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### RESEARCH ARTICLE

#### CLIMATE CHANGE A REPERCUSSION OF HUMAN INDUCED SYSTEMS

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#### Abstract

Climate change includes both the global warming driven by human emissions of greenhouse gases, and the resulting large-scale shifts in weather patterns. Though there have been previous periods of climatic change, since the mid-20th century, humans have had unprecedented impact on Earth's climate system and caused change on a global scale. The largest driver of warming is the emission of greenhouse gases, of which more than 90% are carbon dioxide and methane. Fossil fuel burning (coal, oil, and gas) for energy consumption is the main source of these emissions, with additional contributions from agriculture, deforestation, and industrial processes. The human cause of climate change is not disputed by any scientific body of national or international standing. Temperature rise is accelerated or tempered by climate feedbacks, such as loss of sunlight-reflecting snow and ice cover, increased water vapour (a greenhouse gas itself), and changes to land and ocean carbon sinks. Temperature rise on land is about twice the global average increase, leading to desert expansion and more common heat waves and wildfires. Increasing rates of evaporation cause more intense storms and weather extremes. Temperature rise is amplified in the Arctic, where it has contributed to melting permafrost and the retreat of glaciers and sea ice. Additional warming also increases the risk of triggering critical thresholds called tipping points. Impacts on ecosystems include the relocation or extinction of many species as their environment changes, most immediately in coral reefs, mountains, and the Arctic. Human impacts include undernutrition and hunger from reduced crop yields, declining fish stocks, increases in vector-borne diseases, potentially severe economic impacts, increased global economic inequality, more people living in uninhabitable climate zones, and increased migration. Effects such as these have led the World Health Organization to declare climate change the greatest threat to global health in the 21st century. Even if efforts to minimize future warming are successful, some effects will continue for centuries, including rising sea levels, rising ocean temperatures, and ocean acidification.

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## Introduction:-

Global warming became the most popular term after NASA climate scientist James Hansen used it in his 1988 testimony in the U.S. Senate. In the 2000s, the term climate change increased in popularity. Global warming usually refers to human-induced warming of the Earth system, whereas climate change can refer to natural as well as anthropogenic change. The two terms are often used interchangeably. Various scientists, politicians and media figures have adopted the terms climate crisis or climate emergency to talk about climate change, while using global heating instead of global warming. The policy editor-in-chief of The Guardian explained that they included this language in their editorial guidelines "to ensure that we are being scientifically precise, while also communicating clearly with readers on this very important issue". Oxford Dictionary chose climate emergency as its word of the year in 2019 and defines the term as "a situation in which urgent action is required to reduce or halt climate change and avoid potentially irreversible environmental damage resulting from it". Patterns of warming are independent of where greenhouse gases are emitted, because the gases persist long enough to diffuse across the planet; however, localized black carbon deposits on snow and ice do contribute to Arctic warming. Since the pre-industrial period, global average land temperatures have increased almost twice as fast as global average surface temperatures. This is because of the larger heat capacity of oceans, and because oceans lose more heat by evaporation. Over 90% of the additional energy in the climate system over the last 50 years has been stored in the ocean, warming it<sup>1</sup>. The remainder of the additional energy has melted ice and warmed the continents and the atmosphere. The Northern Hemisphere and North Pole have warmed much faster than the South Pole and Southern Hemisphere. The Northern Hemisphere not only has much more land, but also more snow area and sea ice, because of how the land masses are arranged around the Arctic Ocean. As these surfaces flip from reflecting a lot of light to being dark after the ice has melted, they start absorbing more heat. The Southern Hemisphere already had little sea ice in summer before it started warming<sup>2-3</sup>. Arctic temperatures have increased and are predicted to continue to increase during this century at over twice the rate of the rest of the world. Melting of glaciers and ice sheets<sup>4</sup> in the Arctic disrupts ocean circulation, including a weakened Gulf Stream, causing increased warming in some areas.

## Aerosols and Clouds

Air pollution, in the form of aerosols, not only puts a large burden on human health, but also affects the climate on a large scale<sup>5</sup>. From 1961 to 1990, a gradual reduction in the amount of sunlight reaching the Earth's surface was observed, a phenomenon popularly known as global dimming<sup>6</sup>, typically attributed to aerosols from biofuel and fossil fuel burning. Aerosol removal by precipitation gives tropospheric aerosols an atmospheric lifetime of only about a week, while stratospheric aerosols can remain in the atmosphere for a few years. Globally, aerosols have been declining since 1990, meaning that they no longer mask greenhouse gas warming as much. In addition to their direct effects (scattering and absorbing solar radiation), aerosols have indirect effects on the Earth's radiation budget. Sulphate aerosols act as cloud condensation nuclei and thus lead to clouds that have more and smaller cloud droplets<sup>7</sup>. These clouds reflect solar radiation more efficiently than clouds with fewer and larger droplets. This effect also causes droplets to be more uniform in size, which reduces the growth of raindrops and makes clouds more reflective to incoming sunlight<sup>8</sup>. Indirect effects of aerosols are the largest uncertainty in radiative forcing. While aerosols typically limit global warming by reflecting sunlight, black carbon in soot that falls on snow or ice can contribute to global warming<sup>9</sup>. Not only does this increase the absorption of sunlight, it also increases melting and sea-level rise. Limiting new black carbon deposits in the Arctic could reduce global warming by 0.2 °C (0.36 °F) by 2050.

## Land Surface Change

Humans change the Earth's surface mainly to create more agricultural land. Today, agriculture takes up 34% of Earth's land area, while 26% is forests, and 30% is uninhabitable (glaciers, deserts, etc.). The amount of forested land continues to decrease<sup>10</sup>, largely due to conversion to cropland in the tropics<sup>11-12</sup>. This deforestation is the most significant aspect of land surface change affecting global warming<sup>13-14</sup>. The main causes of deforestation are: permanent land-use change from forest to agricultural land producing products such as beef and palm oil (27%), logging to produce forestry/forest products (26%), short term shifting cultivation (24%), and wildfires (23%).

In addition to affecting greenhouse gas concentrations, land-use changes affect global warming through a variety of other chemical and physical mechanisms. Changing the type of vegetation in a region affects the local temperature, by changing how much of the sunlight gets reflected back into space (albedo), and how much heat is lost by evaporation. For instance, the change from a dark forest to grassland makes the surface lighter, causing it to reflect more sunlight. Deforestation can also contribute to changing temperatures<sup>15</sup> by affecting the release of aerosols and other chemical compounds that influence clouds, and by changing wind patterns<sup>16</sup>. In tropic and temperate areas the

net effect is to produce a significant warming, while at latitudes closer to the poles a gain of albedo (as forest is replaced by snow cover) leads to an overall cooling effect. Globally, these effects are estimated to have led to a slight cooling, dominated by an increase in surface albedo<sup>17-18</sup>.

### Solar and Volcanic Activity

Physical climate models are unable to reproduce the rapid warming observed in recent decades when taking into account only variations in solar output and volcanic activity<sup>19</sup>. As the Sun is the Earth's primary energy source, changes in incoming sunlight directly affect the climate system. Solar irradiance has been measured directly by satellites<sup>20</sup>, and indirect measurements are available from the early 1600s. There has been no upward trend in the amount of the Sun's energy reaching the Earth. Further evidence for greenhouse gases being the cause of recent climate change come from measurements showing the warming of the lower atmosphere (the troposphere), coupled with the cooling of the upper atmosphere (the stratosphere). If solar variations were responsible for the observed warming, warming of both the troposphere and the stratosphere would be expected, but that has not been the case.

Explosive volcanic eruptions represent the largest natural forcing over the industrial era. When the eruption is sufficiently strong (with sulphur dioxide reaching the stratosphere) sunlight can be partially blocked for a couple of years, with a temperature signal lasting about twice as long. In the industrial era, volcanic activity has had negligible impacts on global temperature trends. Present-day volcanic CO<sub>2</sub> emissions are equivalent to less than 1% of current anthropogenic CO<sub>2</sub> emissions.

### Conclusion:-

The changing pattern of world in terms of habitation, civilization and development has posed certain significant threats on the climate the urbanisation . the green house gas concentration , land use pattern, the industrialization , the human induced warming in the earth system are the major reasons for the emerging and spreading climate change all across the globe. Various scientists, politicians and media figures have adopted the terms climate crisis or climate emergency to talk about climate change, while using global heating instead of global warming. Temperature rise on land is about twice the global average increase, leading to desert expansion and more common heat waves and wildfires. Increasing rates of evaporation cause more intense storms and weather extremes.

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