Perspective: World Water Day 2025 | Glacier Preservation & Water Management

For Prelims: World Water Day, Glaciers, Global Warming, Climate Change, Water Cycle, Sea level Rise, Ganga, Brahmaputra, Indus, Permafrost Thaw, Glacial Lake Outburst Floods.

For Mains: Importance of Glaciers, Impact of Climate Change on Glaciers

What is the Context?

World Water Day, celebrated annually on 22nd March, focuses attention on important global water issues. This year, the **theme highlights glaciers,** one of the most critical ecosystems. Glaciers and ice sheets, which store around **70% of the world's freshwater,** play an essential role in global water consumption and security. However, these glaciers are **melting at an accelerating rate** due to rising global temperatures.

What is the Importance of Glaciers?

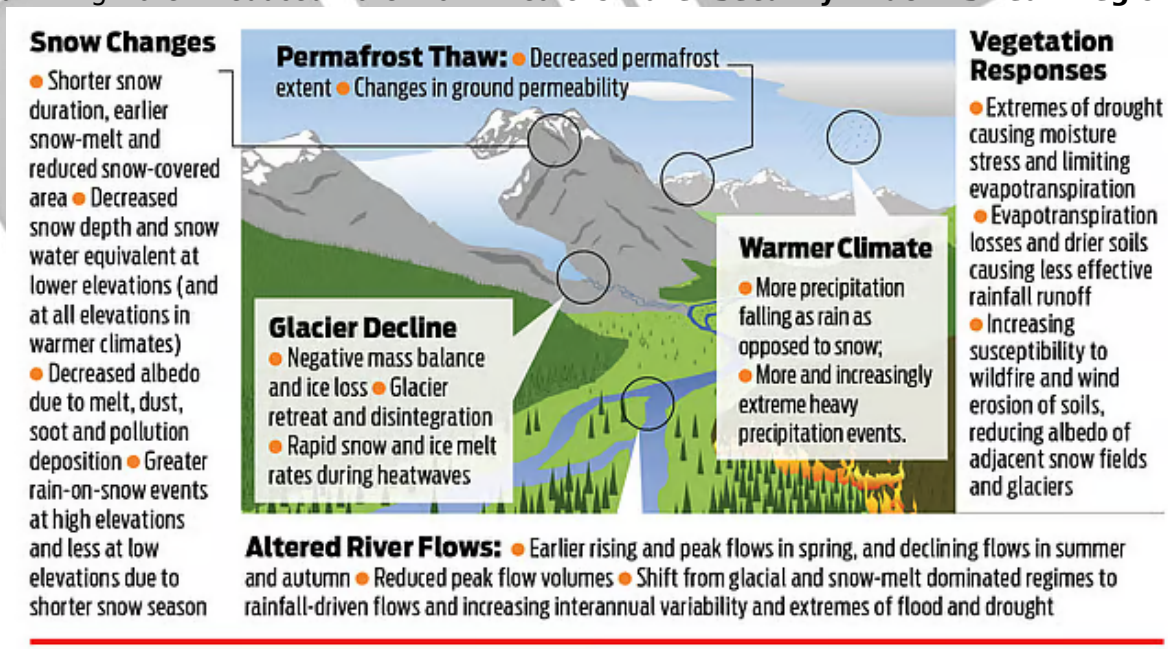
- **About:**
  - A glacier is an **accumulation of ice and snow** that slowly flows over land. At higher altitudes, **more snow usually falls** than melts, which increases its amount.
  - Eventually, the surplus of built-up ice begins to flow downhill. At lower elevations, there is usually a **higher rate of melt** or icebergs break off that removes ice mass.
  - Glaciers are primarily located in polar regions like Greenland, the **Canadian Arctic**, and Antarctica due to low solar insolation in higher latitudes.
  - Tropical glaciers are found in high-altitude mountain ranges near the **Equator,** such as the **Andes** in **South America.**
  - **Around 2% of Earth's total water** is stored in glaciers.
  - Glaciers **also exist on the fringes of ice sheets**. Around 20,000 years ago, during the **Last Glacial Maximum** (the time when Earth's ice sheets were at their largest), the Laurentide Ice Sheet covered much of North America. The weight of the ice formed basins that later filled with water to become the Great Lakes.
  - Glaciers are called the **water towers of the world,** feeding rivers like the Ganga, Brahmaputra, and Indus, which support agriculture, hydropower, and drinking water for vast populations.
  - The World Glacier Monitoring Service (WGMS), which tracks 210,000 glaciers, has recorded significant deglaciation from 1976 to 2023, particularly in recent years.
- **Importance:**
  - **Freshwater Source**: Glaciers are vital reservoirs of freshwater, storing about **70% of the world's freshwater,** thus making them indispensable for the global water cycle. They serve as **essential sources of water** for drinking, irrigation, energy generation, and ecosystem services for billions of people worldwide.
  - **Climate Indicators**: Glaciers provide **valuable information about past**

climates, making them critical indicators of climate change. Their melting is directly linked to **global warming** and **rising sea levels.**

- **Water Security**: In regions such as the **Hindu Kush Himalaya (HKH)** and the **Andes**, glaciers provide water to large populations. This water is essential for agriculture, hydropower, and daily living.
- **Environmental and Economic Stability**: Glacial meltwater is crucial for sustaining agriculture in mountainous regions, which depend on **seasonal snowmelt for irrigation**. These regions also rely on glaciers for **hydropower generation.**
- **Sea Level Contribution**: The melting of glaciers contributes significantly to rising sea levels. This can have devastating effects on **coastal regions**, including **flooding**, **erosion**, and ecosystem destruction.

What are the Challenges in the Preservation of Glaciers?

- **Accelerated Glacier Melting:** Glaciers are melting faster than ever due to rising temperatures, which is exacerbated by **dust storms** and **wildfires** depositing particulate matter that accelerates the melting process.
- **Permafrost Thaw**: Rising temperatures are causing **permafrost to thaw at an increased rate**, releasing **organic carbon** and other elements into the atmosphere, contributing to further **climate change**. Thawing also destabilizes mountain slopes, increasing the risk of **landslides and rockfalls.**
- **Erratic Snowfall Patterns**: Warmer temperatures are **altering snowfall patterns**, leading to less snow cover, especially at lower elevations. This disrupts the water cycle and affects the timing and availability of meltwater.
- **Glacial Lake Outburst Floods (GLOFs)**: Melting glaciers form glacial lakes with **unstable moraine walls,** which can collapse and cause **catastrophic floods,** threatening downstream communities and infrastructure.
- **National Water Security Challenges**: India, which has about 10,000 glaciers in the Himalayan region, faces significant water security challenges. Despite having **18% of the world's population,** India has access to only **4% of global water resources,** putting pressure on its water systems and resources.
- **Declining Water Availability**: As glaciers melt, there is a **decline in long-term water availability** for various sectors. Glacial meltwater is crucial for agriculture, hydropower, and drinking water. Reduced water flow threatens **water security in downstream regions.**



Way Forward

- **Glacier Preservation and Water Resource Management:** Ongoing glacier preservation efforts

should be integrated into water management plans, particularly in regions like **Ladakh and Arunachal Pradesh,** to address the dual challenges of population growth and rising temperatures that are straining water resources.

- **Enhanced Early Warning Systems**: Increasing investment in **early warning systems for disasters like GLOFs** and landslides can mitigate the impact of glacier-related hazards on vulnerable populations.
- **Public Awareness and Global Cooperation**: Initiatives such as the **declaration of 2025 as the International Year of Glaciers' Preservation** and World Day for Glaciers are crucial in raising global awareness about the importance of glaciers and the need for urgent action to preserve them.
- **National Mission for Sustaining the Himalayan Ecosystem (NMSHE):** This initiative, is part of India's **National Action Plan on Climate Change**, focuses on understanding the impacts of climate change on the **Himalayan ecosystem**. It aims to monitor glaciers and develop strategies to protect these vital water sources.
- **Erratic Snowfall Patterns:** Stabilize regional climates by strengthening global climate agreements, such as the **Paris Agreement**, and implementing carbon pricing mechanisms like the **European Union's Emissions Trading System (ETS).**
- **Policy Integration:** Advocate for the inclusion of glacier preservation into national and regional climate strategies, water management policies, and **Disaster Risk Reduction (DRR)** frameworks.

UPSC Civil Services Examination Previous Year's Question (PYQs)

Prelims

Q. With reference to the water on the planet Earth, consider the following statements: (2021)

1. The amount of water in the rivers and lakes is more than the amount of groundwater.
2. The amount of water in polar ice caps and glaciers is more than the amount of groundwater.

Which of the statements given above is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

Ans: (b)

Q. With reference to India, Didwana, Kuchaman, Sargol and Khatu are the names of (2021)

(a) glaciers

(b) mangrove areas

(c) Ramsar sites

(d) saline lakes

Ans: (d)

Mains

Q. How do the melting of the Arctic ice and glaciers of the Antarctic differently affect the weather patterns and human activities on the Earth? Explain. **(2021)**

Q. How will the melting of Himalayan glaciers have a far-reaching impact on the water resources of India? **(2020)**

Q. Bring out the relationship between the shrinking Himalayan glaciers and the symptoms of climate change in the Indian sub-continent. **(2014)**