Tropentag, October 9-11, 2007, Witzenhausen

"Utilisation of diversity in land use systems:
Sustainable and organic approaches to meet human needs"

Development and Application of a Bio-Economic Agroforestry Model for the Tropics

Tinne Van Looy, Erik Mathijs, Eric Tollens

K.U. Leuven, Land Management and Economics, Belgium

Abstract

In the past 15 years biological and bio-economic agroforestry models have been developed for yield and profitability predictions. Biological models use complicated mathematical equations to model specific biological interactions. Bio-economic models combine simplified mathematical equations with economic calculations for discounted cost-benefit analyses. The paper describes the development, use and potential extensions and improvements of a bio-economic model, specifically developed for tropical agroforestry trials. The tree component are farmer-selected indigenous fruit-producing species. Hence, species specific growth functions, as used in a bio-economic model predicting rubber yields in South East Asia, could not be used. Moreover, by using growth functions one cannot account directly for interaction effects. This deficiency was overcome by using mathematical equations, analogous to FarmSAFE, a bio-economic model predicting profitability of agroforestry systems with wood producing tree species in Europe on plot and farm level. Equations modelling water competition in FarmSAFE are replaced for equations modelling nutrient fluxes, as this interaction effect is more prevalent in a (sub-)humid tropical climate. As in FarmSAFE, equations modelling light competition are included. Predicted biomass production is divided over stored woody biomass and yearly fruit production. Species specific parameters are used to calculate net present values of various agroforestry systems, recently planted in Venezuelan and Brazilian project villages. These are compared one to another and vis-à-vis the traditional systems prevailing in the area. First results show a positive profitability of the agroforestry system vis-à-vis the traditional system, in spite of increased labour demand. Further research should reveal to which extent an increase in profitability, which is an adoption enhancing factor, can compensate for an increase in labour pressure from a social point of view. The uncertainty of model predictions, due to a lack of time-series data, can partly be overcome by including stochastic distributions for key parameters. In the future the model will allow calculating bio-energy balances, as market prices of products with underdeveloped markets do not reflect the real value of agricultural production. This will allow for the comparison of the ability to strengthen food security, one of the MDGs, of the different agroforestry systems introduced.

Keywords: Net Present Value, non wood forest production, nutrient fluxes, underutilised species

Contact Address: Tinne Van Looy, K.U. Leuven, Land Management and Economics, W. de Croylaan 42, 3001 Leuven, Belgium, e-mail: tinne.vanlooy@biw.kuleuven.be