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Soil and Necromass Carbon Dioxide efflux in a moist semi-deciduous forest under recovery from selective logging in Ghana

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Carbon dioxide (CO2) fluxes from necromass and soil play very important role in the carbon budget of the forest ecosystem. These components are sometimes not quantified correctly during carbon accounting, leading to uncertainties. Though soil is a large repository of carbon, it also releases carbon into the atmosphere via soil respiration, a process which is a great contributor in the global carbon cycle. Studies conducted on belowground carbon dynamics in the African tropical forest ecosystems focused on stocks, with inadequate information on the fluxes of soil CO2. This study was carried out in Bobiri Forest Reserve, a moist semi-deciduous forest in Ghana, under recovery from selective logging, represented by post-logged-years sites. The sites were 12- (Y12), 22- (Y22), 55- (Y55) post-logged-years sites and a Strict Nature Reserve (SNR) with no logging history. The objectives were to quantify the necromass CO2 efflux and investigate seasonality, magnitude and abiotic controls of total soil respiration. The contributions by various components to total soil respiration were also investigated. Closed chamber method was used to measure soil and necromass respiration at monthly intervals over a period of one year, by means of infrared gas analyser. The coarse woody debris CO2 efflux levels were high in the highly decomposed categories in the Y55 and SNR. The total CO2 efflux ranged from 0.13 (±0.04 SE) in Y22 to 0.22 (±0.07 SE) MgCha-1 year-1 in SNR. Total soil respiration had a strong seasonal influence with the values in the wet season being higher than those in the dry season. The total soil respiration was estimated to be 18.03 and 17.83 MgCha-1 year-1 at the 12- and 55-year-old sites, respectively. The contribution to total respiration by roots and rhizosphere was 24.02 and 34.58 %, mycorrhizae was 16.97 and 14.26 %, litter was 27.42 and 25.17 % and soil organic matter was 31.59 and 25.99 % for the 12- and 55-year-old post-logged sites, respectively. The 55-year-old post-logged site thus exhibited a higher autotrophic respiration proportion of 48.84 % compared to a value of 40.99 % by the 12-year-old post-logged site. Soil moisture had a greater influence on soil respiration than soil temperature. Forest age had greater influence on soil respiration, and the partitioning of total soil respiration into the various components well depicted the contribution from autotrophic and heterotrophic respiration.

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Comparative Ecology of African Tropical Forests: A pan-tropical synthesis

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Background: The world's second largest expanse of closed-canopy tropical forest occurs in Africa, but is little studied compared to Amazonia and Southeast Asian forest.
Methods: Here we utilise the African Tropical Rainforest Observation Network (AfriTRON) of ~400 long-term monitoring plots across 12 African countries, where all stems >10 cm diameter are measured and identified, plus RAINFOR (Amazonia) and other standardised plot data to compute standardised ecological parameters for African tropical forests, and them compare with parameters derived from similar networks in Amazonia and Asia.
Results: African tropical forests have very low stem density compared to other forests; are, on average, taller forest than typical Amazonian forests, but similar height to Asian forests; have higher aboveground biomass than most Amazon forests, but similar biomass to Asian forests; have much lower alpha-diversity than Amazonian and Asian forests, and lower beta- and gamma-diversity. Additional results will also be presented.
Discussion: African forests have unique historical biogeographic circumstances, notably a much more intact megafauna community than either Amazonia or SE Asia, and large reductions in forest area in glacial periods. This may substantially explain why the three major blocks of the world's tropical forests differ greatly from one another in terms of forest structure, function and diversity, and implies likely differing outcomes from today's global environmental changes.
Conclusion: African tropical forests differ substantially in terms of both structure and composition when compared to Amazonian and SE Asia forests.