

Climate Change: A Global Issue

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Abstract

Our Earth's climate has transformed throughout history. Climate change is a complex process and it is believed that if we do not firmly curb it now, there are going to be catastrophic consequences. There have been several cycles of glacial advance and retreat. An overwhelming scientific consensus maintains that climate change is primarily because of the human usage of fossil fuels, which releases CO₂ and other greenhouse gases into the atmosphere. The gases trap heat within the atmosphere, which can have a range of effects on ecosystems, including rising sea and ocean levels, severe weather events, and droughts that render landscapes more susceptible to wildfires. This review brings an insight into the different causes and effects of the climate change and why we must act immediately to safeguard our planet called Earth.

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INTRODUCTION

Climate change has become the greatest environmental threat in present time, jeopardizing human health, communities, economy, and national security. Climate change is a complex phenomenon that is affecting our health, community and national economy in diverse ways. Its full-scale impact is difficult to understand and predict far in advance. However, based on every year's report, scientists warn that if we do not firmly curb climate change now, the consequences are likely to be disastrous. But, the irony is that only few people are aware of how it can affect them. Children, the elderly, and communities living in poverty are among the most vulnerable.

Climate change, together with Global warming, refers to an increase in average global temperatures. Natural events and human activities are believed to contribute to increase in average global temperatures. A warming planet leads to a change in climate which can thereby affect weather

in various ways- many places will be hotter, some wetter, others drier. Climate change has resulted in the rising seas, raging storms, searing heat, ferocious fires, severe drought, and punishing floods. In 2010, according to the US agency, the National Oceanic and Atmospheric Administration (NOAA), year 2005 was considered to be the warmest on record. Scientists from different research groups in 48 countries confirm that the past decade was the warmest on record and that the Earth has been growing warmer over the last 50 years.^[1] It is likely that the earth could warm by an additional 7.2 degrees Fahrenheit during the 21st century if we fail to reduce emissions from burning fossil fuels, such as coal and oil. This rise in average temperature will have far-reaching effects on the earth's climate patterns and on all living beings. Many of these changes have already begun. The NOAA has suggested 7 climate indicators that are expected to increase while 3 are likely to decrease in a warming world.^[2] Those expected to increase include: ocean

heat content, sea surface temperature, sea level, temperature over oceans, humidity, tropospheric temperature, and temperature over land. Among the indicators likely to decrease are the sea ice level, glaciers, and snow cover (Figure 1).

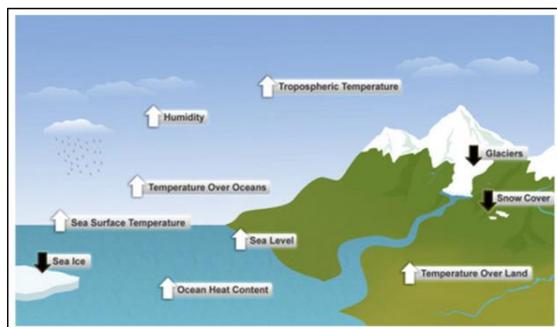


Fig. 1. Climate Indicators Expected to Change in the Warming World.^[2]

Our planet has warmed by an average of nearly 1°C in the past century. This might not sound much, but on a global scale it's a huge increase and it's creating big problems for people and wildlife. A rise of even 2°C is expected to bring devastating effects that include severe storms and floods in some areas while droughts in other countries. Seas would become more acidic, as a result of which coral and krill would die and food chains destroyed. Arctic sea ice would also be effected such that there will be little or no ice in summers. Scientists predict a possible rise of upto 6°C this century, if the greenhouse gas emissions are not stopped immediately. This will lead to rainforests dying, increased melting of the ancient ice sheets of Greenland and Antarctica, dramatic sea level rises, and people and animals suffering along the way.

CAUSES OF CLIMATE CHANGE

In order to protect our earth from the devastating consequences of climate change and ensure its safety, it is important to understand the factors behind this change. These include:

- (i) **Burning fossil fuels:** In past 150 years, the world's industrialized nations have altered the balance of the carbon cycle

by burning large amounts of fossil fuels, including concentrated carbon such as coal, oil and gas.

- (ii) **Breeding cattle and cutting down forests:** Industrialized nations have also breeding vast numbers of methane-producing livestock and cutting down the forests that naturally absorb CO₂ from the air.
- (iii) **Trapped CO₂:** The extra carbon dioxide in the atmosphere traps more of the sun's heat, so it's been raising global temperatures. The speed of change has been faster than any natural process, and faster than many natural systems can adapt.

EFFECTS OF CLIMATE CHANGE

The Intergovernmental Panel on Climate Change has warned that: "The impacts of climate change in the polar regions over the next 100 years will exceed impacts forecast for other regions, and will have globally significant consequences." Effects of climate change include:

Melting of Glaciers and Ice Sheets

One of the most pronounced effects of climate change has been melting of masses of ice across the world. Glaciers and ice sheets are large, slow-moving assemblages of ice that covers 10% of the world's land area and are also the world's largest reservoir, holding approximately 75% of fresh water.^[3] Glaciers are retreating almost everywhere around the world-including in the Alps, Himalayas, Andes, Rockies, Alaska and Africa (National Snow and Ice Data Center World Glacier Monitoring Service) (Figure 2). Both the extent and thickness of Arctic sea ice has declined rapidly over the last several decades.^[4,5] Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and that the snow is melting earlier.^[6,7]

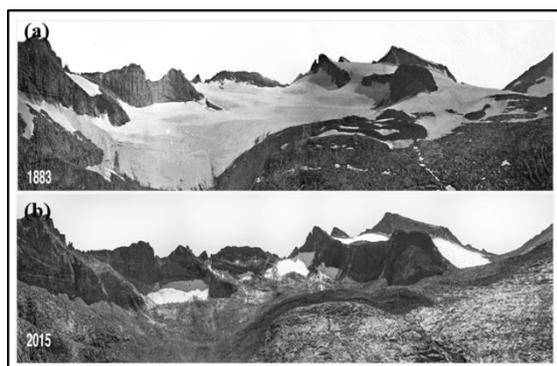


Fig. 2. Depiction of Decreased Snow-Cover in Last 20 Years.

The melting back of the glaciers and ice sheets has two major impacts. First, areas that rely on the runoff from the melting of mountain glaciers are very likely to experience severe water shortages as the glaciers disappear. Less runoff will lead to a reduced capability to irrigate crops as freshwater dams and reservoirs more frequently go dry. Also, glacial runoff is used to power hydroelectric plants, sustain fish runs and irrigate crops as well as to supply the needs of large metropolitan areas. As the volume of runoff decreases, then the energy, urban, and agricultural infrastructures of such locations are likely to be stressed.

Ocean and Sea Level Rise

Global sea level rose about 17 cm (6.7 inches) in the last century. The rate in the last decade, however, is nearly double that of the last century.^[8] There are 3 major processes by which climate change directly affects sea level. As the temperature increases, (*i.e.*, its density goes down as temperature rises), warming climate causes seawater to expand contributing to sea level rise due to thermal expansion. Scientists have determined that due to thermal expansion, global sea level has been steadily rising since 1900 at a minimum rate of 0.04 to 0.1 inches/year.^[9] The oceans have absorbed much of this increased heat, with the top 700 m (about 2300 feet) of ocean showing warming of 0.302° Fahrenheit

since 1969.^[10] A second, and less certain, contributor to sea level rise is the melting of glaciers and ice caps. IPCC's Fourth Assessment estimated that, during the second half of the 20th century, melting of mountain glaciers and ice caps led to about a 2.5 cm rise in sea level. The third process that can cause sea level to rise is the loss of ice mass from Greenland and Antarctica. Were all the ice on Greenland to melt, a process that would likely take many centuries to millennia, sea level would go up by roughly 7 meters. While there are obviously many challenges to projecting future sea level rise, even a seemingly small increase in sea level can have a dramatic impact on many coastal environments. With sea level projected to rise at an accelerated rate for at least several centuries, very large numbers of people in vulnerable locations are going to be forced to relocate. If relocation is delayed or populations do not evacuate during times when the areas are inundated by storm surges, very large numbers of environmental refugees are likely to result. Species that rely upon the existence of sea ice to survive are likely to be especially impacted as the retreat accelerates, posing the threat of extinction for polar bears, seals, and some breeds of penguins.

Ocean Acidification

Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30%.^[11,12] This increase is the result of humans emitting more carbon dioxide into the atmosphere and hence more being absorbed into the oceans. The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing by about 2 billion tons per year.^[13] Each year, oceans absorb nearly one-third of human emissions of carbon dioxide (CO₂), transferring most of it to the deep ocean. Over the past 200 years, the increasing CO₂ emissions from fossil fuel combustion

have led to an exponential increase in the net amount of CO₂ being dissolved in the ocean. Dissolved CO₂ creates carbonic acid, which reduces the ocean pH level, making it more acidic. The most direct impacts of ocean acidification will be on marine ecosystems. A decrease in ocean pH would affect marine life by lowering the amount of calcium carbonate (the substance created when CO₂ is initially dissolved) in the water, the substance required to build their shells. Such a decrease would put the productivity and even the survival of thousands of marine species at risk.^[14] To prevent the rapid acidification of the ocean and hold the pH level within an acceptable range for marine life, the atmospheric CO₂ concentration needs to be kept below no more than about 450 parts per million (ppm).

Thermohaline Circulation

Another impact of glacial retreat is the possible effect fresh melt water will have on the thermohaline circulation. Driven by density gradients in ocean waters, the thermohaline (or deep ocean overturning) circulation is made up of the global flow of ocean currents. Because both temperature and salinity are influenced by changes in the climate, there are concerns about the ways in which the thermohaline circulation might be affected.^[15]

Global Temperature Rise

Our Earth is getting warmer, whether the cause is human activity or natural calamities. All three major global surface temperature reconstructions show that Earth has warmed since 1880. According to an ongoing temperature analysis conducted by scientists at NASA's Goddard Institute for Space Studies (GISS), the average global temperature on Earth has increased by about 0.8° Celsius (1.4° Fahrenheit) since 1880. Two-thirds of the warming has occurred since 1975, at a rate of roughly 0.15–0.20°C per

decade.^[16] Reports say that 20 warmest years having occurred since 1981 and with all 10 of the warmest years occurring in the past 12 years.^[17] Even though the 2000s witnessed a solar output decline resulting in an unusually deep solar minimum in 2007–2009, surface temperatures continue to increase.^[18–20]

NEED TO ACT NOW!

Instead of stepping on or easing off the accelerator, we need to be slamming on the brakes. We must not only slow the rise of CO₂ levels in the atmosphere, instead we must reverse it. We must start putting efforts to reduce CO₂ from 390 to 350 ppm right from now. That should stop the planet's accumulation of heat. Stabilizing the CO₂ level will require rapidly reducing CO₂ emissions until nature can absorb carbon faster than we emit it – in practical terms, cutting emissions to nearly zero.

In view to achieve a “climate-safe” future, it is required to implement the following:

- (i) Encouraging a new international climate pact: The pact to be implemented should be unprejudiced and legally binding.
- (ii) Sponsoring energy efficiency: This is the most rapid and cost-effective way to reduce CO₂ emissions.
- (iii) Promoting renewable energy sources: Such as wind, solar and geothermal power.
- (iv) Stopping greenhouse gas emissions from deforestation: Currently responsible for 20% of all emissions.
- (v) Developing and promoting climate change adaptation strategies: This will safeguard the most vulnerable people and the most exposed ecosystems.

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