Burned Amazonian forests hold significant soil carbon stocks — yet remain unrecognised by carbon credit programmes

Forest fires and agricultural conversion are depleting soil carbon across the Arc of Deforestation. New experimental evidence from Mato Grosso shows that even repeatedly burned forests retain substantially more soil carbon than land converted to agriculture, yet this carbon pool has no financial protection under existing standards such as VERRA/VCS.

Author and contact: Prof.Ted Feldpausch, University of Exeter. Brief based on research from Naval, Feldpausch et al. (2025). Catena 254: 108924 · ,Mato Grosso, Brazil · Soil depth 0–30 cm · Last fire event 2010; soils sampled 2019

01 · SOIL CARBON STOCKS (0–30 CM DEPTH)

Agriculture removes twice as much soil carbon as repeated fire

Carbon stocks corrected by equivalent soil mass method; intact forest used as reference. N = 11 sampling points per forest site; n = 6 for agriculture.

Land use	Soil C stock	vs intact
Intact forest Undisturbed · Legal Reserve	Baseline	**Baseline** reference
Burned annually Forest · 2004–2010	−16%	**−16%** −8.0 Mg C ha⁻¹
Burned triennially Forest · 2004, 2007, 2010	−19%	**−19%** −9.7 Mg C ha⁻¹
Long-term agriculture Soybean rotation · no-till since 2008	−38%	**−38%** −19.1 Mg C ha⁻¹

Key findings: Fire damage persisted ≥9 years after last burn · Fire frequency did not significantly change soil C loss · Burned forest soil C is 36% higher than agriculture

02 · THE DEFORESTATION MULTIPLIER

Converting forest to agriculture destroys carbon equivalent to 115% of the original aboveground stock

Deforestation eliminates 100% of aboveground biomass carbon — equivalent to one entire forest. It then triggers a further 38% loss of soil carbon. In total, the Amazon ecosystem loses carbon worth approximately 1.2 × the original forest's aboveground pool.

INTACT FOREST

Aboveground C
~125 Mg C ha⁻¹

Soil C (0–30 cm)
50.5 Mg C ha⁻¹

Total: 175.5 Mg C ha⁻¹

→

AFTER DEFORESTATION & AGRICULTURE

Aboveground C lost
−125 Mg C ha⁻¹ (−100%)

Soil C lost
−19.1 Mg C ha⁻¹ (−38%)

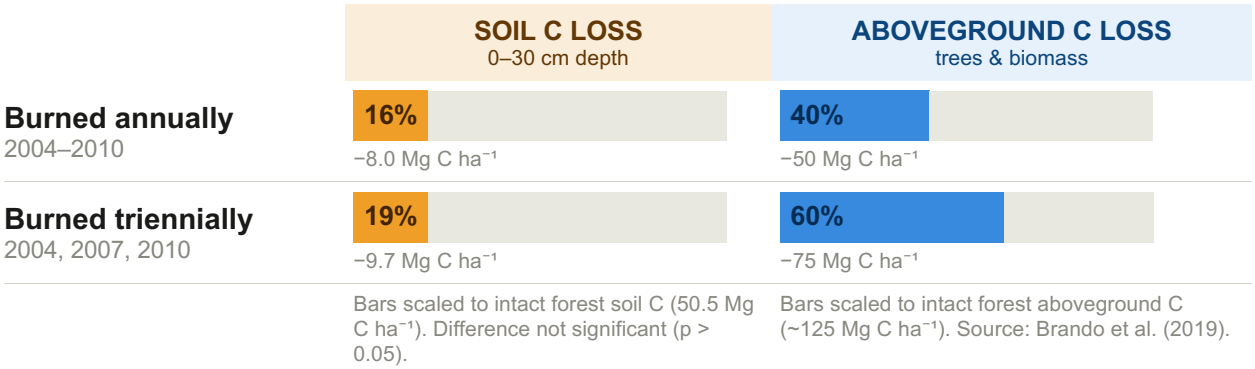
Soil C remaining
31.4 Mg C ha⁻¹

Total lost: −144.1 Mg C ha⁻¹

03 · FIRE FREQUENCY EFFECT

Soil carbon is resilient to fire frequency — aboveground carbon is not

Annually and triennially burned forests showed statistically equivalent soil C loss. Yet aboveground C loss rose 50% nnial burns. Soil and vegetation carbon dynamics are decoupled under fire.



04 · THE POLICY GAP

Burned forests protect more carbon than agriculture, but receive no credit

Repeatedly burned Amazonian forests store approximately 36% more soil carbon than land converted to agriculture, and this pool persists for at least nine years after the last fire. Yet no existing soil carbon credit standard — including VERRA/VCS, or agribusiness sustainability certification schemes — recognises or compensates landowners for protecting degraded but carbon-rich forests within *reservas legais* or on private land. Without financial incentive, burned forests face continued pressure for agricultural conversion.

Soil carbon gradient across land-use types — NO CREDIT STANDARD EXISTS

A gradient-based soil carbon credit standard could cover all three land-use types — rewarding protection of intact forest most, but also recognising burned forests as a significant intermediate stock with far greater carbon value than agriculture.

CALL TO ACTION · FOR POLICYMAKERS AND CARBON STANDARD BODIES

Develop a soil carbon credit standard for the Amazon that recognises burned forests

Amazonian soils store approximately 70 Pg C in the upper metre. Providing financial protection for burned forests under a tiered soil carbon credit scheme would slow deforestation at the agricultural frontier, limit greenhouse gas emissions, and support the livelihoods of landowners maintaining degraded but carbon-rich forests.

01

Develop tiered soil carbon credits covering intact, burned, and agricultural land — with VERRA/VCS methodology for the Amazon

02

Invest in wildfire prediction, detection, and suppression infrastructure to protect soil carbon stocks of the Arc of Deforestation

03

Halt agricultural expansion into burned reservas legais — where soil carbon stocks are still 36% higher than converted land

Author and contact: Prof.Ted Feldpausch, University of Exeter

Brief based on research from Naval, Feldpausch et al. (2025). Impacts of repeated forest fires and agriculture on soil organic matter and health in southern Amazonia. Catena 254: 108924. doi:10.1016/j.catena.2025.108924 · Funding: Amazon PyroCarbon Project (NERC-FAPESP NE/W001691/1), CAPES, NSF, CNPq.

UKRI Natural Environment Research Council

FAPESP FUNDAÇÃO DE AMPARO À PESQUISA DO ESTADO DE SÃO PAULO