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Congo Basin Peatlands — Ancient Carbon Release and Climate Implications

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SUBJECTS COVERED

ENVIRONMENT GEOGRAPHY

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WHY IN NEWS

Research from ETH Zurich published in *Nature Geoscience* found that lakes in the Democratic Republic of Congo — Lake Mai-Ndombe and Lake Tumba — are releasing carbon trapped for over 3,000 years from surrounding tropical peatlands, raising fresh alarm about the Congo Basin as a potential carbon bomb under climate stress.

WHAT ARE PEATLANDS?

Peatlands are wetland ecosystems characterised by the accumulation of **peat** — partially decomposed organic matter (plant remains) that builds up over thousands of years in waterlogged, oxygen-deprived conditions. Peat accumulates because decomposition is slower than plant growth in these anaerobic environments.

Feature	Detail
Peat formation	Requires thousands of years of waterlogged conditions
Carbon storage	Stores carbon in organic form (not CO_2)
Global coverage	~3% of Earth's land surface
Carbon stored	~550 Gt C — **twice the carbon in all forests combined**
Vulnerability	Once drained/disturbed, rapid oxidation releases stored CO_2

Types of peatlands:

- **Temperate/boreal peatlands** — well-studied (Scandinavia, Canada, Siberia)
- **Tropical peatlands** — less studied but carbon-dense (Amazon, Congo Basin, Southeast Asia)

THE CONGO BASIN — SCALE AND SIGNIFICANCE

The **Congo Basin** covers approximately **3.7 million km²** across six countries (DRC, Republic of Congo, Cameroon, Gabon, Central African Republic, Equatorial Guinea). It is:

The **world's second-largest rainforest** after the Amazon

Home to the **world's largest tropical peatland complex** (discovered comprehensively only in 2017)

Among the **least-studied** major forest ecosystems globally

THE CONGO PEATLAND DISCOVERY (2017)

Prior to 2017, the Congo Basin peatlands were poorly mapped. A landmark 2017 study in *Nature* (by Lewis et al.) revealed that the **Cuvette Centrale** peatland in DRC and Republic of Congo:

Covers **145,500 km²** — roughly the size of England

Stores approximately **30 billion tonnes of carbon** — equivalent to **20 years of US fossil fuel emissions**

Is 0.3% of Earth's land surface yet holds **~one-third of global tropical peatland carbon**

THE NEW ETH ZURICH FINDINGS (2026)

The study published in ***Nature Geoscience*** by researchers at **ETH Zurich (Swiss Federal Institute of Technology)** focused on two major lakes in DRC:

LAKE MAI-NDOMBE AND LAKE TUMBA

Both are shallow, floodplain lakes in the Congo Basin wetland system

Surrounded by extensive peatlands that have been accumulating carbon for millennia

Key finding: Up to **40% of CO_2 emissions** from these lakes originates from peat older than **3,000 years**. This means carbon that has been safely locked away since before the Iron Age is now entering the atmosphere.

Why is old carbon releasing now? The mechanism involves:

Peat drying — climate change + deforestation → lower water tables → aerobic conditions in previously waterlogged peat

Organic matter breakdown — aerobic bacteria decompose ancient peat, releasing CO_2

River/lake transport — dissolved organic carbon from peat enters waterways → lakes → atmosphere

CLIMATE FEEDBACK LOOP RISK

The Congo peatland carbon release exemplifies a **positive feedback loop** in climate science:

`Global warming → Peat dries out → More CO₂ released → More warming → More peat drying`

This is particularly dangerous because:

The carbon stored in Congo peatlands alone (~30 Gt C) represents a **massive potential emission**

Once released, this carbon **cannot be recaptured** on human timescales

The feedback is **self-amplifying** — initial warming triggers more release, which triggers more warming

COMPARISON WITH AMAZON

While the Amazon has received more attention for deforestation-driven carbon loss, the Congo Basin peatlands may represent a **comparable or larger risk** from a climate feedback perspective because:

Peat carbon is **more concentrated** than forest biomass carbon

Peat release is **harder to reverse** than reforestation (takes millennia to rebuild)

Infrastructure for monitoring and protection is **far less developed** in DRC than Brazil

THREATS TO CONGO PEATLANDS

DEFORESTATION

The Congo Basin is experiencing **accelerating deforestation** — primarily from:

Subsistence agriculture (slash-and-burn)

Artisanal logging

Large-scale commercial agriculture encroachment

DRC had the world's second-highest rate of primary forest loss in recent years.

CLIMATE CHANGE

Longer dry seasons in equatorial Africa projected under climate models threaten the waterlogged conditions that maintain peat integrity.

GOVERNANCE GAPS

DRC is one of the world's poorest countries. Conservation challenges include:

Weak institutional capacity for peatland monitoring

High dependence on forest resources for livelihoods

Ongoing armed conflict in eastern DRC affecting conservation work

GLOBAL PEATLAND POLICY CONTEXT

UNFCCC AND PEATLANDS

Peatlands are increasingly recognised in **climate negotiations** under **Article 5** of the Paris Agreement (protecting carbon sinks). However, tropical peatlands — especially in Africa — remain underrepresented in national carbon accounting.

RAMSAR CONVENTION

The **Ramsar Convention on Wetlands** (1971) is the primary international framework for wetland conservation. Lake Mai-Ndombe is a **Ramsar Site** (designated 1996). However, Ramsar designation does not guarantee protection against all threats.

UK-CONGO BASIN PARTNERSHIP

The UK, US, and Norway launched the **Central African Forest Initiative (CAFI)** to fund peatland and forest conservation in the Congo Basin — committing to fund conservation in exchange for low-deforestation commitments.

INDIA'S CONNECTION

UPSC framing — why this matters for India:

India's **monsoon rainfall** is partly modulated by the **Congo Basin's moisture flux** — deforestation and carbon release there can affect global circulation patterns

UNFCCC negotiations: India participates in climate finance discussions where Congo peatland protection comes up under **REDD+** (Reducing Emissions from Deforestation and forest Degradation)

India's own peatlands — notably in **Arunachal Pradesh, Manipur, Nagaland** — face similar pressures, making this research globally applicable

Loss and Damage Fund (established COP27, operationalised COP28): Congo peatland damage is exactly the type of slow-onset climate harm the fund is meant to address

UPSC RELEVANCE

Congo Basin, Lake Mai-Ndombe, Lake Tumba, ETH Zurich, Nature Geoscience, peatlands, Cuvette Centrale, Ramsar Convention, CAFI.

MAINS GS-3:

Carbon sinks and climate feedback loops; tropical forest conservation; peatland ecology; UNFCCC mechanisms.

ESSAY:

"Ancient carbon stores and the limits of climate diplomacy."

📌 FACTS CORNER — KNOWLEDGEPEDIA

CONGO BASIN — KEY FACTS:

Size: **~3.7 million km²** (second-largest tropical rainforest after Amazon)

Countries: **DRC, Republic of Congo, Cameroon, Gabon, CAR, Equatorial Guinea**

Congo peatland (Cuvette Centrale): **145,500 km²** — roughly size of England

Peatland carbon stored: **~30 billion tonnes** (~20 yrs of US fossil fuel emissions)

Global share: **0.3% of Earth's land** stores **~1/3 of tropical peatland carbon**

ETH ZURICH STUDY (2026):

Published in: ***Nature Geoscience***

Lakes studied: **Lake Mai-Ndombe + Lake Tumba** (DRC)

Key finding: **Up to 40% of CO_2** from these lakes comes from peat **>3,000 years old**

Mechanism: Peat drying → aerobic decomposition → ancient CO_2 release

PEATLANDS — GLOBAL CONTEXT:

Cover: **~3% of Earth's land** globally

Carbon: **~550 Gt C** (twice all forests combined)

Tropical peatlands: Less studied than boreal; disproportionately carbon-dense

Boreal peatlands: Canada, Siberia, Scandinavia — well-mapped

KEY POLICY FRAMEWORKS:

Ramsar Convention (1971): Wetland conservation treaty; 172 parties; Lake Mai-Ndombe is a Ramsar site (1996)

CAFI: Central African Forest Initiative — UK, US, Norway fund Congo Basin conservation

REDD+: UN mechanism for reducing deforestation emissions; covers peatlands

Paris Agreement Article 5: Encourages conservation and enhancement of carbon sinks

CLIMATE FEEDBACK:

Positive feedback loop: Warming → Peat dries → CO_2 release → More warming

Irreversible on human timescales — once released, cannot be recaptured quickly

Tipping point risk: Large-scale peat release could push Earth toward irreversible warming

INDIA'S PEATLANDS:

Located in: Arunachal Pradesh, Manipur, Nagaland (Northeast India)

Face similar pressure from deforestation and agricultural expansion

OTHER RELEVANT FACTS:

2017 *Nature* study (Lewis et al.): First comprehensive mapping of Congo peatlands — discovered 30 Gt C store

ETH Zurich: Swiss Federal Institute of Technology, Zurich — top-ranked research university globally

Southeast Asia peatlands (Indonesia, Malaysia): Well-known for fires releasing ancient carbon; Indonesia drained ~25 million ha of peatlands

Loss and Damage Fund: Established COP27 (Sharm el-Sheikh, 2022); operationalised COP28 (Dubai, 2023); covers slow-onset events like peatland degradation

Sources: ETH Zurich, Nature Geoscience, PIB

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