

Climate Change Analysis



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CS685A: Data Mining Project

Guide:

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Introduction

In today's era, large-scale industries are fueling environmental degradation which when combined on a global scale can cause extreme weathers, economic loss, and frequency of natural disasters. Therefore, we need to act on the sources that are inducing climate change and in-turn reduce the rate of global temperature rise.

We aim to analyze the common factors that induce climate change.

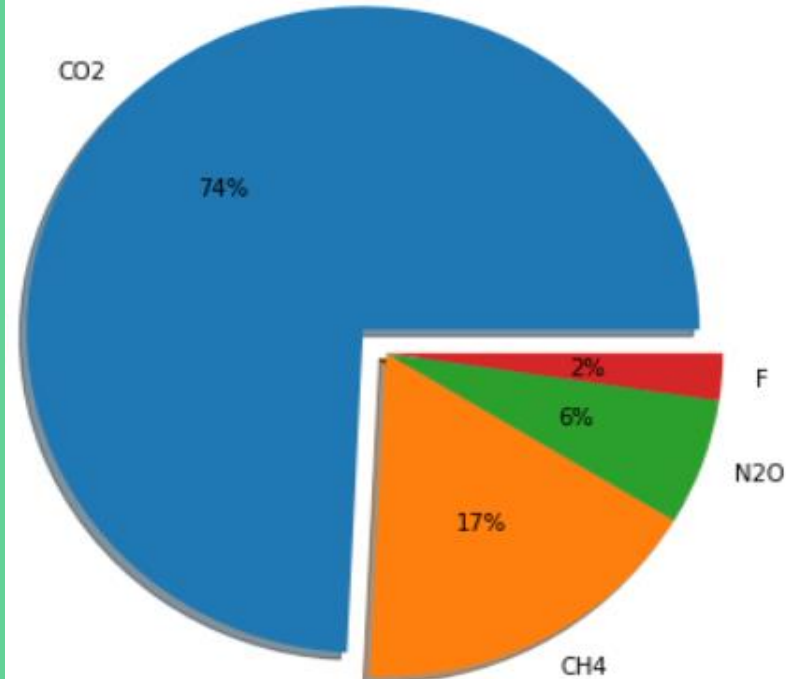
1. Global Greenhouse-Gas Emissions
2. Rise in Temperature
3. Melting of Glaciers
4. Rise in Sea-level
5. Plastic Waste in Oceans
6. Deforestation and Correlation with Endangered Indigineous Species
7. Natural Disasters

Greenhouse- Gas Emissions

Greenhouse gases trap heat and make the planet warmer. These gas absorb and emit radiant energy within the thermal infrared range, causing the greenhouse effect.

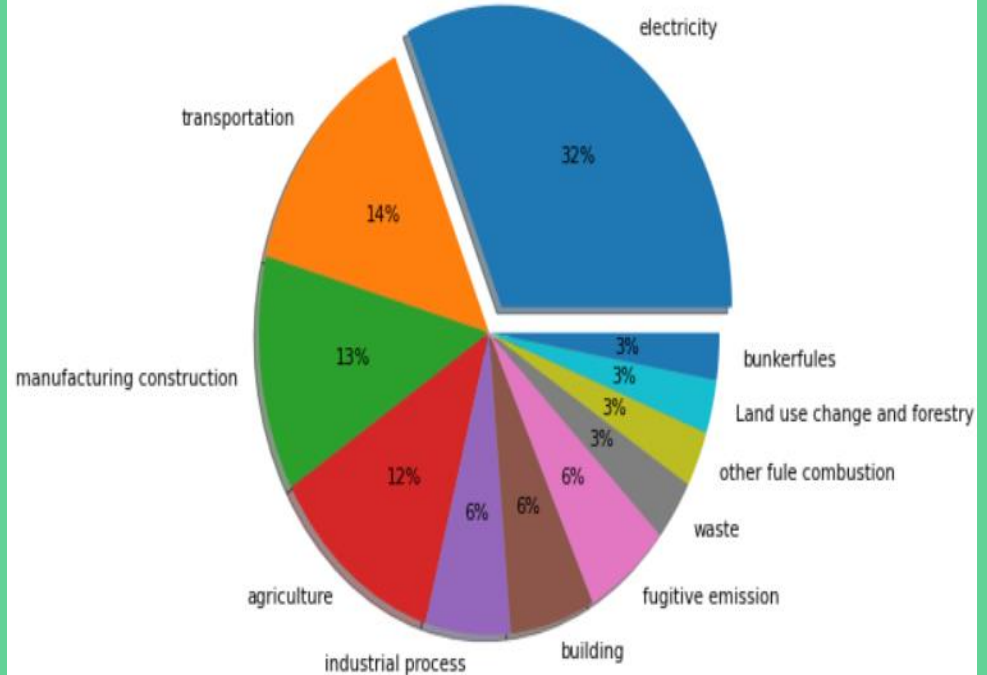
Analysis on Greenhouse Gases

Contribution of Greenhouse Gases for year 2018

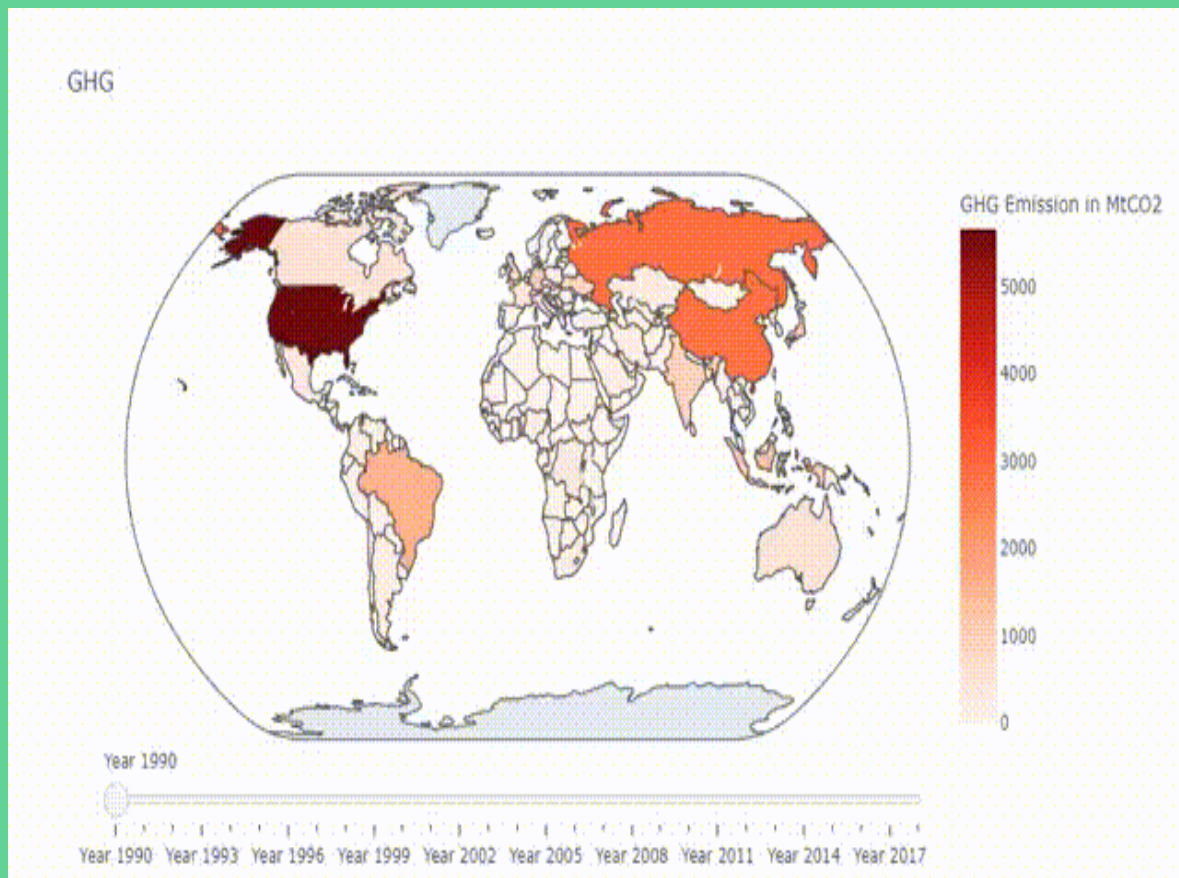


Sector Wise Greenhouse Gas Emission

Sector wise greenhouse gas emission: 2018

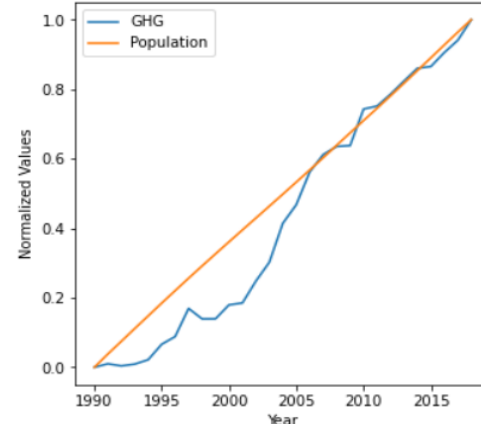


Change in global GHG emission over the last 29 years

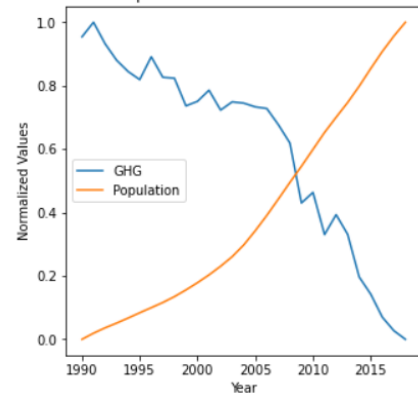


Correlation between GHG Emission and population

Correlation between Population and GHG Emission for World



Correlation between Population and GHG Emission for the United Kingdom



Top 5 highest and lowest producers of GHG

	2016	2017	2018
Country			
Kiribati	0.000234	0.000231	0.000227
Nauru	0.000192	0.000189	0.000227
Tuvalu	0.000085	0.000084	0.000083
Liechtenstein	0.000064	0.000042	0.000062
Niue	0.000000	0.000000	0.000000

Top 5 Countries with highest percent ghg emission

	2016	2017	2018
Country			
China	23.987563	24.132663	24.276564
United States	12.380051	12.123066	12.250428
India	6.579159	6.774751	6.941144
Russia	4.187373	4.191718	4.219940
Indonesia	3.105873	3.096496	3.526336

Bottom 5 countries with lowest percent ghg emission

Top 5 Highest and Lowest producers of GHG Emission per million population

	2016	2017	2018
Country			
Singapore	42.592821	44.294154	43.971315
Brunei	40.067557	39.813325	40.120291
Qatar	37.741408	38.943351	39.163355
United Arab Emirates	36.142603	36.468060	35.108628
Bahrain	34.198513	33.197754	32.304516

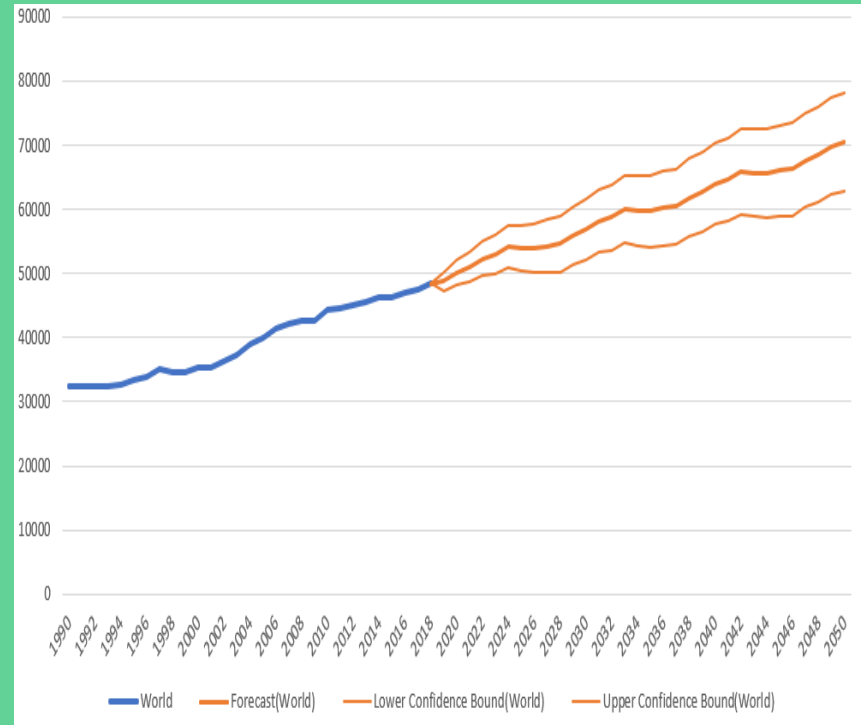
Top 5 countries with highest ghg emission per million population

	2016	2017	2018
Country			
Comoros	0.779289	0.823207	0.804977
Liechtenstein	0.796707	0.529031	0.791181
Yemen	0.850995	0.801514	0.775474
Ghana	0.590901	0.636644	0.680281
Rwanda	0.581892	0.571740	0.558447

Bottom 5 countries with lowest ghg emission per million population

Greenhouse Gas Emission Forecasting

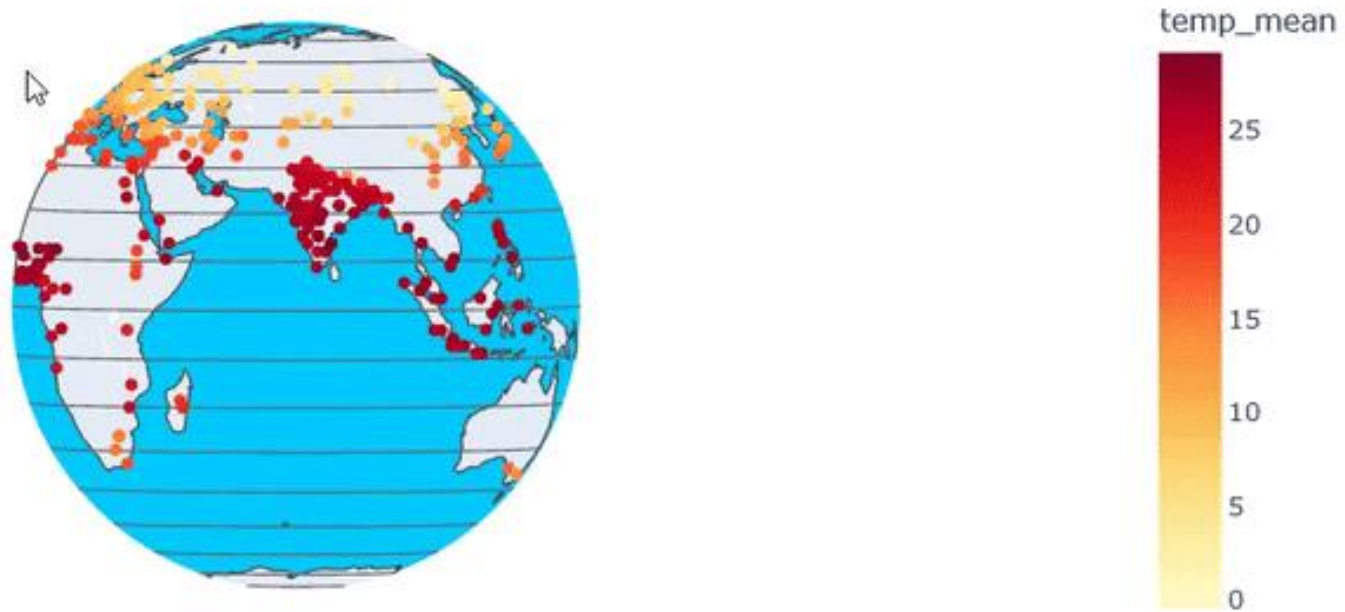
In the last 29 years, the emission of greenhouse gases increased from 32K mtCO₂ to 48K mtCO₂ and reaching the year 2050, it will cross the mark of 70K mtCO₂. It is heavily dependent on the population and sectors like electricity and transportation.



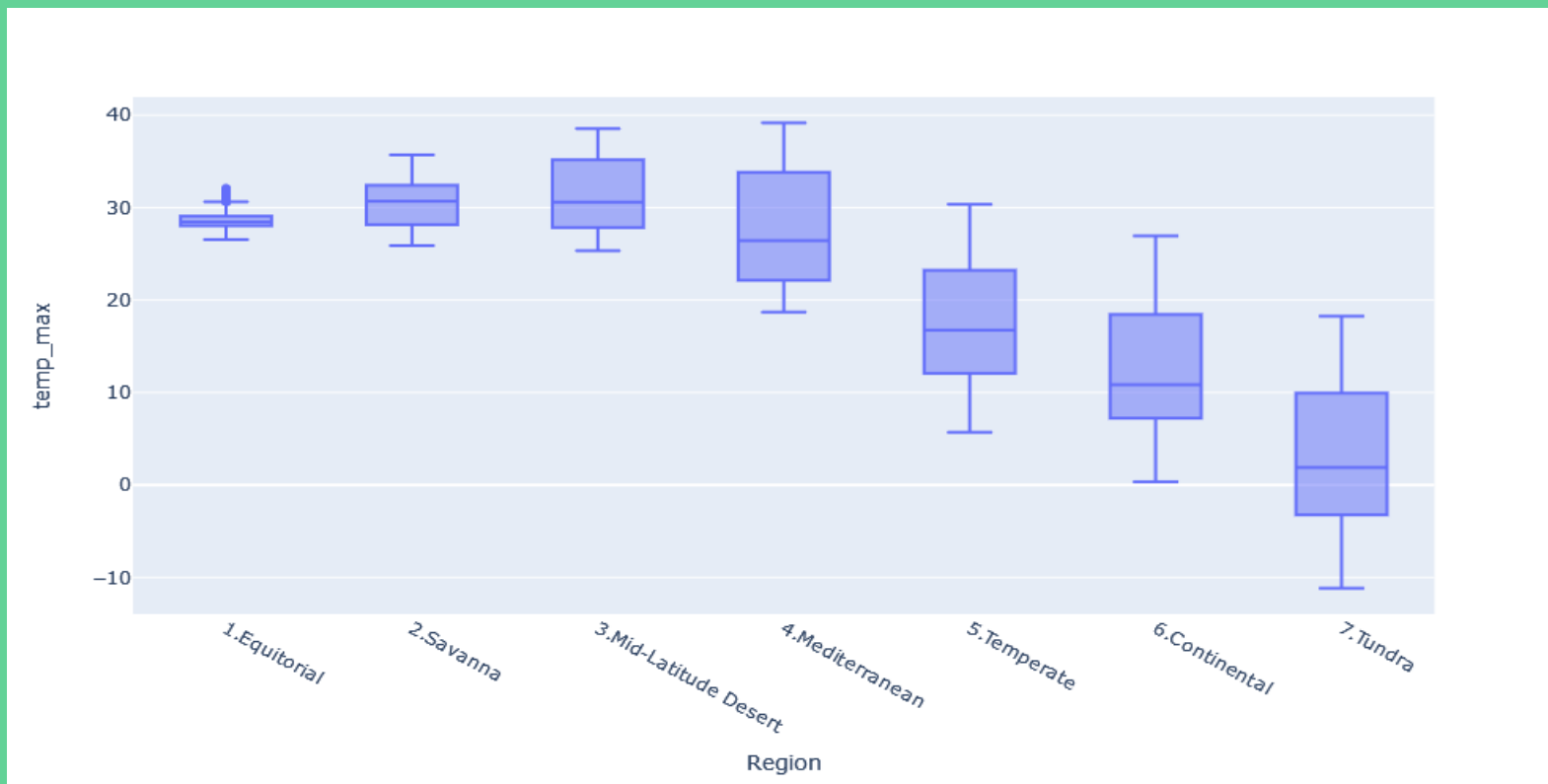
Rise in Temperature

We will investigate the change in temperature over the years across each country and every climatic region.

Yearly City-wise Average Temperature Visualization

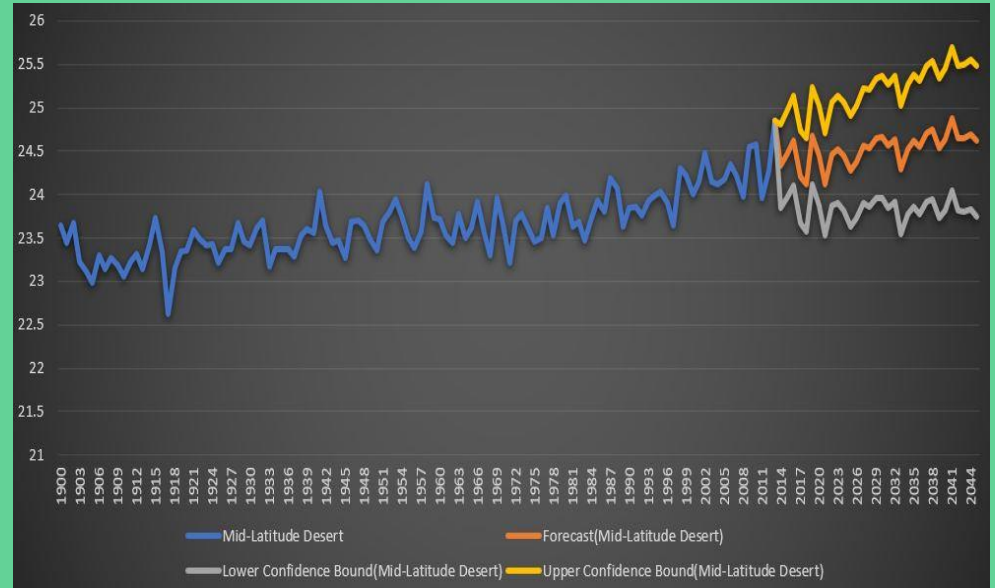


Box Plot Showing Max Temperature Range Recorded Over The Years For Each Region



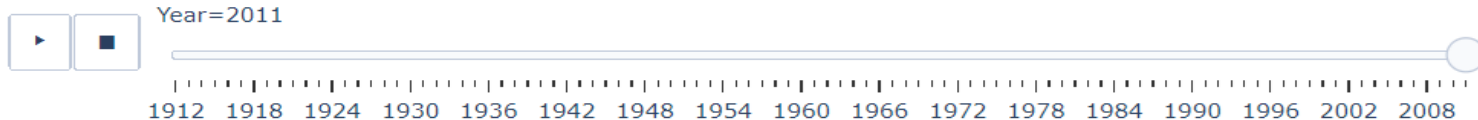
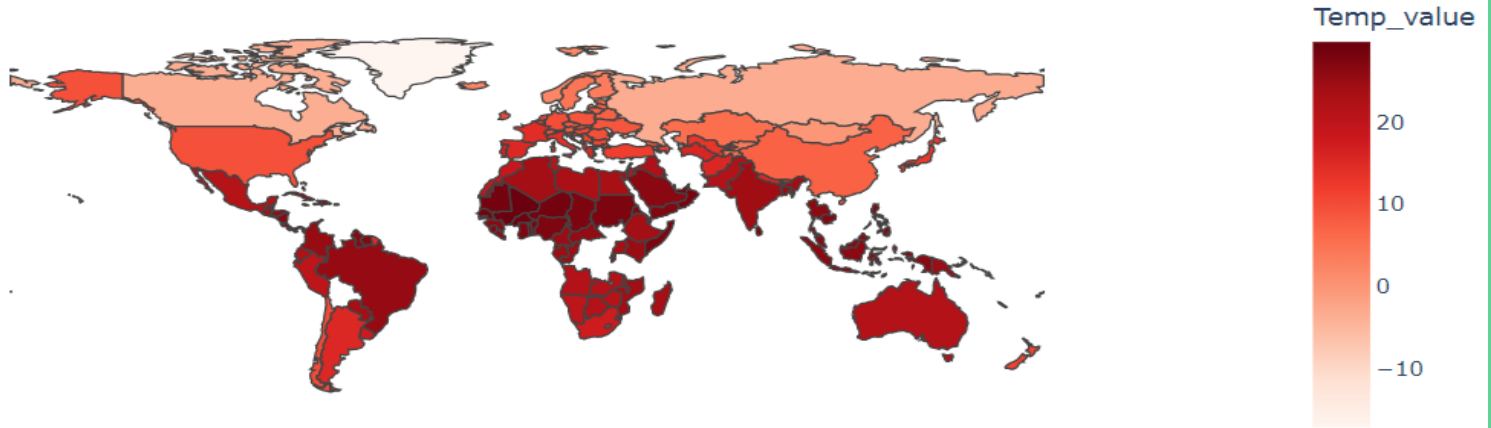
Temperature Forecasting (2013-2045) Mid-Latitude Desert Climate region

- ❖ Temperature Change is more intense at places closer to poles than the ones near the equator



Country-wise average Temperature Visualization for Year 2011 (world-wide) .

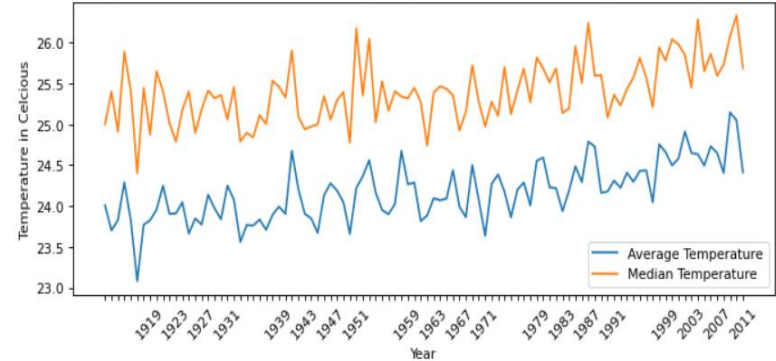
MAP 1: Below map shows average temperature data over last 100 years for every country world-wide



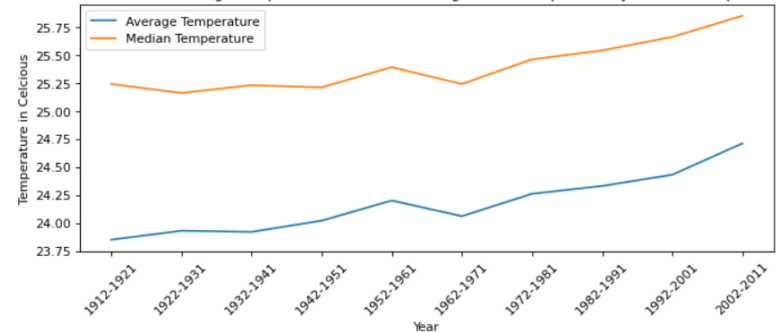
Rise in Temperature

We can clearly visualize from the graphs that average and median temperature value is rising at a certain rate year by year. The rate is increasing year by year. If this rate would keep increasing, it'll lead to lots of problems including risk to public health. The risk to public health are greatest when high temperatures mix with other weather conditions to cause what's known as an 'Excessive Heat Event'.

Below graph shows how median and average temperature values of India got varied in past 100 years



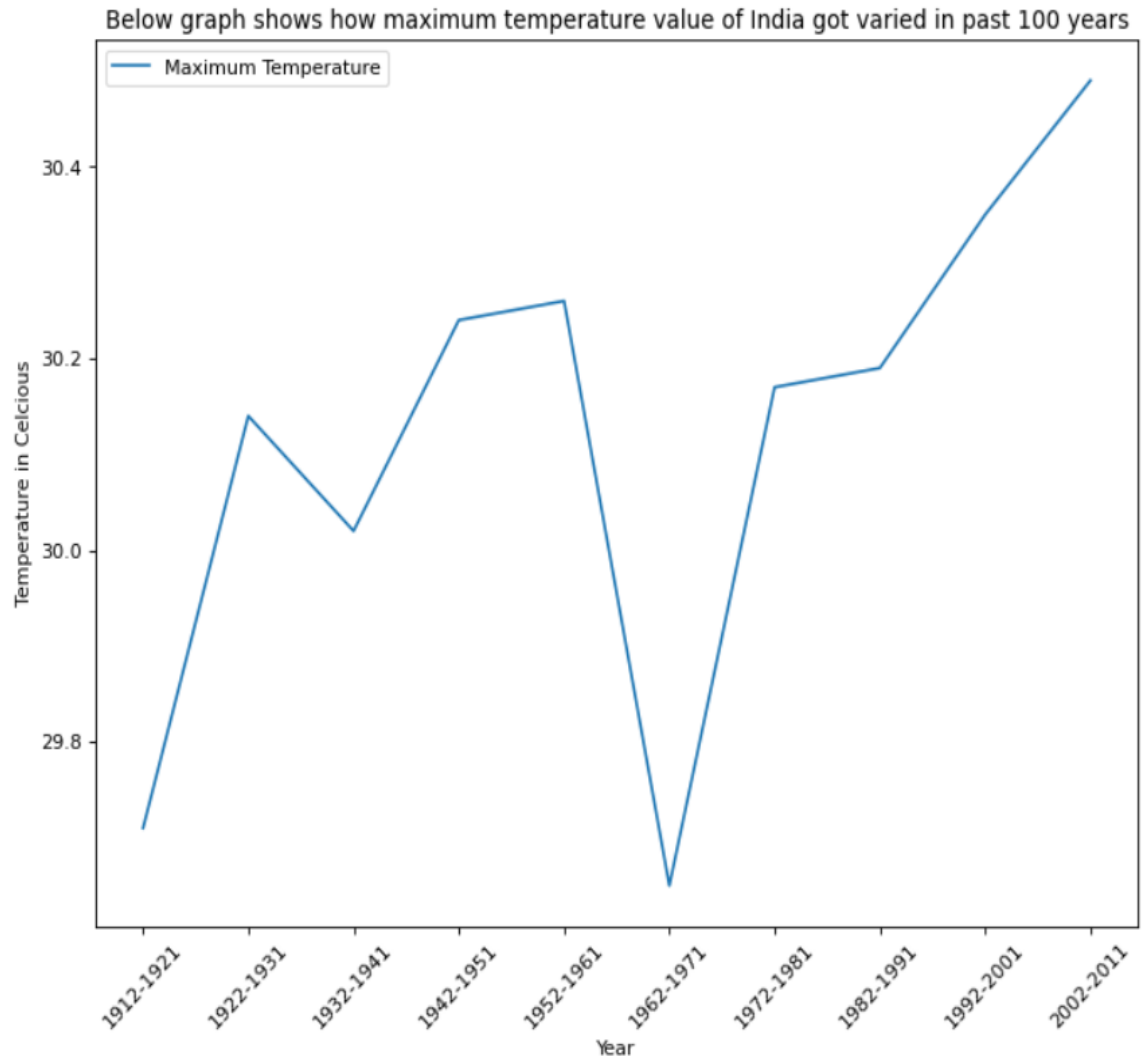
Below graph shows same data with 10-year moving average in past 100 years.



Rising value of maximum temperature occurring every year

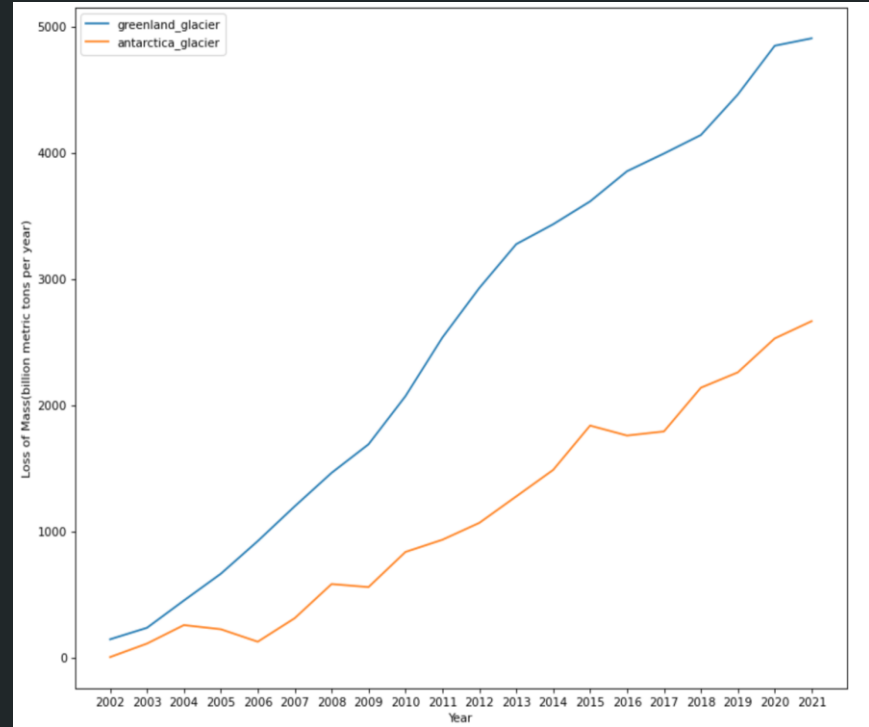
So as we can see from graph, maximum temperature value is also increasing year by year.

Most climate change experts agree that greenhouse gases – which trap heat and prevent it from leaving the Earth's atmosphere – are mostly responsible for the temperature spike. Even with a worldwide emphasis on reduced greenhouse emissions, temperatures values continue to climb. That's the main reason why every summer we feel temperature more than the previous



Melting of Glaciers

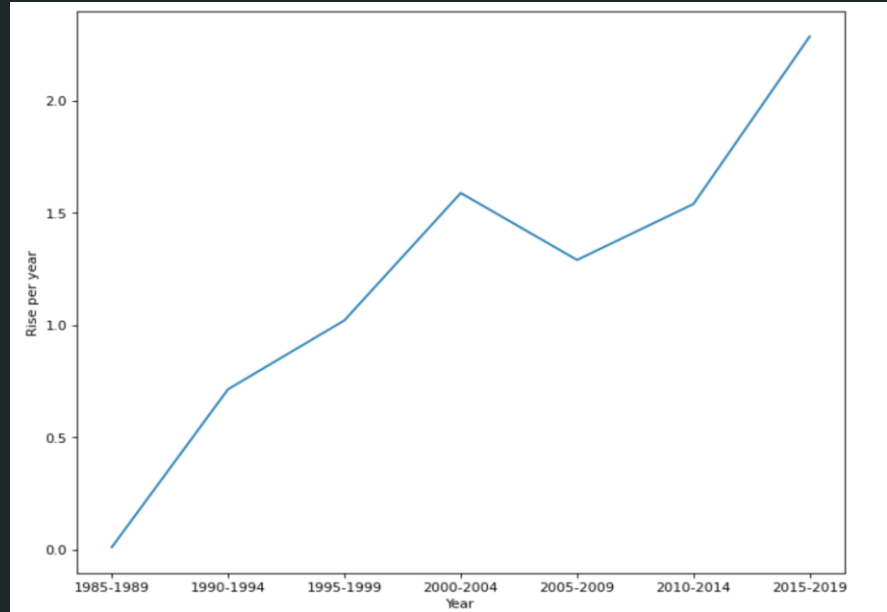
- Glaciers are melting at a very high speed.
- According to 3D satellite measurements of all the world's mountain sources, we are losing 31% extra snow that we used to lose 15 years back.
- Scientists across the world are blaming human activities for this high rate.
- Using recent satellite data, scientists are suggesting that we are losing around 300 billion metric tons of ice and snow since 2015.



Rise in Sea level

We can clearly visualize that Sea level is rising at a very high rate. The rate is increasing year by year. If this rate would keep increasing, we may lose 50% of Mumbai, Cochin, Bhavnagar, Mangalore, Chennai and many more cities by this century.

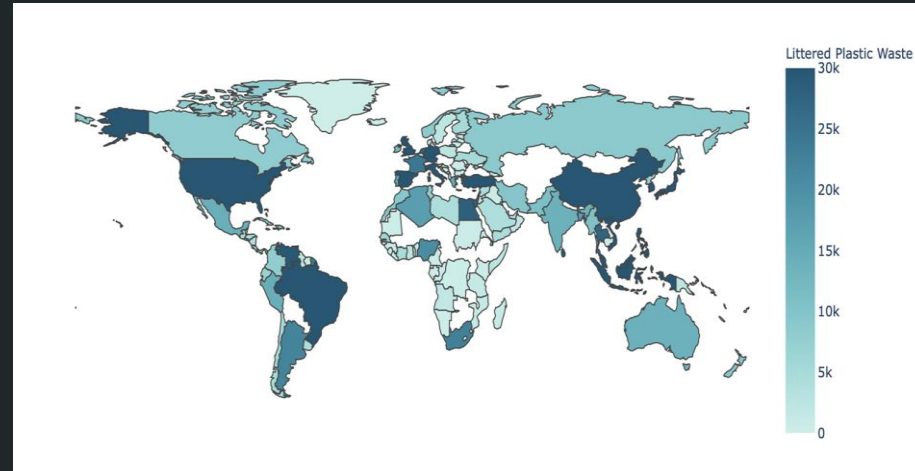
Rise in Sea-level (1985-2019)



Plastic Waste from countries

- Rising Sea levels and melting of glaciers are not only problems going in oceans, but they are even more big problems which will affect human and aquatic lives in a very dangerous way.
- One of them is Mismanaged Plastic wastes which goes in the oceans through various ways.
- Now, when the sea animals consume these plastics, those toxins from plastics breaks inside their bodies.
- Then human consuming those seafoods are also consuming these toxins. The problem is that some of these toxins are linked to hormonal inabilities and developmental problems.

MAP : Coastal Population VS Littered Plastic Waste



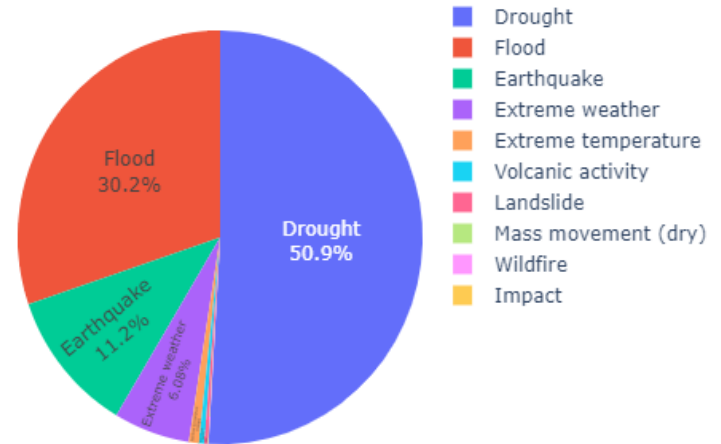
Natural Disasters

Top 3 Natural Disasters by Number of Global Deaths:

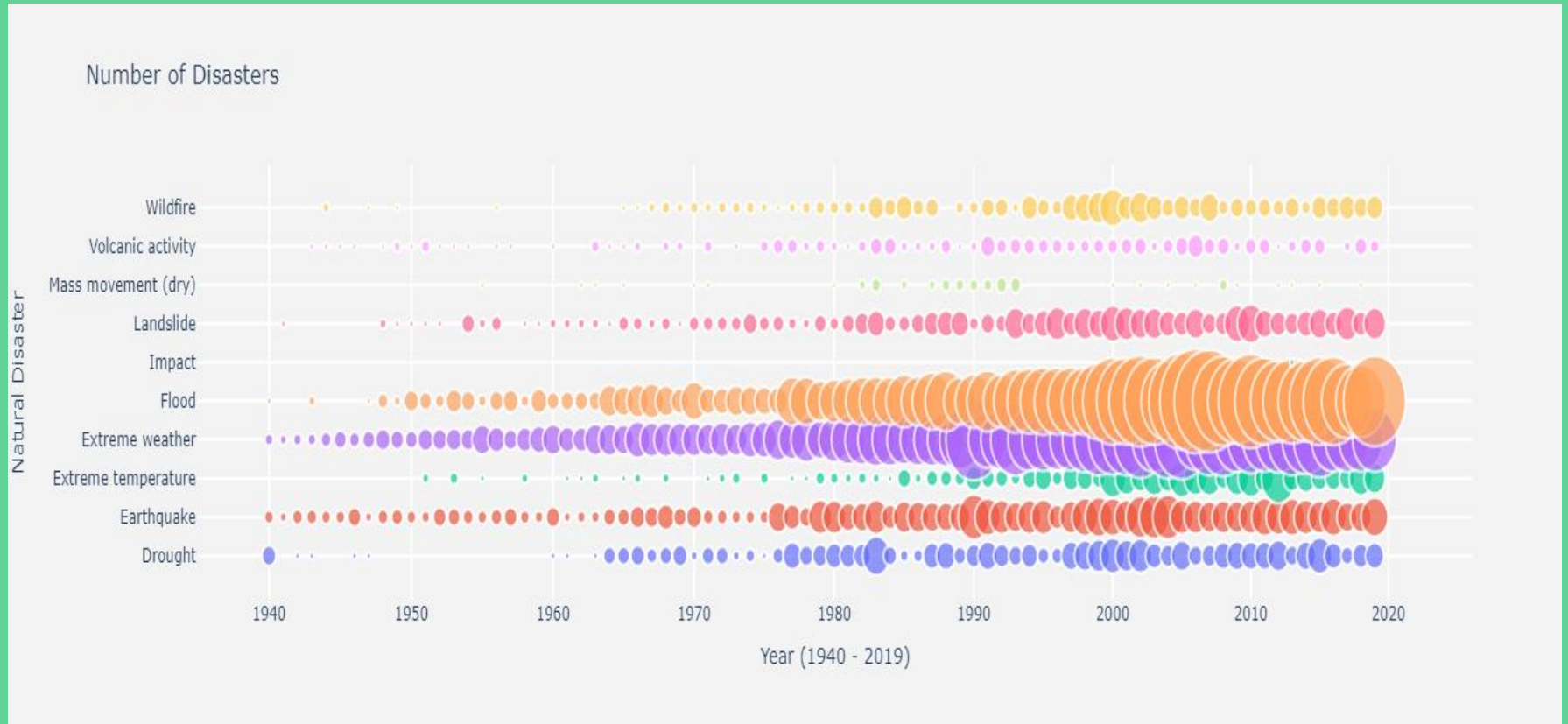
1. Draught
2. Flood
3. Earthquake

We analyze the global data for common natural disasters.

Contribution of Natural Disaster on Global Deaths

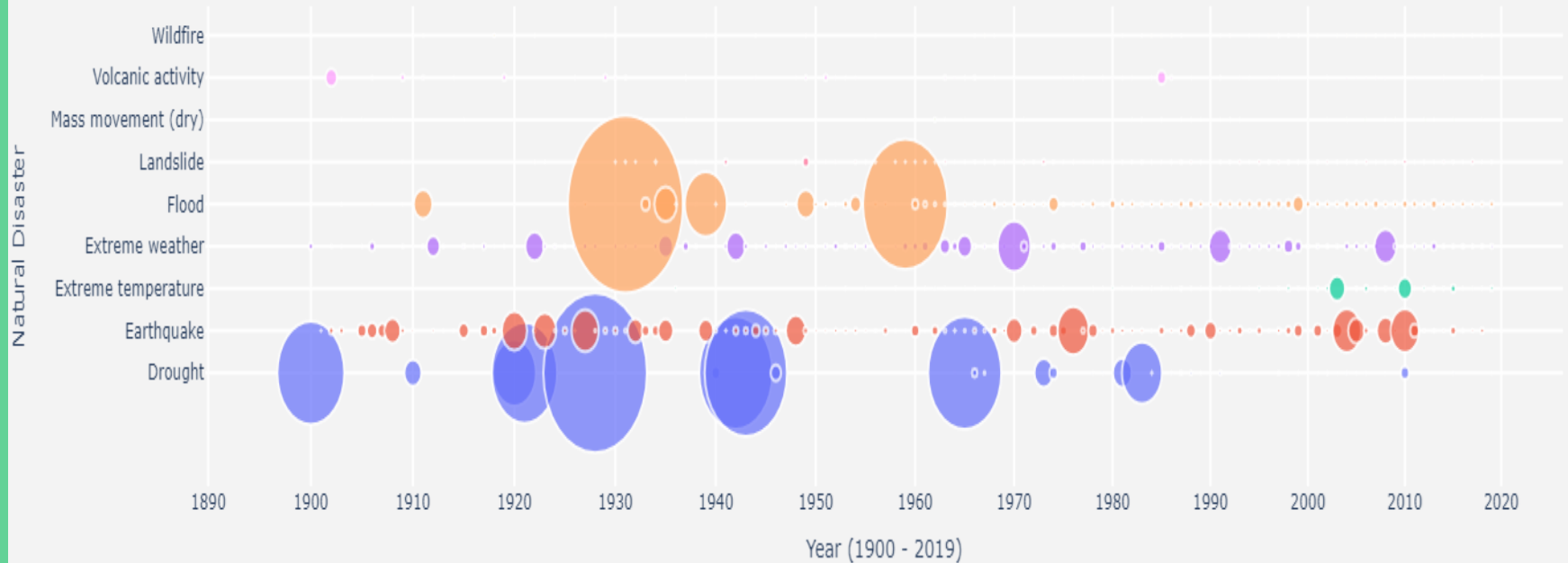


Frequency of Natural Disasters has Increased in the Past Few Decades



Drought, Floods, and Earthquakes Have Wrecked the Most Havoc

Deaths from Natural Disasters



Deforestation

We will investigate if there is any relationship between the amount of forest area lost due to deforestation and the number of endangered indigenous species.

We calculated the pearson and spearman correlation coefficient between the amount of forest area lost due to deforestation and the various number of endangered indigenous species.

There seems to be a weak positive correlation between the amount of forest area lost due to deforestation and the number of endangered indigenous species for :

- Birds
- Mosses
- Lichens

```
result1.corr(method='pearson')['Value']  
  
(Mammals, Value)      -0.130449  
(Birds, Value)        0.190268  
(Reptiles, Value)     0.128025  
(Amphibians, Value)   -0.052378  
(Vascular plants, Value) -0.042646  
(Mosses, Value)       0.218978  
(Lichens, Value)      0.176176  
(Invertebrates, Value) 0.197381  
Value                 1.000000  
Name: Value, dtype: float64
```

```
result1.corr(method='spearman')['Value']  
  
(Mammals, Value)      -0.111995  
(Birds, Value)        0.213570  
(Reptiles, Value)     0.059321  
(Amphibians, Value)   -0.225694  
(Vascular plants, Value) 0.052372  
(Mosses, Value)       0.288660  
(Lichens, Value)      0.472527  
(Invertebrates, Value) 0.078139  
Value                 1.000000  
Name: Value, dtype: float64
```

```
spearmanr(result1[('Birds', 'Value')], result1['Value'], nan_policy='omit')  
SpearmanrResult(correlation=0.21357034772008127, pvalue=0.3053300912247075)
```

```
spearmanr(result1[('Mosses', 'Value')], result1['Value'], nan_policy='omit')  
SpearmanrResult(correlation=0.288660106867137, pvalue=0.27824469326976997)
```

```
spearmanr(result1[('Lichens', 'Value')], result1['Value'], nan_policy='omit')  
SpearmanrResult(correlation=0.47252747252747257, pvalue=0.08796742461254232)
```

Conclusion

In this project we have analyzed the data for common factors that induce climate-change. These events are highly correlated.

- High GHG-Emission causes Global Warming
- Global warming Melts the Ice-Sheets and Glaciers
- Melting of Glaciers Causes a Rise in Sea-Level
- The combined effect of the above results into frequent natural disasters and climate anomalies.