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IMPORTANT INSIGHTS

Nepal Flash Flood Disaster Highlights Cascading Himalayan Hazards and Growing Risks from Newly Formed Barrier Lakes

Recent Developments:

- Following the devastating **26 August 2026 flash flood** in Nepal's Rasuwa district, satellite observations identified **new water bodies and unstable barrier lakes** along the avalanche pathway near the Nepal–Tibet border.
- The disaster is linked to a major **ice-rock avalanche and glacial collapse**, which generated enormous debris, temporarily obstructed river channels and released destructive floodwaters into the **Bhote Koshi–Trishuli river system**.
- At least two new lakes have emerged in the affected upper catchment, creating concerns about a possible **Landslide Lake Outburst Flood (LLOF)** or further cascading flood events if unstable debris barriers breach or overflow.
- The continuing instability has complicated rescue operations and threatens settlements, hydropower infrastructure and connectivity along the strategically important **Gyirong–Rasuwadighi corridor**.

Understanding the Disaster: From Avalanche to Flash Flood:

Sequence of the Cascading Hazard:

- Preliminary satellite imagery and scientific assessments indicate that a large mass of **ice and rock collapsed from a high-altitude Himalayan slope** near the Nepal–Tibet border and travelled rapidly into the valley below.
- The resulting **ice-rock avalanche** deposited enormous quantities of debris in river channels, creating a temporary natural obstruction and impounding water behind the debris mass.
- Once water pressure exceeded the strength of the unstable natural barrier, water, sediment, ice and boulders were released downstream as a powerful **flash flood and debris flow**.
- The event demonstrates a classic **cascading hazard chain** in which one geological or cryospheric event triggers successive hazards: **glacial instability → ice-rock avalanche → river blockage → barrier lake formation → dam breach or overflow → flash flood → downstream infrastructure failure**.

Why Himalayan Disasters Can Escalate Rapidly:

- The Himalayas combine **steep topography, active tectonics, unstable slopes, glaciers, intense precipitation and densely interconnected river valleys**, making cascading hazards particularly destructive.
- A single upstream failure can travel rapidly through narrow valleys, carrying water, sediment and large boulders towards settlements and infrastructure downstream.
- Climate change can increase cryospheric instability through **glacier retreat, accelerated snow and ice melt and changes in high-altitude temperature conditions**, while geological and seismic processes continue to destabilise mountain slopes.
- The growing concentration of **roads, hydropower projects, settlements and trade infrastructure** in narrow Himalayan valleys increases exposure even when the original hazard occurs in remote terrain.

Barrier Lakes: Formation and Characteristics:

What Is a Barrier Lake?

- A **barrier lake**, also known as a **landslide lake**, forms when a landslide, rockfall, avalanche or debris flow obstructs a river valley and creates a natural dam.
- Water accumulates upstream because the debris barrier either completely blocks the channel or substantially reduces its capacity to discharge water.
- Unlike engineered dams, such natural barriers are often **heterogeneous, unconsolidated and structurally unstable**, making their behaviour difficult to predict.
- Their stability depends upon factors such as **dam material, dam height, seepage, inflow volume, slope gradient, rainfall and the rate of erosion**.

Why Barrier Lakes Are Dangerous:

- A newly formed barrier can impound large volumes of water within a short period, particularly where glacier-fed rivers and steep catchments generate high inflows.
- Continued water accumulation can cause **overtopping**, while seepage can progressively weaken the debris barrier from within.
- Additional rainfall, avalanches, rockfalls or seismic disturbances can further destabilise the natural dam.
- If the barrier fails suddenly, the stored water can be released together with sediment and debris, producing an exceptionally destructive downstream flood.

Landslide Lake Outburst Flood: Mechanism and Risks:

How an LLOF Occurs:

- A **Landslide Lake Outburst Flood (LLOF)** occurs when a natural dam created by landslide or avalanche debris fails and rapidly releases impounded water.
- The failure may result from **overtopping, internal erosion, slope failure, excessive hydrostatic pressure or a fresh geological disturbance**.
- The released flow can transport enormous quantities of **water, mud, sediment, rocks and vegetation**, increasing its destructive capacity.
- The downstream impact can extend far beyond the original blockage because narrow mountain valleys channelise and accelerate the flood wave.

Comparison with a GLOF:

- A **Glacial Lake Outburst Flood (GLOF)** occurs when water stored in a glacial lake is suddenly released following the failure or overtopping of its containing barrier.
- Such barriers may consist of **terminal moraines, ice dams or other glacier-related formations**.
- An **LLOF and GLOF differ primarily in the nature of the barrier**, but both involve rapid release of impounded water and can generate destructive floods.
- In the Himalayan context, the two hazards may also interact because glacier collapse can initiate an avalanche, which can subsequently create a debris barrier lake and trigger an LLOF.

Newly Formed Lakes and Continuing Secondary Risks:

Persistent Threat of a Second Flood:

- Satellite observations have raised concerns regarding **multiple unstable water bodies** along the path of the original avalanche and in the upstream catchment.
- One of the lakes formed where avalanche debris obstructed the drainage system, while another developed closer to the area of glacial and slope failure.
- Different scenarios remain possible, including **gradual drainage, controlled overflow, partial dam erosion or sudden catastrophic breach**.
- Therefore, the original disaster cannot be treated as a single completed event because the affected Himalayan catchment continues to generate **secondary and cascading risks**.

Challenges for Rescue and Relief Operations:

- Continuing instability makes rescue operations hazardous because emergency personnel may themselves be exposed to fresh floods, avalanches and debris flows.
- Damaged roads and bridges restrict access to remote valleys and delay the movement of heavy rescue equipment.
- Hydropower tunnels and infrastructure located within narrow river valleys can become particularly vulnerable to sudden sediment-laden floods.
- Continuous **satellite surveillance, field reconnaissance and real-time hydrological monitoring** are therefore essential during the emergency response.

Bhote Koshi–Trishuli River System: Geographic Context:

Bhote Koshi River:

- The **Bhote Koshi** is part of the wider **Koshi river basin** and represents an important Himalayan river system connecting high-altitude Tibetan catchments with Nepal.
- It originates in Tibet, where its upper reaches are associated with the **Poiqu river system**, before flowing through steep Himalayan terrain into Nepal.
- The river's **steep gradient, confined valleys and high sediment load** make it vulnerable to flash floods, debris flows and other high-energy mountain hazards.
- Hazards originating in remote upstream areas can therefore reach populated valleys rapidly and leave limited time for evacuation.

Trishuli River:

- The **Trishuli River** is a major river system of central Nepal and forms part of the broader **Narayani–Gandaki basin**.
- Floodwaters travelling through upstream Himalayan tributaries can enter the Trishuli system and subsequently threaten settlements and infrastructure farther downstream.
- The disaster illustrates how hazards can propagate through **connected river networks**, expanding the geographical scale of impacts.

Strategic and Economic Significance:

Gyirong–Rasuwagadhi Corridor:

- The **Gyirong–Rasuwagadhi corridor** is an important trans-Himalayan connectivity route linking Nepal and Tibet.
- The corridor supports **cross-border trade, transit, tourism and regional connectivity**, making infrastructure disruption strategically significant.
- Flood damage can simultaneously affect **border infrastructure, roads, bridges and commercial supply chains**, transforming a natural disaster into an economic and geopolitical challenge.

Hydropower Vulnerability:

- Nepal's Himalayan rivers possess significant hydropower potential, leading to the construction of numerous projects along high-energy mountain valleys.
- However, the concentration of hydropower infrastructure in narrow river corridors increases exposure to **flash floods, debris flows, landslides and lake-outburst events**.
- Disaster-risk assessment must therefore become an integral component of **hydropower planning, environmental assessment and infrastructure design**.

Climate Change and Himalayan Cryosphere Risks:

Warming Mountain Systems:

- Rising temperatures are accelerating **glacier retreat and cryospheric change** across the Hindu Kush Himalaya, contributing to the formation and expansion of potentially unstable lakes.
- Glacier thinning can also alter the stability of surrounding slopes and increase the probability of ice and rock collapses.
- Climate change does not replace geological hazards, but it can interact with tectonic and geomorphological processes to create **compound and cascading disaster risks**.

Increasing Hazard Complexity:

- Traditional disaster management often examines hazards individually, such as floods, landslides or avalanches.
- Himalayan events increasingly demonstrate the need for a **multi-hazard approach**, because one hazard can directly trigger another.
- Risk assessments should therefore integrate **cryosphere monitoring, slope stability, hydrology, seismic activity, weather forecasting and downstream exposure**.

Key Challenges for Disaster Risk Reduction:

Monitoring Remote High-Altitude Regions:

- Remote Himalayan terrain is difficult to monitor through conventional ground-based observation because of extreme weather and limited accessibility.
- Many potentially dangerous events occur in transboundary catchments where critical source areas may lie outside the jurisdiction of downstream countries.
- This creates an urgent requirement for **satellite-based observation, remote sensing, automated sensors and real-time data transmission**.

Transboundary Data Sharing:

- The Nepal disaster demonstrates that upstream hazards can rapidly create downstream consequences across national borders.
- Effective disaster management requires timely sharing of **hydrological information, glacier observations, lake levels, weather data and hazard alerts**.
- Transboundary cooperation should therefore move from post-disaster information exchange towards **institutionalised early warning and early action mechanisms**.

Way Forward:

Develop Multi-Hazard Early Warning Systems:

- Himalayan early warning systems should integrate **satellite imagery, automated weather stations, river-level sensors, seismic observations and artificial intelligence-based anomaly detection**.
- Warning systems should focus not only on known glacial lakes but also on sudden hazards such as **ice-rock avalanches and newly formed barrier lakes**.
- Communities should receive alerts through reliable last-mile communication systems supported by evacuation protocols.

Strengthen Risk-Sensitive Infrastructure:

- Roads, bridges and hydropower projects in Himalayan valleys should be designed using **hazard mapping, flood modelling and climate-risk projections**.
- Critical infrastructure should avoid highly exposed flood paths wherever technically feasible.
- Existing projects should undergo periodic safety assessments to account for changing upstream hazard conditions.

Institutionalise Transboundary Cooperation:

- Himalayan countries should establish stronger arrangements for **real-time data sharing, joint scientific monitoring and coordinated emergency response**.
- Regional institutions and scientific organisations can facilitate common methodologies for monitoring glaciers, unstable slopes and hazardous lakes.
- Such cooperation is essential because **disaster risks do not recognise political boundaries**.

Conclusion:

- The Nepal flash flood demonstrates the extreme vulnerability of the Himalayas to **compound and cascading hazards**.
- A high-altitude ice-rock avalanche can trigger a sequence involving river blockage, barrier lake formation and catastrophic downstream flooding within a short period.
- The emergence of new unstable lakes shows that disaster risk can persist even after the initial flood has passed.
- Building Himalayan resilience therefore requires a shift from isolated hazard management towards **integrated multi-hazard monitoring, climate adaptation, risk-sensitive infrastructure and transboundary cooperation**.

Value Addition for UPSC:

Key Concepts for Mains Answers:

- Cascading disaster risk, compound hazards, cryosphere instability, barrier lake, landslide lake outburst flood
- Glacial lake outburst flood, multi-hazard early warning system, risk-sensitive infrastructure, transboundary disaster governance
- Source-to-sea risk assessment, last-mile connectivity, climate-induced geomorphological change

PM Modi's Central Asia Visit Strengthens India's Security, Connectivity and Energy Partnerships Across the Eurasian Heartland

Recent Developments:

- Prime Minister Narendra Modi is undertaking a four-day visit to **Uzbekistan and the Kyrgyz Republic from 29 August to 1 September 2026**, reflecting India's renewed strategic engagement with Central Asia.
- The Prime Minister visited **Tashkent, Uzbekistan, on 29–30 August** for bilateral discussions aimed at strengthening cooperation in **trade and investment, digital connectivity, defence, energy, education and people-to-people exchanges**.
- He subsequently travelled to **Bishkek, Kyrgyz Republic**, to participate in the **26th Shanghai Cooperation Organisation (SCO) Summit, held from 31 August to 1 September 2026**.
- India, a full member of the **SCO since 2017**, is expected to emphasise its regional vision centred on **Security, Connectivity and Opportunity**, while advocating collective action against terrorism, separatism and extremism.
- The visit assumes greater geopolitical significance because Central Asia has emerged as an important arena of interaction among **Russia, China, India, Western powers and other regional actors**.

Central Asia: Strategic and Geographic Significance:

The Five Central Asian Republics:

- Central Asia comprises five post-Soviet republics—**Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan**—located at the strategic intersection of **Russia, China, South Asia, West Asia and Europe**.
- The region's location gives it considerable geopolitical significance because it can influence **continental connectivity, energy transportation and regional security** across Eurasia.
- Historically, Central Asia remained closely connected with Russia through political, economic and linguistic networks, while China has substantially expanded its economic and infrastructure footprint during the post-Soviet period.
- The region has therefore increasingly become a theatre of **geopolitical competition and geo-economic engagement**, rather than remaining confined to the influence of a single major power.

India's Extended Neighbourhood:

- India officially considers the Central Asian countries part of its **Extended Neighbourhood**, reflecting the region's direct relevance to India's strategic and economic interests.
- India's engagement received greater institutional momentum through the **Connect Central Asia Policy**, announced in **2012**, which emphasised political cooperation, security engagement, economic relations and connectivity.
- Prime Minister Modi further elevated this outreach by becoming the **first Indian Prime Minister to visit all five Central Asian countries in 2015**.
- The first **India-Central Asia Summit in January 2022** institutionalised leader-level engagement, with the participating countries agreeing to hold the summit every two years and establish supporting ministerial and official-level mechanisms.

Why Central Asia Matters to India:

Energy and Mineral Security:

- Central Asia possesses substantial reserves of **uranium, hydrocarbons and strategic minerals**, making it important for India's long-term energy and resource security.
- **Kazakhstan** possesses significant uranium and mineral resources and has emerged as an important partner for India's civilian nuclear energy requirements.
- **Turkmenistan** possesses major natural gas reserves and is central to the proposed **Turkmenistan–Afghanistan–Pakistan–India gas pipeline**.
- **Uzbekistan** possesses substantial reserves of gold, uranium and natural gas, while the **Kyrgyz Republic and Tajikistan** possess considerable hydropower potential.
- Diversified access to these resources can reduce India's vulnerability to excessive dependence on limited geographical sources of energy and critical minerals.

Strategic Balancing:

- China's economic influence in Central Asia has expanded substantially through trade, infrastructure investments and the **Belt and Road Initiative**.
- India's deeper engagement provides Central Asian countries with additional strategic and economic partnerships, thereby supporting their objective of maintaining **strategic autonomy and diversified external relations**.
- India's approach should not be viewed solely through the prism of competition with China, as the region also offers opportunities for **cooperative regional development and multipolar engagement**.
- Nevertheless, sustained Indian engagement is important to prevent the strategic space of Central Asia from becoming excessively dominated by any single external power.

Regional Security:

- Central Asia's proximity to **Afghanistan** makes regional stability directly relevant to India's security interests.
- The Taliban's return to power has intensified concerns regarding **terrorism, radicalisation, extremism and the possible movement of transnational terrorist organisations**.
- Central Asian states and India therefore share an interest in preventing Afghanistan from becoming a source of cross-border instability.
- The **SCO** provides India with an important multilateral platform to discuss regional security challenges alongside Central Asian countries, Russia and China.

Connectivity: India's Major Strategic Challenge:

Lack of Direct Overland Access:

- India faces a structural connectivity challenge because it lacks **direct overland access to Central Asia through Pakistan**.
- This geographical constraint increases transportation costs and limits the volume of direct trade between India and the landlocked Central Asian republics.
- Improving connectivity is therefore one of the most important requirements for converting India's historical and diplomatic links into sustained economic engagement.

International North–South Transport Corridor:

- The **International North–South Transport Corridor (INSTC)** provides an important alternative connectivity framework linking India with Eurasia through maritime, rail and road networks.
- Integration of the corridor with **Iran's Chabahar Port** can potentially provide India with greater access to Afghanistan and Central Asia without dependence on Pakistani territory.
- Chabahar therefore has significance beyond bilateral India-Iran relations and represents an important component of India's broader **Eurasian connectivity strategy**.
- Greater coordination between India, Iran and Central Asian countries can help develop economically viable multimodal routes.

Central Asia and the Shanghai Cooperation Organisation:

Importance of the SCO for India:

- The **Shanghai Cooperation Organisation** was established in **2001** and has evolved into an important Eurasian platform for cooperation on security, political issues and regional economic engagement.
- India became a **full member in 2017**, enabling it to participate more directly in discussions affecting Central Asian security and regional connectivity.
- The organisation allows India to maintain institutional engagement with Central Asian states while simultaneously interacting with major Eurasian powers.
- India's priorities at the SCO include combating **terrorism, separatism and extremism**, strengthening connectivity and expanding mutually beneficial economic cooperation.

Limitations of the SCO:

- The SCO includes states with significant **strategic rivalries and divergent geopolitical interests**, which can limit consensus and effective implementation.
- India must therefore use the organisation as one component of a broader Central Asia strategy rather than relying exclusively on multilateral engagement.
- Bilateral partnerships with individual Central Asian countries remain essential because their economic priorities and security concerns differ significantly.

Civilisational and Cultural Connections:

Historical Linkages:

- India and Central Asia share centuries-old connections through **trade routes, migration, Buddhism, cultural exchanges and historical empires**.

- The region historically served as an important connecting space between the Indian subcontinent and wider Eurasia.
- Such civilisational connections provide India with a form of **soft power**, which can complement contemporary strategic and economic engagement.

India–Uzbekistan Cultural Relations:

- Uzbekistan occupies a particularly important place in India's historical engagement with Central Asia.
- **Termez and the Kara Tepa archaeological complex** provide important evidence of the historical spread of Buddhism and cultural interaction between the Indian subcontinent and Central Asia.
- Shared linguistic and cultural influences are also visible in aspects of vocabulary, food and historical traditions.
- These connections can support greater cooperation in **education, tourism, cultural exchanges, academic research and people-to-people relations**.

Economic and Development Cooperation:

Expanding Trade and Investment:

- Central Asia offers opportunities for India in **pharmaceuticals, information technology, digital services, education, healthcare, mining and infrastructure development**.
- Uzbekistan has emerged as an important economic partner, and the current visit seeks to further expand cooperation in **trade, investment, defence, digital connectivity and energy**.
- Stronger institutional connectivity and improved transport corridors will be necessary for India to fully utilise the region's commercial potential.

Development Partnership:

- India can strengthen its regional profile through **capacity building, education, digital public infrastructure, healthcare cooperation and technical assistance**.
- These sectors allow India to differentiate its engagement by focusing on **human-centric and demand-driven development partnerships**.
- Such cooperation can create long-term goodwill without generating excessive debt dependence or political sensitivity.

Major Challenges for India:

Connectivity Constraints:

- The absence of direct land connectivity remains the most significant practical obstacle to expanding India–Central Asia trade.
- Alternative routes through Iran and the wider Eurasian connectivity network require sustained infrastructure development and political coordination.

Regional Security Uncertainty:

- Instability in Afghanistan continues to pose risks relating to **terrorism, extremism and cross-border organised crime**.
- A deteriorating regional security environment can undermine economic projects and transport corridors.

Great-Power Competition:

- Central Asia is witnessing increasing engagement from **China, Russia, the United States, Türkiye, the European Union and other regional powers.**
- India must expand its influence without forcing Central Asian countries to choose between competing geopolitical blocs.

Economic Competition:

- India's economic presence remains smaller than that of several major regional powers, particularly China.
- India therefore requires greater private-sector participation and commercially viable projects to complement government-led diplomacy.

Way Forward:***Build Reliable Connectivity:***

- India should accelerate coordination on **Chabahar Port and the International North–South Transport Corridor** while exploring additional multimodal links with Central Asian partners.
- Connectivity projects must focus on commercial viability, predictable logistics and sustained institutional coordination.

Strengthen Security Cooperation:

- India should expand cooperation in **counter-terrorism, intelligence sharing, border management, cyber security and capacity building.**
- Regular dialogue on Afghanistan should remain an important component of India-Central Asia engagement.

Deepen Economic Integration:

- India should focus on sectors where it possesses comparative advantages, including **pharmaceuticals, digital technology, education, healthcare and renewable energy.**
- Greater business-to-business engagement is required to transform diplomatic goodwill into sustained economic partnerships.

Expand People-to-People Relations:

- Scholarships, academic exchanges, cultural programmes and tourism can strengthen India's long-term societal connections with Central Asia.
- Civilisational diplomacy should complement rather than substitute for modern **economic and strategic engagement.**

Conclusion:

- Prime Minister Modi's Central Asia visit reflects India's sustained effort to transform the region into a more important pillar of its **Extended Neighbourhood and Eurasian strategy.**
- Central Asia is significant for India's **energy security, mineral access, regional security, connectivity and geopolitical influence.**
- However, India's ambitions remain constrained by limited direct connectivity and intense geopolitical competition.

- A successful long-term strategy will require India to combine **connectivity diplomacy, economic engagement, security cooperation and civilisational soft power**.
- The ultimate objective should be to develop Central Asia as a region of **shared prosperity and strategic stability**, while ensuring that India's interests remain meaningfully represented in the evolving Eurasian geopolitical order.

UNCCD COP17 Advances Global Action on Land Restoration, Drought Resilience and Sustainable Management of Fragile Ecosystems

Recent Developments:

- The **17th session of the Conference of the Parties to the United Nations Convention to Combat Desertification** was held in Ulaanbaatar, Mongolia, from 17–28 August 2026 under the theme “**Restoring Land. Restoring Hope.**”
- COP17 brought together governments, scientists, civil society organisations, Indigenous Peoples, pastoralists and other stakeholders to address the interconnected challenges of **desertification, land degradation and drought**.
- The conference gave particular attention to **rangelands, pastoral communities, drought resilience, nature-based solutions, innovative finance and sustainable land management**.
- **Egypt will host the 18th session of the UNCCD Conference of the Parties in Sharm El-Sheikh in 2028.**
- India emphasised **community-led and science-based land restoration**, predictable international finance and conservation of **Open Natural Ecosystems**, while highlighting progress towards its land restoration commitments.

Key Outcomes of UNCCD COP17:

Land Restoration as a Development Priority:

- COP17 recognised that **land restoration** is not merely an environmental objective but is closely connected with **food security, livelihoods, water security, poverty reduction and human displacement**.
- Land degradation can reduce agricultural productivity, weaken ecosystem services and intensify competition over natural resources, thereby creating additional socio-economic vulnerabilities.
- The official COP17 agenda also considered the relationship between **desertification, land degradation, drought and migration**, highlighting the broader human-security implications of land degradation.

Rangelands and Pastoral Communities:

- The conference placed special emphasis on **rangelands and pastoralists**, recognising the ecological and economic importance of grasslands, savannas and other open ecosystems.
- Sustainable rangeland management can simultaneously support **livelihood security, biodiversity conservation, carbon storage and climate resilience**.
- The focus was particularly relevant because **2026 is the International Year of Rangelands and Pastoralists**, with Mongolia playing a prominent role in advancing the agenda.

Drought Resilience:

- COP17 strengthened the focus on moving from **post-drought relief towards anticipatory drought preparedness and resilience-building**.
- A comprehensive **Drought Resilience Index** was highlighted as a tool for assessing countries' capacity to anticipate, prepare for and adapt to drought risks through data-driven vulnerability assessment.
- The approach can support more efficient allocation of public resources by identifying vulnerable regions before drought impacts become severe.

Innovative Drought Finance:

- The **Drought Resilience Investment Facility** was presented as an innovative financing mechanism intended to use public resources to reduce investment risks and attract private and institutional capital.
- Such financing can support **water security, climate-resilient agriculture, drought preparedness and land restoration**.
- COP17 also maintained strong emphasis on mobilising additional financial resources because developing countries continue to face significant gaps in financing for drought resilience.

Drought Governance:

- Countries did not reach agreement on a **legally binding global drought agreement**, leaving the issue for further negotiations.
- However, drought was given a more prominent institutional position, with the COP17 process providing for **drought as a standalone agenda item from COP18 onwards**.
- A comprehensive global framework could promote **national drought plans, early-warning systems, monitoring networks, data sharing and predictable financing mechanisms**.

India's Position at COP17:***Conservation of Open Natural Ecosystems:***

- India highlighted the importance of **Open Natural Ecosystems**, including grasslands, savannas, scrublands, ravines and deserts.
- India launched its first **Guide to Grasslands and Other Open Natural Ecosystems**, seeking to improve recognition and conservation of ecosystems that have historically been undervalued because of their limited tree cover.
- Landscapes such as the **Thar, Banni and Deccan savannas** demonstrate that ecological importance cannot be assessed only through forest cover.
- Conservation of these ecosystems is important for **biodiversity, pastoral livelihoods, soil conservation, groundwater and climate resilience**.

Progress under the Bonn Challenge:

- India has brought **21.76 million hectares** of degraded land under restoration efforts against its target of restoring **26 million hectares by 2030**.
- India's restoration approach increasingly links **land productivity, ecosystem services, biodiversity conservation, climate action and rural employment**.
- The government has reported that restoration activities have generated approximately **1.22 billion person-days of employment**, demonstrating the potential of ecological restoration as a development intervention.

Community-Based Restoration:

- India advocated recognising **pastoral communities as custodians of ecosystems**, securing appropriate grazing rights and integrating traditional ecological knowledge with modern scientific methods.
- Community-protected landscapes such as **Orans of Rajasthan** demonstrate how local institutions can contribute to biodiversity conservation, vegetation protection and water-resource management.
- This approach supports the principle that restoration becomes more sustainable when local communities participate in planning, implementation and monitoring.

Understanding the UNCCD:

Origin and Mandate:

- The **United Nations Convention to Combat Desertification** was adopted in **1994** and emerged from the global environmental process initiated by the **1992 Earth Summit in Rio de Janeiro**.
- It is one of the three major **Rio Conventions**, alongside the conventions dealing with climate change and biological diversity.
- The UNCCD provides the principal international framework for addressing **desertification, land degradation and drought**, with particular emphasis on sustainable land management.

Land Degradation Neutrality:

- **Land Degradation Neutrality** seeks to maintain or improve the quantity and quality of land resources necessary for ecosystem functioning, food production and human well-being.
- It is closely associated with **Sustainable Development Goal Target 15.3**, which calls for achieving a land-degradation-neutral world.
- The approach emphasises avoiding new degradation, reducing ongoing degradation and restoring already degraded land.

Conference of the Parties:

- The **Conference of the Parties** is the principal decision-making body of the UNCCD.
- It reviews implementation by Parties, considers scientific and policy recommendations and adopts decisions necessary for advancing the objectives of the Convention.
- COP17's official documentation included dedicated work on **rangelands and pastoralists, drought policy, migration, land tenure and sand and dust storms**.

Major Challenges in Combating Land Degradation:

Ecological Challenges:

- **Unsuitable afforestation, soil erosion, declining soil organic carbon and salinisation** can undermine restoration efforts.
- Treating natural grasslands and scrublands as wastelands may encourage inappropriate tree plantations that disturb native biodiversity and pastoral livelihoods.
- Excessive cultivation and inefficient fertiliser use can reduce soil quality, while poorly managed irrigation can accelerate **soil salinity and waterlogging**.

Agricultural and Livelihood Vulnerabilities:

- Agricultural incentives may encourage **water-intensive crops** in regions already facing groundwater stress.
- Shrinking **Common Property Resources**, including grazing lands, can increase pressure on remaining pastures and accelerate degradation.
- Insecure land tenure can particularly affect women farmers and reduce their access to **institutional credit, insurance, subsidies and extension services**.

Institutional Fragmentation:

- Responsibilities for land, forests, agriculture, water and rural development are distributed across multiple institutions, often resulting in fragmented interventions.
- Effective restoration therefore requires **landscape-level planning** rather than isolated departmental schemes.
- Drought management also needs to move from reactive relief towards **anticipatory risk reduction and resilience-building**.

Finance and Climate Risks:

- Land restoration often has long gestation periods and uncertain financial returns, making it difficult to attract private investment.
- Weak **Measurement, Reporting and Verification** systems can further constrain investment in carbon, biodiversity and ecosystem-service markets.
- Climate change is increasing rainfall variability in many regions, with intense rainfall followed by prolonged dry periods contributing to **runoff, soil erosion, reduced groundwater recharge and reservoir siltation**.

India's Major Initiatives:

National and Landscape-Level Measures:

- The **National Action Plan for Combating Desertification** provides an overarching framework for addressing land degradation and desertification through convergence of government programmes.
- The **Pradhan Mantri Krishi Sinchayee Yojana** supports watershed development, rainwater harvesting and soil-moisture conservation.
- The **Green India Mission** seeks to improve forest quality, ecosystem services and carbon sequestration under the broader climate-policy framework.
- The **Soil Health Card Scheme** provides farmers with scientific recommendations regarding soil nutrients and fertiliser use.
- The **Desertification and Land Degradation Atlas of India** developed using space-based technologies supports identification and monitoring of degraded land.
- **Mission Amrit Sarovar** promotes creation and rejuvenation of water bodies, supporting groundwater recharge and drought resilience.
- The **Aravalli Green Wall Initiative** seeks to restore degraded landscapes across the Aravalli region and strengthen ecological resilience.

Way Forward:

Policy and Governance:

- India should promote **agro-ecological zoning** so that agricultural incentives, electricity support and procurement policies become better aligned with local ecological conditions.
- Drought financing should increasingly become **trigger-based and anticipatory**, allowing resources to reach vulnerable regions before severe impacts occur.
- **Ridge-to-Valley planning** at the district level can integrate interventions related to agriculture, forests, water resources and rural development.

Ecological Restoration:

- Grasslands, savannas and scrublands should be recognised as **distinct ecosystems** rather than treated as degraded forests.
- Restoration should prioritise **native species, invasive-species management, soil-carbon restoration, regenerative agriculture and water-efficient farming**.
- Crop residues should be incorporated into **circular bioeconomies**, including biomass-based energy and bio-CNG, to reduce open burning while generating economic value.

Technology and Finance:

- **Satellite imagery, soil-moisture sensors, artificial intelligence and geographic information systems** should be integrated for localised drought prediction and ecosystem monitoring.
- Blended finance and public de-risking mechanisms can encourage private investment in **land restoration, sustainable agroforestry and drought-resilient agriculture**.
- Stronger monitoring and verification frameworks are necessary to improve the credibility of carbon and biodiversity-related financial instruments.

Conclusion:

- **UNCCD COP17** reinforced the understanding that land restoration is simultaneously an environmental, economic, social and human-security priority.
- India's emphasis on **community participation, scientific restoration, ecosystem conservation and predictable finance** reflects the need to integrate ecological sustainability with development objectives.
- The future of drought governance should shift from **crisis response to anticipatory resilience**, supported by reliable data, early-warning systems and accessible finance.
- Achieving **Land Degradation Neutrality** will ultimately require coordinated action involving governments, communities, farmers, pastoralists, scientists and private investors.
- Sustainable land management can therefore become a pathway towards **food security, climate resilience, biodiversity conservation, livelihood protection and inclusive rural development**.

Value Addition for UPSC:

Key Concepts:

- **Land Degradation Neutrality:** Avoid degradation, reduce ongoing degradation and restore degraded land.
- **Nature-Based Solutions:** Address societal challenges through protection, sustainable management and restoration of ecosystems.

- **Ecosystem-Based Adaptation:** Use ecosystem management to help communities adapt to climate-related risks.
- **Anticipatory Action:** Take preventive measures before a forecast hazard produces severe impacts.
- **Landscape Approach:** Manage interconnected ecosystems and human activities across administrative boundaries.
- **Ridge-to-Valley Approach:** Integrate land and water conservation from upper catchments to downstream areas.

India's Nuclear Energy Expansion Strengthens Energy Security, Decarbonisation, Indigenous Technology and the Vision of Viksit Bharat 2047

Recent Developments:

- India is positioning **nuclear energy** as a reliable, low-carbon and technology-intensive component of its long-term development strategy through the **Nuclear Energy Mission for Viksit Bharat**, indigenous reactor technologies and the **SHANTI Act, 2025**.
- The **Nuclear Energy Mission** targets **100 GW of nuclear power capacity by 2047** and aims to operationalise at least **five indigenous Small Modular Reactors by 2033**.
- India currently has **8.78 GW of nuclear power capacity**, which is projected to rise to about **22 GW by 2031–32** through progressive completion of projects already under implementation.
- The **500 MWe Prototype Fast Breeder Reactor at Kalpakkam** achieved **first criticality on 6 April 2026**, marking India's formal entry into the **second stage of its three-stage nuclear power programme**.
- The **SHANTI Act, 2025** seeks to facilitate wider participation of the private sector in the nuclear energy programme while supporting the expansion envisaged under the Nuclear Energy Mission.

Nuclear Energy: Basics and Significance:

How Nuclear Power Generation Works:

- A nuclear power plant generates electricity from the **heat released through controlled nuclear fission**.
- During fission, a neutron strikes a fissile nucleus such as uranium or plutonium, causing it to split and release **heat and additional neutrons**, thereby sustaining a controlled chain reaction.
- The released heat converts water into **steam**, which rotates a turbine connected to a generator and produces electricity.
- Nuclear power therefore provides **firm and dispatchable electricity**, making it particularly relevant for meeting base-load requirements alongside variable renewable energy.

Why Nuclear Energy Matters for India:

- Nuclear energy can provide large-scale electricity with **low lifecycle greenhouse-gas emissions**, thereby supporting India's **Net Zero target by 2070**.
- Its high capacity factor enables continuous generation without the intermittency associated with solar and wind power.
- Nuclear power can reduce dependence on imported fossil fuels and strengthen **energy security**.

- Expansion of indigenous nuclear technology can promote **strategic autonomy, industrial capability, skilled employment and technological self-reliance.**

Status of Nuclear Energy in India:

Current Capacity and Expansion:

- India has **24 nuclear power reactors with an installed capacity of 8.78 GW**, while additional reactors are at different stages of construction and implementation.
- The official roadmap envisages increasing capacity to approximately **22 GW by 2031–32**, followed by further expansion towards **100 GW by 2047**.
- The expansion strategy combines **large indigenous PHWRs, Light Water Reactors, Fast Breeder Reactors and Small Modular Reactors.**
- The government has approved pre-project activities for **two 500 MW Fast Breeder Reactors at Kalpakkam**, supporting the expansion of the second stage of India's nuclear programme.

Nuclear Energy Mission for Viksit Bharat:

- The **Nuclear Energy Mission**, announced in the **Union Budget 2025–26**, seeks to establish nuclear energy as an important source of reliable low-carbon electricity.
- The mission has earmarked **₹20,000 crore** for research and development of indigenous **Small Modular Reactors.**
- The government aims to operationalise at least **five indigenous SMRs by 2033**, with applications including captive power generation, replacement of retiring fossil-fuel plants and electricity supply to remote locations.
- Indigenous SMR designs under development include the **220 MWe Bharat Small Modular Reactor, 55 MWe Small Modular Reactor and a High Temperature Gas Cooled Reactor for hydrogen production.**

India's Three-Stage Nuclear Power Programme:

Stage I — Pressurised Heavy Water Reactors:

- The first stage is based primarily on **Pressurised Heavy Water Reactors using natural uranium** as fuel.
- Spent fuel is reprocessed to recover **plutonium**, which becomes an important input for the second stage.
- India has developed substantial indigenous expertise in the design, construction, operation and fuel-cycle management of PHWR technology.

Stage II — Fast Breeder Reactors:

- The second stage uses **plutonium-based fuel** in Fast Breeder Reactors to generate electricity while producing additional fissile material.
- The **500 MWe PFBR at Kalpakkam achieved first criticality on 6 April 2026**, marking a major milestone in India's nuclear strategy.
- The PFBR uses **uranium-plutonium mixed oxide fuel** and a uranium-238 blanket to breed additional plutonium, thereby improving fuel utilisation.

Stage III — Thorium Utilisation:

- The third stage envisages the use of **uranium-233 derived from thorium** to exploit India's substantial thorium resources.

- Thorium-232 is **fertile rather than fissile**, meaning that it cannot sustain a conventional fission chain reaction by itself but can be converted into fissile uranium-233 through neutron irradiation.
- India's long-term three-stage strategy therefore seeks to transform its relatively limited uranium resources and substantial thorium resources into greater **energy security and fuel-cycle sustainability**.

Applications Beyond Electricity:

Healthcare:

- Nuclear technology supports **medical imaging, cancer diagnosis, radiotherapy and radiopharmaceutical development**.
- Institutions such as **BARC, IGCAR, Tata Memorial Centre and TIFR** contribute to indigenous nuclear medicine and advanced medical technologies.
- Radiation technology also supports the sterilisation of medical equipment, strengthening infection-control practices.

Agriculture:

- **Radiation-induced mutagenesis** can help develop crop varieties with desirable characteristics such as higher yield, early maturity and greater tolerance to drought, salinity, heat and diseases.
- Nuclear techniques can therefore contribute to **climate-resilient agriculture and food security**.

Food Preservation:

- **Food irradiation** can extend the shelf life of agricultural commodities, fish and spices by controlling microorganisms, insects and other spoilage agents.
- Longer shelf life can reduce post-harvest losses and facilitate transportation over longer distances.

Minerals and Rare Earth Elements:

- Nuclear analytical techniques support the **exploration, characterisation and quality assessment of mineral resources**.
- India has developed indigenous reference materials and analytical capabilities relevant to the **rare earth element ecosystem**, strengthening critical-mineral security.

Semiconductors and Advanced Materials:

- Nuclear research contributes to the production of **high-purity materials and specialised isotopes** required in advanced electronics and semiconductor applications.
- Indigenous materials capabilities can strengthen technological self-reliance in strategically important industries.

Green Hydrogen:

- Nuclear reactors can potentially support **low-carbon hydrogen production** by combining reliable electricity with high-temperature process heat.
- Nuclear-powered hydrogen could complement renewable-based electrolysis and reduce dependence on fossil-fuel-based hydrogen production.

Nuclear Safety and Regulation:

Defence-in-Depth:

- Indian nuclear facilities follow the principle of **Defence-in-Depth**, involving multiple physical barriers, redundant systems and independent safety layers.
- Nuclear plants are designed with safeguards against external hazards such as **earthquakes, floods, cyclones and tsunamis**.
- Emergency shutdown, cooling, radiation monitoring and emergency preparedness systems provide additional protection.

Radiation Protection:

- Radiation exposure is managed through the **ALARA principle**, which requires exposure to be kept **As Low As Reasonably Achievable**.
- Radiation safety also involves prescribed dose limits, shielding, protective equipment, trained personnel and dedicated health-physics systems.
- The **Atomic Energy Regulatory Board** plays a central role in regulatory oversight and safety assessment of nuclear installations.

Radioactive Waste Management:

- Radioactive waste is treated, conditioned and disposed of under prescribed safety standards to minimise risks to humans and the environment.
- India has developed indigenous technologies for the **vitrification of high-level radioactive waste**, converting it into stable glass forms suitable for long-term management.

Major Challenges:

High Capital Cost and Long Construction Periods:

- Nuclear projects require large upfront investments, complex regulatory processes and long construction periods.
- Delays can increase project costs and postpone the expected contribution to the energy mix.

Safety and Public Acceptance:

- Nuclear accidents, although rare, can have severe consequences, making **safety culture, transparent regulation and public communication** essential.
- Public acceptance also depends on credible emergency preparedness and effective radioactive-waste management.

Fuel and Technology Constraints:

- India's uranium resources are relatively limited and require supplementation through domestic exploration and international cooperation.
- The transition towards advanced reactors and thorium utilisation requires sustained **research, development, fuel-cycle innovation and skilled human resources**.

Financing and Private Participation:

- Achieving **100 GW by 2047** requires substantial investment and institutional capacity.
- Wider private participation under the **SHANTI Act, 2025** can mobilise additional capital and technology, but must operate within a robust framework of **liability, regulation, safeguards and public accountability**.

Way Forward:

Accelerating Indigenous Capacity:

- India should expand domestic manufacturing of **reactor components, nuclear-grade materials, fuel-cycle technologies and safety systems**.
- Indigenous PHWRs and SMRs can reduce technology dependence and strengthen domestic industrial capabilities.

Expanding SMRs:

- **Small Modular Reactors** can complement large reactors because of their modular construction, flexible deployment and potential suitability for captive and remote applications.
- Their deployment can support decarbonisation of **hard-to-abate industrial sectors** while reducing dependence on fossil-fuel-based captive power.

Strengthening Safety and Governance:

- Nuclear expansion must remain anchored in **independent regulatory oversight, transparent safety assessments, emergency preparedness and effective radioactive-waste management**.
- Private-sector participation should therefore be accompanied by strong institutional safeguards and clear accountability mechanisms.

Integrating Nuclear Energy with Renewables:

- Nuclear power should complement, rather than replace, renewable energy in India's clean-energy transition.
- **Firm nuclear generation** can provide grid stability while solar and wind generation expands, thereby supporting a diversified low-carbon electricity system.

Conclusion:

- India's nuclear programme has evolved from a long-term strategic vision into an increasingly important pillar of **energy security, decarbonisation and technological self-reliance**.
- The **Nuclear Energy Mission for Viksit Bharat**, the **SHANTI Act, 2025**, indigenous PHWRs, SMRs and the successful first criticality of the **PFBR** collectively mark a new phase in India's nuclear development.
- The ultimate challenge is to expand nuclear capacity rapidly without compromising **safety, environmental responsibility, economic viability and regulatory credibility**.
- A balanced combination of nuclear energy, renewables, storage, grid modernisation and energy efficiency can strengthen India's pathway towards **Viksit Bharat 2047 and Net Zero emissions by 2070**.

Value Addition for UPSC:

Key Concepts:

- **Nuclear Fission:** Splitting of a heavy atomic nucleus into smaller nuclei with the release of energy.
- **Nuclear Fusion:** Combining light atomic nuclei to release energy; it powers the Sun and remains under development for commercial electricity generation.
- **Fissile Material:** Material capable of sustaining a nuclear fission chain reaction, such as uranium-235 and plutonium-239.
- **Fertile Material:** Material that can be converted into fissile material after neutron absorption, such as thorium-232 and uranium-238.
- **Breeder Reactor:** A reactor designed to produce more fissile material than it consumes.
- **SMR:** A nuclear reactor generally designed with a smaller electrical capacity and modular construction for flexible deployment.
- **Defence-in-Depth:** A nuclear safety philosophy based on multiple independent and redundant protective barriers.
- **ALARA:** The principle of keeping radiation exposure as low as reasonably achievable.

Pradhan Mantri Jan Dhan Yojana at 12 Years: Deepening Financial Inclusion through Digital Access, Social Security and Formal Credit

Recent Developments:

- The **Pradhan Mantri Jan-Dhan Yojana (PMJDY)**, launched on **28 August 2014** as the National Mission for Financial Inclusion, has completed **12 years of implementation** in 2026.
- As of **19 August 2026**, PMJDY had **59.09 crore accounts**, deposits of about **₹3.17 lakh crore**, and **41.29 crore RuPay debit cards**. Women held **32.92 crore accounts**, while **45.95 crore accounts** were located in rural and semi-urban centres.
- The next phase of financial inclusion requires a shift from **account ownership to active financial usage**, with greater emphasis on savings, insurance, pensions, formal credit, digital payments and financial literacy.

PMJDY: Objectives and Evolution:

Core Objectives:

- PMJDY seeks to provide affordable access to **basic savings and deposit accounts, remittances, credit, insurance and pension** for financially excluded sections of society.
- A **Basic Savings Bank Deposit Account (BSBD)** can be opened through a bank branch or a **Business Correspondent (Bank Mitra)** outlet without a minimum-balance requirement.
- The scheme was initially designed around universal banking access for households, but its strategic focus was subsequently shifted from **“every household”** to **“every unbanked adult”**, thereby broadening individual-level coverage.

Major Benefits:

- PMJDY account holders receive a **RuPay debit card** with an accident insurance cover of **₹2 lakh** for eligible accounts opened after 28 August 2018.
- Eligible account holders can access an **overdraft facility up to ₹10,000**, subject to prescribed conditions.
- PMJDY accounts provide an important platform for **Direct Benefit Transfer (DBT)** and access to social-security schemes such as **PMJJBY, PMSBY and APY**, along with the **MUDRA** ecosystem.

Achievements and Significance:

Expansion of Financial Inclusion:

- PMJDY has created one of the world's largest formal banking networks for previously underserved populations, with **59.09 crore accounts** recorded by August 2026.
- Deposits of approximately **₹3.17 lakh crore** indicate that financial inclusion has progressed beyond mere account opening towards greater participation in the formal financial system.
- The presence of **45.95 crore rural and semi-urban accounts** demonstrates the scheme's importance in addressing the geographical dimension of financial exclusion.

Women and Inclusive Development:

- Women account holders constitute approximately **56%** of total PMJDY beneficiaries, strengthening women's direct access to formal financial services.
- Individual ownership of bank accounts can improve women's control over income, facilitate access to government transfers and strengthen participation in household financial decisions.

JAM Architecture and DBT:

- PMJDY forms the **bank-account pillar of the Jan Dhan-Aadhaar-Mobile (JAM) architecture**, which has enabled large-scale digital delivery of government benefits.
- The combination of bank accounts, identity authentication and mobile connectivity can reduce intermediary dependence, improve targeting and strengthen transparency in welfare delivery.
- Consequently, PMJDY has evolved from a banking-access programme into an important component of **digital governance and welfare-state architecture**.

PMJDY and Broader Economic Transformation:

Formalisation and Credit Access:

- Formal bank accounts create transaction histories that can gradually improve access to **institutional credit**, reducing dependence on informal lenders.
- Greater formalisation can support integration with schemes such as **MUDRA**, micro-insurance and pension products, thereby connecting financial inclusion with livelihood security.

Financial Inclusion and Poverty Reduction:

- Financial inclusion can improve household resilience by facilitating savings, insurance, credit and timely receipt of welfare transfers.
- However, account ownership alone does not automatically translate into economic empowerment; the quality, frequency and diversity of financial usage remain equally important.

Major Challenges:

Dormancy and Limited Financial Usage:

- A major challenge is ensuring that accounts remain **active and economically meaningful** rather than functioning primarily as channels for receiving and withdrawing DBT.
- Cash-heavy usage limits opportunities for building savings, credit histories and investment habits.

Digital and Infrastructure Divide:

- Weak connectivity, inadequate digital literacy and fear of cyber fraud can restrict the adoption of **UPI, mobile banking and Aadhaar-enabled payment services** in rural and remote areas.
- Biometric authentication failures and network disruptions can particularly affect last-mile transactions where beneficiaries depend heavily on Bank Mitras.

Limited Credit and Insurance Deepening:

- The **overdraft facility** has not achieved its full potential because eligibility requirements, irregular incomes and repayment concerns can constrain access.
- Similarly, greater awareness and sustained engagement are required to convert basic bank-account ownership into wider participation in **micro-insurance and pension schemes**.

Institutional and Behavioural Constraints:

- Financial inclusion requires continued investment in **Bank Mitra networks, financial literacy and consumer protection**, especially among first-generation banking users.
- Cyber fraud, mis-selling, inadequate grievance redressal and low awareness can undermine trust in digital financial services.

Way Forward:

From Financial Access to Financial Deepening:

- Policy should move from “**banking the unbanked**” to “**empowering the banked**” by encouraging regular savings, responsible credit, insurance and pension participation.
- Small-value savings products, flexible micro-credit and suitable insurance products can make formal finance more relevant to irregular-income households.

Strengthening Last-Mile Infrastructure:

- Bank Mitra networks should be strengthened through better remuneration, reliable connectivity, interoperable devices and effective grievance-redressal mechanisms.
- **Offline and low-connectivity digital payment solutions** can improve financial access in remote regions.

Improving Financial Literacy:

- Financial literacy programmes should focus not only on account opening but also on **cybersecurity, digital payments, insurance, pensions, responsible borrowing and savings behaviour**.
- Behavioural nudges can encourage beneficiaries to retain a small portion of DBT receipts as savings rather than withdrawing the entire amount immediately.

Expanding Women's Financial Empowerment:

- Women-led banking models such as **Bank Sakhis** can strengthen trust, accessibility and financial literacy among rural women.
- Greater integration of PMJDY with **Self-Help Groups, livelihood programmes and micro-enterprises** can convert financial access into productive economic participation.

Value Addition for UPSC:

- **Key Concept:** Financial inclusion should be assessed through four dimensions — **Access, Usage, Quality and Impact** — rather than merely through the number of bank accounts opened.
- **JAM Framework:** **Jan Dhan + Aadhaar + Mobile** represents the technological foundation for targeted and scalable welfare delivery.
- **Way Forward Formula:** **Universal Access → Active Usage → Financial Deepening → Economic Empowerment.**
- **Mains Insight:** The success of PMJDY should ultimately be measured not by how many accounts exist, but by whether financially excluded households can **save securely, access affordable credit, manage risks and participate productively in the formal economy.**



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QUESTIONS

1. Consider the following statements regarding Himalayan disaster dynamics and cryospheric processes:

- (1) Landslide Lake Outburst Floods (LLOFs) and Glacial Lake Outburst Floods (GLOFs) are distinguished primarily by the nature of the impounding barrier rather than the downstream mechanism of flood release.
- (2) Naturally formed barrier lakes are characterized by homogeneous, well-consolidated structural compositions that make their breaching behavior highly predictable.
- (3) Climate change increases cryospheric instability primarily by accelerating glacier retreat, thinning, and altering thermal profiles of high-altitude slopes.
- (4) Cascading hazards in mountain catchments refer to a weather-induced floods and landslides within a specific river basin.

How many of the above statements are correct?

- (A) All four
- (B) Only three
- (C) Only two
- (D) Only one

2. In the context of Eurasian geopolitical strategies, which of the following best defines India's foreign policy concept of the "Extended Neighbourhood"?

- (A) A formal bilateral security protocol designed exclusively to safeguard physical frontiers with immediate sovereign border nations.
- (B) A regional economic trade agreement created to permanently eliminate tariff and non-tariff barriers among SAARC countries.
- (C) A comprehensive naval doctrine aimed at conducting regular freedom of navigation operations across Western Pacific waters.
- (D) A strategic foreign outreach framework extending core economic and security priorities to geographically contiguous regions.

3. Given below are two statements, one labeled as Assertion (A) and the other as Reason (R):

Assertion (A): Treating natural grasslands and scrublands as "wastelands" for monoculture afforestation can worsen regional land degradation and deplete groundwater.

Reason (R): Open Natural Ecosystems feature native vegetation adapted to local hydrology, whereas deep-rooting tree plantations in semi-arid zones can excessively extract groundwater reserves.

Select the correct answer using the code given below:

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
- (C) (A) is true but (R) is false.
- (D) (A) is false but (R) is true.

4. Consider the following statements:

Statement 1: Small Modular Reactors (SMRs) are suitable for deployment in captive industrial power generation and remote regions due to their modular construction and smaller footprint.

Statement 2: The SHANTI Act, 2025 was introduced to facilitate wider private sector participation and capital mobilization in India's nuclear energy sector.

Which one of the following is correct in respect of the above statements?

- (A) Both Statement 1 and Statement 2 are correct and Statement 2 is the correct explanation for Statement 1
- (B) Both Statement 1 and Statement 2 are correct but Statement 2 is NOT the correct explanation for Statement 1
- (C) Statement 1 is correct but Statement 2 is incorrect
- (D) Statement 1 is incorrect but Statement 2 is correct

5. Consider the following social security and micro-financial initiatives in India:

- (1) Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY)
- (2) Pradhan Mantri Suraksha Bima Yojana (PMSBY)
- (3) Atal Pension Yojana (APY)
- (4) PM Self-Reliant India (PM-SRI) Equity Fund

How many of the above social security schemes are directly integrated with PMJDY accounts for automated premium payments and coverage?

- (A) Only one
- (B) Only two
- (C) Only three
- (D) All four

ANSWER KEY



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