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POSTNOTE

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Biodiversity loss in the Amazon rainforest


Photo: Neil Palmer/CIAT

The biodiversity of the Amazon rainforest provides a multitude of services which are essential to human well-being. This POST note explores the drivers behind the ongoing loss of biodiversity in the Amazon. It also discusses the role of policy in developing solutions to tackle declining biodiversity.

Overview

- Biodiversity provides several services, which are essential to human well-being.
- The Amazon rainforest harbours over 10% of the world's known species.
- Both deforestation (i.e. forest loss) and degradation (i.e. declining forest condition) have led to biodiversity loss.
- Both disturbances have been driven by crop and pasture expansion, gold mining, timber extraction and forest fires.
- Policies have tended to focus on curbing deforestation rather than degradation, with mixed success.
- Policy considerations may include area-based conservation, wildlife corridors and monitoring techniques.

Background

Biodiversity is the variety of life on Earth, including the diversity of genes, individuals, populations and ecosystems.[1] The natural environment provides several ecosystem services, which are essential to human well-being, including crop pollination, water purification and flood protection.[2] As such, biodiversity has been valued at USD 125-140 trillion per year, globally.[3]

The Amazon rainforest is the largest tropical forest in the world, spanning nine countries in South America.[4] It is inhabited by over 10% of the world's known species alongside 47 million people, with which it provides food, water and materials.[4] Humans destroy more forest than the area of Belgium each year, making the Amazon rainforest the world's most threatened ecosystem.[4]

Policy Context

From the 1960s, governments across South America promoted the exploitation of the Amazon for its natural resources, generating economic growth and prosperity.[5]

Deforestation consequently peaked in the early 2000s, prior to Brazil's 2004 Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm).[4] This policy effectively curbed deforestation in Brazil until the new government took office in 2019.[4] Additional policies have seen mixed success, rather resulting in the spatial and temporal redistribution of deforestation.[4] Almost half (49%) of the Amazon rainforest is currently protected.[5]

Drivers of Biodiversity Loss

Deforestation is a rainforest's loss of land cover and subsequent change in land use.[6] Humans have destroyed over 17% of the Amazon's primary forest (Box 1) since the 1970s.[4] By contrast, degradation is the worsening of a forest's condition and the services it provides.[6] 38% of the Amazon has been degraded.[6]

Deforestation is primarily motivated by large-scale agriculture, including cattle ranching and crop production.[4] Pasture expansion has driven deforestation in the northern Amazon, while crop expansion (of soy and oil palm) has done so in the south.[4] Conversely, gold mining is the main driver in Guyana and Suriname.[4]

Forest degradation is driven both by factors related to, and independent of, deforestation. Agricultural expansion following deforestation exposes forest to deletarious edge effects (Box 1).[6] By contrast, timber may be extracted far from the edge, facilitating the spread of fires deep into the forest.[6] These factors frequently interact to worsen degradation. For example, fires resulting from agriculture can spread rapidly among thinned forest, especially during droughts.[6]

Studies have shown both deforestation and forest degradation have contributed to substantial biodiversity loss in the Amazon, with species of high functional value (Box 1) worst affected.[7,8] Both types of disturbance significantly alter species distributions; sensitive species are lost to low-level disturbance, while resistant species dominate highly disturbed forests.[7] In general, the conservation of primary forest is pivotal to maintaining biodiversity.[8]

Box 1: Glossary of key terms.[5,7,8]

- *Primary forest* – pristine forest that has experienced minimal human disturbance.
- *Edge effects* – the reduced quality of habitats at their edges due to fragmentation.
- *Functional value* – the role a species plays in the provision of ecosystem services.
- *Wildlife corridors* – corridors of land between protected areas, improving connectivity.

Solutions for Biodiversity Loss

About half of the Amazon is protected via area-based conservation, which has effectively curbed crop expansion but less so pasture expansion.[4] The compensation of local landowners for partaking in environmental restoration could increase engagement.[9,10] The identification of target areas for conservation, and collaboration between governments, landowners and indigenous communities, are important factors in determining the cost of implementing protected areas.[11]

Protected areas, enforced via fines and embargoes, have led to the intensification of existing agricultural land.[4] While this spares adjacent forest, it has sometimes come at the expense of deforestation "spill over" to other areas.[4,12] Therefore, policies restricting land use while promoting alternative production methods might more effectively reduce overall deforestation due to agriculture.[12]

Zoning of different land uses can help protect larger sections of forest, thereby reducing the degrading edge effects of deforestation.[7] This could improve connectivity, and therefore the resilience, of species populations.[7] The collaboration of governments to develop trans-national wildlife corridors (Box 1) would help maximise the effect of this policy.[5]

Finally, monitoring methods could help enforce the policies enacted by governments. Detailed forest monitoring technology such as spaceborne light-detecting and ranging (LiDAR) has become considerably more affordable in recent years.[6] Additionally, the protection gained from monitoring may spill over to help conserve adjacent forest.[4]

Endnotes

1. Gaston, K. J., et al. (2013). Biodiversity: an introduction. John Wiley & Sons.
2. DEFRA (2007). An introductory guide to valuing ecosystem services. Department for Environment, Food and Rural Affairs, London.
3. OECD (2019). *Biodiversity: Finance and the Economic and Business Case for Action*, report prepared for the G7 Environment Ministers' Meeting, 5-6 May 2019.
4. Hanggli, A., *et al.* (2023). *Environmental Research Letters*, 18(7), 073001. https://doi.org/10.1088/1748-9326/acd408
5. Garda, A. A., *et al.* (2010). *Systematics and Biodiversity*, 8(2), 169-175. https://doi.org/10.1080/14772000.2010.484435
6. Lapola, D. M., *et al.* (2023). *Science*, 379(6630), eabp8622. https://doi.org/10.1126/science.abp8622
7. Barlow, J., *et al.* (2016). *Nature*, 535(7610), 144-147. https://doi.org/10.1038/nature18326
8. Gibson, L., *et al.* (2011). *Nature*, 478(7369), 378-381. https://doi.org/10.1038/nature10425
9. Lemos, M. C., *et al.* (2008). *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1498), 1897-1902. http://doi.org/10.1098/rstb.2007.0038
10. da Silva, R. F. B., *et al.* (2023). *Science of The Total Environment*, 904, 166681. https://doi.org/10.1016/j.scitotenv.2023.166681
11. Lessmann, J., *et al.* (2019). *Biological Conservation*, 235, 250-259. https://doi.org/10.1016/j.biocon.2019.04.022
12. Brandao Jr, A., *et al.* (2020). *Sustainability*, 12(3), 1277. https://doi.org/10.3390/su12031277