Modeling Human-Landscape System Dynamics to Support Reward Mechanisms for Agro-biodiversity Conservation in Jambi Province

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

Correspondence:
Grace Villamor (gracev@uni-bonn.de)

Grace Villamor[1], Quang Bao Le[2], Meine van Noordwijk[3] and Paul L.G. Vlek[1]

Zentrum für Entwicklungsforschung
Center of Development Research
University of Bonn

Introduction

Tradeoff between biodiversity and agricultural productivity has been studied at static level (Figure 1) but needs to be understood dynamically. An interdisciplinary modeling approach hopefully helps to capture the complexities of dynamic systems and feedback loops among different ecosystems in a landscape. In this on-going study, a multi-agent system (MAS) modeling approach will simulate and visualize the temporal and spatial scale effects on the tradeoffs between ecosystem goods and services while integrating a system dynamic model to capture the issue of multi-scales. This research will develop a tool-based approach in assessing ecosystem service tradeoffs to support designing payments or rewards for ecosystem services (P/RES) schemes.

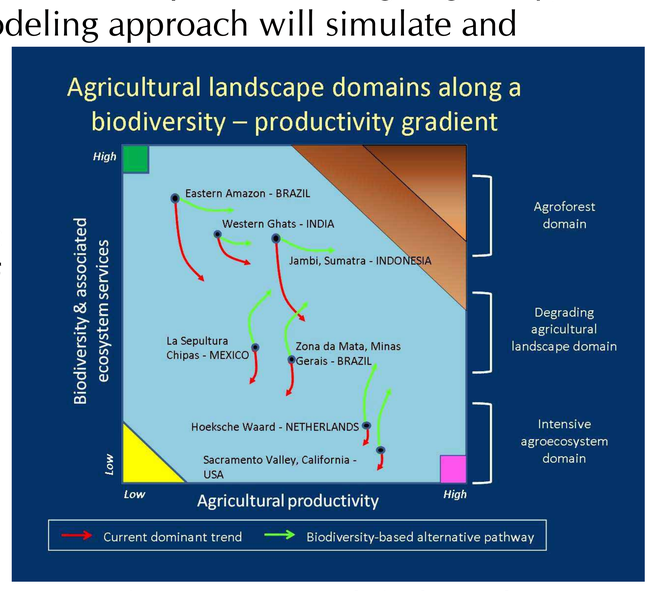


Figure 1. DIVERSITAS' study sites framework on agro-biodiversity project. (Source: www.diversitas.international.org)

Objectives

- To parameterize and validate a MAS model to explore temporal and spatial impacts of PES interventions (different designs of P/RES) on the trade-offs between agro/biodiversity and biomass/food production as the main categories of ES;
- To identify synergy and tradeoffs between the main categories of ES using the MAS model under different modes/options of ecosystem management;
- To understand the various values and perceptions of main stakeholders on the different ES of a given agro-biodiversity landscape simulated by MAS model (using Rapid Agro-Biodiversity Appraisal), and to judge the opportunity for 'bundling' services; and
- To recommend an approach to assess the ES tradeoffs using a MAS model.

Framework

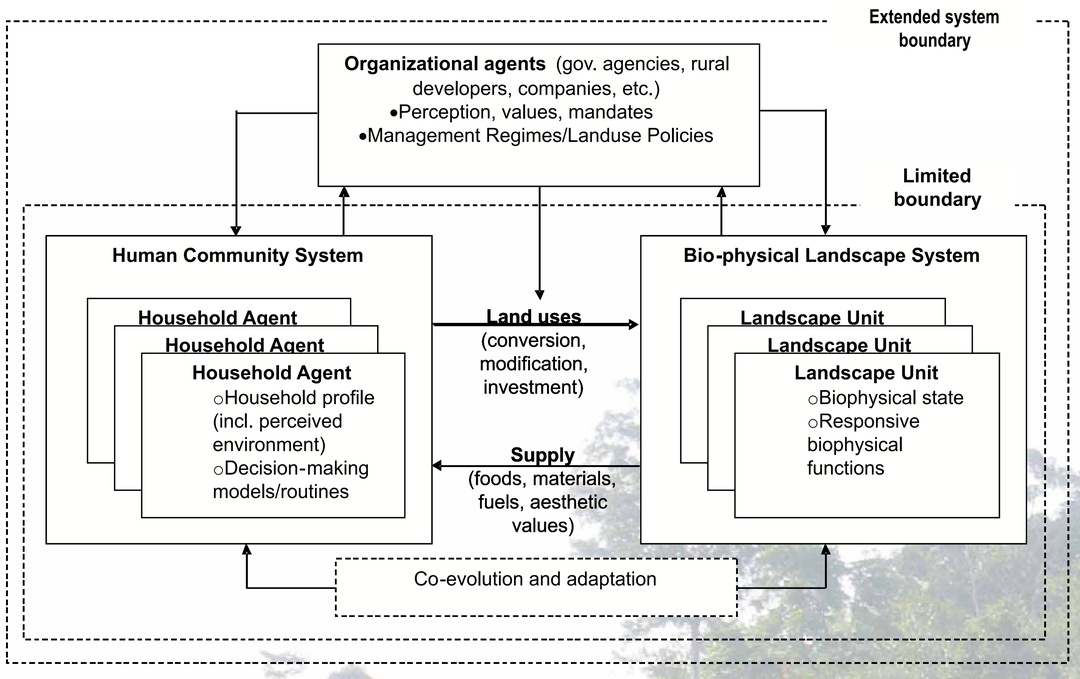


Figure 2: Framework of the multi-agent systems model is composed of three 3 components – Human community system; biophysical landscape system; and human-environment interrelations.

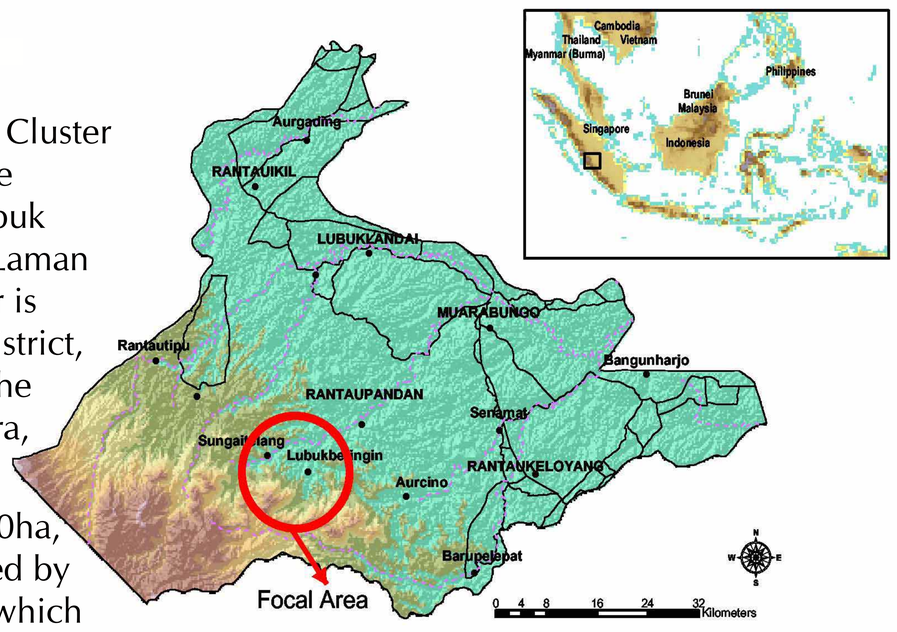
Research Questions

- How can the tradeoffs between ecosystem services (ES) (e.g. agricultural production and agro-biodiversity protection) be modeled to support the design of P/RES schemes?
- How can stakeholders' values and perceptions be integrated in the model and used in the design and implementation of P/RES schemes?
- How can the complexity of human-landscape systems be represented using a MAS model? schemes?

Study Site

The Lubuk Beringin Cluster is composed of three villages namely, Lubuk Beringin, Buat and Laman Panjang. The cluster is located in Bungo District, Jambi Province, in the southwest of Sumatra, Indonesia.

With approx. 12,000ha, the area is dominated by rubber agroforests which function as corridor for endangered species.



Modeling Approach

Integration of two models namely: 1) Land-Use DynAmic Simulator (LUDAS), a multi-agent systems model where decision-making of individual agents on land-use change are captured (Le et al., 2008; Le, 2005) (Figure 1); and 2) FALLOW model, a system dynamic model which will capture the issues of multi-scales and provides toolboxes to assess the consequences of landscape dynamics in terms of human carrying capacity, water functions, biodiversity and carbon stocks (van Noordwijk, 2002).

Assessing Tradeoffs

MAS model serves as a virtual landscape for testing interventions at the same time will serve as computational laboratory to assess impacts and tradeoffs. The following are the 'what if' scenarios to be assessed.

No.	Scenario	Key Parameters
1	Current setting	Use current parameters setting
2	Agricultural intensification for food production (**without considering other ES**)	Increased the number of crop plots
3	Creation of a carbon sequestration project (tree-based system) for a period of 20 years (**with P/RES scheme**)	Use current price of carbon dioxide per ton/ha (5$/ton/ha)
4	Agro-biodiversity market improvement through eco-certification or "green premium" (with **P/RES scheme**)	Price of agrobiodiversity products will be 25-50% increased from the current setting

Expected Output

The model outputs will be the assessment of the tradeoffs and land use changes in forms of potential time-series graphs, maps and landscape-metric and ecosystem services indices under different scenarios.

References

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Acknowledgment

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[1] Centre for Development Research (ZEF), University of Bonn, Germany
[2] Institute of Environmental Decisions, Natural and Social Science Interface, ETH Zurich, Switzerland
[3] World Agroforestry Centre (ICRAF) SEA, Indonesia