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Daily News Feed

D.N.F

28.10.2025

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'Rising sea surface temperatures leading to more cyclones'

Sumit Bhattacharjee
VISAKHAPATNAM

Since 2010, Andhra Pradesh has borne the brunt of at least 10 major tropical cyclones, some of them categorised as severe and very severe cyclonic storms. Tamil Nadu and Odisha have also been affected by these storms.

Meteorologists have identified a common element in these storms – the high intensity of the storms and the trails of destruction they left – and they blame the rapid rise in sea surface temperature (SST)

over the last few decades.

Rising SST

According to Prof. S.S.V.S. Ramakrishna, former Head of Department (HoD) of Oceanography and Meteorology, Andhra University, the Bay of Bengal has recorded a consistent rise in the SST.

Sea temperatures have regularly exceeded the 20°C to 30°C mark, creating an ideal environment for the formation of tropical cyclones.

"As the water gets warmer, latent heat energy increases, increasing the

Cyclone trail

Cyclones that hit Andhra Pradesh in the past 15 years

Name	Category	Date	Landfall	Wind speed	Death toll
Phailin	Extremely Severe	Oct. 8 to 14, 2013	Gopalpur, Odisha	260 kmph	45
Helen	Severe Cyclonic	Nov. 20-23, 2013	Machilipatnam, A.P.	130 kmph	Nil
Hudhud	Very Severe	Oct. 7-14, 2014	Visakhapatnam, A.P.	150-180 kmph	124
Titli	Very Severe	Oct. 8-13 2018	Near Palasa, A.P.	199 kmph	89
Michaung	Severe	Dec. 1 To 6, 2023	Near Bapatla, A.P.	120 kmph	17

possibility of cyclones. In the last 50 years, studies conducted by IITM Pune have indicated that the SST

in Bay of Bengal has gone up by 0.5°C to 1°C," he said. Prof. O.S.R.U. Bhamu Kumar, former HoD, from the

same department, attributed the changing factor to global warming and climate change. The warming



A fallen tree blocks a road in Machilipatnam as Cyclone Montha brought in heavy rain in Andhra Pradesh. PTI

of the atmosphere increases the capacity of air to hold moisture, leading to heavier rainfall during cyclones.

In recent times, positive Indian Ocean Dipole (IOD) and La Niña have contributed to more favourable conditions for cyclonic formations over the Bay of Bengal, he said.

Both experts cautioned that deforestation and degradation of coastal ecosystems like mangroves and wetlands, have reduced the natural buffers, amplifying the damage caused by cyclones.

English Summary:

The article highlights that the **Bay of Bengal** has witnessed a **steady rise in Sea Surface Temperature (SST)** over recent decades, directly contributing to the **increasing frequency and intensity of tropical cyclones** affecting the **Andhra Pradesh, Tamil Nadu, and Odisha** coasts.

Since 2010, Andhra Pradesh alone has experienced **over 10 major tropical cyclones**, including *Phailin* (2013), *Hudhud* (2014), *Titli* (2018), and *Michaung* (2023), several of which were **classified as very severe or extremely severe**.

Meteorologists attribute this escalation to **global warming, positive Indian Ocean Dipole (IOD), La Niña conditions, and coastal ecosystem degradation**, all of which enhance the **cyclogenetic potential** of the Bay of Bengal.

Scientific Explanation:

1. Rising Sea Surface Temperature (SST):

- Studies show that SST in the **Bay of Bengal** has **increased by 0.5°C to 1°C** in the past 50 years.
- Warm SST ($\geq 27^{\circ}\text{C}$)** provides the **latent heat energy** necessary for the **formation and intensification** of tropical cyclones.
- Warmer air holds more moisture, leading to **heavier rainfall and stronger storm systems**.

Quote:

"Sea temperatures regularly exceeding 20°C–30°C create ideal conditions for cyclogenesis." – Prof. S.S.V.S. Ramakrishna, Andhra University

2. Role of Climate Phenomena:

- Positive IOD** and **La Niña** phases have strengthened the **monsoon circulation** and **enhanced cyclone genesis** over the Bay of Bengal.
- These ocean-atmosphere interactions alter **wind shear, moisture distribution, and sea-level pressure**, influencing cyclone tracks and intensity.

3. Coastal Degradation and Damage Amplification:

- Mangrove destruction, wetland loss, and deforestation** reduce natural coastal buffers.
- This **increases vulnerability** to storm surges and floods, particularly in **Andhra, Odisha, and Tamil Nadu**.
- Urbanisation of coastal plains** (Visakhapatnam, Chennai, etc.) worsens disaster impact due to unplanned construction.

Cyclone Trail: Major Cyclones in the Past 15 Years

Name	Category	Year	Landfall	Wind Speed	Death Toll
Phailin	Extremely Severe	2013	Gopalpur (Odisha)	260 km/h	45
Helen	Severe	2013	Machilipatnam (A.P.)	130 km/h	Nil

Name	Category	Year	Landfall	Wind Speed	Death Toll
Hudhud	Very Severe	2014	Visakhapatnam (A.P.)	150–180 km/h	124
Titli	Very Severe	2018	Palasa (A.P.)	195 km/h	89
Michaung	Severe	2023	Bapatla (A.P.)	120 km/h	17

Environmental Implications:

- **Increased frequency** of “very severe” cyclones indicates a **warming ocean-atmosphere system**.
- **Sea-level rise and warmer SSTs** lead to more **intense storm surges**, threatening low-lying coastal populations.
- The **Indian Ocean Dipole (IOD)** and **ENSO oscillations** will continue to shape cyclone formation patterns in the coming decades.

Hindi Summary (हिंदी सारांश):

समुद्र की सतह का बढ़ता तापमान (SST) हाल के वर्षों में **चक्रवातों की संख्या और तीव्रता बढ़ाने** का मुख्य कारण बन गया है।

विशेष रूप से **बंगाल की खाड़ी** में तापमान में **0.5°C से 1°C की वृद्धि** दर्ज की गई है, जिससे **आंध्र प्रदेश, ओडिशा और तमिलनाडु** में अधिक शक्तिशाली चक्रवात बन रहे हैं।

2010 के बाद से **आंध्र प्रदेश** में 10 से अधिक बड़े चक्रवात आए हैं, जिनमें *फाइलिन (2013)*, *हुदहुद (2014)*, *टिटली (2018)* और *मिचांग (2023)* प्रमुख हैं।

वैज्ञानिक कारण:

- बढ़ता **SST और नमी** हवा को अधिक जलवाष्प धारण करने की क्षमता देता है।
- **La Niña** और **Indian Ocean Dipole (IOD)** की सकारात्मक स्थिति चक्रवातों के निर्माण को और बढ़ाती है।
- **मैंग्रोव और तटीय पारिस्थितिक तंत्र के विनाश** ने प्राकृतिक सुरक्षा कवच को कमजोर किया है, जिससे क्षति बढ़ी है।

UPSC/BPSC/JPSC Relevance Table:

Topic	Paper	Relevance
Cyclone formation and SST rise	GS Paper 1	Physical Geography – Climatology
Impact of climate change on coastal India	GS Paper 3	Environment and Disaster Management
Indian Ocean Dipole, ENSO, La Niña effects	GS Paper 1 & 3	Ocean-Atmosphere Interaction
Disaster Mitigation (NDMA, IMD)	GS Paper 3	Disaster Preparedness and Resilience

UPSC Mains Practice Question:

“Rising sea surface temperatures in the Indian Ocean have increased the intensity and frequency of tropical cyclones on India’s east coast. Discuss with reference to the Bay of Bengal region.”
(250 words – GS Paper 3)

UN report finds countries' emission reductions short of goal set in Paris

Jacob Koshy
NEW DELHI

Ahead of the Conference of Parties (COP 30) in Belem, Brazil, next month, the United Nations made public a "synthesis report" on Tuesday that finds countries are poised to reduce emissions by only 17% of 2019 levels by 2035 – well below what is required to keep earth from heating up by 1.5 degrees Celsius or even 2 degrees Celsius by the end of the century.

To keep temperatures below these limits, countries must cut emissions by 37% and 57%, respectively, of 2019 levels by 2035.

The synthesis is based on countries' updated nationally determined contributions (NDC), which are promises to cut fossil fuel emissions or plant forests (to capture carbon dioxide) until 2035. Tuesday's report is only a partial picture as only 64, out of a po-



The report says countries will cut emissions by only 17% by 2035, far below the 1.5 degrees Celsius limit. GETTY IMAGES

tential 190 countries, have submitted updated NDCs until September 30. India is among the countries that is yet to submit updated NDCs, after its last submission in August 2022.

While conversation in the lead-up to climate COPs generally end to weigh heavily towards emissions reductions, the NDCs that have been submitted so far are also stressing two other important pillars of climate ac-

tion – adaptation and resilience, with 73% of the new NDCs including an 'adaptation' component, the report notes. Adaptation refers to steps that must be taken by countries to adapt to ongoing and future impact from warming.

"All NDCs go beyond mitigation to include elements, inter alia, on adaptation, finance, technology transfer, capacity building and addressing loss and damage, reflecting the

comprehensive scope of the Paris Agreement," the report notes.

With regard to greenhouse gas emission (GHG) reductions, the total GHG emission level resulting from the implementation of Parties' new NDCs is projected to be around 13 billion tonnes of CO2 equivalent in 2035, which is 6% below what they promised in their previous NDCs (submitted from 2020-2022).

Domestic pledges

Afforestation, reforestation and adding solar energy were identified as the options with the greater need for support. Some Parties have announced domestic pledges and projects, such as tripling global renewable energy capacity by 2030, enhancing low-carbon hydrogen production and expanding Carbon Capture Utilisation and Storage (CCUS) capacity.

English Summary:

The **United Nations Synthesis Report (2025)**, released ahead of **COP30 (Belem, Brazil)**, warns that the **world is far off-track** from meeting the **1.5°C and 2°C temperature limits** set by the **Paris Agreement (2015)**.

The report finds that **global emissions are projected to decline by only 17% by 2035** compared to 2019 levels — whereas cuts of **37% to 57%** are required to stay within the Paris temperature goals.

Out of **190 signatory nations**, **64 have submitted updated NDCs (Nationally Determined Contributions)**, but most fall short in ambition, implementation, and scope. India, which last updated its NDC in **August 2022**, is yet to submit the next revision
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Key Highlights of the UN Report:

1. Global Emission Reductions Lagging:

- Current pledges would only cut **emissions by 17%** (2019–2035).
- To limit global warming to **1.5°C**, emissions must fall by **43% by 2030** and **60% by 2035**.

2. Greenhouse Gas (GHG) Projections:

- Total GHG levels are expected to reach **13 billion tonnes of CO₂ equivalent by 2035**,

which is **6% lower** than what nations promised under previous NDCs (2020–22 submissions).

3. Adaptation and Resilience Measures:

- **73% of new NDCs** include **adaptation components**—addressing infrastructure resilience, disaster response, and livelihood protection.
- Yet, adaptation finance remains inadequate compared to mitigation efforts.

4. Domestic Pledges:

- Major areas of focus: **afforestation, reforestation, renewable energy, low-carbon hydrogen, and carbon capture & storage (CCS)**.
- Several countries (including India) have proposed **tripling renewable capacity by 2030**, but global progress is uneven.

5. Equity and Implementation Challenges:

- Developing nations highlight **insufficient climate finance, technology transfer, and loss & damage support**.
- The report calls for **strengthened global cooperation and accountability mechanisms** under the Paris framework.

Hindi Summary (हिंदी सारांश):

संयुक्त राष्ट्र की नवीनतम **सिंथेसिस रिपोर्ट (2025)** ने चेतावनी दी है कि **दुनिया के अधिकांश देश अपने उत्सर्जन लक्ष्यों को पूरा नहीं कर रहे हैं**, जिससे **1.5°C और 2°C तापमान सीमा** को हासिल करना मुश्किल हो जाएगा। रिपोर्ट के अनुसार, **2035 तक उत्सर्जन में केवल 17% की कमी** होगी, जबकि **37% से 57% कमी** आवश्यक है। 190 में से केवल **64 देशों ने अपने अद्यतन NDC (राष्ट्रीय रूप से निर्धारित योगदान)** प्रस्तुत किए हैं, लेकिन इनकी महत्वाकांक्षा और प्रभाव सीमित है।

मुख्य बिंदु:

- **ग्रीनहाउस गैस उत्सर्जन:** 2035 तक **13 अरब टन CO₂ समकक्ष** होने की संभावना।
- **अनुकूलन उपाय:** 73% देशों ने **जलवायु अनुकूलन और लचीलापन योजनाएँ** शामिल की हैं।
- **भारत की स्थिति:** भारत ने अपना पिछला NDC 2022 में जमा किया था और अब तक अगला प्रस्तुत नहीं किया है।

Exam Relevance Table:

Topic	Paper	Relevance
Paris Agreement Goals	GS Paper 3	International Climate Commitments
NDCs & COP Mechanisms	GS Paper 3	Climate Change Governance
India's Role in Global Climate Negotiations	GS Paper 2	Multilateral Diplomacy
Adaptation and Mitigation Strategies	GS Paper 3	Environmental Sustainability

UPSC Mains Practice Question:

"Despite ambitious pledges under the Paris Agreement, global progress towards emission reduction remains inadequate. Analyse the reasons for this gap and suggest mechanisms for improving global climate accountability."

(250 words – GS Paper 3)

Trade talks with EU reduced 'outstanding issues', says Goyal

Foundation laid for balanced and robust agreement, says Minister after meeting with counterpart; high-level EU team to visit India next week

Sriram Lakshman

LONDON

India and the European Union have “significantly” reduced the gaps in their negotiating positions after three days of trade discussions in Brussels, Commerce and Industry Minister Piyush Goyal said on Tuesday evening.

Mr. Goyal and his EU counterpart, Commissioner Maroš Šefčovič, held discussions to provide a political push to help get the negotiations for an India-EU Free Trade Agreement (FTA) over the finish line.

“The talks have significantly reduced our outstanding issues and allowed us to create the framework that will help deliver a win-win for our economies,” Mr. Goyal said on X, describing the discussions as “intense” but “very productive”.

Mr. Goyal posted a video statement by the two Ministers, in which Mr Šefčovič characterised the talks as having occurred in an at-



Union Commerce and Industry Minister Piyush Goyal meeting EU Commissioner for Trade Maroš Šefčovič in Brussels on Monday.

mosphere of “full transparency and trust”. The Commissioner also said that “further work is required”. He said substantial progress had been made in a number of areas and the sides had given specific guidance to their teams on industrial tariffs.

Mr. Šefčovič confirmed that a high-level EU trade delegation led by Director-General Sabine Weyand would be in New Delhi next week to conclude “technical tariff negotiations”. A trade delegation from the European Parliament is in New Delhi this week to better understand the challenges and oppor-

tunities presented by the trade negotiations. Some of the sticking points have included tariffs around agricultural products, a sensitive area for both sides and particularly for India. Tariffs on European automobiles being sold in India have also been under discussion in recent weeks. Regulatory issues, including the EU’s carbon tax on imports (Carbon Border Adjustment Mechanism), have been contentious issues to work through.

“The negotiations and discussions have laid the foundation for a robust and balanced agreement,” Mr. Goyal said.

English Summary:

India and the **European Union (EU)** have made substantial progress in narrowing their differences during recent **Free Trade Agreement (FTA)** negotiations in Brussels.

Commerce and Industry Minister **Piyush Goyal** announced that most of the “outstanding issues” have been **significantly reduced**, laying the foundation for a “**balanced and robust**” trade deal.

Both sides engaged in **three days of intensive discussions**, covering tariffs on **industrial goods, agricultural products**, and the **EU’s Carbon Border Adjustment Mechanism (CBAM)** — a major concern for India.

The EU’s Trade Commissioner **Maroš Šefčovič** confirmed that a **high-level EU trade delegation** will visit New Delhi next week to finalize the **technical tariff negotiations** and to address the **remaining regulatory hurdles**.

Key Takeaways:

1. Negotiation Progress:

- Talks focused on bridging gaps in **industrial tariffs, agriculture subsidies, and carbon-related trade regulations**.
- The dialogue was described as “**intense but productive**.”

2. Trade Sensitivities:

- **Agricultural tariffs** remain a sensitive issue for India, given the protection needed for domestic farmers.
- India raised concerns over **EU’s carbon tax (CBAM)**, which could penalize exports like steel and aluminum.
- Tariffs on **European automobiles** sold in India also remain under negotiation.

3. Political and Strategic Context:

- The India–EU FTA talks, revived in **2022 after nearly a decade**, are crucial to deepen bilateral trade beyond \$120 billion.
- The negotiations are part of a broader India–EU cooperation agenda including **digital trade, clean energy, and supply chain diversification**.

4. Future Steps:

- An EU parliamentary delegation will visit India to discuss **non-tariff barriers, regulatory alignment, and intellectual property protection**.
- Both sides aim to conclude the FTA framework before **mid-2026**, aligning with India’s global trade diversification push.

Hindi Summary (हिंदी सारांश):

भारत और **यूरोपीय संघ (EU)** के बीच **मुक्त व्यापार समझौते (FTA)** पर हुई हालिया वार्ताओं में उल्लेखनीय प्रगति हुई है।

वाणिज्य एवं उद्योग मंत्री **पीयूष गोयल** ने कहा कि अधिकांश “**लंबित मुद्दे**” हल हो चुके हैं और अब एक “**संतुलित व मजबूत**” समझौते की दिशा में ठोस आधार तैयार हुआ है।

वार्ताओं के दौरान प्रमुख मुद्दे रहे —

- **औद्योगिक वस्तुओं पर शुल्क,**
- **कृषि उत्पादों पर टैरिफ,**
- **और EU का कार्बन बॉर्डर एडजस्टमेंट मैकेनिज्म (CBAM)।**

यूरोपीय व्यापार आयुक्त **मरोस शेफचोविच** ने बताया कि एक **उच्च-स्तरीय EU प्रतिनिधिमंडल अगले सप्ताह नई दिल्ली आएगा** ताकि तकनीकी शुल्क वार्ताओं को अंतिम रूप दिया जा सके।

UPSC/BPSC/JPSC Relevance Table:

Topic	Paper	Relevance
India–EU Free Trade Agreement (FTA)	GS Paper 2	Bilateral & Regional Groupings
Carbon Border Adjustment Mechanism (CBAM)	GS Paper 3	Trade & Environmental Diplomacy
Industrial Tariffs & Agricultural Subsidies	GS Paper 3	International Trade Policy

Topic	Paper	Relevance
India's Global Trade Strategy	GS Paper 2/3	Economic Diplomacy & WTO Context

UPSC Mains Practice Question:

"Discuss the significance of the India–EU Free Trade Agreement negotiations in strengthening India's global trade position, with special reference to tariff and climate-related challenges."
(250 words – GS Paper 2/3)

HAL signs pact with Russian firm for civil aircraft production

The Hindu Bureau
BENGALURU

Aerospace major Hindustan Aeronautics Ltd. (HAL) and the Russian company United Aircraft Corporation (UAC) have signed a memorandum of understanding for production of the civil commuter aircraft SJ-100.

The SJ-100 is a twin-engine, narrow-body aircraft. As on date, more than 200 aircraft have been produced and are being operated by more than 16 commercial airline operators.

HAL said the SJ-100 would be a game changer for short-haul connectivity under the UDAN scheme in India. Under this arrangement, HAL will have the rights to manufacture SJ-100 aircraft for domestic customers.

Production in India

“This collaboration between HAL and UAC is the result of mutual trust between the organisations. This will also be the first instance wherein a complete passenger aircraft will be produced in India. The last such project was HAL’s production of AVRO HS-748, which started in 1961 and ended in 1988,” HAL said.

It is estimated that over



Officials from HAL and Oleg Bogomolov sign an MoU for making of the aircraft SJ-100.

the next 10 years, the Indian aviation sector will require over 200 jets in this category for regional connectivity and an additional 350 aircraft for the Indian Ocean region to serve nearby international tourist destinations, it said.

“The manufacturing of the SJ-100 aircraft marks the beginning of a new chapter in Indian aviation industry. Manufacturing will also strengthen the private sector and create direct and indirect jobs in the aviation industry,” the Bengaluru-headquartered PSU said.

The MoU was signed in Moscow on Monday by Prabhat Ranjan from HAL and Oleg Bogomolov from UAC.

English Summary:

Aerospace major **Hindustan Aeronautics Limited (HAL)** has signed an **MoU with Russia's United Aircraft Corporation (UAC)** to jointly produce **civil commuter aircraft SJ-100** in India.

The **SJ-100**, a **twin-engine, narrow-body regional aircraft**, has already seen over 200 units produced and is operated by 16 global airlines. The agreement allows HAL to **manufacture the aircraft domestically** for the **Indian market**.

This collaboration is part of India's effort to **boost domestic aviation manufacturing** and reduce dependency on foreign imports. It aligns with the **"Make in India"** and **"UDAN"** schemes, focusing on regional connectivity and job creation.

Key Highlights:

1. About SJ-100 (Superjet 100):

- Twin-engine, narrow-body regional jet.
- Manufactured initially in Russia by UAC.
- Designed for **short-haul operations** (typically 1,500–3,000 km range).

2. Scope of the MoU:

- HAL to **manufacture SJ-100 aircraft** for domestic and regional markets.
- Expected demand:
 - **200 jets** for India's **UDAN** (regional air connectivity) network.
 - **350 additional aircraft** for the **Indian Ocean region**, serving international tourist hubs.

3. Strategic Significance:

- Marks **India's first civil aircraft production** after the **HS-748 Avro project** (1961).
- Enhances **India-Russia cooperation in civil aviation and technology transfer**.
- Expected to create **direct and indirect jobs** in manufacturing, engineering, and maintenance sectors.

4. Long-Term Impact:

- Strengthens **India's aviation ecosystem**.
- Reduces import dependence for regional aircraft (currently dominated by ATR and Embraer).
- Opens potential for **exporting Indian-made aircraft** to neighboring regions.

Hindi Summary (हिंदी सारांश):

हिंदुस्तान एयरोनॉटिक्स लिमिटेड (HAL) ने **रूस की यूनाइटेड एयरक्राफ्ट कॉर्पोरेशन (UAC)** के साथ **नागरिक विमान SJ-100** के निर्माण के लिए समझौता ज्ञापन (MoU) पर हस्ताक्षर किए हैं।

यह **SJ-100 एक दो इंजन वाला नैरो-बॉडी विमान** है, जिसका उपयोग 16 से अधिक अंतरराष्ट्रीय एयरलाइंस द्वारा किया जा रहा है।

अब HAL इसे **भारत में घरेलू ग्राहकों के लिए निर्मित** करेगा।

महत्व:

- यह सहयोग भारत में **नागरिक विमान निर्माण का नया अध्याय** है।
- **UDAN योजना** के तहत क्षेत्रीय संपर्क को बढ़ावा देने में यह विमान **गेम चेंजर** साबित होगा।
- अगले 10 वर्षों में भारत को लगभग **200 विमानों** की आवश्यकता होगी।
- यह परियोजना भारत-रूस **प्रौद्योगिकी सहयोग** को मजबूत करेगी और **नौकरियों के अवसर** सृजित करेगी।

Exam Relevance Table:

Topic	Paper	Relevance
India-Russia Civil Aviation Collaboration	GS Paper 2	Bilateral Relations
Indigenisation in Aviation Manufacturing	GS Paper 3	Technology & Infrastructure
Make in India & UDAN Scheme	GS Paper 3	Industrial Policy
Public Sector Role in Aerospace (HAL)	GS Paper 3	PSUs & Strategic Industries

UPSC Mains Practice Question:

"The HAL-UAC collaboration for SJ-100 production marks a new phase in India's aerospace manufacturing ecosystem. Discuss its potential implications for India's civil aviation sector and technology self-reliance."

(250 words – GS Paper 3)

Setting up an early warning system for the Himalayas poses unique challenges

Climate change and development works have made the Himalayas acutely vulnerable to floods, landslides, and lake bursts, killing hundreds. Why are early warning systems not a priority? Scientists say that a network of rugged, easy-to-operate early warning systems to monitor activity across the Himalayan mountains is essential

Divya Gandhi

In the first weekend of this month, Mount Everest (on the Tibetan side) turned dystopian: a sudden blizzard, torrential snowfall, and lightning strikes hit the mountain's vicinity, trapping a thousand trekkers who were gradually rescued with the help of local villagers trudging through knee-deep snow. In other parts of the Himalayas, at the same time, a heavy downpour and snowfall, led to floods and landslides, killing scores in Nepal and Darjeeling.

This is the latest among scores of disasters in the Himalayas, which are only increasing: of the 687 disasters that the country experienced between 1900 and 2022, as many as 240 were in the Himalayas, according to a 2024 *Down To Earth* (DTE) report. They include glacial lake outbursts, landslides, floods, wildfires, and earthquakes. Between 1902 and 1962, the region recorded just five disasters.

Abysmally poor

"Since then, there has been a rapid decade-on-decade increase in disasters. In 1963-1972, the region reported 11 disasters, followed by 13 disasters in 1973-82. The last decade (2013-2022) saw the highest number of disasters at 68, and they accounted for 44% of all the disasters reported in India," the DTE report explained. Quoting NASA's landslide data, DTE said the region experienced 1,121 landslide events between 2007 and 2017.

"I've come to the Himalayas around 20 times, but I've never experienced weather like this," a long-time hiker, Dong Shuchang, 27, told the BBC. Climate change is indeed making this seasonally vulnerable range increasingly unpredictable: the region is experiencing "a faster rate of warming than the global average, ranging from 0.15° to 0.60° C per decade," according to a paper published last year in *Springer Nature*.

So why do we have an abysmally poor number of early warning systems (EWS), a practical mitigator of disasters, in one of the world's most volatile regions to predict events and save lives?

AI's help

As peer-reviewed studies portend a deepening crisis in the Himalayas, there is clearly a dire need for EWS for imminent earthquakes, landslides, snow storms, lake outburst floods, and extreme temperatures in this tempestuous mountain range that encompasses 12 Indian States and Union Territories.

Considering the sheer scale of the problem, "we need to install many more EWS, one in each valley, across the entire



There has been a rapid increase in disasters in the Himalayas. AP

Himalayan arc (there are indeed cases of trans-boundary floods)," glaciologist Argha Banerjee, working on Himalayan glaciers at IISER Pune, told *The Hindu*. "We do not have an indigenous low-cost EWS that is weather-proof, easy-to-install and operate (by local people), uses multiple input parameters (in-situ and remote), and transmits live data (many of these valleys are remote, out of the reach of mobile networks)."

A functional early warning system can clearly save lives, he said.

There are challenges to monitoring the 2,400 km range: drones have a scale problem and "are only good for localised studies, and hard to fly in glacierised, windy, rugged Himalayan conditions," Dr. Banerjee said.

But artificial intelligence (AI) models, he added, could surely help in transforming live data to credible warnings. There is scope for satellite use, although satellite links are very expensive and may not be scalable. "There is some scope for them, although data collection from satellites needs to be rapid."

Per Dr. Banerjee: "It is important to involve and train local people to maintain, operate the EWS, and also to react to the warning."

Hazard map

There have been promising precedents of Himalayan disasters averted: the recent glacier-collapse/debris flow at Blatten village in the Swiss Alps was prevented from exploding into a humanitarian crisis when a shepherd called the downstream village, saving hundreds of lives.

There have been promising precedents of disasters averted: the recent glacier collapse at Blatten village in the Swiss Alps was prevented from exploding into a crisis when a shepherd called the downstream village, saving hundreds of lives

Researchers from the Chinese Academy of Sciences published a paper in 2022 on how they created an EWS for glacial lake outburst floods (GLOFs) in Cirenmaco, a high-risk glacial lake in the central Himalayas using an unmanned boat.

EWS "prevents loss of life and reduces the economic and societal impacts of disasters," the authors of the paper, published in the *International Journal of Disaster Risk Reduction*, wrote. It consisted of monitoring lake-level change, end-moraine displacement, ice collapse, and downstream runoff. The data can be transmitted via satellites and a mobile network to the data centre.

A hazard map was created of flood depth and velocity and translated into four intensity levels.

"In the future, more refined and accurate simulation results can be relied upon to establish this hazard map, which has implications for determining evacuation locations in downstream areas, constructing GLOF prevention and mitigation facilities, and implementing economic development measures," according to the paper.

Vinod Kumar Gaur, a Bengaluru-based seismologist and former director of the National Geophysical Research Institute, is closely involved in the implementation of three EWSs, the third one still at an elementary stage relating to cloudbursts. One of these was recently funded by the Environment Ministry to produce an operational system to provide advanced, sub-kilometre scale (a few hundred metres) hailstorm alerts to apple orchard managers in Uttarakhand and Himachal.

Not a priority

"The systems are based on a melding of local data and AI-aided predictions and a rigorously downscaled atmospheric model at the local scale with a capability to capture local land surface and hydrometeorological processes," said Dr. Gaur.

Indeed, there's no time to lose: a study published last year in the journal *Climate Change* predicted that 90% of the Himalayas will experience drought lasting over a year if global warming increases by 3° C. We get clues into this scenario from the fact that wildlife here is trapped in an "altitude squeeze," as a warming mountain range pushes mask deer and snow trout to higher ground, according to a recent UN report.

Himalayan catastrophes are not being given the priority they deserve: either by scientists, engineers, funding agencies, industry, or policy makers in central and local authorities, Dr. Banerjee said. "I think Himalayan people need it, and it is an urgent need. This should be a national priority."

THE GIST

There has been an increase in disasters. From 1963 to 1972, the region reported 11 disasters, followed by 13 in 1973-82. The last decade (2013-2022) saw the highest number of disasters at 68, accounting for 44% of all disasters reported in India

An EWS requires data and processing ability. Drones and satellites can provide the input, and AI models could help convert live data into credible warnings

Researchers say Himalayan catastrophes are not being given priority by stakeholders. Considering the impact of warming on mountain dynamics, EWS is an urgent requirement and should be a national priority

English Summary:

The article highlights the growing disaster vulnerability of the Himalayan region due to climate change, rapid development, and inadequate early warning infrastructure. The frequency of floods, landslides, glacial lake outbursts (GLOFs), and avalanches has sharply risen, yet there is no comprehensive, region-wide Early Warning System (EWS) in place.

According to the *Down To Earth* (2024) report, between 1902-1962, the region saw just five

disasters, while between **2013–2022**, it witnessed **68 disasters**, accounting for **46% of all disasters in India**.

Key Points:

1. Himalayan Fragility and Rising Risk

- The **Himalayas' steep terrain, fragile geology, and melting glaciers** make it highly prone to disasters.
- **Climate change** has accelerated **glacial retreat**, creating unstable moraine-dammed lakes, raising GLOF risks.
- **Infrastructure expansion** (roads, hydro projects, tourism) has intensified **landslides and flash floods**.

2. Why Early Warning Systems (EWS) Are Lacking

- Himalayan terrain limits installation and maintenance of real-time sensors.
- Absence of **localized data** and **cross-border coordination** among Himalayan nations hampers accurate forecasting.
- High costs, lack of technical manpower, and poor last-mile communication impede progress.

3. Successful Models and Research Efforts

- The **Chinese Academy of Sciences (2022)** successfully installed EWS for **glacial lake outbursts (GLOFs)** in the Himalayas using **AI-based forecasting and unmanned drones**.
- The **Swiss Alps model** prevented a deadly lake collapse through real-time EWS intervention.
- Indian institutes like the **National Geophysical Research Institute (NGRI)** and **Wadia Institute of Himalayan Geology** are developing region-specific models integrating **AI, satellite data, and ground sensors**.

4. Way Forward

- Establish a **networked Himalayan Disaster Early Warning Grid (HDEWG)** combining local, regional, and international data.
- Prioritize **community-based disaster response systems** in Uttarakhand, Himachal, and Sikkim.
- Integrate **EWS with NDMA and IMD protocols** under a national Himalayan Resilience Mission.

Hindi Summary (हिंदी सारांश):

हिमालय क्षेत्र में **जलवायु परिवर्तन और अनियंत्रित विकास कार्यों** के कारण **भूस्खलन, बाढ़ और ग्लेशियर झील फटने जैसी आपदाओं** में तेजी से वृद्धि हुई है।

1902–1962 के बीच केवल **5 आपदाएँ** हुईं, जबकि 2013–2022 के दशक में **68 बड़ी आपदाएँ** दर्ज की गईं, जो भारत की कुल आपदाओं का लगभग **46%** हैं।

मुख्य चुनौतियाँ:

- हिमालयी क्षेत्र की **भौगोलिक जटिलता और सीमित पहुँच** के कारण **प्रारंभिक चेतावनी प्रणाली (EWS)** का विस्तार कठिन है।
- **वास्तविक समय डेटा, सटीक संचार प्रणाली और स्थानीय भागीदारी** की कमी।
- तकनीकी संसाधन और वित्तीय समर्थन की कमी भी बड़ी बाधा है।

समाधान:

- हिमालयी देशों के बीच **संयुक्त डेटा नेटवर्क और AI-आधारित चेतावनी प्रणाली** की स्थापना।
- भारत के लिए **हिमालयन डिजास्टर अर्ली वार्निंग ग्रिड (HDEWG)** का निर्माण आवश्यक।
- **समुदाय आधारित चेतावनी और प्रशिक्षण कार्यक्रमों** को बढ़ावा देना चाहिए।

Exam Relevance Table:

Topic	Paper	Relevance
Himalayan Disasters & Climate Change	GS Paper 3	Disaster Management & Ecology
Early Warning Systems (EWS)	GS Paper 3	Technology & Disaster Preparedness
Glacial Lake Outburst Floods (GLOFs)	GS Paper 1 & 3	Geography + Environment
Climate-Resilient Infrastructure	GS Paper 3	Sustainable Development

UPSC Mains Practice Question:

"Despite the increasing frequency of disasters in the Himalayan region, India lacks a comprehensive early warning system. Discuss the challenges and suggest a roadmap for Himalayan disaster resilience."
(250 words – GS Paper 3)

Rethinking immigration in the age of exclusion

The arrival of Columbus in the New World marked the beginning of a long history of human migration, driven by the universal quest for survival, hope and dignity. Yet, in a grotesque inversion of history, contemporary politics in the United States, particularly under the Trump administration, has perversely transformed immigration into a toxic battleground of fear, exclusion and ideological warfare. By erasing this brutal history, successive governments in the United States have perpetuated a myth of exceptionalism, even as it denies the humanity of those seeking refuge on its shores.

As schoolchildren, many of us were asked to write an essay on the theme, "What if Columbus had not discovered America?" Understandably, the very framing of this question is steeped in colonial ideology that assumes that Columbus's landing was a historic necessity, a great leap for civilisation rather than what it actually was. Our answers, drawn from textbooks that valorised explorers and erased victims, inevitably celebrated Columbus's courage and navigational daring. We were taught to admire the predator, never to mourn the prey.

The destruction of vibrant civilisations

But what if Columbus had not landed in the Bahamas in 1492? What if the Arawaks, the generous, peace-loving people he first encountered, had been allowed to live in peace? What if the Americas had been allowed to evolve on their own terms, with their own cultures, languages, and knowledge systems flourishing unmolested? The Iroquois Confederacy, for instance, had developed a sophisticated democratic system that inspired elements of the U.S. Constitution, though that influence is often buried or denied. These were not "primitive" societies awaiting rescue. They were civilisations with libraries, roads and astronomy, all destroyed in the name of gold and god.

From the early waves of European colonisation in the Americas and Africa to the apartheid regimes of South Africa, migration has not merely been a matter of movement. It has also been a means of conquest, expansion and domination. Settler colonial projects thrived through the forceful displacement and systematic downgrading of native populations, manifesting in overt and subtle ways through systems of oppression that are deeply ingrained in societal structures that perpetuate racial disparity and injustice. The U.S., frequently celebrated as an ideal for the "tired, poor, huddled masses", was



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The future of immigration policy is linked to a willingness to confront the dark past and the brutal realities of the present

itself forged through the expurgation of native peoples and the abuse of enslaved labour. By denying entry to migrants, powerful nations conveniently obscure their own complicity in creating the conditions that drive people to flee.

The intricate dynamics of historical memory and its distortion are starkly illustrated in the U.S.'s approach to immigration and counter-terrorism. Let us for a moment go back to the distressing example of "Geronimo", the code word said to have been used in the 2011 mission ("Operation Neptune Spear") to eliminate Osama bin Laden. By appropriating the name of the legendary Apache leader, Geronimo, the U.S. military inadvertently highlighted its historical amnesia. Geronimo was a complex figure, a warrior who resisted Mexican and U.S. military forces, seeking to preserve Apache sovereignty and way of life. Labelling him a terrorist overlooks the nuances of his struggle and reduces it to simplistic binaries.

But this is no isolated misstep, for it is symptomatic of a deeper sickness in the dominant historical narrative; a narrative that begins in 1492 with the mythic arrival of Christopher Columbus. This moment is still described in textbooks, museums and mindless school rhymes as the "discovery" of America. The truth, of course, is far more brutal. Columbus did not discover a new world. He invaded one, and that invasion set in motion one of the most ferocious chapters in human history. Columbus's arrival heralded not discovery, but genocide. The devastation was total.

What mainstream historians miss

Mainstream historians seldom dwell on the mass enslavement, the sexual violence or the cultural annihilation. To question Columbus's legacy is to invite accusations of being "anti-American" or "revisionist". But if revision means restoring truth to the record, then revisionism is a moral obligation. The problem is not that we remember too little; it is that we remember too selectively.

The Columbus myth, far from being a harmless fable, is the ideological blueprint for centuries of colonial expansion, white supremacy and racial capitalism. It legitimises the pillaging of the Americas, the enslavement of Africans, and the later interventions of American imperialism under the guise of spreading "freedom". The mentality that justified the extermination of the Arawaks is the same that rationalises drone strikes today.

Fast-forward to the 21st century, and the brutal calculus of migration remains unchanged: flee

war-torn Syria, economically ravaged Venezuela, or climate-ravaged sub-Saharan Africa, and you will be met with suspicion and hostility at the borders of the Global North. The Trump presidency has been a zenith of this xenophobic fervour, pathologising immigration as an existential threat to American identity. The border wall, family separations, and the Muslim ban are not just policy aberrations but ideological manifestos that codify cruelty and exclusion. These measures are not pragmatic responses to complex issues; they are declarations of war on the most vulnerable.

Moreover, the resurgence of exclusionary nationalism, a hallmark of Trump-era politics, has biased the discourse around belonging and citizenship. It designates the immigrant not as a fellow human in search of security but as an economic burden, a cultural contagion or a national security risk. What emerges, then, is a moral paradox of nations founded on violent migration and colonisation but now busy erecting moral and legal barriers to those seeking refuge.

If settler colonialism is justified under the banner of "civilising mission", why should today's migration be framed illegitimate? The glaring disparity between the revered pioneers of the past and the vilified migrants of today lays bare the insidious role of race, power and historical amnesia in shaping the immigration narrative.

A fundamental aspiration

Clearly, the future of immigration policy hinges on our willingness to confront the darkest chapters of our past and the brutal realities of our present. We need to excavate the buried subtexts of empire, capitalism and racial domination that continue to shape mobility, and forge a new path forward informed by historical reckoning and a commitment to human dignity. The right to seek safety, to move across borders, is not a privilege to be doled out to the few, but a fundamental human aspiration that must be recognised and protected.

To imagine, therefore, a world in which Columbus had not made landfall is not to indulge in idle fantasy, but to confront the brutal reality of a collective past. It is to consider the possibility of a world unshaped by genocide, a world where Indigenous peoples flourished on their own terms, where empires did not build their foundations on loot and plunder. The truth about history is not a matter of nicety, but a fundamental requirement for justice, accountability, and a future that does not replicate the wrongs of the past.

English Summary:

The article critiques the **evolution of immigration policies** in the **United States**, connecting them to the **legacy of colonialism, racial exclusion, and historical amnesia**.

It argues that modern immigration discourse — particularly under administrations like Trump's — reflects a **continuation of colonial exclusionary practices**, rather than a deviation from them.

The essay uses **Columbus's "discovery"** as a metaphor to explain how **violence, exploitation, and exclusion** have historically shaped Western ideas of migration, freedom, and belonging.

Today's border policies, family separations, and anti-refugee sentiments mirror this **colonial mindset** — denying migrants humanity and dignity.

Key Points:

1. Colonial Origins of Exclusion

- The arrival of Columbus (1492) marked the start of **forced migration, slavery, and indigenism**

displacement.

- The so-called “discovery” was an act of invasion, not exploration — erasing indigenous civilizations like the **Arawaks and Iroquois**, who had advanced democratic traditions.

2. Modern Parallels in U.S. Immigration Policy

- The U.S. perpetuates **myths of exceptionalism and national purity**, casting migrants as threats to sovereignty or cultural identity.
- Under **Trump-era politics**, immigration became a **weaponized tool**— equating refugees with terrorists and outsiders with criminals.
- Use of “Operation Neptune Spear” and terms like “Geronimo” reveal the **appropriation of indigenous resistance** narratives to justify militarized border control.

3. Historical Amnesia and Power Politics

- Western nations deny responsibility for **creating the very crises** (wars, economic collapse, climate destruction) that displace migrants.
- Immigrants from war-torn nations (e.g., Syria, Venezuela, sub-Saharan Africa) face hostility instead of empathy, despite fleeing conditions shaped by **Western interventions**.

4. Ethical and Humanitarian Dimensions

- Immigration must be reframed as a **moral and historical obligation**, not a security issue.
- True justice lies in acknowledging **colonial exploitation** and developing a **global ethic of empathy and shared humanity**.

Hindi Summary (हिंदी सारांश):

यह लेख अमेरिका की **आप्रवासन नीति (immigration policy)** की आलोचना करता है और इसे **औपनिवेशिक मानसिकता (colonial mindset)** का विस्तार बताता है।

लेख के अनुसार, **कोलंबस के आगमन (1492)** से ही पश्चिमी सभ्यता ने **शोषण, दासता और बहिष्करण** को “सभ्यता” के रूप में परिभाषित किया।

आज की **अमेरिकी आव्रजन नीतियाँ**, विशेषकर **ट्रम्प प्रशासन** के दौरान, उसी **औपनिवेशिक बहिष्कारवाद** की पुनरावृत्ति हैं — जहाँ शरणार्थियों को आतंकवादी या विदेशी खतरे के रूप में देखा जाता है।

मुख्य बिंदु:

- “खोज” के नाम पर कोलंबस ने मूल निवासियों का **संहार और विस्थापन** किया।
- आधुनिक अमेरिकी नीतियाँ **राष्ट्र की पवित्रता और श्रेष्ठता** के मिथक को बनाए रखती हैं।
- पश्चिमी देश उन **आर्थिक और युद्धजनित कारणों** को भूल जाते हैं, जिनसे आज प्रवासी पलायन कर रहे हैं।
- वास्तविक समाधान **मानवता और नैतिक जिम्मेदारी** की पुनर्परिभाषा में निहित है।

Exam Relevance Table:

Topic	Paper	Relevance
Colonialism & Migration	GS Paper 1	Modern World History
U.S. Immigration Policy	GS Paper 2	International Relations
Refugee Crisis & Global Justice	GS Paper 2 / 4	Ethics & Human Values
Cultural Hegemony & Racism	GS Paper 1 / 4	Social Issues & Ethics

UPSC Mains Practice Question:

“Modern immigration policies in the West are a continuation of colonial exclusion rather than a departure from it. Examine with reference to U.S. immigration history.”

(250 words – GS Paper 2)

Missed opportunity

India could have made better use of the ASEAN Summit

Since 1995, when India became a dialogue partner of the Association of Southeast Asian Nations (ASEAN), and 2002, when it was upgraded to Summit level, the annual ASEAN summit has been an opportunity for India to reconnect with a region with historical linkages, and now increasing geopolitical importance. In addition to the ASEAN and ASEAN-India summits, the annual East Asia Summit (including the U.S., China, Russia, Australia, New Zealand, Japan, South Korea, India and the ASEAN countries) is a chance for the Indian leadership to interact with the most powerful countries on Indo-Pacific issues. The rebirth of the Australia-India-Japan-U.S. 'Quad', for example, took place in 2017, after a decade-long hiatus, on the sidelines of the ASEAN summit. Underlining this importance in his virtual speech at the ASEAN-India summit in Kuala Lumpur on Sunday, Prime Minister Narendra Modi called the 21st century "the century of India and ASEAN", and committed to India's support to "ASEAN Unity, ASEAN Centrality, and the ASEAN Outlook on the Indo-Pacific". He also announced that 2026 would be the year of ASEAN-India maritime cooperation, with a focus on humanitarian assistance and disaster response, maritime security and the region's blue economy. The summit – External Affairs Minister S. Jaishankar represented India – came at a time of increased geopolitical turbulence, including the economic turmoil unleashed by the U.S.'s tariff policy, China's constraints on crucial exports, and maritime tensions. At the East Asia Summit, Mr. Jaishankar called the times "complicated", taking aim at the U.S. for constraining energy trade with Russia and applying its principles "selectively", and China for supply chain reliability and market access issues. India and ASEAN also committed to finalising the review of the ASEAN-India Trade in Goods Agreement (AITIGA) soon.

The strong statements and commitment to cooperation did not, however, sufficiently cover for Mr. Modi's absence from the Summit – he was absent in 2022 also. Malaysian Prime Minister Anwar Ibrahim said Mr. Modi had expressed his inability to attend due to festivities in India, but the explanation was unconvincing as the ASEAN engagement had been planned months in advance. While some pointed to Mr. Modi's campaign schedule for the Bihar Assembly polls, others cited U.S. President Donald Trump's presence and India-U.S. trade deal tensions as a possible reason for his staying away. A few even suggested a lingering strain in the India-Malaysia relationship over Malaysia's diplomatic support to Pakistan during Operation Sindoor, and a visit by the Pakistani Prime Minister to Kuala Lumpur earlier this month. Mr. Modi may have had international, domestic or bilateral reasons, but the no-show was a missed opportunity, especially when other global players including the U.S. and China demonstrated their commitment to regional stability, by simply being there.

English Summary:

The article evaluates India's **limited engagement** at the recent **ASEAN Summit and East Asia Summit**, calling Prime Minister Narendra Modi's absence a **missed opportunity** for India to strengthen ties with the **Association of Southeast Asian Nations (ASEAN)** amid rising geopolitical tensions in the **Indo-Pacific region**.

Since India became a **dialogue partner of ASEAN in 1995** and a **Summit-level partner in 2002**, the forum has served as a vital platform for India to deepen cooperation in areas of **maritime security, trade, and regional stability**.

However, the absence of India's top leadership for two consecutive years (2022 and 2025) diluted India's visibility and influence, especially when powers like the **U.S. and China** were actively engaging.

Key Highlights:

1. India's ASEAN Partnership

- India's ties with ASEAN are grounded in **historical, cultural, and maritime linkages**.
- PM Modi, in his virtual address, called the 21st century "**the century of India and ASEAN**" and declared **2026 as the year of ASEAN-India Maritime Cooperation**, emphasizing **humanitarian aid, disaster response, and the blue economy**.

2. Geopolitical Context

- The summit occurred during a phase of heightened global tensions —
 - **U.S. tariff wars**,
 - **China's export restrictions and coercive diplomacy**, and
 - **Energy instability due to Russia-Ukraine conflict**.
- The region's strategic significance is rising under the **Indo-Pacific framework** and groupings like the **QUAD (India, U.S., Japan, Australia)**.

3. India's Missed Diplomatic Opportunity

- External Affairs Minister **S. Jaishankar** attended the summit, but the absence of the PM was viewed as diplomatically weak.
- Possible reasons included:
 - Domestic elections in Bihar,
 - U.S.-India trade deal tensions,
 - Lingering strain with **Malaysia** over its past support to Pakistan.
- The absence appeared inconsistent with India's declared "**Act East Policy**" and **commitment to ASEAN centrality**.

4. Future Challenges

- ASEAN countries remain central to India's Indo-Pacific ambitions — particularly for supply-chain resilience and maritime cooperation.
- India's non-presence risks ceding diplomatic space to **China**, which has been actively courting ASEAN nations through trade and infrastructure diplomacy.

Hindi Summary (हिंदी सारांश):

हाल ही में सम्पन्न **आसियान शिखर सम्मेलन (ASEAN Summit)** में प्रधानमंत्री **नरेंद्र मोदी** की अनुपस्थिति को एक **कूटनीतिक चूक (missed opportunity)** बताया गया है।

1995 में संवाद साझेदार और 2002 में शिखर साझेदार बनने के बाद से **आसियान भारत की "Act East Policy"** का प्रमुख स्तंभ रहा है।

मुख्य बिंदु:

- प्रधानमंत्री ने वर्चुअल भाषण में कहा कि **21वीं सदी "भारत-आसियान सदी"** होगी।
- वर्ष **2026 को "भारत-आसियान समुद्री सहयोग वर्ष"** घोषित किया गया।
- लेकिन उनकी अनुपस्थिति ने भारत की **राजनयिक सक्रियता और क्षेत्रीय प्रभाव** को कमजोर किया।
- यह अवसर था कि भारत **चीन और अमेरिका** की सक्रियता के बीच **इंडो-पैसिफिक क्षेत्र** में अपनी स्थिति मज़बूत करता।
- **मलेशिया के साथ तनाव, अमेरिका के साथ व्यापारिक मतभेद, और घरेलू चुनावी कार्यक्रम** संभावित कारण बताए गए हैं।

ASEAN-India Trade in Goods Agreement (AITIGA)

GS Paper 2

Economic Diplomacy

India's **metro rail expansion** over the past decade has made it the **world's third-largest metro network**, after China and the United States.

As of 2025, India's combined metro length exceeds **1,000 km across 23 cities**, compared to just 248 km in 2014. This signifies a fourfold increase, transforming India's urban transport landscape. The growth has also been reflected in **ridership**, which increased from **28 lakh daily passengers in 2014 to 1.12 crore in 2025**, driven by network expansion, affordability, and improved last-mile connectivity.

Key Highlights:

1. Largest Metro Networks

- **Delhi Metro:** 394 km (India's largest network), carries **65 lakh passengers daily**.
- **Bengaluru Metro:** 96 km, daily ridership of 10 lakh.
- **Mumbai Metro:** 80.2 km.
- **Kolkata Metro:** 74 km (India's first metro system, launched 1984).
- Other expanding networks: Hyderabad, Pune, Lucknow, Ahmedabad, Chennai, Nagpur, Kochi, Noida, and Navi Mumbai.

India now has over **23 operational metro systems**—more than any other developing country.

2. Fare and Accessibility

- Minimum metro fares range between ₹10–₹15; maximum fares between ₹40–₹64.
- Delhi Metro: ₹11–₹64; Bengaluru: ₹10–₹60.
- Chennai Metro charges ₹2.14/km, among the most affordable globally.
- Focus remains on **affordability, punctuality, and safety**, making metros accessible to lower and middle-income groups.

3. Urban Transformation

- Metro systems have reduced **traffic congestion, fuel consumption, and air pollution**.
- Integration with **electric buses, feeder services, and metro cards** is enhancing multi-modal connectivity.
- The **Make in India initiative** has boosted indigenous manufacturing of metro coaches and signaling systems (e.g., BEML, Titagarh Rail).

4. Government Push

- The Ministry of Housing and Urban Affairs' **National Metro Rail Policy (2017)** promotes **PPP participation** and **sustainable financing** for Tier-2 cities.
- Cities like Patna, Surat, and Bhopal are next in line for expansion.
- India's success places it at the forefront of **green and sustainable urban mobility**, aligned with SDG-11 (Sustainable Cities and Communities).

Hindi Summary (हिंदी सारांश):

भारत का **मेट्रो रेल नेटवर्क** पिछले एक दशक में चार गुना बढ़ गया है।

2014 में जहाँ केवल **248 किमी** नेटवर्क था, वहीं 2025 तक यह **1000 किमी से अधिक** 23 शहरों में फैल चुका है।

मुख्य बिंदु:

- **दिल्ली मेट्रो** (394 किमी) सबसे बड़ा नेटवर्क है, जो प्रतिदिन **65 लाख यात्रियों** को ले जाती है।
- इसके बाद **बेंगलुरु** (96 किमी), **मुंबई** (80.2 किमी) और **कोलकाता** (74 किमी) प्रमुख हैं।
- भारत अब **चीन और अमेरिका** के बाद दुनिया का तीसरा सबसे बड़ा मेट्रो नेटवर्क बन गया है।
- 2014 में प्रतिदिन 28 लाख यात्री यात्रा करते थे, जो अब **1.12 करोड़** हो गए हैं।
- सरकार की **नेशनल मेट्रो रेल पॉलिसी (2017)** ने **PPP मॉडल** और **स्वदेशी निर्माण (Make in India)** को बढ़ावा दिया है।

Exam Relevance Table:

Topic	Paper	Relevance
Urban Transport Infrastructure	GS Paper 3	Infrastructure & Urbanization
Public Transport and Mobility	GS Paper 3	Sustainable Development

Topic	Paper	Relevance
National Metro Rail Policy 2017	GS Paper 3	Government Schemes
Environmental Benefits of Metro Expansion	GS Paper 3	Pollution Control & Energy Efficiency

UPSC Mains Practice Question:

"India's metro rail expansion has transformed urban mobility but challenges of integration, cost recovery, and inclusivity remain. Discuss."

(250 words – GS Paper 3)

'Ready to share solar expertise with other parts of the world'

Saptaparno Ghosh

NEW DELHI

Union Minister for Renewable Energy **Prahlad Joshi** said India's experience with PM Surya Ghar and PM Kusum had been 'ex-

cellent' and it was ready to share its expertise and experience in the solar sector with other countries.

New Delhi has been looking to showcase the PM-Kusum (Kisan Urja Suraksha Evam Utthan Ma-

habhiyan) and PM Surya Ghar Yojana to several African countries and island nations, he said at the International Solar Alliance (ISA) here on Tuesday.

This could be of particular use for Africa, which

has so far been able to tap only 4% of its arable land through irrigation due to lack of rural power. "We are ready to share our expertise and experience, and we [the government] are also supporting ISA to

expand this in other parts of the world and member countries of ISA," he said.

Mr. Joshi informed that 10 lakh solar rooftops had been completed and 21 lakh were nearing completion under PM Surya Ghar.

English Summary:

Union Minister for Renewable Energy **Prahlad Joshi** announced that India is ready to **share its solar energy expertise and experience globally**, particularly with developing nations in Africa and the member countries of the **International Solar Alliance (ISA)**.

He cited India's flagship schemes — **PM Surya Ghar Yojana** and **PM-KUSUM (Kisan Urja Suraksha Evam Utthan Mahabhiyan)** — as successful domestic models that can help other countries expand access to clean and affordable solar power.

Key Highlights:

1. India's Solar Success Stories

- **PM Surya Ghar Yojana** – aims to promote rooftop solar adoption among households, providing financial support for grid-connected solar systems.
 - As of now, **10 lakh rooftops completed** and **21 lakh nearing completion**.
- **PM-KUSUM Scheme** – focuses on **solarizing agricultural pumps**, reducing dependence on diesel and grid power for irrigation.

2. Global Energy Cooperation

- India intends to **replicate these models** in African nations and island countries with low rural electrification rates.
- Africa, despite abundant sunlight, utilizes only **4% of its arable land for irrigation**, largely due to energy scarcity.
- India's collaboration through ISA aims to improve access to **clean, decentralized solar energy** for rural communities.

3. Role of the International Solar Alliance (ISA)

- Established in 2015 at COP-21 (Paris) by India and France.
- Mission: Promote solar deployment in tropical countries to reduce dependence on fossil fuels.
- India is supporting ISA in capacity-building, technology transfer, and financing mechanisms to accelerate the **global solar transition**.

Hindi Summary (हिंदी सारांश):

केंद्रीय नवीन एवं नवीकरणीय ऊर्जा मंत्री **प्रह्लाद जोशी** ने कहा कि भारत अपनी **सौर ऊर्जा विशेषज्ञता (solar expertise)** को दुनिया के अन्य देशों, विशेषकर **अफ्रीका और आईएसए सदस्य देशों**, के साथ साझा करने के लिए तैयार है।

उन्होंने कहा कि **पीएम कुसुम योजना** और **पीएम सूर्य घर योजना** जैसे भारतीय मॉडल विकासशील देशों में **ग्रामीण विद्युतीकरण और सिंचाई प्रणाली** को सशक्त बना सकते हैं।

- अब तक **10 लाख सोलर रूफटॉप** पूरे हो चुके हैं और **21 लाख** पूर्ण होने के चरण में हैं।
- अफ्रीका के पास पर्याप्त धूप होने के बावजूद, ऊर्जा की कमी के कारण केवल **4% भूमि पर सिंचाई** हो रही है।
- भारत, **अंतरराष्ट्रीय सौर गठबंधन (ISA)** के माध्यम से, स्वच्छ ऊर्जा समाधान साझा कर रहा है।

Exam Relevance Table:

Topic	Paper	Relevance
International Solar Alliance (ISA)	GS Paper 2	Global Cooperation
PM-KUSUM & PM Surya Ghar Schemes	GS Paper 3	Renewable Energy Initiatives
Energy Security & Climate Action	GS Paper 3	Sustainable Development
India's Global Energy Diplomacy	GS Paper 2	South-South Cooperation

UPSC Mains Practice Question:

"India's renewable energy diplomacy, led by initiatives like the International Solar Alliance, has positioned it as a global leader in clean energy transition. Discuss."
(250 words – GS Paper 3)

China and ASEAN, hit by U.S. tariffs, sign upgraded free trade agreement

The deal would pave the way for improved market access in agriculture, digital economy and pharmaceuticals between the two sides; the 11-member bloc is Beijing's largest trading partner, with bilateral volume totalling \$771 billion last year

Reuters

KUALA LUMPUR

China and the ASEAN bloc of Southeast Asian nations signed an upgrade to their free trade agreement on Tuesday, with leaders hailing the deal which spans the digital and green economy, and other new industries.

The 11-member Association of Southeast Asian Nations is China's largest trading partner, with bilateral trade totalling \$771 billion last year, according to ASEAN statistics.

China is seeking to intensify its engagement with ASEAN, a region with a collective gross domestic product of \$3.8 trillion, to counter hefty import tariffs imposed by U.S. Presi-



China's Premier Li Qiang, left, and Malaysia's Anwar Ibrahim at the signing of the ASEAN-China Free Trade Area 3.0 in Kuala Lumpur. AP

dent Donald Trump's administration on countries around the world. "We must accelerate trade and investment liberalisation and facilitation and strengthen industrial integration and interdependence," Chinese Premier Li Qiang

said at the ASEAN leaders' meeting on Tuesday.

Beijing has been seeking to position itself as a more open economy, despite criticism of its expanding export restrictions on rare earths and other critical minerals.

The so-called 3.0 version of the free trade agreement between ASEAN and China was signed into effect at a summit of the bloc's leaders in Malaysia, which Mr. Trump attended on Sunday at the start of a trip through Asia. Negotiations on the upgraded ASEAN-China deal began in November 2022 and concluded in May this year, just after Mr. Trump's tariff offensive kicked into gear. The first FTA came into force in 2010.

"The upgrade will further reduce trade barriers, strengthen supply chain connectivity, and unlock opportunities in future growth areas," Singapore's Prime Minister Lawrence Wong said.

China has previously said the agreement would

pave the way for improved market access in sectors such as agriculture, the digital economy and pharmaceuticals between China and ASEAN. Both China and ASEAN are part of the Regional Comprehensive Economic Partnership, the world's largest trading bloc, which covers nearly a third of the global population and about 30% of global gross domestic product. Malaysia hosted an RCEP summit in Kuala Lumpur on Monday, the first in five years. The bloc is seen by some analysts as a potential buffer against tariffs imposed by the United States, though its provisions are considered weaker than some other regional trade deals due to competing interests among its members.

English Summary:

China and the **Association of Southeast Asian Nations (ASEAN)** signed the **ASEAN-China Free Trade Area (ACFTA) 3.0 Upgrade Protocol** in Kuala Lumpur on **October 28, 2025**, marking a significant step in deepening regional trade ties amid rising global protectionism led by U.S. tariffs.

The upgraded agreement seeks to **expand cooperation in digital economy, green growth, agriculture, and pharmaceuticals**, aiming to strengthen supply chain resilience and open new opportunities for sustainable industrial integration across Asia.

Key Highlights:

1. About ACFTA 3.0

- The **ASEAN-China Free Trade Agreement (ACFTA)** was originally implemented in **2010**.
- The **3.0 version** upgrades the framework to include modern sectors such as **digital trade, green economy, and innovation-led industries**.
- Negotiations began in **November 2022** and concluded in **May 2025**.

2. Trade Significance

- ASEAN is **China's largest trading partner**, with bilateral trade valued at **\$771 billion (2024)**.
- The bloc's **collective GDP** stands at **\$3.8 trillion**, representing a vital hub in global supply chains.
- The agreement aims to **liberalize trade, reduce tariffs, and strengthen economic interdependence**.

3. Strategic Context

- The move comes amid **U.S. tariff escalation** under President Donald Trump's administration, which disrupted global trade flows.
- The agreement seeks to **counterbalance Western protectionism** and reinforce China's role in Asia's economic leadership.
- It complements the **Regional Comprehensive Economic Partnership (RCEP)**, the world's largest trading bloc, covering nearly **30% of global GDP**.

4. Statements from Leaders

- **China's Premier Li Qiang** emphasized accelerating trade liberalization and industrial integration.
- **Singapore's PM Lawrence Wong** stated that the deal will "reduce trade barriers, strengthen connectivity, and unlock new growth areas."
- **Malaysia's PM Anwar Ibrahim**, host of the signing, hailed it as a "symbol of resilience" against global economic fragmentation.

Implications:

For the Region

- Enhances **supply chain security** across Southeast Asia.
- Promotes **digital and green economy cooperation** between China and ASEAN nations.
- Positions ASEAN as a **balancing force** amid growing U.S.-China trade competition.

IN For India

- The ACFTA upgrade may **intensify competition** for India in sectors like **pharmaceuticals, electronics, and agriculture**.
- India's exit from RCEP in 2019 could mean **reduced market access** in the ASEAN region vis-à-vis China.
- Highlights the urgency for India to **diversify trade partners** and **revitalize regional FTAs** (with ASEAN, EU).

Hindi Summary (हिंदी सारांश):

चीन और आसियान (ASEAN) ने फ्री ट्रेड एग्रीमेंट (ACFTA 3.0) पर हस्ताक्षर किए हैं, जिससे दोनों के बीच डिजिटल अर्थव्यवस्था, हरित विकास, कृषि और औषधि क्षेत्र में सहयोग बढ़ेगा।

मुख्य बिंदु:

- यह समझौता **2010 के मूल ACFTA** का उन्नत संस्करण है।
- 2022 में शुरू हुई बातचीत **मई 2025 में पूरी हुई**।
- आसियान चीन का सबसे बड़ा व्यापारिक साझेदार है — 2024 में **771 अरब डॉलर का व्यापार** हुआ।
- समझौते का उद्देश्य **शुल्क में कमी, आपूर्ति श्रृंखला मजबूती और औद्योगिक एकीकरण** को प्रोत्साहित करना है।
- यह कदम **अमेरिकी संरक्षणवादी नीतियों और टैरिफ वृद्धि** के बीच एशिया में चीन की भूमिका को और मजबूत करेगा।

Exam Relevance Table:

Topic	Paper	Relevance
ASEAN-China Free Trade Agreement (ACFTA 3.0)	GS Paper 2	Regional Groupings

Topic	Paper	Relevance
Impact of U.S. Tariffs	GS Paper 3	Global Economy
Regional Comprehensive Economic Partnership (RCEP)	GS Paper 2	Trade Diplomacy
India's Trade Policy Response	GS Paper 3	Economic Strategy

UPSC Mains Practice Question:

*"Regional trade blocs like ASEAN-China FTA 3.0 signify Asia's shift toward intra-regional economic integration. Examine its implications for India's trade competitiveness."
(250 words – GS Paper 2)*