# <Hurricane Harvey And its Damage Record >

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## Hurricane Harvey

In 2017, Hurricane Harvey became one of the costliest hurricanes on record, causing approximately $125 billion in damage. Most of the damage was caused from flooding with some areas receiving over 40 inches (102 cm) of rain.

Hurricanes are large weather events with a specific definition – a rotating low-pressure weather system with sustained winds of 74+ mph (119 km/h). Harvey became a hurricane August 24th, made landfall on the 25th, and was downgraded to a tropical storm on August 26th.

The impact of Harvey was felt over much more than just 3 days. In the 2017 storm events data set, Harvey related events are reported beginning August 17th and end September 3rd as the system moved north and east across the United States. Flooding, thunderstorms, hail, and tornadoes are just a few of the weather events related to Harvey.

One of your tasks as the hired data scientist is to find the two states with the most damage from Harvey related events.

## Background and Scope

### Importing the Data

```
StormEvents2017finalProject = readtable("G:\Exploratory Data Analysis\StormEvents\StormEvents_2
%filtering data by date as we need to analyze only the Harvey Dates
StormEvents2017finalProject = StormEvents2017finalProject(StormEvents2017finalProject.Begin_Dat
StormEvents2017finalProject = StormEvents2017finalProject(StormEvents2017finalProject.End_Date_
```

```
StormEvents2017finalProject = 2160×24 table
```

...

| | EpisodeID | Event_ID | State | Year | Month | Event_Type | CZ_Name |
|---|---|---|---|---|---|---|---|
| 1 | 119542 | 726661 | 'IOWA' | 2017 | 'August' | 'Tornado' | 'STORY' |
| 2 | 119542 | 726659 | 'IOWA' | 2017 | 'August' | 'Tornado' | 'BOONE' |
| 3 | 119542 | 726660 | 'IOWA' | 2017 | 'August' | 'Tornado' | 'STORY' |
| 4 | 119542 | 717362 | 'IOWA' | 2017 | 'August' | 'Heavy Rain' | 'AUDUBON' |
| 5 | 119542 | 717363 | 'IOWA' | 2017 | 'August' | 'Heavy Rain' | 'POLK' |
| 6 | 119542 | 717364 | 'IOWA' | 2017 | 'August' | 'Thunderstorm Wind' | 'POWESHIEK' |

| | EpisodeID | Event_ID | State | Year | Month | Event_Type | CZ_Name |
|---|---|---|---|---|---|---|---|
| 7 | 120232 | 720731 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'NORFOLK (C)' |
| 8 | 120232 | 720732 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'NORTHAMPTON' |
| 9 | 120232 | 720735 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'NORTHAMPTON' |
| 10 | 120232 | 720737 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'PORTSMOU... |
| 11 | 120232 | 720739 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'PRINCE G... |
| 12 | 120232 | 720740 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'PRINCE G... |
| 13 | 120232 | 720741 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'PRINCE G... |
| 14 | 120232 | 720744 | 'VIRGINIA' | 2017 | 'August' | 'Heavy Rain' | 'SUFFOLK (C)' |

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## Two States Most Impacted by Harvey

```
StormEvents2017finalProject.Total_Cost=StormEvents2017finalProject.Property_Cost+StormEvents201
StormEvents2017finalProject.Total_Cost(ismissing(StormEvents2017finalProject.Total_Cost))=0;
Most_Impact=groupsummary(StormEvents2017finalProject,"State","sum","Total_Cost");

Most_Impact = sortrows(Most_Impact,'sum_Total_Cost','descend')
```

Most_Impact = 57×3 table

| | State | GroupCount | sum_Total_Cost |
|---|---|---|---|
| 1 | 'TEXAS' | 272 | 4.6093e+10 |
| 2 | 'LOUISIANA' | 85 | 75277000 |
| 3 | 'NEBRASKA' | 62 | 16154000 |
| 4 | 'NORTH ... | 59 | 12331500 |
| 5 | 'WASHIN... | 2 | 4000000 |
| 6 | 'FLORIDA' | 68 | 2237000 |
| 7 | 'MINNESOTA' | 24 | 1625000 |
| 8 | 'MISSIS... | 39 | 915000 |
| 9 | 'NEW YORK' | 109 | 639000 |
| 10 | 'TENNESSEE' | 46 | 504000 |
| 11 | 'IOWA' | 54 | 498000 |
| 12 | 'PENNSY... | 203 | 491630 |
| 13 | 'KENTUCKY' | 20 | 435000 |
| 14 | 'INDIANA' | 6 | 300000 |

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### As We Can see the two most effected states are Texas and Louisiana

### Table of Events for Two Most Impacted States Texas and Louisiana

```
Events_of_Most_Impacted_Cities = StormEvents2017finalProject(ismember(StormEvents2017finalProje
```

Events_of_Most_Impacted_Cities = 357×25 table

...

| | EpisodeID | Event_ID | State | Year | Month | Event_Type | CZ_Name |
|---|---|---|---|---|---|---|---|
| 1 | 119753 | 723472 | 'TEXAS' | 2017 | 'August' | 'Tropical Storm' | 'MONTGOMERY' |
| 2 | 119753 | 723473 | 'TEXAS' | 2017 | 'August' | 'Tropical Storm' | 'FORT BEND' |
| 3 | 119753 | 723449 | 'TEXAS' | 2017 | 'August' | 'Tropical Storm' | 'GALVESTON' |
| 4 | 119753 | 723474 | 'TEXAS' | 2017 | 'August' | 'Tropical Storm' | 'SAN JACINTO' |
| 5 | 119753 | 723475 | 'TEXAS' | 2017 | 'August' | 'Tropical Storm' | 'WALKER' |
| 6 | 119753 | 723648 | 'TEXAS' | 2017 | 'August' | 'Tropical Storm' | 'POLK' |
| 7 | 120011 | 719146 | 'TEXAS' | 2017 | 'August' | 'Flash Flood' | 'EL PASO' |
| 8 | 120012 | 719147 | 'TEXAS' | 2017 | 'August' | 'Thunderstorm Wind' | 'EL PASO' |
| 9 | 120012 | 719148 | 'TEXAS' | 2017 | 'August' | 'Flash Flood' | 'EL PASO' |
| 10 | 119746 | 719493 | 'TEXAS' | 2017 | 'August' | 'Flash Flood' | 'HARDIN' |
| 11 | 119746 | 719496 | 'TEXAS' | 2017 | 'August' | 'Flash Flood' | 'JASPER' |
| 12 | 119746 | 719497 | 'TEXAS' | 2017 | 'August' | 'Flash Flood' | 'NEWTON' |
| 13 | 119753 | 720340 | 'TEXAS' | 2017 | 'August' | 'Flash Flood' | 'FORT BEND' |
| 14 | 119826 | 718436 | 'TEXAS' | 2017 | 'August' | 'Thunderstorm Wind' | 'MIDLAND' |

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```
Events_of_Most_Impacted_Cities.CZ_Name=categorical(Events_of_Most_Impacted_Cities.CZ_Name);
Events_of_Most_Impacted_Cities.Event_Type=categorical(Events_of_Most_Impacted_Cities.Event_Type
```

**Converting County and Event Type into categorical As it will be easy for plotting data**

## Visualizations

### Figure of Event Types

Create a figure showing the type and number of occurances for events related to Harvey in the two states

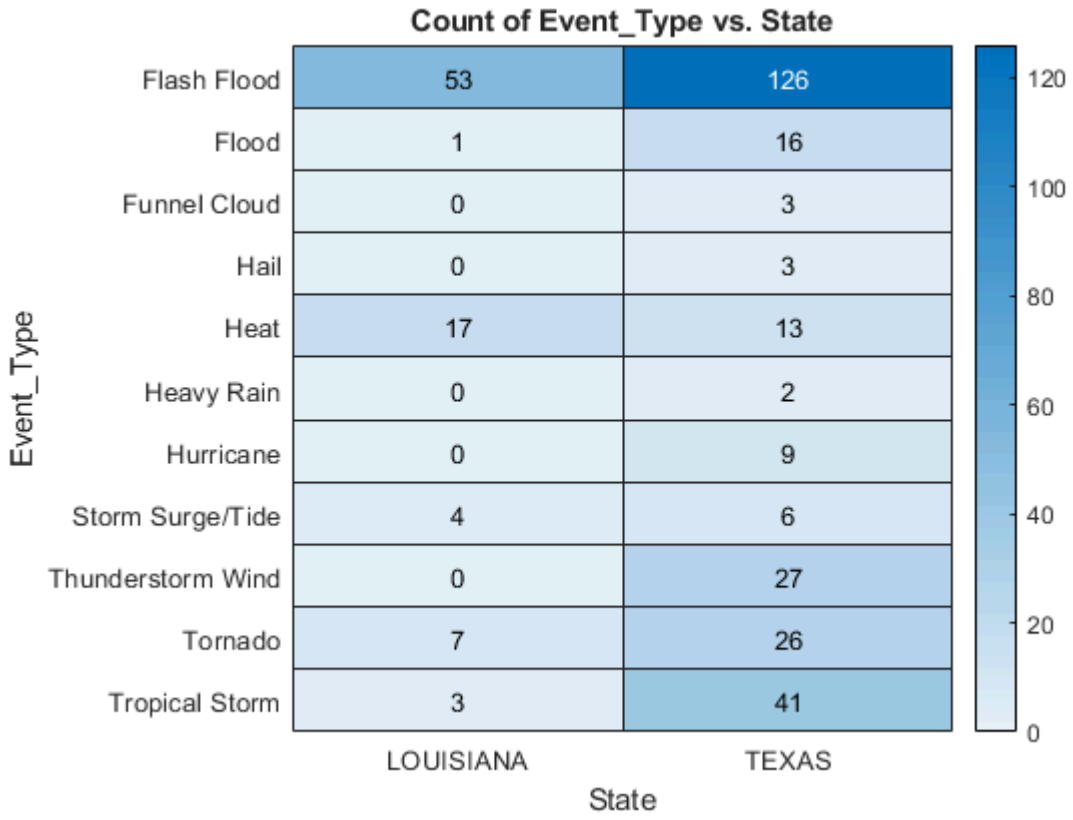
```
typecount=groupsummary(Events_of_Most_Impacted_Cities,"Event_Type")
```

typecount = 11×2 table

| | Event_Type | GroupCount |
|---|---|---|
| 1 | Flash Flood | 179 |

| | Event_Type | GroupCount |
|---|---|---|
| 2 | Flood | 17 |
| 3 | Funnel Cloud | 3 |
| 4 | Hail | 3 |
| 5 | Heat | 30 |
| 6 | Heavy Rain | 2 |
| 7 | Hurricane | 9 |
| 8 | Storm Surge/Tide | 10 |
| 9 | Thunderstorm Wind | 27 |
| 10 | Tornado | 33 |
| 11 | Tropical Storm | 44 |

```
heatmap(Events_of_Most_Impacted_Cities,"State","Event_Type")
```



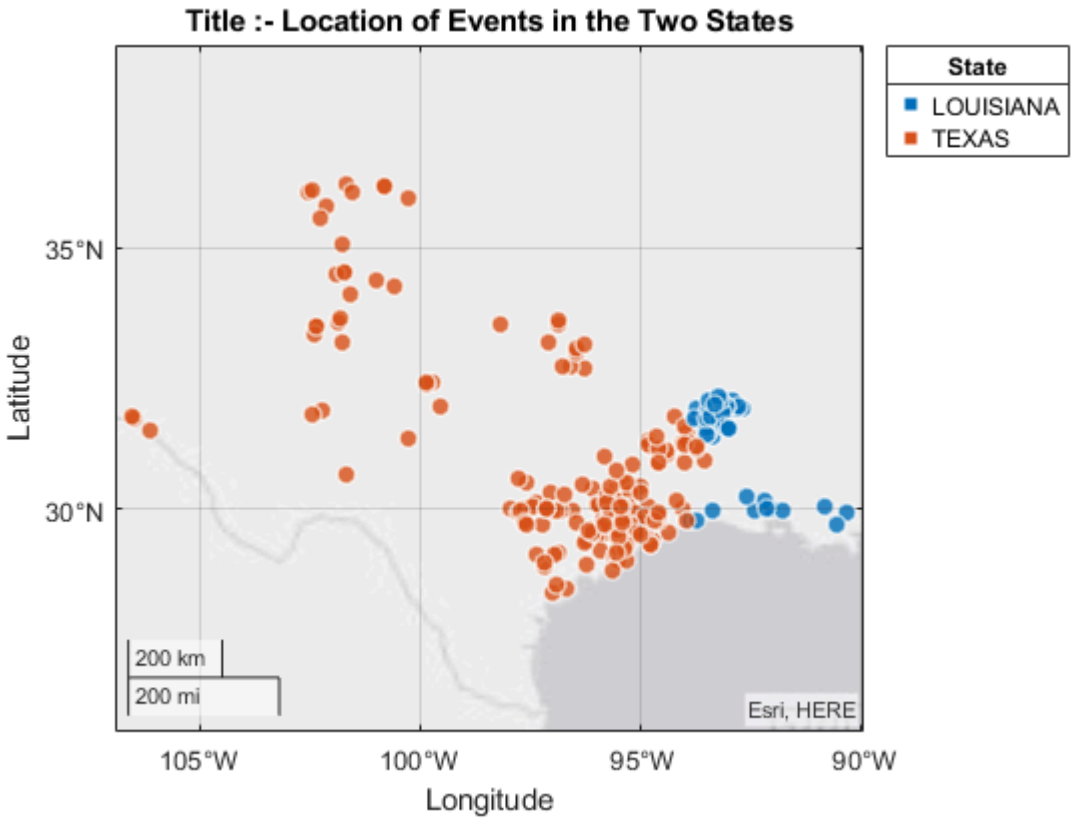

## Figure of Event Locations

Show the location of events in the two states. Be sure to use different markers for the two states

```
geobubble(Events_of_Most_Impacted_Cities,"Begin_Lat","Begin_Lon","ColorVariable","State")
```

```
legend show

title('Title :- Location of Events in the Two States')
```




## Analysis

### Three Counties with Most Events in State 1

Either type out, show in a table, or show in a clear visualization the three counties with the most events in state 1.

```
Events_of_Most_Impacted_City_1 = Events_of_Most_Impacted_Cities(strcmp(Events_of_Most_Impacted_
```

```
Events_of_Most_Impacted_City_1 = 272×25 table
```

...

| | EpisodeID | Event_ID | State | Year | Month | Event_Type | CZ_Name |
|---|---|---|---|---|---|---|---|
| 1 | 119753 | 723472 | 'TEXAS' | 2017 | 'August' | Tropical Storm | MONTGOMERY |
| 2 | 119753 | 723473 | 'TEXAS' | 2017 | 'August' | Tropical Storm | FORT BEND |
| 3 | 119753 | 723449 | 'TEXAS' | 2017 | 'August' | Tropical Storm | GALVESTON |
| 4 | 119753 | 723474 | 'TEXAS' | 2017 | 'August' | Tropical Storm | SAN JACINTO |
| 5 | 119753 | 723475 | 'TEXAS' | 2017 | 'August' | Tropical Storm | WALKER |
| 6 | 119753 | 723648 | 'TEXAS' | 2017 | 'August' | Tropical Storm | POLK |

| | EpisodeID | Event_ID | State | Year | Month | Event_Type | CZ_Name |
|---|---|---|---|---|---|---|---|
| 7 | 120011 | 719146 | 'TEXAS' | 2017 | 'August' | Flash Flood | EL PASO |
| 8 | 120012 | 719147 | 'TEXAS' | 2017 | 'August' | Thunderstorm Wind | EL PASO |
| 9 | 120012 | 719148 | 'TEXAS' | 2017 | 'August' | Flash Flood | EL PASO |
| 10 | 119746 | 719493 | 'TEXAS' | 2017 | 'August' | Flash Flood | HARDIN |
| 11 | 119746 | 719496 | 'TEXAS' | 2017 | 'August' | Flash Flood | JASPER |
| 12 | 119746 | 719497 | 'TEXAS' | 2017 | 'August' | Flash Flood | NEWTON |
| 13 | 119753 | 720340 | 'TEXAS' | 2017 | 'August' | Flash Flood | FORT BEND |
| 14 | 119826 | 718436 | 'TEXAS' | 2017 | 'August' | Thunderstorm Wind | MIDLAND |

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```
counties_1=groupsummary(Events_of_Most_Impacted_City_1,"CZ_Name");

counties_1 = sortrows(counties_1,'GroupCount','descend')
```

counties_1 = 95×2 table

| | CZ_Name | GroupCount |
|---|---|---|
| 1 | HARRIS | 21 |
| 2 | GALVESTON | 17 |
| 3 | FORT BEND | 13 |
| 4 | ANGELINA | 12 |
| 5 | BRAZORIA | 12 |
| 6 | SABINE | 12 |
| 7 | BASTROP | 9 |
| 8 | CHAMBERS | 8 |
| 9 | CALDWELL | 7 |
| 10 | MONTGOMERY | 6 |
| 11 | MATAGORDA | 5 |
| 12 | WHARTON | 5 |
| 13 | CALHOUN | 4 |
| 14 | FAYETTE | 4 |

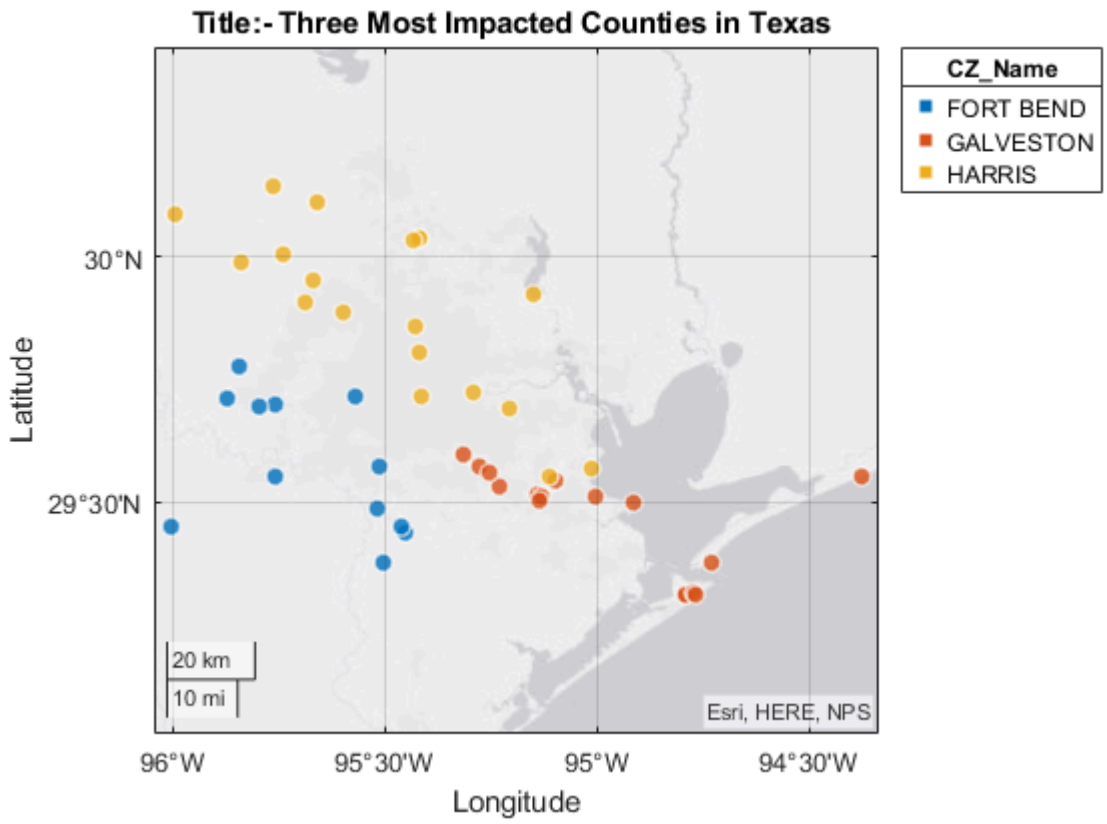
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```
Events_of_Most_Impacted_City_1_Counties = Events_of_Most_Impacted_City_1(ismember(Events_of_Mos
Events_of_Most_Impacted_City_1_Counties.CZ_Name=removecats(Events_of_Most_Impacted_City_1_Count

geobubble(Events_of_Most_Impacted_City_1_Counties,"Begin_Lat","Begin_Lon","ColorVariable","CZ_N

legend show
```

```
title('Title:- Three Most Impacted Counties in Texas ')
```




***As We can see in the Table the top three counties based on EventCount are Harris , Galvinson , Fort Blend***

## Three Counties with Most Events in State 2

Either type out, show in a table, or show in a clear visualization the three counties with the most events in state 2.

```
Events_of_Most_Impacted_City_2 = Events_of_Most_Impacted_Cities(strcmp(Events_of_Most_Impacted_
counties_2=groupsummary(Events_of_Most_Impacted_City_2,"CZ_Name");

counties_2 = sortrows(counties_2,'GroupCount','descend')
```

counties_2 = 30×2 table

| | CZ_Name | GroupCount |
|---|---|---|
| 1 | NATCHITOC... | 21 |
| 2 | SABINE | 15 |
| 3 | RED RIVER | 9 |
| 4 | WINN | 6 |
| 5 | VERMILION | 4 |
| 6 | CAMERON | 3 |
| 7 | DE SOTO | 3 |

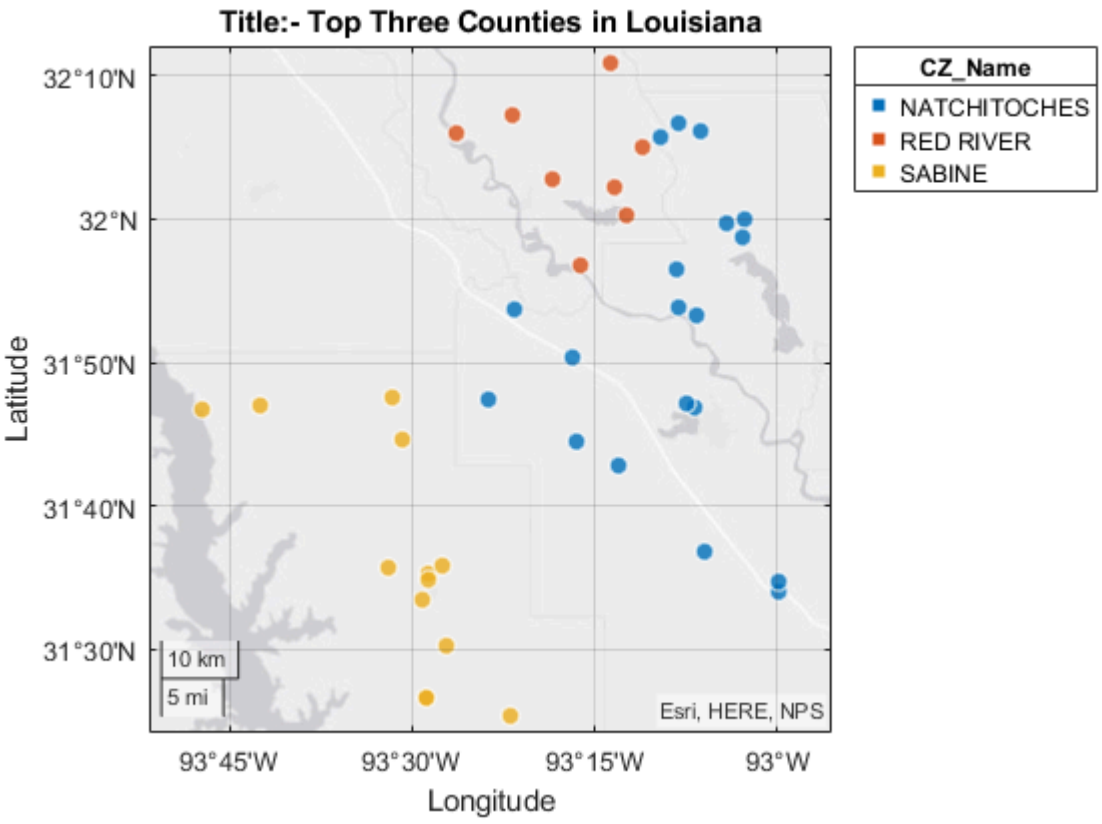
| | CZ_Name | GroupCount |
|---|---|---|
| 8 | UNION | 2 |
| 9 | ACADIA | 1 |
| 10 | BEAUREGARD | 1 |
| 11 | BIENVILLE | 1 |
| 12 | BOSSIER | 1 |
| 13 | CADDO | 1 |
| 14 | CALCASIEU | 1 |

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```
Events_of_Most_Impacted_City_2_Counties = Events_of_Most_Impacted_City_2(ismember(Events_of_Mos
Events_of_Most_Impacted_City_2_Counties.CZ_Name=removecats(Events_of_Most_Impacted_City_2_Count
geobubble(Events_of_Most_Impacted_City_2_Counties,"Begin_Lat","Begin_Lon","ColorVariable","CZ_N

legend show

title('Title:- Top Three Counties in Louisiana')
```




***As We can see in the Table the top three counties based on EventCount are Natchitoches , Sabine , Red River***

## Three Counties with Highest Property Cost in State 1

Either type out, show in a table, or show in a clear visualization the three counties with the highest reported property cost in state 1. *Be sure to include the dollar amount*.

```
counties_1_By_Property_Cost=groupsummary(Events_of_Most_Impacted_City_1,"CZ_Name","sum","Proper

counties_1_By_Property_Cost = sortrows(counties_1_By_Property_Cost,'sum_Property_Cost','descend
```

counties_1_By_Property_Cost = 95×3 table

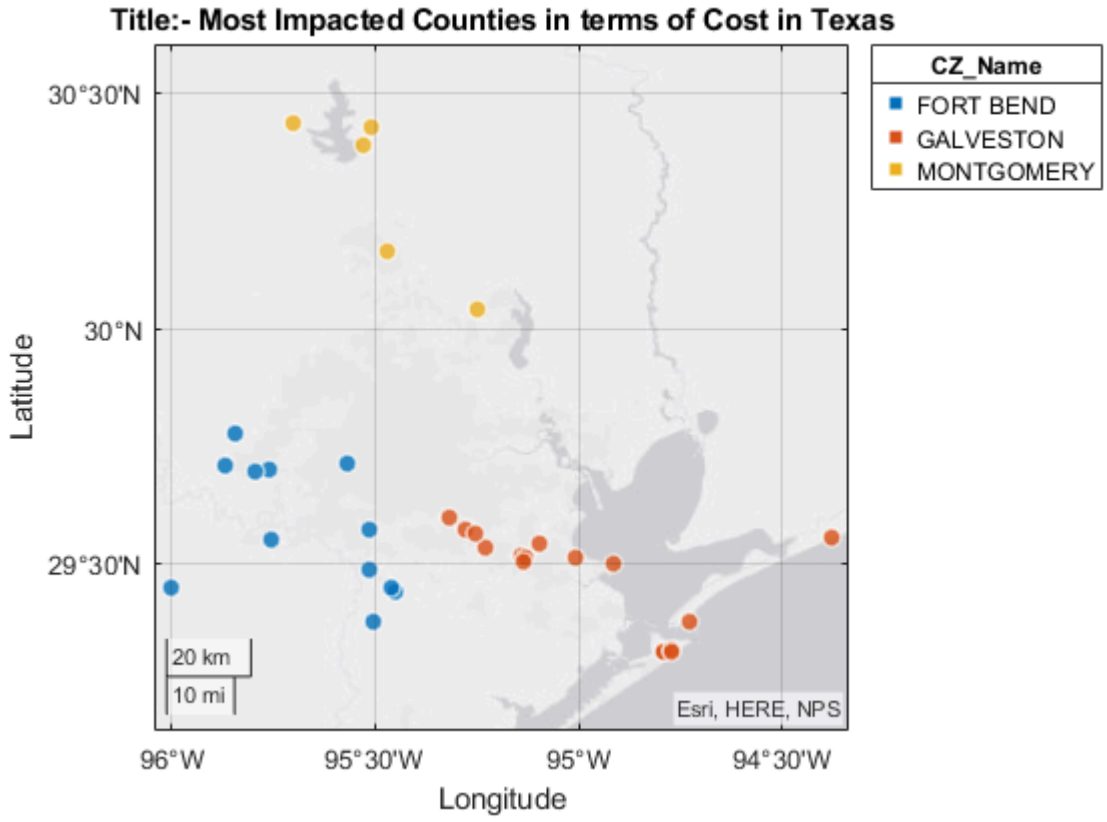
| | CZ_Name | GroupCount | sum_Property_Cost |
|---|---|---|---|
| 1 | GALVESTON | 17 | 2.0000e+10 |
| 2 | FORT BEND | 13 | 1.6004e+10 |
| 3 | MONTGOMERY | 6 | 1.4000e+10 |
| 4 | HARRIS | 21 | 1.0001e+10 |
| 5 | JEFFERSON | 4 | 3.0000e+09 |
| 6 | BRAZORIA | 12 | 2.0008e+09 |
| 7 | ARANSAS | 2 | 1.9500e+09 |
| 8 | ORANGE | 2 | 1.5000e+09 |
| 9 | NUECES | 2 | 1.3000e+09 |
| 10 | WALKER | 4 | 1.2000e+09 |
| 11 | LIBERTY | 4 | 1.0000e+09 |
| 12 | SAN JACINTO | 3 | 700000000 |
| 13 | HARDIN | 1 | 600000000 |
| 14 | POLK | 2 | 600000000 |

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```
counties_1_By_Property_Cost_most3= Events_of_Most_Impacted_City_1(ismember(Events_of_Most_Impac
counties_1_By_Property_Cost_most3.CZ_Name=removecats(counties_1_By_Property_Cost_most3.CZ_Name,
geobubble(counties_1_By_Property_Cost_most3,"Begin_Lat","Begin_Lon","ColorVariable","CZ_Name")

legend show

title('Title:- Most Impacted Counties in terms of Cost in Texas')
```




## Three Counties with Highest Property Cost in State 2

Either type out, show in a table, or show in a clear visualization the three counties with the highest reported property cost in state 2. *Be sure to include the dollar amount*.

```
counties_2_By_Property_Cost=groupsummary(Events_of_Most_Impacted_City_2,"CZ_Name","sum","Proper

counties_2_By_Property_Cost = sortrows(counties_2_By_Property_Cost,'sum_Property_Cost','descend
```

counties_2_By_Property_Cost = 30×3 table

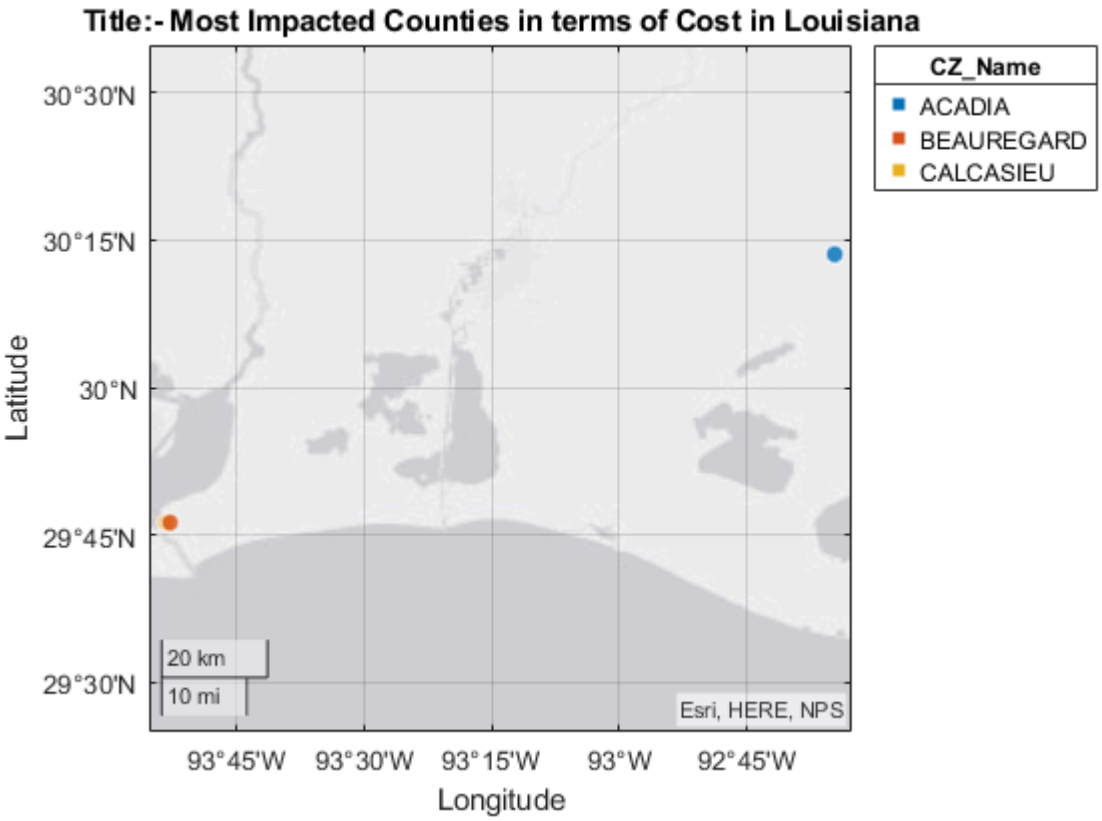
| | CZ_Name | GroupCount | sum_Property_Cost |
|---|---|---|---|
| 1 | CALCASIEU | 1 | 60000000 |
| 2 | BEAUREGARD | 1 | 15000000 |
| 3 | ACADIA | 1 | 200000 |
| 4 | CAMERON | 3 | 72000 |
| 5 | VERMILION | 4 | 5000 |
| 6 | BIENVILLE | 1 | 0 |
| 7 | BOSSIER | 1 | 0 |
| 8 | CADDO | 1 | 0 |
| 9 | CALDWELL | 1 | 0 |

| | CZ_Name | GroupCount | sum_Property_Cost |
|---|---|---|---|
| 10 | CLAIBORNE | 1 | 0 |
| 11 | DE SOTO | 3 | 0 |
| 12 | EAST CAME... | 1 | 0 |
| 13 | GRANT | 1 | 0 |
| 14 | IBERIA | 1 | 0 |

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```
counties_2_By_Property_Cost= Events_of_Most_Impacted_City_2(ismember(Events_of_Most_Impacted_Ci
counties_2_By_Property_Cost.CZ_Name=removecats(counties_2_By_Property_Cost.CZ_Name,["NATCHITOCH
geobubble(counties_2_By_Property_Cost,"Begin_Lat","Begin_Lon","ColorVariable","CZ_Name")

title('Title:- Most Impacted Counties in terms of Cost in Louisiana')
```




## Conclusions and Recommendations

Summarize your analysis. Make a recommendation supported by the data.

After the the complete analysis of Hurricane Harvey , I would recommend you to visit The following Counties of the two most effected States:-

- Texas - Its the most Effected State. I would recommend to Visit ***Galveston (****Most damaged in terms of Property cost in Texas****), Fort Blend , Montgomery.*** And ***Harris*** too if Possible as its the one facing the most number of Events in Texas.
- Louisiana- Its the second Most Effected State. I would recommend to Visit ***Calcasieu (****Most damaged in terms of Property cost in Louisiana****), Beauregard , Acadia.***

Louisiana Faced less destruction as its not a Living Area , Comparitively much less Populated.