



Journey of Sanchi Stupa to Europe

For Prelims: [East Gate of Sanchi Stupa](#), [Sanchi Stupa](#), [Toranas](#), [Buddha](#), Satavahana Dynasty, [Jataka Tales](#), [Shalabhanjika](#), [Manushi Buddhas](#), [Enlightenment](#), [Shunga Period](#), [Archaeological Survey of India \(ASI\)](#)

For Mains: Significance and preservation of India's heritage sites, Buddhism

Source: [IE](#)

Why in News?

Recently, India's External Affairs Minister visited the **replica** of the [East Gate of Sanchi Stupa](#) standing in front of **Humboldt Forum museum** in Berlin, Germany.

- It is a **1:1 reproduction** of the original structure standing at almost **10 metres high and 6 metres wide**, and weighing roughly 150 tonnes.

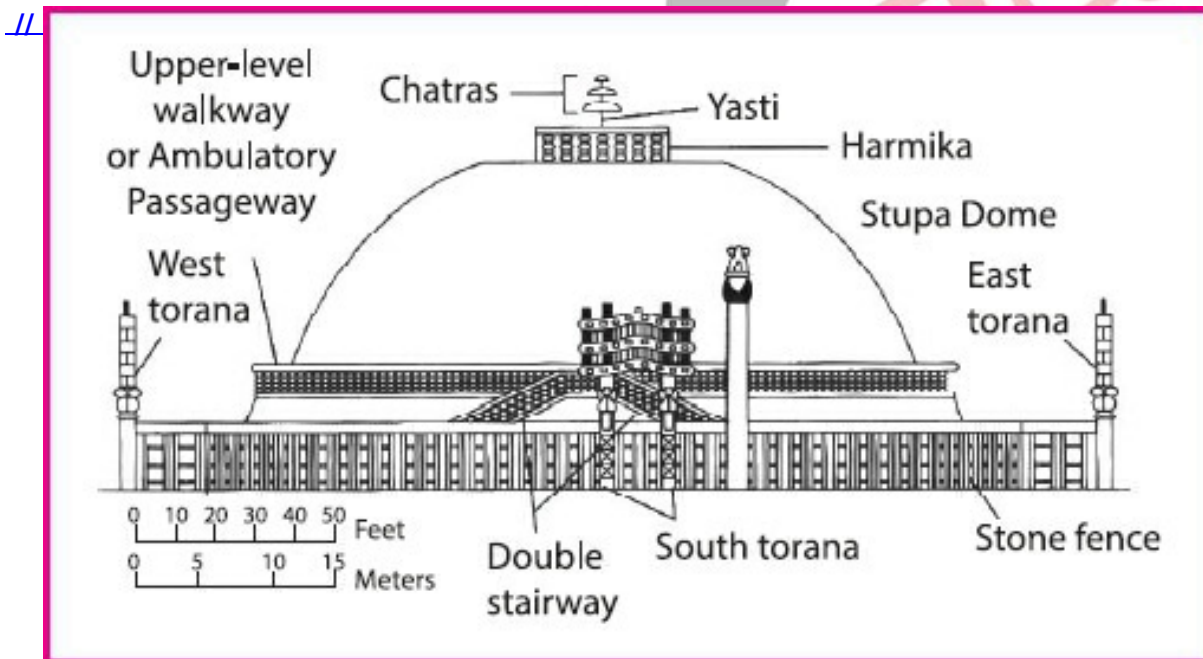
Journey of East Gate of Sanchi Stupa to Europe

- The **East Gate of Sanchi Stupa** was cast in plaster by **Lieutenant Henry Hardy Cole** for the [Victoria and Albert Museum](#) in the **late 1860s**.
- **Multiple copies of this cast were later made**, and displayed across Europe.
 - A plaster cast of the original gate was on **display** in the entrance hall of the **Königliches Museum für Völkerkunde Berlin** from **1886**.
 - A cast of this preserved copy was made of **artificial stone in 1970**.
- **The latest Berlin replica too traces its origin to this original cast.**
 - It was made with the help of [3D scanning](#), modern robots, skilled German and Indian sculptors, and enlarged photos of the **original torana** for aid.

What are Key Facts about the Sanchi Stupa?

- **Construction of Sanchi Stupa:** It was built by **Ashoka** in the **third century BC**.
 - Its construction was overseen by **Ashoka's wife Devi**, who hailed from the nearby trading town of **Vidisha**.
 - The development of the Sanchi complex was supported by patronage from Vidisha's **mercantile community**.
- **Expansion:** During the **2nd century BC (Shunga period)**, the stupa was enlarged with sandstone slabs, a **circumambulatory walkway**, and a **harmika** with a **chattra (umbrella)**.
 - From the **1st century BC to the 2nd century AD**, four stone gateways or **toranas were added**, adorned with detailed carvings depicting Buddhist iconography and stories.
- **Rediscovery of Sanchi Stupa:** It was in abject ruins when it was **discovered** by British officer **Henry Taylor in 1818**.

- **Alexander Cunningham** led the **first formal survey** and excavations at Sanchi in **1851**.
- **Preservation Efforts:** In **1853**, **Sikander Begum of Bhopal** offered to send Sanchi gateways to **Queen Victoria**, but the removal plans were delayed due to the **1857 revolt** and transportation issues.
 - In 1868, the Begum renewed the offer, but the colonial authorities declined it, opting for **in-situ preservation**. A **plaster cast** of the eastern gateway was created instead.
 - The site was restored to its present condition by **Archaeological Survey of India (ASI)** director-general **John Marshall in the 1910s** with funding from the begums of nearby Bhopal.
 - Marshall's efforts led to the creation of a **museum in 1919** at the site to preserve artefacts and manage conservation.
- **Architecture of Sanchi Stupa:**
 - **Anda:** It is a **hemispherical mound** built on earth.
 - **Harmika: Square railing** on top of the mound. It is believed to be the living place of god.
 - **Chattra:** It is the **umbrella** built on the top of the dome.
 - **Yashti:** It is the **central pillar** supports a triple umbrella structure called chattra.
 - **Railing:** It **surrounds the stupa**, demarcating the sacred area and providing a physical boundary between the holy space and the external environment.
 - **Pradakshinapatha (Circumambulatory Path):** It is a **walkway around the stupa** that allows devotees to walk in a clockwise direction as a form of worship.
 - **Torana:** Torana is a monumental **gateway or entrance** structure in Buddhist stupa architecture.
 - **Medhi:** It refers to the **base** which forms a platform on which the main structure of the stupa stands.



- **UNESCO Recognition:** Sanchi Stupa was inscribed as a **UNESCO World Heritage site** in 1989.

What are the Key Features of the Gateways of Sanchi Stupa?

- **Construction:** The **four gateways (toranas)**, oriented to the four cardinal directions, were constructed in the **first century BCE**.
 - Gateways were built over a period of a few decades during the **Satavahana dynasty's rule**.
- **Structure:** These gateways are made of **two square pillars** which support a superstructure comprising **three curved architraves (or beams)** with spirally-rolled ends.
- **Engravings:** The pillars and the architraves are adorned with beautiful **relief and**

sculptures depicting scenes from the **Buddha's life**, stories from the **Jataka tales**, and other Buddhist iconography.

- It includes the **shalabhanjika** (a fertility emblem represented by a **yakshi** grasping the branch of a tree), elephants, winged lions, and peacocks.
- However, the gates **do not represent the Buddha** in his **human form**.

▪ **Philosophical Significance:** The three curved **architraves (or beams)** have the following philosophical significance.

- **Upper Architrave:** It represents the **seven Manushi Buddhas** (previous Buddhas incarnation).
- **Middle Architrave:** It depicts the scene of the **Great Departure**, when prince **Siddhartha leaves Kapilavastu** to live as an ascetic in search of **enlightenment**.
- **Lower Architrave:** It depicts **Emperor Ashoka** visiting the **Bodhi tree** under which the **Buddha attained enlightenment**.

GAUTAM BUDDHA

Believed to be 9th of the 10 incarnations of Lord Vishnu (Dashavatar)

BIRTH

- Born as Siddhartha (563 BC)
- Birthplace - **Lumbini** (Nepal) near **Kapilavastu**

PARENTS

- Father - elected ruler of Kapilavastu; headed **Shakya republican clan**
- Mother - princess from **Koshalan dynasty**

IMPORTANT EVENTS

- Buddha's Birth
- The Great Departure (Mahabhinishkramana)
- Enlightenment (Nirvana)
- First Sermon (Dhammachakraparivartan)
- Death (Mahaparinirvana)

*Buddha referred to himself as **Tathagata** (one who has thus come/gone) and has been addressed as **Bhagavat** (in Buddhist texts)*

CONTEMPORARIES

- Vardhaman Mahavira
- Bimbisara
- Ajatshatru

OTHER IMPORTANT PLACES ASSOCIATED WITH BUDDHA

- **Bodh Gaya** (Enlightenment) (named Buddha after attaining enlightenment)
- **Sarnath** (first sermon)
- **Vaishali** (Last sermon)
- **Kushinagara** (death place (483 BC))

Conclusion

- The Sanchi Stupa stands as a monumental testament to ancient Buddhist architecture and devotion. As a **UNESCO World Heritage site**, the stupa continues to inspire reverence and scholarly interest, bridging the past with contemporary global appreciation. Recent examples, such as Germany's construction of a replica of the East Gate of Sanchi Stupa, underscore the universal value of preserving such monuments.

Drishti Mains Question:

Q. Discuss the architectural evolution and historical significance of the Sanchi Stupa

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q. Consider the following historical places: (2013)

1. Ajanta Caves
2. Lepakshi Temple
3. Sanchi Stupa

Which of the above places is/are also known for mural paintings?

- (a) 1 only
(b) 1 and 2 only
(c) 1, 2 and 3
(d) None

Ans: (b)

Q. Some Buddhist rock-cut caves are called Chaityas, while the others are called Viharas. What is the difference between the two? (2013)

- (a) Vihara is a place of worship, while Chaitya is the dwelling place of the monks
(b) Chaitya is a place of worship, while Vihara is the dwelling place of the monks
(c) Chaitya is the stupa at the far end of the cave, while Vihara is the hall axial to it
(d) There is no material difference between the two

Ans: (b)

Mains

Q. Indian philosophy and tradition played a significant role in conceiving and shaping the monuments and their art in India. Discuss. (2020)

Q. Early Buddhist Stupa-art, while depicting folk motifs and narratives successfully expounds Buddhist ideals. Elucidate (2016)

International Cooperation on Green Hydrogen

For Prelims: [International Conference on Green Hydrogen 2024 \(ICGH-2024\)](#), [G20 Nations](#),

[Paris Commitments](#), [Green Hydrogen](#), [International Energy Agency \(IEA\)](#), [Grey Hydrogen](#), [Electrolysis](#), [Fuel Cells](#), [Rare Materials](#), [Hydrogen Council](#), [Horizon Europe](#), [Global Hydrogen Coalition](#).

For Mains: International cooperation for scaling up production of green hydrogen.

Source: [LM](#)

Why in News?

Recently, the Prime Minister (PM) virtually addressed the second [International Conference on Green Hydrogen 2024 \(ICGH-2024\)](#) being held at [Bharat Mandapam, New Delhi](#).

- The PM emphasised the need for **international cooperation** to scale up **green hydrogen production, reduce costs**, and promote **research and development**.

What are Key Highlights of ICGH-2024?

- **Counting India's Achievements:** India is among the first [G20 nations](#) to fulfil its [Paris commitments](#) on green energy. India's commitments were fulfilled **9 years ahead** of the target of 2030.
 - India pledged to increase **non-fossil energy** capacity to **500 GW (gigawatts)** and **reduce** the total projected carbon emissions by **1 billion tonnes** by 2030.
 - **Installed non-fossil fuel capacity** in India increased by nearly **300%** over the past decade.
- **Emerging Importance of Green Hydrogen:** Green Hydrogen is identified as a key component in the global energy landscape, with potential to **decarbonise difficult-to-electrify sectors** such as refineries, fertilisers, steel, and heavy-duty transportation.
 - It can also serve as a **storage solution for surplus renewable energy**.
- **Investment in Research:** The conference called for investments in **cutting-edge research and development**, partnerships between industry and academia and encouragement for **start-ups and entrepreneurs** of the Green Hydrogen.
 - PM urged the **domain experts** and the scientific community to lead the way in [Green Hydrogen adoption](#).
- **G20 Summit Insights:** PM underlined the [New Delhi G-20 Leaders' declaration](#) that adopted five high-level **voluntary principles on Hydrogen** that are helping in the creation of a **unified roadmap**.
- **Critical Questions:** PM asked about ways to improve electrolyser efficiency, use seawater and [municipal wastewater](#) for production, and explore **Green Hydrogen's role** in public transport, shipping, and waterways.

Note

- India has announced an exclusive partnership with the **European Hydrogen Week**, set to take place in November 2024.
- It highlights India's intent to address the **green regulations** of the [European Union](#).
- Also, **Indian Railways** plans field trials of the first **hydrogen fuelled train** in January 2025.
 - **A 1200 KW DEMU (Diesel Electric Multiple Unit)** will be converted into a **hydrogen fuel cell-based DPRS** (Distributed Power Rolling Stock) for the trials.

Why International Cooperation is Needed in Promotion of Green Hydrogen?

- **High Production Costs:** According to the [International Energy Agency \(IEA\)](#), the cost of producing **green hydrogen** can range from **USD 3 to USD 8 per kilogram**, significantly higher than **grey hydrogen** produced from fossil fuels.
- **Technology and Infrastructure Investment:** The cost of **alkaline electrolyzers** has decreased by **40% between 2014 and 2019**, but further **cost reductions** are **needed** to make green hydrogen **competitive**.
- **Electrolysis Costs:** Green hydrogen is produced through **electrolysis**, which requires substantial amounts of electricity. As of 2023, the **production cost of green hydrogen remains high** compared to conventional hydrogen.
- **Efficiency of Electrolyzers:** According to India's **Ministry of New and Renewable Energy**, current electrolyzers are **not yet efficient enough** for widespread adoption. Research and development are required to improve efficiency and reduce costs.
- **Resource Availability:** According to the [European Commission](#), the availability of **rare materials** for electrolyser and **fuel cells** presents another challenge.
 - The need for metals like **platinum and iridium** can constrain the scalability of green hydrogen technologies.
- **Scaling Up Production:** Scaling up production to meet global demands poses a significant challenge.
 - The [EU's Hydrogen Roadmap](#) indicates that achieving the necessary scale for green hydrogen production requires coordinated efforts across industries and governments.

How can International Cooperation Help in Promotion of Green Hydrogen?

- **Scaling Up Production:** An estimate from a recent [Hydrogen Council report](#) suggests that Asia will require **USD 90 billion** investment in hydrogen projects by 2030.
 - According to the [IEA](#), **joint ventures** and cross-border **collaborations** can significantly accelerate the scaling of green hydrogen production technologies by leveraging diverse **technological capabilities** and **manufacturing resources**.
- **Economies of Scale:** The [European Commission](#) highlights that joint international initiatives can drive down costs through shared investments and bulk purchasing of materials.
 - For example, a group of 30 pioneering European energy companies officially launched **"HyDeal Ambition"** with the aim of delivering **100% green hydrogen** across Europe at a low cost of **Euro 1.5/kg**.
- **Shared Infrastructure:** Shared infrastructure for green hydrogen production, storage, and distribution can lower investment costs and make the technology more economically viable.
 - Collaborative infrastructure projects, like the **Asia-Pacific Hydrogen Association's** regional networks, illustrate how shared facilities can decrease costs.
- **Innovation Through Partnerships:** Global partnerships drive innovation by bringing together diverse research perspectives and funding sources.
 - E.g., the **Global Hydrogen Coalition** is a prominent example of a platform that brings together **governments, industry leaders, and research institutions** to drive innovation in hydrogen technologies.
- **Unified Policies and Regulations:** International collaboration helps in developing **cohesive policies and regulations** that support green hydrogen development.
 - The 2023 G20 Summit, under India's presidency, adopted **voluntary principles for green hydrogen** which would help in creating a **common roadmap**.
- **Investment and Funding:** Joint **funding initiatives and investment** from international sources can accelerate research and deployment.
 - E.g., Several research and innovation projects on hydrogen are ongoing within [Horizon Europe](#), the EU's Framework Programme for Research and Innovation.
 - These projects are managed through the **Clean Hydrogen Partnership (2021-2027)**, a joint public-private partnership supported by the European Commission.

NATIONAL GREEN HYDROGEN MISSION

NODAL MINISTRY

- ▶ Ministry of New and Renewable Energy

OBJECTIVE

- ▶ Decarbonise energy/industrial/mobility sector
- ▶ Develop indigenous manufacturing capacities
- ▶ Create export opportunities for GH_2 and its derivative

COMPONENTS OF NGHM

- ▶ Strategic Interventions for Green Hydrogen Transition Programme (SIGHT)
- ▶ Strategic Hydrogen Innovation Partnership (SHIP) (PPP for R&D)

GH_2 is not commercially viable at present; current cost in India is around ₹350-400/kg. The National Hydrogen Energy Mission aims to bring it down under ₹100/kg.

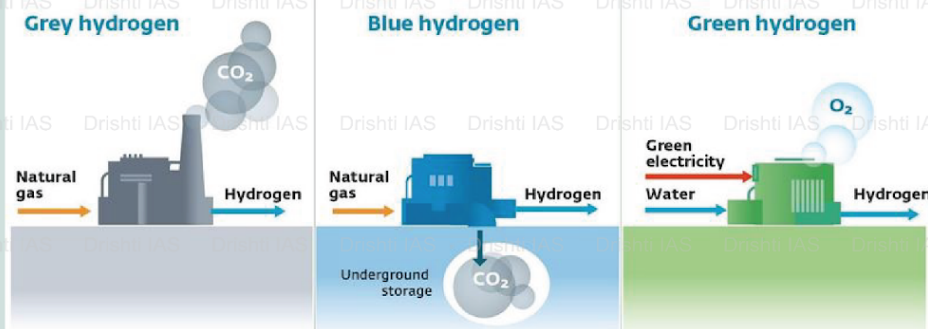
Expected Outcomes by 2030

- ◆ At least 5MMT GH_2 annual production
- ◆ Rs 1 lakh crore fossil fuel import savings
- ◆ 6 lakh jobs
- ◆ 50MMT CO_2 annual emissions averted
- ◆ ₹ 8 lakh crore investment

HYDROGEN AND GREEN HYDROGEN

Hydrogen is the most common element in nature but exists only in combination with other elements. It has to be extracted from naturally occurring compounds (like water).

Green Hydrogen (GH_2) is made by splitting water through an electrical process called electrolysis, using an electrolyser powered by renewable energy (RE).



Conclusion

International cooperation is **essential** for advancing green hydrogen. By **sharing technology, harmonising policies, and pooling investments**, nations can overcome production and infrastructure challenges. Collaborative efforts ensure efficient **global supply chains**, reduce costs, and foster public acceptance. **Unified global action** accelerates the transition to a sustainable energy future and maximises green hydrogen's potential.

Drishti Mains Question:

Q. How can international cooperation contribute to the promotion and development of green hydrogen as a sustainable energy source?

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Consider the following heavy industries: (2023)

1. Fertilizer plants
2. Oil refineries
3. Steel plants

Green hydrogen is expected to play a significant role in decarbonizing how many of the above industries?

- (a) Only one
(b) Only two
(c) All three
(d) None

Ans: (c)

Q. With reference to green hydrogen, consider the following statements : (2023)

1. It can be used directly as a fuel for internal combustion.
2. It can be blended with natural gas and used as fuel for heat or power generation.
3. It can be used in the hydrogen fuel cell to run vehicles.

How many of the above statements are correct?

- (a) Only one
(b) Only two
(c) All three
(d) None

Ans: (c)

Q. Hydrogen fuel cell vehicles produce one of the following as “exhaust” (2010)

- (a) NH_3
(b) CH_4
(c) H_2O
(d) H_2O_2

Ans: (c)

La Niña Predictions

For Prelims: [La Niña](#), [El Niño Southern Oscillation \(ENSO\)](#), [the eastern Pacific](#), [trade winds](#), [climate change](#), [National Oceanic and Atmospheric Administration \(NOAA\)](#), [Bureau of Meteorology \(BoM\)](#), [India Meteorological Department \(IMD\)](#), [Madden Julian Oscillation \(MJO\)](#), [the Arabian Sea](#), [cyclone](#).

For Mains: Differentiate between El Niño and La Niña, its affect on Indian weather conditions.

Source: [IE](#)

Why in News?

Recently, all **major global meteorological agencies** have notably **missed the mark** in their **predictions for La Niña in 2024**.

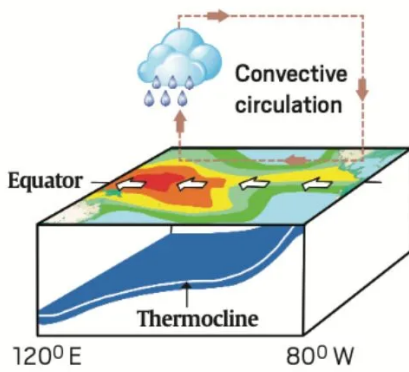
- India had relied on this crucial climate phenomenon to bring increased rainfall during August-September 2024.

What is La Niña?

- La Niña**, meaning "**The Little Girl**" in Spanish, is a phase of the [El Niño Southern Oscillation \(ENSO\)](#), a phenomenon that significantly drives global natural climate variability.
 - ENSO is characterized by **fluctuations in sea surface temperatures** across the **tropical Pacific Ocean**, resulting from atmospheric variations above.
 - These **changes disrupt global atmospheric circulation** and have widespread impacts on weather patterns across the world.
- The ENSO **occurs in irregular cycles** ranging from two to seven years and comprises **three phases**: warm (El Niño, or "The Little Boy" in Spanish), cool (La Niña), and neutral.
- During the **neutral phase**, [the eastern Pacific](#) (near the northwestern coast of South America) is **cooler than the western Pacific** (around the Philippines and Indonesia).
 - This **temperature difference arises due to** prevailing [trade winds](#), driven by Earth's rotation, which move from east to west between 30 degrees north and south of the equator, pushing warmer surface water westward.
 - As a result, **cooler waters from below rise to the surface** to replace the displaced warm water.
- During the [El Niño phase](#), **trade winds weaken**, resulting in **less displacement of warm waters** along the American coasts, causing the eastern Pacific to warm more than usual.
- In the **La Niña phase**, **trade winds strengthen**, pushing larger volumes of water toward the western Pacific, leading to **cooler temperatures in the eastern Pacific**.
 - In India, **El Niño** is typically linked to **reduced rainfall during the monsoon season**, while **La Niña tends to enhance monsoon activity**.
 - The most recent El Niño event occurred between June 2023 and May 2024, following one of the longest recorded La Niña episodes, which lasted from 2020 to 2023.
- The **impacts of both El Niño and La Niña-related hazards**, including extreme temperatures, heavy rainfall, and droughts, have been intensified by [anthropogenic climate change](#).

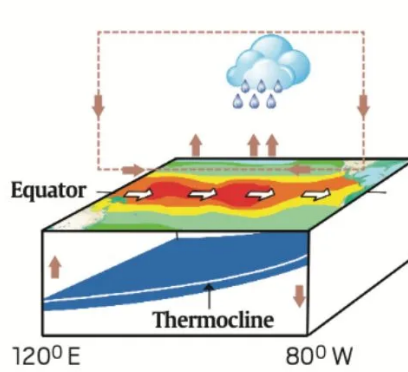
THE THREE PHASES OF EL NIÑO SOUTHERN OSCILLATION (ENSO)

The illustrations show the Pacific Ocean around the equator and the trade winds above it. The heat map shows water temperature. Thermocline is the layer of water separating the warmer surface water and cooler water below



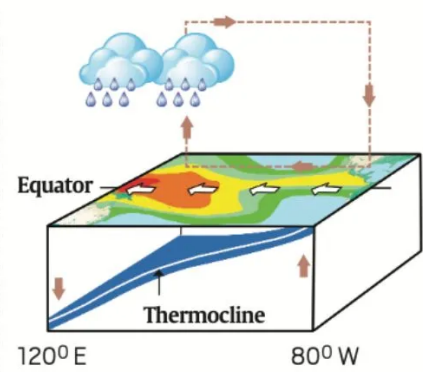
Neutral phase

Eastern Pacific is cooler than Western; thermocline indicates upwelling in the east as trade winds carry surface water westward; normal rainfall in Asia



El Niño phase

Difference in temperature between East and West Pacific decreases; lesser upwelling in east; rain clouds get pulled towards the Americas, Asia gets less rain



La Niña phase

Eastern Pacific is much cooler than Western; considerable upwelling in the east as more surface water heads westward; heavy rainfall in Asia



El Niño Southern Oscillation (ENSO)

Describes the fluctuations in temperature between the ocean and atmosphere **in the east-central Equatorial Pacific**

Significance:

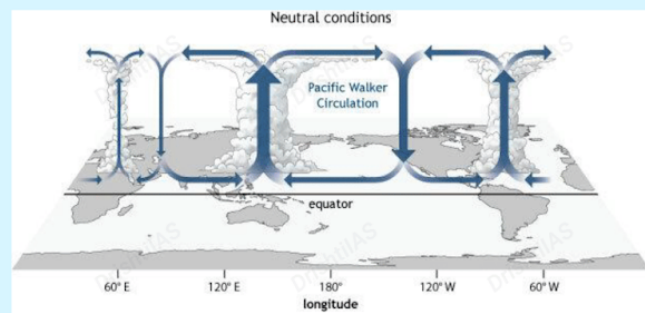
- Ability to change the global atmospheric circulation, influencing temperature and precipitation worldwide

States of ENSO:

- The two opposite phases - **El Niño** and **La Niña**
- The middle of the continuum - **Neutral**

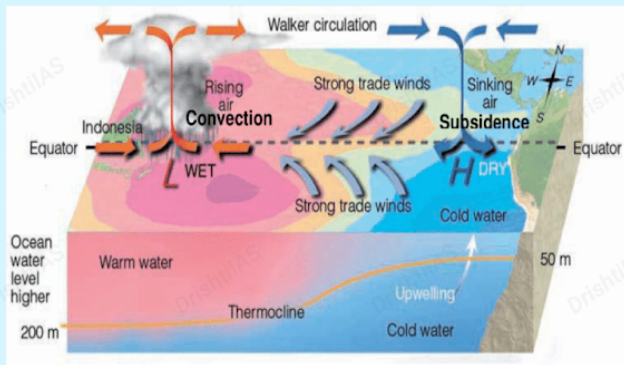
Walker Circulation (WC)

- An **atmospheric system of air flow** in the equatorial Pacific Ocean
 - The trade winds across the tropical Pacific flow from east to west: air rises above the warm waters of the western Pacific, flows eastward at high altitudes, and descends over the eastern Pacific
- WC and ENSO:
 - **A weak/reverse WC produces El Niño**
 - **Stronger WC results in La Niña**



Normal (non ENSO) Conditions in the Pacific Ocean

NEUTRAL ENSO



- **Trade winds (easterlies) blow west** along the equator, taking warm water from S. America towards Asia
- To replace that warm water, **cold water rises from the depths** — a process called **upwelling**
 - **El Niño and La Niña** are two climate patterns that **break these normal conditions**
- During an El Niño, sea level pressure tends to be lower in the eastern Pacific and higher in the western Pacific while the opposite tends to occur during a La Niña
 - This see-saw in atmospheric pressure between the eastern and western tropical Pacific is called the **Southern Oscillation (SO)**

What did Global Weather Models Predict in 2024?

- One of the strongest **El Niño events** on record **concluded in June 2024**, after which the **ENSO**

entered a neutral phase.

- Initial forecasts from multiple global weather models predicted the onset of La Niña conditions around July. However, by mid-July, it became evident that La Niña would be delayed.
- The US-based **NOAA** indicated that the transition from neutral to positive sea surface temperatures, signaling the **shift from ENSO neutral to La Niña**, would likely **occur between August and October**.
 - Similarly, the **Bureau of Meteorology (BoM) in Australia** maintained a La Niña 'watch' in July 2024, predicting the development of **cooler-than-usual sea surface conditions** in the latter half of the year.
 - Since its initial Long Range Forecast issued in mid-April, the **India Meteorological Department (IMD)** consistently projected the emergence of La Niña.
- Crucially, **La Niña was expected to enhance rainfall in August and September 2024**, with seasonal prediction hinging on La Niña's development, which was anticipated to result in 'above normal' rainfall during the final two monsoon months.

El Niño and La Niña

El Niño

- Warming of the ocean surface/ Above average sea surface temp. (SST)
- Easterly winds either weaken or start blowing in the opposite direction
- First noticed by Peruvian fishermen in the 1600s
- More frequent than La Niña

Impacts

- Drastically higher rainfall in S. America (coastal flooding and erosion)
- Droughts in Indonesia and Australia; wildfires
- Weaker monsoons and even droughts in India and SE Asia
- Reduces the upwelling of cooler, nutrient-rich waters from the deep - along the west coast of South and Central America.

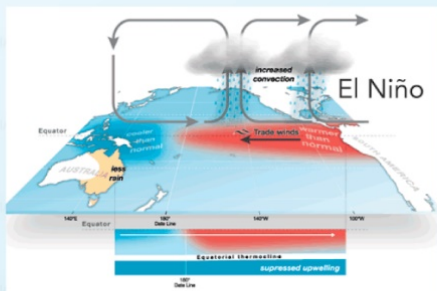


Fig. 1 - Depiction of El Niño Phenomenon

La Niña

- Also called El Viejo, anti-El Niño, or simply "a cold event"
- Normal easterly winds along the equator become even stronger
- May last 1-3 years, unlike El Niño (which usually lasts no more than a year)

Impacts

- Heavier rains in SE Africa, catastrophic floods in Australia
- Drier-than-normal conditions in S. America
- Summer Monsoon rainfall - greater than normal rainfall in India; beneficial for agriculture dependent Indian economy
- Off the west coast of the Americas, upwelling increases, bringing cold, nutrient-rich water to the surface.

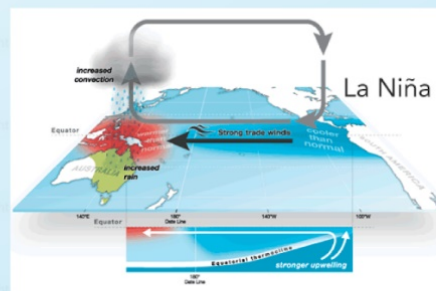


Fig. 2 - Depiction of La Niña Phenomenon

Oceanic Niño Index (ONI)

- It is a measure of the departure from normal sea surface temperature in the east-central Pacific Ocean.
- It is the standard means by which each El Niño episode is determined, gauged, and forecast.

Why were Initial Predictions off the Mark?

- The **reason cited by weather meteorologists for the error** in predicting La Niña's onset is its **expected mild intensity**.
 - **Weather models** tend to detect signals **more accurately during strong La Niña** (or El Niño) phases, but are **less precise with weaker ones**.

- Additionally, various factors influence surface and subsurface conditions across the Pacific Ocean, including **inter-seasonal variability in atmospheric conditions, winds, and pressure**.
 - These are closely linked to the movement of [the Madden Julian Oscillation \(MJO\)](#), an **eastward-moving band of rain-bearing winds and clouds**.
 - The **interaction of these** different weather systems **complicates predictions**.
- Recent forecasts suggest that the first signs of La Niña's onset will likely appear by late September or early October, with **La Niña peaking in November and continuing throughout the winter in the northern hemisphere**.

What will be the La Niña's Impact on Indian Weather?

- La Niña is typically **associated with enhanced rainfall during India's southwest monsoon**.
 - However, since 2024 monsoon season is nearly over and **La Niña conditions have yet to develop in the equatorial Pacific Ocean**, this climatic phenomenon will not directly influence the country's rainfall at present.
- If La Niña begins by late September or October, it may **influence rainfall during the northeast monsoon season** (October-December), which primarily affects Tamil Nadu, coastal Andhra Pradesh, Rayalaseema, southern interior Karnataka, and Kerala.
 - Climatologically, **La Niña is not favorable for northeast monsoon rainfall**, although there have been exceptions in the past.
- The north Indian Ocean basin, including the **Bay of Bengal and the Arabian Sea**, typically **experiences cyclone development during March to May and October to December**, with peak activity in May and November.
 - **During La Niña years**, there is a **higher likelihood of frequent cyclogenesis**, with storms potentially being more intense and longer-lasting.
 - La Niña years have historically been associated with **harsher and colder winters**.

Drishti Mains Question:

Discuss the phenomenon of La Niña and its impact on the Indian monsoon. How does it differ from El Niño in terms of its effects on India's climate?

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q. La Nina is suspected to have caused recent floods in Australia. How is La Nina different from El Nino? (2011)

1. La Nina is characterised by an usually cold ocean temperature in equatorial Indian Ocean whereas El Nino is characterised by unusually warm ocean temperature in the equatorial Pacific Ocean.
2. El Nino has adverse effect on south-west monsoon of India but La Nina has no effect on monsoon climate.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Ans: (d)

Mains

Q. Drought has been recognized as a disaster in view of its spatial expanse, temporal duration, slow onset and lasting effects on vulnerable sections. With a focus on the September 2010 guidelines from the National Disaster Management Authority (NDMA), discuss the mechanisms for preparedness to deal with likely El Nino and La Nina fallouts in India? **(2014)**

Fecal Microbiota Transplantation

[Source: TOI](#)

Why in News?

The concept of using **fecal matter as a medical treatment**, known as **fecal microbiota transplantation (FMT)**, has gained attention as a game-changer for treating **gut disorders**, despite its initial unsettling nature.

- India has made progress in this field, and the treatment is reshaping lives, though it still faces challenges.

What is Fecal Microbiota Transplantation?

- **About:** FMT involves the transfer of fecal material from a healthy donor into the **gastrointestinal tract** of a patient with an imbalanced or **unhealthy gut microbiota**.
 - The primary goal is to **repopulate the recipient's gut with beneficial bacteria from the donor**, helping to restore a healthy microbiome and improve gut health.
- **Benefits:** The human gut is home to a diverse community of microorganisms that play crucial roles in **digestion, immune function, and protection against harmful pathogens**.
 - FMT helps to correct disruptions in the gut microbiome, often caused by factors such as **antibiotics, steroids, or infections like *Clostridium difficile*** (a bacterium that can cause diarrhoea, colitis, and serious bowel problems).
 - By introducing healthy bacteria, FMT aims to restore balance and enhance overall gut function.
- **Challenges and Limitations:** FMT is not yet regulated by **central health authorities like the [Indian Council of Medical Research \(ICMR\)](#)**, which raises concerns about standardisation and safety.
 - The process requires **stringent donor screening to avoid risks**, including infectious diseases and microbiome diversity.
 - The 'yuck' factor linked with fecal material remains as a barrier for many patients, despite the treatment's efficacy.
- **Future of FMT:** Researchers stress that more studies are needed to fully understand the role of microbiomes and establish FMT as a standard care practice.
 - Trials and studies are essential to refine protocols and ensure the safety and effectiveness of FMT. Comprehensive guidelines and protocols are needed to standardise the practice and address ethical concerns.

WHAT IS FMT?

■ Faecal Microbiota Transplantation (FMT) is a procedure that delivers a healthy human donor's stool to another person via colonoscopy, enema or nasogastric (NG) tube. It can come in the form of pills which is an easier way to perform FMT. Last year, US FDA approved a pill for C diff infections



WHAT IS IT USED TO TREAT?

■ Mainly debilitating gastrointestinal infections that keep recurring despite antibiotic therapy. Doctors in India have found it to be useful treatment for alcohol-associated hepatitis, autism

Gut Microbiota

- It refers to the **vast collection of trillions of microorganisms**, including bacteria, viruses, fungi, and protozoa, that **inhabit the human gastrointestinal tract**. This diverse community plays a crucial role in maintaining overall health and supporting various bodily functions.
- It helps in breaking down complex food components and produces essential vitamins like B12 and K. Beneficial microbes prevent harmful bacteria from colonising the gut.
- **Metabolism & Energy Balance:** Influences fat storage, energy absorption, and has links to obesity, metabolic disorders and including [Autism](#).
- **Gut-Brain Connection:** Affects mood and mental health through the gut-brain axis, linked to anxiety and depression.

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Consider the following statements in respect of probiotics:

1. Probiotics are made of both bacteria and yeast.
2. The organisms in probiotics are found in foods we ingest but they do not naturally occur in our gut.
3. Probiotics help in the digestion of milk sugars.

Which of the statements given above is/are correct?

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

Ans: (c)

Exp:

- Probiotics are a combination of live beneficial bacteria and/or yeasts that naturally live in your body. Bacteria is usually viewed in a negative light as something that makes you sick. **Hence, statement 1 is correct.**

High Altitude Pathogens

Source: NYT

Why in News?

Recently, studies over **Japan** at altitudes up to 10,000 feet, have found different **bacteria** and **fungi** types in the air, **which could be the cause of Kawasaki diseases.**

- Scientists have been studying **airborne microbes** since the 1920s, capturing **spores** and other biological particles floating in the atmosphere.

What are the Key Facts about the Study?

- **Air Sampling Over Japan:** Researchers conducted flights to collect **airborne particles** over the **Sea of Japan**, focusing on **air masses** from China.
 - The samples contained a rare mineral called **hafnium**, likely originating from Chinese mines.
 - Northeastern China could be a significant source of airborne pathogens due to extensive farming, **livestock** operations, and **soil erosion.**
- **Connection to Kawasaki Disease:** The study was inspired by research linked to **Kawasaki disease.**
 - It was observed that Kawasaki disease cases in Japan increased when winds blew from **northeast China**. This suggests that winds may transport **pathogens** or other elements that contribute to the disease.

Hafnium

- Hafnium is a **good absorber of neutrons** and is used in the **control rods of nuclear reactors.**
- Hafnium is also used in **vacuum tubes** as a **getter**, a material that combines with and removes trace gases from vacuum tubes.
- Hafnium has been used as an **alloying agent** in iron, titanium, niobium and other metals.

What is Kawasaki Disease?

- **About:** Kawasaki disease, or Kawasaki syndrome, is an **inflammation**, in the walls of **blood vessels** that carry blood throughout the body.
 - The inflamed blood vessels increases the risk of tearing or narrowing, **limiting blood flow** to tissues and organs.
- **Prevalence:** It primarily affects children aged **6 months to 5 years**.
 - It occurs in about **10 to 20 per 100,000 children** under 5 in the US and Canada, while in Japan, Korea, and Taiwan, it affects **50 to 250 per 100,000 children** under 5.
- **Causes:** The exact cause of Kawasaki disease is unknown, but it is suspected to be linked to **bacterial or viral infection**, environmental factors, or genetics.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q. Consider the following kinds of organisms: (2012)

1. Bacteria
2. Fungi
3. Flowering plants

Some species of which of the above kinds of organisms are employed as biopesticides?

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

Ans: (d)

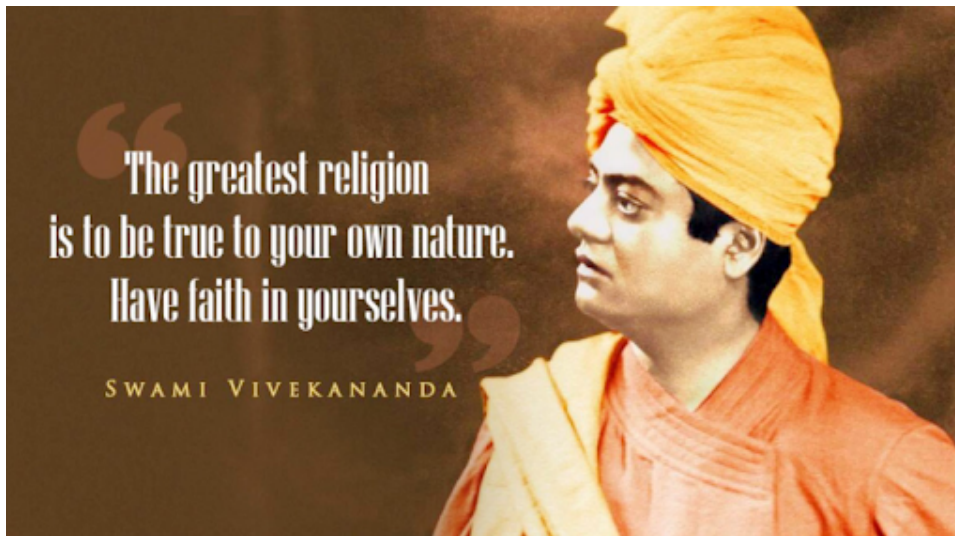
132nd Anniversary of Swami Vivekananda's 1893 Chicago Speech

[Source: PIB](#)

Recently, on the **132nd anniversary of Swami Vivekananda's 1893 Chicago speech**, the Prime Minister of India highlighted its enduring message of unity, peace, and brotherhood, emphasising its continued inspiration for generations.

- **Swami Vivekananda**, a key figure in introducing **Hinduism, Yoga, and Vedanta** to the West, spoke at the **Parliament of the World's Religions (PWR) in Chicago in 1893**, advocating for religious tolerance.
 - He condemned **sectarianism, bigotry** (complete intolerance of any belief), and **fanaticism**, highlighted Hinduism's inclusivity with its sheltering of **Jews and Zoroastrians** and aligned his message with the **Bhagavad Gita's** teaching of universal unity.

- PWR originating from the **1893 World's Columbian Exposition in Chicago**, it serves as a global platform for interfaith dialogue. Based in Chicago, it is an international NGO affiliated with the [United Nations Department of Public Information](#).
- **Swami Vivekananda was born as Narendranath Datta in Calcutta on 12th January, 1863. He was the chief disciple of [Ramakrishna Paramhansa](#) and advocated the doctrine of service, education, and spiritual upliftment.**
 - He founded the [Ramakrishna Mission](#) in 1897 to propagate the ideals of Advaita Vedanta. He died in 1902 at Belur Math, the headquarters of Ramakrishna Math & Ramakrishna Mission.
- **[National Youth Day](#)** is celebrated every year to observe the birth anniversary of Swami Vivekananda.



Read more: [Swami Vivekanada](#)

IGI Among the World's Best Connected Airports

Source: [HT](#)

According to the **Official Airline Guide (OAG)**'s report, Delhi's **Indira Gandhi International Airport (IGIA)** secured **24th position** (among the top 50 most internationally connected airports worldwide) reflecting its **growing importance as a [global aviation hub](#)**.

- OAG is the **world's leading data platform** for the global travel industry.
 - According to the report, **the first position was secured by London's Heathrow Airport (LHR)**, followed by Kuala Lumpur International Airport (KUL) in Malaysia.
- IGI Airport has been awarded as the **first [NetZero Carbon Emission Compliant airport](#)** in India. It is the only airport in the country with four runways.
 - It also inaugurated the **country's first elevated cross taxiway in 2023**.
- **India's Aviation Sector:**
 - India has emerged as the **third-largest domestic aviation market in the world**, after the USA and China.
 - India's airport network has witnessed a remarkable transformation, doubling its operational airports from **74 in 2014 to 148 in April 2023**, facilitating increased air travel accessibility.

- The **Ministry of Civil Aviation (MoCA)** has taken initiatives to work towards carbon neutrality and achieving **net zero carbon emissions** at airports in the country.

Read More: [India's Ambitious Airport Expansion Plan](#)

Beekeeping as Deterrent on Bangladesh Border

Source: [HT](#)

Recently, the **Border Security Force (BSF)** has started using **beekeeping** as an **innovative strategy** to deter **cross-border infiltration** and **smuggling** activities from Bangladesh.

- BSF jawans have been trained to use **apiaries**—box-like structures with frames where bees build hives.
- The bees are used to create a **natural deterrent** along the border, as the **threat of bee stings** discourages smugglers and infiltrators from approaching the fence.
 - Since the installation of the apiaries, incidents of **fence-cutting and illegal entry** have almost **reached zero**.
- The initiative not only serves a **security purpose** but also provides jawans with the opportunity to learn **beekeeping**, which they can continue as a **source of income** after retirement.
- Bangladesh and India share a **4,096-kilometre border**, the **fifth-longest** in the world.
 - The border touches the Indian states of **Assam, West Bengal, Mizoram, Meghalaya, and Tripura**.



Read More: [India-Bangladesh Relations](#)

Exercise Eastern Bridge

[Source: PIB](#)

The **7th edition** of the bilateral air exercise between [Indian Air Force \(IAF\)](#) and **Royal Oman Air Force** is scheduled to be conducted from 11th to 22nd September 2024 at **Masirah, Oman**.

- It will include complex **aerial manoeuvring**, air-to-air and air-to-ground operations, and logistical coordination.
- The **first edition** was held between the two Air Forces at **Thumrait, Oman in 2009**.
- **India's Other Military Exercise with Oman:**
 - [Naseem Al-Bahr](#): Between Indian **Navy** and Royal Navy of Oman.
 - [AL Najah](#): Between Indian and Royal **Army** of Oman.
- **Oman Location:** Oman's strategic location near the entrance to the [Strait of Hormuz](#) and overlooking the [Arabian Sea](#) makes it an important partner of India in West Asia and the Indian Ocean region.



Read More: [India-Oman Strategic Dialogue](#)

Philadelphi Corridor

[Source: TG](#)

The **Israeli Prime Minister** intends to control the **Philadelphi corridor**, including the **Rafah crossing** after its occupation in the **Israel-Hamas war**.

- The demand threatens to **stall negotiations** for a ceasefire with **Hamas**.
 - Both Egypt and Hamas reject **Israeli military presence** on the Philadelphi corridor.
- **Philadelphi Corridor:**
 - It is a **14 kilometres long strip** of land that represents the entirety of the border area between **Gaza and Egypt**.
 - It includes the **Rafah crossing** and runs from the **Mediterranean Sea** to the **Kerem Shalom crossing** with Israel.
 - Under the **Camp David peace treaty 1979**, a limited number of **Egyptian troops** were allowed, but **no heavy armour** was permitted.
 - After the 2005 Israeli withdrawal from Gaza, the corridor was designated a **demilitarised border zone**.
 - Since 2005, Egypt and the Palestinian Authority were responsible for managing the corridor.
 - It was the **only link for Gaza** with the outside world **not controlled by Israel**.
 - **Hamas gained control of Gaza in 2007**, which led to increased tension and ongoing cross-border smuggling activities.



Read More: [Israel-Hamas Conflict and its Global Impact](#)

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