

Integrated Technologies for Wildfire Preparedness and Early Detection



**Bushfire
Research**
Centre of Excellence

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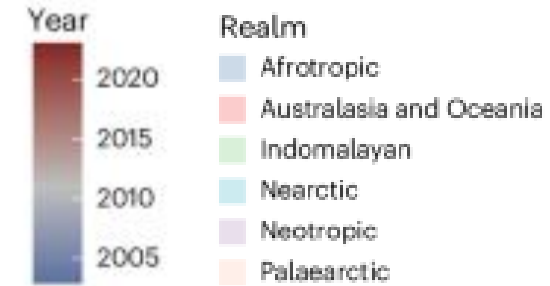


Strong upward trend in extreme fire events

Frequency



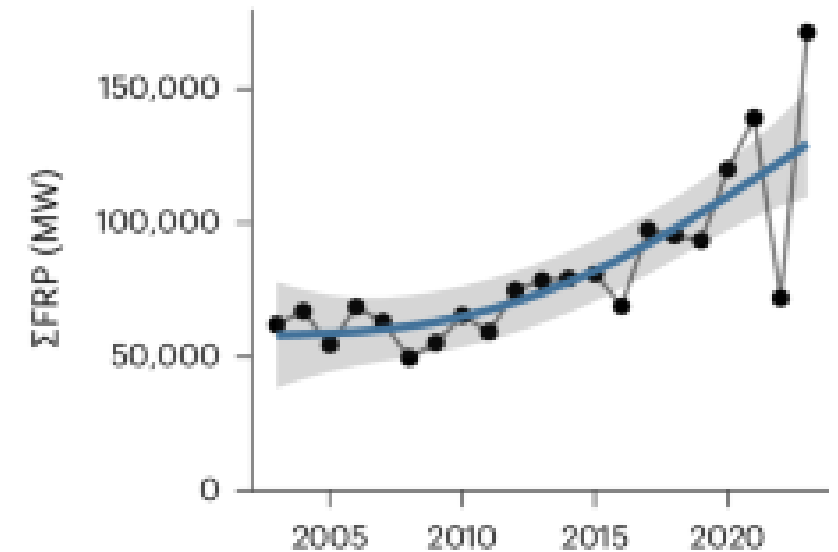
Energetically extreme fires
defined as the top 0.01% for fire radiative power (FRP)
from 2003 to 2023



Intensity

c

Mean of top 20
 Σ FRP events per year



shifts the focus from
reactive firefighting to
proactive ignition management
saving resources, ecosystems and lives

Building a Nervous System for Wildfire Risk Mitigation



Satellite



Scout Drones



Cameras on
Fire Towers



Lighting
detectors



On Ground Sensors



Ecologically sensitive area

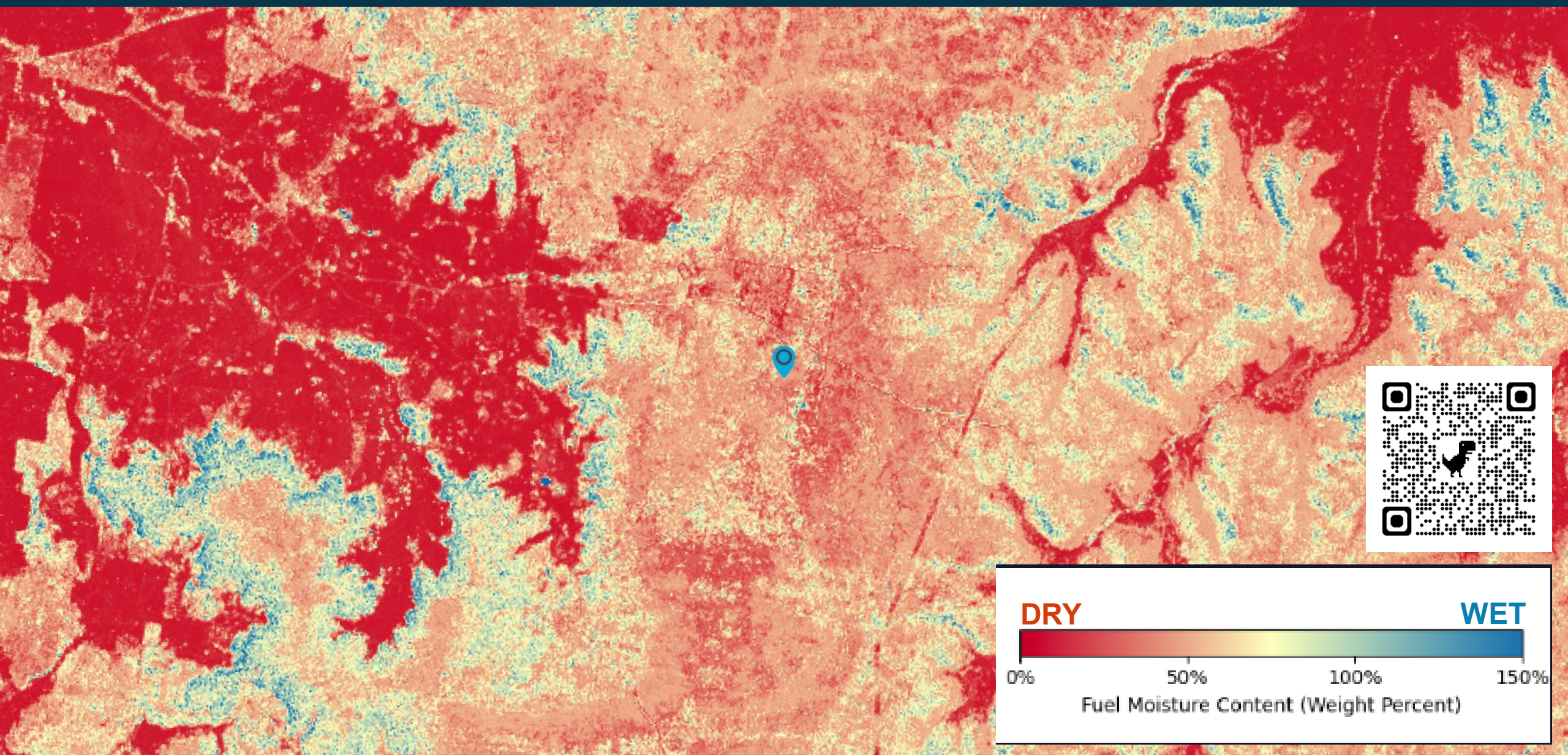
Blind spot for tower

WUI

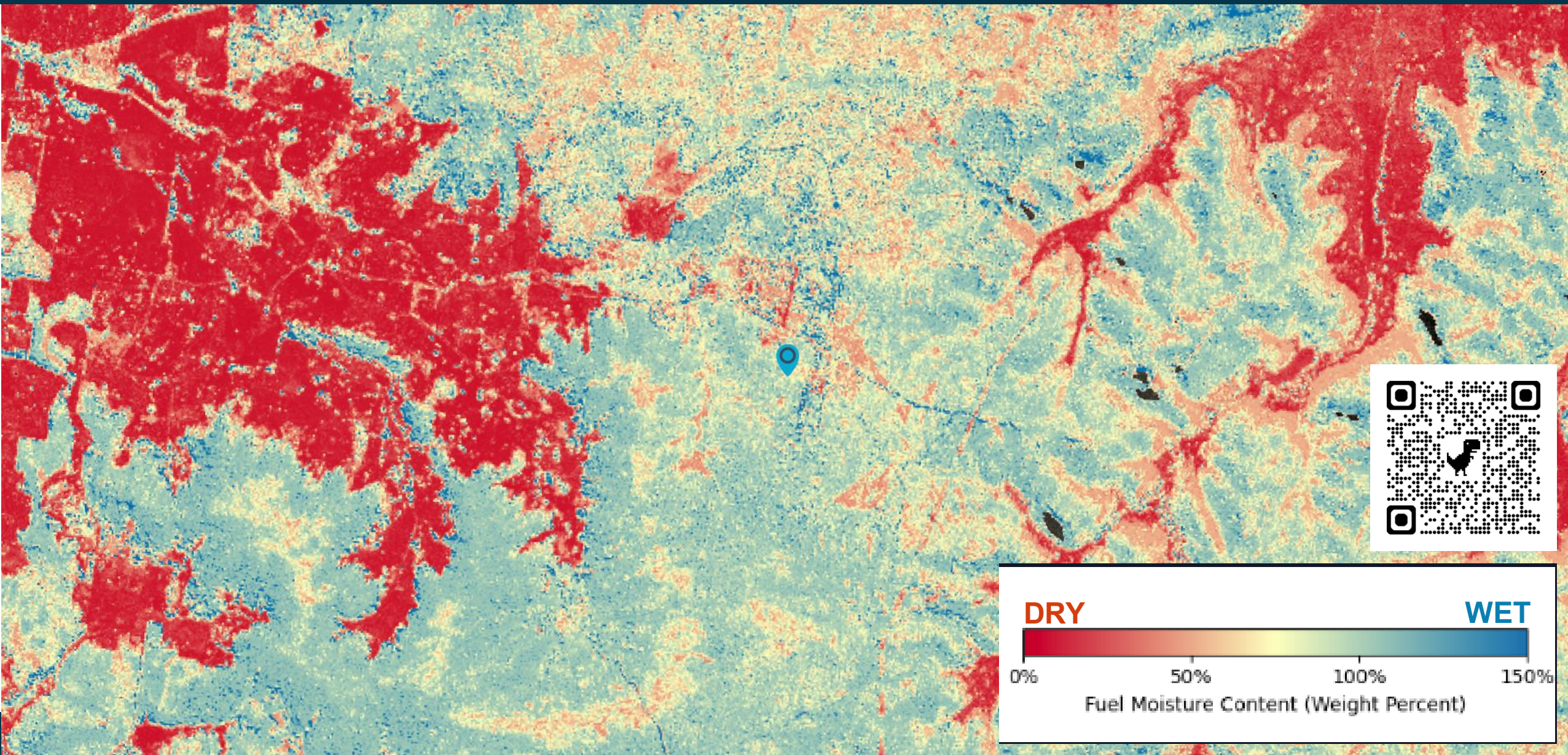




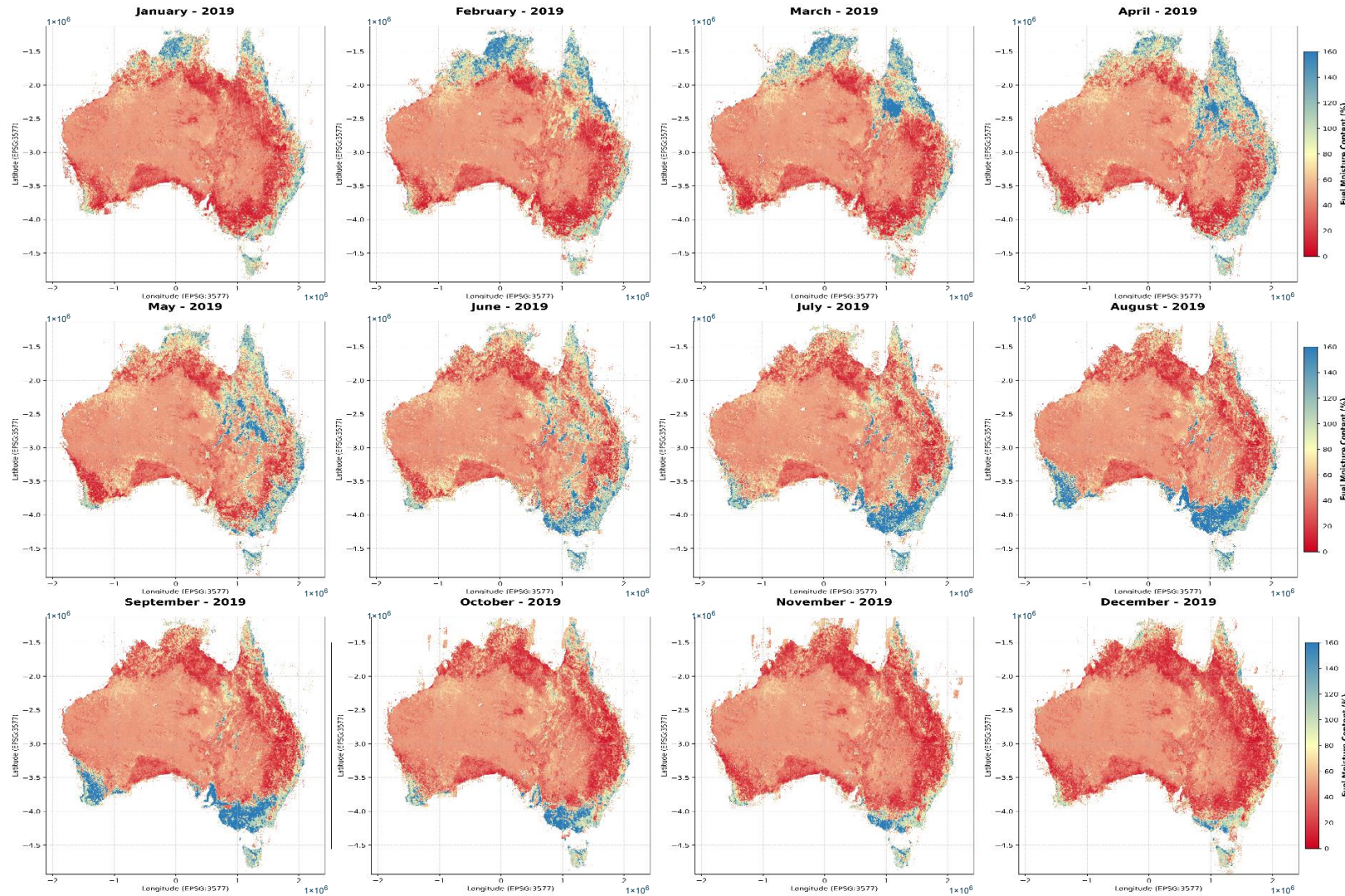
Fuel Moisture Content – 30th Jan 2020, Kain's Flat (NSW)



Fuel Moisture Content – 5 moths earlier ...



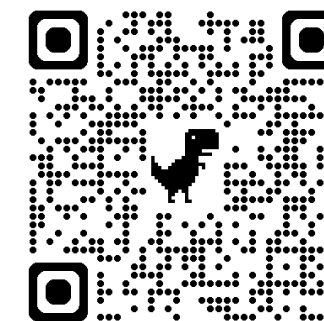
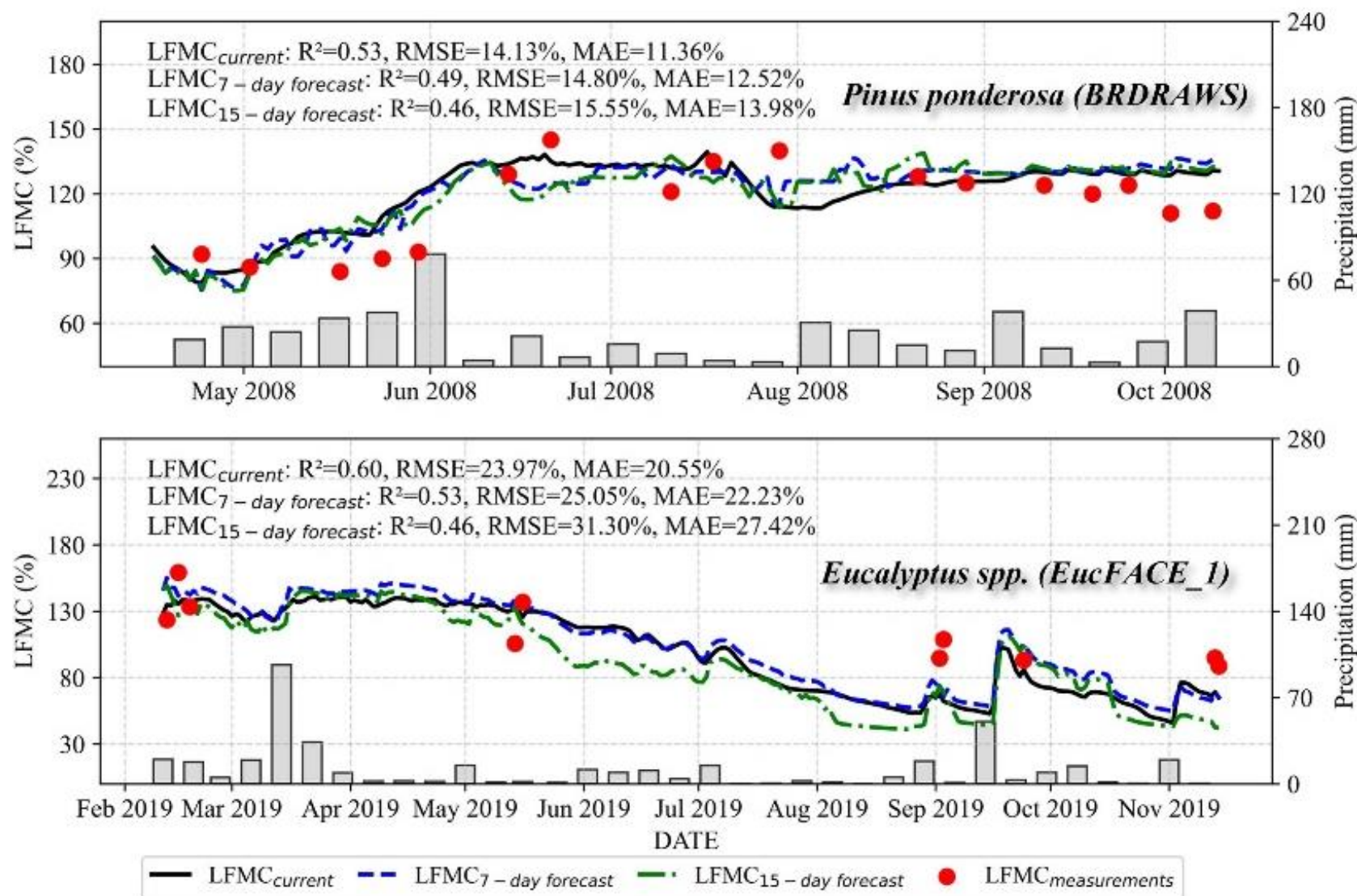
Australian Operational Product → Shared APEC Capability



Wildfire Pilot Dryness

Not every APEC economy
needs to build this capability
from scratch.

Anticipating Flammability: Fuel Moisture Forecasting



OzFuel: Space-Based Fuel Flammability Monitoring

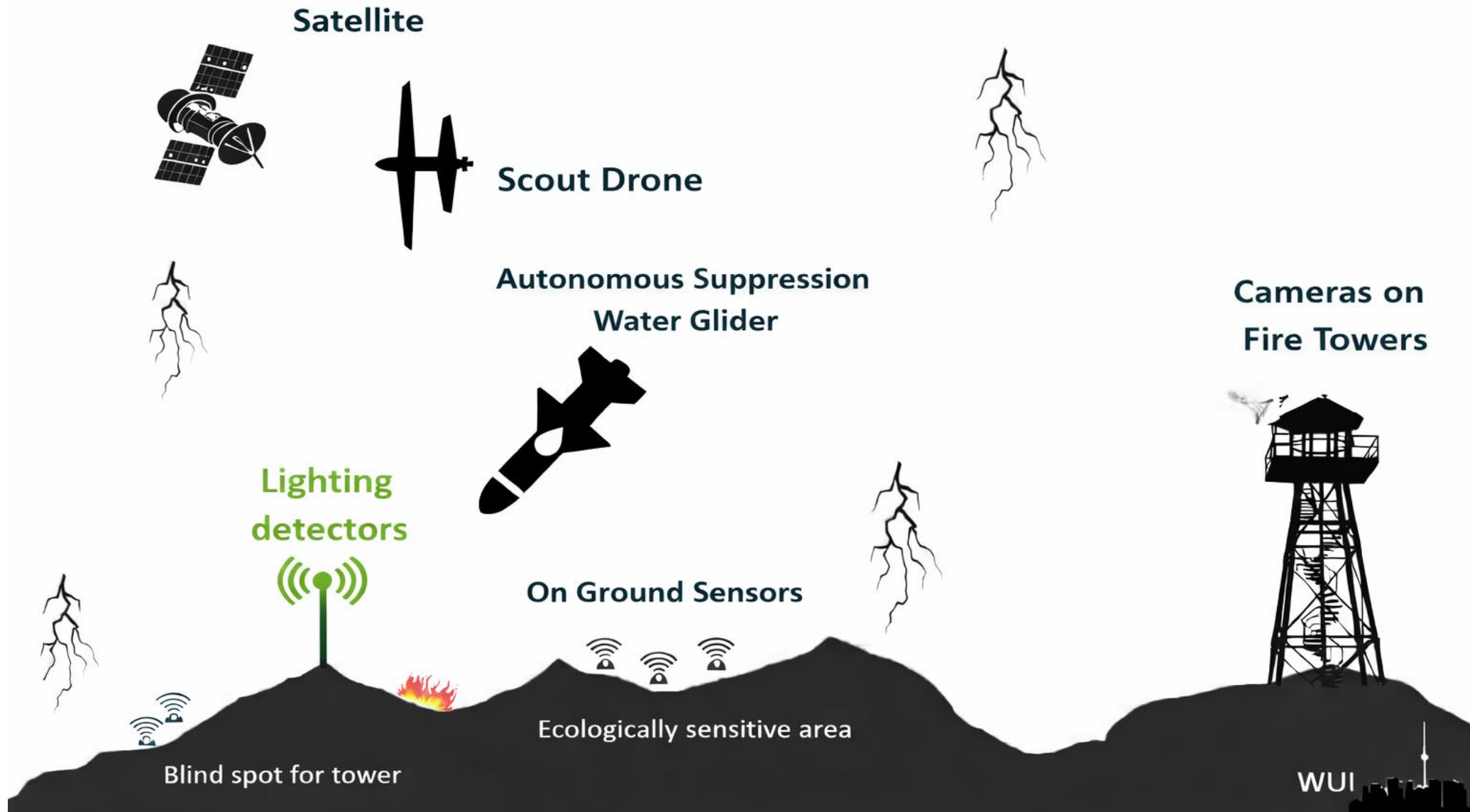


ANU 3D printed engineering model for the OzFuel telescope

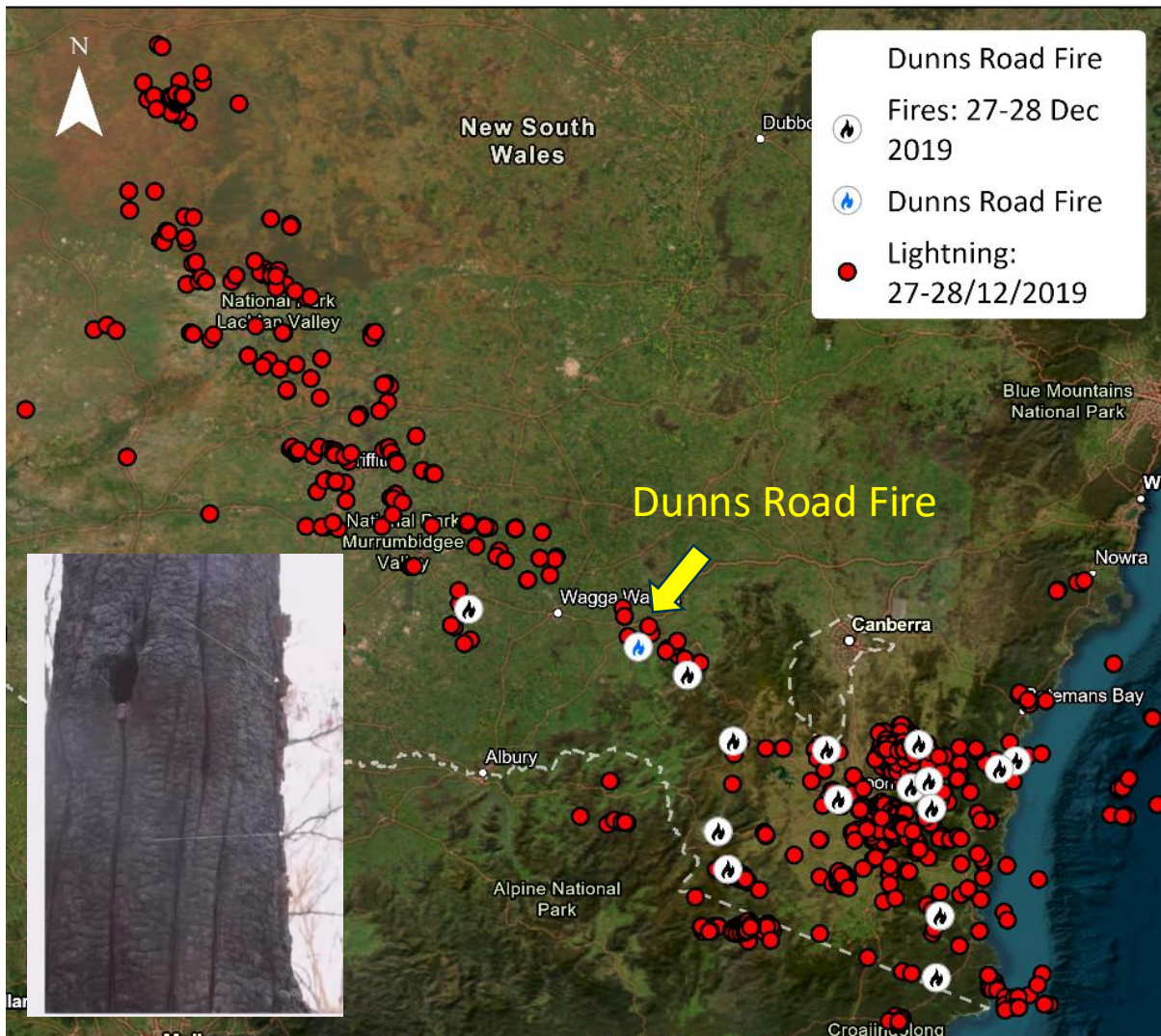
- Specifically designed to monitor vegetation flammability from space
- Complements active fire missions by addressing pre-fire risk



Building a Nervous System for Wildfire Risk Mitigation



The Dunns Road Fire: when a fire starts unseen



- ~1,000 strikes, 27–28 Dec 2019
- Lightning hit ~11:50 PM, undetected ~12 hrs
- Crews arrived ~1 hr later; fire 3–5 km²

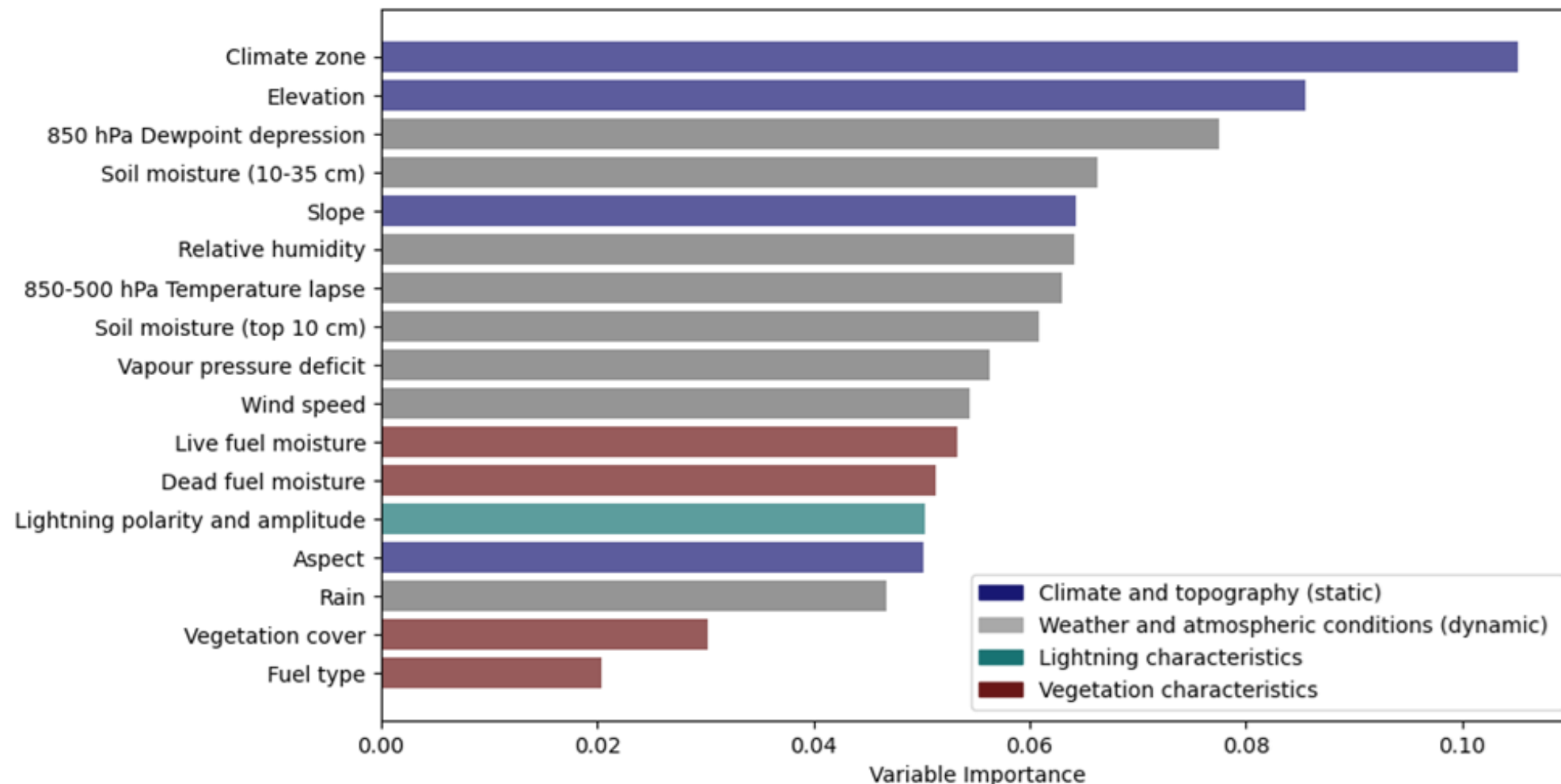
THE FINAL IMPACT

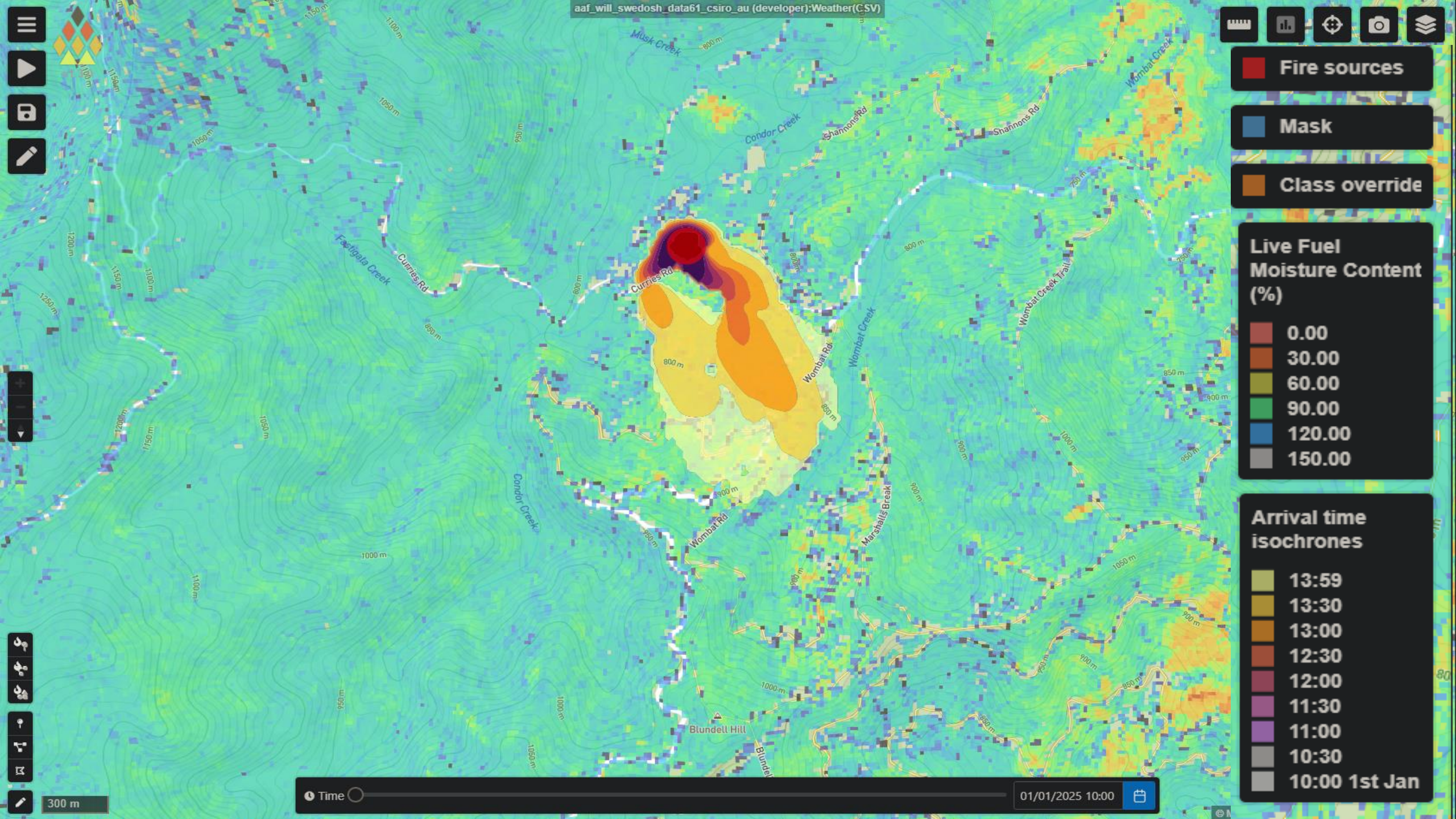
- Burned for 7 weeks
- Consumed 334,000 ha
- Destroyed/ damaged 1,024 structures (186 homes, 27 business)
- \$56 million in damage
- Tragically, one fatality

Tree hit by lightning, with evidence of sap extrusion.
Photo from NSW Coroner's Report via Canberra Times

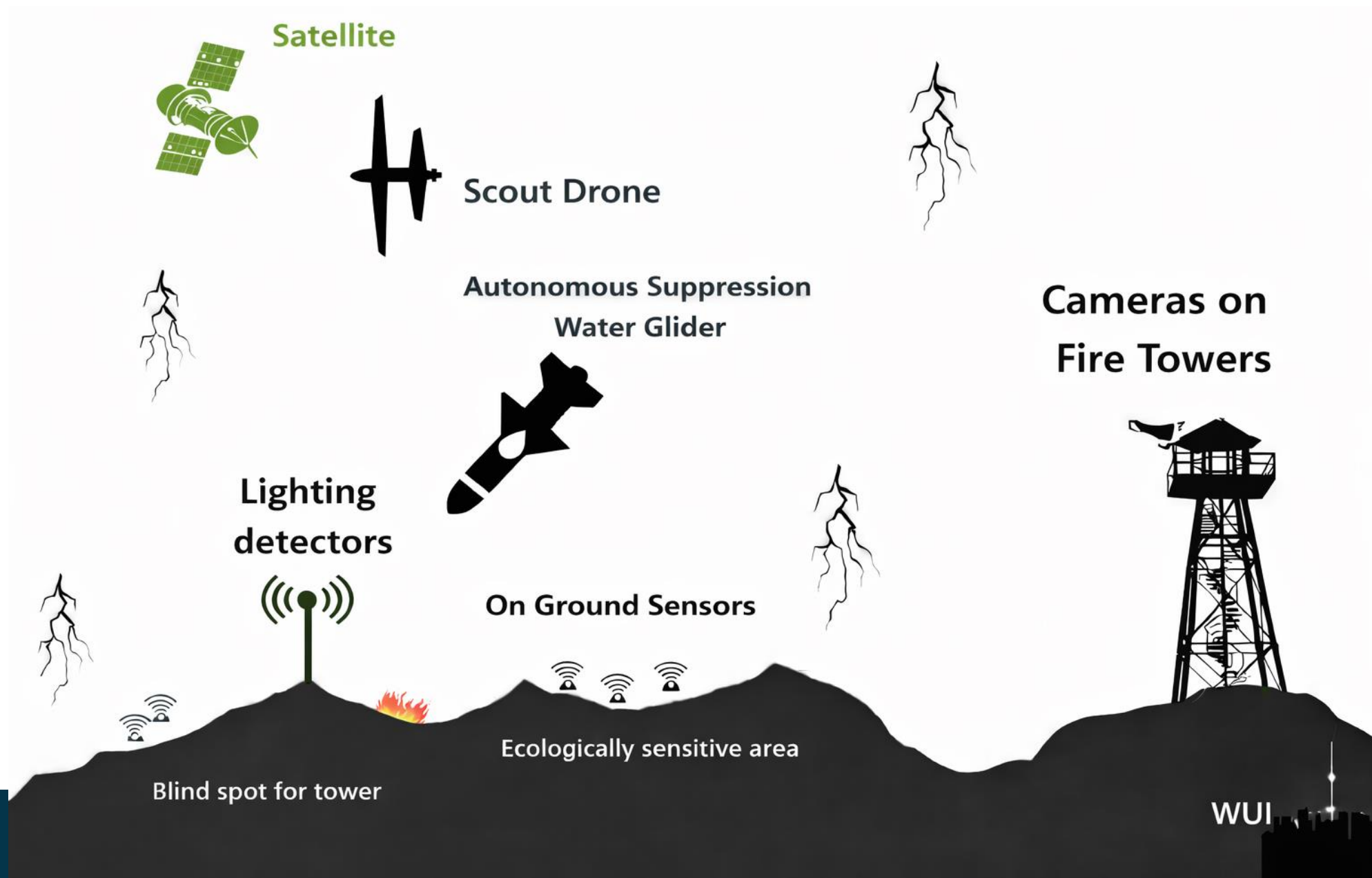
Modelling Lightning-Driven Ignitions

- Weather and geography have the strongest influence



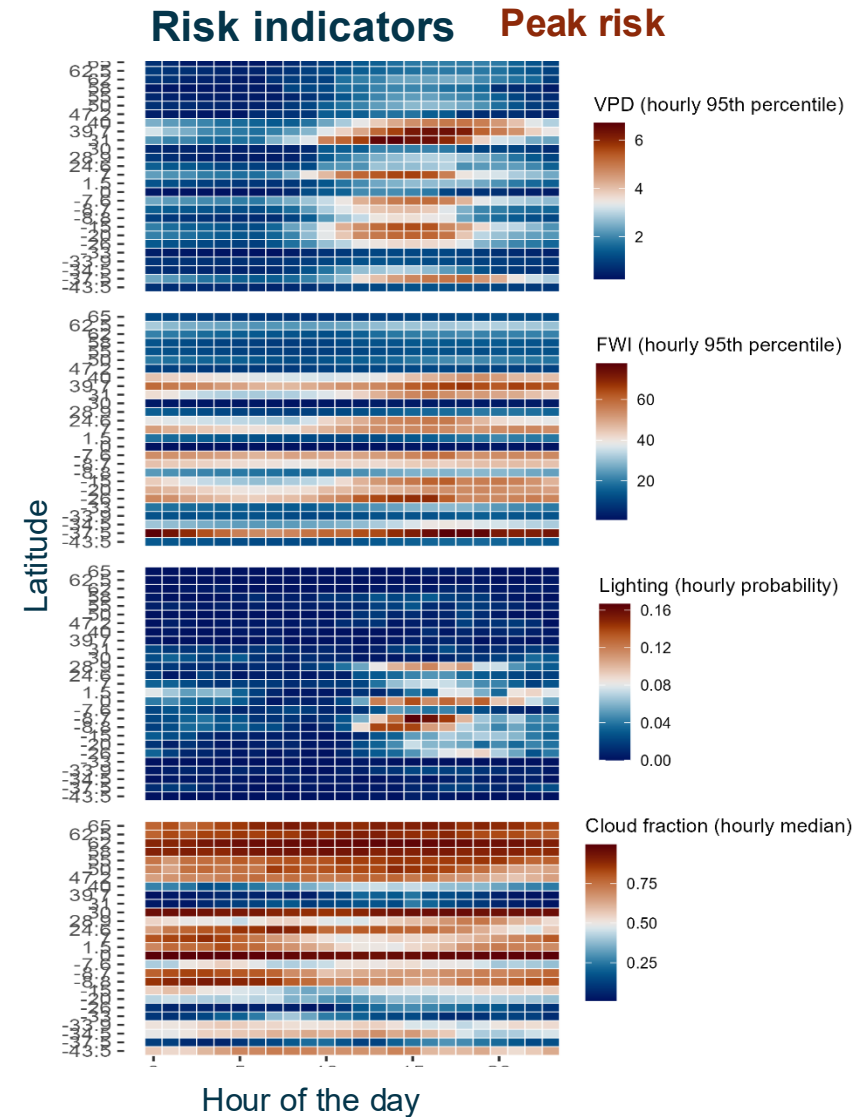
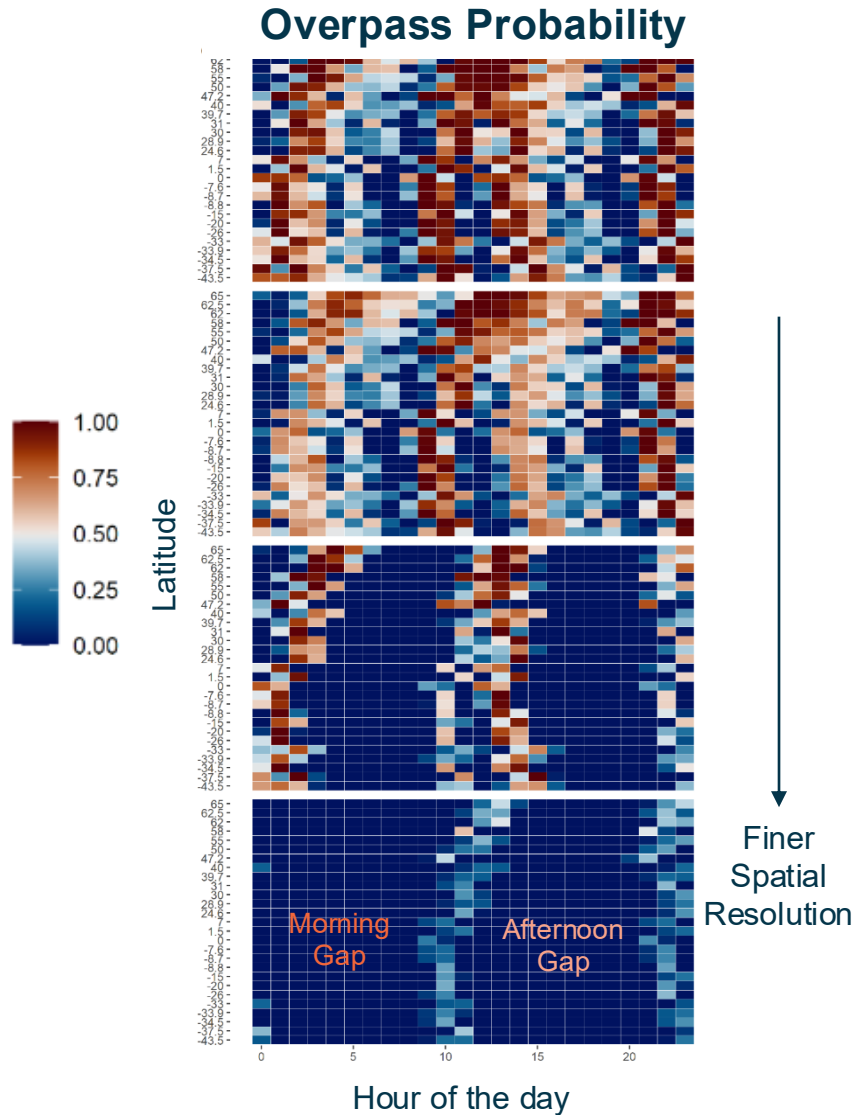


Building a Nervous System for Wildfire Risk Mitigation

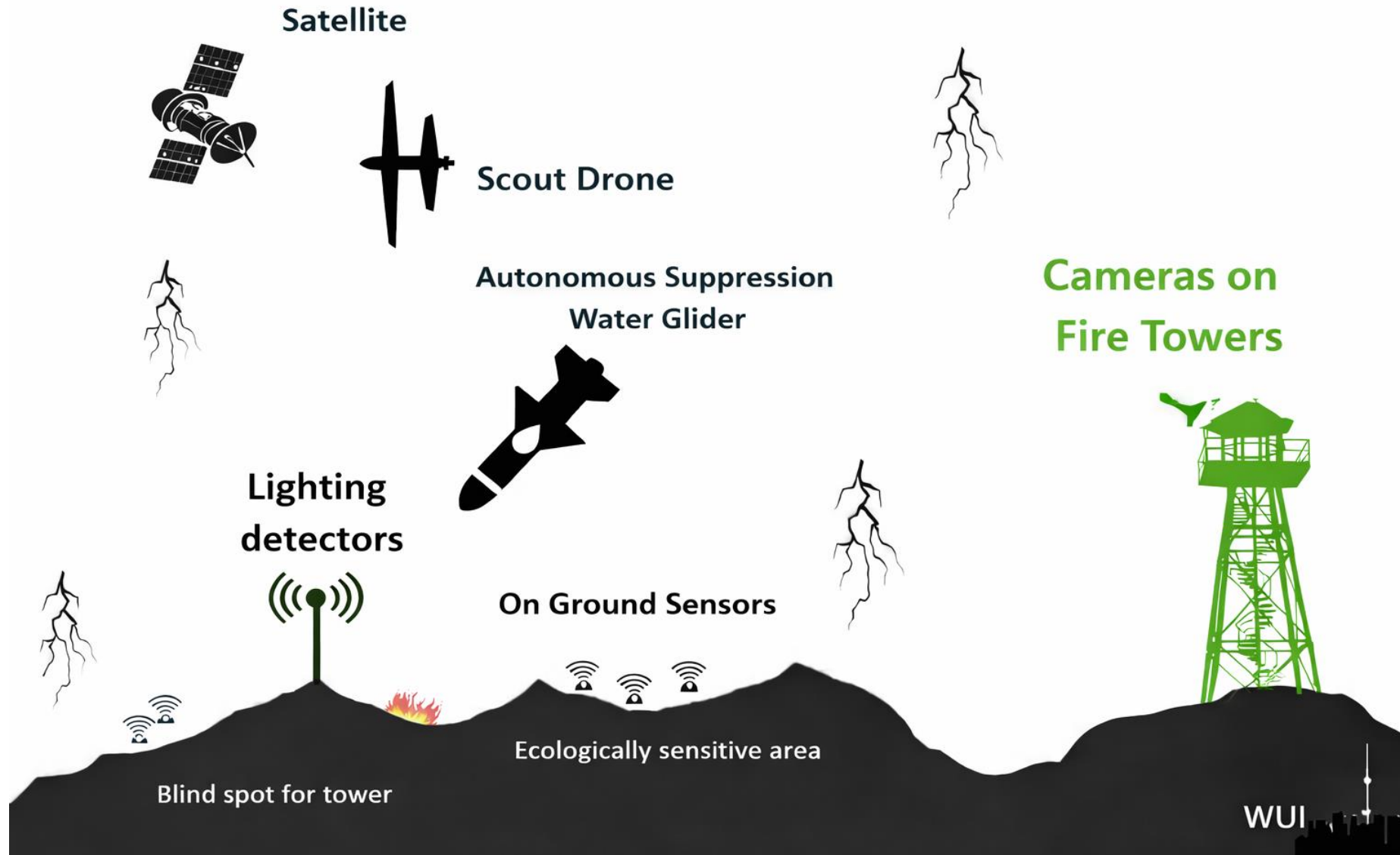


Fire Monitoring Gap: Capacity vs. Risk

Analysis for
2024 across 29
locations



Building a Nervous System for Wildfire Risk Mitigation

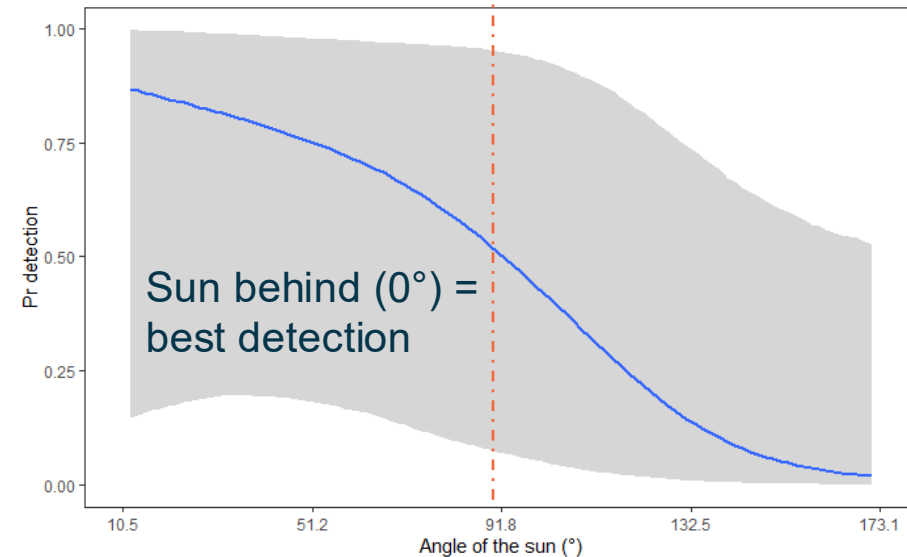
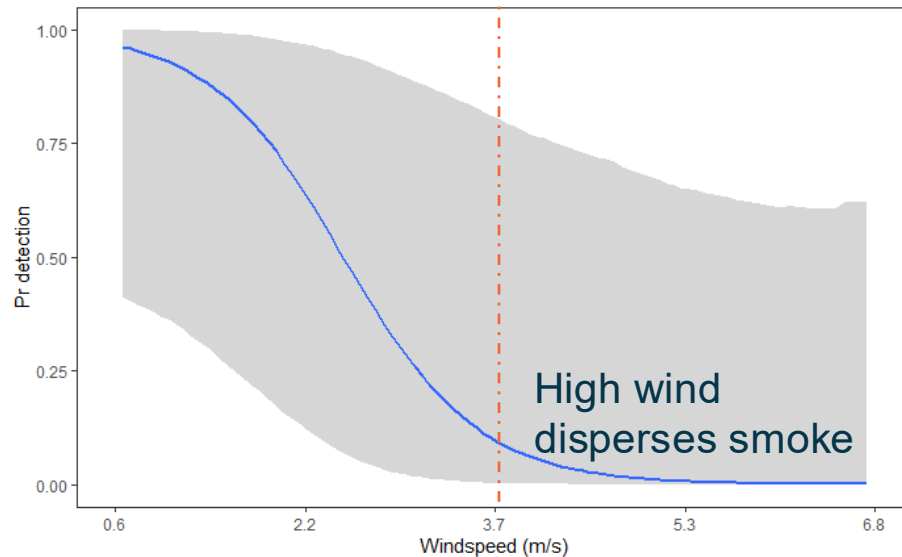
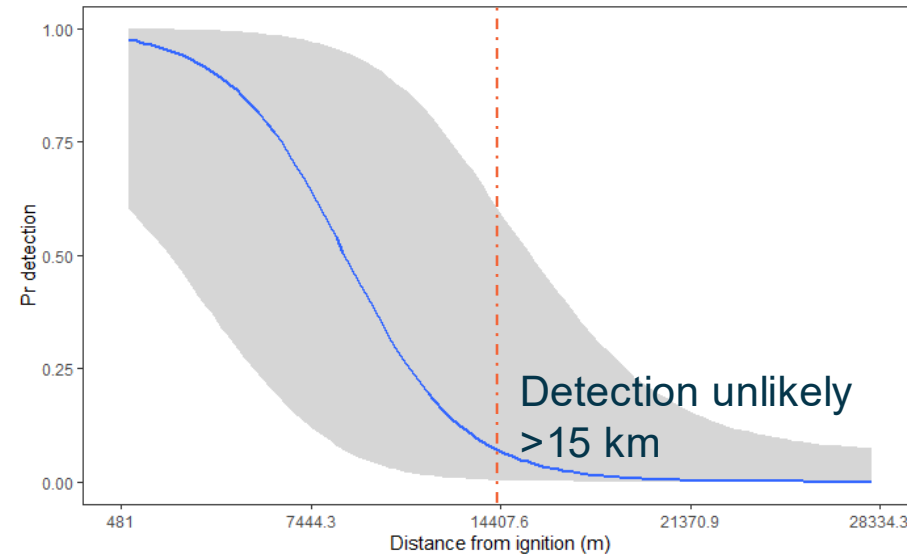
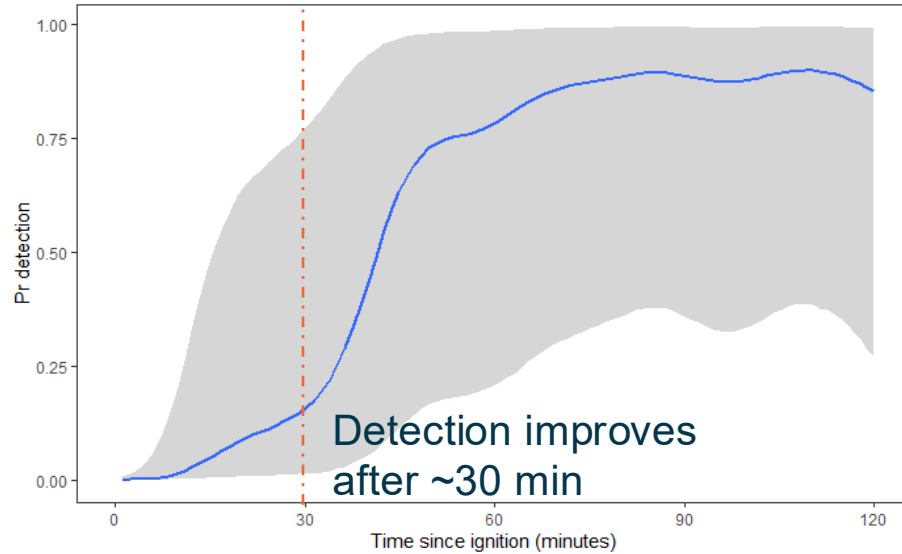




Yan et al. 2022

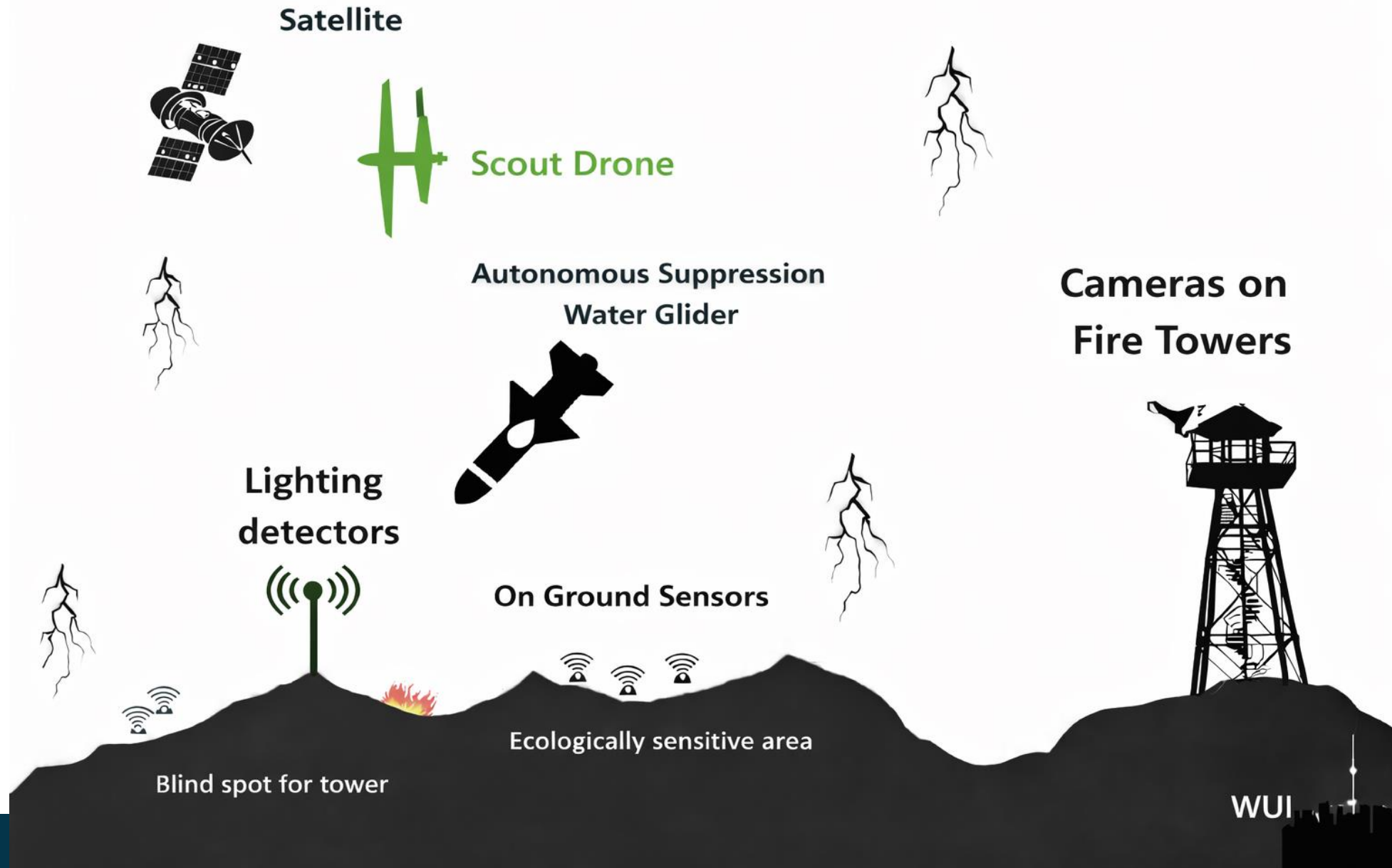


Camera early detection is sensitive to conditions

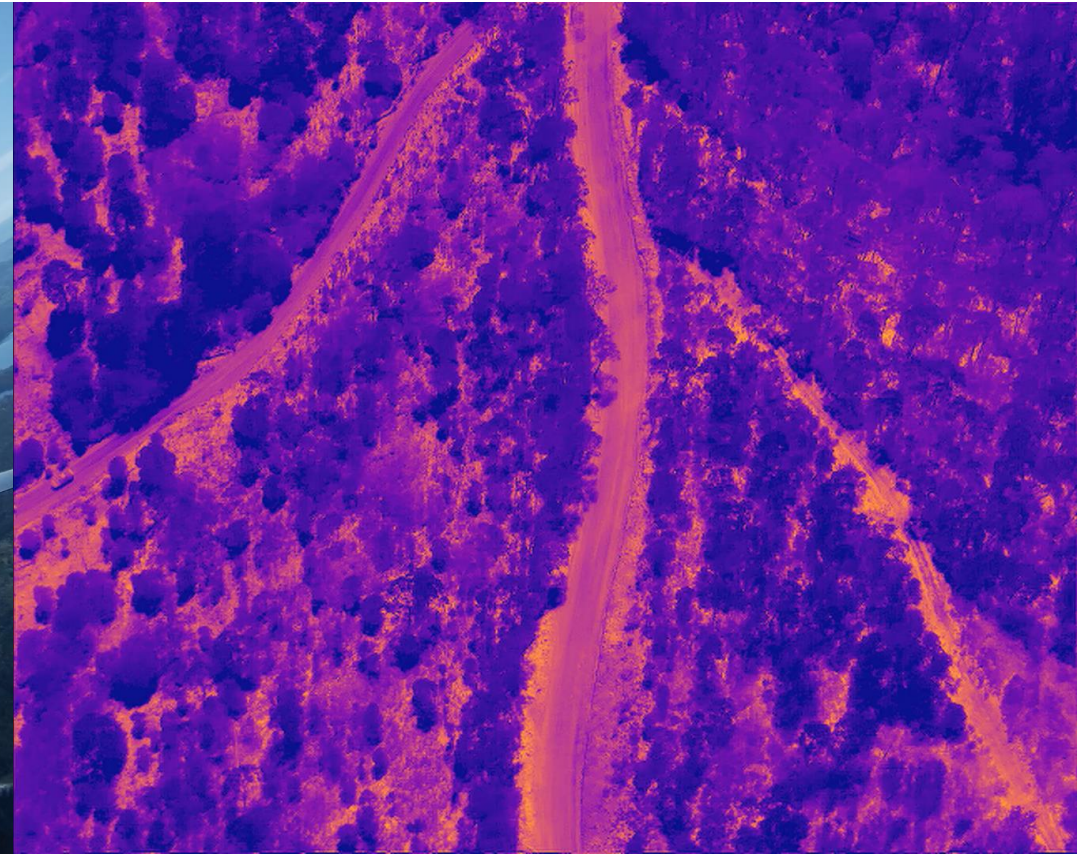


Pr detection based on prescribed burns smoke detection efficacy."

Building a Nervous System for Wildfire Risk Mitigation



Drone on a Beyond Visual Line of Sign (BVLOS) mission

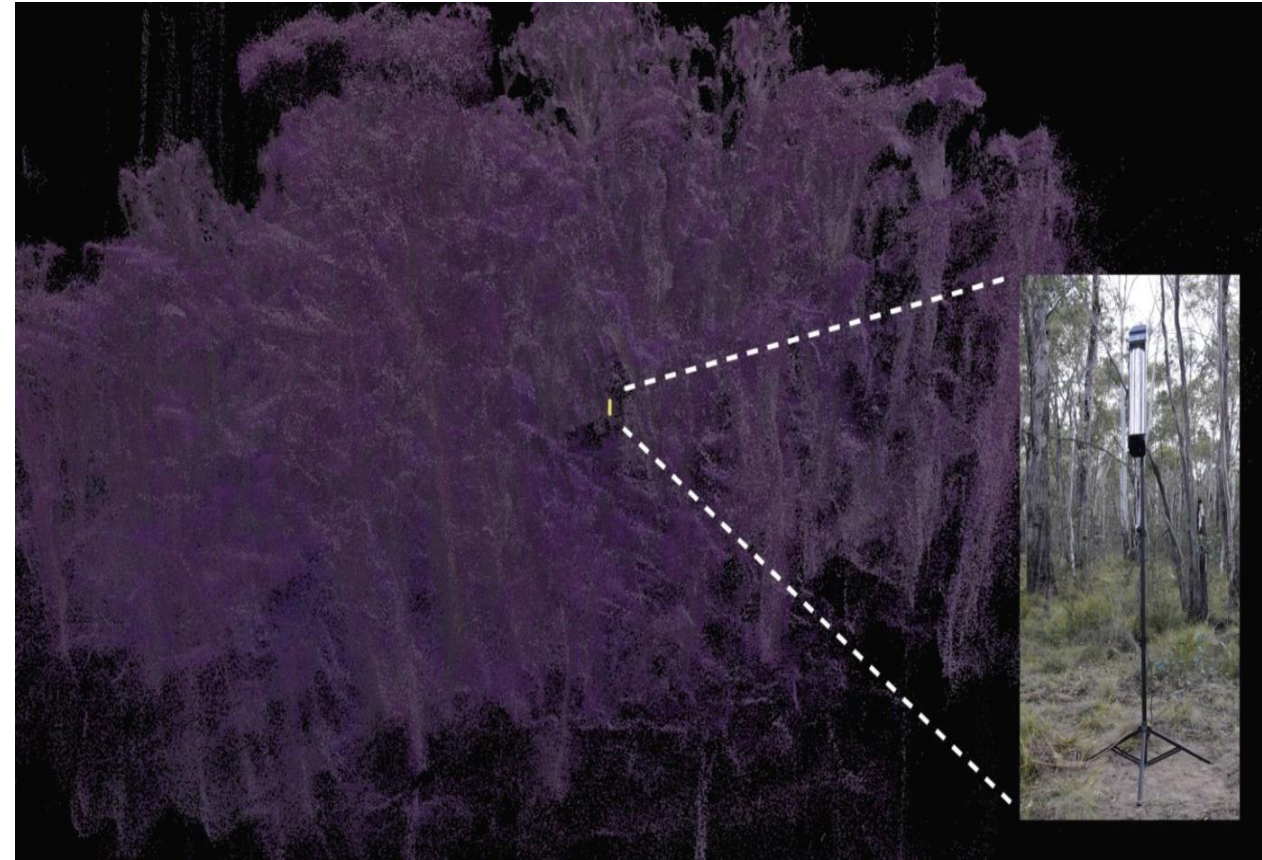


BVLOS operation detecting and confirming a controlled ignition source

Drone: 3D reconstruction of the surrounding fuel



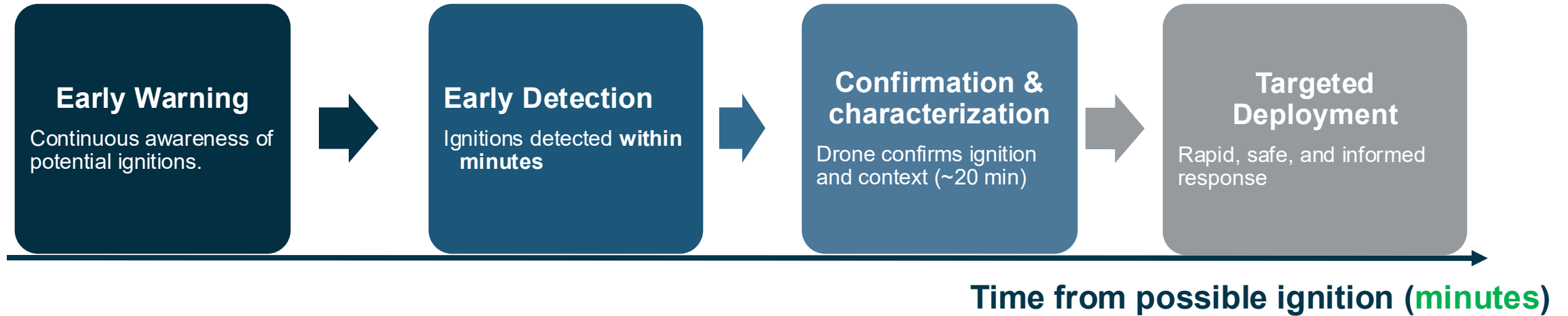
DAY



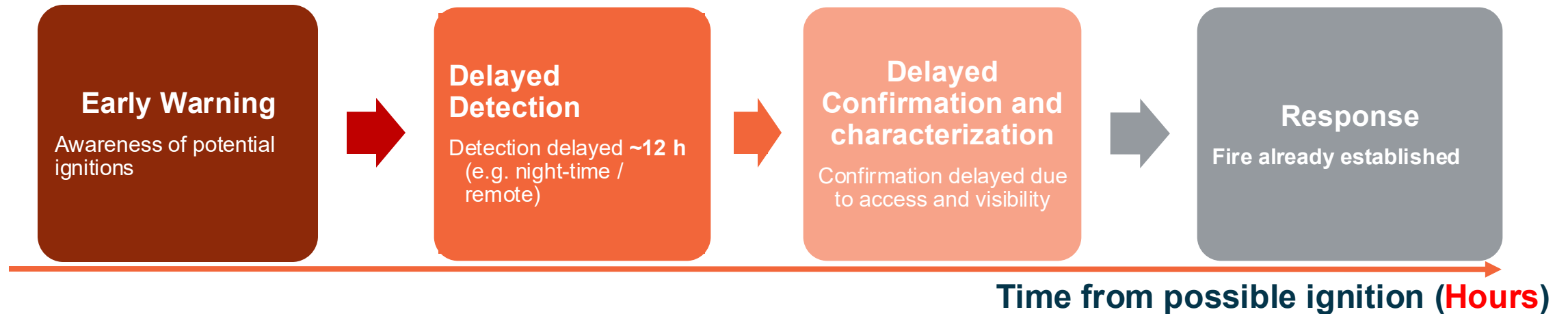
NIGHT

Integrated system: minutes rather than hours

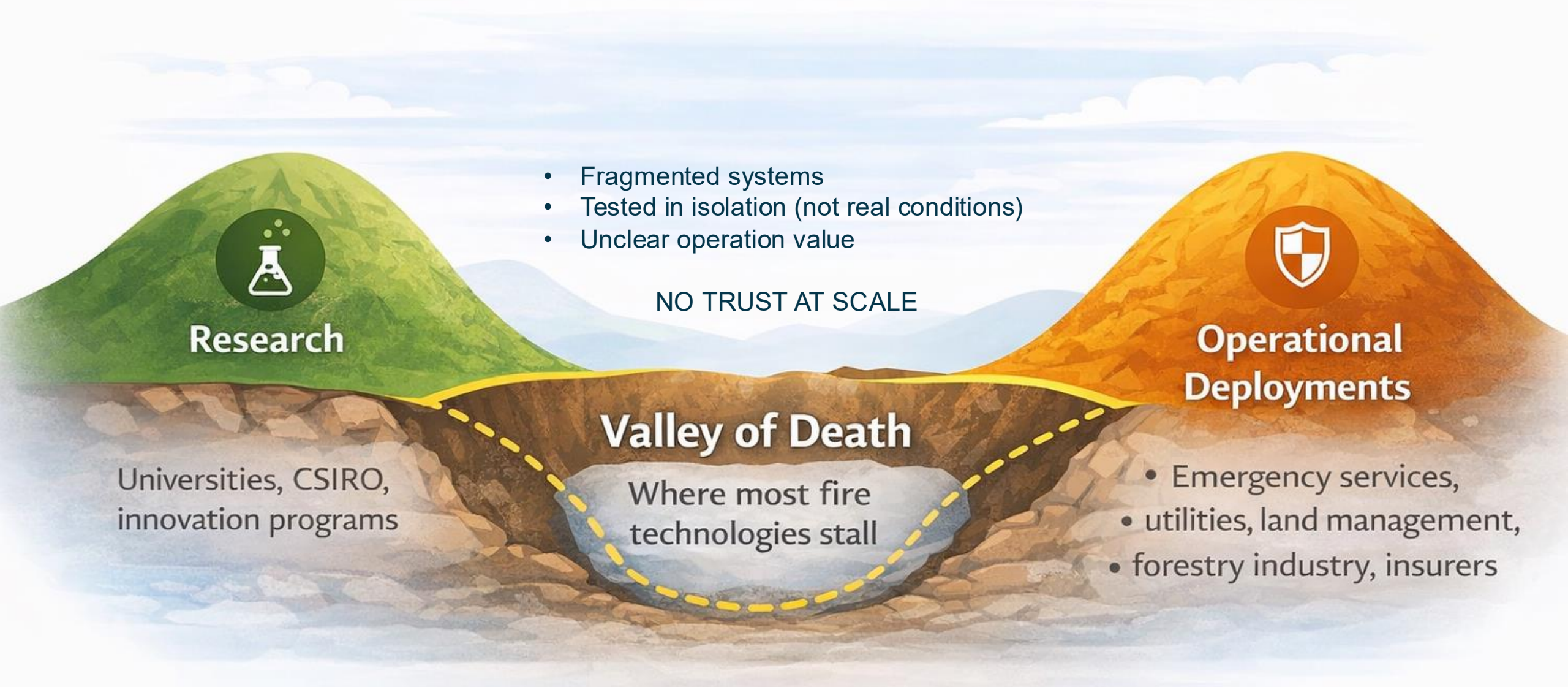
Demo of autonomous technologies



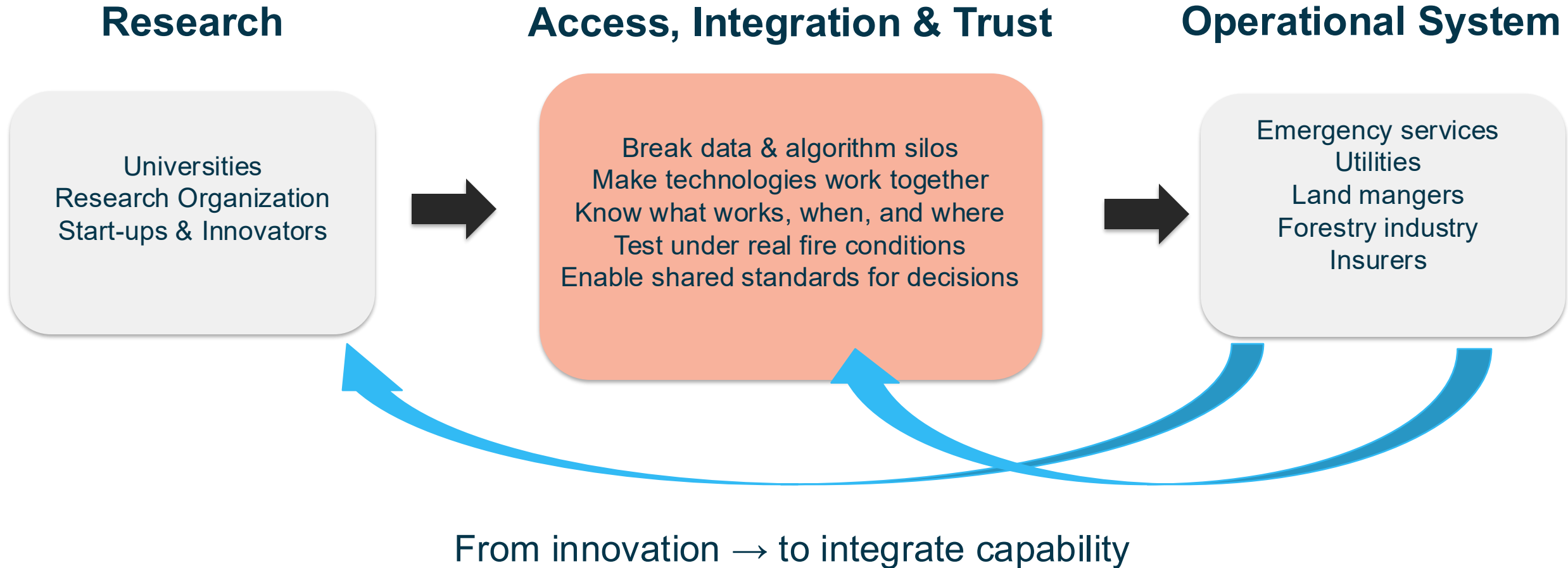
Under current operational constraints of crewed aircraft



The real gap is not innovation. It is adoption



Building the pathway to integrated systems



What this means for APEC members economies?

- **Share what can be shared:** Satellite data, validation frameworks, standards, algorithms and knowledge don't necessarily need to be recreated by every economy.
- **Adapt what must be local:** Fuel types, fire regimes, infrastructure, operational procedures and institutional capacity vary enormously across APEC.
- **Build systems, not technology silos:** Investment should connect preparedness, ignition intelligence, detection and response.
- The goal is not more data. **The goal is more time to act.**

Thank you

Contact Us

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Learn more:

