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Linkages between tree species identity and soil organic matter chemistry in an experimental plantation in Central Panama

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Studies have shown that species can influence soil physical, chemical and biological properties. Here we investigated whether soil organic matter composition is altered by tree species. The study was conducted in an experimental tree plantation in Central Panama. The plantation contains 9-year-old single-species stands of *Cedrela odorata, Tabebuia rosea, Anacardium excelsum, Luehea seemannii,* and *Hura crepitans*. We measured carbon (C) and nitrogen (N) content, C:N ratio, carbon (δ^{13}C) and nitrogen (δ^{15}N) isotopic signatures in green leaves, leaf litter and mineral soil (0-10 cm depth). The distribution of lipids (n-alkanes) in plant and soil material was examined to assess the contribution of species-specific plant organic matter to the formation and turnover of soil organic matter. Lipid extraction, fractionation and analyses were done using accelerated solvent extraction, column chromatography and gas chromatography-mass spectrometry, respectively.

Plant tissue chemistry differed significantly among species. For example, the C:N ratio in *Anacardium excelsum* was 2 times higher compared to *Hura crepitans.* Plant tissue δ^{13}C values ranged from -27.2 ‰ (*Tabebuia rosea*) to -31.7 ‰ (*Cedrela odorata*).Although the majority of the n-alkanes in all plant tissue samples were in the range C_{29}-C_{33} with a high odd over even predominance, species specific differences were found. For example, the distribution of n-alkanes in *Anacardium excelsum* leaves peaked at C_{29} which differed from *Hura crepitans* which had a large C_{31} component.

Soil C:N ratio differed among stands suggesting that species-specific organic matter input altered soil properties. In contrast, no relationship was found between plant and soil δ^{13}C values. Soil δ^{13}C values (-19.6 to -22.8 ‰) were significantly more positive than plant detritus δ^{13}C values. This indicates that a high proportion of soil organic carbon still originates from the former C4 pasture vegetation. The distribution of n-alkanes in soil samples peaked at C_{19} and C_{33}which was significantly different from leaves and leaf litter. The low abundance of C_{29} to C_{31} n-alkanes in soil suggests that these n-alkanes were metabolized or re-synthesized during decomposition and diagenesis. The molecular distribution of soil organic matter might also be influenced by organic matter input derived from grasses, sedges and shrubs which grow in the understory.

The lack of a strong species effect on soil organic matter at our study site may partly be explained by the young age of the stands. The species effect on soil properties may also be masked by differences in environmental factors (e.g. topography, soil texture, etc.) among stands.