GLACIAL RETREAT IN THE EASTERN HIMALAYAS OF ARUNACHAL PRADESH - ENVIRONEMNT

NEWS: *A recent study has revealed that **110 glaciers have disappeared in the Eastern Himalayas of Arunachal Pradesh over a period of 32 years (1988-2020)**.*

WHAT'S IN THE STUDY?

- This highlights the **rapid retreat of glaciers**, which has significant **implications for hydrology (water availability) and climate** in the region.
- The loss of glaciers means reduced water reserves, potential changes in river flow, and an increased risk of natural disasters like floods and landslides.

Key Findings of the Study

- **Glacial Lakes Formation:**
  - The study found that glaciers covering **309.85 square kilometers** have been retreating at a rate of **16.94 square kilometers per year**.
  - As glaciers melt, they expose bedrock and form **glacial lakes**, which store large amounts of meltwater.
  - These lakes pose a high risk of **Glacial Lake Outburst Floods (GLOFs)**, which occur when the lakes overflow or their natural barriers fail, causing sudden floods downstream.
  - The number of glaciers in the region **decreased from 756 to 646** between **1988 and 2020**, indicating a significant reduction in glacial coverage.

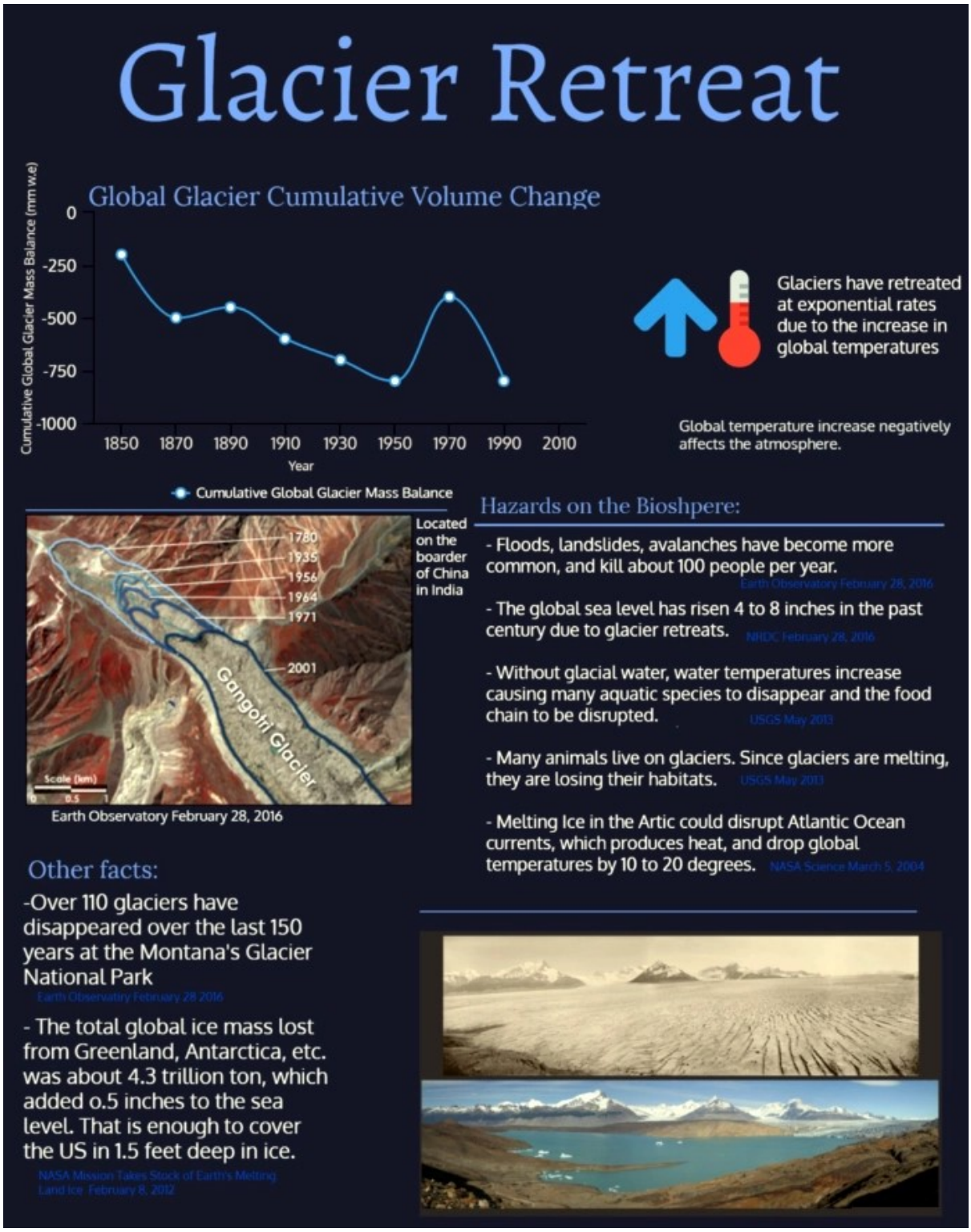
What is Glacial Retreat?

- **About:**
  - Glacial retreat refers to the **process of a glacier shrinking or receding in size** over time due to a decrease in ice accumulation or an increase in ice melt.
- **Causes:**
  - This can be caused by a number of factors, including **rising global temperatures, changes in precipitation patterns,** or changes in the geography of the surrounding landscape.
- **Impacts:**
  - As a glacier retreats, it can lead to a number of significant environmental impacts, including **changes in water availability, alterations to local ecosystems, and increased risk of natural disasters** such as **floods** and **landslides.**
  - In addition, the **loss of glacial ice can contribute to rising sea levels,** which can have significant impacts on coastal communities and **ecosystems** around the world.

Causes of Glacial Retreat

- **Rise in Temperature:**
  - The **eastern Himalayas** are experiencing **a temperature rise higher than the global average**, with an increase ranging between **0.1°C and 0.8°C per decade**.

- This warming trend is expected to continue, with potential temperature rises of **5-6°C by the end of the century**.
- Additionally, precipitation (rainfall and snowfall) in the region is projected to increase by **20-30%**.
- Over the past century, the temperature in the region has **already risen by approximately 1.6°C**, intensifying glacial melt.



Implications of Glacier Retreat

- **Impact on Freshwater Supply:**
  - The retreat of glaciers poses a major threat to the **freshwater supply** for over **1.3 billion people living downstream** in India, China, Nepal, Bangladesh, and Pakistan.
  - Many of the region's major rivers originate from these glaciers, providing water for drinking, agriculture, and industry.
- **Himalayan Glaciers as the 'Third Pole':**
  - The Himalayan glaciers are often called the **'Third Pole'** because they **hold the largest reserve of ice outside the Arctic and Antarctic regions**.
  - These glaciers play a critical role in **maintaining the region's hydrological balance** by feeding major rivers like the Ganga, Brahmaputra, and Indus.
  - Their melting not only affects regional water security but also contributes to **global sea level rise**, which can lead to coastal flooding and displacement of populations worldwide.
- **Impact on Biodiversity and Agriculture:**
  - Glacial retreat leads to changes in **temperature, water availability, and precipitation patterns**, affecting biodiversity in the Himalayan ecosystem.
  - Many species of flora and fauna depend on stable climatic conditions in the region. Any disruption can lead to **habitat loss and species migration**.
  - Agriculture in the Himalayan foothills and downstream areas relies on **glacier-fed rivers** for irrigation. Any alteration in river flow patterns can disrupt **crop cycles, food production, and rural livelihoods**.
- **Effect on Hydropower Generation and Irrigation Systems:**
  - Many **hydropower projects in India, Nepal, and Bhutan** depend on glacial meltwater for electricity generation.
  - As glaciers retreat, **seasonal variations in river flows become unpredictable**, leading to challenges in maintaining **steady hydropower output**.
  - Reduced water supply can also impact **irrigation**, affecting millions of farmers who depend on glacier-fed rivers for growing crops.

Himalayan Glaciers in India

The Himalayan glaciers can be categorized into three major river basins:

1. Indus River Basin

- The **Indus River** originates in the **Tibetan Plateau**, near **Lake Mansarovar** and **Mount Kailash**.
- It flows **westward**, passing **south of the Karakoram Range** and **north of the Great Himalayas**, before reaching **Mt. Nanga Parbat** in Pakistan.
- The river then turns **sharply southward**, flowing through Pakistan and draining into the **Arabian Sea near Karachi** after traveling **2,880 kilometers**.

2. Ganga River Basin

- The **Ganga River** originates from the **Gangotri Glacier** in Uttarakhand, India.
- At its source, it is known as **Bhagirathi**, which later joins **Alaknanda at Devprayag** to form the **Ganga**.
- The Ganga is one of the most important rivers in India, providing water for **agriculture, drinking, and industry**.

3. Brahmaputra River Basin

- The **Brahmaputra River** (also known as **Yalu Zangbu or Tsang Po** in Tibet) originates from the **glaciers of the Kailash Range, just south of Lake Konggyu Tsho** in Tibet.
- It is among the **longest rivers in the world**, flowing:
    - **1,625 kilometers in Tibet**
    - **918 kilometers in India**
    - **337 kilometers in Bangladesh**
- The river finally drains into the **Bay of Bengal**, playing a crucial role in supporting **agriculture and livelihoods** in Northeast India and Bangladesh.

Importance of Snow Fields & Glaciers in the Himalayas

- **Earth's Radiation Balance:**
    - The snow-covered Himalayan glaciers contribute to **Earth's albedo effect**, which means they reflect **sunlight back into space**, helping **regulate global temperatures**.
- **Attracting the South-West Monsoon:**
    - The difference in temperature between the **Himalayan snow-fields** and the **Indian Ocean** helps **pull the South-West monsoon** toward the Indian landmass, bringing rainfall crucial for agriculture.
- **Key Indicator of Climate Change:**
    - Himalayan **snow-fields and glaciers act as climate indicators** since they respond quickly to variations in temperature.
    - Their retreat signals **rising global temperatures** and increasing climate-related risks.

Mitigation and Adaptation Strategies

Addressing the retreat of Himalayan glaciers requires a combination of **mitigation (reducing causes) and adaptation (adjusting to changes) strategies**:

1. **Reducing Greenhouse Gas Emissions:**
    - Cutting **carbon emissions** through **renewable energy adoption, energy efficiency, and sustainable transportation** is essential to slow down global warming.
2. **Enhancing Climate Resilience:**
    - Strengthening **early warning systems for floods and landslides**, along with **better infrastructure planning**, can help communities adapt to changing conditions.
3. **Sustainable Water Management:**
    - Developing **efficient irrigation methods**, promoting **rainwater harvesting**, and implementing **drought-resistant crops** can reduce dependence on glacier-fed rivers.
4. **International Cooperation:**
    - Since the Himalayan glaciers impact multiple countries, regional cooperation between **India, China, Nepal, Bhutan, and Pakistan** is necessary for sustainable water resource management.
5. **Community Involvement:**
    - Local communities must be **educated and involved in conservation efforts** to promote **sustainable tourism, afforestation, and disaster preparedness**.

Conclusion

The **rapid retreat of glaciers in the eastern Himalayas** is a serious concern, affecting water security, climate stability, and biodiversity. **Reducing carbon emissions, implementing sustainable water management practices, and fostering international collaboration** are crucial for mitigating the impact. By taking action today, we can ensure **water security and ecological balance for future generations**.

Source: https://www.thehindu.com/sci-tech/energy-and-environment/arunachal-pradesh-lost-110-glaciers-in-32-years-study/article69176258.ece