Soil water dynamics in agroforestry systems

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A central biophysical agroforestry hypothesis is that trees and crops can efficiently grow together on the same site. Water and nutrient use efficiency may be optimized by the spatially and/or temporally complementary exploitation of soil resources. The development of productive and economically viable agroforestry systems thus requires an improved knowledge about the competition between plant species for the normally limited nutrient and water resources of soils. Aiming at the economical and ecological optimization of agroforestry systems experimental field studies in combination with model applications may provide necessary data and information for evaluating different land use systems. While field studies are important for the study of the system behavior under "real world" conditions, models allow a detailed insight into internal soil-plant processes and interactions (e.g. exploration of root water uptake patterns), have a high experimental potential and thus a great system analysis capacity. By using scenario techniques they may significantly contribute to optimization strategies (e.g. quantification of fluxes as indicators for sustainability, simulation of management practices like pruning or irrigation). Field studies are again necessary for providing transport parameters, initial and boundary conditions and calibration data sets. Our contribution focuses on an integrated approach of system analysis. In this context results from an ongoing experiment for the recultivation of degraded sites in the Central Amazon Basin are presented and compared to results from other field studies. Model applications with WHNSIM and HYDRUS-2D are presented and their potential use for understanding agroforestry system behavior and their optimization will be discussed.