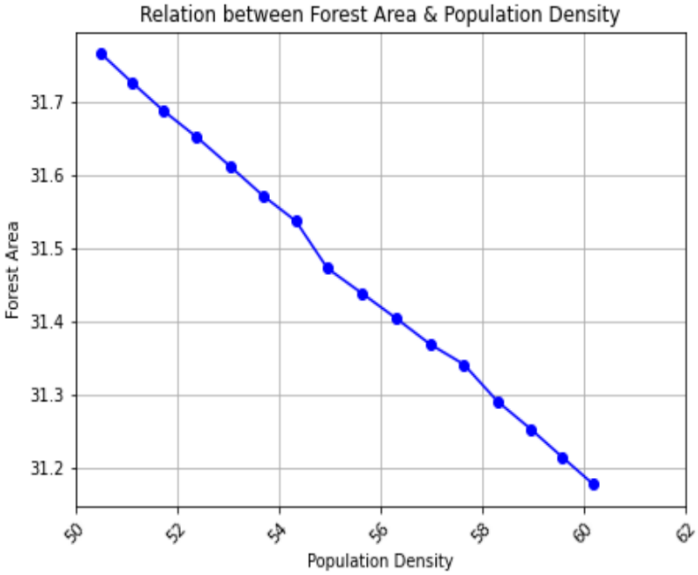
Eco Connectivity: Investigating CO2 Emission Dynamics, Forest Area Changes, and Population Trends

Introduction:

The adverse effects of Carbon emissions start from Climate change (increasing global temperatures) to Food security. Many human rights organizations are running worldwide raising their voices on climate change and deforestation. Did this make any change? Are they impactful? Let's find out in detailed analysis comparing the Carbon Emissions, Forest area depletion, and renewable energy usage over the years 2005 - 2020 along with the interlinking population growth.

The forest area of the world at the beginning of 2005 was 31.76% of the world's land area which came down to 31.17% by the end of 2020. There is a fall of 0.59% of forest area in 15 years which is approximately 57,900 Acres of forest area lost during 2005 to 2020.

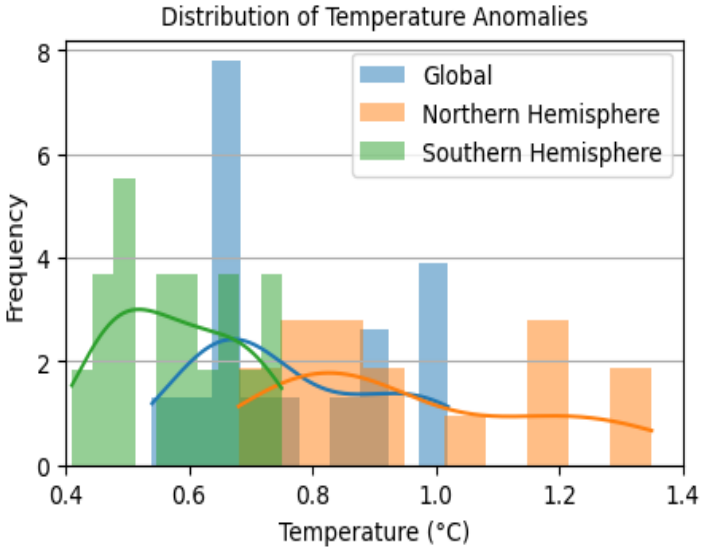


From the line plot, we can see that there is a gradual decrease in the forest area as the population density continues to grow. Urbanization plays a main role in this as more and more people need more and more housing and forests are being cleared to meet the demand.

The population density of the world at the beginning of 2005 was 50.5 people per sq. km. of land area. This has drastically increased to 60.2 people per sq. km. by 2020. Throughout the years from 2005 to 2020, we have seen an average of 1% increase in population every year compared to the previous year.

As deforestation increases, there will be an increase in the overall Carbon emissions of the world. From the dataset, we can observe that CO2 emissions in the year 2005 were at 4.3 metric tons and had risen 4.7 by the year 2013. Later it showed a decline making it 4.3 metric tons in the year 2020.

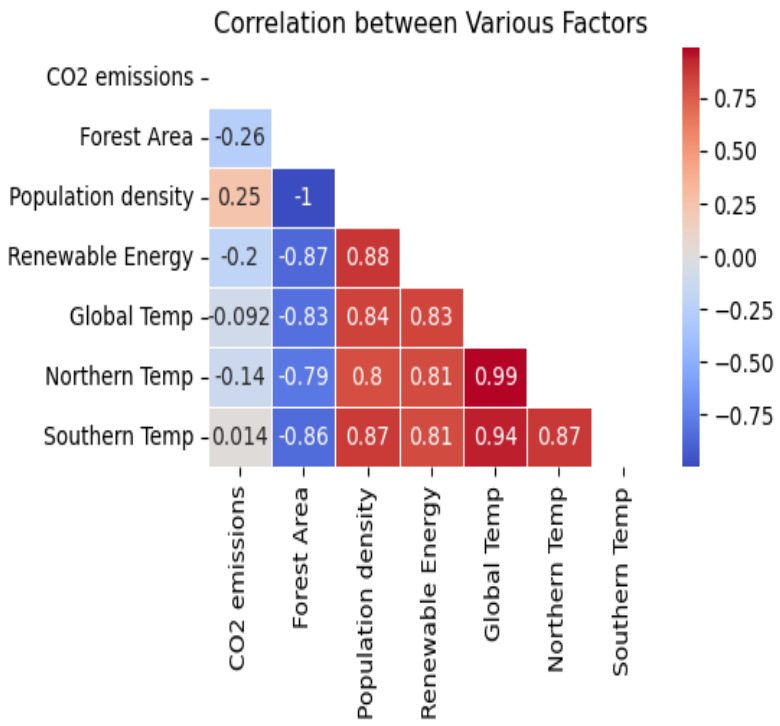
All these factors have an impact on the world's temperatures - the average earth temperature has seen a rise overall in these years. From the histogram, we can understand the distribution of temperature anomalies in different zones over the years. We can observe that there has always been an increase in the global temperatures every year and a few times it has even increased by 0.7 to 1 degree a year which is very high. However, the southern hemisphere temperature had grown by 0.4 to 0.7 in all these years whereas the northern hemisphere temperatures have grown more frequently at 0.7 to 1.3 degrees yearly. Also, we can observe that global temperature has increased more steadily by 0.7 degrees yearly. For the period 2005-2020, the maximum temperature change of 1.02 degrees occurred in 2016 and 2020, and the minimum temperature change of 0.54 degrees in 2008. The mean temperature change is at 0.76



overall globally, 0.57 in the southern hemisphere, and 0.96 in the northern hemisphere. Thus, we can see the northern hemisphere's temperature rose more than the southern hemisphere.

The distribution of Northern Hemisphere temperatures has a stronger right tail which depicts that the attribute has positive skewness (0.59). Also, the distribution curve for the northern hemisphere is flatter which states that they have a low kurtosis value (-1.076). A similar pattern is exhibited for global and southern temperatures.

The heatmap below represents the relationship between the factors of the data. Negative values between the factors represent that there is an inverse relation between the factors and the positive value represents that they are proportional to each other.



The value between the population density and forest area is at -1 which is the highest negative value correlation. This means that as the population density grows, the forest area decreases. The forest area also has negative correlation values with all the temperatures. It has values of -0.83, -0.79, and -0.86 with the global, northern, and southern temperatures. This implies that a reduction in the forest area causes the temperatures to rise further. CO2 emissions also have a negative correlation with the forest area i.e., as the forest area reduces CO2 emissions increase. Also, we can observe that CO2 emissions negatively correlate with the temperatures and renewable energy usage. Population density has a substantial positive relationship with temperature changes, with a correlation value of 0.84 to global temperatures while it is 0.8 and 0.87 with northern and southern hemispheres respectively. This means temperatures are rising concerning population growth.

Conclusion:

From this analysis, we can conclude that strong steps are necessary to stop the further rise of global temperatures. Increasing forest area by afforestation or preserving it by preventing deforestation is critical to combat temperature rise. Also, increasing the use of renewable energy consumption will reduce CO2 emissions and help combat climate change. Additionally, measures to contain population growth will help reduce the burden of providing sustenance on Earth. The clear correlations between these factors and temperature anomalies serve as a stark reminder of the consequences of inaction.

Referred Datasets:

https://databank.worldbank.org/source/environment-social-and-governance-(esg)-data

https://www.kaggle.com/datasets/willianoliveiragibin/global-warming-on-earth

GitHub link:

https://github.com/pratapponnam/ADS---Statistics-and-Trends-Assignment

Author: Pratap Bhargav Ponnam

Student-ID:23027654