

# Towards Comprehensive Wildfire Risk Assessment for Alaska's Electricity Grid Infrastructure

Alaska Geosummit 2023

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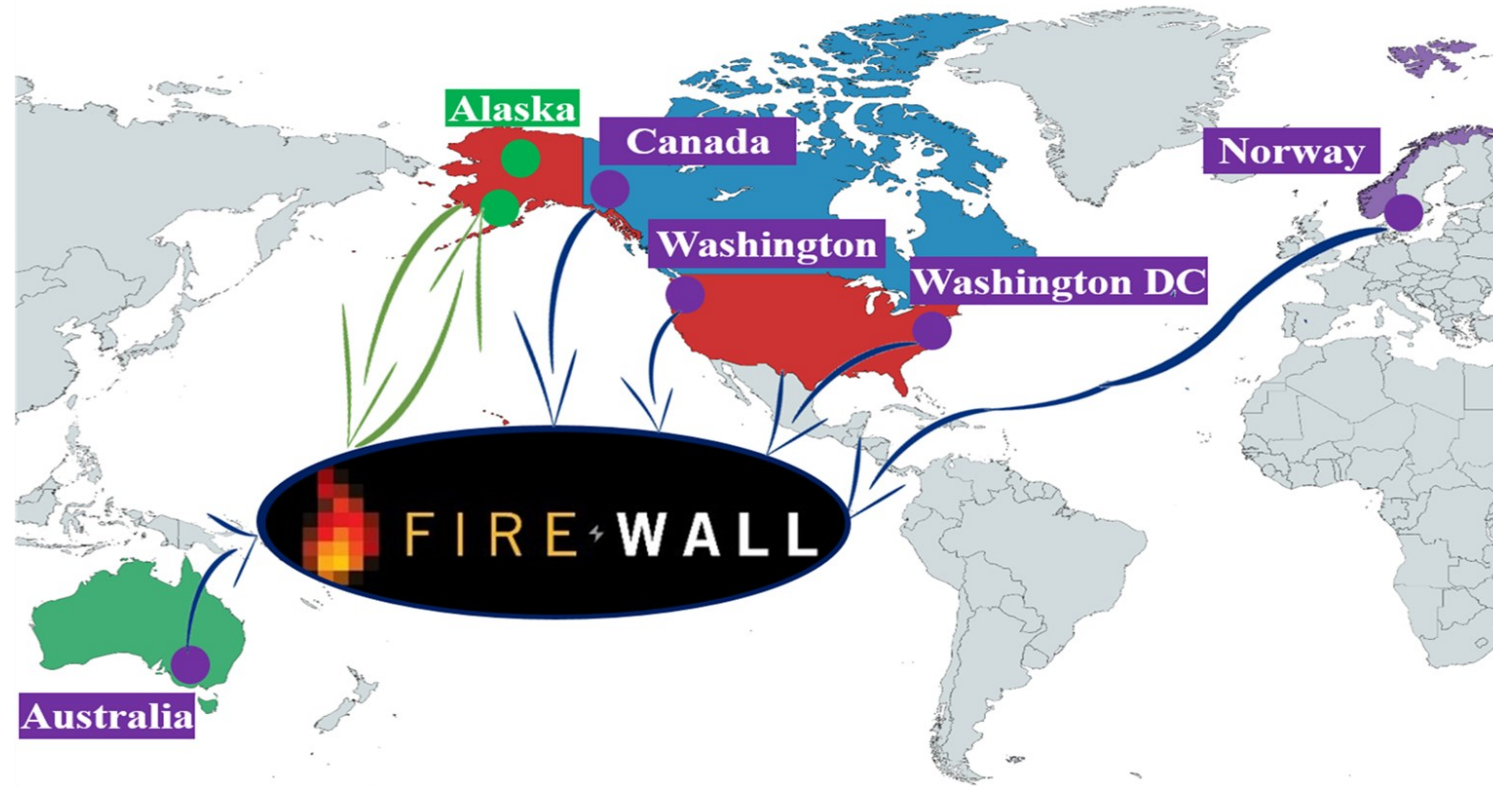
Photo: NPS/ Y MATSUI



UNIVERSITY of ALASKA  
ANCHORAGE



# Foundations for Improving Resilience in the Energy Sector against Wildfires on Alaskan Lands (FIREWALL)





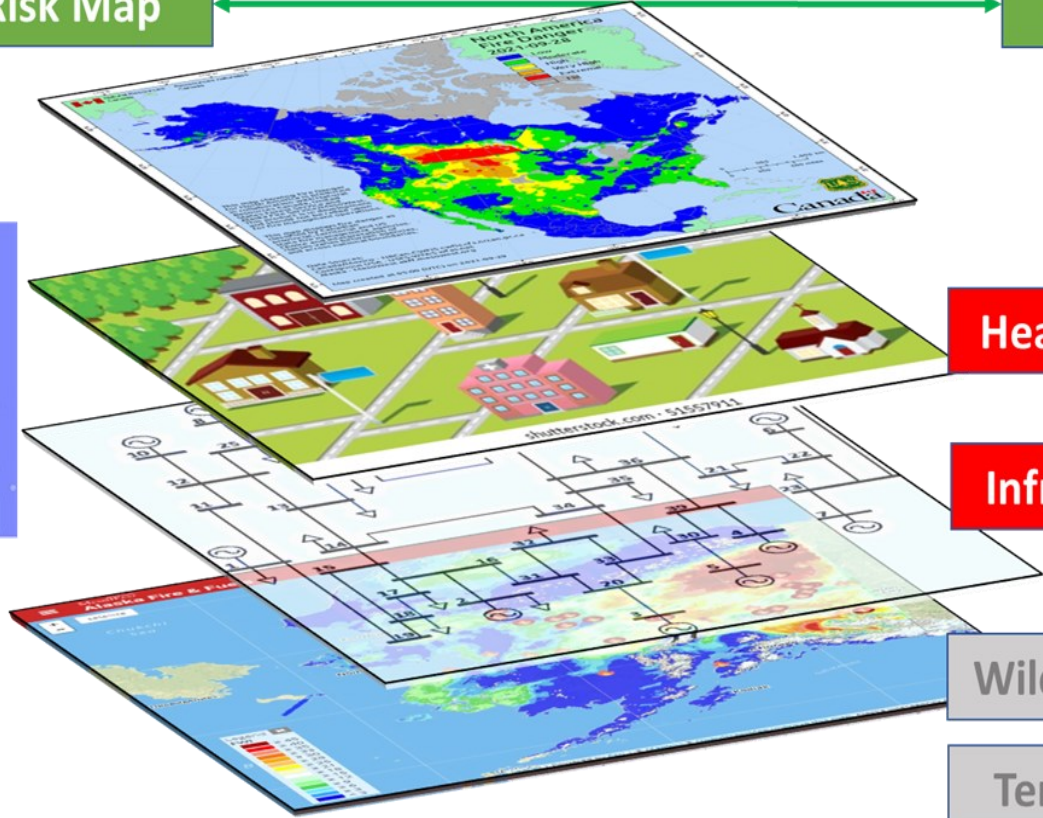


# Envisioned Outcome

**FIREWALL ALERT:**  
An Interactive Platform for Informed and Coordinated Decision-Making

Wildfire Risk Map

Consequences



Health Vulnerability

Infrastructure Layer

Wildfire Hazard Map

Temperature Layer

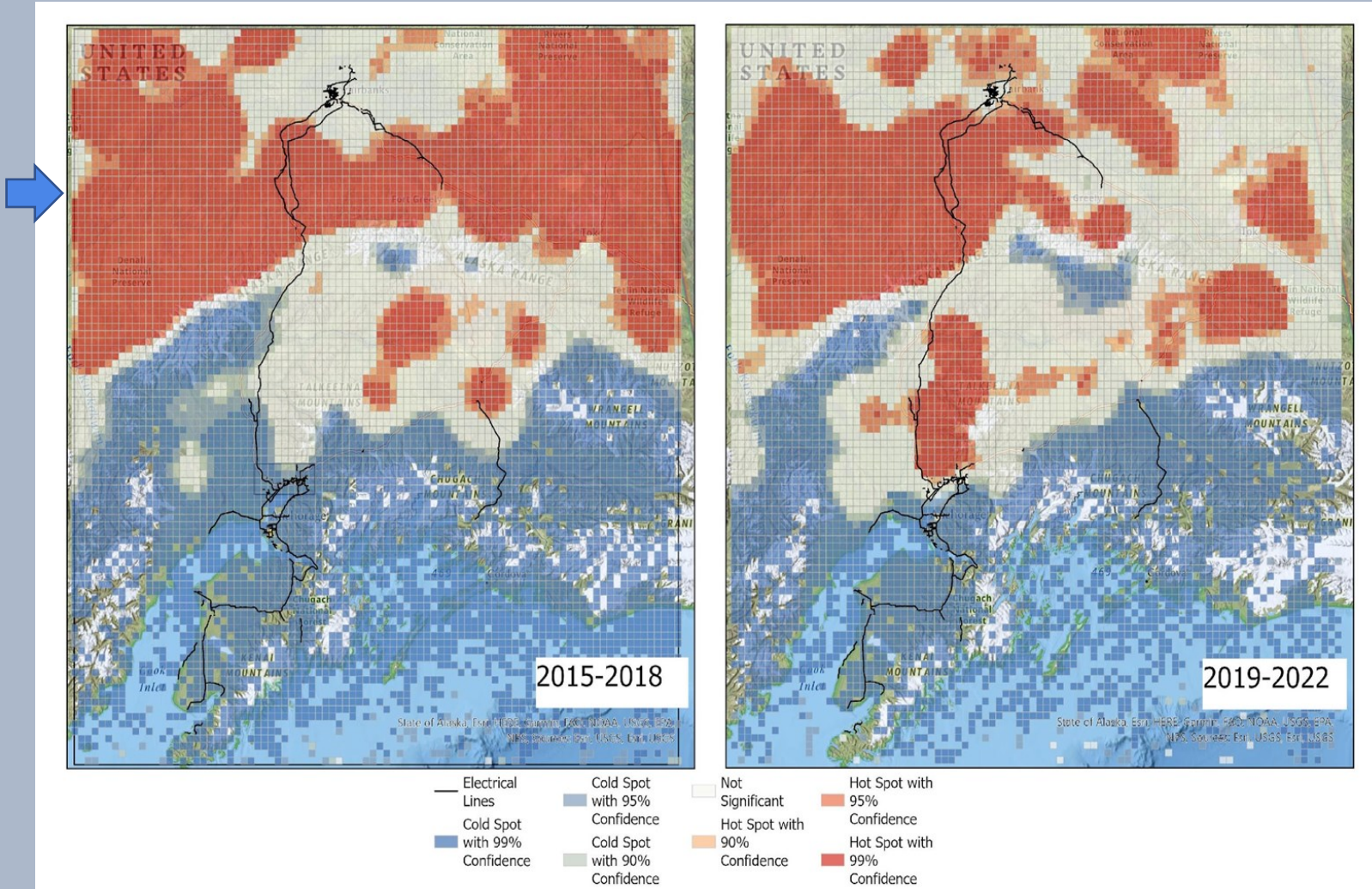
# Evaluating Lightning-Caused Wildfire Risk to Alaska's Power Grid Infrastructure

## Hot Spot Analysis of Cloud to Ground Lightning Strikes

The majority of burned area in Alaska is attributed to lightning-ignited fires, and this trend is anticipated to intensify in correlation with rising temperature. We found that lightning patterns are changing around Alaska's population centers.

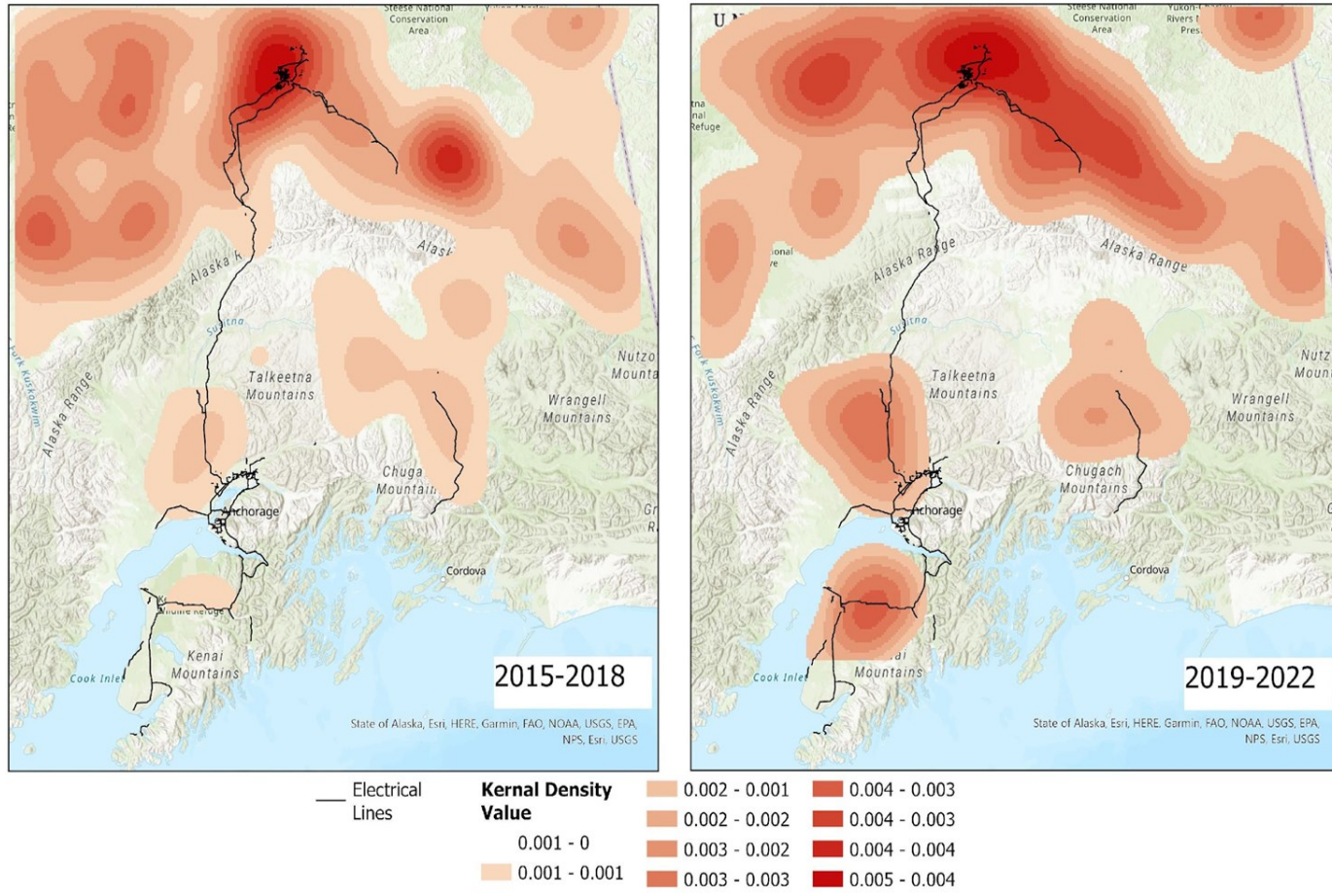
Electricity networks are highly vulnerable to climatological threats, especially forest fires and especially in Alaska.

Lack of readily available and expandable fire risk data for conducting risk assessments of critical infrastructures in Alaska.





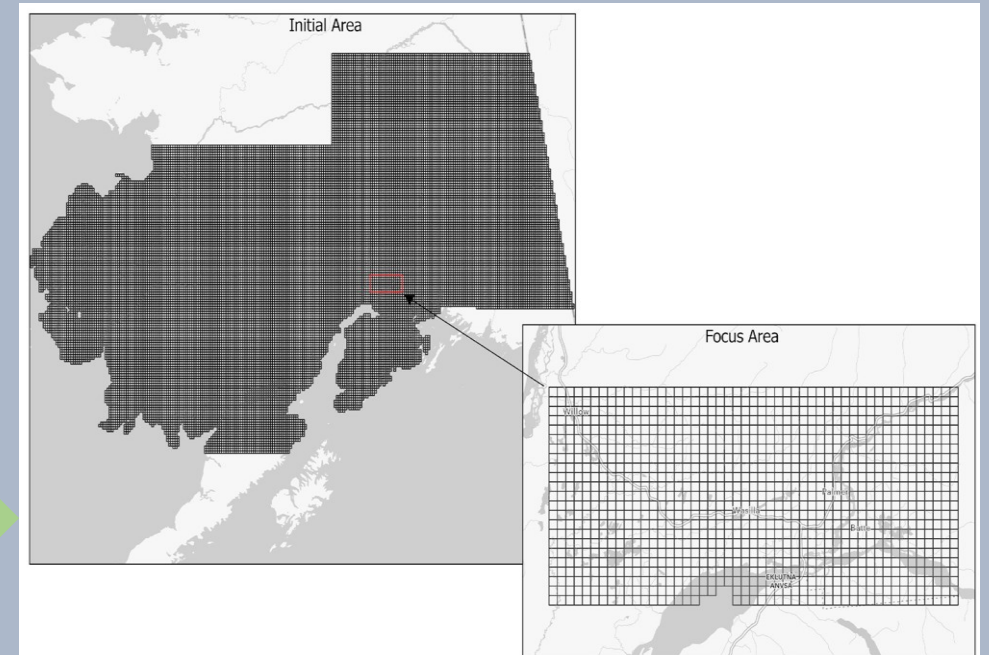
## Kernel Density of Lightning Ignited Fires

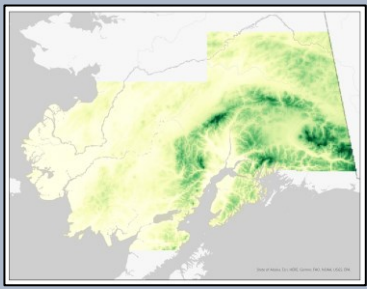


The Boreal Forest is fire prone and the size of area burned is projected to double by 2050 and triple by 2100 under continued emissions and further warming.  
Sanford, 2015

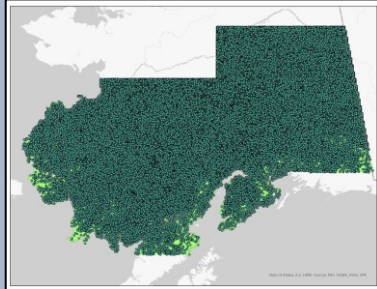
Following a similar trend to lightning strikes, lightning-ignited fire patterns are also changing.

These pattern changes led to the selection of our focus area within our initial study area.

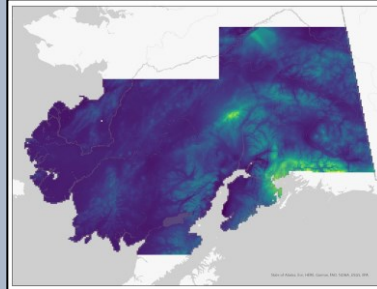




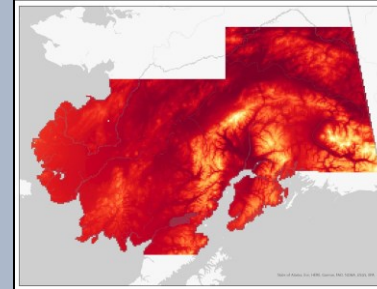
Elevation



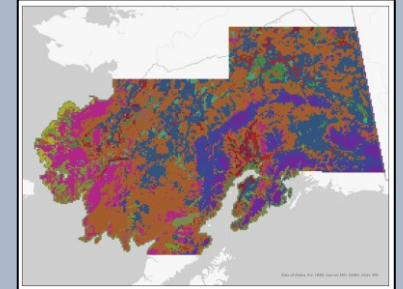
Lightning



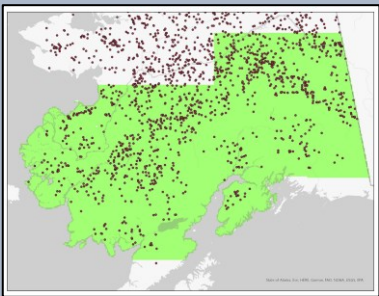
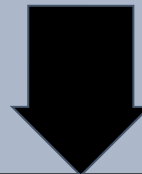
Precipitation



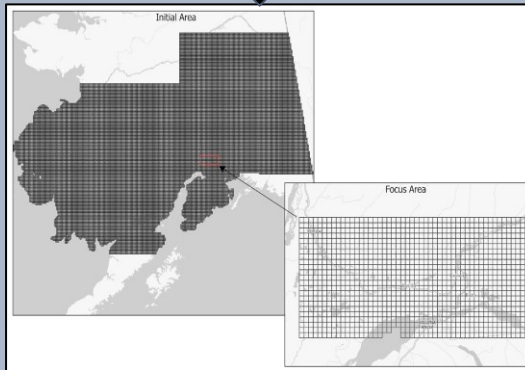
Temperature



Land cover



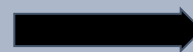
Lightning-ignited fires



Initial area: 3.3x3.3 mile fishnet  
Focus area: 1x1 mile fishnet

Two probability distributions combined to calculate fire risk:

- Distance-based probability
- Historical event count probability



Machine Learning & Data Analytics



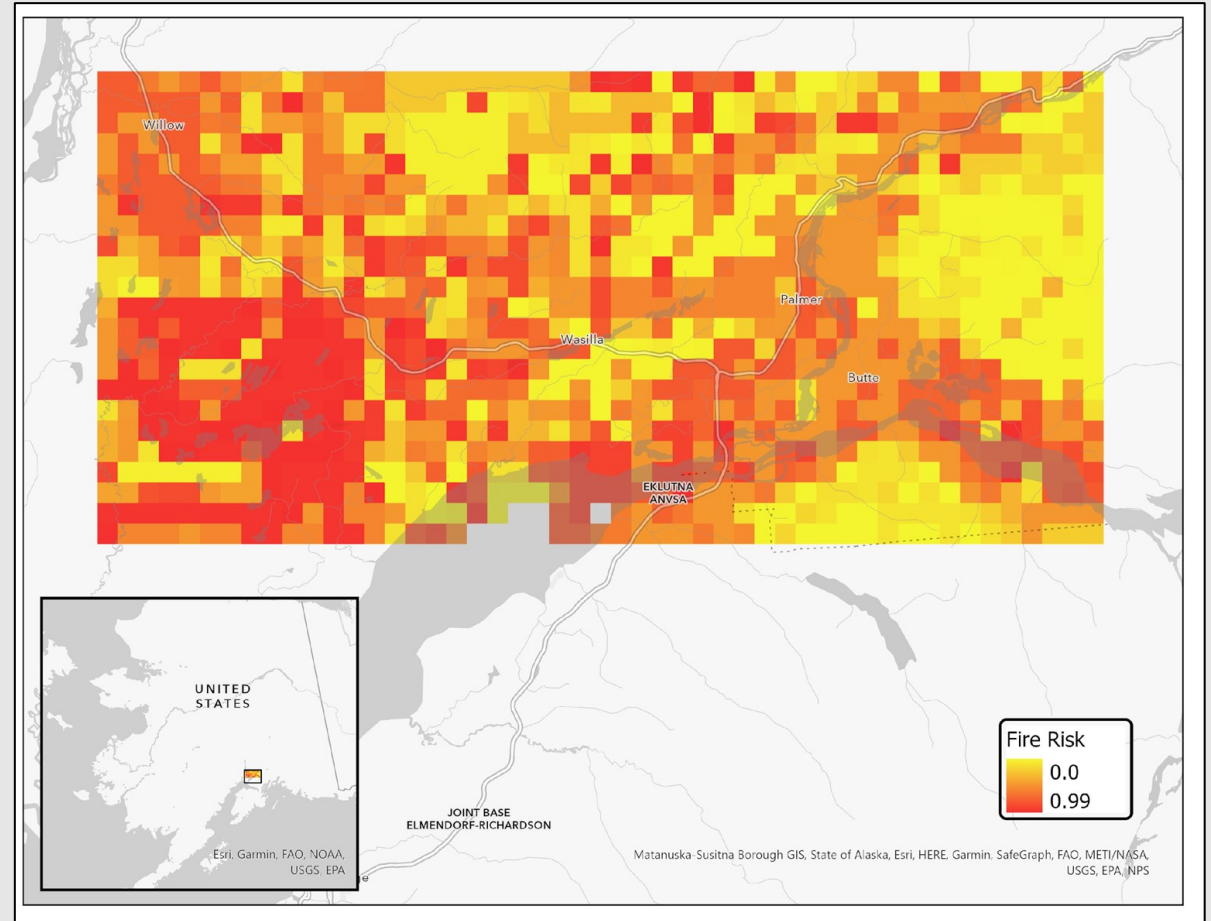
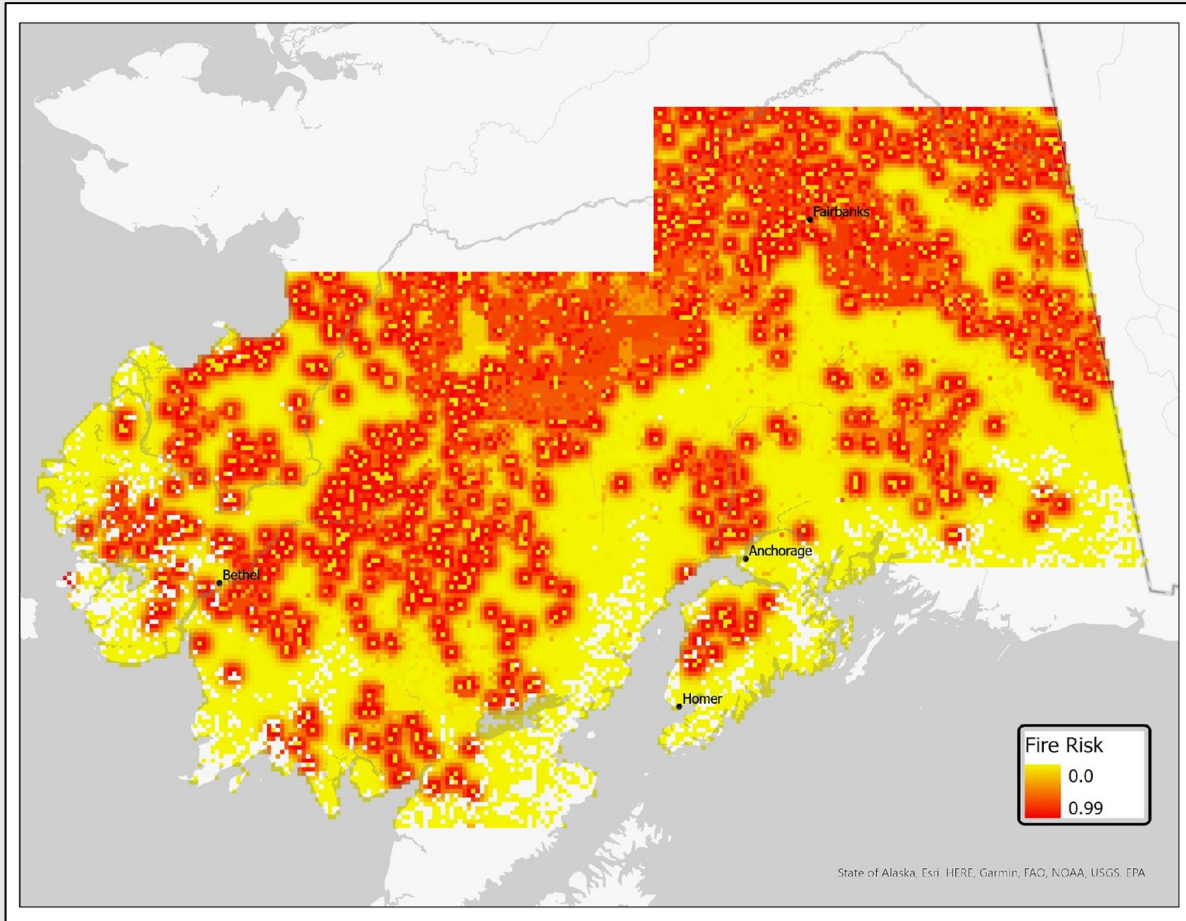
**Feature Selection:** Significant features exhibiting substantial correlations identified and retained, while redundant or weakly correlated features are systematically removed.

**Decision Tree Regression:** gradual assembly of a decision tree by segmenting the dataset into subsets guided by those features. An iterative progression was sustained until distinct termination criteria were satisfied.

2015-2022



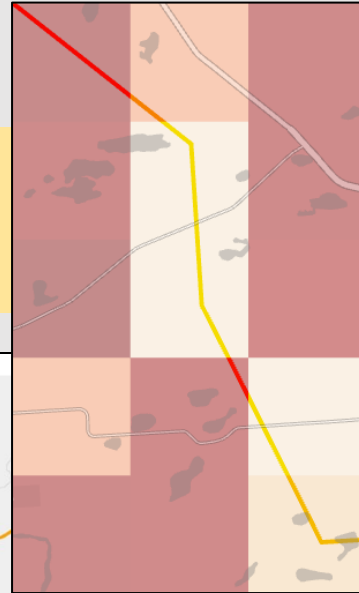
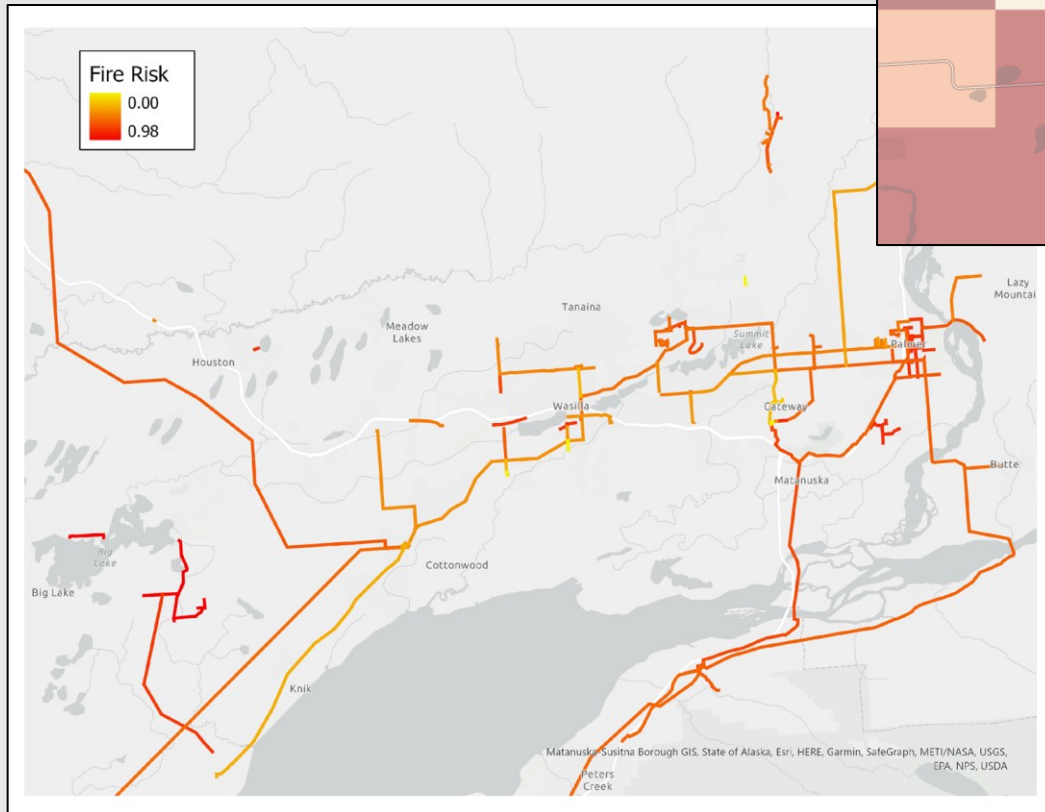
# Predicted Fire Risk Maps



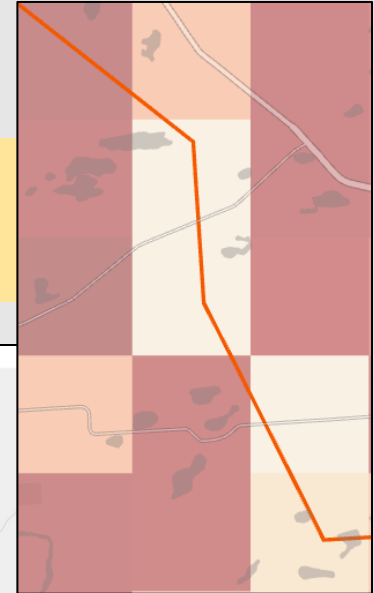
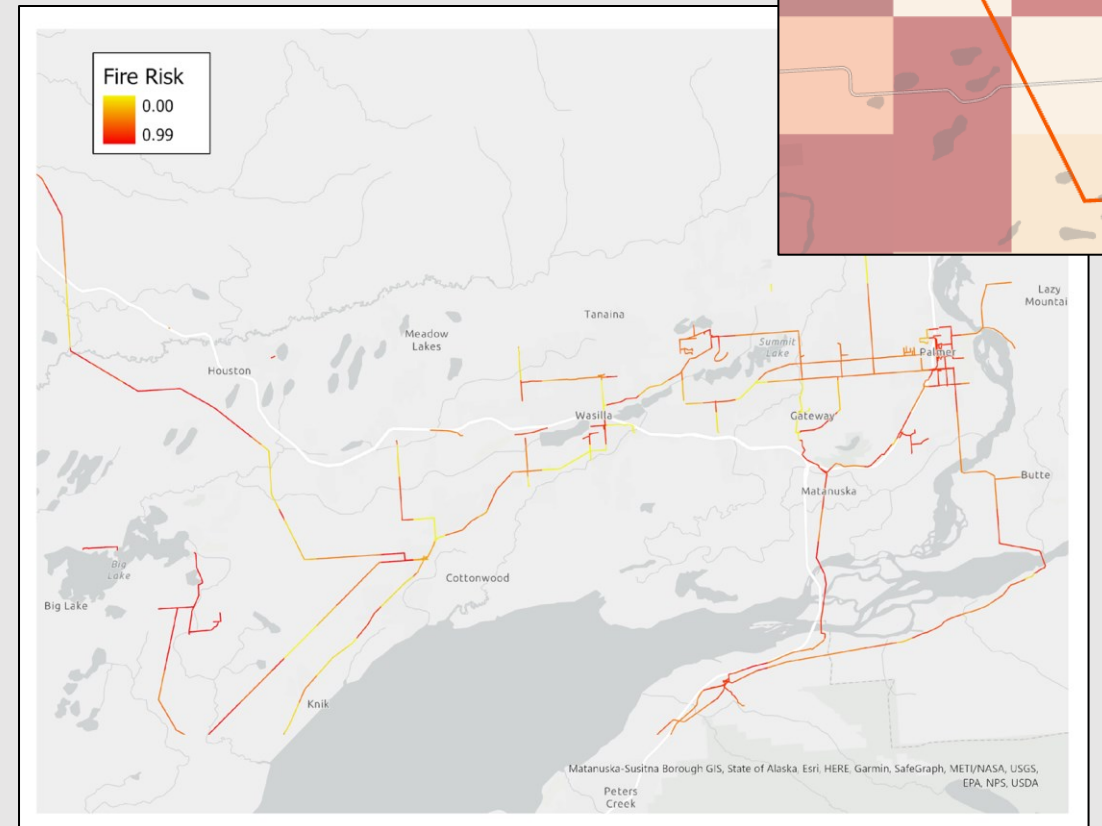


# Applying Fire Risk to Electricity Infrastructure: Two Methods

*Spatial join* to assign fire risk value to each infrastructure based on the average fire risk value for all fishnet squares the infrastructure intersects

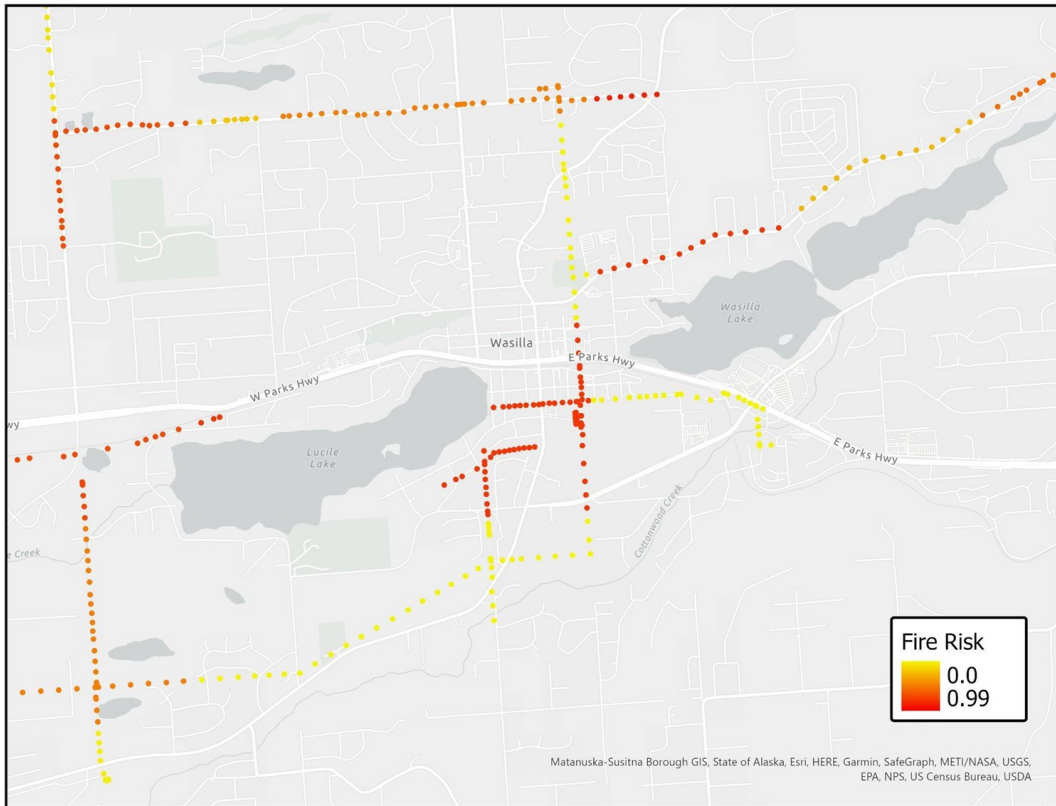


*Clip* the fishnet to the shape and location of the infrastructure



# Future Work

## Fire Risk Applied to Electric Utility Poles



- So far we have established a framework for assessing fire risk that can be applied to power infrastructure using readily available data.
- Improved data sets with higher temporal resolution have the potential to assess high risk areas in real-time.
- Including other sources of fire ignition.
- Identifying and including vulnerabilities within communities and built environments.
- Precise and understandable wildfire risk assessment plays a pivotal role in decision-making and preparedness in fire prone areas like Alaska.





# Thank You!

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