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## Slash-and-Mulch in Amazonia does not Result in Significant Soil Carbon Sequestration

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### Abstract

Slash-and-burn land-use is associated with significant C-emissions during the burn. Substitution of fire by slash-and-mulch has been proposed as an alternative management option which could potentially reduce emissions and improve soil quality by increasing C-stocks in SOM. This implies that part of aboveground biomass, transferred to the soil surface as mulch, actually is incorporated into the topsoil OM-pool. Here we investigate if slash-and-mulch of fallow regrowth immobilises significant amounts of biomass and increases topsoil OM-contents for prolonged time-spans.

Research was conducted in the SE-periphery of Amazonia in Zé Doca and Sta Luzia do Paruá counties, representative of clayey and sandy Oxisols respectively. Slash-and-mulch operations were conducted with the bushchopper technology (SHIFT-capoeira / Embrapa-Tipitamba). Sites were subsequently cultivated with maize-bean and maize-water melon cropping sequences. We investigate (i) the velocity of decomposition of the mulch layer, by comparing biomass of secondary forests (5 sites, 2–15 y-old) with mulch biomass after 1 year, and (ii) the incorporation of mulch biomass into topsoil (0–10 cm and 10–20 cm) OM, by comparing physical OM-fractions of topsoil in 15 secondary forest and paired 1-y-old slash-and-mulch sites.

One year after slash-and-mulch, a mere 30% of original forest biomass remained as mulch. This percentage was not affected by fertiliser and liming treatments, nor by the aboveground biomass of the preceding forest.

No significant effects of the mulch layer were discernible on topsoil total or heavy-fraction OM-concentrations after one year. There was a slight and near-significant increase in light ( $< 1.7 \text{ g cm}^{-3}$ ) SOM concentration, but this increase did not increase SOM-stocks, due to the simultaneous decrease in topsoil density.

Our results give clear evidence that the extremely rapid decomposition of the mulch layer – consequence of the favourable conditions for microorganisms in humid-tropical climate – impedes any significant long-term incorporation of mulch into SOM. The slight increase of light fraction OM is irrelevant in quantitative terms, and likely ephemeral due to the labile nature of this fraction. Thus, substitution of slash-and-burn by slash-and-mulch as an isolated management feature is inadequate for C-sequestration and SOM buildup in the humid tropics.

**Keywords:** Amazonia, bushchopper, C-sequestration, slash-and-mulch, soil organic matter