Pacific Northwest
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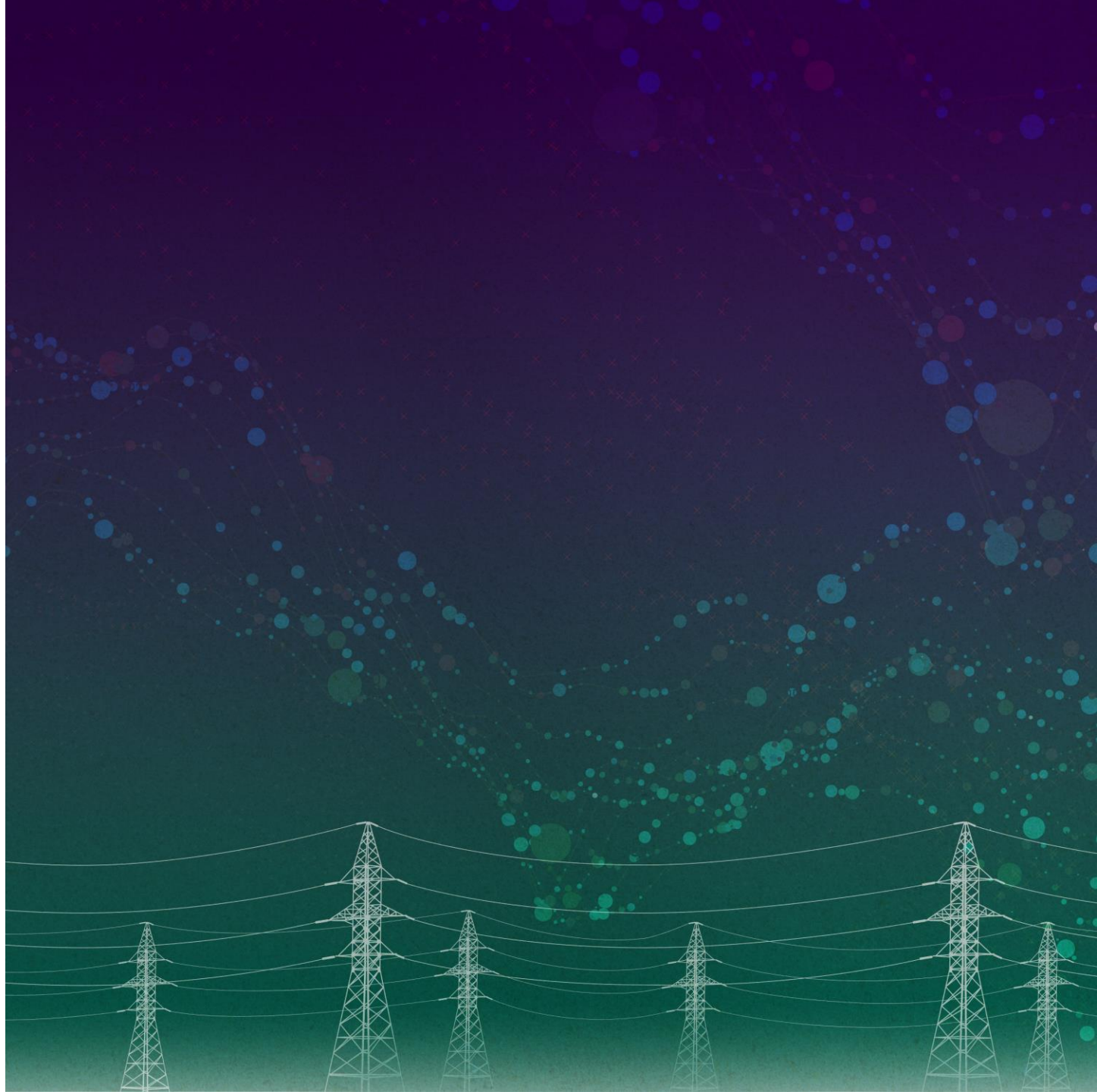
History and Trends of Wildfire in North Central Region

Jerry Tagestad

DOE Pacific Northwest National Laboratory



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Northern Plains

October 2024 Arnegard Fire Photo credit – Travis Blank

- The Northern Plains sees fast-moving fires that can spread rapidly.
- Pre-settlement saw frequent, low-intensity fires sweeping across the Plains.
- Early 20th century, agricultural development, grazing, and fire suppression reduced fire occurrence.
- In the latter half of the century, drought and warmer temperatures led to increasing large and intense wildfires.
- Recent examples of destructive fires were driven by extreme winds

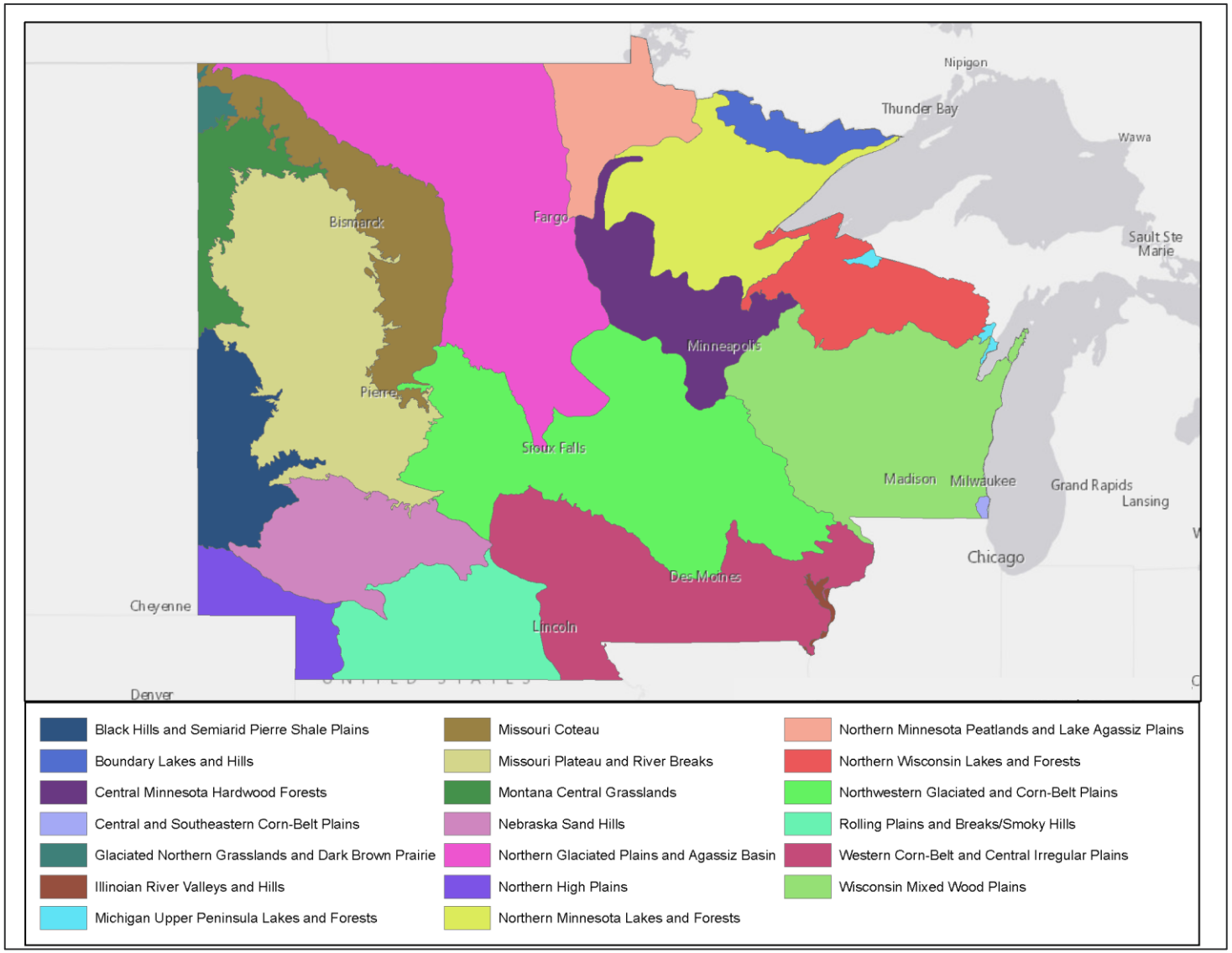
Northern Forests

Peshtigo Fire Illustration – Chicago History Museum

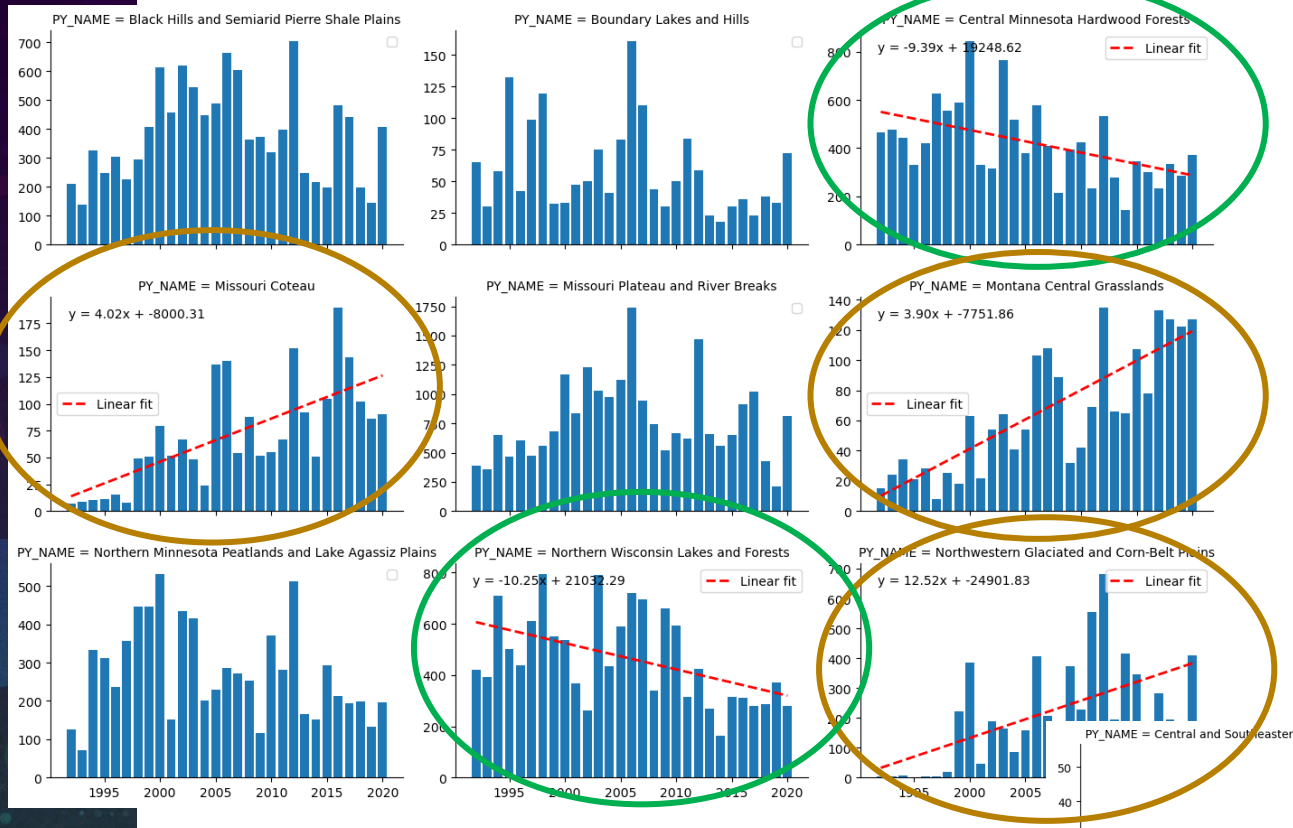
- Early statehood logging left large amounts of slash that fueled catastrophic wildfires. (Peshtigo Fire of 1871
- Mid-20th century, reforestation and recovery shifted toward denser vegetation. Suppression led to a buildup of fuels in many areas.
- Late 20th century prescribed burns and improved fire management practices implemented to restore natural disturbances.
- Recent decades, variable climate - warmer temperatures and altered precipitation patterns has increased biomass.

Pyromes (like ecoregions for fire)

- Geographic regions characterized by similar fire regime patterns
- USFS defines them based on fire, fuel type, climate etc.
- Look at historic (1990-2020) fire occurrence within N Central pyromes (~155,000 fires)

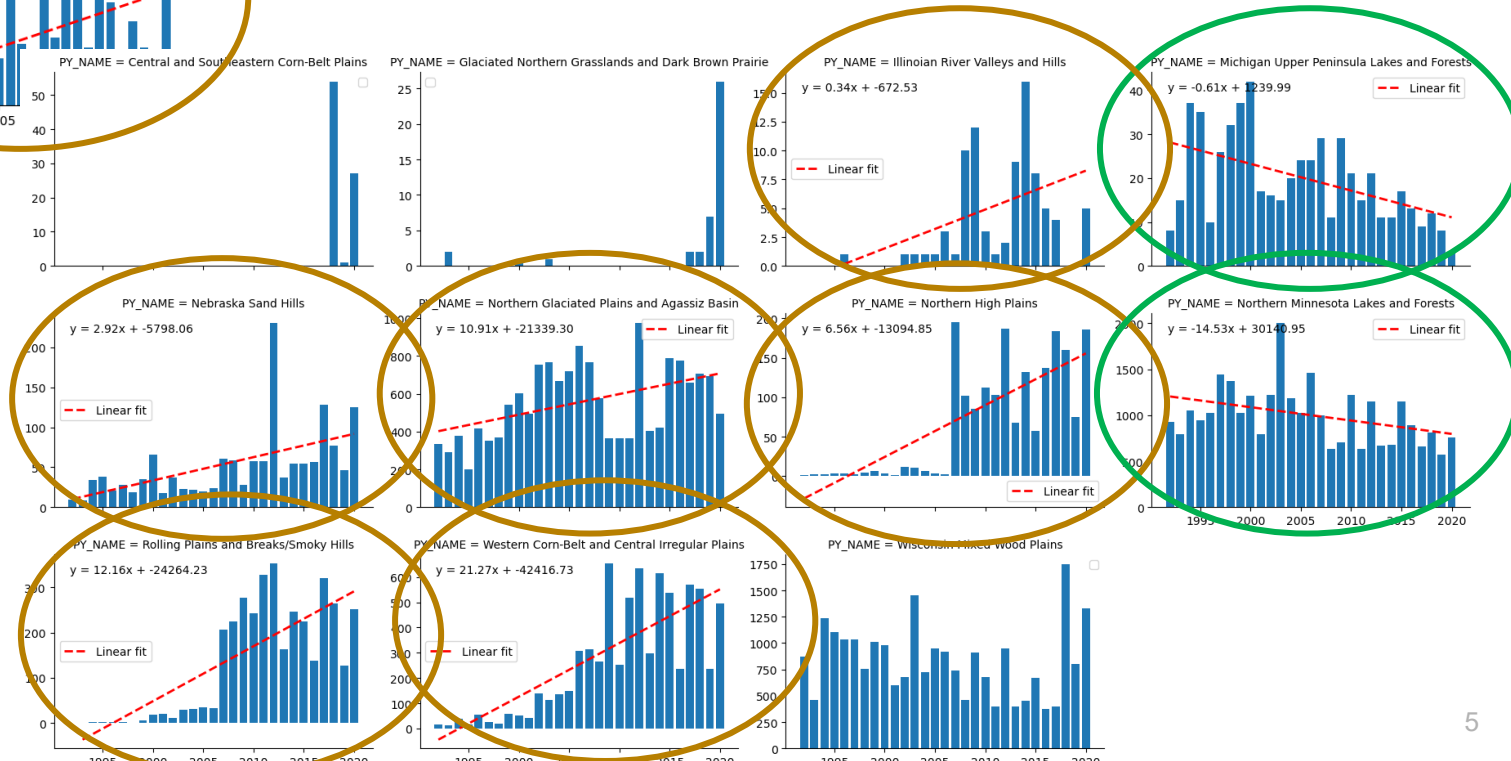


Fire Size Trend by Pyrome



Grasslands

Forests



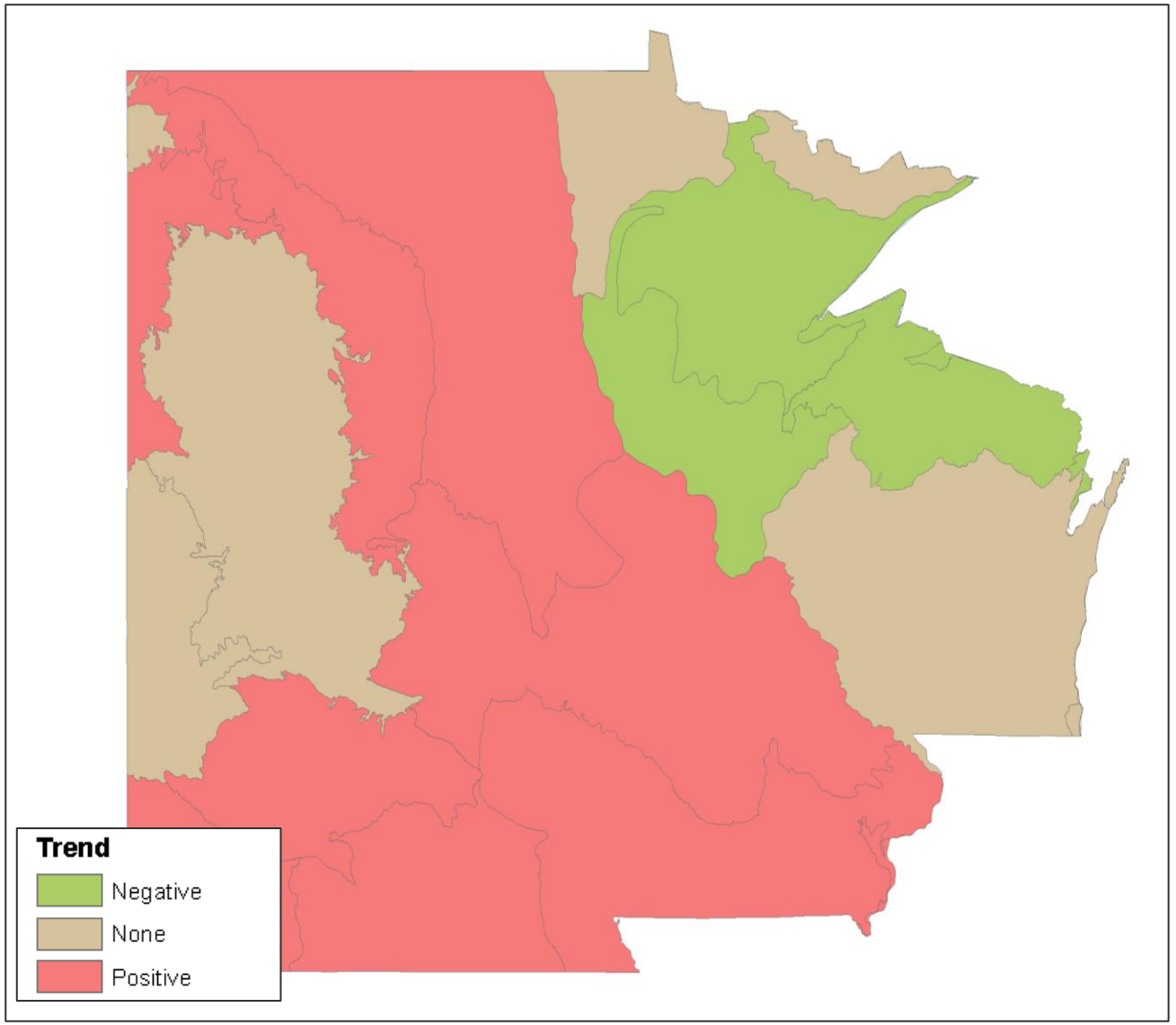
- Fire occurrence data 1900-2020
  - Size
  - Start DOY

Precipitation Time Series - Central Pyromes

Maximum Temperature Time Series - Central Pyro wa)

Fire Occurrence - Trends

- Positive trend areas are grasslands
  - Wind-driven, fine fuels fires
  - limited mitigation options
- Negative trend areas are forested
  - Much higher biomass
  - Fuels treatments can be effective
  - Could be a reflection of wetter fire seasons



Trends in number of fires by pyrome

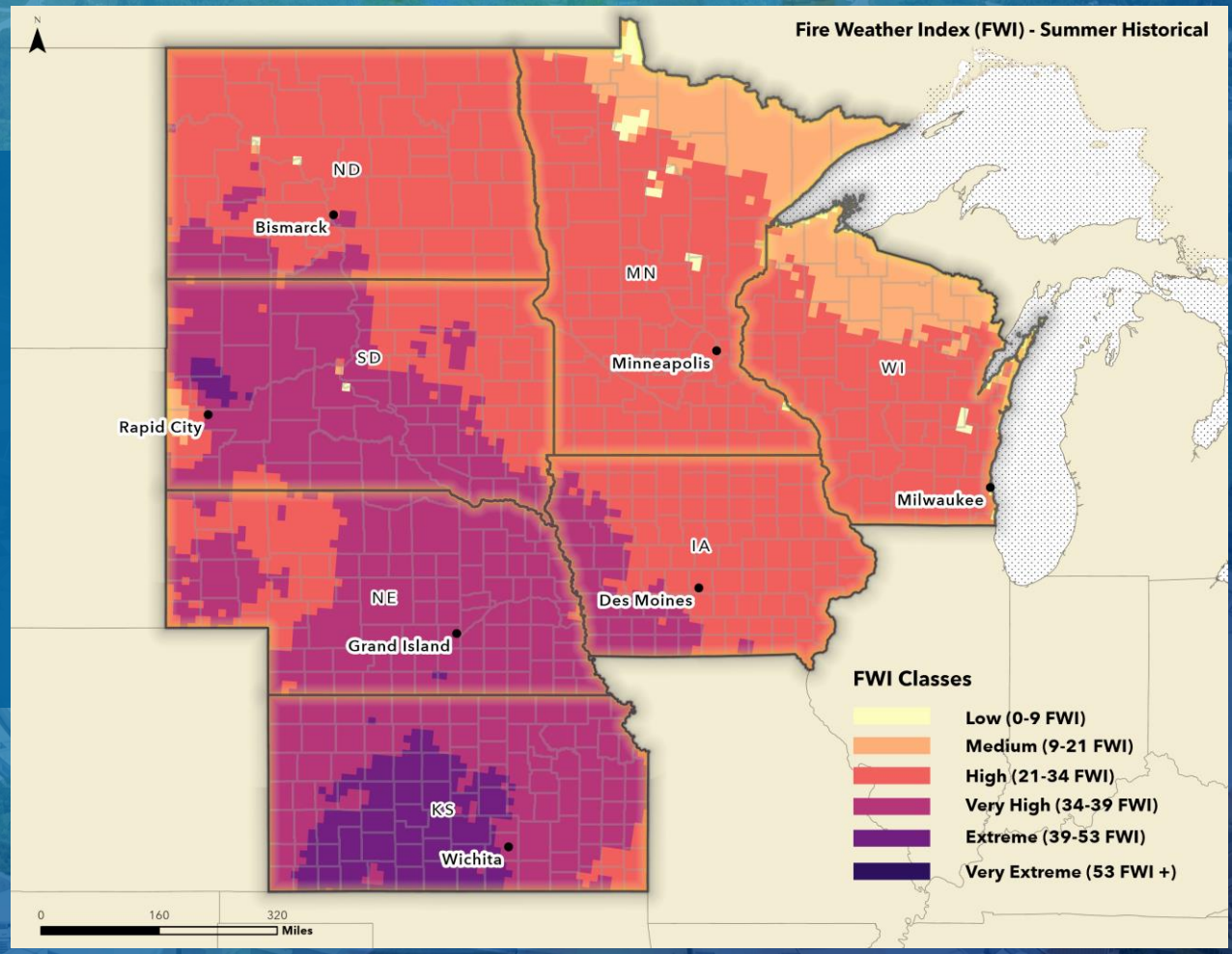
Pos 44/135
Neg 21/135
None 70/135

Thank you

AUGUST 27, 2025

EXPLORING FUTURE WILDFIRE RISK WITH CLIMRR

ASHTON RAFFETY
Sr. Energy Policy & Strategy Analyst
Decision & Infrastructure Sciences
Argonne National Laboratory



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Argonne NATIONAL LABORATORY

ABOUT ARGONNE NATIONAL LABORATORY

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- Through Argonne's unmatched combination of leading researchers, specialized facilities, and high-impact partnerships, we deliver results that advance U.S. prosperity and security.
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Paul K. Kearns
Laboratory Director

UChicago Argonne, LLC
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78 years of service to society

APPA EXTREME HEAT/WILDFIRE COHORTS

Two Cohorts Exploring Wildfire Risk to Enhance WMPs

Cohort 1 / FY25
Austin Energy / Texas
Eugene Water & Electric Board / Oregon
Placer County Water Agency / California
Salt River Project / Arizona
Snohomish County PUD / Washington

Cohort 2 / FY26
Loveland Water & Power / Colorado
Truckee Donner PUD / California
CORE Electric Cooperative / Colorado
Electrical District No. 3 / Arizona
Seattle City Light / Washington
WAPA / Colorado HQ

KEY THEMES FROM INITIAL PLAN REVIEWS

	Vegetation Data	Weather Data	Remote Sensing	AI Tools	PSPS Criteria	Community Risk Assessments
Austin Energy	Vegetation management data	Real-time data feeds	Pano AI system (360-degree ultra-HD cameras)	Pano AI system	PSPS protocols	Collaboration with local fire departments
EWEB	Vegetation and terrain data	Weather and climate indicators	Situational awareness tools	Situational awareness tools	PSPS criteria and thresholds	Community risk and vulnerability assessments
PCWA	Fuel reduction and forest management data	Watershed health monitoring	Hazard tree removal mapping	N/A	N/A	Collaboration with local agencies
SRP	Vegetation and fuel load assessments	Meteorological data (wind speed, humidity, temperature)	AI-enabled infrared cameras (SmokeD)	AI-enabled infrared cameras (SmokeD)	PSPS program	Collaboration with U.S. Forest Service
SnoPUD	Vegetation and terrain data	Weather and fire danger indicators	Grid monitoring and smart devices (SnoSMART project)	Grid monitoring and smart devices (SnoSMART project)	PSPS planning	Wildfire threat analytics & mapping

URL: climrr.anl.gov

ClimRR: GOALS

- ClimRR is the outgrowth of a public-private collaboration between Argonne National Laboratory, the U.S. Department of Energy's Grid Deployment Office, and AT&T.
- Provides free and equitable access to leading, peer-reviewed datasets.
- Contextualize how risks from hazards interact with community-level characteristics to inform resilience planning.
- Empower individuals, organizations, planners and officials at state, local, tribal, and territorial governments to analyze hazard risk to support decision-making.

CENTER FOR RESILIENCE AND DECISION SCIENCE
Argonne National Laboratory

GDO
GRID DEPLOYMENT OFFICE

AT&T

CLIMRR

Data offerings

- Fire weather index
- Temperature & heat index
- Wet bulb globe temperature
- Precipitation & days with no precipitation
- Wind speeds
- Degree Days
- Inland flooding
- Future integration of:
  - Storm surge / coastal flooding
  - Heat waves
  - Growing seasons data

Multiple ways to explore data

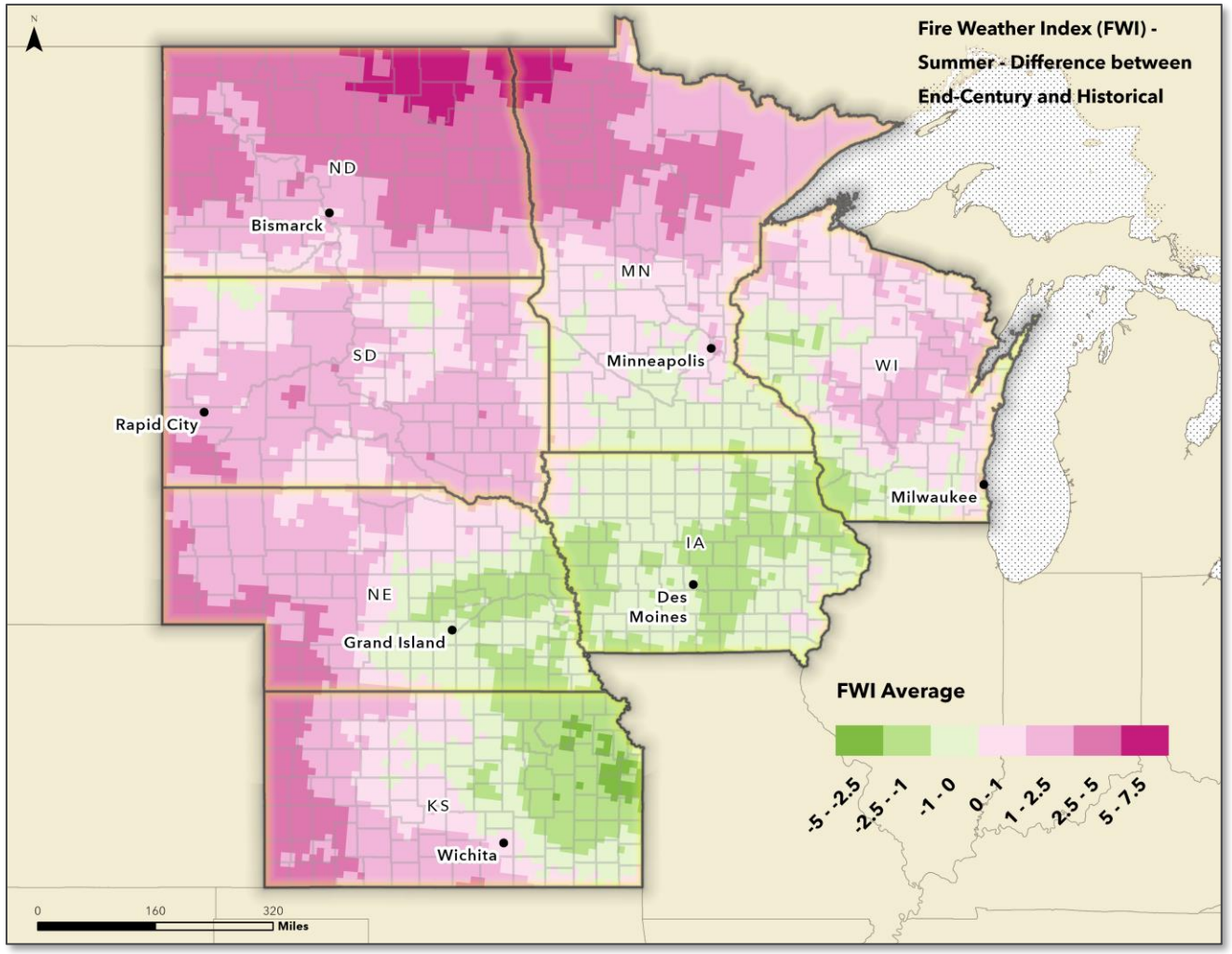
Local Projections Tool

National Map Explorers

Data Catalog

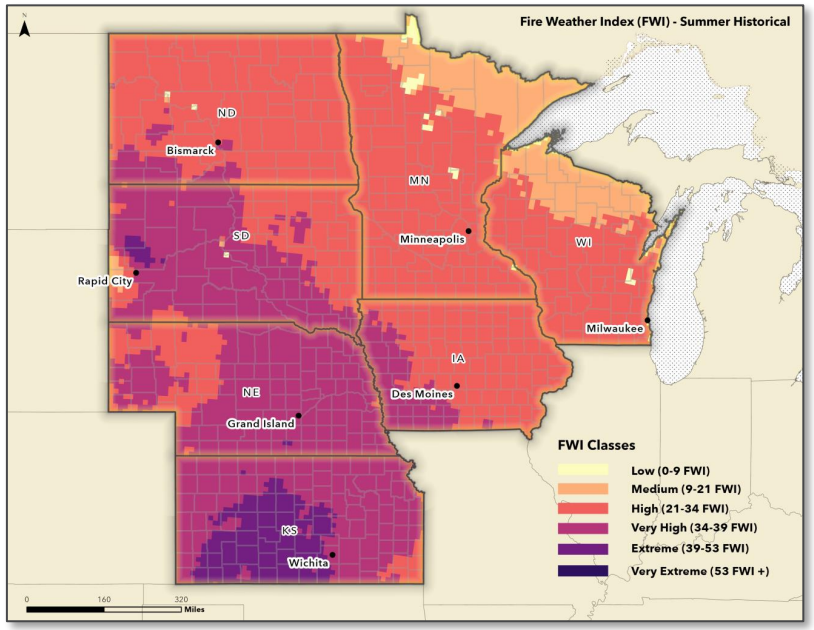
FIRE WEATHER INDEX – MEAN

Measure of Weather Conditions Conducive To Wildfire

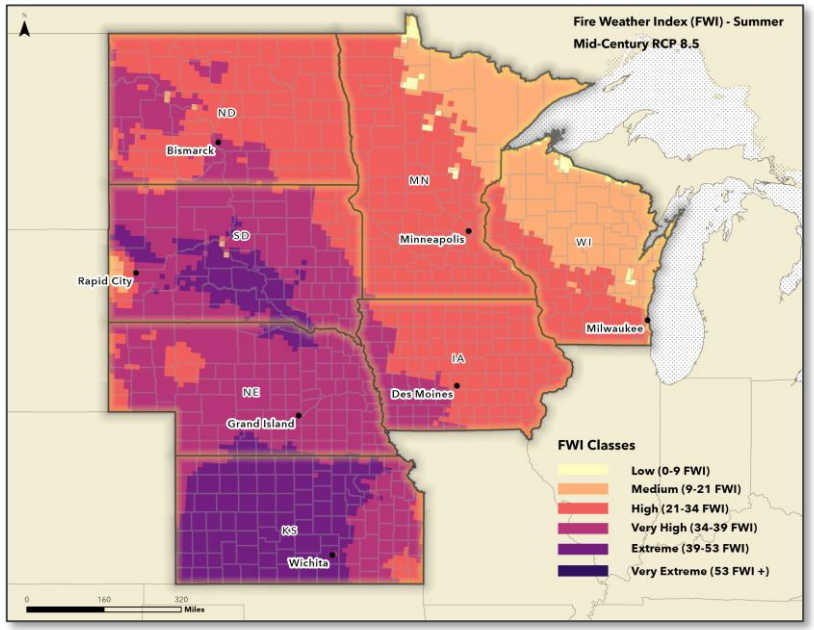


FIRE WEATHER INDEX – CLASSES (EXTREMES)

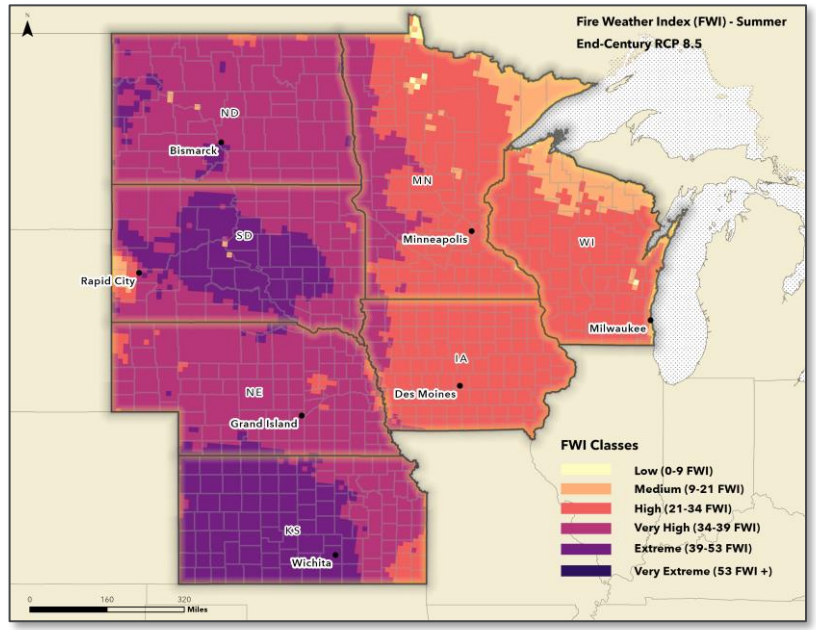
Measure of Weather Conditions Conducive To Wildfire



Summer Historical



Summer Mid-Century



Summer End-Century

FWI Classes were developed using the 95th percentile grid-level FWI value, which are extremes that occur with some level of regularity.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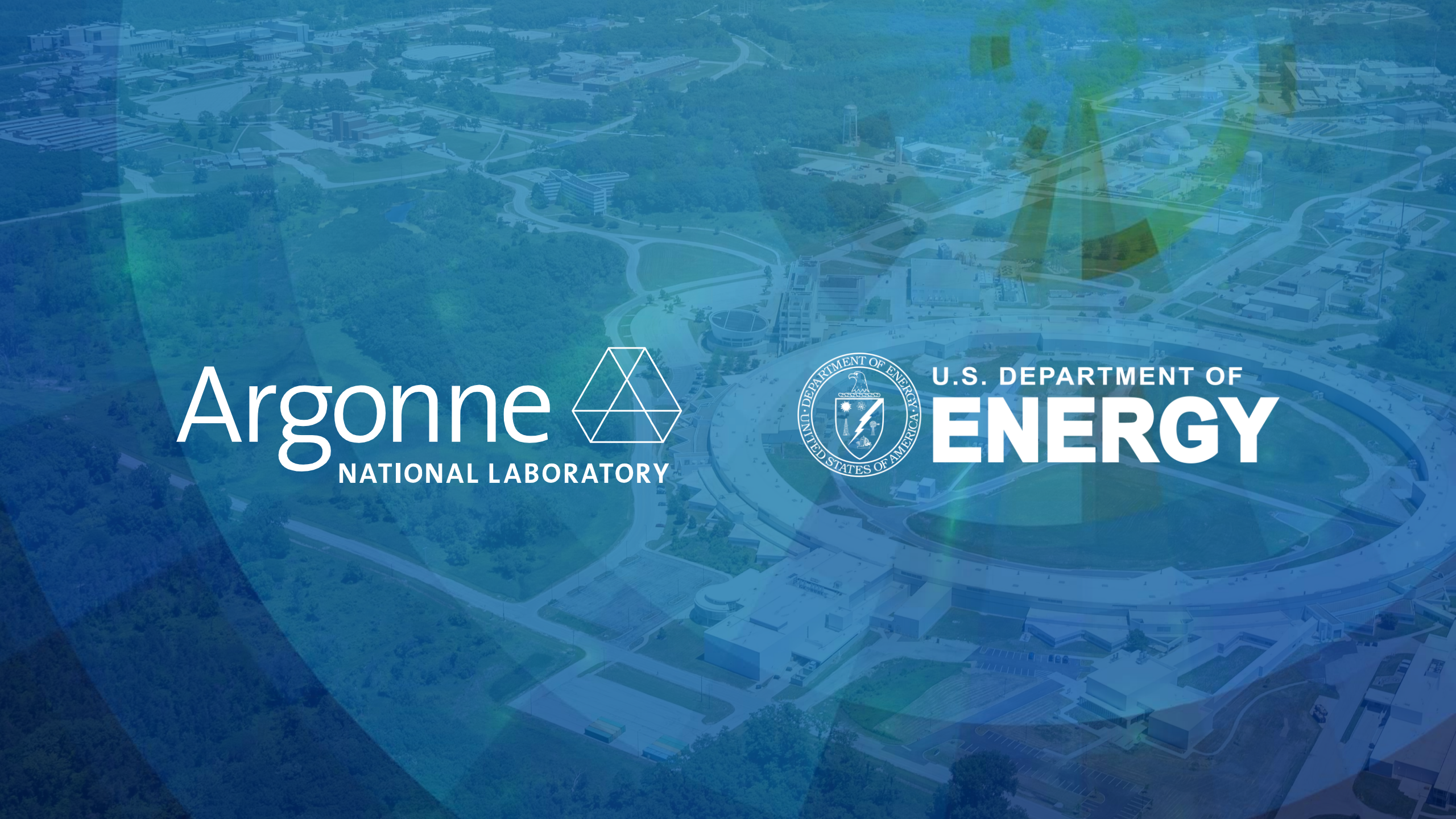
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Climate READi: Power

A Framework for Climate-Informed Utility Planning

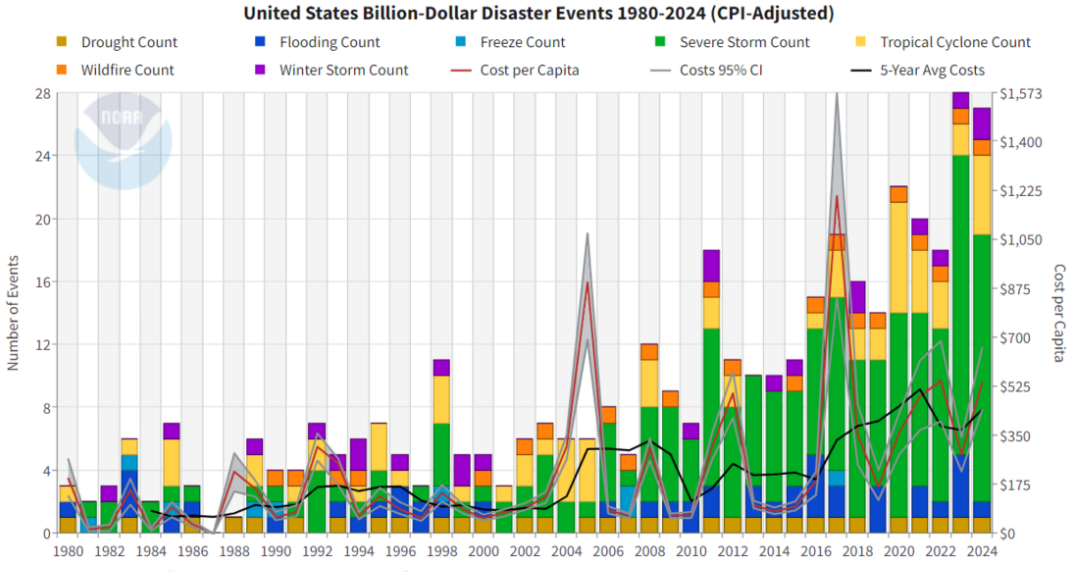
Jacob Mardian, PhD
EPRI

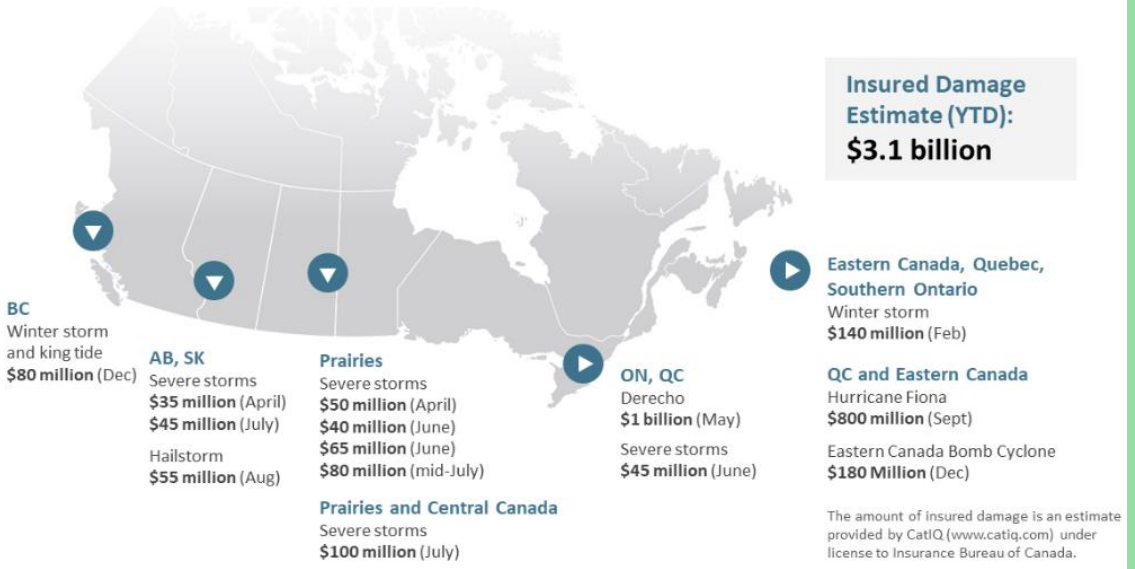
PNNL North-Central Regional Wildfire Workshop
Madison, WI
August 27, 2025

The Costs of Extreme Events

Billion-dollar disasters are growing in cost and increasing in frequency

Without informed and timely adaptation, costs from climate disasters are likely to increase.





Billion-dollar disaster events in the U.S. from 1980 through 2024. Source: NOAA

Canadian Insured Catastrophic Losses-2022 Source: *Insurance Bureau of Canada, 2023*

Cost and Benefits of Proactive Climate Adaptation in the Electric Sector

- Outlines and quantifies the benefits of proactively implementing climate adaptation strategies
- Explores costs of recent disasters and recovery, and comparisons to proactive hardening costs

Proactive adaptation of US transmission and distribution assets reduces future costs by 50%
(Fant et al.)

Savings of $1 billion per company with proactive adaptation just for hurricane-related costs over 20 years
(McKinsey & Co)

Investments in more resilient infrastructure for low- and middle-income countries bring $4 in benefit for every $1 invested
(World Bank)

Without proactive adaptation, damage costs to Canadian transmission and distribution assets will increase by $2.4 billion per year by 2050
(Canadian Climate Institute)

Proactive adaptation of road infrastructure reduces costs by 98.8%. For rail infrastructure, 92.7%
(Neumann et al.)

Proactive adaptation is consistently less expensive than respond & repair

CLIMATE READi

RESILIENCE AND ADAPTATION INITIATIVE

Access all results, story maps, and the framework at:

epri.com/readi

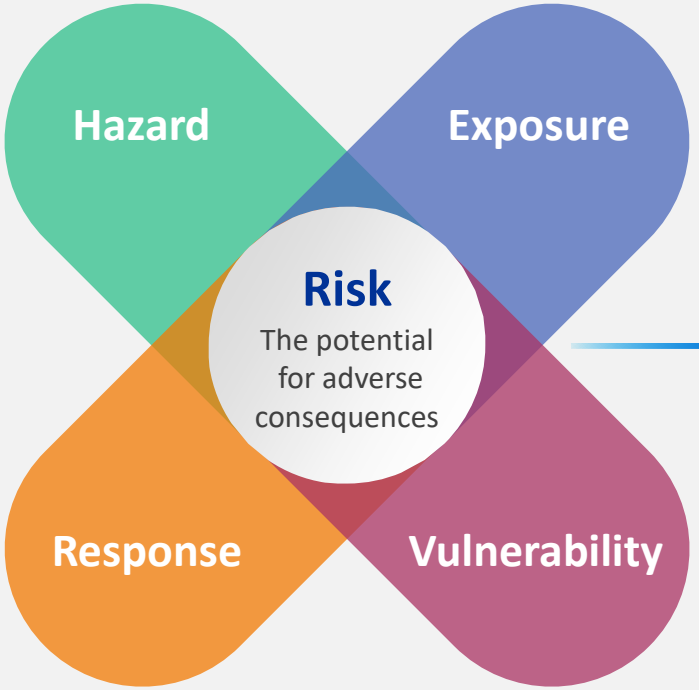
EPRI Climate Resilience and Adaptation Initiative (READi)

- **COMPREHENSIVE:** Develop a *Common Framework* addressing the entirety of the power system, planning through operations
- **CONSISTENT:** Provide an informed approach to climate risk assessment and strategic resilience planning that can be replicated
- **COLLABORATIVE:** Drive stakeholder alignment on adaptation strategies for efficient and effective investment

Final Product: A Common Framework

- Climate data assessment and application guidance
- Vulnerability assessment
- Risk mitigation investment
- Hardening technologies
- Adaptation strategies
- Research priorities

What are the components of physical risk?



Hazard

Potential adverse event or trend

- Examples: Heat wave, wildfire, flood, seasonal shifts, sea level rise

Exposure

Presence of elements in settings or places that could be adversely affected

- Examples: critical infrastructure within floodplain, T&D line though unmanaged vegetation

Vulnerability

Propensity for adverse impact given exposure to a hazard

- Examples: flood depth-damage function (physical), temperature design ratings (physical), poverty (social)

Response

Changes to system state that may alter risk or resilience

- Examples for hazard: decarbonization
- Examples for exposure: population migration, T&D undergrounding
- Examples for vulnerability: design standards evolution, waterproofing, improved cooling efficiency, demand response

Risk must consider both likelihood and consequence as well as response

Wildfire hazard: Assessing historical and projected changes

Historical

Data quantity and quality:

- Great data in the satellite era (1980s to present); prior data not suitable for trend analysis

Trends

- Increases in burned area and costs at a national scale; substantial regional variance

Drivers:

- Warming temperatures and changes in precipitation (longer fire season, changes in fire weather)
- Fuel management and suppression
- Settlement in the Wildland-Urban Interface (WUI); Increased exposure and ignition sources

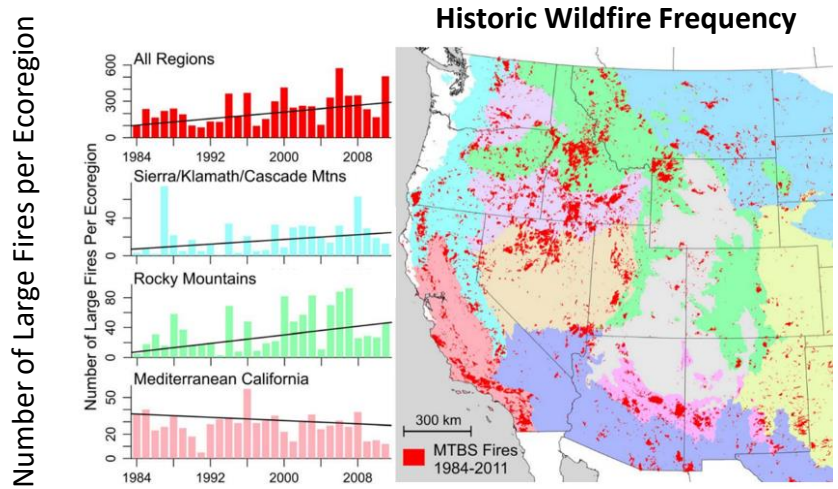
Projections

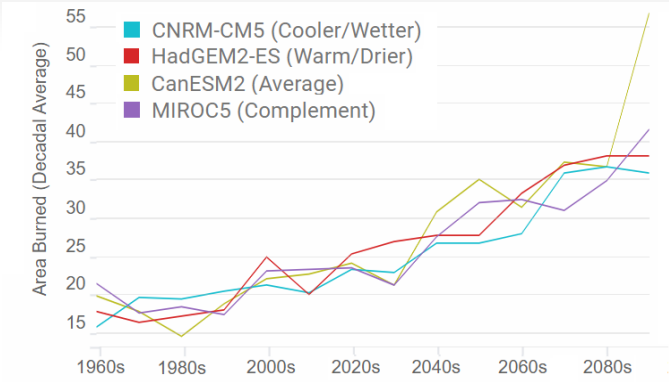
Data quantity and quality

- Wildfires not simulated in Global Climate Models (GCMs); secondary modeling is necessary
- Fire weather ingredients are GCM outputs:
  - Temperature (**High confidence**), precipitation (**Low** to **Medium** depending on spatial scale), wind speed and direction (**Low**)
- Uncertain fuel scenarios, suppression, ignition prevention, and adaptation

Mechanisms of change

- 75% of annual variability in burned area can be explained by a single climate variable – fuel aridity, which depends largely on temperature and precipitation (Abatzoglou & Williams, 2016)
- High temps will dry out fuels due to higher evapotranspiration; need 15% increase in moisture to compensate for 1°F increase in temperature (Flannigan et al., 2016)





Understand scientific consensus & Assess local trends and impacts

Sources: Dennison et al. (2014, top); 4th CA Climate Assessment for Napa, RCP8.5, central population scenario (bottom)

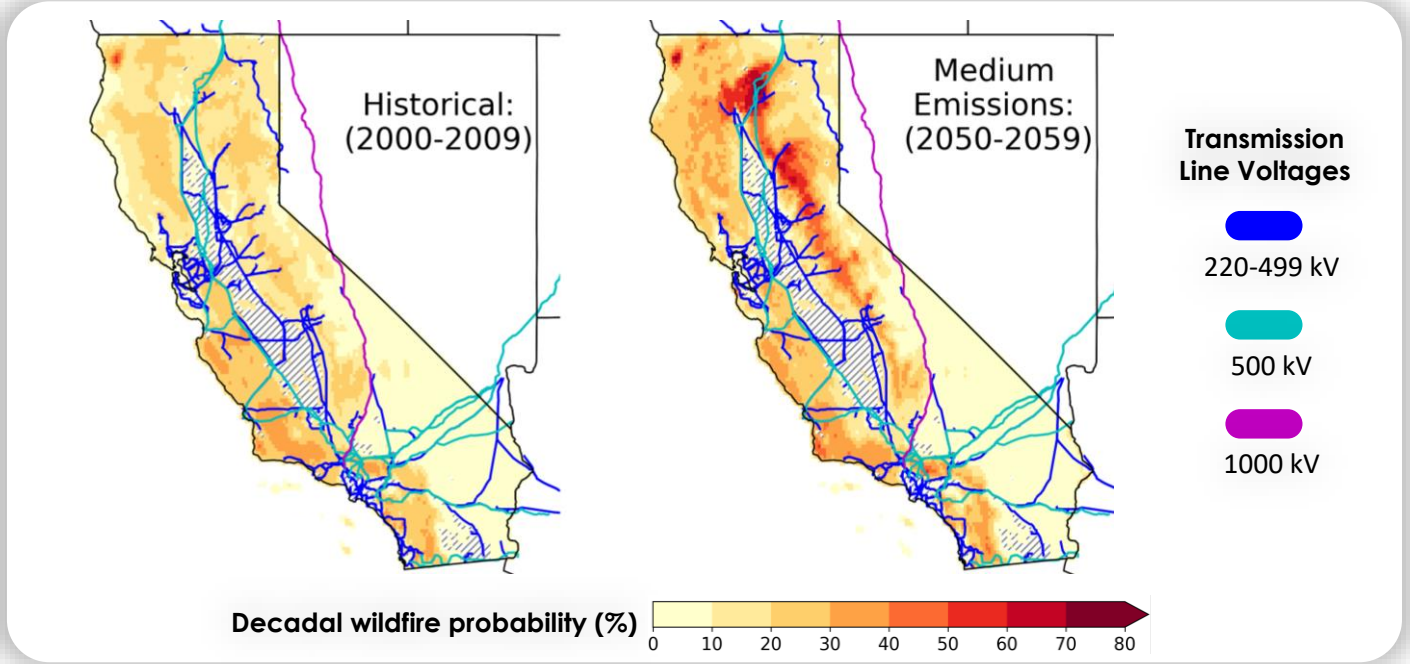
Wildfire exposure: Assessing what's in harm's way

Exposure > Vulnerability > Consequence

Assets/systems located in areas where hazard tracks (e.g., wildfires) pass through

Exposure can be described in absolute terms or linked to the probability of an event.

Vulnerability describes the potential effects of exposure. Impacts are realized when an event occurs where assets are exposed.



Data that can be used to inform exposure assessment:

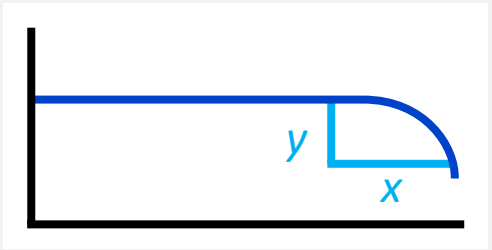
- Geospatial hazard layers
- Indices showing expected changes in conditions
- Specific operating thresholds (connects to vulnerability)
- SME judgment

Source: Cal-Adapt (hazard layer); HIFLD (asset layer). Image produced by EPRI.

Wildfire vulnerability: Metrics to quantify asset impacts

Functions detailing changes to asset efficiency or capacity

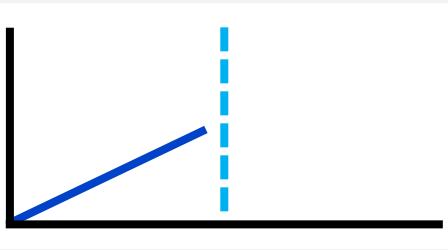
Continuous:



Noticeable asset deterioration:

y% decrease in capacity per increase in x

Threshold:



Asset cut-off / damage:

x mph

y °C

z meters above sea level

Impacts examples: PSPS due to high winds, increased ignition probability with temperature

Associated consequences[1]

Electrical service:

Population without power

Community function:

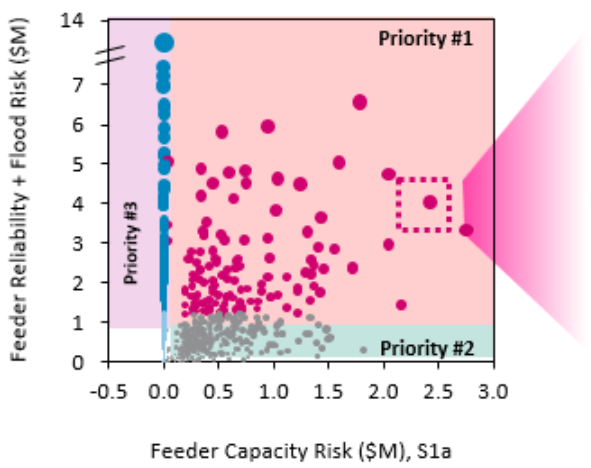
Emergency services without power

Sources: [1] Vugrin et al. (2017)

Wildfire risk: Prioritizing investments

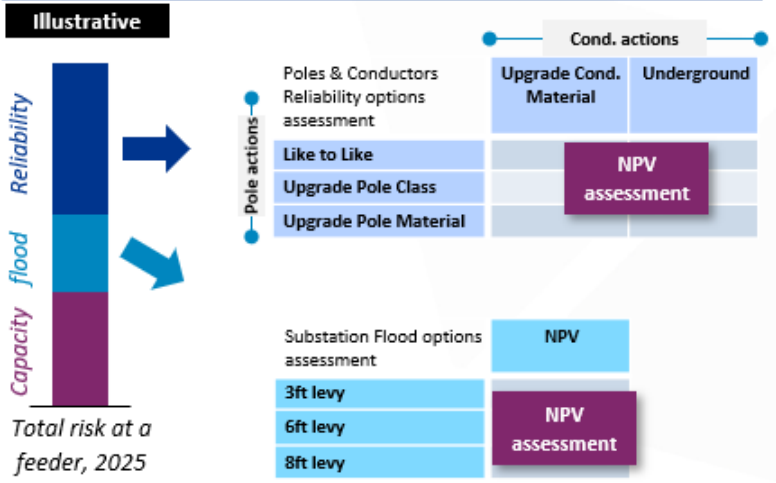
Ameren's Distribution System CVA (Flooding)

1 Prioritize feeders by pre-investment risk



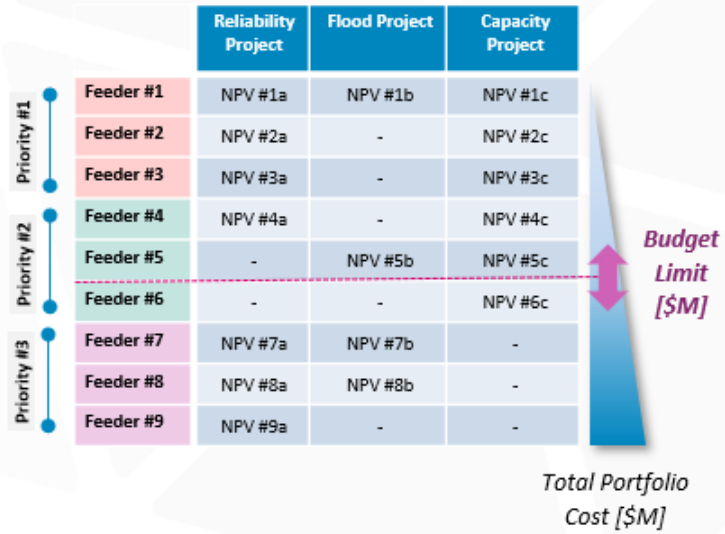
- Segment feeders in priority groups based on the total risk (Capacity & Reliability combined)

2 Establish investment archetypes for bundled asset classes (e.g., feeder upgrade, hardening, etc.)



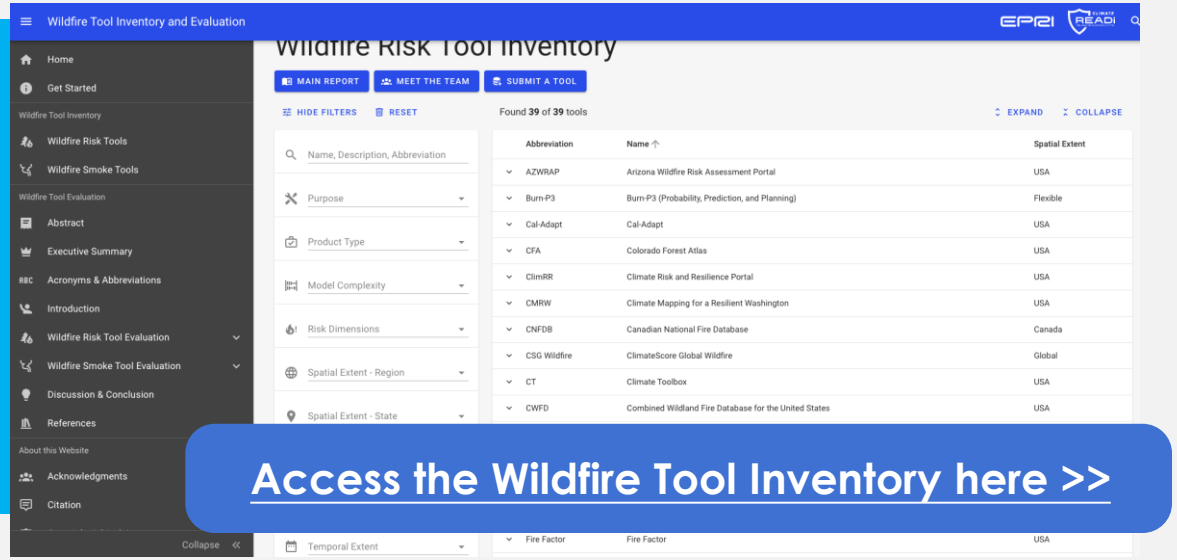
- For a select feeder, identify the potential adaptation options to address the respective risk type
- Conduct NPV assessment across adaption options to identify the best fit risk solution

3 Build Investment Portfolio by priority

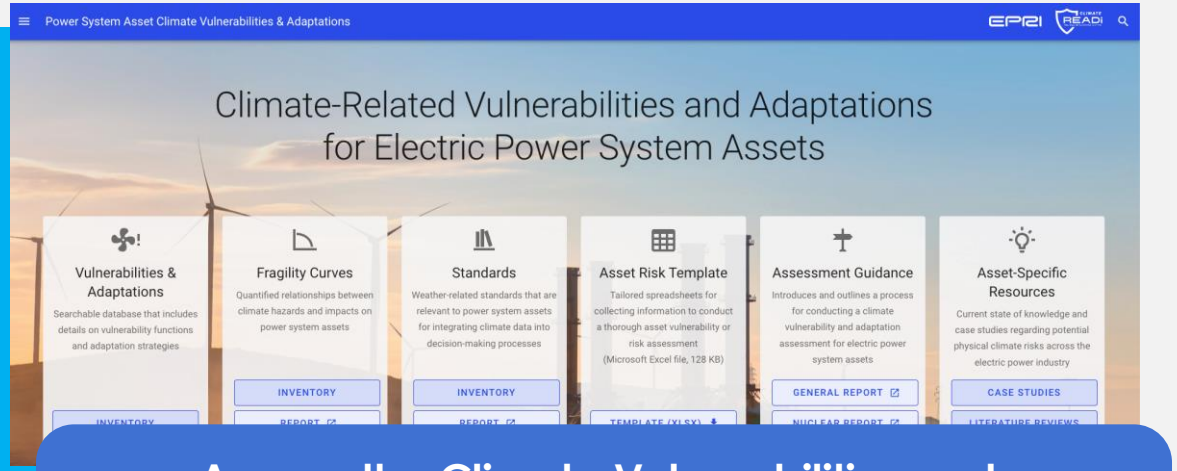


- Populate the investment portfolio for the prioritized list of feeders
- Identify the projects that can be fit into the budget set for the grid plan
- Review and finalize the grid plan

Climate READi Wildfire-Related Resources



Access the Wildfire Tool Inventory here >>



Access the Climate Vulnerabilities and Adaptations Database here >>

1 Discover available tools and data for assessing wildfire risk

2 Discover asset vulnerabilities to wildfires, adaptation strategies, and standards

3 Quantify asset-level risk to wildfires in your service territory

TOGETHER…SHAPING THE FUTURE OF ENERGY®

www.epri.com

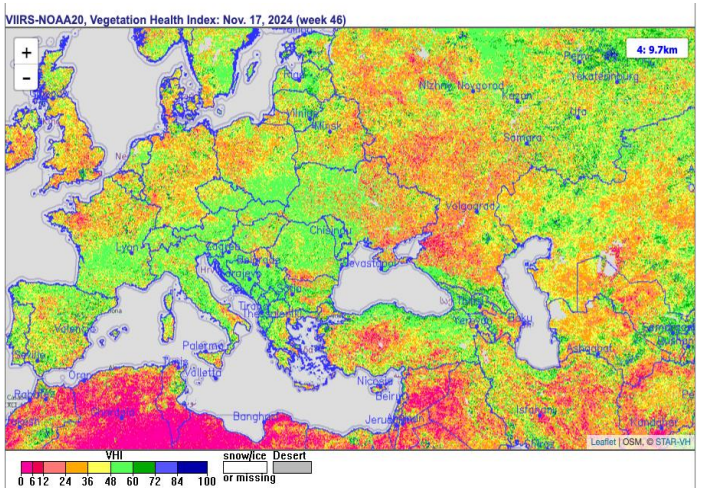
The Next Generation Fire System

Jason Otkin, Mike Pavolonis, Brad Pierce, Justin Sieglaff, Sam Batzli, Bill Bellon, Caitlin Birdsong, Tommy Jasmin, Aditya Kumar, Dave Parker, Chris Schmidt, and Fuyao Wang

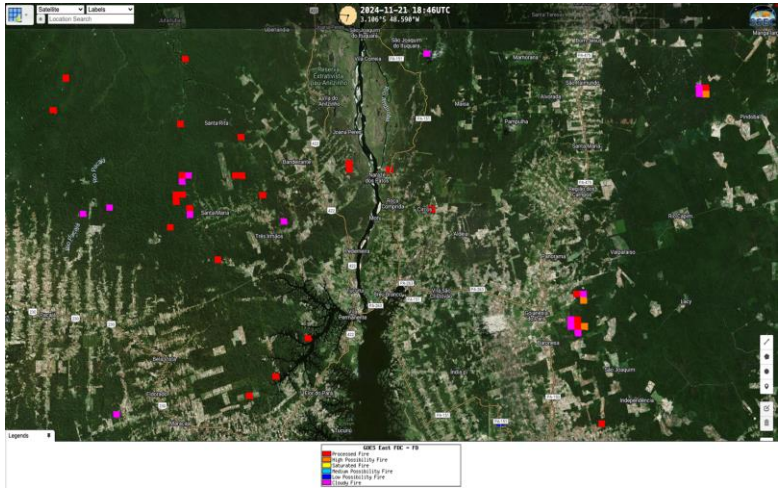
University of Wisconsin-Madison, CIMSS, SSEC
NOAA, NESDIS

Acknowledgement: Disaster Relief Supplemental Act (DRSA) and Bipartisan Infrastructure Law (BIL) funding

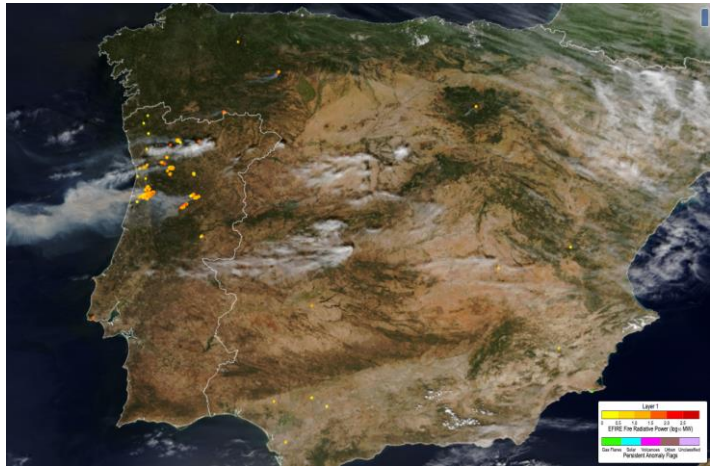
Operational NOAA Satellite Products - Fire



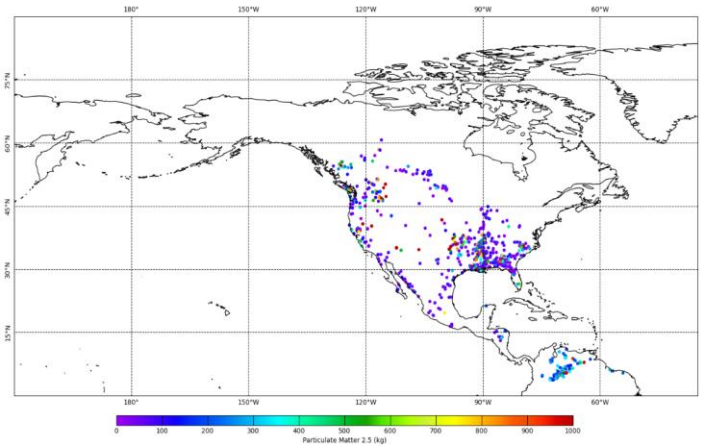
Vegetation Health



ABI Active Fire (FDC)

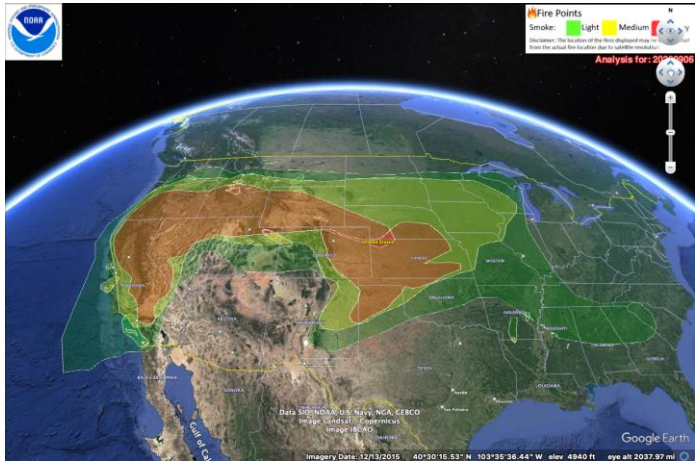


VIIRS Active Fire



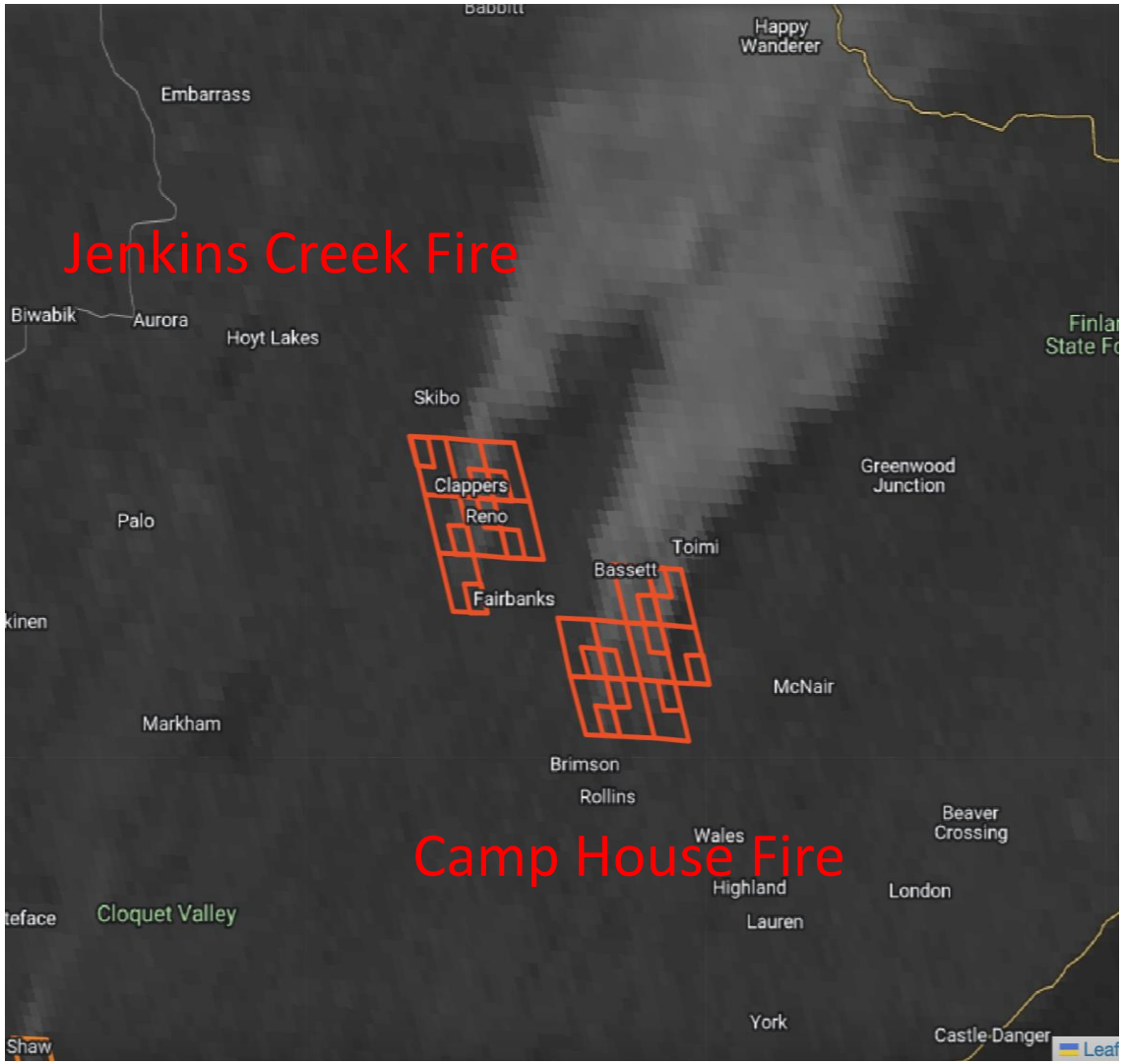
Smoke Production Rate

Smoke Detection and Properties



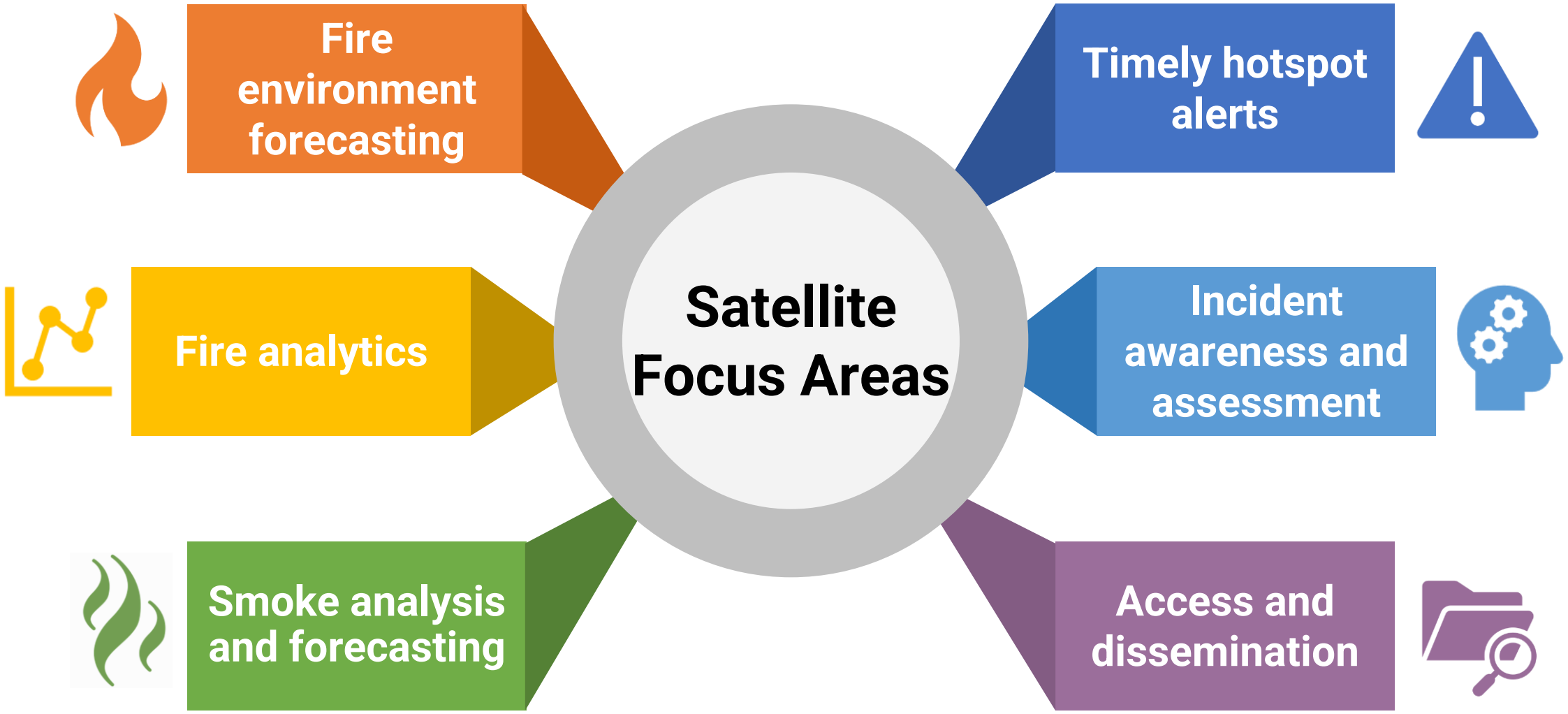
Fire and Smoke Mapping

Next Generation Fire System (NGFS)

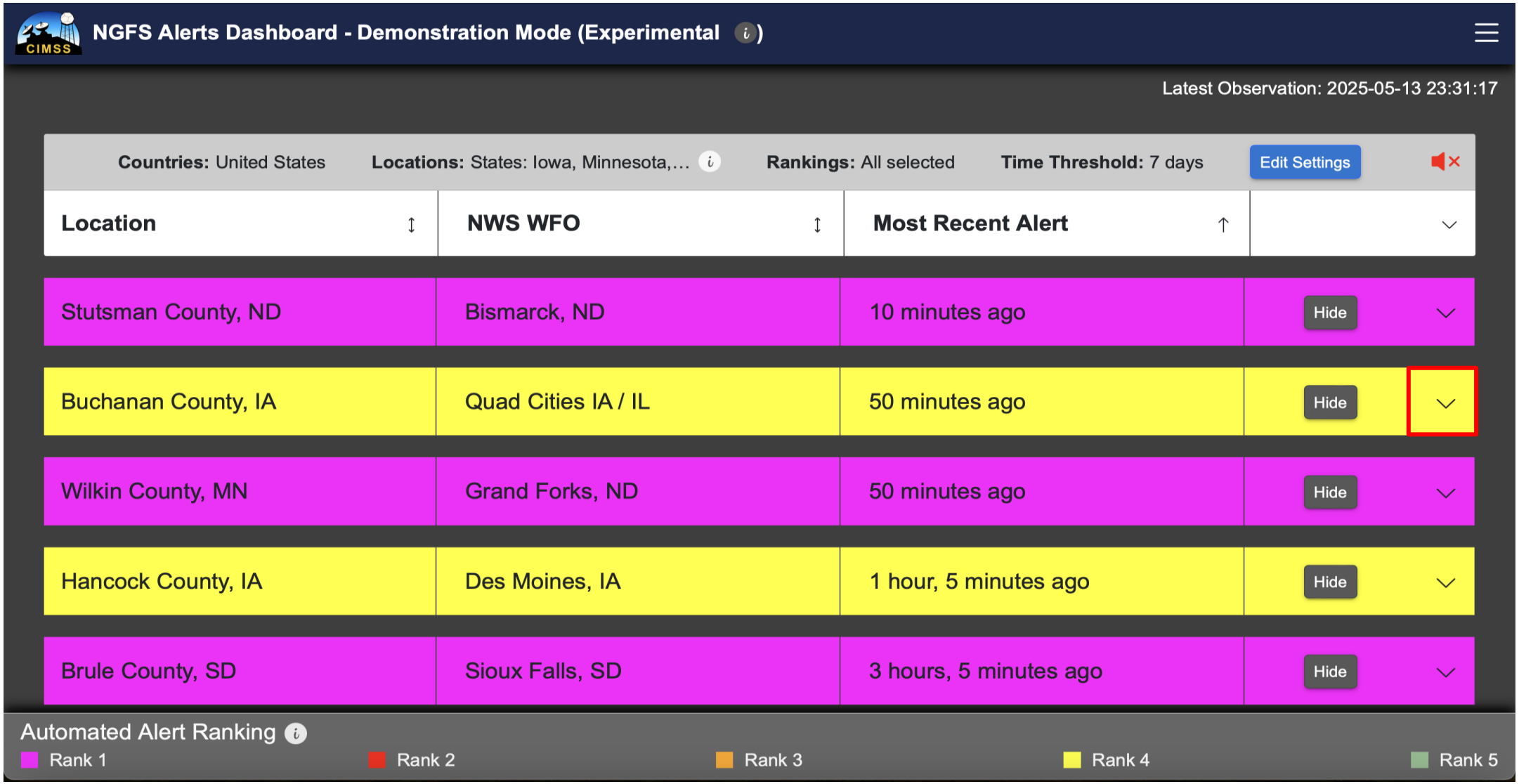


CAPABILITY	DRIVER(S)
Emulate human expert analysis	Early detection and strong performance under clear and cloudy conditions
Event extraction	Align with human perception (convert pixels into features)
Event tracking (needed for alerting)	Near continuous monitoring, advanced metrics, separate new detections from ongoing events
Geospatial layer integration	Context for interpretation, advanced filtering, and data queries
Sensor agnostic and bad data tolerant	Maintainable, scalable, and reliable across a broad range of satellite sensors

NGFS Applications

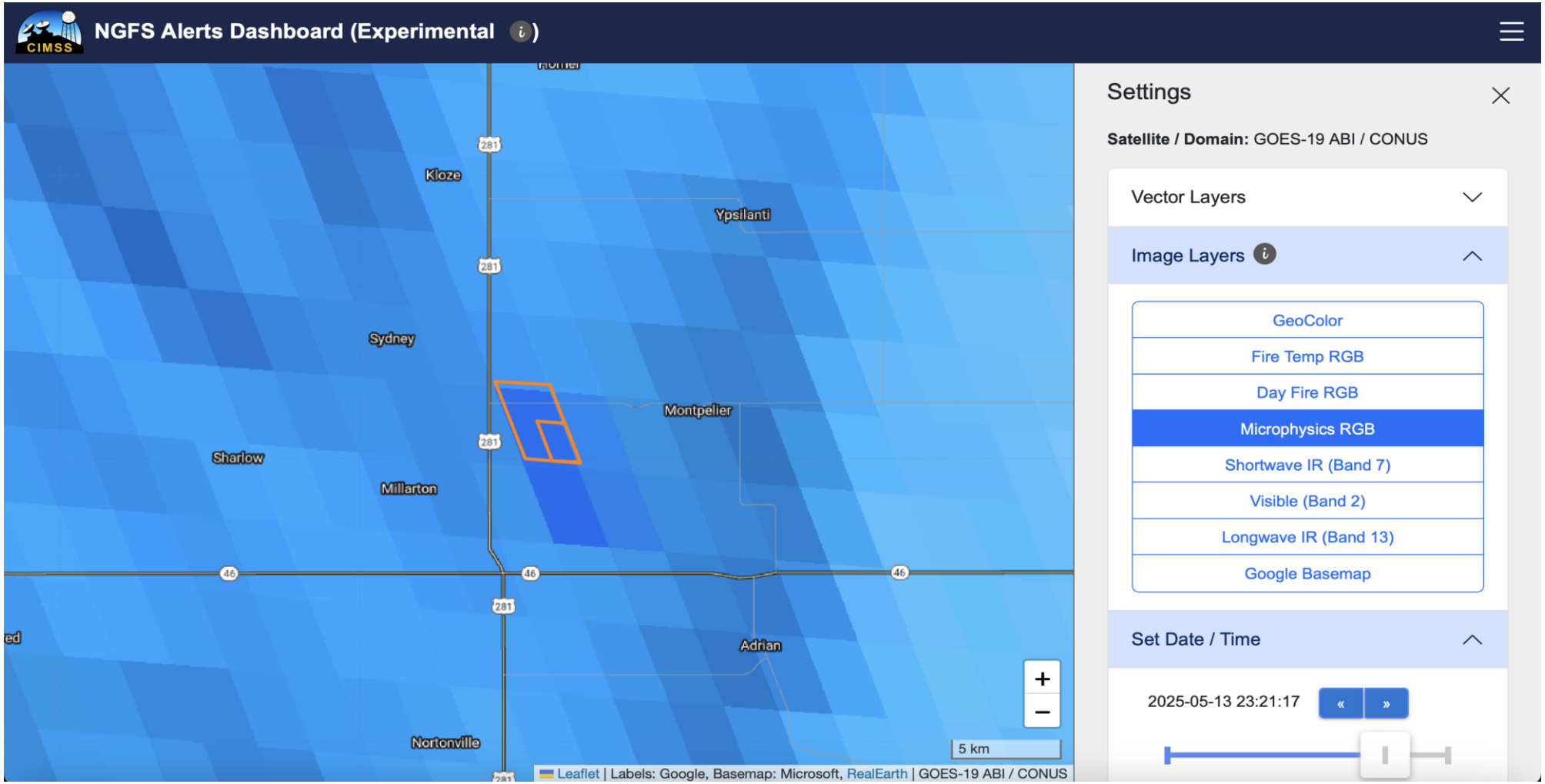


Experimental NGFS Alerts Dashboard



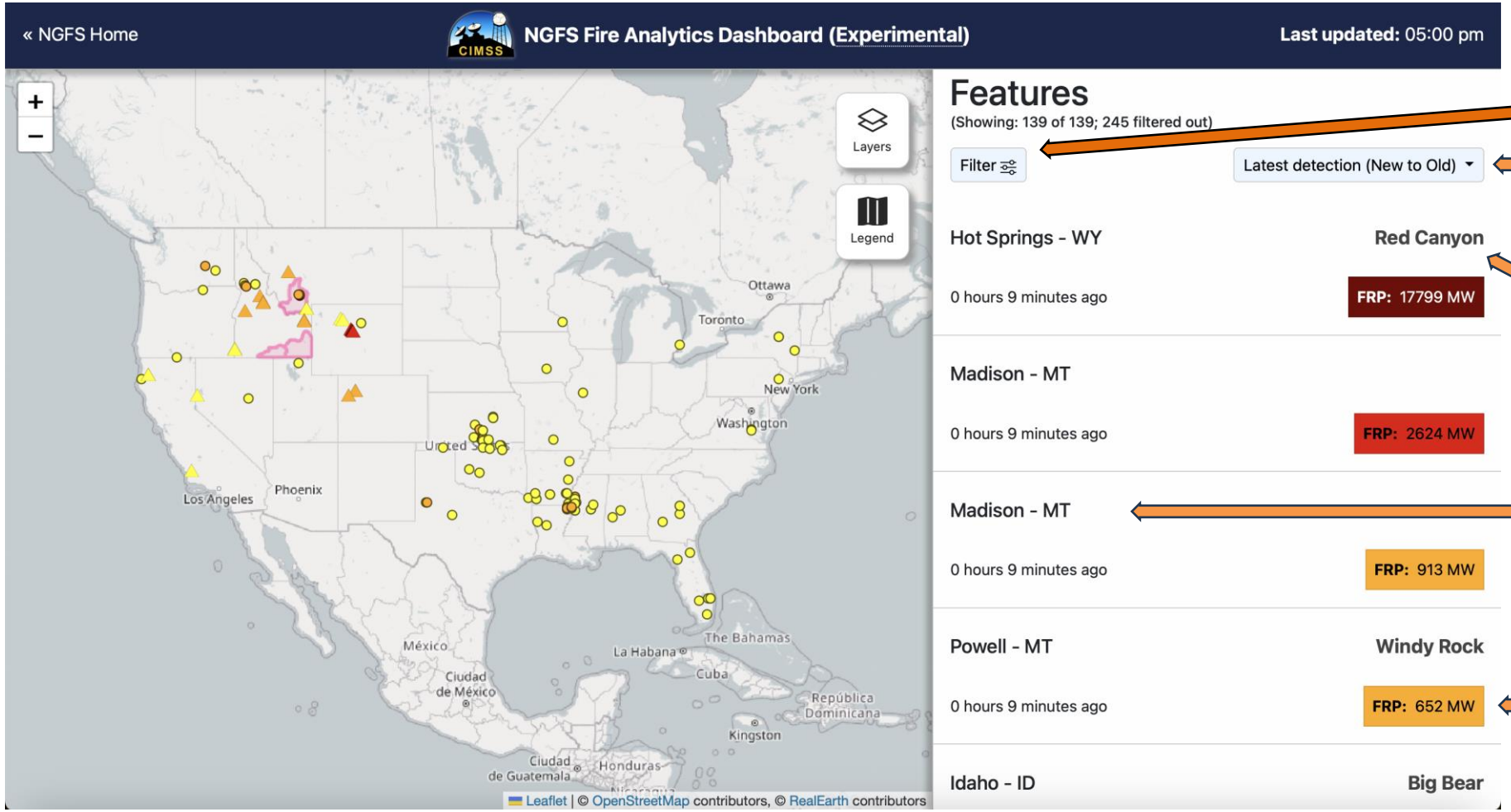
https://cimss.ssec.wisc.edu/ngfs/alerts-dashboard/

Satellite and Surface Data Viewer



*All satellite data has been terrain-corrected to provide more accurate geolocation.

Experimental Fire Analytics Dashboard



Different options to filter or sort features

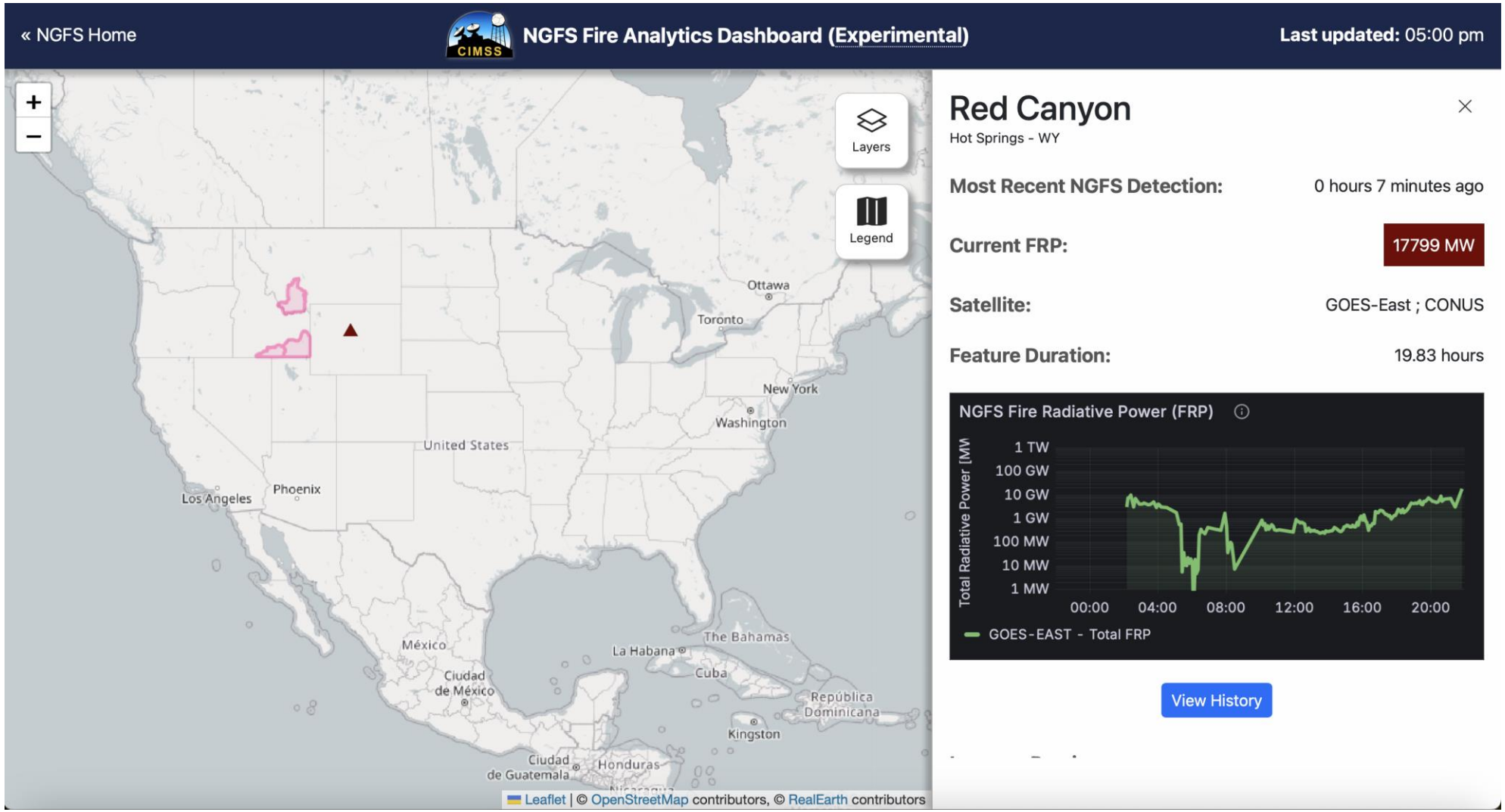
Incident name (if applicable)

County and state

Fire radiative power (intensity)

*This is an experimental system that aims to provide information during the full lifetime of a fire feature (not just the initial alert). It is under active development.

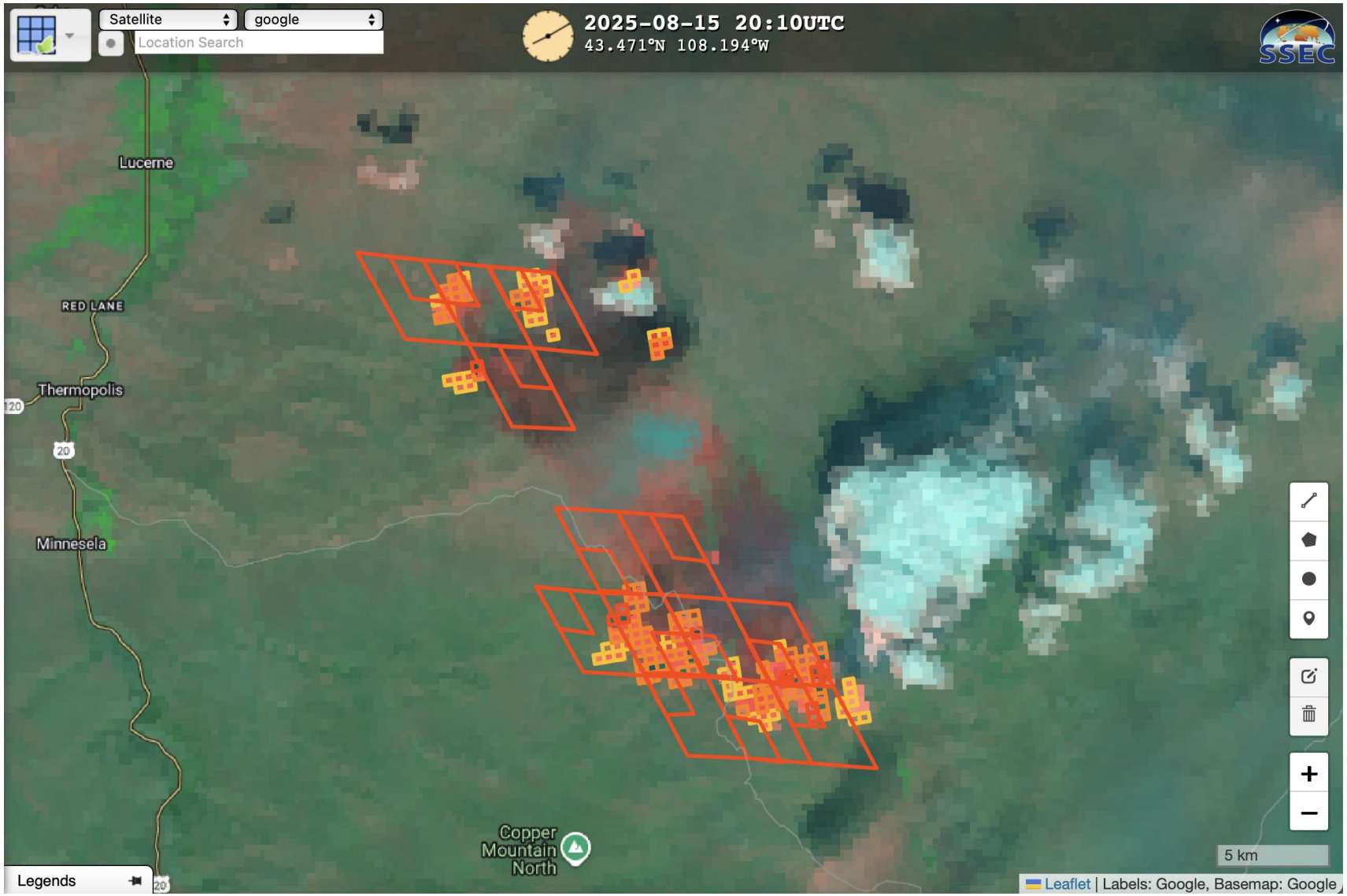
Experimental Fire Analytics Dashboard



Time series of fire radiative power (fire intensity) and satellite imagery

Much more information will be added as we build out the fire analytics dashboard

High-Resolution VIIRS Fire Detections

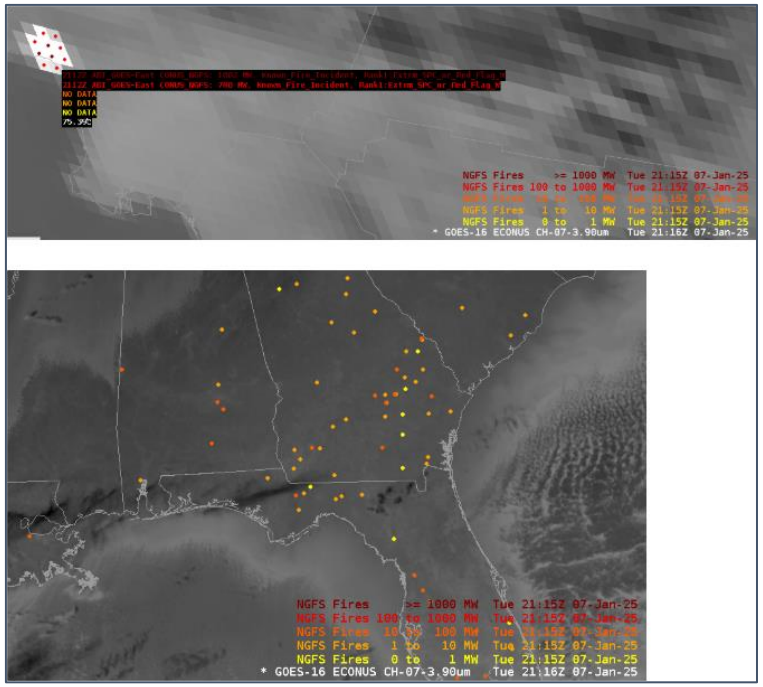


- Small pixels show VIIRS detections; large pixels are from GOES
- High-resolution, but less frequent, VIIRS detections complement the coarser but more frequent GOES detections
- VIIRS can also detect smaller or less intense fires
- VIIRS detections will be added to the fire analytics dashboard

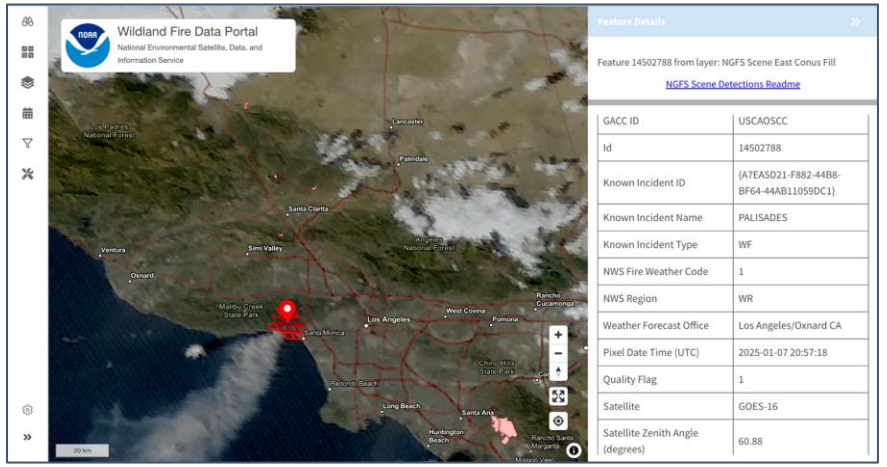
NGFS Product Availability

NGFS Project Website and Dashboards:
https://cimss.ssec.wisc.edu/ngfs/

Experimental feed for NGFS detections from GOES:
https://bin.ssec.wisc.edu/pub/volcat/fire_csv/



AWIPS for National Weather Service forecasters (TOWRpro v25)



Open Geospatial Consortium compliant data services - planned public release later in 2025

NGFS Data and Information

Experimental NGFS fire detection dashboard (highlights new detections)

Imagery interpretation quick guides and short videos on NGFS tools

Experimental NGFS products and imagery in RealEarth

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