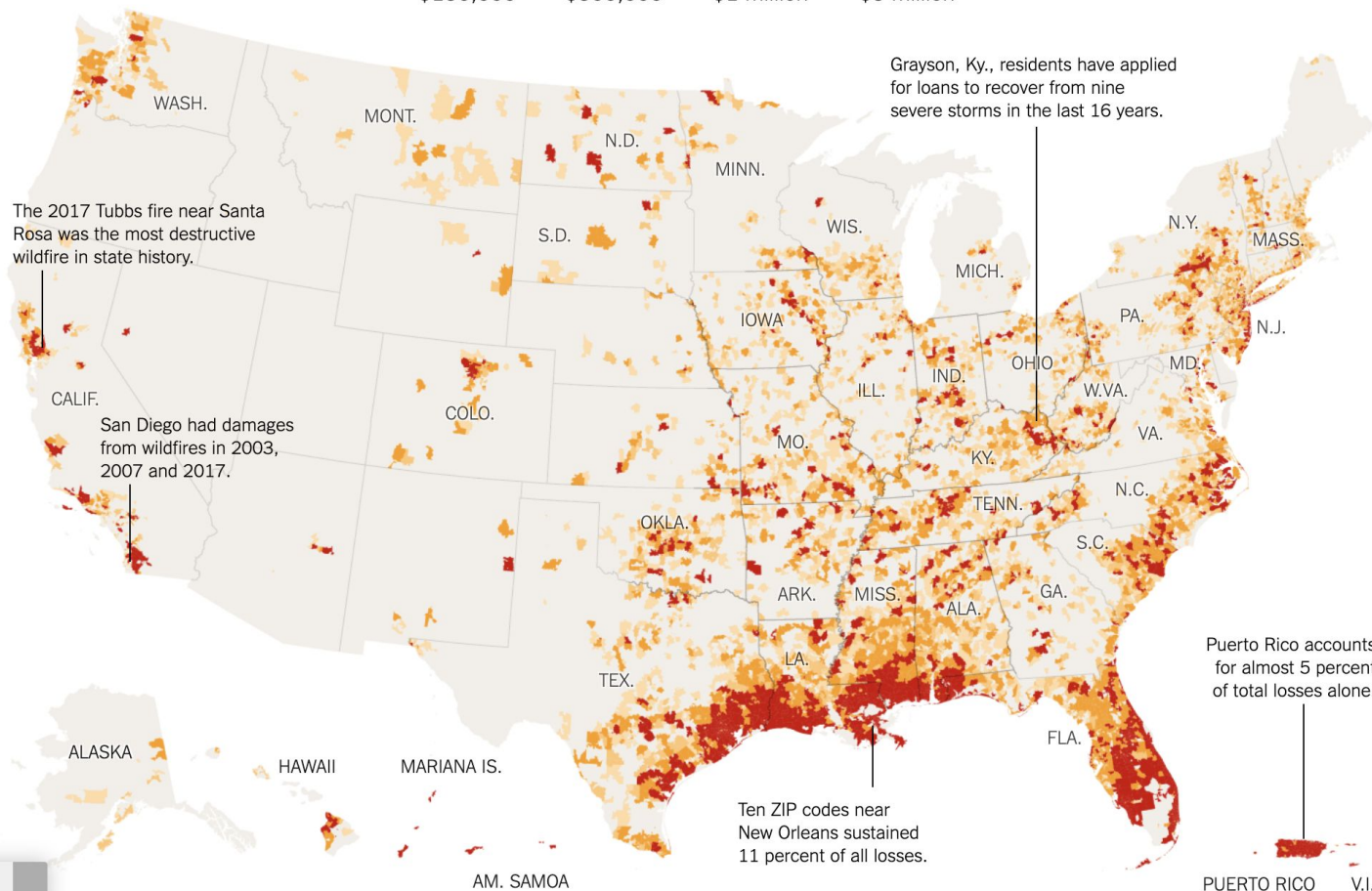# Estimating the Business Impact of Wildfires According to FEMA's Seven Lifelines

Prepared by:
Brenda Hali, Jessie Owens, John Kirby, Larry Curran

Losses in each ZIP code from major natural disasters, 2002-17

$150,000 $500,000 $1 million $5 million

WASH.

MONT.

N.D.

MINN.

The 2017 Tubbs fire near Santa Rosa was the most destructive wildfire in state history.

S.D.

WIS.

Grayson, Ky., residents have applied for loans to recover from nine severe storms in the last 16 years.

N.Y.

MASS.

MICH.

CALIF.

IOWA

ILL.

IND.

OHIO

PA.

N.J.

MD.

W.VA.

VA.

San Diego had damages from wildfires in 2003, 2007 and 2017.

COLO.

MO.

KY.

N.C.

OKLA.

TENN.

S.C.

ARK.

MISS.

ALA.

GA.

Puerto Rico accounts for almost 5 percent of total losses alone.

TEX.

LA.

FLA.

ALASKA

HAWAII

MARIANA IS.

Ten ZIP codes near New Orleans sustained 11 percent of all losses.

AM. SAMOA

PUERTO RICO

V.I.

Map: New York Times

Disasters in California

Occurrences of disasters continue to increase in California…

107,742

Acres burned in California in 2010

1,823,152

Acres burned in California in 2018

$400 billion

Estimated Economic impact to California due to 2018 wildfires
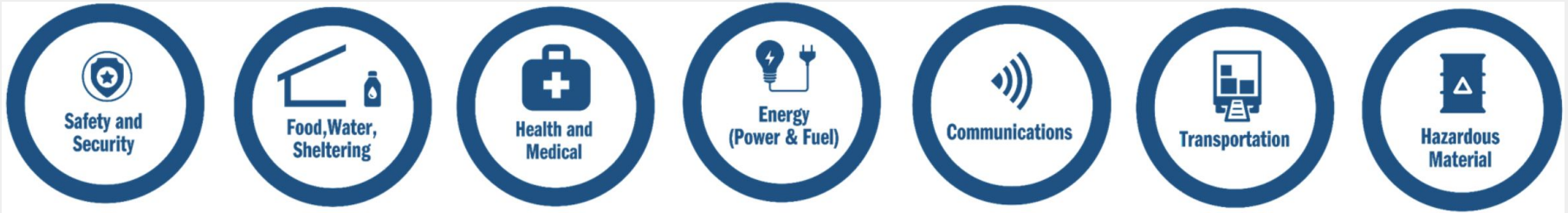
85

Lives lost due to 2018 wildfires

Cedar Fire, October 2003: 273,246 acres, 2,820 structures, 15 lives from San Diego County, #4 on California's top 10 most destructive

Witch Fire, October 2007: 197,990 acres, 1,650 structures, 2 lives from San Diego County, #6 on California's top 10 most destructive

FEMA Lifelines

Challenge

- Identify businesses in a potential disaster zone

- Align businesses to FEMA Lifelines

- Visualize these businesses in relation to:

  - Historical disaster zones

  - High risk future disaster zones

- Case Study: San Diego County

Methodology

Yelp Data

- Assigned lifelines to the businesses in the San Diego Area from Yelp.

- Data from Yelp using Yelp Fusion API
   - Types of queries used: Business Search endpoint

Google Data

- We also used the Google Places API
    - Types of queries used: Nearby Search, Text Search

Methodology

- Code was written with future applicability in mind
- Just need API keys for each service
- Simple change of coordinates and location term
- Short runtime (around 30 minutes)
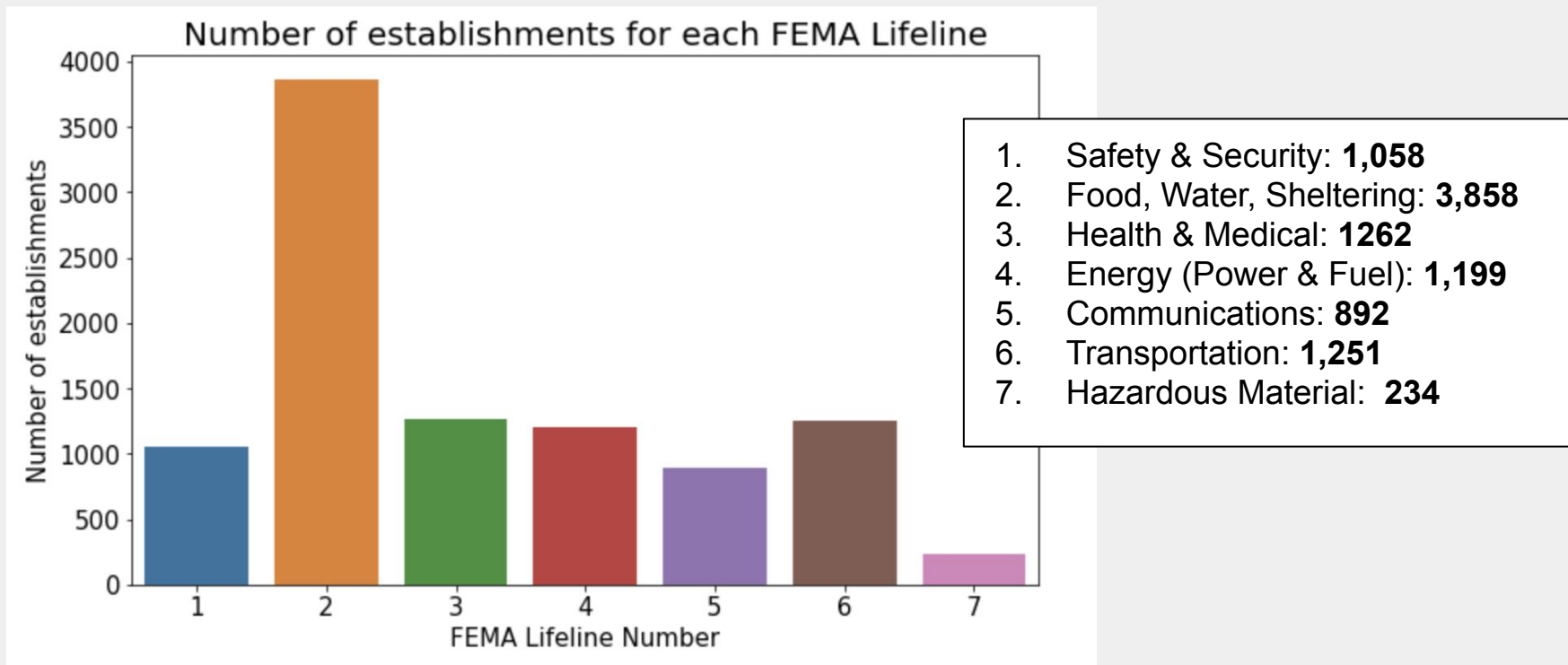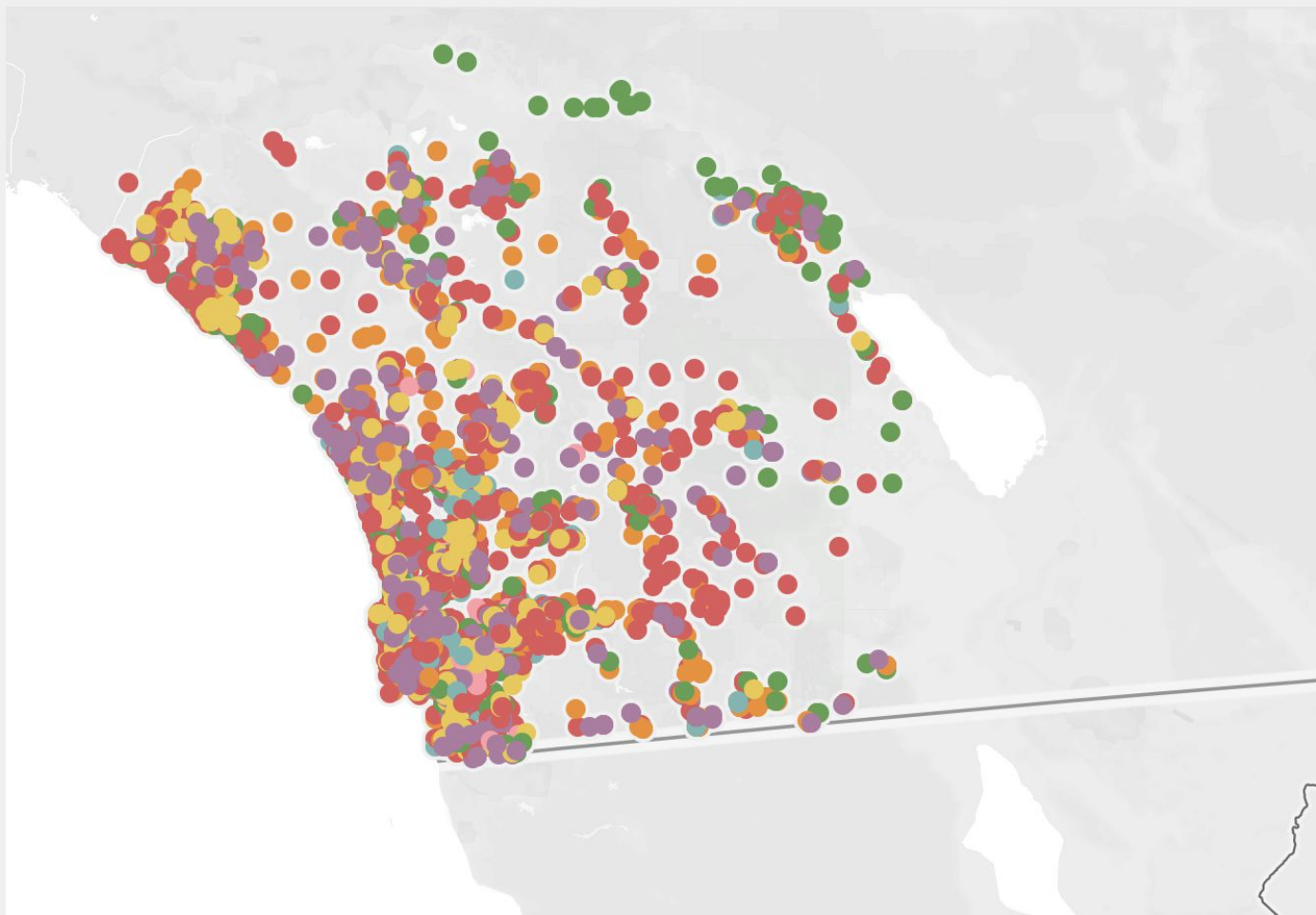- Removed duplicates from Google and Yelp to avoid repeats

Data source

Number of establishments from each API
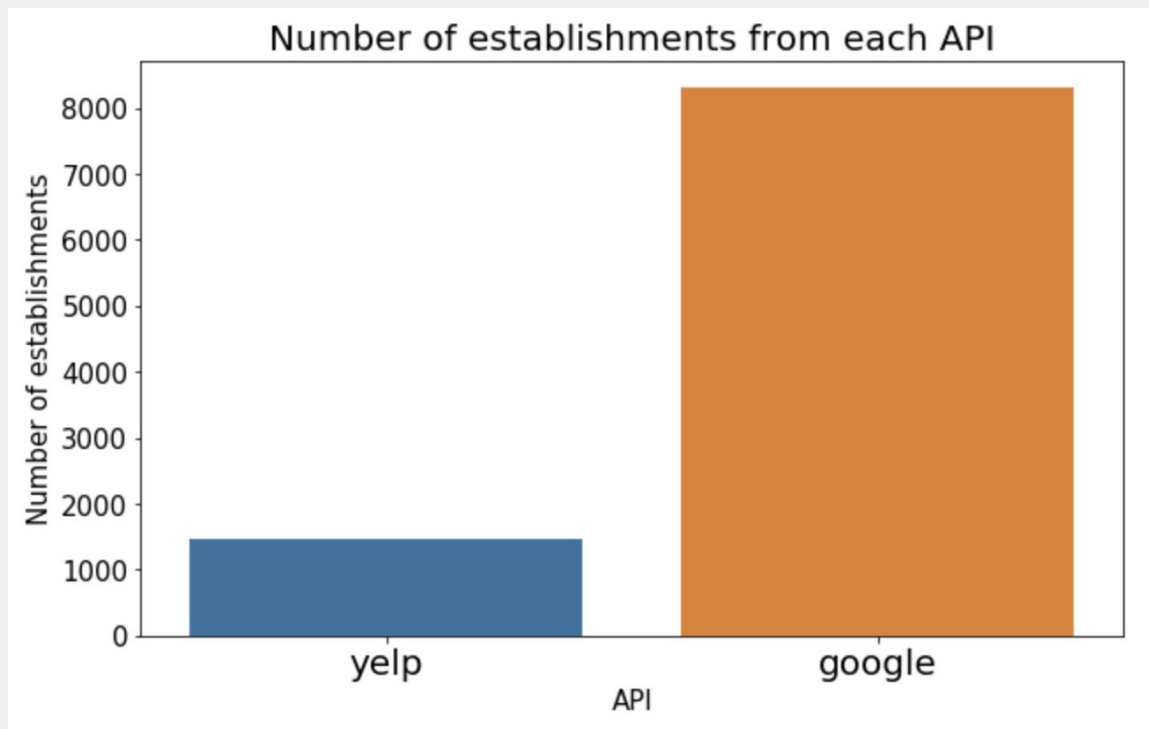
google	8304
yelp	1456

Number of different categories of establishments: 631

Data collected per lifeline

Number of establishments for each FEMA Lifeline

1. Safety & Security: **1,058**
2. Food, Water, Sheltering: **3,858**
3. Health & Medical: **1262**
4. Energy (Power & Fuel): **1,199**
5. Communications: **892**
6. Transportation: **1,251**
7. Hazardous Material: **234**

Safety & Security: **1,058**

Food, Water, Sheltering: **3,858**

Health & Medical: 1262

Energy (Power & Fuel): **1,199**

Communications: **892**

Transportation: **1,251**

Hazardous Material: **234**

Application

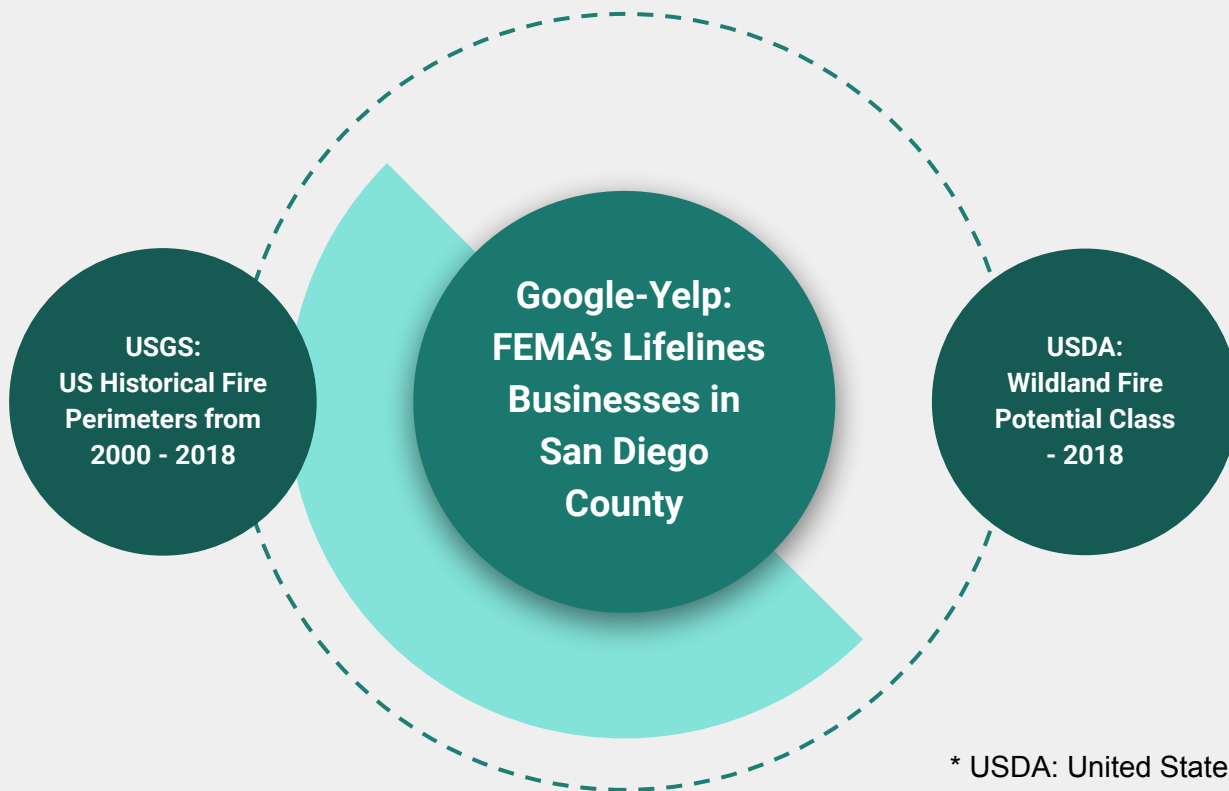**Goals:**

1 Integrate with available datasets

2 User-friendly

3 Scalable

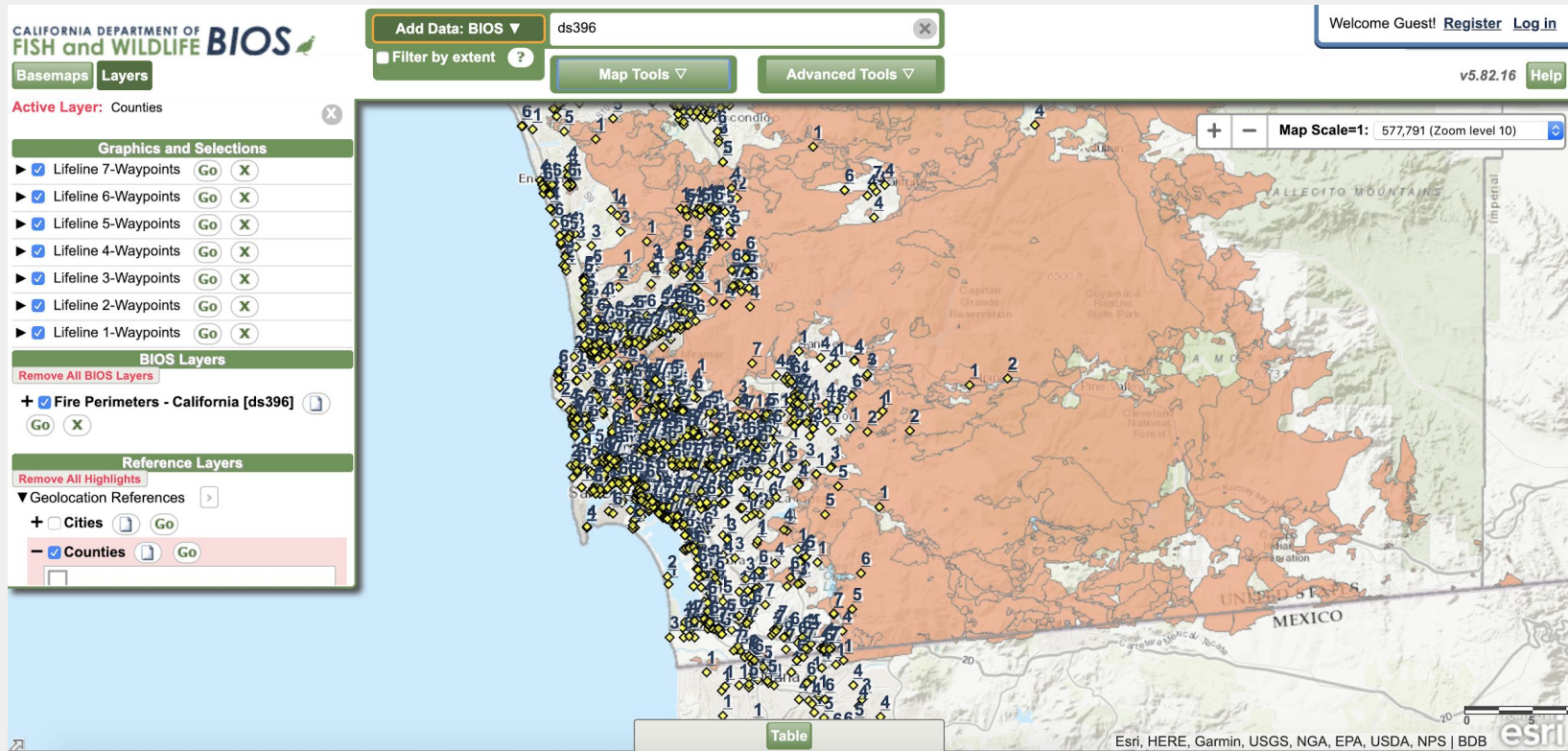# Datasets used to estimate the impact

USGS:
US Historical Fire Perimeters from 2000 - 2018

Google-Yelp:
FEMA's Lifelines Businesses in San Diego County

USDA:
Wildland Fire Potential Class - 2018

* USDA: United States Department of Agriculture
* USGS: United States Geological Survey

Bios
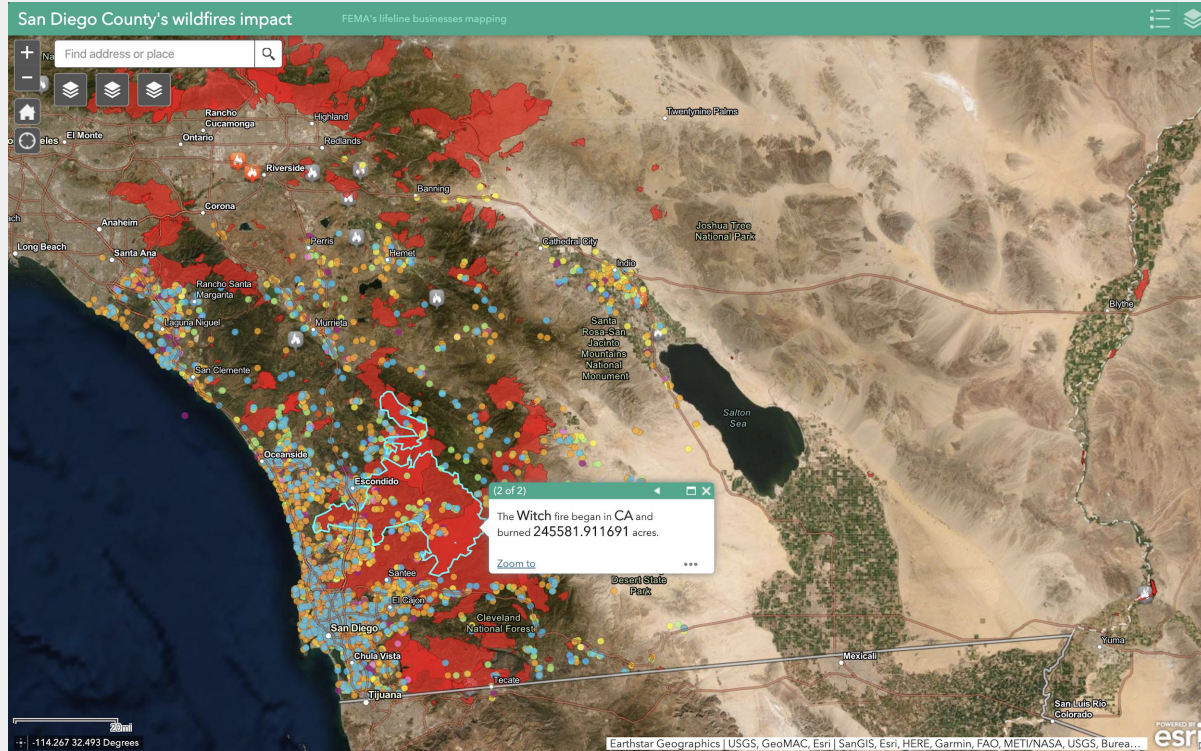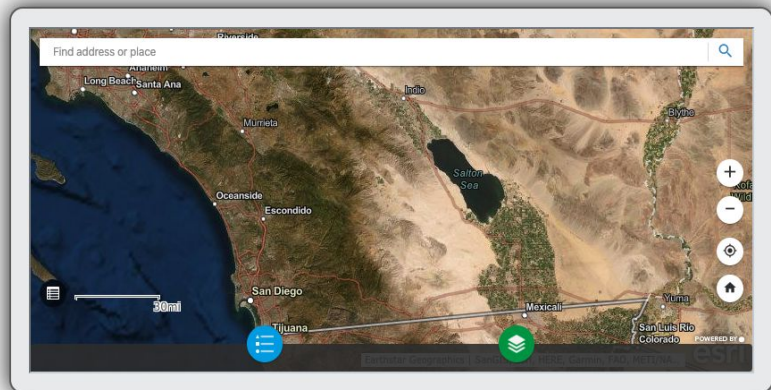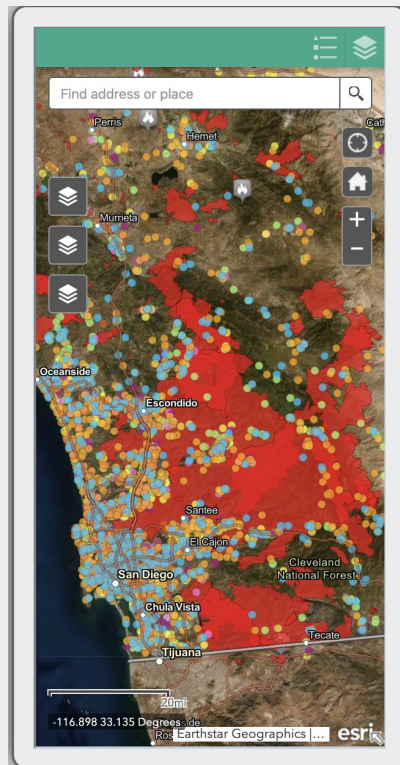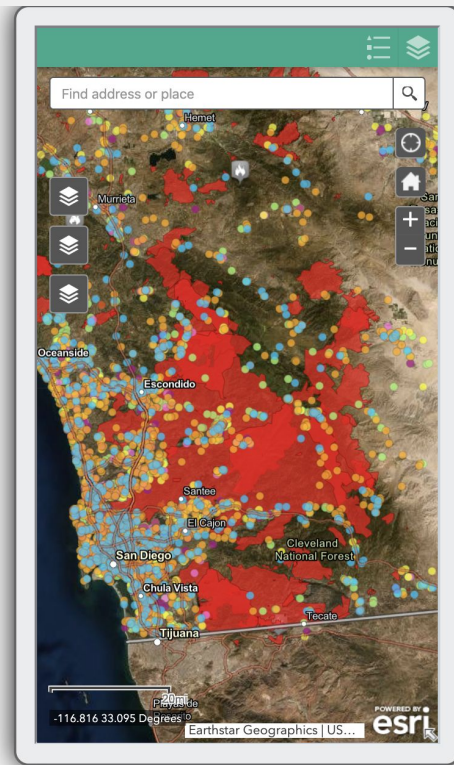
Google Earth Pro

ArcGIS

Live Web App Demo

Responsive

iPhone X 375 x 812

Samsung Galaxy S8 / Samsung Galaxy S8 Plus 360 x 740

iPhone 8 Plus / iPhone 7 Plus / 6s Plus / 6 Plus 414 x 736

Conclusions and Recommendations

Conclusions

- Using data from Google, Yelp, FEMA, and the USDA, we were able to align and map Lifeline businesses in San Diego county.

- Additionally, we were able to overlay historical wildfire data and map current fire activity to provide perspective on potential risks to those Lifeline businesses. This information can help FEMA decision-makers to mobilize and anticipate resource needs during a disaster.

Conclusions, cont'd

- The map can be used as a starting point for:
    - Determining evacuation plans
    - Estimating potential/actual disaster impact

- Our methodology allowed us to run trials over various APIs and mapping software to determine what is the most efficient and what produces the most replicable, user-friendly results.

Recommendations

Public/Private partnerships: Greatly increase the efficiency of identifying and mapping a disaster to assess its impact.

- Yelp/Google can create the ability for businesses to report through their platforms whether they are open/closed due to the disaster
- The Yelp/Google API restrictions can/should be waived for disaster response for faster acquisition of data.

Recommendations, cont'd

Tech Investments: FEMA and other disaster response/recovery agencies should invest in mapping platforms such as ArcGIS

- These can be commercial off the shelf (COTS) or specifically designed for FEMA (Ptolemy, for example)
- Continued updating of technologies and business information can create better models than the "Waffle House Index"

Questions?

Check out the project website:
https://sites.google.com/view/fema-lifeline-business-lines