



UPSC &amp; STATE PCS CURRENT AFFAIRS · UJIYARI.COM

**DAILY CURRENT AFFAIRS**

# Kondagai Lake: A 4,500-Year Climate Record from Tamil Nadu

19 January 2026

**SUBJECTS COVERED**

ENVIRONMENT

SCIENCE &amp; TECH

GEOGRAPHY

**CURATED & WRITTEN BY****Bharat Choudhary**

UPSC Educator &amp; Content Creator •

[linkedin.com/in/epicbharat](https://www.linkedin.com/in/epicbharat)

Free UPSC &amp; State PCS Resources

[ujiyari.com](http://ujiyari.com)

# Kondagai Lake: A 4,500-Year Climate Record from Tamil Nadu

19 January 2026

## WHY IN NEWS

Scientists from the Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow, published a study reconstructing 4,500 years of monsoon variability for peninsular India using sediment cores from Kondagai Lake in Tamil Nadu — providing the longest continuous climate record from this region.

## WHAT IS PALAEOCLIMATOLOGY?

**Palaeoclimatology** is the study of past climates using proxy records preserved in natural archives — ice cores, ocean sediments, cave formations (speleothems), tree rings, coral skeletons, and lake sediments. When thermometers and rain gauges did not exist, these archives recorded climate signals in their physical and chemical properties, which scientists can now decode.

**Lake sediments** are particularly valuable because they accumulate continuously over thousands of years, preserving:

**Pollen grains:** identify past vegetation, which reflects past rainfall and temperature

**Diatoms:** single-celled algae sensitive to water chemistry changes

**Organic carbon and nitrogen isotopes:** indicate past biological productivity and monsoon strength

**Grain size:** reflects the energy of water inflow — stronger monsoons bring coarser sediment

## The Kondagai Lake Study

**Kondagai Lake** is a small freshwater lake in **Sivaganga district, Tamil Nadu**, situated in the semi-arid rain shadow zone east of the Eastern Ghats. Because it lies in a moisture-sensitive zone — receiving just enough rainfall to sustain vegetation but not so much as to mask climate signals — it is an ideal site for palaeoclimate reconstruction.

Scientists drilled sediment cores from the lake bed and analysed them using:

**Pollen analysis (palynology):** to reconstruct vegetation and rainfall changes

**Radiocarbon dating (<sup>14</sup>C AMS dating):** to assign precise ages to sediment layers

**Stable carbon and oxygen isotopes:** to track past monsoon intensity

**Sediment geochemistry:** elemental ratios (Ti/Al, Rb/Sr) as indicators of weathering and runoff

The study covered approximately **4,500 years** (roughly 2,500 BCE to the present), making it one of the longest lacustrine palaeoclimate records from peninsular India.

## KEY FINDINGS

### 1. The 4.2 Kiloyear Event (~2,200–1,900 BCE)

The sediment record showed a marked shift toward drier conditions around **4,200–3,900 years ago** — correlating with the globally documented **4.2 Kiloyear (4.2 ka) Event**. This was a prolonged drought that affected much of the world simultaneously: the Fertile Crescent, the Nile Valley, and the Indus Valley.

The **4.2 ka Event** is widely considered a contributing factor to the decline of several Bronze Age civilisations:

**Indus Valley Civilisation** (Harappan): abandoned large urban centres like Mohenjo-daro and Harappa; population shifted eastward to the Gangetic plains

**Akkadian Empire** (Mesopotamia): collapsed around 2,150 BCE

**Old Kingdom of Egypt:** ended around 2,200 BCE

The Kondagai Lake record provides the first high-resolution evidence of this event from the **Eastern Ghats rain shadow**, strengthening the pan-Indian picture of this climatic disruption.

### 2. Medieval Warm Period (900–1,200 CE)

The study identified a phase of enhanced Southwest Monsoon rainfall corresponding to the **Medieval Warm Period** (MWP), broadly 900–1,200 CE. This aligns with other Indian proxy records and with historical accounts of agricultural expansion and prosperity in peninsular kingdoms.

### 3. Little Ice Age (1,300–1,850 CE)

A weakening of monsoon intensity was detected in the **Little Ice Age** window — a globally cool phase characterised by reduced solar output and increased volcanism. Reduced rainfall during this period has been linked to agrarian stress and political instability in several Indian regional kingdoms.

### 4. Industrial-Era Shifts (Post-1850)

The most recent sediment layers show an abrupt shift — increasing organic carbon and changes in pollen assemblages — consistent with land-use change (agricultural expansion, deforestation) and the onset of industrialisation-driven climate forcing.

## WHY DOES THIS MATTER FOR INDIA?

### Monsoon Variability and Agriculture

The **Southwest Monsoon** delivers 70–90% of India’s annual rainfall between June and September. Even small shifts in its intensity or onset timing can cause widespread drought or flooding. Understanding natural monsoon variability helps separate the **natural signal** from **anthropogenic forcing** in today’s climate change projections.

### Reservoir Management and Water Security

Long-term climate records help hydrologists understand the **statistical range** of wet and dry extremes that reservoir systems must be designed to handle. A 4,500-year record reveals droughts more severe than any in the 150-year instrumental record — critical data for planning India’s water infrastructure.

### IPCC and Climate Models

India contributes data to the IPCC’s paleoclimate working groups (Working Group I). Studies like the Kondagai research provide **validation benchmarks** for the climate models used to project 21st-century rainfall patterns over the Indian subcontinent.

## BIRBAL SAHNI INSTITUTE OF PALAEOSCIENCES (BSIP)

**BSIP, Lucknow** is one of India’s premier research institutes in the earth sciences. Named after **Birbal Sahni** (1891–1949), a pioneering Indian palaeobotanist who contributed to understanding Gondwana flora and the geological evolution of the Indian subcontinent, BSIP specialises in:

- Plant fossil (palaeobotany) research
- Quaternary science (climate and landscape change over the last 2.6 million years)
- Palynology (pollen studies)
- Geochronology (age dating using isotopes)

It functions under the **Department of Science and Technology (DST)**, Government of India.

## UPSC RELEVANCE

### Prelims:

- BSIP Lucknow — under DST
- 4.2 Kiloyear Event — Indus Valley decline
- Palaeoclimate proxy methods (pollen, isotopes, radiocarbon)

Southwest Monsoon — June–September, 70–90% of India’s rainfall

Birbal Sahni — Indian palaeobotanist

**Mains GS-1:** Climate and civilisational decline; monsoon variability; Indus Valley Civilisation **Mains GS-3:** Climate change impacts; water security; IPCC working groups; scientific institutions

---

**★ FACTS CORNER — KNOWLEDGEPEDIA**
**KONDAGAI LAKE STUDY:**

Location: Sivaganga district, Tamil Nadu (Eastern Ghats rain shadow zone)

Study period: 4,500 years (~2,500 BCE to present)

Lead institution: BSIP, Lucknow (under DST)

Methods: pollen analysis, radiocarbon dating, stable isotopes, sediment geochemistry

**4.2 KILOYEAR EVENT:**

Time: ~4,200–3,900 years ago (~2,200–1,900 BCE)

Nature: global mega-drought — reduced monsoon, Nile flooding, Near East precipitation

Civilisations affected: Harappan (India), Akkadian Empire (Mesopotamia), Old Kingdom Egypt

Evidence in India: Harappan urban centres abandoned; population migrated east

**PALAEOCLIMATE PROXIES — QUICK REFERENCE:**

Ice cores: trapped air bubbles contain ancient atmosphere; drill sites: Antarctica, Greenland

Speleothems (stalagmites/stalactites): oxygen isotopes record past rainfall and temperature

Tree rings (dendrochronology): ring width reflects growing season conditions

Pollen grains: identify past plant communities and hence past climate zones

Lake sediment: continuous archive; grain size, isotopes, organics, pollen all preserved

**BIRBAL SAHNI:**

Indian palaeobotanist (1891–1949)

BSIP named after him; established at Lucknow

Parent body: DST, Government of India

**BSIP MAJOR RESEARCH AREAS:**

Quaternary palaeoclimate and palaeohydrology

Palynology and palaeobotany

Geochronology (radiocarbon, luminescence dating)

**SOUTHWEST MONSOON — KEY DATA:**

Duration: June–September

Coverage: 70–90% of India's annual rainfall

Origin: ITCZ shift + differential heating of Indian Ocean and landmass

El Nino Southern Oscillation (ENSO): El Nino typically weakens Indian SW monsoon

**OTHER RELEVANT FACTS:**

Medieval Warm Period: ~900–1,200 CE; enhanced monsoon in South Asia

Little Ice Age: ~1,300–1,850 CE; global cooling; reduced Indian monsoon intensity

IPCC Working Group I: physical science basis of climate change

India's Southwest Monsoon onset: Kerala, around June 1 (normal date)

Sources: Birbal Sahni Institute of Palaeosciences, The Hindu

---

CURATED & WRITTEN BY

# Bharat Choudhary

UPSC Educator & Content Creator

 [linkedin.com/in/epicbharat](https://www.linkedin.com/in/epicbharat)

---

Published on [ujyari.com](http://ujyari.com) · Free UPSC & State PCS Current Affairs