EGU2020-13788
https://doi.org/10.5194/egusphere-egu2020-13788
EGU General Assembly 2020


# Impact of rainforest transformation into oil-palm plantations on Si pools in soils

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As oil-palm plantations are expanding rapidly in SE Asia, it is essential to ensure that soil functions are sustained after land-use transformation. This includes the maintenance of well-balanced soil nutrient levels to prevent soil degradation as well as understanding soil silicon (Si) dynamics to optimize oil-palm management. However, studies on the influence of oil-palm cultivation on soil Si pools have not yet been undertaken, although it is known that oil palms accumulate Si in their biomass and should thus affect Si pools and cycling. We hypothesized that under oil-palm monocultures, Si losses may exceed Si input into soils, due to (1) erosion of phytolith-enriched topsoils, (2) increased Si uptake by oil palms, (3) harvest and palm-frond management. The aim of this study is to compare Si pools in Acrisols of Sumatra (Indonesia) under rainforest and oil-palm plantations to assess whether these soil Si pools are significantly depleted under oil-palm plantations. We included both well-drained and riparian sites, hypothesizing that riparian sites are less prone to net Si depletion, as they receive additional Si through regular flooding and slope water from higher areas. Soil samples (1 g) from soil profiles (≤ 1 m, n = 4 for each land-use type and topographic position) were subjected to sequential Si extraction to determine mobile Si, adsorbed Si, Si in soil organic matter, Si occluded in pedogenic oxides and hydroxides, and biogenic Si.

Si in soil organic matter (SOM) and biogenic Si represent the largest Si pools in the Acrisols. Our preliminary results suggest that these pools are controlled by land use rather than by topographic position (riparian versus well-drained). Ah horizons under oil-palm plantations have lower contents of Si in SOM (0.052-1.04 mg $g^{-1}$) than those under rainforest (0.59-1.5 mg $g^{-1}$). There is no significant difference between well-drained and riparian sites, as Si input by slope water and flooding does not affect Si in SOM. Besides, the concentrations of biogenic Si are lower in soils under oil-palm plantations than under rainforest. The contents of both mobile and adsorbed Si in soils are similar to marginally higher in riparian soils (5-30 µg $g^{-1}$), compared to well-drained soils (5-20 µg $g^{-1}$), with no clear difference between land-use types. These Si fractions unlike Si in SOM are most directly influenced by Si input through slope water and flooding.