



Tropentag, October 5-7, 2011, Bonn

“Development on the margin”

Modelling Social-ecological Systems to Understand Ecosystem Service Trade-offs

GRACE VILLAMOR¹, QUANG BAO LE², PAUL L. G. VLEK¹, MEINE VAN NOORDWIJK³

¹University of Bonn, Centre for Development Research (ZEF), Germany

²ETH Zurich, Natural and Social Science Interface (NSSI), Institute for Environmental Decisions (IED), Switzerland

³World Agroforestry Centre (ICRAF), Southeast Asian Research Program, Indonesia

Abstract

Ecosystem services (ES) trade-offs occur when the provision of the ES is reduced as a consequence of increased use of another ES. The growing demand to meet the human needs particularly for food causes the decline in other ecosystem services such as (agro)biodiversity which are both crucial to human wellbeing. In the recent years, payments or rewards for ecosystem services (PES) as a market based instrument has widely recognised as a management approach to address both the environment conservation and human welfare while serves as a policy instrument to deal with the ES trade-offs. However, there is no solid understanding how PES could affect the synergies and trade-offs among ES. The challenge of ES trade-offs assessment lies on the complexity of ecosystem dynamics in which human and natural processes are coupled. The general problem of all ecological analyses and all environmental decision process is the enormous complexity of the investigated ecosystems and landscape patterns. Coupled human-landscape system is characterised as non-linear (chaotic dynamics), with unpredictable behaviour and interactions that span multiple levels of biological organisations or spatiotemporal scales. Since complex system violates the assumptions of reductionist techniques, the need to work across all manner of human boundaries at different geographic scales (including downstream and upstream relations) is required. It involves an interdisciplinary work and cross-sectional approach of disciplinary boundaries (social and ecological sciences) to understand these complexities. To address this complexity, this research applies a multi-agent system modelling approach (MAS) to simulate and visualise the temporal and spatial scale effects on the trade-offs between goods and services. This research aims to develop a tool-based approach using MAS model to assess ES trade-offs and to support the design of PES schemes.

Keywords: Agent based modelling, ecosystem service trade-offs, social-ecological systems