Negotiation-support toolkit for learning landscapes

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42 | Trade-off analysis for land-use scenarios (TALaS)

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Trade-off Analysis for Land-use Scenarios (TALaS) is based on a suite of tools that carry out ex-ante analysis of the impact of development strategies on the trade-offs between livelihoods and ecosystem services. The tool combines the use of a spatially explicit land-use-change model, a land-use profitability analysis tool as well as other tools that aim to quantify ecosystem services, that is, biodiversity, carbon and hydrological functions. TALaS is useful for exploring suitable development strategies that can balance growth in the economy and livelihoods while maintaining or enhancing ecosystem services.

Introduction

Development strategies sometimes need to consider both economics/livelihoods and ecological aspects. Very often, development strategies were planned solely for economic benefits without concern for the negative impact they might have on the ecological values of the landscape.

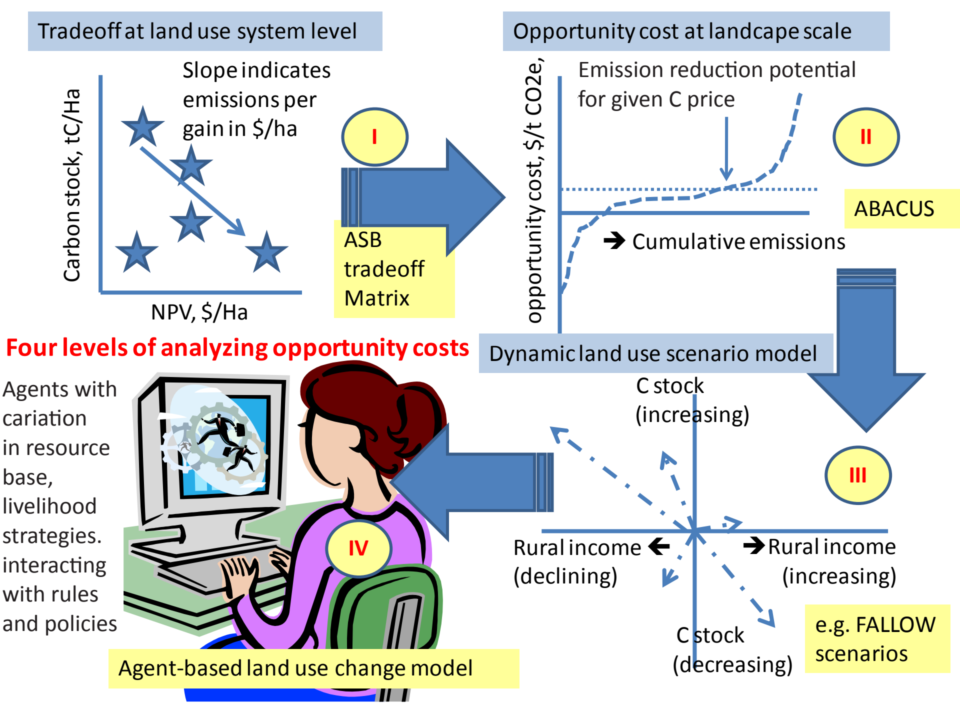

Figure 42.1. Four levels of complexity in analyzing trade-offs: TAlaS (a type III method) builds on tools of type I (trade-off matrix) and type II (Abacus), making use of the FALLOW model

There are four possible directions where implementation of a land-use strategy can lead (Figure 42.1). For example, emphasizing the economic aspect will lead the future of the landscape to have better economic aspects relative to the baseline but most likely will bring a decline in ecologic values ('red development' strategy). An ideal development strategy should bring improvement both in economic and ecologic aspects ('green development').

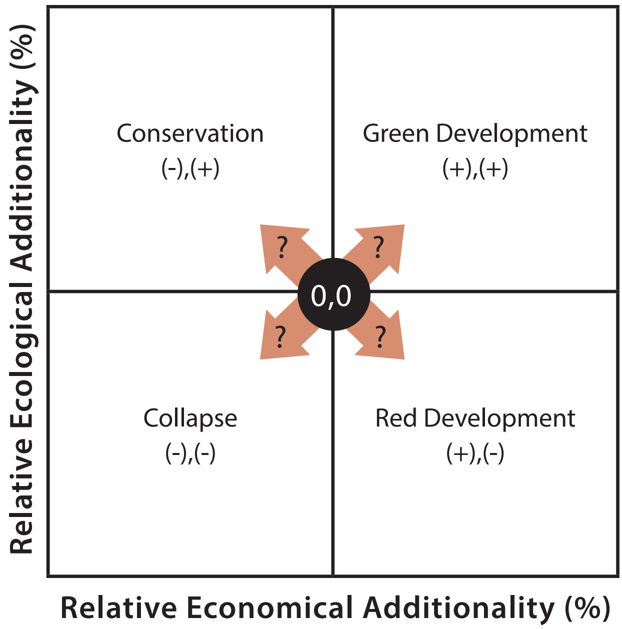

Figure 42.2. Conceptual diagram depicting plausible impact of development strategies

Note: Economic (X axis) and ecological value (Y axis) relative to the initial condition before implementing the strategies (baseline, central point of the diagram)

An ex-ante analysis of several plausible development strategies will help policy makers and natural resource managers understand the impact of their strategies on the landscape. Such an analysis could support the establishment of 'green' development strategies. TALaS was developed for that purpose. It is based on a spatially explicit, land-use-change model (FALLOW), an ex-ante analysis based on scenarios of development strategies (that can be derived from LUWES activities) and combined with land-use profitability analysis (LUPA) and ecological values of the various land-use systems (see RaCSA, QBSur and RHA).

Objectives and steps

TALaS offers a suite of tools that can be used to assess the impact of development on trade-offs between livelihoods and ecosystem services. Steps involved in carrying out each tool are available within each section of the tool.

Example of application

Ex-ante analysis was carried out in Tanjung Jabung Barat district, Jambi province (Mulia et al 2013). The development strategies explored are listed in Table 42.1. The district is located in the eastern part of Sumatra with total area of about 500 000 hectares. The landscape is complex, with peat and mineral soils, the Bukit 30 National Park, former Kesatuan Pengusahaan Hutan Produksi (KPHP/ production forests), industrial forest plantations with acacia trees and large-scale oil-palm plantations (Figure 42.3a). For agricultural crops, smallholders in the district cultivate maize and rice as staples as well as soy beans, cassava, groundnut and other vegetables. Different types of tree-based systems also exist, consisting mainly of rubber (*Hevea brasiliensis*) agroforests. Other important tree-based systems include coffee and coconut agroforests and oil-palm plantations, which was the new commodity introduced into the landscape that quickly drew attention owing to its higher economic returns. Product diversification in the landscape could help to maintain the income of smallholding farmers when they are faced with a harvesting or marketing problem in relation to one specific commodity. Coconut and betel nut are common multipurpose tree species that are often introduced into the system, either as important products or as a 'live fence' or marker of land tenure.

Table 42.1. Four land-use scenarios for FALLOW model simulation that consider the present and future of the rural landscape in Tanjung Jabung Barat, Jambi province

No.	Scenario	Description	Remarks
1	Business as usual	No protection for trees outside the Bukit 30 National Park (BTNP); for conversion into smallholding plots Illegal conversion of protected peat forest (Hutan Lindung Gambut/HLG) into smallholding plots Six types of tree-based system and two types of agricultural crops simulated as livelihoods' options for local people	No new concessions for oil, coal and natural gas exploration are assumed for 30-year simulation No change in road and settlement distribution and market price is assumed during 30-year simulation
2	Protected peat forest	Protection of the HLG No protection for trees outside the legally protected forests (HLG and BTNP); for conversion into smallholding plots	Other conditions are the same as business as usual
3	REALU	Protection of rubber and coffee systems: no conversion is allowed to other livelihoods' options. Post-production rubber and coffee systems are rejuvenated Protection for trees inside HLG, BTNP and ex-KPHP	Supporting low carbon emission development and product diversification Other conditions are the same as business as usual
4	Green REALU	Similar to REALU scenario, plus: New oil-palm plantations can only be established in non-productive non-peat soils (that is, shrub or grass lands on non-peat soils) Post-production rubber systems are not rejuvenated but are instead allowed to naturally develop into secondary forest	Oil palm is introduced on shrub or grass lands to increase profitability and carbon stock Other conditions are the same as business as usual

The FALLOW model was run for 30 years. The land-use profitability data was based on Sofiyuddin et al (2012). Simulation results showed that implementation of three development scenarios that considered protection of remaining peat forest and/or local agroforestry resulted in lower economic levels relative to the baseline scenario (Figure 42.3b). The baseline scenario allowed conversion of remaining peat/mineral forests and agroforestry plots into smallholding oil-palm plantations that give higher economic returns. Scenarios that considered a larger protection area to prevent conversion into oil-palm plantations resulted in lower economic levels compared to the baseline. On the other hand, carbon stock levels in the baseline scenario were the lowest because of massive conversion of remaining peat/mineral forests and local agroforests to oil palm.

Other examples of TALaS application are given by Suyamto et al (2005), van Noordwijk et al (2008), Lusiana et al (2012) and Tata et al (2013).

a) **b)**

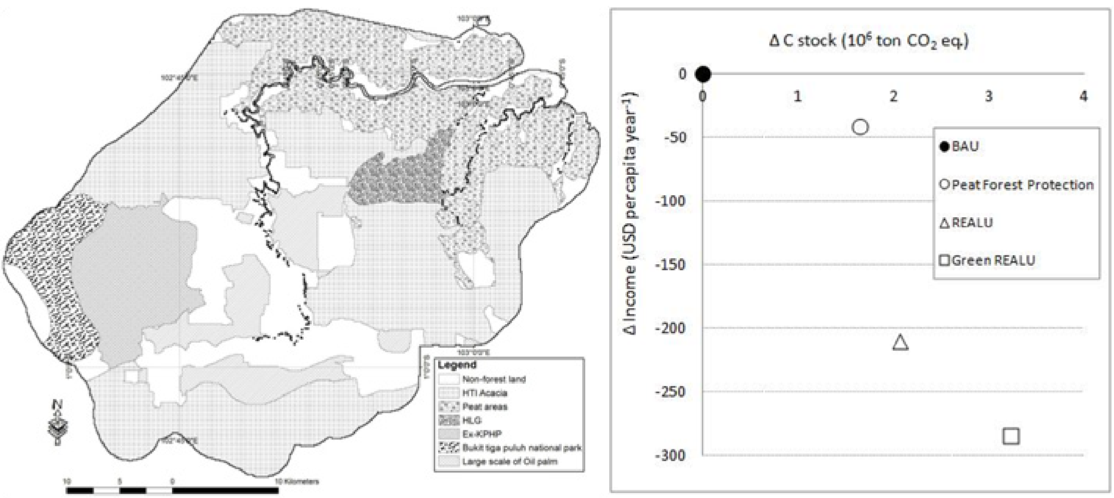

Figure 42.3. a) Area boundaries in the district; and b) impact of each scenario application relative to the baseline scenario

Note: Ecological impact is represented by standing carbon stock in the landscape and economic impact by income per capita measured as the average over the 30-year simulation

Key references

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The landscape scale is a meeting point for bottom–up local initiatives to secure and improve livelihoods from agriculture, agroforestry and forest management, and top–down concerns and incentives related to planetary boundaries to human resource use.

Sustainable development goals require a substantial change of direction from the past when economic growth was usually accompanied by environmental degradation, with the increase of atmospheric greenhouse gasses as a symptom, but also as an issue that needs to be managed as such.

In landscapes around the world, active learning takes place with experiments that involve changes in technology, farming systems, value chains, livelihoods' strategies and institutions. An overarching hypothesis that is being tested is:

> Investment in institutionalising rewards for the environmental services that are provided by multifunctional landscapes with trees is a cost-effective and fair way to reduce vulnerability of rural livelihoods to climate change and to avoid larger costs of specific 'adaptation' while enhancing carbon stocks in the landscape.

Such changes can't come overnight. A complex process of negotiations among stakeholders is usually needed. The divergence of knowledge and claims to knowledge is a major hurdle in the negotiation process.

The collection of tools—methods, approaches and computer models—presented here was shaped by over a decade of involvement in supporting such negotiations in landscapes where a lot is at stake. The tools are meant to support further learning and effectively sharing experience towards smarter landscape management.

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