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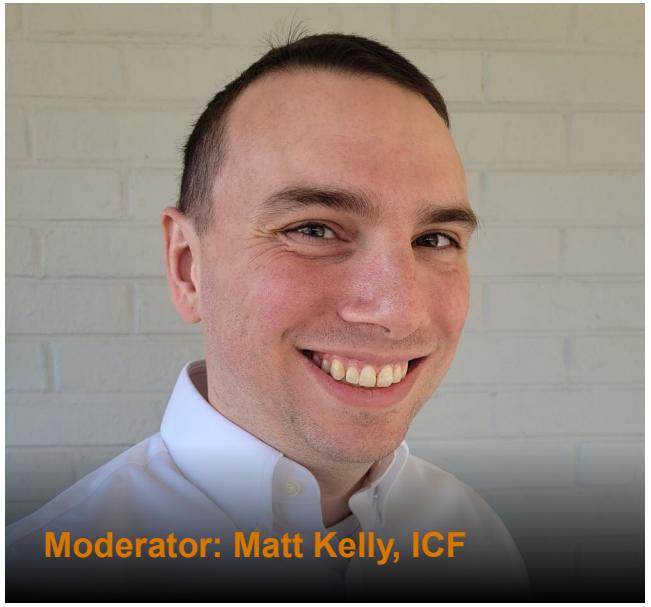
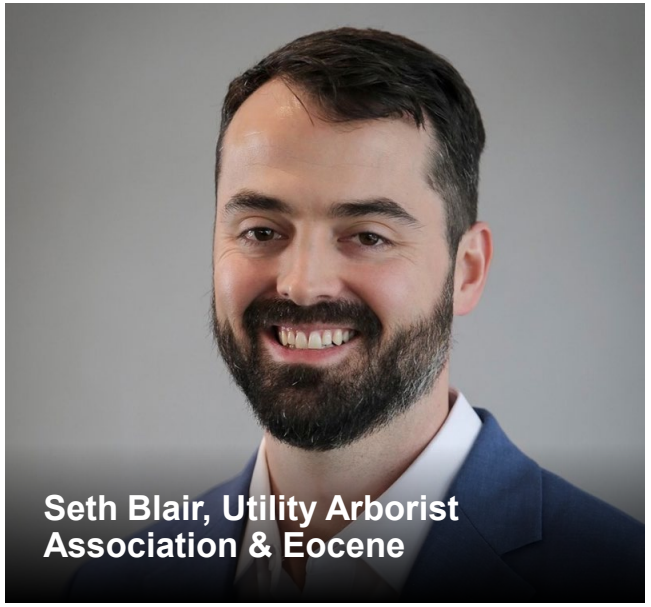
State of Wildfire: Data, History, and Practice





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Fire Data for the Piedmont – History and Trends

Jerry Tagestad

U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

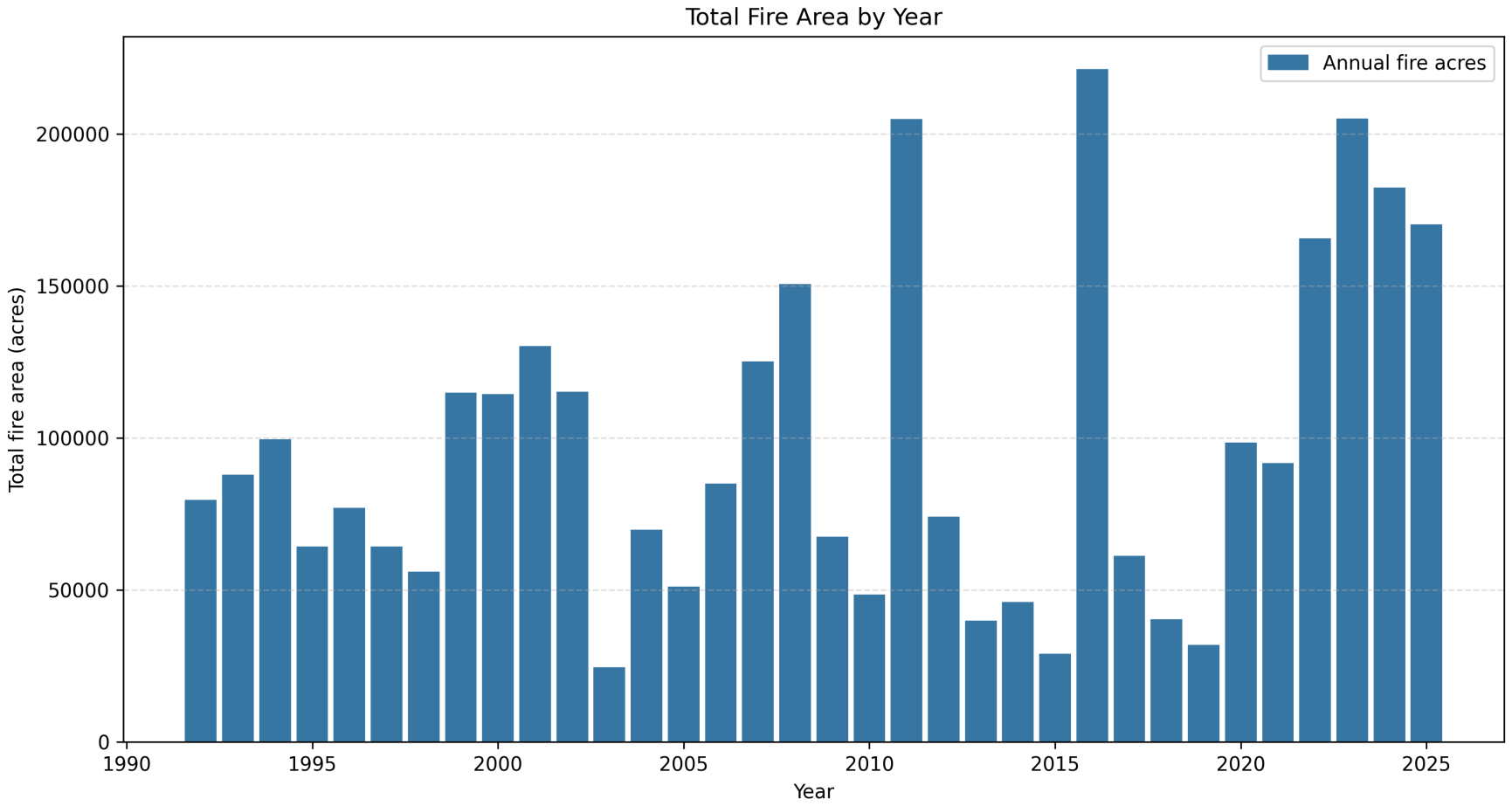
Combined Two Datasets

- InFORM Fire Occurrence
  - 2020-2026
- USFS FOD
  - 1992-2019
- Authoritative ≠ Perfect

https://data-nifc.opendata.arcgis.com/datasets/nifc::inform-fire-occurrence-data-records/about

https://www.fs.usda.gov/rds/archive/products/RDS-2013-0009.7/RDS-2013-0009.7_Data_Format2_GDB.zip

Piedmont Region Burned Trends 1992-2026



Mann-Kendall trend analysis:
Period: 1990–2025
Trend: no trend
P-value: 0.102121
Significant at alpha=0.05: False

SOURCE: Combined FOD & InFORM

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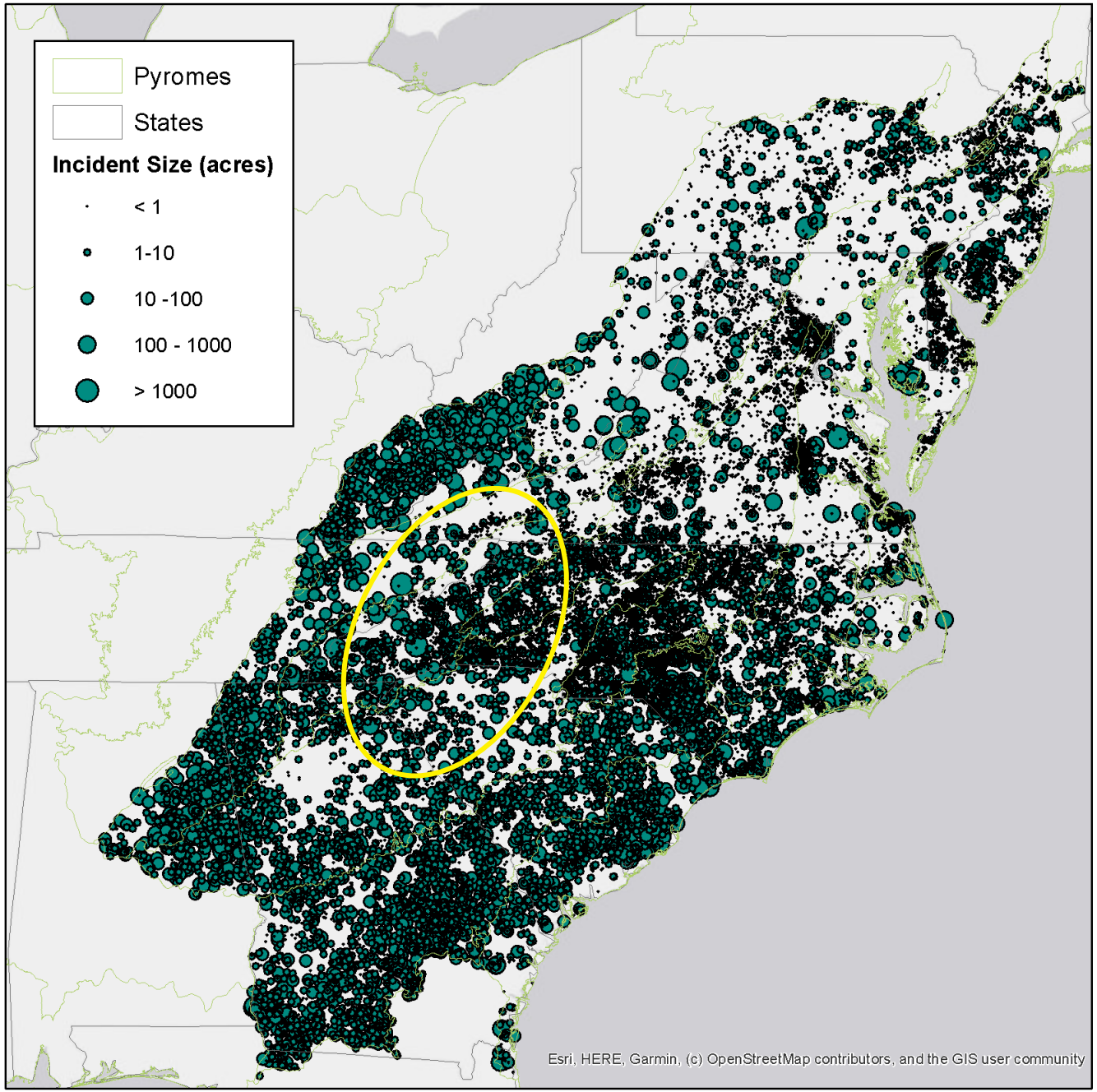
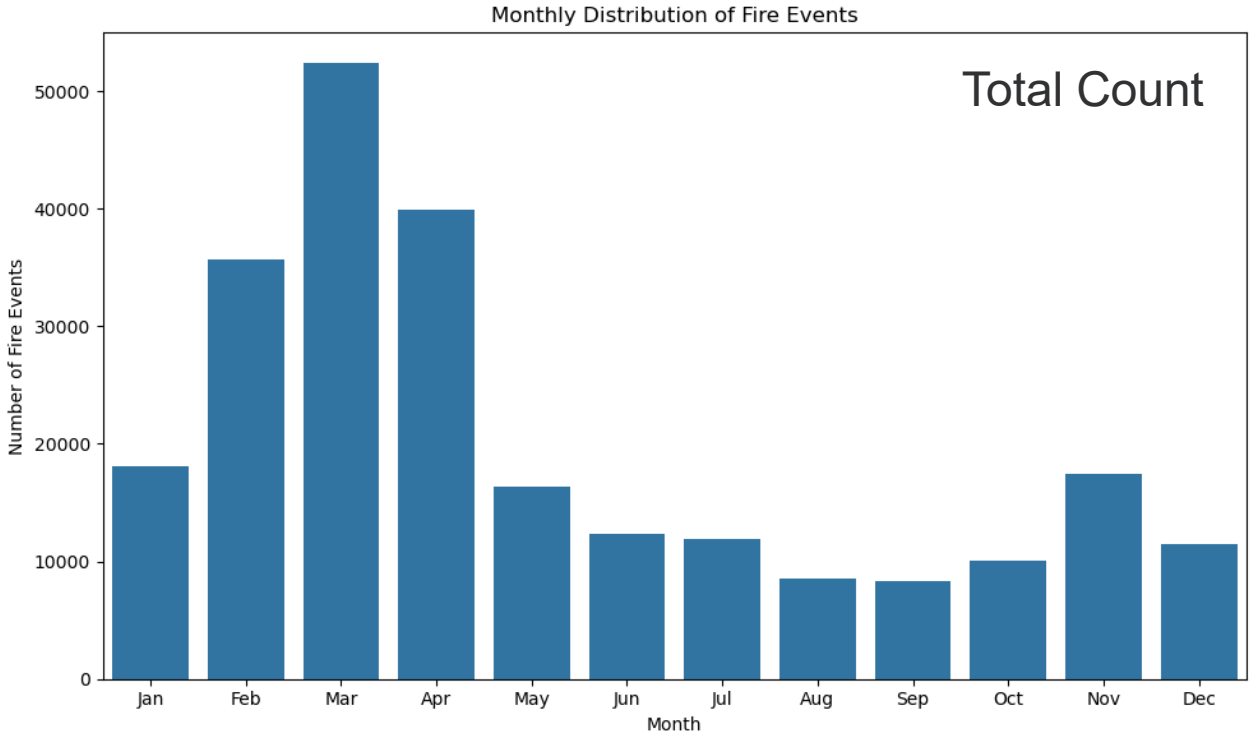
2025 Fires

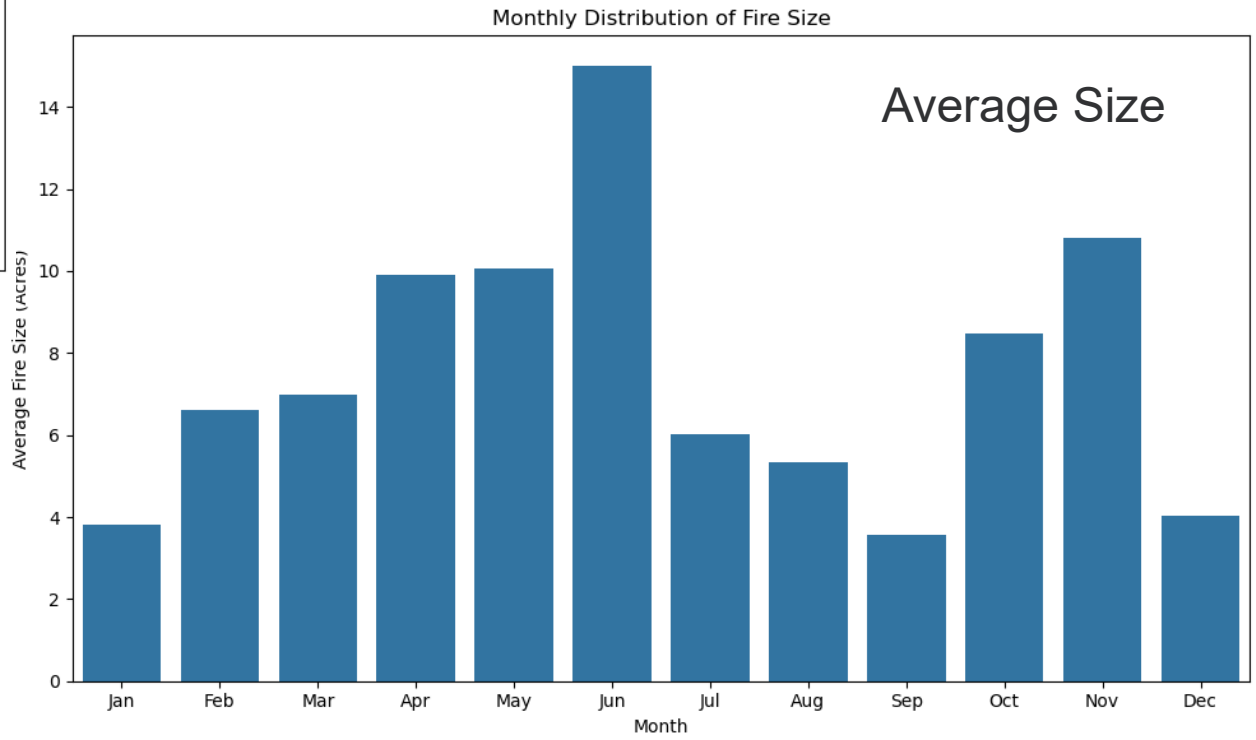
- Piedmont region ~30,000 acres burned
- Downed timber from hurricane Helene could contribute to fire size in some areas



SOURCE: InFORM

Piedmont Fires by Month 1992-2020

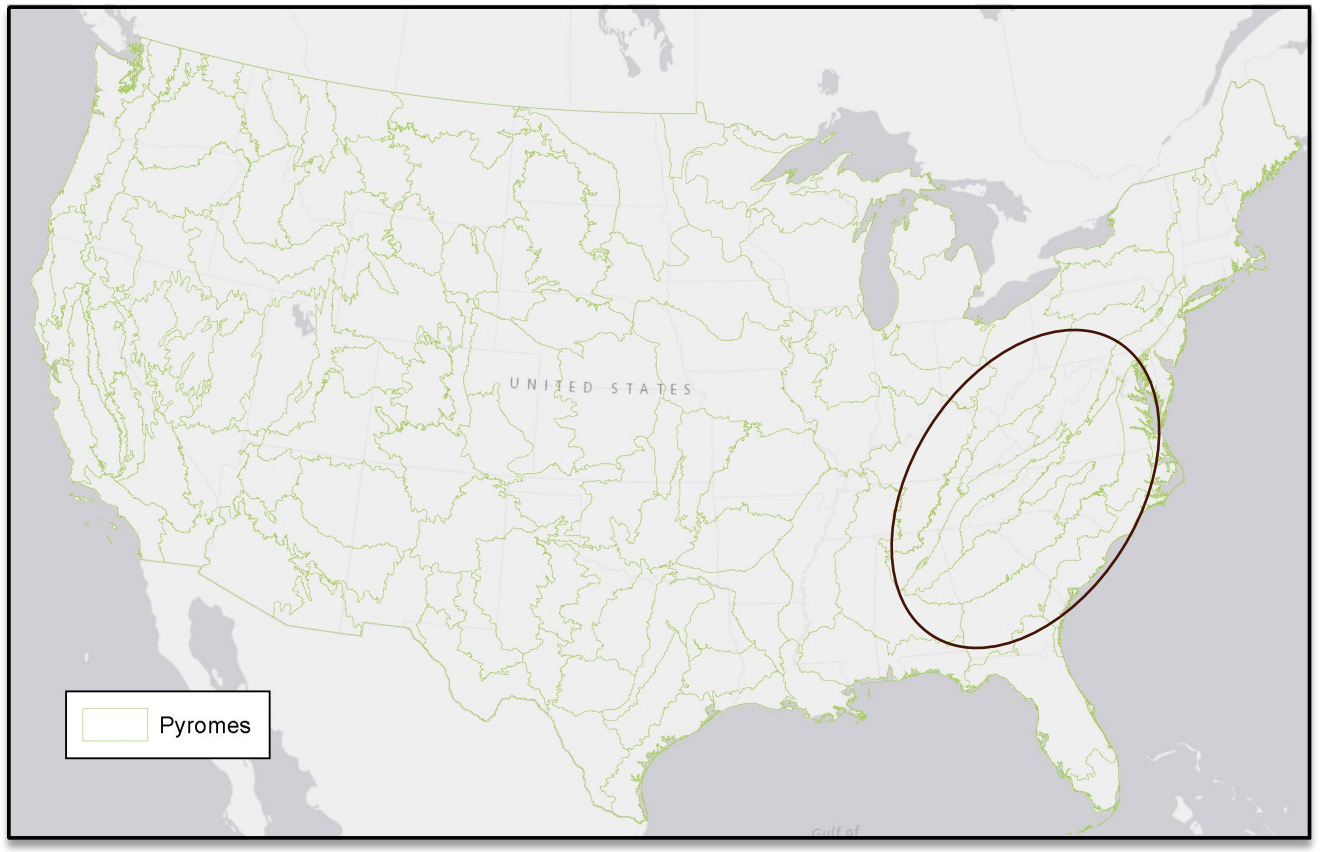




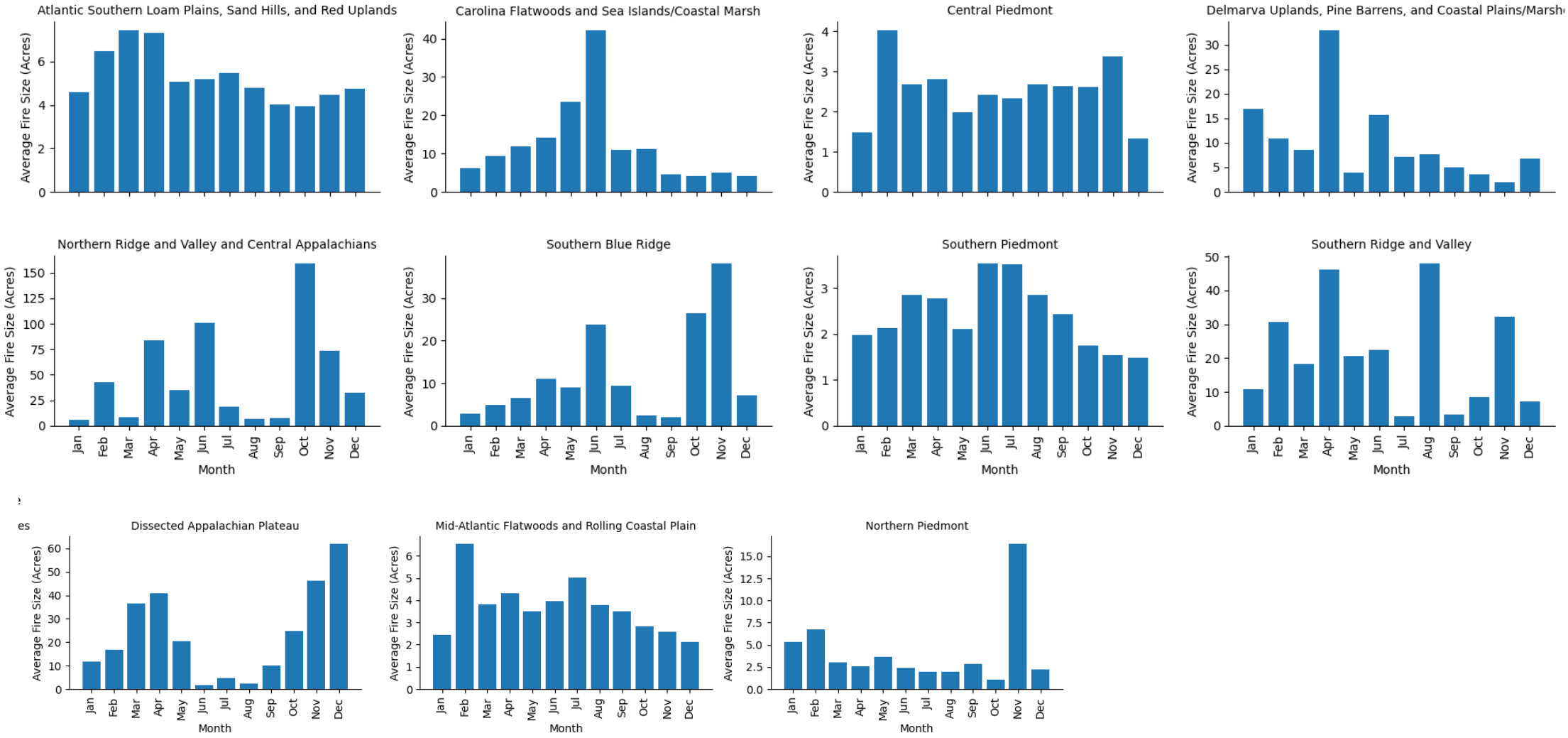
SOURCE: USFS FOD

Pyromes (like ecoregions for fire)

- Geographic regions characterized by similar fire regime patterns
- USFS defines them based on fire history, fuel type, climate etc.
- Look at historic (1992-2026) fire occurrence within Piedmont pyromes

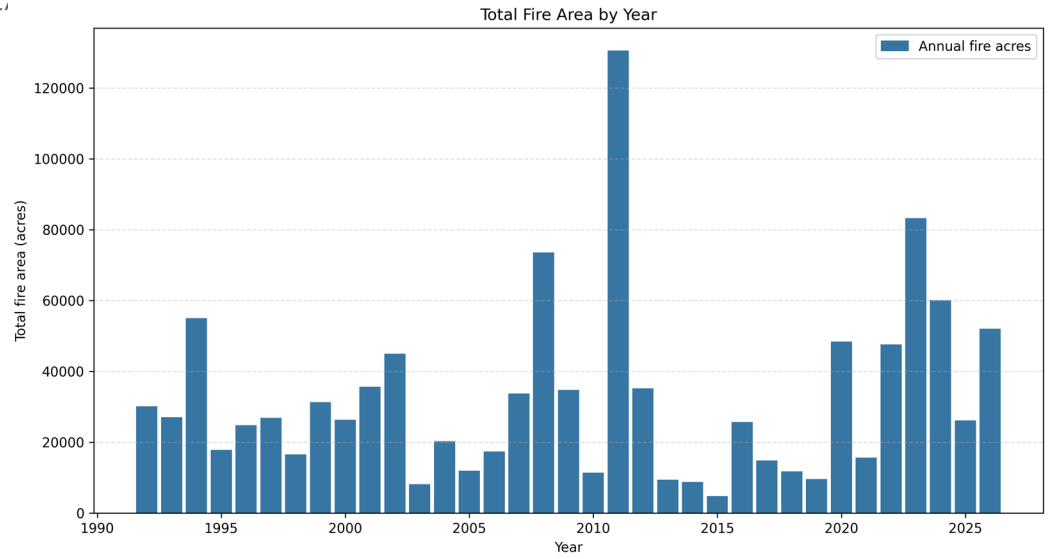


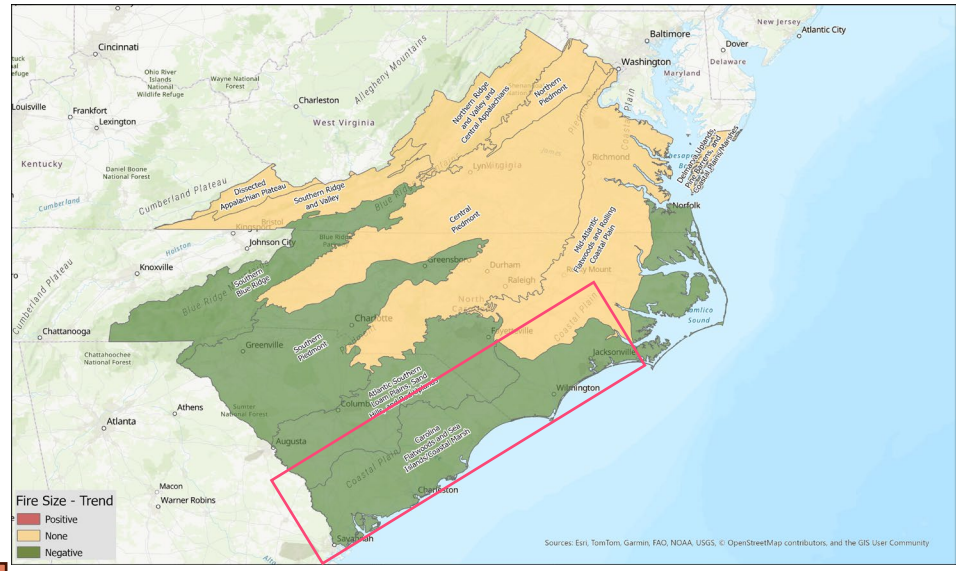
Piedmont Fire Timing by Month 1990-2020



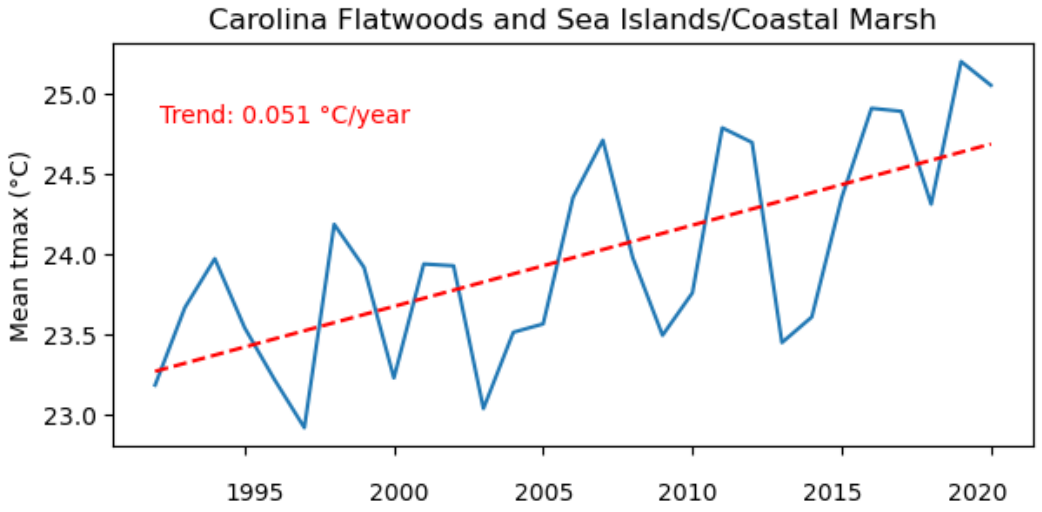
SOURCE: USFS FOD

Carolina Flatwoods and Sea Islands/Coastal Marsh





Vapor-pressure deficit (VPD) is a measure of how "thirsty" the air is.
Warm air can hold more water vapor than cool air. A **high VPD** means the air has a strong drying power. A **low VPD** means the air is nearly saturated and removes moisture more slowly.



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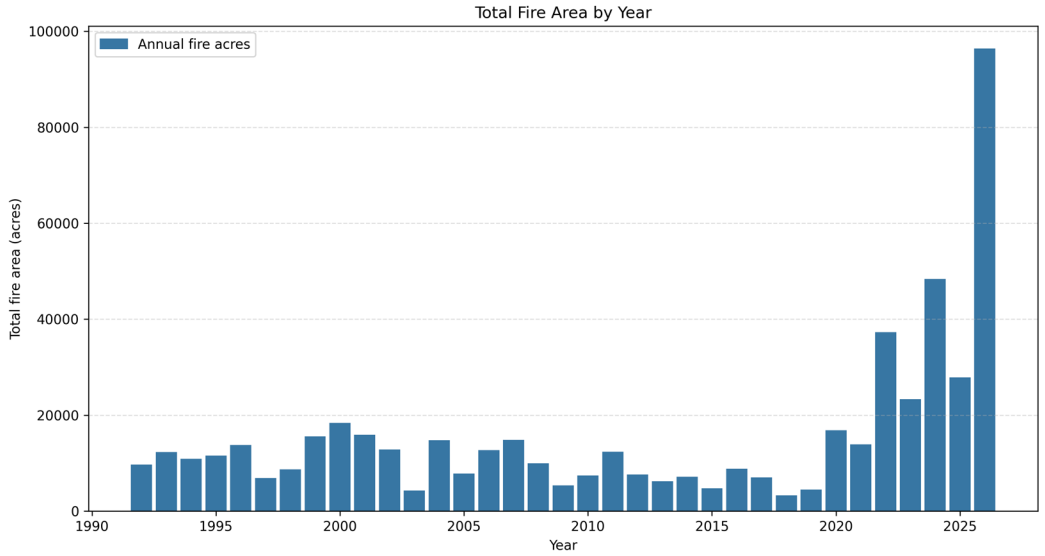
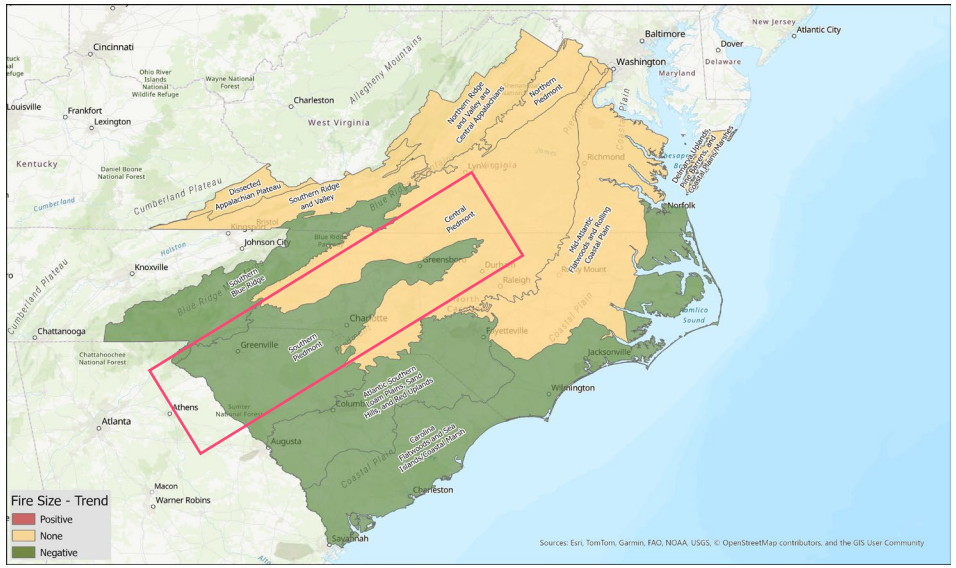
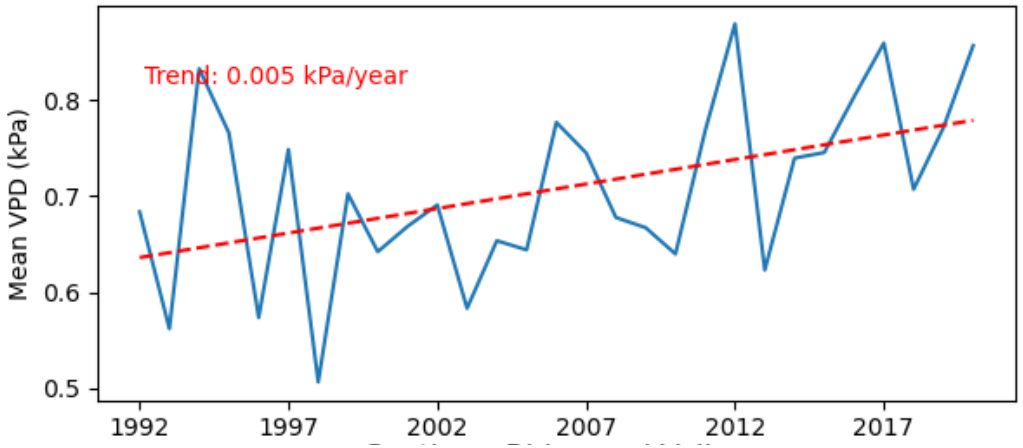
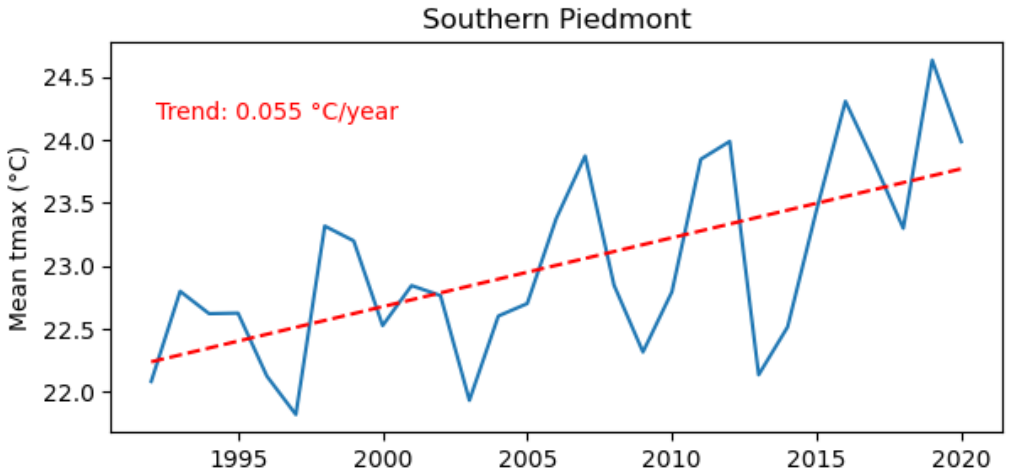
Southern Piedmont

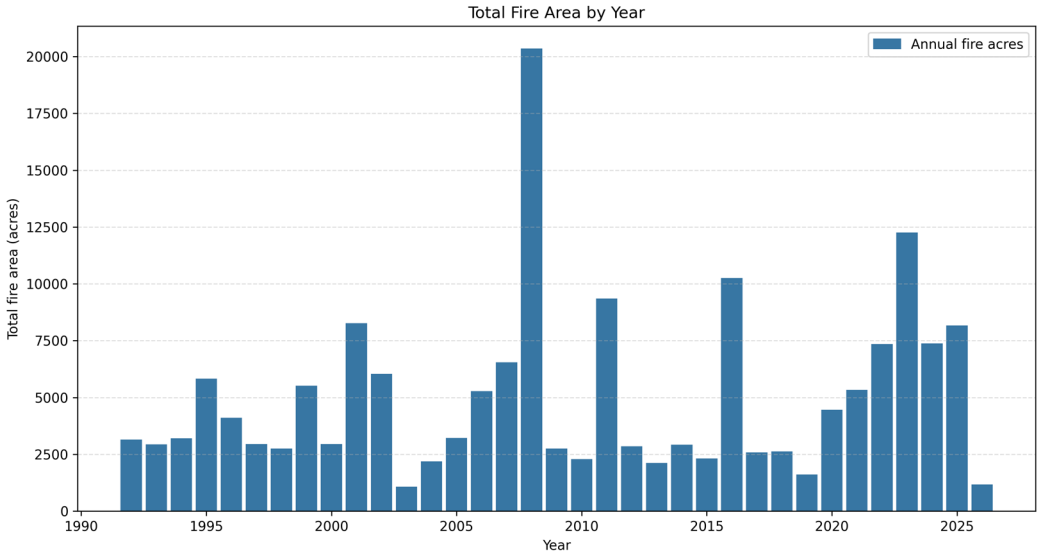


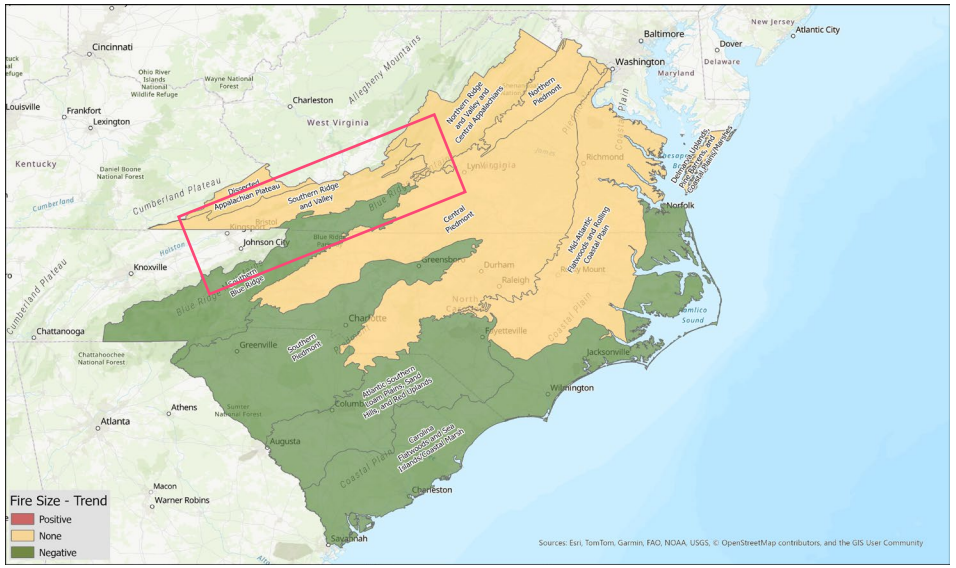


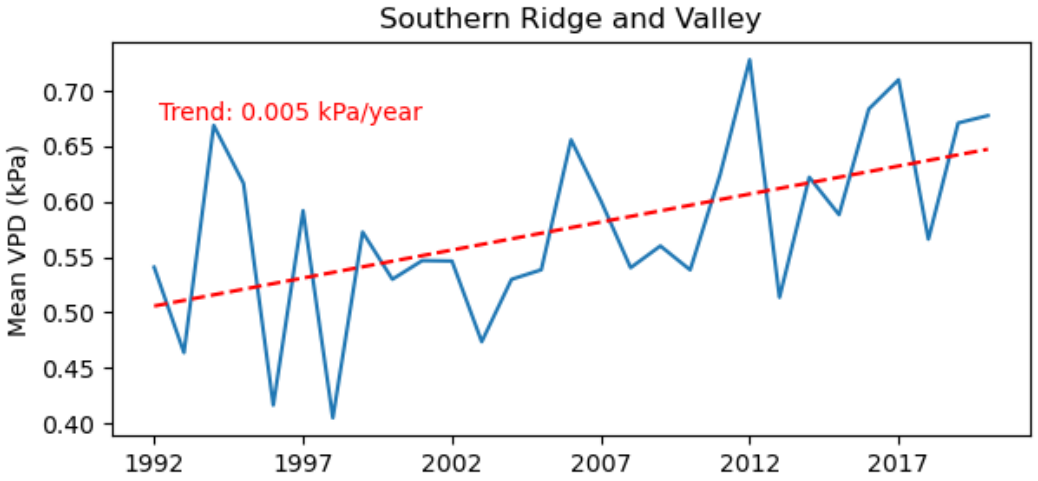


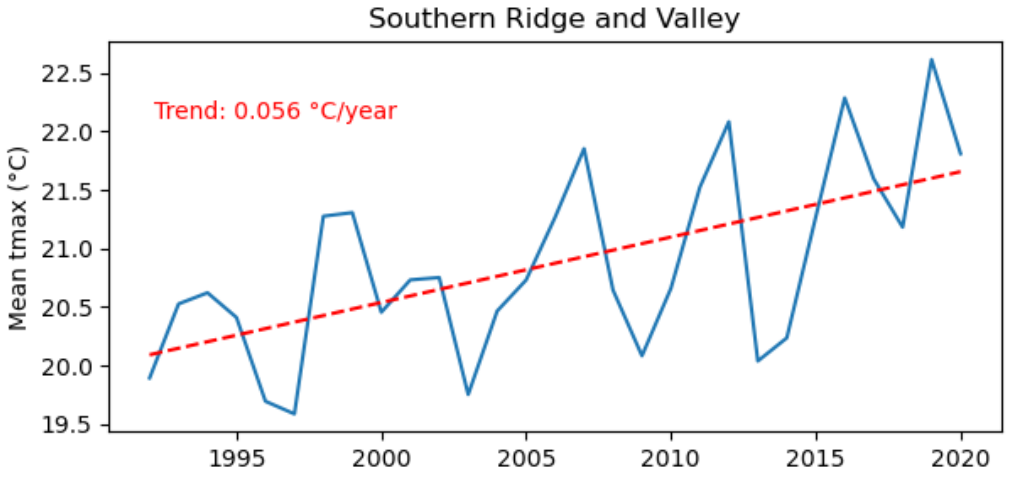


Southern Ridge and Valley



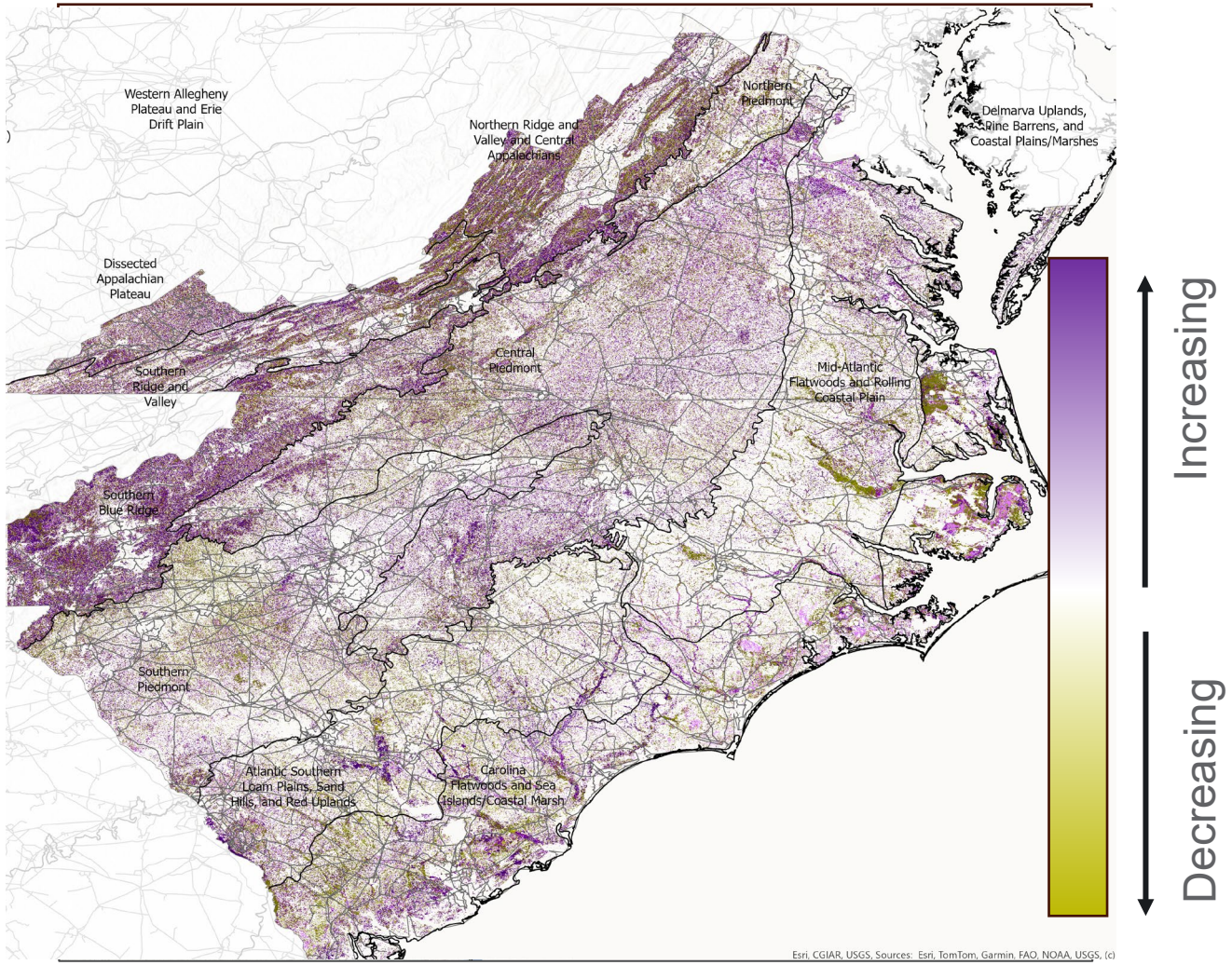






Biomass Increase? Or Decrease?

- USFS TreeMap
  - Nationwide data on tree biomass (tons/acre)
  - 30 meter resolution for 2016, 2020, and 2022
- Mapped 2016-2022 change in biomass
- Increase in biomass may indicate where fires may be more damaging (increased fuel load)



Piedmont Data Take Aways

- Fire reporting by states, military, and other land managers is improving but still has challenges.
- Wildfire conditions can occur during any month.
- Wildfire count increases in the spring and average size is highest in early summer (on average over the entire region).
- Individual regions/pyromes show unique patterns in timing and acreage.
- Temperature and vapor-pressure deficit (1990-2020) show an increase throughout the region.
- Limited biomass increases in coastal regions.
- Western extents of Piedmont states show mostly biomass increase.

Powerline-Ignited Wildfires: Understanding Risk and Improving Prediction

Huilin Huang[1], Ye Liu[2], Jingfan Xia[1]

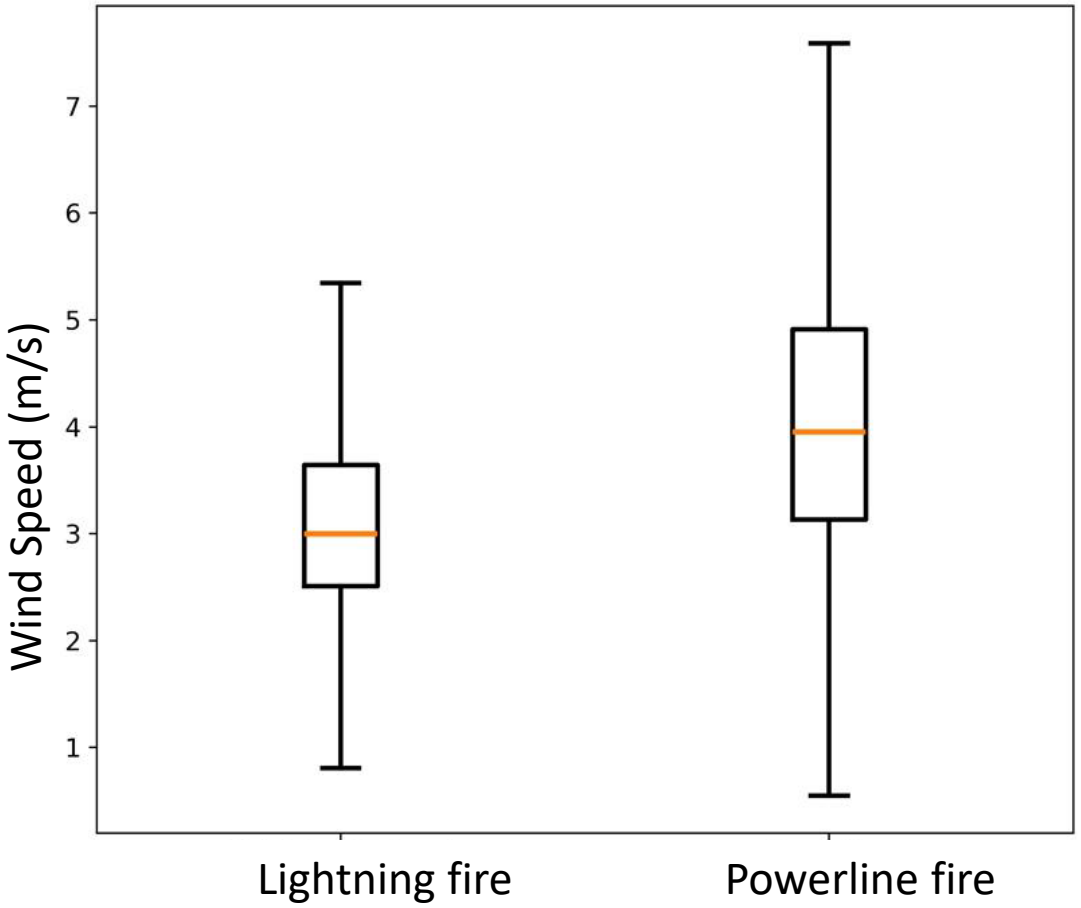
1. Department of Environmental Sciences, University of Virginia
2. Pacific Northwest National Laboratory

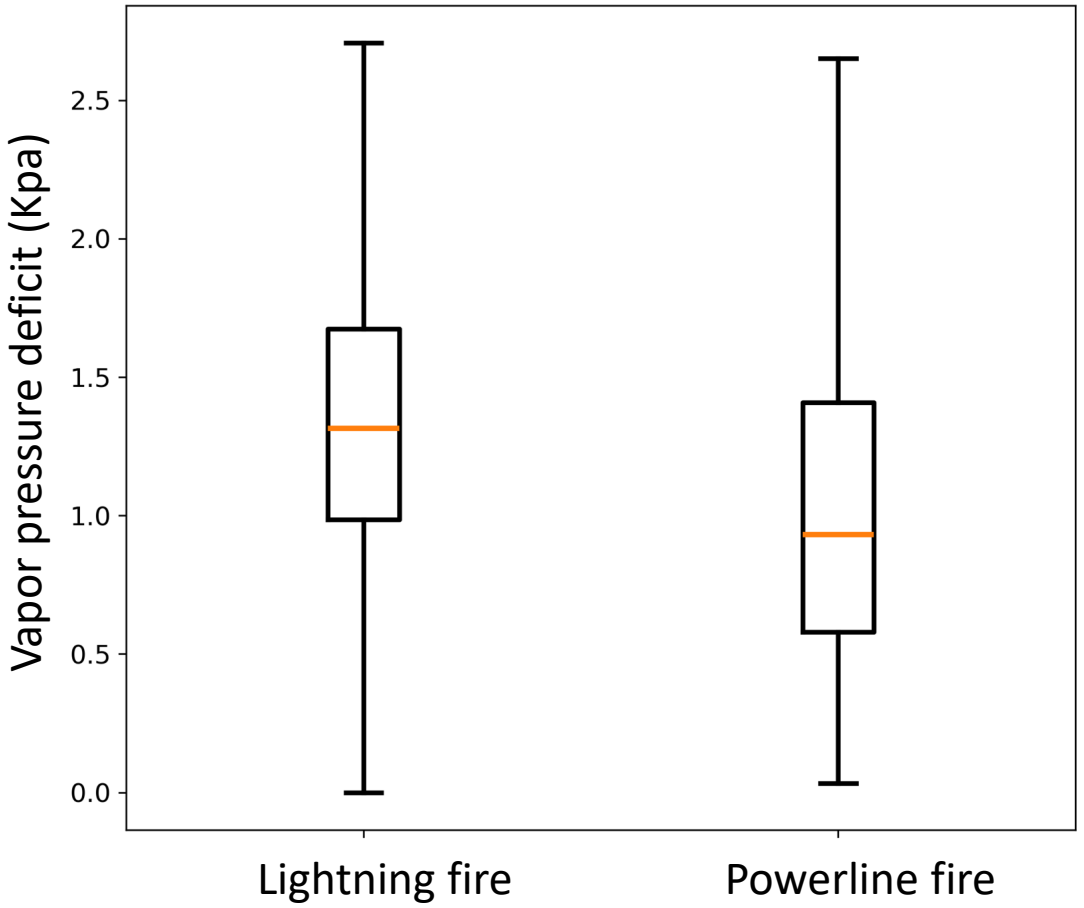
Powerline Fire as Emerging Risk

Powerline Fire in Rockingham county Virginia, March 2024

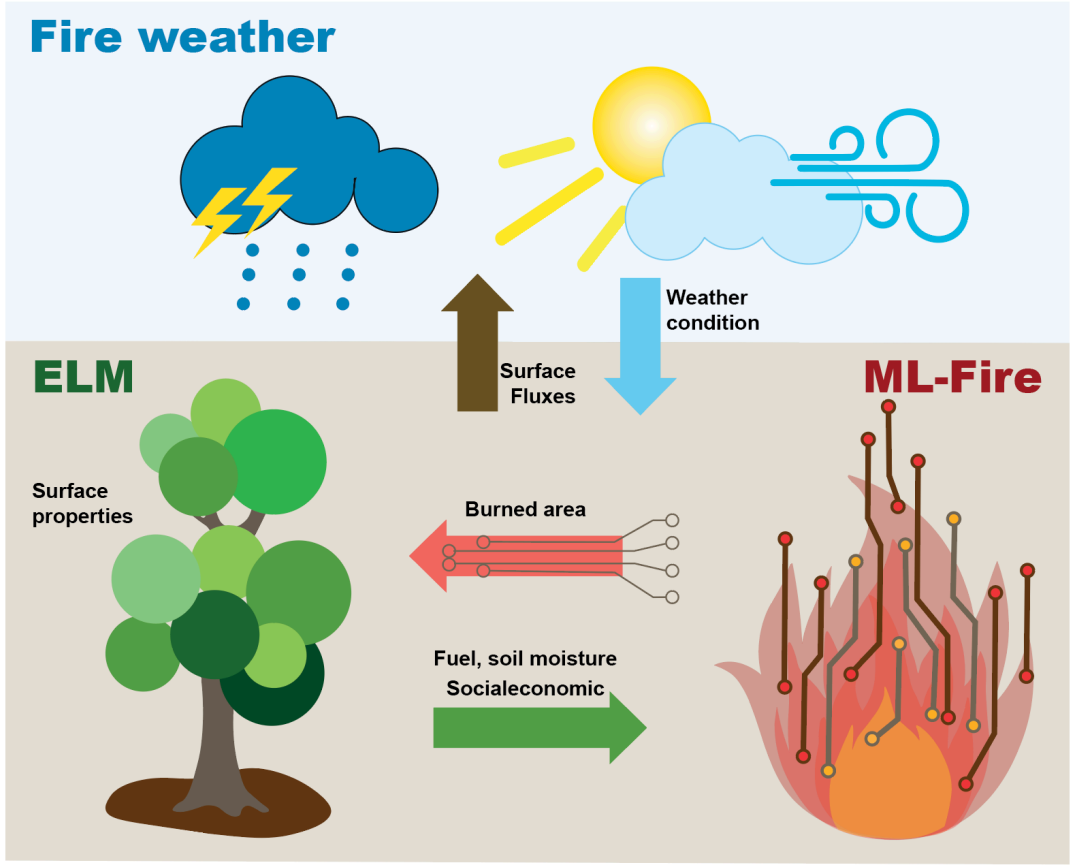
Burned about ~7 Days and 2,600 acres

Powerline Fire Interactions with Fire Weather





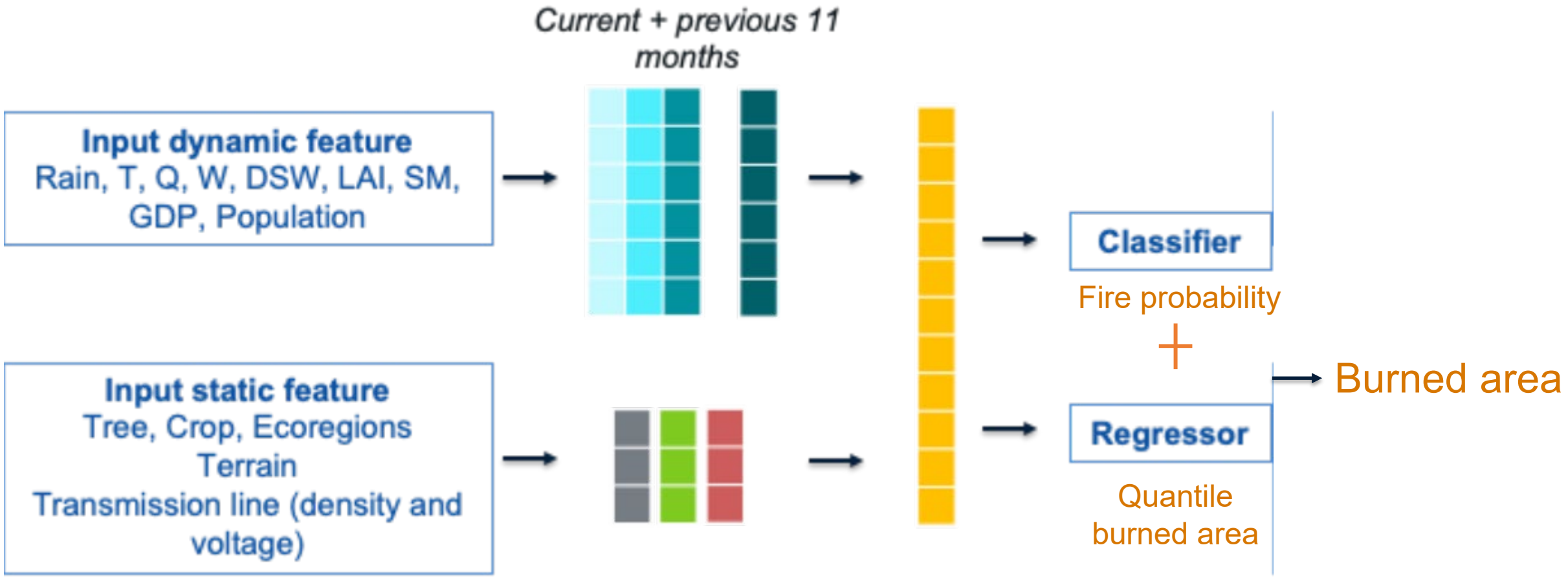
Machine-learning Fire Model Within Land Model



Fire model with powerline ignition

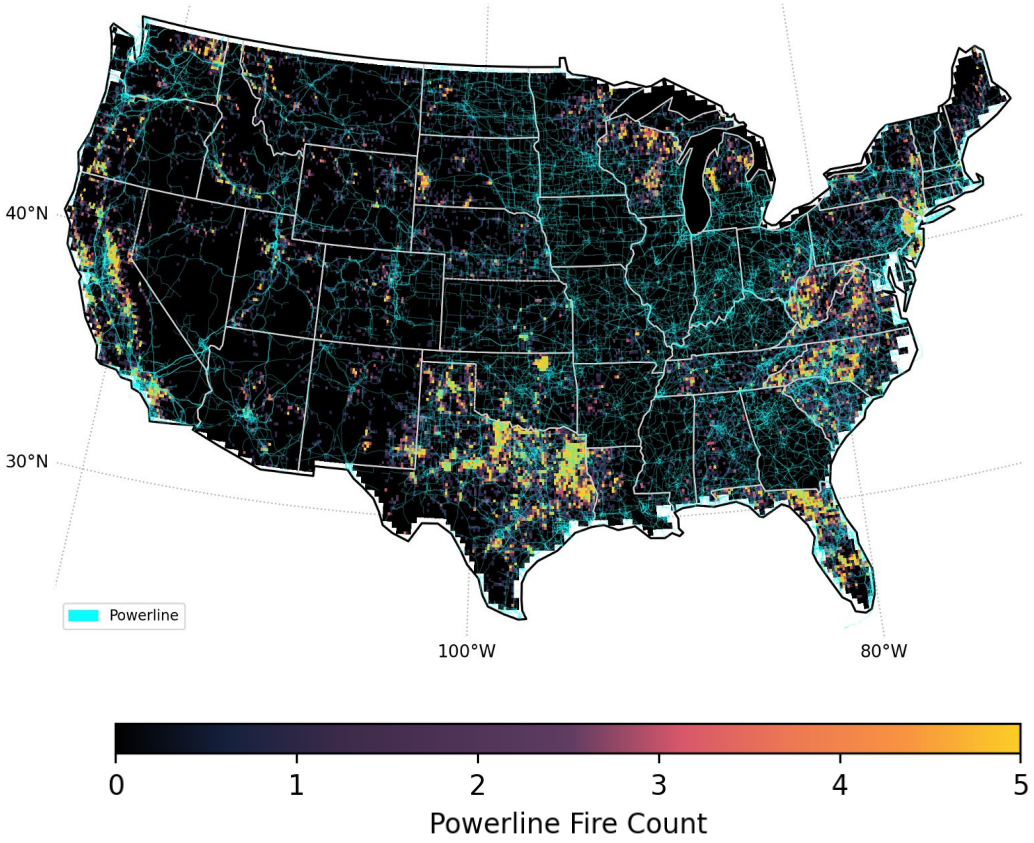
Meteorological forcing		
Temperature	Current and past 11 months	NLDAS (12.5 km)
Relative humidity		
Wind speed		
Precipitation		
Fuel condition		
Soil moisture	Current and past 11 months	ELM-BGC (12.5 km)
Leaf area index		
Land Property		
Tree fraction	Static	MODIS
Crop fraction		MODIS
Ecoregions		EPA
Topography		GTOPO
Powerline Property		
Powerline density	Static	HIFLD
Voltage	Static	HIFLD
Target		
Fire occurrence	Current month	GFED5
Burned area	Current month	GFED5

Predicting Fire Probability and Burned Area

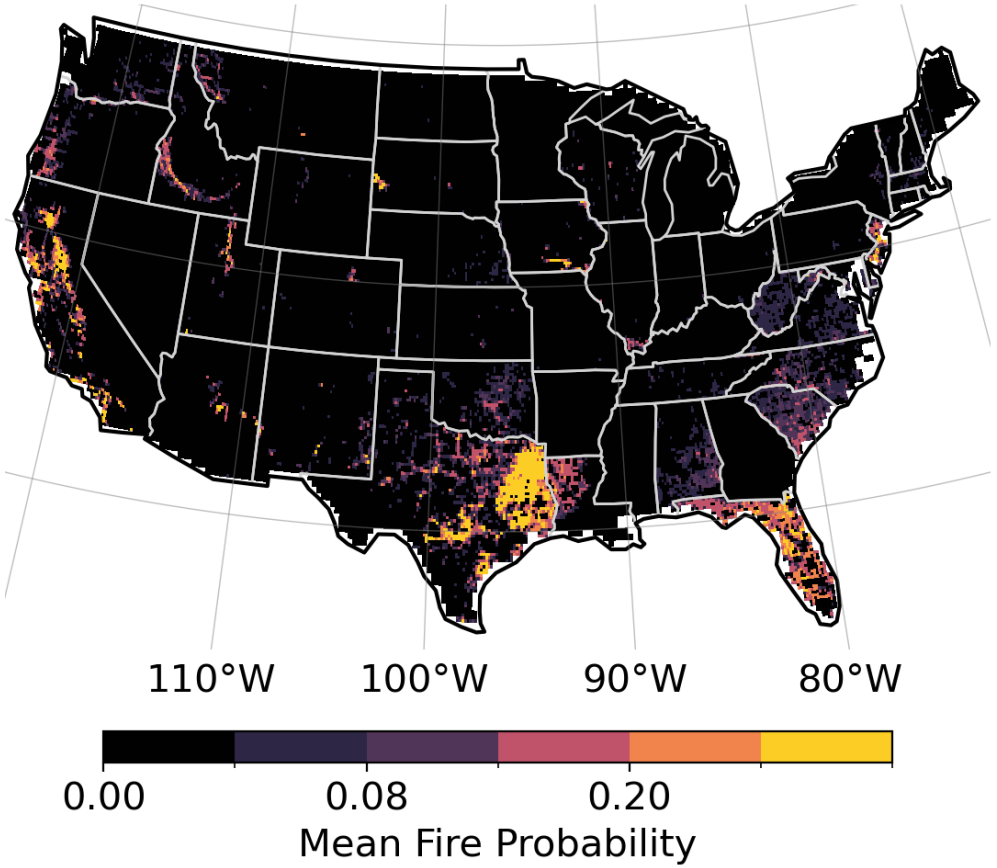


Predicted Powerline Ignition in ML4Fire

Powerline and powerline ignition (2001-2020)



Fire probability due to powerline



- ML4Fire predicts powerline fire
- Noted data limitation at the state level

Liu, Huang et al. (In Prep)

Utility Vegetation Management in the Piedmont

August 12th, 2026
Wildfire Risk and Resilience Workshop
Seth Blair

Eocene℠ Environmental Group

UAA® UTILITY ARBORIST ASSOCIATION

Utility Vegetation Management 101

- Exists to support the utility mission of “safe and reliable” service

- UVM goals: *facilitate the intended use of the site* (Miller, 2021)
  - Prevent outages
  - Maintain clearance between vegetation and facilities

- Good vegetation management is the basis for good wildfire management

Vegetation contact typically responsible for 20-25% of a system’s outages

What a Utility Forester Manages

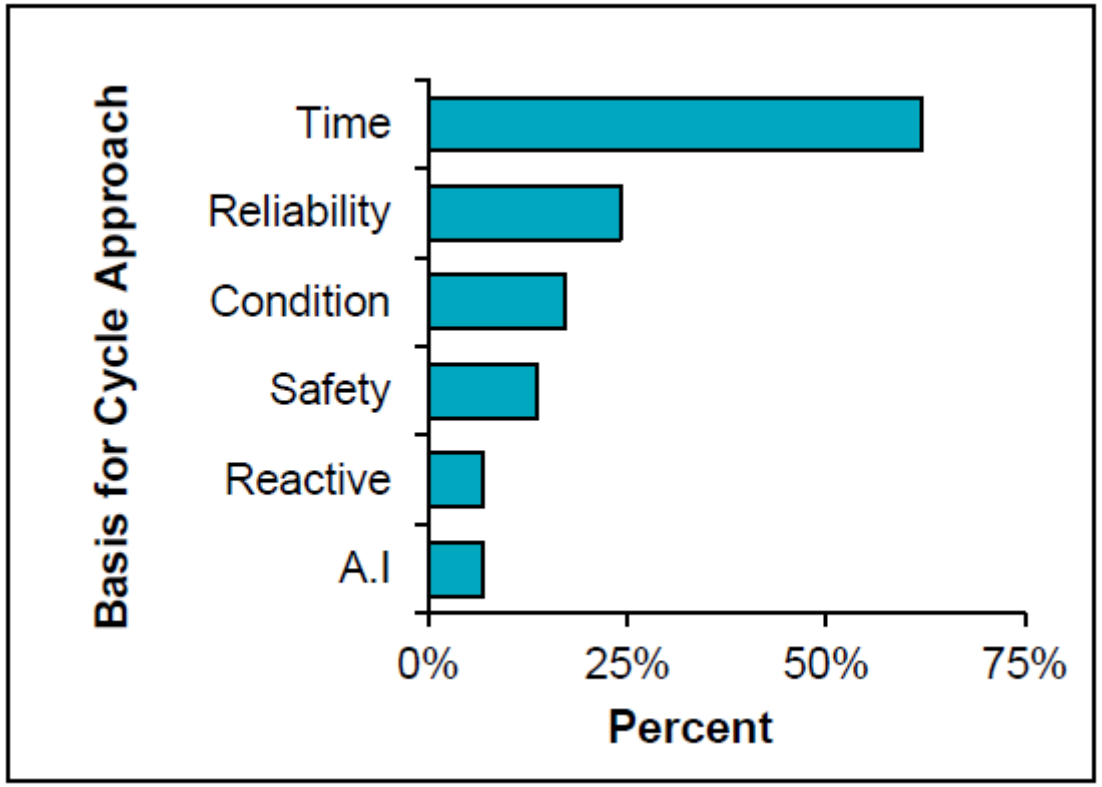
- **Potentially thousands of line miles**
- Coordinates tree crews, work planners, budgets, and logistics
- Routine maintenance, mid-cycle programs, and herbicide operations
- Storm response and reactive work
- New construction, permitting, and community engagement
- Customer notification, inquiries, refusals, and complaints

Approaches to UVM

- 25% employ various scheduling approaches, but most use semi-fixed intervals (4.5 years) to maintain vegetation on a cyclical basis
- Adoption of other strategies are increasing
- Utility Arborist Association developing white paper on best practices for Condition-Based VM (CBVM)
- CBVM integrates satellite imagery, LiDAR, and other available data into UVM workflows

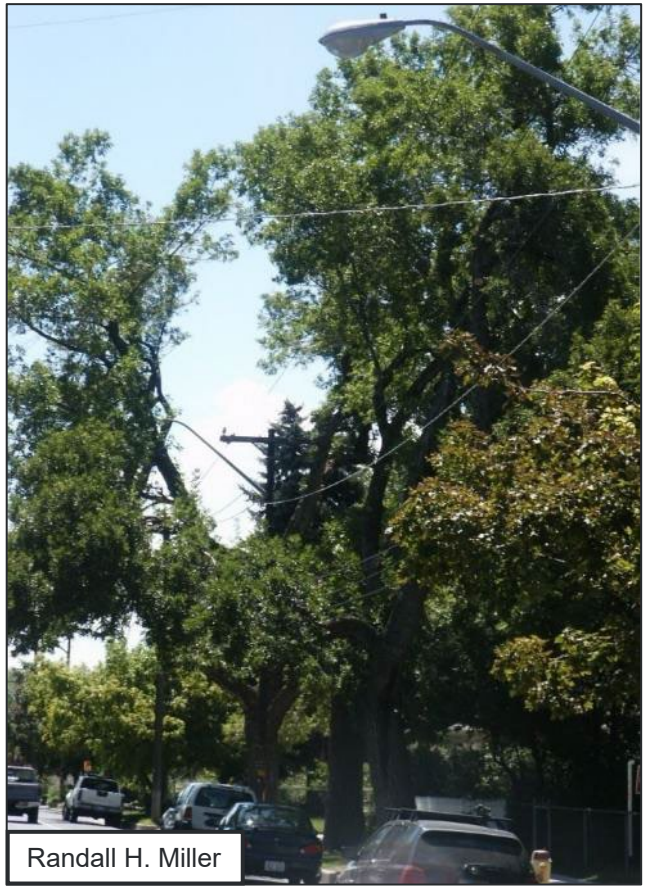
Utility Vegetation Management in North America:
Results from a 2024 Utility Forestry Census of Tree Activities & Operations

n = 30 utility respondents



Utility Pruning

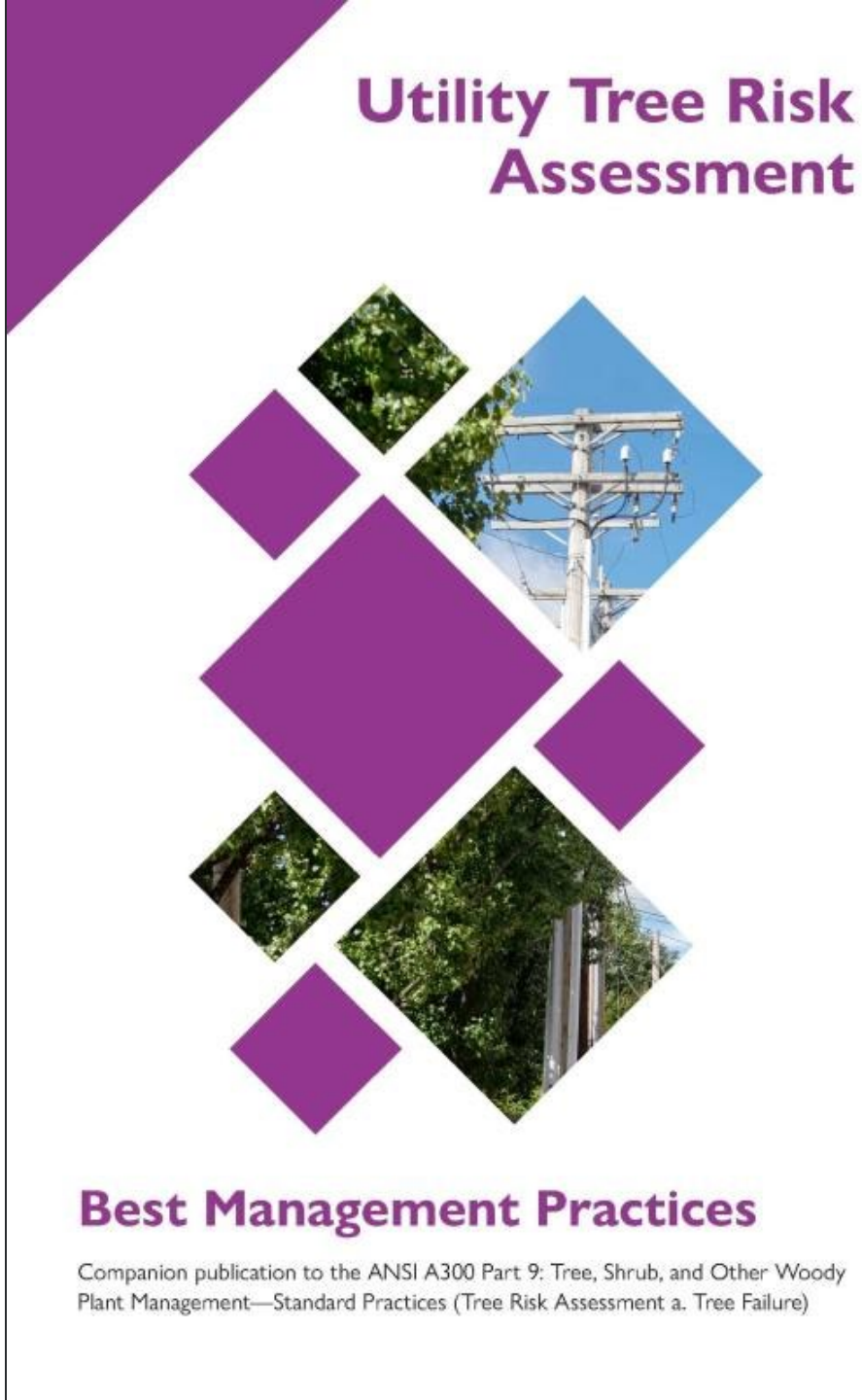
- Grow in contacts make up 7 - 8% of vegetation caused outages (distribution)
- ~ 90% of trees touched are pruned
- Somewhat “predictable” and systematic
- Easement rights typical, but still met with public resistance



Randall H. Miller

Tree Risk Management

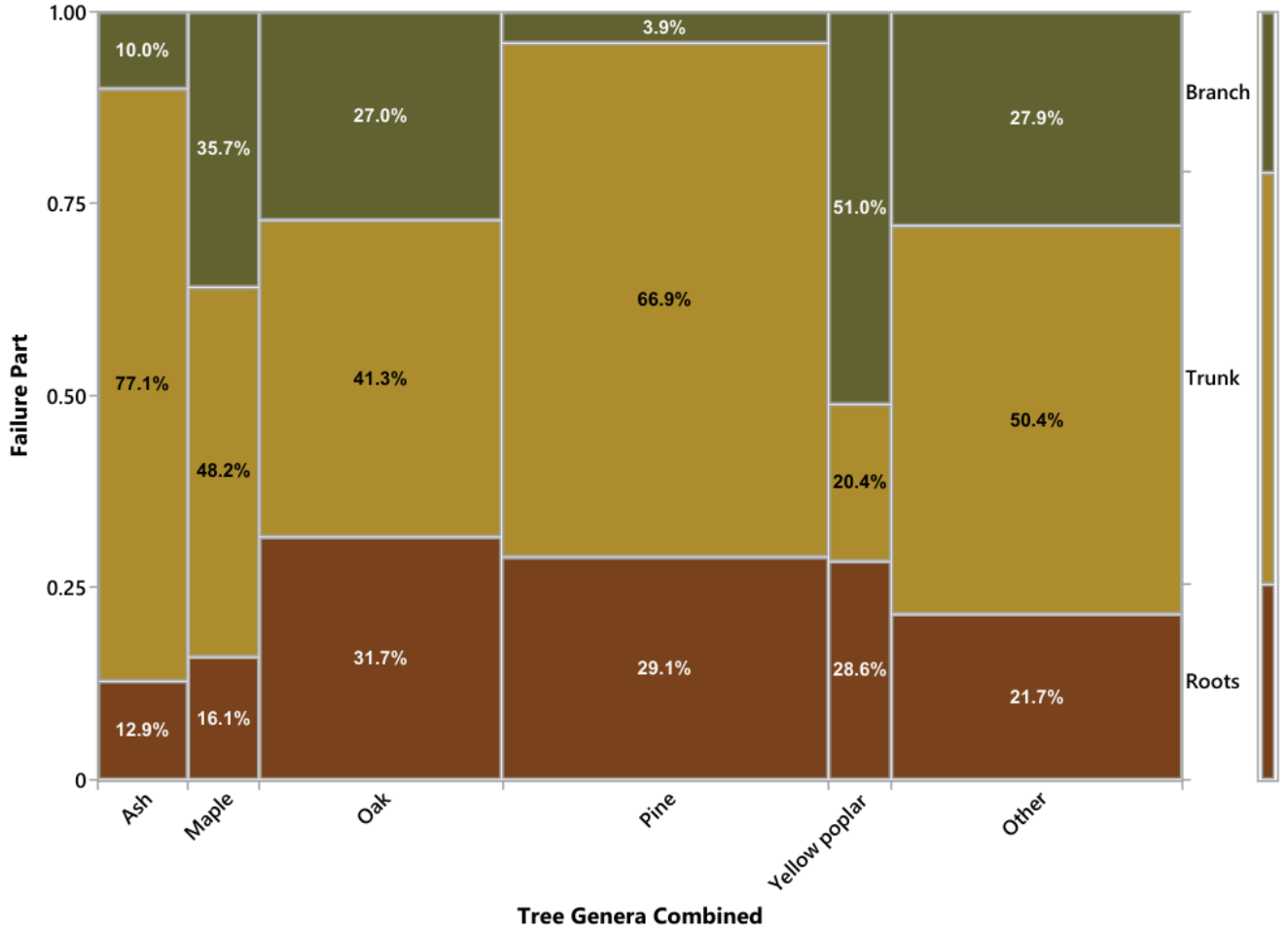
- Identifying and performing tree removals in large tree populations
    - Often off right-of-way where rights and social license are limited
- Likelihood of failure, contact, and consequence severity drive removals
- **Most trees are low risk**, yet off-ROW failures cause more than 1/3 of vegetation-caused interruptions
- **Most line contacts come from failed trees** an arborist would not have flagged for removal
- Even when observable, "**tree defects**" do not always correlate with tree failure (Koeser et al., 2023)



Tree Caused Outage Research – Piedmont Specific

- 46.6% of investigated tree failures had trees with no observable defects (Musick et al., 2026)
- Understanding how trees fail supports decisions in the field and at a landscape scale
- Most peer-reviewed tree risk modeling occurs in other regions

An Analysis of Electric Distribution Tree-Caused Outages: Retrospective Case Series



Other Active UVM Research

- TREE Fund supported research building a shareable, vegetation-caused outage database
  - UAA subcommittee standardizing outage investigation fields for consistency across regions and utilities

- TREE Fund also awarded a 2026 research grant for prescribed fire as a UVM tool

The Utility Arborist Research Fund Grant, which supports research that benefits utility tree care professionals, is being awarded to Michael Demchick of the University of Wisconsin- Stevens Point for the project "Use of Prescribed Fire and Barrens Seeding in Power Line Rights-of-Way as a Mechanism of Vegetation Management and Ecological Restoration" in the amount of $49,538.

Piedmont Specific Challenges

NOAA: Hurricane Isabel

Valentine's Day Ice Storm 2021

Severe weather vulnerabilities have operational impacts that span well beyond the event

Emerald ash borer

Pine stands (e.g., Ips, southern pine beetle, and natural mortality)

Pest pressure and adjacent forest characteristics/ownership

Plus invasive species, fast growth rates, development, a diverse customer base, and public perceptions of wildfire risk.

Summary

- UVM and wildfire directly tied
- Landscape-scale remote sensing, data, and modeling should continue to direct utility arborists to the right locations with clear objectives
- Quantitative research enables qualitative evaluations in the field
- Standardization of tree caused outage information and region-specific research are needed

References

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- Utility Arborist Research Fund Grant Program – TREE Fund
- Home - Utility Arborist Association