



Tropentag, October 5-7, 2011, Bonn

“Development on the margin”

Understanding Land Use Decision-making Using Bayesian Networks in Yunnan, China

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Abstract

Strict enforcement of forest protection and massive afforestation campaigns contributed to the significant increase in China's forest cover during the last 20 years. At the same time, demographic changes in rural areas due to changes in reproduction patterns, the emigration of younger population segments as well as an increasing availability of off-farm employment pulled people away from agriculture. Concurrently, farmers frequently switched to less labour intensive agricultural activities such as the plantation of trees on former cropland to produce cash crops or timber.

We identified the proximate factors and underlying causes that influence the decisions of farm households to plant trees on former cropland with Bayesian networks (BN). BNs allow including causal relationships in data analysis and can combine qualitative stakeholder knowledge with quantitative data. We defined the structure of the network with expert knowledge and in-depth discussions with land users. The network was calibrated and validated with data from a survey of 509 rural households in two upland areas of Yunnan province, southwest China. The two study sites exhibit high poverty incidences and experienced large deforestation rates on sloping lands that led to severe soil erosion and water runoff.

Results substantiate the influence of land endowments, labor availability, off-farm opportunities and forest policies for switching from cropland to tree plantations. Moreover, ethnicity and education are strong predictors of the decision to plant trees by forming land use traditions and shaping access to information. The thorough causal understanding of land use decision-making allows us to explore various scenarios such as the effect of an ongoing decrease of the rural labour pool and of agro-environmental policies with improved spatial targeting. In that way, we contribute to a better understanding of local forest transitions and identify sustainable development pathways in poverty-stricken mountainous areas of China.

Keywords: Bayesian belief networks, decision making, forest transition, land use change, Yunnan