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Soil carbon losses and decomposition in riparian areas under lowland rainforest transformation systems on Sumatra, Indonesia

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Indonesia′s forest is ranked among the Amazonian and the Kongo Basin as the largest tropical rainforest area worldwide. However, Indonesia experiences a severe forest loss since the 1970s. One primary pressure for a permanent conversion from forest to plantations is a high global demand for agricultural products.
The roles of resulting transformation of tropical riparian rainforests for ecological functions have yet received little attention in scientific research. Especially C stocks in soils of riparian zones are strongly affected by climate and land use changes that lead to changes in water regime and ground water level drops.
We investigated the effects of rainforest transformations in riparian and well-drained areas of Sumatra, on soil C content, stocks and decomposability. C losses after conversion of rainforests to rubber and oil palm plantations in riparian areas were compared to that in plantations in well-drained mineral soils.

C content in Ah-horizons of well-drained soils under oil palm and rubber plantations decreased for 70% and 62% after forest conversion. In riparian soils, C content decreased between 25% and 66% (with extreme values up to 91%) after land use change. There, soil C content is not only dependent on vegetation inputs, but also on a complex riparian soil pedogenesis.
Carbon stocks in well-drained soils decreased by conversion from forest to oil palm plantations for about 42% and in rubber plantation for about 40%. In riparian soils carbon stocks decreased from 269 Mg C ha-1 to 46 Mg C ha-1 (68%) in oil palm and 43 Mg C ha-1 (71%) in rubber plantations.
Delta 13C signature in riparian soils shows an inhomogeneous depth profile ranging from -26 to -31‰ whereas well-drained soils show a homogenous picture with more enriched δ13C signature with increasing depth. This inhomogeneous depth profile in riparian soils indicates that erosion and deposition dynamics overlie the decomposition effects on the SOC isotopy.