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### **THE HINDU NEWSPAPER**

#### **12 NOVEMBER 2025**

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<b>PCS Special:</b>		<b>12 November 2025</b>
	<b>UPPCS</b>	
1.	<b>Japanese movie actor Tatsuya Nakadai, star of Kurosawa films, dies aged 92</b> जापानी फिल्म अभिनेता तात्सुया नाकादाई, कुरोसावा की फिल्मों के स्टार, का 92 वर्ष की आयु में निधन	
2.	<b>Esha-Samrat, Aishwary win silver at the Worlds</b> ईशा-समराट और ऐश्वर्य ने वर्ल्ड चैम्पियनशिप में जीता रजत पदक	

## Warm welcome



Prime Minister Modi was received by Bhutan's Prime Minister Tshering Tobgay on Tuesday, on his arrival in the mountain nation for a two-day visit. He will participate in the 70th birthday celebrations of Jigme Singye Wangchuk, the country's fourth King. PTI (REPORT ON PAGE 4)

Prime Minister Modi was received by Bhutan's Prime Minister Tshering Tobgay on Tuesday, on his arrival in the mountain nation for a two-day visit. He will participate in the 70th birthday celebrations of Jigme Singye Wangchuk, the country's fourth King.



# Japanese movie actor Tatsuya Nakadai, star of Kurosawa films, dies aged 92

PCS

**Agence France-Presse**

TOKYO

Japanese stage and movie actor Tatsuya Nakadai, who starred in a string of Akira Kurosawa films, including the lead in *Ran*, has died aged 92, his acting school said on Tuesday.

Nakadai first rose to fame in Japan and internationally under director Masaki Kobayashi, who cast him in his epic anti-war trilogy *The Human Condition* of the late 1950s and early 1960s.

His acting school, Mumeijuku, did not say when Nakadai died or give any other details.

Nakadai had a walk-on part in Kurosawa's 1954 classic *Seven Samurai* but



**Long career:** Tatsuya Nakadai continued acting until recently, performing this year at a theatre in the Noto region.

later effectively replaced Toshiro Mifune as the famed director's go-to leading man after Mifune went his own way.

He was the main protagonist in Kurosawa's *Kagemusha* (1980), which won the Palme d'Or top prize at

the Cannes film festival.

The actor also played the doomed warlord who divides his kingdom between his sons in *Ran*, Kurosawa's 1985 film based on the Shakespeare play "King Lear".

Nakadai also starred in

Kurosawa's 1961 samurai film *Yojimbo* – with Mifune – and worked with other directors, including Hiroshi Teshigahara and Kon Ichikawa.

He set up Mumeijuku, a private acting school and troupe, in 1975 together with his late wife, the actor Yasuko Miyazaki, educating younger actors.

One former pupil is Koji Yakusho, who won best actor at the Cannes Film Festival in 2023 for his role in Wim Wenders' *Perfect Days*.

Nakadai continued acting until recently, performing this year at a theatre in the Noto region that was still reeling from a deadly earthquake on New Year's Day last year.

**Japanese movie actor Tatsuya Nakadai, star of Kurosawa films, dies aged 92**  
जापानी फिल्म अभिनेता तात्सुया नाकादाई, कुरोसावा की फिल्मों के स्टार, का 92 वर्ष की आयु में निधन

- **Japanese stage and movie actor Tatsuya Nakadai, who starred in a string of Akira Kurosawa films,** including the lead in *Ran*, has died aged 92, his acting school said on Tuesday.  
जापानी रंगमंच और फिल्म अभिनेता तात्सुया नाकादाई, जिन्होंने अकीरा कुरोसावा की कई फिल्मों में अभिनय किया, जिनमें 'रन' (Ran) में मुख्य भूमिका भी शामिल है, का 92 वर्ष की आयु में निधन हो गया, यह जानकारी उनकी अभिनय विद्यालय ने मंगलवार को दी।
- **Nakadai first rose to fame in Japan and internationally** under director **Masaki Kobayashi**, who cast him in his **epic anti-war trilogy "The Human Condition"** of the late **1950s and early 1960s**.  
नाकादाई ने जापान और अंतरराष्ट्रीय स्तर पर प्रसिद्धि हासिल की निर्देशक मासाकी कोबायाशी के तहत, जिन्होंने उन्हें 1950 के दशक के अंत और 1960 के दशक की शुरुआत में बनी अपनी महाकाव्य विरोधी युद्ध त्रयी "द ह्यूमन कंडीशन" में अभिनय करने का अवसर दिया।
- His acting school, Mumeijuku, did not say when Nakadai died or give any other details.



उनके अभिनय विद्यालय “मुमेजुकु” (Mumei Juku) ने यह नहीं बताया कि नाकादाई का निधन कब हुआ या अन्य कोई विवरण साझा नहीं किया।

- Nakadai had a walk-on part in Kurosawa's 1954 classic “Seven Samurai” but later effectively replaced Toshiro Mifune as the famed director's go-to leading man after Mifune went his own way.  
नाकादाई ने कुरोसावा की 1954 की क्लासिक फिल्म “सेवन समुराई” में एक छोटी भूमिका निभाई थी, लेकिन बाद में प्रसिद्ध निर्देशक के पसंदीदा नायक के रूप में तोशिरो मिफुने की जगह ले ली, जब मिफुने ने अलग रास्ता चुना।
- He was the main protagonist in Kurosawa's “Kagemusha” (1980), which won the Palme d'Or top prize at the Cannes Film Festival.  
वह कुरोसावा की 1980 की फिल्म “कागेमुशा” के मुख्य पात्र थे, जिसने कान्स फिल्म फेस्टिवल में सर्वोच्च पुरस्कार पाल्मे डी'ओर जीता था।
- The actor also played the doomed warlord who divides his kingdom between his sons in “Ran”, Kurosawa's 1985 film based on Shakespeare's play “King Lear”.  
अभिनेता ने फिल्म “रन” (1985) में उस विनाश की ओर बढ़ते राजा की भूमिका निभाई, जो अपना राज्य अपने बेटों में बाँट देता है, यह फिल्म कुरोसावा द्वारा शेक्सपियर के नाटक “किंग लियर” पर आधारित थी।
- Nakadai also starred in Kurosawa's 1961 samurai film “Yojimbo” — with Toshiro Mifune — and worked with other directors, including Hiroshi Teshigahara and Kon Ichikawa.  
नाकादाई ने कुरोसावा की 1961 की समुराई फिल्म “योज़िम्बो” में भी अभिनय किया — तोशिरो मिफुने के साथ — और उन्होंने हिरोशी तेशिगाहारा और कॉन इचिकावा जैसे अन्य निर्देशकों के साथ भी काम किया।
- He set up Mumeijuku, a private acting school and troupe, in 1975 together with his late wife, actor Yasuko Miyazaki, educating younger actors.  
उन्होंने 1975 में अपनी दिवंगत पत्नी, अभिनेत्री यासुको मियाज़ाकी के साथ मिलकर एक निजी अभिनय विद्यालय और नाट्य मंडली “मुमेजुकु” की स्थापना की, ताकि युवा कलाकारों को प्रशिक्षण दिया जा सके।
- One former pupil is Koji Yakusho, who won best actor at the Cannes Film Festival in 2023 for his role in Wim Wenders' “Perfect Days”.  
उनके एक पूर्व छात्र कोजी याकुशो हैं, जिन्होंने विम वेंडर्स की फिल्म “परफेक्ट डेज़” में अपनी भूमिका के लिए 2023 के कान्स फिल्म फेस्टिवल में सर्वश्रेष्ठ अभिनेता का पुरस्कार जीता।
- Nakadai continued acting until recently, performing this year at a theatre in the Noto region that was still reeling from a deadly earthquake on New Year's Day last year.  
नाकादाई ने हाल तक अभिनय जारी रखा, और इस वर्ष उन्होंने नोटो क्षेत्र के एक थिएटर में प्रदर्शन किया, जो अभी भी पिछले वर्ष नववर्ष के दिन आए भूकंप से उबरने की प्रक्रिया में था।



## Esha-Samrat, Aishwary win silver at the Worlds

### SHOOTING

#### PCS

#### Sports Bureau

Esha Singh and Samrat Rana combined to claim silver in the 10m air pistol mixed team event, going down 10-16 to the Chinese pair of Qianxun Yao and Kai Hu in the gold medal match at the ISSF World Championships in Cairo on Tuesday.

Samrat, who had won the individual gold a day earlier ahead of Kai, was in excellent form, but the duo was pulled down by Esha, who only had five scores of 10 or over in the 13 series they shot. Qianxun, who already has two individual golds so far, added a third to her tally.

Earlier in the day, Aishwary Pratap Singh Tomar finished second in the men's 50m rifle 3P with 466.9 points behind China's Liu Yukun (467.1) and ahead of France's Romain Aufrere (454.8). Niraj Kumar, the other Indian in the final, shot 432.6 to end fifth. The 24-year-old Aishwary had qualified in top spot with a world record equalling 597-40x in the qualifications.

He stayed within reach of the top spot in the final and was only 0.1 points adrift after the penultimate shot, but a 9.8 on the last shot to Liu's 10.1 cost him gold.

India is now second on the table behind China with three gold, three bronze and five silver medals.

## Esha-Samrat, Aishwary win silver at the Worlds ईशा-समराट और ऐश्वर्य ने वर्ल्ड चैम्पियनशिप में जीता रजत पदक

• **Esha Singh and Samrat Rana** combined to claim **silver in the 10m air pistol mixed team event**, going down 10-16 to the Chinese pair of Qianxun Yao and Kai Hu in the gold medal match at the ISSF World Championships in Cairo on Tuesday.

ईशा सिंह और सम्राट राणा ने काहिरा में आयोजित आईएसएसएफ वर्ल्ड चैम्पियनशिप में 10 मीटर एयर पिस्टल मिक्स्ड टीम इवेंट में रजत पदक जीता, जहाँ वे गोल्ड मेडल मैच में चीन की जोड़ी कियानशुन याओ और काई हु से 10-16 के अंतर से हार गए।

• **Samrat, who had won the individual gold a day earlier ahead of Kai, was in excellent form, but the duo was pulled down by Esha, who only had five scores of 10 or over in the 13 series they shot.**

सम्राट, जिन्होंने एक दिन पहले काई को पछाड़ते हुए व्यक्तिगत स्वर्ण पदक जीता था, बेहतरीन फॉर्म में थे, लेकिन जोड़ी को ईशा के औसत प्रदर्शन ने प्रभावित किया, जिन्होंने 13 सीरीज़ में केवल पाँच बार 10 या उससे अधिक अंक प्राप्त किए।

• **Qianxun, who already has two individual golds so far, added a third to her tally.**

कियानशुन, जिनके पास पहले से ही दो व्यक्तिगत स्वर्ण पदक थे, ने अपने खाते में तीसरा स्वर्ण पदक जोड़ा।

• **Earlier in the day, Aishwary Pratap Singh Tomar finished second in the men's 50m rifle 3P with 466.9 points, behind China's Liu Yukun (467.1) and ahead of France's Romain Aufrere (454.8).**

दिन की शुरुआत में, ऐश्वर्य प्रताप सिंह तोमर ने पुरुषों की 50 मीटर राइफल 3पी स्पर्धा में 466.9 अंकों के साथ दूसरा स्थान हासिल किया, जहाँ वे चीन के लियू युकुन (467.1) से पीछे और फ्रांस के रोमै औफ्रेरे (454.8) से आगे रहे।

• **Niraj Kumar, the other Indian in the final, shot 432.6 to end fifth.**  
नीरज कुमार



## GS Paper 1: History, Society and Geography

**TOPICS COVERED**

**12 November 2025**

### History

- INA not founded by Subhas Bose, he took up the reins only later, claims new book**  
आईएनए की स्थापना सुभाष बोस ने नहीं की थी, उन्होंने बाद में इसकी बागडोर संभाली — नई किताब का दावा
- Turkish military plane crashes in Georgia: Ministry**  
तुर्की का सैन्य विमान जॉर्जिया में दुर्घटनाग्रस्त: मंत्रालय

**History**

**12/11/2025**

### Mass burial



GS I: History

Health and civilian workers conduct a mass burial of Palestinians at a cemetery in Khan Younis, in the southern Gaza Strip, on Monday. The Health Ministry in Gaza said it had received the bodies of 15 Palestinian prisoners under the U.S.-brokered ceasefire exchange deal. AFP



Health and civilian workers conduct a mass burial of Palestinians at a cemetery in Khan Younis, in the southern Gaza Strip, on Monday. The Health Ministry in Gaza said it had received the bodies of 15 Palestinian prisoners under the U.S.-brokered ceasefire exchange deal.

# INA not founded by Subhas Bose, he took up the reins only later, claims new book

**GS I: History**

**Bishwanath Ghosh**

KOLKATA

A new book claims that Netaji Subhas Chandra Bose didn't establish the Indian National Army (INA) and that it was initially set up by the Japanese Army intelligence and Indian nationalists outside India to fight a common enemy – the British.

According to the book, 'The Forgotten Indian Prisoners of World War II', authored by Gautam Hazarika, Netaji took over the INA only later and brought it wider recognition as a force against Britain.

"[The formation of the INA] was a joint plan, pos-



Netaji Subhas Chandra Bose

sible only with both sides in agreement. There was a pre-war alliance between the Japanese Army intelligence and Indian nationalists outside India. Major Fujiwara Iwaichi and Giani Pritam Singh agreed to it in Bangkok days before Japan attacked Pearl Harbour/

Southeast Asia on December 7/8, 1941," Mr. Hazarika told *The Hindu*.

According to the book, Captain Mohan Singh of the 14th Punjab Regiment in the British Indian Army became the first commander of the INA.

When asked about the basis of his findings, Mr. Hazarika said the proof was in the archives and in the INA memoirs and histories.

Mr. Hazarika said Netaji reached Singapore in July 1943. During the interregnum, Rash Behari Bose kept alive the INA, which was then handed over to Netaji, who took it to greater heights.

**INA not founded by Subhas Bose, he took up the reins only later, claims new book**

**आईएनए की स्थापना सुभाष बोस ने नहीं की थी, उन्होंने बाद में इसकी बागडोर संभाली — नई किताब का दावा**

- **A new book claims that Netaji Subhas Chandra Bose didn't establish the Indian National Army (INA) and that it was initially set up by the Japanese Army intelligence and Indian nationalists outside India to fight a common enemy — the British.**

एक नई किताब का दावा है कि नेताजी सुभाष चंद्र बोस ने इंडियन नेशनल आर्मी (आईएनए) की स्थापना नहीं की थी, बल्कि इसे शुरुआत में जापानी सेना की खुफिया शाखा और भारत से बाहर के भारतीय राष्ट्रवादियों ने ब्रिटिशों के खिलाफ साझा दुश्मन के रूप में लड़ने के लिए बनाया था।



- According to the book, **'The Forgotten Indian Prisoners of World War II'**, authored by **Gautam Hazarika**, **Netaji took over the INA only later and brought it wider recognition as a force against Britain.**  
गौतम हज़ारिका द्वारा लिखित पुस्तक 'द फॉरगॉटन इंडियन प्रिजनर्स ऑफ वर्ल्ड वॉर II' के अनुसार, नेताजी ने बाद में आईएनए की बागडोर संभाली और इसे ब्रिटेन के खिलाफ एक बड़ी शक्ति के रूप में प्रसिद्धि दिलाई।
- "[The formation of the INA] was a joint plan, possible only with both sides in agreement. **There was a pre-war alliance between the Japanese Army intelligence and Indian nationalists outside India.** Major **Fujiwara Iwaichi** and **Giani Pritam Singh** agreed to it in **Bangkok days before Japan attacked Pearl Harbour/Southeast Asia on December 7/8, 1941,**" Mr. Hazarika told The Hindu.  
"[आईएनए का गठन] एक संयुक्त योजना थी, जो दोनों पक्षों की सहमति से ही संभव थी। युद्ध से पहले, जापानी सेना की खुफिया इकाई और भारत से बाहर के भारतीय राष्ट्रवादियों के बीच एक गठबंधन हुआ था। मेजर फुजिवारा इवाइची और ज्ञानि प्रीतम सिंह ने इस पर बैंकॉक में सहमति जताई थी, जापान के 7/8 दिसंबर 1941 को पर्ल हार्बर/दक्षिण-पूर्व एशिया पर हमले से कुछ दिन पहले," श्री हज़ारिका ने द हिंदू से कहा।
- According to the book, **Captain Mohan Singh of the 14th Punjab Regiment in the British Indian Army became the first commander of the INA.**  
पुस्तक के अनुसार, ब्रिटिश भारतीय सेना की 14वीं पंजाब रेजिमेंट के कैप्टन मोहन सिंह आईएनए के पहले कमांडर बने।
- When asked about the **basis of his findings**, Mr. Hazarika said the **proof was in the archives and in the INA memoirs and histories.**  
जब उनसे उनके निष्कर्षों के आधार के बारे में पूछा गया, तो श्री हज़ारिका ने कहा कि सबूत अभिलेखों, आईएनए की स्मृतियों और ऐतिहासिक दस्तावेजों में हैं।
- Mr. Hazarika said **Netaji reached Singapore in July 1943.** During the **interregnum, Rash Behari Bose kept alive the INA, which was then handed over to Netaji, who took it to greater heights.**  
श्री हज़ारिका ने कहा कि नेताजी जुलाई 1943 में सिंगापुर पहुंचे। इस बीच, रास बिहारी बोस ने आईएनए को जीवित रखा, जिसे बाद में नेताजी को सौंपा गया, जिन्होंने इसे नई ऊंचाइयों तक पहुंचाया।

## + Turkish military plane crashes in Georgia: Ministry

GS I: Mapping

**Agence France-Presse**  
ISTANBUL

A Turkish military cargo plane carrying 20 passengers and crew crashed in Georgia on its way home from Azerbaijan, the Defence Ministry said on Tuesday.

"Our C-130 military cargo plane, which took off from Azerbaijan to return home, has crashed at the Georgia-Azerbaijan border," the Ministry said in a statement, confirming there were "20 personnel on board, including flight crew". Rescue operations were ongoing, it added.

Footage circulating in Azerbaijani media appeared to show the plane

**Erdogan said Turkiye was working with the Georgian authorities 'to reach the wreckage'**

spinning horizontally as it fell out of the sky, sending up a large cloud of black smoke after crashing.

Footage said to be from the crash site purportedly showed the blackened wreckage burning. Turkiye's Defence Ministry asked the press not to publish images of the crash.

President Recep Tayyip Erdogan said Turkiye was working with the Georgian authorities "to reach the wreckage".

### Turkish military plane crashes in Georgia: Ministry

#### ▶ तुर्की का सैन्य विमान जॉर्जिया में दुर्घटनाग्रस्त: मंत्रालय

- **A Turkish military cargo plane carrying 20 passengers and crew crashed in Georgia on its way home from Azerbaijan,** the Defence Ministry said on Tuesday.

20 यात्रियों और चालक दल को ले जा रहा एक तुर्की सैन्य कार्गो विमान जॉर्जिया में दुर्घटनाग्रस्त हो गया, जब वह अज़रबैजान से अपने देश लौट रहा था, यह जानकारी रक्षा मंत्रालय ने मंगलवार को दी।

- "Our **C-130 military cargo plane**, which took off from Azerbaijan to return home, has crashed at the **Georgia-Azerbaijan border,**" the Ministry said in a statement, confirming there were "**20 personnel on board, including flight crew**".

मंत्रालय ने एक बयान में कहा, "हमारा C-130 सैन्य कार्गो विमान, जो अज़रबैजान से अपने देश लौटने के लिए रवाना हुआ था, जॉर्जिया-अज़रबैजान सीमा पर दुर्घटनाग्रस्त हो गया है," और पुष्टि की कि "विमान में कुल 20 लोग सवार थे, जिनमें उड़ान चालक दल भी शामिल था।"

- **Rescue operations were ongoing,** it added. मंत्रालय ने जोड़ा कि बचाव कार्य जारी हैं।



- Footage circulating in Azerbaijani media appeared to show the plane spinning horizontally as it fell out of the sky, sending up a large cloud of black smoke after crashing.  
अज़रबैजानी मीडिया में प्रसारित वीडियो फुटेज में यह दिखाई दिया कि विमान आकाश से गिरते समय क्षैतिज रूप से घूम रहा था, और दुर्घटनाग्रस्त होने के बाद काले धुएँ का एक बड़ा गुबार उठता दिखाई दिया।
- Footage said to be from the crash site purportedly showed the blackened wreckage burning.  
दुर्घटनास्थल से बताए जा रहे फुटेज में काले पड़े मलबे को जलते हुए दिखाया गया।
- Turkiye's Defence Ministry asked the press not to publish images of the crash.  
तुर्की के रक्षा मंत्रालय ने मीडिया से दुर्घटना की तस्वीरें प्रकाशित न करने का अनुरोध किया।
- President Recep Tayyip Erdogan said Turkiye was working with the Georgian authorities "to reach the wreckage."  
राष्ट्रपति रेचेप तैयप एर्दोआन ने कहा कि तुर्की, जॉर्जियाई अधिकारियों के साथ मिलकर "विमान के मलबे तक पहुँचने के लिए काम कर रहा है।"

<b>GS Paper II: Polity, Governance, And International Relations</b>	
<b>TOPICS COVERED</b>	<b>12 November 2025</b>
	<b>Polity</b>
1.	<b>SC says SIR is not the first; Opposition says it's being done in too much haste</b> सुप्रीम कोर्ट ने कहा SIR पहली बार नहीं हो रहा; विपक्ष ने कहा इसे बहुत जल्दबाज़ी में किया जा रहा है
2.	<b>SC acquits Koli in Nithari case, says convictions can't rest on 'conjecture'</b> सुप्रीम कोर्ट ने निठारी केस में कोली को बरी किया, कहा— सज़ा 'अनुमान' पर आधारित नहीं हो सकती
3.	<b>The infirmities in the SIR of electoral rolls</b> मतदाता सूची के SIR में कमज़ोरियाँ
	<b>International Relations</b>
4.	<b>Armed men in Mali publicly killed a TikTok influencer, say authorities</b> माली में सशस्त्र पुरुषों ने एक टिकटॉक इन्फ्लुएंसर की सार्वजनिक रूप से हत्या की, अधिकारियों का कहना है
5.	<b>Iraqis vote in parliamentary election marked by tight security</b> कड़ी सुरक्षा व्यवस्था के बीच इराकियों ने संसदीय चुनाव में मतदान किया



6.

**Ukraine war, China's critical mineral dominance on agenda at G7 meet**  
**यूक्रेन युद्ध और चीन का महत्वपूर्ण खनिजों पर प्रभुत्व G7 बैठक के एजेंडे में**

**Polity**

12/11/2025

## SC says SIR is not the first; Opposition says it's being done in too much haste

**CS II: Polity: Elections**  
**Krishnadas Rajagopal**  
NEW DELHI

The Supreme Court on Tuesday interrogated Opposition parties, leaders, and NGOs for their negative portrayal of the Election Commission's special intensive revision (SIR) of electoral rolls, including their claims that the exercise amounts to "citizenship screening" in disguise and threatens to disenfranchise lakhs of voters.

"You people want to project as if revision of electoral rolls is happening for the first time in this country! We also know the ground reality. A Constitutional functionary is undertaking an exercise... There can be some procedural deficiency. Those can be pointed out and rectified. You are saying as if the democratic process is being threatened... There is already an electoral roll, this is just a process to revise it," Chief Justice of India-designate Justice Surya Kant said, addressing Tamil Nadu's ruling party, the Dravida Munnetra Kazhagam (DMK), and leaders from West Bengal.

Tamil Nadu and West Bengal are among the 12 States and Union Territories included in the second phase of the SIR exercise, announced on October 28, covering 51 crore voters.

Senior advocate Kapil Sibal, representing the DMK and some West Bengal MPs, took on the challenge from the Bench, responding that revisions have indeed happened in the past, but pointing out



Officials distribute enumeration forms as part of the SIR on Mousuni Island in West Bengal. AFP

that the process in those instances was careful and long, taking almost three years.

"Now, the EC wants it done in a month... Ultimately, lakhs of people are going to be excluded from the voter list," he replied.

The enumeration stage for SIR 2.0 will continue till December 4 and the EC will release the draft electoral rolls on December 9. The final electoral rolls will be published on February 7, 2026.

### Chink in poll exercise

The senior counsel said that only 61.43% enumeration forms have been given out in Tamil Nadu so far, during seven days of distribution till November 10. Of these, only 4,713 forms have been digitised. "If this is taken into account, lakhs of forms cannot be digitised before the date of publication of the draft electoral roll. Hence, there is imminent danger of lakhs of voters losing their franchise," Mr. Sibal argued.

Mr. Sibal termed the current SIR a "farfetched exercise", referring to the EC's inexplicable inclusion

of an "extract of the electoral roll of Bihar SIR with reference to July 1, 2025" in its list of 13 types of documents that could be submitted as proof of identity during scrutiny in the second phase of the SIR.

"An extract of the electoral roll of the Bihar SIR has been added as the 13th document. What has the Bihar SIR got to do with elections in Tamil Nadu was not made clear. This has become a cause of confusion in the minds of the electors as well as parties in Tamil Nadu and other States..." Mr. Sibal said.

The Bench issued notice to the EC on the petitions challenging the constitutionality of the SIR.

Advocates Prashant Bhushan and Neha Rathi, appearing for the NGO Association for Democratic Reforms, suggested alternative measures to weed dead and duplicate voters.

Mr. Bhushan said the EC had a de-duplication software which can be run to identify duplicate names. Gram sabhas or panchayat sabhas could be organised to identify voters who had migrated or were dead.

**SC says SIR is not the first; Opposition says it's being done in too much haste**

**सुप्रीम कोर्ट ने कहा SIR पहली बार नहीं हो रहा; विपक्ष ने कहा इसे बहुत जल्दबाज़ी में किया जा रहा है**

• The Supreme Court on Tuesday interrogated Opposition parties, leaders, and NGOs for their negative portrayal of the Election Commission's special intensive revision (SIR) of electoral rolls, including their claims that the exercise amounts to "citizenship screening" in disguise and threatens to disenfranchise lakhs of voters.

**मंगलवार को सुप्रीम कोर्ट ने विपक्षी दलों, नेताओं और एनजीओ से सवाल किया कि उन्होंने चुनाव आयोग के विशेष गहन पुनरीक्षण (SIR) की नकारात्मक तस्वीर क्यों पेश की है, जिसमें यह दावा किया गया है कि यह अभ्यास "नागरिकता की जांच" के रूप में किया जा रहा है और लाखों मतदाताओं के मताधिकार को खतरा है।**

• "You people want to project as if revision of electoral rolls is happening for the first time in this country! We also know the ground reality. A Constitutional functionary is undertaking an exercise... There can be some procedural deficiency. Those can be pointed out and rectified. You are saying as if the democratic process is being threatened... There is already an electoral roll, this is just a process to revise it," Chief Justice of India-designate Justice Surya Kant said,

addressing Tamil Nadu's ruling party, the DMK, and leaders from West Bengal.

"आप लोग ऐसा दिखाना चाहते हैं जैसे देश में पहली बार मतदाता सूची का पुनरीक्षण हो रहा है! हमें भी जमीनी हकीकत पता है। एक संवैधानिक प्राधिकारी यह अभ्यास कर रहा है... इसमें कुछ प्रक्रियात्मक कमी हो सकती है, जिन्हें इंगित कर सुधारा जा सकता है। आप ऐसा कह रहे हैं जैसे लोकतांत्रिक प्रक्रिया खतरे में है... पहले से ही मतदाता सूची है, यह केवल

उसका पुनरीक्षण है," भारत के भावी मुख्य न्यायाधीश न्यायमूर्ति सूर्यकांत ने कहा, यह बात उन्होंने तमिलनाडु की सत्ताधारी पार्टी DMK और पश्चिम बंगाल के नेताओं से कही।



- **Tamil Nadu and West Bengal** are among the **12 States and Union Territories** included in the **second phase of the SIR exercise**, announced on **October 28**, covering **51 crore voters**.  
तमिलनाडु और पश्चिम बंगाल उन 12 राज्यों और केंद्र शासित प्रदेशों में शामिल हैं जो 28 अक्टूबर को घोषित SIR अभ्यास के दूसरे चरण में हैं, जिसमें 51 करोड़ मतदाता शामिल हैं।
- **Senior advocate Kapil Sibal**, representing the **DMK and some West Bengal MPs**, took on the challenge from the Bench, responding that revisions have indeed happened in the past, but pointing out that the process in those instances was **careful and long**, taking **almost three years**.  
वरिष्ठ अधिवक्ता कपिल सिब्बल, जो DMK और कुछ पश्चिम बंगाल के सांसदों का प्रतिनिधित्व कर रहे थे, ने कहा कि पहले भी पुनरीक्षण हुए हैं, लेकिन उस समय की प्रक्रिया सावधानीपूर्वक और लंबी थी, जिसमें लगभग तीन वर्ष लगे।
- “Now, the **EC wants it done in a month...** Ultimately, **lakhs of people are going to be excluded** from the voter list,” he replied.  
“अब चुनाव आयोग इसे एक महीने में पूरा करना चाहता है... नतीजतन, लाखों लोग मतदाता सूची से बाहर हो जाएंगे,” उन्होंने उत्तर दिया।
- The **enumeration stage for SIR 2.0 will continue till December 4** and the **EC will release the draft electoral rolls on December 9**. The **final electoral rolls will be published on February 7, 2026**.  
SIR 2.0 के लिए गणना चरण 4 दिसंबर तक जारी रहेगा और चुनाव आयोग 9 दिसंबर को मसौदा मतदाता सूची जारी करेगा। अंतिम मतदाता सूची 7 फरवरी, 2026 को प्रकाशित की जाएगी।
- **Chink in poll exercise:** The senior counsel said that only **61.43% enumeration forms** have been given out in **Tamil Nadu** so far, during seven days of distribution till **November 10**. Of these, only **4,713 forms have been digitised**.  
मतदान अभ्यास में कमी: वरिष्ठ वकील ने कहा कि अब तक तमिलनाडु में केवल 61.43% गणना प्रपत्र 10 नवंबर तक सात दिनों के वितरण में दिए गए हैं। इनमें से केवल 4,713 प्रपत्रों का डिजिटलीकरण हुआ है।
- “If this is taken into account, **lakhs of forms cannot be digitised** before the date of publication of the draft electoral roll. Hence, there is **imminent danger of lakhs of voters losing their franchise**,” Mr. Sibal argued.  
“यदि इसे ध्यान में रखा जाए, तो लाखों प्रपत्रों का डिजिटलीकरण मसौदा मतदाता सूची जारी होने की तारीख से पहले संभव नहीं। इसलिए, लाखों मतदाताओं के मताधिकार खोने का खतरा आसन्न है,” श्री सिब्बल ने तर्क दिया।
- Mr. Sibal termed the current **SIR a “farcical exercise”**, referring to the EC’s **inexplicable inclusion** of an “**extract of the electoral roll of Bihar SIR with reference to July 1, 2025**” in its list of **13 types of documents that could be submitted as proof of identity** during scrutiny in the second phase of the SIR.  
श्री सिब्बल ने वर्तमान SIR को “एक मज़ाकिया अभ्यास” बताया, यह कहते हुए कि चुनाव आयोग ने “1 जुलाई 2025 के संदर्भ में बिहार SIR की मतदाता सूची का अंश” को पहचान प्रमाण के रूप में प्रस्तुत किए जा सकने वाले 13 प्रकार के दस्तावेजों की सूची में अस्पष्ट रूप से शामिल किया है।
- “An extract of the electoral roll of the **Bihar SIR has been added as the 13th document**. What has the Bihar SIR got to do with elections in Tamil Nadu was not made clear. This has become a **cause of confusion** in the minds of the electors as well as parties in Tamil Nadu and other States...” Mr. Sibal said.  
“बिहार SIR की मतदाता सूची का अंश 13वें दस्तावेज़ के रूप में जोड़ा गया है। बिहार SIR का तमिलनाडु के चुनावों से क्या संबंध है, यह स्पष्ट नहीं किया गया। इससे मतदाताओं और राजनीतिक दलों के मन में भ्रम उत्पन्न हो गया है...” श्री सिब्बल ने कहा।
- The **Bench issued notice to the EC** on the petitions challenging the **constitutionality of the SIR**.  
पीठ ने SIR की संवैधानिकता को चुनौती देने वाली याचिकाओं पर चुनाव आयोग को नोटिस जारी किया।
- **Advocates Prashant Bhushan and Neha Rathi**, appearing for the **NGO Association for Democratic Reforms (ADR)**, suggested **alternative measures** to weed out **dead and duplicate voters**.  
अधिवक्ता प्रशांत भूषण और नेहा राठी, जो एनजीओ एसोसिएशन फॉर डेमोक्रेटिक रिफॉर्स



(ADR) की ओर से उपस्थित हुए, उन्होंने मृत और डुप्लिकेट मतदाताओं को हटाने के लिए वैकल्पिक उपाय सुझाए।

- Mr. Bhushan said the **EC had a de-duplication software** which can be run to **identify duplicate names**. Gram sabhas or panchayat sabhas could be organised to identify voters who had migrated or were dead.

श्री भूषण ने कहा कि चुनाव आयोग के पास डुप्लिकेट नामों की पहचान करने के लिए एक “डी-डुप्लीकेशन सॉफ्टवेयर” है। ग्राम सभाएं या पंचायत सभाएं आयोजित की जा सकती हैं ताकि प्रवासी या मृत मतदाताओं की पहचान की जा सके।

# SC acquits Koli in Nithari case, says convictions can't rest on 'conjecture'

Top court says upholding his conviction would amount to 'manifest miscarriage of justice' when he had been acquitted in 12 other related cases arising from the same set of facts and evidence

GS II: Polity: Curative  
Petition and Review  
Petition

The Supreme Court on Tuesday acquitted Surendra Koli, the prime accused in the Nithari killings, in the only case where his conviction and life sentence had remained in force. The court said that convictions, particularly in cases involving capital punishment, cannot rest on mere “conjecture” and that due process must prevail even in the most horrific crimes.

A Bench of Chief Justice of India B.R. Gavai and Justices Surya Kant and Vikram Nath observed that upholding the 2011 verdict convicting Mr. Koli would amount to “manifest miscarriage of justice” when he had already been acquitted in 12 other connected cases arising from the same set of facts and evidence. The Bench therefore directed that he be released forthwith, if not required in any other case or proceeding.

The Bench was hearing Mr. Koli's curative petition,



The court acknowledged that the Nithari killings were heinous and that the suffering of the families is beyond measure. FILE PHOTO

his final legal remedy before the Supreme Court.

## Overturning of ruling

Tuesday's verdict draws to a close nearly two decades of litigation surrounding one of India's most harrowing criminal trials. It also marks a rare instance of the apex court overturning its own earlier ruling through the exercise of its extraordinary curative jurisdiction.

In July, the Supreme Court had affirmed Mr. Koli's acquittal in 12 of the 13 cases linked to the Nithari killings, citing serious pro-

cedural lapses, unreliable evidence, and multiple irregularities in the investigation. It had accordingly dismissed the Central Bureau of Investigation's (CBI) appeals against the Allahabad HC's 2023 judgments.

## Final and last case

The curative petition concerned the sole case in which Mr. Koli's conviction and death sentence had been upheld by the Supreme Court in 2011. The Allahabad High Court had commuted the sentence to life imprisonment in 2015, citing inordinate delay in

the disposal of his mercy petition. His review petition had earlier been dismissed after an open-court hearing on October 28, 2014.

The court acknowledged that the Nithari killings were “heinous” and that the “suffering of the families is beyond measure”.

The Nithari killings, which came to light in 2007, stunned the nation with their sheer depravity. The discovery of skeletal remains of several children in a drain behind a Noida house where Mr. Koli worked as a domestic aide exposed a series of murders that shocked the public conscience. The house belonged to businessman Moninder Singh Pandher, who was also named as an accused in multiple chargesheets.

Following widespread public outrage, the probe was transferred to the CBI, which alleged that Mr. Koli lured young girls to the house, sexually assaulted and killed them, and mutilated their bodies.

**SC acquits Koli in Nithari case, says convictions can't rest on 'conjecture'**

सुप्रीम कोर्ट ने निठारी केस में कोली को बरी किया, कहा— सज़ा 'अनुमान' पर आधारित नहीं हो सकती

- The top court said upholding his conviction would amount to 'manifest miscarriage of justice' when he had been acquitted in 12 other related cases arising from the



same set of facts and evidence.

सर्वोच्च न्यायालय ने कहा कि जब कोली को उसी तथ्यों और सबूतों से जुड़े 12 अन्य मामलों में बरी किया जा चुका है, तो उसकी सज़ा को बरकरार रखना 'न्याय का स्पष्ट दुरुपयोग' होगा।

- The **Supreme Court on Tuesday acquitted Surendra Koli**, the prime accused in the Nithari killings, in the only case where his conviction and life sentence had remained in force.

मंगलवार को सुप्रीम कोर्ट ने सुरेंद्र कोली को बरी कर दिया, जो निठारी हत्याकांड के मुख्य आरोपी थे, और यह एकमात्र मामला था जिसमें उनकी सज़ा और उम्रकैद बरकरार थी।

- The court said that **convictions**, particularly in cases involving **capital punishment**, cannot rest on mere "**conjecture**" and that **due process** must prevail even in the most **horrific crimes**.

अदालत ने कहा कि सज़ाएं, विशेषकर मृत्युदंड वाले मामलों में, केवल "अनुमान" पर आधारित नहीं हो सकतीं और यहां तक कि सबसे भयानक अपराधों में भी विधिक प्रक्रिया का पालन आवश्यक है।

- A **Bench of Chief Justice of India B.R. Gavai and Justices Surya Kant and Vikram Nath** observed that upholding the 2011 verdict convicting **Mr. Koli** would amount to "**manifest miscarriage of justice**" when he had already been acquitted in **12 other connected cases** arising from the same set of facts and evidence.

भारत के मुख्य न्यायाधीश बी.आर. गवई और न्यायमूर्ति सूर्यकांत तथा विक्रम नाथ की पीठ ने कहा कि 2011 के फैसले में कोली को दोषी ठहराना "न्याय का स्पष्ट दुरुपयोग" होगा, जबकि उन्हें उसी तथ्यों और सबूतों से जुड़े 12 अन्य मामलों में पहले ही बरी किया जा चुका है।

- The **Bench therefore directed** that he be **released forthwith**, if not required in any other case or proceeding.

पीठ ने इसलिए निर्देश दिया कि यदि किसी अन्य मामले में आवश्यकता न हो, तो उसे तुरंत रिहा किया जाए।

- The **Bench was hearing Mr. Koli's curative petition**, his final legal remedy before the Supreme Court.

पीठ कोली की सुधारात्मक याचिका सुन रही थी, जो सुप्रीम कोर्ट में उनकी अंतिम कानूनी अपील थी।

- **Overturning of ruling:** Tuesday's verdict draws to a close nearly **two decades of litigation** surrounding one of **India's most harrowing criminal trials**.

फैसले का उलटफेर: मंगलवार का फैसला लगभग दो दशकों से चल रही कानूनी प्रक्रिया का अंत करता है, जो भारत के सबसे भयावह आपराधिक मुकदमों में से एक थी।

- It also marks a **rare instance** of the apex court overturning its own earlier ruling through the exercise of its **extraordinary curative jurisdiction**.

यह इस बात का भी दुर्लभ उदाहरण है कि सर्वोच्च न्यायालय ने अपनी ही पहले की सुनवाई को पलट दिया, अपनी असाधारण सुधारात्मक अधिकारिता का उपयोग करते हुए।

- In **July**, the **Supreme Court had affirmed Mr. Koli's acquittal** in **12 of the 13 cases** linked to the Nithari killings, citing **serious procedural lapses, unreliable evidence**, and **multiple irregularities in the investigation**.

जुलाई में, सुप्रीम कोर्ट ने कोली की बरी होने की पुष्टि की थी जो निठारी हत्याकांड से जुड़े 13 में से 12 मामलों में थी, और इसमें गंभीर प्रक्रियात्मक चूकें, अविश्वसनीय साक्ष्य, तथा जांच में कई अनियमितताओं का हवाला दिया गया था।

- It had accordingly **dismissed the CBI's appeals** against the **Allahabad HC's 2023 judgments**.

इसके अनुसार, अदालत ने इलाहाबाद उच्च न्यायालय के 2023 के फैसलों के खिलाफ सीबीआई की अपीलों को खारिज कर दिया।

- **Final and last case:** The curative petition concerned the **sole case** in which **Mr. Koli's conviction and death sentence** had been upheld by the Supreme Court in 2011.

अंतिम और आखिरी मामला: सुधारात्मक याचिका उस एकमात्र मामले से संबंधित थी जिसमें कोली की सज़ा और मृत्युदंड को 2011 में सुप्रीम कोर्ट ने बरकरार रखा था।

- The **Allahabad High Court had commuted the sentence to life imprisonment** in 2015, citing **inordinate delay in the disposal of his mercy petition**.



इलाहाबाद हाईकोर्ट ने 2015 में सज़ा को उम्रकैद में बदल दिया, यह कहते हुए कि उनकी दया याचिका के निपटारे में अत्यधिक देरी हुई थी।

- His review petition had earlier been dismissed after an open-court hearing on October 28, 2014.  
उनकी पुनर्विचार याचिका को पहले ही खारिज कर दिया गया था, जो 28 अक्टूबर 2014 को खुले न्यायालय में सुनवाई के बाद हुआ था।
- The court acknowledged that the Nithari killings were “heinous” and that the “suffering of the families is beyond measure”.  
अदालत ने स्वीकार किया कि निठारी हत्याकांड “घृणित” था और “परिवारों का दुख असीमित” है।
- The Nithari killings, which came to light in 2007, stunned the nation with their sheer depravity.  
निठारी हत्याकांड, जो 2007 में सामने आया, ने अपनी अत्यंत क्रूरता से पूरे देश को झकझोर दिया था।
- The discovery of skeletal remains of several children in a drain behind a Noida house where Mr. Koli worked as a domestic aide exposed a series of murders that shocked the public conscience.  
नोएडा के एक घर के पीछे नाले में कई बच्चों के कंकाल मिलने से, जहां कोली घरेलू नौकर के रूप में काम करता था, हत्या की एक श्रृंखला उजागर हुई, जिसने जनचेतना को हिला दिया।
- The house belonged to businessman Moninder Singh Pandher, who was also named as an accused in multiple chargesheets.  
वह घर व्यवसायी मोनिंदर सिंह पंधेर का था, जिन्हें भी कई आरोपपत्रों में आरोपी के रूप में नामित किया गया था।

Following widespread public outrage, the probe was transferred to the CBI, which alleged that Mr. Koli lured young girls to the house, sexually assaulted and killed them, and mutilated their bodies.

व्यापक जनक्रोध के बाद, जांच सीबीआई को सौंपी गई, जिसने आरोप लगाया कि कोली ने छोटी लड़कियों को बहला-फुसलाकर बुलाया, उनका यौन शोषण और हत्या की, तथा उनके शवों के टुकड़े किए।

#### Review Petition — Asking the Supreme Court to Re-check Its Own Judgment

- When the Supreme Court delivers a final judgment, it normally cannot be appealed anywhere else.
- But if someone feels the Court made an error — like missing a key fact or misinterpreting the law — they can file a Review Petition.
- Think of it like politely asking the Court: “Please re-check your own decision once more; there may have been a mistake.”

#### Legal basis:

- It is provided under Article 137 of the Indian Constitution.
- The Supreme Court itself has the power to review its own judgments or orders.

#### Conditions:

- The mistake must be obvious and apparent — not something that requires long arguments again.
- Example: If the Court said a law was repealed when it was actually still in force, that’s an apparent error.

#### Example:

- In the Rupa Ashok Hurra case (2002), a Review Petition was filed after the Court upheld a conviction.
- The petitioner said the Court had overlooked certain documents. This case later led to the creation of a new remedy — the Curative Petition.

#### Curative Petition — The “Last Door” of Justice

- Sometimes, even after a Review Petition is dismissed, people still feel a grave injustice has happened — maybe due to bias, violation of natural justice, or procedural unfairness.



- The **Curative Petition** is the **final and rarest remedy** to correct such miscarriages of justice.

**Origin:**

- It was evolved by the **Supreme Court itself in 2002** in the case **Rupa Ashok Hurra v. Ashok Hurra & Anr.**
- The Court said: *“We must have a last chance to cure our own mistake if it has caused real injustice.”*
- Hence the name — **Curative = to cure the defect.**

**Who can file it:**

- Only after the **Review Petition is dismissed.**
- The petitioner must clearly show that there was a **violation of natural justice** (e.g., they were not heard properly) or **judicial bias.**

**How it is handled:**

- The **Curative Petition is first circulated to the three senior-most judges and the judges who delivered the original judgment.**
- If they agree that there is a genuine reason, only then is it listed for hearing — otherwise it's dismissed right away.

**Example:**

- In **Yakub Memon's case (2015)**, the Supreme Court dismissed his Curative Petition before his execution in the 1993 Bombay blasts case.
- The Court said all legal remedies had already been exhausted and no miscarriage of justice was found.

**3. Key Difference — In Simple Terms**

Feature	Review Petition	Curative Petition
<b>When Filed</b>	After a judgment, before it becomes final	Only after Review Petition is dismissed
<b>Purpose</b>	To correct an <b>apparent error</b>	To <b>cure gross injustice or violation of natural justice</b>
<b>Legal Basis</b>	Article 137 of the Constitution	Judicial creation (Rupa Ashok Hurra case, 2002)
<b>Frequency</b>	Common	Extremely rare
<b>Example</b>	Typing or factual error, wrong application of law	Bias, unfair hearing, serious miscarriage of justice



## The infirmities in the SIR of electoral rolls

ISS II: Polity: Election

MCQ

The Special Intensive Revision of electoral rolls (SIR) ordered by the Election Commission of India (ECI) in 12 States and Union Territories (Tamil Nadu, Kerala, West Bengal, Uttar Pradesh, Madhya Pradesh, Rajasthan, Chhattisgarh, Goa, Gujarat, Puducherry, Andaman and Nicobar Islands, and Lakshadweep), where elections are due, has provoked strong protests from some State governments – some have challenged it in the Supreme Court of India. The SIR was conducted in Bihar earlier, beginning in June; the Assembly election has just been held in the State.

The Opposition had opposed the SIR in Bihar on various grounds which included the haste with which such a massive exercise was sought to be done. The Opposition challenged it in the Court on the ground that, *inter alia*, the ECI's power to conduct such an extensive revision after a summary revision done as recently as in 2024 was unconstitutional. Although the Court made some interim observations and directions to protect a voter's right, the constitutional issues have not been settled.

The ECI claimed, while justifying the SIR in Bihar, that the last SIR had been conducted in 2002-03 with demographic changes since then due to large-scale urbanisation, migration and death. Therefore, it was necessary to revise the roll comprehensively to reflect the latest demographic picture in the State.

### The issue of timing

The ECI, no doubt, has the statutory right to conduct a comprehensive revision of the electoral roll. But the question as to why it should be done just a couple of months before elections to the Assembly has remained unanswered. The point is that intensive revision involves a massive exercise of enumeration which requires enumerators to visit every household and collect data, deal with claims and objections and decide appeals. In fact, between 2003 and 2024, there have been five general elections to the Lok Sabha and many elections in the States and Union Territories. But the ECI did not conduct an SIR anytime during this period, which is unexplainable. Therefore, it is intriguing why the ECI has chosen to conduct an SIR just before the Bihar elections and now a few months before the Assembly elections in Kerala, Tamil Nadu and West Bengal.

The preparation and the revision of the electoral roll in the country is dealt with under Section 21 of the Representation of the People



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Although the top court made interim observations and directions to protect a voter's right, the Election Commission of India's actions do raise questions

(RP) Act, 1950. This section provides for the revision of the roll before the general election to the Lok Sabha or the State Assemblies and revision in "any year" if the ECI so directs.

### On revisions and voter citizenship

It also provides for a special revision in any constituency or a part of it on the direction of the ECI. A careful reading of this legal provision would reveal that the revision before the general election is mandatory and the other revisions are done as and when the ECI directs this; the reasons have to be recorded by the ECI for undertaking such revisions.

Further, a closer look at Rule 25 of the Registration of Electors Rules 1960 would show that revision of the roll done before the elections under Section 21(2)(a) is summary in character and the revision done under Section 21(2)(b) in 'any year' is an intensive revision. The intensive revision is akin to the preparation of a new roll.

Intensive revision, as the name implies, is a comprehensive, and hence time-consuming exercise. Therefore, it should be presumed that this exercise is delimited from the elections and is done in any year when there is no likelihood of a general election. Since the revision before the election is linked to the elections, it can be reasonably assumed that only a summary revision can be done before an election. So, the SIR of the rolls just a couple of months before the elections is not envisaged under the RP Act, 1950.

Another important issue which has come up in the context of the SIR is the nature of the documents which are sought by the ECI to prove the citizenship of voters. Under Article 326 of the Constitution, a voter has to be a citizen of India. So, the issue of citizenship becomes important at the time of enrolment of voters in the electoral list. The documents demanded by the ECI from applicants did not include Aadhaar as the ECI is of the opinion that Aadhaar is not a proof of citizenship.

The matter was settled by the Supreme Court, through an interim order, by directing the ECI to accept Aadhaar also as a document to establish the identity of the voter. As a matter of fact, the main question that arises here is what exactly the powers of the ECI are to determine which documents are necessary to prove the citizenship of Indians.

Citizenship is governed by Articles 5 to 11 of the Constitution and the Citizenship Act of 1955. Under these, Indian citizenship is acquired by

birth, descent, registration and naturalisation.

The point to note in the context of the SIR is that the law relating to citizenship is administered by the Ministry of Home Affairs and not the ECI. Article 326 says that only a citizen can be the voter, so the question of citizenship of the voter becomes crucially important when the electoral roll is prepared by the ECI which has the exclusive authority to prepare the roll for election to the Assemblies and Parliament. But how does the ECI determine citizenship? Or can the ECI specify the documents to prove the citizenship of voters?

The simple answer is that the ECI is not the authority which can specify the documents to prove citizenship. It can be done only by the Ministry of Home Affairs of the Government of India. In fact, the ECI can only verify the documents so notified by the government. It is legally not right for the ECI to say that it has the power to determine the citizenship question and to not accept a particular document for this purpose. But the problem is that the Ministry of Home Affairs has so far not notified any comprehensive list of documents which are required by voters to prove their citizenship. In fact, Article 326 impliedly requires the government to specify such documents. In the absence of such a list, the ECI arrogates to itself the power to specify the list of documents which voters should produce before it to prove their citizenship. How can the ECI exercise a power which is vested in the Home Ministry?

### A key decision

It is not clear how many voters whose names were in the roll till 2024 were removed from the voters' list in Bihar after the SIR on the ground that they are not citizens because they could not produce any of the documents specified by the ECI. In this context, the Supreme Court's decision in *Lal Babu Hussein And Others v. Electoral Registration Officer And Others* (1995) is of crucial importance. It said: "In the second situation, since the name is already entered, it must be presumed that before entering his name the concerned officer must have gone through the procedural requirements under the statute".

Article 14 forbids any arbitrary action by the state or its agencies. Article 21 forbids the deprivation of the liberty of any person except in accordance with a fair and just procedure. The legal and constitutional authorities need to adhere to these constitutional directions.

## The infirmities in the SIR of electoral rolls

### मतदाता सूची के SIR में कमज़ोरियाँ

## Special Intensive Revision (SIR) of Electoral Rolls by the Election Commission of India (ECI)

### भारत निर्वाचन आयोग (ECI) द्वारा मतदाता सूची का विशेष गहन पुनरीक्षण (SIR)

- The **Special Intensive Revision of electoral rolls (SIR)** ordered by the **Election Commission of India (ECI)** in **12 States and Union Territories** (Tamil Nadu, Kerala, West Bengal, Uttar Pradesh, Madhya Pradesh, Rajasthan, Chhattisgarh, Goa, Gujarat, Puducherry, Andaman and Nicobar Islands, and Lakshadweep), where elections are due, has **provoked strong protests** from some **State governments** — some have **challenged it in the Supreme Court of India**.

भारत निर्वाचन आयोग (ECI) द्वारा 12 राज्यों और केंद्र शासित प्रदेशों (तमिलनाडु, केरल, पश्चिम बंगाल, उत्तर प्रदेश, मध्य प्रदेश, राजस्थान, छत्तीसगढ़, गोवा, गुजरात, पुडुचेरी, अंडमान और निकोबार द्वीपसमूह और लक्षद्वीप)\*\* में आदेशित मतदाता सूची के विशेष गहन पुनरीक्षण (SIR) ने कई राज्य सरकारों के कड़े विरोध को उकसाया है — कुछ ने इसे भारत के सर्वोच्च न्यायालय में चुनौती दी है।

- The **SIR was conducted in Bihar** earlier, beginning in **June**; the **Assembly election** has just been held in the State.



SIR पहले बिहार में किया गया था, जो जून में शुरू हुआ; राज्य में हाल ही में विधानसभा चुनाव संपन्न हुआ है।

- The **Opposition** had opposed the SIR in Bihar on various grounds which included the **haste with which such a massive exercise was sought to be done**.  
विपक्ष ने बिहार में SIR का विरोध विभिन्न आधारों पर किया था, जिनमें इस तरह के वृहद् अभियान को जल्दबाजी में करने की आलोचना शामिल थी।
- The **Opposition challenged it in the Court** on the ground that, inter alia, the **ECI's power to conduct such an extensive revision after a summary revision done as recently as in 2024 was unconstitutional**.  
विपक्ष ने इसे अदालत में चुनौती दी, यह कहते हुए कि **ECI का अधिकार**, जिसने 2024 में हाल ही में एक संक्षिप्त पुनरीक्षण किया था, उसके बाद इतना व्यापक पुनरीक्षण करना असंवैधानिक है।
- Although the **Court made some interim observations and directions to protect a voter's right, the constitutional issues have not been settled**.  
यद्यपि अदालत ने मतदाता के अधिकार की रक्षा के लिए कुछ अंतरिम टिप्पणियाँ और निर्देश दिए, लेकिन संवैधानिक मुद्दे अभी तक सुलझाए नहीं गए हैं।
- The **ECI claimed, while justifying the SIR in Bihar, that the last SIR had been conducted in 2002-03 with demographic changes since then due to large-scale urbanisation, migration and death**.  
**ECI ने दावा किया** कि बिहार में SIR को उचित ठहराते हुए कहा गया कि अंतिम SIR 2002-03 में किया गया था, और तब से अब तक बड़े पैमाने पर शहरीकरण, प्रवासन और मृत्यु के कारण जनसांख्यिकीय परिवर्तन हुए हैं।
- Therefore, it was necessary to **revise the roll comprehensively to reflect the latest demographic picture in the State**.  
अतः राज्य की ताज़ा जनसांख्यिकीय स्थिति को प्रतिबिंबित करने के लिए मतदाता सूची का व्यापक पुनरीक्षण आवश्यक था।

### The Issue of Timing समय का मुद्दा

- The **ECI, no doubt, has the statutory right to conduct a comprehensive revision of the electoral roll**.  
इसमें कोई संदेह नहीं कि **ECI को वैधानिक अधिकार** प्राप्त है कि वह मतदाता सूची का व्यापक पुनरीक्षण कर सके।
- But the question as to why it should be done just a couple of months before elections to the Assembly has remained unanswered**.  
लेकिन यह प्रश्न कि इसे विधानसभा चुनाव से कुछ ही महीने पहले क्यों किया जाना चाहिए, अब भी अनुत्तरित है।
- The point is that intensive revision involves a massive exercise of enumeration which requires enumerators to visit every household, collect data, deal with claims and objections, and decide appeals**.  
मुद्दा यह है कि गहन पुनरीक्षण एक बड़े पैमाने की गणना प्रक्रिया है, जिसमें गणनाकारों को प्रत्येक घर का दौरा करना, डेटा एकत्र करना, दावे और आपत्तियों से निपटना, और अपीलों का निर्णय करना शामिल है।
- In fact, between **2003 and 2024**, there have been **five general elections to the Lok Sabha** and many elections in the **States and Union Territories**, but the **ECI did not conduct an SIR anytime during this period, which is unexplainable**.  
वास्तव में 2003 से 2024 के बीच लोकसभा के पाँच आम चुनाव और कई राज्यों व केंद्र शासित प्रदेशों के चुनाव हुए, लेकिन इस अवधि में **ECI ने किसी भी समय SIR आयोजित नहीं किया**, जो अस्पष्ट और अजीब है।
- Therefore, it is **intriguing why the ECI has chosen to conduct an SIR just before the Bihar elections and now a few months before the Assembly elections in Kerala, Tamil Nadu and West Bengal**.  
अतः यह चिंताजनक है कि **ECI ने SIR आयोजित करने का निर्णय क्यों लिया**, पहले बिहार चुनाव से ठीक पहले, और अब केरल, तमिलनाडु और पश्चिम बंगाल के विधानसभा चुनावों से कुछ महीने पहले।



## Legal Framework: Representation of the People (RP) Act, 1950

कानूनी ढांचा: जन प्रतिनिधित्व अधिनियम (RP अधिनियम), 1950

- The **preparation and the revision** of the electoral roll in the country is dealt with under **Section 21 of the Representation of the People (RP) Act, 1950**.  
देश में मतदाता सूची की तैयारी और पुनरीक्षण का प्रावधान जन प्रतिनिधित्व अधिनियम (RP अधिनियम), 1950 की धारा 21 के अंतर्गत किया गया है।
- This section provides for the **revision of the roll before the general election to the Lok Sabha or the State Assemblies**, and also **revision in "any year" if the ECI so directs**.  
यह धारा यह प्रावधान करती है कि लोकसभा या राज्य विधानसभाओं के आम चुनाव से पहले मतदाता सूची का पुनरीक्षण किया जाएगा, और यदि ECI निर्देश दे, तो किसी भी वर्ष में पुनरीक्षण किया जा सकता है।

## On Revisions and Voter Citizenship संशोधनों और मतदाता नागरिकता पर

- It also provides for a **special revision** in any constituency or a part of it on the direction of the **ECI**.  
यह किसी निर्वाचन क्षेत्र या उसके किसी भाग में निर्वाचन आयोग (ECI) के निर्देश पर विशेष संशोधन का भी प्रावधान करता है।
- A careful reading of this legal provision would reveal that the **revision before the general election is mandatory** and the other revisions are done as and when the **ECI directs this; the reasons have to be recorded by the ECI for undertaking such revisions**.  
इस कानूनी प्रावधान को ध्यान से पढ़ने पर पता चलता है कि सामान्य चुनाव से पहले संशोधन अनिवार्य है और अन्य संशोधन तब किए जाते हैं जब ECI निर्देश देता है, ऐसे संशोधनों के लिए कारणों को ECI द्वारा दर्ज किया जाना आवश्यक है।
- Further, a closer look at **Rule 25 of the Registration of Electors Rules, 1960** would show that **revision under Section 21(2)(a) is summary in character and revision under Section 21(2)(b) is an intensive revision**.  
आगे, मतदाताओं के पंजीकरण नियम, 1960 के नियम 25 पर गहराई से नज़र डालने पर पता चलता है कि धारा 21(2)(a) के तहत संशोधन संक्षिप्त स्वरूप का होता है और धारा 21(2)(b) के तहत किया गया संशोधन गहन संशोधन (intensive revision) होता है।
- The **intensive revision is akin to the preparation of a new roll**.  
गहन संशोधन एक नई मतदाता सूची तैयार करने के समान होता है।
- **Intensive revision is a comprehensive and time-consuming exercise**.  
गहन संशोधन एक व्यापक और समय लेने वाली प्रक्रिया है।
- Therefore, it should be presumed that this exercise is **delinked from the elections** and is done in any year when there is **no likelihood of a general election**.  
अतः यह माना जाना चाहिए कि यह प्रक्रिया चुनावों से पृथक होती है और उस वर्ष की जाती है जब सामान्य चुनाव की संभावना नहीं होती।
- Since the revision before the election is linked to the elections, it can be reasonably assumed that **only a summary revision can be done before an election**.  
चूँकि चुनाव से पहले किया गया संशोधन चुनावों से जुड़ा होता है, इसलिए यह माना जा सकता है कि केवल संक्षिप्त संशोधन ही चुनाव से पहले किया जा सकता है।
- So, the **Special Intensive Revision (SIR) of the rolls just a couple of months before the elections is not envisaged under the RP Act, 1950**.  
अतः चुनावों से कुछ महीने पहले मतदाता सूचियों का विशेष गहन संशोधन (SIR) जन प्रतिनिधित्व अधिनियम, 1950 के तहत प्रावधानित नहीं है।
- Another important issue in the context of **SIR** is the **nature of the documents** sought by the **ECI** to prove the **citizenship of voters**.  
SIR के संदर्भ में एक और महत्वपूर्ण मुद्दा यह है कि ECI द्वारा मांगे गए दस्तावेजों की प्रकृति, जिनसे मतदाताओं की नागरिकता सिद्ध की जाती है।
- Under **Article 326 of the Constitution**, a voter has to be a **citizen of India**.  
संविधान के अनुच्छेद 326 के तहत, एक मतदाता का भारत का नागरिक होना आवश्यक है।



- The issue of **citizenship** becomes important at the time of **enrolment of voters**.  
मतदाता पंजीकरण के समय नागरिकता का प्रश्न महत्वपूर्ण हो जाता है।
- The **ECI** did not include **Aadhaar** among documents as it believes **Aadhaar is not a proof of citizenship**.  
ECI ने दस्तावेजों में आधार को शामिल नहीं किया क्योंकि उसका मानना है कि आधार नागरिकता का प्रमाण नहीं है।
- The **Supreme Court**, through an **interim order**, directed the **ECI** to also **accept Aadhaar as a document to establish voter identity**.  
सुप्रीम कोर्ट ने अंतरिम आदेश के माध्यम से ECI को निर्देश दिया कि वह आधार को मतदाता की पहचान के प्रमाण के रूप में स्वीकार करे।
- The main question is what exactly are the **powers of the ECI** to determine which documents are needed to **prove Indian citizenship**.  
मुख्य प्रश्न यह है कि भारतीय नागरिकता साबित करने के लिए आवश्यक दस्तावेजों को निर्धारित करने में ECI की शक्तियाँ क्या हैं।
- **Citizenship is governed by Articles 5 to 11 and the Citizenship Act, 1955**.  
नागरिकता का प्रावधान संविधान के अनुच्छेद 5 से 11 और नागरिकता अधिनियम, 1955 द्वारा किया गया है।
- Indian citizenship is acquired by **birth, descent, registration, and naturalisation**.  
भारतीय नागरिकता जन्म, वंश, पंजीकरण, और प्राकृतिककरण द्वारा प्राप्त की जा सकती है।
- The **law relating to citizenship** is administered by the **Ministry of Home Affairs (MHA)**, not by the **ECI**.  
नागरिकता से संबंधित कानून का प्रशासन गृह मंत्रालय (MHA) करता है, ECI नहीं।
- **Article 326** says only a **citizen can be a voter**, so citizenship becomes crucial when the **electoral roll is prepared by ECI**.  
अनुच्छेद 326 कहता है कि केवल नागरिक ही मतदाता हो सकता है, इसलिए जब ECI मतदाता सूची तैयार करता है, तब नागरिकता का प्रश्न अत्यंत महत्वपूर्ण हो जाता है।
- The **ECI is not the authority to specify documents to prove citizenship**.  
ECI वह प्राधिकरण नहीं है जो नागरिकता साबित करने के लिए आवश्यक दस्तावेज निर्धारित कर सके।
- **This can only be done by the Ministry of Home Affairs (MHA)**.  
यह कार्य केवल गृह मंत्रालय (MHA) द्वारा किया जा सकता है।
- The **ECI can only verify the documents notified by the government**.  
ECI केवल उन्हीं दस्तावेजों का सत्यापन कर सकता है, जिन्हें सरकार द्वारा अधिसूचित किया गया हो।
- **It is legally not right for the ECI to claim power to determine citizenship or reject a document**.  
ECI का यह दावा करना कि उसे नागरिकता निर्धारण का अधिकार है या किसी दस्तावेज को अस्वीकार करना, कानूनी रूप से गलत है।
- The **MHA has not yet notified any comprehensive list of documents** required to prove citizenship.  
अब तक गृह मंत्रालय ने नागरिकता सिद्ध करने के लिए आवश्यक दस्तावेजों की कोई व्यापक सूची अधिसूचित नहीं की है।
- **Article 326** impliedly requires the government to specify such documents.  
अनुच्छेद 326 अप्रत्यक्ष रूप से सरकार से ऐसे दस्तावेज निर्दिष्ट करने की अपेक्षा करता है।
- In absence of such a list, the **ECI assumes the power** to specify documents voters must produce to prove citizenship.  
ऐसी सूची के अभाव में, ECI स्वयं को यह अधिकार दे देता है कि वह नागरिकता सिद्ध करने के लिए दस्तावेजों की सूची निर्धारित करे।
- The question arises — how can **ECI exercise a power** that is **vested in the Home Ministry?**  
प्रश्न उठता है — ECI उस शक्ति का उपयोग कैसे कर सकता है जो गृह मंत्रालय में निहित है?

## A Key Decision

### एक प्रमुख निर्णय

- It is unclear how many voters in **Bihar** were removed from the list after **SIR 2024** for lack of documents proving citizenship.



यह स्पष्ट नहीं है कि बिहार में SIR 2024 के बाद कितने मतदाताओं को नागरिकता साबित करने वाले दस्तावेज़ न होने के कारण सूची से हटाया गया।

- The **Supreme Court's decision in Lal Babu Hussein v. Electoral Registration Officer (1995)** is crucial.  
सुप्रीम कोर्ट का 1995 का निर्णय (लाल बाबू हुसैन बनाम निर्वाचन पंजीकरण अधिकारी) अत्यंत महत्वपूर्ण है।
- The Court said: **once a name is entered in the roll, it is presumed that procedural requirements under law were followed.**  
न्यायालय ने कहा: एक बार जब किसी नाम को सूची में दर्ज कर लिया जाता है, तो यह माना जाता है कि कानूनी प्रक्रिया के आवश्यक प्रावधानों का पालन किया गया है।
- **Article 14 forbids arbitrary state action, and Article 21 forbids deprivation of liberty except through fair and just procedure.**  
अनुच्छेद 14 राज्य की मनमानी कार्रवाई को निषिद्ध करता है, और अनुच्छेद 21 न्यायसंगत और उचित प्रक्रिया के बिना स्वतंत्रता से वंचित करने को रोकता है।
- Legal and constitutional authorities must **adhere to these constitutional directions.**  
कानूनी और संवैधानिक प्राधिकरणों को इन संवैधानिक निर्देशों का पालन करना चाहिए।

## International Relations

12/11/2025

### BAMAKO

## Armed men in Mali publicly killed a TikTok influencer, say authorities



AFP

### GS II: Africa

Armed men in Mali abducted and publicly executed TikTok influencer Mariame Cissé in Tonka after she posted videos supporting the military, authorities said on Monday. Cissé had received death threats. Even though JNIM is known to operate in the area, no group has taken responsibility for the killing yet. AP

**Armed men in Mali publicly killed a TikTok influencer, say authorities**  
माली में सशस्त्र पुरुषों ने एक टिकटॉक इन्फ्लुएंसर की सार्वजनिक रूप से हत्या की, अधिकारियों का कहना है

- **Armed men in Mali abducted and publicly executed TikTok influencer Mariame Cissé in Tonka after she posted videos supporting the military, authorities said on Monday.**

माली में सशस्त्र पुरुषों ने टिकटॉक इन्फ्लुएंसर मरियम सिसे का टोंका में अपहरण कर सार्वजनिक रूप से निष्पादन किया, जब उन्होंने सैन्य बलों के समर्थन में वीडियो पोस्ट किए, ऐसा अधिकारियों ने सोमवार को बताया।

**Cissé had received death threats.**

सिसे को पहले ही मौत की धमकियाँ मिल चुकी थीं।



- Even though JNIM is known to operate in the area, no group has taken responsibility for the killing yet.  
हालांकि जेएनआईएम (JNIM) इस क्षेत्र में सक्रिय संगठन के रूप में जाना जाता है, लेकिन अभी तक किसी भी समूह ने इस हत्या की जिम्मेदारी नहीं ली है।

## BAGHDAD

### Iraqis vote in parliamentary election marked by tight security



GS II: IR: West Asia

Iraqis headed to the polls on Tuesday to vote in a parliamentary election marked by tight security and a boycott by a major political bloc — the popular Sadrist Movement, led by influential Shia cleric Muqtada al-Sadr. Turnout was sparse in the early hours of Tuesday. Initial results were expected on Wednesday. AP

### Iraqis vote in parliamentary election marked by tight security

कड़ी सुरक्षा व्यवस्था के बीच इराकियों ने संसदीय चुनाव में मतदान किया

- Iraqis headed to the polls on Tuesday to vote in a parliamentary election marked by tight security and a boycott by a major political bloc — the popular Sadrist Movement, led by influential Shia cleric Muqtada al-Sadr.

मंगलवार को इराकी नागरिकों ने संसदीय चुनाव में मतदान किया, जो कड़ी सुरक्षा व्यवस्था और एक प्रमुख राजनीतिक गुट — लोकप्रिय सदरिस्ट आंदोलन (Sadrist Movement) के बहिष्कार से चिह्नित था, जिसका नेतृत्व प्रभावशाली शिया धर्मगुरु मुक़तदा अल-सद्र कर रहे हैं।

- Turnout was sparse in the early hours of Tuesday.

मंगलवार की सुबह के शुरुआती घंटों में मतदान की भागीदारी कम रही।

- Initial results were expected on

Wednesday.

प्रारंभिक परिणाम बुधवार को आने की उम्मीद थी।

PATRIOTIC



# Ukraine war, China's critical mineral dominance on agenda at G7 meet

GS II: IR

**Agence France-Presse**  
MONTREAL

G7 Foreign Ministers gather in Canada on Tuesday for meetings expected to focus on Ukraine and find consensus on a path forward to end the four-year-old conflict. Options to fund Ukraine's war needs could feature prominently at the talks in Canada's Niagara region on the U.S. border.

The diplomats are meeting after U.S. President Donald Trump slapped sanctions on Moscow's two largest oil companies in October, slamming Russian President Vladimir Putin over his refusal to end the conflict. Mr. Trump has also pushed other European countries to stop buying oil that he says funds Moscow's war machine.



**Key talks:** The forum's top diplomats are meeting in Canada which had hosted this year's G7 Leaders' Summit in June. REUTERS

Ukraine is enduring devastating Russian attacks on its energy infrastructure, but Canadian Foreign Minister Anita Anand stopped short of promising concrete outcomes to aid Kyiv at the Niagara talks.

#### Multilateralism

She told *AFP* a priority for the meeting was broaden-

ing discussion beyond the Group of Seven, which includes Britain, Canada, France, Germany, Italy, Japan and the United States.

"For Canada, it is important to foster a multilateral conversation, especially now, in such a volatile and complicated environment," Ms. Anand said.

Representatives from

Saudi Arabia, India, Brazil, Australia, South Africa, Mexico and South Korea will also be on hand.

U.S. Secretary of State Marco Rubio is set to hold bilateral talks with Ms. Anand on Wednesday.

The G7's top diplomats are meeting two weeks after the group's energy secretaries agreed on further steps to counter China's dominance of critical mineral supply chains.

Beijing has established commanding market control over the refining and processing of various minerals—especially the rare earth materials needed for the magnets that power sophisticated technologies.

A U.S. State Department official told reporters that critical mineral supply chains would be "a major point of focus."

## Ukraine war, China's critical mineral dominance on agenda at G7 meet यूक्रेन युद्ध और चीन का महत्वपूर्ण खनिजों पर प्रभुत्व G7 बैठक के एजेंडे में

- **G7 Foreign Ministers** gather in Canada on Tuesday for meetings expected to focus on Ukraine and find consensus on a path forward to end the four-year-old conflict.

G7 के विदेश मंत्री मंगलवार को कनाडा में एकत्र हुए, जहाँ बैठक का मुख्य उद्देश्य यूक्रेन पर केंद्रित रहना और चार साल पुराने संघर्ष को समाप्त करने के लिए सहमति बनाना है।

- **Options to fund Ukraine's war needs** could feature prominently at the talks in Canada's Niagara region, on the U.S. border.

यूक्रेन की युद्ध आवश्यकताओं के लिए वित्तपोषण के विकल्प पर चर्चा कनाडा के यू.एस. सीमा से सटे नियाग्रा क्षेत्र में प्रमुखता से की जाएगी।

- The diplomats are meeting after U.S. President Donald Trump slapped sanctions on Moscow's two largest oil companies in October, slamming Russian President Vladimir Putin over his refusal to end the conflict.

यह बैठक ऐसे समय में हो रही है जब अमेरिकी राष्ट्रपति डोनाल्ड ट्रंप ने अक्टूबर में मॉस्को की दो सबसे बड़ी तेल कंपनियों पर प्रतिबंध लगाए, और रूसी राष्ट्रपति व्लादिमीर पुतिन की संघर्ष समाप्त करने से इनकार करने के लिए आलोचना की।

- **Mr. Trump** has also pushed other European countries to stop buying oil that he says funds Moscow's war machine.

ट्रंप ने अन्य यूरोपीय देशों पर भी दबाव डाला कि वे तेल खरीदना बंद करें, क्योंकि उनके अनुसार यह मॉस्को की युद्ध मशीन को वित्तपोषित करता है।

- **Ukraine is enduring devastating Russian attacks** on its energy infrastructure, but Canadian Foreign Minister Anita Anand stopped short of promising concrete



outcomes to aid Kyiv at the Niagara talks.

यूक्रेन अपने ऊर्जा ढाँचे पर रूस के विनाशकारी हमलों का सामना कर रहा है, लेकिन कनाडा की विदेश मंत्री अनिता आनंद ने नियोग्रा वार्ता में कीव की मदद के लिए किसी ठोस परिणाम का वादा नहीं किया।

- **Multilateralism** — She told AFP a priority for the meeting was **broadening discussion beyond the Group of Seven, which includes Britain, Canada, France, Germany, Italy, Japan and the United States.**  
बहुपक्षवाद — उन्होंने एएफपी को बताया कि बैठक की प्राथमिकता सात देशों के समूह से परे चर्चा का विस्तार करना है, जिसमें ब्रिटेन, कनाडा, फ्रांस, जर्मनी, इटली, जापान और संयुक्त राज्य अमेरिका शामिल हैं।
- “For Canada, it is important to foster a **multilateral conversation**, especially now, in such a **volatile and complicated environment**,” Ms. Anand said.  
सुश्री आनंद ने कहा, “कनाडा के लिए यह आवश्यक है कि वह बहुपक्षीय संवाद को प्रोत्साहित करे, विशेष रूप से अब, जब दुनिया का माहौल बेहद अस्थिर और जटिल है।”
- **Representatives from Saudi Arabia, India, Brazil, Australia, South Africa, Mexico and South Korea** will also be on hand.  
सऊदी अरब, भारत, ब्राज़ील, ऑस्ट्रेलिया, दक्षिण अफ्रीका, मेक्सिको और दक्षिण कोरिया के प्रतिनिधि भी बैठक में शामिल होंगे।
- **U.S. Secretary of State Marco Rubio** is set to hold **bilateral talks** with Ms. Anand on Wednesday.  
अमेरिकी विदेश मंत्री मार्को रुबियो बुधवार को सुश्री आनंद के साथ द्विपक्षीय वार्ता करेंगे।
- The **G7's top diplomats** are meeting two weeks after the **group's energy secretaries** agreed on **further steps to counter China's dominance of critical mineral supply chains.**  
G7 के शीर्ष राजनयिक यह बैठक दो सप्ताह बाद कर रहे हैं, जब समूह के ऊर्जा सचिवों ने चीन के महत्वपूर्ण खनिज आपूर्ति श्रृंखला पर प्रभुत्व का मुकाबला करने के लिए आगे की रणनीति पर सहमति जताई थी।
- **Beijing has established commanding market control** over the **refining and processing of various minerals** — especially the **rare earth materials** needed for the magnets that power sophisticated technologies.  
बीजिंग ने विभिन्न खनिजों के शोधन और प्रसंस्करण पर मजबूत बाजार नियंत्रण स्थापित किया है, विशेषकर वे दुर्लभ धातुएँ (rare earth materials) जो उन्नत तकनीकी उपकरणों के चुंबकों में प्रयुक्त होती हैं।
- A **U.S. State Department official** told reporters that **critical mineral supply chains** would be “**a major point of focus.**”  
एक अमेरिकी विदेश विभाग अधिकारी ने पत्रकारों को बताया कि महत्वपूर्ण खनिज आपूर्ति श्रृंखलाएँ “मुख्य केंद्र बिंदु” होंगी।



**GS Paper III: Economy, S&T, Environment, DM, &IS**

**TOPICS COVERED**

12\_11\_2025

**Economy**

1. **Exploited workers, a labour policy's empty promises**

शोषित श्रमिक, श्रम नीति के खोखले वादे

2.

**Copper added to list of critical minerals, but U.S. has plenty**

कॉपर को महत्वपूर्ण खनिजों की सूची में शामिल किया गया, लेकिन अमेरिका के पास पहले से ही पर्याप्त भंडार है

**S&T**

3.

**Why can we recycle only some kinds of plastics?**

हम केवल कुछ प्रकार के प्लास्टिक को ही क्यों रीसायकल कर सकते हैं?

4.

**When data became the first responder**

जब डेटा पहला उत्तरदाता बना

5.

**What do forensic experts do after blasts?**

विस्फोटों के बाद फॉरेंसिक विशेषज्ञ क्या करते हैं?

6.

**Why do astronauts wear pressurised suits?**

अंतरिक्ष यात्री दबावयुक्त सूट क्यों पहनते हैं?

7.

**What's the status of the rare earth hypothesis?**

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**QUIZ**

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9.

**SC judge: imported ideas may not save endangered species**

सुप्रीम कोर्ट के जज: पश्चिमी विचार लुप्तप्राय प्रजातियों को नहीं बचा सकते

10.

**India recorded the highest greenhouse gas emissions for 2024**

भारत ने 2024 में सबसे अधिक ग्रीनहाउस गैस उत्सर्जन दर्ज किया

11.

**'Lucifer' bee with devil-like horns found in Australia**

ऑस्ट्रेलिया में शैतान जैसे सींगों वाली 'लूसिफर' मधुमक्खी की खोज



	<b>DM</b>
12.	<b>When data became the first responder</b> <b>जब डेटा पहला उत्तरदाता बना</b>

**Economy**

12/11/2025

## Exploited workers, a labour policy's empty promises

GS III: Economy: Employment

In July, while probing instances of forced labour in the seafood industry on India's eastern coast, this writer met hundreds of women driven to desperation, peeling fish heads on cold tables without gloves, all for meagre wages as farming failed their families. Promised Employees' State Insurance (ESI) and Provident Fund benefits at the time of recruitment, they were reclassified as "daily wagers" a month before my visit. There was a modest wage hike, but they lost both benefits as the company stopped contributions. Vulnerable, they toil long hours –trapped in exploitation that has come to define forced labour – exposing the fragility of their legal safeguards in India's labour landscape.

Against this grim backdrop – where 11 million people endure modern slavery in India, the world's highest – the Bharatiya Janata Party-led government unveiled the draft Shram Shakti Niti 2025, which is claimed to be a "future-ready" policy cloaked in "ancient Indian ethos" from texts such as Manusmriti, but is blind to the brutal realities that workers face.

### A case of 'employer ease'

Since late 2021, this writer has interviewed thousands of workers in steel factories, sandstone quarries, seafood plants, and textile mills (across west, northwest, east and south India) hired through middlemen on daily wages, without contracts and stripped of their rights. Paid off the payroll through contractors, these workers are denied legal benefits, languishing as part of the 90% informally employed workforce in India, as in a 2024 International Labour Organization (ILO) report.

This policy flouts labour laws, enables wage theft and erodes worker dignity, defying constitutional protections under Articles 14, 16, and 23. It is a cynical rebrand favouring cultural nostalgia and employer ease over justice for workers.

The policy introduces a portable Universal Social Security Account, merging Employees' Provident Fund Organisation, Employees' State Insurance Corporation, Pradhan Mantri Jan Arogya Yojana, e-SHRAM, and State boards for lifelong health, pension, maternity, accident, and life insurance across sectors – invoking Article 41 (right to work, education, and public assistance). Yet, it dodges funding – no gig employer



**Rejimon Kuttappan**  
is a forced labour investigator

The draft Shram Shakti Niti 2025 further exposes the gaps in India's labour landscape

mandates or state matches – risking the e-SHRAM's paltry payouts. Digital IDs, in a situation of only 38% household literacy, result in the exclusion of women, senior citizens and low-literates, violating Article 15. Further, the absence of union safeguards affects bargaining. The initial phase must enforce offline access and tripartite funds, else this is a case of exploitation.

On the occupational safety front, the policy pledges strict enforcement of the 2020 Occupational Safety, Health and Working Conditions Code, with risk audits and gender-sensitive standards, honouring Directive 42 (state can make provision to secure just and humane conditions of work and for maternity relief) and ILO Convention 155 (women's care-role risks).

But the goal of "near-zero fatalities" by 2047 appears fanciful without penalties and given the reality of inspector shortages. Digital tools exclude informal workers, undermining equality; ignoring gig mental health, while union audits weaken Article 19.

### Areas of concern

The hints that the Ministry of Labour and Employment (MoLE) will become an employment facilitator, by using the Artificial Intelligence (AI)-driven National Career Service (NCS) for job matching, credential checks, and skill alignment in Tier-II/III cities and micro and small medium enterprises, merging Skill India to tackle 91.75% graduate mismatches. Yet, absent AI bias safeguards risk caste- and gender-based Article 15 violations.

Ignoring the Wages Code minima for 12 million gig workers – where "flexibility" is a cover for abuse – and unclear transition benefits demand ethics audits and union-vetted algorithms to curb tech-driven inequality.

The policy targets 35% female labour participation by 2030 (from 33.7%) through affordable childcare, flexible gigs, equal pay and apprenticeships –aligning with Article 15's gender equity and the ILO Convention 195's mobility goals. However, without quotas, penalties or sufficient maternity support for informal workers, there can hardly be success. Overlooking youth mental health and caste-gender data gaps hides the unique challenges that Dalit women face, making

union-led audits essential for true dignity and progress.

The policy's green-tech vision promotes AI-enhanced safety measures and reskilling opportunities for coal workers, aligning with the climate goals of Sustainable Development Goal 13 and the livelihood rights of Article 21. However, "just transitions" lack substance without income support or union involvement, risking violations of ILO Convention 29. Widening rural-AI gaps and urban-centric green jobs marginalise 400 million informal workers. Tripartite funding and Organisation for Economic Co-operation and Development (OECD) safeguards are essential to avert an exploitative eco-trap that undermines dignity.

The policy, which hints at convergence through Labour and Employment Policy Evaluation Index (LEPEI) dashboards, aims to realise Article 12's vision – of just governance – by linking the National Education Policy with Digital India. However, weak enforcement of the Digital Personal Data Protection Act risks enabling surveillance and undermining Article 19's freedoms.

Amid exploitation and digital optimism, the Shram Shakti Niti 2025 projects a "rights-driven, future-ready" vision for Viksit Bharat. But there are gaps beneath its ambitious rhetoric such as weak regulatory oversight, digital exclusion, unenforced penalties and a fragile adherence to ILO conventions. All these would only accelerate the decline of unions in an expanding gig economy.

### It is about dignity, rights and justice

Without concrete funding and institutional safeguards, the promise of universal social protection may collapse under its own weight. For millions trapped in informal and forced labour, the policy's success will ultimately be measured not by its digital dashboards, but by its power to restore dignity, rights, and justice to India's working poor.

The 2025-47 rollout needs urgent pilots, with rights audits for accountability. There needs to be tripartite enforcement, offline access for digitally excluded workers, and transparent grievance redressal. Without these, there is the risk of symbolic rhetoric over justice for India's labouring millions.

## Exploited workers, a labour policy's empty promises शोषित श्रमिक, श्रम नीति के खोखले वादे

- In July, while probing instances of **forced labour in the seafood industry on India's eastern coast**, this writer met **hundreds of women driven to desperation, peeling fish heads on cold tables without gloves, all for meagre wages as farming failed their families**.  
जुलाई में, जब भारत के पूर्वी तट पर सीफूड उद्योग में बलपूर्वक श्रम (forced labour) के मामलों की जांच



की जा रही थी, तब लेखक ने सैकड़ों महिलाओं से मुलाकात की जो मजबूरी में बिना दस्ताने ठंडी मेजों पर मछलियों के सिर छील रही थीं, क्योंकि खेती से उनके परिवारों का गुजर-बसर नहीं हो पा रहा था।

- **Promised Employees' State Insurance (ESI) and Provident Fund benefits at the time of recruitment, they were reclassified as "daily wagers" a month before the visit.**  
भर्ती के समय उन्हें **कर्मचारी राज्य बीमा (ESI)** और **भविष्य निधि लाभ** देने का वादा किया गया था, लेकिन लेखक की यात्रा से एक माह पहले उन्हें **"दैनिक वेतनभोगी (daily wagers)"** के रूप में पुनः वर्गीकृत कर दिया गया।
- There was a modest **wage hike**, but they lost both benefits as the company stopped contributions.  
मामूली **वेतन वृद्धि** हुई, परंतु कंपनी द्वारा योगदान बंद करने के कारण उन्हें दोनों लाभों से वंचित कर दिया गया।
- **Vulnerable, they toil long hours — trapped in exploitation that has come to define forced labour** — exposing the fragility of their **legal safeguards** in India's **labour landscape**.  
वे कमजोर स्थिति में लंबे समय तक काम करती हैं — **शोषण (exploitation)** में फंसी हुई जो अब **बलपूर्वक श्रम (forced labour)** की पहचान बन चुका है — यह भारत के **श्रम परिदृश्य** में उनके **कानूनी सुरक्षा उपायों** की नाजुकता को उजागर करता है।
- Against this grim backdrop — where **11 million people endure modern slavery** in India, the world's highest — the **Bharatiya Janata Party-led government** unveiled the **draft Shram Shakti Niti 2025**, claimed to be a **"future-ready"** policy cloaked in **"ancient Indian ethos"** from texts such as **Manusmriti**, but blind to workers' brutal realities.  
इस भयावह परिदृश्य में — जहाँ भारत में **1.1 करोड़ लोग (11 million people)** **आधुनिक दासता (modern slavery)** झेल रहे हैं, जो विश्व में सबसे अधिक है — **भारतीय जनता पार्टी** के नेतृत्व वाली सरकार ने **"ड्राफ्ट श्रम शक्ति नीति 2025 (draft Shram Shakti Niti 2025)"** जारी की, जिसे **"भविष्य के लिए तैयार (future-ready)"** और **"प्राचीन भारतीय विचारधारा (ancient Indian ethos)"** पर आधारित बताया गया, किंतु यह मजदूरों की कठोर वास्तविकताओं से अंधी है।

### A Case of 'Employer Ease'

#### 'नियोक्ता सुविधा' का मामला

- Since **late 2021**, this writer has interviewed thousands of workers in **steel factories, sandstone quarries, seafood plants, and textile mills** (across west, northwest, east, and south India) hired through **middlemen on daily wages**, without **contracts**, and stripped of **their rights**.  
2021 के अंत से लेखक ने पश्चिम, उत्तर-पश्चिम, पूर्व और दक्षिण भारत के **इस्पात कारखानों, बलुआ पत्थर खदानों, सीफूड प्लांट्स, और टेक्सटाइल मिलों** में काम करने वाले हजारों मजदूरों से बातचीत की, जिन्हें **बिचौलियों** के माध्यम से **दैनिक वेतन** पर बिना **अनुबंधों** के रखा गया और उनके **अधिकारों** से वंचित किया गया।
- **Paid off the payroll through contractors, these workers are denied legal benefits, languishing as part of the 90% informally employed workforce in India, as per a 2024 ILO report.**  
ठेकेदारों के माध्यम से भुगतान किए जाने के कारण इन मजदूरों को **कानूनी लाभ** नहीं मिलते, और वे भारत के **90% असंगठित कार्यबल (informally employed workforce)** का हिस्सा बने हुए हैं, जैसा कि **2024 की ILO रिपोर्ट** में बताया गया है।
- **This policy flouts labour laws, enables wage theft, and erodes worker dignity, defying constitutional protections under Articles 14, 16, and 23.**  
यह नीति **श्रम कानूनों** का **उल्लंघन (flout)** करती है, **वेतन चोरी (wage theft)** को बढ़ावा देती है और **मजदूर गरिमा (worker dignity)** को कमजोर करती है, जो **अनुच्छेद 14, 16 और 23** के तहत **संवैधानिक सुरक्षा** का उल्लंघन है।
- It is a **cynical rebrand, favouring cultural nostalgia and employer ease over justice for workers**.  
यह एक **कपटपूर्ण पुनः ब्रांडिंग (cynical rebrand)** है जो **मजदूर न्याय** की तुलना में **सांस्कृतिक पुरानी यादों** और **नियोक्ता सुविधा** को प्राथमिकता देती है।

### Policy Provisions and Issues

#### नीति के प्रावधान और समस्याएँ



- The policy introduces a **portable Universal Social Security Account**, merging **EPFO, ESIC, PM Jan Arogya Yojana, e-SHRAM**, and **State Boards** for **lifelong health, pension, maternity, accident, and life insurance** across sectors — invoking **Article 41 (right to work, education, and public assistance)**.  
नीति में एक पोर्टेबल यूनिवर्सल सोशल सिक्योरिटी अकाउंट शुरू किया गया है जो ईपीएफओ (EPFO), ईएसआईसी (ESIC), प्रधानमंत्री जन आरोग्य योजना, ई-श्रम (e-SHRAM), और राज्य बोर्डों को मिलाकर जीवनभर स्वास्थ्य, पेंशन, मातृत्व, दुर्घटना, और जीवन बीमा प्रदान करेगा — यह अनुच्छेद 41 (काम, शिक्षा और सार्वजनिक सहायता का अधिकार) को संदर्भित करता है।
- Yet, it **dodges funding** — no **gig employer mandates** or **state matches** — risking **e-SHRAM's paltry payouts**.  
फिर भी यह वित्तपोषण से बचती है, क्योंकि इसमें न तो गिग नियोक्ताओं पर दायित्व हैं और न ही राज्य योगदान (state matches) — जिससे ई-श्रम के मामूली भुगतान जोखिम में पड़ जाते हैं।
- Digital IDs**, in a situation of only **38% household literacy**, result in **exclusion of women, senior citizens, and low-literates**, violating **Article 15**.  
केवल 38% घरेलू साक्षरता की स्थिति में डिजिटल आईडी (Digital IDs) के कारण महिलाओं, वरिष्ठ नागरिकों और अल्प साक्षर लोगों का बहिष्कार हो रहा है, जो अनुच्छेद 15 का उल्लंघन है।
- The **absence of union safeguards** affects **bargaining power**; the **initial phase** must enforce **offline access** and **tripartite funds**, else this is a **case of exploitation**.  
संघ सुरक्षा (union safeguards) की अनुपस्थिति से सौदेबाजी की शक्ति प्रभावित होती है; प्रारंभिक चरण में ऑफलाइन पहुंच और त्रिपक्षीय कोष (tripartite funds) लागू किए जाने चाहिए, अन्यथा यह शोषण का मामला है।

### Occupational Safety Concerns व्यावसायिक सुरक्षा संबंधी चिंताएँ

- On **occupational safety**, the policy pledges strict enforcement of the **2020 Occupational Safety, Health and Working Conditions Code**, with **risk audits** and **gender-sensitive standards**, honouring **Directive 42** and **ILO Convention 155**.  
व्यावसायिक सुरक्षा के मोर्चे पर नीति ने 2020 व्यावसायिक सुरक्षा, स्वास्थ्य और कार्य परिस्थितियाँ संहिता (Code) को सख्ती से लागू करने, जोखिम ऑडिट (risk audits) करने और लैंगिक संवेदनशील मानकों का पालन करने का वादा किया है, जिससे निर्देश सिद्धांत 42 और ILO कन्वेंशन 155 का सम्मान होता है।
- But the **goal of "near-zero fatalities" by 2047** appears **fanciful** without **penalties** and given the **shortage of inspectors**.  
परंतु 2047 तक "लगभग शून्य मृत्यु (near-zero fatalities)" का लक्ष्य दंडात्मक प्रावधानों की कमी और निरीक्षकों की कमी (shortage of inspectors) के कारण अवास्तविक (fanciful) प्रतीत होता है।
- Digital tools** exclude **informal workers**, **undermining equality**; ignoring **gig workers' mental health**, while **union audits** weaken **Article 19**.  
डिजिटल उपकरण (Digital tools) असंगठित मजदूरों को बाहर कर रहे हैं जिससे समानता (equality) प्रभावित हो रही है; साथ ही गिग श्रमिकों के मानसिक स्वास्थ्य की उपेक्षा और संघ ऑडिट द्वारा अनुच्छेद 19 को कमजोर किया जा रहा है।

### Areas of Concern चिंता के क्षेत्र

- The hints that the **Ministry of Labour and Employment (MoLE)** will become an **employment facilitator**, by using the **Artificial Intelligence (AI)-driven National Career Service (NCS)** for **job matching, credential checks, and skill alignment** in **Tier-II/III cities** and **micro and small medium enterprises**, merging **Skill India** to tackle **91.75% graduate mismatches**. Yet, absent **AI bias safeguards** risk **caste- and gender-based Article 15 violations**.  
यह संकेत हैं कि श्रम और रोजगार मंत्रालय (MoLE) एक रोजगार सुविधा प्रदाता बनेगा, जो कृत्रिम बुद्धिमत्ता (AI) संचालित नेशनल करियर सर्विस (NCS) का उपयोग करेगा नौकरी मिलान, प्रमाण-पत्र जांच, और कौशल संरेखण के लिए, खासकर द्वितीय/तृतीय श्रेणी शहरों और सूक्ष्म एवं लघु-मध्यम उद्यमों



में। स्किल इंडिया को मिलाकर 91.75% स्नातक असंगतियों को दूर किया जाएगा। लेकिन AI पूर्वाग्रह सुरक्षा उपायों की अनुपस्थिति जाति और लिंग आधारित अनुच्छेद 15 के उल्लंघन का जोखिम पैदा करती है।

- Ignoring the **Wages Code minima for 12 million gig workers** — where “flexibility” is a cover for abuse — and unclear **transition benefits demand ethics audits and union-vetted algorithms to curb tech-driven inequality.**

1.2 करोड़ गिग वर्कर्स के लिए वेतन संहिता की न्यूनतम सीमा की अनदेखी — जहाँ “लचीलापन (flexibility)” दुरुपयोग का एक आवरण है — और अस्पष्ट **संक्रमण लाभ** के कारण **नैतिक ऑडिट** तथा **यूनियन द्वारा अनुमोदित एल्गोरिद्म** की आवश्यकता है ताकि **तकनीक-चालित असमानता** को रोका जा सके।

- The **policy targets 35% female labour participation by 2030 (from 33.7%) through affordable childcare, flexible gigs, equal pay and apprenticeships — aligning with Article 15’s gender equity and the ILO Convention 195’s mobility goals.** However, without **quotas, penalties or sufficient maternity support for informal workers**, there can hardly be success.

नीति का लक्ष्य 2030 तक महिला श्रम भागीदारी को 35% (वर्तमान 33.7% से) तक बढ़ाना है, **सस्ती बाल देखभाल, लचीले गिग कार्य, समान वेतन और प्रशिक्षता** के माध्यम से। यह **अनुच्छेद 15 के लैंगिक समानता सिद्धांत** और **आईएलओ कन्वेंशन 195 के गतिशीलता लक्ष्यों** के अनुरूप है। परंतु **आरक्षण, दंडात्मक प्रावधानों या अनौपचारिक श्रमिकों के लिए पर्याप्त मातृत्व समर्थन** के बिना सफलता कठिन है।

- Overlooking **youth mental health and caste-gender data gaps** hides the unique challenges that **Dalit women** face, making **union-led audits** essential for true dignity and progress.

**युवा मानसिक स्वास्थ्य और जाति-लिंग डेटा अंतरालों** की अनदेखी **दलित महिलाओं** द्वारा झेले जाने वाले **विशिष्ट चुनौतियों** को छिपाती है, जिससे **यूनियन-नेतृत्व वाले ऑडिट** वास्तविक गरिमा और प्रगति के लिए आवश्यक बन जाते हैं।

- The policy’s **green-tech vision** promotes **AI-enhanced safety measures and reskilling opportunities for coal workers**, aligning with the **climate goals of Sustainable Development Goal 13 and the livelihood rights under Article 21.** However, “**just transitions**” lack substance without **income support or union involvement**, risking violations of **ILO Convention 29.**

नीति का **ग्रीन-टेक दृष्टिकोण** कोयला श्रमिकों के लिए **AI-सक्षम सुरक्षा उपायों** और **पुनः कौशल अवसरों** को बढ़ावा देता है, जो **सतत विकास लक्ष्य 13 के जलवायु लक्ष्यों** और **अनुच्छेद 21 के आजीविका अधिकारों** के अनुरूप है। परंतु **आय समर्थन या यूनियन की भागीदारी** के बिना “**न्यायसंगत संक्रमण**” का कोई ठोस आधार नहीं है, जिससे **आईएलओ कन्वेंशन 29** का उल्लंघन होने का खतरा है।

- **Widening rural-AI gaps and urban-centric green jobs** marginalise **400 million informal workers.** **Tripartite funding and OECD safeguards** are essential to avert an **exploitative eco-trap** that undermines **dignity.**

**ग्रामीण-AI अंतरालों का बढ़ना और शहरी-केंद्रित हरित नौकरियों का प्रसार 40 करोड़ अनौपचारिक श्रमिकों** को हाशिये पर धकेल रहा है। **त्रिपक्षीय वित्तपोषण और OECD सुरक्षा उपाय** आवश्यक हैं ताकि **गरिमा को कमजोर करने वाले शोषणकारी पारिस्थितिक जाल** से बचा जा सके।

- The policy, which hints at convergence through **Labour and Employment Policy Evaluation Index (LEPEI) dashboards**, aims to realise **Article 12’s vision — of just governance — by linking the National Education Policy with Digital India.** However, weak enforcement of the **Digital Personal Data Protection Act** risks enabling **surveillance** and undermining **Article 19’s freedoms.**

नीति जो **श्रम और रोजगार नीति मूल्यांकन सूचकांक (LEPEI)** डैशबोर्ड के माध्यम से एकीकरण का संकेत देती है, का उद्देश्य **अनुच्छेद 12 के न्यायपूर्ण शासन के दृष्टिकोण** को साकार करना है, **राष्ट्रीय शिक्षा नीति** को **डिजिटल इंडिया** से जोड़कर। लेकिन **डिजिटल व्यक्तिगत डेटा संरक्षण अधिनियम** के कमजोर प्रवर्तन से **निगरानी को बढ़ावा** मिल सकता है और **अनुच्छेद 19 की स्वतंत्रताओं** को कमजोर किया जा सकता है।

- Amid exploitation and digital optimism, the **Shram Shakti Niti 2025 projects a “rights-driven, future-ready” vision for Viksit Bharat.** But there are gaps beneath its ambitious rhetoric such as **weak regulatory oversight, digital exclusion, unenforced penalties and a fragile adherence to ILO conventions.** All these would only accelerate the **decline of unions** in an expanding **gig economy.**

**शोषण और डिजिटल आशावाद** के बीच, **श्रम शक्ति नीति 2025** एक “**अधिकार-आधारित, भविष्य-तैयार**” **विकसित भारत** की दृष्टि प्रस्तुत करती है। लेकिन इसके महत्वाकांक्षी भाषण के नीचे **कमजोर नियामक निगरानी, डिजिटल बहिष्कार, अप्रवर्तित दंड और ILO सम्मेलनों के प्रति कमजोर प्रतिबद्धता** जैसी **खामियां** हैं। ये सभी केवल **गिग अर्थव्यवस्था में यूनियनों के पतन** को तेज करेंगे।



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**It is about dignity, rights and justice**  
यह गरिमा, अधिकार और न्याय के बारे में है

- Without **concrete funding** and **institutional safeguards**, the promise of **universal social protection** may collapse under its own weight.  
ठोस वित्तपोषण और संस्थागत सुरक्षा उपायों के बिना, सार्वभौमिक सामाजिक सुरक्षा का वादा अपने ही भार तले ढह सकता है।
- For millions trapped in **informal and forced labour**, the policy's success will ultimately be measured not by its **digital dashboards**, but by its **power to restore dignity, rights, and justice to India's working poor**.

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## Copper added to list of critical minerals, but U.S. has plenty



**Stocked up:** The pricing differential has already drawn massive amounts of physical copper into the U.S. AP

GS III: Economy  
Reuters  
LONDON

Copper has been added to the U.S. government's list of critical minerals – the metals deemed vital to the country's economic and national security.

Fortunately, the United States has already accumulated what is the world's second largest copper stockpile, behind China's state reserves.

It has done so without spending a dollar of federal money. Rather, the copper market has done all the work in the form of a yawning arbitrage gap between the U.S. price traded by the CME, and the international price traded on the London Metal Exchange (LME).

The pricing differential has already drawn massive amounts of physical copper into the United States. And it's still doing so as the market bets that the critical mineral designation, first flagged in August, increases the chances of U.S. import tariffs. When U.S. President Donald Trump ordered an investigation into copper imports on national security grounds in February, the market moved quickly to price in the potential for U.S. import tariffs similar to those already imposed on steel and aluminium.

The CME spot premium over the London market stretched to almost \$3,000 per metric ton at one stage in July, creating an extraordinary opportunity for the world's largest traders to ship as much physical metal as they could get their hands on to the United States.

The premium imploded in July when the Trump administration blind-sided the market by imposing tariffs on imports of copper semi-manufactured products but deferring until July 2026 a decision on refined metal.

So it seemed, but the arbitrage gap has been widening again. The spot CME premium has rebounded from under \$100 per ton in August to over \$300, while the 10-month forward premium is now priced at almost \$800 per ton.

Sure, the current arbitrage gap is not nearly as wide as it was in July, but it's more than enough to cover the physical costs of shipping units to the U.S. This year's tariff trade is visible in the form of rising copper stocks held by the CME, which has only domestic U.S. delivery points.

CME stocks have mushroomed from a February low of 83,900 tons to over 335,000 tons. CME warehouses now hold more copper than the LME and Shanghai Futures Exchange combined.

Metal is still arriving in the CME delivery network everyday, mostly at New Orleans but there have also been inflows at Baltimore, Salt Lake City and Tucson. What's on the CME may be just the tip of the iceberg. Consultancy Benchmark Minerals Intelligence thinks there is in total between 731,000 and 831,000 tons of "economically trapped" copper in the United States. Trapped in the sense that it would now require a huge inversion of the arbitrage between the United States and the rest of the world to free up metal for re-export.

Indeed, given the renewed widening in the U.S. premium, the likelihood is for more metal to join the growing copper mountain rather than move the other way.

अनौपचारिक और जबरन श्रम में फंसे लाखों लोगों के लिए, नीति की सफलता अंततः उसके डिजिटल डैशबोर्ड से नहीं बल्कि भारत के श्रमिक गरीबों को गरिमा, अधिकार और न्याय बहाल करने की क्षमता से मापी जाएगी।

•The 2025-47 rollout needs urgent pilots, with rights audits for accountability. There needs to be tripartite enforcement, offline access for digitally excluded workers, and transparent grievance redressal. Without these, there is the risk of symbolic rhetoric over justice for India's labouring millions.

2025-47 कार्यान्वयन योजना के लिए अत्यावश्यक पायलट परियोजनाओं, उत्तरदायित्व हेतु अधिकार ऑडिट, त्रिपक्षीय प्रवर्तन, डिजिटल रूप से वंचित श्रमिकों के लिए ऑफलाइन पहुँच, और पारदर्शी शिकायत निवारण प्रणाली की आवश्यकता है। इनके बिना, भारत के करोड़ों श्रमिकों के लिए न्याय के बजाय प्रतीकात्मक भाषण का जोखिम रहेगा।

## Copper added to list of critical minerals, but U.S. has plenty

कॉपर को महत्वपूर्ण खनिजों की सूची में शामिल किया गया, लेकिन अमेरिका के पास पहले से ही पर्याप्त भंडार है

•Copper has been added to the U.S. government's list of critical minerals — the metals deemed vital to the country's economic and national security.

कॉपर को अमेरिकी सरकार की महत्वपूर्ण खनिजों की सूची में शामिल किया गया है — ये वे धातुएँ हैं जो देश की आर्थिक और राष्ट्रीय सुरक्षा के लिए आवश्यक मानी जाती हैं।

•Fortunately, the United States has already accumulated what is the world's second largest copper stockpile, behind China's state reserves.

सौभाग्य से, संयुक्त राज्य अमेरिका ने पहले ही दुनिया का दूसरा सबसे बड़ा कॉपर भंडार इकट्ठा कर लिया है, जो केवल चीन के सरकारी भंडार से पीछे है।

•It has done so without spending a dollar of federal money. Rather, the copper market has done all the work in the form of a yawning arbitrage gap between the U.S. price traded by the CME and the international price traded on the London Metal Exchange (LME).

यह सब संघीय धन का एक डॉलर भी खर्च किए बिना हुआ है। दरअसल, यह कॉपर बाजार के कारण हुआ, जिसमें अमेरिका के CME द्वारा तय कीमत और लंदन मेटल एक्सचेंज (LME) की अंतरराष्ट्रीय कीमत के बीच विशाल मूल्य अंतर (arbitrage gap) बना।

•The pricing differential has already drawn massive amounts of physical copper into the United States.

इस मूल्य अंतर के कारण बहुत बड़ी मात्रा में वास्तविक कॉपर अमेरिका में खींचा चला आया है।

•And it's still doing so as the market bets that the critical mineral designation, first flagged in August, increases the chances of U.S. import tariffs.

और अब भी ऐसा हो रहा है क्योंकि बाजार का मानना है कि अगस्त में घोषित महत्वपूर्ण खनिज का दर्जा मिलने से अमेरिकी आयात शुल्क लगाए जाने की संभावना बढ़ गई है।

•When U.S. President Donald Trump ordered an investigation into copper imports on national security grounds in February, the market moved quickly to price in the potential for U.S. import tariffs similar to those already imposed on steel and aluminium.

जब अमेरिकी राष्ट्रपति डोनाल्ड ट्रंप ने फरवरी में राष्ट्रीय सुरक्षा के आधार पर



कॉपर आयात की जांच के आदेश दिए, तो बाजार ने तुरंत संभावित अमेरिकी आयात शुल्क को ध्यान में रखकर प्रतिक्रिया दी, जो पहले से स्टील और एल्युमिनियम पर लागू हैं।

- The CME spot premium over the London market stretched to almost \$3,000 per metric ton at one stage in July, creating an extraordinary opportunity for the world's largest traders to ship as much physical metal as they could get their hands on to the United States.

जुलाई में एक समय, CME स्पॉट प्रीमियम लंदन बाजार की तुलना में लगभग \$3,000 प्रति मीट्रिक टन तक बढ़ गया, जिससे दुनिया के सबसे बड़े व्यापारियों को अमेरिका में जितना संभव हो सके उतना कॉपर भेजने का अभूतपूर्व अवसर मिला।

- The premium imploded in July when the Trump administration blind-sided the market by imposing tariffs on imports of copper semi-manufactured products but deferring until July 2026 a decision on refined metal.

जुलाई में प्रीमियम अचानक गिर गया, जब ट्रंप प्रशासन ने बाजार को चौंकाते हुए कॉपर अर्ध-निर्मित उत्पादों पर शुल्क लगाया, लेकिन शुद्ध धातु पर निर्णय जुलाई 2026 तक टाल दिया।

- So it seemed, but the arbitrage gap has been widening again. The spot CME premium has rebounded from under \$100 per ton in August to over \$300, while the 10-month forward premium is now priced at almost \$800 per ton.

ऐसा लगा कि स्थिति स्थिर हो गई है, लेकिन मूल्य अंतर फिर से बढ़ रहा है। अगस्त में \$100 प्रति टन से नीचे रहा CME स्पॉट प्रीमियम अब \$300 से ऊपर पहुंच गया है, जबकि 10 महीने आगे का प्रीमियम लगभग \$800 प्रति टन है।

- Sure, the current arbitrage gap is not nearly as wide as it was in July, but it's more than enough to cover the physical costs of shipping units to the U.S.

हालांकि, वर्तमान मूल्य अंतर जुलाई जितना बड़ा नहीं है, लेकिन यह अमेरिका तक धातु भेजने की भौतिक लागत को पूरा करने के लिए पर्याप्त है।

- This year's tariff trade is visible in the form of rising copper stocks held by the CME, which has only domestic U.S. delivery points.

इस वर्ष का शुल्क-व्यापार CME द्वारा रखे गए बढ़ते कॉपर भंडारों के रूप में स्पष्ट रूप से दिखाई दे रहा है, जो केवल अमेरिकी घरेलू वितरण केंद्रों तक सीमित हैं।

- CME stocks have mushroomed from a February low of 83,900 tons to over 335,000 tons.

CME के कॉपर भंडार फरवरी में 83,900 टन से बढ़कर 3,35,000 टन से अधिक हो गए हैं।

- CME warehouses now hold more copper than the LME and Shanghai Futures Exchange combined.

CME के गोदाम अब LME और शंघाई फ्यूचर्स एक्सचेंज दोनों को मिलाकर भी अधिक कॉपर रखते हैं।

- Metal is still arriving in the CME delivery network every day, mostly at New Orleans, but there have also been inflows at Baltimore, Salt Lake City and Tucson.

CME वितरण नेटवर्क में अभी भी रोजाना कॉपर आ रहा है, मुख्य रूप से न्यू ऑरलियन्स में, लेकिन बाल्टीमोर, सॉल्ट लेक सिटी और टक्सन में भी आवक दर्ज की गई है।

- What's on the CME may be just the tip of the iceberg. Consultancy Benchmark Minerals Intelligence thinks there is in total between 731,000 and 831,000 tons of "economically trapped" copper in the United States.

जो CME में दिख रहा है वह केवल हिमखंड का ऊपरी हिस्सा हो सकता है। परामर्श फर्म बेंचमार्क मिनरल्स इंटेलिजेंस का अनुमान है कि अमेरिका में कुल 7,31,000 से 8,31,000 टन "आर्थिक रूप से फंसा हुआ कॉपर" मौजूद है।

- Trapped in the sense that it would now require a huge inversion of the arbitrage between the United States and the rest of the world to free up metal for re-export.

"फंसा हुआ" इसलिए कहा गया है क्योंकि इसे फिर से निर्यात के लिए मुक्त करने हेतु अमेरिका और बाकी दुनिया के बीच मूल्य अंतर में बड़े उलटफेर की आवश्यकता होगी।

- Indeed, given the renewed widening in the U.S. premium, the likelihood is for more metal to join the growing copper mountain rather than move the other way.

वास्तव में, अमेरिकी प्रीमियम में फिर से बढ़ती को देखते हुए, संभावना यही है कि अधिक कॉपर इस बढ़ते भंडार का हिस्सा बनेगा, बजाय इसके कि वह बाहर जाए।



**S&T**

**12/11/2025**



**GS III: S&T**

Say hello to the Milky Way's most active star-forming region, as captured by the James Webb Space Telescope. Called the Sagittarius B2 molecular cloud, it's located only a few hundred light years from the galaxy's central supermassive black hole. NASA, ESA, CSA, STSCI

**Say hello to the Milky Way's most active star-forming region, as captured by the James Webb Space Telescope. Called the Sagittarius B2 molecular cloud, it's located only a few hundred light years from the galaxy's central supermassive black hole. NASA, ESA, CSA, STSCI**



# All plastics are not the same

GS III: S&T



**Q. Why can we recycle only some kinds of plastics?**

**A:** 'Plastics' is an umbrella term for various materials

with some similar properties. Each type of plastic has a different polymer structure and set of additives. These differences decide how a piece of plastic behaves when it is heated, ground down, and remade, which is why only some kinds can be recycled in practice. Thermoplastics like the PET in water bottles and HDPE in milk jugs soften when heated and harden when cooled. This property allows them to be melted, filtered, and reshaped with limited damage, so they are widely collected. Thermosets like the many epoxy resins and some rubber parts form permanent chemical bonds when they're first made. They crack rather than melt when heated, so they can't be recycled by normal heat-based methods. Even among thermoplastics, recycling depends on purity. Labels, food residues, dyes, fillers, flame retardants, and plasticisers change how the melt flows and weakens the final product. Multilayer packaging combines different polymers (for example, PET, polyethylene, and



Recycling happens only when there is a steady demand for the recycled pellets. STICKERIT/UNSPLASH

aluminum) to keep food fresh, but these layers are hard to separate, so the item is often not recyclable.

Collecting, sorting, washing, and remelting also cost money, so recycling happens only when there is a steady demand for the recycled pellets. Bottles and jugs have large and cleaner waste streams and established buyers whereas many films, foams, and mixed plastics don't. Newer chemical recycling methods can in principle break polymers to simpler molecules, but they are energy-intensive and not yet broadly deployed.

### For feedback and suggestions

for 'Science', please write to [science@thehindu.co.in](mailto:science@thehindu.co.in) with the subject 'Daily page'

## Why can we recycle only some kinds of plastics?

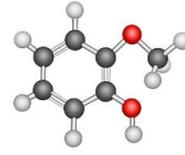
हम केवल कुछ प्रकार के प्लास्टिक को ही क्यों रीसायकल कर सकते हैं?

- 'Plastics' is an umbrella term for various materials with some similar properties. 'प्लास्टिक' विभिन्न सामग्रियों के लिए एक व्यापक शब्द है जिनमें कुछ समान गुण होते हैं।
- Each type of plastic has a different polymer structure and set of additives.** प्रत्येक प्रकार के प्लास्टिक की एक अलग पॉलिमर संरचना और योजक (Additives) का सेट होता है।
- These differences decide how a piece of plastic behaves when it is heated, ground down, and remade, which is why only some kinds can be recycled in practice. ये अंतर तय करते हैं कि जब किसी प्लास्टिक को गर्म किया जाता है, पीसा जाता है, या पुनर्निर्मित किया जाता है,



तब वह कैसे व्यवहार करेगा — यही कारण है कि व्यवहार में केवल कुछ प्रकार के प्लास्टिक को ही रीसायकल किया जा सकता है।

- **Thermoplastics like the PET in water bottles and HDPE in milk jugs soften when heated and harden when cooled.**  
थर्मोप्लास्टिक जैसे कि पानी की बोतलों में PET और दूध के जगों में HDPE गर्म होने पर नरम हो जाते हैं और ठंडा होने पर कठोर हो जाते हैं।



Epoxy resin



- This property allows them to be melted, filtered, and reshaped with limited damage, so they are widely collected.

यह गुण उन्हें सीमित क्षति के साथ पिघलाने, छानने और पुनः आकार देने की अनुमति देता है, इसलिए इन्हें व्यापक रूप से एकत्र किया जाता है।

- **Thermosets like many epoxy resins and some rubber parts form permanent chemical bonds when they're first made.**

थर्मोसेट्स, जैसे कई एपॉक्सी रेज़िन और कुछ रबर के हिस्से, पहली बार बनने पर स्थायी रासायनिक बंधन बनाते हैं।

- **They crack rather than melt when heated, so they can't be recycled by normal heat-based methods.**

ये गर्म होने पर पिघलने के बजाय फट जाते हैं, इसलिए इन्हें सामान्य गर्मी-आधारित तरीकों से रीसायकल नहीं किया जा सकता।

- **Even among thermoplastics, recycling depends on purity.**

यहां तक कि थर्मोप्लास्टिक में भी, रीसायकलिंग शुद्धता (Purity) पर निर्भर करती है।

- Labels, food residues, dyes, fillers, flame retardants, and plasticisers change how the melt flows and weaken the final product.

लेबल, खाद्य अवशेष, डाई, फिलर्स, फ्लेम रिटार्डेंट्स और प्लास्टिसाइज़र यह बदल देते हैं कि पिघलन कैसे बहती है और अंतिम उत्पाद को कमजोर करते हैं।

- **Multilayer packaging combines different polymers (for example, PET, polyethylene, and aluminum) to keep food fresh, but these layers are hard to separate, so the item is often not recyclable.**

मल्टीलेयर पैकेजिंग विभिन्न पॉलिमर (जैसे PET, पॉलीथिलीन और एल्युमिनियम) को मिलाकर भोजन को ताज़ा रखती है, लेकिन इन परतों को अलग करना कठिन होता है, इसलिए ऐसी वस्तुएँ अक्सर रीसायकल नहीं की जा सकतीं।

- Collecting, sorting, washing, and remelting also cost money, so recycling happens only when there is a steady demand for the recycled pellets.

संग्रह, छंटवाई, धुलाई और पुनः पिघलाने में भी लागत आती है, इसलिए रीसायकलिंग केवल तब होती है जब रीसायकल किए गए पेलेट्स की स्थिर मांग होती है।

- Bottles and jugs have large and cleaner waste streams and established buyers whereas many films, foams, and mixed plastics don't.

बोतलों और जगों का अपशिष्ट प्रवाह बड़ा और साफ़ होता है तथा इनके लिए खरीदार मौजूद होते हैं, जबकि कई फिल्मों, फोम और मिश्रित प्लास्टिक के लिए ऐसा नहीं होता।

- Newer chemical recycling methods can in principle break polymers to simpler molecules, but they are energy-intensive and not yet broadly deployed.

नई रासायनिक रीसायकलिंग विधियाँ सिद्धांत रूप में पॉलिमर को सरल अणुओं में तोड़ सकती हैं, लेकिन ये ऊर्जा-गहन (Energy-intensive) होती हैं और अभी तक व्यापक रूप से लागू नहीं की गई हैं।



## Thermoplastics — “The Reusable Plastics”

- Thermoplastics **soften when heated and harden again when cooled** — just like **butter or wax**.



- Because of this property, they can be **melted, reshaped, and recycled** several times without much damage.

#### Everyday examples:

- **PET (Polyethylene Terephthalate):** Used in **water bottles and cold drink bottles**. These bottles can be collected, melted, and made into **new bottles, clothes (polyester fibers), or packaging**.
- **HDPE (High-Density Polyethylene):** Used in **milk jugs, shampoo bottles, and detergent containers**. These can also be **melted and remolded** into new containers, pipes, or even playground equipment.

#### Thermosets — “The One-Time Plastics”

- **Thermoset plastics form strong, permanent chemical bonds** when they are first made.
- **Once hardened, they cannot be melted again**. If you try to heat them, they **crack, burn, or break down** — they don't soften.
- Because of this, **they cannot be recycled** through normal melting or remolding methods.

#### Everyday examples:

- **Epoxy resins:** Found in **adhesives, electrical circuits, and coatings**. Once they harden, they stay solid forever.
- **Rubber parts:** Like **tyres or electrical insulation** — they can't be melted and reshaped; they must be repurposed or ground into powder for reuse.

PATRIOTIC IAS



# What do forensic experts do after blasts?

What is the primary job of forensic experts in cases of blasts or explosions? How do they determine whether an explosion was intentional or accidental? What are some of the tests they conduct on the samples they collect from the site? Do multiple divisions of a forensic science laboratory collaborate?

**EXPLAINER**

**EXPLAINER**

**Shamim Haque Mondal**

**The story so far:**

**I**n November 10, New Delhi witnessed a massive explosion near the Red Fort complex. An i20 car parked at the signal of the complex exploded, destroying several nearby cars, buses, and the people inside them. As of now, 13 people have been confirmed dead.

**What do forensic experts do?**

Experts of the Explosives Department of the Delhi Forensic Laboratory visited the scene within half an hour along with police personnel. The primary job of forensic experts in such situations is to observe and analyse the cause from a scientific perspective. They collect necessary samples and arrange for quick laboratory tests so that the cause of the accident can be found, or the identities of the people involved in the crime can be verified in a science-based manner.

It is worth noting that various media houses often report that forensic members collect samples from the site, which is partly accurate; the site does provide a wealth of information for any skilled forensic expert. However, an explosion is different from other crimes; here everything is shattered in an instant. Explosions generate intense pressure and heat, causing everything at the scene to burn to ashes, thereby complicating the work of experts. Despite the challenges, they persist in their efforts. Locard's principle states that a criminal will leave something at the scene and bring something when he arrives; both are equally important as evidence in forensics. Thus, there must be a sample linking the suspect to the scene, from which it could be possible to guess the intensity of the explosion, the source, and what kind of explosives were used. Photographers are also present and take pictures of the site from different



**Probing:** Forensic technicians work at the site of the explosion in New Delhi, on November 10. REUTERS

angles, and experts make a sketch of it, which serve as a guideline for various stages of analysis. Along with this, various burnt pieces (which experts call debris), broken parts of the car, carbon powder, etc. are collected from the scene. These samples are then analysed by explosives experts in the laboratory using spectroscopic and chromatographic techniques to determine the type of chemicals used.

During the on-site inspection, it is necessary to figure out if any piece of electronic gadget has been found, because in remote-controlled explosions, an auto-timer, the best activation technique, is usually used. However, no timer or electronic circuit has been found in the Delhi incident.

**What kind of tests are done?**

After gathering and analysing the initial data, experts then try to reconstruct the crime scene to better understand the explosion's timing. For this, experts use Fourier Transform Infrared Spectroscopy (FTIR) and Attenuated Total Reflectance-FTIR (ATR-FTIR). In these tests, forensic experts analyse the spectrum of the absorbed light to find out how the collected samples interact with infrared light.

The chemical composition of explosives is detected using field-specific Raman spectroscopy. Advanced Scanning Electron Microscopy (SEM) is used to analyse the morphology of the fragments found after the explosion, while Energy Dispersive X-ray (EDX) techniques are

used for fundamental analysis of the residues. Scientists also use thermal analysis to determine information about explosives, such as chemical activity and stability.

Additionally, fire is an important factor in any explosion – how it spreads, how far it spreads, and the total loss caused by fire all depend on statistical data. That's why experts use laser-based scene mapping, flashpoint testing, etc. to try to determine the source of the fire and the presence of any combustible material that caused it to spread so much. Therein they decide whether it was an accident or an intentional explosion.

**Are only explosives experts involved?**

In the current incident, the role of the vehicle is crucial. Therefore, CCTV footage of the car needs to be thoroughly examined to find out whether anyone got in or got down in order to form an idea about the attacker. A cyber-forensic expert is necessary to achieve this.

Again, experience says that in any accident, especially in the case of organised heinous crimes like explosions, the engine number and the chassis (the metal frame of a vehicle onto which the other parts fit) number of the cars are changed before they are used for the crime purpose, so it is necessary to find out the actual engine number and chassis number of the car with the help of 'thermochemical examination', which is popularly known as etching. Typically, the investigating agency employs a forensic physicist for this. Moreover, DNA analysis of the body parts found at the crime scene is a must, as their families are waiting.

Therefore, in the event of an explosion, multiple divisions of a forensic science laboratory must collaborate to assist investigators in solving the crime and to ensure that the scientific analysis of various evidence is presented before a court of law.

*Shamim Haque Mondal is a researcher in the Physics Division, State Forensic Science Laboratory, Kolkata.*

**THE GIST**

Experts of the Explosives Department of the Delhi Forensic Laboratory visited the scene within half an hour along with police personnel.

Fire is an important factor in any explosion – how it spreads, how far it spreads, and the total loss caused by fire all depend on this statistical data. That's why experts use laser-based scene mapping, flashpoint testing, etc. to try to determine the source of the fire and the presence of any combustible material that caused it to spread so much.

In the event of an explosion, multiple divisions of a forensic science laboratory must collaborate to assist investigators in solving the crime.

## What do forensic experts do after blasts? विस्फोटों के बाद फॉरेंसिक विशेषज्ञ क्या करते हैं?

- On November 10, New Delhi witnessed a massive explosion near the Red Fort complex. 10 नवंबर को नई दिल्ली में लाल किला परिसर के पास एक भीषण विस्फोट हुआ।
- An i20 car parked at the signal of the complex exploded, destroying several nearby cars, buses, and the people inside them. परिसर के सिग्नल पर खड़ी एक i20 कार में विस्फोट हुआ, जिससे आसपास की कई कारें, बसें और उनमें बैठे लोग नष्ट हो गए।
- As of now, 13 people have been confirmed dead. अब तक 13 लोगों की मौत की पुष्टि हुई है।

## What do forensic experts do? फॉरेंसिक विशेषज्ञ क्या करते हैं?

- Experts of the Explosives Department of the Delhi Forensic Laboratory visited the scene within half an hour along with police personnel. दिल्ली फॉरेंसिक प्रयोगशाला के विस्फोटक विभाग के विशेषज्ञ पुलिस कर्मियों के साथ आधे घंटे के भीतर घटनास्थल पर पहुंचे।
- The primary job of forensic experts in such situations is to observe and analyse the cause from a scientific perspective. ऐसी स्थितियों में फॉरेंसिक विशेषज्ञों का मुख्य कार्य है वैज्ञानिक दृष्टिकोण से कारण का अवलोकन और विश्लेषण करना।
- They collect necessary samples and arrange for quick laboratory tests so that the cause of the accident can be found or the identities of the people involved can be verified



scientifically.

वे आवश्यक नमूने एकत्रित करते हैं और त्वरित प्रयोगशाला परीक्षणों की व्यवस्था करते हैं ताकि दुर्घटना के कारण का पता लगाया जा सके या शामिल लोगों की पहचान वैज्ञानिक रूप से सत्यापित की जा सके।

## Challenges in Explosion Forensics

### विस्फोट फॉरेंसिक में चुनौतियाँ

- It is worth noting that while media reports often say that forensic members collect samples, **an explosion is different from other crimes** because **everything is shattered in an instant**. यह ध्यान देने योग्य है कि मीडिया रिपोर्टों में अक्सर कहा जाता है कि फॉरेंसिक टीम नमूने एकत्र करती है, लेकिन **विस्फोट अन्य अपराधों से अलग होता है, क्योंकि इसमें सब कुछ पलभर में नष्ट हो जाता है।**
- Explosions generate intense pressure and heat, causing everything at the scene to burn to ashes**, making the work of experts **extremely difficult**. विस्फोट से तीव्र दाब और गर्मी उत्पन्न होती है, जिससे घटनास्थल की हर चीज राख में बदल जाती है, और विशेषज्ञों का कार्य बेहद कठिन हो जाता है।
- Despite the challenges, experts **persist in their efforts** to uncover scientific evidence. चुनौतियों के बावजूद विशेषज्ञ वैज्ञानिक साक्ष्य खोजने के अपने प्रयास जारी रखते हैं।

## Locard's Principle in Forensic Science

### फॉरेंसिक विज्ञान में लोकार्ड का सिद्धांत

- Locard's principle states that a criminal always leaves something at the scene and brings something when he arrives; both are equally important as evidence.** लोकार्ड का सिद्धांत कहता है कि अपराधी जब आता है तो कुछ लेकर आता है और जब जाता है तो कुछ छोड़कर जाता है; दोनों ही साक्ष्य के रूप में समान रूप से महत्वपूर्ण हैं।
- Thus, there must be a **sample linking the suspect to the scene**, from which it is possible to **guess the intensity, source, and type of explosives used**. इसलिए एक ऐसा नमूना अवश्य होता है जो संदिग्ध को घटनास्थल से जोड़ता है, जिससे विस्फोट की तीव्रता, स्रोत और उपयोग किए गए विस्फोटक के प्रकार का अनुमान लगाया जा सकता है।

## Collection and Analysis of Evidence

### साक्ष्य का एकत्रीकरण और विश्लेषण

- Photographers take pictures of the site from different angles, and experts make sketches, which serve as guidelines for various stages of analysis.** फोटोग्राफर विभिन्न कोणों से घटनास्थल की तस्वीरें लेते हैं, और विशेषज्ञ स्केच बनाते हैं, जो विश्लेषण के विभिन्न चरणों के लिए दिशानिर्देश के रूप में काम करते हैं।
- Various burnt pieces (debris), broken car parts, carbon powder, etc. are collected from the scene.** घटनास्थल से विभिन्न जले हुए टुकड़े (मलबा), टूटी हुई कार के हिस्से, कार्बन पाउडर आदि एकत्र किए जाते हैं।
- These samples are then analysed by explosives experts using spectroscopic and chromatographic techniques to determine the type of chemicals used.** इन नमूनों का विस्फोटक विशेषज्ञ स्पेक्ट्रोस्कोपिक और क्रोमैटोग्राफिक तकनीकों का उपयोग कर विश्लेषण करते हैं ताकि यह पता लगाया जा सके कि कौन-से रासायनिक पदार्थ उपयोग किए गए।

## Electronic Evidence and Remote-Controlled Explosions

### इलेक्ट्रॉनिक साक्ष्य और रिमोट-कंट्रोल विस्फोट

- During the on-site inspection, experts look for any **piece of electronic gadget**, since **remote-controlled explosions** often use an **auto-timer** as an activation technique. स्थल निरीक्षण के दौरान विशेषज्ञ किसी इलेक्ट्रॉनिक उपकरण के हिस्से की तलाश करते हैं, क्योंकि रिमोट-कंट्रोल विस्फोटों में आमतौर पर ऑटो-टाइमर को सक्रियण तकनीक के रूप में उपयोग किया जाता है।
- However, **no timer or electronic circuit** has been found in the **Delhi incident**. हालांकि, दिल्ली की घटना में कोई टाइमर या इलेक्ट्रॉनिक सर्किट नहीं मिला है।



## What kind of tests are done?

### किस प्रकार के परीक्षण किए जाते हैं?

- After gathering and analysing the initial data, experts then try to **reconstruct the crime scene** to better understand the explosion's timing.  
प्रारंभिक डेटा एकत्रित और विश्लेषण करने के बाद, विशेषज्ञ अपराध स्थल का पुनर्निर्माण करने का प्रयास करते हैं ताकि विस्फोट के समय को बेहतर ढंग से समझा जा सके।
- For this, experts use **Fourier Transform Infrared Spectroscopy (FTIR) and Attenuated Total Reflectance-FTIR (ATR-FTIR)**.  
इसके लिए विशेषज्ञ फूरियर ट्रांसफॉर्म इन्फ्रारेड स्पेक्ट्रोस्कोपी (FTIR) और एटेन्यूएटेड टोटल रिफ्लेक्टेंस-FTIR (ATR-FTIR) का उपयोग करते हैं।
- In these tests, forensic experts analyse the **spectrum of the absorbed light** to find out how the collected samples interact with infrared light.  
इन परीक्षणों में, फोरेंसिक विशेषज्ञ अवशोषित प्रकाश के स्पेक्ट्रम का विश्लेषण करते हैं ताकि यह पता चल सके कि एकत्रित नमूने इन्फ्रारेड प्रकाश के साथ कैसे प्रतिक्रिया करते हैं।
- The **chemical composition of explosives** is detected using **field-specific Raman spectroscopy**.  
विस्फोटकों की रासायनिक संरचना का पता क्षेत्र-विशिष्ट रमन स्पेक्ट्रोस्कोपी का उपयोग करके लगाया जाता है।
- **Advanced Scanning Electron Microscopy (SEM)** is used to analyse the **morphology of the fragments** found after the explosion.  
एडवांस्ड स्कैनिंग इलेक्ट्रॉन माइक्रोस्कोपी (SEM) का उपयोग विस्फोट के बाद मिले टुकड़ों की संरचना (morphology) का विश्लेषण करने के लिए किया जाता है।
- **Energy Dispersive X-ray (EDX) techniques** are used for **fundamental analysis of the residues**.  
एनर्जी डिस्पर्सिव एक्स-रे (EDX) तकनीक का उपयोग अवशेषों के मौलिक विश्लेषण के लिए किया जाता है।
- Scientists also use **thermal analysis** to determine information about explosives such as **chemical activity and stability**.  
वैज्ञानिक थर्मल एनालिसिस का उपयोग विस्फोटकों की रासायनिक गतिविधि और स्थिरता जैसी जानकारी प्राप्त करने के लिए भी करते हैं।
- Additionally, **fire** is an important factor in any explosion — how it spreads, how far it spreads, and the total loss caused by fire all depend on **statistical data**.  
इसके अलावा, किसी भी विस्फोट में आग एक महत्वपूर्ण तत्व होती है — यह कैसे फैलती है, कितनी दूर तक फैलती है, और आग से होने वाला कुल नुकसान सांख्यिकीय डेटा पर निर्भर करता है।
- That's why experts use **laser-based scene mapping** and **flashpoint testing** to determine the **source of the fire** and the **presence of any combustible material** that caused it to spread.  
इसलिए विशेषज्ञ लेज़र-आधारित सीन मैपिंग और फ्लैशपॉइंट टेस्टिंग का उपयोग आग के स्रोत और ज्वलनशील पदार्थों की उपस्थिति का पता लगाने के लिए करते हैं जिन्होंने आग को फैलने में मदद की।
- Therein they decide whether it was an **accident** or an **intentional explosion**.  
इसी से यह तय किया जाता है कि यह दुर्घटना थी या जानबूझकर किया गया विस्फोट।

## Are only explosives experts involved?

### क्या केवल विस्फोटक विशेषज्ञ ही शामिल होते हैं?

- In the current incident, the role of the **vehicle** is crucial. Therefore, **CCTV footage** of the car needs to be thoroughly examined to find out whether anyone got in or got down in order to form an idea about the attacker.  
वर्तमान घटना में वाहन की भूमिका अत्यंत महत्वपूर्ण है। इसलिए, कार की सीसीटीवी फुटेज को ध्यानपूर्वक जांचना आवश्यक है ताकि यह पता चल सके कि कोई व्यक्ति उसमें सवार हुआ या उतरा, जिससे हमलावर की पहचान बन सके।
- A **cyber-forensic expert** is necessary to achieve this.  
इसे पूरा करने के लिए एक साइबर-फोरेंसिक विशेषज्ञ आवश्यक है।



- Again, experience says that in any accident, especially in **organised heinous crimes like explosions**, the **engine number** and **chassis number** of the cars are changed before they are used for the crime purpose.  
अनुभव बताता है कि किसी भी दुर्घटना में, विशेषकर संगठित घृणित अपराधों जैसे विस्फोटों में, कारों के **इंजन नंबर** और **चेसिस नंबर** को अपराध से पहले बदल दिया जाता है।
- So it is necessary to find out the **actual engine number and chassis number** of the car with the help of **thermochemical examination**, popularly known as **etching**.  
इसलिए कार का **वास्तविक इंजन नंबर और चेसिस नंबर थर्मोकेमिकल परीक्षा** (जो आमतौर पर **एटचिंग** के रूप में जानी जाती है) की मदद से पता लगाना आवश्यक है।
- Typically, the investigating agency employs a **forensic physicist** for this.  
आमतौर पर जांच एजेंसी इसके लिए एक **फॉरेंसिक भौतिक विज्ञानी** को नियुक्त करती है।
- Moreover, **DNA analysis** of the **body parts** found at the crime scene is a must, as their families are waiting.  
इसके अलावा, अपराध स्थल पर पाए गए **शरीर के अंगों का डीएनए विश्लेषण** आवश्यक है, क्योंकि उनके परिवार प्रतीक्षा कर रहे होते हैं।
- Therefore, in the event of an explosion, **multiple divisions of a forensic science laboratory** must collaborate to assist investigators in solving the crime.  
इसलिए, विस्फोट की स्थिति में, **फॉरेंसिक विज्ञान प्रयोगशाला के कई विभागों** को जांचकर्ताओं की अपराध सुलझाने में मदद के लिए सहयोग करना होता है।
- This ensures that the **scientific analysis of various evidence** is presented before a **court of law**.  
इससे यह सुनिश्चित किया जाता है कि विभिन्न साक्ष्यों का **वैज्ञानिक विश्लेषण अदालत** के समक्ष प्रस्तुत किया जाए।

Feature	Spectroscopy	Chromatography
Purpose	Identify what substances are and how much	Separate a mixture into its components
Principle	Interaction of light/electromagnetic radiation with matter	Movement of substances through a medium (paper, gas, liquid)
Output	Spectra (graph showing intensity vs wavelength)	Chromatogram (peaks showing different substances)
Example	IR spectrum for drug analysis	HPLC to separate compounds in drug



# Why do astronauts wear pressurised suits?

Why is it mandatory to wear IVA suits during ascent and descent of the spacecraft?

**GS III: S&T**

**Unnikrishnan Nair S.**

**S**pace is the vast area beyond the earth's atmosphere, filled with stars, planets, and galaxies. In this airless environment, one of the most critical differences from life here is the absence of atmospheric pressure.

**Why is pressure important?**

The atmosphere is a thick layer of gases held around the earth by its gravity. It protects us from harmful solar radiation, keeps temperatures stable, and provides gases to respire. The atmospheric pressure presses down on our bodies with about 20 tonnes of force, but we don't feel it because our bodies have evolved to push back with equal force, balancing it out. As we go higher, the atmosphere gets thinner and its pressure drops.

When a human body is suddenly exposed to vacuum, a sequence of sudden lethal effects occur, including

ebullism (boiling of bodily fluids at low pressure), decompression (rapid loss of atmospheric pressure in a spacecraft), and lack of oxygen (hypoxia). The absence of atmospheric pressure causes gases to expand rapidly in the lungs and tissues, leading to loss of consciousness in seconds and death in a few minutes.

**How are astronauts protected?**

Astronauts wear special suits during space travel for their safety. Extra-vehicular activity (EVA) suits or spacesuits are for walks and work outside the spacecraft, like fixing external components and conducting maintenance. They have 12-14 layers and serve as a personal spacecraft, protecting its wearer against the vacuum of space, extreme temperatures, radiation, and space debris. Each EVA suit weighs 100-130 kg. Likewise, intra-vehicular activity (IVA) suits are worn inside the spacecraft and include a flight suit and a

pressure suit. A flight suit is a general-purpose garment worn by pilots and astronauts, primarily for fire resistance, and protection against environmental conditions like temperature extremes or low pressure at high altitudes. A pressure suit is a specialised garment designed to protect against the extremely low pressure environment of high altitudes or space. It provides full-body pressurisation, oxygen supply, and thermal regulation, making it more robust than a standard flight suit. The pressure suit weighs about 8-10 kg and has two or three major layers, depending on the model.

In 1961, Yuri Gagarin, the first human to go to space, wore a specialised IVA suit called SK-1. The U.S. and Russia have developed eight to 10 IVA suit designs.

**Is wearing an IVA suit mandatory?**

In the tragic Soyuz 11 mission in 1971, three cosmonauts died when returning to

the earth. When the crew's descent module separated from the orbiting module, a vent valve meant to balance cabin pressure opened too early at about 168 km altitude. It didn't close properly, causing the air to rush out quickly, suffocating the cosmonauts. The disaster led to major safety changes in the Soviet space program, including bringing in a mandate to wear IVA suits during ascent and descent. These phases are dynamic and under exigency may involve high G-forces, sudden loss of cabin pressure, extreme heat, and vibrations, all of which pose serious risks.

**Which IVA suit does Gaganyaan use?**

In Gaganyaan, India's first human spaceflight mission, the 'gaganyatris' will be using the Russian Sokol KV2 suit manufactured by Zvezda. The suit consists of two layers: an inner pressure bladder made of rubberised polycaprolactam to remain airtight, and an outer restraint layer of white nylon canvas for structural support and protection. Many astronauts have worn the Sokol suit and it has been involved in more than 128 Soyuz crewed missions.

While the Sokol suit provides vital assurance, it also underscores a key phase in India's space journey: leveraging global expertise while pursuing the goal of indigenous human spaceflight capability.

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**THE GIST**

▼ The atmosphere is a thick layer of gases held around the earth by its gravity. It protects us from harmful solar radiation, keeps temperatures stable, and provides gases to respire.

▼ A pressure suit is a specialised garment designed to protect against the extremely low pressure environment of high altitudes or space.

▼ In Gaganyaan, India's first human spaceflight mission, the 'gaganyatris' will be using the Russian Sokol KV2 suit manufactured by Zvezda.

## Why do astronauts wear pressurised suits?

अंतरिक्ष यात्री दबावयुक्त सूट क्यों पहनते हैं?

- Why is it mandatory to wear IVA suits during ascent and descent of the spacecraft?  
अंतरिक्ष यान के उद्गमन (ascent) और अवरोहण (descent) के दौरान IVA सूट पहनना अनिवार्य क्यों है?

### Space and Atmospheric Pressure

अंतरिक्ष और वायुमंडलीय दाब

- **Space is the vast area beyond the earth's atmosphere, filled with stars, planets, and galaxies.**  
अंतरिक्ष पृथ्वी के वायुमंडल के बाहर का विशाल क्षेत्र है, जो तारों, ग्रहों और आकाशगंगाओं से भरा हुआ है।
- In this **airless environment**, one of the most critical differences from life on Earth is the **absence of atmospheric pressure**.  
इस निर्वात वातावरण में, पृथ्वी के जीवन से सबसे महत्वपूर्ण अंतर वायुमंडलीय दाब का अभाव है।

### Why is pressure important?

दाब क्यों महत्वपूर्ण है?

- The **atmosphere** is a thick layer of **gases** held around the Earth by its **gravity**.  
वायुमंडल गैसों की एक मोटी परत है जो पृथ्वी के गुरुत्वाकर्षण द्वारा उसके चारों ओर बनी रहती है।
- It **protects** us from **harmful solar radiation**, **keeps temperatures stable**, and **provides gases to respire**.  
यह हमें हानिकारक सौर विकिरण से सुरक्षा प्रदान करता है, तापमान को स्थिर रखता है, और श्वसन के लिए गैसों उपलब्ध कराता है।
- The **atmospheric pressure** presses down on our bodies with about **20 tonnes of force**, but we don't feel it because our bodies have evolved to **balance it out**.  
वायुमंडलीय दाब हमारे शरीर पर लगभग 20 टन बल से दबाव डालता है, लेकिन हम इसे महसूस नहीं करते क्योंकि हमारे शरीर ने इसे संतुलित करने के लिए विकास किया है।



- As we go **higher**, the atmosphere becomes **thinner** and its **pressure drops**.  
जैसे-जैसे हम ऊँचाई पर जाते हैं, वायुमंडल पतला होता जाता है और उसका दाब कम हो जाता है।

### Effects of Vacuum on Human Body

#### मानव शरीर पर निर्वात का प्रभाव

- When a human body is **suddenly exposed to vacuum**, a series of **lethal effects** occur, including **ebullism** (boiling of bodily fluids at low pressure), **decompression**, and **lack of oxygen (hypoxia)**.  
जब मानव शरीर को अचानक निर्वात के संपर्क में लाया जाता है, तो घातक प्रभावों की एक श्रृंखला उत्पन्न होती है, जिसमें इबुलिज़्म (कम दबाव पर शारीरिक तरल पदार्थों का उबलना), डीकंप्रेशन, और ऑक्सीजन की कमी (हाइपोक्सिया) शामिल हैं।
- The **absence of atmospheric pressure** causes gases in the **lungs and tissues to expand rapidly**, leading to **loss of consciousness in seconds** and **death in a few minutes**.  
वायुमंडलीय दाब के अभाव में फेफड़ों और ऊतकों में गैसों तेजी से फैल जाती हैं, जिससे कुछ सेकंड में होश खोना और कुछ मिनटों में मृत्यु हो जाती है।

### How are astronauts protected?

#### अंतरिक्ष यात्रियों की सुरक्षा कैसे की जाती है?

- Astronauts wear special suits** during space travel for their safety.  
अंतरिक्ष यात्री अपनी सुरक्षा के लिए अंतरिक्ष यात्रा के दौरान विशेष सूट पहनते हैं।
- Extra-Vehicular Activity (EVA) suits or spacesuits** are used for **spacewalks and external repairs**.  
एक्स्ट्रा-व्हीक्युलर एक्टिविटी (EVA) सूट या स्पेससूट का उपयोग अंतरिक्ष में चलने और बाहरी मरम्मत कार्यों के लिए किया जाता है।
- EVA suits have **12–14 layers** and act as a **personal spacecraft**, protecting against **vacuum, extreme temperatures, radiation, and space debris**.  
EVA सूट में 12–14 परतें होती हैं और यह व्यक्तिगत अंतरिक्ष यान की तरह काम करता है, जो निर्वात, अत्यधिक तापमान, विकिरण और अंतरिक्ष मलबे से सुरक्षा देता है।
- Each **EVA suit weighs 100–130 kg**.  
प्रत्येक EVA सूट का वजन 100–130 किलोग्राम होता है।
- Intra-Vehicular Activity (IVA) suits** are worn **inside the spacecraft** and include a **flight suit** and a **pressure suit**.  
इन्ट्रा-व्हीक्युलर एक्टिविटी (IVA) सूट अंतरिक्ष यान के भीतर पहने जाते हैं और इनमें फ्लाइट सूट और प्रेशर सूट शामिल होते हैं।
- A **flight suit** is a **general-purpose garment** for **fire resistance** and **protection from extreme temperatures or low pressure** at high altitudes.  
फ्लाइट सूट एक सामान्य उपयोग का परिधान है, जो आग से सुरक्षा और अत्यधिक तापमान या कम दाब से बचाव प्रदान करता है।
- A **pressure suit** is designed for **protection against extremely low pressure** and provides **full-body pressurisation, oxygen supply, and thermal regulation**.  
प्रेशर सूट को अत्यंत कम दाब से सुरक्षा के लिए बनाया गया है और यह पूरे शरीर का दाब नियंत्रण, ऑक्सीजन आपूर्ति और तापीय नियंत्रण प्रदान करता है।
- The **pressure suit weighs 8–10 kg** and has **two or three major layers**, depending on the model.  
प्रेशर सूट का वजन 8–10 किलोग्राम होता है और इसमें मॉडल के अनुसार दो या तीन मुख्य परतें होती हैं।

### Historical Development of IVA Suits

#### IVA सूट का ऐतिहासिक विकास

- In **1961**, **Yuri Gagarin**, the **first human in space**, wore a specialised **IVA suit** called **SK-1**.  
1961 में, यूरी गगारिन, जो अंतरिक्ष में जाने वाले पहले व्यक्ति थे, ने एक विशेष IVA सूट SK-1 पहना था।
- The **U.S. and Russia** have developed **8–10 different IVA suit designs**.  
अमेरिका और रूस ने 8–10 विभिन्न प्रकार के IVA सूट डिज़ाइन विकसित किए हैं।



## Is wearing an IVA suit mandatory?

### क्या IVA सूट पहनना अनिवार्य है?

- In the **Soyuz 11 mission (1971)**, three cosmonauts died during re-entry due to **loss of cabin pressure** caused by a valve malfunction at **168 km altitude**.  
सोयुज 11 मिशन (1971) में, तीन कॉस्मोनॉट्स की मृत्यु हुई जब 168 किमी ऊँचाई पर वाल्व खराबी के कारण कैबिन का दबाव खत्म हो गया।
- The tragedy led to **major safety changes** in the **Soviet space program**, making **IVA suits mandatory during ascent and descent**.  
इस त्रासदी के बाद सोवियत अंतरिक्ष कार्यक्रम में महत्वपूर्ण सुरक्षा सुधार किए गए, जिनके तहत उठान और अवतरण के दौरान IVA सूट पहनना अनिवार्य कर दिया गया।
- These phases are **high-risk** due to **G-forces, pressure loss, heat, and vibrations**.  
ये चरण उच्च जोखिम वाले होते हैं क्योंकि इनमें जी-फोर्स, दबाव हास, ताप और कंपन जैसी स्थितियाँ होती हैं।

## Gaganyaan and the Sokol KV2 Suit

### गगनयान और सोकोल KV2 सूट

- In **Gaganyaan**, India's **first human spaceflight mission**, astronauts will use the **Russian Sokol KV2 suit** made by Zvezda.  
गगनयान, भारत के पहले मानव अंतरिक्ष मिशन में, अंतरिक्ष यात्री ज्वेज़्दा द्वारा निर्मित रूसी सोकोल KV2 सूट का उपयोग करेंगे।
- The suit has **two layers**: an **inner pressure bladder** made of **rubberised polycaprolactam**, and an **outer nylon canvas layer** for protection.  
इस सूट में दो परतें होती हैं: रबरयुक्त पॉलीकैप्रोलैक्टम से बनी अंदरूनी दाब परत, और सुरक्षा के लिए बाहरी नायलॉन कैनवास परत।
- The **Sokol suit** has been used in **over 128 Soyuz crewed missions**.  
सोकोल सूट का उपयोग 128 से अधिक सोयुज मानव मिशनों में किया जा चुका है।
- It represents India's phase of **leveraging global expertise** while developing **indigenous human spaceflight capability**.  
यह भारत के उस चरण का प्रतीक है जहाँ देश वैश्विक विशेषज्ञता का उपयोग करते हुए अपनी स्वदेशी मानव अंतरिक्ष उड़ान क्षमता विकसित कर रहा है।



**KEYWORD**

# What's the status of the rare earth hypothesis?

Findings from the Kepler and James Webb Space Telescope suggest that while earth-sized planets in habitable zones are not as rare as once thought, the conditions necessary for complex life may still be uncommon

ISS: S&T  
Vasudevan Mukunth

**T**he rare earth hypothesis was proposed in a 2000 book by palaeontologist Peter Ward and astronomer Donald Brownlee. It argues that while simple, microbial life may be common in the universe, complex, multicellular life is likely uncommon. The idea is rooted in a particular place in the universe meeting a chain of successive conditions.

While we often talk about life as ranging from simple (e.g. bacteria and yeast) to complex (e.g. humans and octopuses), life itself is a complex phenomenon and the product of many factors falling in place. Studying these factors on the earth itself has been an arduous and even now an unfinished task; and looking for them on planets located several light years away remains extraordinarily fraught. Scientists studying the possibility of life on other planets have busied themselves with particular aspects over time. Some focus on planetary ingredients such as a rocky world with surface water in the habitable zone of the host star. Other scientists have been concerned with system-level architectures such as giant planets in particular places in the universe. Still others have been looking into long-term climate regulation and a persistent atmosphere. And so on.

Since 2000, we have accumulated significantly more data about exoplanets and planetary science. And the big picture that has emerged is mixed: several conditions required for life look less restrictive than scientists once feared whereas many others look harder to meet than scientists had hoped.

## Understanding a planet

Let's consider how often potentially habitable earth-sized planets occur. Studies based on early data from the NASA Kepler telescope (2009-2018) suggested that a significant fraction of sun-like stars in the Milky Way galaxy hosts small planets receiving starlight comparable to what the earth receives. One study even found that roughly a fifth of sun-like stars may harbour earth-sized planets in their habitable zones, although the data had many uncertainties.

More recent work has concluded, based on Kepler data, that there's a non-negligible rate at which rocky planets occur in the habitable zones of stars called GK dwarfs. These and similar findings have concluded that worlds of roughly the right size at roughly the right distance from a suitable star are not rare, thus weakening the most sweeping claim in the hypothesis. The question has thus shifted from 'where a planet is' to 'what a planet is like'. In the solar system, Mercury is too close to the sun to host earth-like life whereas Pluto is too far away. But while both the earth and Venus are in the sun's habitable zone, Venus's atmosphere renders it deadly for earth-like life.

One important open issue is whether small planets around cool, active M-dwarf stars can retain their atmospheres and surface water over billions of years. Modelling studies have indicated that planets that spend millions of years exposed to intense stellar radiation – like that M-dwarf stars are known to emit –



An illustration which shows a hycean world – an exoplanet with a liquid water ocean beneath a hydrogen-rich atmosphere – orbiting a red dwarf star. REUTERS

tend to lose water and build up false-positive oxygen atmospheres.

Say intense ultraviolet radiation from an M-dwarf star breaks up water molecules on the planet:  $H_2O \rightarrow H + OH$ . Further breakdown leads to O and H atoms accumulating in the atmosphere. Over time, the H escapes to space more easily than O, and the O atoms left behind pair up to form O<sub>2</sub>. If there aren't enough surface 'sinks' that can absorb this oxygen fast enough – the way rocks and oceans do on the earth – the O<sub>2</sub> will accumulate. When a telescope looks at this planet and finds an excess of oxygen in its atmosphere, scientists may think the planet's surface has photosynthesis, which is how the earth's atmosphere has lots of oxygen. But it's actually due to the M-dwarf star's radiation.

On the other hand, some planets around M-dwarf stars can keep their air for a long time, even if most can't. If the star's magnetic outflows – streams of charged particles blown off the star by its magnetic field – are weak or shaped in such a way that they don't hit the planet hard, and if the planet is farther out and cooler, its atmosphere will be eroded more slowly. A strong planetary magnetic field can also deflect a part of the stellar wind, while a massive planet with ongoing volcanic activity can replace some of the lost gases.

These are all system-specific conditions that require a specific mix of star activity, magnetic fields, orbit, planet mass, rotation, and internal heat. When they line up well, a planet can retain its atmosphere for billions of years. However, such planets are in the minority because M-dwarf stars often produce strong flares and many close-in planets lack strong magnetic shields.

Scientists can directly test these

observations today. Using NASA's James Webb Space Telescope (JWST), astronomers have started measuring the heat emitted from nearby rocky exoplanets. In TRAPPIST-1c, which is located near the inner edge of its system's habitable zone 40.7 lightyears away, the JWST has ruled out a thick atmosphere rich in carbon dioxide. Previously, scientists using JWST data had also found that the innermost planet, TRAPPIST-1b, likely lacked a substantial atmosphere.

These are only two worlds in one system, yet they show that earth-sized isn't synonymous with earth-like. Scientists still need more measurements of cooler, more temperate planets to understand how often atmospheres survive where earth-like life could plausibly persist.

## Climate stabilisation

Another pillar of the rare earth hypothesis is long-term climate stabilisation. On the earth, the weathering of continental rocks and the recycling of carbon between the earth's interior and the atmosphere have buffered the climate over geologic time. Many researchers have linked this buffering to plate tectonics, which subduct a carbonated crust and build new surface rocks. This said, the interiors of planets behave in different ways. Rocky planets can have one stiff shell that barely moves, long quiet times broken by short bursts of crust movement or plate-like tectonics (as on the earth). A planet can even switch between these modes over time. Some models also show that without modern plate tectonics, a planet might still keep a habitable climate by balancing volcanism (which adds gases), weathering (removes gases), burial (traps materials), and crustal foundering (sinks the crust).

Scientists don't have consensus either: while plate tectonics could help maintain a stable climate that in turn can support complex life, it may not be strictly required for life to begin.

## The role of giants

A third line of debate is the role of giant planets like Jupiter. The old intuition was that Jupiter 'shields' the earth by deflecting comets and asteroids. Subsequent studies have complicated this story, however. Depending on a giant planet's mass and orbit, scientists have found that it can reduce or increase the flux of impactors to the inner system and it can also deliver water-rich bodies early on. In other words, there seems to be no universal 'filter' on this front; it all depends on the system's architecture. This conclusion has weakened the claim that a Jupiter-like planet is a necessary precondition for complex life on a rocky planet in the same system.

Thus, on the question of finding small, temperate planets, many scientists today argue that the occurrence rate of earth-sized planets in the habitable zones of sun-like stars is non-zero and may be a few tens of percent, per Kepler data, depending on the definitions and extrapolations. That undermines the notion that the earth's basic orbital and size configuration is vanishingly uncommon. On the other hand, on the question of planets' ability to retain atmospheres, have long climate cycles, be able to avoid catastrophic events, and so on, the data has become more sobering. The results keep open the possibility that truly earth-like surface environments supporting complex biospheres are less common than the count of earth-sized planets in the habitable zone would suggest.

## Not definitive

Two more threads bear on the rare versus common debate. First, a recent effort to place an upper limit on the number of earth-like planets emphasised that a lot hinges on atmospheric processes that scientists can't yet survey at scale. Second, searches for technosignatures – signs of technology made by extra-terrestrial life, especially things nature is unlikely to produce on its own – have sharpened the limits on the prevalence of civilisations whose activities emit radio waves (such 'radio-loud' activities on the earth include broadcasting for TV and radio and air traffic control). Multi-year surveys of thousands of stars by the Breakthrough Listen project haven't found any convincing signals so far. While not detecting something doesn't prove that it's absent, it sets upper limits on how common it could be in the cosmos.

Taken together, the rare earth hypothesis remains plausible for complex life but it can't be said to be demonstrably true. At this juncture, three developments could change the picture: (i) if scientists detect atmospheres on rocky, temperate planets, preferably around sun-like stars, showing gases consistent with active surface water cycles; (ii) if scientists place stronger better constraints on tectonic regimes on exoplanets (even indirectly), indicating whether long-term climate stabilisers are widespread or rare; and (iii) scientists detect biosignatures or technosignatures. The first steps are already underway. Extremely large ground telescopes currently under construction as well as future space missions are aimed squarely at planets with temperate atmospheres.

Until their observations mature, however, a fair summary seems to be: while microbial life could be common, long-lived ecosystems straddling land and ocean and capable of producing complex life may still be scarce. This seems to be as far as the data can take us today.



## What's the status of the rare earth hypothesis?

### रेयर अर्थ परिकल्पना की स्थिति क्या है?

- Findings from the **Kepler** and **James Webb Space Telescope** suggest that while **earth-sized planets in habitable zones** are not as rare as once thought, the **conditions necessary for complex life** may still be uncommon.  
केप्लर और जेम्स वेब स्पेस टेलीस्कोप के निष्कर्ष बताते हैं कि रहने योग्य क्षेत्रों (habitable zones) में पृथ्वी के आकार के ग्रह पहले की तुलना में उतने दुर्लभ नहीं हैं, लेकिन जटिल जीवन के लिए आवश्यक परिस्थितियाँ अभी भी दुर्लभ हो सकती हैं।

## Rare Earth Hypothesis

### रेयर अर्थ परिकल्पना

- The **rare earth hypothesis** was proposed in **2000** by **Peter Ward** (palaeontologist) and **Donald Brownlee** (astronomer).  
रेयर अर्थ परिकल्पना वर्ष 2000 में जीवाश्म विज्ञानी पीटर वार्ड और खगोलशास्त्री डोनाल्ड ब्राउनली द्वारा प्रस्तावित की गई थी।
- It argues that while **simple microbial life** may be **common**, **complex multicellular life** is likely **uncommon** in the universe.  
यह कहती है कि सरल सूक्ष्मजीवी जीवन सामान्य हो सकता है, लेकिन जटिल बहुकोशिकीय जीवन संभवतः दुर्लभ है।
- The idea depends on a chain of **successive favourable conditions** occurring in a particular region of the universe.  
यह विचार ब्रह्मांड के किसी विशेष भाग में लगातार अनुकूल परिस्थितियों के मिलने पर निर्भर करता है।
- While we often talk about life ranging from **simple (bacteria, yeast) to complex (humans, octopuses)**, life itself is a **complex phenomenon** resulting from many factors.  
जब हम जीवन की बात करते हैं, तो हम इसे सरल (बैक्टीरिया, यीस्ट) से लेकर जटिल (मनुष्य, ऑक्टोपस) तक मानते हैं, परंतु जीवन स्वयं अनेक कारकों से निर्मित एक जटिल प्रक्रिया है।
- Studying these factors on Earth has been **difficult and incomplete**, and finding them on planets **light years away** is **extraordinarily challenging**.  
इन कारकों का अध्ययन पृथ्वी पर ही कठिन और अधूरा रहा है, और कई प्रकाश वर्ष दूर स्थित ग्रहों पर इन्हें खोजना अत्यंत चुनौतीपूर्ण है।
- Scientists studying other planets focus on specific aspects:  
अन्य ग्रहों पर जीवन का अध्ययन करने वाले वैज्ञानिक कुछ विशेष पहलुओं पर ध्यान देते हैं –
  - Some focus on **rocky planets** with **surface water** in the **habitable zone**.  
कुछ वैज्ञानिक आवास योग्य क्षेत्र में सतही जल वाले पथरीले ग्रहों पर ध्यान केंद्रित करते हैं।
  - Others study **system architectures** like the role of **giant planets**.  
कुछ अन्य सिस्टम संरचनाओं जैसे विशाल ग्रहों की स्थिति का अध्ययन करते हैं।
  - Some research **climate regulation** and **long-term atmospheres**.  
कुछ वैज्ञानिक जलवायु संतुलन और दीर्घकालिक वायुमंडलीय स्थिरता का अध्ययन करते हैं।

## New Data and Insights

### नए आंकड़े और अंतर्दृष्टियाँ

- Since **2000**, more data has been collected about **exoplanets** and **planetary science**.  
वर्ष 2000 के बाद से ग्रहों और बाह्य ग्रहों पर अधिक आंकड़े एकत्र किए गए हैं।
- The picture is **mixed** — some **conditions for life** appear **less restrictive**, while others are **harder to meet**.  
स्थिति मिश्रित है — कुछ जीवन के लिए आवश्यक शर्तें कम प्रतिबंधात्मक हैं, जबकि अन्य को पूरा करना अधिक कठिन है।

## Understanding a Planet

### एक ग्रह को समझना



- Studies based on **NASA's Kepler Telescope (2009–2018)** suggested that a **large fraction of sun-like stars** may host **small planets with similar starlight** as Earth.  
नासा के केप्लर टेलीस्कोप (2009–2018) पर आधारित अध्ययनों ने संकेत दिया कि सूर्य जैसे तारों का एक बड़ा हिस्सा छोटे ग्रहों की मेजबानी कर सकता है जो पृथ्वी जैसी तारकीय रोशनी प्राप्त करते हैं।
- **One study found that nearly one-fifth of sun-like stars may have Earth-sized planets in their habitable zones, though with uncertainty.**  
एक अध्ययन में पाया गया कि लगभग पाँचवां हिस्सा सूर्य जैसे तारों का अपने आवास योग्य क्षेत्र में पृथ्वी के आकार के ग्रहों की मेजबानी कर सकता है, हालांकि इसमें कुछ अनिश्चितताएँ थीं।
- Later data shows a **non-negligible rate of rocky planets around GK dwarfs**, indicating **Earth-sized planets are not rare.**  
बाद के आँकड़ों से पता चला कि जीके ड्वार्फ तारों के आसपास पथरीले ग्रहों की एक महत्वपूर्ण दर मौजूद है, जिससे यह स्पष्ट होता है कि पृथ्वी जैसे ग्रह दुर्लभ नहीं हैं।
- The question has shifted from **where a planet is to what a planet is like.**  
अब प्रश्न यह नहीं है कि ग्रह कहाँ है, बल्कि यह है कि ग्रह कैसा है।
- In our solar system, **Mercury** is too close to the Sun and **Pluto** is too far away.  
हमारे सौरमंडल में बुध सूर्य के बहुत निकट है और प्लूटो बहुत दूर है।
- **Though both Earth and Venus are in the habitable zone, Venus's atmosphere makes it deadly for life.**  
यद्यपि पृथ्वी और शुक्र दोनों आवास योग्य क्षेत्र में हैं, लेकिन शुक्र का वायुमंडल जीवन के लिए घातक है।

### M-Dwarf Stars and Atmosphere Retention एम-ड्वार्फ तारे और वायुमंडल संरक्षण

- A key question is whether **small planets** around **M-dwarf stars** can retain **atmosphere and surface water** for billions of years.  
एक प्रमुख प्रश्न यह है कि क्या एम-ड्वार्फ तारों के चारों ओर छोटे ग्रह अरबों वर्षों तक वायुमंडल और सतही जल को बनाए रख सकते हैं।
- **Intense radiation from M-dwarf stars can break water molecules ( $H_2O \rightarrow H^+ + OH^-$ ) and lead to false-positive oxygen buildup.**  
एम-ड्वार्फ तारों की तीव्र विकिरण जल अणुओं को तोड़ सकती है ( $H_2O \rightarrow H^+ + OH^-$ ) और इससे झूठा ऑक्सीजन संचय हो सकता है।
- When telescopes detect excess oxygen, scientists may wrongly assume **photosynthesis**, though it's caused by **stellar radiation**.  
जब दूरबीनें अत्यधिक ऑक्सीजन का पता लगाती हैं, तो वैज्ञानिक इसे प्रकाश संश्लेषण का परिणाम मान सकते हैं, जबकि वास्तव में यह तारकीय विकिरण के कारण होता है।
- Some M-dwarf planets may retain their **atmosphere** if the star's **magnetic outflows** are weak and the planet has a **strong magnetic field** or **volcanic activity**.  
कुछ एम-ड्वार्फ ग्रहों का वायुमंडल बना रह सकता है यदि तारे की चुंबकीय हवाएँ कमजोर हों और ग्रह में मजबूत चुंबकीय क्षेत्र या ज्वालामुखीय गतिविधि हो।
- Such stable planets are a **minority** because **M-dwarf stars** often produce **strong flares**, and close-in planets lack magnetic shields.  
ऐसे स्थिर ग्रह अल्पसंख्यक हैं क्योंकि एम-ड्वार्फ तारे प्रायः तीव्र विस्फोट (फ्लेयर) उत्पन्न करते हैं और निकटवर्ती ग्रहों में मजबूत चुंबकीय कवच नहीं होता।

### Recent Observations by JWST जेम्स वेब स्पेस टेलीस्कोप से हाल के अवलोकन

- Using **NASA's James Webb Space Telescope (JWST)**, scientists are measuring **heat emission** from nearby rocky exoplanets.  
नासा के जेम्स वेब स्पेस टेलीस्कोप (JWST) की सहायता से वैज्ञानिक निकटवर्ती पथरीले बाह्य ग्रहों से निकलने वाली ऊष्मा को माप रहे हैं।
- In **TRAPPIST-1c** (40.7 light years away), JWST ruled out a **thick CO<sub>2</sub>-rich atmosphere**.  
**TRAPPIST-1c** (40.7 प्रकाश वर्ष दूर) पर JWST ने घने कार्बन डाइऑक्साइड-समृद्ध वायुमंडल की संभावना को नकारा।



- Earlier, JWST also showed that **TRAPPIST-1b** likely lacks a **substantial atmosphere**.  
पहले, **JWST** ने यह भी पाया कि **TRAPPIST-1b** में संभवतः **महत्वपूर्ण वायुमंडल** नहीं है।
- These results show that **Earth-sized** does not mean **Earth-like**.  
ये परिणाम दर्शाते हैं कि **पृथ्वी के आकार का होना** अनिवार्य रूप से **पृथ्वी जैसा होना** नहीं है।
- Scientists need more data on **cooler, temperate planets** to know how often **atmospheres survive** where **life could persist**.  
वैज्ञानिकों को **ठंडे, मध्यम ग्रहों** पर और अधिक डेटा की आवश्यकता है ताकि वे यह समझ सकें कि **जीवन के अनुकूल वायुमंडल** कितनी बार **स्थिर रह पाते हैं**।

## Climate Stabilisation

### जलवायु स्थिरीकरण

- Another pillar of the **rare earth hypothesis** is **long-term climate stabilisation**.  
**दुर्लभ पृथ्वी परिकल्पना (rare earth hypothesis)** का एक और स्तंभ **दीर्घकालिक जलवायु स्थिरीकरण** है।
- On the earth, the **weathering of continental rocks** and the **recycling of carbon** between the earth's interior and the atmosphere have **buffered the climate** over geologic time.  
पृथ्वी पर **महाद्वीपीय चट्टानों का अपक्षय (weathering)** और पृथ्वी के भीतरी भाग और वायुमंडल के बीच **कार्बन का पुनर्चक्रण** भूवैज्ञानिक समय में **जलवायु को स्थिर** बनाए रखते हैं।
- Many researchers have linked this buffering to **plate tectonics**, which **subduct a carbonated crust** and **build new surface rocks**.  
कई शोधकर्ताओं ने इस स्थिरीकरण को **प्लेट विवर्तनिकी (plate tectonics)** से जोड़ा है, जो **कार्बोनेटेड क्रस्ट को धकेलकर नीचे ले जाती है** और **नई सतही चट्टानों का निर्माण करती है**।
- The interiors of planets behave in different ways.  
ग्रहों के **भीतरी भाग अलग-अलग तरीकों से व्यवहार करते हैं**।
- **Rocky planets** can have one stiff shell that barely moves, long quiet times broken by short bursts of crust movement, or **plate-like tectonics** (as on the earth).  
**पथरीले ग्रहों (Rocky planets)** में एक कठोर परत हो सकती है जो मुश्किल से हिलती है, लंबे शांत काल के बाद क्रस्ट की थोड़ी हलचल होती है, या **प्लेट जैसी विवर्तनिकी** (जैसा कि पृथ्वी पर है) हो सकती है।
- A planet can even **switch between these modes** over time.  
एक ग्रह समय के साथ **इन तरीकों के बीच बदल भी सकता है**।
- Some models show that without modern plate tectonics, a planet might still keep a **habitable climate** by balancing **volcanism, weathering, burial, and crustal foundering**.  
कुछ मॉडल दिखाते हैं कि आधुनिक प्लेट विवर्तनिकी के बिना भी एक ग्रह **ज्वालामुखीय क्रिया (volcanism), अपक्षय (weathering), सामग्री का दफन (burial), और क्रस्ट का डूबना (foundering)** के बीच संतुलन बनाकर **जीवनीय जलवायु (habitable climate)** बनाए रख सकता है।
- Scientists don't have consensus either: while **plate tectonics** could help maintain a **stable climate** that supports **complex life**, it may not be **strictly required** for life to begin.  
वैज्ञानिकों के बीच अभी **सहमति नहीं है**: **प्लेट विवर्तनिकी जटिल जीवन** को समर्थन देने वाली **स्थिर जलवायु** बनाए रखने में मदद कर सकती है, लेकिन जीवन की शुरुआत के लिए यह **अनिवार्य नहीं** हो सकती।

## The Role of Giants

### विशाल ग्रहों की भूमिका

- A third line of debate is the role of **giant planets like Jupiter**.  
तीसरी बहस की दिशा **बृहस्पति जैसे विशाल ग्रहों** की भूमिका से जुड़ी है।
- The old intuition was that **Jupiter 'shields' the Earth** by **deflecting comets and asteroids**.  
पुराना विश्वास यह था कि **बृहस्पति (Jupiter) धूमकेतुओं और क्षुद्रग्रहों को मोड़कर पृथ्वी की रक्षा करता है**।
- Subsequent studies have complicated this story.  
बाद के अध्ययनों ने इस कहानी को **और जटिल बना दिया है**।
- Depending on a **giant planet's mass and orbit**, scientists have found that it can **reduce or increase the flux of impactors** to the inner system and **deliver water-rich bodies** early on.  
**विशाल ग्रह के द्रव्यमान और कक्षा** पर निर्भर करते हुए, वैज्ञानिकों ने पाया है कि यह **आघात करने वाले**



पिंडों (impactors) के प्रवाह को कम या अधिक कर सकता है, और प्रारंभिक समय में जल-समृद्ध पिंडों को पहुंचा सकता है।

- There seems to be no universal **filter** on this front; it all depends on the **system's architecture**.  
इस विषय में कोई **सार्वभौमिक फ़िल्टर** नहीं है; यह पूरी तरह से **सिस्टम की संरचना (architecture)** पर निर्भर करता है।
- This conclusion weakens the claim that a **Jupiter-like planet** is necessary for **complex life** on a rocky planet.  
यह निष्कर्ष इस दावे को कमजोर करता है कि **बृहस्पति जैसा ग्रह** किसी **पथरीले ग्रह पर जटिल जीवन** के लिए आवश्यक है।

## On Earth-sized Planets and Habitable Zones पृथ्वी के आकार वाले ग्रह और जीवन योग्य क्षेत्र

- Many scientists argue that the **occurrence rate of Earth-sized planets** in the **habitable zones of sun-like stars** is **non-zero** and may be a **few tens of percent**, as per **Kepler data**.  
कई वैज्ञानिकों का कहना है कि **सूर्य जैसे तारों के जीवन योग्य क्षेत्रों में पृथ्वी के आकार वाले ग्रहों की उपस्थिति दर शून्य नहीं है** और **कुछ प्रतिशत (Kepler डेटा के अनुसार)** हो सकती है।
- This undermines the notion that the Earth's **orbital and size configuration** is vanishingly uncommon.  
यह धारणा कमजोर पड़ती है कि पृथ्वी की **कक्षा और आकार की संरचना** अत्यंत दुर्लभ है।
- On the other hand, the data on **planets' ability to retain atmospheres, have long climate cycles, and avoid catastrophic events** is more sobering.  
दूसरी ओर, **ग्रहों की वायुमंडल बनाए रखने की क्षमता, दीर्घकालिक जलवायु चक्रों, और विनाशकारी घटनाओं से बचने के आंकड़े अधिक सावधान करने वाले हैं।**
- The results suggest that truly **Earth-like surface environments** supporting **complex biospheres** may be **less common** than the number of **Earth-sized planets** would suggest.  
परिणाम बताते हैं कि **जटिल जैवमंडल (biospheres)** का समर्थन करने वाले वास्तव में **पृथ्वी जैसे सतही वातावरण पृथ्वी के आकार वाले ग्रहों की संख्या से कम सामान्य** हो सकते हैं।

## Not Definitive निष्कर्षपूर्ण नहीं

- Two more threads bear on the **rare versus common** debate.  
**दुर्लभ बनाम सामान्य** बहस पर दो और पहलू प्रभाव डालते हैं।
- A recent effort to place an **upper limit on the number of Earth-like planets** emphasised that a lot depends on **atmospheric processes** that scientists can't yet survey at scale.  
हाल के एक प्रयास में **पृथ्वी जैसे ग्रहों की संख्या की ऊपरी सीमा** निर्धारित करने की कोशिश की गई, जिसमें यह बताया गया कि बहुत कुछ उन **वायुमंडलीय प्रक्रियाओं** पर निर्भर करता है जिन्हें वैज्ञानिक अभी बड़े पैमाने पर नहीं देख सकते।
- Searches for **technosignatures** — signs of technology made by **extra-terrestrial life** — have sharpened the limits on **radio-loud civilisations**.  
**टेक्नोसिग्नचर (technosignatures)** — यानी **परग्रही जीवन द्वारा निर्मित प्रौद्योगिकी के संकेत** — की खोज ने **रेडियो-सक्रिय सभ्यताओं** पर सीमाओं को और स्पष्ट किया है।
- The **Breakthrough Listen project**, after **multi-year surveys of thousands of stars**, hasn't found any convincing signals so far.  
**ब्रेकथ्रू लिसन परियोजना (Breakthrough Listen project)** ने **हजारों तारों के कई वर्षों तक सर्वेक्षण** के बाद अब तक कोई **विश्वसनीय संकेत नहीं पाया है।**
- While not detecting something doesn't prove that it's absent, it sets **upper limits** on how **common** it could be in the cosmos.  
हालांकि किसी चीज़ का पता न चलना उसकी अनुपस्थिति साबित नहीं करता, लेकिन यह इस बात की **ऊपरी सीमा** तय करता है कि वह ब्रह्मांड में कितनी **सामान्य** हो सकती है।
- Taken together, the **rare earth hypothesis** remains **plausible for complex life**, but it can't be said to be **demonstrably true**.



कुल मिलाकर, दुर्लभ पृथ्वी परिकल्पना जटिल जीवन के लिए संभाव्य बनी रहती है, लेकिन इसे साबित रूप से सत्य नहीं कहा जा सकता।

- Three developments could change this picture:  
तीन विकास इस तस्वीर को बदल सकते हैं:
  - Detection of **atmospheres on rocky, temperate planets showing gases consistent with surface water cycles.**  
पथरीले, समशीतोष्ण ग्रहों पर वायुमंडल की खोज, जिनमें जल चक्रों के अनुरूप गैसें हों।
  - Stronger **constraints on tectonic regimes on exoplanets**, showing if **long-term climate stabilisers** are widespread or rare.  
एक्सोप्लैनेट्स पर विवर्तनिक तंत्रों (tectonic regimes) पर अधिक सटीक सीमाएँ, जो दिखाएँ कि दीर्घकालिक जलवायु स्थिरीकरण आम है या दुर्लभ।
  - Detection of **biosignatures or technosignatures.**  
जैविक या प्रौद्योगिकीय संकेतों (biosignatures / technosignatures) की खोज।
- The first steps are already **underway**, with **extremely large ground telescopes** and **future space missions** focusing on **planets with temperate atmospheres.**  
प्रारंभिक कदम पहले से ही चल रहे हैं, जिनमें अत्यंत बड़े ग्राउंड टेलिस्कोप और भविष्य की अंतरिक्ष मिशनों समशीतोष्ण वायुमंडल वाले ग्रहों पर केंद्रित हैं।
- Until their observations mature, a fair summary is: **microbial life** could be **common**, but **complex ecosystems** capable of supporting **long-lived, land-ocean life** may still be **scarce.**  
जब तक इनका अवलोकन पूर्ण नहीं हो जाता, तब तक एक उचित सारांश यह है कि **सूक्ष्मजीव जीवन (microbial life)** सामान्य हो सकता है, लेकिन **स्थल-समुद्र आधारित जटिल पारिस्थितिकी तंत्र (ecosystems)** जो दीर्घकालिक जीवन को बनाए रख सकें, अभी भी **दुर्लभ** हो सकते हैं।

#### Questions and Answers to the previous day's daily quiz: 1. Tycho

Brahe observed the 1572 supernova in this constellation. **Ans:**

**Cassiopeia**

2. The title Tycho Brahe gave to his 1573 treatise. **Ans:** *De nova et nullius aevi memoria prius visa stella*, or "On the new star, never before seen in the memory of any age."

3. The distance of the remnant of SN 1572 from Earth. **Ans:** **Current estimates place it roughly 8,000-9,800 light years away**

4. In the standard Type Ia supernova model, this initiates the explosion of the white dwarf. **Ans:** **The white dwarf accumulates material from a companion star until it reaches a critical mass, triggering a thermonuclear runaway**

5. The reason why Tycho Brahe's observations were considered groundbreaking. **Ans:** **His precise parallax measurements demonstrated that the phenomenon lay among the distant stars, not in Earth's atmosphere, challenging centuries of astronomical assumptions**

6. This philosophical doctrine was unsettled by the appearance of SN 1572. **Ans:** **The Aristotelian belief in a perfect, unchanging celestial sphere was shown to be unreliable**

Visual: Identify this image. **Ans:** **A star map of the constellation Cassiopeia showing the position of the Supernova of 1572**

Early Birds: Nobody got all the correct answers

## QUIZ

### Tycho Brahe's Observation of the 1572 Supernova (SN 1572)

- On **11 November 1572**, Danish astronomer **Tycho Brahe** observed a bright "new star" in the constellation **Cassiopeia**.
- This "new star" was later identified as a **supernova**, designated **SN 1572**, also known as **Tycho's Supernova**.
- Its peak brightness was around **magnitude -4.0**, making it **brighter than Venus** and visible even in daylight.
- The event occurred in the **Milky Way galaxy** and challenged the long-held belief that the **celestial realm was unchanging**.

### Historical and Scientific Significance

- Tycho's detailed observations showed that the "new star" exhibited **no measurable parallax**,

meaning it was far beyond the Moon's orbit.

- This observation **disproved Aristotle's theory** that the heavens were perfect and unalterable.
- The discovery encouraged the scientific community to **improve instruments** and **record celestial positions more accurately**.
- It became a landmark in the **transition from classical astronomy to modern scientific astronomy**.
- SN 1572 remains one of only a few **supernovae observed with the naked eye** in the Milky Way, providing invaluable historical data for modern astrophysics.



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## Astronomical Details

- SN 1572 is classified as a **Type Ia supernova** — a **thermonuclear explosion** of a **white dwarf** star in a **binary system**.
- Observations by **NASA's Chandra X-ray Observatory** have revealed **shock waves and clumpy debris** expanding from the explosion.
- The distance to the remnant is estimated to be around **8,000–10,000 light-years** from Earth.
- The **expanding shell** continues to emit X-rays, helping scientists understand the life cycle of stars and the dynamics of stellar explosions.

## Cassiopeia Constellation and Location

- The constellation **Cassiopeia** is easily recognisable by its distinctive **W-shaped pattern** of five bright stars in the northern sky.
- Tycho's Supernova appeared near the **central region of this W**, visible even to the unaided eye.
- The precise location of the supernova helped astronomers confirm that the event occurred **beyond Earth's atmosphere**, strengthening the concept of a dynamic and evolving universe.

## Recent Research and Updates

- **Modern telescopes** such as the **James Webb Space Telescope** and **Gaia mission** have been used to refine data about SN 1572's remnant and its surrounding environment.
- **Spectral studies** confirm its classification as a **Type Ia supernova**, resulting from the explosion of a white dwarf that had accreted too much material from a companion star.
- Recent analyses suggest that before the explosion, the progenitor system may have **created a low-density cavity** around itself, influencing how the remnant expanded.
- Scientists continue to search for the **possible surviving companion star**, though none has yet been conclusively identified.

## Tycho Brahe's 1573 Treatise — "De nova et nullius aevi memoria prius visa stella"

*(On the New Star, Never Before Seen in the Memory of Any Age)*

### Historical Background

- In **November 1572**, Danish astronomer **Tycho Brahe** observed an exceptionally bright star in the **constellation Cassiopeia**, later identified as a **supernova** (SN 1572).
- The star appeared suddenly, shone brighter than **Venus**, and remained visible for about **18 months**, even in daylight at its peak.
- This event challenged the **Aristotelian belief** that the heavens were immutable and unchanging.
- In response to this celestial phenomenon, Tycho Brahe composed a detailed scientific treatise in **1573**, titled "**De nova et nullius aevi memoria prius visa stella.**"

### Meaning and Translation

- The Latin title translates to: "**On the new star, never before seen in the memory of any age.**"
- The phrase "nova stella" means "**new star,**" from which the modern term "**nova**" and "**supernova**" are derived.

### Purpose and Context of the Treatise

- The treatise was written to **describe Tycho's observations and measurements** of the new star and to analyze its **astronomical and philosophical implications**.
- It represented a **turning point in scientific thought**, blending precise empirical observations with mathematical reasoning.
- Tycho sought to **reconcile the new discovery** with both **astronomy and natural philosophy**, while carefully avoiding religious controversy prevalent in 16th-century Europe.



## Key Observations and Findings in the Treatise

- Tycho meticulously recorded the **position, brightness, and colour** of the new star over time.
- He used **angular measurements** relative to nearby stars in Cassiopeia to determine its fixed position.
- Importantly, Tycho **found no measurable parallax**, proving that the star was **not located within Earth's atmosphere** but in the **celestial realm beyond the Moon**.
- This directly **contradicted Aristotle's cosmology**, which stated that the celestial spheres were **unchangeable and perfect**.
- Tycho's data demonstrated that **change could occur in the heavens**, laying the groundwork for a **scientific revolution in astronomy**.

## Structure and Style of the Work

- The treatise was written in **Latin**, the scholarly language of Europe at the time.
- It was structured as both a **scientific report** and a **philosophical commentary**.
- The tone reflected Tycho's transition from **traditional Aristotelian thought** toward **empirical and mathematical astronomy**, which would later influence scientists like **Johannes Kepler**.

## Impact on the Scientific Revolution

- The publication of "De nova stella" was a **milestone in observational astronomy**.
- It inspired other astronomers, including **Kepler, Galileo, and later Newton**, to rely on **observation and measurement** rather than philosophical speculation.
- Tycho's methods led to a **new era of precision in celestial observations**, marking a shift from medieval cosmology to the **modern scientific method**.
- His work bridged the gap between **Ptolemaic geocentrism** and **Copernican heliocentrism**, paving the way for **Kepler's laws of planetary motion**.

## Relation to Cassiopeia and the 1572 Supernova

- The "new star" appeared in the **constellation Cassiopeia**, which was easily identifiable due to its distinct **W-shaped pattern** of stars.
- Tycho's records helped future astronomers locate the **supernova remnant**, now known as **Tycho's Supernova Remnant (SN 1572)**.
- Modern X-ray and optical telescopes, such as those from **NASA's Chandra X-ray Observatory**, have confirmed that SN 1572 was a **Type Ia supernova** — a thermonuclear explosion of a **white dwarf star**.

## Distance and Nature of the Remnant of Supernova SN 1572 (Tycho's Supernova)

### Introduction

- The **Supernova of 1572 (SN 1572)**, also known as **Tycho's Supernova**, was a **Type Ia supernova** that appeared suddenly in the **constellation Cassiopeia**.
- It was observed and recorded in detail by **Tycho Brahe**, whose findings revolutionized astronomy by proving that changes could occur even in the supposedly "unchangeable" heavens.
- Modern astronomical instruments have now located and studied the **remnant** of this explosion — a vast, expanding shell of gas and dust still glowing across multiple wavelengths of light.

### Current Distance Estimate

- **Current scientific estimates** place the remnant of SN 1572 at a distance of approximately **8,000–9,800 light years** from **Earth**.
- This estimation is derived using **modern radio, optical, and X-ray observations**, particularly data from the **Chandra X-ray Observatory** and **Very Large Array (VLA)**.
- The remnant lies within our own **Milky Way galaxy**, located in the **Perseus Arm**, which is one of the spiral arms of the galaxy.



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## Methods Used to Determine Distance

• Astronomers estimate the distance to supernova remnants using several **astrophysical techniques**, such as:

- **Spectral Analysis:** Studying the emitted radiation across different wavelengths to estimate the expansion velocity and redshift.
- **Proper Motion Measurements:** Tracking the **apparent motion of shock fronts** over time using telescopes like **Hubble Space Telescope (HST)** and **Chandra X-ray Observatory**.
- **Expansion Parallax Method:** Comparing the **angular size** of the remnant with its **known expansion rate** to calculate distance.
- **Interstellar Absorption Studies:** Measuring how much light from the remnant is absorbed by interstellar dust helps gauge its approximate distance within the Milky Way.

## Structure and Composition of the Remnant

- The **remnant of SN 1572** consists of **highly energized gas, shock waves, and expanding stellar debris**.
- Observations show an **asymmetric shell**, indicating that the explosion may not have been perfectly uniform.
- The **Chandra X-ray Observatory** and **European Space Agency's XMM-Newton Telescope** have revealed:
  - Expanding **X-ray-emitting gases** composed of **iron, silicon, and oxygen** — products of the white dwarf explosion.
  - Regions of **high-energy particles** that are being accelerated to near-light speeds, making SN 1572 a **cosmic-ray accelerator**.

## Scientific Importance of Knowing the Distance

- Determining the exact distance to SN 1572's remnant is crucial for several reasons:
  - It allows astronomers to **calculate the explosion's true energy output**, mass of ejecta, and size of the expanding shell.
  - It helps calibrate **Type Ia supernovae** as "**standard candles**", which are used to measure cosmic distances and understand the **expansion rate of the universe**.
  - The study of its distance and remnant morphology also helps in refining **models of stellar evolution** and **galactic structure**.

## Recent Discoveries and Research Updates

- **NASA's Chandra Observatory** and **ESA's XMM-Newton** continue to monitor SN 1572's remnant, providing **high-resolution X-ray maps**.
- **Gaia Mission** (European Space Agency) has provided updated parallax data, improving distance accuracy to around **8,100–9,000 light years**.
- **Infrared and radio observations** from the **Spitzer Space Telescope** and **VLA** have detected fine dust structures, revealing how **supernovae contribute to the chemical enrichment** of the interstellar medium.
- No **surviving companion star** has yet been confirmed, though searches continue to determine the nature of the binary system that caused the explosion.

## Location and Visibility in the Sky

- The supernova remnant lies in the **northern constellation Cassiopeia**, which forms a **distinctive "W" pattern** in the night sky.
- Although the original supernova was **visible to the naked eye** in 1572, today the remnant can be observed only through **powerful telescopes**.



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- Its **angular diameter** in the sky is about **8 arcminutes**, corresponding to a **physical size of roughly 20 light years** across at its estimated distance.

## Type Ia Supernova: The Standard Model and Thermonuclear Explosion of a White Dwarf

### Introduction

- A **Type Ia Supernova** is one of the most energetic stellar explosions in the universe.
- It occurs in a **binary star system**, where one of the stars is a **white dwarf**—the dense, compact remnant of a medium-sized star (like our Sun).
- The explosion is not caused by gravitational collapse (as in Type II supernovae) but by a **thermonuclear runaway reaction** that obliterates the white dwarf.
- These explosions are crucial in astronomy because they act as “**standard candles**” to measure cosmic distances and study the **expansion of the universe**.

### The Progenitor System: Binary Star Setup

- In the **standard Type Ia model**, a white dwarf orbits a **companion star**, which could be:
  - A **main-sequence star** (like the Sun),
  - A **red giant**, or
  - Another **white dwarf** (in the double-degenerate model).
- The **white dwarf** is primarily composed of **carbon and oxygen**, left behind after the star has exhausted its nuclear fuel.
- As it orbits its companion, the white dwarf **gravitationally pulls material (hydrogen or helium gas)** from the outer layers of the companion star—a process called **accretion**.

### Chandrasekhar Limit and Critical Mass

- The **Chandrasekhar Limit** is a crucial concept named after Indian astrophysicist **Subrahmanyan Chandrasekhar** (1910–1995).
- It defines the **maximum mass** that a white dwarf can sustain against gravitational collapse through electron degeneracy pressure.
- This limit is approximately **1.4 times the mass of the Sun ( $1.4 M_{\odot}$ )**.
- When the **accreted mass** from the companion star causes the white dwarf to approach this limit, **electron degeneracy pressure fails** to hold it stable.

### Thermonuclear Runaway: Trigger of the Explosion

- As the mass approaches the **critical Chandrasekhar limit**, the **temperature and pressure** inside the white dwarf increase drastically.
  - Carbon fusion reactions are ignited in the dense core, but because of **degenerate matter**, the temperature rise does not cause expansion.
  - This leads to an uncontrollable, **runaway thermonuclear reaction**.
  - Within seconds, the fusion reactions convert **carbon and oxygen into heavier elements** (like nickel and iron), releasing an enormous amount of energy.
  - The white dwarf is completely **disrupted and blown apart**, leaving behind no neutron star or black hole.

### Energy Output and Observational Characteristics

- The explosion releases about  **$10^{36}$  joules** of energy — equivalent to the **total energy output of the Sun over its entire lifetime**.
- It produces a sharp increase in brightness, making the supernova visible across galaxies.



• The typical **peak luminosity** of a Type Ia supernova is around **5 billion times brighter than the Sun**.

• Key observational features:

- **Absence of hydrogen lines** in its spectrum.
- **Strong silicon absorption lines** (particularly near 615 nm wavelength).
- A **uniform light curve**, which allows astronomers to use them for **distance calibration** in cosmology.

### Variants of the Type Ia Model

• **Single-Degenerate Model:**

The white dwarf accumulates matter from a **non-degenerate companion** (main-sequence or red giant star).

- Explosion occurs when it reaches the **Chandrasekhar mass**.

• **Double-Degenerate Model:**

Two **white dwarfs merge** due to the loss of angular momentum via **gravitational waves**.

- Their merger triggers a **thermonuclear explosion** before collapsing into a neutron star.

• **Sub-Chandrasekhar Model:**

A **detonation in the helium shell** on the white dwarf's surface triggers the **carbon detonation** in the core, even before reaching  $1.4 M_{\odot}$ .

### Astrophysical Importance of Type Ia Supernovae

• **Cosmological Standard Candles:**

Type Ia supernovae have a consistent **peak luminosity**, which allows astronomers to measure **distances to faraway galaxies**.

• **Discovery of Dark Energy:**

Observations of distant Type Ia supernovae in the late 1990s (by the **Supernova Cosmology Project** and **High-z Supernova Search Team**) led to the discovery that the universe's **expansion is accelerating**, implying the existence of **dark energy**.

• **Galactic Chemical Enrichment:**

The explosions produce and disperse **iron-group elements** (Fe, Ni, Co) throughout the interstellar medium, enriching future generations of stars.

• **Supernova Remnants:**

The **expanding shells** of gas (e.g., **Tycho's Supernova Remnant**, SN 1572) help study **shock waves**, **cosmic rays**, and **interstellar gas dynamics**.

### Tycho Brahe's Groundbreaking Observations

#### Introduction

• **Tycho Brahe (1546–1601)** was a Danish astronomer known for his **extremely precise astronomical observations** before the invention of the telescope.

- His work bridged the gap between **ancient astronomy** and the **modern understanding of the cosmos**, influencing scientists like **Johannes Kepler**.

#### Observation of the 1572 Supernova



- In 1572, Tycho observed a **new bright star** in the constellation **Cassiopeia**, now known as **SN 1572** or **Tycho's Supernova**.
- He meticulously recorded its **brightness, position, and changes over time**, producing **accurate star charts**.
- This phenomenon was called a "**nova**", Latin for "new star," as it **suddenly appeared in the sky**.

### Importance of Parallax Measurements

- Tycho conducted **precise measurements of parallax**, the apparent shift of an object's position against distant background stars as seen from different locations on Earth.
- He **found no measurable parallax** for the 1572 nova.

- **Significance:**

- Objects in Earth's **atmosphere** exhibit noticeable parallax.
- Lack of parallax implied the nova was **far beyond the Moon and planets**, lying among the **fixed stars** in the **celestial sphere**.

- This **challenged the prevailing Aristotelian view** that the heavens were **unchanging and perfect** and that all new phenomena were **atmospheric**.

### Why His Observations Were Groundbreaking

- **Refutation of Long-Held Beliefs:**

- Tycho's measurements **disproved centuries-old assumptions** about the immutability of the heavens.

- **Precision in Pre-Telescopic Astronomy:**

- Using **large quadrants, sextants, and other instruments**, he achieved **unprecedented accuracy** in positional astronomy.

- **Foundation for Kepler's Laws:**

- Tycho's accurate star positions allowed **Johannes Kepler** to develop his **laws of planetary motion**, laying the groundwork for **Newtonian mechanics**.

- **Demonstration of the Scale of the Universe:**

- The nova's location among distant stars helped **expand the known scale of the cosmos** and shift the view from a **geocentric to a more expansive universe**.

### Observational Techniques

- **Instruments:**

- Large **armillary spheres, quadrants, and mural instruments** for angular measurement of celestial objects.

- **Methodology:**

- Recorded **daily positions** of stars and celestial events.
- Measured **angular separation** of the nova from known stars to detect **parallax shifts**.



**TELEGRAM CHANNEL:** <https://t.me/patrioticIAS>

**YOUTUBE CHANNEL:** <https://www.youtube.com/@PatrioticIAS>

**CONTACT: 9971932488**



#### • Data Accuracy:

- Achieved **position measurements accurate to about 1 arcminute**, exceptional for the **pre-telescope era**.

#### Impact on Astronomy

- Tycho's observations **marked a turning point** in understanding that the **universe is dynamic**, not immutable.
- Provided a **scientific foundation** for future astronomers to study **stellar evolution**, supernovae, and the **structure of the Milky Way**.
- Established the **importance of careful, long-term observations**, influencing **modern observational astronomy**.

#### Impact of SN 1572 on Aristotelian Philosophy

##### Introduction

- **SN 1572**, also known as **Tycho's Supernova**, appeared in **November 1572** in the constellation **Cassiopeia**.
- Its appearance had profound consequences for **astronomy and philosophy**, challenging long-held beliefs about the **celestial sphere**.

##### Aristotelian Doctrine on the Heavens

- The **Aristotelian worldview** (4th century BCE) dominated astronomy for centuries.
- Key beliefs included:
  - The **celestial realm is perfect, immutable, and eternal**.
  - Stars and planets move in **unchanging, circular orbits**.
  - Any observed change or imperfection in the heavens was thought impossible.
- This doctrine implied that **all astronomical phenomena** occurred **outside Earth's atmosphere** in a fixed, unalterable cosmos.

##### Tycho Brahe's Observations of SN 1572

- Tycho Brahe, a **Danish astronomer**, conducted precise measurements of the supernova.
- He determined its **parallax** (apparent shift in position due to Earth's movement) to be **so small** that it had to lie **among the fixed stars, far beyond the Moon**.
- This proved the **nova was not atmospheric**, directly contradicting earlier assumptions that celestial spheres were immutable.

##### Philosophical Implications

- The **Aristotelian belief in a perfect, unchanging celestial sphere was shown to be unreliable**.
- The **heavens were no longer seen as eternal and flawless**.
- This observation opened the door for:
  - Acceptance of **change in the celestial realm**,
  - Recognition of **transient phenomena like novae and comets**,
  - Foundations for **heliocentric models** and modern astronomy.

##### Historical Significance

- SN 1572 marks a **turning point in the Scientific Revolution**.
- The supernova challenged **centuries of dogma**, inspiring astronomers like **Johannes Kepler** and



later **Galileo Galilei** to question the Aristotelian cosmos.

- Tycho's work exemplified **precision observation over philosophical assumption**, establishing a **new standard for empirical astronomy**.

**Environment**

**12/11/2025**

## SC judge: imported ideas may not save endangered species

**GS III: Environment**

**Krishnadas Rajagopal**  
NEW DELHI

Supreme Court judge Justice P.S. Narasimha on Tuesday said many environmental law principles imported from the West such as "inter-generational equity" are anthropocentric and would hardly be of any assistance in protecting an endangered species from extinction.

Justice Narasimha made these oral observations while hearing a petition filed by M.K. Ranjitsinh on the conservation of the dying species of the Great Indian Bustard, which is being bred in captivity, and the Lesser Florican.

Senior advocate Shyam Divan, appearing for the petitioner, said there were 70 bustards in captivity and 150 in the wild. Lesser Floricans number 70.

"That is all... Captive breeding may be successful with the Great Indian Bustard, but it is not showing success with the Lesser Florican. Extinction is not an option for these two species," he said.

### 'Biblical roots'

Justice Narasimha said principles such as inter-generational equity had "Biblical" roots, with humans at the top.



The Great Indian Bustard

The judge referred to how, 13 years ago, a *amicus curiae* in the red sanders conservation case, had urged the Supreme Court to consider the "intrinsic worth" of an endangered species rather than its "instrumental value to human beings".

He criticised principles such as inter-generational equity which "pre-supposes the higher needs of human beings and lays down that exploitation of natural resources must be equitably distributed between the present and future generation". The judge said the court, in its judgment in the red sanders case, had accepted his submissions on the need to take an ecocentric approach, which "obliges every citizen to have compassion for all living creatures", in biodiversity law.

## SC judge: imported ideas may not save endangered species

**सुप्रीम कोर्ट के जज: पश्चिमी विचार लुप्तप्राय प्रजातियों को नहीं बचा सकते**

- Supreme Court judge Justice P.S. Narasimha on Tuesday said many **environmental law principles imported from the West** such as "inter-generational equity" are **anthropocentric** and would hardly be of any assistance in **protecting an endangered species from extinction**.

सुप्रीम कोर्ट के न्यायाधीश न्यायमूर्ति पी.एस. नरसिम्हा ने मंगलवार को कहा कि पश्चिम से आयात किए गए कई पर्यावरणीय कानून सिद्धांत, जैसे "पीढ़ीगत समानता" (inter-generational equity), मानव-केंद्रित (anthropocentric) हैं और लुप्तप्राय प्रजातियों को विलुप्त होने से बचाने में बहुत मददगार नहीं हो सकते।

- Justice Narasimha made these oral observations while hearing a petition filed by M.K. Ranjitsinh on the **conservation of the dying species of the Great Indian Bustard**, which is being bred in captivity, and the **Lesser Florican**.

न्यायमूर्ति नरसिम्हा ने ये मौखिक टिप्पणियां कीं जब वह एम.के. रंजीतसिंह द्वारा दायर याचिका पर सुनवाई कर रहे थे, जो महान भारतीय तीतर (Great Indian Bustard) और लैसर फ्लोरिकन (Lesser Florican) जैसी विलुप्तप्राय प्रजातियों के संरक्षण से संबंधित है, जिन्हें कैद में प्रजनन के लिए रखा गया है।

- Senior advocate Shyam Divan, appearing for the petitioner, said there were **70 bustards in captivity and 150 in the wild. Lesser Floricans number 70.**

याचिकाकर्ता की ओर से पेश हुए वरिष्ठ अधिवक्ता श्याम दीवान ने कहा कि कैद में 70 तीतर और जंगल में 150 हैं। लैसर फ्लोरिकन की संख्या केवल 70 है।

- "That is all... Captive breeding may be successful with the Great Indian Bustard, but it is not showing success with the Lesser Florican. Extinction is not an option for these two species," he said.

"बस इतना ही... कैद में प्रजनन महान भारतीय तीतर के लिए सफल हो सकता है, लेकिन लैसर फ्लोरिकन में सफलता नहीं दिखा रहा है। इन दोनों प्रजातियों के लिए विलुप्ति कोई विकल्प

नहीं है," उन्होंने कहा।

- 'Biblical roots' — Justice Narasimha said principles such as inter-generational equity had "Biblical" roots, with humans at the top.



‘बाइबिल से जुड़ी जड़ें’ — न्यायमूर्ति नरसिम्हा ने कहा कि “पीढ़ीगत समानता” जैसे सिद्धांतों की जड़ें बाइबिल में हैं, जहां मनुष्य को सर्वोच्च माना गया है।

- The judge referred to how, **13 years ago**, an **amicus curiae** in the **red sanders conservation case** had urged the Supreme Court to consider the “**intrinsic worth of an endangered species**” rather than its “**instrumental value to human beings**”. न्यायाधीश ने उल्लेख किया कि **13 वर्ष पहले**, **रेड सैंडर्स संरक्षण मामले में एक न्यायालय मित्र (amicus curiae)** ने सुप्रीम कोर्ट से आग्रह किया था कि वह **लुप्तप्राय प्रजातियों के “अंतर्निहित मूल्य” (intrinsic worth)** को माने, न कि उनके “**मनुष्यों के उपयोगिता मूल्य**” (instrumental value) को।

- He criticised principles such as **inter-generational equity** which “**pre-supposes the higher needs of human beings** and lays down that **exploitation of natural resources must be equitably distributed between the present and future generation**”.

उन्होंने “पीढ़ीगत समानता” जैसे सिद्धांतों की आलोचना की, जो “**मानव आवश्यकताओं को सर्वोच्च मानते हैं** और यह कहते हैं कि **प्राकृतिक संसाधनों का दोहन वर्तमान और भविष्य की पीढ़ियों के बीच समान रूप से वितरित होना चाहिए।**”

- The judge said the court, in its **judgment in the red sanders case**, had **accepted his submissions on the need to take an ecocentric approach**, which “**obliges every citizen to have compassion for all living creatures**”, in biodiversity law. न्यायाधीश ने कहा कि अदालत ने **रेड सैंडर्स मामले के फैसले में**, “**पर्यावरण-केंद्रित दृष्टिकोण (ecocentric approach)** अपनाते की आवश्यकता पर उनके सुझाव को स्वीकार किया था, जो “**हर नागरिक को सभी जीवित प्राणियों के प्रति करुणा रखने के लिए बाध्य करता है**”, विशेषकर **जैव विविधता कानूनों में**।



# India recorded the highest greenhouse gas emissions for 2024

However, in per capita terms, India's emissions remained less than half the global average

GS III: Environment

DATA POINT

The Hindu Data Team

In 2024, India registered the largest absolute increase in greenhouse gas (GHG) emissions among all countries compared to the previous year. India was the third largest overall emitter of GHGs in 2024, behind only China and the United States, in absolute terms. However, its per capita GHG emissions remained less than half the global average, highlighting the country's relatively low emissions intensity despite rapid absolute growth.

Worldwide, GHG emissions are on an increasing trend. In 2024, 57,700 metric tonnes of CO<sub>2</sub> (MtCO<sub>2</sub>e) of anthropogenic GHG was emitted, the highest on record (Chart 1).

Fossil CO<sub>2</sub> emissions from burning coal, oil, and natural gas accounted for 69% of GHG emissions in 2024 (Chart 2). Emissions from power generation were the largest single source for fossil CO<sub>2</sub>. This was followed by emissions from industrial combustion, transportation, and fuel production. Anthropogenic CH<sub>4</sub> (methane) emissions – emitted majorly during agricultural and waste management procedures – accounted for 16% of GHG emissions, the second largest share. Deforestation and land-use change also amounted significantly to this year's rise in emissions.

In 2024, India's per capita GHG emissions was 3 tCO<sub>2</sub>e, less than half of the global average of 6.4 tCO<sub>2</sub>e (Chart 3a). However, India's per capita GHG emissions grew at 3.7% between 2023 and 2024, much higher than the global average of 0.04% increase (Chart 3b).

The 57,700 MtCO<sub>2</sub>e worth of GHG emitted globally in 2024 was 1,500 MtCO<sub>2</sub>e higher than 2023. India contributed 165 MtCO<sub>2</sub>e to this rise, the highest among all nations. China stood second, contributing 126 MtCO<sub>2</sub>e (Chart 4).

## Carbon climb

The data for the charts were sourced from the United Nations Environment Programme (2025)'s 'Emissions Gap Report 2025: Off target – Continued collective inaction'

Chart 1: Total net anthropogenic greenhouse gas emissions by gas, 1990–2024

TOTAL GHG EMISSIONS 1990–2024

In 2024, 57,700 metric tonnes of CO<sub>2</sub> (MtCO<sub>2</sub>e) of anthropogenic (due to human activities) GHG was emitted, the highest on record

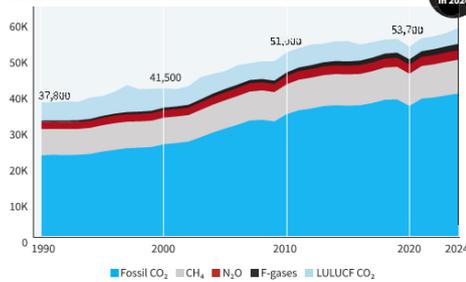


Chart 2: Total net greenhouse gas emissions by gas, sector, and fossil or non-fossil category in 2024

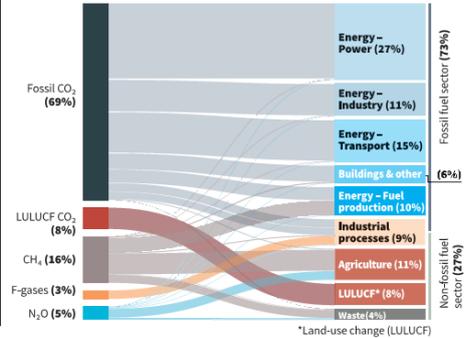


Chart 3A & 3B: Per capita greenhouse gas emissions of the six largest emitters (tCO<sub>2</sub>e/capita/year).

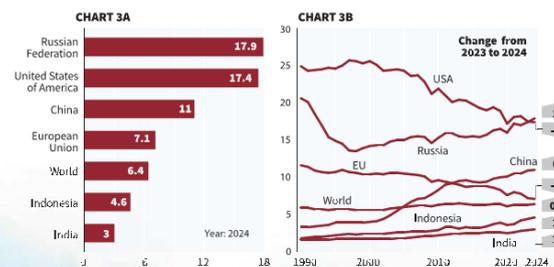
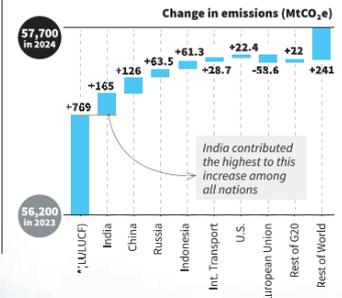


Chart 4: Contributions to the increase in GHG emissions in 2024 from 2023 levels of select actors



## India recorded the highest greenhouse gas emissions for 2024 भारत ने 2024 में सबसे अधिक ग्रीनहाउस गैस उत्सर्जन दर्ज किया

- However, in **per capita terms**, India's emissions remained **less than half the global average**.

हालांकि, प्रति व्यक्ति के आधार पर, भारत का उत्सर्जन वैश्विक औसत का आधे से भी कम रहा।

## India's Greenhouse Gas (GHG) Emissions in 2024 2024 में भारत के ग्रीनहाउस गैस (GHG) उत्सर्जन

- In 2024, India registered the **largest absolute increase** in greenhouse gas (GHG) emissions among all countries compared to the previous year. 2024 में, पिछले वर्ष की तुलना में **भारत ने सभी देशों में ग्रीनहाउस गैस (GHG) उत्सर्जन में सबसे अधिक पूर्ण वृद्धि दर्ज की**।
- India was the **third largest overall emitter** of GHGs in 2024, behind only **China and the United States**, in absolute terms.



भारत 2024 में ग्रीनहाउस गैसों का तीसरा सबसे बड़ा उत्सर्जक था, जो चीन और संयुक्त राज्य अमेरिका के बाद आता है।

- However, its **per capita GHG emissions** remained **less than half the global average**, highlighting the country's **low emissions intensity** despite rapid absolute growth.  
हालांकि, भारत का प्रति व्यक्ति GHG उत्सर्जन वैश्विक औसत का आधा से भी कम रहा, जिससे यह स्पष्ट होता है कि तेज़ वृद्धि के बावजूद देश की उत्सर्जन तीव्रता कम है।
- Worldwide, **GHG emissions are on an increasing trend**.  
वैश्विक स्तर पर, GHG उत्सर्जन में वृद्धि की प्रवृत्ति देखी जा रही है।
- In 2024, **57,700 metric tonnes of CO<sub>2</sub> (MtCO<sub>2</sub>e)** of anthropogenic GHG was emitted, the **highest on record**.  
2024 में, 57,700 मीट्रिक टन CO<sub>2</sub> (MtCO<sub>2</sub>e) मानवजनित GHG उत्सर्जित हुआ, जो अब तक का सबसे अधिक है।
- **Fossil CO<sub>2</sub> emissions** from burning coal, oil, and natural gas accounted for **69%** of total GHG emissions in 2024.  
कोयला, तेल और प्राकृतिक गैस के दहन से उत्पन्न जीवाश्म CO<sub>2</sub> उत्सर्जन ने 2024 में कुल GHG उत्सर्जन का 69% हिस्सा लिया।
- **Emissions from power generation** were the **largest single source** for fossil CO<sub>2</sub>, followed by **industrial combustion, transportation, and fuel production**.  
बिजली उत्पादन से उत्सर्जन जीवाश्म CO<sub>2</sub> का सबसे बड़ा स्रोत था, इसके बाद औद्योगिक दहन, परिवहन और ईंधन उत्पादन आते हैं।
- **Anthropogenic CH<sub>4</sub> (methane) emissions** — mainly from **agriculture and waste management** — accounted for **16%** of GHG emissions, the **second largest share**.  
कृषि और कचरा प्रबंधन से होने वाले मानवजनित CH<sub>4</sub> (मीथेन) उत्सर्जन ने कुल GHG उत्सर्जन का 16% हिस्सा लिया, जो दूसरा सबसे बड़ा योगदान है।
- **Deforestation and land-use change** also contributed **significantly** to this year's rise in emissions.  
वनों की कटाई और भूमि उपयोग में परिवर्तन ने भी इस वर्ष उत्सर्जन में वृद्धि में महत्वपूर्ण योगदान दिया।
- In 2024, India's **per capita GHG emissions** was **3 tCO<sub>2</sub>e**, less than half of the **global average of 6.4 tCO<sub>2</sub>e**.  
2024 में, भारत का प्रति व्यक्ति GHG उत्सर्जन 3 tCO<sub>2</sub>e था, जो वैश्विक औसत 6.4 tCO<sub>2</sub>e का आधा से भी कम है।
- However, India's **per capita GHG emissions** grew at **3.7%** between 2023 and 2024, much higher than the **global average increase of 0.04%**.  
हालांकि, 2023 और 2024 के बीच भारत का प्रति व्यक्ति GHG उत्सर्जन 3.7% बढ़ा, जो वैश्विक औसत वृद्धि 0.04% से कहीं अधिक था।
- The **57,700 MtCO<sub>2</sub>e** worth of GHG emitted globally in 2024 was **1,500 MtCO<sub>2</sub>e** higher than in 2023.  
2024 में वैश्विक स्तर पर 57,700 MtCO<sub>2</sub>e GHG उत्सर्जन हुआ, जो 2023 की तुलना में 1,500 MtCO<sub>2</sub>e अधिक था।
- **India contributed 165 MtCO<sub>2</sub>e** to this rise, the **highest among all nations**.  
इस वृद्धि में भारत का योगदान 165 MtCO<sub>2</sub>e था, जो सभी देशों में सबसे अधिक था।
- **China stood second**, contributing **126 MtCO<sub>2</sub>e** to the global rise in emissions.  
चीन दूसरे स्थान पर रहा, जिसने 126 MtCO<sub>2</sub>e उत्सर्जन वृद्धि में योगदान दिया।



# 'Lucifer' bee with devil-like horns found in Australia

GS III: Environment

Agence France-Press  
SYDNEY

As if deadly snakes, spiders and sharks were not enough, Australia now has a new creepy critter: a "lucifer" bee with devil-like horns.

The species—dubbed *Megachile (Hackeriapis) lucifer*—was found in the State of Western Australia, Curtin University announced on Tuesday.

Kit Prendergast at the university's School of Molecular and Life Sciences discovered the bee while surveying a critically endangered wildflower in 2019 and was immediately drawn to the insect's unique appearance.

"The female had these incredible little horns on her face," she said. A fan of the Netflix TV show "Lucifer", she said the name was the perfect fit for the bee's distinctively devilish appearance.

"It's the first new member of this bee group to be described in more than 20 years, which really shows how much life we still have to discover," Ms. Prendergast said.

She added that she hopes the discovery will raise awareness about the number of undiscovered species that could still be out there, especially in areas threatened by mining.

"Many mining companies still don't survey for native bees, so we may be missing undescribed species, including those that play crucial roles in supporting threatened plants and ecosystems," she said.

"Without knowing which native bees exist and what plants they depend on, we risk losing both before we even realise they're there."

Almost all flowering plants depend on wild pollinators, particularly bees, but habitat loss and climate change are driving many vital species to the brink of extinction.

हैं।"

- She added that she **hopes the discovery will raise awareness** about the number of **undiscovered species** that could still be out there, **especially in areas threatened by mining**.

उन्होंने यह भी कहा कि वह **उम्मीद करती हैं कि यह खोज जागरूकता बढ़ाएगी उन अभी-अनदेखी प्रजातियों की संख्या के बारे में**, जो अब भी मौजूद हो सकती हैं, विशेष रूप से खनन से खतरे वाले क्षेत्रों में।

- "Many mining companies still don't survey for native bees, so we may be missing **undescribed species**, including those that **play crucial roles in supporting threatened plants and ecosystems**," she said.

उन्होंने कहा, "कई खनन कंपनियाँ अभी भी देशी मधुमक्खियों का सर्वेक्षण नहीं करतीं, इसलिए

'Lucifer' bee with devil-like horns found in Australia

ऑस्ट्रेलिया में शैतान जैसे सींगों वाली 'लूसिफर' मधुमक्खी की खोज

• As if **deadly snakes, spiders and sharks** were not enough, **Australia now has a new creepy critter: a "lucifer" bee with devil-like horns**.

मानो घातक साँप, मकड़ियाँ और शार्क ही पर्याप्त न हों, अब ऑस्ट्रेलिया में एक नई अजीब जीव प्रजाति पाई गई है — "लूसिफर" नाम की मधुमक्खी, जिसके सिर पर शैतान जैसे सींग हैं।

• The species — dubbed **Megachile (Hackeriapis) lucifer** — was found in the **State of Western Australia, Curtin University** announced on Tuesday.

इस प्रजाति — जिसका नाम **मेगाकाइल (हैकेरिआपिस) लूसिफर** रखा गया है — की खोज **पश्चिमी ऑस्ट्रेलिया राज्य** में हुई, यह जानकारी **कर्टिन यूनिवर्सिटी** ने मंगलवार को दी।

• **Kit Prendergast** at the university's **School of Molecular and Life Sciences** discovered the bee while **surveying a critically endangered wildflower in 2019** and was immediately drawn to the insect's **unique appearance**.

विश्वविद्यालय के **स्कूल ऑफ मॉलिक्यूलर एंड लाइफ साइंसेज** की **किट प्रेंडरगास्ट** ने इस मधुमक्खी को **2019 में एक गंभीर रूप से विलुप्तप्राय जंगली फूल का सर्वेक्षण करते समय** खोजा और वह तुरंत इसकी **अद्वितीय बनावट** से आकर्षित हो गई।

• "The female had these incredible little horns on her face," she said.

उन्होंने कहा, "मादा मधुमक्खी के चेहरे पर ये अद्भुत छोटे सींग थे।"

• A fan of the **Netflix TV show "Lucifer"**, she said the **name was the perfect fit** for the bee's **distinctively devilish appearance**.

वह **नेटफ्लिक्स टीवी शो "लूसिफर"** की प्रशंसक हैं, और उन्होंने कहा कि यह नाम मधुमक्खी की **विशिष्ट शैतानी बनावट के लिए बिल्कुल उपयुक्त था।**

• "It's the **first new member of this bee group** to be described in **more than 20 years**, which really shows **how much life we still have to discover**," Ms. Prendergast said.

सुश्री प्रेंडरगास्ट ने कहा, "यह इस मधुमक्खी समूह का **20 वर्षों में खोजा गया पहला नया सदस्य है**, जो दिखाता है कि हमारे पास अभी भी खोजने के लिए कितनी नई प्रजातियाँ बाकी



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हम संभवतः अवर्णित प्रजातियों को खो रहे हैं, जिनमें वे भी शामिल हैं जो संकटग्रस्त पौधों और पारिस्थितिक तंत्रों को समर्थन देने में महत्वपूर्ण भूमिका निभाती हैं।”

- “Without knowing which native bees exist and what plants they depend on, we risk losing both before we even realise they’re there.”

“अगर हमें यह नहीं पता कि कौन-सी देशी मधुमक्खियाँ मौजूद हैं और वे किस पौधों पर निर्भर हैं, तो हम दोनों को खो सकते हैं इससे पहले कि हमें उनके अस्तित्व का एहसास भी हो।”

- Almost all flowering plants depend on wild pollinators, particularly bees, but habitat loss and climate change are driving many vital species to the brink of extinction.

लगभग सभी फूल वाले पौधे जंगली परागणकर्ताओं, विशेष रूप से मधुमक्खियों, पर निर्भर हैं, लेकिन आवासीय क्षति और जलवायु परिवर्तन कई आवश्यक प्रजातियों को विलुप्ति के कगार पर पहुंचा रहे हैं।

DM

12/11/2025



## When data became the first responder

Andhra handled Cyclone Montha with maturity in disaster governance

GS III: Disaster Management

STATE OF PLAY

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Andhra Pradesh displayed a new level of maturity in disaster governance while dealing with Cyclone Montha, which struck the State's coast between October 27 and 30. Drawing lessons from the past, Andhra Pradesh fought back with precision – guided by data, technology, and teamwork.

The coordinated and technology-driven response demonstrated how governance can evolve from reactive relief to proactive resilience. Instead of waiting for disaster to strike, Andhra Pradesh anticipated it – pre-positioning resources, keeping transformers ready, and ensuring uninterrupted road access for rescue and restoration.

Digital dashboards, predictive analytics, drone surveillance, and GIS tools replaced traditional paperwork and panic-driven coordination. Through the Andhra Pradesh Weather Forecasting and Early Warning Research Centre (AWARE 2.0) and the Real-Time Governance Society (RTGS), the government built a live, interconnected decision system linking departments from Police and Revenue to Health and Panchayat Raj. The RTGS-led Data Lake project aims to integrate all departmental data to improve efficiency, enable services such as digital document storage, and strengthen analytics-based decision-making.

AWARE 2.0's forecasts proved remarkably accurate, predicting wind speeds between 80 kmph and 100 kmph, closely matching the actual 87 kmph recorded. The system enabled 72-hour early alerts



and facilitated the evacuation of around 10,000 people from high-impact zones in Kakinda and Konaseema. Over 1.1 crore safety messages were sent to citizens, while more than 12,000 grievances were tracked and resolved in real time through the Manamitra citizen engagement platform. Generators, pumps, and heavy machinery were positioned in advance, ensuring immediate response capability. Power utilities deployed transformer repair teams in advance as well, while digital inventory systems tracked resource deployment to eliminate duplication and ensure that smaller mandals were not overlooked.

National Disaster Response Force and State Disaster Response Force teams were deployed in advance across the coastal belt. Critical equipment, from communication kits to high-capacity pumps, was stationed in vulnerable areas. Arterial roads were kept clear for emergencies. Digital inventory management allowed the government to track where every machine, transformer, and vehicle was located.

Now that is over, officials and experts agree that Cyclone Montha must not remain a one-off triumph, but serve as a blueprint for institutionalised resilience. Technology, while indispensable, cannot guarantee safety on its own. True resilience demands that preparedness become a

daily practice. Schools and community buildings must be retrofitted as cyclone shelters; coastal regions reinforced with mangroves and embankments; and budgets must earmark funds for underground power cabling, flood-resistant embankments, and real-time sea-level monitoring.

Andhra Pradesh now has a strong operational blueprint, but sustaining it requires consistent investment and policy continuity. The private sector, too, has a role, by integrating disaster resilience into Environmental, Social, and Governance commitments through insurance coverage, climate-proof infrastructure, and corporate participation in local disaster planning.

Odisha's long-term transformation offers a reference. Since the devastation caused by the 1999 super-cyclone, the State has evolved a community-based preparedness model. Andhra Pradesh can emulate this model by empowering panchayats, decentralising disaster budgets, and embedding climate literacy across administrative levels.

While 'zero casualty' goals rightly focus on saving lives, fiscal planning must also prioritise long-term infrastructure resilience. Disaster mitigation funds should be directed toward strengthening power grids, communication networks, and transport corridors to withstand high-velocity winds and saline corrosion.

Cyclone Montha also exposed the broader ecological dimensions of vulnerability. Deforestation, mangrove loss, and unregulated coastal construction have eroded natural defences. Sustainable coastal planning and ecosystem restoration must, therefore, complement technological innovation.

### When data became the first responder

### जब डेटा पहला उत्तरदाता बना

- Andhra handled **Cyclone Montha** with maturity in disaster governance. आंध्र प्रदेश ने चक्रवात मॉन्था को आपदा शासन में परिपक्वता के साथ संभाला।



## Andhra Pradesh's Disaster Governance during Cyclone Montha

### चक्रवात मोंथा के दौरान आंध्र प्रदेश की आपदा शासन प्रणाली

- **Andhra Pradesh displayed a new level of maturity in disaster governance** while dealing with **Cyclone Montha**, which struck the State's coast between **October 27 and 30**.  
चक्रवात मोंथा, जिसने 27 से 30 अक्टूबर के बीच राज्य के तट पर प्रहार किया, से निपटने में आंध्र प्रदेश ने आपदा शासन में एक नई परिपक्वता का स्तर प्रदर्शित किया।
- Drawing lessons from the past, Andhra Pradesh fought back with **precision — guided by data, technology, and teamwork**.  
अतीत से सबक लेते हुए, आंध्र प्रदेश ने डेटा, तकनीक और टीमवर्क के मार्गदर्शन में सटीकता के साथ प्रतिक्रिया दी।
- The coordinated and **technology-driven response** demonstrated how governance can evolve from **reactive relief to proactive resilience**.  
इस समन्वित और तकनीक-आधारित प्रतिक्रिया ने दिखाया कि शासन प्रणाली कैसे प्रतिक्रियात्मक राहत से सक्रिय लचीलापन की ओर विकसित हो सकती है।
- Instead of waiting for disaster to strike, **Andhra Pradesh anticipated it** — pre-positioning resources, keeping **transformers ready**, and ensuring **uninterrupted road access** for rescue and restoration.  
आपदा के आने की प्रतीक्षा करने के बजाय, आंध्र प्रदेश ने उसका पूर्वानुमान लगाया — संसाधनों को पहले से तैनात किया, ट्रांसफॉर्मर तैयार रखे, और बचाव एवं पुनर्स्थापन के लिए अबाध सड़क पहुंच सुनिश्चित की।
- **Digital dashboards, predictive analytics, drone surveillance, and GIS tools** replaced **traditional paperwork and panic-driven coordination**.  
डिजिटल डैशबोर्ड, पूर्वानुमान विश्लेषण, ड्रोन निगरानी और जीआईएस उपकरणों ने पारंपरिक कागजी कार्यवाही और घबराहट-आधारित समन्वय की जगह ली।
- Through the **Andhra Pradesh Weather Forecasting and Early Warning Research Centre (AWARE 2.0)** and the **Real-Time Governance Society (RTGS)**, the government built a **live, interconnected decision system** linking departments from **Police and Revenue to Health and Panchayat Raj**.  
आंध्र प्रदेश वेदर फोरकास्टिंग एंड अर्ली वॉर्निंग रिसर्च सेंटर (AWARE 2.0) और रीयल-टाइम गवर्नेंस सोसाइटी (RTGS) के माध्यम से सरकार ने पुलिस, राजस्व, स्वास्थ्य और पंचायत राज विभागों को जोड़ने वाला एक लाइव, परस्पर जुड़ा हुआ निर्णय तंत्र बनाया।
- The **RTGS-led Data Lake project** aims to integrate all departmental data to **improve efficiency, enable digital document storage**, and strengthen **analytics-based decision-making**.  
RTGS द्वारा संचालित डेटा लेक परियोजना का उद्देश्य सभी विभागीय डेटा को एकीकृत कर दक्षता बढ़ाना, डिजिटल दस्तावेज़ भंडारण सक्षम करना, और विश्लेषण-आधारित निर्णय-निर्माण को सशक्त बनाना है।
- **AWARE 2.0's forecasts** proved remarkably accurate, predicting **wind speeds between 80 kmph and 100 kmph**, closely matching the **actual 87 kmph recorded**.  
AWARE 2.0 के पूर्वानुमान अत्यंत सटीक साबित हुए, जिन्होंने 80 से 100 किमी/घंटा की हवाओं की गति का अनुमान लगाया, जो वास्तविक 87 किमी/घंटा दर्ज गति से मेल खाती थी।
- The system enabled **72-hour early alerts** and facilitated the **evacuation of around 10,000 people** from high-impact zones in **Kakinada and Konaseema**.  
इस प्रणाली ने 72 घंटे पहले अलर्ट जारी किए और काकीनाडा और कोनसीमा के उच्च-प्रभाव क्षेत्रों से लगभग 10,000 लोगों के सुरक्षित निकासी में सहायता की।
- Over **1.1 crore safety messages** were sent to citizens, while more than **12,000 grievances** were tracked and resolved in real time through the **Manamitra citizen engagement platform**.  
नागरिकों को 1.1 करोड़ से अधिक सुरक्षा संदेश भेजे गए, जबकि 12,000 से अधिक शिकायतें मनमित्र नागरिक मंच के माध्यम से रीयल-टाइम में ट्रैक और हल की गईं।
- **Generators, pumps, and heavy machinery** were positioned in advance, ensuring **immediate response capability**.  
जनरेटर, पंप और भारी मशीनरी पहले से तैनात की गईं, जिससे तत्काल प्रतिक्रिया क्षमता सुनिश्चित हुई।
- **Power utilities deployed transformer repair teams in advance**, while **digital inventory systems tracked resource deployment** to eliminate duplication and ensure that **smaller mandals were not overlooked**.



विद्युत विभागों ने पहले से ट्रांसफॉर्मर मरम्मत टीमों को तैनात किया, जबकि डिजिटल इन्वेंट्री सिस्टम ने संसाधन तैनाती पर नज़र रखी, ताकि दोहराव से बचा जा सके और छोटे मंडलों की अनदेखी न हो।

## Cyclone Montha and Disaster Preparedness चक्रवात मोन्था और आपदा तैयारी

- **National Disaster Response Force (NDRF) and State Disaster Response Force (SDRF) teams were deployed in advance across the coastal belt.**  
राष्ट्रीय आपदा प्रतिक्रिया बल (NDRF) और राज्य आपदा प्रतिक्रिया बल (SDRF) की टीमों को तटीय क्षेत्रों में पहले से तैनात किया गया था।
- Critical equipment, from **communication kits to high-capacity pumps**, was stationed in vulnerable areas.  
संचार किट से लेकर उच्च क्षमता वाले पंपों तक के महत्वपूर्ण उपकरणों को संवेदनशील क्षेत्रों में रखा गया था।
- Arterial roads were kept clear for emergencies.  
आपात स्थितियों के लिए मुख्य सड़कों को साफ रखा गया था।
- **Digital inventory management** allowed the government to track every **machine, transformer, and vehicle.**  
डिजिटल इन्वेंट्री प्रबंधन ने सरकार को प्रत्येक मशीन, ट्रांसफार्मर और वाहन का पता लगाने की अनुमति दी।
- Officials and experts agree that **Cyclone Montha** must serve as a **blueprint for institutionalised resilience**, not a one-time triumph.  
अधिकारियों और विशेषज्ञों का मानना है कि **चक्रवात मोन्था** को केवल एक बार की सफलता नहीं बल्कि **संस्थागत लचीलापन के लिए एक खाका** बनना चाहिए।
- **Technology**, though indispensable, cannot guarantee safety on its own.  
**प्रौद्योगिकी**, जबकि अपरिहार्य है, अपने आप में सुरक्षा की गारंटी नहीं दे सकती।
- True resilience demands that **preparedness become a daily practice.**  
सच्ची लचीलापन की मांग है कि **तैयारी एक दैनिक अभ्यास** बन जाए।
- Schools and community buildings must be **retrofitted as cyclone shelters.**  
स्कूलों और सामुदायिक भवनों को **चक्रवात शरणस्थलों** के रूप में संशोधित किया जाना चाहिए।
- Coastal regions should be reinforced with **mangroves and embankments.**  
तटीय क्षेत्रों को **मैंग्रोव और तटबंधों** से सुदृढ़ किया जाना चाहिए।
- Budgets must earmark funds for **underground power cabling, flood-resistant embankments, and real-time sea-level monitoring.**  
बजट में **भूमिगत बिजली लाइनों, बाढ़ प्रतिरोधी तटबंधों और वास्तविक समय समुद्र-स्तर निगरानी** के लिए धन निर्धारित किया जाना चाहिए।
- **Andhra Pradesh** now has a strong operational blueprint, but sustaining it requires **consistent investment and policy continuity.**  
**आंध्र प्रदेश** के पास अब एक मजबूत परिचालन खाका है, लेकिन इसे बनाए रखने के लिए **निरंतर निवेश और नीति निरंतरता** की आवश्यकता है।
- The **private sector** should integrate disaster resilience into **Environmental, Social, and Governance (ESG)** commitments.  
**निजी क्षेत्र** को आपदा लचीलापन को **पर्यावरणीय, सामाजिक और शासन (ESG)** प्रतिबद्धताओं में शामिल करना चाहिए।
- This includes **insurance coverage, climate-proof infrastructure**, and corporate participation in **local disaster planning.**  
इसमें **बीमा कवरेज, जलवायु-संरक्षित अवसंरचना, और स्थानीय आपदा योजना** में कॉर्पोरेट भागीदारी शामिल है।
- **Odisha's long-term transformation** after the **1999 super-cyclone** serves as a model.  
**1999 के सुपर-चक्रवात** के बाद **ओडिशा का दीर्घकालिक परिवर्तन** एक आदर्श उदाहरण है।
- Andhra Pradesh can emulate this by **empowering panchayats, decentralising disaster budgets, and promoting climate literacy.**  
आंध्र प्रदेश इसे **पंचायतों को सशक्त बनाकर, आपदा बजट का विकेन्द्रीकरण करके, और जलवायु साक्षरता** को बढ़ावा देकर अपना सकता है।



- While ‘zero casualty’ goals focus on saving lives, **fiscal planning** must prioritise **long-term infrastructure resilience**.  
जबकि ‘शून्य हताहत’ लक्ष्य जीवन बचाने पर केंद्रित हैं, **राजकोषीय योजना** को **दीर्घकालिक अवसंरचना लचीलापन** को प्राथमिकता देनी चाहिए।
- **Disaster mitigation funds** should strengthen **power grids, communication networks, and transport corridors**.  
**आपदा शमन निधियों** को **विद्युत ग्रिड, संचार नेटवर्क और परिवहन गलियारों** को मजबूत करने के लिए उपयोग किया जाना चाहिए।
- These should be built to withstand **high-velocity winds and saline corrosion**.  
इन्हें **तेज हवाओं और लवणीय क्षरण** का सामना करने के लिए तैयार किया जाना चाहिए।
- **Cyclone Montha** revealed the **ecological dimensions of vulnerability**.  
**चक्रवात मोन्था** ने **कमजोरी के पारिस्थितिक आयामों** को उजागर किया।
- **Deforestation, mangrove loss, and unregulated coastal construction** have weakened natural defences.  
**वनों की कटाई, मैंग्रोव की हानि, और अनियंत्रित तटीय निर्माण** ने प्राकृतिक सुरक्षा को कमजोर कर दिया है।
- Hence, **sustainable coastal planning** and **ecosystem restoration** must complement **technological innovation**.  
इसलिए, **सतत तटीय योजना** और **पारिस्थितिकी तंत्र की पुनर्बहाली** को **प्रौद्योगिकीय नवाचार** के साथ जोड़ा जाना चाहिए।

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