

CCST EXPERT BRIEFING SERIES

Emerging Technologies for Real-Time Response to Wildfires



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Image: NASA's Earth Observatory - smoke from 2018 Camp Fire, Hill and Woolsey Fires



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BACKGROUND

- Wildfires are a common and natural occurrence in many of California's ecosystems.
- In recent years, the severity and frequency of wildfires in California has increased as a result of a combination of many factors including prolonged drought, historic fire management practices, and a massive tree die-off following a bark beetle infestation.
- The 2018 California wildfire season was the most destructive on record.
- More than 1.8 million acres burned, causing tens of billions of dollars in damages, destroying more than 24,000 structures, and resulting in the deaths of over 100 civilians and emergency responders.
- Climate change models predict that the risk of large, destructive wildfires in California will continue to increase in the future.
- Emergency responders use a number of technologies to locate fires, forecast their movement, and share the information.

EMERGENCY RESPONSE TO WILDFIRES

Emergency response to large, rapidly spreading wildfires that threaten life and/or infrastructure involves coordination of multiple entities at the local, state, and federal level each operating with different missions and jurisdictions.

For example, firefighters are tasked with containing a fire, law enforcement is tasked with overseeing evacuations, and California Highway Patrol is tasked with maintaining roadways for safe travel.

When three major wildfires, the Camp, Hill, and Woolsey fires ignited in November 2018 the state-level emergency response included nearly 10,000 firefighters and hundreds of other responders from a number of entities (green box). In order to efficiently and effectively respond to wildfires,

STATE RESPONDERS INCLUDE:

Cal Office of Emergency Services
 CAL FIRE
 California Highway Patrol
 California National Guard
 California Conservation Corps
 Emergency Medical Services Authority
 California Department of Public Health
 California Air Resources Board
 CalVounteers
 Caltrans
 Department of General Services

emergency responders need access to reliable and timely information on the fire's location and future forecast and the ability to quickly share this information. Researchers and first responders are working together to develop and implement technologies for swift emergency response to wildfires.

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EXAMPLES: How Technology Can Help with Real-Time Wildfire Response

Emergency responders need access to reliable and timely information in order to (1) locate a fire, (2) forecast its spread, and (3) share the information quickly with other responders.

KNOW WHERE THE FIRE IS

Locate fires soon after they start to allow:

- Faster mobilization of local and statewide response.

1

EXAMPLE TECHNOLOGIES:

- Temperature/humidity sensors to detect presence of fire, infrared cameras to detect hot spots.
- UC Berkeley's FUEGO system uses fire tower cameras, satellites, and drones with sensors for early detection of fires.
- **Figure:** NASA satellite image of fire and smoke from the Camp Fire shows utility of satellites and other airborne platforms (drones, planes, etc.) for aerial tracking and monitoring of fires.



Source: NASA Earth Observatory

KNOW WHERE THE FIRE IS GOING

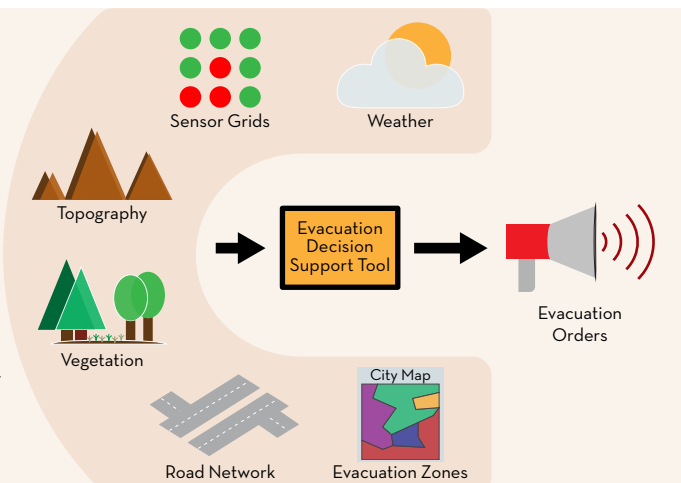
Forecast the spread of a fire to allow:

- Better direction of resources and evacuations based on current conditions.

2

EXAMPLE TECHNOLOGIES:

- UC San Diego's WIFIRE Lab uses sensors, satellites, and weather to forecast fire spread – for application statewide.
- **Figure:** Moraga-Orinda Fire District uses temperature and humidity sensors to locate wildfire along with current weather and maps of the local roads, topography, vegetation, and evacuation zones ("polygons") to inform evacuation plans.



Source: Modified from Dave Winnacker

SHARE THE KNOWLEDGE

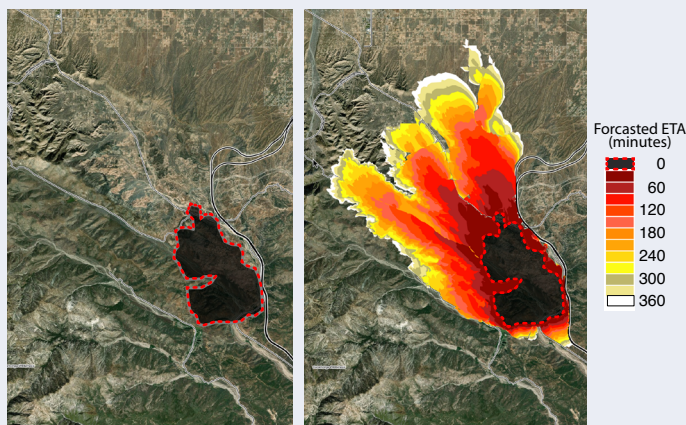
Share information quickly in a common format to allow:

- Coordination among many independent and interdependent entities.
- Access to the same information in an easily digestible form (compatible, visual, etc.).

3

EXAMPLE TECHNOLOGIES:

- **Figure:** WIFIRE's FireMap platform provides a visually intuitive map of 2016 Blue Cut fire showing the current position (left) and forecast (right).



Source: Modified from Crawl et al. 2017



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