

FIRE HISTORY OF AMAZON FORESTS

Amazon forest fire: rare for millennia, absent for 800 years

Intact Amazon forests have not burned for about 800 years. The carbon those ancient fires left is still in their soils; today's fires are a break with that history.

Photo: Paulo Brando

Radiocarbon dating of charcoal buried in the soils of intact Amazon forests shows that the most recent fire at each site came 730 to 850 years ago, around 1200 AD. These forests have now gone longer without fire than at any time in the previous 2,000–3,500 years. Yet the carbon left by their past fires still makes up about a tenth of their soil carbon.

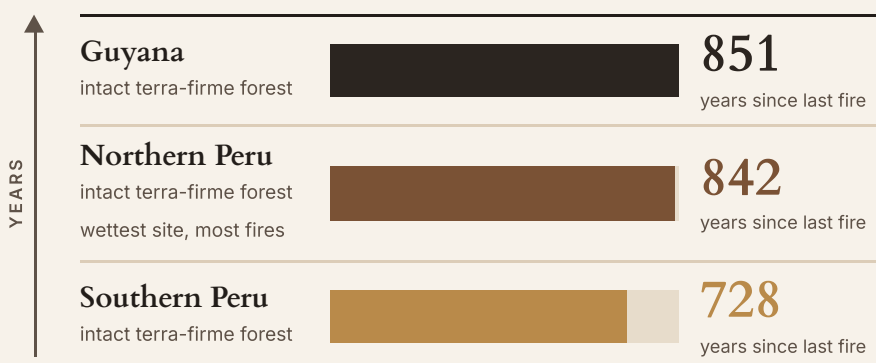
The evidence comes from 33 radiocarbon dates on soil charcoal from three replicate soil pits at each of three intact, terra-firme forest sites in Guyana and northern and southern Peru, combined with the first basin-wide measurement of pyrogenic (fire-derived) carbon in 37 intact forest plots.

KEY MESSAGES

- At the three sites, the last fire was 730–850 years ago.
- Before that, fire was **rare but recurrent**: 4–6 fires per site over 11,500 years.
- The current fire-free period is **longer than any in the previous 2,000–3,500 years**.
- Ancient fires left a **durable carbon legacy**: about 11% of soil carbon to 2 m.
- Today's fires have **no parallel in these forests' last ~800 years**.

01 · TIME SINCE THE LAST FIRE, FROM SOIL CHARCOAL

Old-growth in every sense: no fire since about 1200 AD



455–2,950 years

The typical (median) interval between fires at these sites, before the current fire-free period. Over 11,500 years, each site burned only four to six times.

Median calibrated radiocarbon age of the most recent fire at each site (calendar years before present). Fires are dated from charcoal found 15–70 cm deep in three soil pits per site.

02 · WHAT OLD FIRES LEAVE BEHIND

The fires stopped centuries ago; their carbon did not leave

~800 years

since the last fire in intact forest at the dated sites

11%

of soil carbon to 2 m is still pyrogenic, in forest with no known recent fire

2.8 Gt

pyrogenic carbon in the top metre of Amazon forest soils

3 pits

per site, sampled at the top, are enough to find the most recent fire

Fire-derived carbon laid down by fires at least eight centuries old has persisted, protected by clay and minerals at depth: direct evidence of a store measured in centuries to millennia.

03 · WHY IT MATTERS NOW

These forests may not be adapted to frequent fire. Over millennia, fire came to intact Amazon forest only every few centuries or more. Fire now enters standing forest far more often, through escaped agricultural burns and drought: MapBiomass Fogo mapped 690,000 km² burned across the Amazon biome between 1985 and 2020, 16% of its area (not all of it forest). These forests have no recent history of such a regime.

Each new fire breaks a long record. A forest that has not burned for eight centuries has no recent experience of fire; each new fire emits carbon that took centuries to build.

The legacy is durable. Pyrogenic carbon that has survived eight centuries without fresh inputs is the kind of carbon permanence to maintain carbon in soils that claims require.

KEY TERMS

Radiocarbon dating. Dating charcoal from the decay of carbon-14; it gives the age of the fire that made it.

Fire return interval. The typical time between successive fires at a site.

Terra firme. Upland forest that does not flood seasonally.

Pyrogenic carbon. Charcoal-like carbon left by incomplete burning.

04 · RECOMMENDATIONS: KEEP FIRE OUT OF OLD-GROWTH FOREST

1

FIRE MANAGEMENT AGENCIES AND STATE GOVERNMENTS

Treat any fire in intact forest as exceptional

Prioritise prevention of escaped burns and rapid suppression in standing forest, which has no recent history of fire.

2

CARBON STANDARDS AND REDD+ PROGRAMMES

Credit pyrogenic carbon as durable

Centuries-old fire carbon still in the soil is direct evidence of permanence; measure it to at least 1 m.

3

RESEARCHERS AND FOREST MONITORING PROGRAMMES

Date the last fire before calling a forest undisturbed

Three soil pits per site, with radiocarbon dates from the top charcoal, are enough to set a fire-history baseline.

References. Feldpausch, T.R., Carvalho, L., Macario, K.D., Ascough, P.L., Flores, C.F., Honório Coronado, E.N., Kalamandeen, M., Phillips, O.L. & Staff, R.A. (2022) Forest fire history in Amazonia inferred from intensive soil charcoal sampling and radiocarbon dating. *Frontiers in Forests and Global Change* 5: 815438. doi.org/10.3389/ffgc.2022.815438

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