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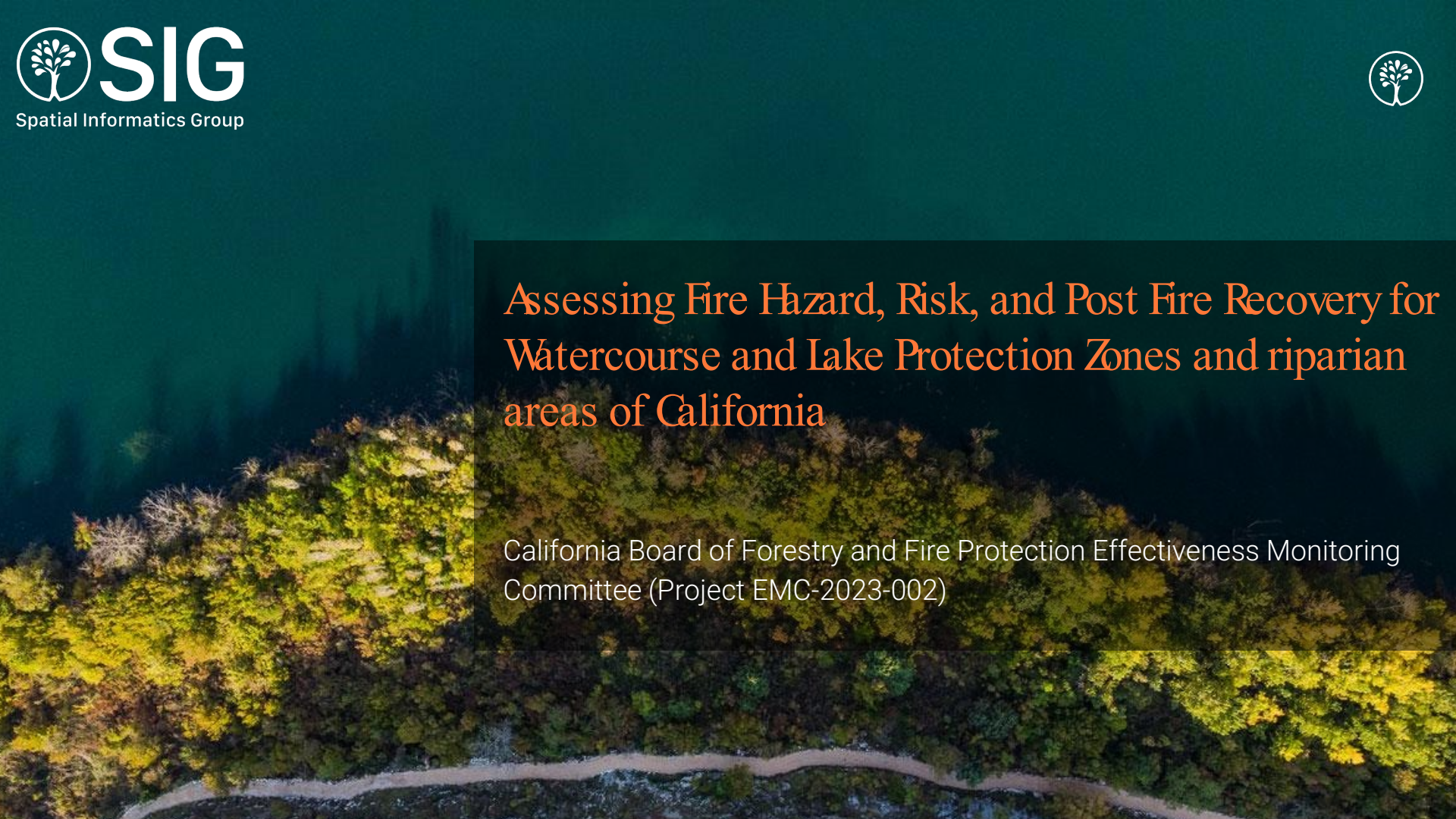
Assessing Fire Hazard, Risk, and Post Fire Recovery for Watercourse and Lake Protection Zones and riparian areas of California

California Board of Forestry and Fire Protection Effectiveness Monitoring Committee (Project EMC-2023-002)



Overview

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Introduction

- Background
- Problem Statement
- Objectives

Methodology

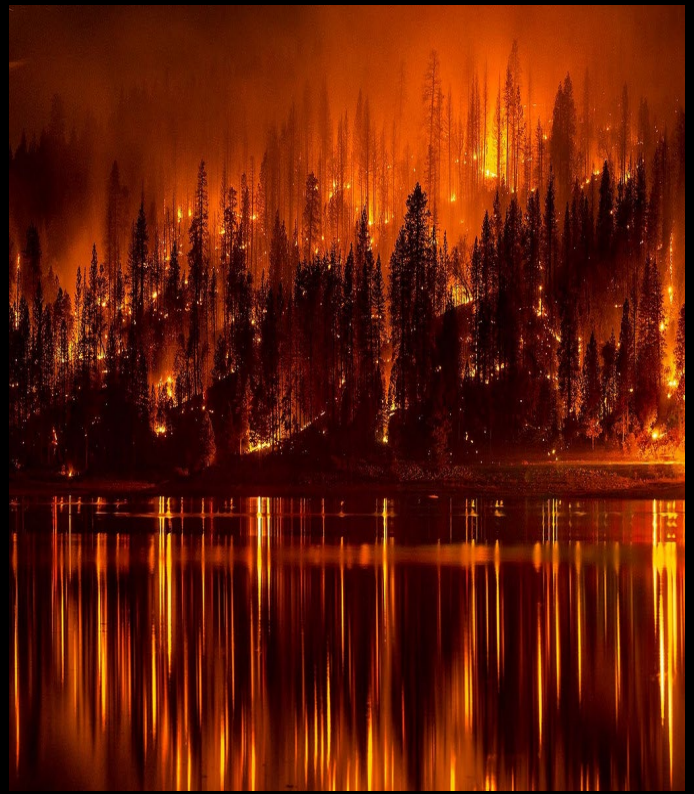
- Approach and Design
- Data and Analysis

Results So Far

- Key Findings
- Challenges and Limitations

Next Steps

- Context and Problem Statement
- Objectives



INTRODUCTION

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Background

Lakes, rivers, and riparian zones in California's forests support biodiversity, provide critical water resources, and offer recreation opportunities, but recent wildfires have severely impacted these areas.

Objectives

Assess fire history, current fire hazards, and vegetation recovery in CA's WLPZ areas, focusing on burn severity, vegetation changes over time, and the impact of forest management practices.

Problem Statement

High-severity wildfires have damaged California's critical water networks and riparian zones, necessitating an assessment of how different management practices affect the resilience and recovery of these areas.

Methodology

Locate WLPZs

- 300’ buffer for all waters
- Cal Hydro lines
- Streamflow model

Fire History and Severity in WLPZs

- CA-wide – WLPZs + Fire
- Acres burned (1970-2023)
- Burn severity MTBS + RAVG (1984-2023)
- Dashboard (draft)

Plumas County Case Study – PFVR

- Post Wildfire Vegetation Monitoring System
  - Landsat + GEE
- LandTrendr
  - NDVI

Fire History, Hazard, Veg by Ownership

- Fire + Stream Classification + THP type

Statistical Analysis

- Assess trends in fire severity and vegetation cover
- Analyze influence of topography (aspect, slope, latitude) on trends
- Determine if management activities had an influence on trends

Flow Permanence Modeling

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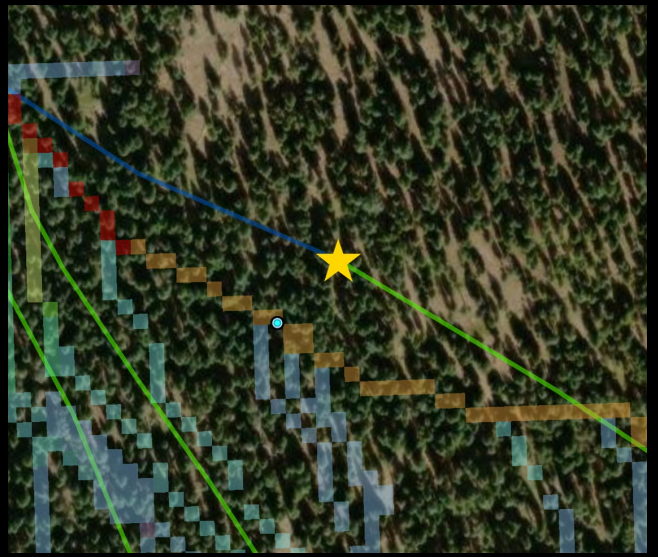
- Starting with flow accumulation derived from DEMs as a first step for determining where water is likely to gather — pointing to spots with a higher chance of sustained flow. An improvement over this method would be Topographic Wetness Index (TWI) which combines flow and slope to highlight areas with higher soil moisture, and a higher likelihood of supporting permanent or near-permanent streams.

- If we stratify by soil types this could improve the predictive power of TWI, since things like soil permeability and water retention can strongly influence where water is held.

- Other useful tools include NDVI (Normalized Difference Vegetation Index) to spot moisture-loving vegetation, climate data (rainfall and temperature) to account for seasonal changes, and land cover data for understanding what's going on in the watershed. On the more advanced end, the USGS PROSPER model offers a data-driven approach to predict stream permanence, and the HEC-HMS model goes even further by simulating streamflow in intricate water systems



Draft Dashboard

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The dashboard can be used to dynamically explore the data.

Draft Dashboard – Plumas County (2021)

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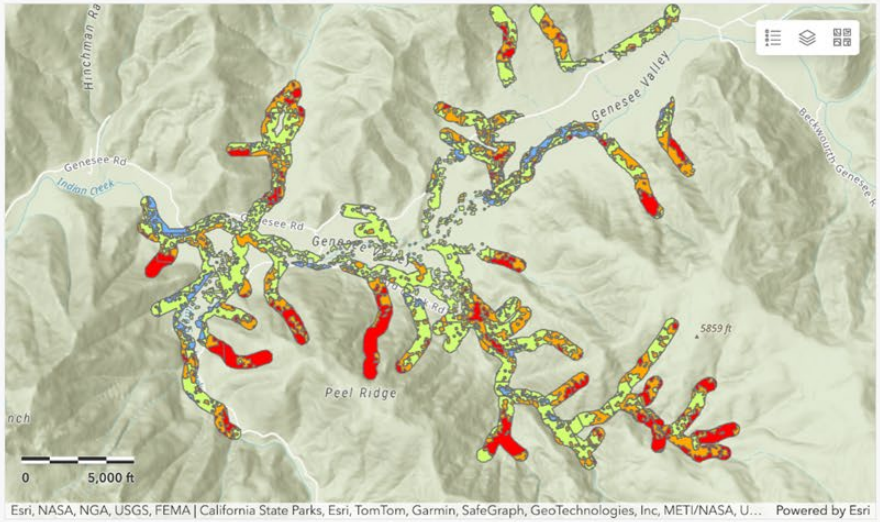
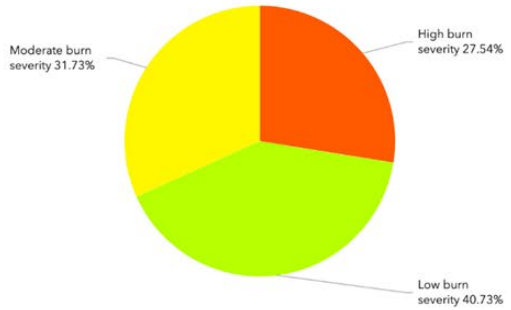
PC537 Hydro Lines vs Fires

Select a County

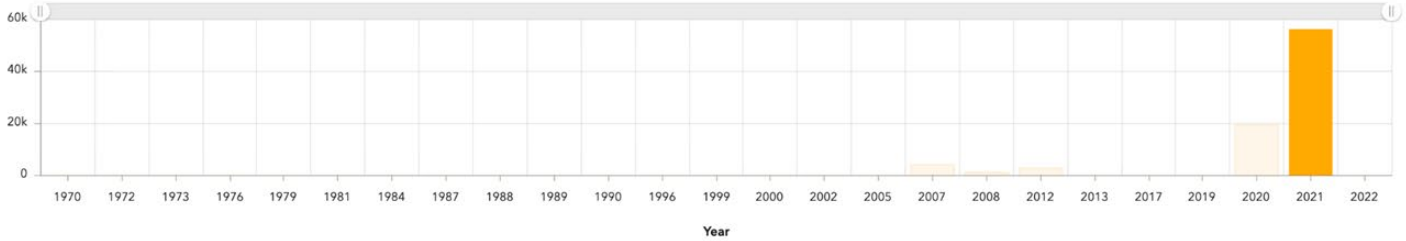
- Lake County
- Lassen County
- Madera County
- Marin County
- Mariposa County
- Mendocino County
- Modoc County
- Mono County
- Monterey County
- Napa County
- Nevada County
- Placer County
- Plumas County
- Sacramento County
- San Bernardino County
- San Mateo County
- Santa Clara County
- Santa Cruz County
- Shasta County
- Sierra County
- Siskiyou County
- Solano County



Burn Severity



Acres Burned per Year



Post Fire Vegetation Recovery Dynamics

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What is LandTrendr?:

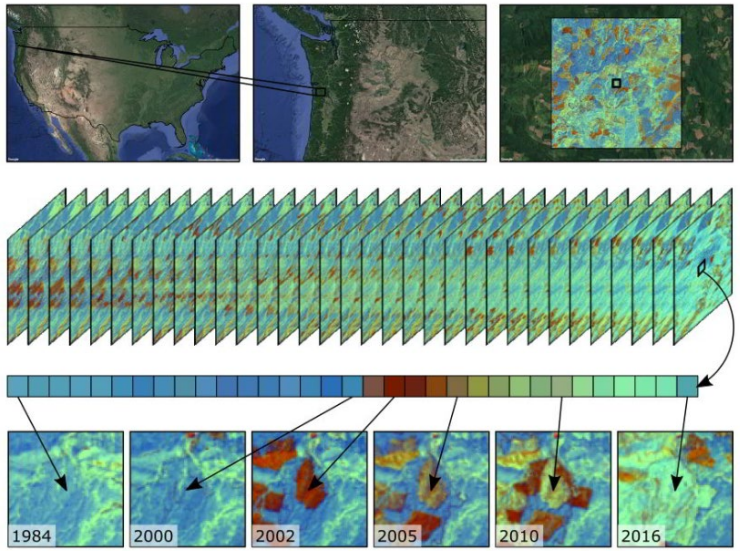
- It's a tool used in environmental monitoring to track how landscapes change over time using yearly composites of Landsat images

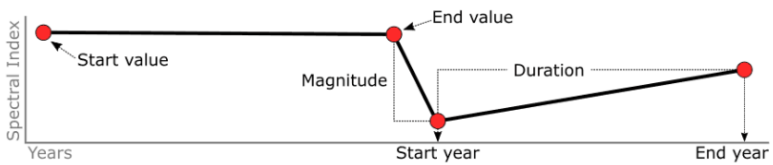
How LandTrendr Works:

- Looks at a time series of images to spot changes
- Segments the values per pixel through time, summarizing changes
- These segments allow LandTrendr to identify when the disturbance occurred, the magnitude, and duration of the disturbance

Applications:

- Environmental monitoring, forest management, and conservation efforts
- By showing long-term changes, it provides detailed information on forest health





Post Fire Vegetation Recovery Dynamics

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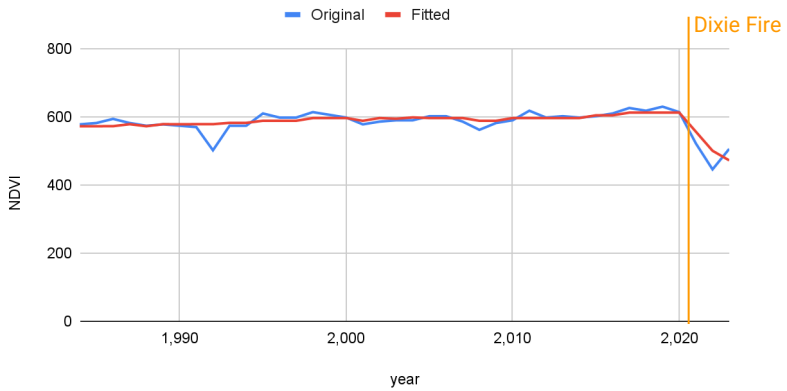
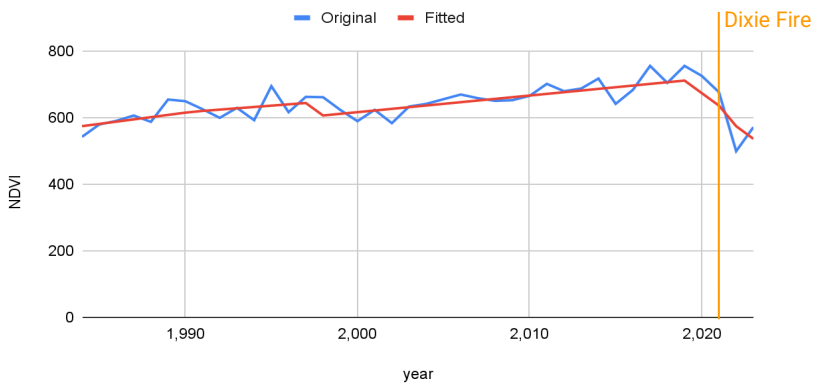
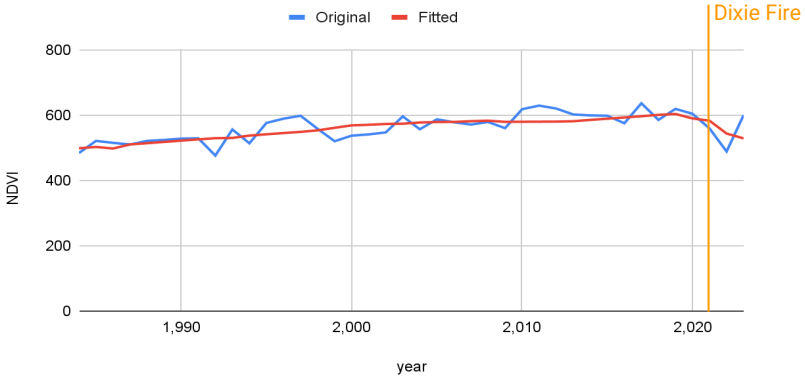
LandTrendr Plumas County



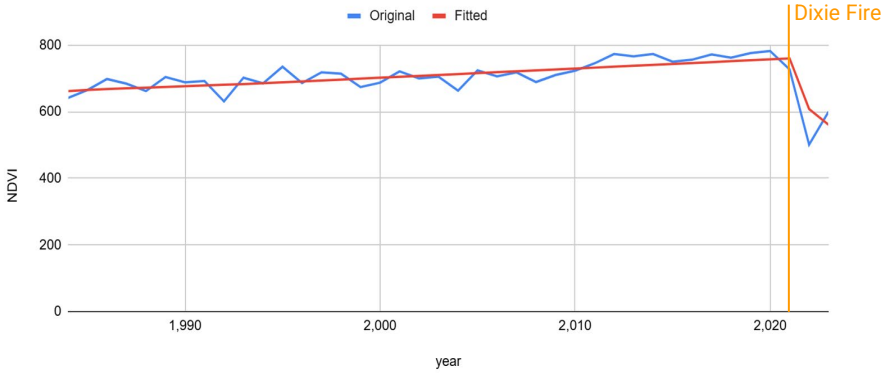
LandTrendr stream group 3 ITS



LandTrendr stream group 3 No treatment



LandTrendr stream group 3 Historic Harvest Area



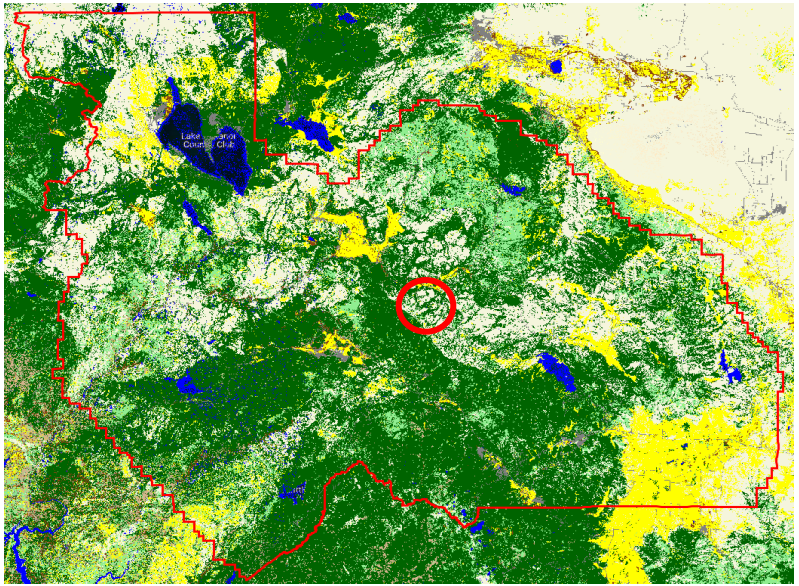
Post Fire Vegetation Recovery Dynamics

Post Fire Vegetation Monitoring System (PFVMS):

- Along with LandTrendr, we are analyzing trends in land cover changes using Google Earth Engine (GEE) and the PFVMS
- The PFVMS contains annual 30 meter Landsat composites of 8 land cover classes from 1984 to 2023

Assessing Watercourse and Lake Protection Zones (WLPZs):

- When we focus on specific zones of interest, like riparian areas, the PFVMS data helps identify where these areas have experienced positive or negative changes in vegetation cover and type
- Once we have identified the riparian areas, we can find the intersection of these areas with areas of known forest treatment
- These areas can then be split by the types of treatments that intersect with riparian areas and the location of these areas within the fire boundary
- From this, we can classify which treatments have led to improvements or degradation in biophysical conditions



Post Fire Vegetation Recovery Dynamics

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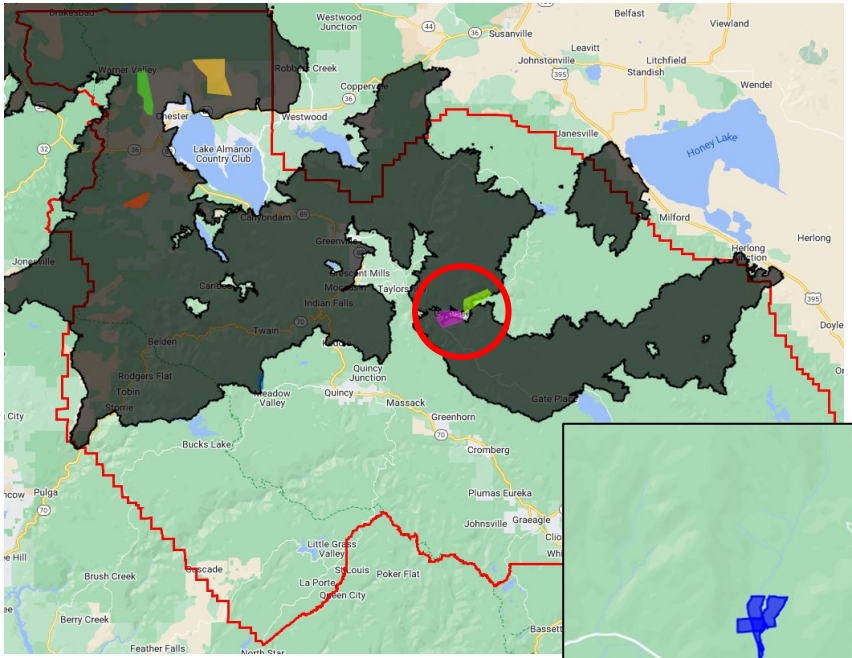
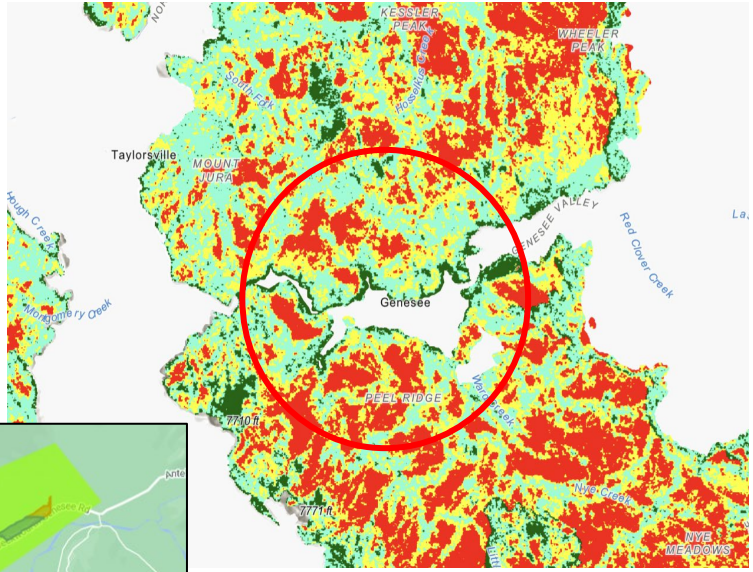
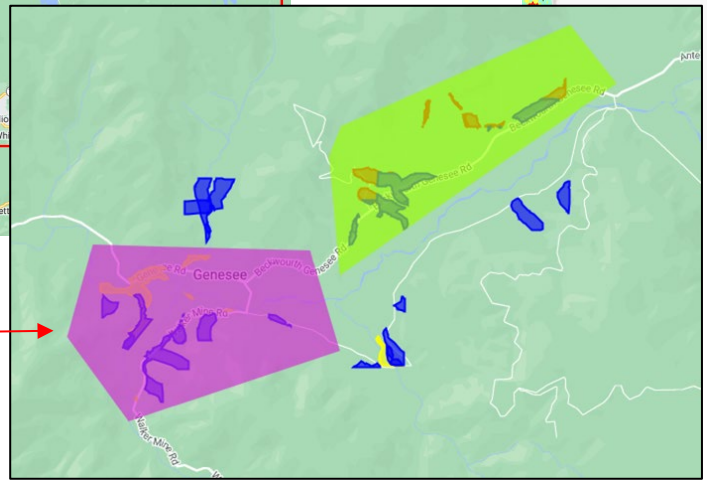


Dixie Fire Scar

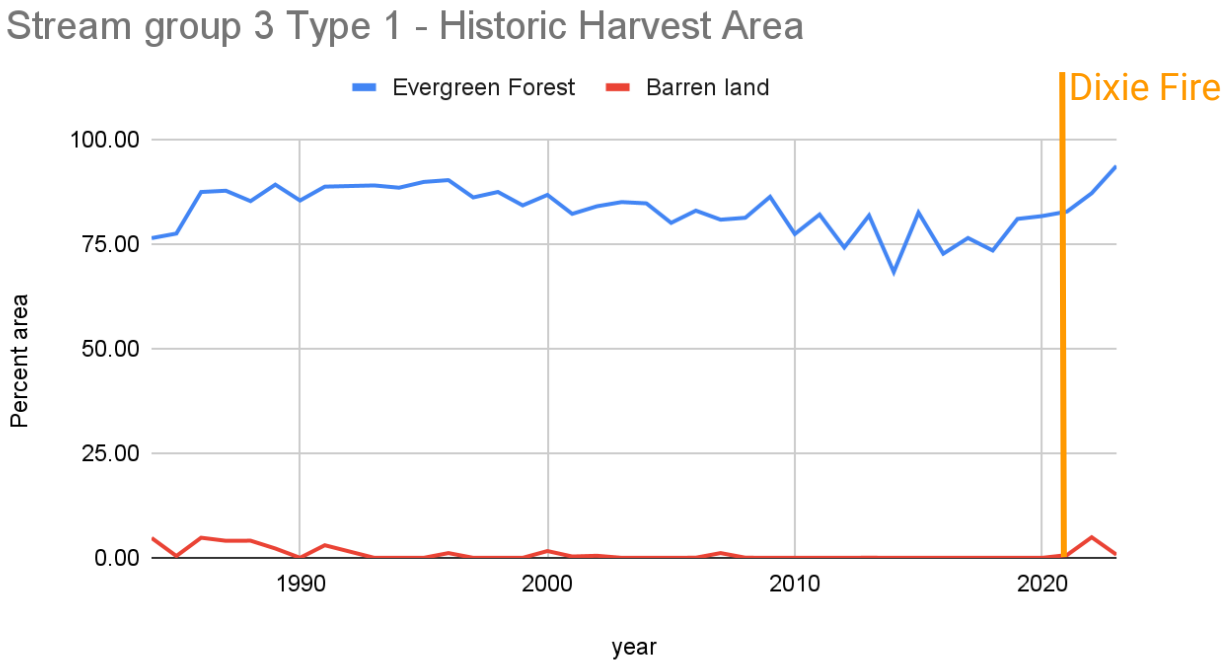


Burn Severity (MTBS)

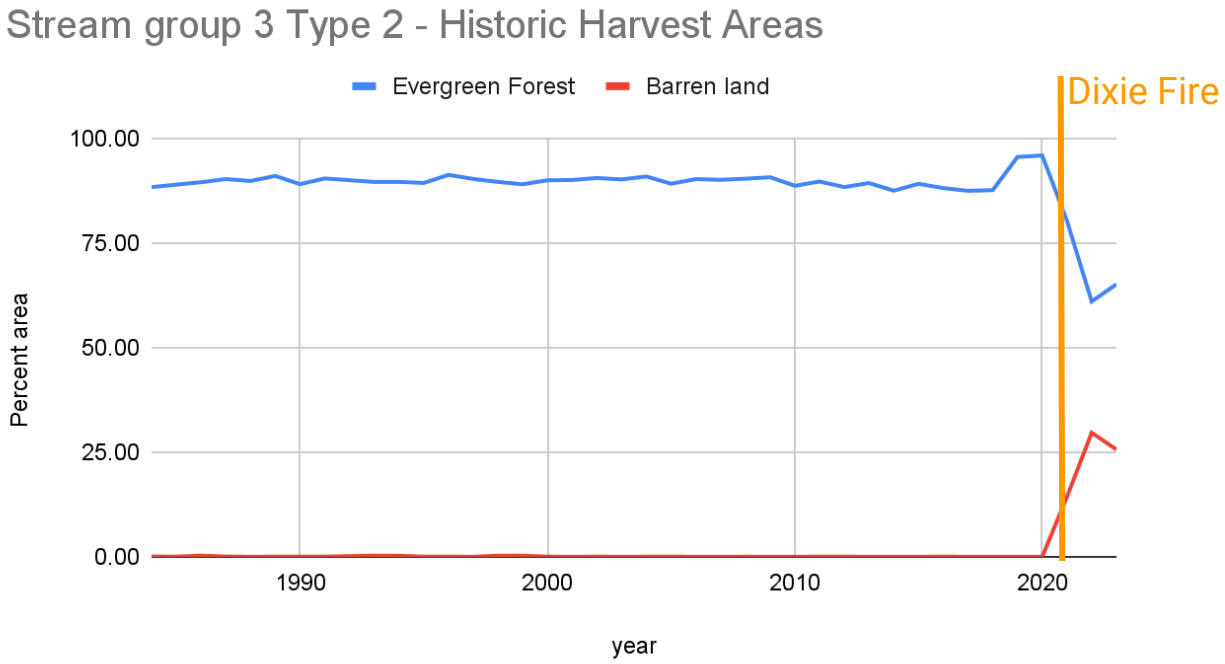


Stream Group 3

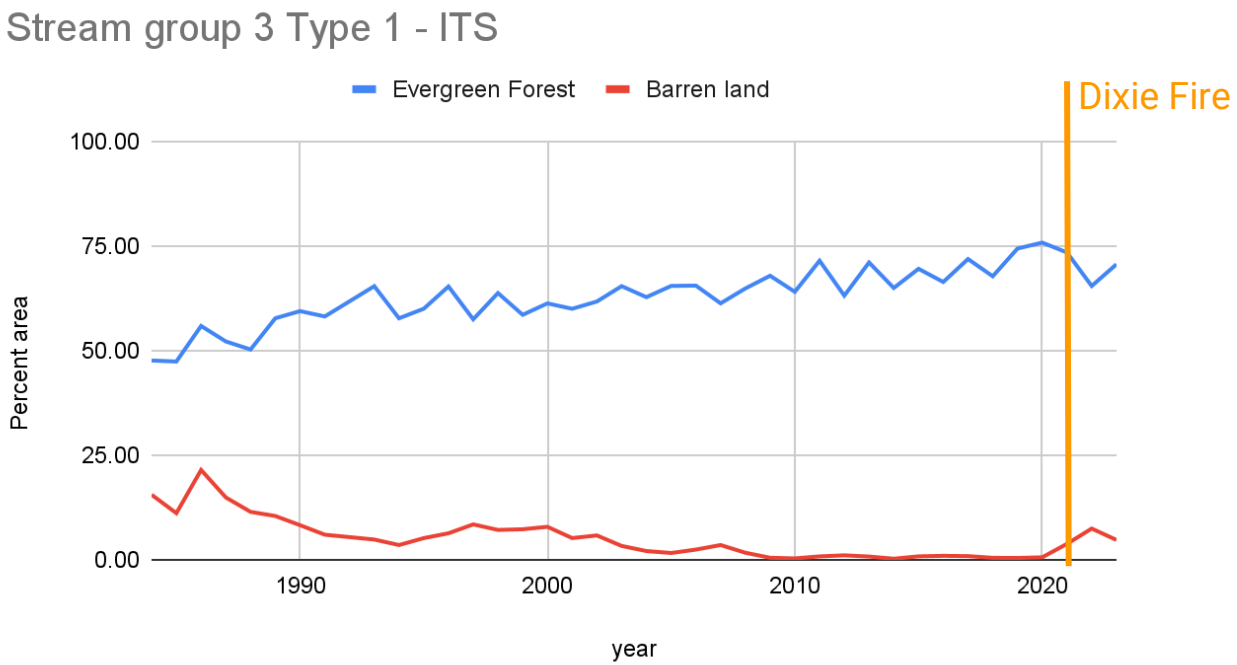
Post Fire Vegetation Recovery Dynamics



Post Fire Vegetation Recovery Dynamics



Post Fire Vegetation Recovery Dynamics



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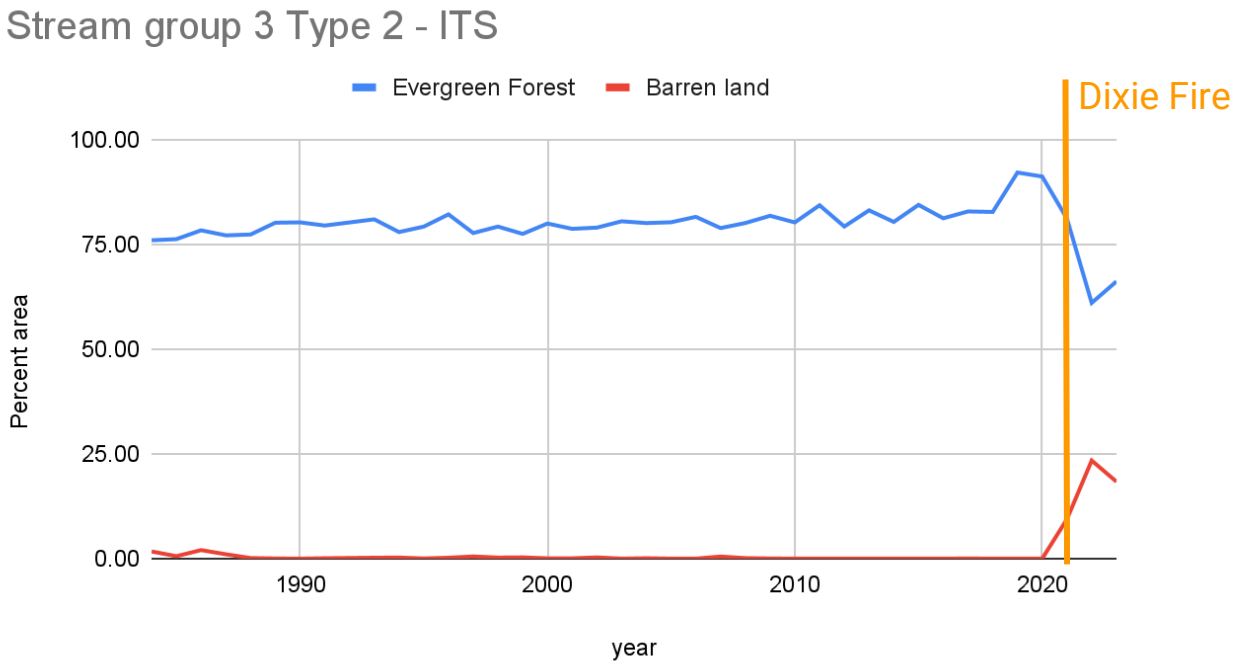

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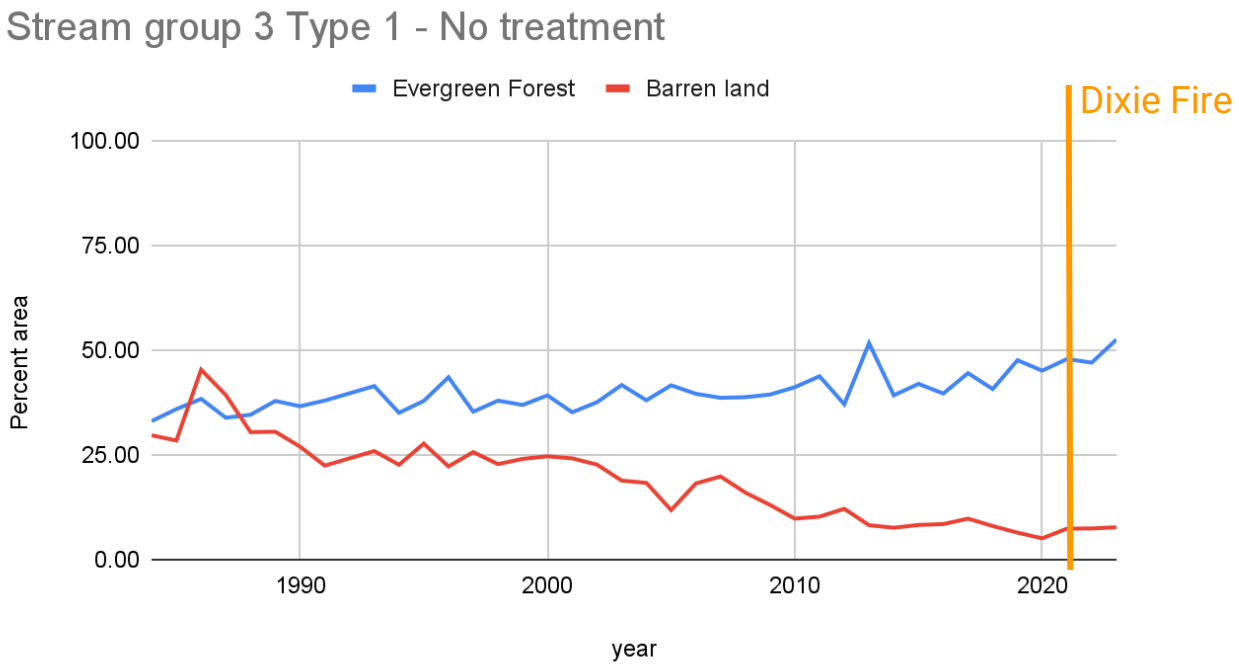

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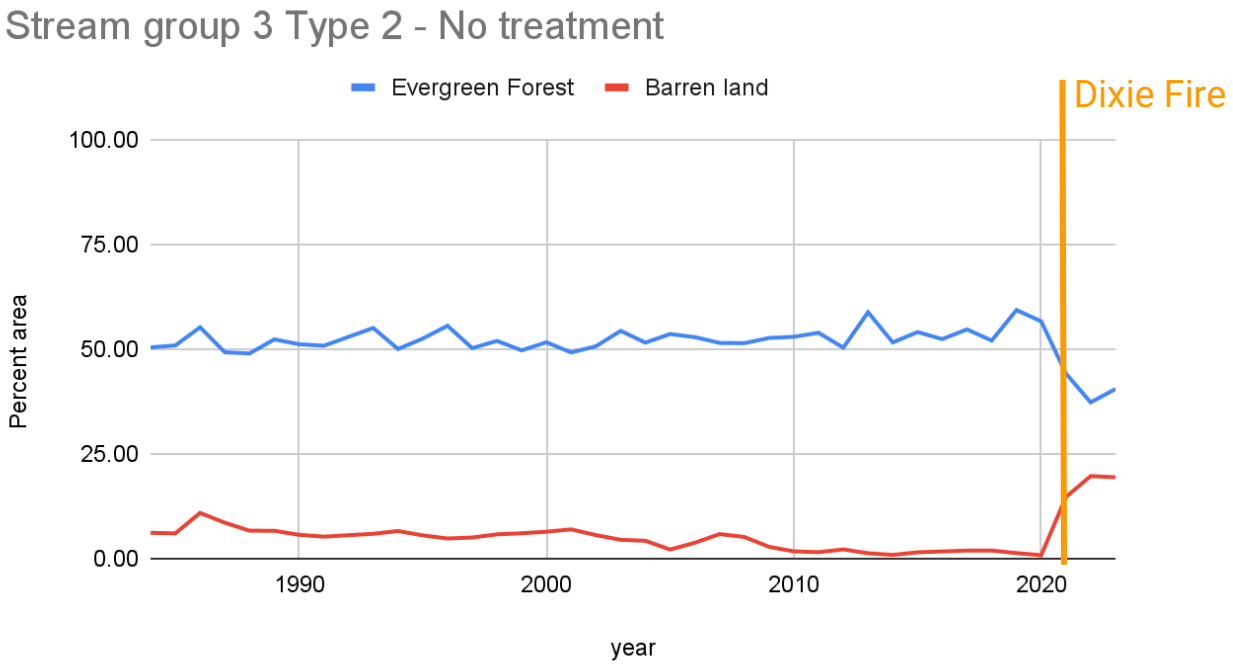

STATISTICAL ANALYSIS

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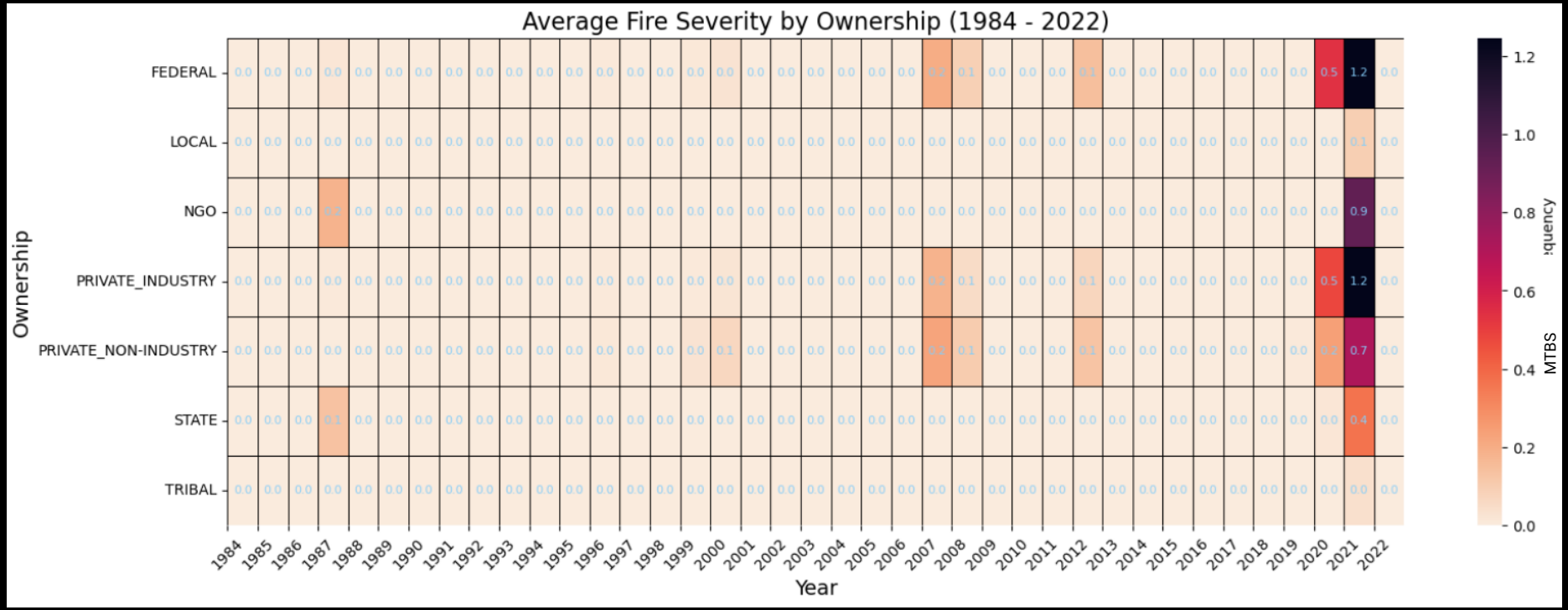

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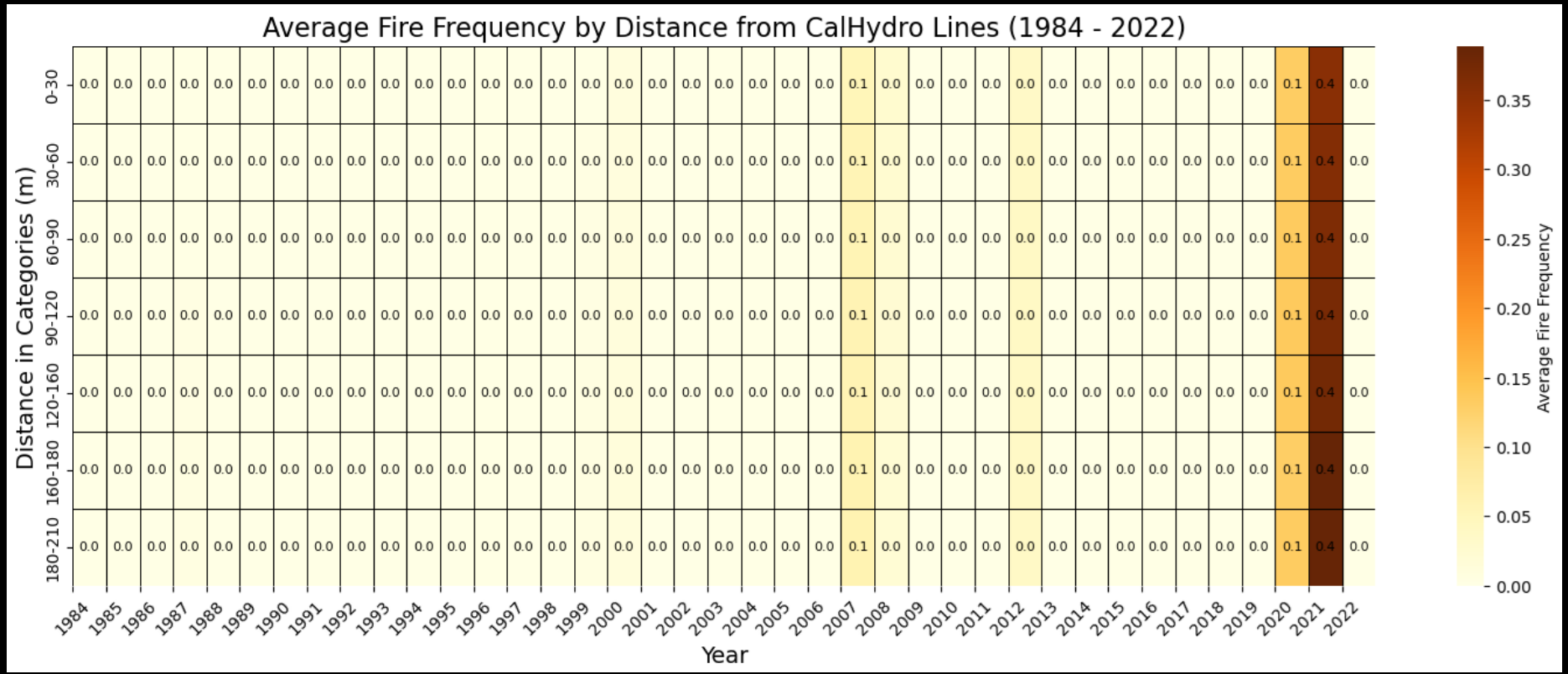

Results So Far

Locate WLPZs

- 300’ buffer catches disturbance signals
- Differences between property type and stream classification

Fire History and Severity in WLPZs

- Historically, low severity fire dominates in WLPZs Statewide
- In 2020 435K acres of WLPZ burned – 34% high severity

Plumas County Case Study – PFVR

- Dixie fire signal varies by property type and WLPZ classification

Statistical Analysis

- Federal and Private-Industrial lands highest fire severity in and out of WLPZs
- 2021 – Fire severity decreases moving towards WLPZs
- 2020 – Fire severity slightly increases moving towards WLPZs

NEXT STEPS

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Expand and Contextualize

- Augment WLPZ dashboard data
  - Trend analysis
- Expand Plumas Co. Case Study
  - additional stream groups
  - Additional fires

Statistical Analysis

- Refining distance analysis
- Long Short-Term Memory Model
- Dr. Greg Fanslow

Target/Visit Field Sites

- PFVM informed ground truthing
- UAV imagery
- 360º imagery