GRIDWISE ALLIANCE

# Building Grid Resilience to Wildfires

June 22, 2022
3-4:30 PM EST

| | |
|---|---|
| 3:00-3:10 | Welcome & Introduction |
| 3:10-3:50 | **Panel 1: Before wildfire season**<br>• Jett Winter, Global Commercial Lead – Grid Analytics & AI, GE Digital<br>• Wade Ward, Supervisor, Fire Mitigation, APS<br>• Bill Messner, Director Wildfire Mitigation & Resiliency, PGE |
| 3:50-4:30 | **Panel 2: During wildfire season**<br>• Andre Coleman, Senior Research Scientist, PNNL<br>• Jeff Cook, VP Transmission Planning and Asset Management, BPA<br>• Chris Guttman-McCabe, Chief Operating Officer, Anterix |

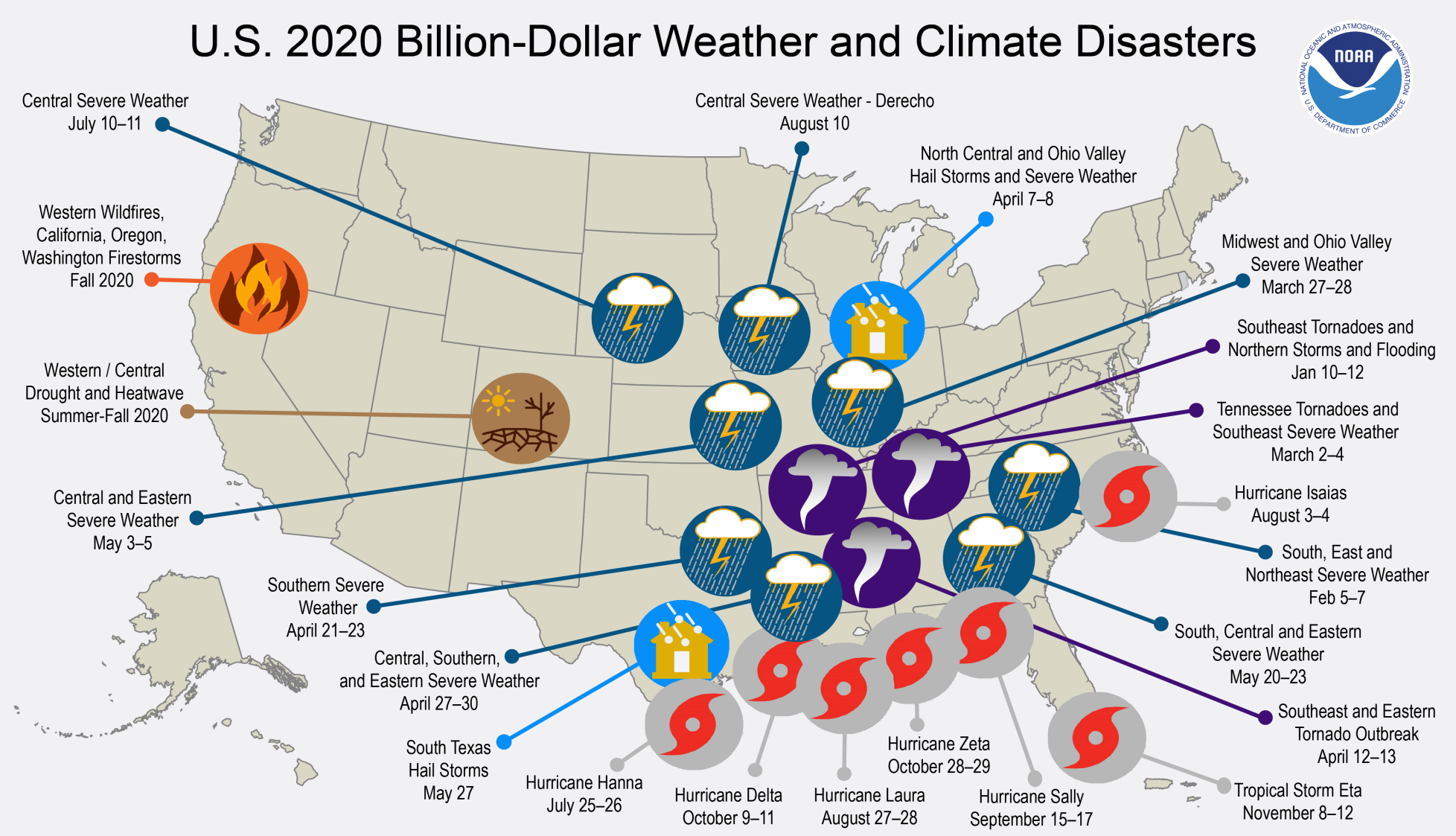
Photo credit: Yichuan Cao/SIPA via AP Images

# Zoom Webinar Logistics

- All audio and video will be muted and turned off for attendees.
- Use the CHAT Window to communicate with the host and/or other audience members.
- Use the Q&A Window to ask any questions throughout the meeting. We will address those in real time or save for the end of the prepared discussion.

# About GridWise…

# Increasing Cost of Weather and Climate Disasters

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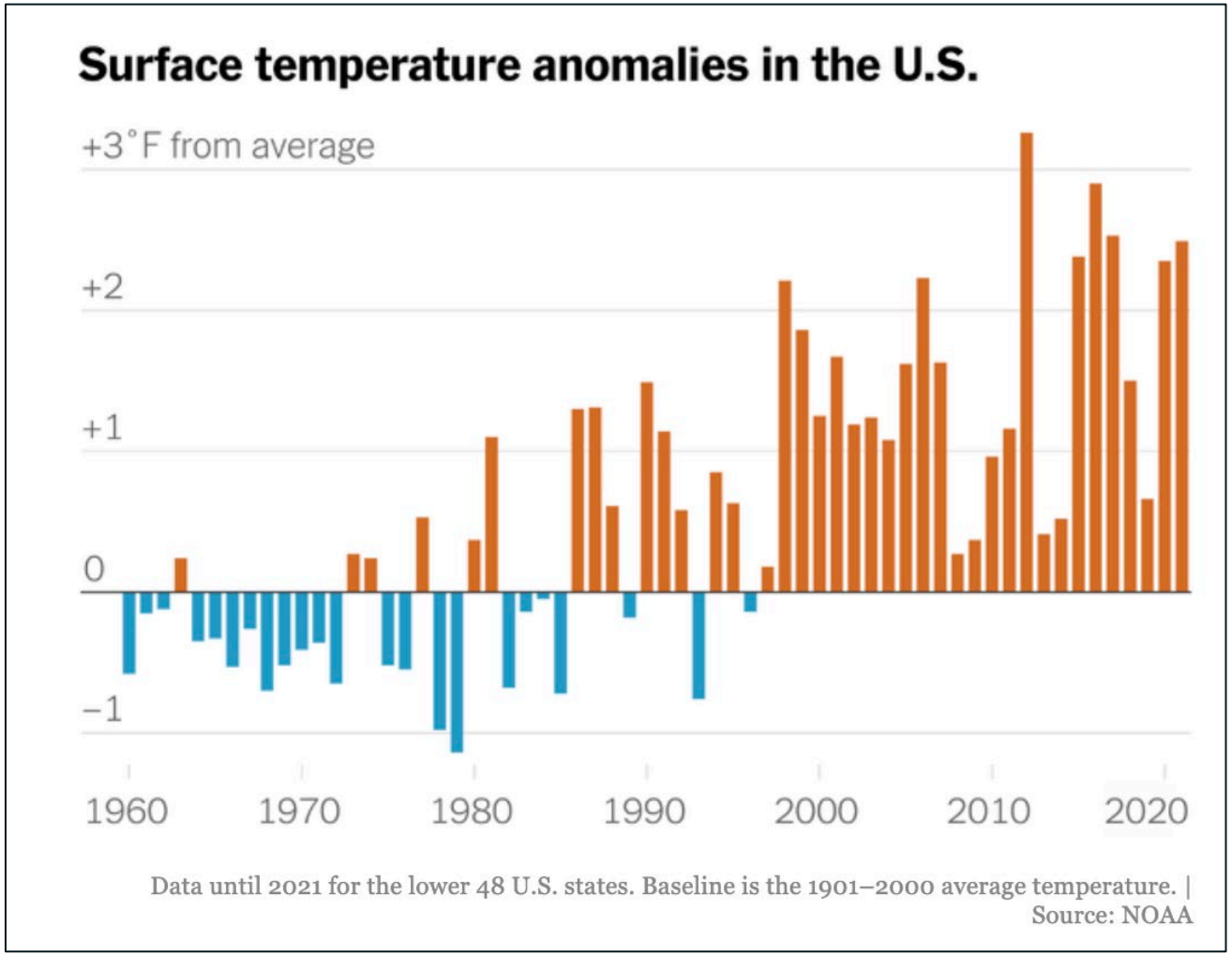
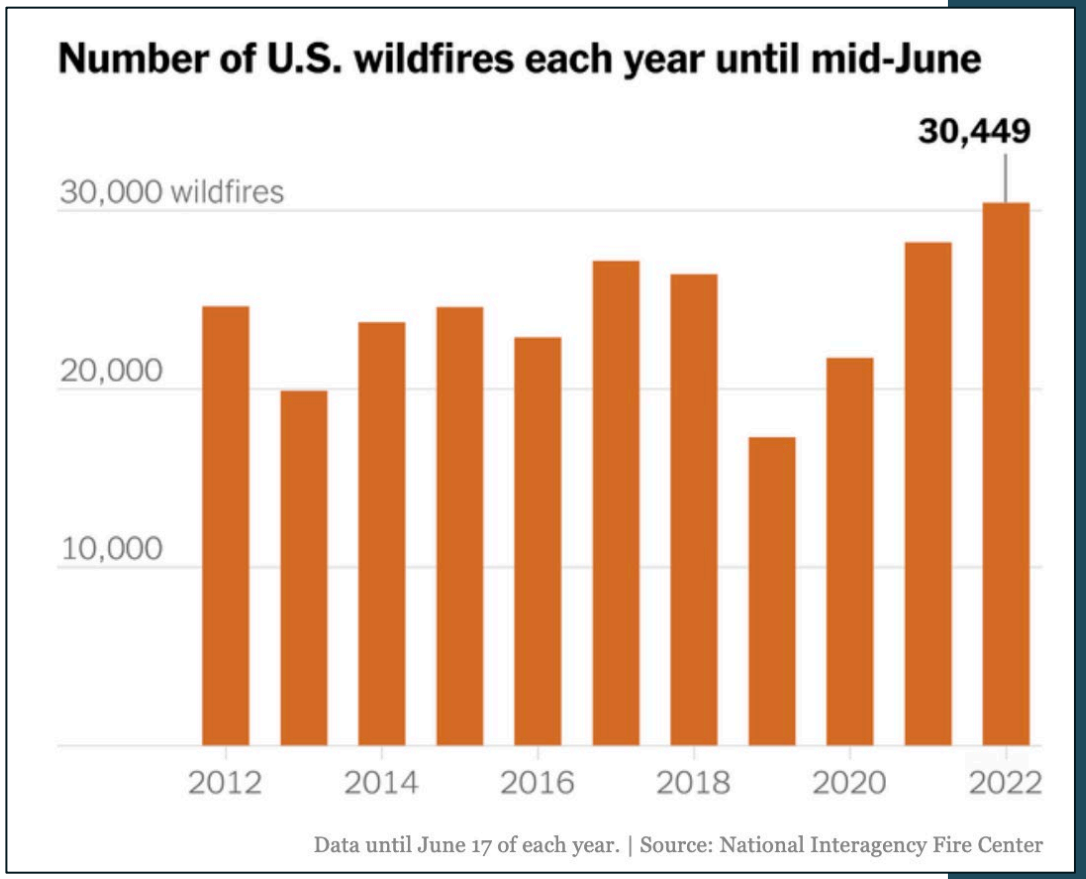
# Increasing wildfire risk today




Figures from New York Times “The Morning” email. June 20, 2022.

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# Federal Funding to Support Grid Resilience

| Program # | Program Name | Funding |
|---|---|---|
| 40101 | Preventing outages and enhancing resilience of the electric grid | $5 billion |
| 40103 | Grid reliability and resilience research, development, and demonstration | $6 billion |
| 40107 | Deployment of technologies to enhance grid flexibility | $3 billion |

# On the agenda

| Topic | Speakers |
| --- | --- |
| **Before wildfire season** | Jett Winter, Global Commercial Lead – Grid Analytics & AI, **GE Digital**<br>Wade Ward, Supervisor, Fire Mitigation, **APS**<br>Bill Messner, Director Wildfire Mitigation & Resiliency, **PGE** |
| **During wildfire season** | Andre Coleman, Senior Research Scientist, **PNNL**<br>Jeff Cook, VP Transmission Planning and Asset Management, **BPA**<br>Chris Guttman-McCabe, Chief Operating Officer, **Anterix** |

# GE Digital

## Leveraging AI in Fire Preparedness

# KEY QUESTIONS TO ANSWER

**01** What are best practices around Vegetation Management

**02** How do I increase frequency, accuracy, and breadth of Asset Inspection

**03** How do I keep core systems up to date with the latest information

# Visual Intelligence Platform

## Vegetation Management

**Encroachment risk analysis**
and prioritized trim schedules

## Asset Inspection

**Asset & Defect recognition**
for condition assessment

## Asset Inventory

**Improve GIS network model**
accuracy

## **Platform** as-a-service

**Data Ingestion** for RGB, LiDAR, IR, Hyperspectral, Multispectral.
**Normalize data** to look across all layers of information
**Built-in AI Engine** for auto-recognition and prediction
**Integrates easily** with current mission-critical T&D software

# Complementary Remote Sensing Technologies

| | SAT. LOW RES* | SAT. HIGH RES* | AIRPLANE | HELICOPTER | FIXED WING | MULTICOPTER | MAPPING CAR* | FOOT PATROLS |
|---|---|---|---|---|---|---|---|---|
| **Sensors available** | Multispectral, Hyperspectral, SAR | Multispectral, Hyperspectral, SAR | LiDAR, RGB, IR, Multispectral, Hyperspectral | LiDAR, RGB, IR, Multispectral, Hyperspectral | LiDAR, RGB, IR, Multispectral, Hyperspectral | LiDAR, RGB, IR, Multispectral, Hyperspectral | LiDAR, RGB | RGB, IR |
| **Spatial Resolution** | **VERY LOW** | **LOW** | **MEDIUM** | **HIGH** | **HIGH** | **HIGH** | **VERY HIGH** | *Depends on device* |
| **Bands** | RGB, NIR | RGB, NIR, Pan | *Depends on payload* | *Depends on payload* | *Depends on payload* | *Depends on payload* | RGB | *Depends on device* |
| **Coverage** | Entire Planet | Entire Planet | Larger Region | Region | Region | Localized | Localized | Localized |
| **Speed** | **DAILY SCANS** | **ON-DEMAND** | **FAST** | **MEDIUM** | **SLOW** | **VERY SLOW** | **MEDIUM** | **VERY SLOW** |
| **Applications** | • Vegetation Identification | • Vegetation Encroachment (Distribution)<br>• Damage Assessment<br>• Trees Health | • Vegetation Encroachment (Transmission) | • Vegetation Encroachment (T&D)<br>• Pole Inspections | • ROW Inspections<br>• Vegetation Management<br>• Terrain Mapping Construction planning and monitoring<br>• Trees Health | • Pole Inspections<br>• Terrain Mapping<br>• Construction Monitoring | • Vegetation Encroachment (D)<br>• Pole Inspections | • Vegetation Encroachment (T&D)<br>• Pole Inspections |

*Can be provided by GE

# Managing Visual Inspection Data

**THE SIZE OF VISUAL INSPECTION DATA CAN BE MEASURED IN 10s OR 100s OF PETABYTES PER YEAR.**

- IMAGES
- THERMAL
- 3D POINT CLOUDS
- HYPERSPECTRAL
- VIDEOS
- MULTISPECTRAL

## DATA MANAGEMENT PLATFORM

1. Support for ingestion of all major visual inspection file types
2. Provides meaningful context to the data
3. Render 2D/3D Scenes, navigate in space and in time
4. Built-in AI Engine for auto-recognition and prediction
5. Generate insights that will be turned into action, which often requires integrating with other software

# Vegetation Management

**CHALLENGES**

- Veg Mgt. / Asset Inspection = largest O&M line for T&D utilities **($10-$100 M per year**)
- Traditional approaches for Visual Data Management are **complex and slow**, often relying on manual processes

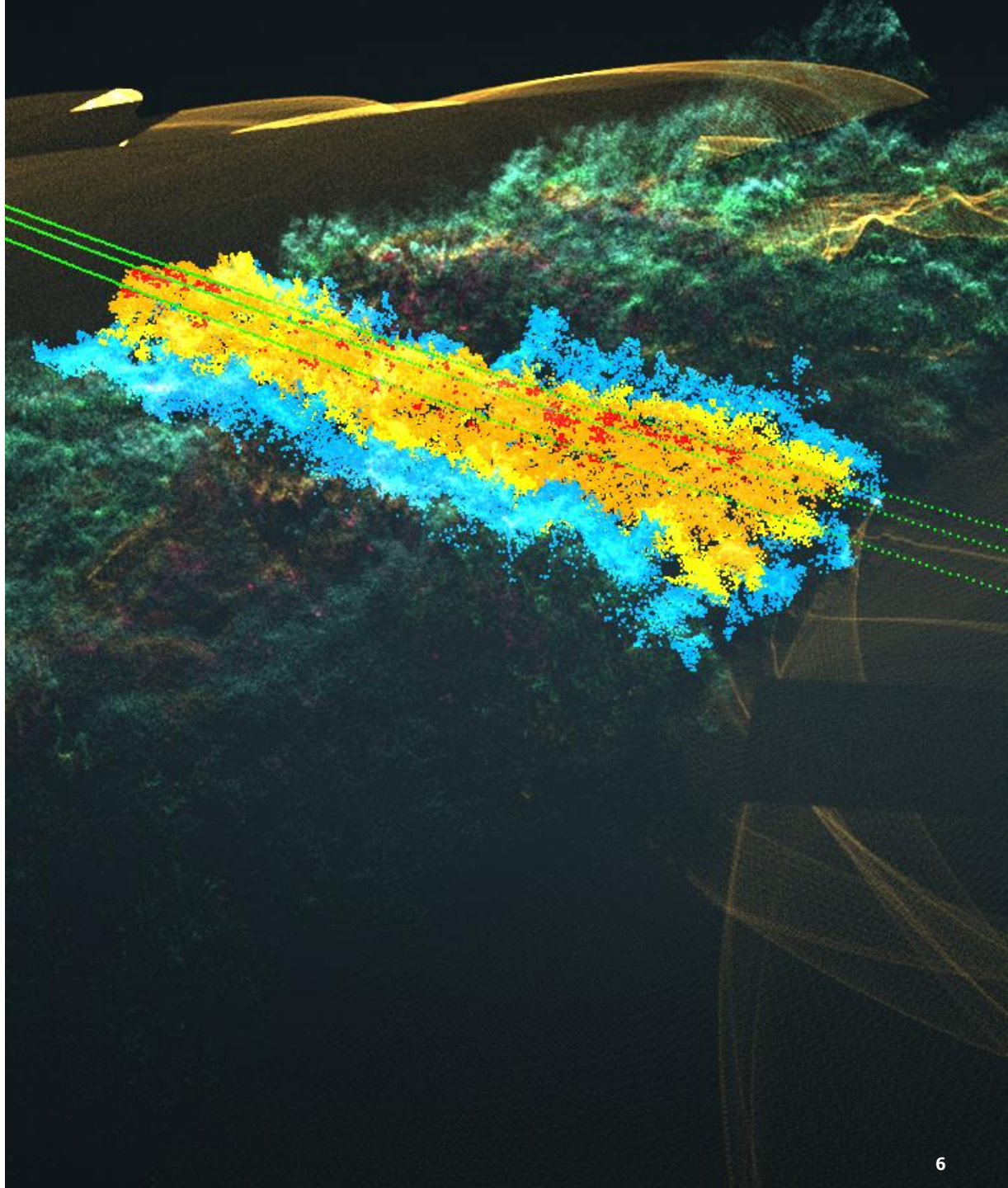
**MISSION**

- **End-to-end Vegetation Management & Asset Inspection Workflows**
- **Industrial AI-Enablement**
- **Faster Time to Value**
- **Unlimited scale, critical systems integrations**

**Increasing reliability**

**Keeping teams safe**

**Reducing costs**



# Asset Inspection

**ASSET & DEFECT RECOGNITION**

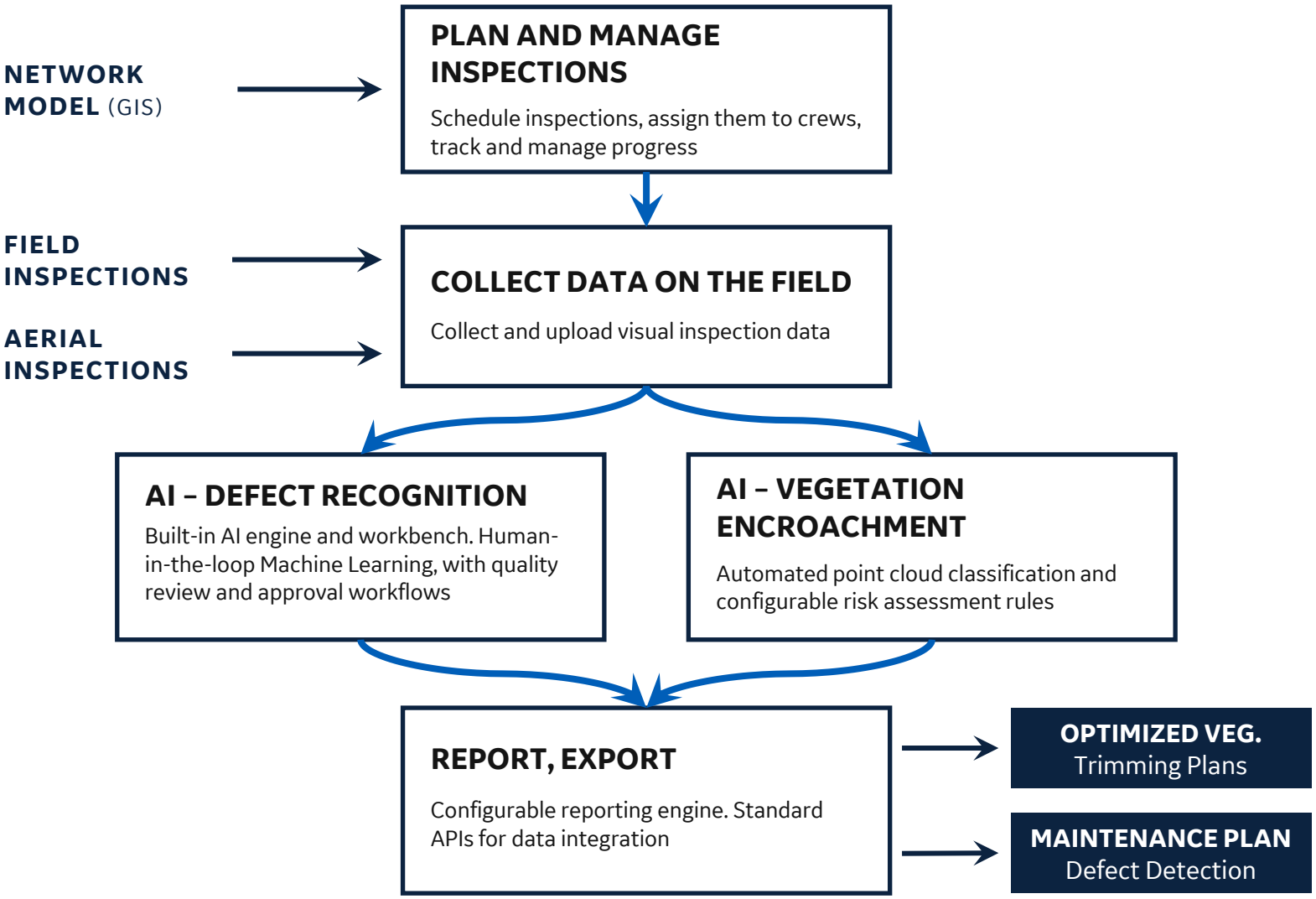
**HOTSPOT DETECTION**

**CHANGE DETECTION LAND SURVEYING**

**EMERGENCY RESPONSE**

**SYSTEM OF RECORD (GIS) UPDATE**

# Injecting the Value – System Integration




## T&D LIBRARY

**DISTRIBUTION:**

- Insulators
- Poles
- Conductors
- Transformers
- Surge Protectors
- Clips
- Disconnectors
- Etc.

**TRANSMISSION:**

- Insulators
- Pylons and structure
- Conductors
- Cross Arms
- Etc.

GE Digital

# APS Fire Mitigation Program Overview

- Arizona Public Service Territory
- Prevention
- Mitigation
- Response

- Distribution Non-Reclosing Strategy (NRS)
- Fire Mitigation Standards
- Fire Mesh
- Predictive Services (Meteorologist)
- Independent Program Assessment
- CFMP Region 3 USDA FS approval
- BLM Fire Plan Approval
- Relationships and coordination with PML

- Programs and Impacts

1

2

3

4

- IVM Program
- High Intensity Fire Impacts
- Prescribe (Rx) Fire Impacts
- Hazard Tree Program
- DSAP

aps®

# PGE Wildfire Mitigation

Bill Messner

June 22, 2022 `

# PGE at-a-glance

## Quick facts

- We are Oregon's largest energy provider, serving nearly half of the state's population and three quarters of all businesses in the state.
- 900,000+ retail customers within a service area of 2 million residents
- 46 percent of Oregon's population lives within PGE service area, encompassing 51 incorporated cities entirely within the state of Oregon
- 75 percent of Oregon's commercial and industrial activity occurs in PGE service area
- We are committed to serving all our customers in a fair and equitable manner, keeping our energy safe and reliable, and our electricity affordable. We are equally dedicated to racial justice and support a diverse and inclusive workplace where our differences are celebrated.

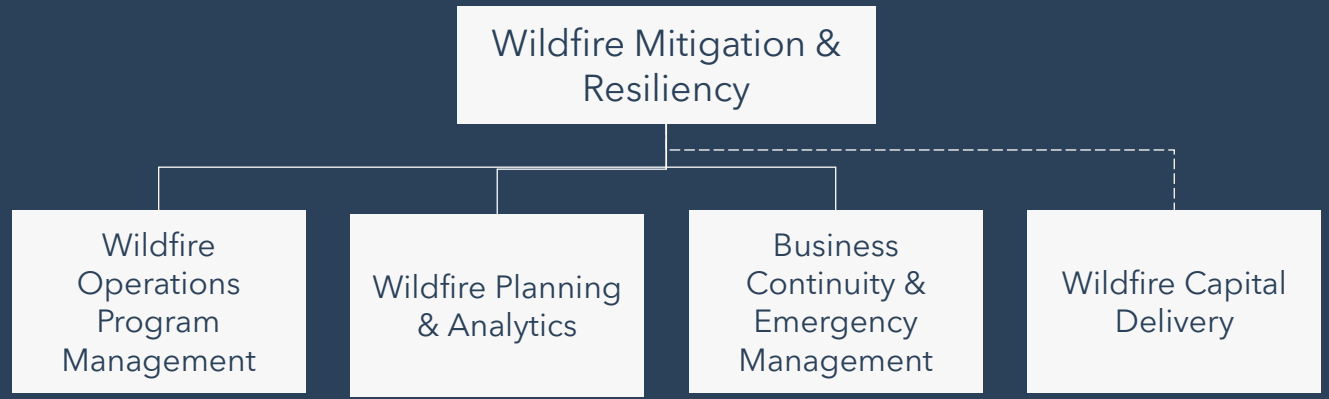
## 3,300+ MWs of Generation


As of 9/30/2020

(1) PGE's Boardman generating plant was retired in late 2020

(2) Wind component expected to be operational in the fourth quarter of 2020

# Wildfire Mitigation & Resiliency Department




**Vision:** Reduce wildfire risks for customers and all PGE stakeholders

**Through:** Risk Mitigation, Increased Resiliency, Compliance, Customer Experience

## Pre-Season

- Enhanced Vegetation Management
- FITNES Inspections & Corrections for High-Risk Areas
- System Hardening (Capital Projects)
- Annual Wildfire Awareness Training
- Operational Modifications for Fire Season
- Pre-Season Stakeholder Engagement

## Fire Season

PSPS Incident Response Plan

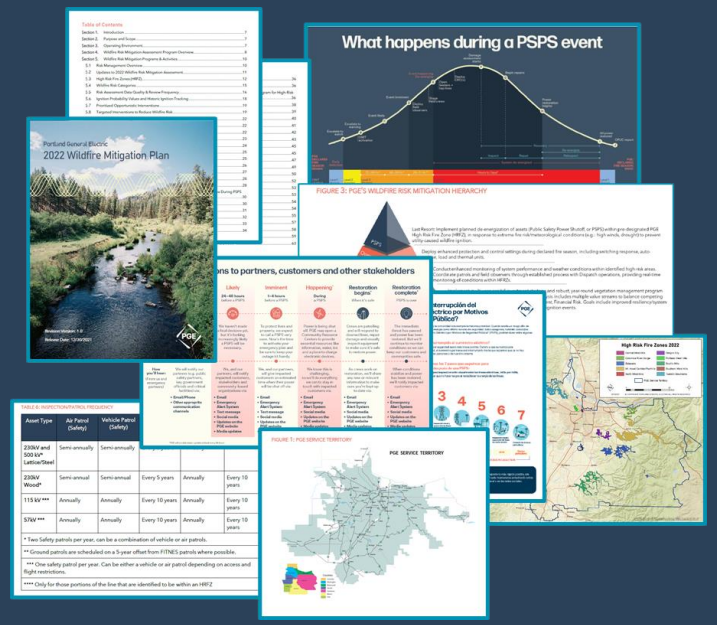
- Situational Awareness
- CIMT Activation
- Stakeholder Engagement
- Customer Experience
- Community Resource Center
- Operations (De/Re-Energization)
- After Action Review
- GIS / IT

## Post-Season

- Post-Season Stakeholder Engagement
- After Season Review
- Evaluation of High-Risk Areas
- Modeling Improvements
- Capital Planning
- Continuous Improvement
- Updating WM&R Plans for the Following Year
- Restart Pre-Season Activities

# 2022 Wildfire Mitigation Plan (WMP)

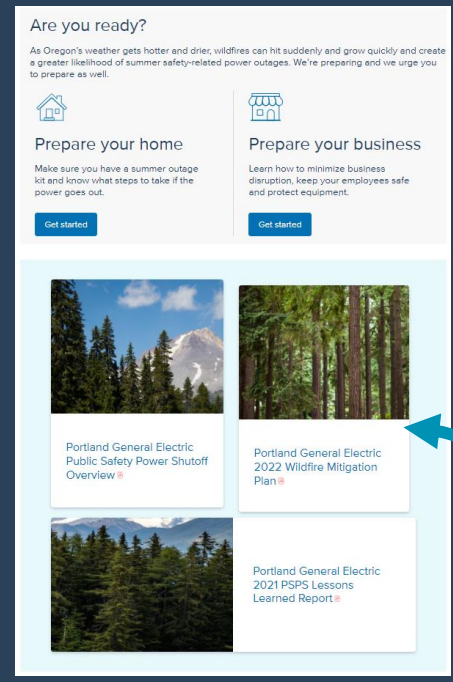
## Submitted to OPUC 12.30.21




## WMP Topics Include

- ✓ Wildfire Risk Mitigation Programs & Activities
- ✓ Operating Protocols
- ✓ Operations During PSPS Events
- ✓ Asset Management & Inspections
- ✓ Vegetation Management
- ✓ Community Outreach & Public Awareness
- ✓ Research & Development

## Available Online



# Decision Making Alignment


- Grid Operations
- Situational Awareness
- Public Safety Power Shutoff
- System Hardening
- Line & Vegetation Maintenance
- Research & Development
- Communications
- Partnership (Regulators & Agencies)
- Training
- Accelerated Learning

**Everything starts with understanding risk; success is integrating and scaling decisions across organization.**

# Wildfire Risk Framework

**Risk (Wildfire) = Likelihood * Consequence**

### Variables

- Likelihood of a spark
- Likelihood of fire propagation
- Likelihood of impact

### Datasets*

- Asset health data/fault/outages
- Fire behavior (wind, burn probability, temperature, topology, humidity, moisture)
- Energy release component, fuel/land cover

### Variables

- Safety
- Environment
- Reliability
- Financial

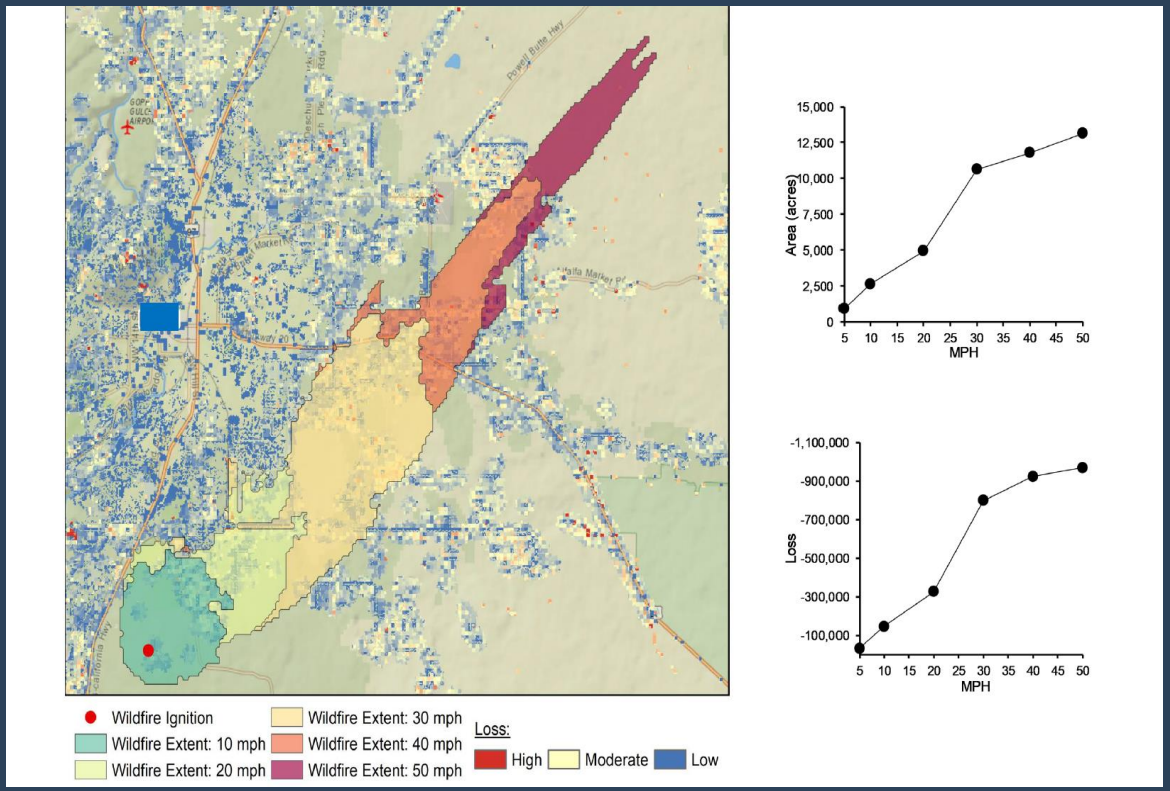
### Datasets*

- Total costs of wildfire study
- Watershed/surface water
- Historic structures
- Species (Salmon, Trout etc.)
- Property
- Critical infrastructure (railways, highways etc)
- Historic structures
- Population density/housing

Risk of wildfire calculated at individual structure/pole location

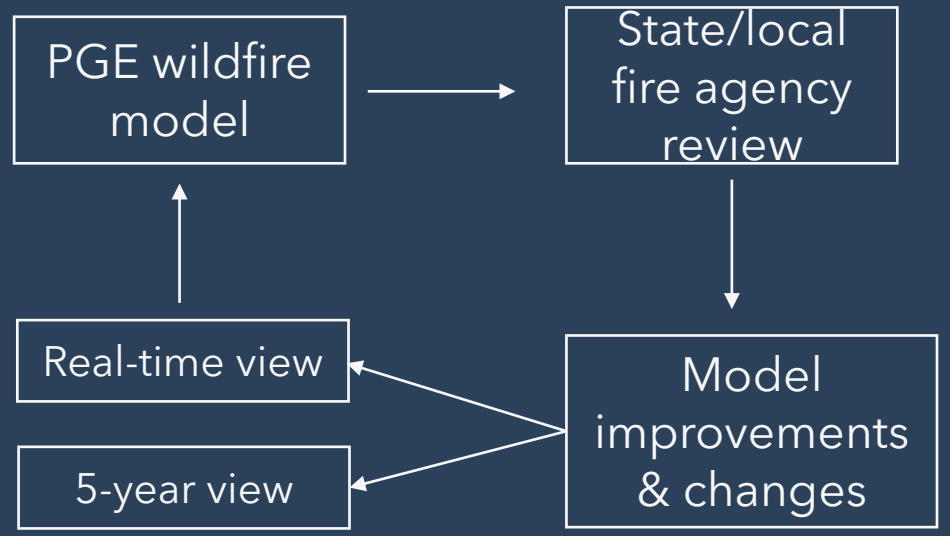
* Does not reflect comprehensive inventory

# Wildfire Risk Process




Example: Fire behavior model from simulated ignition over fuelscape

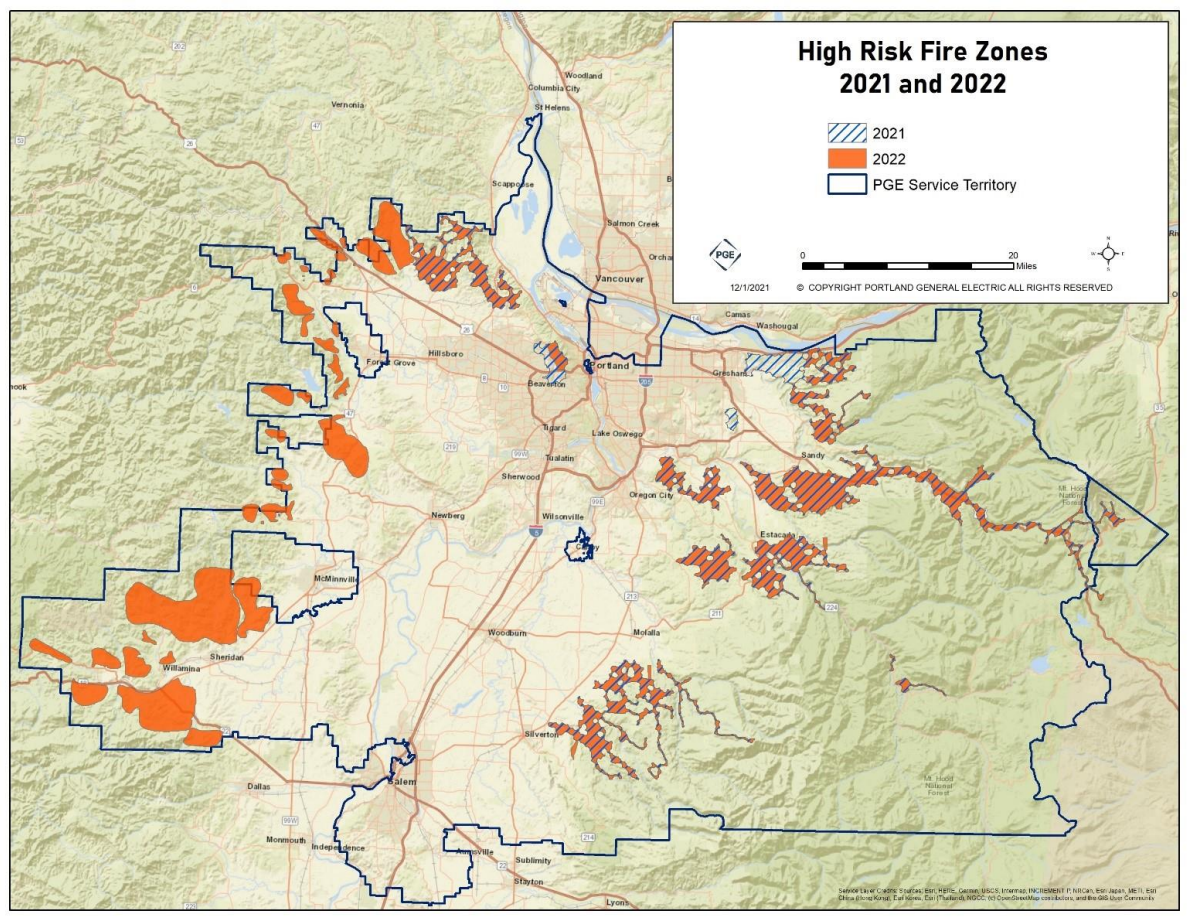
## Annual wildfire risk process




**Wildfire risk must be a combination of science & process with continuous advancement of data, variables and review.**

# Advancing Wildfire Risk Capability

## Risk-based decisions across organization

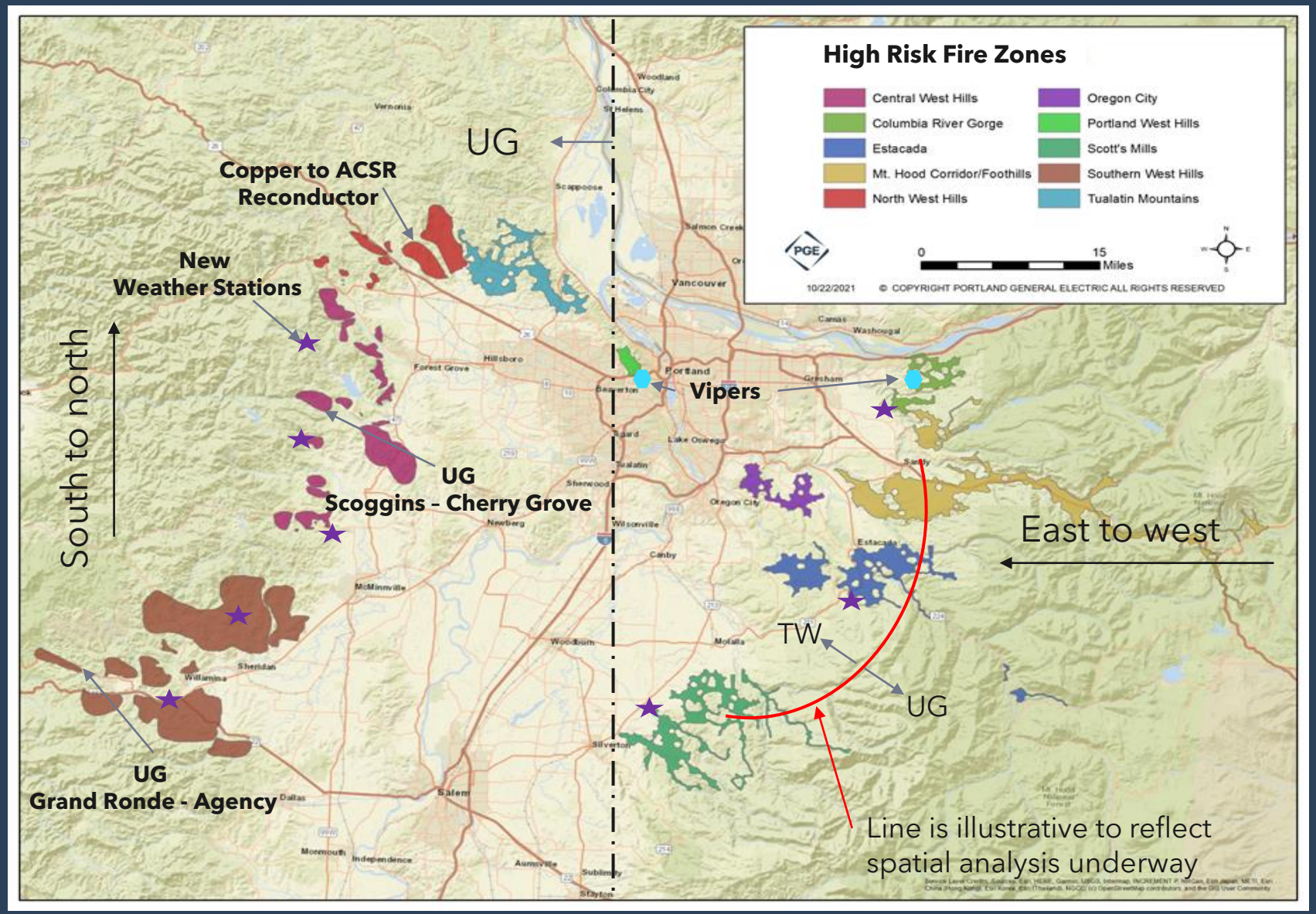



2021 HRFZ's included fire behavior modelling,
vegetation, asset failures, animals, hundreds of weather scenarios, holistic multi-dimensional impact consequences, with impacts ranging from property, habitat, species, cultural, safety, timber, suppression, etc.

↓ **Updated Model**

2022 PGE added new variables: ignition detection probability, egress, access road density, fire response time. Coordination with fire agencies at OR. Dept of Forestry and local fire agencies.

# Wildfire Climate Change Investment Strategy




## Immediate term risk hedging

AI Cameras
Weather Stations
Vipers
Copper reconductor

## Long-term risk hedging

Undergrounding
Covered Conductor
HRFZ Standards
Fire pole wraps

## Mitigation Program Needs

Single/Double Phase SCADA reclosers
*Criteria based design (Stnd's / Engineering)
*Weather/Outage analysis effort

* In flight effort

# Wildfire Risk Summary

1. PGE's inclusion of external collaboration with fire agencies and fire physicists/protection optimizes raw mathematical models

2. Spatial analysis variables i.e. response time significantly influences model characteristics and HRFZ determination

3. PGE looks at wildfire risk to the region not just PGE when planning and developing investment strategy

PNNL-SA-157726

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# Rapid Situational Awareness of Wildfire Events using Remote Sensing and AI

June 22, 2022

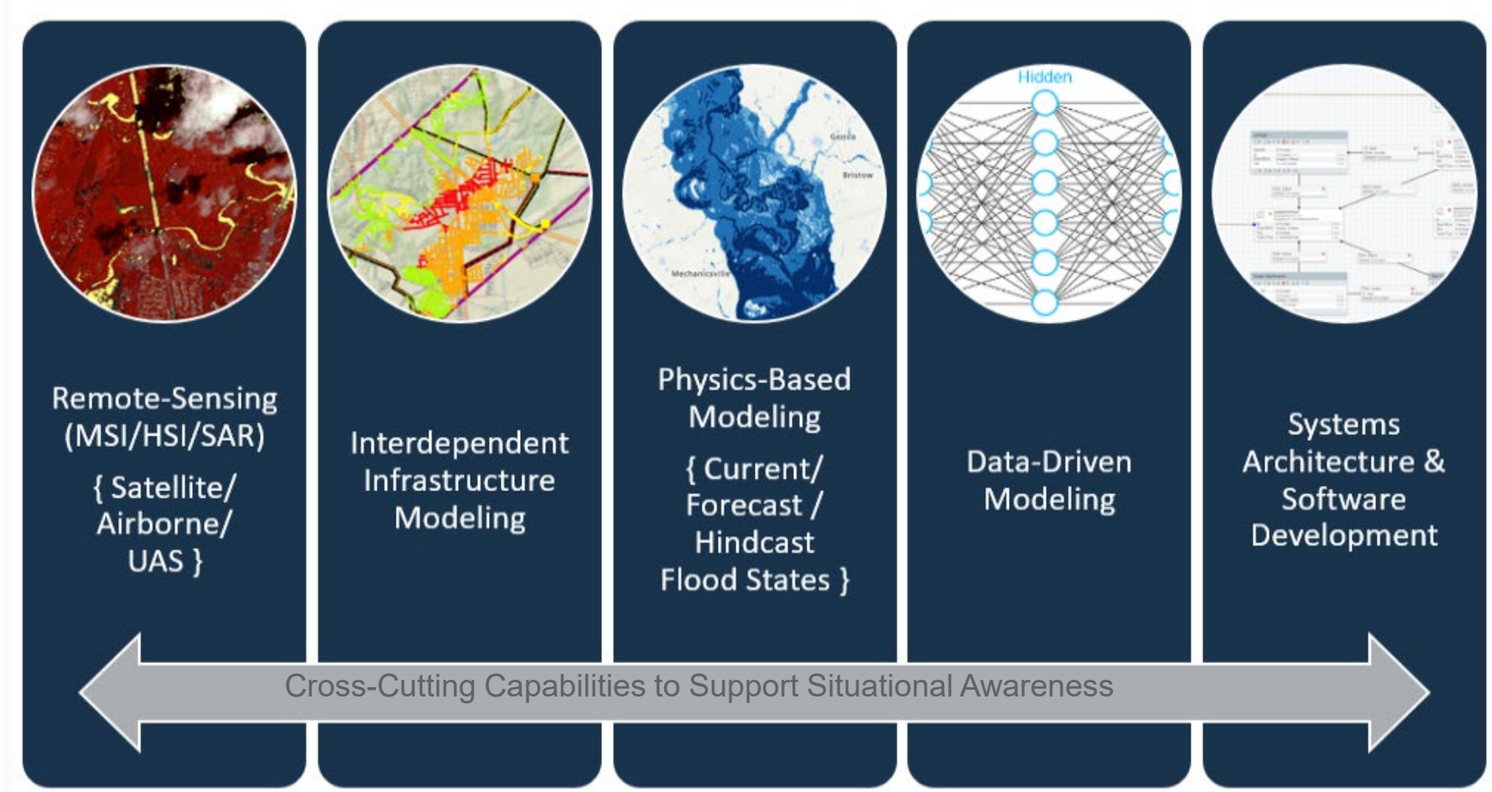
**Andre Coleman, Ph.D.**
Senior Research Scientist

U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

# PNNL's Rapid Response Analytics for Situational Awareness

- Driving Questions for Situational Awareness Support
  - What is the spatial extent of the hazard?
  - What is the timing of the hazard?
  - How many people are at risk?
  - What infrastructure are at risk?
- How Do We Support Events (Prior, During, Post Event)?
  - Predictive modeling and simulation
  - Imagery-based damage analytics
  - Leverage existing simulations
  - Assess existing/forecasted risk to infrastructure



# Rapid Analytics for Disaster Response (RADR)

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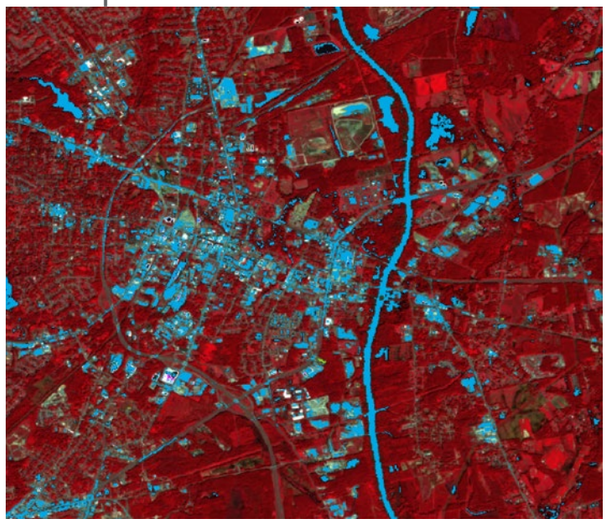
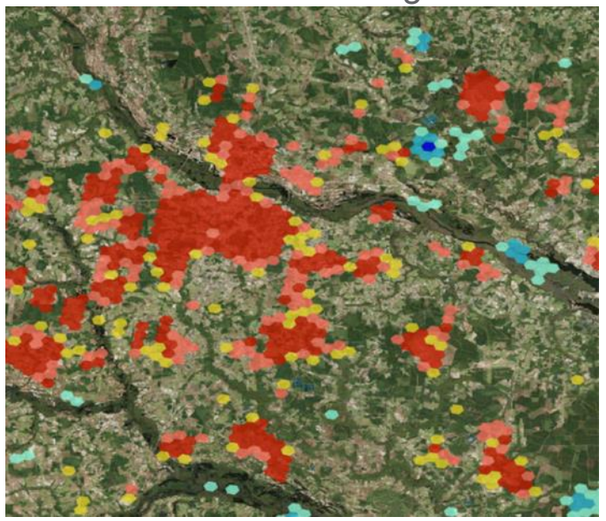
RADR

2020 R&D 100 WINNER

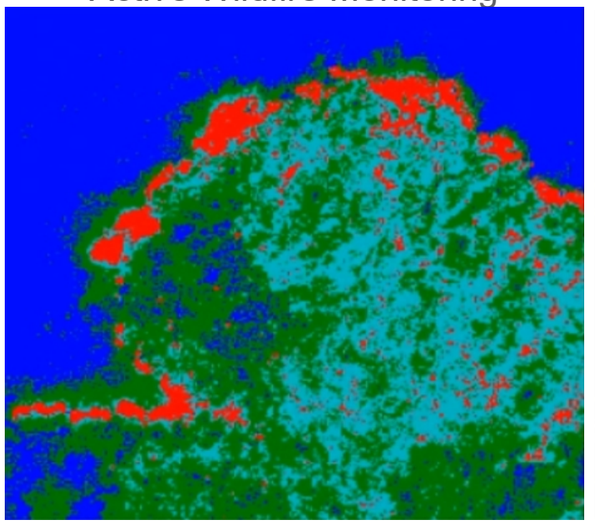
Optical/SAR Flood Detection



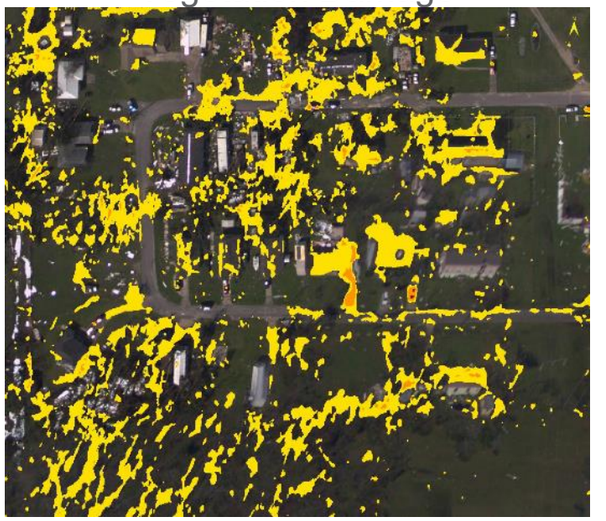
Structural Damage



Active Wildfire Monitoring

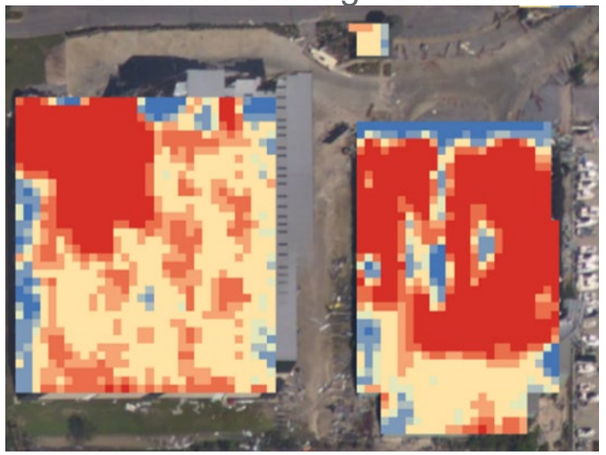


Vegetation Damage

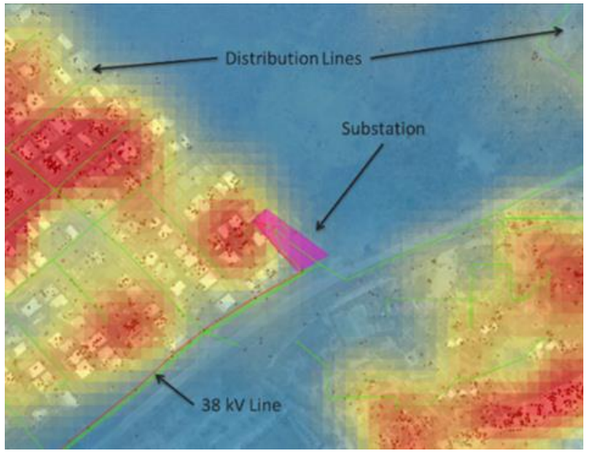


Infrastructure Damage

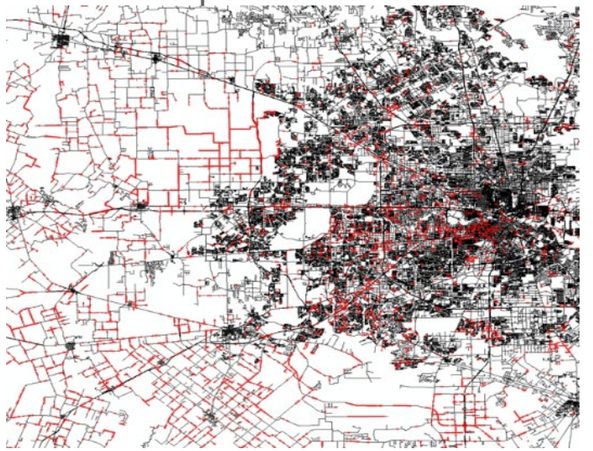
Structure Damage Detection



Rubble/Debris Detection

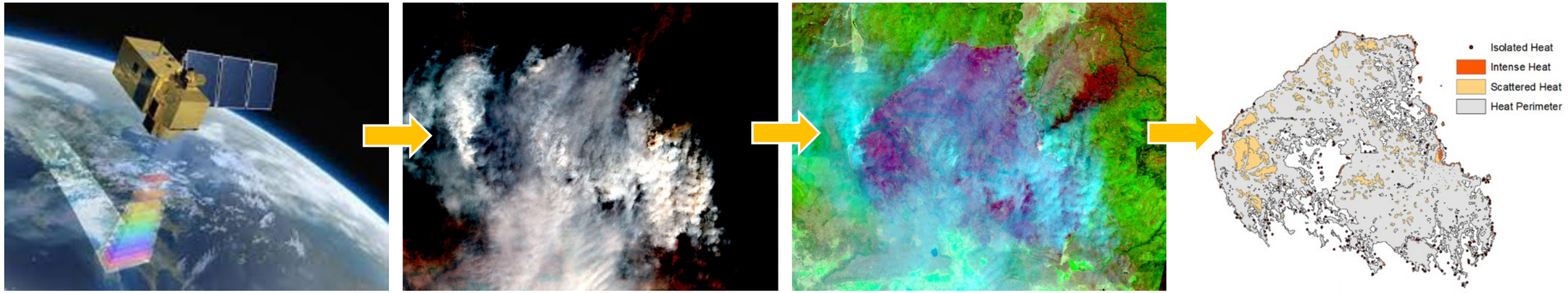



Transportation Barriers

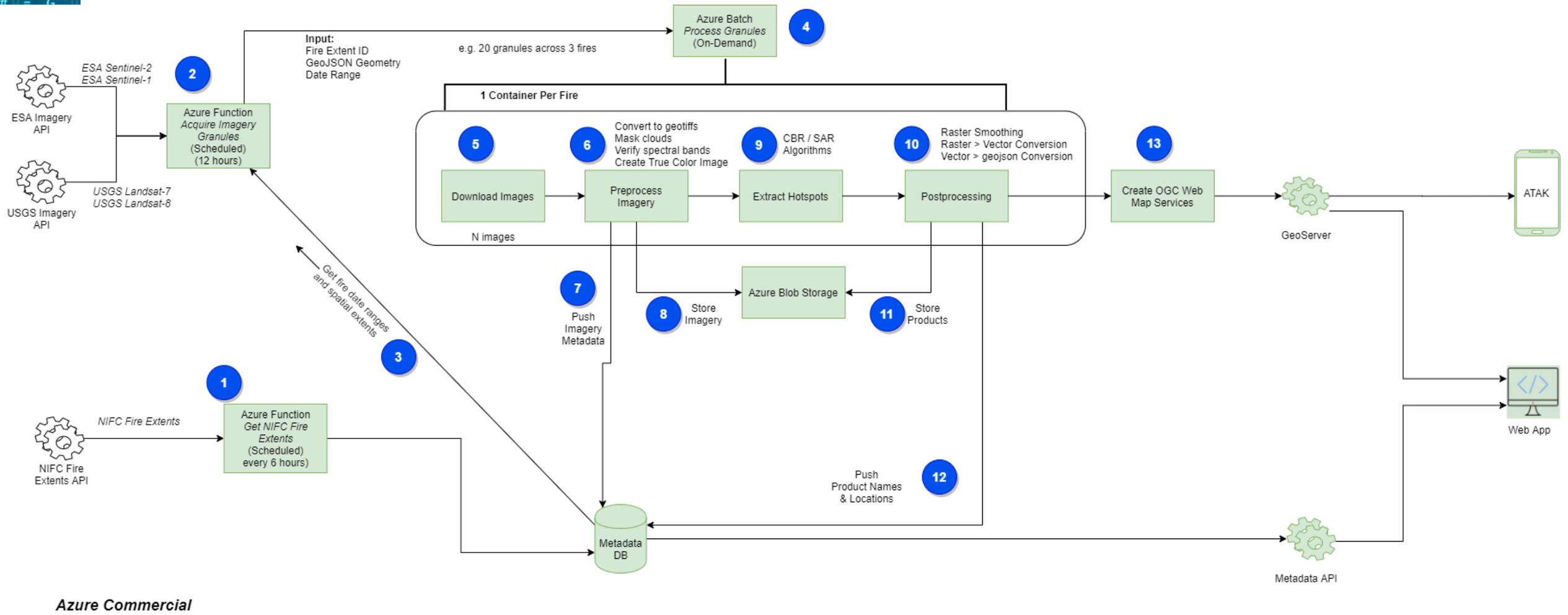


# Rapid Analytics for Disaster Response (RADR) - Wildfire

- Initiated by the White House in 2020 and sponsored by the DoD JAIC on behalf of DoE-AITO
  - Automated, end-to-end, cloud-based, open-data solution that retrieves imagery from numerous high-resolution (30-70 m) earth observation satellites, runs AI-based mapping analytics, and is capable to run globally
  - Advance situational awareness detail and cadence on active fire front, spot fires, scattered heat, unburned areas, and preliminary burn intensity
  - Complement aircraft imaging collection programs (increase timing/fill gaps)
  - Time-series results disseminated via website, mobile app, and web services



# System Architecture




***Azure Commercial***

# Satellite Sensors Evaluated

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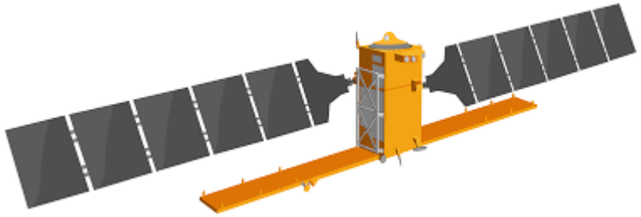
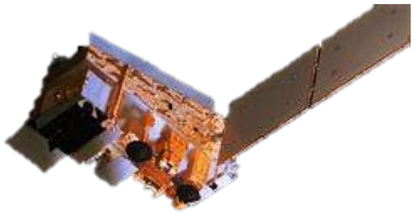
Sentinel-2 (MSI)



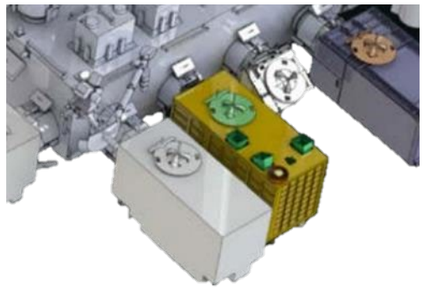
Sentinel-1 (SAR)

Sentinel-3 (MSI+)

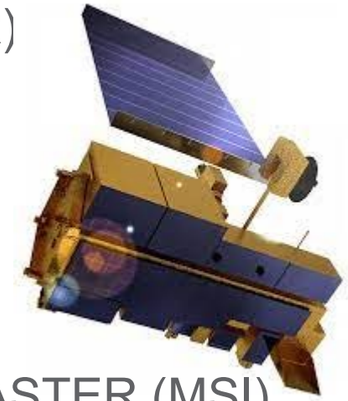


VIIRS (MSI)

GOES (MSI)



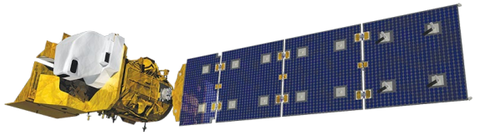
GEDI (LiDAR)



ASTER (MSI)

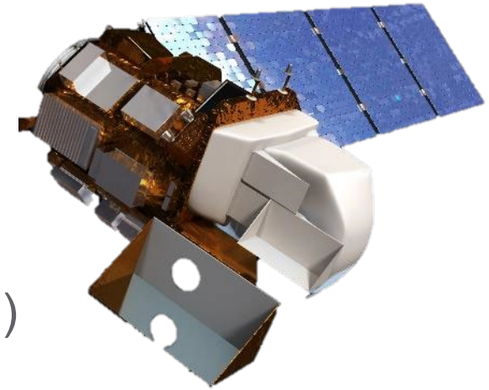
AWiFS (MSI)
LISS-III (MSI)


ECOSTRESS (MSI)



Landsat-9 (MSI)

Landsat-7 (MSI)



Landsat-8 (MSI)

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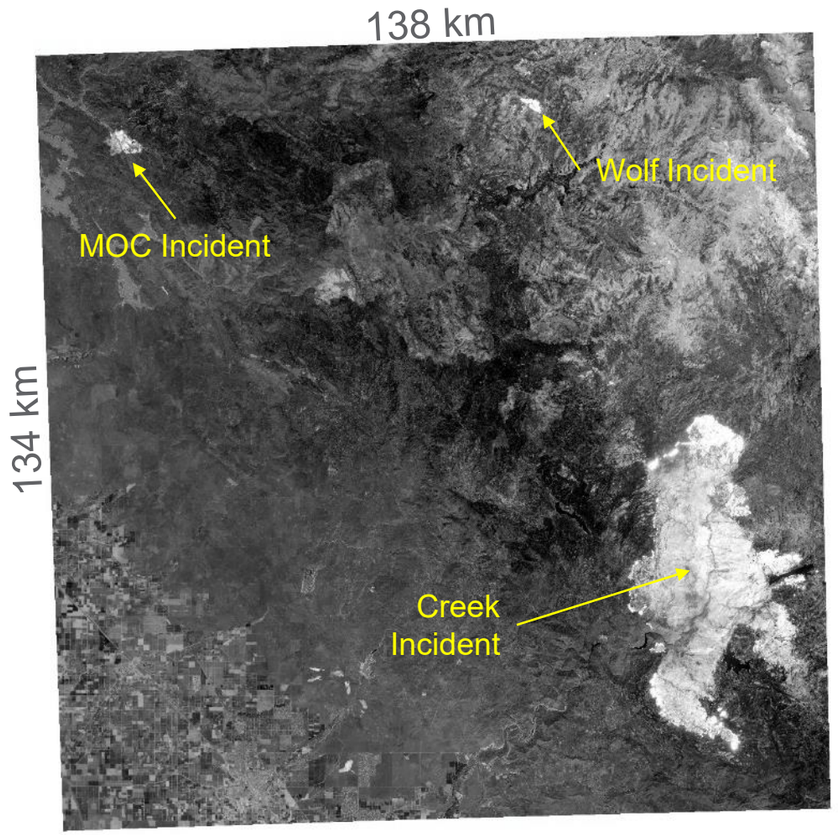
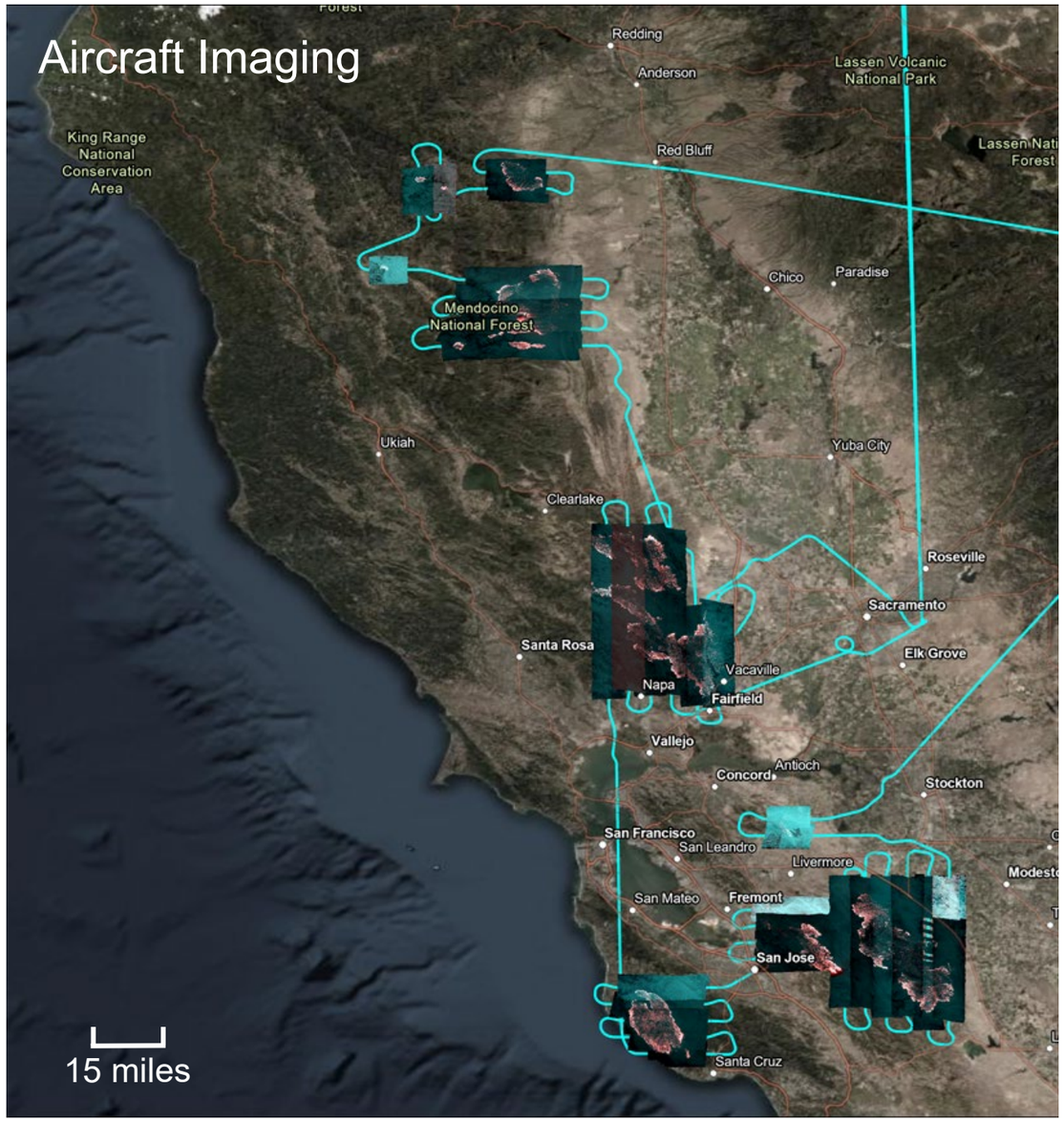
# Satellite Timing & Coverage




- Sentinel-2 MSI (European Space Agency)
  - 18,492 km$^2$ / 7,142 mi$^2$ / 4,569,473 ac
  - 20 m GSD / 138 km swath
  - 5-day revisit

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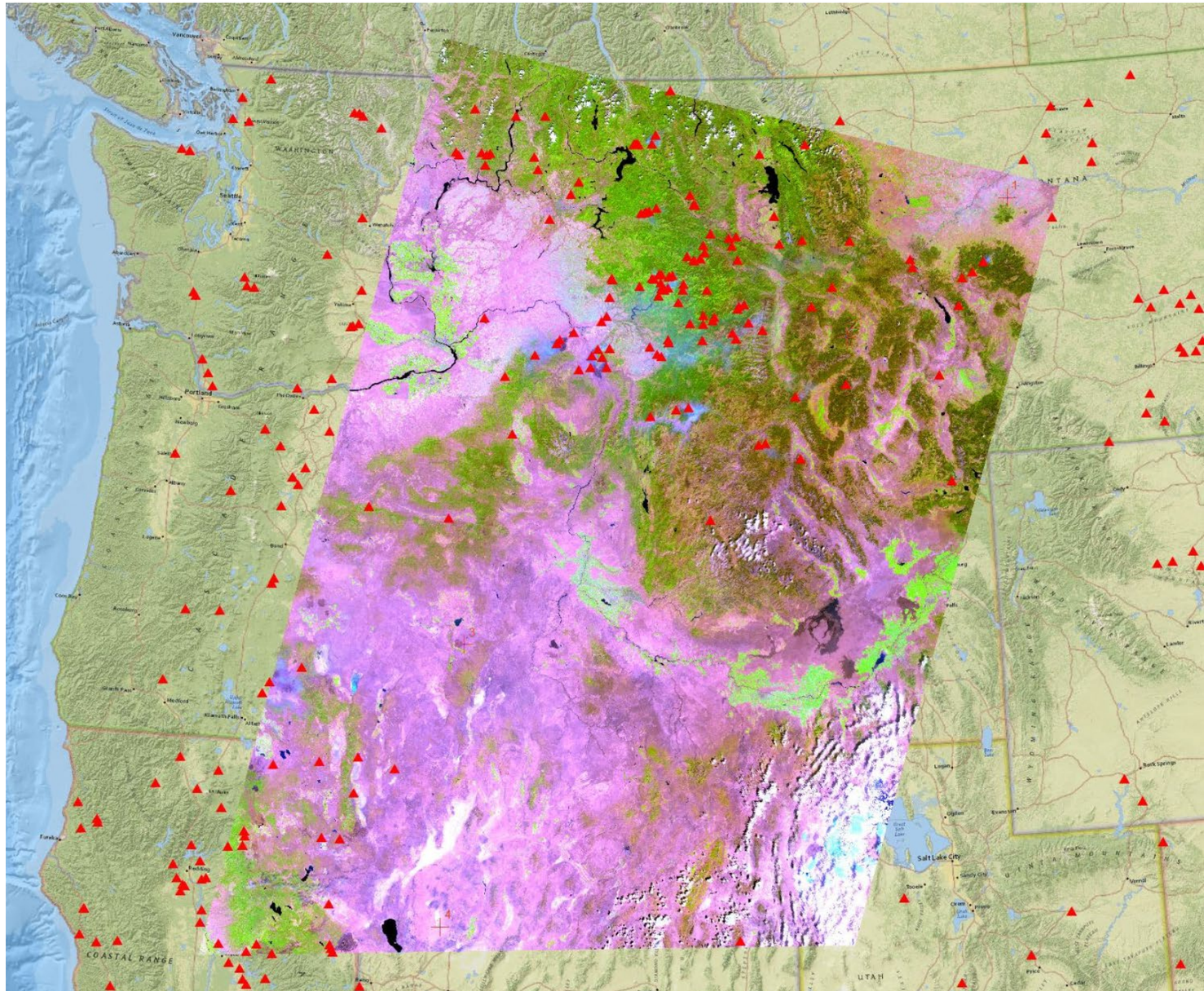
# Satellite Timing & Coverage

- AWiFS Sensor aboard ResourceSat-1 & ResourceSat-2
  - 56 m GSD
  - 740 km swath
  - 5-day revisit
- One single scene captured 153 active fires (24% of all western US fires)
  - July 15, 2021



# Automated Wildfire Mapping

Pacific Northwest NATIONAL LABORATORY

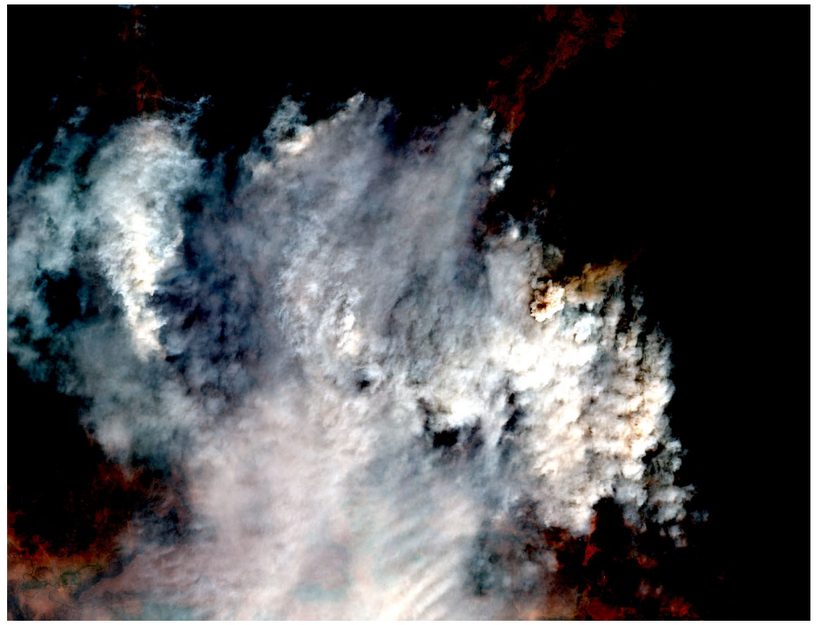
RADR FIRE

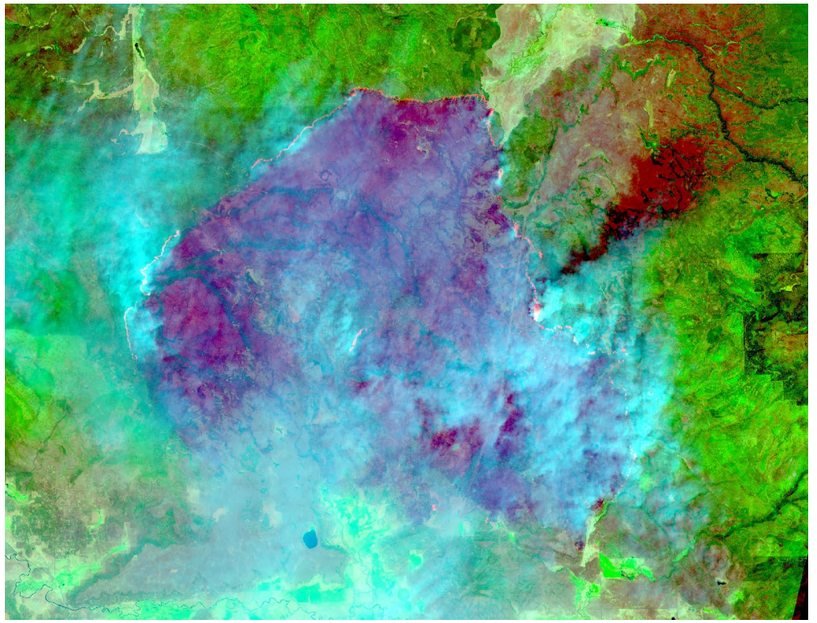
Bootleg Fire, OR
(July 11, 2021)

Start Date:
July 6, 2021

Sentinel-2 (MSI)

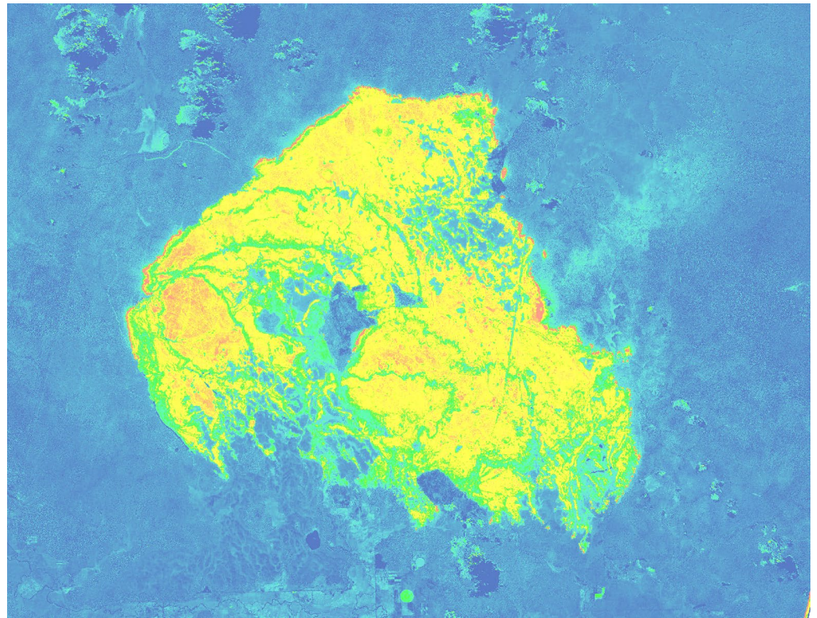
True Color Image (RGB)

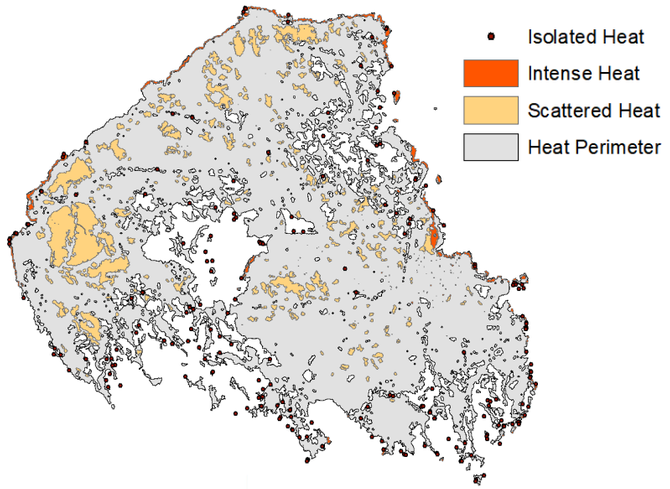




Enhanced Color Image (w/ SWIR)

Continuous Burn Ratio



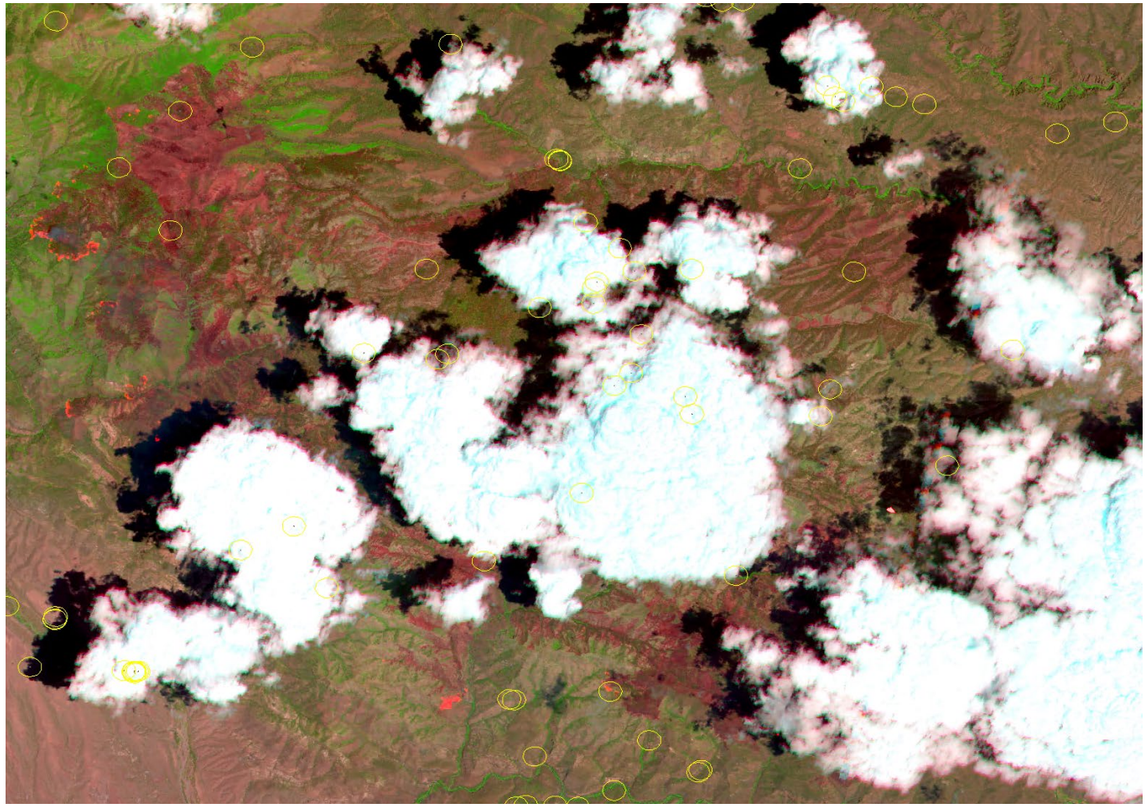



Classified & Vectorized Product

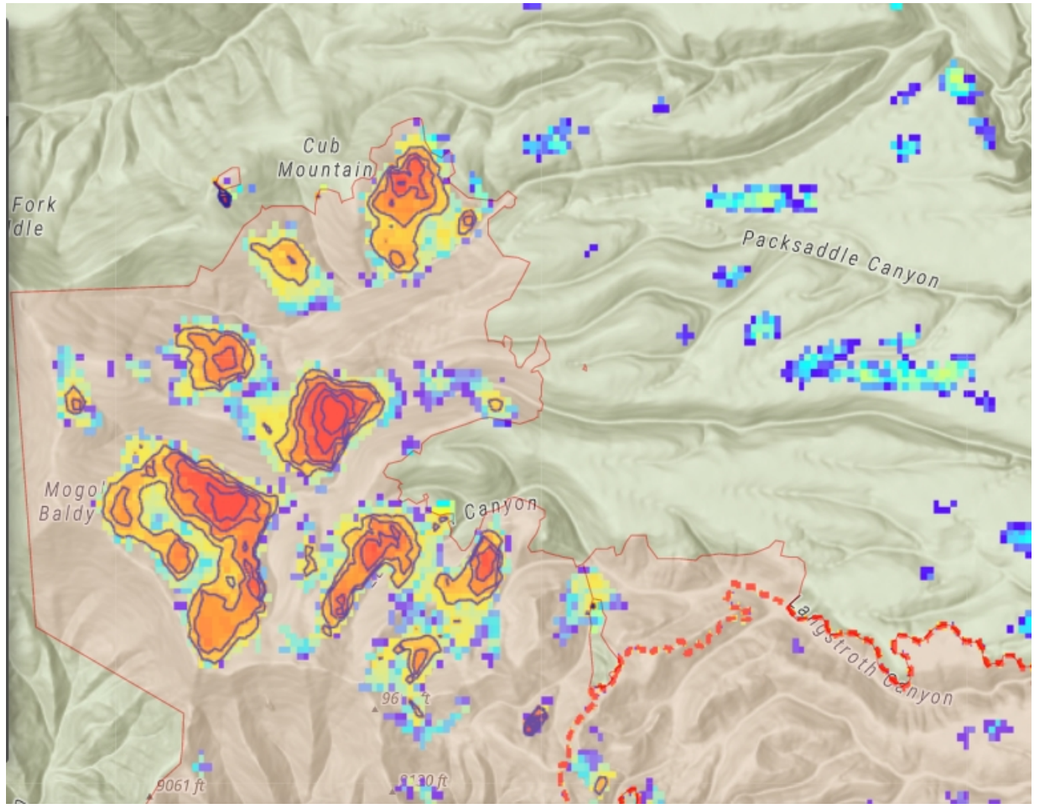
UNCLASSIFIED

# Examples

Johnson Fire NM –6/20/2021
(yellow circles = structures)

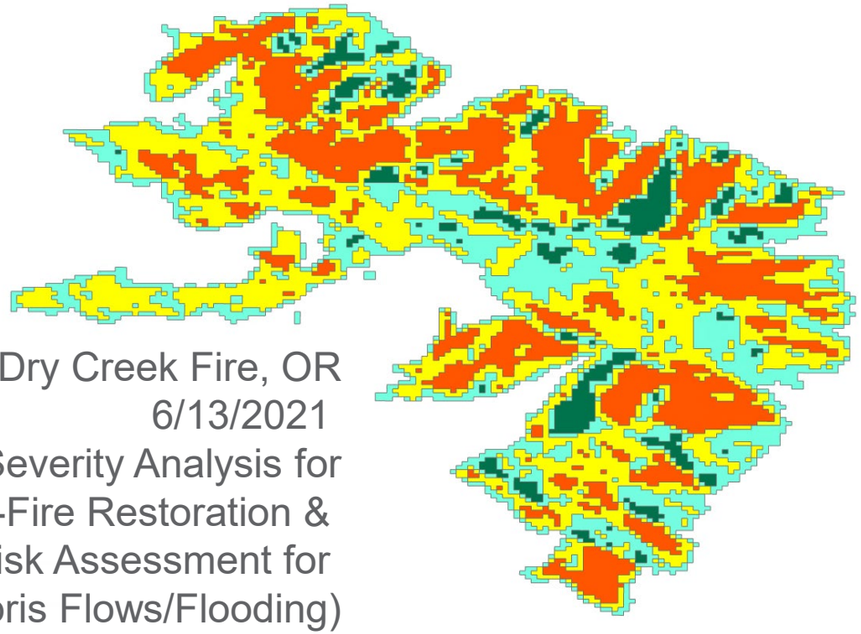


Johnson Fire NM –6/18/2021
(ECOSTRESS Thermal)



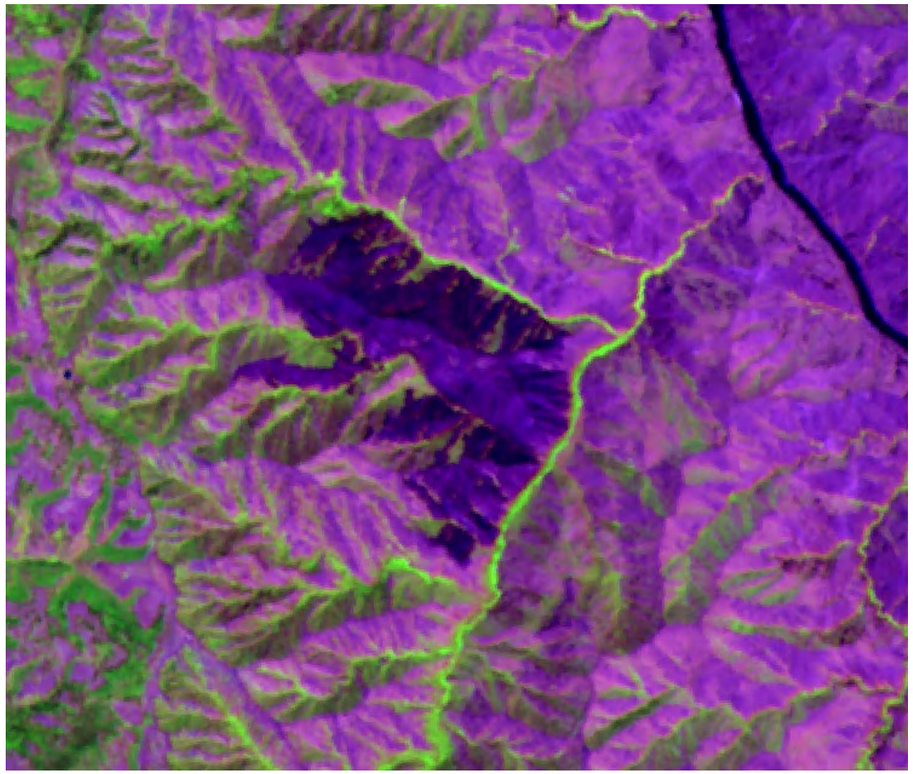
# Examples

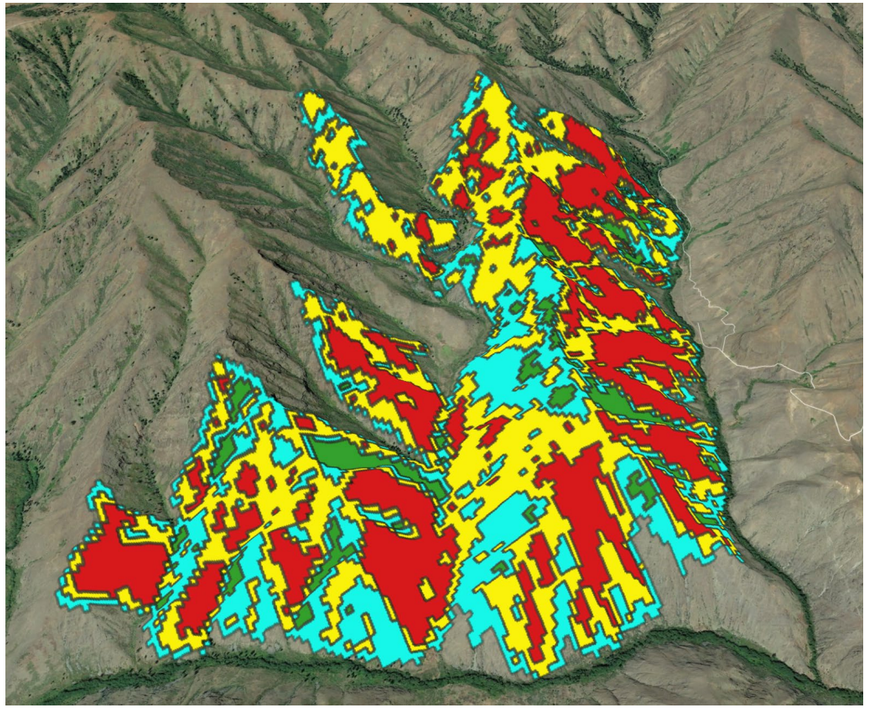
| Acreage of Burn Severity | |
|---|---|
| **Burn Severity** | **Acres** |
| Unburned to Low | 3,465 |
| Low | 4,637 |
| Moderate | 11,632 |
| High | 13,304 |
| Increased Greenness | 450 |
| Non-Processing Area Mask* | 725 |
| **Total** | **34,213** |



Dry Creek Fire, OR
6/13/2021
(Burn Severity Analysis for Post-Fire Restoration & Risk Assessment for Debris Flows/Flooding)

Dry Creek Fire, OR – 6/13/2021
(LISS-3)

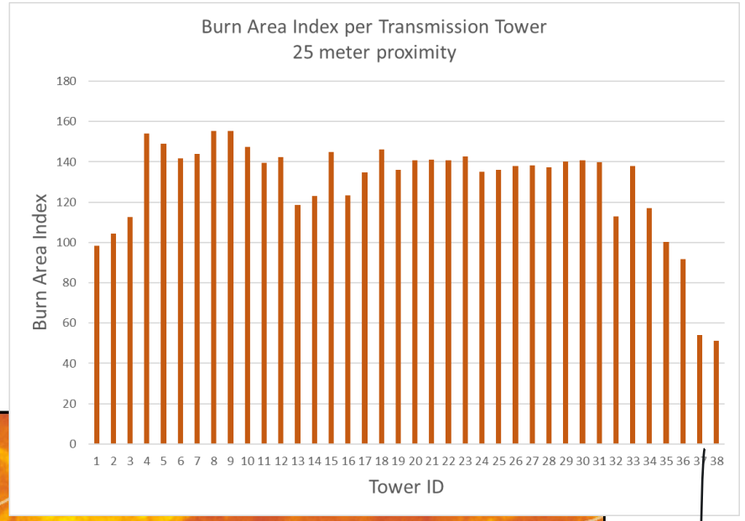


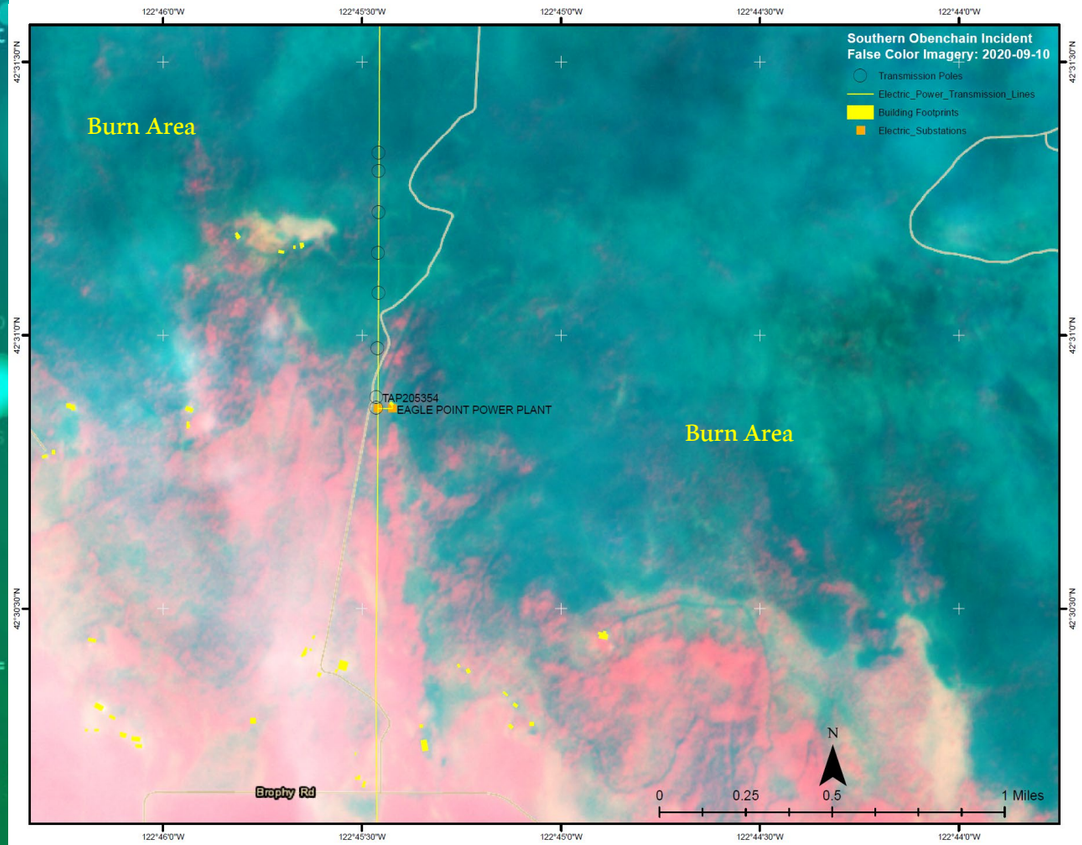


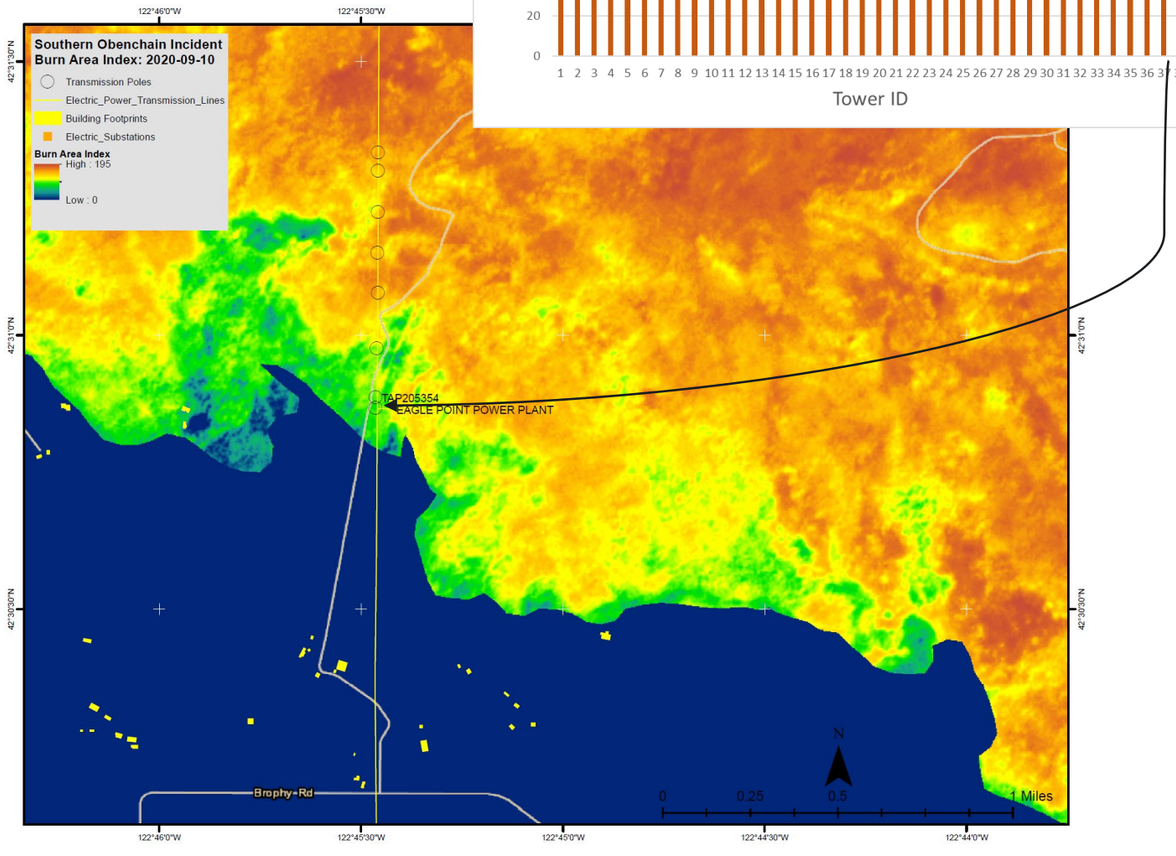
# Fire Analytics for Critical Energy Infrastructure

Pacific Northwest NATIONAL LABORATORY

RADR FIRE



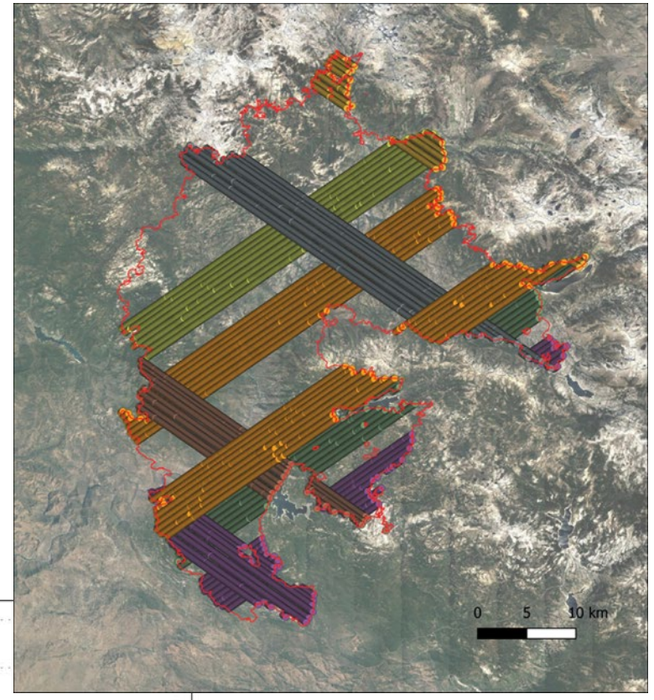
# Fire Behavior Modeling

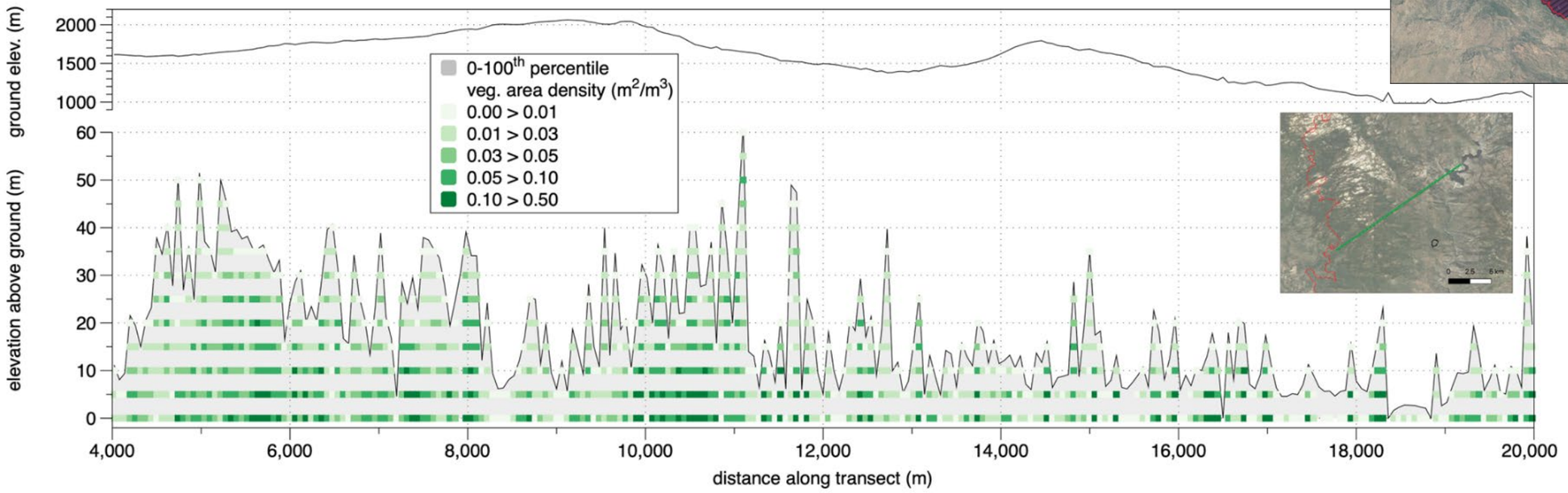
- Vegetation height, density, biomass
  - Structure and fuels → behavior models
- Combine with vegetation stress for risk
- Vegetation management
- Estimate loss of carbon after fires

Showing 9 of 18 available orbits

Each orbit is 6-8 Gb

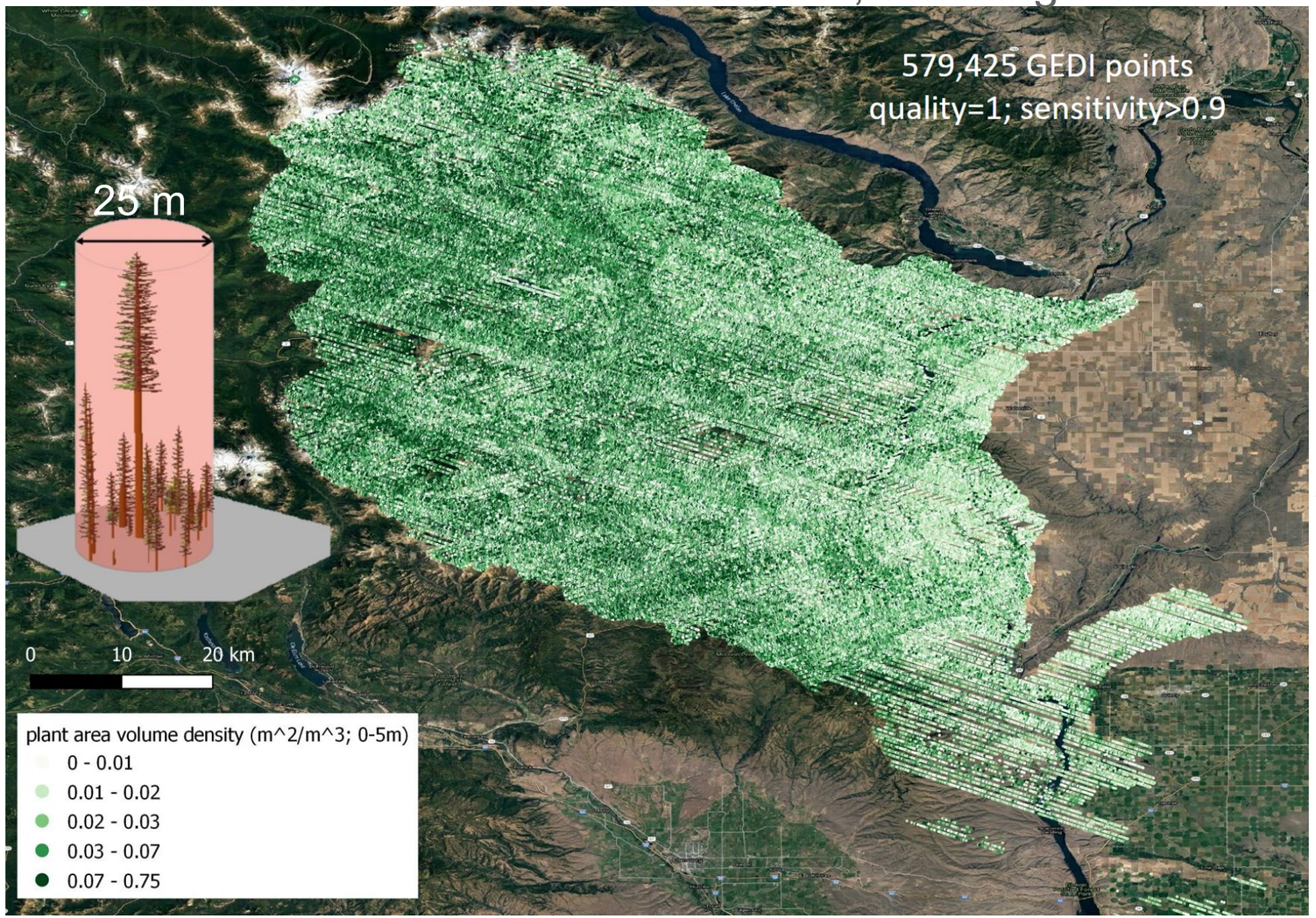
For California = ~14Tb



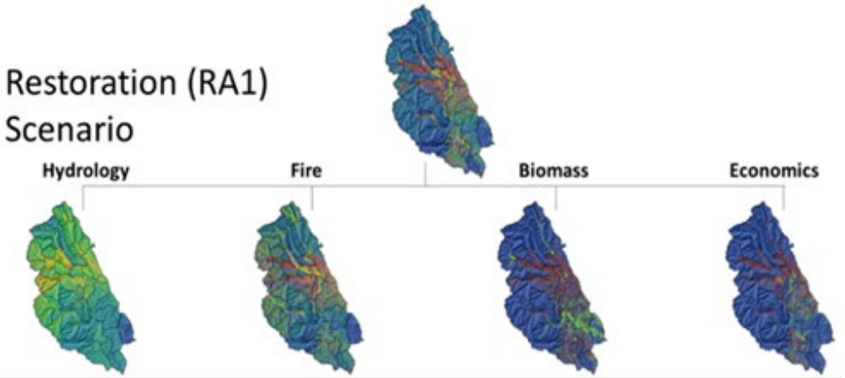



# Vegetation Assessment

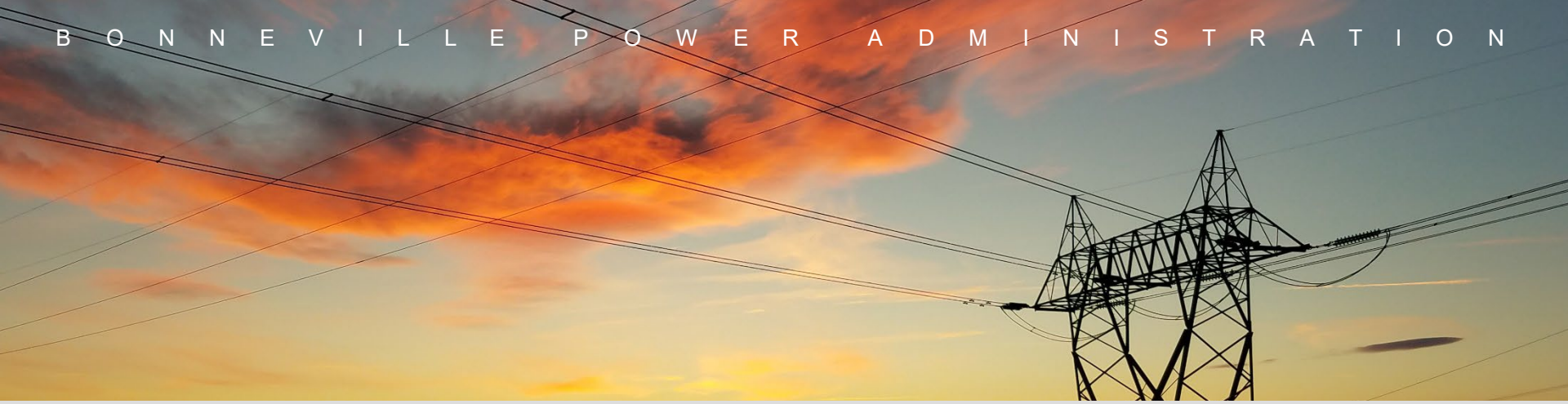
- Vegetation density (0-5m)
  - Entiat and Wenatchee Watersheds, Washington




## Pilot Decision Support Tool for Fuels Mitigation




**Priority locations (warm colors) for forest fuel removal based on combined benefits to hydrologic conditions, reduction in wildfire risk and smoke emissions, available biomass, and economics.**




# Gridwise Forum
# Wildfire Resilience

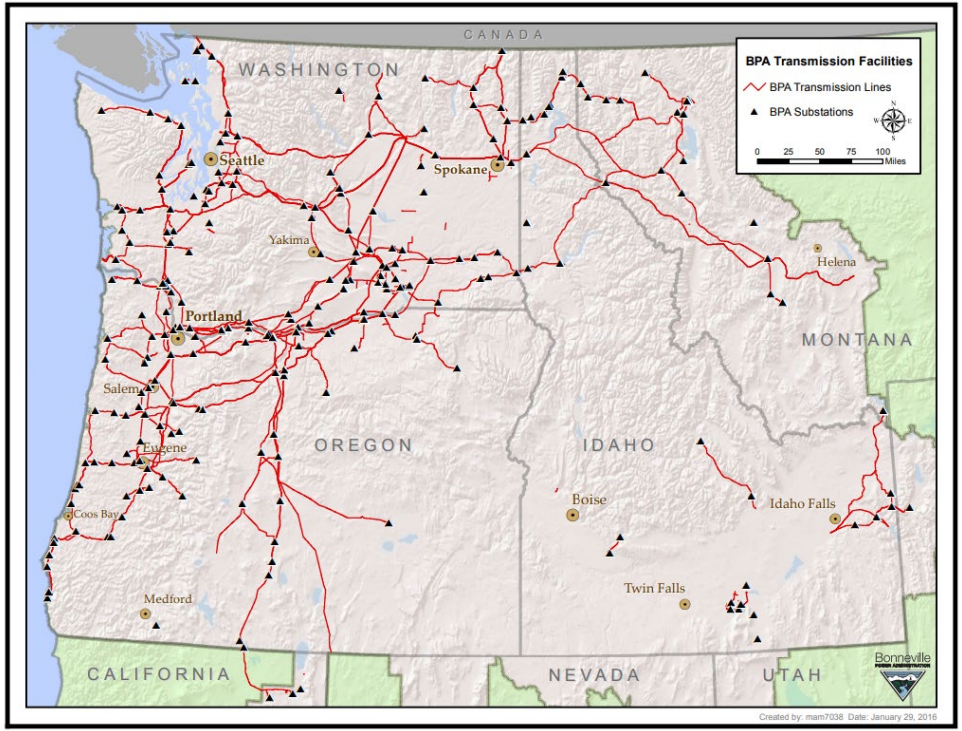
06.22.2022

# Introduction to Bonneville

- BPA markets power from 31 Federal hydro plants, the Columbia Generating Station Nuclear Plant, and several small non-Federal power plants.
- BPA owns no power generators.
- About 80% of the power BPA sells is hydroelectric.
- BPA accounts for about 28% of the electric power consumed within the PNW and over 50% of power consumed in WA.
- BPA recovers all costs from selling power and transmission services.
- BPA, with USCOE & USBR, invests $250 - $300 million per year in Fish & Wildlife programs across the Columbia River basin

# BPA Infrastructure

- BPA owns and operates 15,000+ miles of transmission lines, about 75% of transmission in its service territory
- BPA owns and operates 3500+ miles of fiber optic network
- BPA serves over 300 customers



# Wildfire Effect on BPA 2021

- Overall effects to BPA in 2021
  - 14 Lines removed from service for firefighting
  - 9 Lines relayed out of service for smoke/fire
- Bootleg Fire
  - Started July 6th 2021 – Burned +400k acres
  - 3 Lines relayed out of service
  - July 23rd All restrictions lifted
  - Aug 15th Fire fully contained

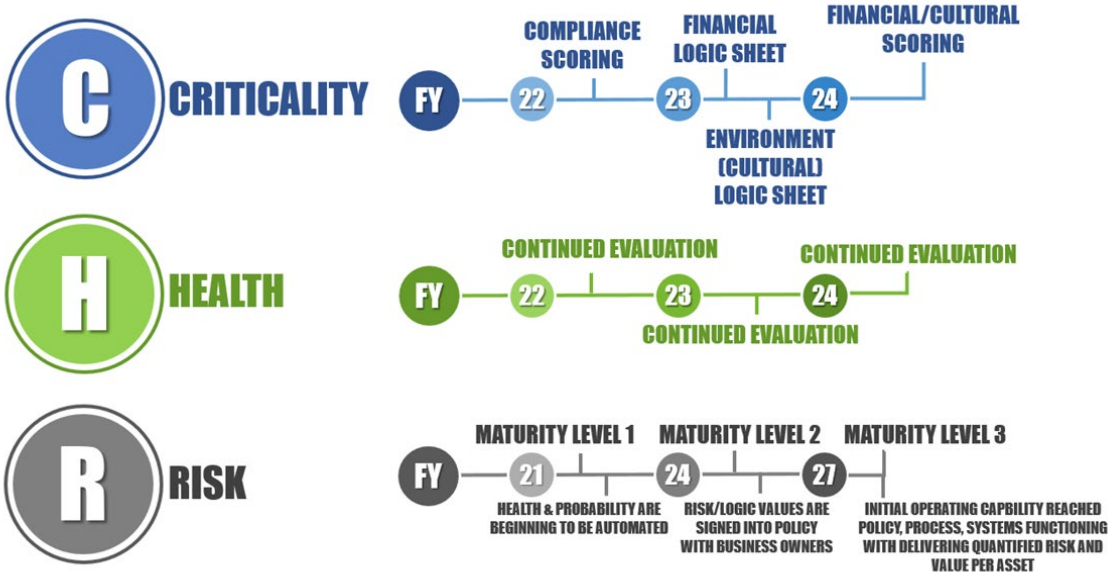
# Maturity and Development

Where we were

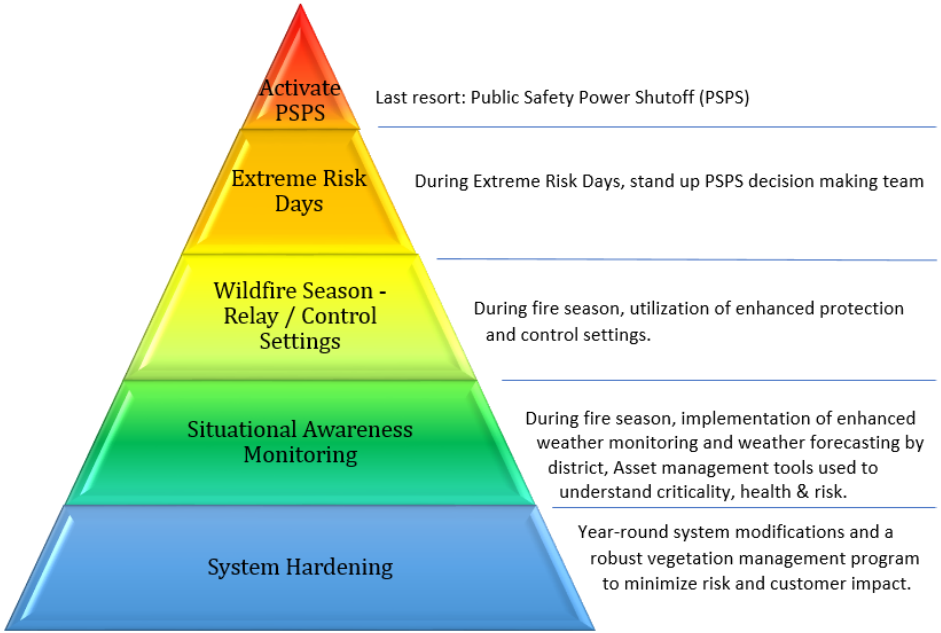
Where we are at

Where we are going

# Risk Assessment



# Mitigation Hierarchy



# Questions??