FACULTY OF MANAGEMENT

FTDS 3401

Data Visualization

Assignment Report - 30%

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Abstract:

An examination of climate change in Pakistan between 1991 and 2015, emphasizing the interactions between population growth, urbanization, deforestation, and greenhouse gas emissions, is presented in this report. To ensure a healthier environment for future generations, governmental policies are urgently needed to mitigate climate change's adverse effects.

Introduction

Pakistan, with its diverse geographical and climatic characteristics, faces major challenges arising from climate change, as seen by a surge in extreme weather events over the past decade. This report attempts to unravel the intricate interplay between Pakistan's vulnerability to climate change impacts and the nation's efforts in addressing these challenges. A comprehensive understanding of the climate threats faced by Pakistan is crucial, given the recurrent spells of floods, droughts, glacial lake outbursts, cyclones, and heatwaves that have exacted a heavy toll on both lives and property, disrupting economic growth.

The geographical expanse of Pakistan, covering 796,000 square kilometers, encompasses a climatic diversity ranging from arid to semiarid regions. The eastern areas receive monsoon rains, while the northern and western regions experience precipitation from western disturbances. The varying topography, from the highest mountain peaks like K-2 to expansive plateaus and river basins, contributes to a complex climate system. Notably, the Indus Basin Irrigation System, covering 65% of the country's total area, plays a pivotal role in agriculture, forming the world's largest contiguous irrigation system.

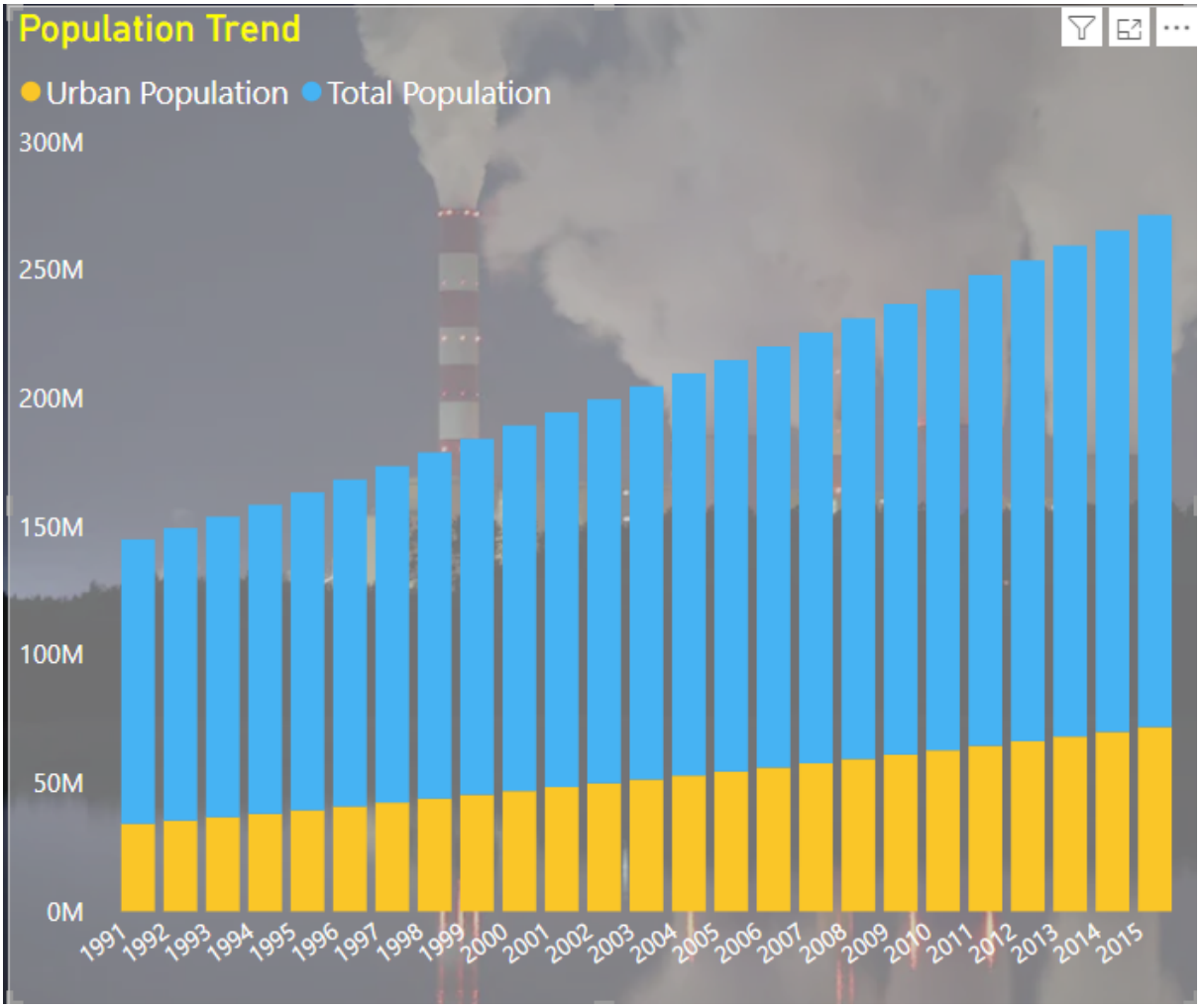
Demographically, Pakistan is the sixth most populous country globally, with a population exceeding 184.5 million. The country faces challenges related to rapid population growth, high fertility rates, urbanization, and severe poverty, particularly in the southern subregions. The impact of climate change on vulnerable populations is exacerbated by the lack of access to resources and opportunities.

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report underscores Pakistan's vulnerability due to distinct geographic, demographic, and socioeconomic factors. The report identifies climate threats such as extreme weather events, glacial melting, and changes in precipitation patterns, with implications for water-dependent sectors like agriculture and energy.

3.0 Visualizations

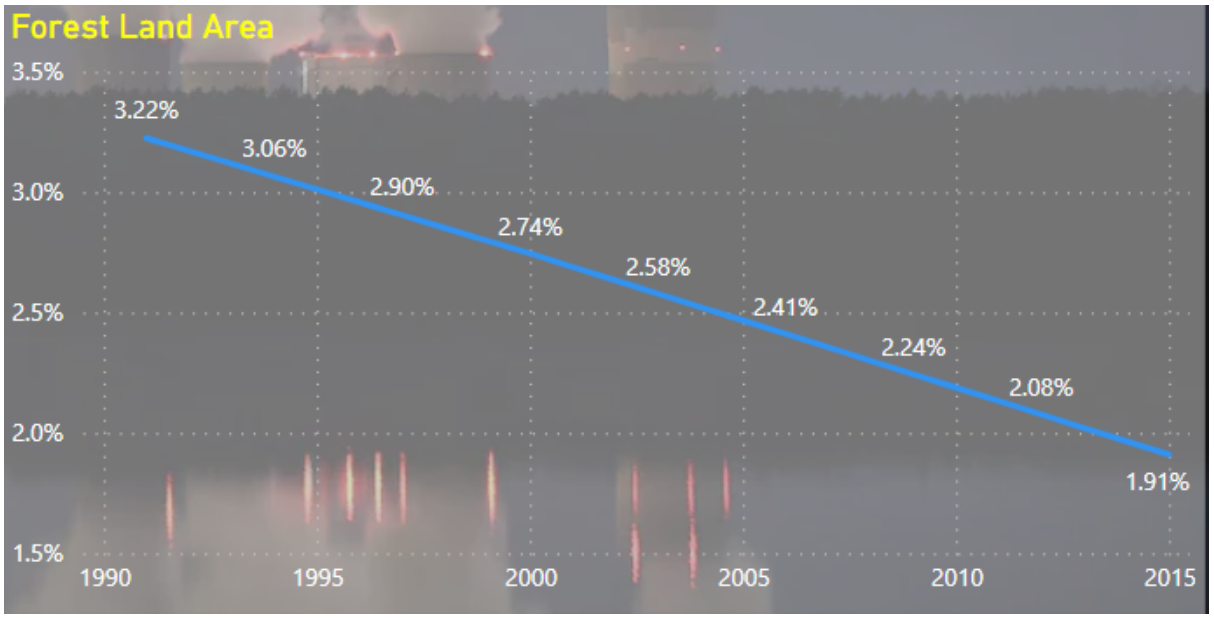
3.1 Visualization 1: Population Growth and Urbanization Over Time

The first visualization focuses on the population dynamics and urbanization trends in Pakistan. It consists of a stacked column chart illustrating the steady increase in the total population, and urban population in Pakistan. The total population started from 111 million in 1991 and reached 199 million in 2015, marking an 80.02% increase. The chart also depicts the parallel rise in urban population with an astounding 110.39% increase during the same period. This visualization provides a clear representation of the demographic shift and the massive influx of people into urban areas due to industrialization and enhanced opportunities.



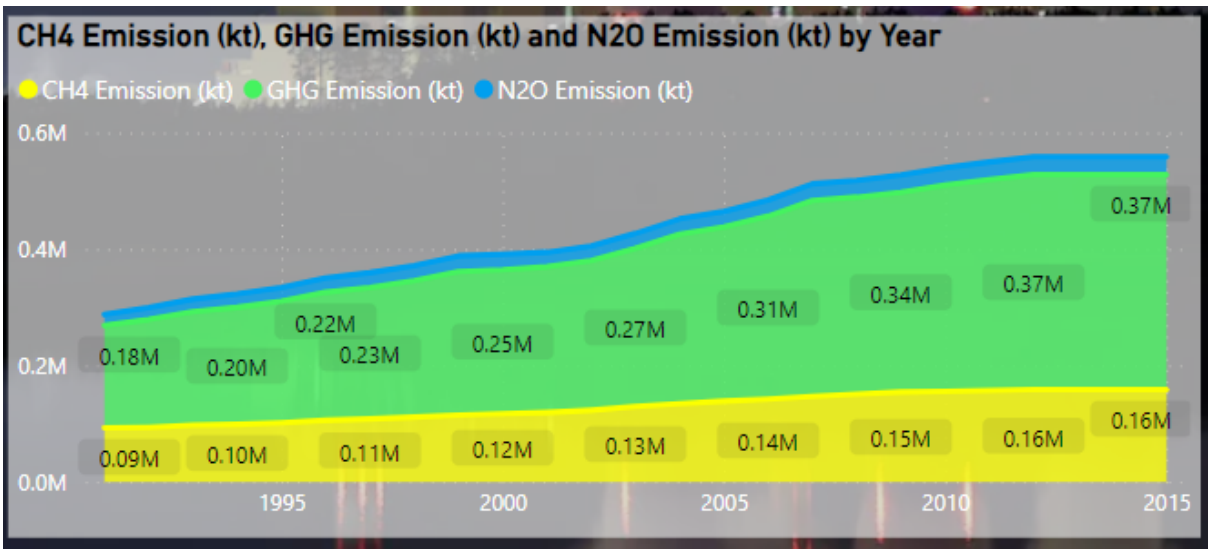
3.2 Visualization 2: Deforestation and Land Use Change

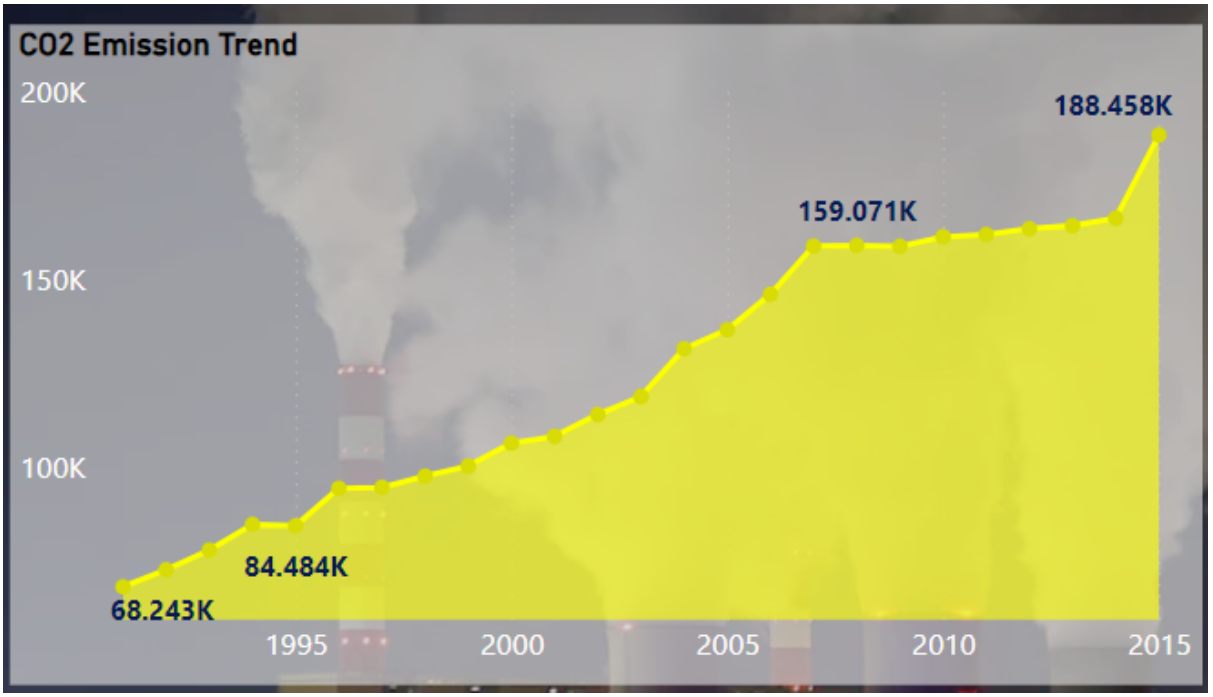
The second visualization delves into the environmental impact of population growth and urbanization by showcasing the decline in forest land area over the years. A line chart vividly illustrates the decrease in forest land percentage from 3.22% in 1991 to 1.91% in 2015. The chart represents the changing proportions of forest land, highlighting the alarming rate of deforestation. This visualization serves to underscore the environmental consequences of accommodating the burgeoning urban population through deforestation.



3.3 Visualization 3: Greenhouse Gas Emissions and Climate Impact

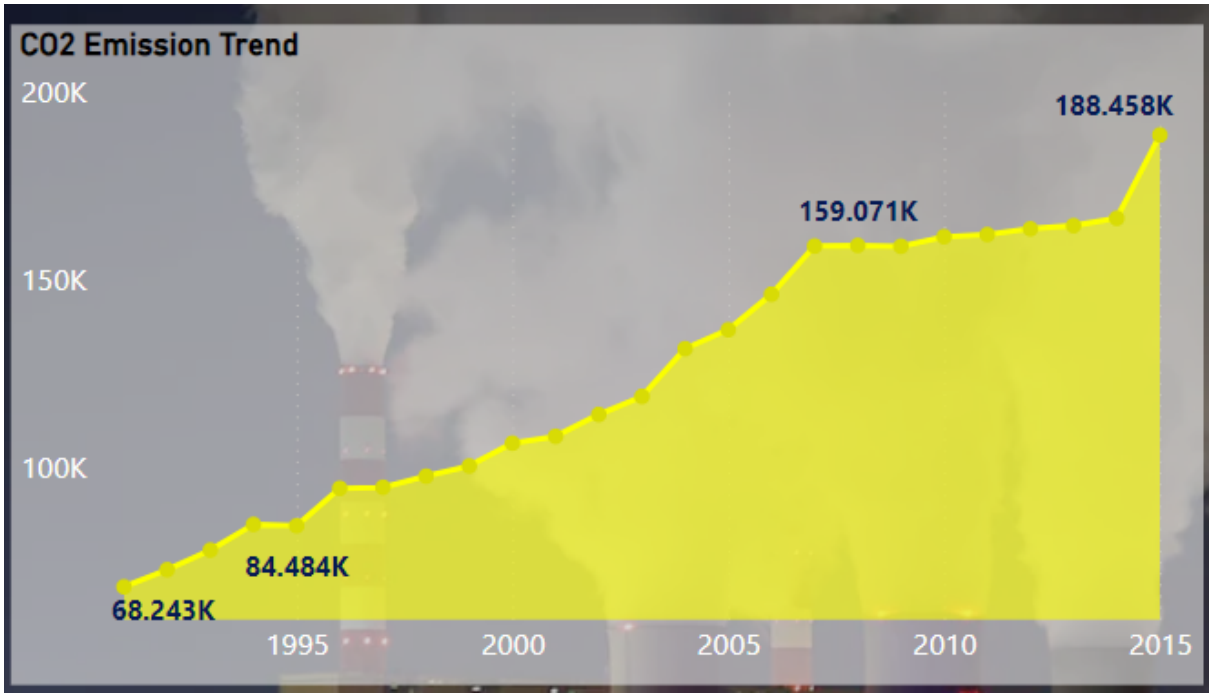
The third visualization focuses on the consequences of urbanization and industrialization on climate change in Pakistan. A line chart exhibits the sharp increase in carbon dioxide (CO2) and a stacked area chart depicts the other harmful gas emissions, revealing a staggering 176% rise from 1991 to 2015. This data is complemented by line graphs illustrating the corresponding shifts in temperature and precipitation patterns over the same period. The graph showcases extreme climate events such as droughts and floods, emphasizing the correlation between increased emissions and adverse weather conditions. To further highlight the urgency of addressing this issue, a callout box provides information on the observed impacts, including global warming and its implications. This visualization aims to underscore the need for government intervention and policy changes to mitigate the environmental impact of industrialization and promote sustainable practices.


CH4 Emission (kt), GHG Emission (kt) and N2O Emission (kt) by Year
CH4 Emission (kt)
GHG Emission (kt)
N2O Emission (kt)
0.6M
0.4M
0.2M
0.0M
0.18M
0.20M
0.22M
0.23M
0.25M
0.27M
0.31M
0.34M
0.37M
0.37M
0.09M
0.10M
0.11M
0.12M
0.13M
0.14M
0.15M
0.16M
0.16M
1995
2000
2005
2010
2015

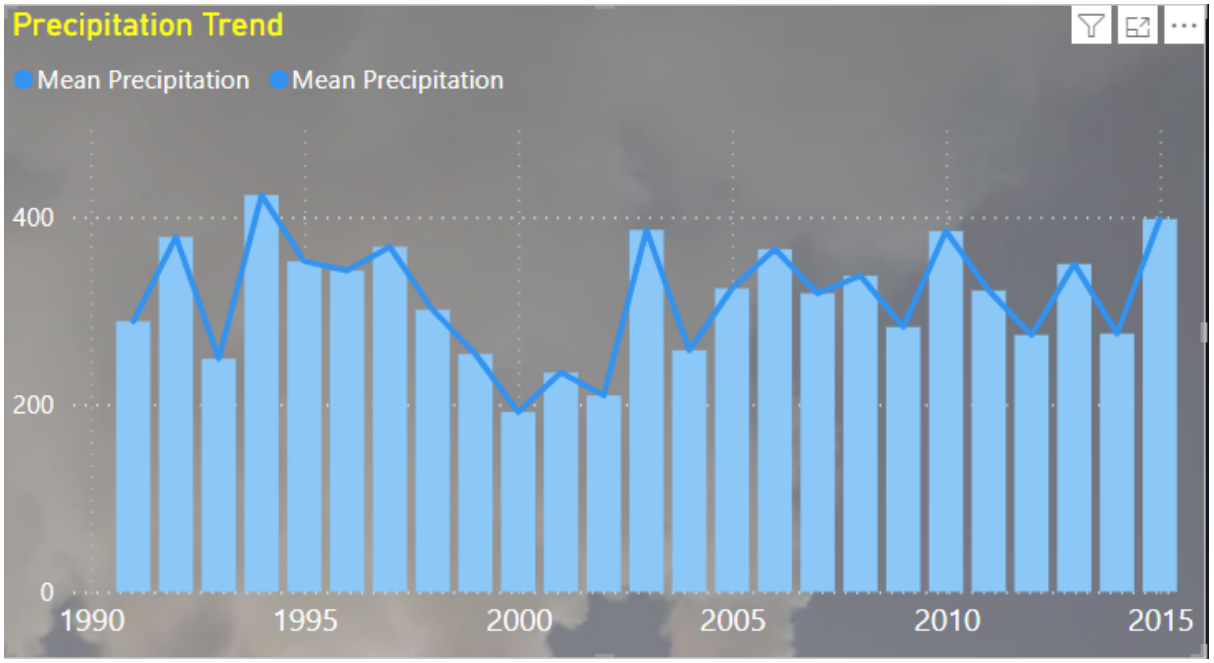

CO2 Emission Trend
200K
150K
100K
188.458K
159.071K
84.484K
68.243K
1995
2000
2005
2010
2015

4.0 Trends in the data

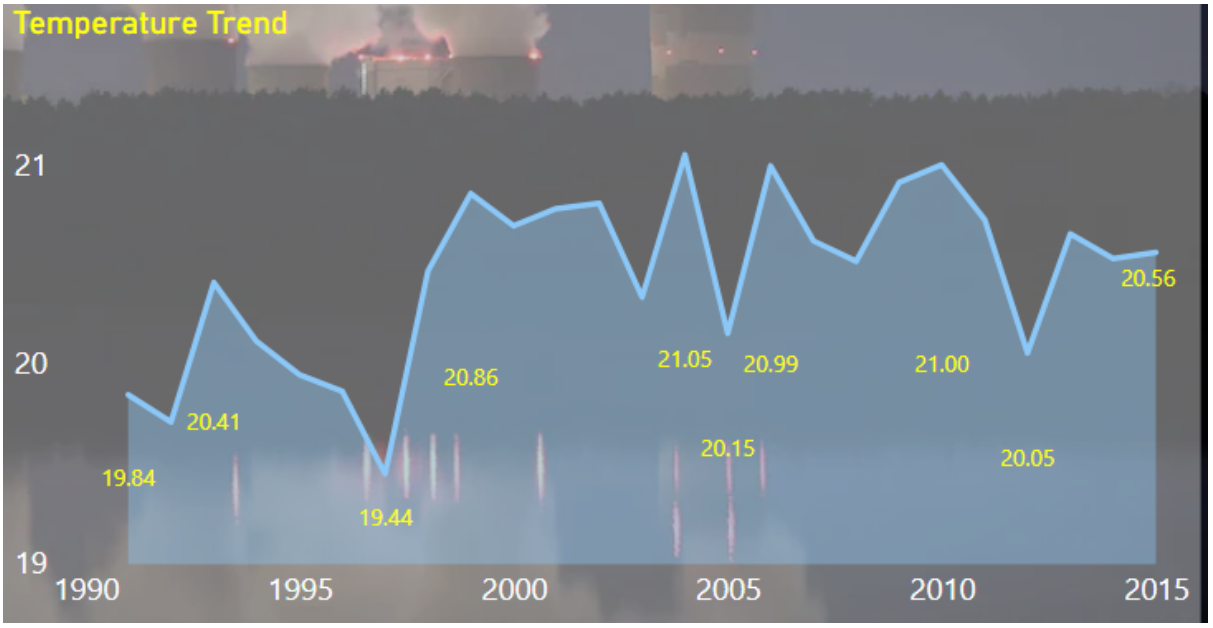
a) CO2 Emission Trend



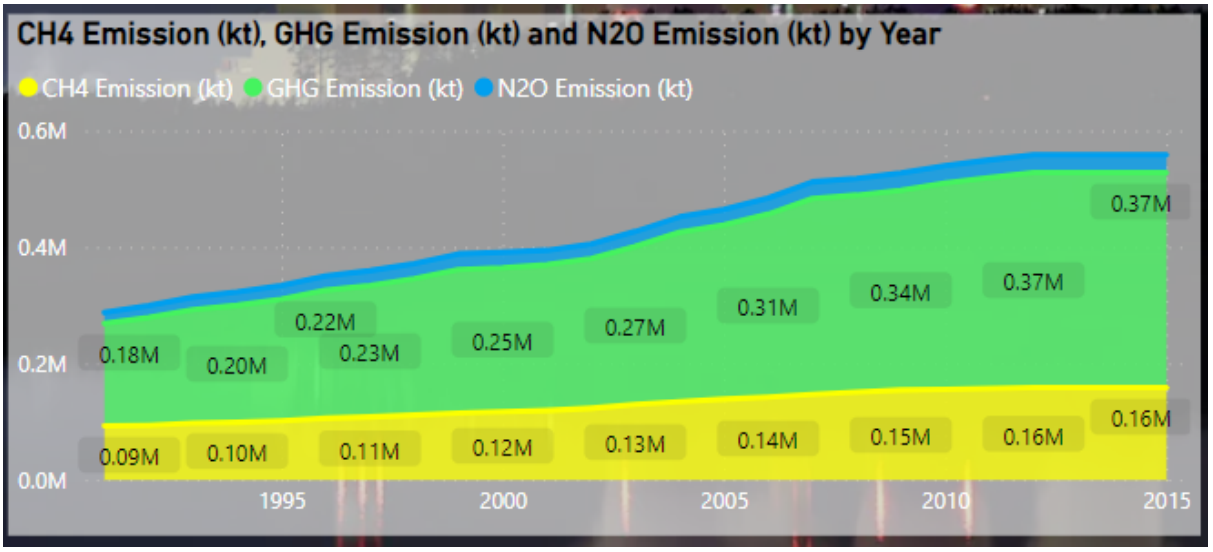
b) Precipitation Trend



c) Temperature Trend



d)Other Gases Emission Trend



5.0 Data story

The story starts in 1991 when the total population of Pakistan was around 111 million and goes forward to 2015 when the population jumped to 199 million, amounting to an 80% increase in the total population. Correlated to that, the Urban Population increased by 110.39 %, showing many people shifted from rural to Urban Areas due to industrialization and increased opportunities.

With the increase in the Urban population and industrialization, we see a decline in the Forest Land Area in Pakistan in passing years from 3.22% in 1991 to 1.91% in 2015, which shows that deforestation was carried out to accommodate such a large increase in Urban population and cities had to outgrow their limits and acquire the surrounding land for development of industries.

With the advancement in Urban cities and increased industrialization, the emission of CO2, carbon-related, and other harmful gases increased by 176% from 1991 to 2015. This caused the temperature and precipitation patterns to vary up to a very large extent showing severe climate conditions such as droughts, floods, global warming, and much more.

The government should make proper policies to limit the use of fossil fuels and make plans to reduce the carbon emissions produced by the nation as fast as possible to fight this drastic change and make future climate conditions better for living beings.

6.0 Conclusion

The conclusion emphasizes the necessity of a paradigm shift, pushing for environmentally conscious urban planning and global cooperation to ensure Pakistan's resilience. It explores the intricate relationship between population growth, urbanization, deforestation, and rising greenhouse gas emissions. A healthier environment can be achieved through sustainable practices. The report advocates strategic government policies. The visualizations illustrate population dynamics, deforestation's environmental impact, and the alarming increase in greenhouse gas emissions. Climate change trends, CO2 emissions, and precipitation levels underscore the urgency of proactive measures. To address environmental and societal needs, sustainable practices must be aligned with the data story.