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Soil microbial metabolic quotient (qCO_2) of twelve ecosystems of Mt. Kilimanjaro

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Soil organic carbon, microbial biomass carbon (MBC) and the metabolic quotient qCO_2 – as sensitive and important parameters for soil fertility and C turnover – are strongly affected by land-use changes all over the world. These effects are particularly distinct upon conversion of natural to agricultural ecosystems due to very fast carbon (C) and nutrient cycles and high vulnerability, especially in the tropics.
In this study, we used an elevational gradient on Mt. Kilimanjaro to investigate the effects of land-use change and elevation on Corg, MBC and qCO_2. Down to a soil depth of 18 cm we compared 4 natural (Helichrysum, Erica forest, Podocarpus forest, Ocotea forest), 5 seminatural (disturbed Podocarpus forest, disturbed Ocotea forest, lower montane forest, grassland, savannah), 1 sustainably used (homegarden) and 2 intensively used ecosystems (coffee plantation, maize field) on an elevation gradient from 950 to 3880 m a.s.l.. Using an incubation device, soil CO_2-efflux of 18 cm deep soil cores was measured under field moist conditions and mean annual temperature.
MBC to Corg ratios varied between 0.7 and 2.3%. qCO_2 increased with magnitude of the disturbance, albeit this effect decreased with elevation. Following the annual precipitation of the ecosystems, both, Corg and MBC showed a hum-shaped distribution with elevation, whereas their maxima were between 2500 and 3000 m a.s.l.. Additionaly, Corg and MBC contents were significantly reduced in intensively used agricultural systems.
We conclude that the soil microbial biomass and its activity in Mt. Kilimanjaro ecosystems are strongly altered by land-use. This effect is more distinct in lower than in higher elevated ecosystems and strongly dependent on the magnitude of disturbance.