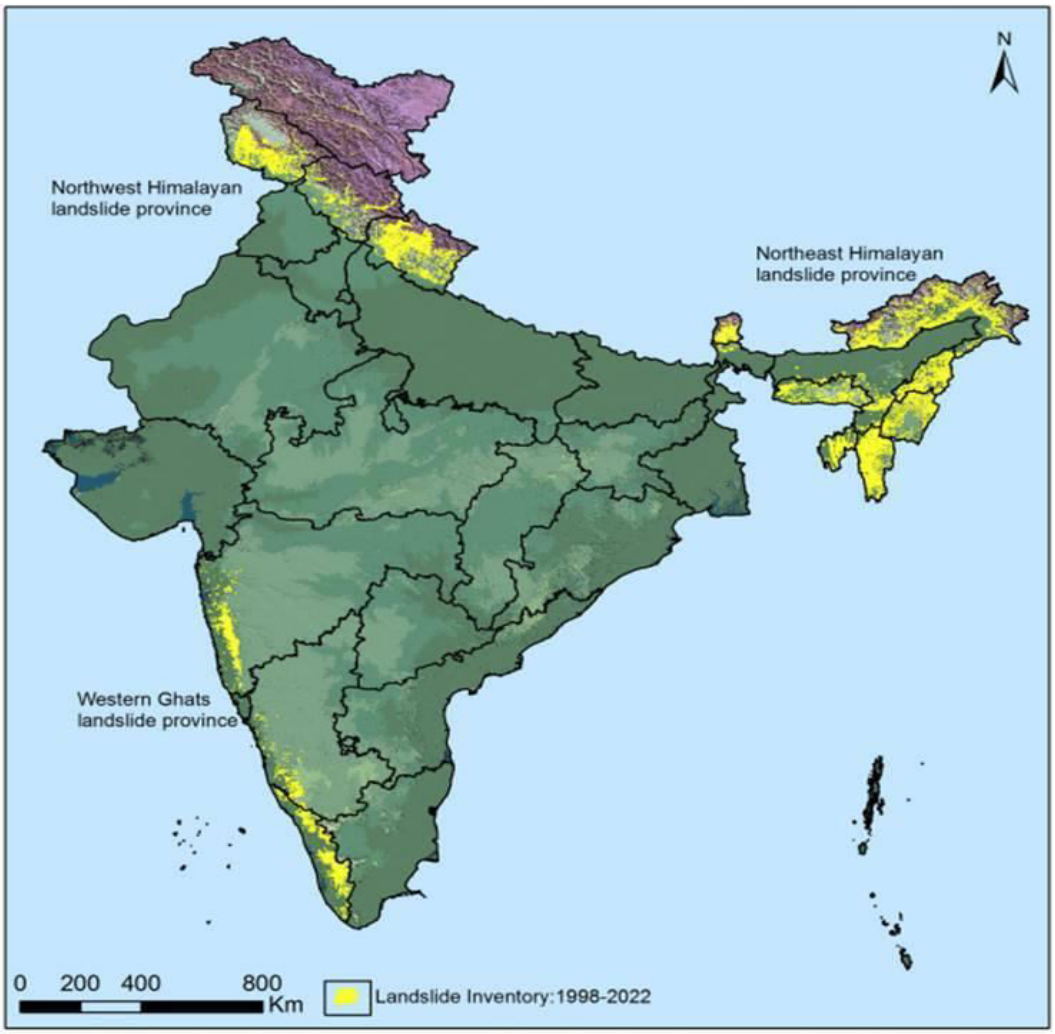
DISASTER MANAGEMENT

❖ **Landslide Atlas of India**

➢ **CONTEXT: In 2022, heavy rain, floods and landslides claimed 835 lives in the country, according to the Statement of Climate of India 2022 released by the India Meteorological Department. With a steady rise in the number of extreme weather events, especially heavy rainfall capable of triggering landslides and floods, the Indian Space Research Organisation (ISRO) recently released the Landslide Atlas of India, a detailed guide identifying landslide hotspots in the country.**

➢ **What causes landslides?**

- Landslides are natural disasters occurring mainly in mountainous terrains where there are conducive conditions of soil, rock, geology and slope. A sudden movement of rock, boulders, earth or debris down a slope is termed as a landslide. Natural causes that trigger it include heavy rainfall, earthquakes, snowmelting and undercutting of slopes due to flooding. Landslides can also be caused by anthropogenic activities such as excavation, cutting of hills and trees, excessive infrastructure development, and overgrazing by cattle.
- Considered among the most frequent natural disasters, landslides are extremely hazardous, posing a threat to human and animal lives, damaging property, roads and bridges, disrupting communication lines and snapping power lines.
- Some of the main factors that influence landslides are lithology, geological structures like faults, hill slopes, drainage, geomorphology, land use and land cover, soil texture and depth, and weathering of rocks. All these are factored in when a landslide susceptibility zone is earmarked for planning and making predictions.



- In India, rainfall-induced landslide events are more common.

Source: Landslide Inventory of India, Landslide Atlas of India, ISRO

- **How are landslides classified and mapped?**
- Landslides are broadly classified based on:

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- ✓ Type of materials involved (rock, debris, soil, loose mud)
- ✓ Type of movement of the material (fall, topple, slide, rotational slide or translational slide)
- ✓ Type of flow of the material.

- Another category is of landslides that spread laterally. Landslides mapped in the ISRO atlas are mainly event-based and season-based.
- ISRO's National Remote Sensing Centre (NRSC), Hyderabad, has created a database of landslide-prone regions of India based on events during 1998 – 2022, primarily along the Himalayas and the Western Ghats.
- In addition to aerial images, high resolution satellite images captured using cameras Indian Remote Sensing (IRS-1D) PAN + LISS-III, satellites ResourceSat-1 and 2, etc., were used to study the landslides over the past 25 years.
- The pan-India landslide database classifies landslides into
  - ✓ Seasonal (2014, 2017 monsoon seasons)
  - ✓ Event-based
  - ✓ Route-based (2000 – 2017).

Landslide hotspot areas in India (1998-2022). (Source: Landslide Inventory of India, Landslide Atlas of India, ISRO)

State	Total no. of landslide events	State	Total no. of landslide events
Mizoram	12,385	Nagaland	2,132
Uttarakhand	11,219	Sikkim	1,569
Tripura	8,070	Himachal Pradesh	1,561
Arunachal Pradesh	7,689	Karnataka	1,904
Jammu and Kashmir	7,280	Tamil Nadu	690
Kerala	6,039	West Bengal	172
Manipur	5,494	Haryana	100
Maharashtra	5,112	Ladakh	23
Meghalaya	2,639	Goa	03
Assam	2,569	Total	80,933

- **How prone is India to landslides?**
- India is considered among the top five landslide-prone countries globally, where at least one death per 100 sq km is reported in a year due to a landslide event. Rainfall variability pattern is the single biggest cause for landslides in the country, with the Himalayas and the Western Ghats remaining highly vulnerable.
- Excluding snow covered areas, approximately 12.6 per cent of the country's geographical land area (0.42 million sq km) is prone to landslides.
- As many as 66.5 per cent of the landslides are reported from the North-western Himalayas, about 18.8 per cent from the North-eastern Himalayas, and about 14.7 per cent from the Western Ghats.
- Nearly half of the country's landslide-prone area (0.18 sq km) is located in the states of Assam, Arunachal Pradesh, Sikkim, Meghalaya, Mizoram, Manipur, Tripura and Nagaland. Uttarakhand, Himachal Pradesh, Jammu and Kashmir cover 0.14 million sq km of the total landslide-prone areas, whereas Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu account for 0.09 million sq km. A relatively small area (0.01 million sq km) of the Araku region in Andhra Pradesh along the Eastern Ghats, too, reports landslide events.
- In the Western Ghats, despite fewer events, landslides were found to be making inhabitants significantly vulnerable to fatalities, especially in Kerala.
- **What does the landslide atlas suggest?**
- Uttakarkhand, Kerala, Jammu and Kashmir, Mizoram, Tripura, Nagaland and Arunachal Pradesh reported the highest number of landslides during 1998 – 2022.
- Mizoram topped the list, recording 12,385 landslide events in the past 25 years, of which 8,926 were recorded in 2017 alone. Likewise, 2,071 events of the total 2,132 landslides reported in Nagaland during this period occurred during the 2017 monsoon season. Manipur, too, showed a similar trend, wherein 4,559 out of 5,494 landslide events were experienced during the rainy season of 2017. Of the total 690, Tamil Nadu suffered 603 landslide events in 2018 alone.
- Among all these states, an alarming situation is emerging from Uttarakhand and Kerala.

Top 30 districts based on exposure to landslides. (Source: Landslide Atlas of India)

- While Uttarakhand's fragility was recently exposed during the land subsidence events reported from Joshimath since January 2023, this Himalayan state has experienced the second highest number (11,219) of

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landslides since 1998, all events since occurring post 2000. The year-wise number of landslide events in the state is: 2003 (32), 2010 (307), 2012 (473), 2013 (6,610), 2017 (1), 2021 (329) and 2022 (1).

- The number of districts with the maximum landslide exposure are in Arunachal Pradesh (16), Kerala (14), Uttarakhand and Jammu and Kashmir (13 each), Himachal Pradesh, Assam and Maharashtra (11 each), Mizoram (8) and Nagaland (7).
- Kerala has been consistently reporting massive landslides since it suffered the century's worst floods in 2018. The year-wise landslide events here are 2018 (5,191), 2019 (756), 2020 (9) and 2021 (29).
- From the events and images obtained, the NRSC ranked Rudraprayag in Uttarakhand at the top of 147 vulnerable districts. It has the highest landslide density in the country, along with having the highest exposure to total population and number of houses.

Rank	District, State	Rank	District, State
1	Rudraprayag, Uttarakhand	16	Mandi, Himachal Pradesh
2	Tehri Garhwal, Uttarakhand	17	Udhampur, Jammu and Kashmir
3	Thrissur, Kerala	18	Idukki, Kerala
4	Rajauri, Jammu and Kashmir	19	Chamoli, Uttarakhand
5	Palakkad, Kerala	20	West district, Sikkim
6	Poonch, Jammu and Kashmir	21	Uttarkashi, Uttarakhand
7	Malappuram, Kerala	22	Cachar, Assam
8	South districts, Sikkim	23	Garhwal, Uttarakhand
9	East district, Sikkim	24	Kottayam, Kerala
10	Kozhikode, Kerala	25	Hamirpur, Himachal Pradesh
11	Imphal west, Manipur	26	Kannur, Kerala
12	Kodagu, Karnataka	27	Pulwama, Jammu and Kashmir
13	Wayanad, Kerala	28	Thiruvananthapuram, Kerala
14	Jammu, Jammu and Kashmir	29	Dehradun, Uttarakhand
15	Ernakulam, Kerala	30	Bilaspur, Himachal Pradesh

PRELIMS

1. H3N2

➢ **CONTEXT: India has recorded deaths of two people, one each in Karnataka and Haryana, due to the Influenza A subtype H3N2 virus. It added that around 90 cases of this virus have been reported across the country.**

- The statement by the authorities has come just days after the Indian Council of Medical Research (ICMR) announced that the recent uptick in the cases of intense cough lasting for over a week coupled with fever, in several parts of India, can be linked to the Influenza A subtype H3N2 virus.

➢ **What is the H3N2 virus?**

- Influenza viruses, which cause the infectious disease known as flu, are of four different types: A, B, C and D. Influenza A is further classified into different subtypes and one of them is the H3N2. According to the United States' Centers for Disease Control and Prevention (CDC), H3N2 caused the 1968 flu pandemic that led to the death of around one million people globally and about 100,000 in the US.
- A 2020 study, published in the journal Nature Communications, found that the strains of the virus have dramatically evolved in the past five decades as people born in the late 1960s and 1970s got infected by it as children.

➢ **What are the symptoms of H3N2?**

- Its symptoms are similar to that of any other flu. They include cough, fever, body ache and headache, sore throat, a runny or stuffy nose and extreme fatigue. Nausea, vomiting and diarrhoea have been seen in very few cases.
- According to the Indian Medical Association (IMA), an infection caused by H3N2 generally lasts for five to seven days and the fever starts going away after three days. However, the coughing can persist for up to three weeks.

➢ **Which age group is more vulnerable?**

- As per the IMA, this virus usually preys on individuals below the age of 15 years or above 50 years of age. Children and those with co-morbidities like asthma, diabetes, heart disease, weakened immune systems and neurological or neurodevelopmental conditions are at a higher risk.

➢ **How to prevent it from spreading?**

- Self-hygiene is the best way to thwart the spread of H3N2. Washing hands before eating or touching face, nose or mouth, carrying pocket sanitiser, and avoiding people already infected with the virus or any other

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seasonal flu are some of the steps one can take to make sure they don't fall sick due to the H3N2 infection. Moreover, a healthy diet that includes plenty of fruits and vegetables can also play a significant role in improving immunity. The doctor added that drinking a lot of fluids, and eating home-cooked, low-spice and low-fat food can also help.

2. Controlled re-entry

➢ **CONTEXT: The Indian Space Research Organisation brought down a satellite in a controlled manner after its end of life, for the first time recently.**

- The weather satellite Megha Tropiques-1, which was developed as a joint mission by Indian and French space agencies, entered the atmosphere after the final two manoeuvres on Tuesday and burnt up over the Pacific Ocean.

➢ **How was the satellite brought down?**

- The Megha Tropiques satellite was launched aboard a PSLV by the space agency in 2011. And, although the planned mission life of the satellite was only three years, it continued providing data on water cycle and energy exchanges in the tropics for nearly a decade.
- With over 120kgs of fuel remaining in the satellite even after being decommissioned, the space agency determined that there was enough to attempt a controlled re-entry, where a series of 20 manoeuvres over eight months lowered the orbit of the satellite such that it re-entered the dense atmosphere and burned up.
- This was the first time that the space agency attempted such a manoeuvre to clear out space debris despite the satellite not being built to do so. "The re-entry was not really planned as part of the mission; there was fuel left so ISRO attempted it. Usually, satellites are left in their orbit and because of the gravitational pull of the earth, they come down to the atmosphere over years and years. When the satellites re-enter the atmosphere, the friction causes it to heat up to extreme high temperatures of thousands of degrees Celsius. Without a heat shield, 99% of a satellite gets burnt up whether in a controlled re-entry or an uncontrolled one.

➢ **Why did ISRO attempt a controlled re-entry?**

- Other than extra fuel conveniently remaining in the satellite after the mission life ended, ISRO attempted the control re-entry to demonstrate and understand the process of doing so.
- With several space fairing nations and private entities launching satellites, mostly in low earth orbits, it has become imperative to keep the space clean. There are thousands of objects flying around in these orbits; not just old satellites and their parts but also last stages of the rockets that take them there. Moving at extremely high speeds, even the smallest debris can destroy active satellites.
- Scarier still is Kessler syndrome – a scenario where the amount of space debris reaches a point where they just create more with one collision triggering others.
- This is the reason the space debris are monitored and sometimes satellites have to be moved from their way. ISRO carried out 21 such collision course manoeuvres in 2022. In fact, the space agency set up a department in 2022 to monitor the space debris and mitigate the risks posed.
- The space agency was also following the guidelines of UN and the Inter-Agency Space Debris Coordination Committee (IADC) that say satellites should be deorbited after mission life – either through controlled entry over a safe impact zone as was attempted by Isro with Megh Tropiques-1, or by bringing it down to reduce the orbital lifetime (the time it would take for a satellite to drop from a particular orbit by itself) to less than 25 years.
- It is also recommended that in such cases stored fuel be removed from the spacecraft to ensure that there are no accidents that break up the satellite in space and create more debris. In the case of Megha Tropiques-1, the orbit of 867 km with 20 degree inclination meant an orbital lifetime of over 100 years. And, there was over 120 kg of fuel left over in the spacecraft.

➢ **What happens to satellites usually?**

- A controlled re-entry like the one attempted by ISRO earlier this week is possible only for satellites in the low-earth orbit – at about 1,000 kms over the surface of the earth. These manoeuvres, however, are not usually attempted because fuel reserves have to be maintained in the satellite after mission life is over.
- And, this is impossible for satellites placed in geo-stationary or geosynchronous orbit – where time taken by the satellite to orbit the earth matches Earth's rotation – because they are at altitudes of nearly 36,000 kms. "For attempting to bring down a satellite from such as orbit, a huge fuel reserve would be needed. This will only make the satellite heavier and costlier at launch,".
- According to official from ISRO, considering it takes debris from the low earth orbit 20 to 30 years to fall to the atmosphere naturally, it would take generations for those in geosynchronous or geo-stationary orbits to fall.

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- In higher orbits Satellites are usually moved to what is known as graveyard orbit. Instead of bringing them down, they are shot upwards at the end of life. These orbits are like parking lots in space where all old satellites are put in. Sometimes a satellite might escape to deep space as well.
  - ✓ A satellite escapes to deep space when its velocity increases enough to get away from the gravitational pull of the earth.

➢ **Have ISRO satellites rained debris in the past?**

- Almost 99.9 per cent of a satellite burns up in the atmosphere. The satellites in low earth orbit are usually smaller and hence more likely to disintegrate complete when they enter the atmosphere.
- In addition, the official from ISRO said, the space agency usually uses aluminium and composites to make the satellites. These materials have a lower burning point and are much easily destroyed in the atmosphere.

ANSWER WRITTING

Q. In recent years India-Australia relationship has chartered a new trajectory and the countries cooperate closely in a wide range of sectors. Analyse.

India and Australia have several commonalities, which serve as a foundation for closer cooperation and multifaceted interaction. Both are strong, vibrant, secular and multicultural democracies. The relationship has grown in strength and importance since India's economic reforms in the 1991 and has made rapid strides in areas such as trade, energy and mining, science & technology, education and defence.

India and Australia cooperate closely in a wide range of sectors:

- Political Cooperation: India and Australia elevated their relationship to the level of Comprehensive Strategic Partnership in 2020. India and Australia co-operate in various multilateral fora. Australia supports India's candidature in an expanded UN Security Council. Both are members of the Commonwealth, G20, QUAD, Trilateral Supply Chain Initiative and the Indo-Pacific Economic Framework (IPEF).
- Economic Cooperation: The Economic Cooperation Trade Agreement (ECTA) is the first free trade agreement signed by India with a developed country in a decade. This has resulted in an immediate reduction of duty to zero on 96% of Indian exports to Australia in value and zero duty on 85% of Australia's exports to India.
- People to People ties: India is one of the top sources of skilled immigrants to Australia. As per the 2021 Census, around 9.76 lakh people in Australia reported their ancestry as Indian origin, making them the second largest group of overseas-born residents in Australia.
- Defence Cooperation: The Mutual Logistics Support Agreement (MLSA) was concluded during the Virtual Summit in 2020, and the two militaries held several joint exercises in 2022. Australia will host military operations with India, Japan, and the US in the "Malabar" exercises off the coast of Perth and has invited India to join the Talisman Sabre exercises later this year.
- Trade and Investment: India is Australia's 9th largest trading partner. Four products: coal, non-monetary gold, copper ores & concentrates and petroleum accounted for over 80 percent of India's imports from Australia. India's major exports to Australia are pearls and gems, jewellery, medicaments and passenger motor vehicles.
  - The ECTA is likely to make import of coal and other minerals, such as copper, nickel, aluminium, manganese, etc., available at competitive prices, which would provide a much-needed boost to India's energy sector.
- Education: The Mechanism for Mutual Recognition of Educational Qualifications (MREQ) was signed recently. This will facilitate mobility of students between India and Australia.
  - Deakin University and University of Wollongong are planning to open campuses in India.
  - More than 1 lakh Indian students are pursuing higher education degrees in Australian universities, making Indian students the second largest cohort of foreign students in Australia.
- Clean energy: The countries signed a Letter of Intent on New and Renewable Energy, which provides for cooperation towards bringing down the cost of renewable energy technologies, especially ultra low-cost solar and clean hydrogen.
- Science & Technology: Formal cooperation in science and technology between Australia and India began in 1986 with the signing of an agreement by the two governments. In 2006, the two Governments set up the Australia-India Strategic Research Fund.

India and Australia share a greater convergence of views on issues, such as value free and open societies, rule of law and a shared commitment to a rule-based order in the Indo-Pacific region. Further, the recently signed India–Australia ECTA has the potential to become a valuable tool in the hands of the Indian industry in realising the vision of Atmanirbhar Bharat.

MCQs

1. With reference to The Space Liability Convention of 1972 consider the following
   1. It defines responsibility in case a space object causes harm.

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2. The Convention also provides for procedures for the settlement of claims for damages.
3. The law does not talk against space junk crashing back to earth.

Which of the above statement/s is/are correct?

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

2. Consider the following pairs on Important Missions on Removing Space Debris by various space agencies across the world
   1. RemoveDebris: European Space Agency
   2. Debris Elimination and Reentry: NASA.
   3. Space Debris Capture Experiment: Japanese Aerospace Exploration Agency (JAXA).
   4. Cleanup Mission: proposed mission by the Russian Space Agency (Roscosmos).
   5. Space Debris Removal System (SDRS): China National Space Administration's (CNSA).

   How many above pairs are correctly matched?

   a) Only one pair b) Only two pairs **c) Only three pairs** d) All the five pairs
3. Kessler Syndrome often mentioned in news, is related to which of the following?
   a) Space Junk
   b) Human Disease
   c) Disease related to Domestic animal
   d) E waste
4. Consider the following statements with reference to H3N2 virus recently seen in news
   1. H3N2 a subtype of Influenza A virus
   2. Presently there is no drug recommended by the World Health Organisation (WHO) for treating illness caused by Influenza A.

   Which of the above statement/s is/are not correct?

   a) 1 only **b) 2 only** c) Both 1 and 2 d) Neither 1 nor 2
5. With reference to landslide atlas of India consider the following
   1. The database includes three types of landslide inventory – seasonal, event-based and route-wise for the 1998-2022 periods.
   2. This Atlas provides the details of landslide present in Landslide provinces of India but it does not include damage assessment of landslide locations.
   3. Globally, landslides rank two in terms of deaths among natural disasters after Earthquake.

   Which of the above statement/s is/are not correct?

   a) 1 and 2 only b) 2 only c) 2 and 3 only **d) 3 only**
6. The number of districts with the maximum landslide exposure are in which of the following state?
   a) Arunachal Pradesh
   b) Kerala
   c) Uttarakhand
   d) Jammu and Kashmir
7. Which of the following state assembly recently passed a resolution against BBC for airing a documentary on the 2002 communal riots?

   a) Madhya Pradesh b) Uttarakhand c) Uttarpradesh **d) Gujarat**
8. Recently in Madhav National Park is in news in context of re-establish tiger population, is situated in which of the following state?

   a) Madhya Pradesh b) Jharkhand c) Maharashtra d) Chhattisgarh
9. With reference to PM VIshwakarma KAushal Samman (PM VIKAS) yojna consider the following
   1. The main objective of the scheme is to improve skills for traditional and age-old crafts.
   2. The entire program is to be integrated with the MSME sector
   3. The scheme also includes financial support

   Choose the correct statement/s using the codes given below

   a) 1 only b) 1 and 2 only **c) 1,2 and 3** d) 3 only
10. LEAN Scheme recently seen in news is associated with which of the following?
    a) Agricultural loans
    b) Educational Loans
    c) MSMEs
    d) Old Age pension

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