



8TH
**INTERNATIONAL
WILDLAND FIRE
CONFERENCE**

**GOVERNANCE
PRINCIPLES:**
Towards an
International
Framework

IMPLEMENTATION OF WILDFIRE TECHNOLOGY SOLUTION IN CALIFORNIA

Lessons Learned and Path Forward

CHIEF PHILIP SELEGUE
DEPUTY CHIEF INTEL, CAL FIRE

JOAQUIN RAMIREZ, PHD
PRESIDENT & CTO, TECHNOSYLVA



After the devastating 2017 and 2018 Fire Seasons, Governor Newsom Announces Innovative Contract for Wildfire Prevention and Response April 2019

For technology solutions to

REDUCE, MITIGATE OR ELIMINATE WILDFIRE RISK



First Responders



Decision Makers



Residents & Visitors



CAL FIRE

developed a concise
*wildfire management
problem statement*
to define the issue.

Photo by Ted Schaffer

01

Early Wildfire Detection

First responders and decision makers are faced with challenges of early wildfire detection, ability to adequately dispatch the most appropriate emergency resources to the scene, and the ability to make appropriate public notifications.

02

Prediction of Wildfire's Path

Decision makers are further challenged to make a definitive prediction of the path of travel of a wildfire based on the terrain fuels, the current and predicted weather factors, and the topography.

TIMELINE

April 2019

01

Request for innovative ideas is released.

August
2019

02

Technosylva is selected for POC.

131 Total Submissions

October - November 2019

03

Evaluation of Technosylva POC solution.

Four CAL FIRE Units

May 2020 - June 2020

04

Technosylva awarded statewide contract and implementation begins.

3-year Contract + 2 extension



About Technosylva

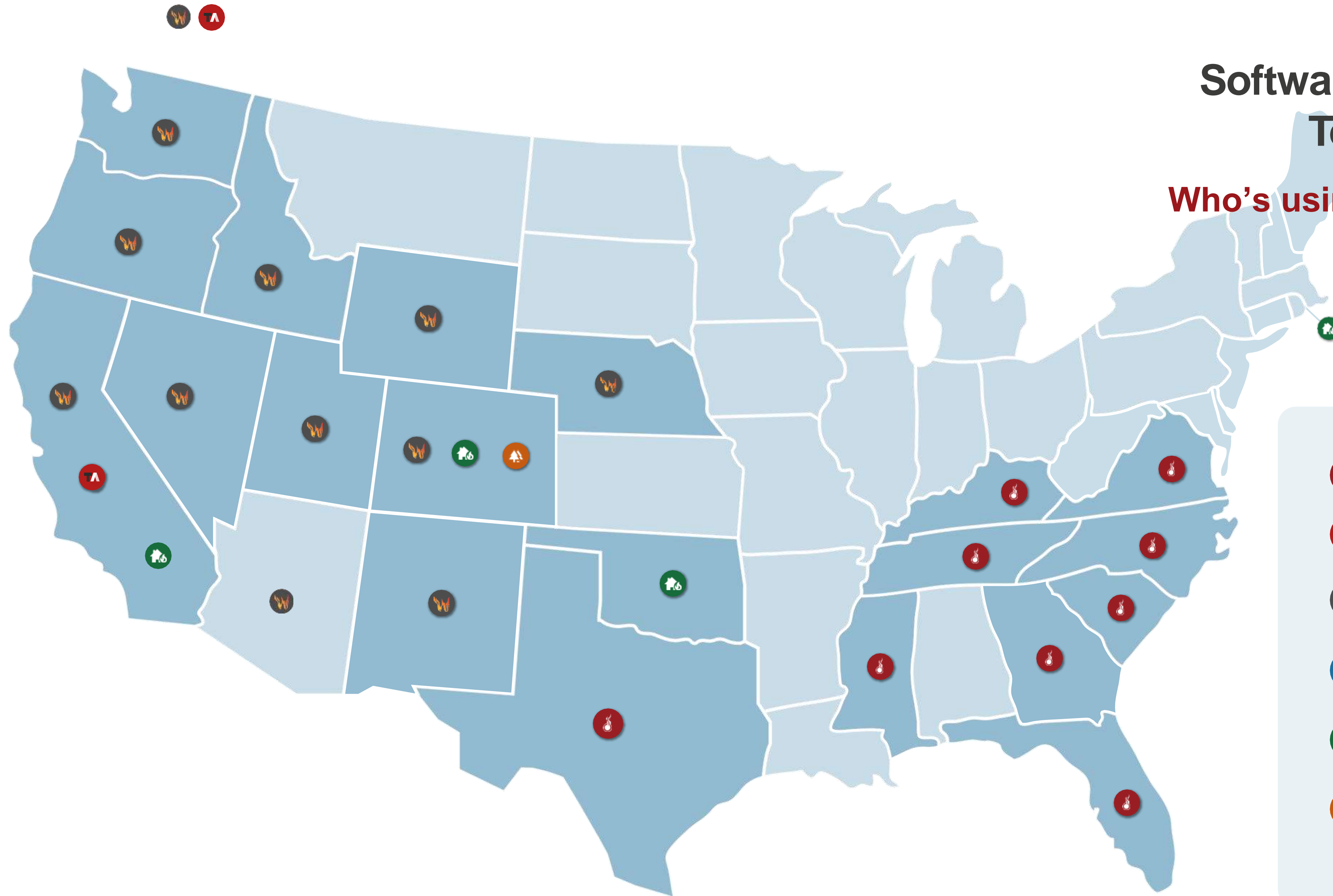
WHO WE ARE / WHAT WE DO







- **We are wildland fire.**
- **We are not a startup & we are not located in Silicon Valley.**
- **Leon, Spain office was established in 1997.**
- **La Jolla, CA office was established in 2013.**
- **We provide advanced technology solutions for wildland fire protection planning, analysis & modeling, and operational response.**
- **We are 90+ people dedicated to wildland fire.**
- **We are a science & technology company.**
- **We are steeped in scientific R&D with a Science & Data Analytics team of 25 members, including 8 PhDs.**
- **In the last two years we have coauthored 31 peer reviewed papers, in collaboration with top researchers worldwide.**

US & Canada

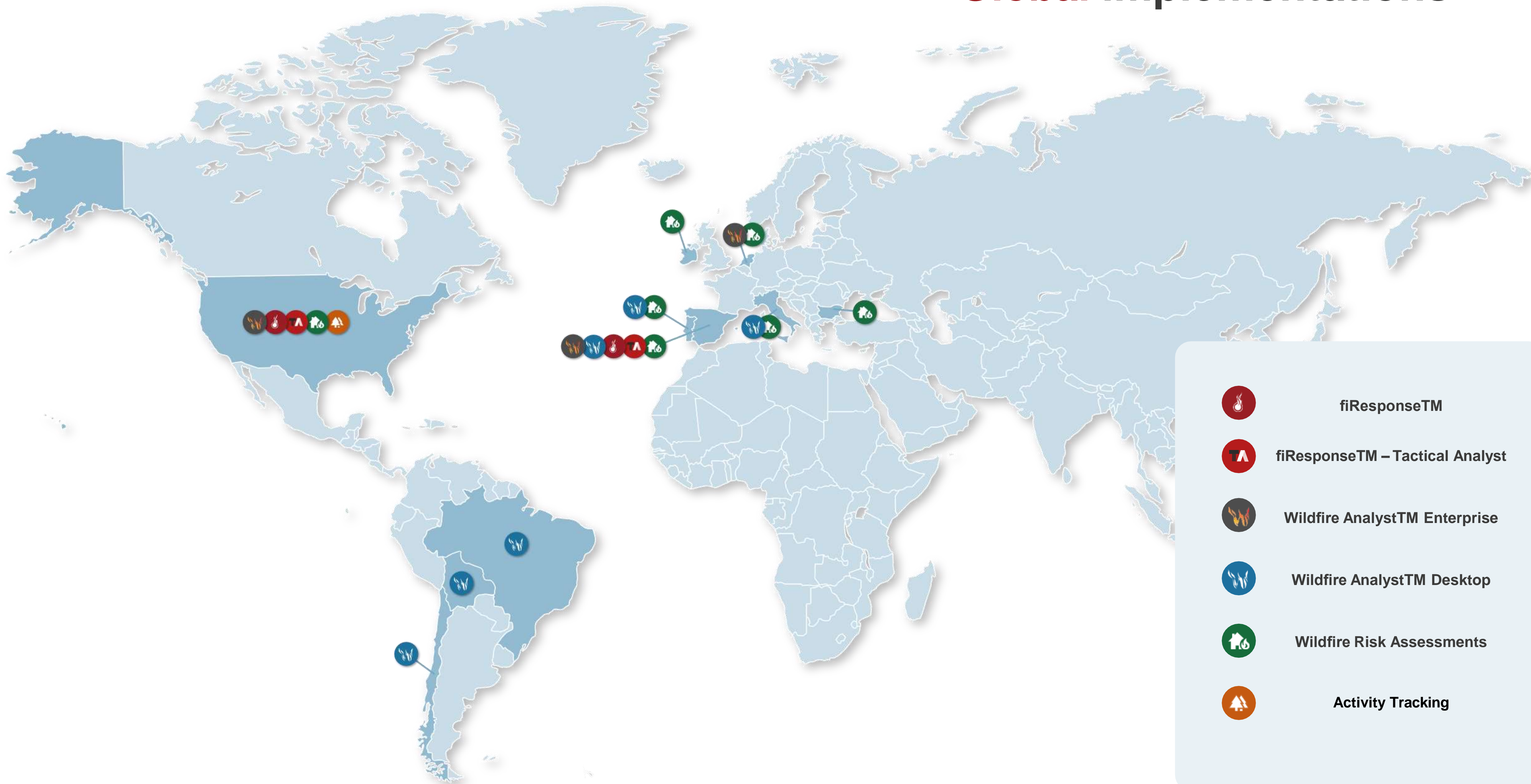
Software Deployments & Technical Services

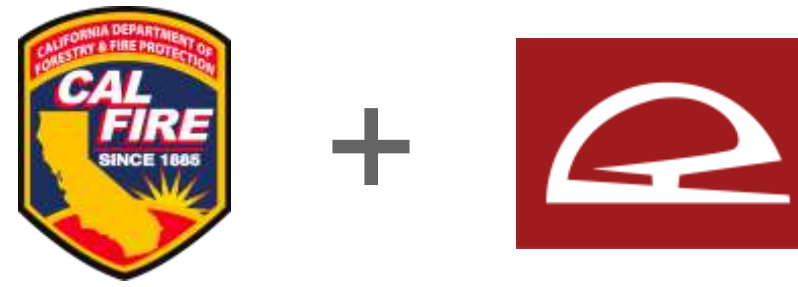
Who's using our technology?



-  fiResponse™
-  fiResponse™ – Tactical Analyst™
-  Wildfire Analyst™ Enterprise Wildfire
-  Analyst™ Desktop
-  Wildfire Risk Assessments
-  Forest Activity Tracking

Global implementations

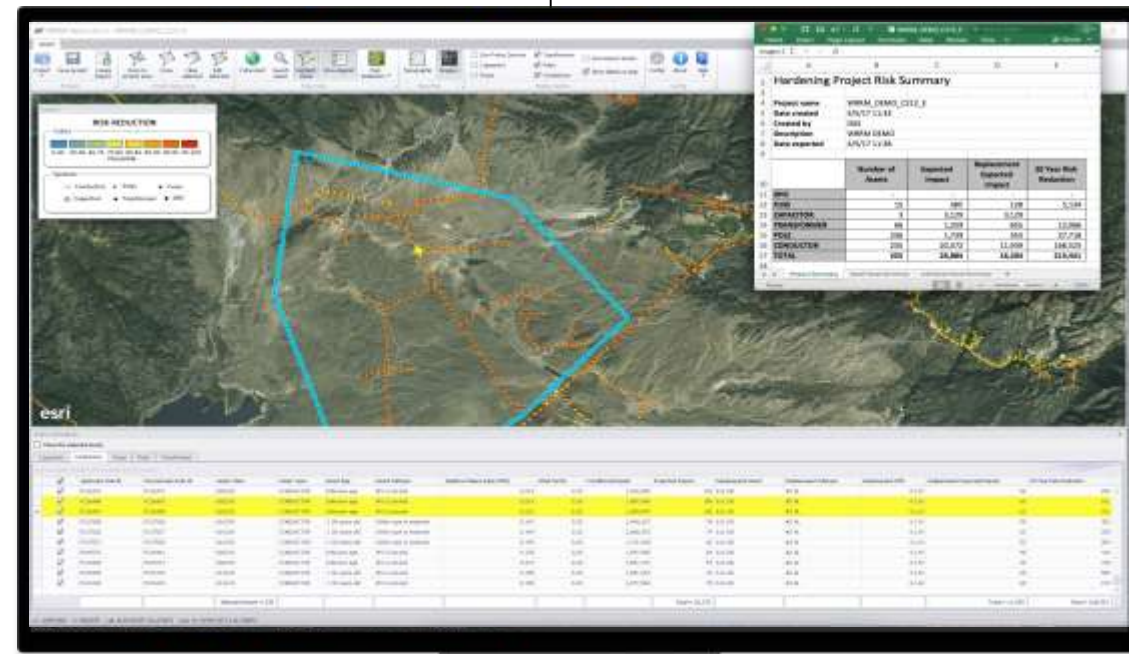




THE CAL FIRE TECHNOSYLVA SOLUTION

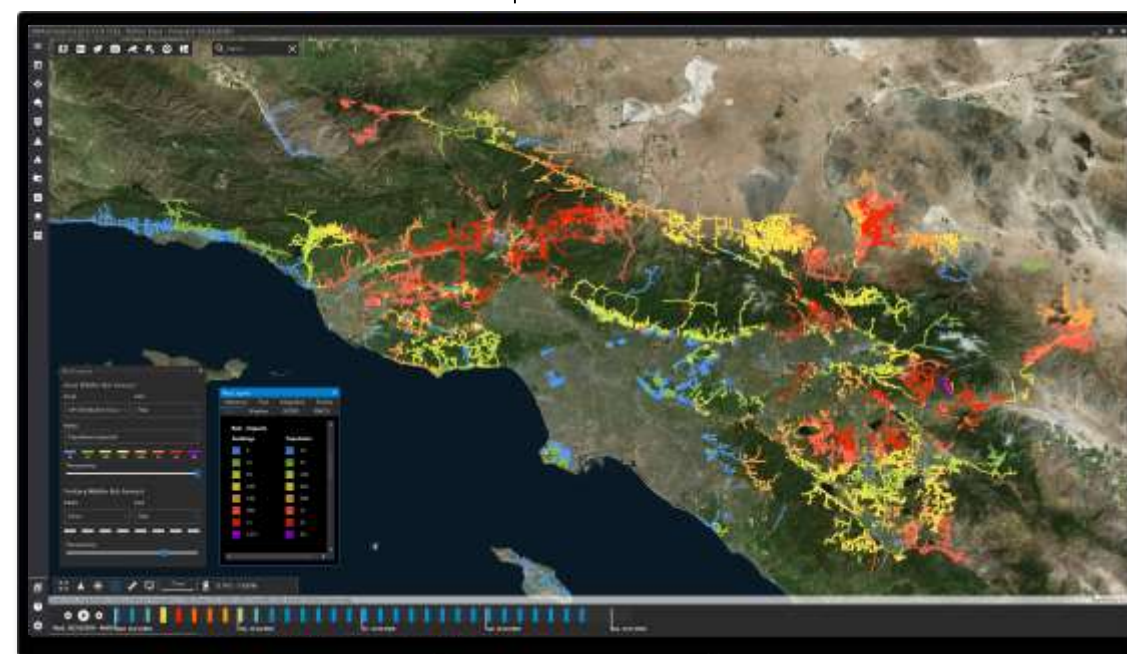
Wildfire Analyst™

Tactical Analyst™



1

 **FIREPLANNER**



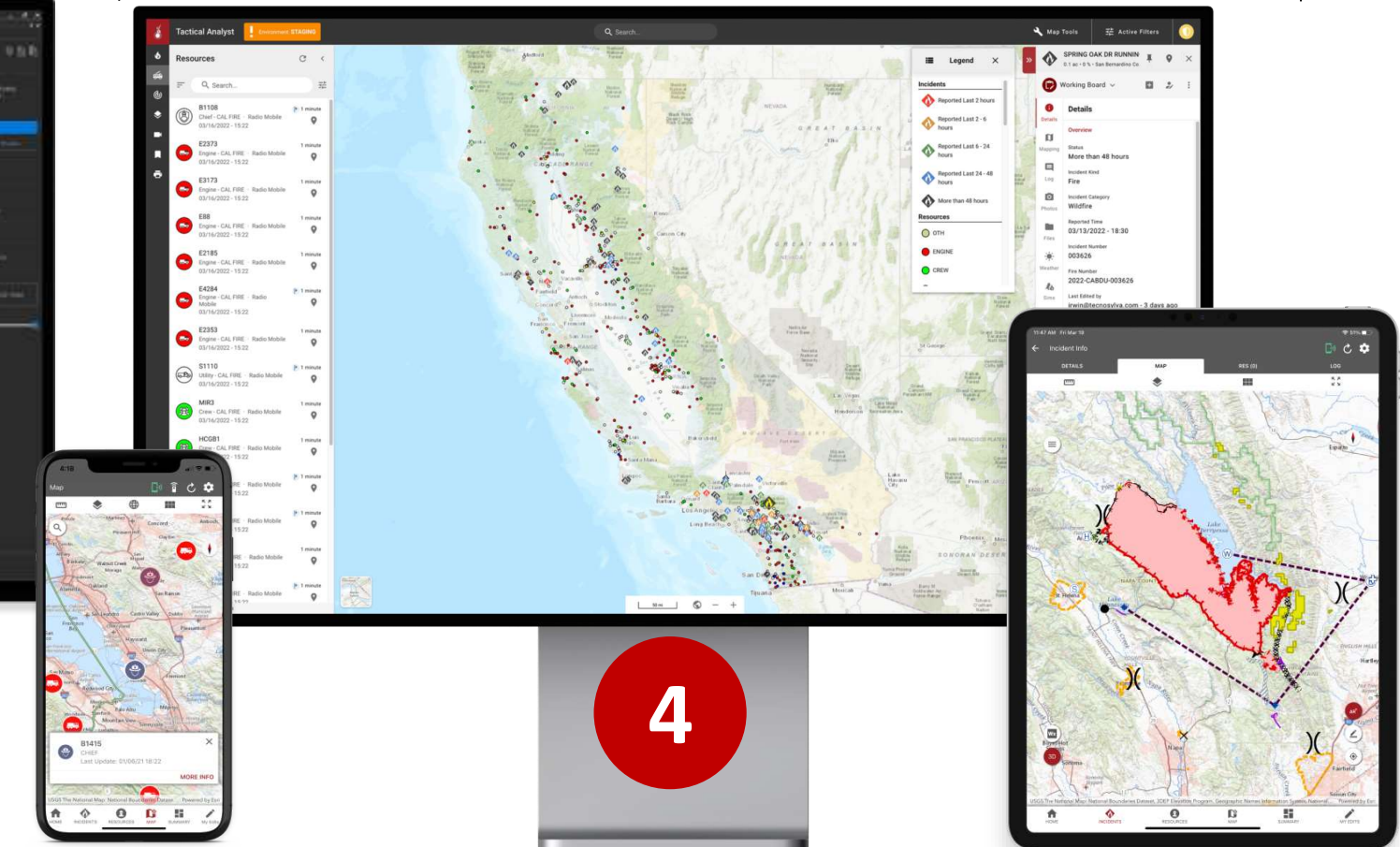
2

 **FIRECAST**



3

 **FIRESIM**



4



TACTICAL ANALYST

Mitigation Planning,
Historical and Future
Scenarios

Planning
Preparation
Prevention

Risk forecast hourly up to
7 days
Initial and Extended Attack

Pre-Suppression
Dispatching

On Demand Real-time
Simulation with Impacts
Model Agnostic

Suppression
Post-Fire

Operational Support
for Active Fire
Situation Awareness

Suppression

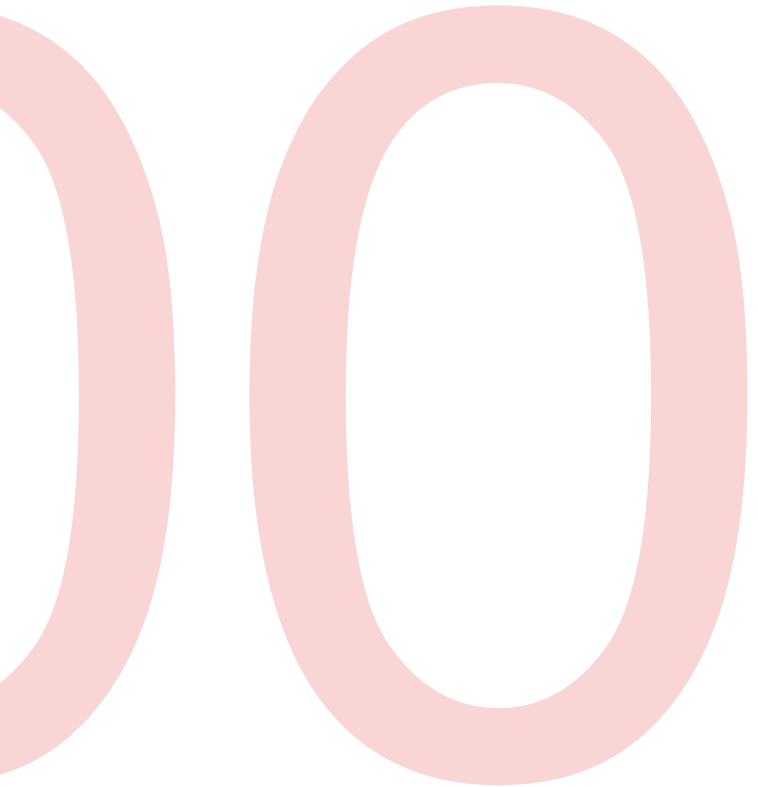


72,423 sims / >30,000 Incidents / 2700 FireGuard / >300 billions sims from 2020



WILDFIRE ANALYST™ CORE CAPABILITIES

Wildfire risk forecasts are derived daily, providing a 5+ day forecast of fire conditions, supporting Units' preparedness.



The screenshot displays the WFA Enterprise [2.2.3.5 CAL FIRE - STG] - Techno Devs - Forecast: 10/12/2021 interface. The main map shows a wildfire risk forecast for California, with colors ranging from blue (low risk) to red (high risk). A 'Risk Forecast' panel is open, showing 'Fire Size Potential' with a 'Raw' unit and a color scale from 0 to 10k. The 'Admin Division' is set to 'All - Statewide'. The right-hand panel, titled 'FireSim', contains configuration options for '1. Ignitions' (Start Drawing, Open Ignitions), '2. Details' (Simulation Mode: Fire Spread (NRTFB), Simulation Type: Test, Name: [empty]), and '3. Adjust Data' (Weather Data: Forecast, Enable WindNinja: checked, Forecast source: WFA-E Forecast, Surface Fuel: None/Custom, Fuel Scenario: CA - TSYL 2021 - October 1st). A 'Run Simulation' button is at the bottom of the right panel. The bottom of the interface shows a timeline from Tue, 10/12/2021 - 00:00 to Sat, 10/16/2021.

The screenshot displays the FireSim software interface. On the left, a map shows a fire simulation area in orange and yellow, with a red outline indicating the fire's perimeter. The interface is divided into several panels:

- Inputs:** 20210917-1.1-1400, 8 hr • 09/17/2021 14:16 - 09/17/2021 22:16, Fireguard • Fireguard Harvester, Fuel Scenario: CA - TSYL 2021 - September 2nd.
- Initial Attack Assessment:** 5 - Extreme (IAA), 5 - Extreme (Fire Behavior Index), N/A (Terrain Difficulty Index).
- Impact Analysis:** 3461.27 ac (Size), 0 (Population), 0 (Places), 1 (Buildings Impacted), 0 (Buildings Destroyed), 0% (Avg. Building Loss Factor).
- Simulation Outputs & Animation:** 09/17/2021 16:00, Show Perimeters, Fire Behavior Layer, Animated Simulation, Transparency.
- Wind Visualization:** Barbs, Animation.
- Comments:** Share Comment.

On the right, a table titled "Load Existing Simulation" lists impacted properties:

Name	Sim_Inc Code	Created Time	IAA	Size (ac)
User: Fireguard Harvester				
20210917-1.1-1400	20210917-1.1-1400	09/17/2021 14:18	5	3,461.27
User: IrwinHarvester				
111	2021-CARRU-128894	09/17/2021 21:01	0	0.00
6TH ST / HY 74 E	2021-CARRU-128711	09/17/2021 13:53	0	0.00
BUCKHORN SUM...	2021-CASHU-010256	09/17/2021 09:38	1	235.51
CA - SNT - 00058761	2021-CASNT-000004	09/17/2021 17:20	0	0.00
CAMINO REAL / LI...	2021-CARRU-128822	09/17/2021 18:21	0	0.00
COUNTY ROAD 25...	2021-CALNU-016793	09/17/2021 07:53	0	0.00
EMIGRANT	2021-CAANF-003521	09/17/2021 15:57	4	3,188.20
ENDERT BEACH R...	2021-CAHUU-009018	09/17/2021 13:27	1	9.78
ENDERT BEACH R...	2021-CAHUU-009018	09/17/2021 13:11	0	0.00
FRESNO	2021-CAFKU-014964	09/17/2021 09:23	1	25.22
GLEN	2021-CARRU-128927	09/17/2021 23:43	0	0.00
HAPPY VALLEY RD...	2021-CASHU-010274	09/17/2021 15:44	2	424.60
HY 111 / AVE 66	2021-CARRU-128748	09/17/2021 15:28	3	354.78
JACQUETTA AV / ...	2021-CARRU-128761	09/17/2021 16:50	0	0.00
JOHNSTON AV HE...	2021-CARRU-128708	09/17/2021 13:52	3	259.16
KENTUCKY	2021-CANEU-0248...	09/17/2021 11:48	1	206.35
KENTUCKY GREEN...	2021-CANEU-0248...	09/17/2021 11:45	1	164.16
LAC-295246	2021-CALAC-295246	09/17/2021 01:38	4	309.73
LAC-295308	2021-CALAC-295308	09/17/2021 04:17	0	0.00
LAC-295702	2021-CALAC-295702	09/17/2021 12:07	0	0.00
LAC-295794	2021-CALAC-295794	09/17/2021 13:45	4	2,669.01
LAC-296049	2021-CALAC-296049	09/17/2021 17:03	0	0.00
LAC-296153	2021-CALAC-296153	09/17/2021 18:58	0	0.00
LAC-296154	2021-CALAC-296154	09/17/2021 18:58	0	0.00
LAC-296167	2021-CALAC-296167	09/17/2021 19:08	0	0.00
OAKDALE	2021-CAMMU-020...	09/17/2021 17:00	1	26.34
PANSY ST MURR	2021-CARRU-128509	09/17/2021 02:06	0	0.00
PARK	2021-CASLU-013546	09/17/2021 19:32	0	0.00
ROLLINS	2021-CANEU-024810	09/17/2021 03:33	1	66.88
ROLLINS LAKE RD...	2021-CANEU-024810	09/17/2021 03:32	1	84.20
TWIN	2021-CAMVU-0177...	09/17/2021 02:45	0	0.00
VOLCOM	2021-CAINF-002538	09/17/2021 10:02	1	418.46
VOLCUM	2021-CAINF-002538	09/17/2021 08:35	1	372.70
WASH	2021-CACDD-013843	09/25/2021 20:42	1	135.62
WASH	2021-CACDD-013843	09/25/2021 15:24	3	137.17

Integration with CAL FIRE dispatch system & FireGuard provides automatic predictions for each fire.

01

Real-time fire spread predictions in seconds.

02

The screenshot displays the WFA Enterprise [2.2.3.5 CAL FIRE - STG] - Techno Devs - Forecast: 09/17/2021 interface. The main window shows a 3D topographic map of a mountainous region with numerous red dots representing ignition points. A toolbar on the left contains various navigation and tool icons. The right sidebar, titled 'FireSim', is divided into 'Inputs' and 'Results' sections. Under 'Inputs', there are three main sections: 1. Ignitions, with 'Start Drawing' and 'Open Ignitions' buttons; 2. Details, which includes dropdown menus for 'Simulation Mode' (set to 'Fire Spread (NRTFB)'), 'Simulation Type' (set to 'Test'), and 'Name'; a table for 'Hours (1-84)' with columns for 'Start Time' (09/17/2021 09:00) and 'End Time' (09/17/2021 17:00); and '3. Adjust Data' with options for 'Weather Data' (Forecast), 'Enable WindNinja' (checked), 'Forecast source' (WFA-E Forecast), and 'Surface Fuel' (None/Custom). A 'Run Simulation' button is located at the bottom of the sidebar. The bottom of the interface features a timeline with a play button and a color-coded bar representing the simulation period from Friday, 09/17/2021 - 09:00 to Tuesday, 09/21/2021. The status bar at the very bottom shows 'Maxar, Esri, HERE, Garmin, GeoTechnologies, Inc.' and 'Powered by Esri'.

WFA Enterprise [2.2.3.5 CAL FIRE - STG] - Techno Devs - Forecast: 12/01/2021

The screenshot displays the FireSim software interface. On the left, a map shows a fire simulation area with a color gradient from red (high intensity) to yellow (low intensity). The 'Impact Analysis' panel in the center-right shows a table of building impacts. The 'Results' panel on the far right provides a summary of the simulation, including an initial attack assessment and impact statistics.

Distance (mi)	Direction	Time To Impact	Impact Datetime
0.64	SSE	5h 41m	09:28
0.07	ENE	5h 42m	09:29
1.46	W	5h 42m	09:29
0.32	SSE	5h 44m	09:31
1.46	W	5h 46m	09:33
1.46	W	5h 47m	09:34
1.52	W	5h 48m	09:35
1.47	W	5h 48m	09:35
1.46	W	5h 50m	09:37
3.13	WSW	5h 50m	09:37
1.46	W	5h 50m	09:37
3.55	SW	5h 51m	09:38
3.14	WSW	5h 51m	09:38
1.47	W	5h 51m	09:38
1.49	W	5h 52m	09:39
1.03	WNW	5h 52m	09:39
1.05	WNW	5h 53m	09:40
1.54	W	5h 55m	09:42
1.02	W	5h 55m	09:42
1.54	WSW	5h 55m	09:42
0.36	SSE	5h 55m	09:42
0.36	SSE	5h 55m	09:42
0.32	SSE	5h 55m	09:42
1.53	W	5h 57m	09:44
1.24	W	6h 1m	09:48
1.60	W	6h 3m	09:50
1.00	W	6h 3m	09:50
1.01	W	6h 3m	09:50
3.04	WSW	6h 5m	09:52

Initial Attack Assessment

3 - High IAA	3 - High Fire Behavior Index	N/A Terrain Difficulty Index
------------------------	--	--

Impact Analysis Summary

6163.64 ac Size	247 Population	8 Places
351 Buildings Impacted	0 Buildings Destroyed	0 % Avg. Building Loss Factor

Simulation Outputs & Animation

12/01/2021 10:00 Show Perimeters

Fire Behavior Layer

Arrival Time Vector (h)

Transparency

Wind Visualization

Barbs Animation

Comments

Share Comment

Buildings: 351

Buildings Number vs Simulation Hour graph

Maxar, Microsoft, Esri, HERE, Garmin

Powered by Esri

Wed, 12/01/2021 - 10:00 | Wed, 12/01/2021 | Thu, 12/02/2021 | Fri, 12/03/2021 | Sat, 12/04/2021 | Sun, 12/05/2021

Automatic analysis of possible impacts to people and buildings.



4

Automatic assessment of initial attack success potential for each fire.

WFA Enterprise [2.2.3.5 CAL FIRE - STG] - Techno Devs - Forecast: 12/01/2021

Additional Results

IAA	Fire Behavior	Weather	Adjust
3 - High			
Size (1hr)	15.7 ac		
Avg. Slope	23%		
Fire Behavior Index	● 3 - High		
Flame Length	5.76 ft		
ROS	21.3 ch/h		
Terrain Difficulty Index	● N/A		
TDI (2hr)	N/A		
TDI (8hr)	N/A		
Growth Potential Index	● 3 - Active		
Perimeter (1hr)	0.5 mi		
Area (a2/a1)	509.7 %		

FireSim

Inputs

LAC-384029
8 hr • 12/01/2021 03:47 - 12/01/2021 11:47
Incident • IrwinHarvester
Fuel Scenario: CA - TSYL 2021 - October 1st

Results

Initial Attack Assessment

3 - High	3 - High	N/A
IAA	Fire Behavior Index	Terrain Difficulty Index

[Open Additional Results](#)

Impact Analysis

6163.64 ac	247	8
Size	Population	Places
351	0	0 %
Buildings Impacted	Buildings Destroyed	Avg. Building Loss Factor

[Open Impact Analysis Table](#)

Simulation Outputs & Animation

12/01/2021 10:00 Show Perimeters

Fire Behavior Layer

Animated Simulation

Transparency

Wind Visualization

Barbs Animation

Comments

[Share Comment](#)

Maxar, Microsoft, Esri, HERE, Garmin

Powered by Esri

Wed, 12/01/2021 - 10:00 Wed, 12/01/2021 Thu, 12/02/2021 Fri, 12/03/2021 Sat, 12/04/2021 Sun, 12/05/2021

WFA Enterprise [2.2.3.5 CAL FIRE - STG] - Techno Devs - Forecast: 07/05/2020

FireSim

Inputs Results

Test - CREWS - 07092020 135018
12 hr • 07/05/2020 13:00 - 07/06/2020 01:00
Test • jramirez
Fuel Scenario:

Initial Attack Assessment

5 - Extreme IAA	3 - High Fire Behavior Index	N/A Terrain Difficulty Index
---------------------------	--	--

Open Additional Results

Impact Analysis

5272.27 ac Size	329 Population	0 Places
145 Buildings Impacted	0 Buildings Destroyed	0 % Avg. Building Loss Factor

Open Impact Analysis Table

Simulation Outputs & Animation

07/05/2020 12:00 Show Perimeters

Fire Behavior Layer

Animated Simulation

Transparency

Wind Visualization

Barbs Animation

Comments

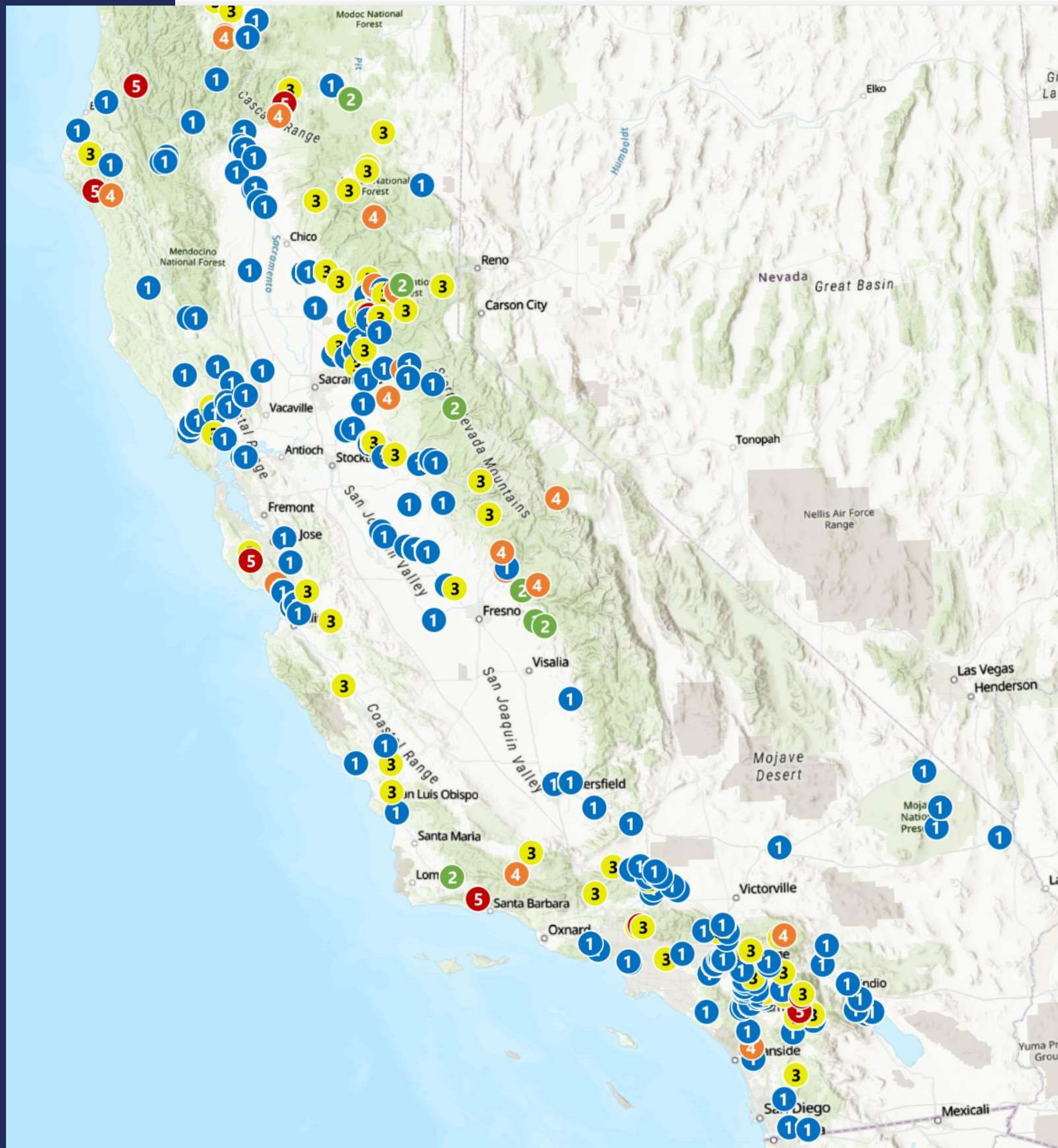
Share Comment

Maxar Powered by Esri

Sun, 07/05/2020 - 12:00 Sun, 07/05/2020 Mon, 07/06/2020 Tue, 07/07/2020

5

Integration with
detection
technologies
facilities
verification of
predictions &
on-going
calibration.



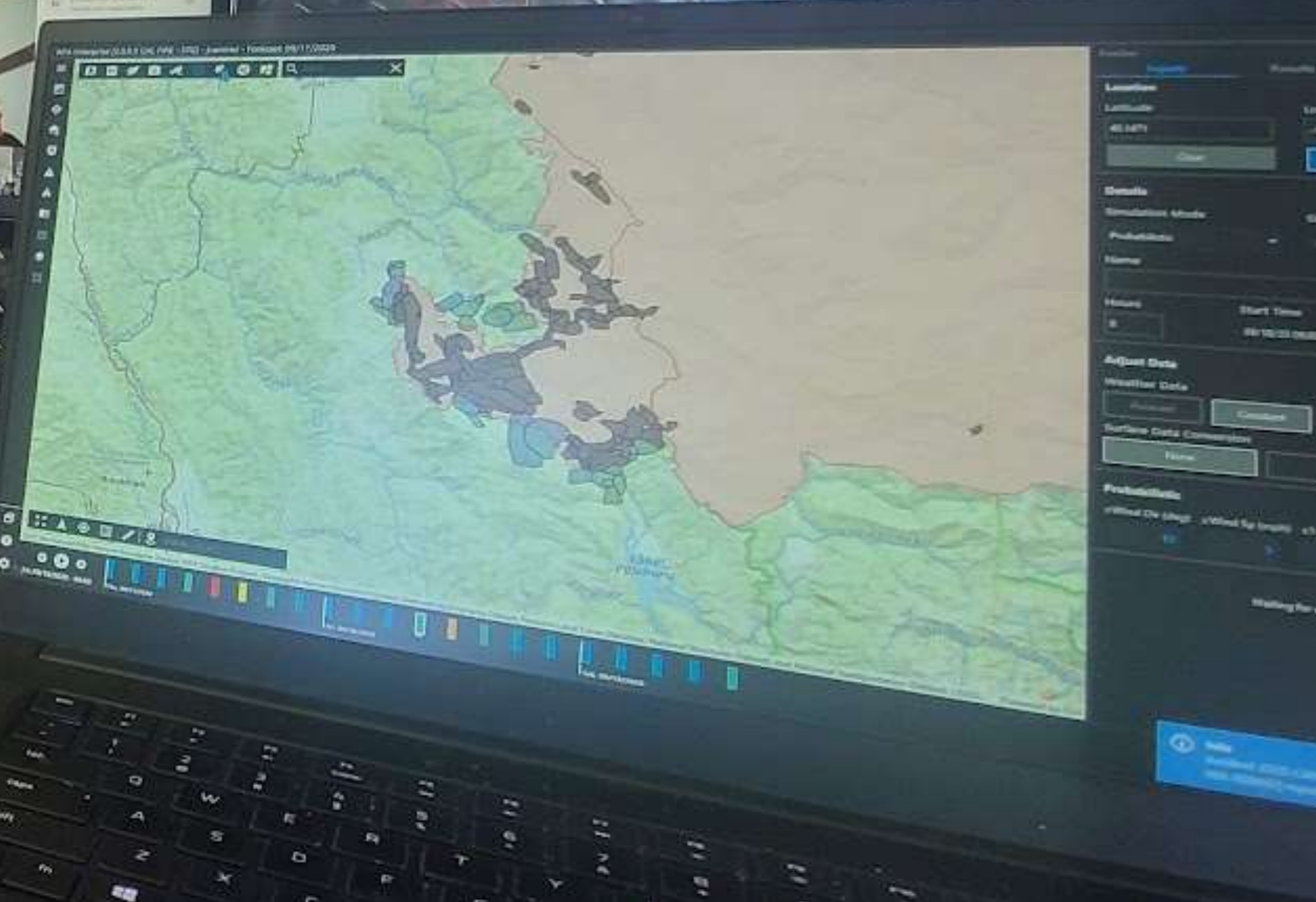
066

Every alert, coming from CAD, FireGuard, Hotspots and Lighting Strikes are automatically simulated and evaluated with an Initial Attack Assessment Index from 1 to 5 to provide intel from the detection time to units on the field

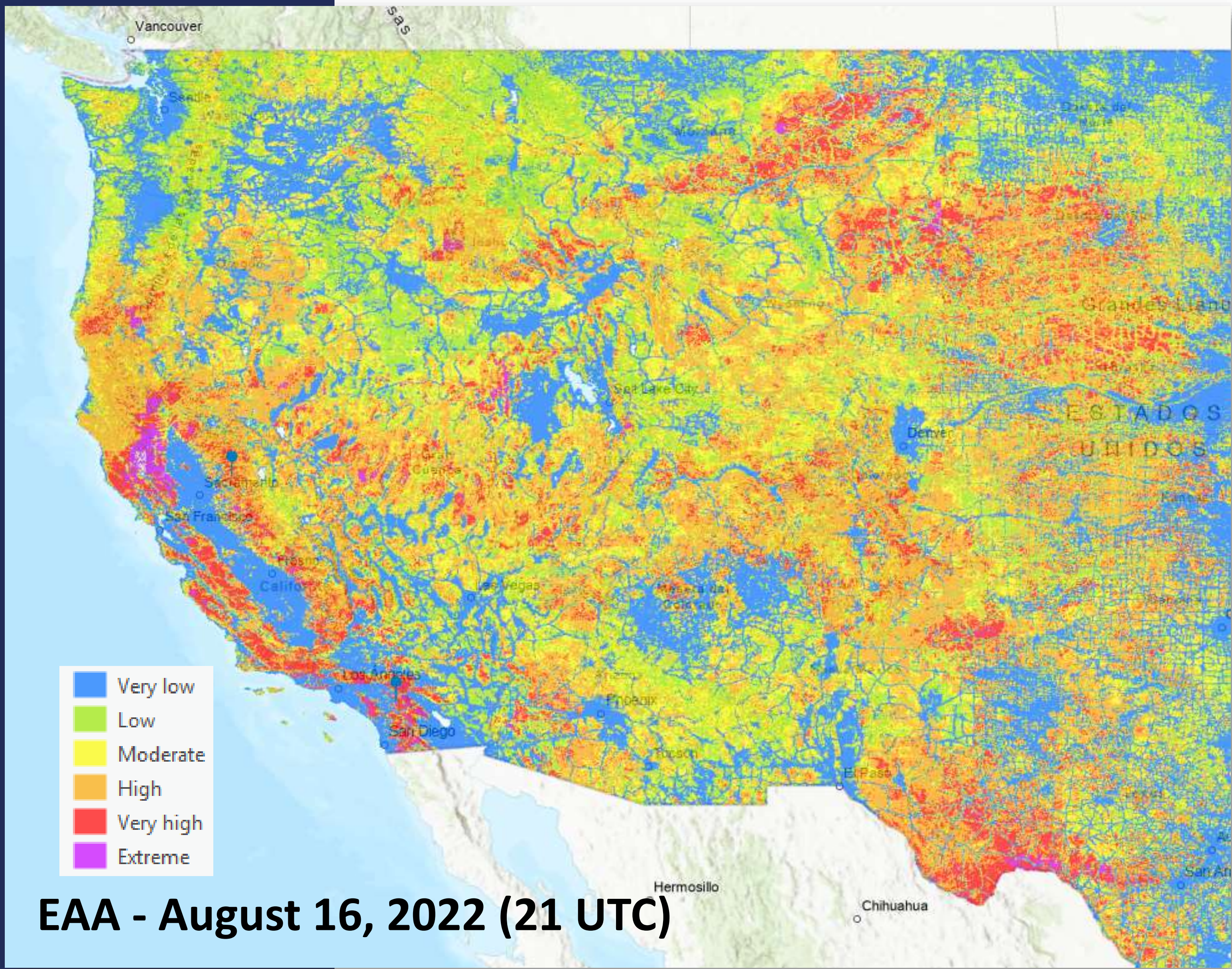
EAA: On going Major Incidents



FBAN



Troy Velin, FBAN at August Complex, Sept 2020

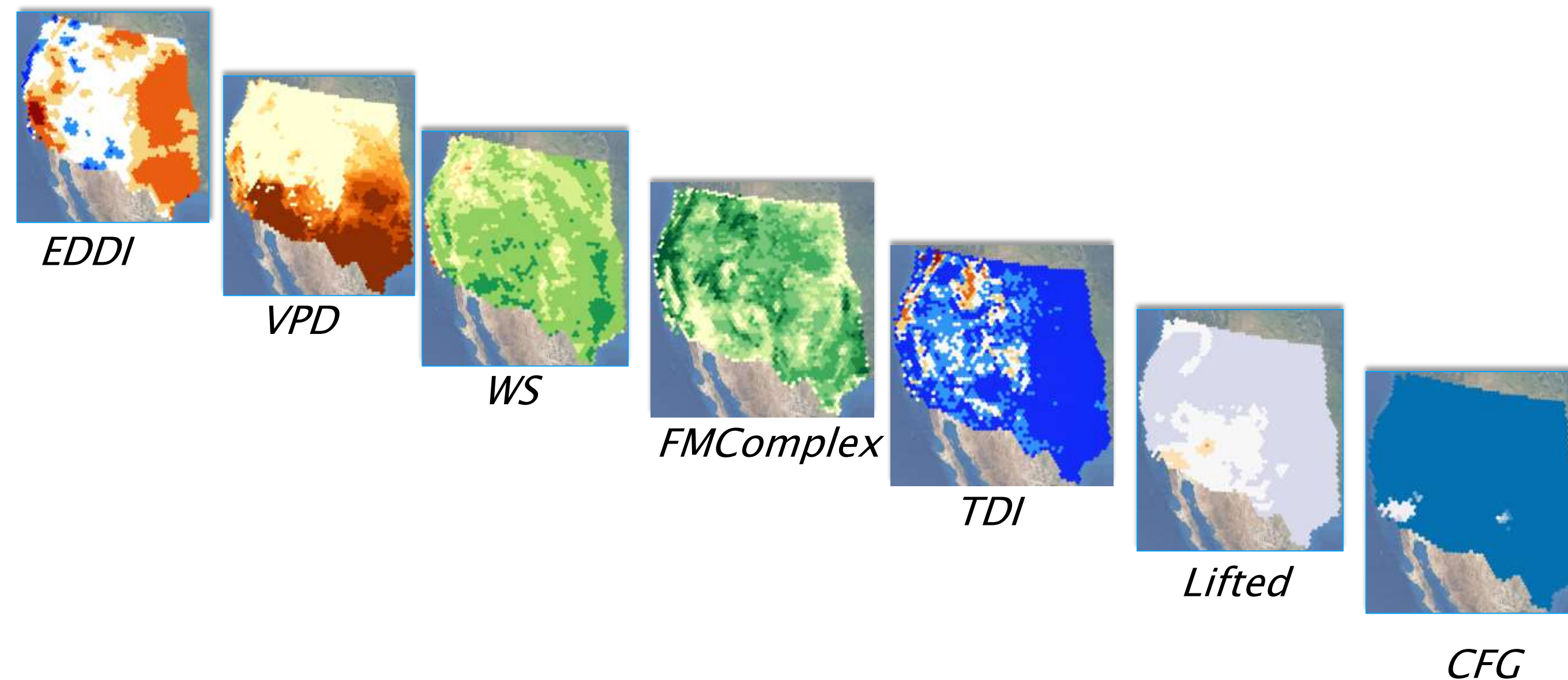


Extended Attack Assessment Index supports incidents that escaped Initial Attack, including variables outside of actual quasiempirical models, supported by ML

Extended Attack Assessment Index (EAA)

EAA is based on different parameters such as fuels, drought, meteorology, physiological response of fuels to environmental conditions, as well as instability conditions or the probability of occurrence of convective conditions.

Through machine learning processes and based on VIIRS data for fire activity, we analyzed the contribution of each variable to EAA to improve model's performance.



09



Wildfire Analyst

Extended Attack Metrics for Current Incidents

Report Generated at: 05/11/2023 13:59 PM



Incident	Acres	Code	05/11	05/12	05/13	05/14	05/15	05/16	05/17
BIG PINES RX		2023-CAANF-001106	1.2	4.9	10.8	11.3	11.2	12.4	8.9
Butterfly RX		2023-CAPNF-000229	5.6	25.8	27.5	25.1	10.6	22.6	25.6
CANAL	0.01	2023-CARRU-067608	1.7	1.2	1.5	2.4	1.5	1.8	1.4
CASE		2023-CARRU-067559	0.3	0.6	1.2	1.7	1.0	1.0	1.6
CESAR CHAVEZ ST COAC		2023-CARRU-067712	1.0	1.0	0.8	0.9	0.8	0.9	0.9
DESERT		2023-CARRU-067384	1.0	0.6	0.4	0.4	0.4	0.5	0.6
DILLON	0.01	2023-CARRU-068384	0.6	0.4	0.4	0.4	0.4	0.4	0.4
ECC WILLITS	0.01	2023-CAMEU-004906	1.0	2.8	2.4	12.7	14.5	3.3	9.7
EDDIES WORLD YERMO		2023-CABDU-005639	1.1	0.9	0.8	1.0	1.3	1.4	1.1
GAZEBO		2023-CARRU-067315	0.5	1.2	2.2	2.9	1.8	3.1	2.0
GRECO CT SANJ		2023-CARRU-067271	0.3	0.7	1.5	1.7	1.2	2.2	1.4
HWY 128 GEYSERVILLE	0.01	2023-CALNU-008808	1.1	1.7	3.9	8.6	5.1	3.3	7.1
I 15 S/ YERMO RD OFRP		2023-CABDU-004745	1.8	1.4	1.3	1.7	2.2	2.3	1.6
ISLAND	0.1	2023-CATIA-000504	3.5	7.1	16.2	12.8	6.9	12.3	8.8
LAKE		2023-CAMEU-005147	1.3	1.8	4.3	11.9	8.6	11.8	5.3
LASSEN		2023-CAFKU-008936	0.6	0.8	1.2	0.8	1.1	1.0	0.8
MACCELE RD / PINON AV		2023-CABDU-005436	4.3	9.5	11.3	7.8	6.4	9.7	9.6
MEADOW		2023-CAMEU-004788	1.0	2.5	4.2	7.6	7.3	6.6	5.8
Mile Post 10.34	0.1	2023-CAHIA-000323	1.6	2.4	4.1	20.9	22.8	16.0	15.0
MT HAVILA VMP 2023 RX		2023-CATCU-004951	1.5	5.9	9.1	15.8	16.1	16.6	16.1
MURRIETA RD PERR		2023-CARRU-067539	0.4	0.8	1.4	2.2	1.1	1.3	1.4
N POE ST LELS		2023-CARRU-067773	0.7	1.0	2.3	3.2	2.5	2.6	2.7
NBY1		2023-CABDU-005840	0.9	0.7	0.5	0.7	1.4	1.1	0.6
NOB	226.97	2023-CABDF-006515	1.0	4.4	7.6	10.8	11.9	10.4	8.3
OXFORD		2023-CAFKU-008948	0.3	0.3	0.3	0.4	0.5	0.3	0.3
PERRIS BL / SUNNYMEAD BL		2023-CARRU-067426	0.4	0.5	1.4	1.6	1.0	1.8	1.6
POURROY RD MURR		2023-CARRU-068306	0.9	0.7	2.1	3.7	3.1	4.5	2.6
RIVER		2023-CACDD-007057	0.6	0.9	0.9	0.9	1.0	1.2	1.0
RIVERSIDE DR / JOY ST		2023-CARRU-068313	0.8	1.0	2.8	3.9	4.0	4.5	3.8
ROUND	4	2023-CAFKU-009036	3.4	4.0	4.8	5.8	5.7	4.8	4.3
S HIGHWAY 101 HOPLAND		2023-CAMEU-005145	1.5	4.4	7.8	10.1	7.9	6.7	9.9
SEMINOLE DR CABA		2023-CARRU-067634	2.5	7.6	9.0	9.3	7.5	9.2	8.0
SIERRA		2023-CANEU-012195	1.2	1.7	4.7	13.4	15.9	12.3	13.5
SUN GOLD ST / INDIO BL		2023-CARRU-067353	0.4	0.3	0.2	0.3	0.3	0.3	0.3
SUNNYMEAD BL MOVA		2023-CARRU-068391	0.4	0.4	1.5	1.7	1.1	2.3	2.0
UKIAH COUNTRY MANOR UKIAH_VALLEY		2023-CAMEU-005032	1.2	1.7	3.9	11.0	7.4	10.5	4.8
VALLEY CENTER RD NEWBERRY_SPRINGS		2023-CABDU-004872	1.0	0.8	0.5	0.8	1.8	1.3	0.7
WHITE FIR DR MENI		2023-CARRU-068181	0.8	0.9	2.3	3.6	2.9	2.9	2.8
WOOD	0.1	2023-CACND-000478	1.5	2.0	2.6	2.7	3.1	4.0	2.9

At Regional Level, Major Incidents can be evaluated side by side to support preparedness levels and resource allocations

10



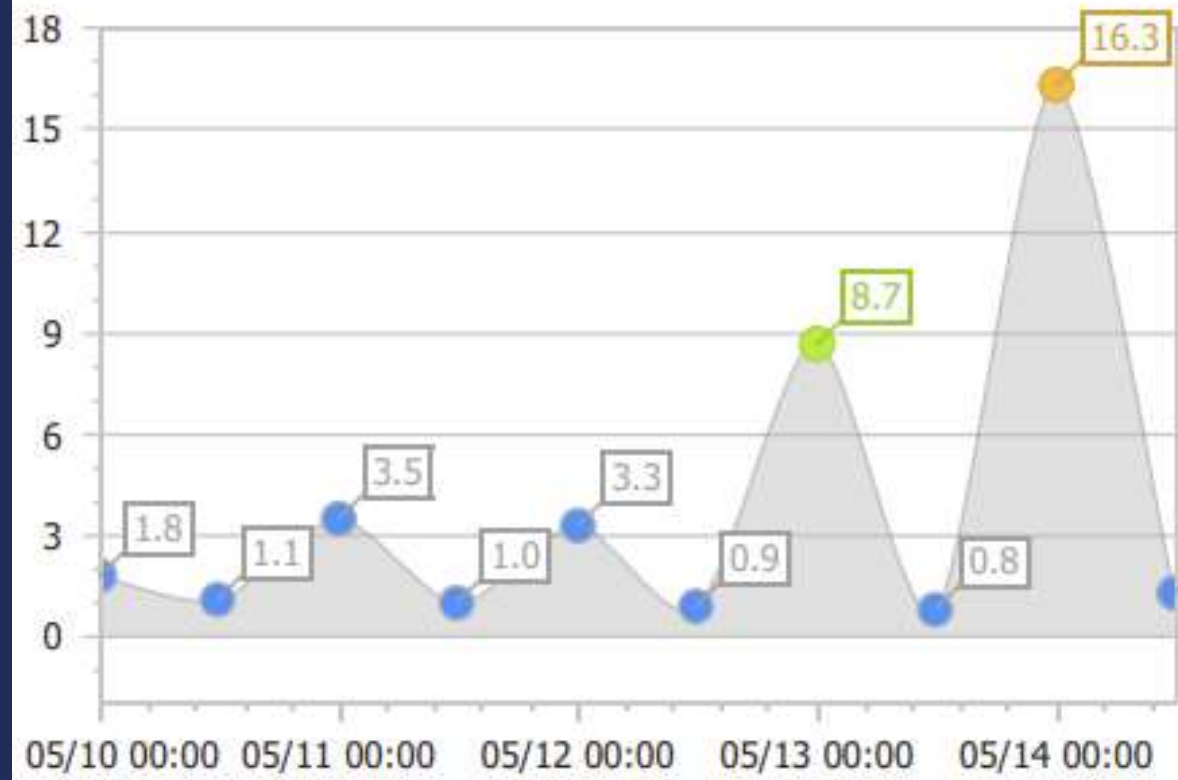
Wildfire Analyst

Extended Attack Metrics Report 2023-WASPS-000027

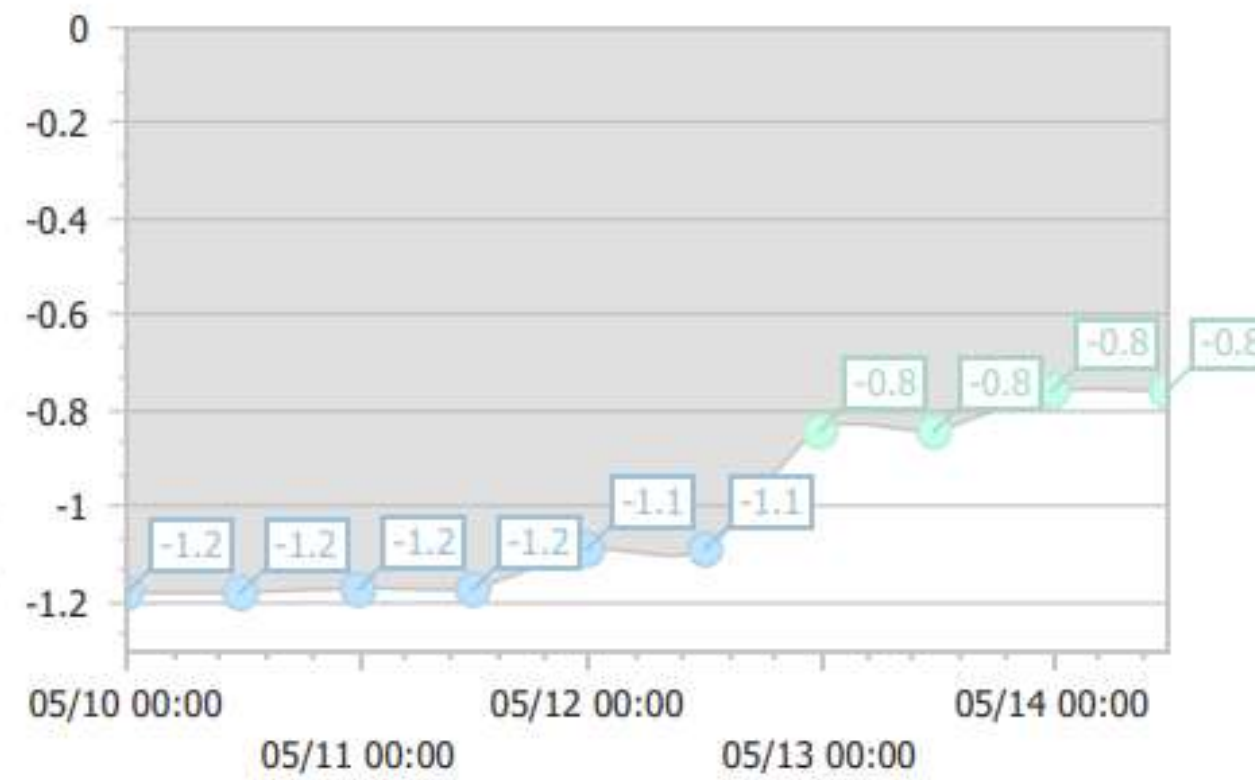
Generated by:
Wildfire
ANALYST

Forecast: 5/10/2023 12:00:00 AM - 5/15/2023 12:00:00 AM Report Generated at: 05/15/2023 14:11 PM

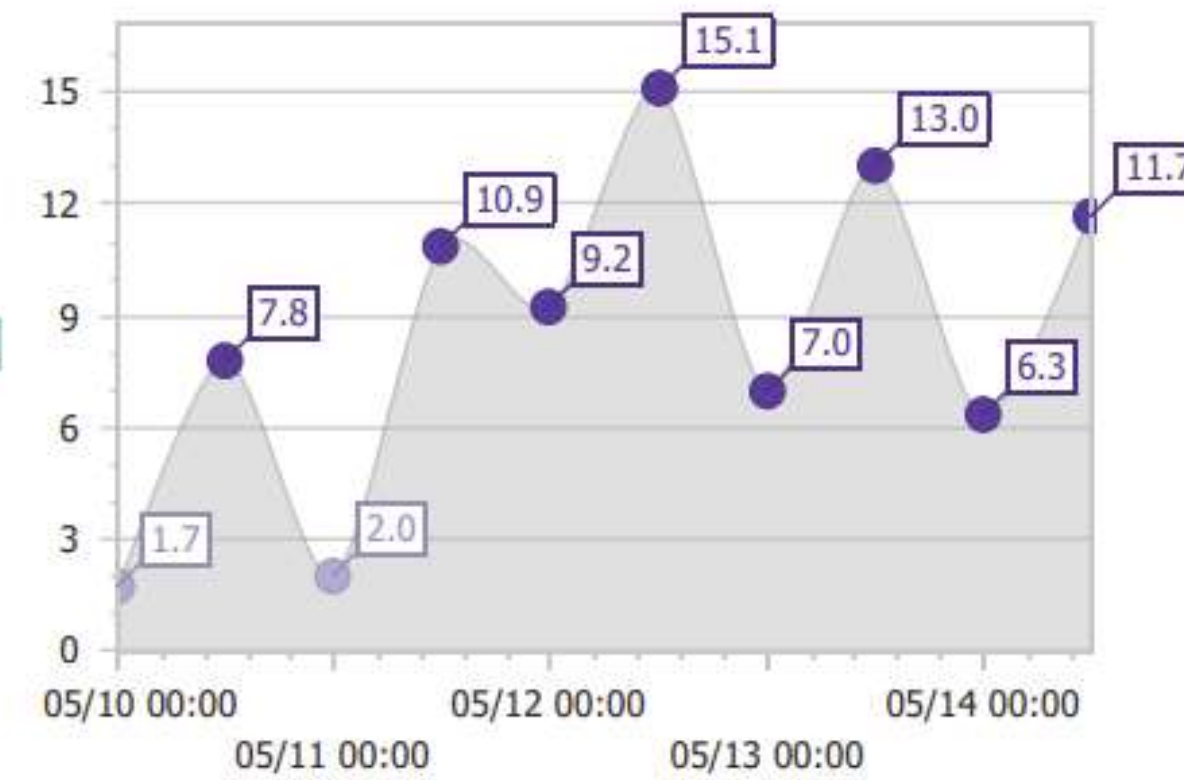
Extended Attack Assessment



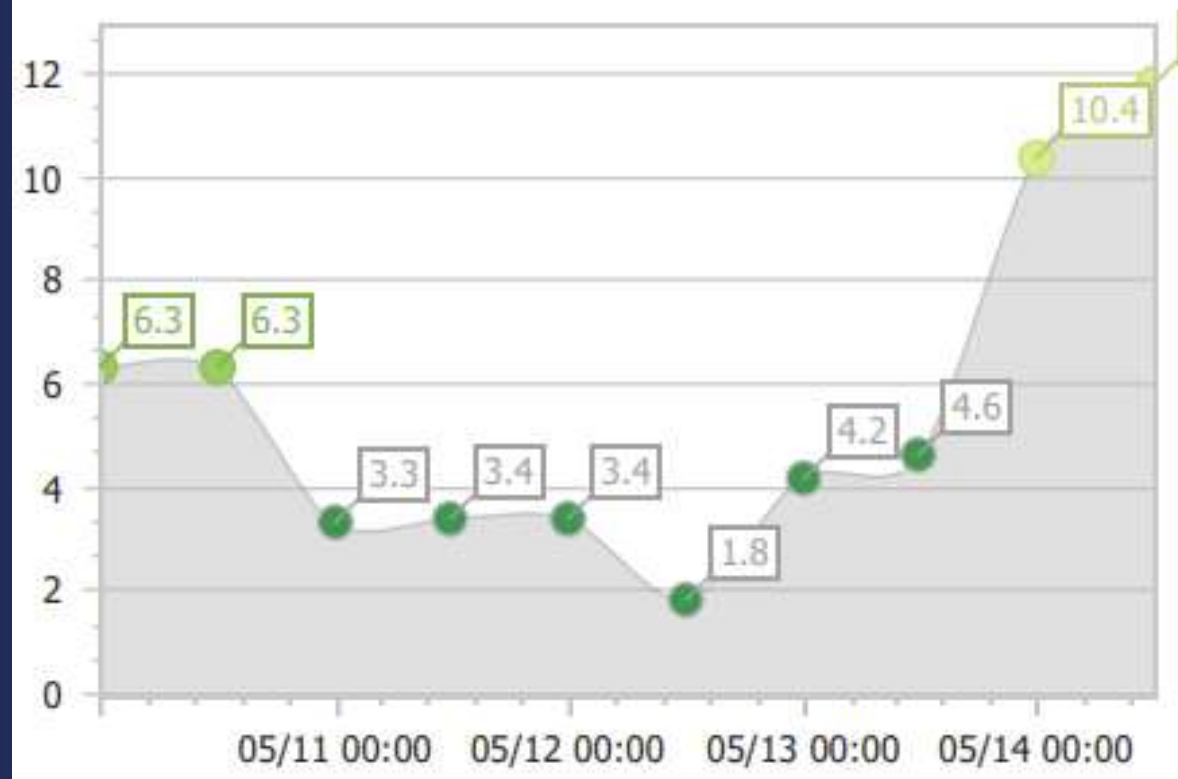
Evaporative Demand Drought Index



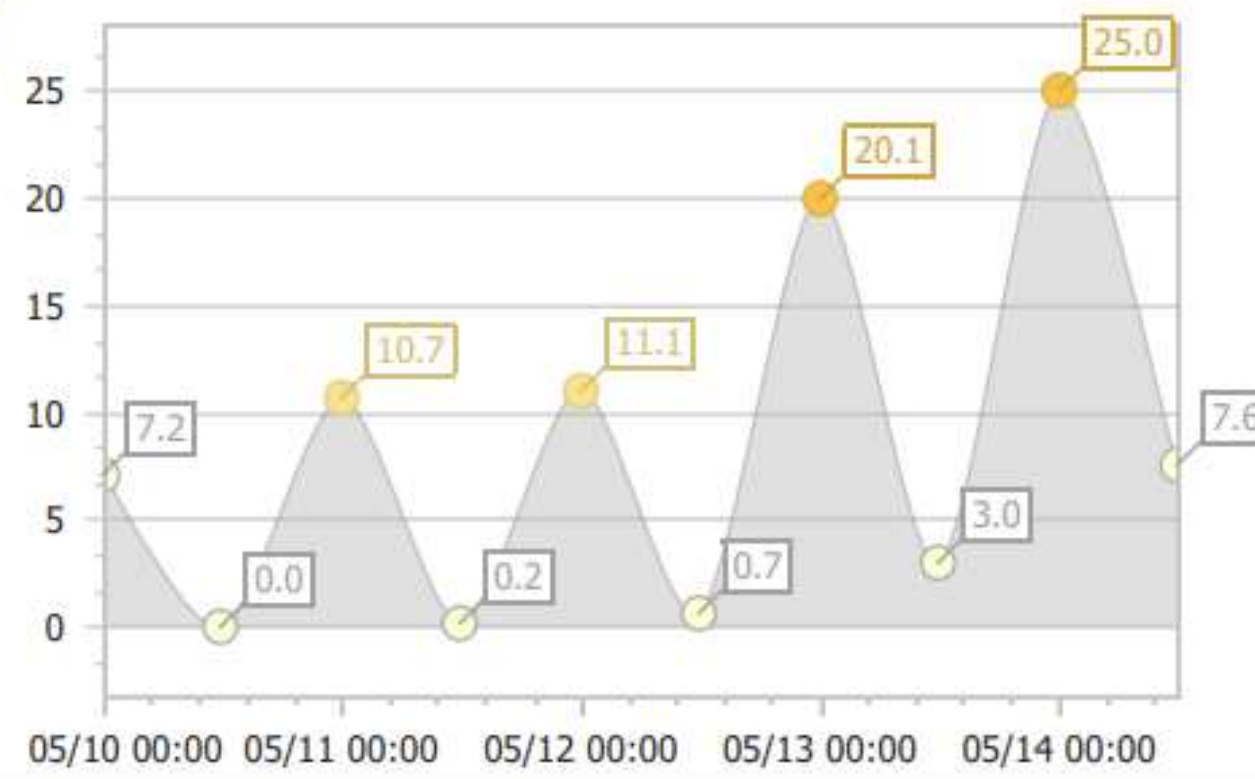
Lifted Index



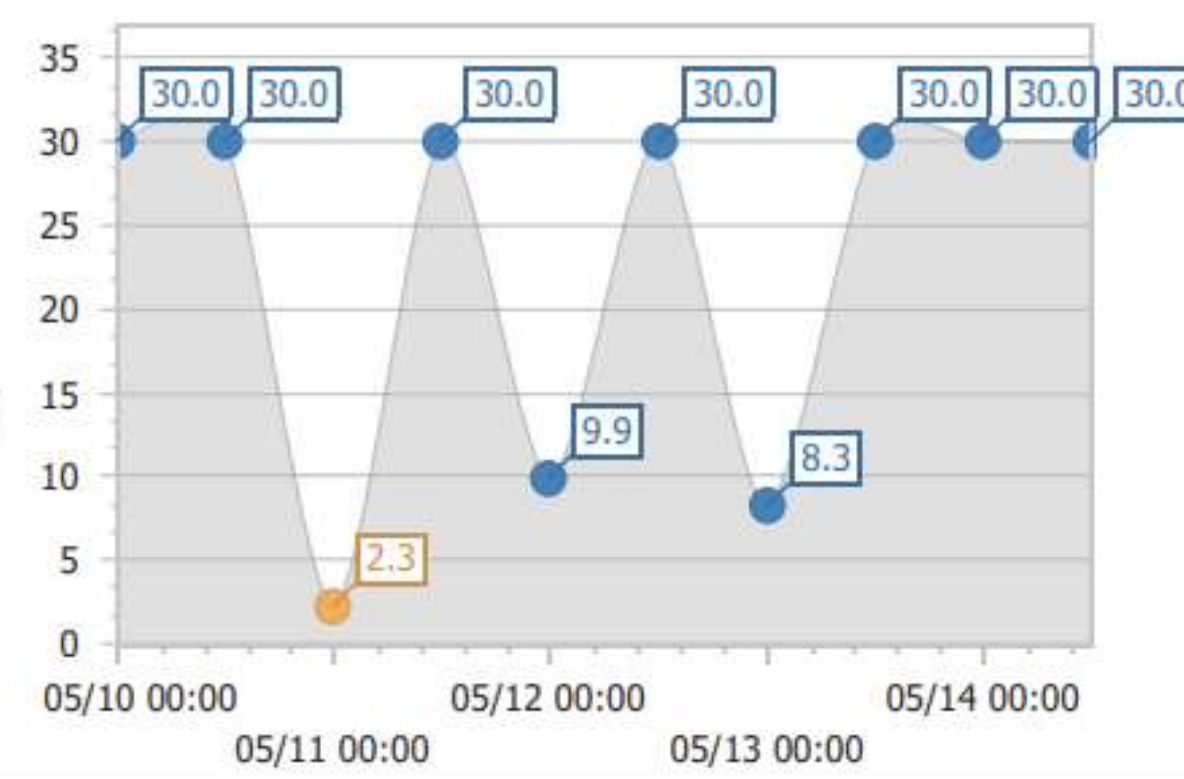
Wind Speed (mph)



Vapor Pressure Deficit (kPa)



Convective Flag

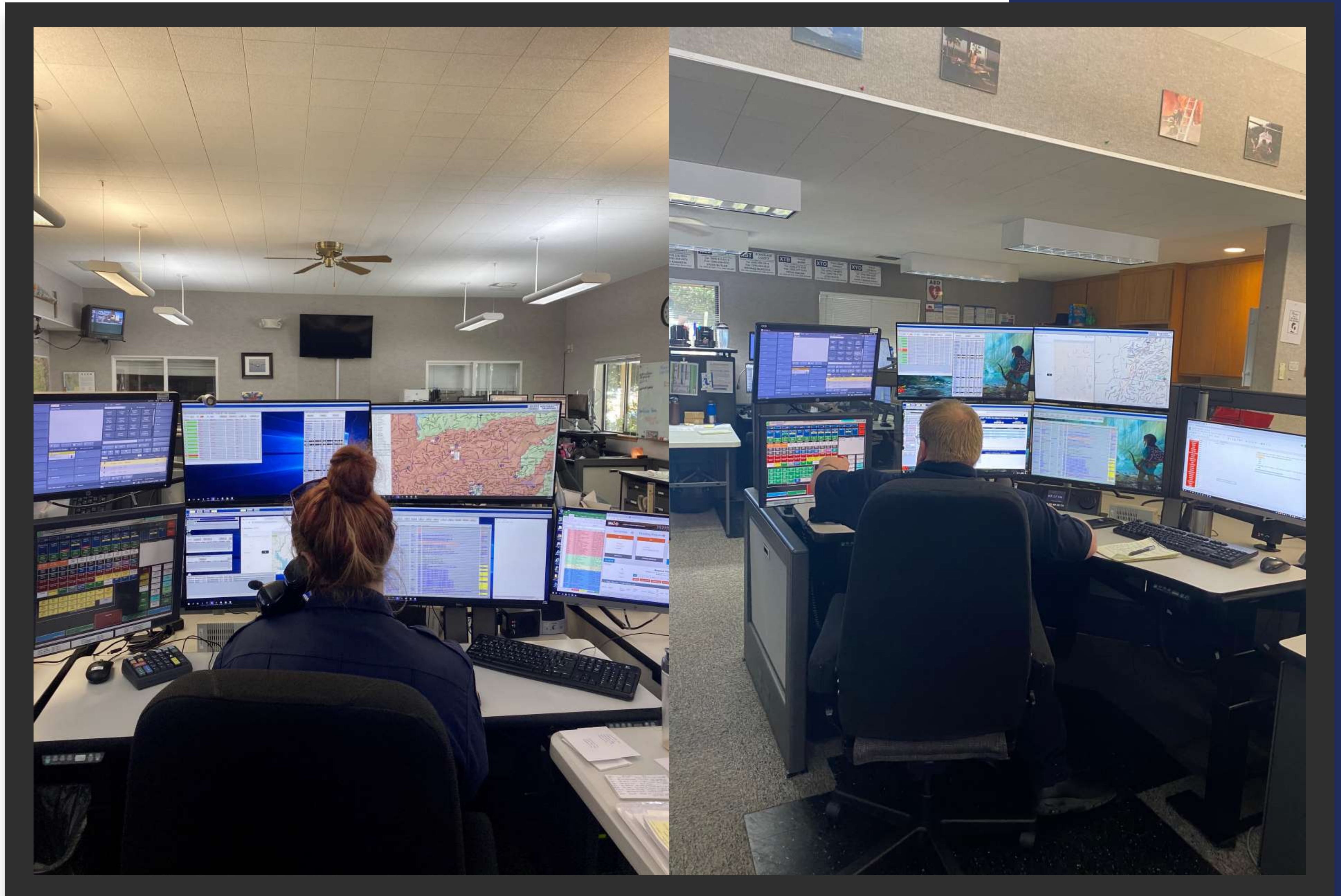


Analysts can assess opportunities for individual incidents based on the different metrics in a one stop shop calibrated with historical fire activity

TACTICAL WORKFLOW

Fire reported to CAL FIRE and input into Computer Aided Dispatch (CAD).

12



WFA Enterprise [2.0.8.7 CAL FIRE - STG] - Techno Devs - Forecast 08/03/2020

The screenshot displays the Wildfire Analyst interface. On the left is a map of California with various wildfire incidents marked by colored diamonds. A tooltip for a specific incident is visible: UniqueFieldIdentifier: 2020-CACND-002309, IncidentName: STAGECOACH, FireDiscoveryDateTime: 08/03/2020 15:29, ModifiedOnDateTime: 08/17/2020 13:41, DailyAcres: 7760, Latitude: 35.464722, Longitude: -118.543611. On the right is an 'Incidents List' table with columns for Incident Code, Protecting Unit, Discovery Time, Daily Acres, Discovery Acres, and Last Edited Time. The table lists numerous incidents, with 'STAGECOACH' highlighted. At the bottom right, there are three blue notification boxes with 'Info' icons, providing details about reported incidents.

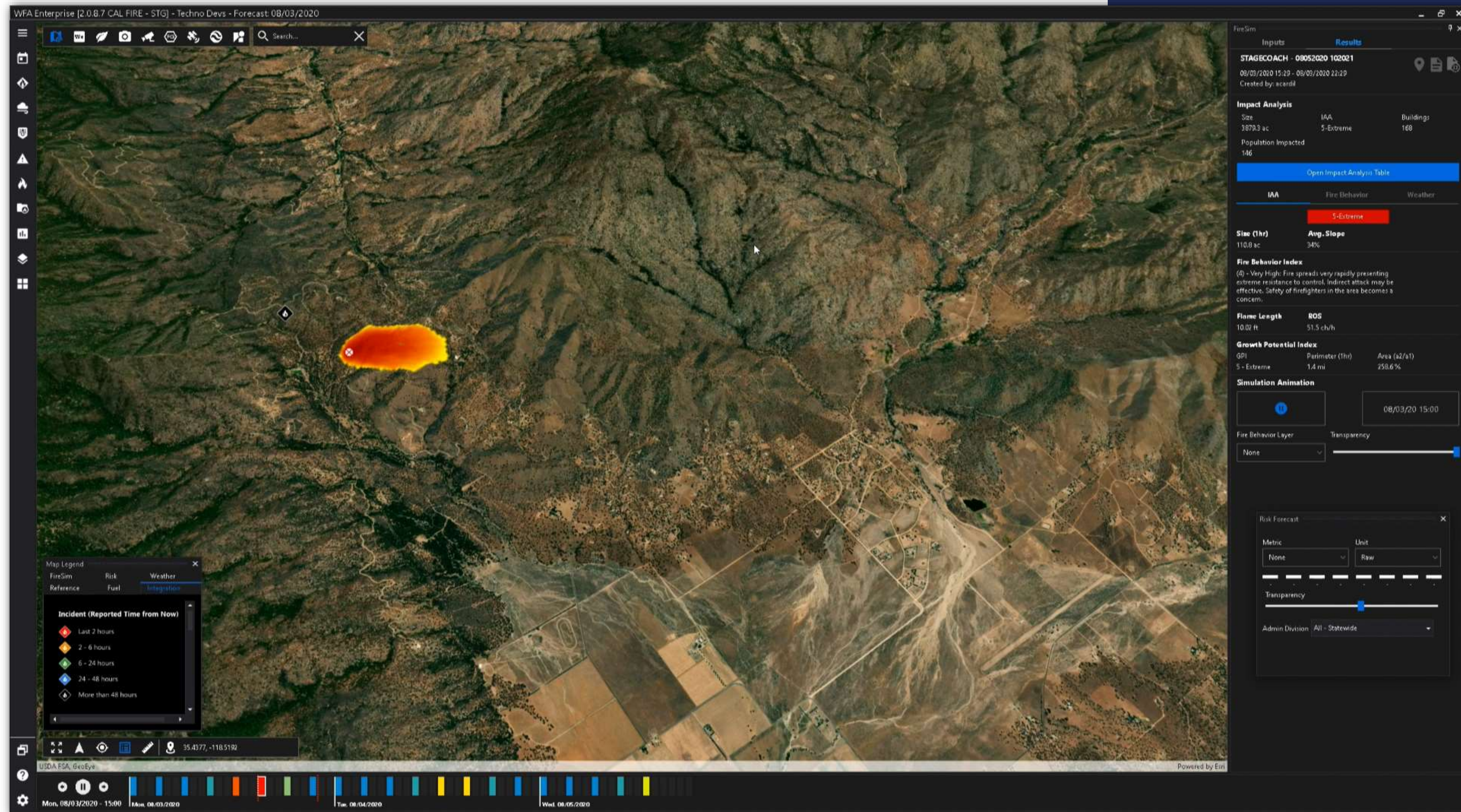
Selected Incident	Incident Code	Protecting Unit	Discovery Time	Daily Acres	Discovery Acres	Last Edited Time
K-F	2020-LANU-004...	LANU	08/11/20 10:45	0.10	0.10	08/11/20 22:18
RAIL	2020-CALNU-013...	CALNU	08/17/20 22:25	0.10	0.10	08/19/20 10:39
RALPH	2020-CABDF-0123...	CABDF	08/15/20 16:26	10.00	10.00	08/16/20 19:02
RAMSHORN	2020-CASHF-0012...	CASHF	08/17/20 14:54	0.10	0.10	08/18/20 11:06
RANCH	2020-CACVD-001...	CACVD	08/02/20 16:30	0.50	0.50	08/17/20 09:05
Rattlesnake	2020-CAKNP-000...	CAKNP	08/16/20 10:24	0.10	0.10	08/16/20 11:43
Red	2020-CASRF-0006...	CASRF	07/27/20 08:23	15,129.00	15,129.00	08/18/20 09:30
RED	2020-CASCU-005...	CASCU	08/16/20 21:37	0.10	0.10	08/17/20 00:26
REID MINE GUINDA	2020-CALNU-013...	CALNU	08/17/20 09:37	0.10	0.10	08/17/20 09:37
RIDGE RD GLENCOE	2020-CATCU-009...	CATCU	08/16/20 08:17	0.10	0.10	08/16/20 08:23
RIVER	2020-CABEU-004...	CABEU	08/16/20 02:38	4,070.00	4,070.00	08/18/20 05:55
ROCKWELL	2020-CAMNF-000...	CAMNF	08/16/20 14:21	400.00	400.00	08/17/20 18:03
ROLLING	2020-CATGU-008...	CATGU	08/16/20 22:30	0.10	0.10	08/16/20 22:30
RUSH	2020-CAKNF-006...	CAKNF	08/16/20 06:54	0.10	0.10	08/16/20 08:40
SALMON	2020-CASHF-0011...	CASHF	07/27/20 10:54	807.00	807.00	08/17/20 17:36
SAMS NECK	2020-CASCU-006...	CASCU	08/17/20 16:46	0.10	0.10	08/17/20 16:46
SAN BENANCIO R...	2020-CABEU-004...	CABEU	08/16/20 05:23	0.10	0.10	08/16/20 05:25
SATTLE	2020-CATNF-0016...	CATNF	08/16/20 14:50	0.10	0.10	08/16/20 17:30
SCU LIGHTNING C...	2020-CASCU-005...	CASCU	08/16/20 16:37	25,000.00	25,000.00	08/18/20 07:18
Shadow	2020-AZORD-001...	AZORD	08/17/20 10:26	0.25	0.25	08/17/20 14:19
Sheep	2020-CAPNF-0012...	CAPNF	08/17/20 12:20	200.00	200.00	08/18/20 12:06
Sheep	2020-CAKNP-000...	CAKNP	08/16/20 10:37	0.50	0.50	08/16/20 17:39
SHU AUGUST U.G...	2020-CASHU-008...	CASHU	08/17/20 21:18	0.10	0.10	08/18/20 09:56
SKYLARK DR LVIL	2020-CARRU-1045...	CARRU	08/16/20 20:58	0.10	0.10	08/16/20 20:59
SKYLINE -- KEEP O...	2020-CARRU-1028...	CARRU	08/13/20 16:40	0.10	0.10	08/17/20 10:00
SKYLINE BL WOO...	2020-CACZU-005...	CACZU	08/18/20 07:35	0.10	0.10	08/18/20 07:36
Slinkard	2020-NVHTF-030...	NVHTF	08/17/20 16:06	0.10	0.10	08/18/20 08:13
SODA	2020-CAKRN-014...	CAKRN	08/12/20 10:05	425.00	425.00	08/18/20 12:10
SOUTH	2020-CASHU-008...	CASHU	08/17/20 22:04	0.10	0.10	08/17/20 22:26
SOUTH	2020-CASHF-0012...	CASHF	08/17/20 16:59	0.10	0.10	08/17/20 18:22
SOUTH DIVISION...	2020-CALNU-013...	CALNU	08/16/20 05:58	0.10	0.10	08/17/20 07:45
SOUTH FORK	2020-CAKNF-006...	CAKNF	08/15/20 11:31	0.10	0.10	08/18/20 11:25
SPRING	2020-CANEU-019...	CANEU	08/17/20 08:36	0.10	0.10	08/17/20 08:41
SPRING	2020-CASHF-0012...	CASHF	08/17/20 15:57	0.75	0.75	08/18/20 07:57
Stage	2020-CALPF-0020...	CALPF	07/28/20 12:13	0.10	0.10	08/17/20 07:43
STAGECOACH	2020-CACND-002...	CACND	08/03/20 15:29	7,760.00	7,760.00	08/17/20 13:41
STEVENS	2020-CASCU-005...	CASCU	08/16/20 01:05	0.10	0.10	08/16/20 01:10
STUHR	2020-CASCU-005...	CASCU	08/17/20 14:16	0.10	0.10	08/17/20 14:41
SUNRISE	2019-CACNF-0026...	CACNF	09/05/19 15:09	0.10	0.10	08/17/20 12:46
TAR	2020-CAFKU-0121...	CAFKU	08/13/20 09:52	0.10	0.10	08/17/20 19:48
TENAVA	2020-CAMMU-017...	CAMMU	08/17/20 08:35	0.10	0.10	08/17/20 11:57
TGU BATT 1 LCA	2020-CATGU-008...	CATGU	08/17/20 09:09	0.10	0.10	08/17/20 09:20
TIPTOP	2020-CABDF-0123...	CABDF	08/15/20 15:02	2.50	2.50	08/17/20 12:55
TOWER 6 / LOT 10	2020-CARRU-1044...	CARRU	08/16/20			
TRAIL	2020-CARRU-1052...	CARRU	08/18/20			
TREAT	2020-CASHU-008...	CASHU	08/16/20			
TRIMMER	2020-CASNF-0011...	CASNF	08/03/20			
TRINITY	2020-CASHF-0001...	CASHF	02/21/20			
TRINITY	2020-CASHU-004...	CASHU	05/03/20 17:03	0.10	0.10	08/16/20 17:52
TUGG	2020-CATCU-009...	CATCU	08/17/20			
VALLEY	2020-CASCU-005...	CASCU	08/16/20			
W-1 FA#20	2020-CANOD-004...	CANOD	08/17/20			
W-2 FA#21	2020-CANOD-004...	CANOD	08/17/20			

13

Wildfire Analyst™ receives incident data and notifies users
All US fires shared through IRWIN Cad integration.

14

Wildfire Analyst™ automatically creates a prediction simulation.

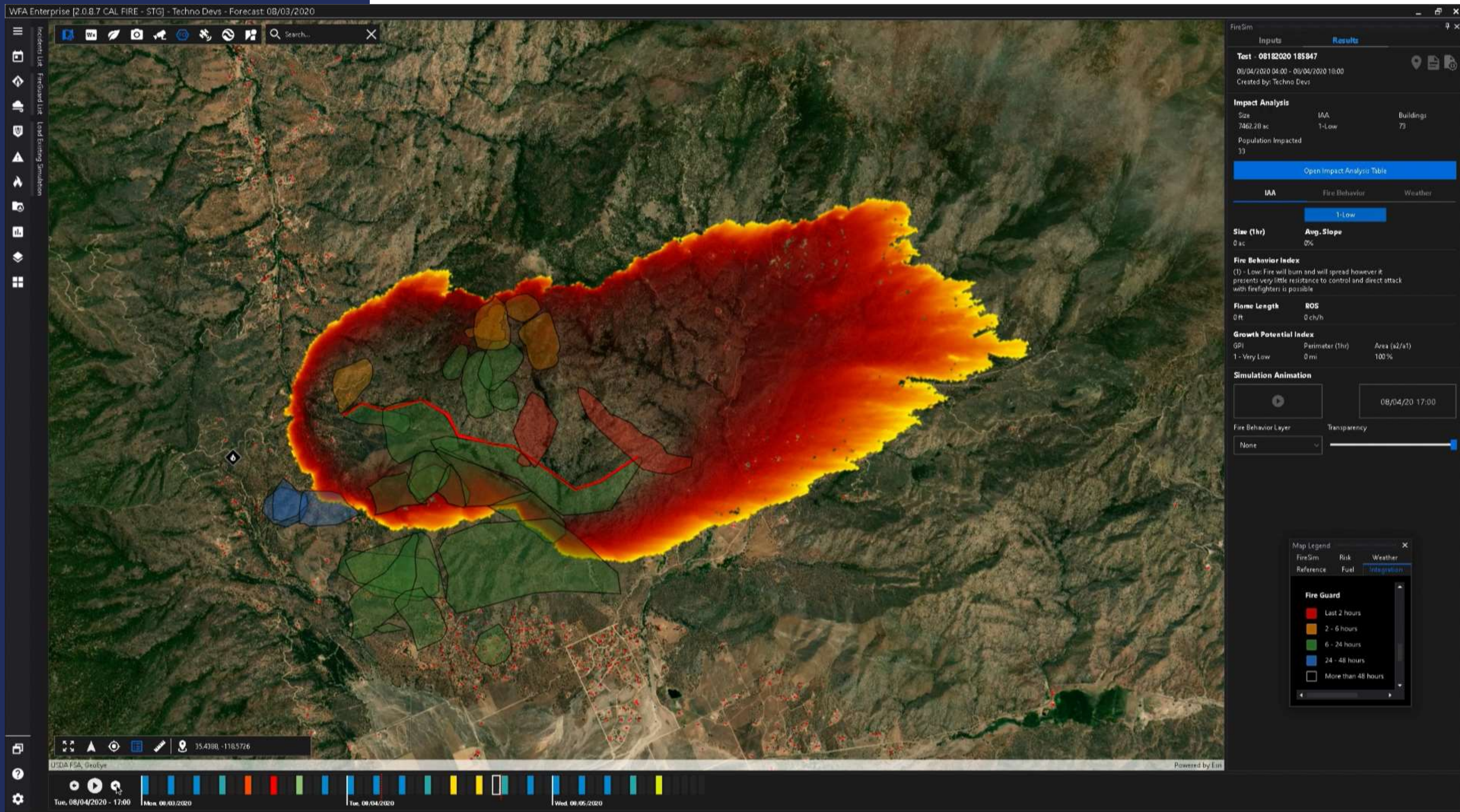


User views ALERTWildfire Cameras for situational awareness/validation.

15

The screenshot displays the WFA Enterprise interface. The main window shows a 3D terrain map with a large, irregularly shaped wildfire simulation area highlighted in red and orange. A smaller inset map in the bottom-left corner shows a red and blue shaded region. The top-left corner of the interface includes a search bar and various tool icons. The bottom-left corner shows the current date and time: 'Mon, 08/03/2020 - 20:00'. The right-hand side of the interface features a 'ALERTWildfire Viewer' window. This window has a 'Camera Name' field set to 'Breckenridge Peak1 - Kern'. Below this is a live video feed showing a forested mountain peak with smoke rising from the trees. The video feed includes a timestamp: 'Axis-BreckenridgePeak1 X: +93.52 Y: -11.40 Z: 1.0 UCSD_zwells.08-03T15:26 © Nevada Seismo Lab 2020/08/03 16:13:54.95'. Below the video feed is a 'Load Existing Simulation' section with a date range from '8/3/20' to '8/8/20' and search and reset buttons. A table below this section lists simulation runs with columns for Name, Sim_Inc Code, Created Time, Duration, IAA, and Size (ac). The table is organized by user: 'Techno Devs' and 'acardill'. The bottom of the interface shows a timeline with colored bars representing different simulation runs and a filter bar at the very bottom.

Name	Sim_Inc Code	Created Time	Duration	IAA	Size (ac)
User: Techno Devs					
Test - Stagecoach - run 2 sim 1 - 08182020 0...		08/18/20 08:04		8	3
Test - Stagecoach - run 2 sim 3 12 hrs - 081820...		08/18/20 08:05		12	4
Test - Stagecoach - run 2 sim 4 8 hrs multi pts...		08/18/20 08:06		8	4
Test - Stagecoach - run 2 sim 5 - 10 hrs multi p...		08/18/20 08:07		10	4
STAGECOACH - 08182020 113451	2020-CAOND-002...	08/18/20 10:34		8	4
STAGECOACH - 08182020 113726	2020-CAOND-002...	08/18/20 10:37		9	5
User: acardill					
STAGECOACH - 08052020 101218	2020-CAOND-002...	08/05/20 01:12		12	8
STAGECOACH - 08052020 102021	2020-CAOND-002...	08/05/20 01:20		7	3
STAGECOACH - 08052020 102103	2020-CAOND-002...	08/05/20 01:21		6	2

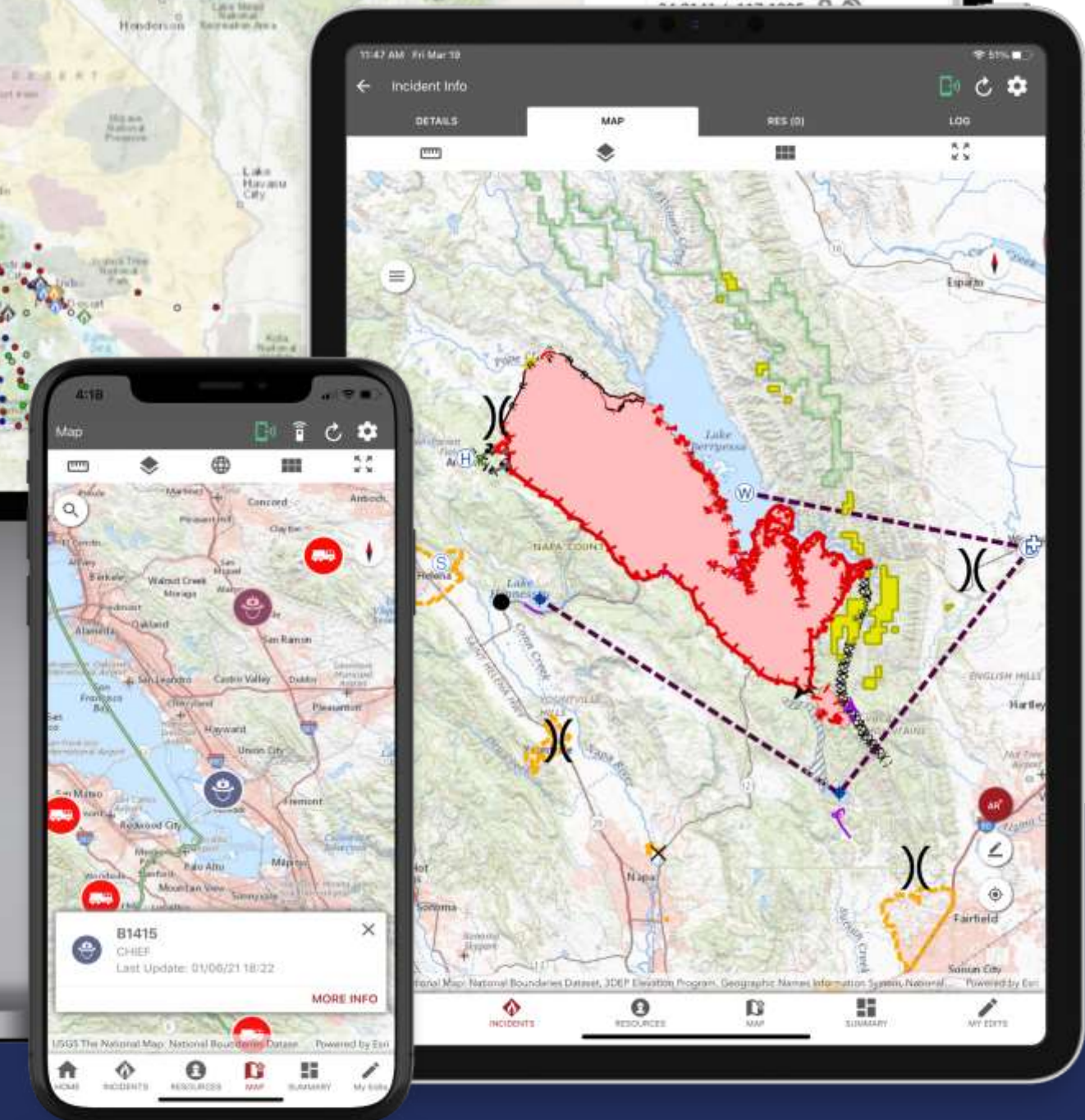
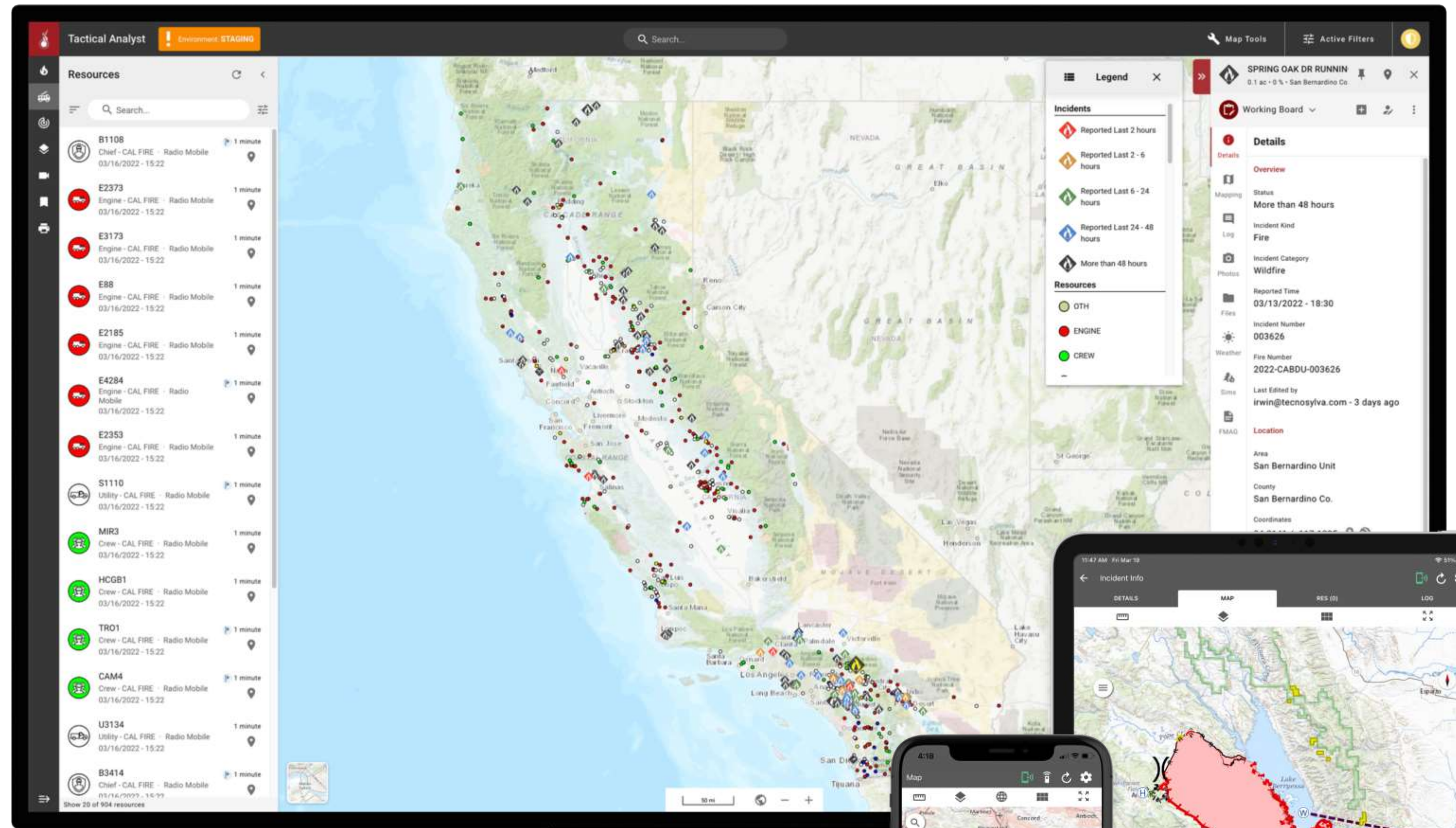


16

User leverages seamless integration within Wildfire Analyst™ to enhance prediction information for operational personnel.



INTEGRATION WITH TACTICAL ANALYST



Tactical Analyst Environment: DEVELOPMENT

Search...

Map Tools Active Filters

POPE CANYON COMPLEX
55000 ac • 0 % • Napa Co.

Working Board

Details

11:47 AM Fri Mar 19 Incident Info

12:17 Incident Info

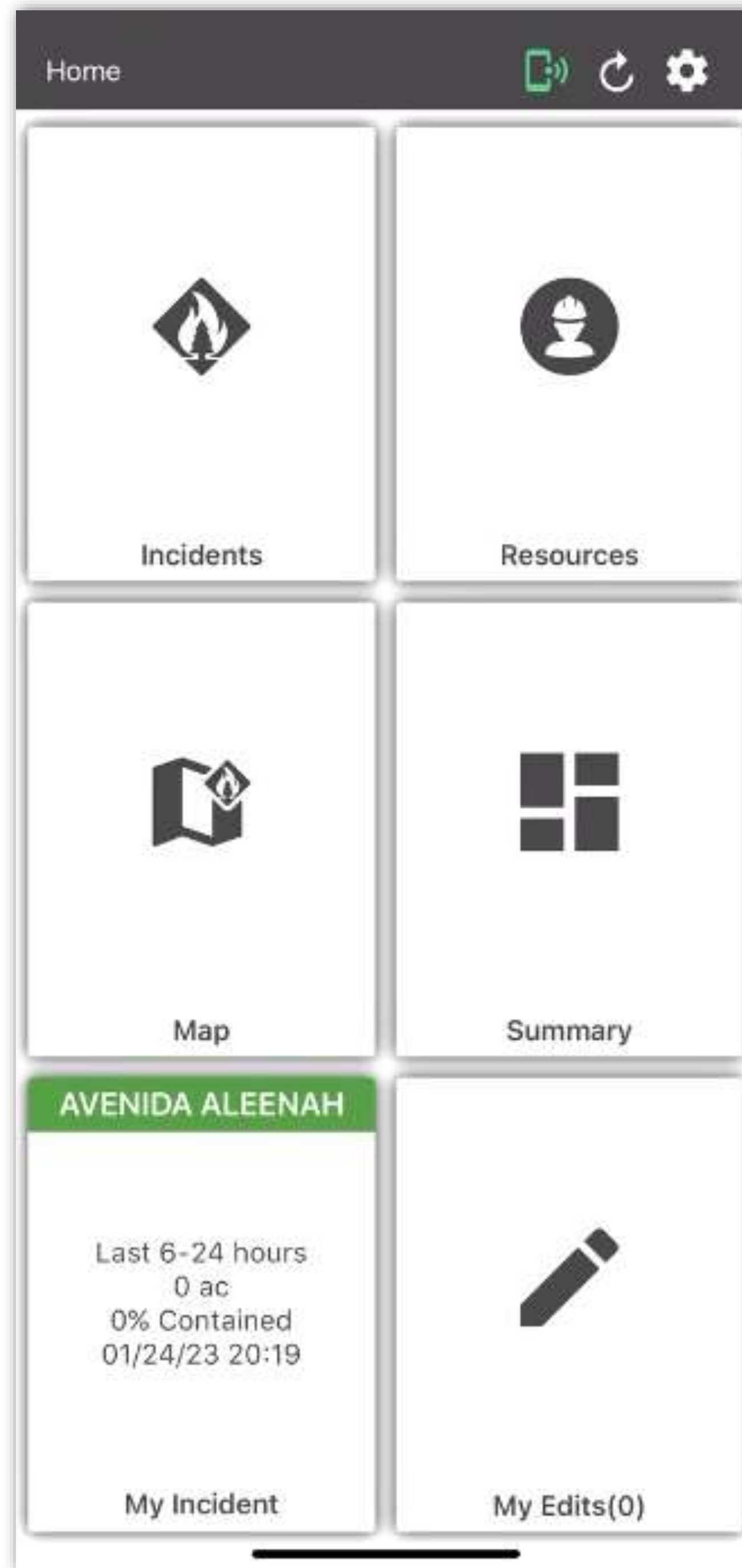
<input type="checkbox"/>	Icon	Label	Access	Status	Visible	Map Method	Folder	Name	Comments	Modified By	Modified At
<input type="checkbox"/>		DP-1	Incident	In Review	Yes	No Data	Point	Drop Point	No Data	djones@tecnosylva.com	01/11/2021 - 14:41
<input type="checkbox"/>		DIV P	Incident	In Review	Yes	No Data	Point	Label	No Data	djones@tecnosylva.com	01/07/2021 - 15:33
<input type="checkbox"/>		DIV L	Incident	In Review	Yes	No Data	Point	Label	No Data	djones@tecnosylva.com	01/07/2021 - 15:31
<input type="checkbox"/>		DIV G	Incident	In Review	Yes	No Data	Point	Label	No Data	djones@tecnosylva.com	01/07/2021 - 15:31

Seamless syncing between web & mobile provides all users with the same incident Centric Common operational picture with predictive intel capabilities.

18

The screenshot displays the Tactical Analyst interface. The main map shows a topographic view of Trabuco Canyon with a yellow fire hazard icon. The right-hand panel provides details for the simulation 'JIM', including its location (553 ac, 95% in Orange Co.), date (03/02/2022 - 11:06), and various metrics: Buildings: 0, Population: 0, Flame Length: 11.11 ft, ROS: 34.7 ch/h, Perimeter: 0.9 mi, Area (a2/a1): 3.5 %, and Shared comments: N/A. The interface also includes a search bar, map tools, and active filters.

Simulations published for an incident in WFA-E are shared to Tactical Analyst.



Units on the field get a One Page report as soon as the incident gets into the CAD through the Tactical Analyst mobile app. They report intel from the Field.

19



Real-Time Resource Tracking in every platform

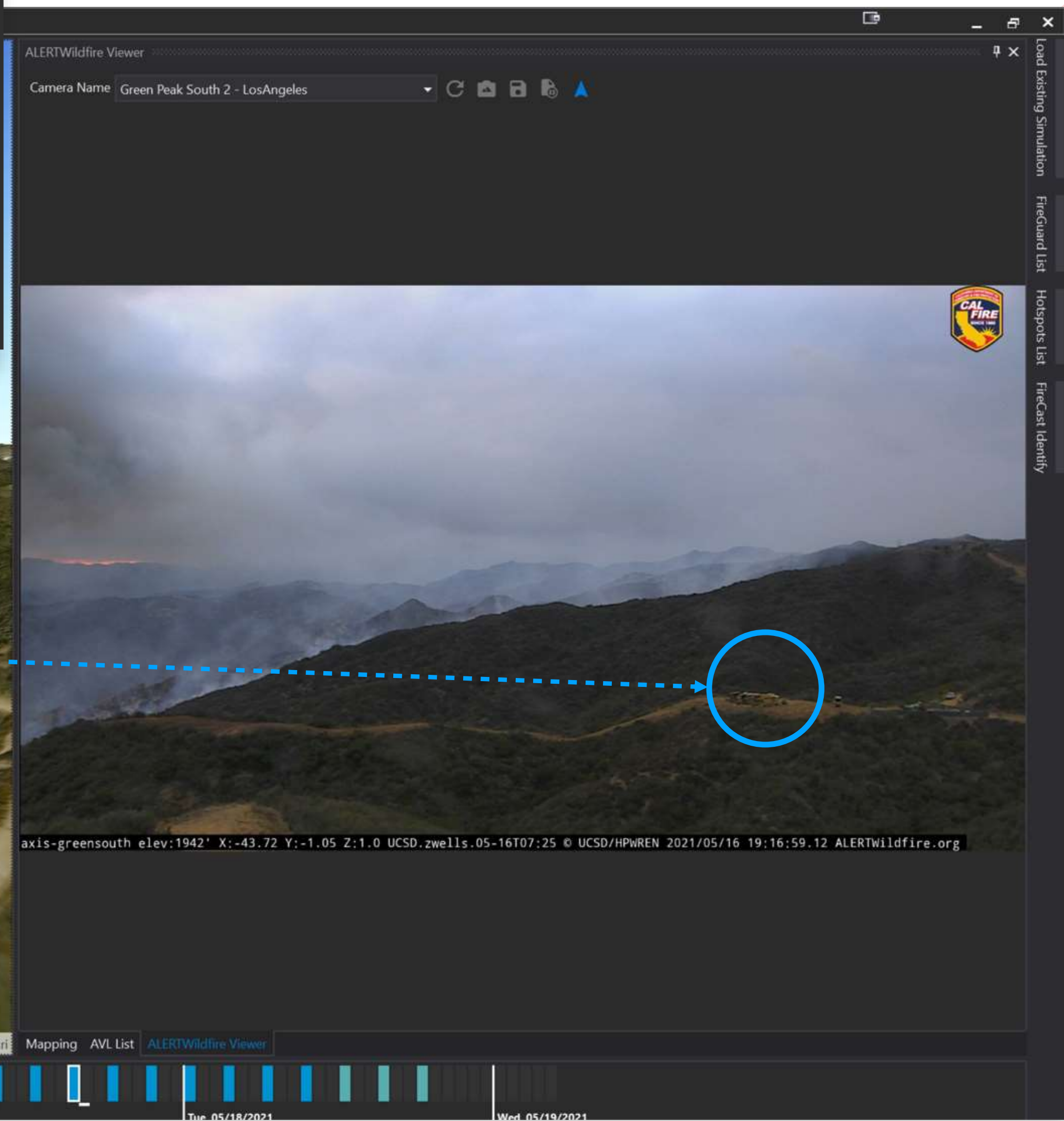
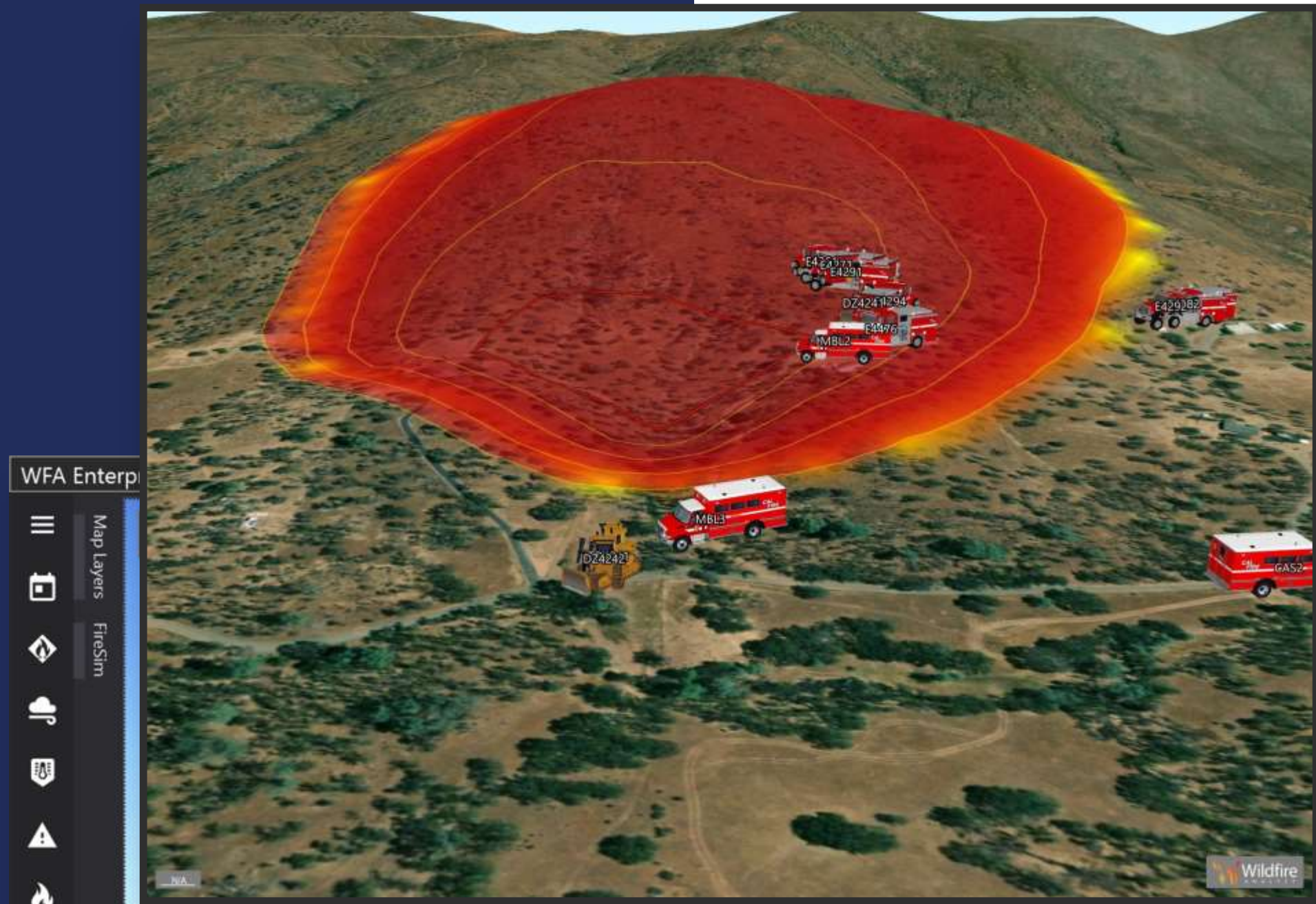
The image displays two views of a real-time resource tracking system. The main view is a desktop web interface titled "Tactical Analyst" with an "Environment: STAGING" indicator. It features a central map of a region including Lake Arrowhead and Running Springs, with a path of resource locations marked by red dots and connected by a dashed line. A sidebar on the left lists resources with their status and response times.

Resource ID	Type	Status	Response Time
E3556	Engine - CAL FIRE	Radio Mobile	about 3 hours
B3516	Chief - CAL FIRE	Radio Mobile	about 5 hours
PD01	Crew - CAL FIRE	Radio Mobile	4 minutes
Q97	Engine - CAL FIRE	Radio Mobile	about 2 hours
PD03	Crew - CAL FIRE	Radio Mobile	3 minutes
E86	Engine - CAL FIRE	Radio Mobile	less than a minute
MIR1	Crew - CAL FIRE	Radio Mobile	less than a minute
B4318	Chief - CAL FIRE	Radio Mobile	less than a minute
E4164	Engine - CAL FIRE	Radio Mobile	less than a minute
E1477	Engine - CAL FIRE	Radio Mobile	less than a minute
E2662	Engine - CAL FIRE	Radio Mobile	less than a minute
P2127	Utility - CAL FIRE	Radio Mobile	less than a minute
B4213	Chief - CAL FIRE	Radio Mobile	less than a minute

The mobile app interface on the right shows a map view with a search bar and a "Select an Item" dropdown menu. The selected item is "E3556 ENGINE" at "SPRING OAK DR RUNNING_SPRINGS". A detailed view of this location is shown below the map, including the following information:

- Location:** 2175 Spring Oak Dr, Running Springs, CA 92382, USA
- Area:** San Bernardino Unit
- County:** San Bernardino Co.
- Coordinates:** 34.2141 / -117.1225
- Measurements:** Affected area: 0.1 ac; % Contained: 0%
- Assessment:** Distance to Homes (mi): NO DATA; Structures Lost: 0; Structures Threatened: 0

2021



Real-time tracking of air and ground resources in 3D.

Integration of State wide Aerial resource tracking with full motion video viewing.

22

WFA Enterprise [2.2.3.5 CAL FIRE - STG] - Techno Devs - Forecast: 10/30/2021

Drone & Full Motion Video Connect

Viewer Load Existing Video

CalFire Intel 17V Courtney Aviation
VEH: +40°38.1452', -121°25.8045', ALT: 24288f (G), FOV 10.54°
TGT: +40°36.8261', -121°22.1965', ALT: 6348f (G), RANG: 25791f

TILT -23°
PAN -155°

1216f

03:52:17 PM
AUG 27 2021
22:52:17 Z

29F

2021/08/27 15:52:19

Name:	User:	Incident:	Provider:	Source:
20210827DixieNorthV	Courtney Aviation		AERIAL	COURTNEY
Latitude:	Longitude:	Altitude:	Heading:	Pitch:
40.6359	-121.4301	7403m	105.4	3.4

Maxar, Esri, HERE, Garmin

Powered by Esri

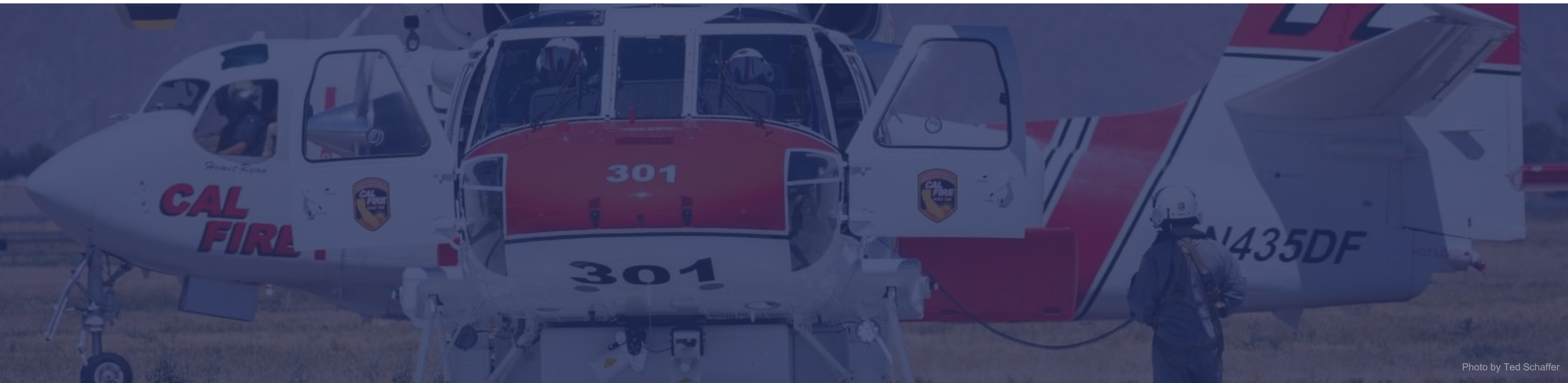
Sat, 10/30/2021 - 15:00 Sat, 10/30/2021 Sun, 10/31/2021 Mon, 11/01/2021 Tue, 11/02/2021 Wed, 11/03/2021

CALFIRE STRATEGIC APPLICATIONS

01 Evaluating risk forecasts to enhance existing processes for augmentation of resources, staffing patterns, and pre-positioning of resources.

02 Provides leadership the tools to relay information about fire conditions with partners and stakeholders.

03 Provide better granularity of risk for CAL FIRE Units assessing local fire conditions on a daily basis.





CAL FIRE TACTICAL APPLICATIONS

01

Near to real-time situational awareness to assist us in allocation of resources, planning for evacuations, damage assessment and recovery.

02

Single repository of data from disparate data sources including field observations, allowing field personnel to focus on the task at hand. Minimizing their need to seek out information from varying delivery mechanisms or systems.

03

Empower firefighters to obtain, deliver & update data based on field observations, providing enhanced levels of accuracy.

BENEFITS

01

Enhance CAL FIRE's ability to measure, mitigate & eliminate the threat to human life & personal property, infrastructure, & damage to California's natural resources.

02

Empower CAL FIRE personnel with leading edge technology to conduct day to day operations.

03

Provide real-time awareness to first responders.

04

More effectively protect communities-at-risk.

05

Accurately evaluate a fire situation, disseminate information and allocate the necessary resources.

06

Assists CAL FIRE personnel with additional tools to reduce the damage and destruction from wildfires, leading to a more resilient California for generations to come.



Supporting the Leading CAL FIRE Intel Community



8TH
**INTERNATIONAL
WILDLAND FIRE
CONFERENCE**

**GOVERNANCE
PRINCIPLES:**
Towards an
International
Framework

IMPLEMENTATION OF WILDFIRE TECHNOLOGY SOLUTION IN CALIFORNIA

Lessons Learned and Path Forward

CHIEF PHILIP SELEGUE
DEPUTY CHIEF INTEL, CAL FIRE

JOAQUIN RAMIREZ, PHD
PRESIDENT & CTO, TECHNOSYLVA