|  |
| --- |
| **Quantifying the magnitude and persistence of human degradation of global tropical moist forests using Landsat and GEDI data** |
| Tropical forest degradation from selective logging, fire, and edge effects is a major driver of carbon and biodiversity loss ([Pearson et al. 2017](https://doi.org/10.1186/s13021-017-0072-2); [Baccini et al. 2017](https://doi.org/10.1126/science.aam5962); [Barlow et al. 2016](https://doi.org/10.1038/nature18326)). The rate of degradation is comparable to that of deforestation and exceeds it during extreme climatic events ([Vancutsem et al. 2021](https://doi.org/10.1126/sciadv.abe1603)). However, the actual extent of degradation impacts is likely underestimated, and large uncertainties remain in quantifying its persistence at global tropical scale ([Gao et al. 2020](https://doi.org/10.1088/1748-9326/abaad7)).We quantify the magnitude and persistence of multiple types of degradation on forest structure over the pantropical belt by combining Landsat-based wall-to-wall maps of forest degradation, deforestation and regrowth from 1990 to 2022 ([Vancutsem et al. 2021](https://doi.org/10.1126/sciadv.abe1603)) with spatially discontinuous estimates of canopy height and biomass from spaceborne LIDAR (GEDI, [Dubayah et al. 2020](https://doi.org/10.1016/j.srs.2020.100002)) from 2019-2022.Based on more than 40 million sample footprints of GEDI data, we estimate that forest height decreases due to selective logging and fire by 15 and 50 % respectively, with low rates of recovery even after 20 years. Agriculture and road expansion trigger a 20-30% reduction in canopy height and biomass at the forest edge, with persistent impacts measurable up to 1.5 km inside the forest. Edge effects encroach on 18% (~206 Mha) of the remaining tropical moist forests, an area more than 200% larger than previously estimated ([Brinck et al. 2017](https://doi.org/10.1038/ncomms14855)). Finally, degraded forests with more than 50% canopy loss are significantly more vulnerable to subsequent deforestation.Taken together, our findings call for greater efforts to prevent degradation and protect already degraded forests to meet the conservation pledges made at the recent United Nations Climate Change and Biodiversity conferences. |