CLIMATE CHANGE ANALYSIS

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Github link: https://github.com/antonyroynell/ADS_Assignment2
Datasource link : https://data.worldbank.org/topic/climate-change

Abstract:

Climate change is one of the biggest and scariest issues that the world faces today. It is one of the problems that require quick action in order to save the future of this planet. The changes that happen to the planet's temperature and shift in the weather of this planet are caused primarily by humans burning fossil fuels as a result of which the greenhouse gases are emitted in huge quantities.

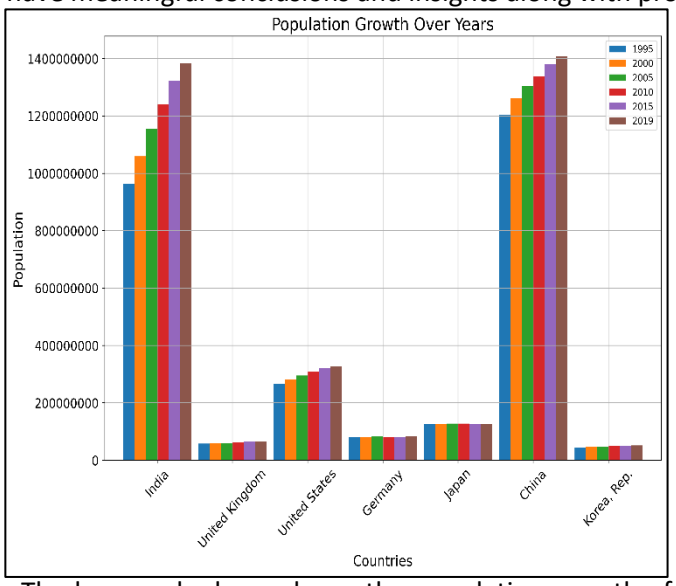
Climate change can affect the world in many ways. Rise in the planet's temperature, rise in the sea levels, melting of polar ice and reducing quality of biodiversity are some of the major issues that are a direct result of climate change. Some of the issues are irreversible and are expected to remain the same for hundreds of years to come. These problems are evident right now as a lot of countries and islands have reported the rise in sea levels and are also experiencing severe drought and wildfires. Global temperature is still on the rise and is still expected to increase in the following years if humans decide not to make a drastic change in their lifestyle very soon. Reducing the burning of fossil fuels and switching to renewable and clean energy will make a great impact against climate change as this will reduce greenhouse gas emissions.

Taking the factors of climate change into consideration, five major factors that can impact climate change drastically have been selected for 7 superpower nations of the world and has been analyzed to verify whether these factors truly are a reason for climate change. The five factors are Total greenhouse emissions (kt of CO2 equivalent), CO2 emissions (kt), Population, renewable energy consumption (% of total final energy consumption) and forest area (sq km).

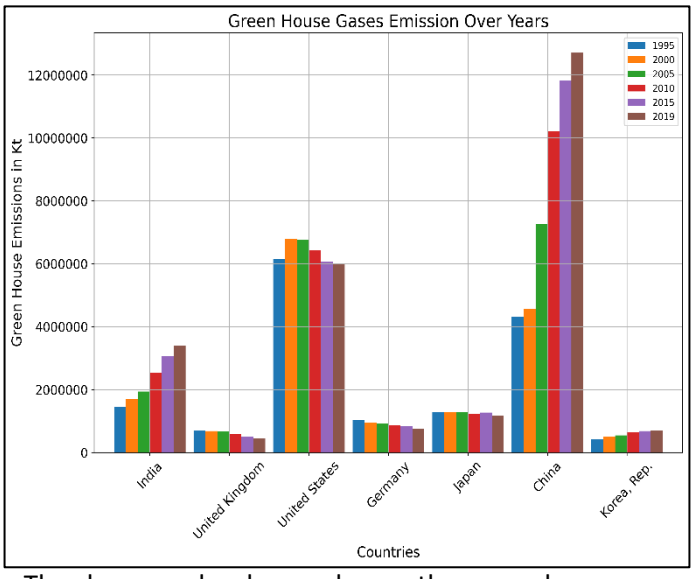
Greenhouse gases include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and water vapor and are mainly emitted due to burning fossil fuels. Analyzing the greenhouse gas emissions for the top 7 countries can help to determine and identify which are the worst performing countries in this sector. Analyzing CO2 emissions is important as CO2 is the most dangerous greenhouse gases that has the largest impact on climate change and the analysis will help to determine and understand the increase or decrease in the CO2 emissions for 7 countries in the past years.

This analysis will help in determining if the other three factors Population, Renewable energy consumption (% of total final energy consumption) and forest area (sq km) have an impact on climate change for the 7 countries and will also give a conclusion whether these factors have to be controlled and regulated so that climate change can be slowed down or stopped for a better future of this planet.

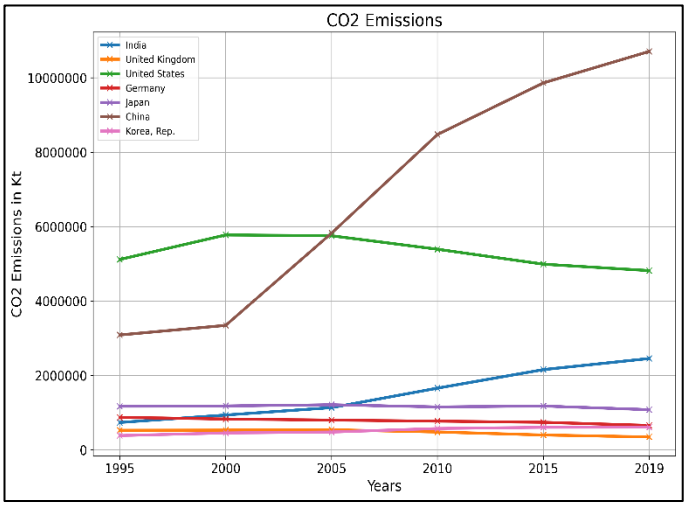
Introduction : 5 factors that contribute to climate change has been selected, studied, analysed and visualized to have meaningful conclusions and insights along with proof.



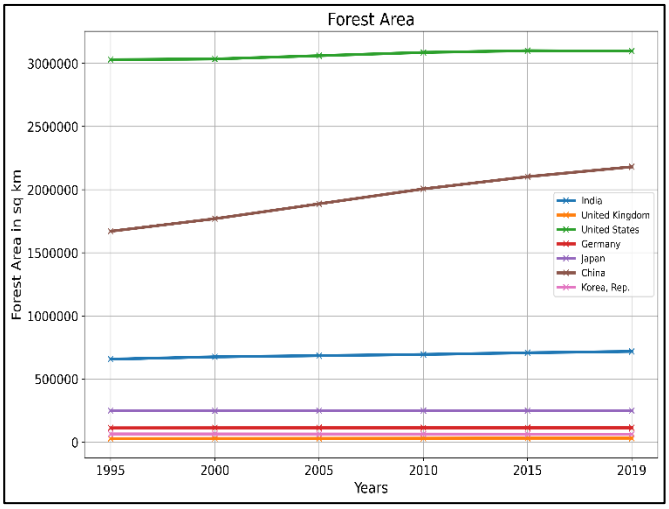
The bar graph above shows the population growth of the top 7 world countries from the year 1995 to 2019 with 5-year interval. Population of India and China have increased drastically over the years which implies the greenhouse gas emission must also have increased over the years. The USA has shown a slight increase in population over the years. United Kingdom, Germany, Japan and South Korea have maintained a steady population over the years. Increase in population implies that the greenhouse gas emission should also increase as more people would be burning fossil fuels which can increase greenhouse gases emission. But it can be observed in the next bar graph, for countries United Kingdom, Germany and Japan, the greenhouse gases emission has gone down even though they had a slight increase in the population over the years.



The bar graph above shows the greenhouse gas emissions over years for TOP 7 countries of the world from the year 1995 to 2019 with a 5-year interval. As expected, greenhouse gas emission for countries India and China have increased drastically since their population also grew over the past years. For these 2 countries, population can be considered as a leading cause for increase in the greenhouse gases emissions. United Kingdom, Germany and Japan have shown a slight decrease in their greenhouse gases' emissions since 1995 to 2019 even though they had a slight increase in their population over the same time which proves population cannot be considered as a major factor for greenhouse gases emission for these countries. This also proves that UK, Germany and Japan were successful in fighting climate change over the years.

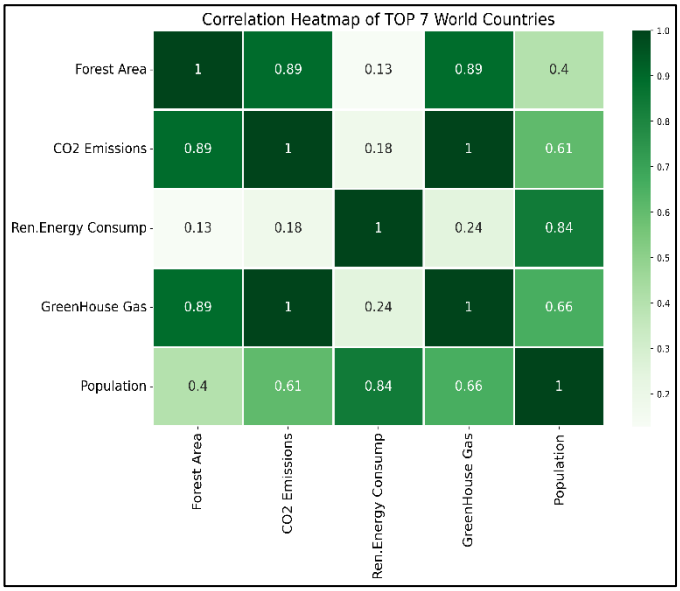


The above line plot shows the time series for forest area (sq km) for the top 7 countries of the world from 1995 to 2019. Forests can be a huge help to bring down carbon dioxide in the air. It can be observed that China is the only country that has shown any increase in the forest area over the years. All the other countries have maintained the same forest area over the years or have experienced a slight decline in the forest area. High industrialization and increase in the population are a few reasons why deforestation took place in those countries or has prevented the countries from



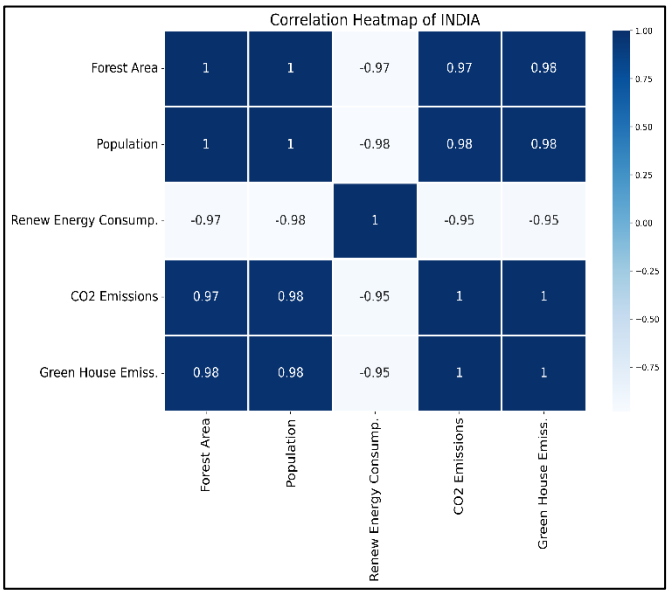
The above line plot shows the time series for CO2 emissions in kt for top 7 countries of the world from 1995 to 2019 with a 5-year interval. CO2 is a major greenhouse gas which is primarily produced by burning fossil fuels. China is the worst performer here as the CO2 emissions have increased drastically in the past years. China has also expanded their forest area, which means their forest resources have increased to reduce the CO2 in the atmosphere. But since the CO2 emissions' growth is very huge, China's growth of forest resources is not big enough to fight CO2 and

expanding their forest area. The only exception here is China who has increased their forest area even though they have multiple industries and high population. Other countries have failed to expand their forest resources over the years due to high industrialization and development which is not sustainable to the environment.



The above heat map shows the correlation between 5 factors that contribute to climate change for the top 7 countries of the world. As it can be observed from the heatmap, correlation between Greenhouse gases and CO2 emissions is the highest with the highest value of 1. This means that there is a very strong positive correlation between greenhouse gases and CO2, and it shows direct proportionality. It can be observed that correlation coefficient value between Renewable energy consumption and population is 0.84 which indicates that as the population increases, more and more people decide to switch to cleaner and eco-friendly renewable energy which is a positive sign for the fight against climate change. The lowest correlation value of 0.13 is between Renewable Energy consumption and Forest area. This shows that increase in the forest area has a very less impact on renewable energy consumption of a country or vice versa. The high values of correlation coefficient between population and CO2 emissions (0.61) and population and Greenhouse gases emission (0.65) shows that these factors have a positive correlation and proves that any growth in the population will result in the increase of CO2 emissions and greenhouse gases emissions. The main three strong conclusions that can be observed from the above heat map is that any increase in the CO2 emission will increase the Greenhouse gases' emission, growth in population results in the increased CO2 and greenhouse gases emissions and any increase in the population will promote the use of renewable energy for the top 7 countries of the world.

reduce its content in the atmosphere. India is another country that has shown increase in the CO2 emission, and it can be observed that the forest area of India has not expanded at all to fight this pollution which is why India is becoming one of the most polluted countries in the world. United States has proved that their measures to fight climate change were successful as they have shown a huge decrease in the CO2 emissions over the years.



The above heat map shows the correlation between 5 factors that contributes to climate change for India. The highest value of correlation coefficient is between Population and CO2 emissions and also between Greenhouse gases emission and population. They have a high value of 0.98 which indicates the increase in the population of India is proportional to the increase in the CO2 and greenhouse gases emission in India. This proves that population control in India can be a very efficient way to bring down CO2 emissions and greenhouse gases emissions in India. The lowest correlation coefficient value is between the renewable energy consumption and population and has a value of -0.98 which is negative correlation and is very close to perfect inverse proportionality. This proves that as the population increases for India, the use of renewable energy tends to decrease. This is a very bad sign as this shows the increasing population burns more fossil fuels instead of switching to cleaner renewable sources of energy. The other interesting observation that can be made from this heat map is the correlation coefficient between Renewable energy consumption and CO2 emission has a very low value of -0.95. This shows negative correlation. This shows increase in the renewable energy consumption has a direct impact on the CO2 emission in India as it reduces the CO2 emissions. Promoting the use of renewable energy can be considered as very effective source of bringing down the CO2 emissions in India as these two factors are inversely proportional. From the above heatmap, it can be concluded that India must switch to renewable energy and should also control their population growth to successfully bring down the CO2 emission levels and greenhouse gases emissions levels.