

New approaches towards sustainability of land-use systems in tropical Brazil

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Traditionally, tropical soils have been frequently used in a sustainable way by slash and burn. But currently, this method accelerates land degradation due to increasing population pressure. Fallow periods are therefore shortened, thus reducing the potential for soil regeneration. There is, without doubt, an urgent need to develop new approaches for sustainable land-use in tropical regions. In the following some interesting activities on this subject are referred on, partly developed within the SHIFT-program.

The SHIFT-program ENV 44 tries to maintain soil fertility in the Bragantina area (Pará) by production of mulch material from fallow vegetation. A main focus with respect to sustainability deserves to be agroforestry. It could be shown by the SHIFT project ENV 45 that individual trees have fundamentally different effects on sustainability, e.g. by different root activity patterns allowing different access to subsoil nutrients (especially nitrogen) and different nitrate leaching rates. In collaboration with the University of Uberlândia and CIAT it was shown that intensive tree fallow using pines strongly enhances soil acidification. If the soil nutrient status allows, the introduction of high quality timber into agroforestry systems, as studied by SHIFT project ENV 42, would enhance the commercial productiveness of the system. An interesting approach towards sustainability of acid soils in South America was developed by CIAT, rotating acid tolerant crops with improved pasture using nitrogen fixing plant species like pueraria. Analyzing the soil solution it could be shown that the nutrient status of these systems is comparable to the one of the natural Cerrado Vegetation. The introduction of the improved pasture rotation also strongly contributes to land-use sustainability by increasing soil organic carbon contents. Recently, we could identify charcoal as an important soil organic carbon constituent contributing to the sustainability of the Terra Preta in Amazonia. This finding offers new approaches to soil organic carbon and nutrient management concepts for sustainable agriculture in the tropics.

Up to now the mulch and agroforestry systems are not fully accepted by land-users. Especially large scale farmers and partly also small-holders prefer mechanized farming with consequent application of mineral fertilizers and biocides. Some of these chemicals are persistent and may accumulate in soil, water, and crops. Since the application of biocides is part of most land-use practices in humid and sub-humid Brazil, the investigation of their environmental behavior and their effects on biodiversity are important issues in the evaluation of sustainability. First results of the SHIFT project ENV 54 show that the dissipation time of frequently used biocides in the Cuiabá (Mato Grosso) region is astonishing short; but nevertheless biocide leaching within the soil does still take place.

All these research lines do contribute to a better understanding and management of tropical land-use systems. Only with a sustainable land management a continuous economic development can take place and at the same time ecological risks on the local and global scale are minimized.