

SUPPLEMENTARY MATERIAL FOR THE DATA PAPER

MADERA: A standardized Pan-Amazonian dataset for tropical timber species

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Amazonian timber species list DBH \geq 10 cm

Our taxonomic consensus database reported 1112 accepted name species, 337 genera, and

72 families of trees that can reach DBH \geq 10 cm in the Amazon lowland rain forest.

According to Cardoso *et al.* (2017) most of the life forms of these species were trees (989 species, 88.94 %), with a minor presence of shrubs or small trees (119 species, 10.70%)

and palm trees (4 species, 0.36%).

Species richness, abundance and hyperdominance

More than four-fifths (80.94%) of the species are concentrated in only 20 families: Fabaceae, Lauraceae, Sapotaceae, Malvaceae, Lecythidaceae, Chrysobalanaceae, Moraceae, Burseraceae, Annonaceae, Vochysiaceae, Myristicaceae, Euphorbiaceae, Melastomataceae, Meliaceae, Myrtaceae, Sapindaceae, Rubiaceae, Apocynaceae, Clusiaceae and Anacardiaceae (Figure S1). The remaining 19.06% of timber species are distributed across 52 families.

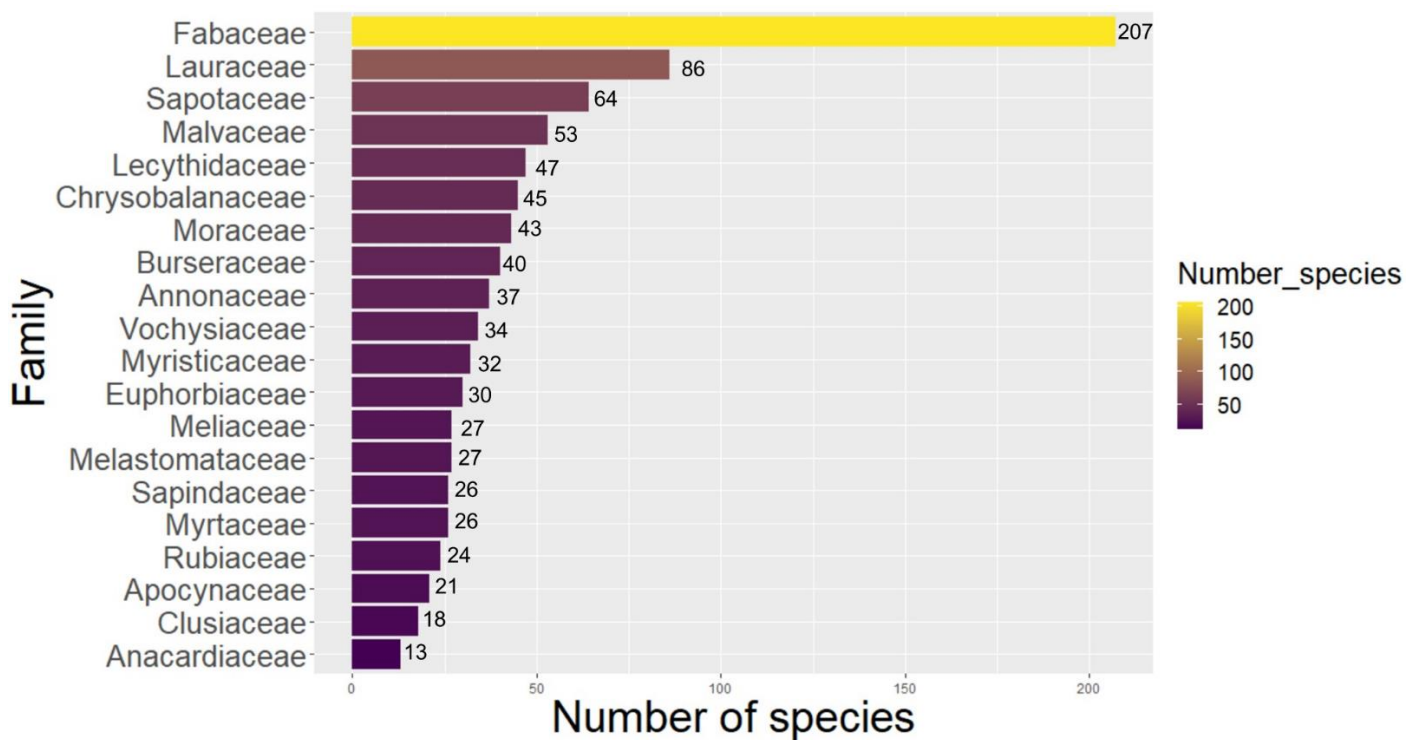


Figure S1. The 20 most species-rich families of timber tree species identified in lowland Amazon rain forests.

Regarding the species – richness from each genus, 31.95% of the included timber species were focused in 20 genera: *Pouteria*, *Licania*, *Inga*, *Ocotea*, *Protium*, *Vochysia*, *Eschweilera*, *Virola*, *Nectandra*, *Swartzia*, *Aniba*, *Ficus*, *Miconia*, *Mouriri*, *Ormosia*, *Talisia*, *Xylopia*, *Cordia*, *Parkia* and *Sloanea*. The 68.13% of species are spread across the 316 remaining genera.

We estimated that 86.81% of all Amazon timber species individuals are represented by just 20 families: Fabaceae, Lecythidaceae, Moraceae, Sapotaceae, Myristicaceae, Burseraceae, Euphorbiaceae, Arecaceae, Malvaceae, Meliaceae, Lauraceae, Annonaceae, Chrysobalanaceae, Urticaceae, Apocynaceae, Anacardiaceae, Vochysiaceae, Clusiaceae, Rubiaceae and Calophyllaceae (Figure S2). The 13.19% of species individuals are spread across the 52 remaining families.

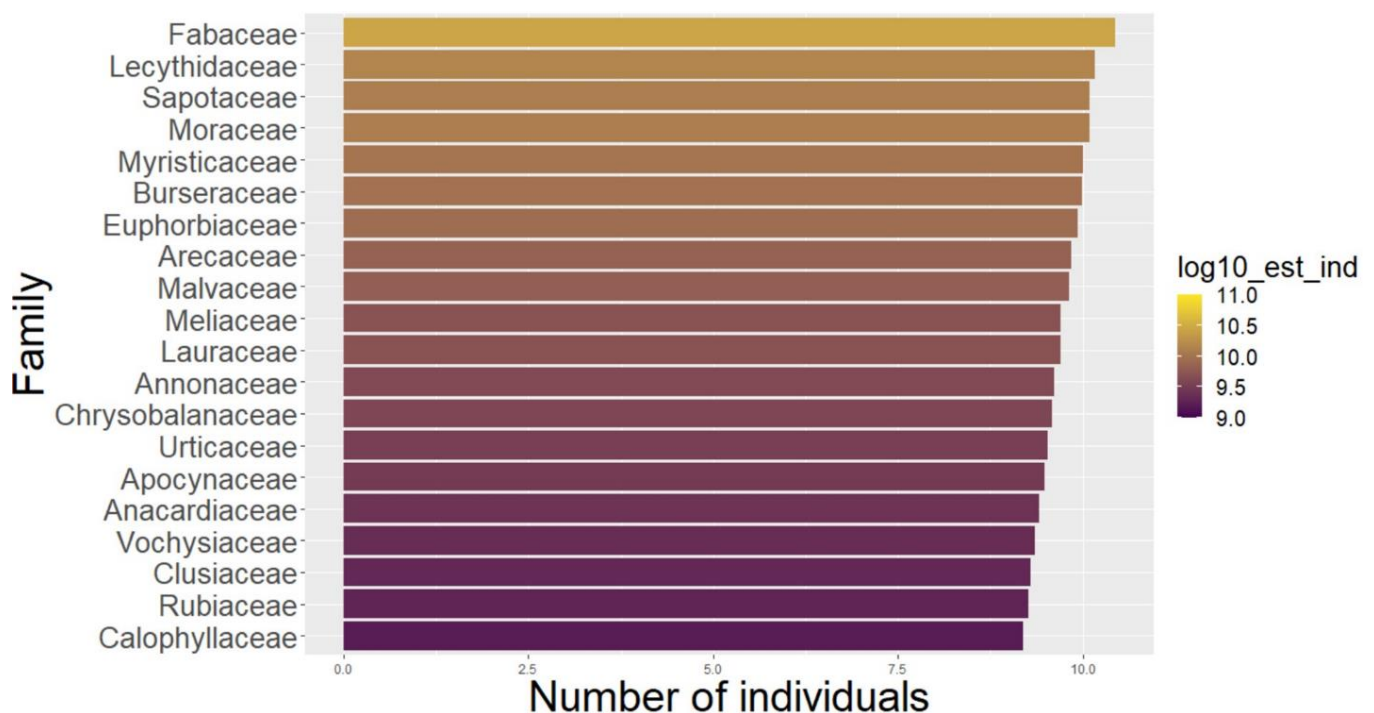


Figure S2. The 20 most abundant families (based on number of individuals on a log₁₀ scale) estimated for the Amazon region using data according to ter Steege *et al.*, (2020).

In addition, we identified 147 hyperdominant timber species (13.2% of the total species) that represented 57.50% of the total abundance estimated for the entire Amazon region. Most of these hyperdominant timber species were predominantly *terra firme* species (forest type 4, 66.0%), with an equal quantity in *igapó*, podzol, *várzea* (forest types 1, 2 and 5, respectively, 8.8%), and slightly fewer in swamps (forest type 3, 7.5%) (ter Steege *et al.*, 2013).

Commercial timber species and CITES appendices

We identified 36 commercial species distributed across 17 families reported by ITTO that matched with our final timber species list. Most of these species (58.3%) belonged to just five families: Fabaceae, Lecythidaceae, Meliaceae, Moraceae and Vochysiaceae. (Figure S3).

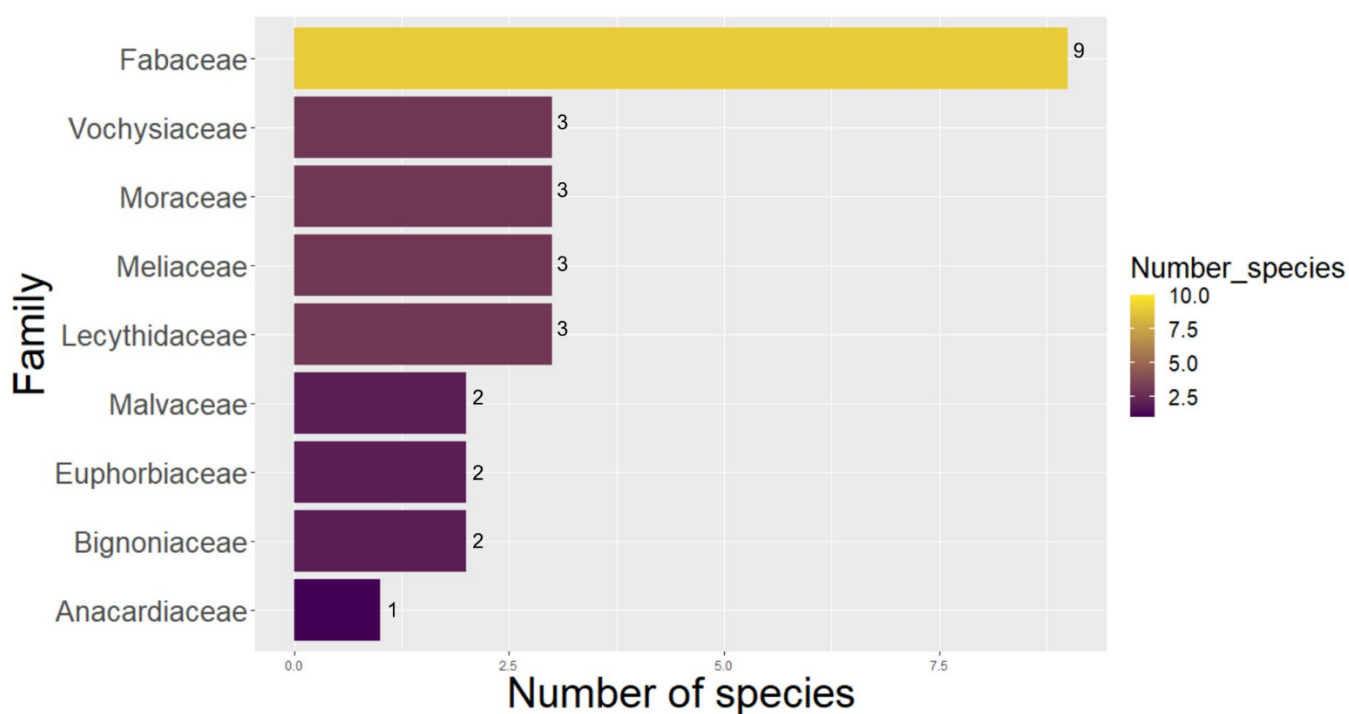


Figure S3. Number of commercial timber species and families of this list according to the International Tropical Timber Organization (2014).

The lesser used species (LUS), also reported by ITTO, and matched with our timber species list, resulting in 125 species distributed in 30 families. The majority (53.6%) of these species are concentrated in five families: Fabaceae, Moraceae, Malvaceae, Lauraceae and Lecythidaceae (Figure S4).

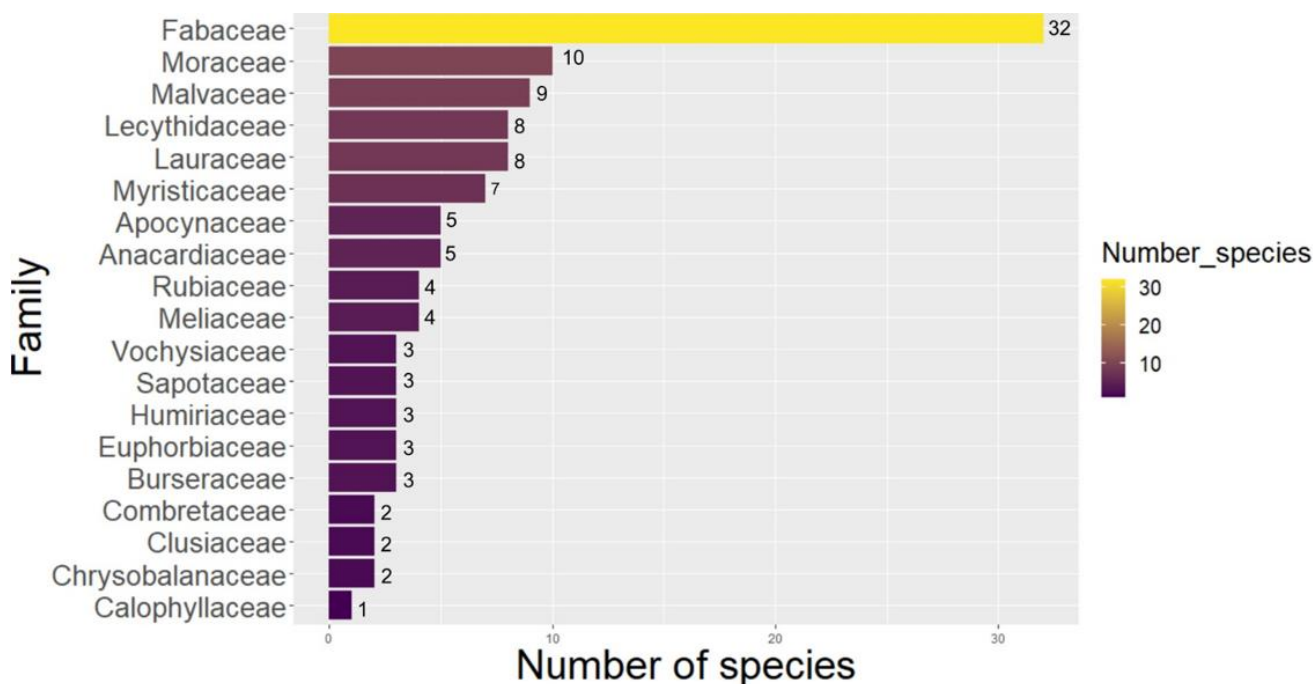


Figure S4. Number of lesser used species (LUS) and families of this timber species list according to the International Tropical Timber Organization (2014).

Finally, we only identified five species in CITES appendices among our 1,112 timber species list. Two of these species belonged to appendix III: *Cedrela angustifolia* (Meliaceae) and *Cedrela fissilis* (Meliaceae), while three of these species belonged to appendix II: *Cedrela odorata* (Meliaceae), *Dalbergia spruceana* (Fabaceae) and *Swietenia macrophylla* (Meliaceae).

Families and species assessed by IUCN up to 2022

We identified 800 species (71.9% of the total list) from 65 families that have been assessed by IUCN Red List Categories among our 1,112 timber species list. In addition, 83.1% of these species were distributed across 21 families with ≥ 10 species each: Fabaceae, Lauraceae, Sapotaceae, Annonaceae, Malvaceae, Moraceae, Lecythidaceae, Burseraceae, Chrysobalanaceae, Euphorbiaceae, Meliaceae, Myristicaceae, Melastomataceae, Vochysiaceae, Clusiaceae, Myrtaceae, Rubiaceae, Sapindaceae,

Apocynaceae and Urticaceae (Figure S5). The 44 families that have been less assessed by IUCN (< 10 spp.) represented the 16.9% remaining.

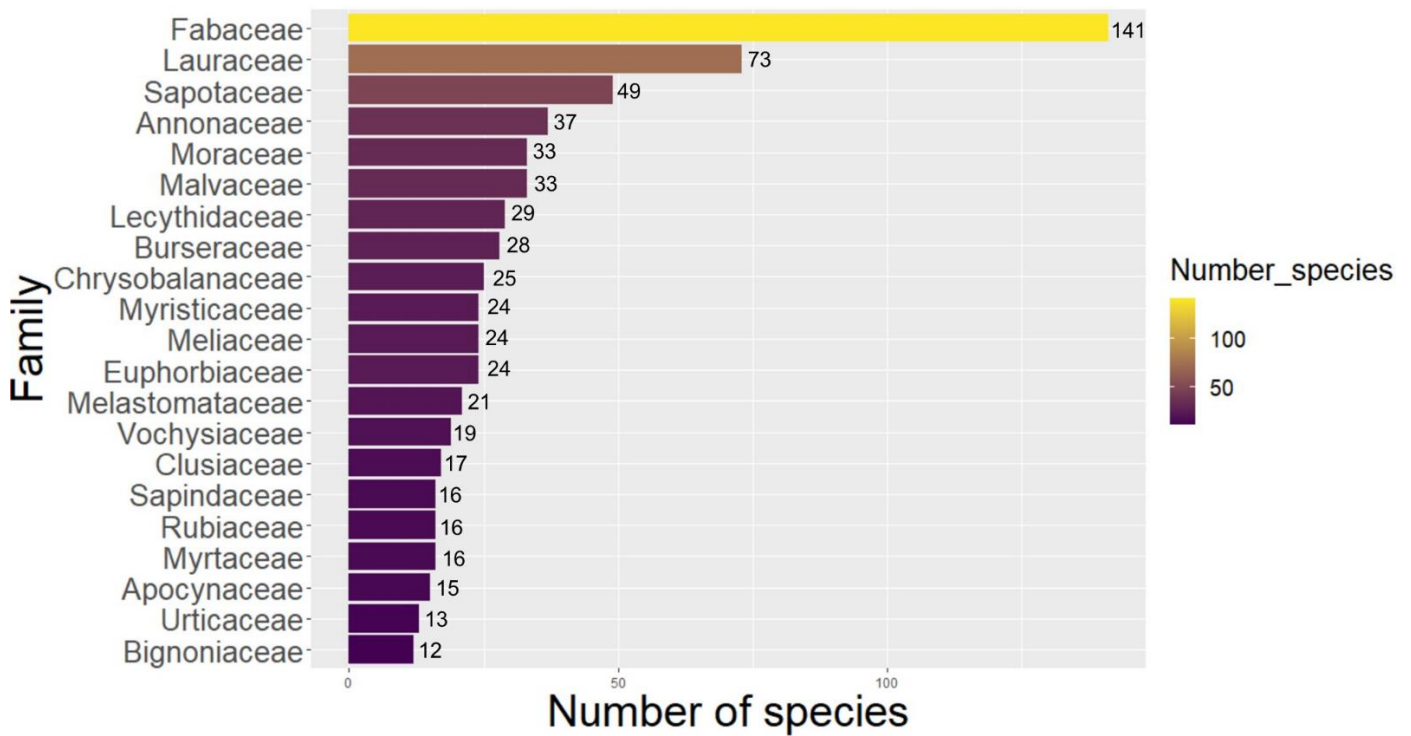


Figure S5. Number of timber species (≥ 10 spp.) and families according to the present study that are assessed by IUCN Red List Categories up to 2022.

Current IUCN Red List Categories for this timber species list

Regarding the 800 timber species (71.9%) from our list that have been assessed by IUCN, most of these species were in the Least Concern category (721 spp., 64.8%), and the 79 remaining species were spread across other Red List Categories (7.1%). In addition, there were a total of 312 timber species (28.1%) that have not been evaluated by IUCN, and therefore their conservation status remains unknown (Table S1).

Table S1. Summary of this Amazon timber species list in each Red List Category up to 2022.

IUCN Red List Category	Number of Amazon timber species	Percentage (%)
Least Concern	721	64.84
Not evaluated	312	28.06
Vulnerable	33	2.97
Endangered	10	0.90
Lower Risk/least concern	11	0.99
Data Deficient	10	0.90
Near Threatened	8	0.72
Lower Risk/near threatened	4	0.36
Lower Risk/conservation dependent	2	0.18
Critically Endangered	1	0.09
Total	1,112	100.00

Amazon timber species threatened by climate change and deforestation scenarios in 2050 (Gomes *et al.*, 2019)

To evaluate the conservation status of Amazonian timber species by 2050 under different climate change scenarios, we used the Representative Concentration Pathways (RCP) from the Intergovernmental Panel on Climate Change (IPCC). RCP categories were established at the IPCC Fifth Assessment Report) and are defined as climate change categories depending on greenhouse concentration trajectories in the atmosphere (IPCC, 2014). Here, we used a low greenhouse gas concentration scenario (RCP 2.6) and the worst-case scenario of high greenhouse gas concentration (RCP 8.5) with different global climate consequences, according to the IPCC categories. We identified a clear increasing tendency of the number of Critically endangered (CR) and Endangered (EN) species in the higher RCP 8.5 compared to the RCP 2.6 scenario. However, the number of Vulnerable (VU) species was almost similar in both scenarios (Figure S6).

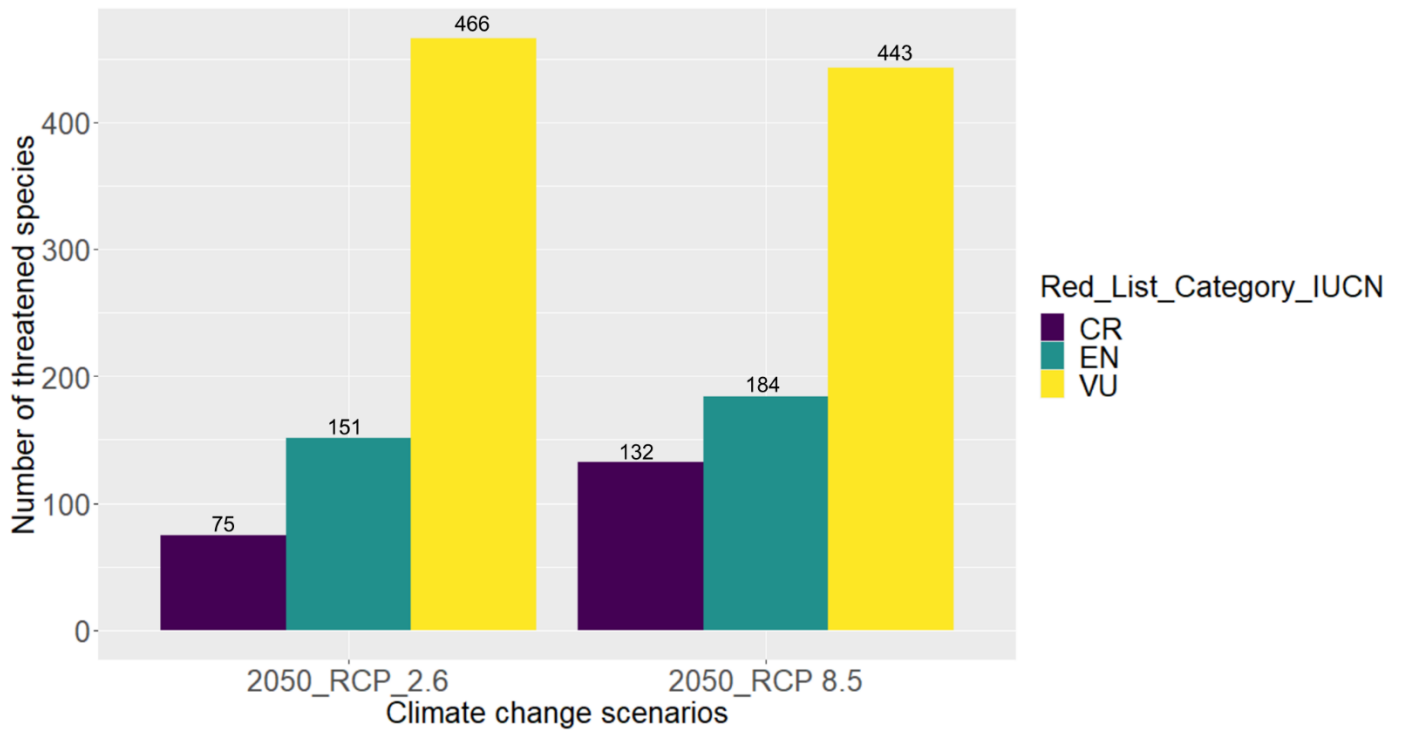


Figure S6. Number of Amazon timber species threatened by 2050 under two different climate change scenarios (RCP 2.6 and RCP 8.5) (Gomes *et al.*, 2019). RCP: representative concentration pathways from the IPCC Fifth Assessment Report (AR5) (IPCC, 2014). Red List Categories IUCN: CR: Critically Endangered, EN: Endangered, VU: Vulnerable.

In addition, the combined scenarios of climate change (RCP 2.6 and RCP 8.5) and Improved Governance Deforestation (IGS) by 2050 also increased the number of CR and EN species more than climate change scenarios alone. Nevertheless, the IGS conditions reduced in less proportion the impact of climate change scenarios themselves for VU species (Figure S7).

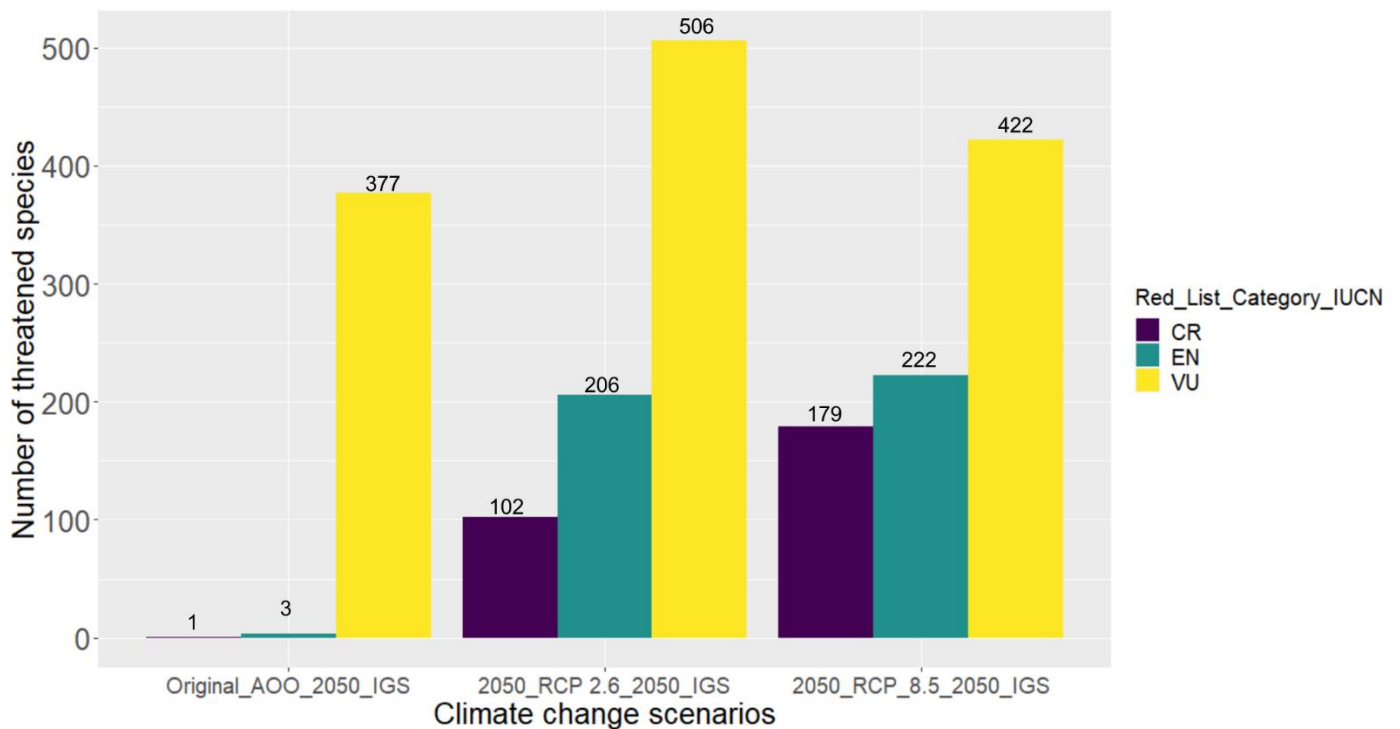


Figure S7. Number of Amazon timber species threatened in the combined scenarios of climate change (RCP 2.6 and RCP 8.5) and improved governance deforestation (IGS) by 2050 (Gomes *et al.*, 2019). RCP: representative concentration pathways from the IPCC Fifth Assessment Report (AR5) (IPCC, 2014). Red List Categories IUCN: CR: Critically Endangered, EN: Endangered, VU: Vulnerable.

On the other hand, the combined scenarios of climate change (RCP 2.6 and RCP 8.5) and Business- as-usual scenario (BAU) by 2050 is the worst-case scenario for CR and EN species. The number of species under these two categories will increase more than under the other scenarios of climate change only and climate change with IGS. However, the number of VU species under this scenario will decrease compared to the other two, just because of the species increase the CR and EN categories (Figure S8).

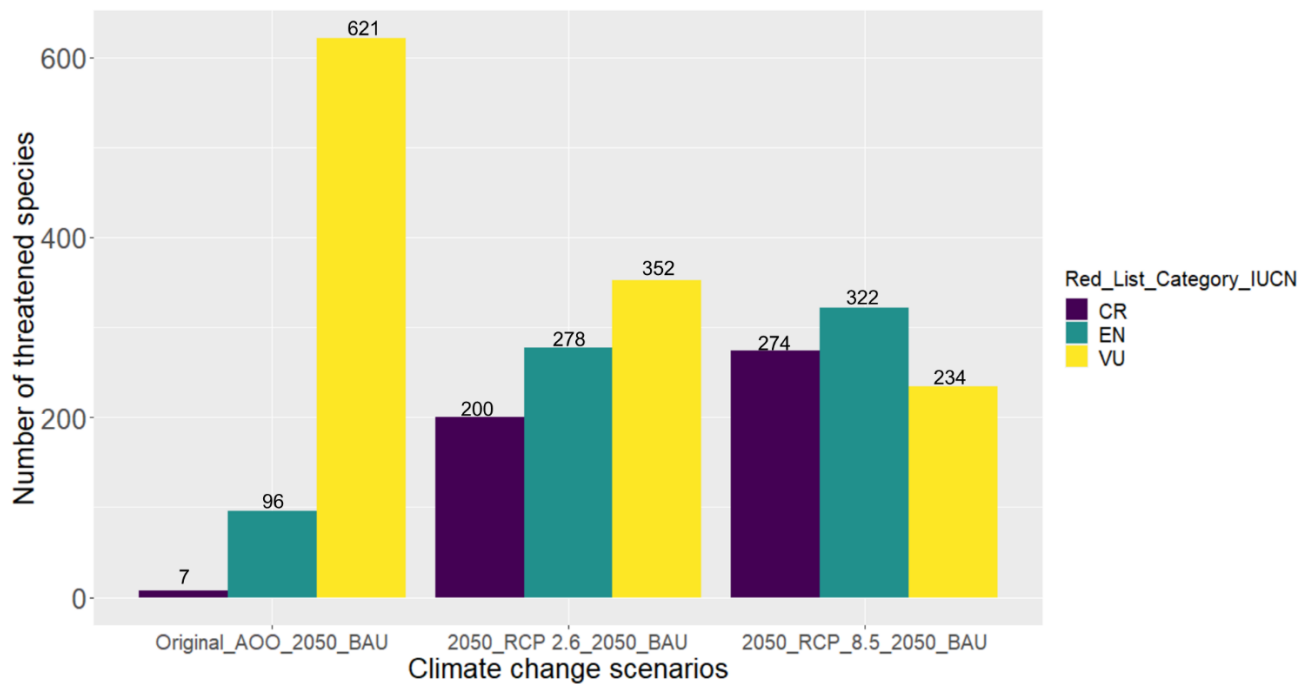


Figure S8. Number of Amazon timber species threatened in the combined scenarios of climate change (RCP 2.6 and RCP 8.5) and business- as-usual scenario (BAU) by 2050 (Gomes *et al.*, 2019). RCP: representative concentration pathways from the IPCC Fifth Assessment Report (AR5) (IPCC, 2014). Red List Categories IUCN: CR: Critically Endangered, EN: Endangered, VU: Vulnerable.

RECOMMENDATIONS

Based on our findings, we suggest the following actions:

- 1) All threatened timber species according to IUCN Red List Categories deserve to be assessed by each country.
- 2) All timber species that have not been evaluated by IUCN, and their conservation status is unknown should also be assessed.
- 3) The species that are commercial (ITTO) and are threatened according to IUCN Red List Categories but are not listed in CITES appendices deserve also consideration for assessment.
- 4) The species that are more vulnerable under climate change and deforestation scenarios according to Gomes et al., (2019) must also be cautiously assessed.

Based on the important list of species presented in this work, it is imperative to consider the role of the Amazon Forest as a key element in the Earth system. A proper management should ensure that biophysical tipping points are not crossed that impede the Amazon Forest to maintain its ecosystem functions, or it could have devastating effects both locally and globally (Bastos Lima et al., 2021).

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