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Modelling Stand Dynamics after Selective Logging: Implications for REDD and Estimations of Aboveground Carbon Pools from Forest Degradation

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Abstract

Forest degradation and biomass damage resulting from logging is currently difficult to evaluate with satellite images, but contributes substantially to carbon emissions in the tropics. To address this situation, a post-logging stand development of a semi-deciduous natural forest in Cameroon was modelled for one felling cycle (30 years) after selective logging.

To simulate how different management practices influence post-logging forest dynamics, we modelled how changes in the minimum felling diameter (MFD) affect stem density, basal area and the related carbon biomass at the end of the felling cycle.

With these MFDs estimated, at 7 % logging damage rate, we found that the stem density of initially harvestable trees reduces from 12.3 (50.4 Mg C ha^{-1}) to 6.7 (32.5 Mg C ha^{-1}) trees per ha and the number of initial residual trees increases from 80 (18.9 Mg C ha^{-1}) to 85.7 (36.8 Mg C ha^{-1}) trees per ha. This corresponds to an avoided damage estimated at 17.9 Mg C ha^{-1}. We also found that increasing mortality and damage intensity also increases the damage on carbon biomass estimated to be 8.9 Mg C ha^{-1} at 10 % or to be 17.4 Mg C ha^{-1} at 15 % logging damage.

Overall, our study shows that proper determination of MFD of logged species taking into consideration their capacity of reconstitution at the end of the felling cycle associated with Reduced Impact Logging (RIL) can avoid up to 35 Mg C ha^{-1}. These estimations could be achieved if there is a combination of policy and measures allowing monitoring of forest development after logging.

Keywords: Carbon estimations, felling cycle, future prediction, logging damage, minimum felling diameter (MFD), moist tropical forest, species reconstitution

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