CHAPTER

17

Negotiation support tools to enhance multifunctioning landscapes

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Highlights

- The multifunctionality of landscapes is currently constrained by gaps between the theory of land use plans and the practice of the political ecology of development
- Reconciled planning units recognize and address gaps between regulations and realities, perspectives of policymakers and local land managers, economic driving factors and land capability
- The diversity of stakeholders of provisioning and other ecosystem services can support multifunctionality in a landscape if pixels and people can be clearly linked to institutions and regulations
- Wide ranging scenario simulations that predict likely consequences ahead of implementation with a model that is acceptable as such can inform the negotiation process

1. Introduction

Land, people and institutions together shape landscapes. People manage land within the limits set by institutions that they respect, but they may break the rules of others that are not effectively enforced. Land use influences ecosystem processes that in turn determine ecosystem functions for the primary land user (taking decisions to use land in a certain way), but also for others. Negative consequences on other stakeholders are the basis of conflicts, but these can be contained if land use rules emerge that are effectively respected and enforced. The rules may include compensation or economic incentives, but these need to have a common point of reference in a joint understanding of how the landscape functions. Where previously 'decision support' systems were focused on informing a single decision-maker, the term 'negotiation support' emerged to describe a process of achieving a shared understanding of how the landscape system functions, the various interests of the main stakeholders, and the various ways these are affected by current status and trends, and by alternative development scenarios (van Noordwijk et al., 2001).

The landscape is a logical focal scale to leverage change at the interface of development and environment, since it is where the implementation will take place and where interventions can still be concretely defined through policy and networks of stakeholders (Sayer et al., 2013). However, the links with scaling-up and scaling-down need to be explicitly represented, as household decisions at a lower-system level drive the action, and broader jurisdictional issues at higher scales provide dynamic policy contexts. Land use planning, as currently known, started in countries where claims to authority by the state were not directly challenged. Even so, land use planning failed where it was seen to be driven as a ‘top down’ process. In reality, rural land use planning in the developing world can be seen as an ‘organized anarchy’, but nevertheless, it has the potential to derive strategic ways to optimize land resources to address climate change-biodiversity-food security crises (Rudel & Meyfroidt, 2014).

The most effective part of the land use planning processes was the ‘zoning’, linking land use restrictions to places. Where the process was largely driven by technocrats relying on ‘objective’ biophysical characteristics, such as land suitability, it needed to be reconciled with the social and political contexts of decision-making and the perceptions and expectations of various actors.

In Indonesia, and similar developing countries, three additional reasons of the failures of land use planning apply. Firstly, institutional settings do not allow the land use planning process to be truly integrative since decision-making on forest land is mostly taken at the national level. Not much power is devolved to lower levels and as a consequence interactions among processes and actors that manage forest land and non-forest land remain weak. Forest land allocation is not part of local development planning, but certain responsibilities on guarding ‘watershed protection’ forests are vested at the local level. This discrepancy brings about inefficiency in the whole landscape planning and at the same time in forest planning and management. Secondly, lack of clarity of land tenure is a challenge for land use planning based on functions as it intersects with existing conflicts over land rights among individuals or groups; such conflicts need to be resolved in the domain of land administration, yet changes in the land use rules, as part of land use planning, can both aggravate and help resolve problems. Thirdly, technical capacity at the local government administration level is not sufficiently developed to lead the technical part of the land use planning process. Both competency and institutional capacity should be addressed. Efforts to bypass government and achieve self-regulation in oil palm as a major commodity value chain have not been successful, however (Ruysschaert & Salles, 2014).

In the remainder of this chapter we will discuss general experience with integrated land use planning as a convening and negotiation process, before introducing a specific ‘tool’ for integrative, inclusive and informed land use planning. We will describe our experience with using this tool in a process of reconciliation of multiple perspectives, before comparing it with wider experience in the concluding remarks.

2. Integrated land use planning as a convening and negotiation process

Land use planning is not only important in producing an implementable plan as an output; the increased probability of success brought about by the process of planning, convening and negotiating (Clark et al., 2011) is perhaps of even more importance. Three key principles in land use planning within landscape approaches are: i) integrative, (i) inclusive, and iii) informed.

The *integrative* principle acknowledges the ineffectiveness of current land-based government regulations and donor-supported, non-governmental programmes at different levels, due to lack of leadership, synergy and coordination at the planning stage. Integrative planning underlines the importance of having synergized processes and aligned objectives across conservation, development, and spatial land-use planning.

Inclusiveness is a buzz word that everybody agrees to ,but the level of operationalization in land-based-related planning really varies. For example, free and prior informed consent (FPIC) enforces inclusiveness of local and indigenous people at the stage where a land-based action is about to be taken, but not necessarily at an earlier stage of diagnosis and option exploration. We argue that inclusiveness should be endorsed as early as at the planning stage.

The *informed* principle ensures that land-based-related planning decisions are made based on knowledge that comes from data, information, and the understanding of processes and functions that are contextual. Scientific and local ecological knowledge within the policy context should be captured and modelled to simulate intervention scenarios, and therefore *ex-ante* (i.e., ahead of implementation) consequences can inform the tradeoff analysis in selecting scenarios (Bateman et al., 2013; van Noordwijk et al., 2013).

3. LUMENS in integrative, inclusive and informed land use planning

In developing countries, the application of such detailed planning within landscape approaches is rare. Three major challenges are: i) a lack of common and agreed spatial allocation within planning units (PU) and inadequate interaction among PUs across various planning processes, ii) the lack of negotiation during land use planning, and iii) the lack of a simple technical tool to allow *ex-ante* tradeoff analysis against scenarios in land use planning.

Building on the experience in reducing conflict over watershed functions in a highly contested watershed in Lampung (Sumatra, Indonesia), where the negotiation support system, consisting of a tool plus a process, was first formulated (van Noordwijk et al., 2001; Clark et al., 2011), the LUWES (Land use planning for low emission development strategy) tool emerged as a next step for district or provincial level subnational governments beyond the analysis of opportunity costs of emission reductions (Dewi et al., 2011). It was set up as a framework with a user-friendly, parsimonious and publicly available software that allows inclusivity, integration and informed negotiation of land use within a landscape. LUWES found its way to broad application in Indonesia as part of a technical step in developing province and district level mitigation action planning (Johana & Agung, 2011). On the process side of LUWES, strong positive feedback was obtained, but the lack of explicit attention to water, biodiversity and multiplier effects in a local economy was seen as an obstacle for full local 'buy-in'.

As a next step forward a tool called Land Use planning for Multiple Environmental Services (LUMENS) is currently taking shape, supported by a working group of potential users and technical experts. Again, it is to be a tool and a process. Application of LUMENS so far has had a district (in Indonesia: Kabupaten) as a focal area, but application at other scales is feasible.

As a process, LUMENS starts with stakeholder mapping, followed by bringing stakeholders into working groups. The district planning office has so far been a logical starting point. These working groups are facilitated in a joint outcome mapping (OM) process, and a series of capacity building trainings in informed negotiation on spatial allocation and land use plans and implementing strategies. OM (Earl et al., 2001) has been widely applied in behavioural change projects in developing countries; it is a vehicle to build consensus on visions, missions and outcome challenges with explicit formulation of the roles and objectives of each group of actors within the overall system and the interaction among them.

In preparation of the tool, a parallel process is the inventory, collection and compilation of data of various types that relate to the focal area. The data are converted to formats that match software packages that jointly form the LUMENS tool. This is a spatially explicit, semi-agent-based model that can accommodate a broad range of scenarios. While it is based on a scientifically sound model, we restrict local data input to be minimal, recognizing the scarcity of reliable on-the-ground data in developing countries, in contrast to increasingly reliable remote sensing data layers in public databases.

The LUMENS tool builds on the modular design of LUWES and allows the developer or future contributors to add more facilities, indicators, modelled processes to suit users' needs, as well as allow users to run only relevant parts of the software, based on their objectives. LUMENS was not developed fully from scratch; development made use of freeware and open source tools such as Quantum-GIS, FragStat, and available routines in the R environment. Figure 17.1 shows the process flow and components of the LUMENS tool. Box 17.1 lists key concepts used for the various modules.

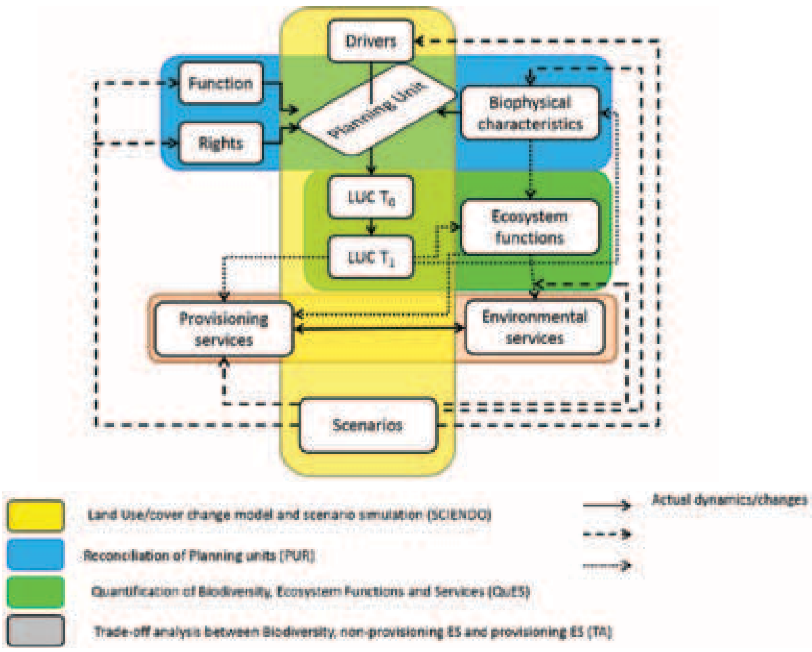

Figure 17.1 Land Use Planning for Multiple Environmental Services (LUMENS): process and components. LUC = Land Use Change; ES = Environmental Services.

Box 17.1

Steps in the LUMENS tool

(also see Figure 17.1)

1. **Delineation of Planning Units (PU's).** The units for subsequent analysis are derived in an iterative process of splitting and lumping a set of spatially explicit and non-overlapping planning units. These units serve to reconcile current socio-economic conditions with existing development and spatial plans and tenure status. Plausible intervention is specific to functions, tenure arrangements, management and other factors, and therefore planning-unit specific.

2. **Driver analysis and spatially explicit modelling of historical land use and land cover changes with respect to each PU**. Two options are provided: for large landscapes with a relatively few PU's or where the dynamics of land use and land cover change and proximate drivers that determine the dynamics are distinctive among PU, modelling is conducted for each PU, recognizing the social interactions between PU's. Otherwise, if the landscape is small, the number of PUs is high, or dynamics within the PU are relatively homogenous, a single model for the entire landscape will be sufficient. We adapt the algorithm of a Land Transformation Model (LTM) from Pijanowski et al. (2002).

3. **Quantification of biodiversity and ecosystem service consequences land use or land cover change (LULCC),** needs to estimate the contribution of each planning unit and emergent properties at the landscape level. The historical biodiversity, watershed functions and carbon stocks are accounted for from past LULCC and as current degree of ecosystem degradation relative to a pre-human reference point. LUMENS adopts the algorithm of the ABACUS tool for carbon storage dynamics (Harja et al., 2013), SWAT (Soil and Water Assessment Tool) (SWAT, 2014) and GenRiver for a water budget model and the Flow Persistence metric (van Noordwijk et al., 2011) at multiple positions in the landscape and Degree of Integration of Focal Area (DIFA) for a biodiversity measure that takes into account the configuration and composition of land uses and cover in quantifying habitat fragmentation by integrating plot-level measurement of species diversity (Dewi et al., 2013).

4. **Baseline scenario for a 'Business As Usual' (BAU) pattern of LULCC and projection of ecosystem service consequences (as in Step 3).** The likely locations of changes are projected from the driver modelling results from Step 2, allowing interactive input on, for example, location of new road development. For the baseline we assume stationary spatial processes. The quantity of change can be drawn from: i) exogenous processes, i.e., as output from other regional or global models, ii) rate of LULCC in the past, assuming a decreased rate of change in forest areas when remaining stocks are being depleted, and iii) forward looking scenario, i.e., foreseen demands from socio-economic development perspectives. Especially for ii) and iii), scenarios should be PU-specific to allow multiple stakeholders to analyze tradeoffs at multiple scale and to increase the accuracy of location projection.

5. **Development of scenarios that are intended to change the BAU trajectory towards either greener development, more aggressive and expansive development, or others.** Scenarios of land use change can range from changes to locally specific drivers that can be translated either into activity data, both non-spatially explicit input such as zone-specific areas of changes, rate of changes, or spatially explicit input such as a new concession. Scenarios can include changes in emission factors from any intervention in agricultural or

silvicultural practices or changes in practices that are associated with better management within stable land use/cover which can reduce biodiversity loss or maintain hydrological functions. A scenario that changes PUs, and therefore restrictions on the management types, is also allowed.

6. **The projection of future LULCC is conducted similarly to Step 4.** Quantification of biodiversity and ecosystem services is conducted on the projected LULCC based on development and/or conservation scenarios as in Step 3. Tradeoff analyses between biodiversity and provisioning and non-provisioning ecosystem services from the multiple scenarios produced from Steps 4 and 5 are included. At the moment, two indicators are considered: land use profitability and the multiplier effect of the land-based sector. Subsequently, a social accounting matrix is utilized for provisioning ecosystem services to compare the opportunity cost of each scenario. The tradeoff analysis, together with other considering factors, serves as a basis for the negotiation process of multiple stakeholders to select a scenario to implement.
7. **Formulation of action plans,** including necessary instruments to implement the most preferred scenario, and to clarify transaction and implementation costs that are not yet captured in the opportunity cost analysis.

Despite the absolute necessity of common perspectives on land capability, land restrictions and land managers across the landscape for inclusive planning, it is rare that zoning is discussed and conducted beyond land capability zoning. We will elaborate the way the process and the tool interact within Planning Unit Reconciliation module (PUR) of the software in conjunction with data compilation and verification, discussions with stakeholder groups and key informants, to flush out the negotiation part of the overall tool.

4. LUMENS as a process: reconciliation of multiple perspectives into PUs

Legal pluralism implies that multiple perspectives on land rights coexist. Negotiation processes often have an 'agree to disagree' stage, where differences are clarified and differentiated from common ground. Within the landscape such a stage can arise between stakeholders which include local and national government, those who self-identify as indigenous people, local communities, migrants and the private sector with land use concessions (Galudra et al., 2014). Recognition of multiple and partially divergent perspectives is needed to move forward in a reconciliation process. Inclusion of the spatial representation of a claim does not imply legal or formal recognition, but it may help in analysis of consequences of current negotiating positions. Planning land uses only based on formal land allocation and ignoring existing uses would result in unrealistic and non-implementable plans. Aligning the functions and the group of stakeholders' desirable uses with the realities and future demands needs to go beyond the typical land capability zoning. Planning unit reconciliation should aim for representation of the perspectives of both the rural poor and urban settlers.

The reconciliation process is technically supported by the PUR module in LUMENS. The module clarifies tenure conflicts or overlapping permits as a first step towards resolving conflicts. PUR provides a technical tool to combine multiple layers of relevant information into planning units that capture multiple views on how to define zones. These planning units then can be discussed and negotiated to produce reconciled planning units.

The process consists of two sequential parts:

1. A zoning process to identify areas of high similarity in a diverse landscape is conducted based on biophysical characteristics, existing spatial plans, local development strategies and socio-economic conditions. Two main activities are: 1) inventories and compilations of land-based development plans, biophysical characteristics (including topography, climate, land use/cover, etc.), maps of permits and concessionaires, and social economic layers (obtained from various government agencies, local community groups, non-governmental organization (NGO)'s, university researchers and other stakeholders at local and national levels); 2) spatial analysis using a Geographical Information System (GIS) to create and combine spatial layers of all available data. The outputs are maps of land parcels making up the landscape, with combined attribute tables of functions, permits and land use/cover. The table reveals conflicting functions and overlapping permits, inconsistencies between functions and existing land use/cover and other peculiarities that need to be resolved. This map enables multiple stakeholders to understand the landscape as a whole, including the potential conflicting agenda and perspectives among them. Multiple stakeholders can use this map as a basis for expressing their perspectives and negotiating them, within the existing regulatory framework for immediate actions, or beyond for further formal process.
2. A reconciliation process to divide the landscape into planning units with minimum inconsistency of, and conflicts in functions, uses and perspectives. The first option in the technical steps is to have the forum of multiple stakeholders to go into the details of each of the problematic areas and resolve them manually case-by-case through discussions. This option can be very time consuming if the quality of data layers is low and complexities of land-related issues are high. The second option is to have the forum discuss the hierarchy or level of priorities among the data layers occupied to produce the planning units, for example, land allocation as the highest level of priority, community-based management as the second, and permits as the third. This hierarchy can be developed by discussions or through an Analytic Hierarchy Process (AHP). Each inconsistency and conflicting allocation can then be resolved, automatically setting such rules in the software. There are cases where reconciliation is not possible without some further legal process and in this case such land parcels are grouped into a class with a particular note on potential conflict.

Figure 17.2 Merangin working group conducting planning unit reconciliation (left); mosaic of cropland and agroforests in river valley of Merangin (right).

The reconciled planning units, as the way to divide up the landscape, become the basis of stakeholder mapping (i.e., who makes decisions, who are the actors, who benefits), deriving understandings on drivers of land use changes in the past, quantifying the contributions of areas, actors, institutions on the past changes and impacts, identifying hotspots of threats, deciding on leverage points and interventions, planning for development and conservation, and advising on benefit-sharing and distribution of a rewards for a ecosystem services provision scheme. This step can be one of the tools within a safeguard information system of the Reducing Emissions from Deforestation and forest Degradation (REDD+) mechanism. All the subsequent steps within land use planning will rely on the PUs for the historical analysis of land use/cover changes and ecosystem functions, for the baseline scenario development and intervention scenario developments. PUs can also be altered as part of intervention scenarios. Conventional land use planning does not acknowledge the multiple perspectives and mostly refers to either the legal perspective or the purely biophysical land capability.

Others steps within LUMENS (Box 17.1) are more technical in nature and are not elaborated further here, but examples of results are provided in Box 17.2.

Box 17.2

LUMENS Application in Merangin, Jambi, Indonesia

Merangin is a district located in the southwest of Jambi Province, Sumatra. The total area spans 7,679 km^2, from lowlands in the east extending up to Bukit Barisan mountain range foothills in the west (Figure 17.3). Starting in 2011, researchers from the World Agroforestry Centre (ICRAF) have been collaborating with a working group in Merangin District, to develop land use plans within low emission development strategies using the LUWES tool. Since 2013, the working group has broadened the scope of analysis beyond carbon through the application of LUMENS, by considering biodiversity and watershed functions as well.

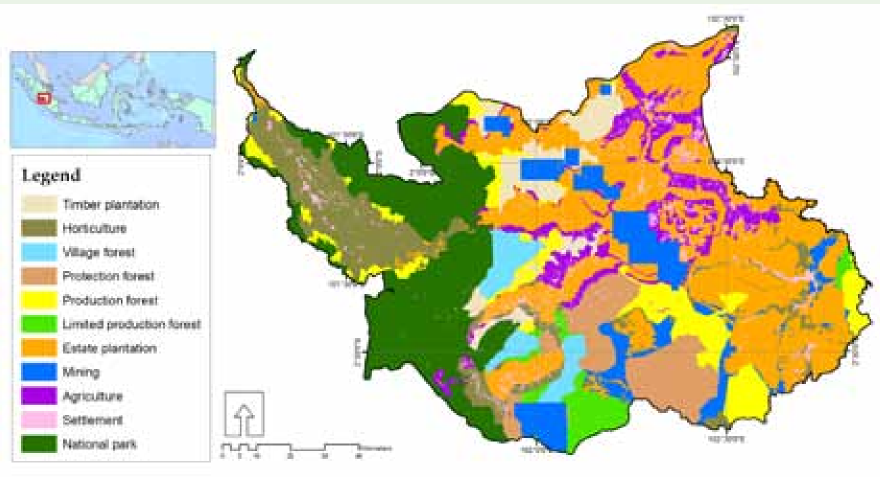

Figure 17.3 Planning Unit map resulting from the reconciliation process.

Based on historical time series of land cover maps of Merangin in 1990-2000-2005-2010, the land cover change in Merangin consists of deforestation and forest degradation to mixed rubber forest systems followed by the vast increases of oil palm monoculture and rubber monoculture plantations. As the result of the reconciliation of PUs (Step 1 of LUMENS), a PU map was produced (Figure 17.3).

Several scenarios of future land uses and land use changes have been built based on historical dynamics and trends: 1) Business as usual scenario (BAU): historical change is retained, assuming stationary processes and drivers; 2) Expansive agricultural development scenario (Expand): speeds up the conversion of forest to oil palm, acacia plantation, and agroforests; 3) Green development scenario (Green): undisturbed forests will remain intact, most logged over forest is retained, degraded areas in protected forest areas rehabilitated. Figure 17.4 showed the simulated land cover map of Merangin in 2015-2020-2025 under the three different scenarios.

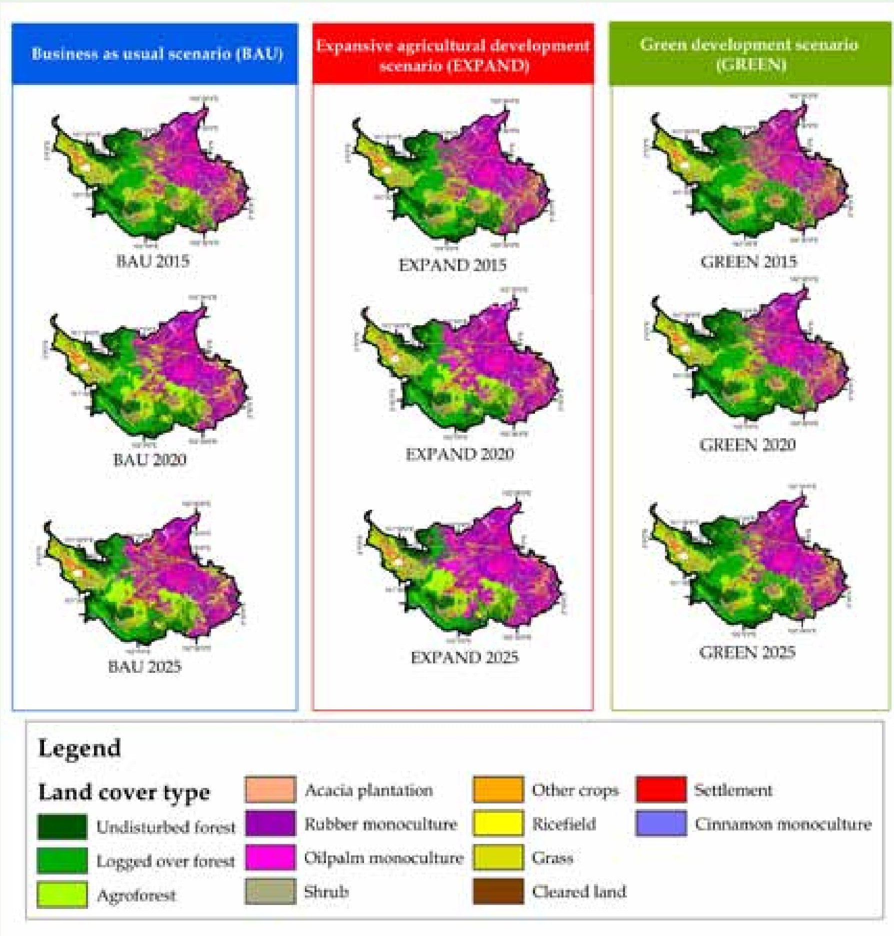

Figure 17.4 Projections of land use/cover maps to 2025 under the three different scenarios.

Figure 17.5 shows the Degree of Integration for Focal Area (DIFA), one of biodiversity indicators within LUMENS, continuing to decline under the Expand (13.11%) and BAU (14.29%) scenarios, but remaining stable relative under the Green scenario (17.95%). Cumulative net emission increase under Expand and BAU. Spatially explicit projections of the above scenarios up to 2025 are used to further estimate the *ex-ante* economic benefit and ecosystem services from the LULCC. The BAU scenario projection up to 2025 shows on average a 3.1% growth in total land use profitability, while that from Green shows a -0.2% growth and Expand, 6.9%. Opportunity costs (i.e., the economic benefit generated from land use changes that result in carbon dioxide (CO_2) emissions) are relatively high. From the BAU scenario, only 7.6% of total emissions (Figure 17.4) are associated with less than 5 USD. In total, the Green scenario reduces 23% (199.3 ton CO_2 equivalent (e)/hectare (h) a) of emissions from the BAU scenario (258.5 tCO_2e/ha), while Expand increases emissions by 6% (275.1 tCO_2e/ha). Considering the difference between total land use profitability between the Green and BAU scenarios, the opportunity cost of implementing the Green scenario amounts to 26.1 USD per t of reduced CO_2e emissions, which is towards the high side of carbon's market price. Relying on full compensation benefits from external sources will neither be feasible nor sustainable. Co-investment between internal actors and external players is deemed necessary for maintaining ecosystem services in the long run. Beyond carbon, biodiversity and watershed functioning are perhaps the two most relevant factors to local actors and communities.

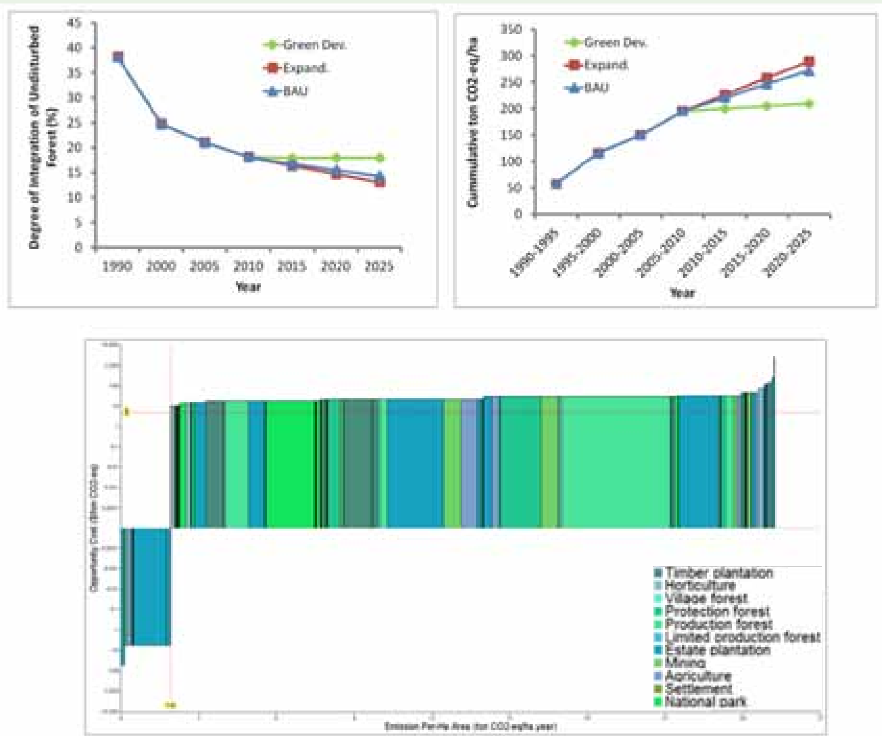

Figure 17.5 Changes over time (due to actual land use/cover changes until 2010, and scenario-based projection of land use/cover changes from 2015-2025) for the DIFA biodiversity measure (top left), land-based emissions (top right) and Opportunity Cost Curve of the BAU scenario from 2010-2015 (bottom).

5. Concluding remarks

Beyond well-explored principles, there are major gaps in operationalizing a productive landscape approach in tropical landscapes. In LUMENS, a landscape is interpreted as a contiguous area, large enough to contain heterogeneity in biophysical characteristics and human-social-political-cultural dimensions, with intra-dependencies that dictate some shared agenda among the constituents. The intended outcome of the tool is the identification of common objectives and the establishment of agreed rules, with the final goal of achieving sustainability. The application recognizes the jurisdictional level at which the process of development of policies and regulation, and development and conservation planning and strategies take place. It is compatible with 'jurisdictional approaches' as discussed in the REDD+ arena.

The experience from working in Merangin District in Jambi Province, Indonesia, has been insightful and encouraging. Facilitation and capacity strengthening of the multiple stakeholder negotiations in planning have been fruitful on many accounts resulting in: raised awareness, developed skills, an improved database, active interaction among members and with external actors, and feedback with regards to tool development. We trust that the outcome of the process will take us closer toward an operational landscape approach to achieve a sustainable landscape. Technical backstopping and relatively low resource support have brought the working group to a different level of interaction and informed decision-making processes. The working group is to collaborate further in refining and finding better options and scenarios, formalizing the results and mainstreaming them into policies and implementation. Some members have also been invited to share their experiences with other districts and at the province and national levels. Currently the district is a strong candidate for REDD+ piloting, with funding available through the national programme that allows some action plans to be implemented.

LUMENS software is to be developed further before the alpha version is launched. However the proof of concept has been very encouraging. Further development will be to link the scenario models at the district scale with optimization models at a broader scale to cater for global and national drivers better, and therefore to accommodate wider ranges of policy scenarios. Proof of application in several other districts in other provinces in Indonesia is planned, with possibilities of further applications elsewhere. In the current discussions on appropriate scales and institutions to reduce emissions that derive from forest conversion, a combination is needed between changes in the way forest institutions operate and changes in the way local governments interact with forests. Whether this is called a 'landscape approach' or a 'jurisdictional approach', it requires both technical tools to effectively use the wealth of spatial data that can currently be generated, and a process of negotiations between stakeholders who initially may be far apart in perspectives. The tools need to be flexible for use under various circumstances, but yet be sufficiently defined to speed up learning and transfer to other users. In very few, if any landscapes, will emission reductions be a dominant rationale for actions – it is thus important that the tools focus on multiple environmental services, with emission reductions as an easily quantified co-benefit.

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Community meeting in Lanzi Village, Uluguru Tanzania. Photo credit: Miika Makela