La Nina: Impacts, Mechanisms, and Predictions

For Prelims: [La Nina](#), [Pacific Ocean](#), [El Nino Southern Oscillation (ENSO)](#), [Trade Winds](#), [Monsoon](#), [Palm Oil Production](#), [Oceanic Nino Index](#).

For Mains: El NiNo and La NiNa, its effect on weather conditions.

Why in News?

The long-anticipated [La Nina](#) has emerged, but the [Pacific Ocean](#)**'s cooling is mild** and unlikely to cause as many weather problems as usual.

- Its **delayed arrival** may have been influenced by the **world's oceans being much warmer** than the last few years.
- La Nina conditions emerge in the **tropical Pacific in December**.
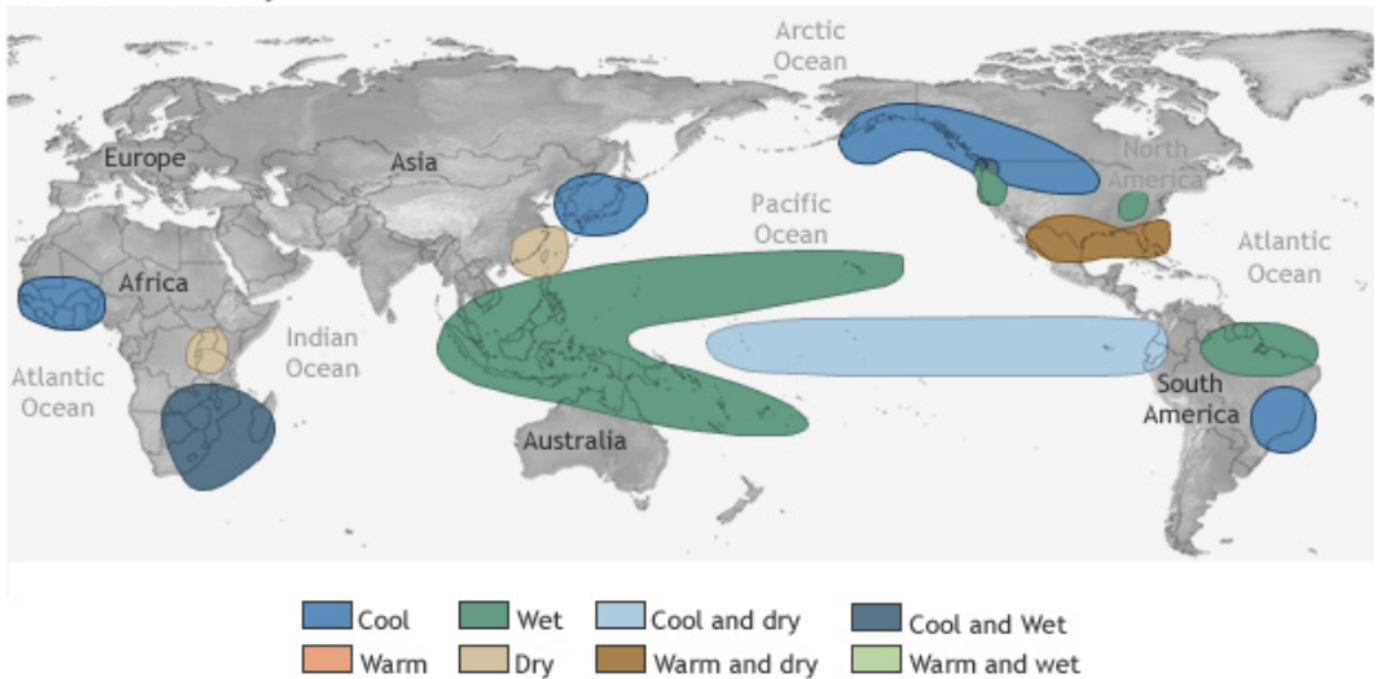
What is La Nina?

- **About:** La Niña, meaning **"The Little Girl" in Spanish**, is a **cool phase of the** [El Nino Southern Oscillation (ENSO).](#)
    - It is characterized by **colder-than-normal** [sea surface temperatures](#) in the eastern Pacific Ocean.
    - La Nina is one of the three phases of ENSO, alongside [El Nino](#) **(the warm phase)** and the **neutral phase.**
- **Mechanism:** In La Nina, the [trade winds](#) **strengthen**, pushing **warm water** toward the **western Pacific.**
    - **Cooler waters** from below **rise in the eastern Pacific**, causing a **temperature drop** in that region.
- **Cycles:** La Niña occurs in **irregular cycles**, typically lasting from **two to seven years,** and often follows an El Nino event.
- **Recent Events:** The most recent La Nina phase lasted from **2020 to 2023**, before transitioning to an El Nino phase in mid-2023.
- **Climate Change:** The **intensity** of La Nina's impacts, such as **extreme temperatures and unusual weather patterns**, is exacerbated by anthropogenic climate change.

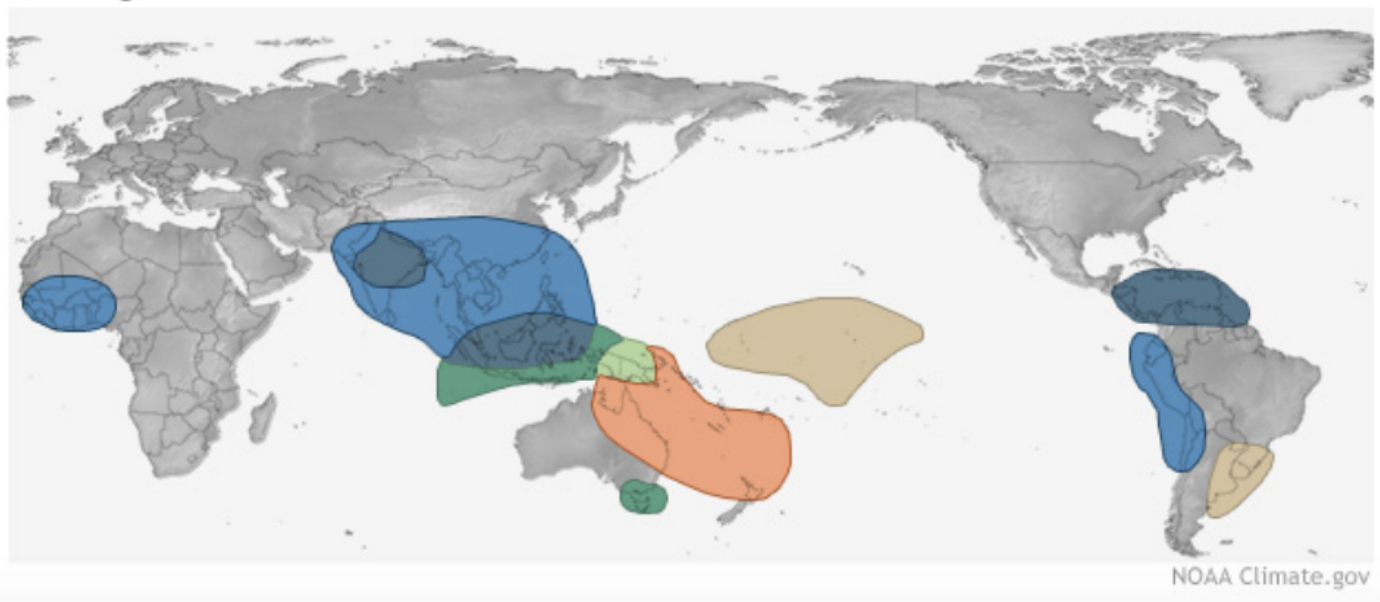## What are the Potential Regional Impacts of La Nina?

- **Asia:** In India, La Nina is expected to lead to **above-average** [monsoon](#) **rainfall** from **July to September**, which may result in a **decrease** in the production of **pulses** in the Indo-Gangetic Plains, but **rice production** may see an **increase.**
    - In Southeast Asia, including **Indonesia, Malaysia, and the Philippine**, La Nina brings **above-average rainfall**, causing [flooding](#) but boosting **rice and** [palm oil production.](#)

- **South America:** In Southern **Brazil, Uruguay, northern Argentina, and southern Bolivia,** La Nina causes **below-average rainfall**, leading to [**drought**](#) and affecting soybeans and maize.
    - In contrast, **Northern Brazil, Colombia, Venezuela, and parts of Ecuador and Peru** experience wetter conditions, leading to potential **flooding.**
- **Africa:** In East Africa, La Nina brings **drier conditions** in December and January, negatively impacting crops harvested in **February and March.**
    - In **Southern Africa**, La Nina causes **above-average summer rainfall**, benefiting agriculture with higher yields of **maize, sorghum, wheat, and soybeans**.
- **Oceania:** In Australia, the region experiences a**bove-average rainfall in the northern and eastern regions**, often linked to **severe flooding.**
- **North America:** In the US, La Nina causes **drier conditions** in the **south and wetter, stormier weather in the north**, including Alaska and Canada.

December-February

Legend:
- Cool
- Wet
- Cool and dry
- Cool and Wet
- Warm
- Dry
- Warm and dry
- Warm and wet

June-August

NOAA Climate.gov

What is El Nino-Southern Oscillation?

- **About:** ENSO is a **recurring climate pattern** involving **periodic changes** in the temperature of

waters in the **central and eastern tropical Pacific Ocean**, affecting global weather patterns.
- **Historical Context:** The term El Nino was used by South American fishermen for **warm Christmas waters.**
    - **Sir Gilbert Walker** discovered the **Southern Oscillation**, linking sea pressure changes to atmospheric conditions in the **1960s,** leading to the **ENSO term.**
    - **La Nina and Neutral** became widely used in the **1980s.**
- **Phases of ENSO:**
    - **El Nino: Warming ocean temperatures** in the central/eastern Pacific, weakens **easterly winds**, reducing rainfall in Indonesia and increasing it in the central/eastern Pacific.
    - **La Nina: Cooling ocean temperatures** in the central/eastern Pacific, **strengthens easterly winds**, increasing rainfall in Indonesia and decreasing it in the central/eastern Pacific.
    - **Neutral:** Tropical Pacific sea surface temperatures are **average**, with atmospheric conditions showing signs of **either El Nino or La Nina.**
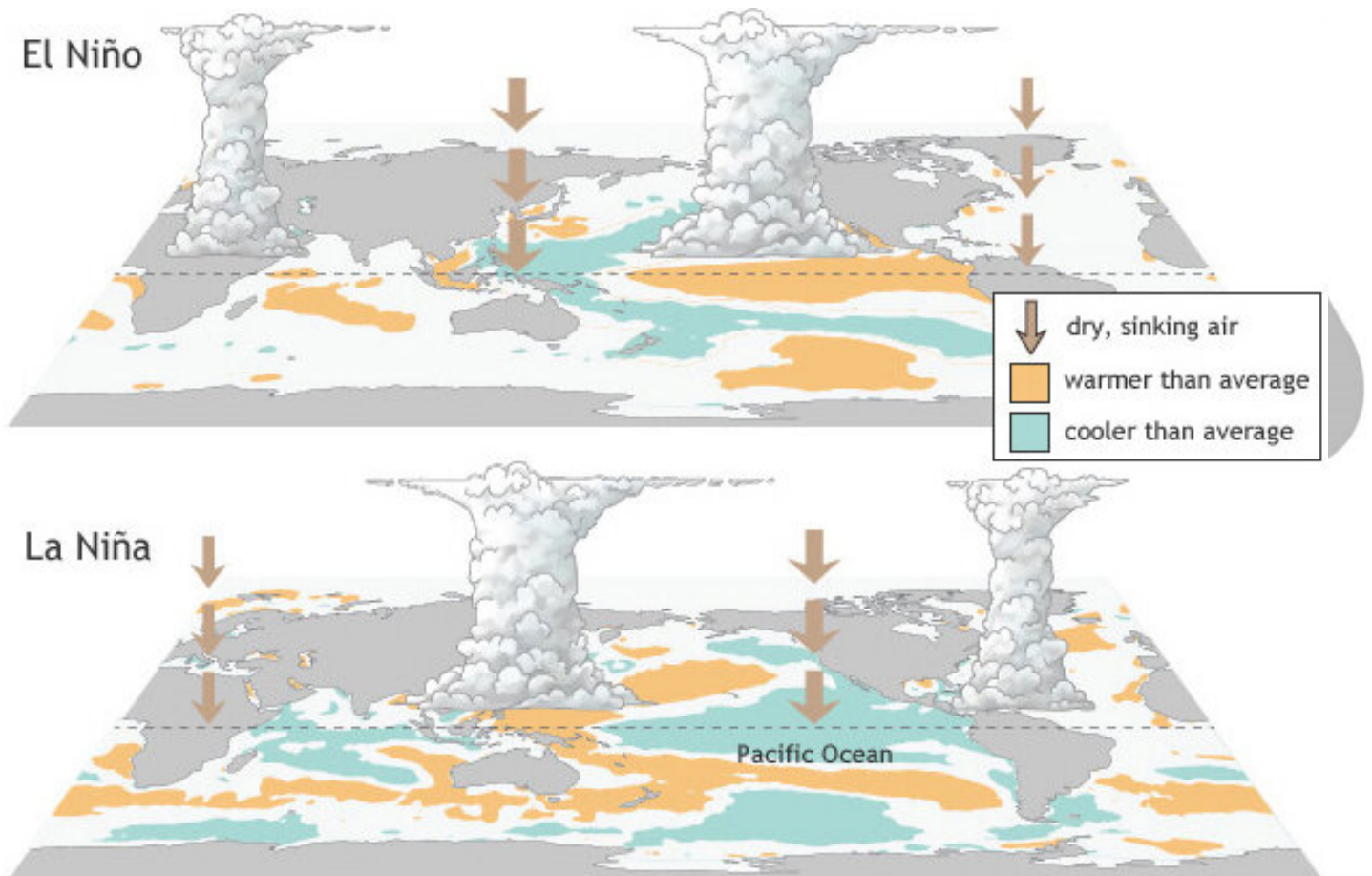
- **ENSO Cycle:** The ENSO cycle oscillates **every 3 to 7 years**, with sea surface temperatures varying between **1°C to 3°C above or below average.**

How La Nina and El Nino are Predicted?

- **Climate and Observational Data:** Scientists use **climate models** alongside observational data (such as **sea surface temperatures, trade wind strength, and data from satellites and ocean buoys**) to predict the onset of ENSO events (El Nino and La Nina).
    - **Ocean buoys** are **floating devices** placed in the ocean for various purposes, including **environmental monitoring, data collection, and navigation.**
- **Oceanic Nino Index: ONI** It compares the **3-month average sea surface temperatures** in the East-Central Tropical Pacific with the **30-year average.**
    - When the difference between the **two is 0.5º C or higher,** it is an El Nino, and when it is **–0.5º C or lower, it is a La Nina.**
- **Nino-3.4 Index:** This index **helps to identify the thresholds** that define El Nino and La Nina

events.
- A value of **0.5°C or greater** is indicative of the **event's initiation**, while a **strong event** requires a temperature anomaly of **1.5°C or more.**
- **Lead Time for Predictions:** La Nina events can be forecasted up to **two years in advance** if they follow a strong El Niño.

Conclusion

La Nina, the cool phase of the El Niño-Southern Oscillation (ENSO), influences **global weather patterns**, affecting **rainfall, agriculture, and climate extremes**. Accurate forecasting through models and indices like **ONI and Nino-3.4** is vital for mitigating its impacts, especially as **anthropogenic climate change** amplifies its intensity and unpredictability.

Drishti Mains Question:

Q. How does the El Niño-Southern Oscillation (ENSO) influence weather patterns across the globe?

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 an adverse effect on the 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)**