**Title:** Rubber’s inclusion in zero-deforestation legislation is necessary but not sufficient to reduce impacts on biodiversity

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**Abstract:**

Agricultural commodity production is a major driver of tropical deforestation and biodiversity loss. Natural rubber from *Hevea brasiliensis*, a valuable commodity without viable substitutes, has recently been included in the EU deforestation regulation that aims to halt imports of goods containing embedded deforestation. Sustained growth in demand for rubber is driven by increasing tyre production, caused by rising transport flows and personal car ownership. We show that average natural rubber yields remain static, meaning 2.7 – 5.3 million ha of additional plantations could be needed 2020-2030 to meet demand. A systematic literature search identified 106 case studies concerning transitions to and from rubber, revealing that substantial rubber plantation area expansion since 2010 has occurred at the expense of natural forest. Eliminating deforestation from rubber supply chains requires support for millions of smallholder growers to maintain or increase production from existing plantations, without land or water degradation. Supply-chain traceability efforts offer opportunities to deliver such support. While the inclusion of rubber in EU legislation is a positive step, it is critical to ensure that smallholders are not marginalized to avoid exacerbating poverty, and that other markets follow suit to avoid displacement of rubber-driven deforestation to unregulated markets.

**Main text:**

Avoiding tropical deforestation is critical to protect biodiversity, address climate change, protect ecosystem service delivery, and support indigenous peoples (IPBES, 2019). As conversion to agricultural land is a key driver of forest loss (Pendrill, Gardner, et al., 2022), there are increasing initiatives to eliminate deforestation from agricultural commodity supply chains (Lyons-White et al., 2020; Seymour & Harris, 2019). Legislative proposals to regulate the import of deforestation-linked commodities have recently been approved in the EU (Directorate-General for Environment, 2021a; Jahnz & Stoycheva, 2022), and are currently under consideration in the US (S.2950 - 117th Congress (2021-2022): FOREST Act of 2021, 2021) and the UK (DEFRA, 2021).

Natural rubber (*Hevea brasiliensis*) is essential for the manufacture of vehicle and aeroplane tyres (comprising 70% of global natural rubber consumption), medical equipment, prophylactics and sportswear (Laroche et al., 2022). A voluntary rubber sustainability initiative, the Global Platform for Sustainable Natural Rubber (GPSNR), works to address deforestation alongside other sustainability concerns (<https://sustainablenaturalrubber.org>). Sustainability guidelines for Chinese businesses investing in rubber plantations and processing overseas includes a zero-deforestation principle (CCCMC, 2017), although these have not been widely adopted (Jiang, 2022). Meanwhile, 62% of 30 key large-scale rubber growers or processors have made voluntary zero-deforestation commitments, although only 14% provide evidence of monitoring deforestation within their operations or supply chains (ZSL/SPOTT, 2022).