UNIVERSITÄT HOHENHEIM

Building and testing a farmers' decision-making model along a gradient of crop intensification in northern Thailand and Vietnam

SFB 564 - The Uplands Program - Subproject C 4.2 - Impact of Intensification on Land Use Dynamics and Environmental Services of Tropical Mountainous Watersheds

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I. Background

- Farmers' land use decisions are influenced by both biophysical and socio-economic opportunities and constraints.
- Rapid agricultural intensification and altered land use systems in the mountainous regions of Northern Thailand and Vietnam may be attributed to the changing socioeconomic conditions and preferences of farmers.
- The Land Use Change Impact Assessment (LUCIA) tool is a biophysical model that dynamically simulates water, soil and plant-related processes at the landscape scale[1]. At its current stage, LUCIA is used for scenario analysis with predefined land cover and management.

II. Study aim

- To build a simple farmers' decision-making model, which integrates land use as an endogenous parameter into LUCIA model, but does not require a full economic analysis.
- To determine the relevant biophysical and socioeconomic criteria for decision making and develop flexible simple decision-making rules.

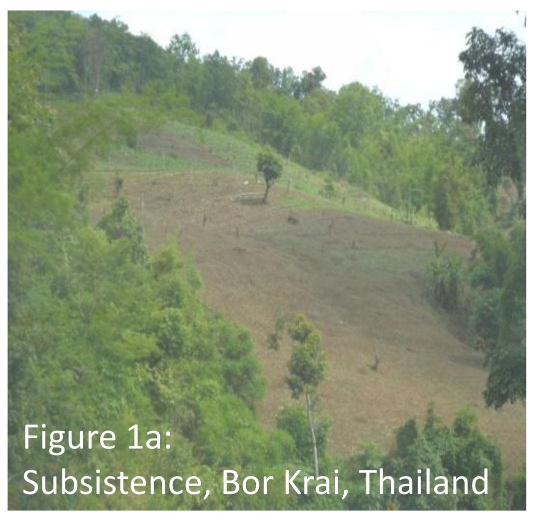
Figure 1a:
Subsistence, Bor Krai, Thailand


Figure 1b:
Small scale, Chieng Khoi, Vietnam


Figure 1c:
Commercial, Mae Sa, Thailand

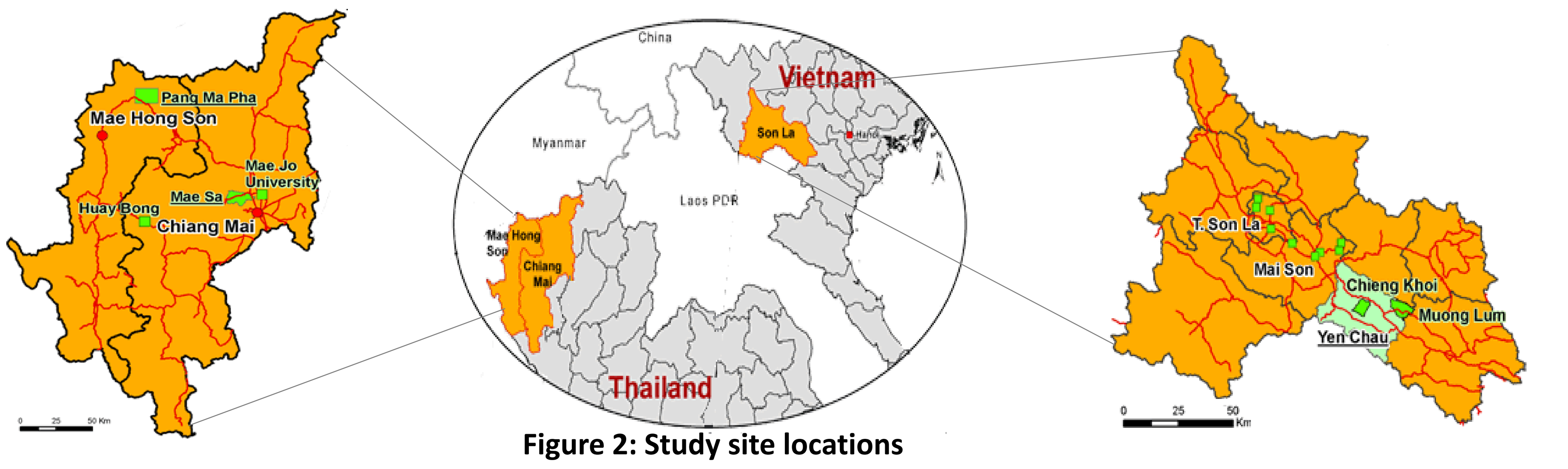

Figure 2: Study site locations

III. Model concept

The decision making model utilizes a two staged approach:

- The suitability stage to determine suitable crops for each spatial position in the landscape, using crop suitability maps created from secondary data (Fig. 3)
- Plot allocation rules for subsistence production based on food requirements
- A feasibility-prioritization (decision) stage reflecting farmers' preferences on plot and crop choice

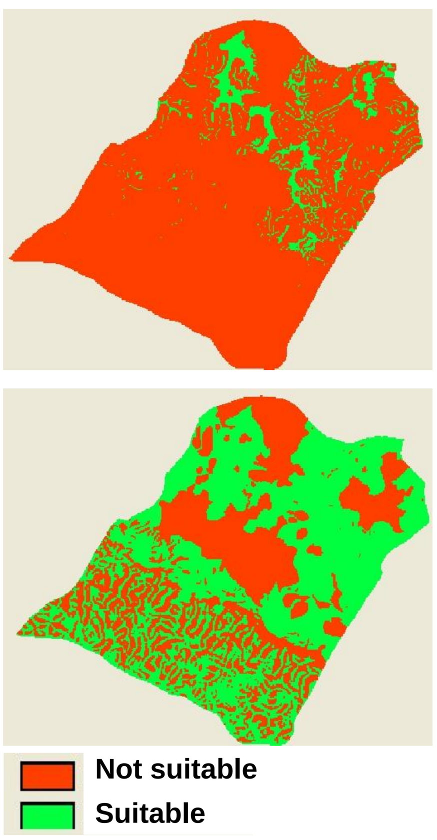

Figure 3: Crop-specific suitability map samples for paddy (top) and upland crops (bottom).

Suitability level

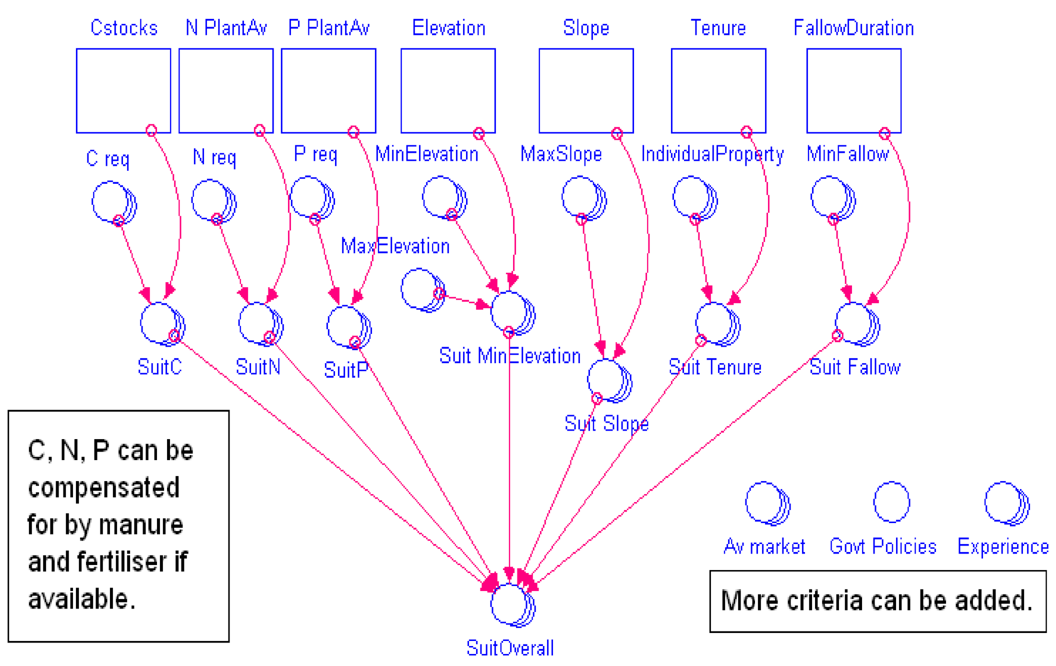

Figure 4: Crop suitability criteria and decision rules for the creation of suitability maps, the first stage of the decision making model .

Parameterize & calibrate

Decision level

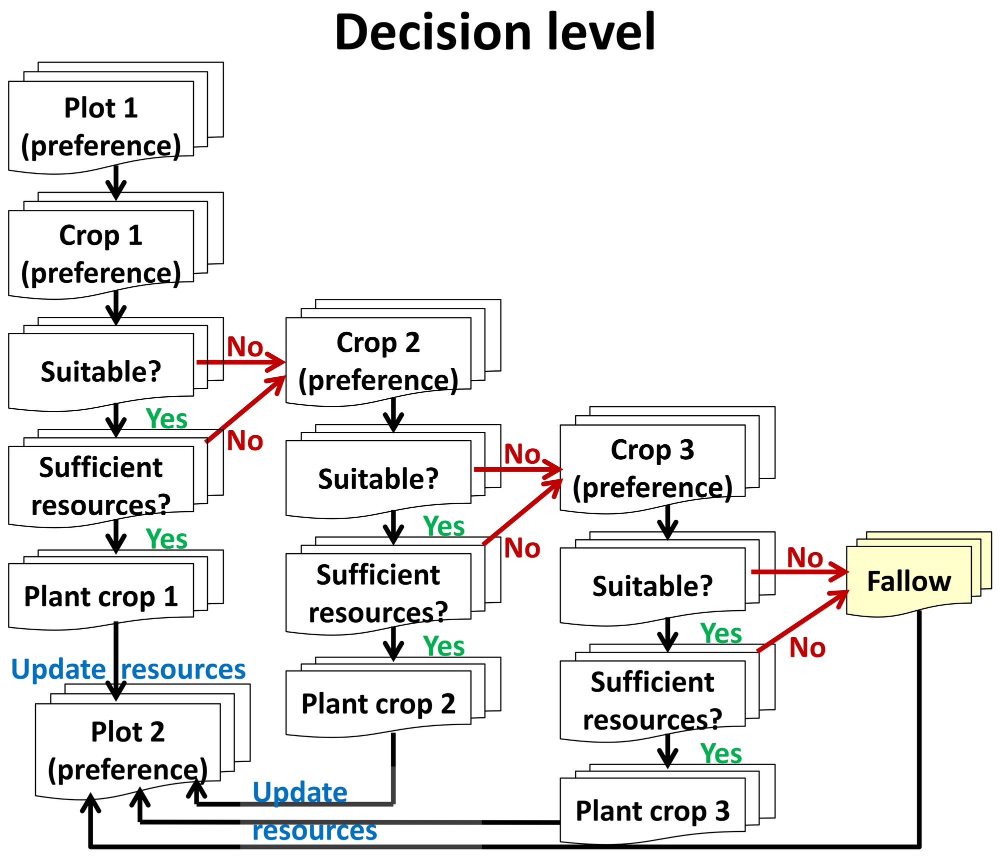

Figure 5: Decision rules on plot and crop choice based on suitability and prioritization of farmers' preferences (Fig. 7).

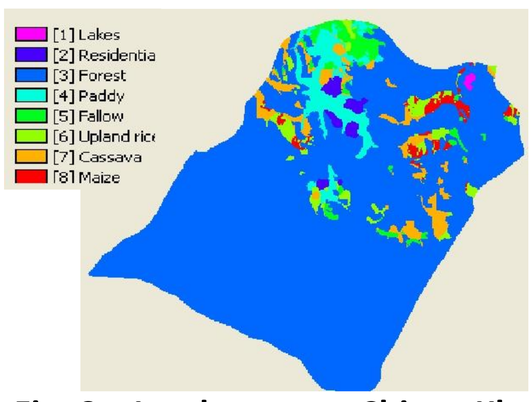

Fig. 6a: Land use map Chieng Khoi

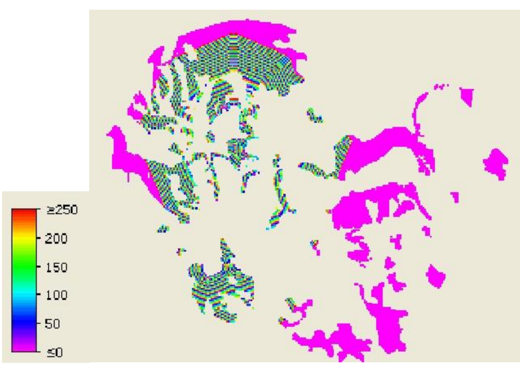
Fig. 6b: Choice plots allocated to household IDs; state land, subsistence plots, residential areas excluded (test run).

IV. Methods

- Focus group discussions (old and young farmer groups) and semi-structured household interviews in both countries (54 households in total), which addressed issues on :
  - Household labour, income and expenses
  - Soil classification and crop suitability
  - Land use history
  - Crop preferences and reasons
  - Factors considered in choice of plot and land use
  - Yield and profit thresholds
- Use of secondary data[2,3] to create suitability maps based on crop maximum elevation and slope, minimum soil fertility, depth and texture requirements.

V. Preliminary results and discussion

- Relevant biophysical criteria for crop - plot decisions were elevation, slope, and soil fertility according to local soil classification. These were used to develop the simple decision rules for the suitability maps (Fig. 4).
- The common criteria which form the decision rules for plot choice (Fig. 6) across intensification levels were biophysical factors and land tenure. Investment costs, markets and risks played only minor roles for plot choice (Fig. 7).
- Significant differences in relevance were found in pairwise comparisons of single plot choice criteria between the villages, the most significant being the role of food provision in Bor Krai compared to Chieng Khoi and Mae Sa (Table 1).

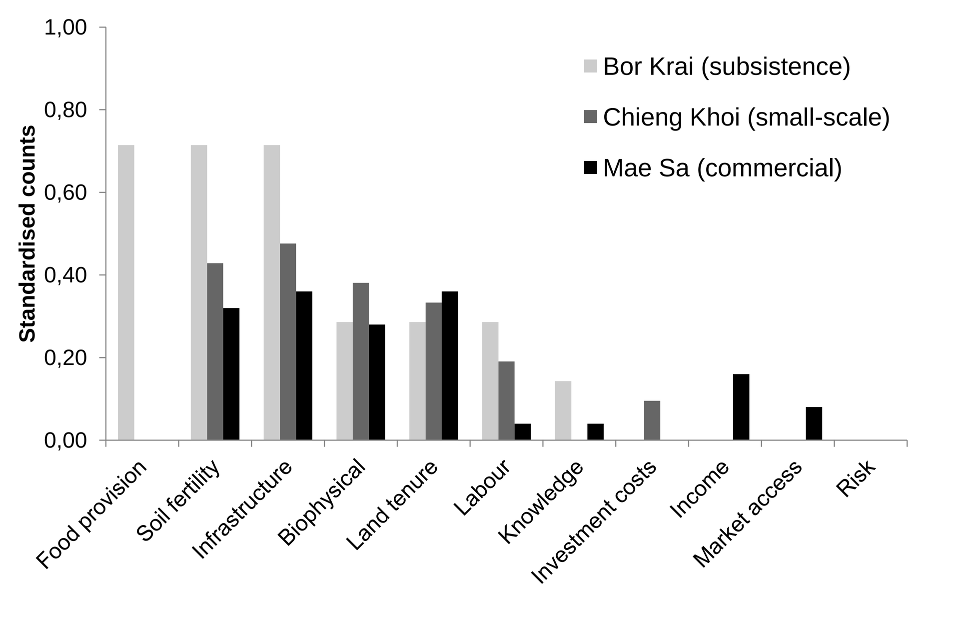

Figure 7: Standardized counts of decision criteria for first plot choice of farmers for subsistence, small scale and commercial intensification levels.
Bor Krai: n=7; Chieng Khoi: n=22; Mae Sa: n = 25

Table 1: Cramer's V test for relationship between decision factors and sites in cross-tabs (range 0 to 1; values with * are significant in a Chi square test (2-sided asymptotic significance < 0.1))

	Bor Krai vs Chieng Khoi	Bor Krai vs Mae Sa	Chieng Khoi vs Mae Sa
Food provision	**0.809***	**0.813***	n.a.
Soil fertility	0.222	**0.332***	0.138
Infrastructure	0.147	**0.295***	0.186
Biophysical	0.109	0.005	0.136
Land tenure	0.070	0.065	0.004
Labour	0.058	0.348	**0.280***
Knowledge	**0.335***	0.176	0.138
Investment costs	0.192	n.a.	**0.278***
Income	n.a.	0.200	**0.286***
Market access	n.a.	0.137	0.198

VI. Outlook

- Validation of the decision making model with georeferenced aerial images
- Integration of the decision model as a module in the LUCIA-Choice model
- Improved scenario analysis with dynamic land use change in LUCIA-Choice

References
1.Marohn, C., Cadisch, G. 2011. Documentation and manual of the LUCIA model v1.2.
2.Sys, C., van Ranst, E., Debaveye, J., Beernaert, F. (1993). Land Evaluation Part III. Crop requirements. Agric. Publications No.7. General Administration for Development Cooperation, Brussels, Belgium.
3.Food and Agriculture Organization of the United Nations (2007). Crop environmental requirements. Retrieved Nov. 2011 from Ecocrop database.

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