

Development of Agro-Forestry Models to assess productivity and environmental protection capacity

Eckart Priesack and Florian Heinlein

Helmholtz Zentrum München, German Research Center for Environmental Health, Institute of Biochemical Plant Pathology, Oberschleissheim, Germany (priesack@helmholtz-muenchen.de)

Based on plot scale experiments and simulations we develop and parameterize a new agro-forestry model within the ecosystem modelling framework Expert-N that combines tree growth and crop respectively grass growth models assuming three different field areas: (i) tree strip area, (ii) transition area between trees and crop/grass and (iii) crop/grass land area to simulate the complete field scale agro-forestry system.

We characterised plant architectures of small plant groups of trees and agricultural crop to explicitly simulate light attenuation and plant internal water flow, which further determines simulation of leaf photosynthesis and nutrient uptake and consequently plant growth.

Soil organic matter turnover and specific crop residue management is modelled for the different growing areas by applying the organic matter turnover models SOILN and CENTURY and the Expert-N surface litter turnover model adapted to include tree litter: twigs, branches and specific fruits.

The model is parameterized and tested using experimental data obtained by sub-projects of the BONARES SIGNAL Project that investigates agro-forestry systems. It is the aim to study scenarios to analyse possible impacts of various management options (tree & crop area, tree & crop species, crop rotations, harvesting intervals, exposition) on soil and ecosystem properties (biodiversity, C-sequestration, nitrate leaching, flooding, soil erosion).