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Review Article

Polar Ice Caps Melting- A Hallmark to Vanishing Ice along with a Global Climate Change- and Addressing Solutions to it

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Abstract

There is a firm evidence that polar ice-caps are, in places, swiftly melting. This is both in response to emergence from the last ice age but also ongoing rises in atmospheric carbon dioxide. In the Arctic and the Antarctic Peninsula the number of glaciers retreating and retreat rates are increasing and there is much consensus on some effects of this on biodiversity. Ice reduction is leading to new sea- ways, and habitat for ice associated organisms is regionally dying out.

More light and heat will get entrance into the water column, increasing primary productivity and sinks for CO_2. Melt water flow into seas is causing freshening, stratification, and near-shore sedimentation. These factors negatively influence on biodiversity by clogging and burying the plankton eaters living on the seabed.

Changes in water-mass properties and current dynamics will influence the deeper communities of animals, even the deep sea by, for example, by carrying less oxygen. Such processes will make polar regions more susceptible to invasive species. Losing Antarctic species is a loss to global biodiversity and

some evidence suggests particular sensitivity to environmental aspects.

Keywords: Temperature alteration pattern; Global warming and sea-rise; Black aerosols; Third-polar ice; Biodiversity impact

1. Introduction

The expression "polar ice cap" to be one thing of a name, because the term ‘ ice cap’ itself is applied to all the barely bodies that square measure over land, and canopy underneath fifty thousand km2 with larger bodies square measure alluded to as ice sheets [1]. The structure of the ice can fluctuate. For example, Earth's pole covers square measure principally water ice, although Mars' polar ice covers square measure a mix of robust carbonic acid gas and water ice [2]. Polar ice covers structure since high-scope regions get less energy as sun oriented radiation from the Sun than central districts, conveyance regarding lower surface temperatures. Earth's polar covers have modified drastically throughout the foremost recent twelve thousand years.

Occasional types of the ice covers happens owing to shifted sun high-powered energy bodily process because the planet or moon rotates round the Sun. what is more, in geological time scales, the ice covers might develop or contract owing to setting selection [3].

2. Importance of Polar Ice Caps

Cold ocean ice keeps the polar areas cool and helps moderate worldwide atmosphere. Ocean ice contains a splendid surface; eightieth of the daylight that strikes it's mirrored once more into house. As ocean ice softens within the middle year, it uncovered the dim ocean surface. Instead of reflective eightieth of the daylight, the ocean retains ninetieth of the daylight.

As per logical estimations, each the thickness and degree of summer, ocean ice within the Icy have shown a sensational decay within the course of recent years. This is often in keeping with perceptions of a warming Cold. The deficiency of ocean ice in addition will presumably quicken a worldwide temperature alteration patterns and to alter atmosphere styles [4]. Ice sheets are important markers of associate degree Earth-wide temperature boost and environmental modification severally. Softening ice sheets raise rising ocean levels. The deficiency of frosty ice likewise diminishes the live of latest water accessible for plants and creatures that require new water to endure [5].

3. Difference between Polar Ice Caps and Glaciers

While the facts demonstrate that the two ice sheets and ice floes are huge masses of ice that can be found in cold districts, there is a significant contrast between them. Fundamentally, ice sheets begin ashore, and ice floes structure in vast water and are a type of ocean ice [6]. Glacial masses are shaped by the recrystallization of day off other strong precipitation that doesn't altogether soften, in any event, during dissolving season. The fallen snow packs over numerous years (at a rate that relies upon temperature and wetness) into ice. A glacial mass may likewise acquire mass from the refreezing of meltwater at its base.

Despite the fact that glacial masses are taken care of essentially by snowfall, they may likewise develop because of freezing of downpour, hail, hoarfrost, and rime; torrential slides may contribute snow to an icy mass also. Ice sheets are found in Cold territories, Antarctica, and on high mountains in mild and even heat and humidity. Icy masses that stretch out in ceaseless sheets and cover a huge landmass, like Antarctica or Greenland, are called ice sheets [7]. In the event that they are comparable however more modest, they are named ice covers. Icy masses kept to a way that coordinates their developments are mountain ice sheets, those that spread on level ground at the foot of a glaciated area are piedmont glacial masses, and those that spread from a glaciated district onto the sea are ice racks [8].

Ice floes, then again, are made of frozen seawater. In quiet conditions, a soupy suspension of precious stones assembled frazil sticks to shape sheets and afterward keeps on developing by a base freezing measure named congelation. Under more tempestuous conditions, frazil precious stones gather into flapjacks. As they develop, they thicken and stack on top of each other, in the long run shaping ice floes. Ice floes are genuinely portable and float about on the sea's surface. The organization and life pattern of ice floes in the Antarctic Sea are unique in relation to those in the Cold Sea [9].

4. Causes of Polar Ice Caps Melting

Polar ice caps and glaciers have been melting slowly due to various reasons; the climate change being the main reason. Some of the main reasons for shrinking of ice caps are described below:

1. Burning of fossil fuel
2. Increase in deforestation
3. Oil and gas drilling
4. Ships breaking the ice bergs
5. Ocean warming

4.1 Burning of fossil fuel

The heat that is produced during burning of the fuels like coal, gas and oil cause the melting of the ice caps. It has been studied that at this rate the melting of the Antarctic ice will cause the sea level to rise up to 50m. This rise in sea level can be prohibited if global warming is restricted or controlled. The greenhouse gases have already caused a lot of damage to the ice caps, hence there should be some other fuels used that are less harmful.

4.2 Increase in deforestation

Deforestation has a lot of adverse affects, one of the effects is the increase in melting of ice caps with deforestation. The effect lies in the fact that as more and more trees are cut down, clear landforms are formed which alters the wind speed and also indirectly links with the precipitation. Thus, deforestation leading to climatic disturbances ultimately shrink the ice caps faster. For example, the effects of deforestation have been evaluated for Mount Kilimanjaro [10]. Global warming plays an important role in the whole process of shrinkage of the ice caps.

4.3 Oil and gas drilling

The process of extraction of oil and gas and other fuels result in the release of methane. Methane has heat locking ability and increases global warming. It is more hazardous for the environment than carbon dioxide. Hence, with rise in global warming the

glaciers start melting.

4.4 Ships breaking the ice bergs

According to NSIDC (National Ice and Ice Data Center) the shipwrecks and accidents of the ships with the large icebergs can also lead to shrinking of the ice caps. Any icebreaker cruising into the large pieces of ice exposes more surface area of the glaciers to the sun and hence contributes to melting.

4.5 Ocean warming

The temperature of the oceans increases as they absorb almost 90% of the earth's warmth. This is the reason for the marine glaciers melting which are on the poles near Alaska.

5. Effects of Polar Ice Caps Shrinking

The melting of polar ice caps has impacts on various fields of biodiversity and ecology. Some of the effects are described below:

5.1 Increase in global mean temperature

The anthropogenic global warming has caused a lot of changes in the cryospheric elements like the Arctic ice sheets, the Greenland and the mountain glaciers. These changes can lead to increasing the global mean temperature GMT. On average the evaluated median additional global warming is 0.43 degrees Celsius [11].

5.2 Effect on carbon cycle

The carbon cycle is one of the most significant processes for keeping the ecological community alive. Recent studies have shown the icebergs as important factors in the continuation of this cycle. Thus the melting of ice caps has also affected the carbon cycle and may lead to drastic ecological changes [12].

5.3 Effect on the marine ecosystem

The polar ice caps and glaciers play a crucial role in maintaining the marine ecosystem and biodiversity. Their role extends to the sea temperature, circulation and sea ice formation. They impact the marine food webs which are dependent on the temperature and climate. Thus due to melting of these icebergs many problems are faced by the marine world [13].

5.4 Effect on wildlife

The ice caps are linked with a number of factors that affect the tundra wildlife. The sustainability depends on these ice caps so when they melt they affect herbivore populations, thaw-induced collapse of structures used by wildlife for reproduction, and thermal erosion of ice wedges reducing waterfowl habitat [14]. Glaciers are directly linked with the increasing sea levels. This is leading to a number of consequences causing problems for domestic lifestyle due to increased risks of floods, as well as the wildlife interrupting their usual migration cycles and other problems.

5.5 Effect on sea levels

The melting of ice caps increases the sea level casing problems for domestic lifestyle [15].

5.6 Scarcity of freshwater

Studies show that the melting ice caps continuously would result in less downstream of fresh water. Indus, Brahmaputra and Ganges basins—fed by High Mountain Asia glaciers are subjected to face loss of glacial water in the coming years. The fresh water availability will be ultimately affected [16] .

5.7 Effect on coral reefs

The sea level rises due to glacial melt which has a number of consequences. The coral reefs serve various benefits for the ecological sustenance. But they are sensitive to the fluctuating temperatures and heat shocks which they face due to the increasing global warming. Thus the melting of icebergs is also very harmful for the coral reefs.

5.8 Shortage of electricity

In major parts of the world, the electricity is dependent on the flowing water which comes from the gradually melting ice caps. But if this source is terminated there will be an energy crisis faced by the world. The production of electricity through other means can lead to pollution.

6. Statistical Analysis of Melting of Polar Ice

The polar ice caps are melting approximately six times faster than in 1990s. Most of the ice loss occurred in Antarctica and Greenland due to poor climatic conditions. Checking out the changes in polar glaciers and ice streams is a concerning task because they are an appreciable indicator of global environmental change. There is a survey done on polar ice by many organizations including radar altimetry (ICESat), SPOT 5 stereoscopic analysis of polar ice, International polar year project (IPY) [17].

YEARS	Average Arctic ice extent
1978	7.5 million square kilometers
1982	7.3 million square kilometers
1986	7.1 million square kilometers
1990	6.8 million square kilometers
1994	6.45 million square kilometers
1998	6 million square kilometers
2002	5.8 million square kilometers
2006	5 .5 million square kilometers
2010	5 million square kilometers [18]

Table : Statistical table.

In Greenland and Antarctica, in 1990s there was 81 billion metric tons loss of polar ice caps. In 2010, the loss arose to 475 billion metric tons

In 2002, Chunk of ice from the East side of Antarctic Peninsula broke.

Figure 1: Ice sheets melting and a threat to polar bears.

Figure 2: Polar ice caps melting is a threat to biodiversity.

7. Polar Ice Caps in 2020

A Siberian heat wave in spring 2020 caused the Arctic ice melting season coming earlier because of the high Arctic temperature 14 to 18 degrees Fahrenheit (8-10C). An analysis by NASA and National Snow and Ice Data Center suggests that 2020 minimum extent

is only 3.74 million square kilometers [19]. It is said by Nathan Kurtz, scientist at NASA's Goddard Space Flight Center in Greenbelt Maryland.

"The earlier the melt season starts, the more ice you generally lose"

8. Third Polar Ice

The Hindukush Himalaya is sometimes referred to as 'a third pole' because of the icy region it contains. Recent thinning of glaciers over the Himalayas has been a hot debate as these glaciers supply water to large river systems.

9. Black Aerosols

Black Carbon (BC) aerosols are released from incomplete combustion. They are badly affecting weather, temperature and hydrology. Black aerosol covers are also having an impact on snow cover.

In Himalayas, from 1990 to 2000 ice cover decreased by 0.9% due to aerosols. Due to Indian Black aerosol emission, this decline has reached to 36% [20].

10. Guliya Ice Cap

Guliya is a large ice cap found in the western Kunlun mountains on the Tibetan Plateau surrounded by 30-40 meter ice walls. Decreased precipitation rates in the Himalaya region is having disastrous effects of ice belts [21]. In this region, ice core of 6200m altitude has been reduced to 3080m.

11. Important Facts about Polar Caps

- The amount of water locked up in ice and snow is about 1.7% of all water on Earth, but the majority of total fresh water on Earth about 68.7% is locked up in ice caps [22]
- Polar ice caps are about 15 million years ago. However, certain scientists suggest that south polar ice cap was decayed so it is no more

than three million years ago

- Portions of ice caps melt and refreeze as the seasons change
- In the last 100 years. Melting ice has caused the sea level to rise upto 8 inches

12. Addressing Solutions

The Arctic ice cap decreases to a very small size in every September and then begins to regrow again. The extent of that dwindling is shrinking by 14% after every ten years. If there is less ice, more radiations from the Sun would be absorbed by open water and there would be only minute reflection back into the atmosphere. There, no ice would be formed therefore, the Arctic ice has reached beyond a "Tripping point".

- Giant walls and cooling tunnels are the best ways to save polar ice from melting
- Tunnels can be built under the ice through which the ice can be thickened and there would be least drainage into oceans and lakes
- By cooling hot bedrock underneath. There would be less friction and lesser heat to cause the ice to melt [23]
- Millions of tiny glass beads can be spread around the Arctic ice to reflect the sunlight away
- By cutting emissions from black aerosols, tropospheric ozone and hydrofluorocarbons
- Combined artificial icebergs can be created by collecting water from melting glaciers, removing salt from it and placing the frozen icebergs around the polar ice caps

13. Conclusion

Different conventional methods should be applied to stop an environment from being degraded. The Arctic region is highest vulnerable to high temperatures than any other place in the world due to which polar ice caps are getting melted. Animals dependent on ice-habitats like polar bears, Arctic seals and walruses are threatened. Polar ice caps help fight against global warming but there is a time to enact because global warming is now actually hunting for the ice caps. The environment around the polar ice caps is a 'driller's nightmare' and there is a huge threat to ice to be completely melted. Ice melting is also having an impact on economy as the industries are affected as well. So, there should a strong eye kept on the issue of polar ice melting so that there would be a least impact on climate as well as victims.

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