Tropentag, September 19-21, 2012, Göttingen - Kassel/Witzenhausen

"Resilience of agricultural systems against crises"

Season of Burning Influences Fire Induced P-Losses in Ghana

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Abstract

Between November and February of each year about 45-60 % of the northern region (29 % Ghana) of Ghana gets burned. The fires are associated with plant nutrient transfers of which local losses of P is of major concern given that it is relatively unavailable to crops in the prevailing Fe rich soils. Bush fires, however, provide essential cultural and socio-economic goods and services (as in hunting and land preparation for agriculture) at relatively cheap cost to the local population: making it difficult to implement fire prevention strategies across the region. The need arise therefore to device means by which fires may be used to provide the usual services but at a reduced cost to soil P losses. In this study early (November) and late (January) burn season losses are estimated by a difference in P load before (plant tissues) and after (ash) combustion for each combusted IGBP (International Geosphere Biosphere Program) land cover type. The seasonal variations are then compared to provide ecological insights into efficient means of reducing the nutrient losses during burns. Least mean loss (kg km^{-2}) occurs across shrublands (127–148) while highest losses occur across grasslands (129–402). Given that 88 % and 10 % of the annual burns occur across savannah and woody savannah vegetations, the respective P losses of 170–260 and 158–270 kg km^{-2} has greater impact on local P losses than the relatively high losses across shrubland and grassland vegetations. Besides woody savannah vegetation where P losses are highest during early burns than late burns, late burn losses across savannah, grassland and shrubland vegetations are higher than early burn losses due to comparable tissue concentrations but higher combusted dry material in the late season. Comparatively low tissue moisture also enhances combustibility and render late burns vulnerable to higher P losses. Early burns are suggested to reduce local P losses. The patches of unburned vegetation created by the early burns also inhibit late burn occurrence, may enhance wildlife sustenance and promote tree seedling growth and establishment for carbon capture and storage.

Keywords: Bush fire, food security, fuel load, phosphorus nutrition, savannah

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