# In Depth – Melting Himalayas

Ice protects the Earth and oceans by reflecting excess heat back into space. However, human activity, especially since the industrial revolution has led to rapid global warming and consequently climate change. This human-caused climate change is already being seen around the world, in the form of extreme weather, shifting wildlife populations and habitats, extinction of a large number of species from the planet and a range of other impacts.

**One of the most dramatic evidence that Earth's climate is warming rapidly is the dwindling disappearance of mountain glaciers around the world.** Scientists have observed that glaciers in two parts of the world - Antarctica and Asia - have been impacted to a large extent by rising temperatures.

A recent study has revealed that Himalayan glaciers are melting twice as fast now as they were before the turn of the century. The figure is double the amount of melting that took place from 1975 to 2000. **Scientists have warned that even if the world significantly curbs emissions in the coming decades, more than a third of the world's remaining glaciers will melt before the year 2100.**

## Himalayan Glaciers

- The Himalayan Mountains are the **third largest deposits of ice** and snow in the world after Antarctica and the Arctic.
- **Spanning 2,000 Kms and with 600 billion tonnes of ice,** the Himalayan glaciers supply 800 million people with water for irrigation, hydropower and drinking.
- More than 750 million people in India, Pakistan and Bangladesh get their water from rivers that originate from the Himalayan glaciers, that is more than twice the population of the United States getting its water from a singular source.
    - **The Gangotri glacier,** one of the largest in the Himalayan mountains, is the **source of the river Ganga,** the most important source of freshwater and electricity in India and Bangladesh.

## Monsoon and Indian Glaciers

- **Glaciers depend on heavy precipitation to replenish ice on an annual basis,** but, if **monsoons** are disrupted, ice is depleted. As the glaciers melt, rivers flood, with the flooding of rivers, people, crops and livestock get drowned and hydroelectric plants are disrupted.
- Also, **weaker monsoons** mean less rainfall for the country as a whole that invariably leads to **drought and desertification of land.**

## Present Situation of Himalayan Glaciers

The latest study published in the Journal Science Advances, is the latest indication that climate change is eating up the Himalayan Glaciers. Authors of the study analyzed four decades of ice lost for 650 glaciers in the Himalayas and they found that :

- Between the years 1975 to 2000, an average of four billion tonnes of ice were being lost each year and between the years **2000 to 2016**, glaciers melted approximately twice as fast implying that Himalayan glaciers **lost about 8 billion tonnes of ice each year** on an average during this

period.

- Since the **year 2000**, glaciers have been **shrinking at an average of 0.5 meters per year.**
- Of the total ice mass present in the year 1975, about 87% remained in the year 2000 and 72% remained in the year 2016.
- The study also asserted that **rising temperatures are responsible** for the accelerated loss of ice and thus is threatening the water supplies of hundreds of millions of people downstream across much of Asia.
    - **The temperature in the region has risen 1 degree celsius higher than those from 1975 to 2000.**
- Other factors are **changes in rainfall** with reductions tending to reduce ice cover and the **burning of fossil fuels** which lead to a clog over snowy glaciers absorbing sunlight and dramatically increasing the melting rate of ice.

## Reasons for the Melting of Glaciers

- Since the early 1900s, many glaciers around the world have been rapidly melting. **Human activity is at the root of this phenomenon.**
    - Since the industrial revolution, **carbon dioxide and other greenhouse emissions** have raised temperatures even at the poles.
    - Scientists project that if emissions continue to rise unchecked, the Arctic could be ice free in the summer by the year 2040.
- The primary reason for melting glaciers is **climate change,** especially global warming.
- **Local air pollution as well as infrastructure building in the mountains** also has a small contribution.
    - In recent years the temperature has been rising in the Himalayas because of the land use.
    - Many concrete buildings have been erected on hill stations, vehicles are going in the hill stations, these factors have disturbed the ambience of the glaciers and this has caused the melting to be faster than what it was earlier.
- Human activities that have led to melting of ice glaciers are:
    - **Burning of fossil fuels** that result in the buildup of greenhouse gases thus influencing the warming trend because they trap heat in the atmosphere.
    - **Oil and gas drilling** that emits methane. Methane is more damaging to the environment than carbon dioxide, locking in heat more efficiently and escalating global warming.
    - **Deforestation** has a lot of negative effects like rise in sea levels.
    - **Ice breaking ships** that head to the north in the Arctic ocean during summer. The broken ice has lesser ability to reflect back the sun rays, which means that water takes in more heat, this results in hotter water and consequently more ice melting.
    - **Anything that uses energy** like industries, power plants, transport system and emits carbon dioxide, contribute to climate change or glacial melt.

### Climate Change due to Global Warming

- Several decades ago in the year 1975, **an economist Dr. William Nordhaus** saw the warming planet as a threat to the global economy. He said an increase in the global average temperature of 2 degree celsius caused by man made carbon dioxide would change the world climate in ways not seen in several thousand years and over the decades the world has indeed witnessed rapid changes resulting from global warming.
- According to a temperature analysis conducted by scientists at NASA's Goddard Institute for Space Studies, **the average global temperature on the Earth has increased about by 0.8 degree celsius since the year 1880**, the earliest year for which reliable instrumental records are available worldwide.
    - Two-thirds of the warming has occurred since 1975, at a rate of roughly 0.15 to 0.20 degree celsius per decade.
    - **The year 2015 was the first year in which the global annual average surface temperature reached 1 degree celsius above the pre industrial level.** Each year, since then, the global average has however close to or above the one degree celsius mark.
    - The temperature rise may appear small in number but it has brought about vast changes in the world climate. Even the one degree global change is significant because it takes a vast amount of heat to warm all the oceans, atmosphere and land by that much.

- Scientists believe that the increased volumes of carbon dioxide and other greenhouses released by the **burning of fossil fuels, land clearing and agriculture and other human activities are the primary sources of global warming** that has occurred over the past 50 years and by the year 2100, it is predicted that average global temperature could increase between 1.4 and 5.8 degree celsius.
- The decade from the years 2014 to 2023 has also been predicted to be the warmest in more than 150 years of record keeping.

**Impact of Climate Change and Global Warming**

- **Ice is melting worldwide, especially at the North and the South Poles.** This includes mountain glaciers and ice sheets covering Antarctica and Greenland and the Arctic Sea ice. For example, in Montana's Glacier National Park, the number of glaciers has declined to fewer than 30 from more than 150 in the year 1910.
- **The melting ice contributes to rise in sea level.**
    - Scientists say that global sea levels are rising 0.13 inches every year.
    - The rise has been rapid in recent years and has threatened low-lying islands and coastal cities.
- **Rising temperatures are affecting wildlife and habitats.** Melting glaciers and vanishing ice has made survival of certain species difficult pushing them towards extinction.
    - Scientists say that oceans have absorbed most of the extra heat and carbon dioxide even more than the earth, making the seas both warmer and more acidic.
    - Warmer waters are bleaching coral reefs and driving stronger storms.
    - **Rising ocean acidity threatens shellfish, including the tiny crustaceans without which marine food chains would collapse.**
- The world is witnessing **more frequent and extreme weather events** like bushfire, cyclones, droughts and floods.
- Climate change is a **major threat to agriculture.** Where, how and when farmers grow food is vitally connected to climate's normal pattern.
    - Farm yields are more likely to face attacks from weeds, diseases and pests.
- A warmer atmosphere is also increasing the **formation of ground level ozone, also known as** Smog **in polluted regions.**

**What if rising temperatures are not contained?**

- Sea levels could rise between 10 or 32 inches or higher by the end of the century.
- Hurricanes and other storms are likely to become stronger, floods and drought will become more common and the world faces risk of decades long mega drought by the year 2100.
- Less fresh water will be available since glaciers store about three quarters of the world's freshwater.
- **Waterborne diseases** will spread to vast areas and there could be a resurgence of Zika Virus.
- Ecosystems will continue to change, some species may venture farther more while some others who are unable to adapt could become extinct.

**Step Taken**

- The United Nations signed the Paris Agreement **in 2016**, an international treaty designed to keep the average global temperature well below 2 degree celsius above pre-industrial levels.

## Importance of Glaciers

- Glacial till or unsorted glacial sediment **provides fertile soil** for growing crops.
- Deposits of sand and gravel are used to make concrete and asphalt.
- The most important resource provided by glaciers is **freshwater**. Many rivers are fed by the melting ice of glaciers.
- Glacials are also responsible for **digging basins for most of the world's lakes** and carve much

of the **earth's mountain scenery.**
    - The dramatic diverse landscape of Yosemite Valley, California was sculpted entirely by glaciers during the last ice age.
- **Ice acts like a protective cover over the Earth and oceans.** It reflects excess heat back into the space and keeps the planet cooler.
- Glaciers can range from several hundred to several thousand years old and thus **provide a scientific record of how climate has changed overtime.**

## Impact of Melting of Glaciers

- **Extreme flooding,** resulting in an abrupt rise in water input to other water bodies like rivers, lakes and seas.
- Melting glaciers are causing a **loss of biodiversity** and also animals are losing homes.
    - Rising water temperatures and water levels affect fish and aquatic plants which in turn affects birds that rely on them.
    - Coral reefs that need sunlight for photosynthesis are also affected when water levels increase and block sunlight from reaching them.
    - Fish species that depend on corals for food are killed due to loss of their food.
- **Absence of glaciers will lead to drought and desertification of land.**
- **Recontamination of the environment:** A lot of chemical pollutants and pesticides that become airborne get deposited in chilly places with glaciers. The rapid melting of glaciers is now discharging them back into water bodies.
- **Economic costs** of melting glaciers affect the whole world. Each continent is experiencing flooding and other glacial related disasters that require huge intervention and financial capital to mitigate.
- Reducing glaciers is also causing a **scarcity of freshwater** that is worsening with **rising population**.
- Rapid glacial melt in Antarctica and Greenland **influences ocean currents.** A massive amount of very cold glacial melt water entering warmer oceans water slows down ocean currents.
- If glaciers melt, fixed deposit of snow goes down, thus causing **drying of the springs.**
- Lastly, the melting glaciers is **accelerating global warming** as other formations on the Earth are not able to deflect as much heat as glaciers.

## Solutions

- In order to stop the temperature from rising, the only solution is to **cool the planet** as advised by the scientists. For this, the world not only needs to **slow down greenhouse gas emissions but also reverse them.**
- There are 1,98,000 glaciers in the world and India alone has about 9,000 of them. However, all of these glaciers are mostly unexplored. **More detailed research is required to fully understand the state of glaciers and the risk their loss poses.**