Mitigating Wildfire Risk and Promoting Equity through Optimal Grid Operations & Planning

Sofia Taylor

University of Wisconsin-Madison
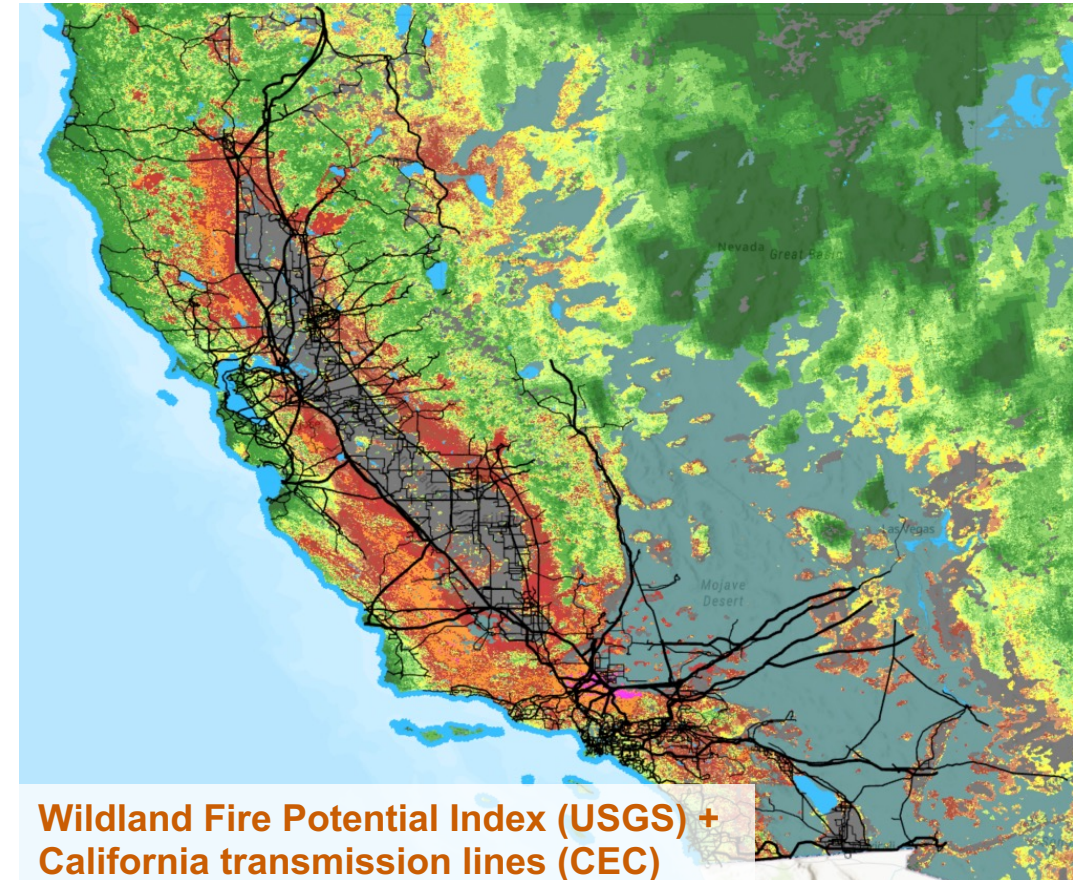
smtaylor8@wisc.edu

2023 EAP Conference: Energy, Fire, and Changing Landscapes

Assessing wildfire ignition risk from powerlines

- Electric power infrastructure can **ignite wildfires** through electrical faults

- We can use **wildfire potential maps** to quantify the potential for fire spread, if a fault occurs

$$risk = f \ (probability, \ impact)$$

Image: **TAMU**

Wildland Fire Potential Index (USGS) + California transmission lines (CEC)

2

Mitigating wildfire ignition risk from powerlines

Short-term mitigation:

- Preemptive power shutoffs

- Disable automatic reclosers

Long-term mitigation:

- Vegetation management

- Upgrade components (e.g., covered conductors, fire-resistant poles)

- Convert overhead cables to underground lines

3

Mitigating wildfire ignition risk from powerlines

Short-term mitigation:

- Preemptive power shutoffs

- Disable automatic reclosers

Operations decisions

Long-term mitigation:

- Vegetation management

- Upgrade components (e.g., covered conductors, fire-resistant poles)

- Convert overhead cables to underground lines

Planning decisions

Mitigating wildfire ignition risk from powerlines

Short-term mitigation:

- Preemptive power shutoffs

- Disable automatic reclosers

Operations decisions

Long-term mitigation:

- Vegetation management

- Upgrade components (e.g., covered conductors, fire-resistant poles)

- Convert overhead cables to underground lines

Planning decisions

We can use mathematical **optimization** to make planning decisions that are optimal across many operations scenarios

Objectives in grid planning optimization

- **Minimize wildfire ignition risk** from power line faults

- **Maximize power delivered** to customers, with weights for customer **vulnerability** to power outages

Social Vulnerability Index
U.S. Centers for Disease Control & Prevention

Taylor, Sofia, Setyawan, Gabriela, Cui, Bai, Zamzam, Ahmed, and Roald, Line. *Managing Wildfire Risk and Promoting Equity through Optimal Configuration of Networked Microgrids*. United States: N. p., 2023. Web. doi:10.1145/3575813.3595196.

- **Minimize electricity rate increases** incurred to expensive long-term mitigation efforts

California Test System (CATS)

- An openly available, geographically-accurate synthetic test system for (optimal) power flow studies that is geo-located in the state of California.

- Does not reveal any Critical Energy/Electric Infrastructure Information (CEII)

We describe the procedure that we used to create the model in our paper:

California Test System (CATS): A Geographically Accurate Test System based on the California Grid

Sofia Taylor*, *Student Member, IEEE*, Aditya Rangarajan*, *Student Member, IEEE*, Noah Rhodes, *Student Member, IEEE*, Jonathan Snodgrass, *Member, IEEE*, Bernie Lesieutre, *Senior Member, IEEE*, Line A. Roald, *Member, IEEE*