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Using pan-tropical biomass maps to improve IPCC Tier 1 default level emission factors – a case study for the Democratic Republic of the Congo (DRC)

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The IPCC proposes three Tier levels for greenhouse gas emission monitoring with a hierarchical order in terms of accuracy as well as data requirements/complexity. While Tier 1 provides default above-ground biomass (AGB) values per ecological zone and continent, Tier 2 and 3 are either based on country-specific remote sensing or permanent sample-plot data. Due to missing capacities most developing countries have to rely on Tier 1 default values, which show highest uncertainties. Furthermore, IPCC Tier 1 values lack transparency as they are based on a variety of studies that have been repeatedly updated and combined with expert opinions, thus blurring the original data sources. A possible way to increase credibility is a conservative monitoring approach, following the principle of conservativeness, thus reducing the likelihood of unjustified payments for emission reductions not reflecting reality. For the implementation of that principle knowledge about the distribution of the biomass within each ecological zone is essential. However, such information is not available for the IPCC Tier 1 values, which only provide mean values and/or AGB ranges that are not based on a common statistical analysis. Using the pan-tropical datasets of Saatchi et al (Proc Natl Acad Sci USA, 108, 9899-9904, 2011; 1km spatial resolution) and Baccini et al (Nat Climate Change, 2:182-185, 2012; 500m spatial resolution) we calculated the mean AGB values as well as their 50% confidence intervals for each ecological zone within the DRC using Globcover2009 as forest/non-forest mask and the FAO ecological zones dataset. Such analysis is more transparent while at the same time leading to "statistically improved" Tier 1 values, potentially allowing a conservative monitoring approach by selecting the lower bound of the confidence interval for emission estimation during the reference period and the higher bound for the assessment period. Within the DRC Baccini generally delivers higher AGB estimates than Saatchi but even Baccini shows between 81t/ha and 143t/ha lower estimates for Tropical Rain Forests and Moist Deciduous Forests respectively than IPCC. While the AGB values for Tropical Dry Forest of both maps are similar to the IPCC, Tropical Mountain Systems cannot easily be compared as their IPCC data lack a mean value. A recent study by Mitchard et al (Carbon Balance and Management, 8, 10, 2013) compared both pan-tropical datasets, pointing out notable differences in the Congo basin. However, their analysis revealed that none of both maps is generally superior. Therefore, we suggest using the average of both maps as a reasonable approximation to the real but unknown AGB values, thus resulting in 213±69t/ha for Tropical Rain Forests, 94±19t/ha for Moist Deciduous Forests, 119±31t/ha for Tropical Dry Forests and 182±61t/ha for Tropical Mountain Systems of the DRC while the corresponding IPCC values are 310t/ha, 260t/ha, 120t/ha and 40-190t/ha.