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Impact of land management on soil arachnofauna (Arachnida) in the southwest Pará, Brazil [6]

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Much of the biodiversity found in tropical forests lives in the soil (Decaëns et. al. 2006). Unfortunately the global demand for agricultural commodities produced in the Amazonia is growing and this region is increasingly affected by drought, fragmentation and forest fires (Laurance et. al. 2002). The changing of soil use in Amazonia is intense and the conversion of native forest for agricultural practices or pasture is the principal factor pressing the remaining native forests (Fearnside 2006). Additionally, very few information about diversity patterns of soil arachnid is available in Amazonia and the consequences of different land management techniques on this fauna are virtually unknown. The soil macrofauna plays important rules regulating soil physical properties, soil carbon storage and maintaining nutrient cycles, thus providing a whole host of ecosystem services that helps to increase the heterogeneity in soils and the soil ecosystem's resilience and resistance to ecological disturbance (Decaëns et. al. 1994).

Understanding changes that directly influence these processes are important for local people, whose livelihoods depend on agriculture practices or pasture areas. In fact, determining the composition of macrofauna is crucial to understand the ecologic complex of these assemblages. Additionally, several organisms of soil fauna can be proposed as bioindicators of soil quality and sustainability. The AMAZ (2007-2011) is an international project carried on Brazil and Colombia aiming to evaluate Amazonian landscapes changed by

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familiar agriculture. The social and economic importance of this kind of agriculture is well recognized, but its environmental impact is not sufficiently known. Therefore, this study integrates the project AMAZ under the title "Ecosystems Services and Agricultural Systems Support on Landscapes in Oriental Amazonia" with the objective to evaluate socioeconomic aspects, the impacts on the landscape structure and the biodiversity in Amazonia. The samples were extending to sites in Colombia and Brazil but, so far, reliable results are limited to samples taken in Brazilian Amazonia.

The experiment was established between April and June 2008, during the dry season. Three sites (windows) were chosen on southwestern Pará state: Palmares II in Parauapebas municipality, Maçaranduba in Nova Ipixuna municipality and Travessão 338 Sul in Pacajá municipality. Each window was divided in three sub-windows (total of 9), and each sub-window was divided in three plots (total of 45). Each plot was divided in five sampling points (45 points each window). A total of 135 spatially independent points were sampled. Five different vegetation types (systems) under each window were identified: forest, "capoeira" (secondary forest), "juquira" (secondary forest dominated by herbaceous and shrubs), pasture and "roça' (shifting cultivation). The sampling methodology used to collect soil and litter macro-invertebrates was based on the Tropical Soil Biology and Fertility Program (TSBF method): which was the digging on soil one block of dimensions 25 cm long, 25 cm wide and 20 cm deep and two blocks 25x25x10 cm on each sampled point. The macrofauna were hand-sorted in the field and the arachnids were stored in 80% alcohol. In the laboratory, the arachnids were counted and identified. All analyses were based only on adults. The voucher specimens are stored in the collection of Museu Paraense Emílio Goeldi in Belém, Pará, Brazil. Patterns of species richness between three windows and vegetation system were analyzed by visual inspection of 95% confidence intervals of individual-based rarefaction curves. To compare arachnids' communities among the various types of land use and to try to identify their determinants, we used a principal component analysis (PCA).

From a total of 897 arachnids (Araneae, Opiliones, Pseudoscorpiones, Schizomida and Scorpiones), 111 species (including morphospecies) were identified: 48 species in Palmares, 52 in Maçaranduba, and 37 in Pacajá. Rarefaction analyses showed that Pacajá significantly harboured more species of Arachnida than the other windows, although none of the accumulation curves approached saturation. Forest system comprised significantly more species of Arachnida (78 adults – 50 species) followed by juquira (35-30), capoeira (22-14), pasture (22-13) and roça (11-9).

The abundance and diversity of arachnids communities varied significantly in relation to the land use. The principal component analysis clearly separated two point of forest system (in Palmares II and Maçaranduba) from the other systems. According the Monte-Carlo test ($p=0.001$) there was a significant difference of the relationships of the arachnid communities between the windows. The PCA result suggested that this pattern can at least be partly explained by changes in structural features of the soil, by agricultural practices

or pasture. Altogether, in forest systems, biological activity is concentrated in the litter and few centimetres upper the soil. In fact, most similar studies reported a reduction in the macrofauna density in used landscapes when compared with the original forest (e.g. Lavelle et. al. 1992, Decaëns et.al. 1994). Our study suggests that soil arachnid fauna can be considered as a sensitive indicator of land management.

As mentioned, forest and juquira systems had higher abundance and species richness than the remaining systems. Besides, these systems exhibited more dense litter and consequently more soil biological activity. This conclusion is supported by other studies in Amazonia where population sizes and species richness are clear negatively influenced by human impacts on land management. The addition of the samples obtained in Colombia and the analysis of soil and environmental variables will be essential to understand the population dynamics and the process of arachnofauna re-colonization in these regenerating environments.

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