

Optimizing Tradeoffs of Public Safety Power Shutoffs for Wildfire Risk Reduction

Noah Rhodes

Department of Electrical and Computer Engineering

University of Wisconsin-Madison, Madison WI



Electric Grid - Wildfire Interactions

Power lines are **impacted by** fires

- Increased risk of flashovers due to smoke
- Power shutoff for safety of firefighters
- Direct damage to equipment

Many studies: Chobineh et al (2015), etc



Source: KTLA



Source: SF Chronicle



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Power lines can **ignite** fires

- Arcing due to faulty equipment
- Sparks from downed lines



Source: C.L. Benner, B.D. Russell, J.A. Wischkaemper, K. Muthu-Manivannan, and R.E. Taylor. *DFA Technology Detects Circuit Device Failures—Experience of Mid-South Synergy*. Annual Conference for Protective Relay Engineers, 2019



Ignition events are not uncommon



Kilmore East fire, deadliest of the Black Saturday Fires 2009, was started by a power line and killed 159

**national
museum
australia**

PG&E inspections of equipment that sparked deadly Camp fire were flawed, state regulators say



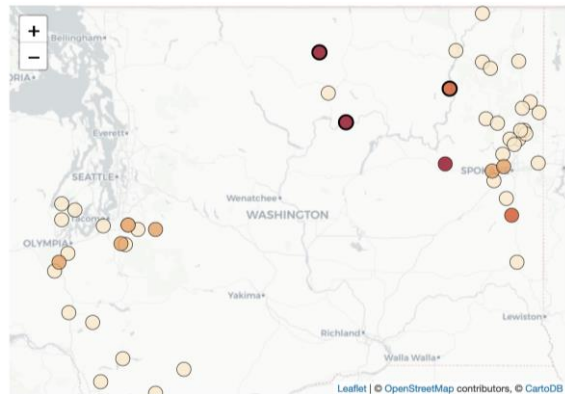
Helicopters perform a drop on the Camp fire in November 2018 outside of Pulga, Calif., on the North Fork of the Feather River. (Carolyn Cole / Los Angeles Times)

Los Angeles Times

- In California, PG&E reported more than **400 ignition events** in 2015-2017

- In Texas, more than **1000 fires** estimated to be ignited by power lines every year.

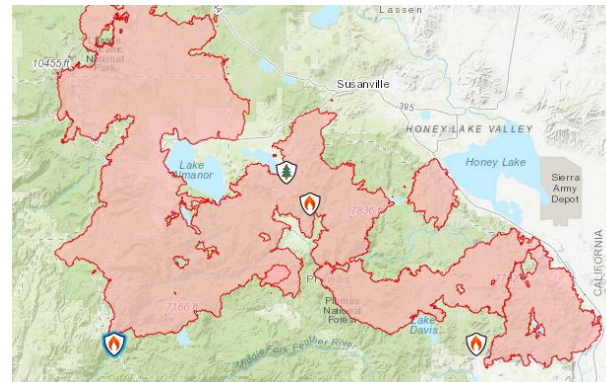
2020 Labor Day week fires in Washington state



Source: state Department of Natural Resources

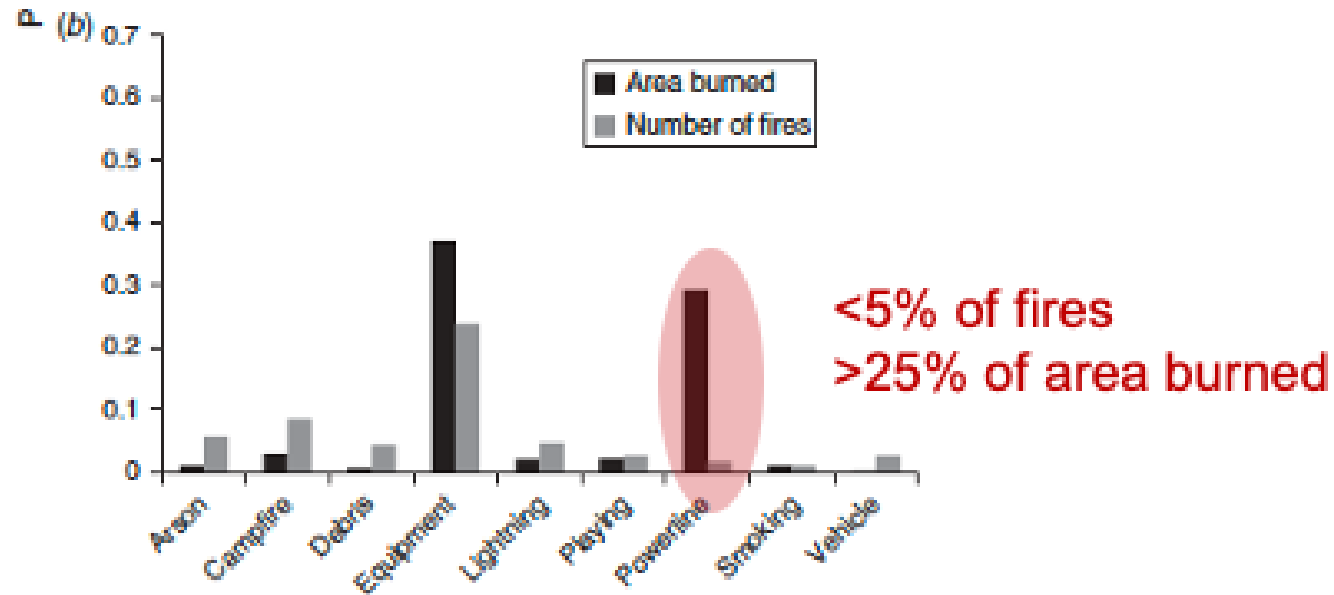
Leaflet | © OpenStreetMap contributors, © CartoDB
Mapping: Emily M. Eng / The Seattle Times
Data reporting: Manuel Villa / The Seattle Times

Dixie Fire InciWeb - Incident Information System



- In Washington state, **47 fires** were ignited by power lines on Sep 7-8 2020

Wildfires ignited by power lines are often large



Wildfires in San Diego County. Figure from Syphard, Alexandra D., and Jon E. Keeley. "Location, timing and extent of wildfire vary by cause of ignition." *International Journal of Wildland Fire* 24.1 (2015): 37-47.

Reducing Wildfire Risk



Measures to reduce probability of ignition¹:

Undergrounding of lines^{2,3}

+ reduces risk to zero

- costly!

Vegetation management³/
maintenance of equipment

+ quicker to implement

- some risk remains,
significant ongoing cost

Change protection systems
settings/new equipment

+ quicker to implement

- some risk remains,
longer power outages

Public safety power shutoffs⁴

**+ reduces risk to zero,
quick to implement**

**- very disruptive,
high societal cost**

¹ PG&E, "Pacific Gas and Electric Company Amended 2019 Wildfire Safety Plan," Tech. Rep., 2019

² S. Taylor and L. Roald, Sofia Taylor and Line A. Roald, "A framework for risk assessment and optimal line upgrade selection to mitigate wildfire risk", Electric Power Systems Research, 2022

³ A. Kody, R. Piansky, and D. Molzahn, "Optimizing Transmission Infrastructure Investments to Support Line De-energization for Mitigating Wildfire Ignition Risk," 2022

⁴ N. Rhodes, L. Ntamo, and L. Roald, "Balancing Wildfire Risk and Power Outages Through Optimized Power Shut-Offs," Dec. 2020

Public Safety Power Shut-Offs

PG&E could shut off power across Bay Area starting Wednesday



PG&E could conduct a “public safety power shutoff” across most of Northern California this week. Photo: Tracey Taylor

Update, Oct. 8, 10:30 a.m.: A PG&E spokeswoman said the utility still hasn’t decided whether to shut off power for portions of an unprecedented 30 counties throughout Northern California. If the “public safety power shutoff” occurs, it would most likely begin early Wednesday morning, the start of a high-wind period expected to last through Thursday afternoon, said Tamar

October 2019

Approximately 2.5 million people lost power

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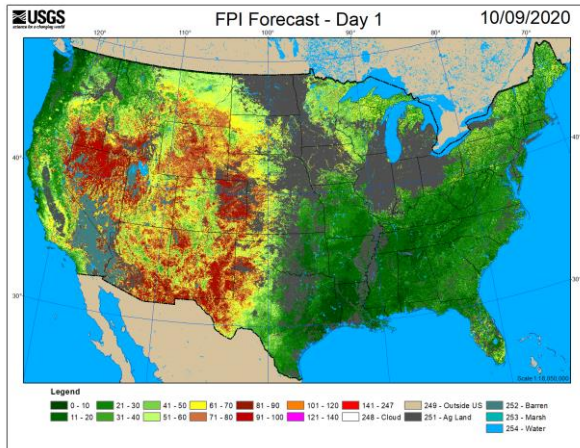
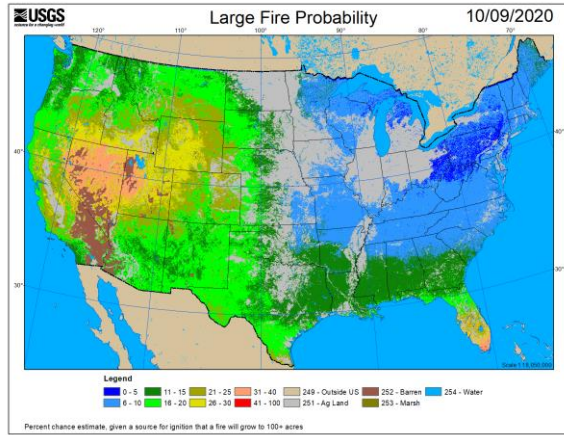
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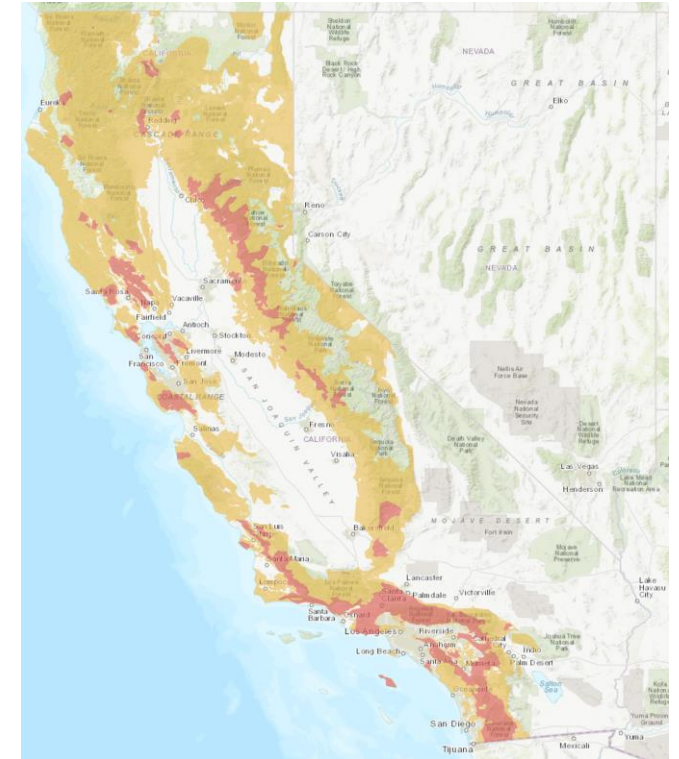
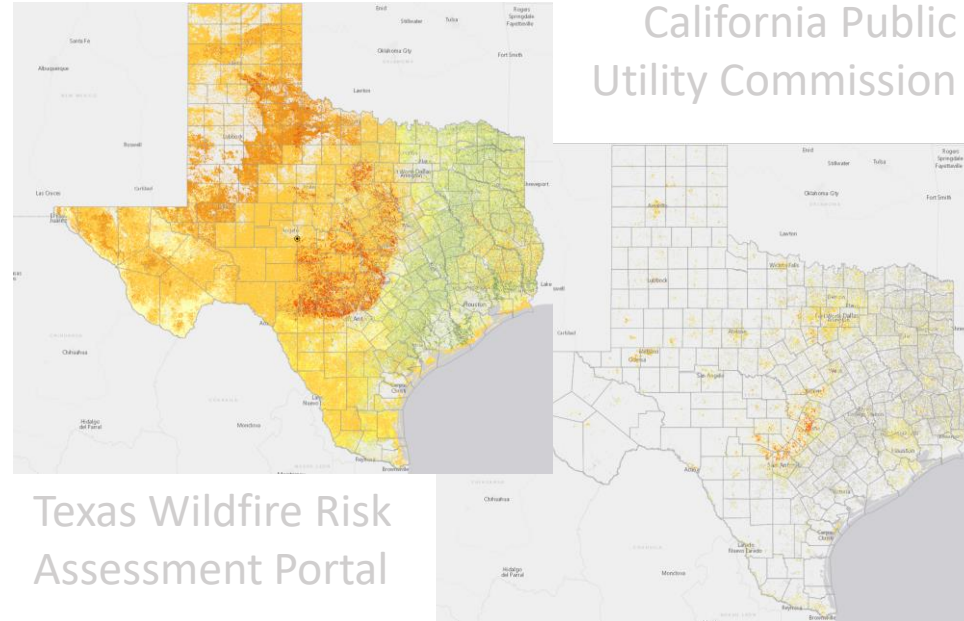
but

114 potential wildfires were avoided

Wildfire Risk Data



USGS



Many different wildfire risk assessments
What is the right kind of assessment for the electric grid?