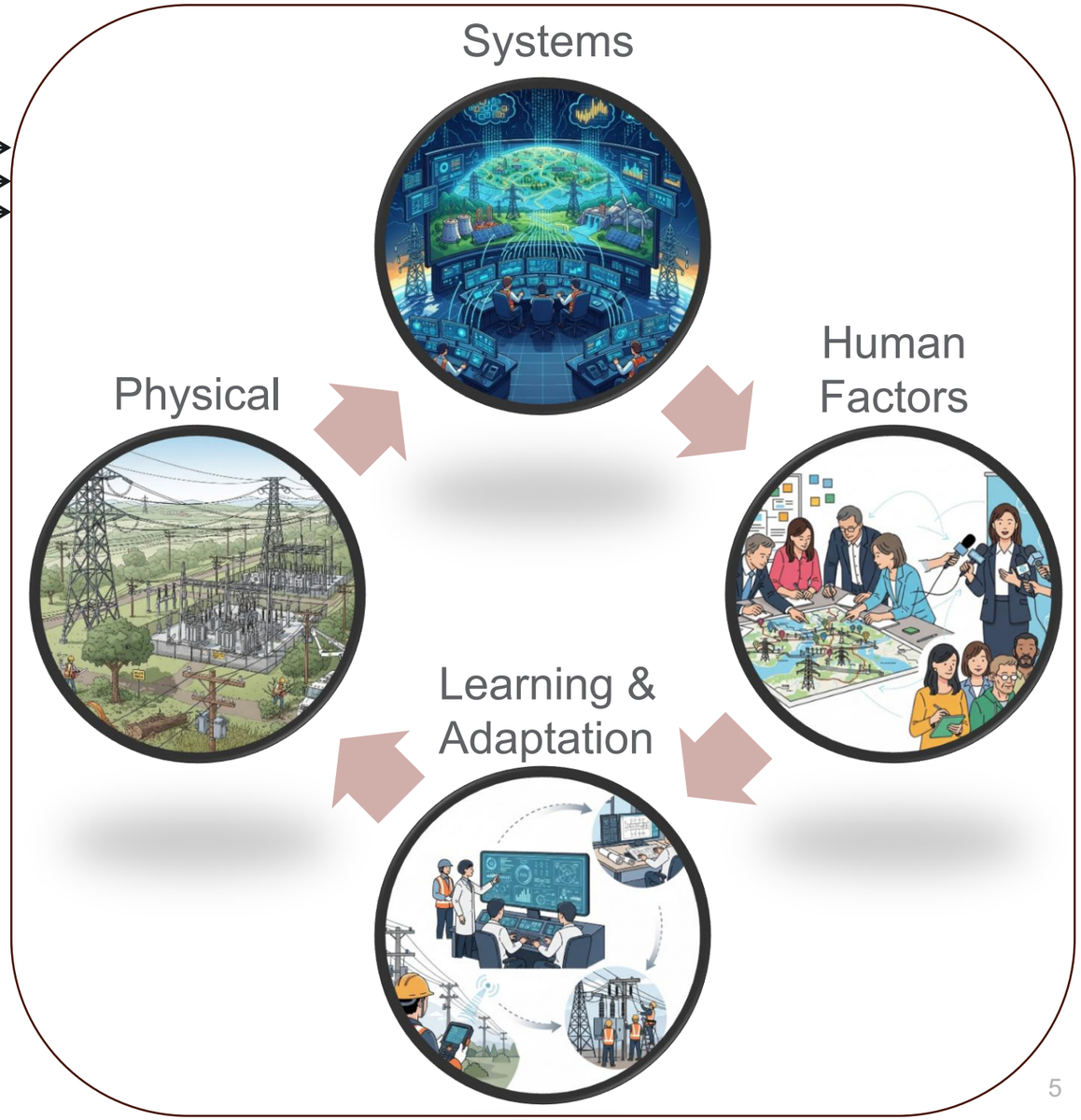


- **Emerging Risk:** fires are occurring in areas traditionally considered low-risk
- Concerning because of the high biomass availability

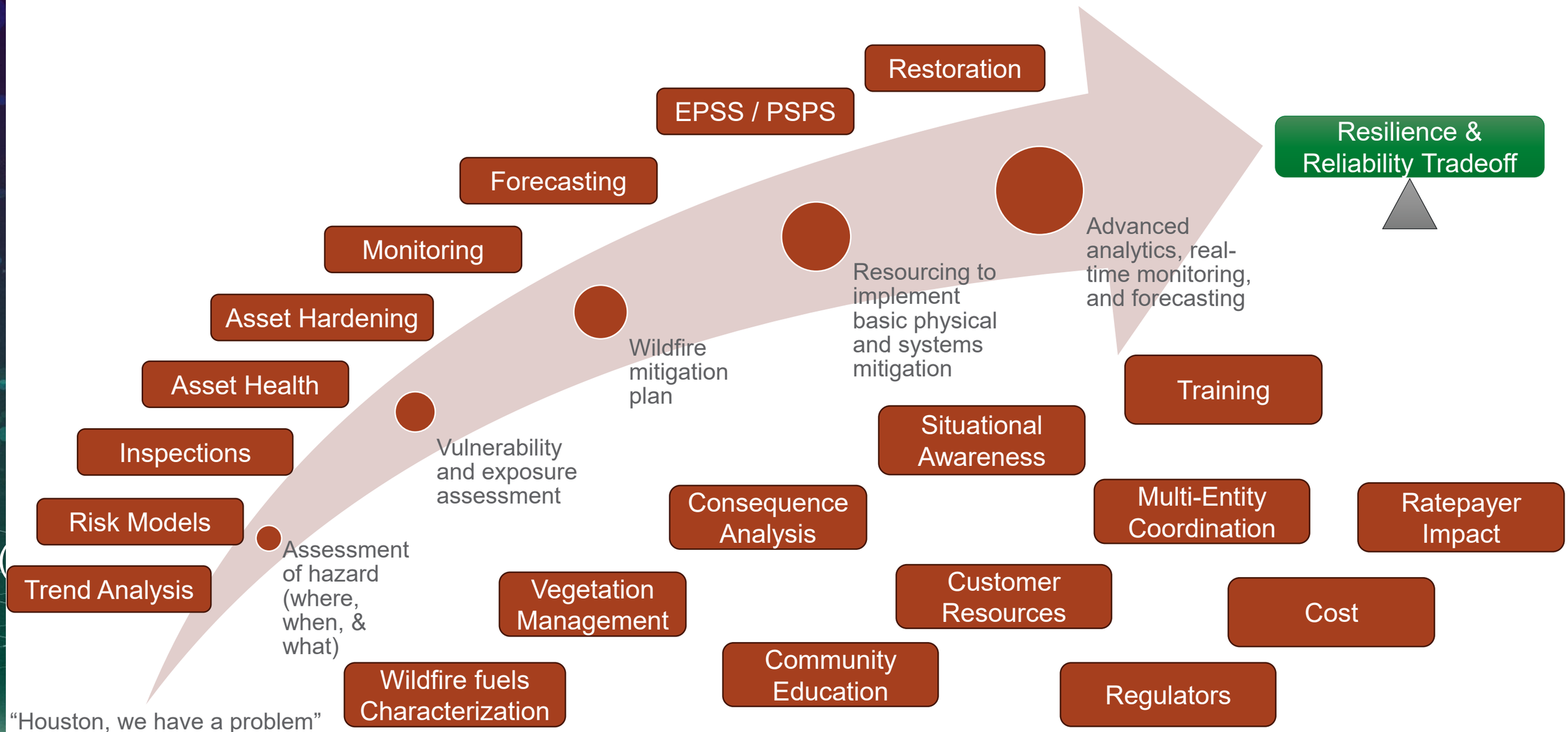
Mitigating Wildfire Risk for Utilities



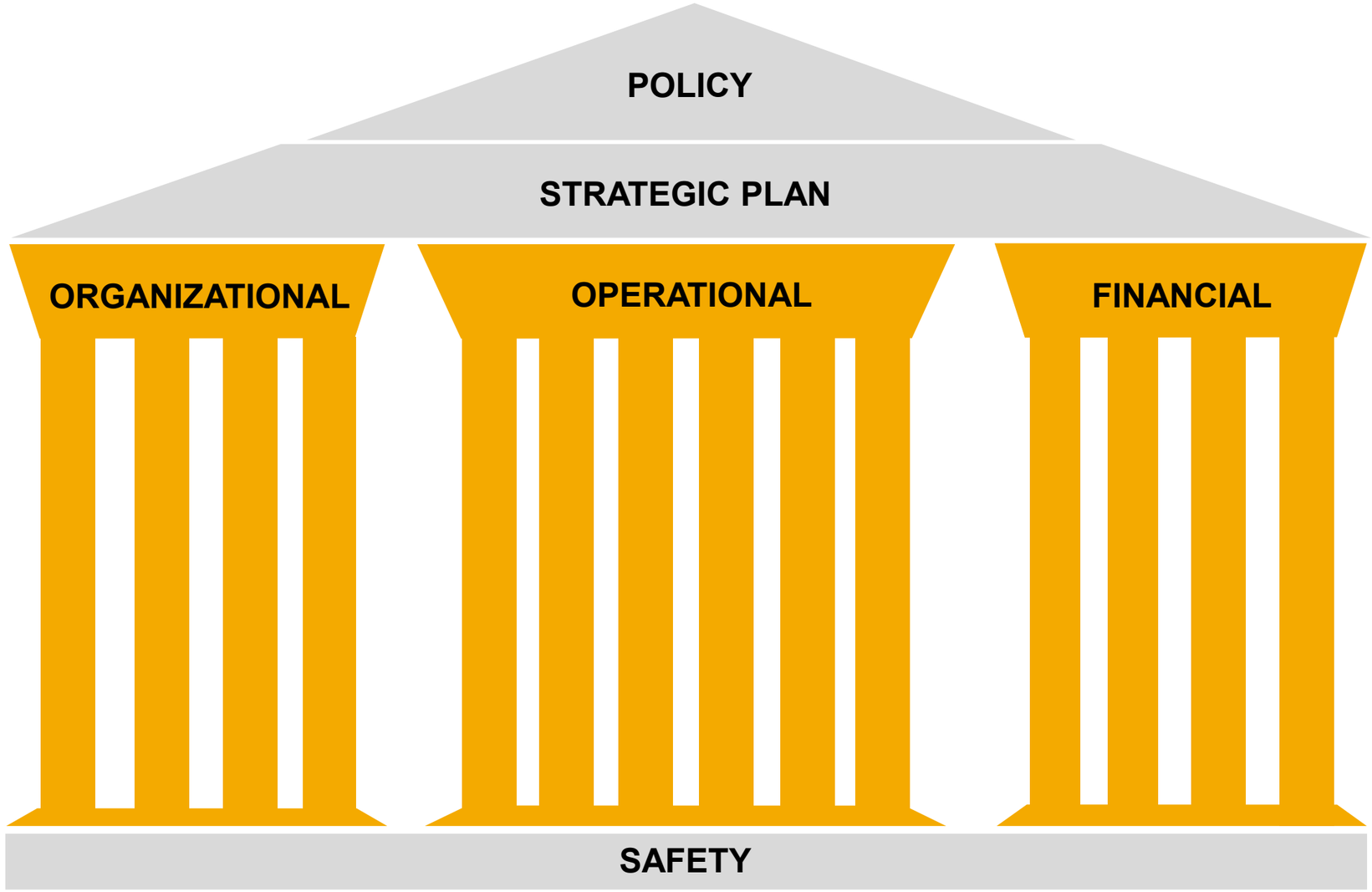
Impact event timeline for risk and resilience mitigation (adapted from Stankovic et al. 2023)



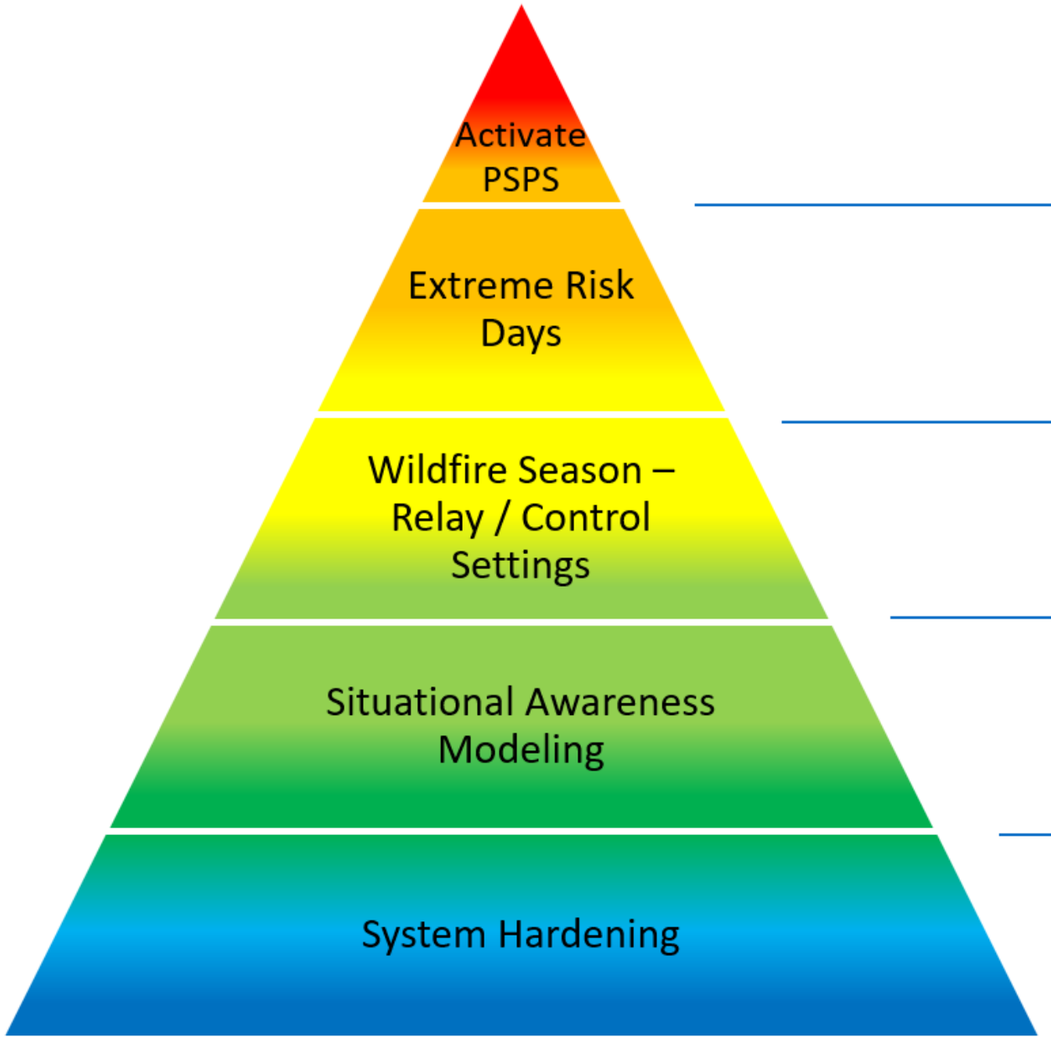
Wildfire Risk Mitigation is a Journey



Resiliency Framework



Resiliency Measures



Last resort: Public Safety Power Shutoff (PSPS)

During Extreme Risk Days, activate PSPS decision making team

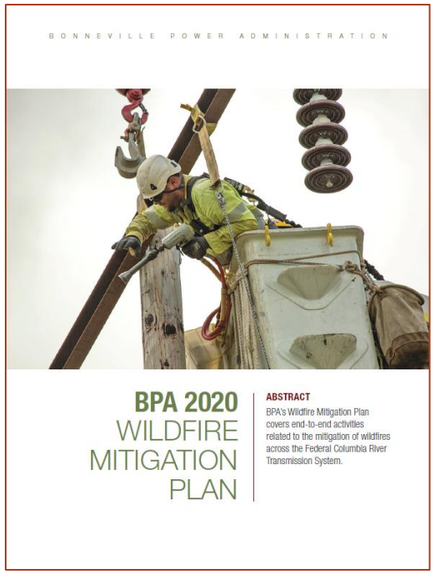
During wildfire season, utilization of enhanced protection and control settings

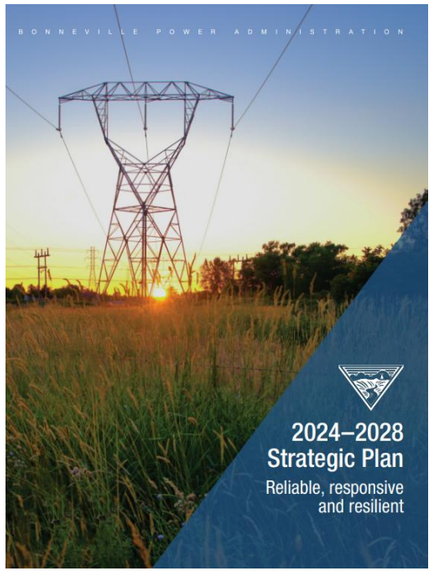
During wildfire season, implementation of enhanced weather monitoring/forecasting and asset management tools to understand risk

Year-round system modifications and robust vegetation management program to minimize risk

BPA's Wildfire Mitigation Journey

2019	2020	2021	2022	2023	2024	2025
• Wildfire mitigation starts	• First WMP • Internal cross-coordination	• PSPS program • PSPS table-top exercise • Wildfire mitigation team created	• Static wildfire risk model	• Work prioritization • PSPS meeting with distribution customers	• Wildfire mitigation program manager	• Wildfire safety training • Wildfire spread models





Notable Progress

Vegetation management

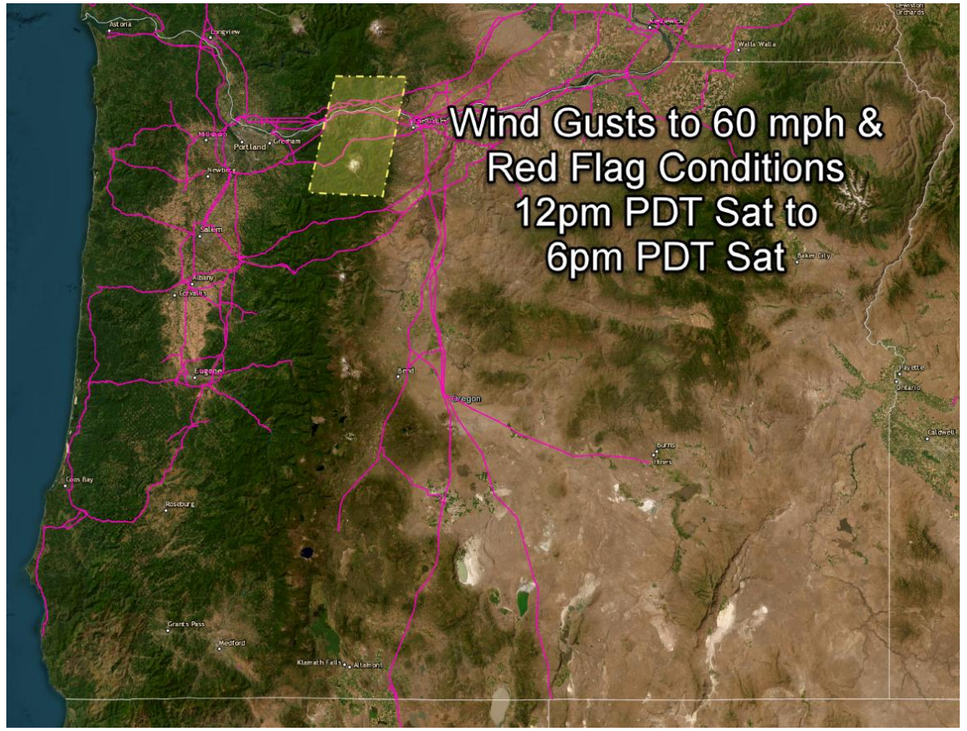


Table-top exercises

Wood pole fire retardants

BPA Collaboration

- International Wildfire Risk Mitigation Consortium (IWRMC)
- Electric Power Research Institute (EPRI) Wildfire Advisory Group
- CEATI Wildfire Mitigation and Resiliency Working Group
- Utility discussions

- Power Marketing Administrations (WAPA, SWPA, SEPA)
- U.S. Forest Service (USFS)
- DOE: CESER, GRIP, GDO
- National Laboratories (Argonne, PNNL, Sandia)
- Utility discussions

- Oregon Wildfire & Electric Collaborative
- Washington Wildfire Working Group
- Utility and stakeholder discussions

RADR-Fire Lifecycle
-Triple-Line Defense for Wildfire Resiliency

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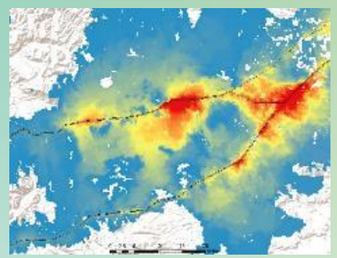
RADR FIRE

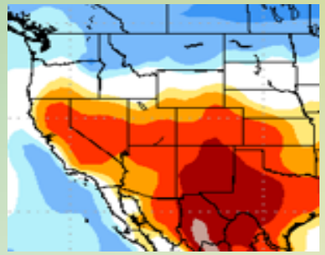
PREVENTION & MITIGATION

Pre-Season Fire Risk



- Vegetation Management
- Infrastructure Hardening
- Community Resiliency
- Consequence Analysis
- Planning, Preparedness, Monitoring, & Policy Actions

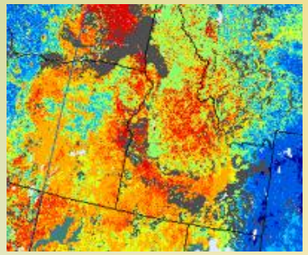
Forecasted Fire Risk



- Planning, Preparedness, Monitoring, & Policy Actions
- Consequence Analysis
- Vegetation Management
- Community Resiliency
- Infrastructure Hardening

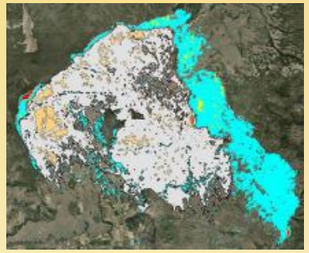
RESPONSE

Current Fire Risk



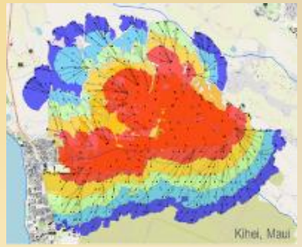
- Monitoring, & Policy Actions
- EPSS PSPS
- Infrastructure & Site Operations
- Consequence Analysis

Active Event Monitoring



- Situational Awareness
- Resourcing & Response
- Infrastructure & Site Operations
- EPSS/ PSPS

Forecasted Fire Spread



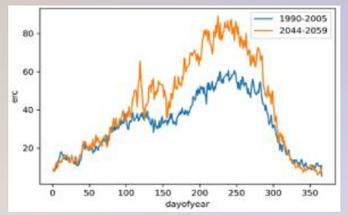
- Resourcing & Response
- Community Protection
- Evacuation
- Infrastructure & Site Operations
- Scenario Analysis

RECOVERY & PREPAREDNESS

Post-Event

- Community Protection
- Infrastructure Protection
- Flood Risk
- Landslide Risk
- Recovery
- Monitoring

Long-Term Future Risk



- Long-Term Planning & Mitigation
- Policy Development
- Strategic Investments

Multi-Temporal Wildfire Risk Forecasting

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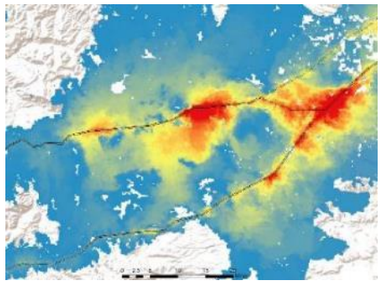
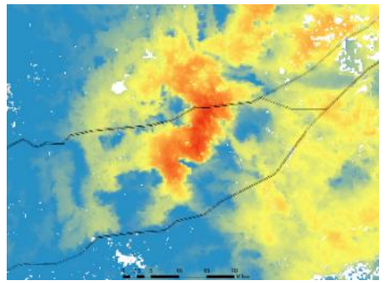
Mitigation Actions

- Vegetation Management
- Community Resiliency
- Infrastructure Hardening
- EPSS/PSPS Planning
- Consequence Analysis

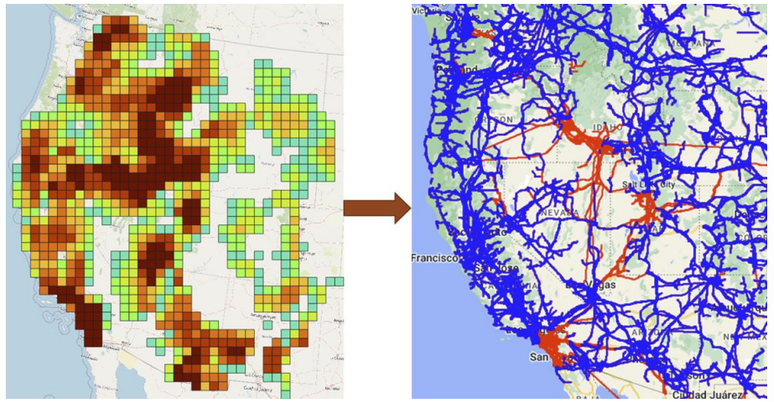
Annual Baseline Fire Risk



Corridor-Only Ignitions



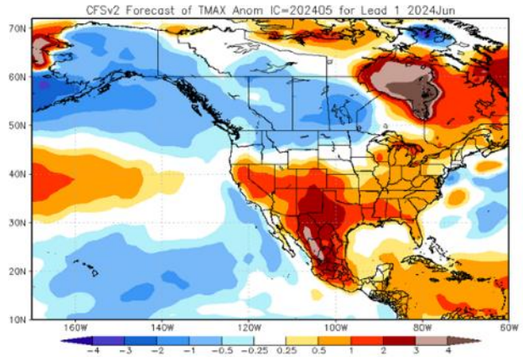
Landscape-Wide Ignitions



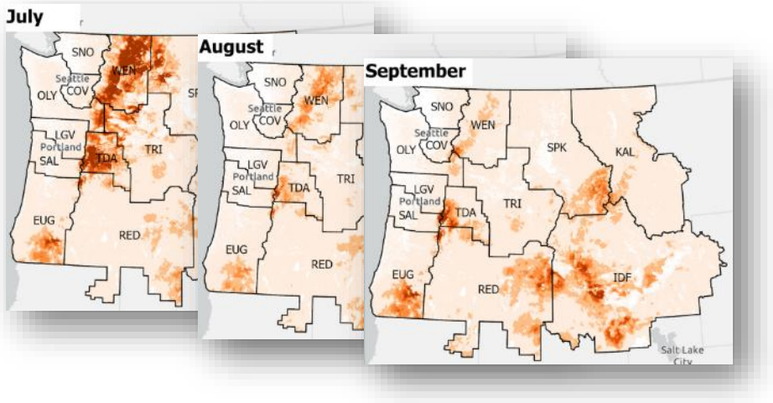
Infrastructure Fragilities - Wildfire Risk Evaluation of the System (WIRES)

Monthly Forecast Wildfire Risk

Medium-Range Ensemble Meteorological Forecasts

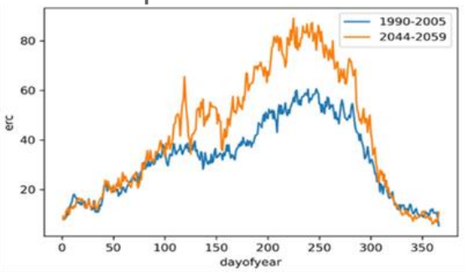


Monthly Wildfire Risk Forecasts (1-7 months)

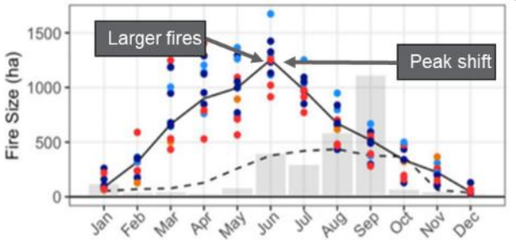


Long-Term Future Wildfire Risk

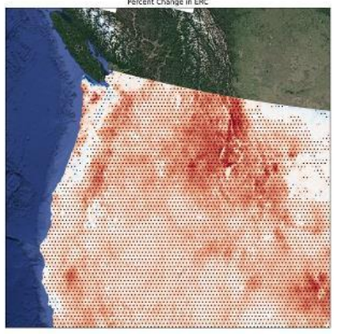
CMIP-5 & CMIP-6 Multiple RCPs / SSPs



Shifts in Fire Size and Timing

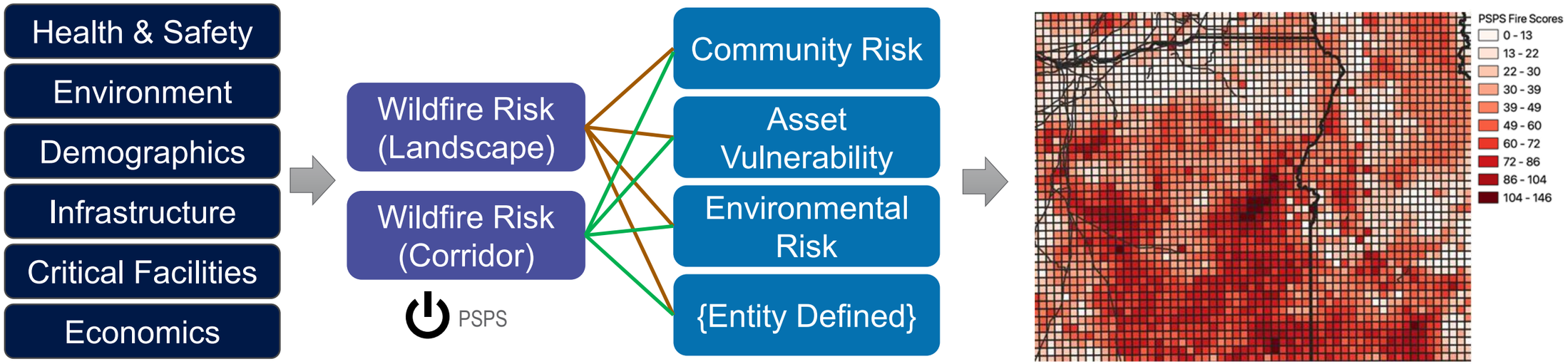


% Change in Risk



Consequence Analysis Modeling -Aid in Mitigation Prioritizations

- Multi-criteria decision analysis tool for ranking *wildfire ignition* or *de-energization* in relation to high-value resources and assets
  - Quantitatively score consequences
- Data-driven prioritization tool informs planning, operations, & field operations
- Run at multiple time horizons – pre-season, weekly, monthly, long-term future



User-Defined Weights / Priorities

Fire Modeling Scenarios

Topic-Level Consequence Risk

Compound Consequence Risk Score

Utility Wildfire Mitigation Plan Database

- PNNL created a database of all known and discrete utility Wildfire Mitigation Plans (WMPs) from across the United States and Canada.
- The purpose of the database is to provide a single consolidated location for access to all WMPs, organized by utility, year, location, and other metadata.
- The database features short citable analyses, map filters, and search functions.

wildfire.pnnl.gov/mitigationplans

409	170	9	18
Number of Wildfire Mitigation Plans	Number of Utilities Represented	Years Represented (2019-2028)	Number of States Represented

Conclusion

- To enable effective resilience planning, there is a need to model and plan at different spatial and temporal horizons to meet different operational phases

- Evaluating and determining the reliability and resilience balance is complex
  - i.e., how do you know if you're doing too much or too little?

- Wildfire mitigation is a journey with short-term wins and long-haul actions
  - Recognize that adaptation is mandatory amongst changing conditions
  - Dedicated utility wildfire mitigation teams

- Recognition that most individual utilities have varied approaches for assessing risk (data sources, models, metrics) and implementing risk mitigation
  - Drive towards standard resiliency frameworks, consistent data sources, and best methods

- Collaboration/Coordination
  - Wildfire risk and mitigation is a multi-entity landscape-scale challenge
  - Need for improved public-private coordination and development of common objectives
  - Communication, partnerships, holistic planning, exercises, and mitigation are critical

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Thank you

Andre Coleman
andre.coleman@pnnl.gov

Kelly Miller
klmiller@bpa.gov

WILDFIRE RISK & RESILIENCE @PNNL

PNNL Team
Andre Coleman
Lee Miller
Troy Saltiel
Ilan Gonzalez-Hirshfeld
Kyle Larson
Arielle Catalano
Krystal Ayala
Victoria Sinnott

BPA Team
Kelly Miller
Amber Churchill
Matt Weaver
Becca Woods
Chuck Sheppard
John Tyler
Jessica Simmons
James Hillegas-Elting
Jeff Cook

Wildfire Risk: Changing Utility Business Models

- Providing credible, data-driven insights into the evolving financial and regulatory landscape facing utilities and highlight key trends such as the rise of self-insurance, expanded liability exposure, increasing insurance premiums and limitations, impacts on cost of capital, asset valuation changes and the redistribution of wildfire-related risk.

Webinar on Wildfire and Consequences for the Utility Business Model
August 19 at 10 am PT

Register >>
Landscape analysis >>
Project overview and Technical Advisory Committee >>

Edge Cases

- Wildfire near Ashcroft, British Columbia, August 5, 2025 was caused by a fish
- Investigators determined that the fish had likely been scooped up by an osprey from a river 2-miles away
- *Perhaps* because of the excessive heat/exhaustion, the bird had dropped the fish, which hit the conductor wire
- The line faulted and ignited the dry grass below