Mass Wasting in Sedongpu Gully of Tibet

For Prelims: Mass Wasting, **Avalanches**, **Glaciers**, **Gorge**, Gully, Sedongpu Gully, **Earthquake**, **Erosion**

For Mains: Disaster Management, Important Geophysical Phenomena, Climate Change and Geophysical Events

Source: TH

Why in News?

A recent study in the *Journal of Rock Mechanics and Geotechnical Engineering* has raised concerns about the **increasing frequency of mass wasting events in Tibet's Sedongpu Gully** since 2017, with implications for India's northeastern states due to the region's proximity and river systems.

What are the Key Highlights of the Study?

- **Increased Frequency of Mass Wasting:** The study documents a significant rise in mass wasting events in the Sedongpu Gully since 2017.
    - **Using satellite data from 1969 to 2023,** the study identified 19 major mass-wasting events, categorised into **ice-rock avalanches, ice-moraine avalanches, and glacier debris flows.** Notably, 68.4% of these events occurred after 2017.
    - Over 700 million cubic meters of debris have been mobilized in the Sedongpu Gully catchment since 2017. This substantial volume of debris has implications for downstream river systems.
- **Historical Context:** The earliest recorded mass wasting event in the Sedongpu Gully occurred between 1974 and 1975, with notable activity resuming in 1987.
- **Causes of Increased Activity:** The rise in mass wasting events is attributed to long-term **warming of the region and increased seismic activity.**
    - Sedongpu basin consists mostly of **Proterozoic (2.5 billion to 541 million years ago) marble** and the conditions indicate its land surface temperature ranges from **-5º to -15º C,** rarely exceeding 0º C before 2012.
        - Recent data from the nearby weather stations revealed that the annual temperature in this **area increased at rates of 0.34º to 0.36º C** during 1981-2018, which is higher than the global average (since 1970 the global average temperature has been rising at a rate of 1.7°C per century).
- **Impact on Tsangpo River:** The debris from **mass wasting events** has temporarily blocked the **Tsangpo River and its tributaries,** leading to concerns about potential flash floods downstream, particularly in Arunachal Pradesh and Assam.
    - Notably, such **blockages caused catastrophic flash floods in** Arunachal Pradesh and Assam in 2000.

Sedongpu Gully

- The Sedongpu Gully is located in the **catchment area of the Sedongpu Glacier in Tibet.** A gully is a type of **landform shaped by erosion caused by flowing water**, mass movement, or both.
- The Sedongpu **Gully flows into the Yarlung Zangbo (**Tsangpo River), near a sharp bend called the **Great Bend**. Here, the **river curves around Mt. Namcha Barwa** (7,782 meters) **and Mt. Gyala Peri** (7,294 meters) to form a gorge that is 505 km long and 6,009 meters deep. This is **one of the deepest gorges on Earth.**
- The Great Bend is close to **Tibet's border with Arunachal Pradesh**, where the Tsangpo flows as the **Siang River.**
    - In Assam further downstream, the **Siang meets the Dibang and Lohit** to **form the Brahmaputra,** which flows as the **Jamuna in Bangladesh**.

What is Mass Wasting?

- **Definition:** Mass wasting is the **downslope movement of rock, soil, and debris** under the influence of gravity. It includes various types of slope movements such as rock falls, slumps, and debris flows.
- **Key Triggers for Mass Wasting:** Heavy rainfall can saturate soil, increasing its weight and making it more prone to movement.
    - Quick melting of snow can add significant amounts of water to the soil, leading to instability.
    - **Earthquakes** (Seismic activity) can shake the ground and initiate **landslides.**
    - **Volcanic Eruption** can destabilise slopes through eruptions and associated seismic events.
    - **Erosion** by water bodies can undercut slopes and lead to mass wasting.
- **Types of Mass Wasting Events:**
    - **Rock Fall or Topple:** This involves the **falling, bouncing, and rolling of rock** debris down a slope. It can **occur suddenly and with significant impact.**
    - **Landslides and Rock Slides:** These events involve **large masses of soil** and rock sliding down a slope.
    - **Debris Flows:** A debris flow is a rapid downslope movement of **water-saturated rock debris and soil**, resembling wet cement. It moves quickly and can be very destructive.
    - **Avalanche:** An avalanche is a sudden mass movement of **rock or ice** under gravity. It can **occur in both mountainous and glacial regions.**
    - **Slope Creep:** This is a gradual, **slow movement of soil and rock down a slope,** often imperceptible **over short periods** but significant over longer timescales.

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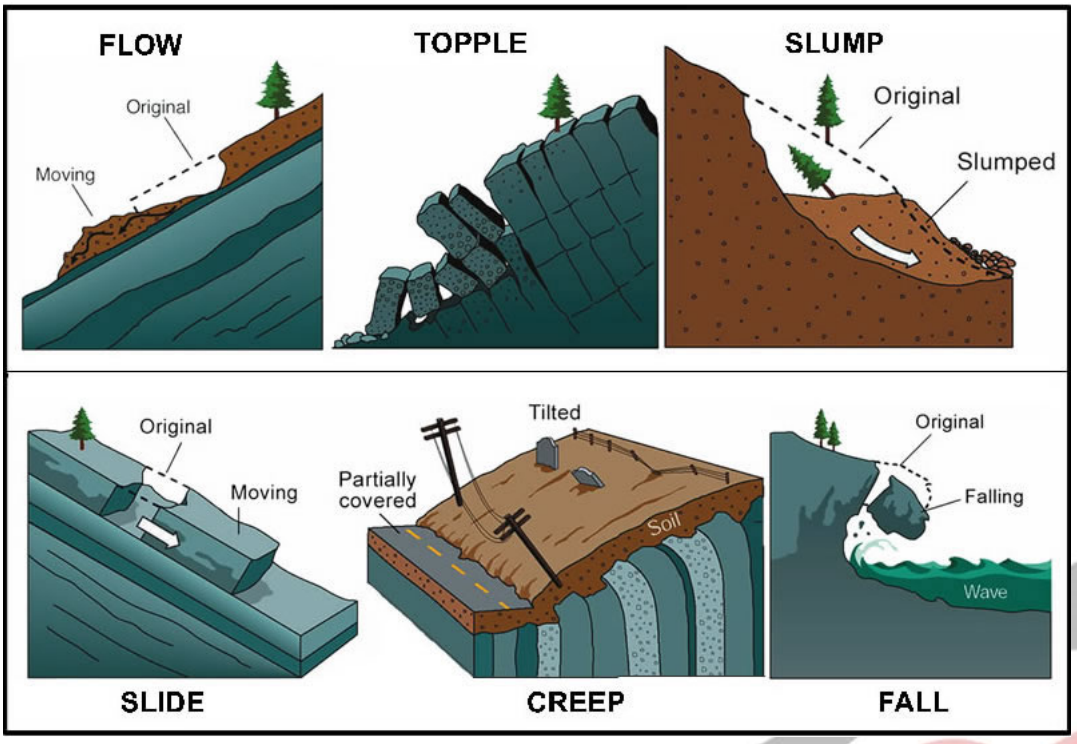

How does Mass Wasting in Tibet Affect India and Bangladesh?

- **Downstream Effects:** The sediment mobilized by these events can affect the **Tsangpo River and its tributaries.**
    - The river flows into India and joins the Brahmaputra, which is already one of the **most sediment-laden rivers in the world.**
    - **China plans to set up a 60-gigawatt project on the Tsangpo,** which will have thrice the capacity of China's **three Gorges project on the Yangtze**, the world's largest hydropower plant.
        - This seismically unstable region, which experienced the 8.6-magnitude 1950 **Assam-Tibet earthquake** and the 6.4-magnitude **2017 Nyingchi earthquake**, may see increased sedimentation in the **Tsangpo-Siang-Brahmaputra-Jamuna river system**, with serious implications for **India and Bangladesh.**
- **Flooding and Navigation Issues:** The **Brahmaputra carries over 800 tonnes of sediment at Pandu in Guwahati,** increasing to more than a billion tonnes at Bahadurabad in Bangladesh.
    - Increasing sedimentation may make the river **more intensely braided in the Assam plains, leading to more bank erosion.**
    - The sedimentation **can elevate the river beds, leading to flood hazards** and the channels may get choked with sand and silt in the lean season, making navigation difficult and affecting livelihoods related to fishing.

Way Forward

- The study underscores the **need for ongoing monitoring of geophysical events to manage sedimentation** and assess their impact on the Brahmaputra and its tributaries.
    - There is a call for further research to better understand the trends and implications of mass wasting in this critical region.
- **Promote reforestation and afforestation efforts to stabilize slopes** and reduce erosion. Implement **sustainable land use planning** to avoid development in high-risk areas.
- Employ **erosion control measures, such as terraces,** check dams, and gabions, to prevent soil erosion and reduce the risk of mass wasting.
- Conduct regular disaster risk assessments to identify vulnerable areas and prioritize mitigation measures.

Drishti Mains Question:

Q. What is the impact of increased mass wasting events in the Sedongpu Gully on river systems in India's northeastern states?

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. Which of the following is/are tributary/tributaries of Brahmaputra?

1. Dibang
2. Kameng
3. Lohit

Select the correct answer using the code given below:

(a) 1 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (d)

Mains:

Q. Differentiate the causes of landslides in the Himalayan region and Western Ghats. **(2021)**