

CO₂ Emission from Land Use Changes for Oil Palm Development

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The rapidly expanding oil palm (OP) plantation has been feared to cause a rapid loss of natural forest and an escalation of CO₂ emission. This on-going study is conducted to (i) analyse land use change trajectories for OP plantation development in Indonesia, Malaysia and Papua New Guinea (PNG) and (ii) estimate CO₂ emission as caused by the land use changes (LUC). LUC analysis was based on 1990, 2000, 2005 and 2010 Landsat TM interpretation with verification using statistical data, Google Earth images and other related studies. Biomass and soil C losses and gains were included in CO₂ emission calculation with emission factors based on a literature review. The analysis shows that OP plantation in Sumatra, Kalimantan and Papua of Indonesia has grown from 1.33 Mha in 1990 to 7.7 Mha in 2010. Forest displacement caused by OP plantation was 27% in the last five years and much less in the earlier years which was less than half of unverified claims that it was >55%. In Malaysia, OP plantation grew from 2.03 to around 5 Mha in 2010 with state forest, rubber and cocoa plantations as the major initial land uses. PNG's OP plantation grew from around 50,000 ha in 1990 to about 125,574 ha in 2010 and this caused only about 3% deforestation. Literatures varied in the estimate of forest C stock from 93 to 300 t ha⁻¹, time average plantation crops from 30 to 60 t ha⁻¹, shrub around 30 t ha⁻¹ and grassland from 2-10 t ha⁻¹, implying that conversion of forest to plantation results in a net positive emission and rehabilitation of degraded shrub or grassland for plantation results in a net positive sequestration. Estimate of CO₂ emission from peat oxidation under OP plantation varied from 23 to 90 t ha⁻¹ yr⁻¹. The estimated net annual CO₂ emissions for OP development in the three major islands of Indonesia between 2005 to 2010 is 133 Mt which was 19% of emissions from all land use changes. Emission from BG peat oxidation accounted for 19% to 66% of the total annual CO₂ emissions from OP plantation depending on the land use change trajectories. The use of peatland is about 20% in Indonesian OP plantation. We recommend that future development of OP plantation be prioritized on low C-stock lands. The use of peatland should be put as the last resort with the implementation of sustainable peatland management.