

California Wildfires and How Precipitation Affects Them



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Agenda

- Project overview
- Data collection
- Hypotheses
- Implications

Project Overview

- Central question: *The Effect of Precipitation on Wildfires*
- Scope:
 - California
 - 1932-2018
 - Top 20 Largest California Wildfires

Data Collection

- **Datasets**

- *Top 20 Largest California Wildfires (Kaggle.com)*
- *Level of precipitation during each month each incident occurred (<https://www.ncdc.noaa.gov/cag/>)*

- **Parameters**

- Fire name
- Cause
- County
- Month, Year
- Precipitation (in)
- Acres burned, Structures destroyed, Casualties

- **Limitations**

- Size of dataset
- Difficulties in finding data

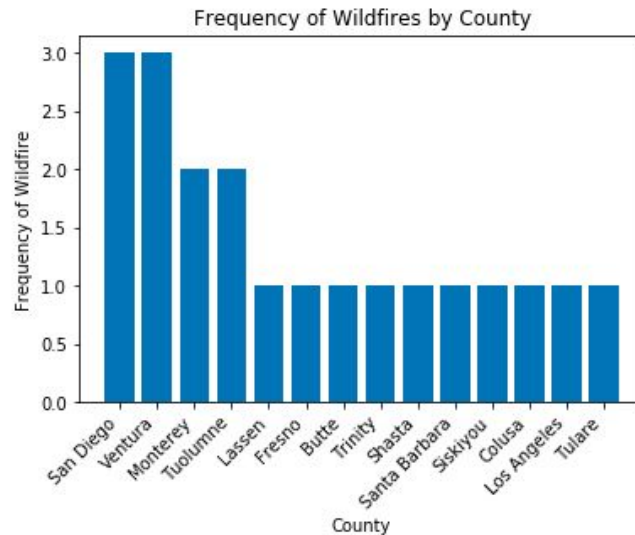
Merged Data

Fire Name	Cause	Acres	Structures	Deaths	County	Month	Year	Rainfall (in)
Mendocino Complex	Under Investigation	459123	280	1	Colusa	July	2018	0.00
Thomas	Powerlines	281893	1063	2	Ventura	December	2017	0.01
Cedar	Human Related	273246	2820	15	San Diego	October	2003	0.01
Rush	Lightning	271911	0	0	Lassen	August	2012	0.05
Rim	Human Related	257314	112	0	Tuolumne	August	2013	0.10
Zaca	Human Related	240207	1	0	Butte	November	2018	6.08
Carr	Human Related	229651	1614	8	Fresno	July	2015	0.56
Matilija	Undetermined	220000	0	0	Tulare	July	2002	0.01
Witch	Powerlines	197990	1650	2	Tuolumne	August	1987	0.03
Klamath Theater Complex	Lightning	192038	0	2	Trinity	August	1999	0.32
Marble Cone	Lightning	177866	0	0	Monterey	July	1977	0.00
Laguna	Powerlines	175425	382	5	San Diego	September	1970	0.01
Basin Complex	Lightning	162818	58	0	Monterey	June	2008	0.00
Day Fire	Human Related	162702	11	0	Ventura	September	2006	0.01
Station	Human Related	160557	209	2	Los Angeles	August	2009	0.01
Camp Fire	Powerlines	153336	18804	85	Santa Barbara	July	2007	0.00
Rough	Lightning	151623	4	0	Shasta	July	2018	0.05
McNally	Human Related	150696	17	0	Ventura	September	1932	0.53
Stanislaus Complex	Lightning	145980	28	1	San Diego	October	2007	0.15
Big Bar Complex	Lightning	140948	0	0	Siskiyou	June	2008	0.11



Is there a correlation between total amount of rainfall in a specific area and the total number of wildfires

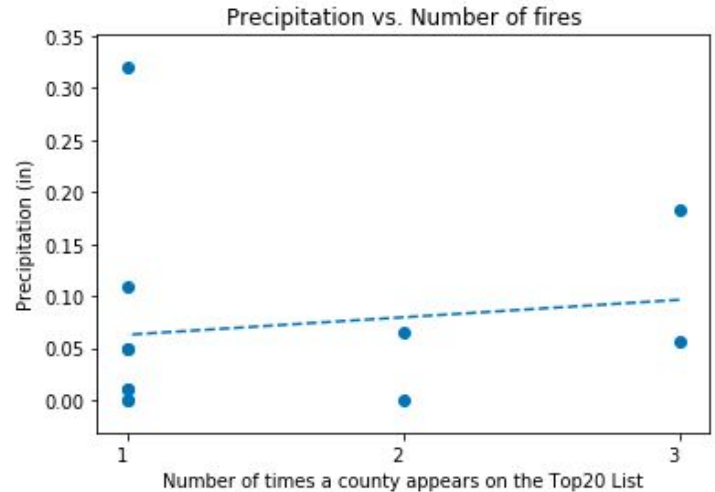
- Key Parameters:
 - Number of times a county appear on the Top 20 list
 - Total precipitation for the county of the given month that the fire occurs



Results

- Removed outliers: Butte, Fresno
- R-value: 14.06%

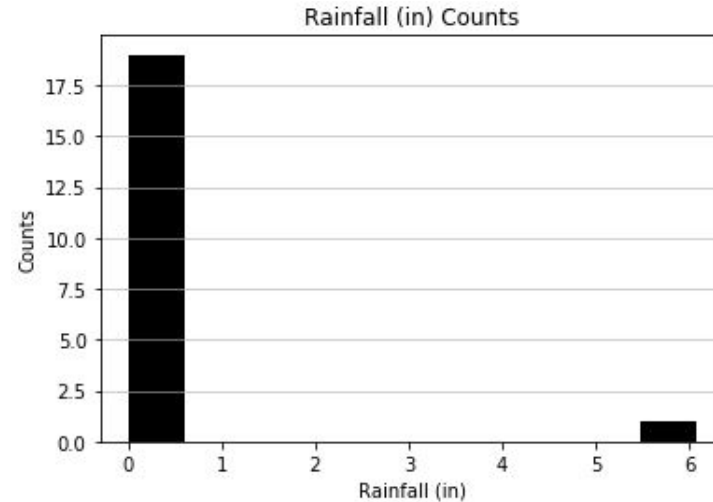
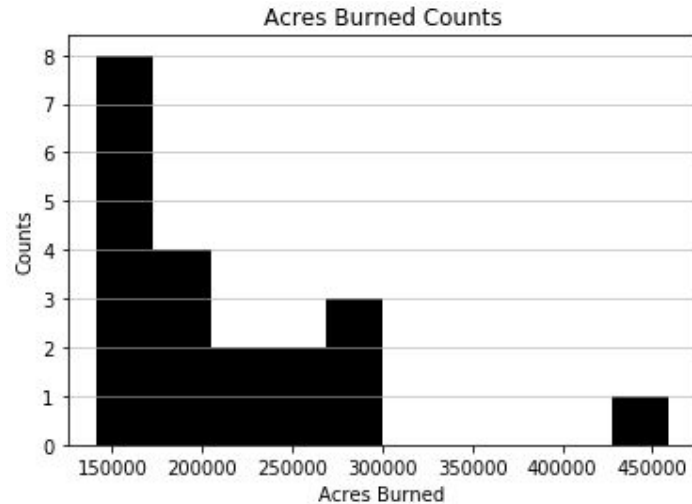
Conclusion: There is weak to no correlation between the number of large wildfires that occurs in a county and the amount of precipitation it experiences during the same month.



Is there a correlation between rainfall and the total number of acres burned?

Normal Check: cannot conclude we have a normal data set

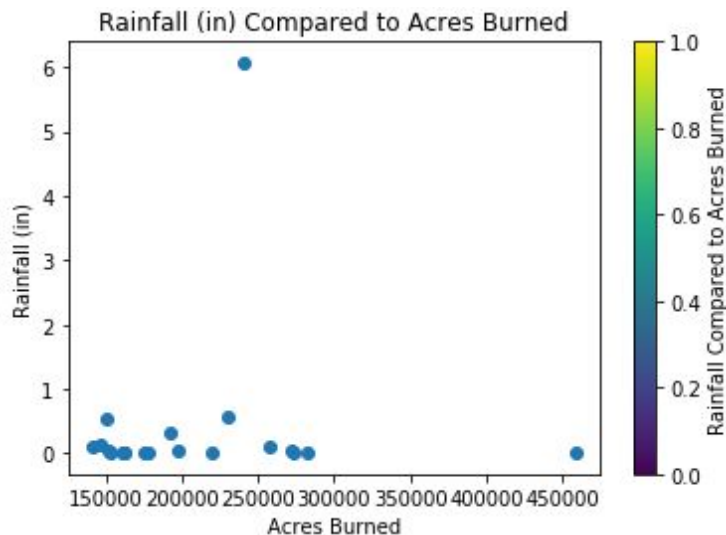
- Acres Burned - p value = 3.96
- Rainfall (in) - p value = 1.10



Is there a correlation between rainfall and the total number of acres burned?

Outlier Identified:

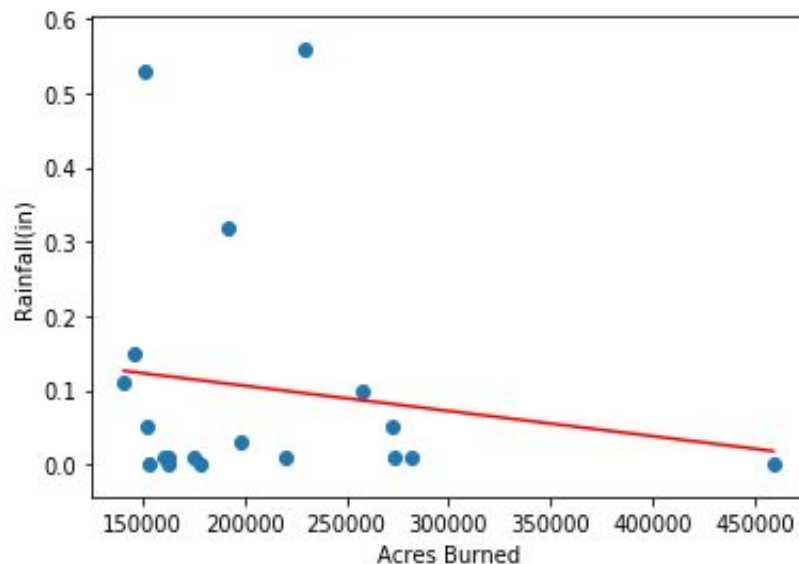
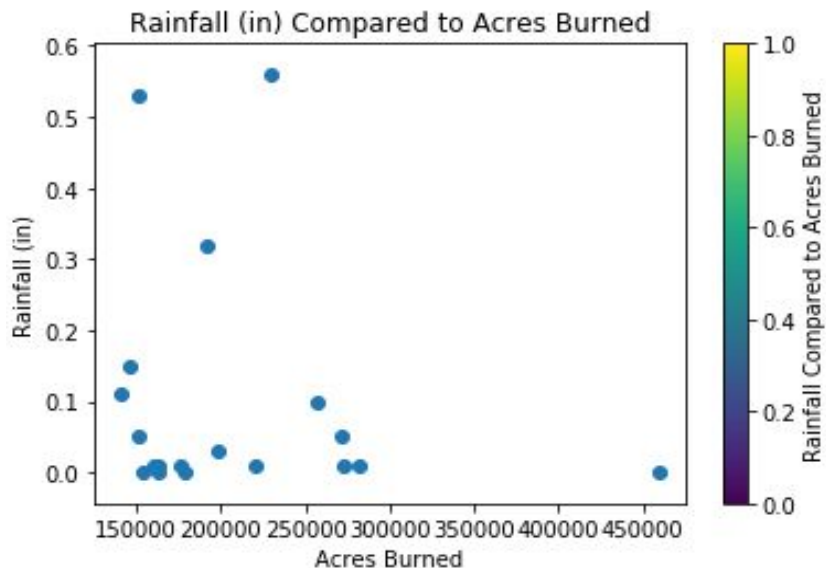
- Zaca Wildfire in 2018: 6+ inches of rainfall



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Is there a correlation between rainfall and the total number of acres burned?

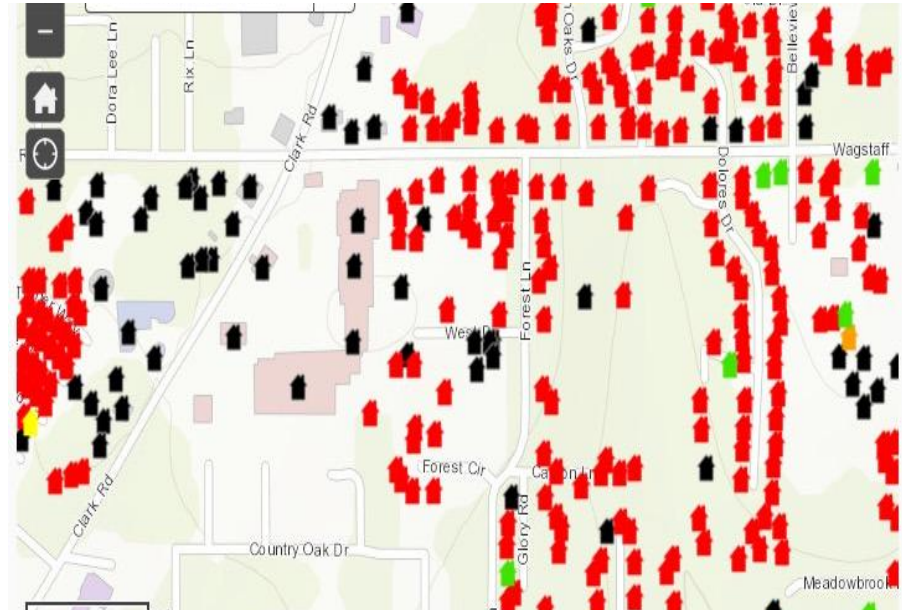
- After removal of the Zaca wildfire we see a better scatter but a trend cannot be identified
- The correlation coefficient = -0.15 represents a negative trend which is in general what you may think: as inches of rainfall decrease more acres burn



Is there a correlation between the number of structures affected and rainfall?

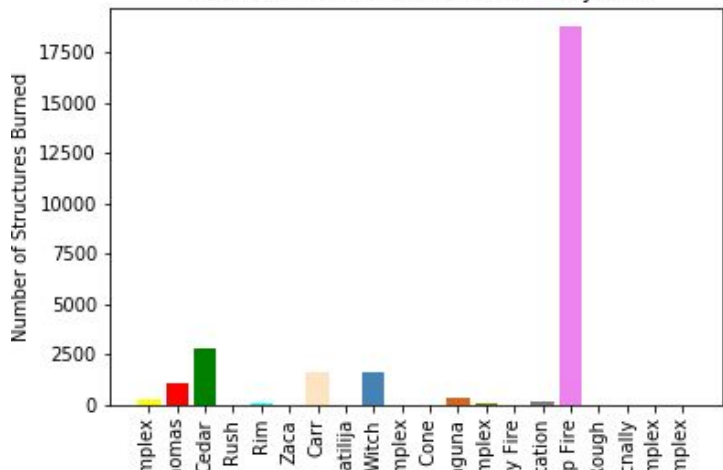
H1: If there is less rainfall during the month of a wildfire, then there will be a higher number of structures burned.

H0: The number of structures burned does not depend on rainfall.

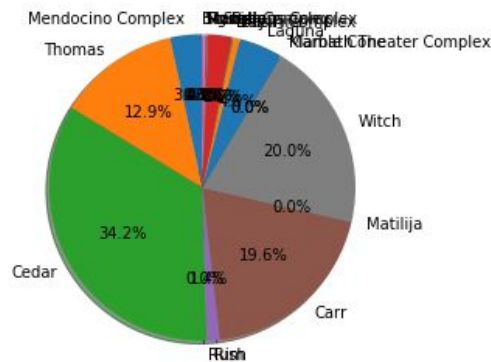
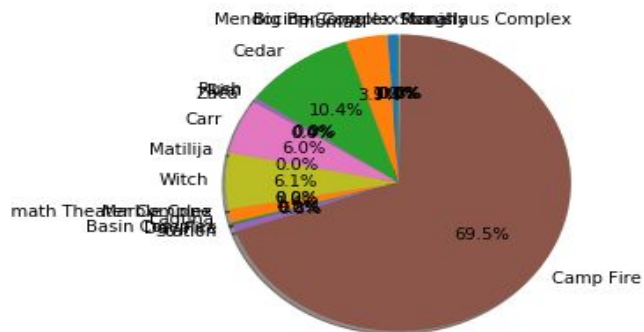
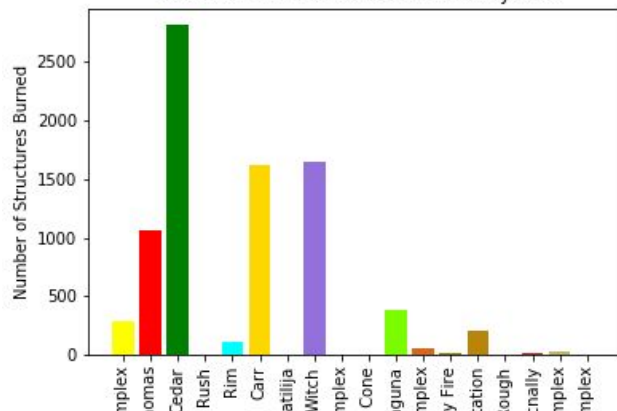


rainfall?

The Number of Structures Burned by Fire

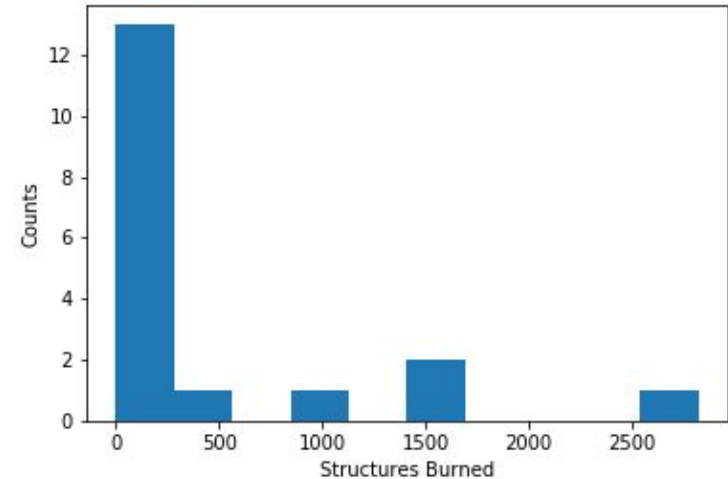
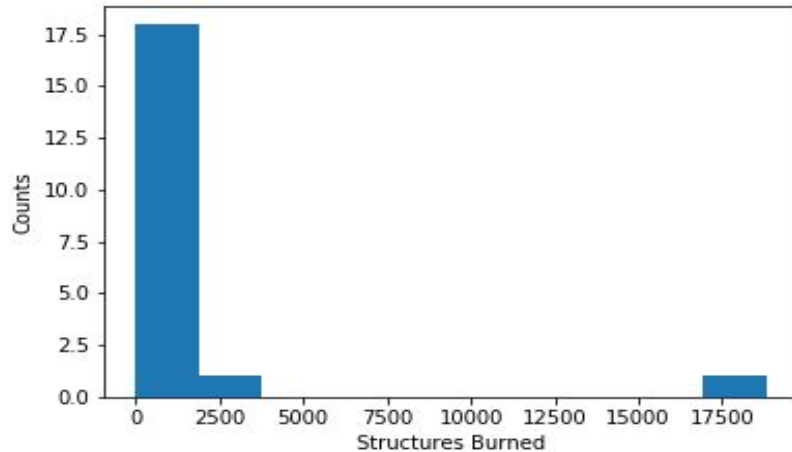


The Number of Structures Burned by Fire



Is there a correlation between the number of structures affected and rainfall?

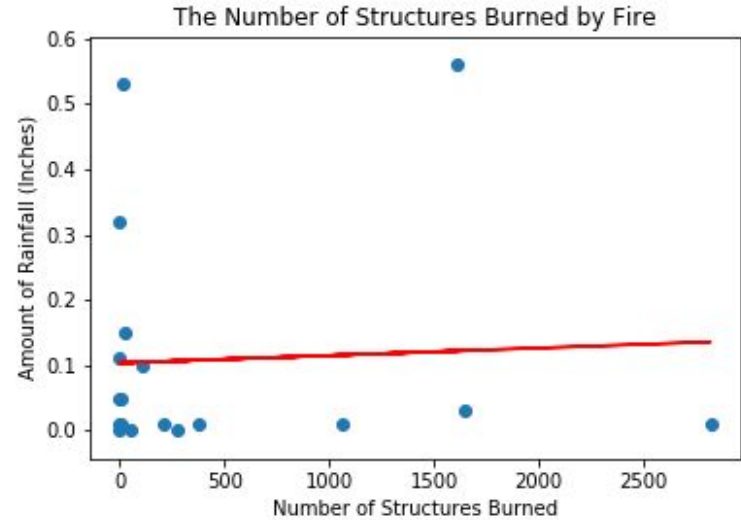
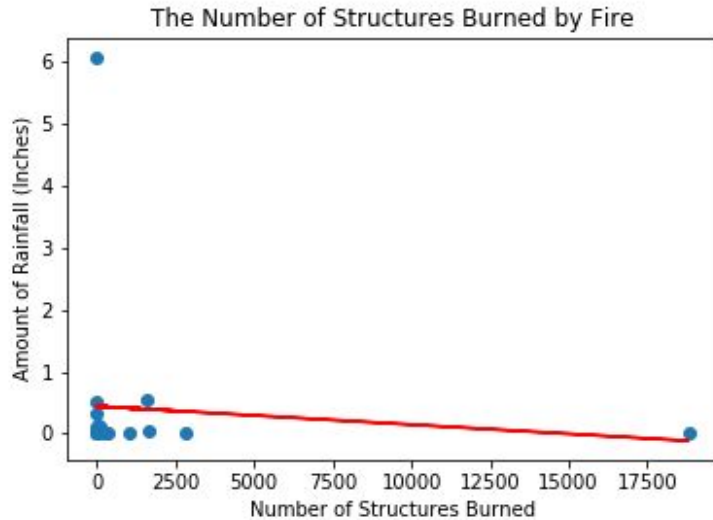
- In our data, there were two noticeable outliers: Camp Fire and Zaca
- After calculating for outliers for both structures burned and rainfall, 4 outliers were found for both structures burned and rainfall
- Cedar, Carr, Witch, and Campfire were outliers for the number of structures burned as they are values above 1379.5 (2820, 1614, 1650, and 18804)
- Zaca, Carr, Klamath, and Mcnally were outliers for rainfall as they are above .285 (6.08, 0.56, 0.32, 0.53)



NormaltestResult(statistic=49.12559350315376, pvalue=2.150368604412691e-11)

Is there a correlation between the number of structures affected and rainfall?

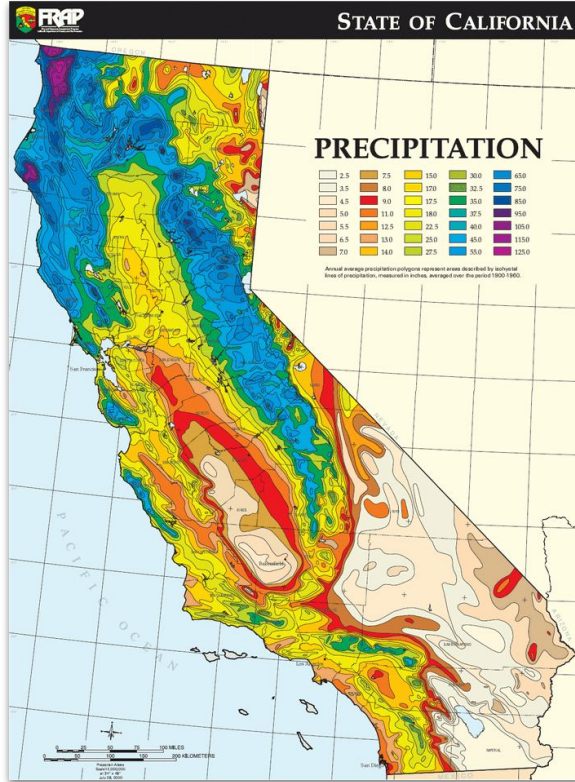
- When graphing for correlation, the r-value is -0.09 but after removing our outliers of Camp Fire and Zaca, our r-value is $.05$ - there is no correlation
- With a p-value of 2.15 , we cannot reject our null hypothesis



Is there a correlation between the number of deaths and rainfall?

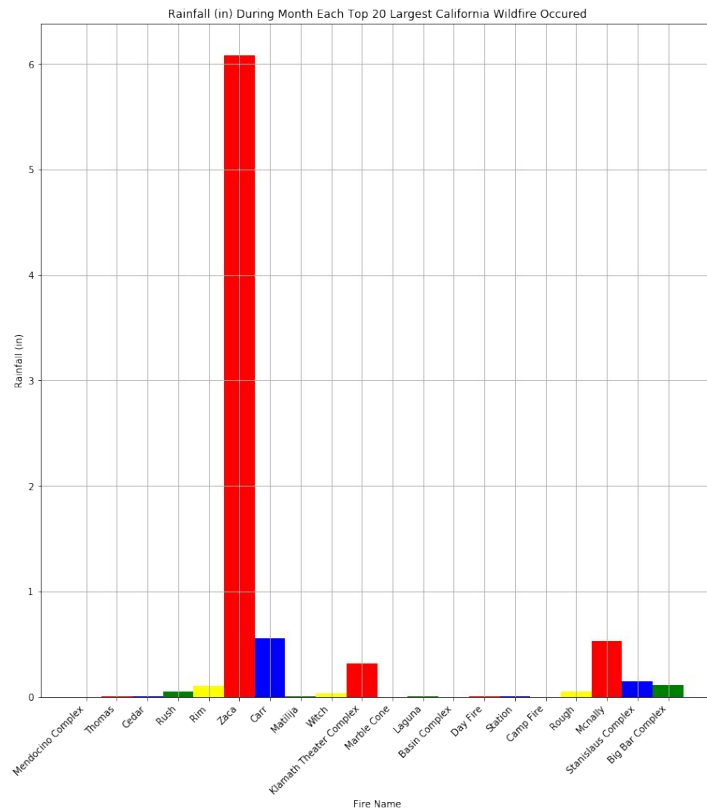
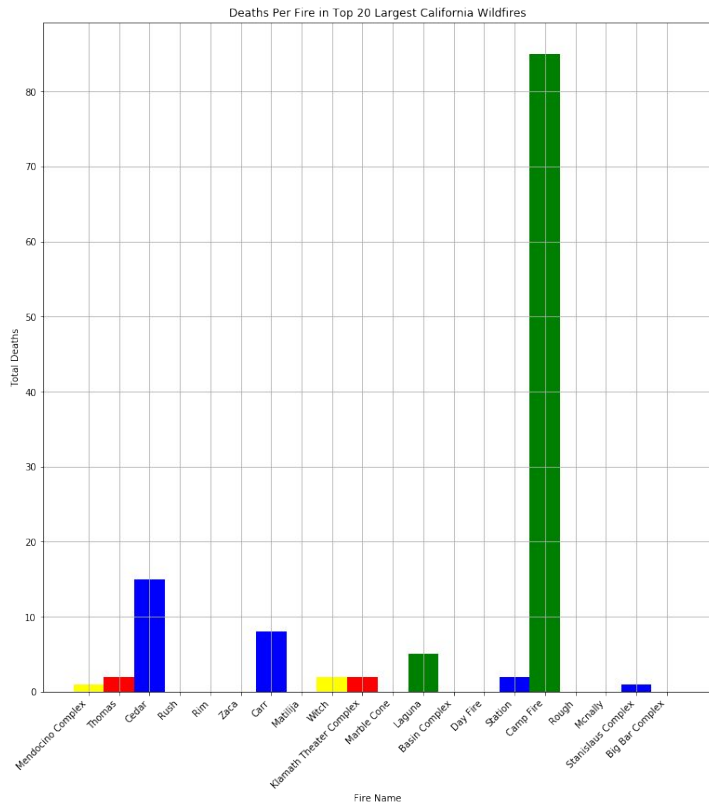
H1: If there is less rainfall during the month of a large wildfire, then the number of deaths per fire will increase.

H0: There is no statistically significant relationship between rainfall and the number of deaths per fire.



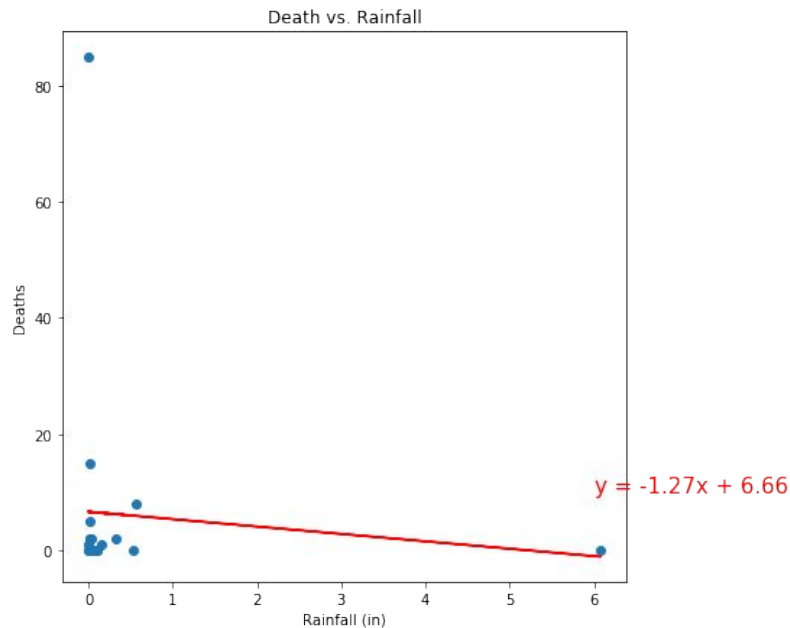
Is there a correlation between the number of deaths and rainfall?

- Imported data set
- Plotted bar plot to show deaths per fire and rainfall during month of fire:



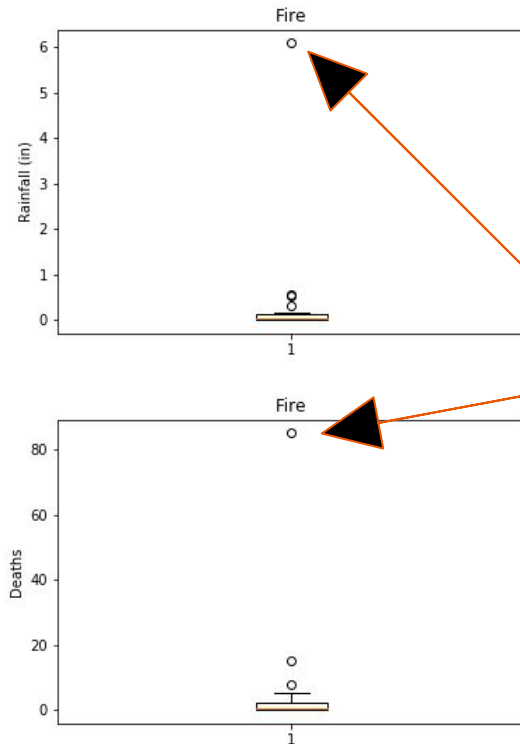
Is there a correlation between the number of deaths and rainfall?

- Plotted scatter of linear regression for rainfall and deaths for each fire
- Correlation of deaths and rainfall for the top 20 largest California wildfires:



R squared:

0.00820944012545549 = No linear relationship

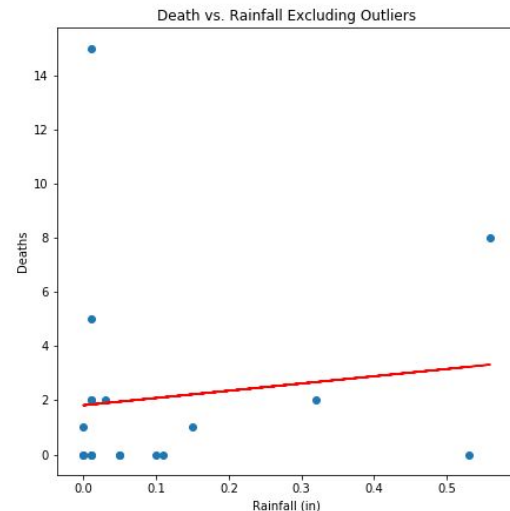


Box and
Whisker Plot
to show
Outliers

Is there a correlation between the number of deaths and rainfall?

- Correlation of deaths and rainfall for the top 20 largest California wildfires excluding outliers:

Index	Fire Name	Cause	Acres	Structures	Deaths	County	Month	Year	Rainfall (in)
0	Mendocino C	Under Invest	459123	280	1	Colusa	July	2018	0
1	Thomas	Powerlines	281893	1063	2	Ventura	December	2017	0.01
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19	Big Bar Com	Lightning	140948	0	0	Siskiyou	June	2008	0.11



Remove Outliers “Zaca” for rainfall and “Camp Fire” for number of deaths.

R squared: 0.015240264992158624 = Still no linear relationship

Is there a correlation between the number of deaths and rainfall?



For this question, we can conclude:

This data shows that there is no relationship or effect on the amount of total rainfall during the month of a large wildfire and how many deaths are caused by that fire.

Conclusion

Things to keep in mind:

- Data sample could be too small to be accurately representative of all California wildfires.
- Weather data is tough to access.

Main Conclusion: Based on **our** data, we cannot determine that precipitation impacts wildfires or the effects wildfires have on the area they occurred in.

List of other factors that likely have more of an impact on wildfires than rain does:

- Human Related
- Lightning
- Powerlines
- Vegetation
- Temperature
- Ground Water
- Other climate related factors

