



## Northeast India From Frontier to Frontrunner

**For Prelims:** [Northeast region](#), [Living root bridges](#), [Kaziranga National Park](#), [Inner Line Permit](#), [PM-DevINE](#), [Siliguri Corridor](#)

**For Mains:** Act East Policy and Role of Northeast India, Border Management and National Security in Northeast

[Source:TH](#)

### Why in News?

The Prime Minister at the “**Rising Northeast: The Investor Summit**” declared that the [Northeast Region \(NER\) of India](#) is no longer a “frontier” but a “frontrunner” in India’s growth journey. Highlighting its strategic importance and economic potential, he emphasized the region’s evolving role as a gateway for trade with [Southeast Asia](#).

**Note:** The **Ministry of Development of North Eastern Region (DoNER)** is organizing the **Rising Northeast Summit to unlock the investment and trade potential of the NER of India**.

- The initiative aims to project NER as a dynamic economic corridor with strategic connectivity to ASEAN and BBN (Bangladesh, Bhutan, Nepal) countries.
- Rising North East Investors Summit 2025 drew an **unprecedented Rs 4.3 lakh crore in investment interest**, setting the stage for the NER to become India’s next economic powerhouse.

### How is the Northeast Emerging as a ‘Frontrunner’ for India’s Growth?

- **Bio-economy and Natural Resources:** The NER, referred to as ‘**Ashta Lakshmis**’, highlights the region’s vast potential in renewable energy, agro-based industries, eco-tourism, and strategic manufacturing.
  - The region’s biodiversity is being leveraged for **green growth**. Assam is a major hub for [tea production](#), while Arunachal Pradesh leads in **bamboo-based industries**.
  - The region holds **40% of India’s hydropower potential (~62,000 MW)**, yet only 6.9% is harnessed. Solar potential is estimated at **57,360 MW with only 17% installed capacity**.
- **Tourism and Human Capital Strengths:** The Northeast’s natural beauty and vibrant culture make it a perfect destination for eco-friendly and sustainable tourism.
  - Key attractions include [Meghalaya’s living root bridges](#), [Sikkim’s eco-tourism](#), [Kaziranga National Park](#), and [Kamakhya Temple](#) in Assam, and [Manipur’s Loktak Lake](#). These sites boost local livelihoods and promote eco-friendly travel.
  - Additionally, high literacy rates among NER (~80%) and a high proportion of English-

speaking populations contribute to the region's workforce readiness.

- States like Manipur and Mizoram are national leaders in sports like football, boxing, and weightlifting.

- **Gateway to Southeast Asia:** The Northeast is central to [India's Act East Policy](#), serving as a bridge to ASEAN and Indo-Pacific markets.
  - Projects like the [India-Myanmar-Thailand Trilateral Highway](#) and the **Kaladan Multi-Modal Transit Transport Project** are enhancing regional connectivity.
  - Development of ports like **Sittwe in Myanmar** and **Chittagong in Bangladesh** will connect Northeast India to key Indian Ocean shipping routes, boosting India-ASEAN trade from **USD 125 billion to USD 200 billion over the next decade**.
- **Critical to National Security:** NER shares 5,484 km of borders with five countries (**Myanmar, Bangladesh, Nepal, Bhutan, Tibet/China**) plays a frontline role in national security.
  - The [Siliguri Corridor \(Chicken's Neck\)](#) is a vital **strategic and economic lifeline**, connecting Northeast India to the rest of the country and serving as a key transit hub for trade with Bhutan, Bangladesh, and Nepal.
- **Infrastructure Push:** The central government has significantly increased funding with 10% of the Ministry of Road Transport and Highways' budget allocated to the Northeast.
  - The [North East Special Infrastructure Development Scheme \(NESIDS\)](#), launched in 2018, has a USD 1 billion allocation for roads, water, and power.
  - Projects like the [Sela Tunnel in Arunachal Pradesh](#) are improving all-weather connectivity to remote areas. New initiatives like the upcoming [Semiconductor Plant in Assam](#) mark a shift toward high-tech industrial investment.



# What are the Challenges in Making Northeast India a Frontrunner?

- **Historical Insurgency and Security Issues:** Decades of insurgent movements (Naga, Mizo, ULFA, NDFB) created instability, affecting investment and development.
  - **Cross-border infiltration from Bangladesh and Myanmar** has posed persistent security challenges.
  - The [2023 ethnic violence in Manipur](#) between Meiteis and Kukis highlights deep-rooted tensions and fragile inter-community relations and **identity politics prevent** a unified development approach.
  - Fear of “outsiders” and demands for perpetuation of [Inner Line Permits \(ILP\)](#) create resistance to migration, investment, and entrepreneurship.
- **Agricultural Distress and Employment Gaps:** Although agriculture is the mainstay, the region faces serious issues like low productivity and lack of modern techniques.
  - **Middlemen dominance is prevalent in NER**, which traps farmers in debt and low income. Even cooperatives struggle to compete against these intermediaries.
  - Despite high literacy and English proficiency, a lack of industry-ready skills affects employability.
- **Low Tourist Footfall:** The region’s huge tourism potential is underutilized due to limited connectivity, safety concerns, and weak marketing.
- **Dependency on Central Funds:** Many NER states heavily rely on Union government support, indicating low fiscal self-reliance.
- **Limited Industrial Base:** Industrial development is uneven, and **high logistics costs discourage** large-scale investments.
- **Geographical Constraints and Environmental Vulnerability:** Difficult terrain, frequent floods, and landslides hamper infrastructure development and connectivity.
  - The Northeast faces **frequent floods, landslides, and erratic rainfall** that harm infrastructure and livelihoods.
  - The **2022 Assam floods**, which displaced millions, highlight the region’s ecological vulnerability, while climate change threatens agriculture and water security.
- **Drug Trafficking:** Proximity to the **Golden Triangle** makes the NER vulnerable to narcotics trafficking, especially in Manipur and Mizoram.
  - Rise in drug addiction among youth, overburdening healthcare systems and worsening the social fabric.

## What are Initiatives Related to Development of the Northeast Region?

- [PM’s Development Initiative for North East Region \(PM-DevINE\)](#)
- [North East Industrial Development Scheme \(NEIDS\)](#)
- [Mission Organic Value Chain Development for North Eastern Region \(MOVCDNER\)](#)
- [Uttar Poorva Transformative Industrialization Scheme \(UNNATI\)](#)
- [National Bamboo Mission](#)
- [Bharatmala Pariyojana](#)

## How can the NER be made the Frontrunner for India’s Growth??

- **Promoting Tourism and Cultural Economy:** Develop eco-tourism, spiritual tourism, and ethnic village circuits under [Swadesh Darshan 2.0](#) and [Dekho Apna Desh initiatives](#).
  - Encourage homestay models and cultural entrepreneurship through training and **micro-credit via Startup India and MUDRA loans**.
  - Organize more international cultural festivals (like **Hornbill and Pang Lhabsol**) to position the region as a soft power hub.
- **Human Capital Development:** Set up multidisciplinary universities and skill centers in partnership with institutions like IIT-Guwahati. Tailor skilling to regional strengths (e.g., handicrafts, agri-tech, hospitality, disaster response).
- **Promoting Organic Agriculture:** Provide better market access via **NE-RACE**, reducing the

### **middleman burden**

- Provide price incentives for organic produce, along with branding and marketing support under the [MOVCDNER](#).

- **Deepening Industrialization:** Revamp NEIDS with real-time monitoring, faster approvals, and targeted sectoral clusters (e.g., organic food, handicrafts, pharma, and agro-processing).
  - Establish **Border Economic Zones (BEZs)** in Nagaland, Manipur, and Mizoram similar to **Special Economic Zones (SEZs)** with plug-and-play infrastructure to boost industrial growth and cross-border trade.
- **Strengthening Infrastructure:** Expedite the rollout of **BharatNet through 5G corridors**, digital literacy programs, and tech hubs in every state capital.
  - Expand the **UDAN Scheme** with better last-mile air links, especially for tourist circuits and border trade zones.
- **Addressing Insurgency and Ethnic Conflicts:** Promote ethnic reconciliation via inclusive local governance, youth inter-community programs, job creation and ensuring political representation.
  - The **Lokur Committee (1965)** recommended **safeguarding tribal land rights, improving education, healthcare, employment for ST communities, and enhancing welfare schemes to tackle socio-economic challenges.**

### **Drishti Mains Question:**

Discuss the strategic significance of Northeast India in the context of India's Act East Policy and evolving geopolitical dynamics in the Indo-Pacific.

## **UPSC Civil Services Examination, Previous Year Questions (PYQs)**

**Q.** Cross-border movement of insurgents is only one of the several security challenges facing the policing of the border in North-East India. Examine the various challenges currently emanating across the India-Myanmar border. Also, discuss the steps to counter the challenges. **(2019)**

## **Strengthening Urban Biodiversity**

**For Prelims:** [Biodiversity](#), [International Day for Biological Diversity](#), [United Nations](#), [Convention on Biological Diversity \(CBD\)](#), [United Nations General Assembly \(UNGA\)](#), [United Nations Decade on Biodiversity](#), [Urban Heat Island Effect](#), [Wetlands](#), [Forest Survey of India \(2023\)](#), [Kunming-Montreal Global Biodiversity Framework \(GBF\)](#), [Sustainable Development Goals \(SDGs\)](#), [Reserved Forest](#), [Ramsar Site](#), [Miyawaki Method](#).

**For Mains:** Need of urban biodiversity and Ways to strengthen urban biodiversity in India.

[Source: TH](#)

## **Why in News?**

Urban [biodiversity](#) is vital for a **healthy planet** and **human well-being** but faces severe threats, from **habitat loss** and **climate change**. On [International Day for Biological Diversity \(22<sup>nd</sup> May\)](#), the theme **"Harmony with nature and sustainable development"** stresses the urgent need to integrate **ecological conservation** into **urban growth**.

# What is Urban Biodiversity?

- **About: Urban Biodiversity** refers to the **variety of living organisms** (plants, animals, fungi, and microorganisms) found within **cities and urban areas**.
  - It includes all life forms in **human-dominated environments**, such as **parks, gardens, green roofs, wetlands, and built structures**.
- **Key Components:**
  - **Green spaces:** **Parks, gardens, green belts**, lawns, roadside trees.
  - **Blue spaces:** **Lakes, rivers**, canals, ponds, **wetlands**.
  - **Built structures:** **Walls, roofs**, and abandoned buildings that provide habitats (e.g., bats in attics, birds nesting on buildings).
  - **Wildlife corridors:** Paths that allow animals to move **between green patches** (e.g., tree-lined streets)
- **Prominent Examples:**
  - **Wetlands within cities**, e.g., the Okhla Bird Sanctuary in Delhi, Varthur Lake in Bengaluru.
  - **Urban forests and biodiversity parks**, e.g., the Arignar Anna Zoological Park in Chennai.
  - **Rivers and lakes passing through cities**, supporting **aquatic biodiversity** (e.g., In **Pune**, the **Mutha** and **Mula rivers** demonstrate **high biodiversity**, with many **freshwater invertebrate species**).

## What is the Significance of Urban Biodiversity Conservation for India?

- **Mitigating Climate Change & Pollution:** Urban green spaces **reduce urban heat island effect** e.g., **Frankfurt's green belts lowered temperatures by 3.5°C**.
  - Trees **sequester carbon**, filter air pollutants, and **reduce noise pollution** (a **10m-wide tree line cuts noise by 5 decibels**).
  - **Wetlands** and urban forests help in **flood control and groundwater recharge**.
- **Health & Well-being Benefits:** **Parks and green spaces** offer a vital escape from “concrete jungles,” enhancing **mental health**, reducing **stress**, and providing **recreational** opportunities, while also supporting important **pollinators** like **bees** and **butterflies** that help secure **food supply**.
  - E.g., **Green walls shield Delhi from the hot desert winds** blowing in from Rajasthan to the west.
- **Economic Benefits:** Urban trees in mega cities deliver ecosystem services valued at **Rs 8 crore per sq. km annually**, including **air purification, temperature moderation, stormwater management, and aesthetic benefits**.
  - Proximity to parks and water bodies also raises **property values**, boosting **local economies**.
- **Global Commitments:** The **Kunming-Montreal Global Biodiversity Framework (GBF) Target 12** emphasizes **integrating green and blue spaces** into urban planning.
  - The **UN Sustainable Development Goals (SDGs) Goal 11** (Sustainable Cities and Communities) highlights the need to make cities **inclusive, safe, resilient, and sustainable**.

## What are the Key Issues Affecting Urban Biodiversity in India?

- **Rising Urban Sprawl:** In 2025, nearly **50% of the global population** lives in **urban areas**, projected to reach **70% by 2050** pressurising **natural green spaces**.
  - The **Forest Survey of India (2023)** shows major cities have an average forest cover of just **10.26%**, with **Mumbai** highest at **25.43%** and **Ahmedabad** lowest at **3.27%**.
  - From 2021 to 2023, **Chennai and Hyderabad** lost **2.6** and **1.6 sq. km** of forest, reflecting urban growth at the expense of **biodiversity**.
- **Heat Island Effect:** Concrete-dominated cities like **Delhi** are **4-6°C hotter** than rural areas, stressing **urban wildlife**.

- The **surface urban heat island effect** drives **birds** to **suburban areas**, impacting their **breeding** and **foraging**.
- **Loss of Urban Wetlands & Water Bodies:** The East Kolkata Wetlands, a Ramsar site, are under increasing threat from encroachment, endangering critical habitats for migratory birds such as the Northern Pintail.
  - Alarmingly, **just 15% of Chennai's wetlands survive** today—a steep drop from **80%** in earlier decades when the **city's urban footprint** was much smaller.
- **Pollution: Urban pollution—air, water, soil, and noise—harms biodiversity** by **disrupting animal health, communication, and ecosystems**, as seen in **Delhi's toxic air** and **Bangalore's polluted Bellandur Lake**.

## What Measures can be Adopted to Enhance Urban Biodiversity in India?

- **Promoting Green Infrastructure:** Promoting **green infrastructure** like parks, urban forests, wetlands, and green roofs boosts **urban biodiversity** and **climate resilience**.
  - Adopting **UN Habitat's 3-30-300 Rule**—3 trees in view, 30% canopy cover, and parks within 300m—enhances **ecosystem services**, cools cities, and supports wildlife.
- **Development of City Biodiversity Index:** The **City Biodiversity Index**, currently implemented in states like **Telangana** and **Madhya Pradesh**, assesses **native species, ecosystem services, and governance** to help cities create **Local Biodiversity Strategy and Action Plans (LBSAPs)** for **conservation** and enhanced **human well-being**, and should be expanded to all major **Indian cities** in a **phased manner**.
  - The **International Council for Local Environmental Initiative (ICLEI) Asia** developed a **City Biodiversity Index** using **23 indicators** for cities like **Kochi, Gangtok, and Nagpur**.
- **Restore and Protect Urban Water Bodies:** There is an urgent need to **manage garbage dumping** and **treat sewage pollution** in urban lakes using **conventional or nature-based solutions**, alongside **legal protection** to prevent further loss of lakes and wetlands.
  - E.g., The **Madras Race Club land** at **Guindy** is being transformed into a **lake** to enhance **groundwater recharge**, while the **Pallikaranai marsh** in **Chennai**—once a **wasteland** and **garbage dump**—has been partly **restored** and declared a [reserved forest](#) and [Ramsar site](#).
- **Decentralized Greening:** Decentralized greening empowers communities through **pocket parks, gardens, and street trees**, boosting local biodiversity.
  - E.g., Chennai's **Koyambedu market project 2021** regenerated 141 plant species and attracted **key bird and butterfly species**, outperforming the Miyawaki method by mimicking a natural **three-layered forest** on small urban lands.
- **Integrating Biodiversity into Urban Planning:** Enhancing **urban biodiversity** in India requires integrating **biodiversity** into **urban planning** through mandatory **impact assessments** and city-level **action plans** with **green corridors** and **habitat connectivity**.
  - **Strict penalties and enforcement** are needed to **prevent environmental violations** and ensure **sustainable urban growth**.
  - The [Supreme Court](#) of India's **firm action** against the mass tree destruction in **Hyderabad's Kancha Gachibowli area** for IT development sets a **key precedent** for urban biodiversity protection.

## International Day for Biological Diversity

- **About:** The [United Nations](#) declared **22nd May** as the **International Day for Biological Diversity (IDB)** to raise awareness about biodiversity.
  - Originally, the day was celebrated on **29th December**, marking the entry into force of the [Convention on Biological Diversity \(CBD\)](#).
  - However, in **2000**, the UN moved the date to **22nd May** to honor the adoption of the **CBD's text** on that day in **1992**.
- **Biological Diversity:** Biodiversity as a concept, first **coined** by **Walter G. Rosen in 1985** and includes the wide variety of **plants, animals, and microorganisms**, as well as the **genetic differences** within species (like different **crop varieties** and **livestock breeds**) and the variety

of **ecosystems** (lakes, forests, deserts, agricultural landscapes) where many living beings interact.

- These resources are the **foundation** of human civilization e.g.,
  - **Fish** provide **20%** of animal protein for about **3 billion people**,
  - **Plants** make up over **80%** of the human diet, and
  - About **80%** of people in rural areas of developing countries rely on **traditional plant-based medicines** for basic healthcare.
- The **United Nations General Assembly (UNGA)** designated the years **2011-2020** as the **United Nations Decade on Biodiversity**, aiming to advance the implementation of a **strategic plan for biodiversity**.

## Conclusion

**Urban biodiversity** is vital for **climate resilience**, **health**, and **economic prosperity**. With rising **urbanization**, integrating **green-blue spaces** through policies like the **3-30-300 rule**, **City Biodiversity Index**, and **community-driven conservation** is crucial. **Legal protection**, **decentralized greening**, and **wetland restoration** can ensure **sustainable cities**, balancing **development** with **ecological harmony** for **future generations**.

### **Drishti Mains Question:**

“Harmony with nature and sustainable development” is key to conserving urban biodiversity. Discuss the challenges and strategies for promoting biodiversity in rapidly urbanizing cities.

## UPSC Civil Services Examination Previous Year Question (PYQ)

### **Prelims**

**Q. With reference to the role of UN-Habitat in the United Nations programme working towards a better urban future, which of the statements is/are correct? (2017)**

- UN-Habitat has been mandated by the United Nations General Assembly to promote socially and environmentally sustainable towns and cities to provide adequate shelter for all.
- Its partners are either governments or local urban authorities only.
- UN-Habitat contributes to the overall objective of the United Nations system to reduce poverty and to promote access to safe drinking water and basic sanitation.

Select the correct answer using the code given below:

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

Ans: (b)

**Q. As per the Solid Waste Management Rules, 2016 in India, which one of the following statements is correct? (2019)**

- (a) Waste generators have to segregate waste into five categories.

(b) The Rules are applicable to notified urban local bodies, notified towns and all industrial townships only

(c) The Rules provide for exact and elaborate criteria for the identification of sites for landfills and waste processing facilities.

(d) It is mandatory on the part of the waste generator that the waste generated in one district cannot be moved to another district.

**Ans: (c)**

## **Mains**

Q. The frequency of urban floods due to high intensity rainfall is increasing over the years. Discussing the reasons for urban floods, highlight the mechanisms for preparedness to reduce the risk during such events. (2016)

Q. Do government's schemes for up-lifting vulnerable and backward communities by protecting required social resources for them, lead to their exclusion in establishing businesses in urban economies? (2014)

## **ICMR Launches First Stigma Scale for Sickle Cell Disease**

**Source: TH**

### **Why in News?**

The **Indian Council of Medical Research (ICMR)** has developed the ICMR-SCD Stigma Scale for India (ISSSI), the country's first tool to measure and address stigma faced by **sickle cell disease (SCD)** patients and their caregivers. The scale includes two components: ISSSI-Pt for patients and ISSSI-Cg for caregivers.

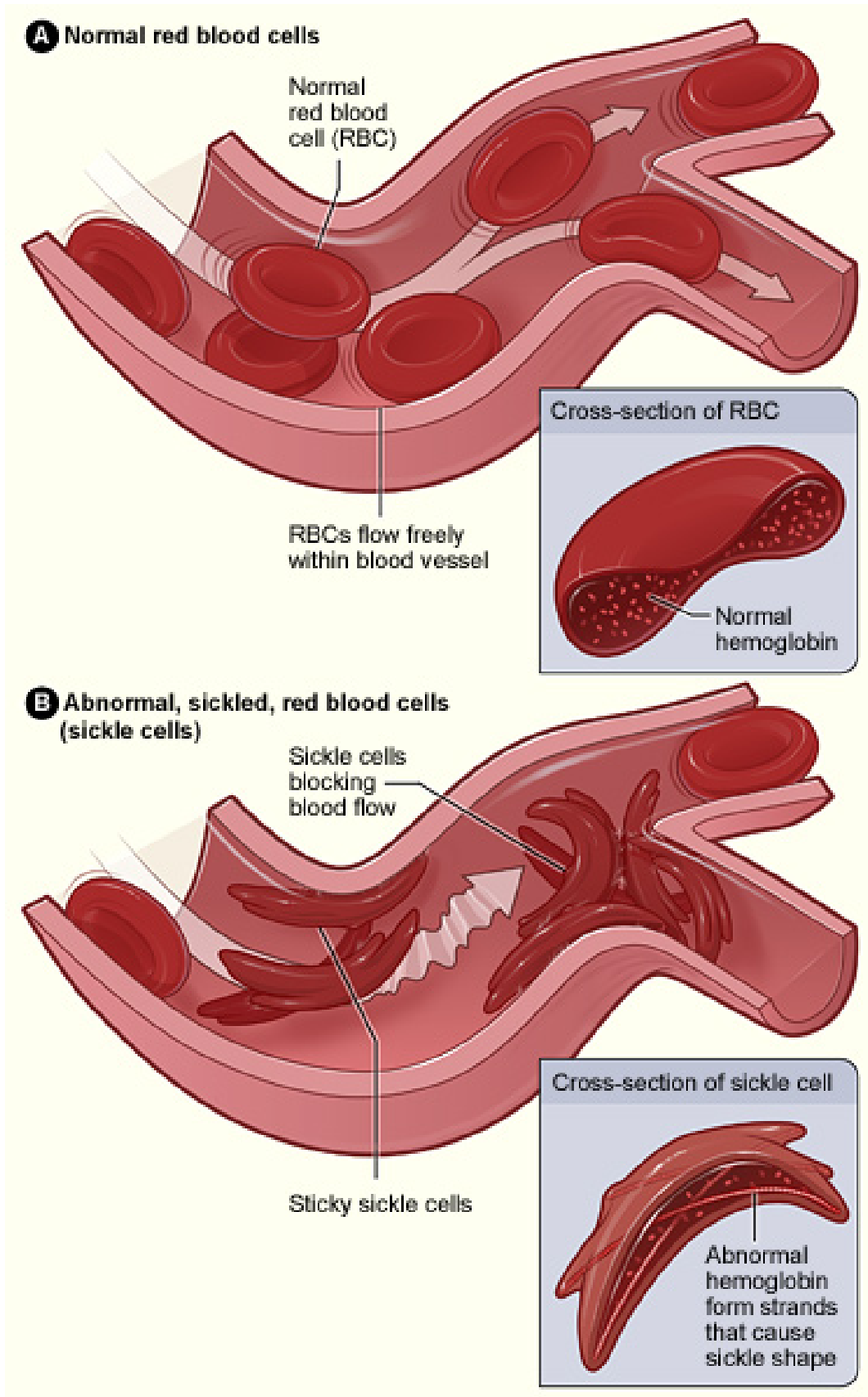
### **What are the Key Features of ICMR-SCD Stigma Scale for India?**

- **Multi-Dimensional Tool:** Assesses stigma in **5 areas- familial/reproductive stigma, disclosure issues, illness burden, discrimination, and healthcare stigma.**
- **Culturally Grounded:** Developed in **6 SCD-endemic districts** to reflect India's tribal, regional, and linguistic diversity.
  - Existing 3 **SCD stigma scales** from **Africa and America** were **unsuitable for India** due to **phenotypic, socio-cultural, and contextual differences**, necessitating a locally relevant tool.
- **Validated & Reliable:** Psychometrically **robust, suitable for clinical use, research, and policy evaluation.**

### **What is Sickle Cell Disease?**

- **About:**
  - **Sickle Cell Disease (SCD)** is a **hereditary blood disorder** caused by a **genetic mutation** in the **haemoglobin gene**, leading to **abnormal, crescent- or sickle-shaped red blood cells (RBC)** instead of the usual round shape.
    - These **sickle-shaped RBCs** are **less flexible and do not move easily** through **small blood vessels**, potentially **leading to blockages.**

- This **impairs blood circulation** and leads to **anaemia**, **organ damage**, **severe pain**, and **reduced lifespan**.



▪ **Causes :**

- Sickle cell disease is a **genetic disorder** caused by **inheriting two mutated  $\beta$ -globin genes**, one from each parent, resulting in the production of abnormal sickle haemoglobin.

▪ **Treatment:**

- **Gene Therapy:** SCD can be treated by **bone marrow** or **stem cell** transplantation by methods like **CRISPR**.
- **Blood Transfusions:** These can help **relieve anemia and reduce the risk of pain crises**.
- Medications for SCD include **Voxelotor** (prevents sickling and anemia), **Crizanlizumab** (reduces vessel blockage and pain crises), **Hydroxyurea** (lowers complications), and **L-glutamine** (reduces pain episodes), along with **nonsteroidal anti-inflammatory drugs (NSAIDs)** and **opiates** for pain relief.

▪ **Prevalence:**

- SCD is a **major public health concern** in India, with the **world's second-largest SCD burden**, with **over 1 million affected individuals**, and **ranks 3rd globally in SCD births** after **Nigeria** and the **Democratic Republic of the Congo**.
- Carrier rates among **tribal groups range from 1% to 40%**, with most patients concentrated in the tribal belt across **Odisha, Jharkhand, Chhattisgarh, Madhya Pradesh, and Maharashtra**.

▪ **Government Initiatives:**

- **National Sickle Cell Anaemia Elimination Mission:** Under this, **CSIR** is developing **gene-editing therapies for SCD**.
- **National Health Mission (NHM) 2013:** Special focus on **SCD**.
- **The National Guidelines for Stem Cell Research 2017:** It **restricts the commercialisation of stem cell therapies** to clinical trials, except for **Bone marrow transplantation (BMT)** for SCD.
- **Rights of Persons with Disabilities (RPwDs) Act, 2016:** SCD is included in the 21 disabilities that provide for **benefits of reservation**.

## UPSC Civil Services Examination Previous Year Question (PYQ)

### Prelims:

**Q. Consider the following statements in the context interventions being undertaken under Anemia Mukht Bharat Strategy : (2023)**

1. It provides prophylactic calcium supplementation for pre-school children, adolescents and pregnant women.
2. It runs a campaign for delayed cord clamping at the time of child-birth.
3. It provides for periodic deworming to children and adolescents.
4. It addresses non-nutritional causes of anaemia in endemic pockets with special focus on malaria, hemoglobinopathies and fluorosis.

## Oil Spills

**Source: TH**

### Why in News?

A Liberian-flagged cargo vessel carrying hazardous materials, including **calcium carbide** and **diesel**, sank off the Kerala coast, raising serious concerns over **oil spills**.

- **Calcium carbide (CaC<sub>2</sub>)** is a chemical that **reacts with seawater** to release [acetylene gas](#), which is **highly flammable** and hazardous.

## What are Oil Spills?

- **About: Oil Spills** refer to the release of **liquid petroleum hydrocarbons** into the environment, particularly into **oceans, rivers, or coastal waters** as a result of human activities.
- **Impact: Diesel, petroleum, crude oil, and other hydrocarbons** may be released from sources such as **tankers, offshore platforms, drilling rigs, or wells** which have **harmful** effects on **marine ecosystems, coastal livelihoods, and human health**.
  - **Marine Ecosystem:** Oil **coats the feathers of seabirds and fur of marine mammals**, leading to **hypothermia and death**. It **clogs fish gills, impairs reproduction**, and becomes toxic when ingested by marine life..
    - Oil films **block sunlight**, affecting **phytoplankton** and reducing oxygen levels. Coral reefs, mangroves, estuaries (e.g., Sunderbans) get smothered, disrupting ecosystems.
  - **Coastal Livelihood:** Oil spills **disrupt fishing, aquaculture, and coastal industries**, causing **economic hardship** for local communities.
    - Contaminated beaches and dead marine life **reduce tourism**, affecting livelihoods and regional economies.
    - **Cleanup and restoration efforts** lead to significant **financial burdens** on governments and industries.
  - **Human Health:** **Health and livelihood risks for indigenous communities** due to seafood contamination and reduced fish catches.

## What are the Measures to Clean Oil Spills?

Method	Description
<b>Bioremediation</b>	Uses <b>oil-degrading bacteria</b> (e.g., <i>Cycloclasticus</i> , <i>Oleispira</i> ) to <b>break down hydrocarbons</b> ; eco-friendly and accelerates natural detoxification.
<b>Containment Booms</b>	<b>Floating barriers</b> that <b>restrict oil spread</b> , aiding in containment, recovery, and minimizing environmental impact.
<b>Skimmers</b>	<b>Mechanical devices</b> that <b>collect oil from the water surface</b> for safe disposal or recycling; effective when deployed quickly.
<b>Sorbents</b>	They <b>absorb or adsorb</b> oil from water and are particularly <b>useful for small spills or residual oil</b> after primary cleanup.  Natural sorbents (Straw, Volcanic ash), Synthetic (Polyester-derived plastic shavings).
<b>Dispersing Agents</b>	<b>Surfactant-based chemicals</b> that <b>break oil into droplets</b> for <b>faster biodegradation</b> . It is effective but may harm marine life due to its <b>potential toxicity</b> .

## Mechanical Recovery



Vessels maneuver containment boom to capture and concentrate spilled oil. Oil is then removed from the water's surface with a skimmer. Recovered oil is stored and disposed of.

- + Oil is removed from the environment.
- Oil and water/debris must be stored.
- Resource intensive (vessels, people, equipment).

## Chemical Dispersants



Chemicals are applied to the oil spill that break the slick into smaller droplets that mix into the water, avoiding contamination of areas like beaches or tide flats.

- + Oil removed from the surface of the water.
- Oil is not actually removed from the environment.
- Impact of oil spill is shifted to below the ocean surface.
- Dispersants themselves may be toxic.

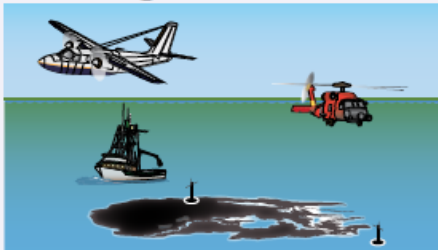
## In-Situ Burning



Vessels maneuver containment boom to contain and thicken the slick. Oil is then burned off the water's surface in a controlled fashion. Oil contained by ice may be able to be burned as well.

- + Oil removed from the surface of the water.
- Potential for air quality impacts due to smoke.
- Residue sinks if not collected and may be toxic.

## Tracking & Surveillance



Spill observation and mapping via aircraft or marine vessel, tracking buoys, or infrared technology may be used to find the spill.

- + Critical for determining the extent and trajectory of an oil slick.
- Method and effectiveness can be very limited by visibility.

## Shoreline Cleanup



Spilled oil which reaches the shore can be collected through a variety of methods, including spraying down with hoses, soaking up with absorbent materials or digging (manually or with heavy equipment).

- + Oil is removed from shoreline or displaced into the water for removal.
- Labor and time intensive.
- Impacts may have already occurred, or could be worsened.

**What are the Legal and Institutional Frameworks on Oil Pollution Control?**

▪ **Indian Legal Framework:**

- **Merchant Shipping Act, 1958:** Serves as the **primary maritime legislation**. Incorporates provisions of the [International Convention for the Prevention of Pollution from Ships \(MARPOL\) Convention](#) to **regulate ship-borne pollution**, including oil discharges.
- **National Oil Spill Disaster Contingency Plan (NOS-DCP), 1993:** Implemented by the **Indian Coast Guard**, as a key **framework for coordinated oil spill response**.
  - Though **not legally binding**, it ensures **timely and integrated action** among stakeholders.
- **National Green Tribunal (NGT) Act, 2010:** [NGT](#) provides a judicial mechanism for swift adjudication of environmental disputes, including marine pollution, and awards compensation for damages.

▪ **International Frameworks:**

- **Bunker Oil Convention (2001):** Ratified by India in 2015 under the [IMO](#), this convention **ensures prompt and adequate compensation** for **damage caused by fuel oil spills from ships' bunkers**, protecting those affected by such pollution incidents.
- **MARPOL 73/78 (Annex I):** India is a party to this **key international convention** aimed at **preventing marine pollution from ships**, covering both **operational discharges and accidental oil spills**.
- **Civil Liability Convention (CLC), 1969 & International Oil Pollution Compensation Fund (IOPC), 1992:** Establish **liability and compensation mechanisms for oil spill damage**. Facilitate **financial recovery and legal recourse for victims** and governments in the event of tanker spills.

## UPSC Civil Services Examination Previous Year Question (PYQ)

### Prelims

**Q. With reference to the United Nations Convention on the Law of Sea, consider the following statements:**

1. A coastal state has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles, measured from baseline determined in accordance with the convention.
2. Ships of all states, whether coastal or land-locked, enjoy the right of innocent passage through the territorial sea.
3. The Exclusive Economic Zone shall not extend beyond 200 nautical miles from the baseline from which the breadth of the territorial sea is measured.

**Which of the statements given above are correct?**

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

**Ans: (d)**

**Q. Which of the following can be threats to the biodiversity of a geographical area? (2012)**

1. Global warming
2. Fragmentation of habitat
3. Invasion of alien species
4. Promotion of vegetarianism

**Select the correct answer using the codes given below:**

- (a) 1, 2 and 3 only

- (b) 2 and 3 only  
(c) 1 and 4 only  
(d) 1, 2, 3 and 4

**Ans: (a)**

**Q. Biodiversity forms the basis for human existence in the following ways: (2011)**

1. Soil formation
2. Prevention of soil erosion
3. Recycling of waste
4. Pollination of crops

**Select the correct answer using the codes given below:**

- (a) 1, 2 and 3 only  
(b) 2, 3 and 4 only  
(c) 1 and 4 only  
(d) 1, 2, 3 and 4

**Ans: (d)**

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## Bharat Forecast System

**Source: IE**

The **India Meteorological Department (IMD)** is set to adopt the indigenously developed **Bharat Forecast System (BFS)**, India's first high-resolution weather model capable of forecasting at a 6 km x 6 km spatial resolution.

- **Bharat Forecast System (BFS)** has been developed by the **Indian Institute of Tropical Meteorology (IITM), Pune**, and will be **operationalised by IMD**.
- BFS significantly **improves upon IMD's existing resolution of 12 km x 12 km**, allowing for **more accurate detection of localised extreme weather events**, such as **cloudbursts and flash floods**.
  - The **current limitation of a 144 sq km unit of analysis** will be reduced to 36 sq km, enabling better micro-level weather predictions.
- The BFS model is expected to enhance **forecasting precision for cyclones, heavy rainfall, and monsoon variability**, especially at the district and sub-district levels.
- The BFS has been **tested in experimental mode since 2022** and is now being scaled for nationwide operational use with **high-performance computing support**.
- Currently, IMD uses the **Coupled Forecasting System (CFS)**, developed under the **Monsoon Mission** and adapted from a US-based model for Indian monsoon forecasting.
  - It also operates the **Global Forecasting System (GFS)**, a coupled ocean-atmosphere model, for forecasts ranging from hours to seasonal scales.

**Read more: [India Developing Early Warning Systems in Partner Nations](#)**

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# Jarosite

[Source: TH](#)

A new study highlights **jarosite** as a **natural luminescent mineral** capable of recording the **timing of ancient Martian** events such as **dust storms, flooding, and volcanic activity**. The mineral, also present in **Gujarat's Kutch region**, offers crucial insights due to its presence **both on Earth and Mars**.

- It is a **yellow-brown mineral** rich in **potassium, iron, and sulphate**, found in **arid, salty environments** like those on **Mars**.
  - It exhibits **radiation-induced luminescence**, serving as a **geological clock** that can record events up to **25,000 years** ago.
- **Occurrence:**
  - **Earth:** It is found in **acid mine drainage, sulfur-rich volcanic zones, and arid, sulfate-rich sedimentary rocks**.
  - **Mars:** It was detected by **NASA's Opportunity and Curiosity rovers** in **Meridiani Planum and Gale Crater**.
- It has been successfully used to **date weathering processes**, particularly with the **Potassium-Argon (K-Ar) dating method**.
  - **Potassium-Argon (K-Ar) dating method** is a **radiometric technique** used to determine the **age of rocks and minerals** based on the **decay of radioactive potassium-40** into **argon-40**.



Read More: [NASA's Mars Sample Return Program](#)

## India Becomes World's 4th Largest Economy

[Source: LM](#)

At the **10<sup>th</sup> NITI Aayog (National Institution for Transforming India) Governing Council Meeting**, NITI Aayog CEO announced that **India has overtaken Japan to become the world's 4th largest economy**, with its GDP crossing **USD 4 trillion**.

- India remains the **world's fastest-growing major economy** and is the only country projected to grow **over 6% annually for the next two years**.
  - This sustained growth is expected to raise India's **Gross Domestic Product (GDP)** to USD

5.58 trillion by 2028, enabling it to surpass **Germany and become the third-largest economy globally.**

- Earlier, the **International Monetary Fund (IMF)** in its **2025 World Economic Outlook Report** projected that India would become the fourth-largest economy **in 2025** with a nominal GDP of USD 4.187 trillion, overtaking Japan's USD 4.186 trillion.
- NITI Aayog:** NITI Aayog was established on **1st January 2015** as the successor to the **Planning Commission of India.**
  - It was created to serve as the **premier policy think tank of the Government of India**, focusing on inclusive and sustainable development through cooperative federalism and a bottom-up approach.
  - The **Prime Minister of India** serves as the Chairperson, while the **Vice-Chairperson** is appointed by the Prime Minister.
  - The **Governing Council** comprises the Chief Ministers of all States and the Lieutenant Governors of Union Territories, ensuring representation from across the country.

# NITI Aayog

(National Institution for Transforming India)

## HISTORY- PLANNING COMMISSION

Set up in **1950**  
to direct investment  
activity

Replaced by **NITI Aayog** on January 1, 2015

### Composition of #NITIAayog

- Chairperson**  
Prime Minister
- Governing Council**  
CMs (States) and Lt Governors (UTs)
- Regional Councils**  
Formed on need-basis, comprising CMs and Lt Govs of the region
- Members**  
Full-time basis
- Part-time Members**  
Max 2, rotational, from relevant institutions
- Ex-officio Members**  
Max 4 from Council of Ministers, nominated by PM
- Special Invited**  
Experts, specialists, practitioners with domain knowledge
- Chief Executive Officer**  
Appointed by PM for fixed tenure (Secy rank)
- Secretariat**  
As deemed necessary

## OBJECTIVES

- Foster **cooperative federalism**
- Develop mechanisms to **formulate credible plans (village level)**
- Interests of **national security** in economic strategy and policy
- Special **attention to weaker sections**
- Provide advice and encouragement to partnerships between **key stakeholders, national-international Think Tanks, research institutions**
- Create **knowledge, innovation and entrepreneurial support system**
- Platform** for inter-sectoral and inter-departmental **issues resolution**
- Maintain **state-of-the-art Resource Centre**

### NITI Aayog vs Planning Commission

NITI Aayog	Planning Commission
Advisory Think Tank	Extra-constitutional body
Wider expertise	Limited expertise
Secretaries (CEO) appointed by PM	Secretaries appointed by usual process
Bottom-up approach	Top-Down approach
No Mandate to impose policies	Imposed policies on states
No power to allocate funds	Allocated funds to ministries/state govts

## Major Initiatives

- SDG India Index
- Atal Innovation Mission
- e-AMRIT Portal (electric vehicles)
- Good Governance Index
- India Innovation Index
- Aspirational District Programme
- 'Methanol Economy' programme

## Issues

- No powers** in granting **discretionary funds** to states
- Only an **advisory body**
- No role** in influencing private or public investment
- Politicisation of the organisation**
- Lacks the requisite power** to bring positive change

## Charaka and Sushruta Legacy

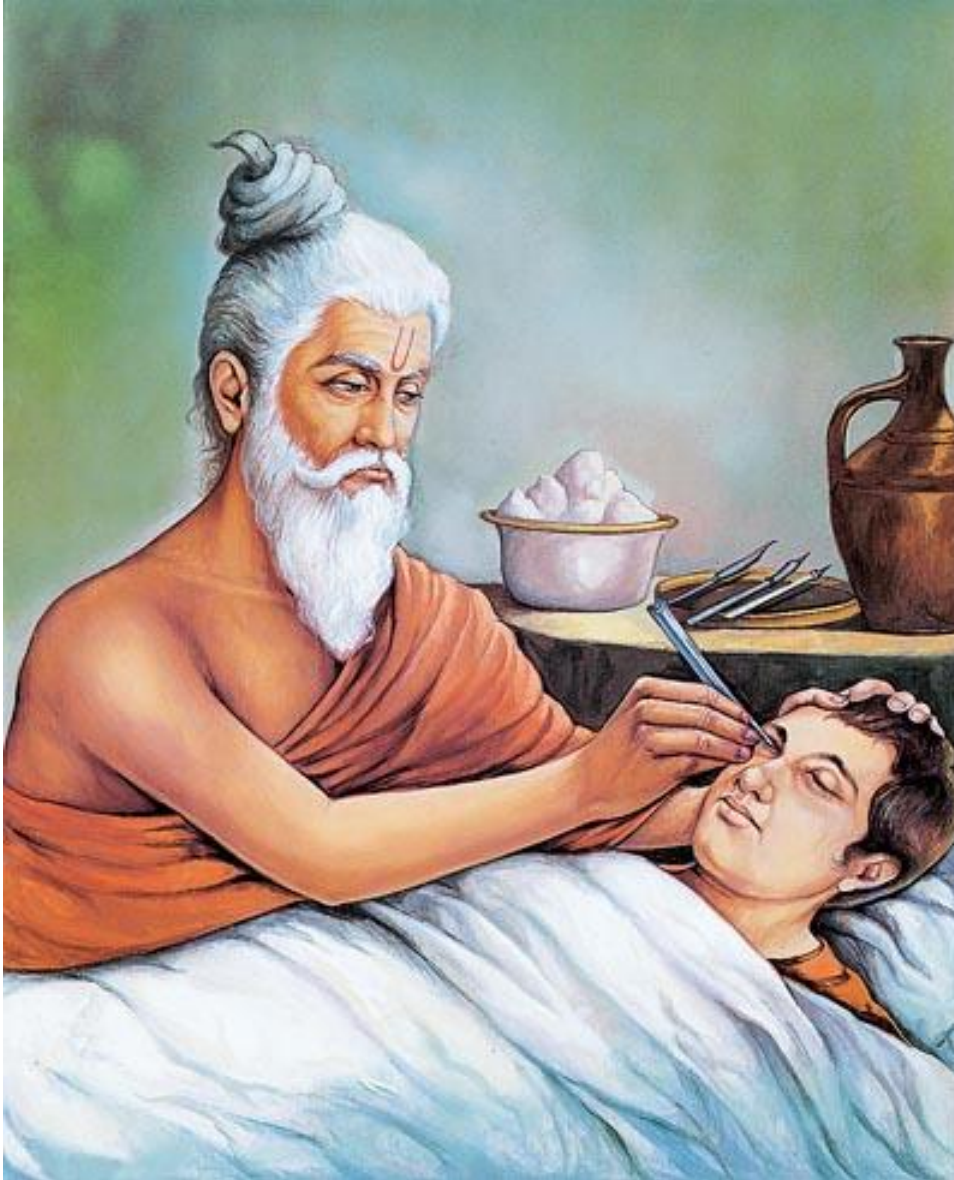
Source: [PIB](#)

The [Vice-President](#) commissioned the statues of [Charaka](#) and [Sushruta](#) at Raj Bhavan, Goa and recalled their contributions.

- **Charaka:** Charaka (around 2nd century BCE and the 2nd century CE), known as the **father of medicine**, served as the **royal physician of Kanishka (Kushan Kingdom)**.
  - He authored the [Charaka Samhita](#), a foundational text of [Ayurveda](#).
  - The **Agnivesha Samhita**, written by **Agnivesa** in the 7th century BCE under the guidance of **Atreya**, was **revised** and **renamed** the **Charaka Samhita** by **Charaka**, and divided it into **eight sections** known as **Ashtanga Sthanas**.
    - **Dhabala** (scholar of Ayurveda) later **added 17 chapters** to the Charaka Samhita.



- **Sushruta: Sushruta** (7th–6th century BCE), an ancient Indian physician, is called the "**Father of Surgery**" and "**Father of Plastic Surgery**."
  - Sushruta was a **disciple of Dhanvantari**, one of the **Navratnas** of **King Vikramaditya (Chandragupta II)**.
  - He authored the **Sushruta Samhita**, one of the earliest texts on plastic surgery.
    - The **Sushruta Samhita** is a part of Ayurveda's **Great Trilogy** alongside **Charaka Samhita** and **Astanga Hridaya**.
  - He performed and documented over **300 surgical procedures**, including **plastic surgery (e.g., rhinoplasty i.e., rebuilding of the nose)**, gutter removal, fracture management, and even caesarean delivery.
    - He treated numerous cases of **Oshtha Sandhan (lobuloplasty)** and **Karna Sandhan (otoplasty)** as well.



**Read More:** [Surgery and Ayurveda](#)