# Wildfires

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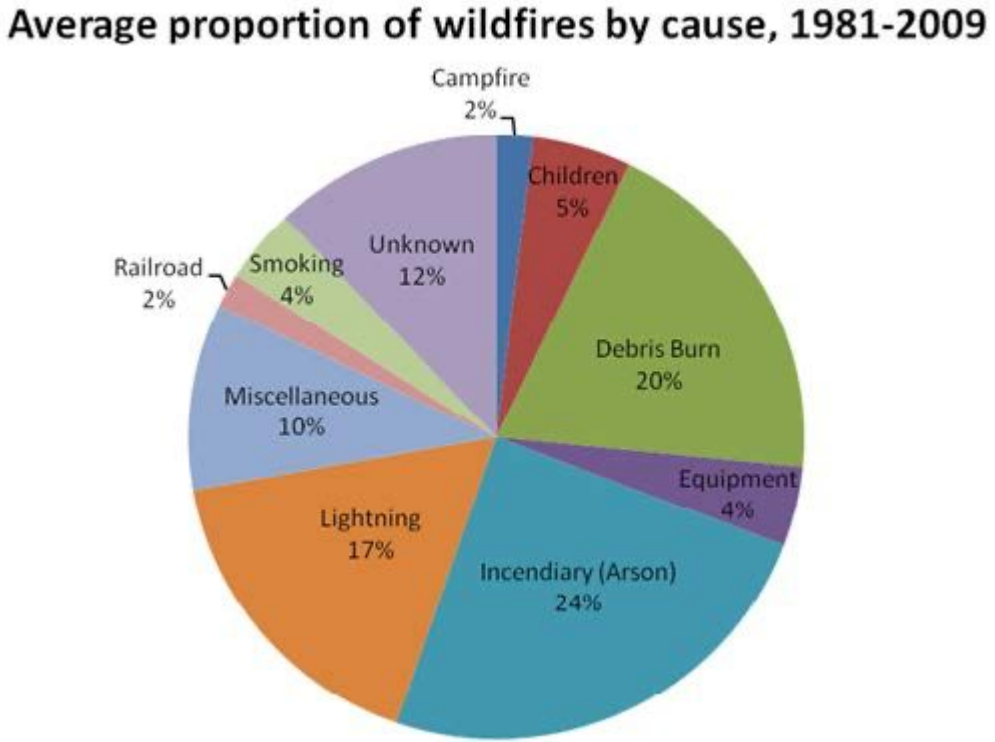
# Introduction

**According to US fire service:**

- more than 700 wildfires occur every year
- burning down approximately 7 million acres of land
- destroying more than 26,000 structures
- The U.S. spends over $5 billion dollars to fight fires each year

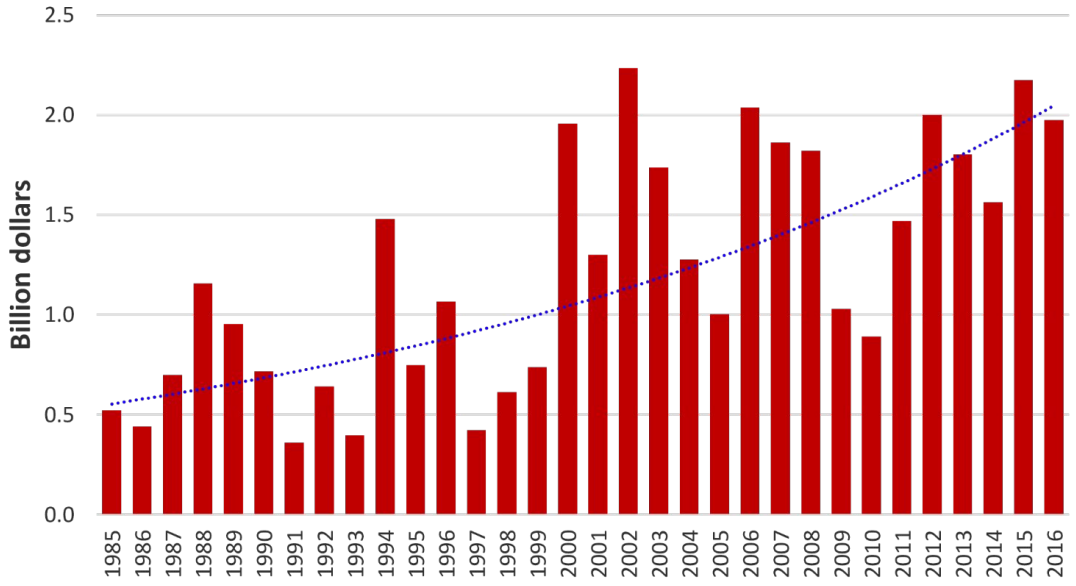
# Wildfire Causes

1. **Human causes**
   a. Smoking
   b. Unattended campfires
   c. Burning Debris
   d. Fireworks
   e. Machinery accidents
   f. Arson
2. **Natural causes**
   a. Lightning
   b. Volcanic eruption

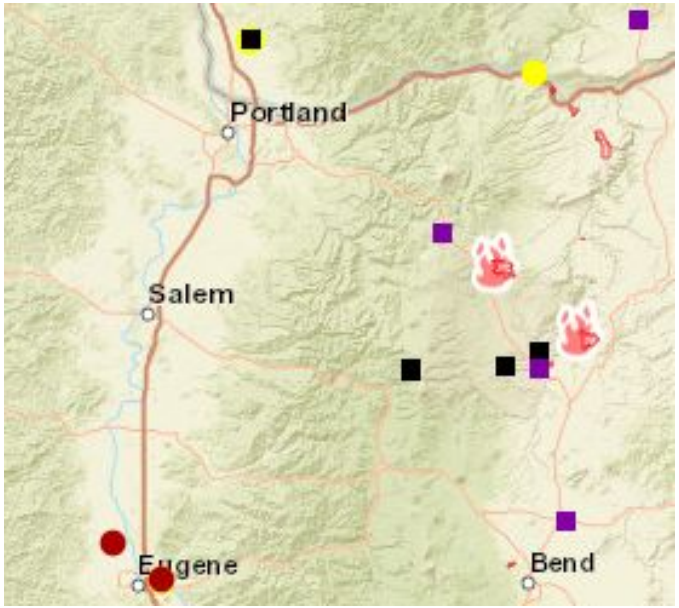


# Effects of Wildfire

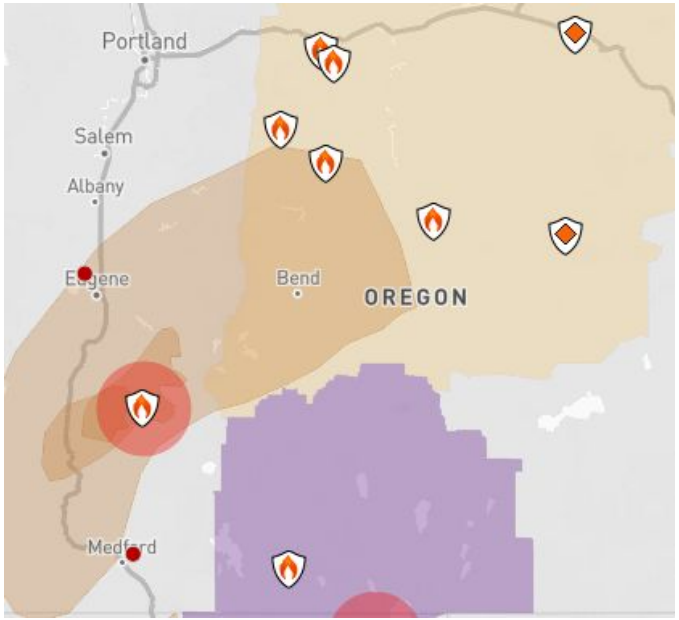
1. Loss of Ecosystems and Biodiversity
2. Forest Degradation
3. Air Pollution
4. Soil Degradation
5. Economic Losses
6. Destruction of Watersheds
7. Impacts to Human Well-being and Health



# Current Visualizations - Live Fire Maps

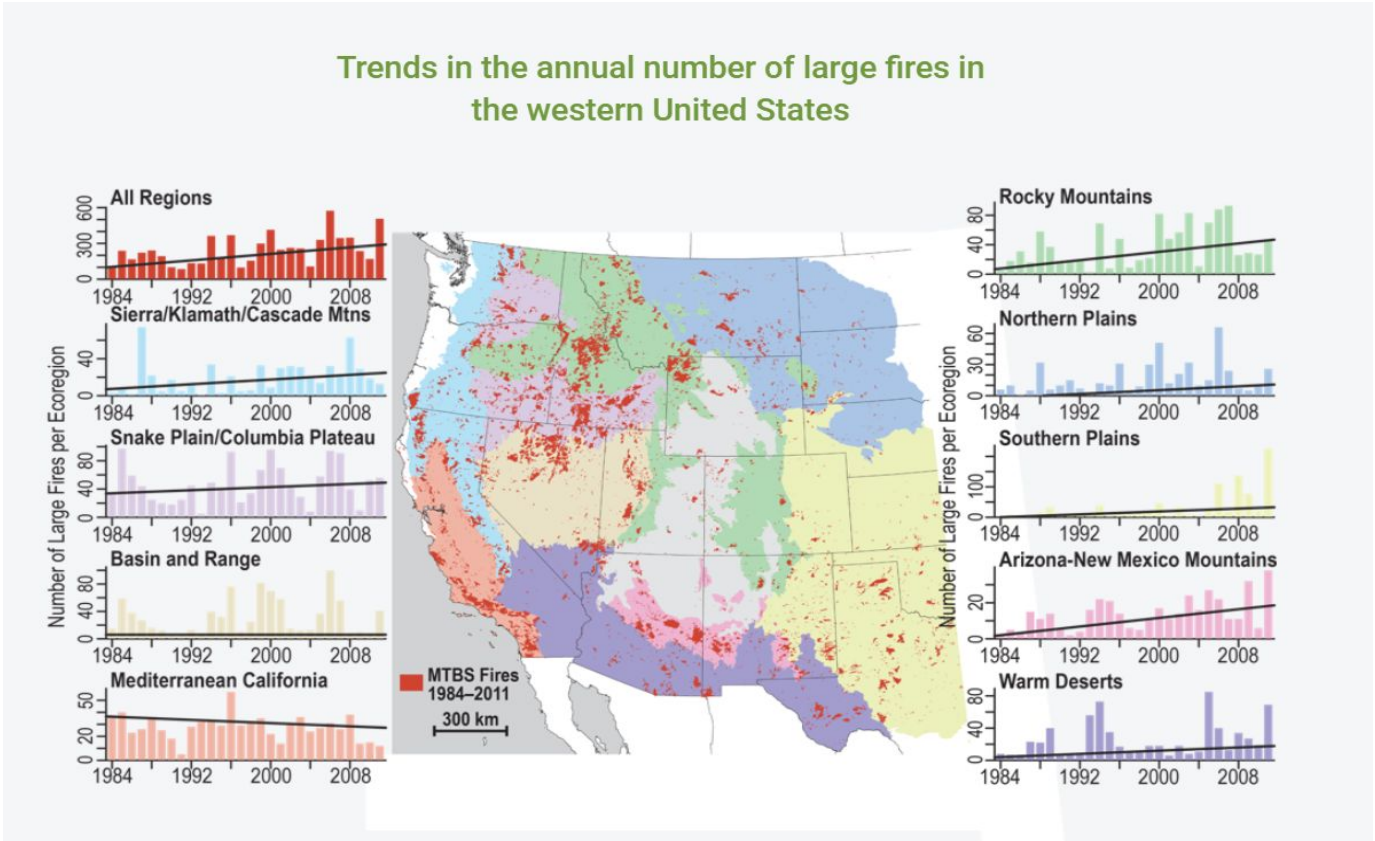



https://www.oregon.gov/odf/fire/pages/firestats.aspx

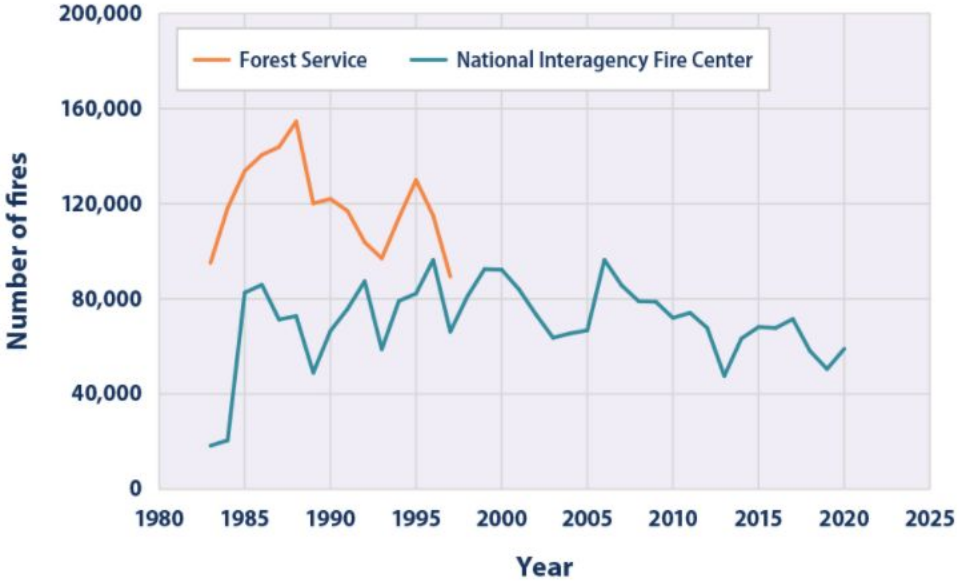



https://data.statesmanjournal.com/fires/

# Current Visualizations - Fire Trends

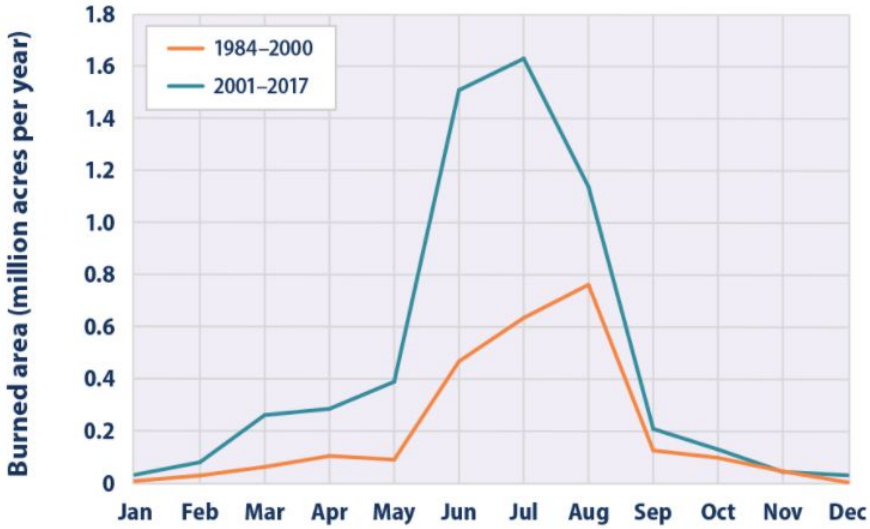


# Current Visualizations - Fire Trends

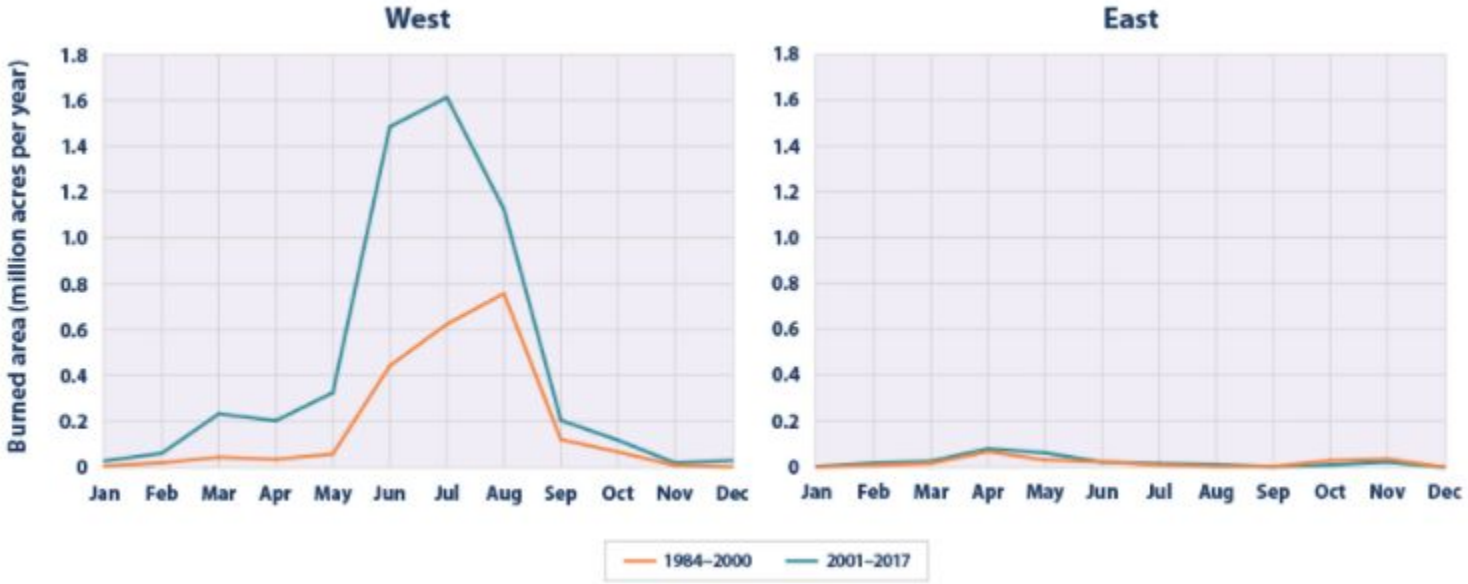



Wildfire Frequency in the United States,1984-2020

Comparison of Monthly Burned Area Due to Wildfires in the United States, 1984-2000 and 2001-2017

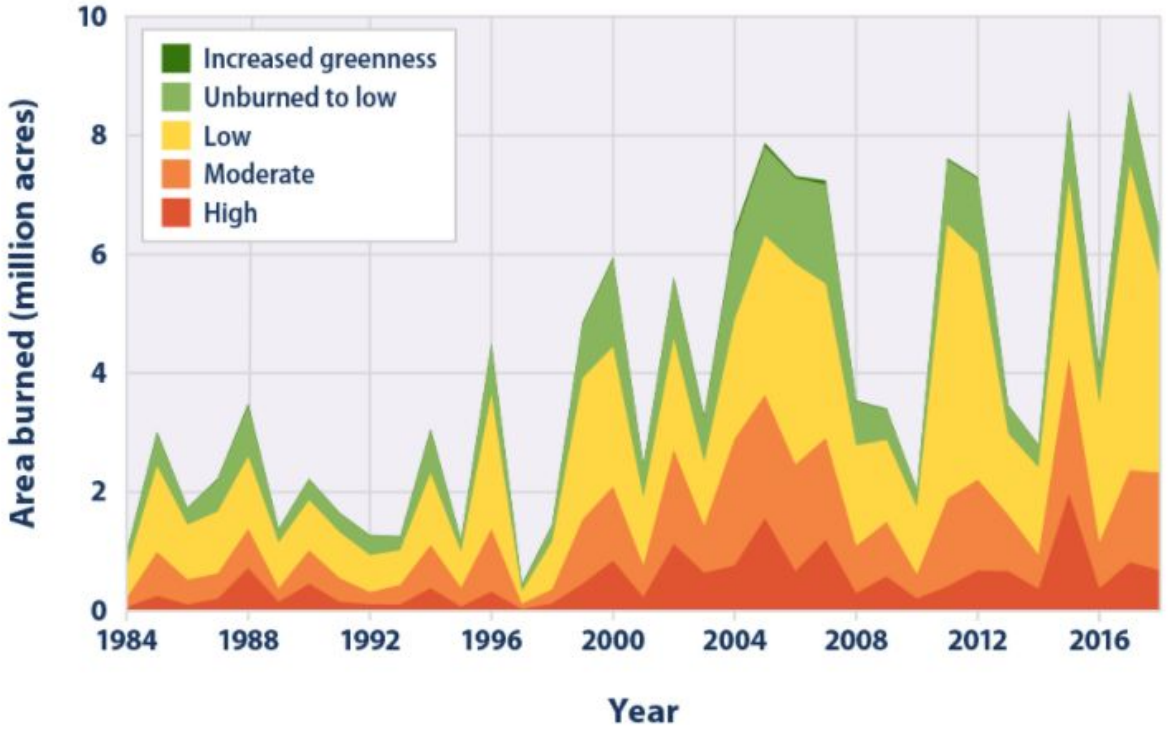


# Current Visualizations - Fire Trends




Comparison of Monthly Burned Area in the United States West and East,1984-2000 vs 2001-2017

# Current Visualizations - Fire Trends




Damage Caused by Wildfires in the united States, 1984-2018

# Problem

- Data is present and not widely used
- Current visualizations do a poor job of showing wildfire change clearly and impactfully
- Better visualizations require advanced knowledge of data modeling and mapping services
    - Animated Maps: California Wildfires from 1910-2019 https://www.youtube.com/watch?v=o58Te06fOkw

# Wildfire Data Set

- 1.88 Million US Wildfires
- Spatial database of wildfires between 1992 and 2015
- Authored by Karen C. Short

## Current Research

My current research is centered around a geospatial fire modeling system (FSim) that is used to map wildfire hazard for risk assessment and other applications (https://www.fs.usda.gov/rds/archive/Product/RDS-2016-0034/). To support this work I have developed and maintain a spatial database of wildfires in the US, 1992-2015, including 1.88 million records from federal, state, and local wildland fire reporting systems (https://www.fs.usda.gov/rds/archive/Product/RDS-2013-0009.4/).

https://www.fs.fed.us/research/people/profile.php?alias=kcshort

# Wildfire Data Set

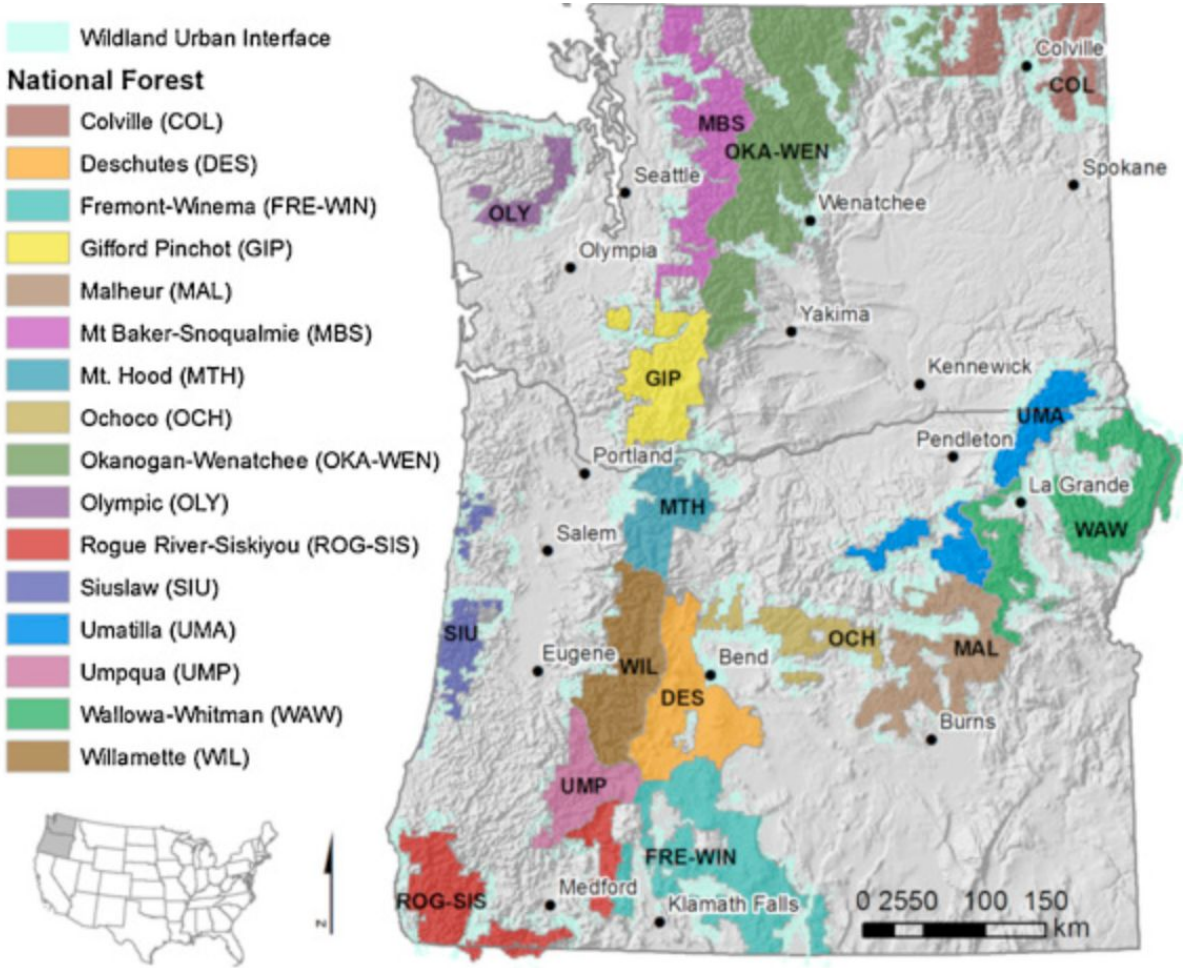
Important fields:

- FIRE_YEAR
- STATCAUSECODE
- CONT_DATE
- FIRE_SIZE
- FIRESIZECLASS
- LATITUDE
- LONGITUDE
- STATE
- COUNTY

# Related Research

Assessing the impacts of federal forest planning on wildfire risk mitigation in the Pacific Northwest, USA

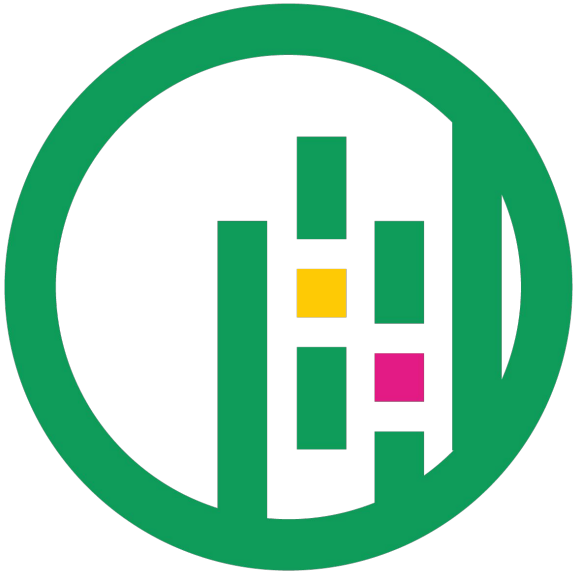
Authors: Alan A. Ager, Michelle A. Day, Karen C. Short, Cody R. Evers




https://doi.org/10.1016/j.landurbplan.2015.11.007

# GeoPandas + geoplot

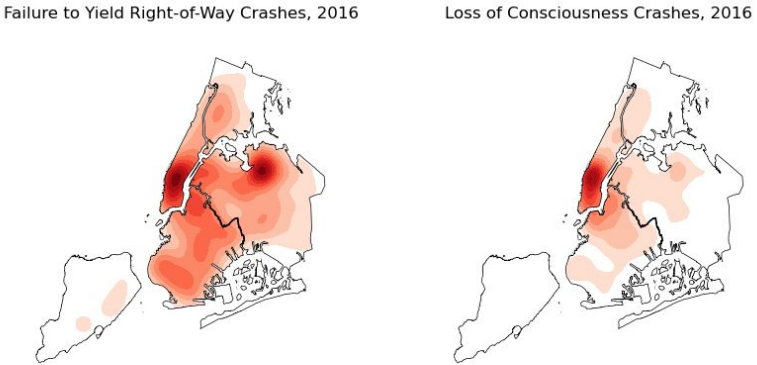
- Created to work with geospatial data in python
- Dependencies:
  - numpy
  - pandas
  - shapely
  - fiona
  - pyproj
- Supports the use of latitude and longitude
- geoplot - data visualization library
  - Extends cartopy and matplotlib

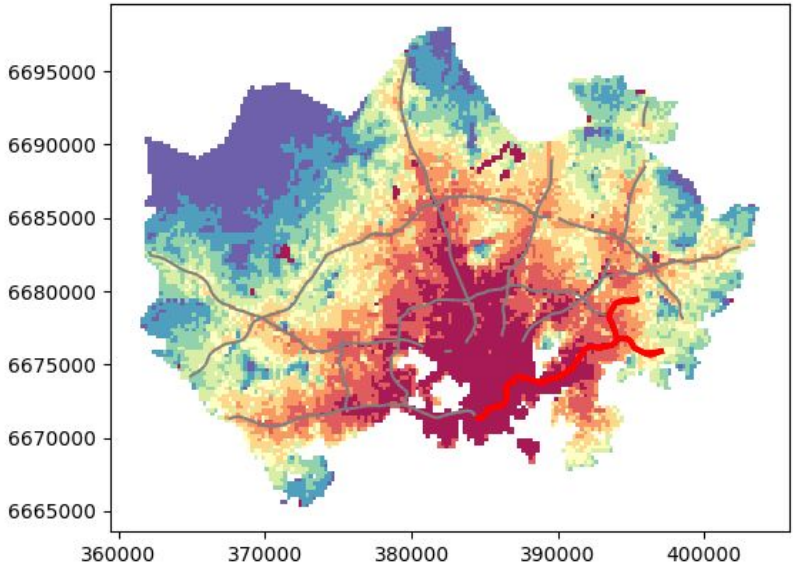


https://geopandas.org/about/logo.html

# Mapping Using GeoPandas + geoplot

- Lots of options for visualization
- Will require lots of experimentation




https://automating-gis-processes.github.io/CSC18/lessons/L5/static-maps.html

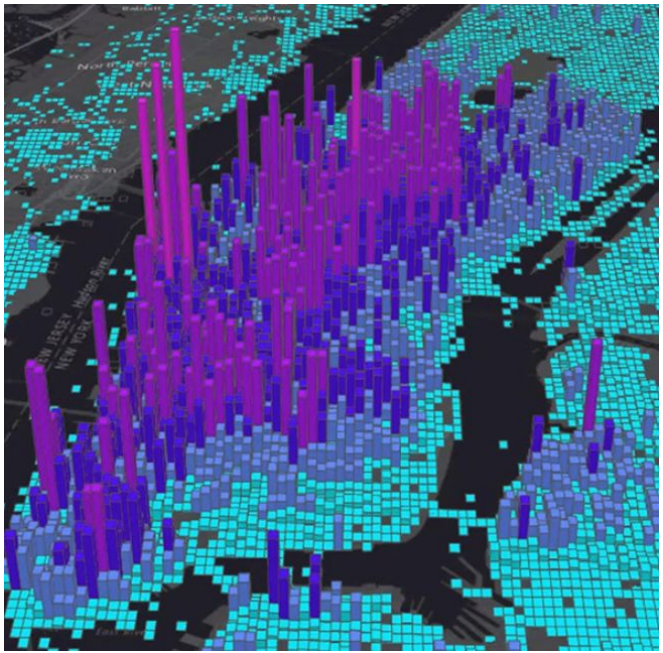
https://residentmario.github.io/geoplot/gallery/plot_nyc_collision_factors.html#sphx-glr-gallery-plot-nyc-collision-factors-py

# Mapping Using ArcGIS

Powerful Geographic Information System

Built for spatial analysis and real time visualization

Integrations with R, python, scikit-learn, TensorFlow

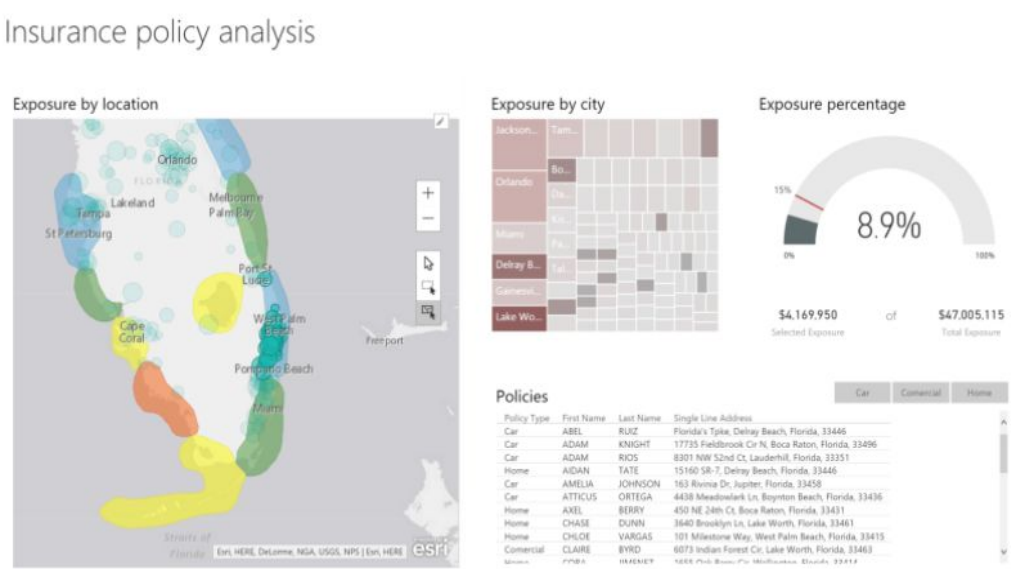


# ArcGIS and PowerBI

A GUI for the data model

Users can interact with visualisations to explore the data

Interaction changes charts linked through the data model



# Project Outcomes

- Explore data visualization using various tools and techniques on the same base data set
- Create visualizations showing the impact climate change has had on wildfires
  - Focus on accessibility and understanding by general public
  - Attempt to clearly show increased fire risks as the years progress

# Sources


- https://www.arcgis.com/apps/MapJournal/index.html?appid=df8a5097d2f741f0bb64f09922413ef1
- https://discover.pbcgov.org/coextension/Lists/NewsEvents/NewsDispForm.aspx?ID=57&ContentTypeId=0x0104002A3D1899F289BA43AD4115A2B52E28BB
- https://eartheclipse.com/environment/various-causes-and-effects-of-wildfires.html
- https://www.fs.usda.gov/rds/archive/Catalog/RDS-2013-0009.4/
- https://www.c2es.org/content/wildfires-and-climate-change/
- https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires
- https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/books/the-language-of-spatial-analysis.pdf
- https://www.sciencedirect.com/science/article/abs/pii/S0169204615002315?via%3Dihub