



Tropentag, September 16-18, 2015, Berlin, Germany

“Management of land use systems for enhanced food security:
conflicts, controversies and resolutions”

Using Bayesian Networks to Depict Favouring Frame Conditions for Sustainable Land Management: Umbuzeiro-Tree Planting by Smallholders in Brazil

VERENA RODORFF¹, LIRON STEINMETZ¹, MARIANNA SIEGMUND-SCHULTZE¹, JAN MERTENS²,
JOHANN KÖPPEL¹

¹*Technische Universität Berlin, Environmental planning, Germany*

²*University of Hohenheim, Inst. of Plant Production and Agroecology in the Tropics and Subtropics, Germany*

Abstract

Dam construction in 1988 changed the economic basis of ten-thousand farming families who resettled involuntarily on the less fertile areas around Itaparica reservoir, semi-arid Northeast Brazil. A few now derive income through irrigated cropping on rather small plots, whereas, the majority of rural dwellers has no access to improved irrigation infrastructure as a compensation for flooding the area. These smallholdings rely on small-scale livestock farming, and collecting fruits and firewood from the Caatinga vegetation (native dry forest). The farmers' livelihoods are however threatened by recurring droughts, in sustainable land-use practices and the difficult access to water. In this context, the 'Umbuzeiro-tree planting experiment' tests the endemic, drought-resistant species *Spondias tuberosa* Arruda, applying different soil amendments. The tree is deemed sacred by indigenous tribes and generally considered multipurpose with several benefits for both ecosystem and people. The purpose of the study is exemplarily estimating the adoption potential of innovations for a sustainable land management, in this case planting the Umbuzeiro-tree. We used constellation analysis to identify elements of the current situation and developed a Bayesian Network (BN) to estimate probabilities of practice uptake. Two representative groups of farmers, an organisation supporting the farmers, a plant cultivation company, and three plant and soil experts took part in the study as main stakeholders. The BN focusses on the sustainable conservation and use of the natural environment (environmental health), and securing incomes of smallholders cultivating dryland crop areas ('sequeiro'). The objectives are mathematically improved or not by 25 interacting nodes under different scenarios. Enabling, disabling or setting factors at different values allows analysing different frame conditions to identify crucial elements for the intervention's future success and positive impact on objectives. Exemplarily, incentives and supply of externally grown, grafted *S. tuberosa* seedlings reinforce likelihood for project innovations being adopted by 41 %. Ultimately, pushing chances for improved farmer incomes while benefitting ecosystem health with long-term character to 91,5 %, *vice versa*, the analysis allows identifying conditions, which may impede farmers to adopt the innovations.

Keywords: Adoption potential, Bayesian networks, Caatinga, native species, Northeast Brazil, smallholdings, sustainable land management