

Developed countries'™ consumption drives 87% of biodiversity loss in developing countries from 1992 to 2022

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Our planet is currently experiencing unprecedented biodiversity loss due to human activities. While countries directly destroy natural and seminatural ecosystems within their borders to facilitate agricultural expansion, increase in livestock numbers, and urbanization, their consumption increasingly drives habitat loss in other countries, which causes biodiversity loss. Quantifying this consumption-based biodiversity loss (i.e., biodiversity footprint) through global supply chains is essential for allocating responsibility, and guiding global conservation policies. For instance, countries with high biodiversity footprints should mobilize investments in conservation and restoration toward countries that suffer from severe biodiversity loss but generate low biodiversity footprints. Therefore, it is imperative to investigate consumption-driven biodiversity loss across all vertebrate species. However, previous studies have approached estimating the biodiversity impacts through global supply chains, yet they lack spatially explicit information regarding range losses for individual species. Existing species-level analysis has primarily focused on deforestation, neglecting non-forest-obligate species and other habitat types that are also crucial to biodiversity. Moreover, it lacks longitudinal data for investigating the cumulative impacts on biodiversity. These limitations constrain our understanding of how consumption impacts specific species globally over longer time periods.

To investigate this gap, this study investigates how consumption contributes to biodiversity loss through a species-specific perspective integrating ecological modeling and multi-region input-output analysis, covering 164 countries and 29816 vertebrate species for the period of 1992-2022. We first assess the habitat-suitable ranges of 29816 terrestrial vertebrates by combining species distribution ranges, habitat types, and elevational preferences. We employ the species-range equivalent loss to assess biodiversity loss at a spatial resolution of 0.0083° (~ 1 km) from national and global perspectives. Then, we link the biodiversity data to the latest GLORIA input-output dataset to examine consumption-based biodiversity loss, or biodiversity footprints, for 164 countries/regions. We downscale the biodiversity footprint to a 0.0083° resolution grid by using proportional responsibility as the weighting factor. Finally, we investigate the contributions to biodiversity footprints across nations at varying development levels and contrast domestic biodiversity loss with outsourced (i.e., driven by foreign consumption).

Our research reveals that global biodiversity loss reached 1899.64 units between 1992 and 2022. Significantly, 1189.00 of these units are attributed to direct anthropogenic drivers, representing a magnitude of loss equivalent to the extinction of 1189 species. The peak of anthropogenic biodiversity loss occurred between 1998 and 2001, reaching a maximum value of 126.31. The hotspots of biodiversity loss occurred mainly in the Brazilian Amazon, Southeast Asia and East Africa. Brazil experienced the largest biodiversity loss, followed by Indonesia and Australia. From a consumption perspective, developed countries are the primary contributors to global biodiversity loss due to high volume of consumption. Developed countries account for the largest share of biodiversity loss on the consumption-based side, reaching 905.82 and contributing 76.18% to the global total. They are also the main contributors to biodiversity loss in developing countries, which drives 86.53% of biodiversity loss in these countries. The United States remains the leading contributor to global consumption-based biodiversity loss, followed by Japan and China.

Outsourced biodiversity loss amounts to 989.52, indicating that 83.22% of global biodiversity loss is

driven by foreign consumption. A total of 121 countries are identified as net exporters of biodiversity loss (representing 73.78% of the total), of which 94.21% of these being developing countries. Brazil, Indonesia, and Australia are the three largest net exporters. Conversely, 43 countries are net importers of biodiversity loss, 67.44% of which are developed countries. It suggests that mitigating global biodiversity loss requires not only local conservation efforts but also demand-side interventions (i.e., recycling of paper and reuse of furniture), especially for high-volume consumption in developed and fast-developing countries.

In summary, our study reveals the responsibility and contribution of global consumption to biodiversity loss over three decades at a refined sectoral and spatial scale. Our results demonstrate that developed countries are the primary sources of biodiversity loss in developing countries. This suggests that there should be international cooperation to address the mismatch between conservation and consumption.