

Department of Geography (PG Department), Patna University

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## CLIMATE CHANGE

The term 'climate' is the long – term average of any region's weather events or says it represents a change in the long term weather patterns. Climate change is not the changes of weather that occur on daily basis. It is the phenomenon of the cumulative change of weather patterns over the long periods i.e. changes in climate.

**Climate Change** – It simply means the change of climate which is linked directly or indirectly with the human activities or due to anthropogenic factors. This has altered the composition of the global atmosphere. The climate of the earth is not static, it keeps on changing during different geological time periods. Climate change has measurable effects i.e. it can be measured like changes in rainfall patterns, major shifts in temperature, wind patterns, aridity and etc. This has threatened the production of foods, to rising sea levels that increases the risk of catastrophic flooding.

### Causes of climate change

#### ➤ **Green House Gases and Human Activities**

Green house gases are naturally present in the atmosphere which acts like the blanket. These green house gases blankets the earth's lower atmosphere and keep it warm. It helps to maintain the average temperature of the earth i.e. 15°C making it suitable to survive. However, the interference of the human activities has disturbed the natural balance of the green house gases. The period after the industrialization has multiplied the natural green house effect by trapping much of the energy emitted by the earth. As population, standard of living and economies grow, so does the concentration level of green house emissions.

According to the UN, there are some basic well – established scientific links :

- The cumulative concentration of GHGs in the earth's atmosphere is directly attributed to the average global temperature on the earth.

- Post industrialization, the concentration of GHGs has been rising rapidly along with the average global temperatures.
- Carbon dioxide is the most abundant GHGs which accounts for the two – third of the GHGs.

Cause for rising emissions –

- a. Burning of coal, oil and gases – they produce harmful nitrous oxide and carbon dioxide.
- b. Deforestation – trees help to absorb Carbon dioxide and thus regulate the climate of the earth. The cutting down of trees has caused lost in the storehouse of CO<sub>2</sub>. Thus the carbons stored in the trees are released in to the atmosphere leading to green house effects.
- c. Livestock farming - livestock acts as the hotspot for the production of the methane. When cattle digest their foods they produce large amount of methane gas.
- d. Fertilizers – fertilizers containing nitrogen emits large amount of nitrous oxide.

### **Effects of climate change**

The global climate is interrelated system which is influenced by various factors. But the human activities have set most of the negative feedback effects. However, the consequences caused by human can be studied directly and indirectly.

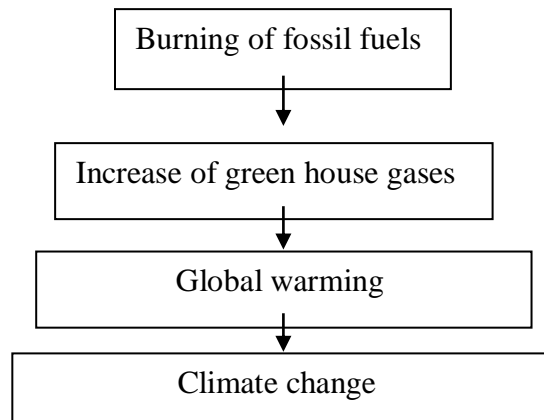
The direct consequences of human made climate change include

- i. increasing maximum temperature
- ii. increasing minimum temperature
- iii. sea level rise
- iv. increase in ocean temperature
- v. change in rainfall pattern
- vi. shrinking glaciers

The indirect consequences are

- i. increase in water crisis and hunger
- ii. rising health risk (due to depletion of ozone layer and increasing average temperature of the earth)
- iii. economic implications to deal with the secondary damage related to the climate change
- iv. the requirement of adaption in all fields(forestry, agriculture, infrastructure, energy, tourism, etc)

**Climate Forcing** – Climate forcing are the important factors in the climate change system that either decrease or increase the effects of the climate system. Positive forcing (here, which increases the temperature) are such as GHGs which warms the earth while negative forcing (here, which decreases the temperature) are such as the effects of the volcanic eruption and aerosols which actually cools the earth.



### **CHAIN OF EVENTS**

#### **Climate change in the past 200 years**

- From 1<sup>st</sup> to 4<sup>th</sup> century - the moisture levels were on the higher side indicating more rainfall. The aridity started increasing after this period and continues till 950AD.
- 950 AD to 1250 AD – known as the little climate optimum, where the temperature increased and people started inhabiting areas like Greenland.
- 1450 to 1880 AD – known as the little Ice Age, where the temperature much cooler than the present day.
- 1880 to 1920 AD – irregular increase in the temperature from 0.2 °C to 0.4 °C.
- 1921 to 1945 – regular increase of 0.4 °C.
- 1946 to 1975 - rapid increase in temperature. The temperature in the northern hemisphere rises rapidly whereas, the same was not observed in the southern hemisphere.

#### **The UN Intergovernmental Panel on Climate Change (IPCC)**

The Intergovernmental Panel on Climate Change (IPCC) was set up by the World Metrological Organization (WMO) and United Nations Environment to provide an objective source of scientific information. IPCC in its 5<sup>th</sup> Assessment Report , 2013 has clarified about the human role in the climate change.

## **Fifth Assessment Report of IPCC**

The Fifth Assessment Report of IPCC has provided a comprehensive assessment of the sea level rise and its effects along with the cumulative emission of CO<sub>2</sub>. It has also warned to limit the warming below 2<sup>0</sup> C.

- From 1880 to 2012, the average global temperature of the earth increased by 0.85<sup>0</sup> C.
- Oceans have warmed, the sea level has risen and the amounts of ice and glaciers have diminished. From 1901 to 2010, the global average sea level has risen by 19cm. In the Arctic region, the sea ice extent has shrunk due to ice loss (with 1.07 x 10<sup>6</sup> km<sup>2</sup> per decade).
- According to the given concentration of carbon dioxide and its ongoing emission, the global mean temperature of the earth will rise above the pre-industrial level by the end of the 21<sup>st</sup> century.

There is alarming evidence that important tipping points, leading to irreversible changes in major ecosystems and the planetary climate system, may already have been reached or passed. Ecosystems as diverse as the Amazon Rainforest and the Arctic Tundra may be approaching thresholds of dramatic change through warming retreat and the downstream effects of reduced water supply in the driest months will have repercussions that transcend generations.

## **Global Warming of 1.5<sup>0</sup>C**

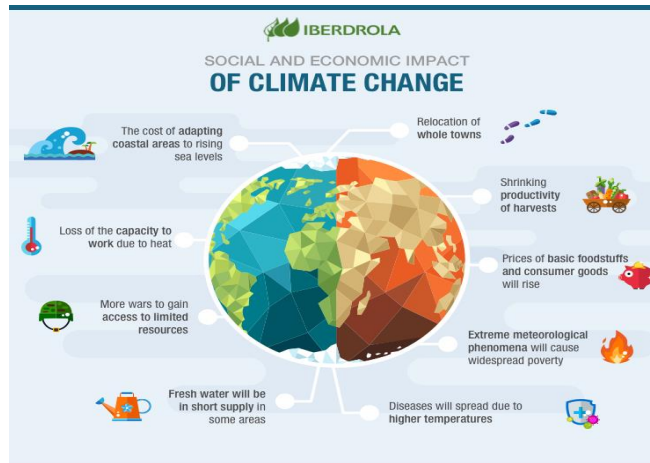
In October 2018, IPCC has issued a special report. The report was on the impacts of global warming of 1.5<sup>0</sup>C and its finding to limit the warming to 1.5<sup>0</sup>C globally. This would require unprecedented changes, far reaching and rapid changes in all aspects of the society. The report assessed that limiting global warming to 1.5<sup>0</sup>C would ensure a more sustainable and equitable society. The reports found that to limit the global warming up to 1.5<sup>0</sup> C require rapid transition in land, industry, energy, buildings, cities and transport.

## Data related with climate change :

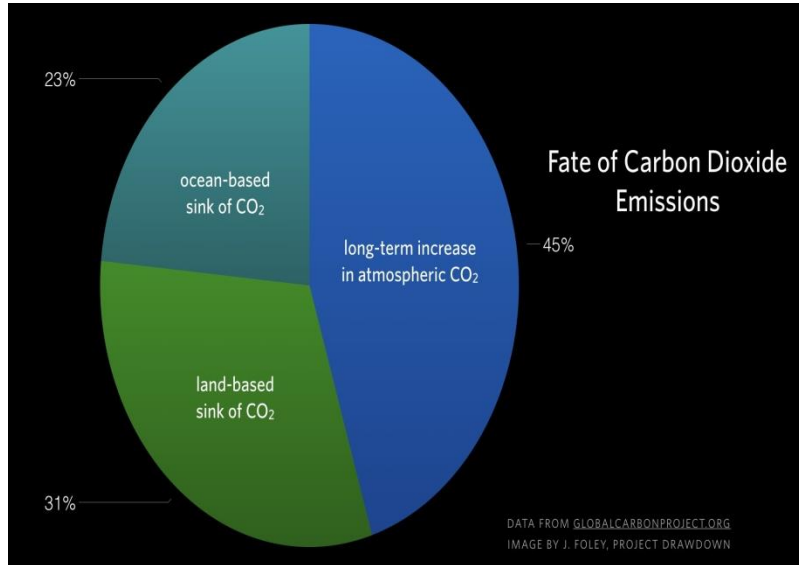
### 1. Data published by World Metrological Organization (WMO)



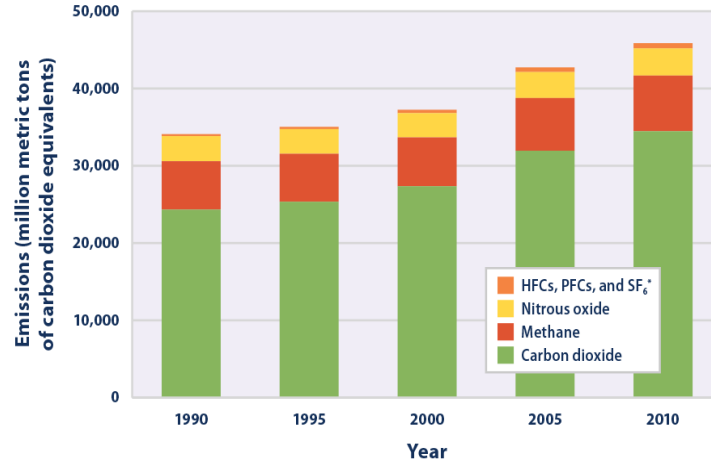
### 2. Impact of climate change on economic and society



### 3. Data published by the Global Carbon Project Organization : Fate of carbon dioxide emissions



### 4. Emissions of different gases (in million metric tons)



Source: World Metrological Organization (WMO)

## 5. Change in Global Surface Temperature

