Climate Change

~ Saving our planet, lifting people out of poverty, advancing economic growth... these are one and the same fight… ~

introduction

In this report, I will be going over climate change and its current effects on the environment, biodiversity, ecosystems, agriculture, human health as well as planet Earth's overall well-being.

Important topics such as specific causes of climate change and what we can do as researchers/data analysts will also be covered.

What is climate change?

The UN (United Nations) definition of climate change refers to “long-term shifts in temperatures and weather patterns.”

These shifts may be natural, but since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels (like coal, oil and gas), which produces heat-trapping gasses.

In simplified terms, it is a drastic change in natural conditions (such as weather) created by or lasting for long periods of time, primarily by human activity.

DATA COLLECTION

As the impacts of climate change become increasingly evident, there is an urgent need for innovative solutions to address this global crisis. Our project focuses on leveraging data analytics to enhance understanding and mitigation of climate change effects. By harnessing vast datasets—The Global Surface Temperature Change data, provided by the National Aeronautics and Space Administration Goddard Institute for Space Studies (NASA-GISS), is publicly accessible. Additionally, the FAOSTAT Temperature Change domain offers extra information, including area names. Since our project prioritizes country names, we opted to utilize the FAO dataset.

You can access the data from the Food and Agriculture Organization of the United Nations.. As stated that the dataset can be used for research, statistical, and scientific purposes, and is available for access, download, copying, and redistribution in accordance with these terms.

The FAOSTAT Temperature Change domain provides statistics on mean surface temperature changes by country, updated annually. The dataset currently covers the period from 1961 to 2019, including monthly, seasonal, and annual mean temperature anomalies—representing temperature changes relative to a baseline climatology from 1951 to 1980. It also includes the standard deviation of temperature changes based on the baseline methodology.

This dataset encompasses all countries and territories globally (as of 2019: 190 countries and 37 other territorial entities) and records temperature changes in degrees Celsius (°C) from 1961 to 2019. Data is released annually and is available in a comma-separated value (CSV) format, consisting of 6.3 megabytes, with 9,656 rows and 66 columns.

The first seven columns detail temperature changes, while the remaining columns provide numerical data on temperature changes from 1961 to 2019. It is important to note that there are missing values for some years.

Descriptive analytics

* Trend Analysis: We examined historical climate data to identify significant trends (e.g., increasing global temperatures)
* Data Visualization: We used graphs, charts and temperature change data in world maps to present complex data sets clearly, enabling better understanding of global warming .

causes/effects OF CLIMATE CHANGE

A question multiple researchers as well as climatologists ask as they begin their research is “what are the specific causes of climate change”? This is incredibly important as you dive deeper into the consequences and data that follows climate change, the only way to fix these issues is to fully comprehend what causes them.

Understanding that, let’s move on to the

causes

OF CLIMATE CHANGE…

Climate change is primarily driven by human activities and natural processes. Here are the main causes:

### **Human Activities**

1. **Greenhouse Gas Emissions**: The burning of fossil fuels (coal, oil, and natural gas) for energy, transportation, and industry releases carbon dioxide (CO2) and methane (CH4), which trap heat in the atmosphere.
2. **Deforestation**: Cutting down forests for agriculture, urban development, and logging reduces the number of trees that can absorb CO2, increasing atmospheric CO2 levels.
3. **Agriculture**: Agricultural practices release greenhouse gasses, including methane from livestock and nitrous oxide from fertilizers.
4. **Industrial Processes**: Certain manufacturing processes emit greenhouse gasses and other pollutants that contribute to climate change.
5. **Waste Management**: Landfills produce methane as organic waste decomposes anaerobically.

### **Natural Processes**

1. **Volcanic Eruptions**: Large eruptions can release CO2 and sulfur dioxide (SO2), temporarily affecting climate patterns.
2. **Ocean Currents and Changes**: Natural variability in ocean currents can influence climate systems, but human-induced changes are overshadowing these effects.
3. **Solar Variability**: Changes in solar radiation can affect the Earth's climate, but this is a minor factor compared to human activities.

### **Feedback Loops**

1. **Ice Melt**: As polar ice melts, less sunlight is reflected away from the Earth, leading to further warming.
2. **Permafrost Thawing**: Thawing permafrost releases stored methane, exacerbating warming.

### **Land Use Changes**

Urbanization and changes in land use alter local climates and contribute to global warming.

These factors combine to create a complex and interconnected system affecting the Earth’s climate. Addressing climate change requires reducing greenhouse gas emissions and promoting sustainable practices.

eFFECTS OF CLIMATE CHANGE ON HEALTH

**Heat-Related Illnesses**: Increased temperatures can lead to heat exhaustion and heatstroke, particularly affecting vulnerable populations such as the elderly and those with pre-existing conditions.

**Respiratory Issues**: Higher temperatures can worsen air quality by increasing ground-level ozone and particulate matter, leading to respiratory problems like asthma.

**Vector-Borne Diseases**: Climate change can expand the range of diseases carried by vectors like mosquitoes and ticks, increasing the risk of illnesses such as malaria and Lyme disease.

**Food and Water Security**: Altered weather patterns can affect agricultural productivity and water availability, leading to malnutrition and waterborne diseases.

**Mental Health**: Natural disasters and displacement caused by climate change can result in stress, anxiety, and other mental health issue

eFFECTS OF CLIMATE CHANGE ON POLLUTION

**Air Quality**: Climate change can exacerbate air pollution, leading to increased respiratory and cardiovascular diseases.

**Water Pollution**: Increased rainfall and flooding can lead to runoff that contaminates water supplies with pollutants and pathogens.

**Chemical Exposure**: Higher temperatures can enhance the release of volatile organic compounds (VOCs) from plants and industrial sources, further degrading air quality.

eFFECTS OF CLIMATE on biodiversity and ecosystem

### **Habitat Loss and Fragmentation**

Rising temperatures and changing precipitation patterns can alter or destroy habitats. Species that depend on specific environments—like coral reefs or wetlands—face increased risks as these ecosystems degrade or disappear.

**Altered Species Distribution**

As temperatures rise, many species are forced to migrate to cooler areas or higher altitudes. This shift can disrupt existing ecosystems, as species interactions—such as predator-prey relationships—are altered.

### **Increased Extinction Rates**

Species that cannot adapt quickly to changing conditions or migrate face higher extinction risks. This is particularly true for specialized species with limited ranges or specific habitat requirements.

### **Changes in Phenology**

Climate change can shift the timing of natural events, such as flowering, breeding, and migration. These changes can lead to mismatches in food availability and reproductive cycles, impacting survival rates.

### **Ocean Acidification**

Increased carbon dioxide levels lead to ocean acidification, which affects marine ecosystems, particularly coral reefs and shellfish. This can reduce biodiversity and disrupt food chains.

### **Invasive Species Proliferation**

Warmer temperatures and altered ecosystems can facilitate the spread of invasive species, which often outcompete native species for resources, further threatening biodiversity.

**Ecosystem Services Disruption**

Healthy ecosystems provide essential services, such as clean air and water, pollination, and climate regulation. Climate change can impair these services, affecting human well-being and livelihoods.

### **Increased Frequency of Extreme Weather Events**

More frequent and severe weather events, such as hurricanes, droughts, and floods, can devastate ecosystems, disrupt food webs, and lead to loss of habitat and species.

Future CONSIDERATIONS

**Adaptation Strategies**: Developing public health strategies to address heatwaves, improve air quality, and enhance food security will be crucial as climate change progresses.

**Sustainable Practices**: Promoting sustainable agriculture, renewable energy, and urban planning can mitigate climate change and its health impacts.

**Policy and Advocacy**: Stronger policies at local, national, and global levels are essential to reduce greenhouse gas emissions and protect vulnerable populations.

**Public Awareness**: Educating communities about the health risks associated with climate change can empower individuals to take action and adapt.

Conclusion

Climate change poses significant risks to public health, exacerbating pollution and creating new challenges for communities worldwide. Data analytics plays a crucial role in addressing the interconnectedness of climate, health, and environmental factors and highlights the urgent need for comprehensive strategies for both mitigation and adaptation. By prioritizing sustainability and health, we can work towards a more resilient future. Addressing these challenges collectively will be essential for safeguarding public health and ensuring a livable planet for future generations.

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