ASSESSING THE IMPACT OF WILDFIRES ON THE CALIFORNIA ELECTRICITY GRID

Energy Commission Study: CCCA4-CEC-2018-002
August 2018
California's Fourth Climate Change Assessment

Larry Dale, Michael Carnall, Max Wei
Lawrence Berkeley National Laboratory
Gary Fitts, Greenware Technologies
Sarah Lewis MacDonald, Envision Geo

Methods & Data

	Historical 2000 - 2016 →	Projected 2010 - 2050
Statewide	• Collect historical wildfire location and impact data (FRAP and REDBOOK)	• Map projected wildfire risk by location statewide (UC Merced wildfire model, Leroy Westerling) ↓
Transmission	• Identify major transmission paths (WECC and CEC) and analyze historic wildfire impacts.	• Calculate wildfire risk along existing transmission paths and several prospective transmission paths. • Estimate wildfire costs with a grid power flow model (PLEXOS).
Distribution	• Use the wildland-urban interface (WUI) as a proxy for distribution. • Analyze distribution damage and replacement cost (CPUC wildfire reimbursement claims).	• Project the growth of WUI areas (USGS Land Use model, Ben Sleeter), and calculate exposure to wildfire. • Project future wildfire costs to distribution (historical damage and replacement cost).

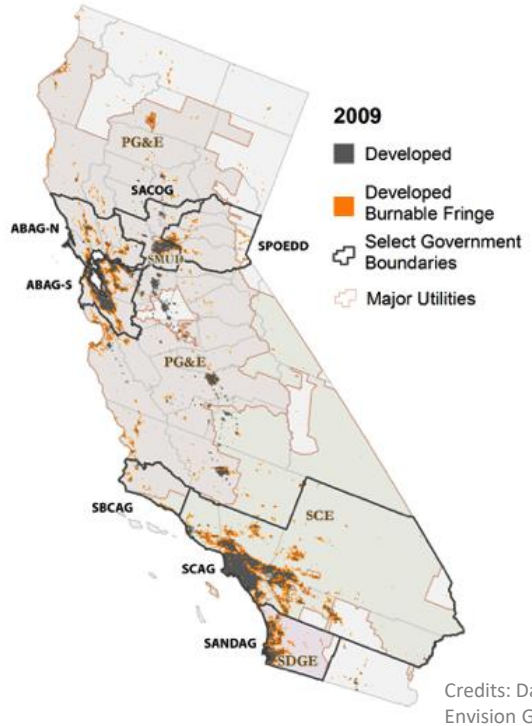
We focused on selected parts of the transmission and distribution grid

Transmission Paths

Credits: Dale et al. 2018.; CEC; WECC Envision Geo

Impact of 351 historical wildfires approaching these paths.

Developed "Fringe" Areas



Credits: Dale et al. 2018.; USGS Envision Geo

Impact of 236 historical wildfires wildfires approaching these fringe areas.

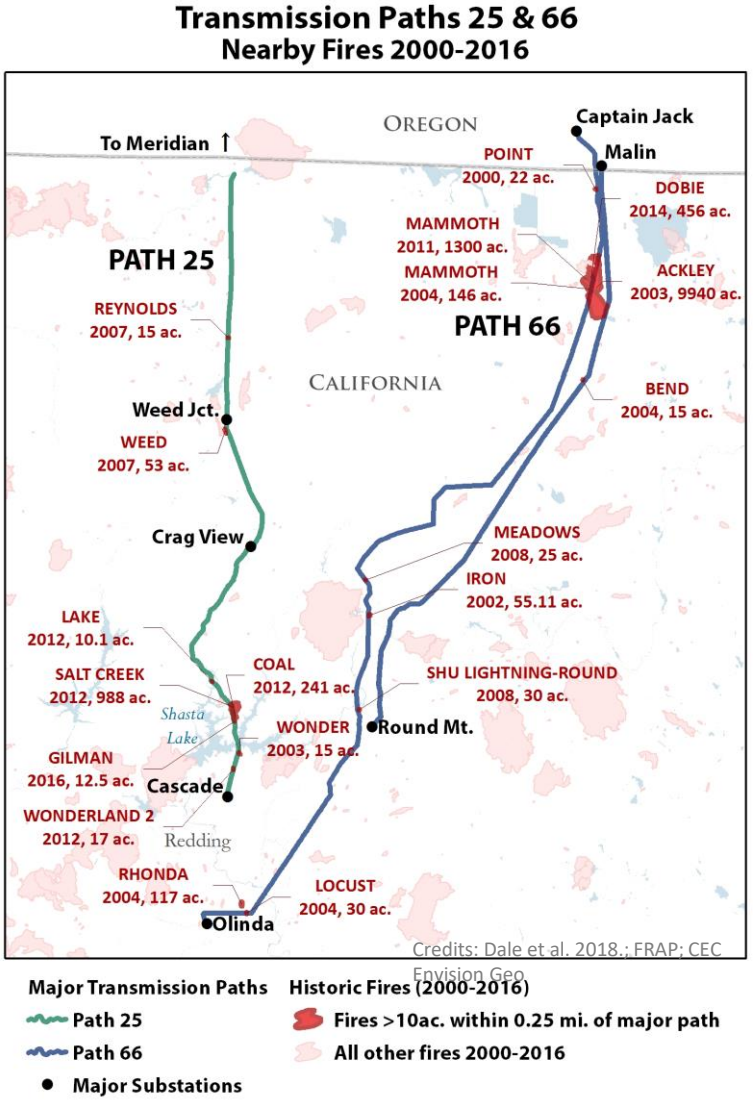
Sample transmission path fire history (2000-2016)

Path 25 (Meridian-Cascade)

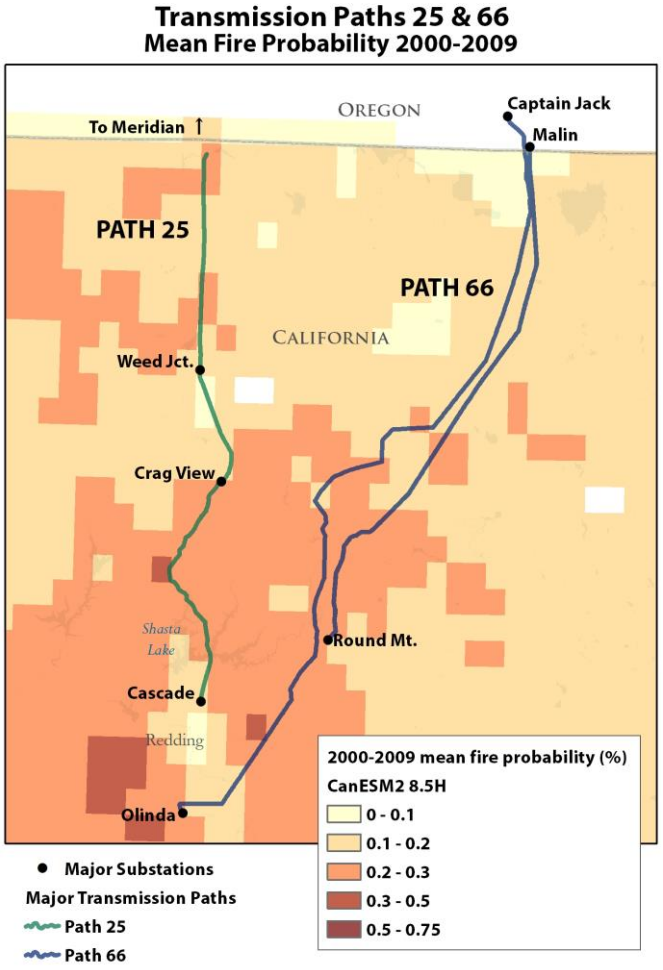
- Single 115kv line
- 6 Fires Within 0.25 mi

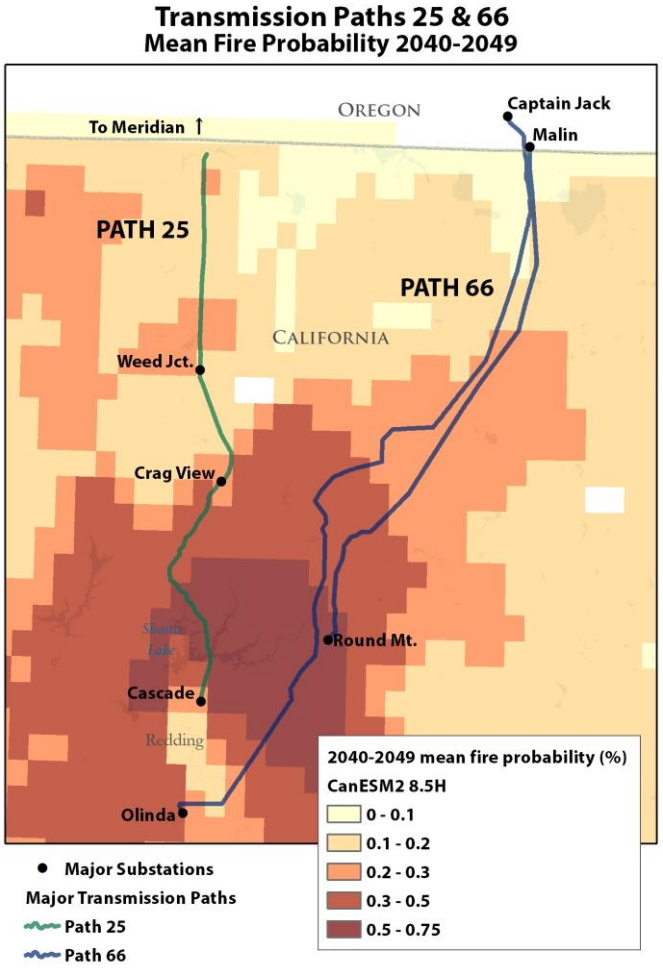
Path 66 (Malin-Round Mountain)

- Three 500kv lines
- 11 Fires Within 0.25 mi



Projected rise in path fire exposure





Credits: Dale et al. 2018.; Westerling et al.; CEC
Envision Geo

Determine path impacts of 351 fires 2000-2016

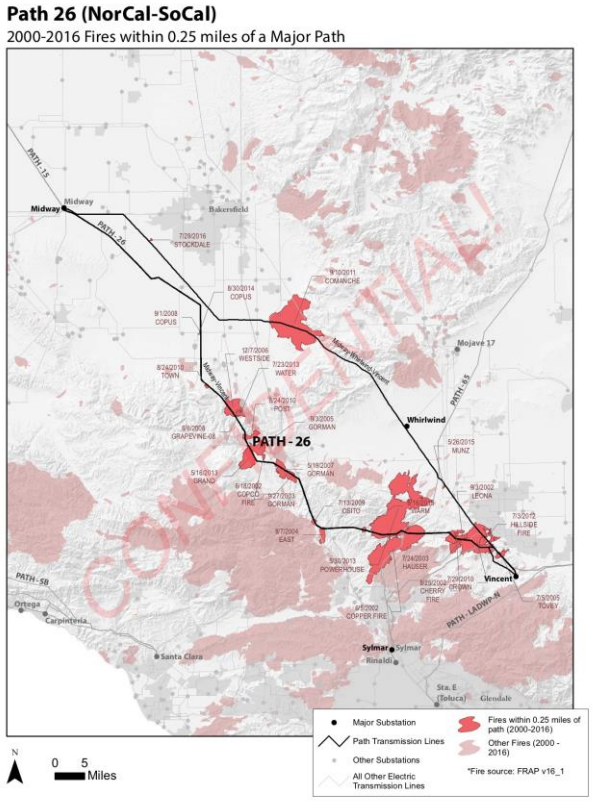
Unofficial CAISO Rating System

		Transmission Impact Severity Level				
		1	2	3	4	5
	Number of Fires	Low Impact	Small line impact	Medium Impact	Large Impact	Very Large Impact
		No CAISO action	Local Impact	Change Dispatch	Large Outage, Re-Dispacth	System Wide Threat
Numbered WECC Paths	125	69%	2%	15%	13%	2%
Other Transmission Paths	226	78%	3%	11%	2%	0%

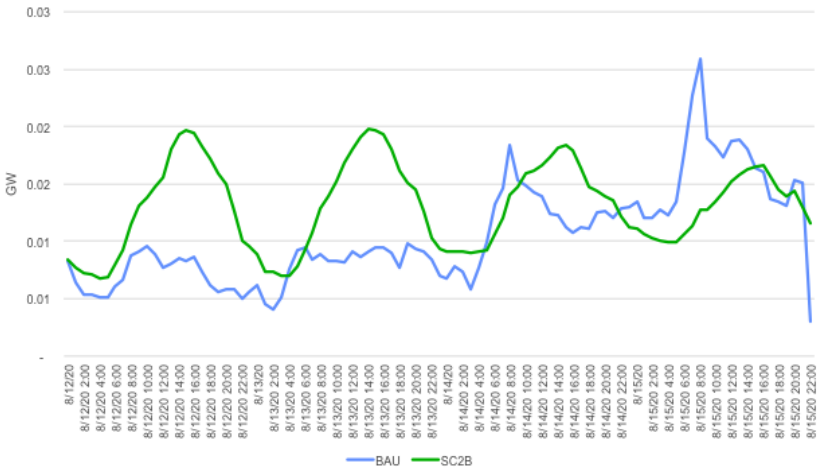
- Most had no impact
- A few had very large impacts

Modeled costs of impacts
PLEXOS (TEPPC 2020 database)

Path 26 Example



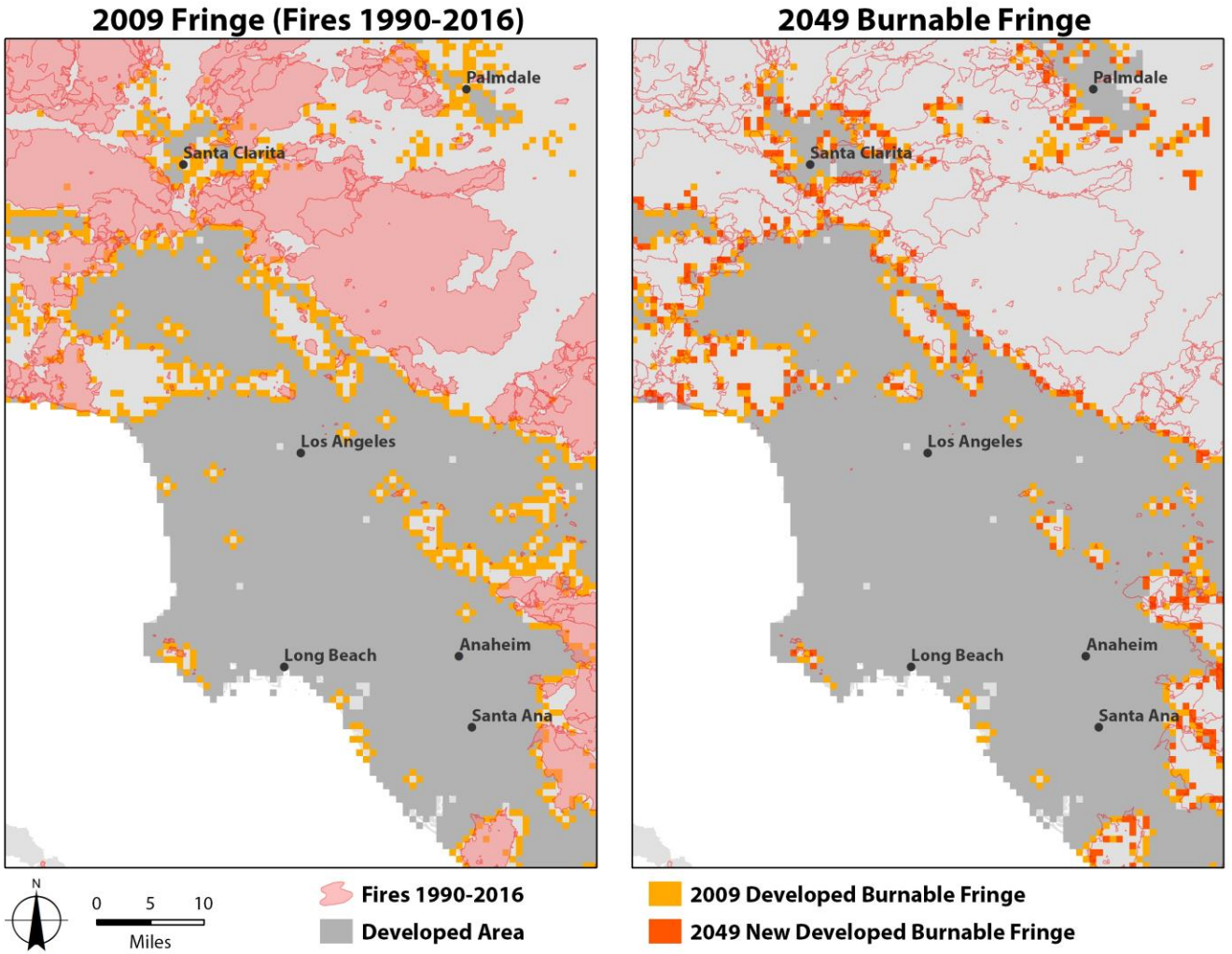
Higher SCE generation costs during event



Credits: Dale et al. 2018.; FRAP; CEC
Envision Geo

Total estimate: $40-$100 million annual all utilities

Identified distribution area fire history (LA Basin)



Credits: Dale et al.; USGS; FRAP
Envision Geo

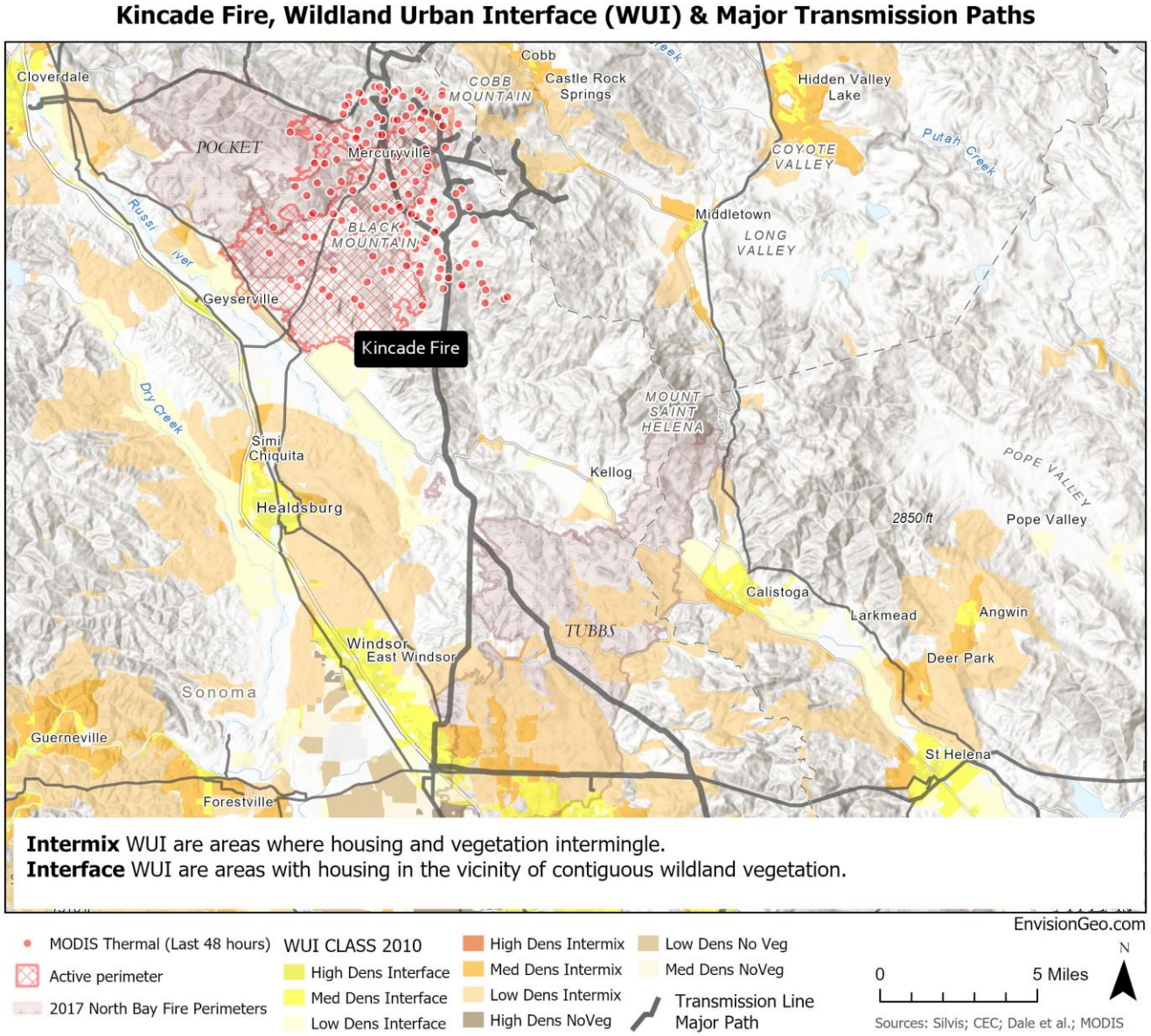
Determined area impacts of 360 fires
function of area burned

		Low	Medium	High	Severe	Catastrophic
	Number fires evaluated	No Fringe Burned	Partial Fringe Cell	Between 2-5 Fringe Cells	Between 6-10 Fringe Cells	Over 10 Fringe Cells
State	360	66%	10%	16%	4%	5%
Northern California	103	*84%*	*5%*	*9%*	*2%*	*0%*
Southern California	257	*58%*	*12%*	*18%*	*5%*	*7%*

Most fires had no impacts on fringe areas.
A few had major impacts.

Source: GIS analysis applied to wildfire fringe data set (Cal Fire 2001-2016)

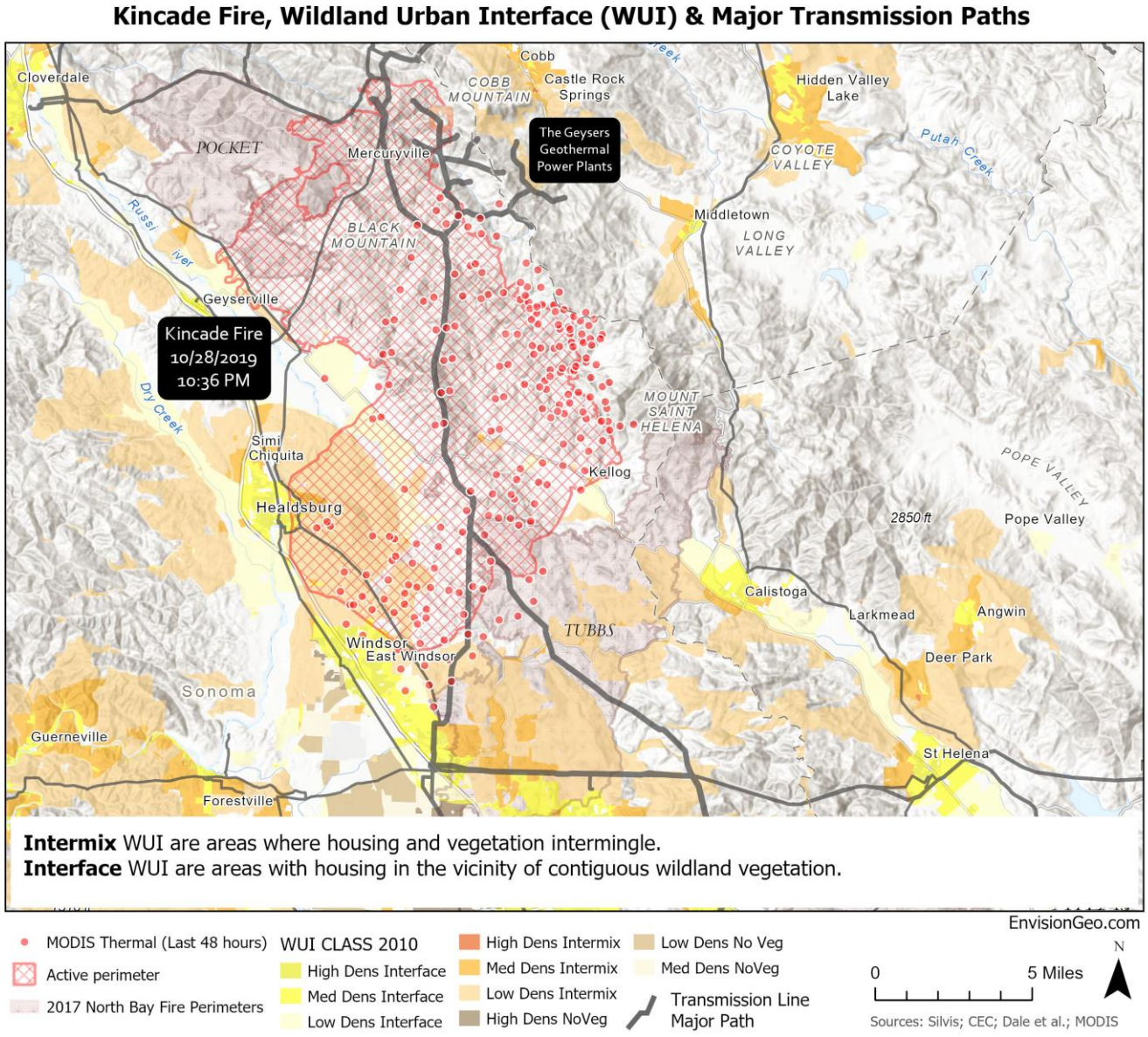
Further WUI Analysis



WUI Intermix, Interface, Density

Credit: Envision Geo

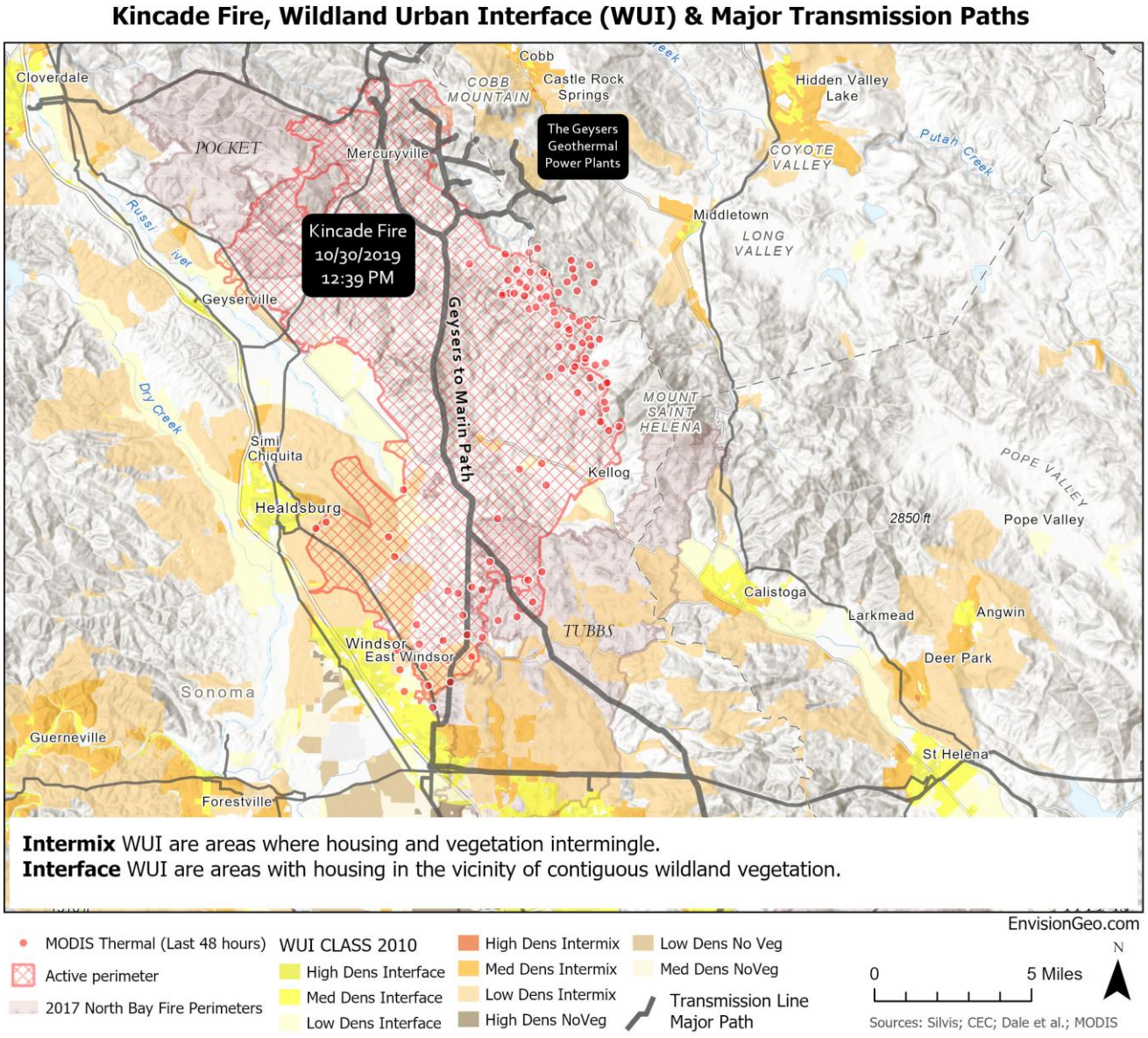
Further WUI Analysis



WUI Intermix, Interface, Density

Credit: Envision Geo

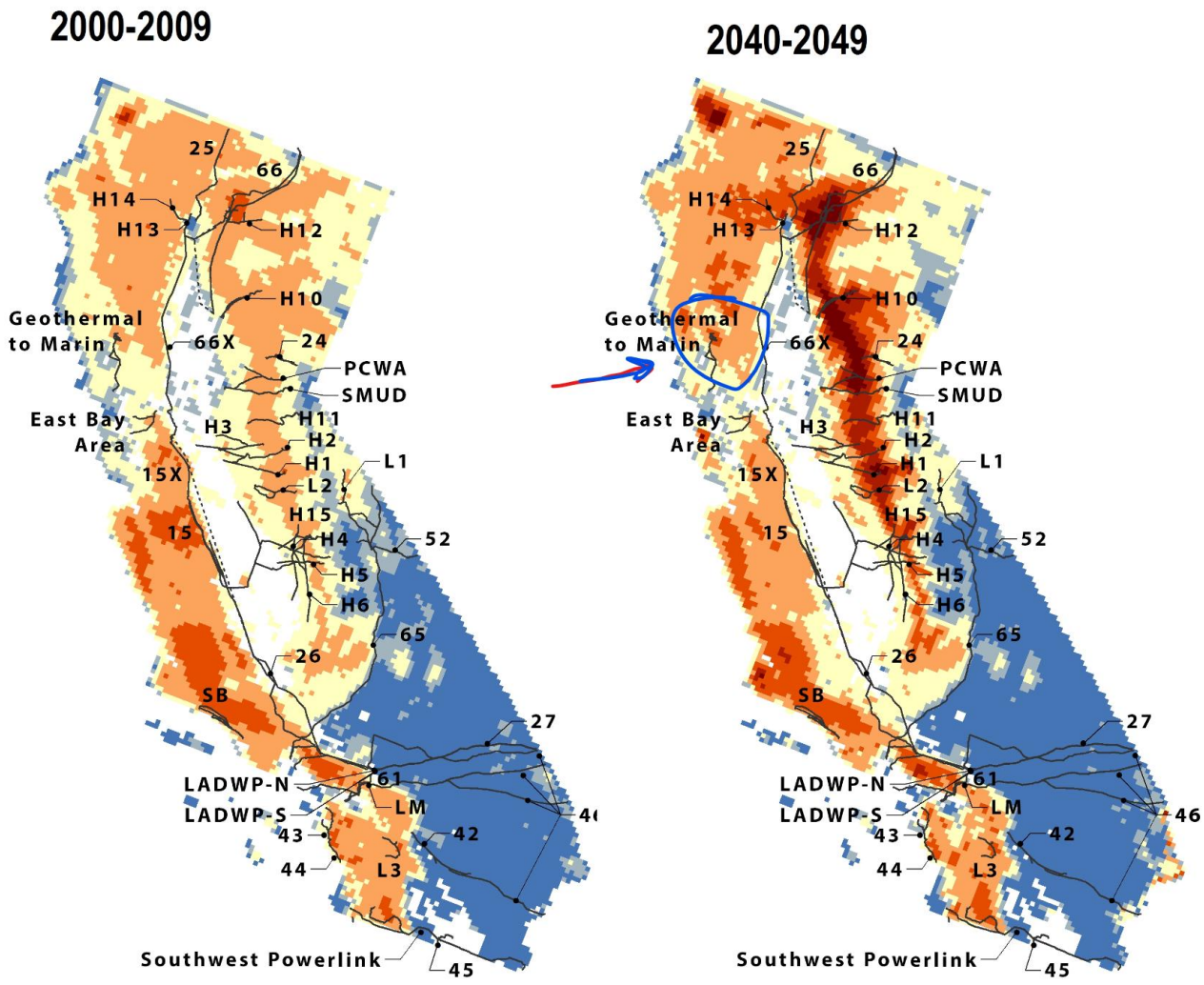
Further WUI Analysis



WUI Intermix, Interface, Density

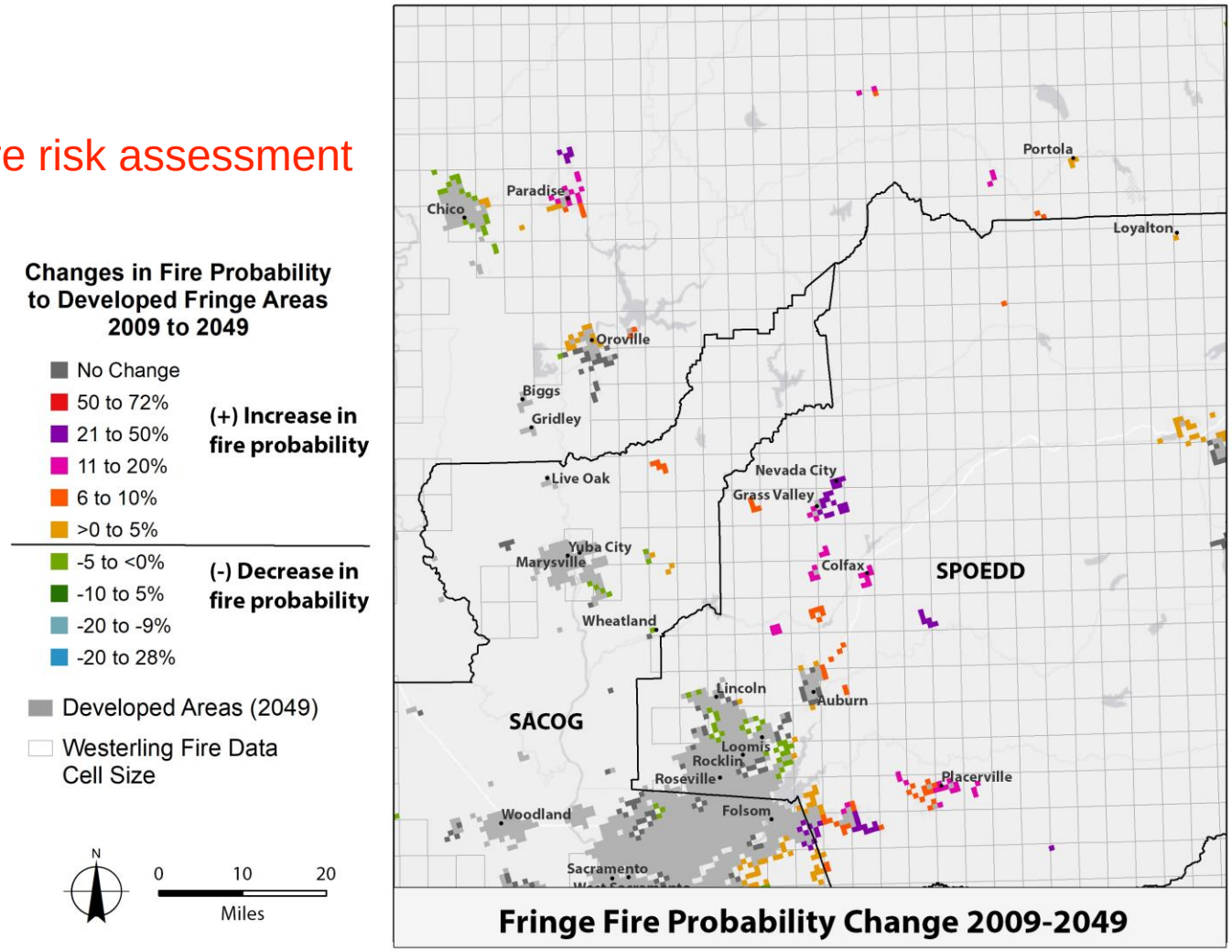
Credit: Envision Geo

These methods have current value



Last year's risk assessment

WUI fire risk assessment



Adaptation options

Transmission

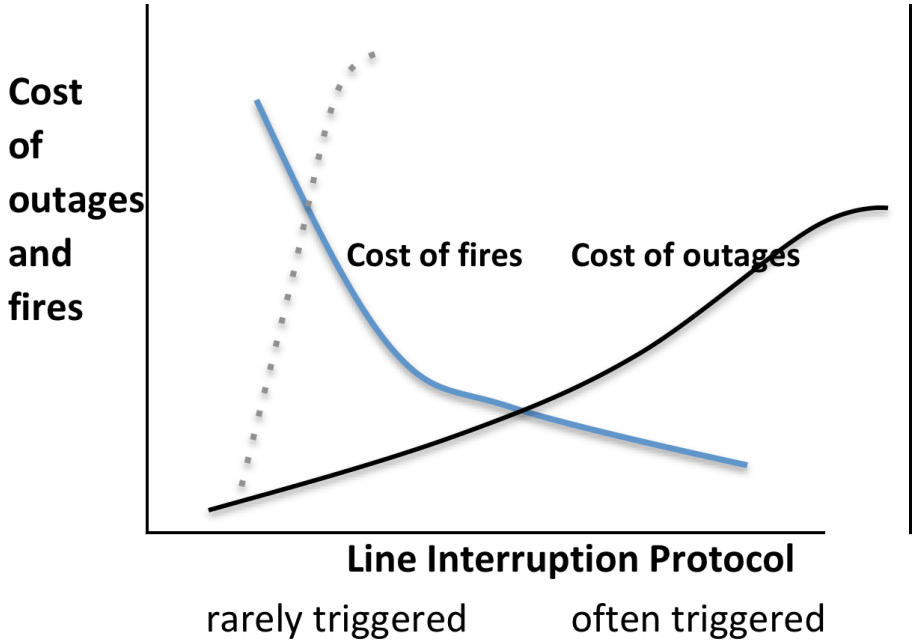
- Minimize transmission
  - — Micro grids
- Move transmission
  - — Underground lines
  - — Move lines to lower risk paths
    - WECC transmission capacity is often concentrated in high risk areas.
- De-energize transmission

Distribution

- Minimize fringe distribution
  - — Encourage urban infill, limit sprawl
- Move distribution
  - — Underground lines
  - — Move lines
    - Particularly in WUI areas
    - Zoning
- De-energize distribution

Focus on de-energizing lines

- Tradeoff between fires and power interruptions
  - How costly are outages?
- UCSB, LBNL LLNL UCSD UCB proposal
- Data needs
  - Wind data
  - grid interruption costs



More Info

Technical Reports

California Energy Commission 4th Climate Assessment

Wildfire

Assessing the Impact of Wildfire on California's Electricity Grid

Climate

Risk To California Energy Infrastructure From Climate Change

Insurance

Impact Of Changing Wildfire Risk On California's Residential Insurance Market

SDGE

A Sempra Energy utility

Lesley K. McAllister Symposium on Climate and Energy Law

The Impacts of Wildfires

- Brian D'Agostino, Director – Fire Science & Climate Adaptation, SDG&E

- November 8, 2019

Executive Summary

The purpose of this presentation is to provide an overview of SDG&E's enhancements since last fire season that will help provide community resilience and mitigate wildfire risk and improve community and stakeholder awareness

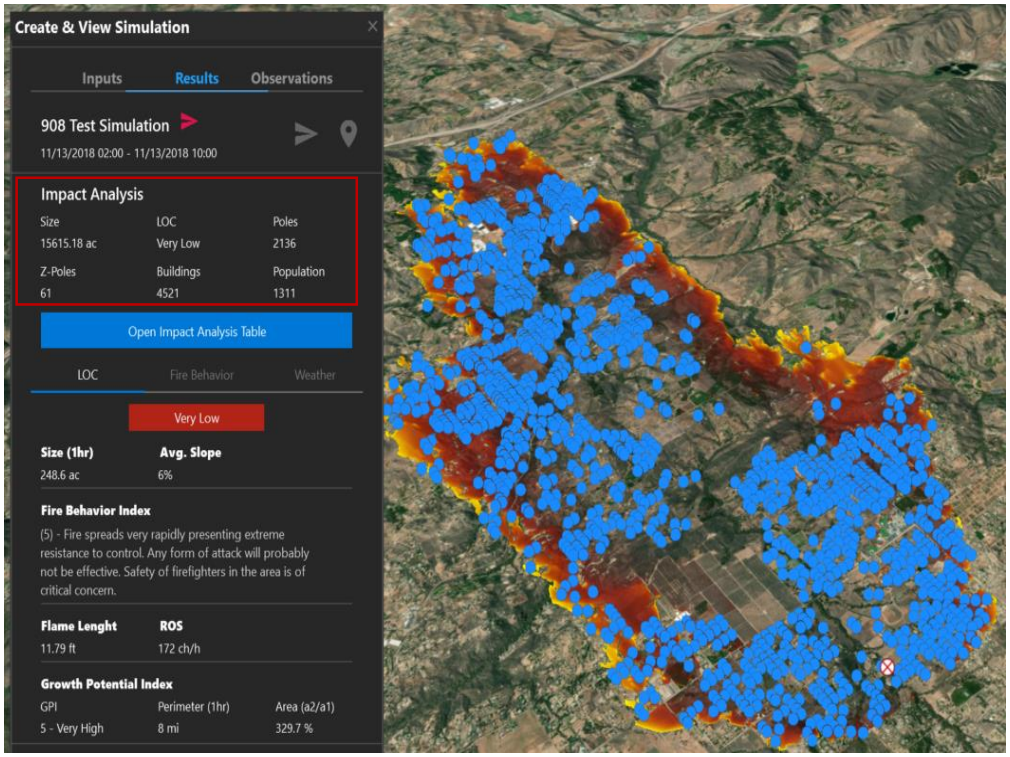
- Significant work has occurred in the implementation of SDG&E's Wildfire Mitigation Plan
- New tools to enhance operational decision making
  - Weather technology enhancements
  - New vegetation risk index
  - New inspection technology
- Additional hardening programs have been implemented
- Enhanced stakeholder awareness events and customer notifications

SDGE
A Sempra Energy utility

Weather Technology Enhancements

SDG&E continues to integrate big data, artificial intelligence and advanced analytics into meteorological operations through the analysis of additional data including tree trimming records and outage history

- Weather network is being upgraded to install additional stations in the Wildland Urban Interface (WUI) and enable 30-second data to support emergency operations
- SDG&E's fire behavior models have been synched with census data to further define the highest risk areas with respect to population density and structures
- SDG&E's Fire Potential Index has been upgraded to include more granular weather data from internal super computing program

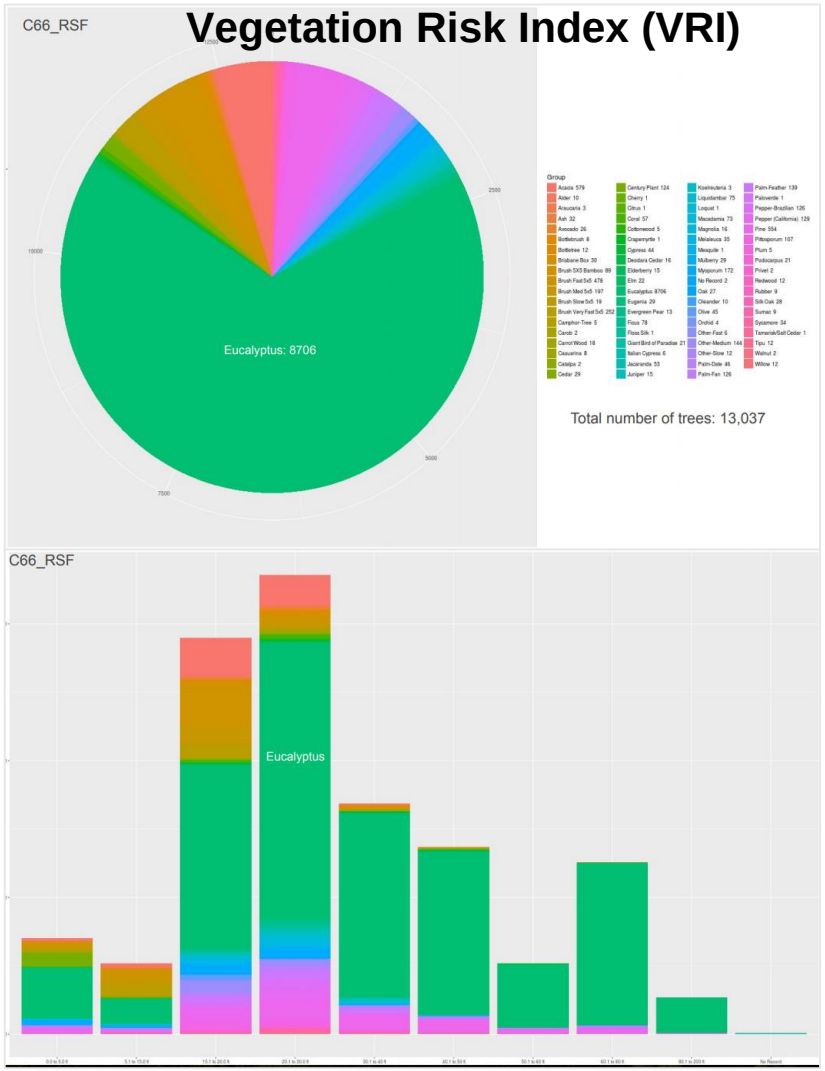


SDGE
A Sempra Energy utility

Improved Operational Decision Making Tools

SDG&E's Fire Scientists and Vegetation Managers have developed a new Vegetation Risk Index (VRI) to support decision making and improve operations during periods of high fire danger

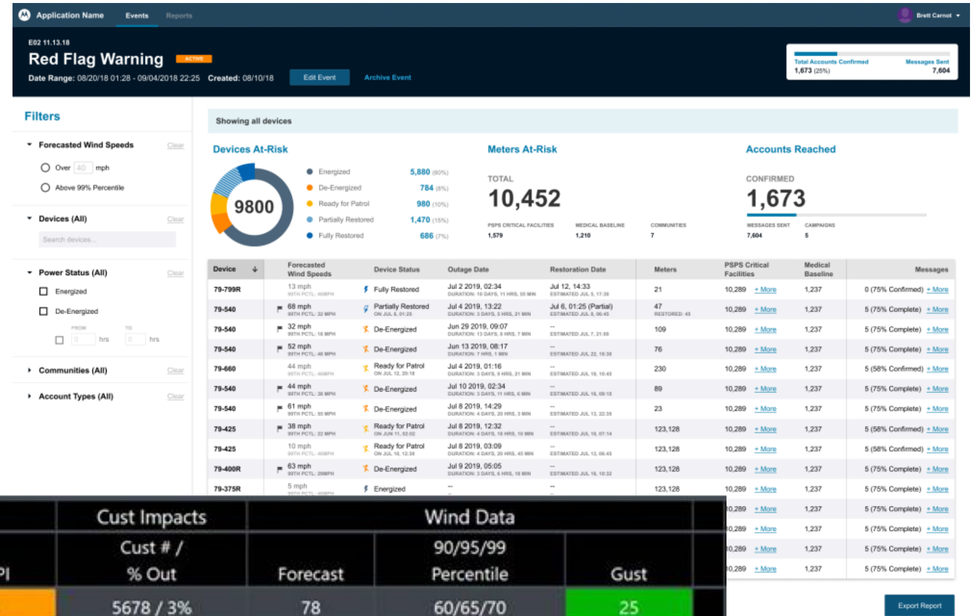
- The new tool quantifies the risk associated with vegetation by analyzing:
  - Total number of trees in the vicinity of a circuit
  - Height of trees
  - Tree species
  - Historical tree related outages
- Key benefits:
  - Assist in operational decisions during fire weather events
  - Prioritize vegetation management efforts
  - Enable more data-driven enhanced vegetation management program



Improved Operational Decision Making Tools

Upgraded Situational Awareness Dashboards have been developed to support decision making

- Situational Awareness Dashboards include:
  - Circuit-level vegetation risk
  - Historical wind information including the identification of the 95th and 99th percentile wind speeds
  - Customer communication analytics



ID Data					Cust Impacts	Wind Data		
Anemometer	VRI	Circuit	Tie Line	Sub/Dist/FPI	Cust # / % Out	Forecast	90/95/99 Percentile	Gust
Santa Ysabel North	X	220,221,222	625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69	625	ST/NE/14	5678 / 3%	78	60/65/70	25
West Rancho Bernardo	N	220,221,222	625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69	625	ST/NE/14	5678 / 3%	78	60/65/70	25
Santa Ysabel North	X	220,221,222	625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69	625	ST/NE/14	5678 / 3%	78	60/65/70	25
West Rancho Bernardo	N	220,221,222	625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69	625	ST/NE/14	5678 / 3%	78	60/65/70	25
Santa Ysabel North	X	220,221,222	625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69	625	ST/NE/14	5678 / 3%	78	60/65/70	25
West Rancho Bernardo	N	220,221,222	625	ST/NE/14	5678 / 3%	78	60/65/70	25
School House Canyon	X	67,68,69	625	ST/NE/14	5678 / 3%	78	60/65/70	25

New Infrastructure Hardening Programs

Infrastructure enhancements will reduce the risk of catastrophic wildfires

Pole Risk Mitigation + Engineering (PRiME)

- Documented pole loading calculations for all poles in SDG&E's service territory (starting in HFTD)
- Leverages improved methodologies including LiDAR[1] imaging, PLS-CADD[2] modeling software, and weather data to perform pole loading assessments of SDG&E's service territory
- Poles requiring construction activities will be remediated as they are identified
- The team replaced over 375 poles in 2019[3] and plans to remediate ~700 by year-end
- Additional ~1,700 poles targeted in 2020

Wire Safety Enhancement (WiSE)

- Targeted replacement of small conductor in the Wildland Urban Interface and coastal canyon areas
- Rebuilding overhead infrastructure to fire hardened construction standards
- 9 circuits targeted in 2019

1) Light Detection and Ranging (LiDAR)
2) Power Line Systems – Computer Aided Design and Drafting (PLS-CADD)
3) As of June 2019

SDGE
A Sempra Energy utility

Increased Stakeholder Awareness

SDG&E has conducted several community events to promote wildfire preparedness, resiliency and safety

- **Open Houses |** Six events across high risk fire areas to educate customers and promote community preparedness
- **Wildfire Resiliency Fairs |** Three events with several community partners :
  - Feeding San Diego
  - Fire Safe Councils
  - SD County Animal Services
  - San Diego Food Bank
  - SD Humane Society
  - Sheriff Departments
  - Sunrise Power Link Grant Program (Alpine Fair)
  - 2-1-1 San Diego
  - American Red Cross
  - Cal-Fire
  - California Highway Patrol
  - Community Emergency Response Team
  - Cleveland National Forest
  - County OES[1]
- **Operation Fire Safe |** A company and community-wide event to enhance wildfire preparedness will take place August 7

1) San Diego County Office of Emergency Services (County OES)

SDGE
A Sempra Energy utility

Customer Notifications

New requirements have been incorporated into processes and technologies

Notifications for the following audiences:

- Affected Customers
- Access and Functional Needs (AFN) Populations
- Critical Businesses + Utilities
- Public Safety Partners + First Responders
- Cal OES[1], Cal FIRE + CPUC[2]

SDG&E Website

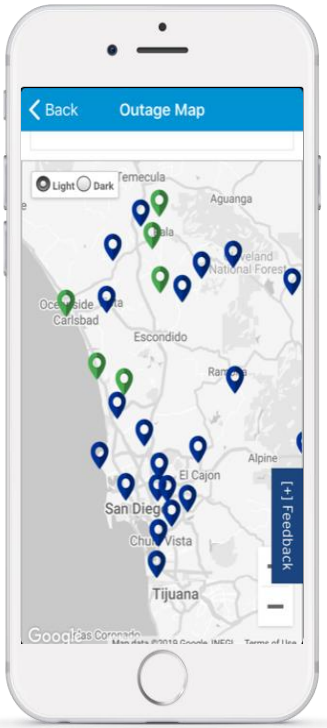
- Public Safety Power Shutoff dedicated web page during events

Communication Channels in Multiple Languages

- Email
- Text
- Phone

Joint IOU Message Coordination with Cal OES[1]

- Direct GIS feed made available sharing PSPS information with Cal OES[1]



Outage notifications delivered in 8 languages

- English
- Mandarin
- Cantonese
- Korean
- Vietnamese
- Tagalog
- Spanish
- Russian

1) California Office of Emergency Services (Cal OES)
2) California Public Utilities Commission (CPUC)