



## National Glacial Lake Outburst Floods Risk Mitigation Programme

**For Prelims:** [Tawang](#), [Dibang Valley](#), [National Disaster Management Authority \(NDMA\)](#), [Glacial Lake Outburst Flood \(GLOFs\)](#), [South Lhonak Lake](#), [Centre for Development of Advanced Computing \(C-DAC\)](#), [Indian Meteorological Department](#), [Landslides](#), [Yarlung Zangbo River](#), [Lake Lowering](#), [Ground Truthing](#), [Thyanbo Glacial Lake](#), [Flash Floods](#), [International Centre for Integrated Mountain Development \(ICIMOD\)](#), [Hindu Kush Himalayas](#).

**For Mains:** Impact of Climate Change on Glacial Lakes and their Consequences.

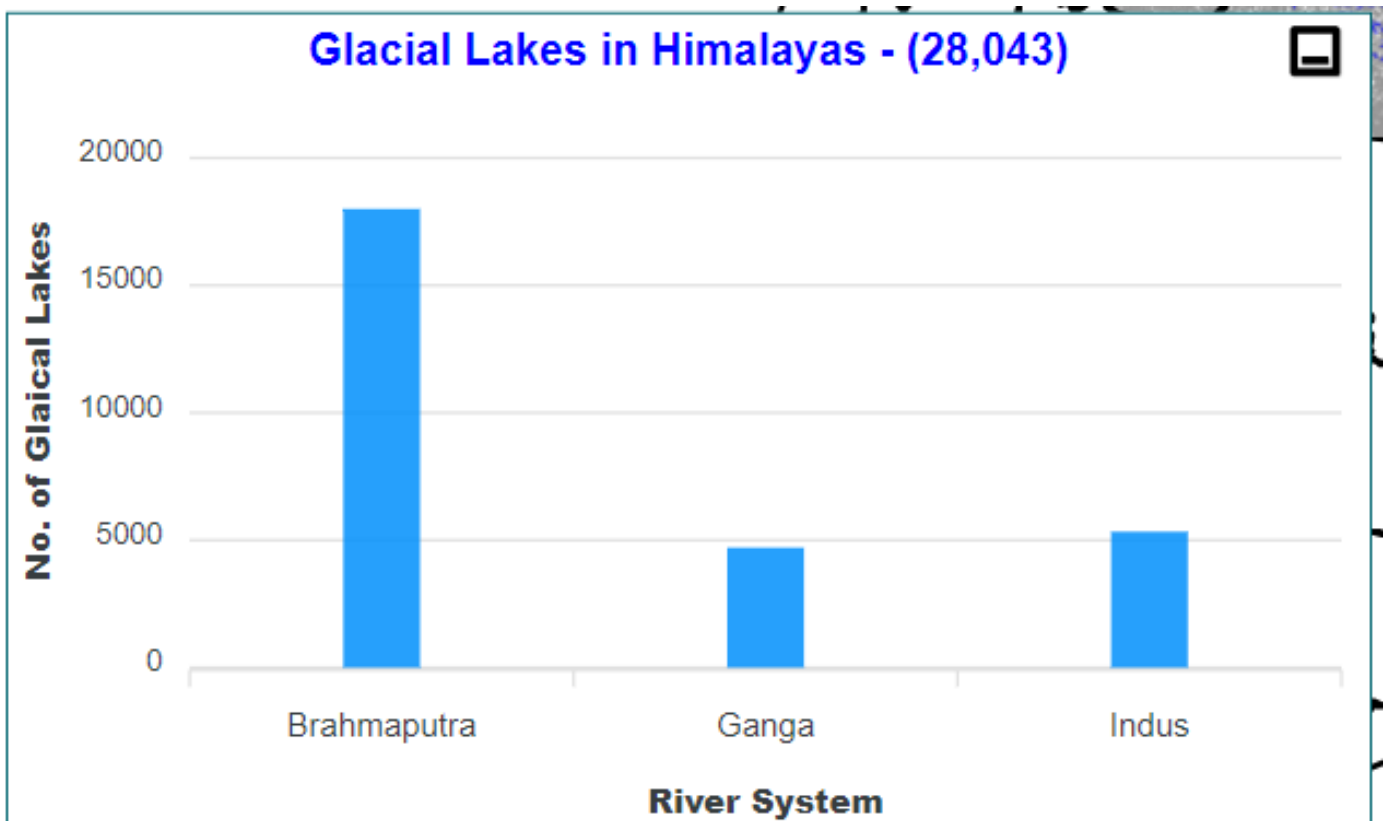
**Source:** [HT](#)

### Why in News?

The **National Disaster Management Authority (NDMA)** has taken up expeditions to glaciers at an altitude of **4500m and above** to map their vulnerability to [Glacial Lake Outburst Flood \(GLOF\)](#).

- Of the nearly **7,500 glacial lakes** in the Indian Himalayas, NDMA has finalised **189 high-risk lakes** that require mitigation measures.

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## What is the National Glacial Lake Outburst Floods Risk Mitigation Programme (NGRMP)?

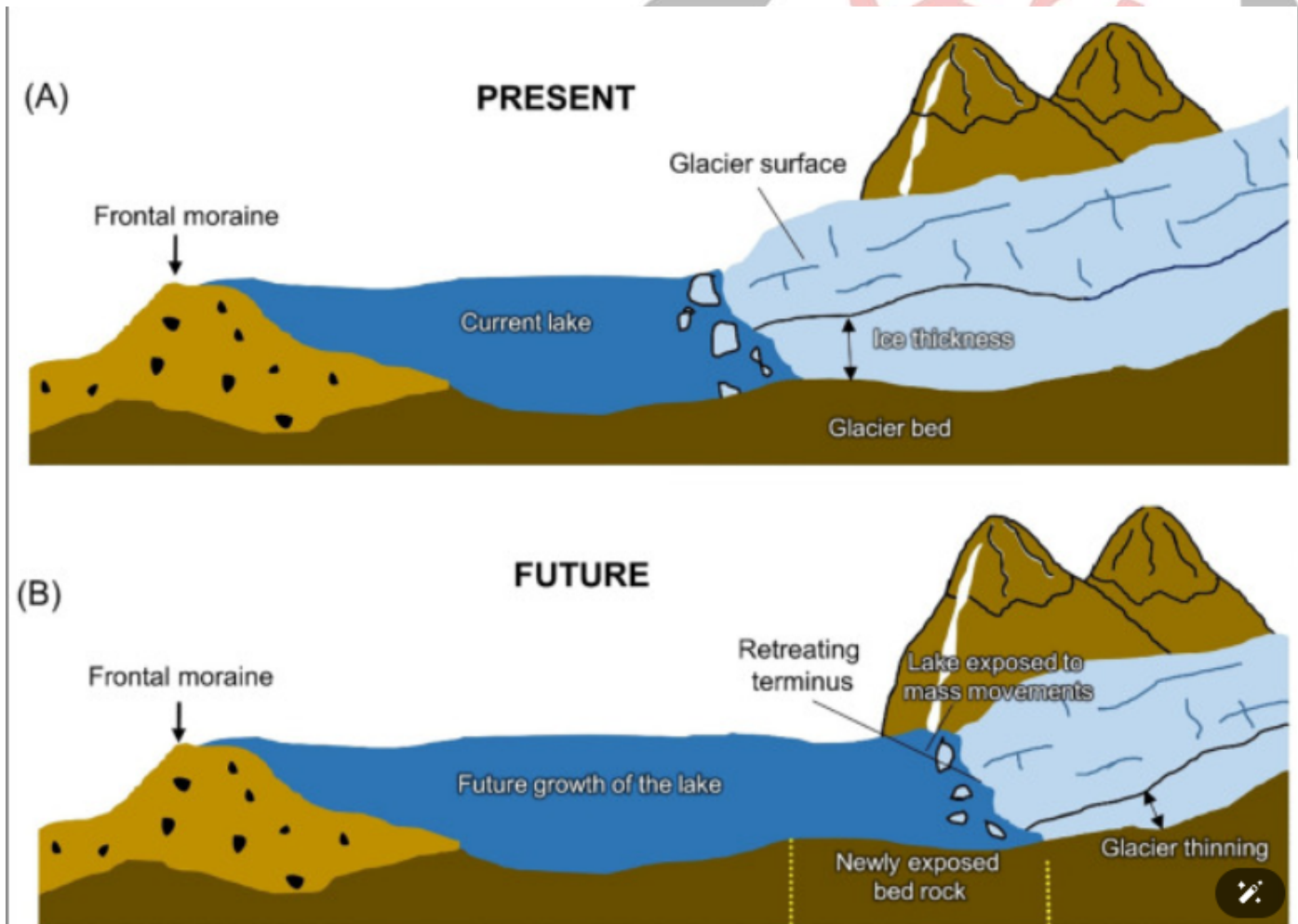
- **About:** It is an initiative launched by the Government of India to address the risks posed by **GLOFs**.
  - **16 teams went out for expedition** out of which 15 teams completed their expedition. Another **seven expeditions are underway**.
    - Of the 15 expeditions completed, **6 were in Sikkim, 6 in Ladakh, 1 in Himachal Pradesh, and 2 in Jammu and Kashmir**.
  - Teams on expeditions assess the **structural stability** and **potential breach points** of glacial lakes, gathering relevant **hydrological and geological samples and data**, measuring water quality and flow rates, identifying risk zones and making downstream communities aware.
- **Objective:**
  - To **assess hazards**, install automated monitoring and **early warning systems**, and implement **lake-lowering measures** to mitigate glacial lake outburst flood (GLOF) risks.
    - **Lake-lowering measures** are techniques used to **reduce the volume of water** in a glacial lake to mitigate the risk of a GLOF.
  - NDMA is focussing on **ground-truthing** of selected 189 “high-risk” glacial lakes.
    - **Ground-truthing** is the process of **validating and verifying data** collected through **remote sensing** or other indirect methods by comparing it with **direct observations** made on-site.
- **Methodology to Prevent GLOF: Three activities** are planned to be executed **simultaneously**.
  - Placement of **automated weather and water level monitoring stations** and early warning systems
  - **Digital elevation modelling** and **bathymetry**.
  - Assessing best means to **reduce the risk of that lake** including by **lake-lowering**.
- **Need of the Study:**
  - **ICIMOD Findings:** As per the **International Centre for Integrated Mountain Development (ICIMOD)**, **Hindu Kush Himalayas** are experiencing rapid, **irreversible**

**changes** due to climate change, increasing the risk of **floods and landslides**.

- **Climate Change:** Due to climate change, India faces **hazards like** extreme **altered FDI (frequency, duration and intensity) of precipitation** and **extreme heat**. It may lead to an increased number of **flash floods**.
- **Previous Incidents of GLOFs:**
  - **Nepal Incident:** Recently, flash floods struck Thame, a village in the **Khumbu region** of Nepal which was due to an outburst flood from **Thyanbo glacial lake**.
  - **Sikkim Flash Flood:** A catastrophic GLOF occurred in **South Lhonak Lake, Sikkim**, in October 2023.
  - **Uttarakhand Flash Floods:** A **glacier breach-induced flood** in February 2021 in Rishi Ganga valley resulted in over 200 deaths and significant damage to hydropower plants and **Raini village**.

## GLOF

- A GLOF is a type of **flood** occurring when **water dammed** by a **glacier or a moraine** is **released** suddenly.
- When glaciers melt, the **water** in these glacial lakes **accumulates** behind loose naturally formed '**glacial/moraine dams**' made of ice, sand, pebbles and ice residue.
- Unlike earthen dams, the weak structure of the moraine dam leads to the **abrupt failure** of the moraine dam on top of the **glacial lake**, which holds a large volume of water.
- A catastrophic failure of the dam can release the water over periods of minutes to days causing **extreme downstream flooding**.



**What are the Recent Developments in NGRMP?**

- **About:** The **Arunachal Pradesh State Disaster Management Authority (APSDMA)** to carry out a survey of high-risk glacial lakes in the [Tawang](#) and [Dibang Valley](#) districts of Arunachal Pradesh.
  - It is part of the larger [National Glacial Lake Outburst Flood \(GLOF\) Mission](#) of the [NDMA](#) to map all glacial lakes in the country.
- **High-Risk Glacial Lakes Identified in Arunachal Pradesh:**
  - **Total High-Risk Lakes: 27 high-risk glacial lakes** have been identified across five districts in Arunachal Pradesh.
    - The lakes are located in **Tawang (6 lakes)**, Kurung Kumey (1), Shi Yomi (1), **Dibang Valley (16)**, and Anjaw (3).
  - The current expedition teams will focus on **three high-risk lakes** in each of the Tawang and Dibang Valley districts.
- **Study Objectives:** The team will study the **accessibility, location, size, elevation, nearby habitations, and land use** of the lakes at risk of GLOF.
  - This will help the [Centre for Development of Advanced Computing \(C-DAC\)](#) and the [Indian Meteorological Department](#) install an [Automatic Early Warning System](#) and an [Automatic Weather Station](#).
- **Significance of the Study:**
  - **Strategic Location:** Both Tawang and Dibang Valley districts share borders with China. It will be closely watched given its strategic location.
  - **Fragile Himalayan Ecosystem:** [Landslides](#) on the Chinese side, caused by China's interference with [Himalayan geology](#) and river systems, could also occur on the Indian side of the border.
  - **Threat of Floods:** In 2018, the Arunachal and Assam governments issued [flood](#) alerts after China reported a landslide blockage at the [Yarlung Zangbo River](#).
  - **Heavy Infrastructure:** The [mega dam](#) being built by China on the Yarlung Tsangpo river in **Medog** near the international border has been a constant worry over fear of adverse impact right from Arunachal to Assam.

**Drishti Mains Question:**

Q. How Himalayas and glacial lakes are increasingly becoming vulnerable to climate change? What steps are being taken to mitigate risks like Glacial Lake Outburst Flood (GLOF)?

**UPSC Civil Services Examination, Previous Year Question (PYQ)**

**Prelims:**

**Q. Siachen Glacier is situated to the (2020)**

- (a) East of Aksai Chin
- (b) East of Leh
- (c) North of Gilgit
- (d) North of Nubra Valley

**Ans: (d)**

**Q. Consider the following pairs (2019)**

**Glacier - River**

1. Bandarpunch : Yamuna
2. Bara Shigri : Chenab
3. Milam : Mandakini
4. Siachen : Nubra
5. Zemu : Manas

**Which of the pairs given above are correctly matched?**

- (a) 1, 2 and 4  
(b) 1, 3 and 4  
(c) 2 and 5  
(d) 3 and 5

**Ans: (a)**

**Q. Consider the following statements: (2010)**

1. On the planet Earth, the fresh water available for use amounts to about less than 1% of the total water found.
2. Of the total fresh water found on the planet Earth 95% is bound up in polar ice caps and glaciers.

**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: (a)**

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**Mains**

**Q.** With reference to National Disaster Management Authority (NDMA) guidelines, discuss the measures to be adopted to mitigate the impact of the recent incidents of cloudburst in many places of Uttarakhand. **(2016)**