Partnership for the Tropical Forest Margins

Towards a Landscape Approach for Reducing Emissions

A Substantive Report of the Reducing Emissions from All Land Uses (REALU) Project

World Agroforestry Centre

Norad

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LIST OF ACRONYMS

ACATPA	Asociacion de cacaoteros tecnificados de Padre Abad
AFOLU	Agriculture, forestry and other land uses
ASB	ASB Partnership for the Tropical Forest Margins, formerly Alternatives to Slash-and-Burn
BAPENAS	The National Planning Board for Development, Indonesia
BAU	Business as Usual
BDS	Benefit Distribution System
CDM	Clean Development Mechanism
CIS	Co-Investment in Landscape Stewardship
CO2	Carbon Dioxide
COP	Conference of Parties
COS	Compensation for Opportunity Skipped
CSR	Corporate Social Responsibility
DNPI	National Council on Climate Change, Indonesia (Dewan Nasional Perubahan Iklim)
FALLOW	Forest, Agriculture, Low-value Lands or Wasteland model
FCPF	Forest Carbon Partnership Facility
FPF	Floodplain with swampy forest, Cameroon
FPG	Floodplain with grass, Cameroon
FPIC	Free and Prior Informed Consent
FRT	Tributaries with swampy forest, Cameroon
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information Systems
HKm	Community-managed forests, Indonesia
HLG	Peat Forest (Hutan Lindung Gambut), Indonesia
ICRAF	The World Agroforestry Centre, formerly the International Centre for Research in Agroforestry
ISRI	Indonesian Soil Research Institute
KPHLG	Peat Forest Protection Management Unit
KPHP	Production Forest Management Unit
LURC	Land Use Right Certificates, Vietnam

LUWES	Land-Use Planning for Low Emission Development Strategy
MRV	Monitoring, Reporting and Verification
NAMAs	Nationally Appropriate Mitigation Actions
NGO	Non-Governmental Organization
NICFI	Norway's Climate and Forest Initiative
NORAD	Norwegian Agency for Development Cooperation
NPV	Net Present Value
NTFP	Non-Timber Forest Products
PES	Payments or rewards for environmental services
PFES	Payment for Forest Environmental Services
RACSA	Rapid Carbon Stock Appraisal
RATA	Rapid Land Tenure Claim Analysis
REAGG	Reducing Emissions from Agricultural Greenhouse Gasses
REALU	Reducing Emissions from All Land Uses
REDD	Reducing emissions from deforestation and forest degradation
REDD+	Reducing Emissions from Deforestation and forest Degradation plus conservation, sustainable management of forests and enhancement of carbon stocks
RELs	Reference Emission Levels
REPeat	Reduce Emissions from Peatlands
RESFA	REDD+ site level feasibility appraisal
Restock	Restocking of degraded landscapes through trees and soil carbon
RPP	Readiness Preparation Plans
RUPES	Rewarding Upland Poor for the Environmental Services
Satgas REDD	National REDD Task Force, Indonesia
SBSTA	Subsidiary Body for Scientific and Technological Advice
SECURED Landscapes	Securing Ecosystems and Carbon benefits by Unlocking Reversal of Emissions Drivers
TALaS	Trade-off Analysis for Land use Scenarios
tCO2e	Tonnes Carbon Dioxide Equivalent
UN-REDD	United Nations collaborative programme on Reducing Emissions from Deforestation and Forest Degradation in developing countries
UNFCCC	United Nations framework convention on climate change
VER	Verified Emission Reduction

EXECUTIVE SUMMARY

This report documents lessons and experiences from the Reduced Emission from All Land Use (REALU) project, implemented by the ASB Partnership for the Tropical Forest Margins (ASB) hosted by the World Agroforestry Centre (ICRAF) from 2009 – 2013 with financial support from Norway's Climate and Forest Initiative (NICFI)/the Norwegian Agency for Development Cooperation (NORAD). The report synthesizes findings and learning from exploratory work on landscape approaches towards emission reductions, the results of which aim to support actors in Reducing Emissions from Deforestation and Forest Degradation (REDD+), agriculture and climate smart landscapes. Given that this is an action research project, this report represents work in progress as the results and outcomes of the project are still being digested and further developed in the current phase of the project titled *SECURED LANDSCAPES* - Securing Ecosystems and Carbon benefits by Unlocking Reversal of Emissions Drivers in Landscapes.

The project

The REALU project goal was to develop through action research, a set of approaches, methodologies and national capacities to implement effective landscape-based strategies for REDD+ within a context of rural sustainable development, national sovereignty, respect for indigenous rights, and the integrity of a global greenhouse gas (GHG) accounting system.

Justification for a landscape approach for reducing emissions has, from the start, been based on a number of factors namely, (a) that most drivers of deforestation originate from outside the forest sector; (b) that absence of a globally agreed upon definition of a forest was a major implementation challenge for a forest-based REDD+ mechanism; (c) that for developing countries, emission reductions from agriculture, peatland management, re-stocking of degraded lands and others could be as significant, if not greater than potential emission reductions from forests; (d) that claims of emission reduction in forests would not be credible unless a landscape accounting method was employed that could quantify leakage and demonstrate additionality; and (e) that full accounting for all land uses will embrace low forest cover countries and reward rural poor (hence more equitable).

The project was structured around four components: two of which were substantive components (namely, demonstration landscapes and comparative action research on landscape approaches to reducing emissions), one method and capacity-building component (national-level backstopping through UN-REDD and FCPF processes) and one knowledge-to-action component (enhancing science-policy interactions). Specific attention is paid to the potential contributions of landscape approaches to REDD+, to the understanding and practice of addressing drivers of deforestation, leakage and the broader interaction of multiple-use landscapes in reducing emissions. The project phase reported herein was implemented in four countries namely, Cameroon, Indonesia, Peru and Vietnam.

Under the demonstration landscapes component, the project explored feasibility of emission reduction, using mainly a participatory scenario development approach in all four project landscapes, namely, Tanjung Jabung Barat District in Jambi Province, Indonesia; Efoulan Municipality in Southern Cameroon; Ba Be District in Bac Kan Province, Vietnam; and Padre Abad Province, in the Ucayali Region in Peru. The Land Use Planning for Low Emissions Development Strategy (LUWES) methodology, which enables the development of baselines, estimation of potential emission reductions and planning of emission reduction schemes, was applied and tested in these landscapes. From the emission reduction potentials identified in the aforementioned processes, and the feasibility assessments (economic and institutional), incentive schemes for REDD+ and sustainable benefits were identified and developed for piloting in each of the landscapes (all of which are at various stages of development and implementation).

These incentive schemes include:

REDD+ through conservation of forest carbon stocks:

1 Co-management in peat protection forest areas with local communities through appropriate community forestry schemes in Tanjung Jabung Barat, Indonesia
2 Communal (council forests) in Efoulan Municipality, Southern Cameroon

REDD+ through agroforestry-based intensification:

1 Tree-based intensification of maize production in Ba Be District, Bac Kan Province, Vietnam
2 Cocoa intensification through tree improvement and domestication in Efoulan, Cameroon
3 Potential of Jelutong (*Dyera lowrii*) for agroforestry and trade in Tanjung Jabung Barat, Indonesia
4 Improving carbon stock within land use units (including cocoa, pastures and forests) in Padre Abad Province, Ucayali, Peru

The objective of this comparative action research was to study the enabling conditions for emission reductions at the landscape scale as determined by factors beyond the operational scale. REDD+ was chosen as a focus given that it is the only land-based mechanism for which rules are being developed with corresponding efforts to build policy, institutional and technical capacities. A REDD+ readiness assessment framework was developed and applied to all four project countries. Some effort has also been put into the analysis of drivers of deforestation at national levels, especially focusing on the extent that these drivers impact and or could potentially impact the projects' landscapes.

The methods and capacity-building component focused on methodology development and refinement and its use in supporting national and sub-national REDD+ readiness processes in project countries through training and application. In the first instance the project focused on updating, training and application of a methodology for REDD+ opportunity cost analysis at the national level (training) and application at landscape levels, with over 250 people trained worldwide. More than fifteen trainings have been conducted in the use of the LUWES methodology, carbon measurement tools and land tenure analysis in various countries at the request of governments and other REDD+ actors. There has also been extensive engagement and contribution to Readiness Preparation Plans (RPP) and Monitoring, Reporting and Verification (MRV) development processes at the national level.

Eventually, the knowledge to action component entailed bringing the results and experiences of the project into the policy and science arena as well as to communities. This involved presenting results at national workshops, symposia at important REDD+ and climate conferences and United Nations Framework Convention on Climate Change (UNFCCC) and other policy forums.

Pathways to impact

The REALU project has initiated potentially high impact processes in policy and decision-making at sub-national and national levels. Firstly, by generating methods on land use planning and opportunity costs for emission reductions and sustainable benefits analysis and training widely on them; reaching more than 250 middle level government and non-government officials in project countries and beyond. While the governments in Peru and Cameroon have shown interest in taking these forward, the government in Indonesia, BAPENAS (the National Planning Board for Development) has recommended the use of the LUWES tool for local governments to plan their actions to reduce GHG for entire provinces in Indonesia. A total of 33 provinces used the tool, enabling each province to estimate their contribution in achieving Indonesia's national goals, to unilaterally reduce GHG emissions by as much as 26% below 2020 projections in addition to a 15% reduction with multilateral support. Decisions relating to how the national emission reduction targets are shared can thus be supported by these tools in these countries.

Secondly, by developing a readiness assessment framework and applying it to all four project countries, it is hoped that it will contribute to a solid basis for adaptive management in the readiness processes. Thirdly, the hope is efforts to understand drivers of deforestation in terms of leverage points and levers for unlocking and reversing drivers of deforestation and degradation, initiated in this project, will become mainstream, thus supporting both policy and decision-making in the medium term. Lastly, by working with actors to design and test diverse (financial and non-financial) emission reduction incentives at the landscape level, the aim is to contribute to potential scaling-up of efforts in the project countries and beyond.

Summary of lessons and recommendations

A number of key lessons have been gained thus far from the exploratory journey into landscapes for emission reduction in the four countries presented below each with corresponding recommendations.

Lesson 1: Incentives targeting non-forest high carbon stock land uses such as agroforestry, tree-based systems and peatlands were found to be attractive, potentially effective and efficient options for achieving REDD+, global climate change objectives and promoting sustainable livelihoods:

> **Recommendation 1:** Further linkage of REDD+ discussions in the international arena with the emerging Nationally Appropriate Mitigation Actions (NAMAs) framing is needed to create rules and incentives for landscape approaches and investments.

Lesson 2: Success in emissions reduction initiatives will need entry points beyond a sole emissions reduction focus given that carbon and its associated finance is unlikely to be a priority concern for local stakeholders:

> **Recommendation 2:** Emissions reduction planning and implementation needs to be integrated into the wider development aspirations of stakeholders if it is to succeed.

> **Recommendations 3:** Landscape approaches would benefit from greater effectiveness and efficiency when synergy is sought between emission reductions and other environmental, social and economic objectives including climate change adaptation and green economy approaches.

Lesson 3: A co-investment approach is emerging as a necessary condition for achieving multiple landscape-level objectives:

> **Recommendation 4:** Key frameworks and models should be developed to enable better private sector involvement (financing and sharing of technical expertise) in emission reductions and sustainable development schemes at the landscape level. This could allow and involve innovative financial mechanisms for public and private investments. Such a mechanism could allow integration and optimization between currently separated mitigation and adaptation funding streams for example.

Lesson 4: Landscape and jurisdictional approaches to emissions reduction can be complementary:

> **Recommendation 5:** Better research is required to understand and identify potential options for landscapes and jurisdictional interactions under different political economy contexts.

> **Recommendation 6:** REDD+ readiness (and indeed future climate change readiness – NAMA, climate smart agriculture and others) needs to invest more in sub-national level REDD+ designs in order to enable landscape approaches for emissions reduction to thrive. Current readiness focuses more on international accountability structures and national levels, which does not automatically translate to a nested-systems architecture required to address drivers of deforestation at the landscape level.

Lesson 5: Nesting landscapes to the national level is a necessary condition for success and scaling-up

> **Recommendation 7:** Rules and guidance for nesting landscapes to the national level are needed. These could include specifying among others issues related to ownership rights to carbon, duties and royalties to be paid on investments, crediting, distribution of national emission targets, benefit sharing, risk management, MRV and baselines.

Lesson 6: Identifying and understanding leverage points and potential levers of emissions beyond landscape boundaries is necessary to address drivers effectively.

> **Recommendation 8:** The design and use of approaches that aim at identifying leverage points and levers for addressing drivers, as opposed to the current identification of land uses responsible for most conversions and a description of the processes, is needed.

Beyond this, leverage points, the potential effects of various levers and the chain of reactions that these levers can have in the reversal of drivers of emissions need to be identified and analysed.

Next steps

A new phase of this project is underway spanning from July 2013 to December 2015. This phase is titled *SECURED LANDSCAPES* - Securing Ecosystems and Carbon benefits by Unlocking Reversal of Emissions Drivers in Landscapes. It will build on the lessons and experiences highlighted above focusing on (i) piloting incentives in five demonstration landscapes in five countries (Cameroon, Democratic Republic of Congo, Indonesia, Peru and Vietnam); (ii) exploring landscape investment and private sector engagement options; (iii) developing frameworks for strategic and tactical nesting of landscapes to national level REDD+ and other relevant activities; and (iv) development of globally relevant methods, policy and investment guidance for decision-making and negotiations in sustainable landscapes.

LIST OF PUBLICATIONS

This list showcases the publications produced during the REALU project (2010-2013). They are all available from ASB's searchable online publications database.

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OUTLINE OF THE REPORT

This report brings together three years of substantive exploratory research on the concept of Reducing Emission from All Land Uses (REALU). Section 1 of this report provides a comprehensive description of the REALU concept approach and the rationale behind it. It describes the operational perspective on landscapes and introduces the four REALU landscapes in which the project operated. Section 2 synthesizes the experiences from the four REALU landscapes in their exploration for potential emission reduction and planning. Section 3 zooms into the second pillar of the REALU concept approach, REPeat – Reducing Emissions from Peatlands, a dominant global source of non-forest, land-based emissions, and stresses the importance of such ecosystems for carbon sequestration. From the emission reduction potentials identified in Section 2 and 3, Section 4 describes the incentive schemes which have been developed in the four REALU landscapes. Section 5 emphasizes the enabling conditions for effective landscape-based strategies such as REDD+ readiness, co-investment in landscapes including engagement of the private sector and developing a clear benefit sharing mechanism. Section 6 highlights the importance of process tools that supports learning, participation and negotiation capacities of relevant actors and focuses on LUWES as an illustrative tool. Finally Section 7 synthesises and shares the lessons from the REALU project as well as recommendations for moving forward with landscape approaches for emissions reduction.

I REALU: AN INTRODUCTION

1.1 The project

1.1.1 REALU project goal and indicator

The **REALU Phase II project goal** is to develop through action research, a set of approaches, methodologies and national capacities to implement effective landscape-based strategies for Reducing Emissions from Deforestation and Degradation (REDD+) within a context of rural sustainable development, national sovereignty, respect for indigenous rights, and the integrity of a global greenhouse gas (GHG) accounting system. This phase of the project is building upon the first phase of the project in 2009-2010 whose research and reviews focused on key areas that could enhance the understanding of landscape approaches to REDD+ and the implications for United Nations Framework Convention on Climate Change (UNFCCC) negotiations.

The **Indicator for goal attainment** is the acceptance and implementation by the national authorities negotiating modalities and procedures for REDD+ agreement beyond the UNFCCC Conference of the Parties (COP) 15, of a broad framework for dealing with GHG emissions from any land use, acknowledging cross-sectoral linkages and leakage, and embracing REDD+, forest protection, and high carbon-stock/low carbon emission development pathways as its pillars.

1.1.2 REALU objectives

The project objectives are to:

1. **Backstop country-level planning and implementation of landscape approaches to REDD+** through the provision of methods, tools and relevant training at multiple levels within the framework of multi-lateral initiatives such as the Forest Carbon Partnership Facility (FCPF) and UN-REDD.
2. **Explore in four demonstration landscapes** (in Asia, Africa and Latin America, namely, Cameroon, Indonesia, Peru and Vietnam) how landscape approaches to REDD+ or a broader approach to reducing emissions from all land uses (REALU) can enhance the protection of natural forests, reduce net emissions while reducing poverty, respecting rights and allowing for sustainable resource access.
3. **Engage in global comparative action research** that explores the relationships between efforts for REDD+ in developing countries, rural poverty and livelihood strategies, ‘carbon rights’, and other land use options and their GHG emissions profiles. Such comparative research provides a global synthesis on readiness for landscape approaches to REALU as a logical next step of REDD+.

4. **Enhance science and policy interactions and expand the global debate on REDD+** and other mitigating strategies through the validation and dissemination of a comprehensive REALU framework and the findings from the REALU II research activities.

1.1.3 REALU project components

Backstopping country level planning and implementation of landscape approaches for REDD+	This component reviewed, tested and further refined methods and tools as necessary for eventual use in landscape approaches to REDD+. It also provided relevant training at multiple levels within the framework of multi-lateral initiatives. In addition, tools for nesting, baselines, additionality and leakage will continue to be developed as these are considered the main challenges for switching from REDD+ to REALU or agriculture, forestry and other land uses (AFOLU) accounting. This component requires building local and national capacity, and therefore readiness, for REDD+/REALU.
Demonstration Landscapes	The project explored in the four pilot landscapes at sub-national/meso level in Cameroon, Indonesia Peru and Vietnam how a landscape approach to REDD+ or a broader approach to REALU can enhance the protection of natural forests, decrease net emissions while alleviating poverty and respecting rights and resource access. The aim is to assess and demonstrate through these pilot sites the extent and modalities of reductions in emissions from all land uses. Specifically understanding of leakage in agriculture-forest mosaics and the ”forest”-”non-forest” interface in the landscape was examined including classic REDD+ projects that focus on ”forest” only, while also addressing other land uses and drivers of deforestation at the landscape level. It also tested methods for “nesting” sub-national to national level baselines and for addressing drivers of deforestation.
Global Comparative Study	This component built upon the results from REALU Phase I. It relied on a country level, global comparative analysis of readiness for landscape approaches to REDD+ in the countries also highlighting the training needs for REDD+ and REALU implementation.
Knowledge to Action	This aimed at facilitating science-policy interaction in decision-making processes and ensuring that the synthesis of lessons learnt at the global level reached both science and international climate change policy communities. This was facilitated through active participation in major science and policy conferences such as UNFCCC COP and the Subsidiary Body for Scientific and Technological Advice (SBSTA) events.

1.2 Why REALU?

Adapted from van Noordwijk et al., 2009 (ASB Policy Brief No. 13) and van Noordwijk, M. & Minang, P.A., 2009 (ASB Policy Brief No. 15)

1.2.1 The absence of a globally agreed definition of 'forest'

One critical issue for REDD+ is to create a standard forest definition applicable at multiple scales. The definition of forest and what is included or not included in REDD+ is still subject to much debate. Definitions of 'forest' exist but are diverse and there is no globally agreed definition of forest under the REDD+ mechanism (van Noordwijk and Minang, 2009). The term 'forest' and 'non-forest' as defined for the UNFCCC, can cover many types of land covers and land uses, varying in presence of trees (including zero tree cover lands for forest land or lots of tress in non-forest land), carbon-storage and carbon-emission potential (Figure 1).

The example of Indonesia illustrates the complexity of determining a forest definition. The term forest can have multiple meanings. In Indonesia, forest refers to woody vegetation with a minimum tree height and cover, but is also linked to specific institutions empowered to manage forests with definitions within both contexts not matching, adding to the complexity. The case of Indonesia actually shows that there are forests with trees, forest without trees, non-forest with trees and non-forest without trees (van Noordwijk and Minang, 2009).

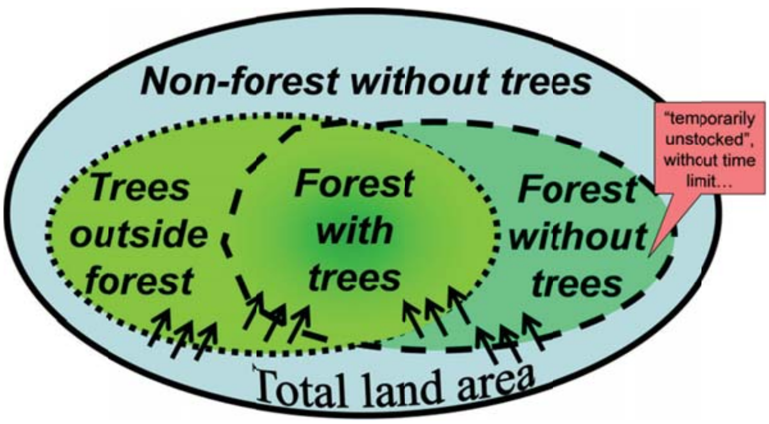


Figure 1 Conceptual figure of different possible forest and non-forest areas. Source: van Noordwijk, et al., 2009, p.2.

Only allowing forest areas to be included under the current REDD+ mechanism limits it applicability. REALU can address this limitation of REDD+ as it takes into account all land use changes that affect carbon storage, whether this involves peatlands or mineral soil, trees outside of the forest, agroforests, plantations or natural forest thereby not requiring an operational definition of forest.

1.2.2 High potential emissions reduction and sequestration in other land uses

While the international community has embraced REDD+, the role played by land outside the forest in storing carbon and reducing emissions has not been sufficiently addressed. While it is clear that deforestation is an important source of global carbon emissions, land use is also a significant contributor of global emissions (20-30%). In many cases, vegetation outside of institutionally defined "forest" contains large amounts of carbon stocks and can contribute more to emissions reduction than institutionally defined forest areas. For instance, one third of Indonesia's forest emissions (a total of 0.6 gigatonnes of carbon per year (GtC/yr)) occur outside institutionally defined forests, and are not accounted for under the current national policy for REDD+. Trees and woody vegetation outside forest and peatlands contain large amounts of carbon stocks that are excluded from current mitigation discussions within the UNFCCC. Therefore, there is a real potential for areas outside the forest to help reduce deforestation and create benefits for local people which needs to be explored across the tropics.

1.2.3 Drivers of deforestation largely outside the forests

So far drivers of deforestation are not adequately addressed within REDD+. Emissions from forests are driven and influenced by actions and factors outside of forests. Hence accounting for emission reductions from forests is unlikely to be possible without consideration of other land uses. Therefore, REDD+, as a partial accounting mechanism of land use and land use change, is challenged by cross-scale issues such as additionality, leakage and permanence. Addressing forests only though the REDD+ mechanism is unlikely to avoid local-level leakage. In Indonesia, for instance, carbon stocks outside of institutional forests are more at risk than those inside, and may be depleted by 2032, partly due to emission leakages from protected forests (Ekadinata *et al.*, 2010).

Landscape approaches and accounting of AFOLU is needed as a way of minimizing leakage and bypassing definition/eligibility questions hampering the implementation of REDD+, CDM and other mitigation options as currently framed under the UNFCCC. Although facing its own challenges, such an approach could be more:

- Effective in bringing major 'leakage' concerns into the accounting rules and allowing increased land use intensity outside forests as a contributor to net emission reductions.

- Efficient by providing many cost-effective options for emissions reduction, including tropical peatlands and smallholder agroforestry.
- Equitable by applying the same accounting rules for Annex-I and non-Annex-I countries, and embracing low-forest-cover countries on a proportionate basis and rewarding the rural poor.

1.2.4 Potential of intermediate land uses such as tree-based agricultural systems

Intermediate land uses such as tree-based agricultural systems or agroforestry systems can mitigate climate change, enhance resilience to climate variability and improve food security and livelihoods. They can therefore lead to greater emissions reductions and larger benefits for local people. Therefore, balancing the roles of agriculture and forestry in climate change mitigation and adaptation, food security and poverty alleviation is a key condition for any initiative in developing countries. Hence understanding the trade-offs between these functions is extremely important for creating win-win strategies and opportunities.

Figure 2 Most tropical forest landscapes are mosaics or interacting land uses that are difficult to separate and are best considered from a landscape level. This picture is one example of such a landscape mosaic.

1.3 How different is REALU from REDD+?

REALU is an evolving framework that seeks to understand the potential for optimizing emission reductions from all land uses in a holistic (bio-physical, technical, policy, social and economic) manner. REALU recognizes REDD+, but tries to address the above highlighted limitations of REDD + and looks beyond the current framing for the mechanism to a possible inclusion of agriculture and land-based Nationally Appropriate Mitigation Actions (NAMAs). The REALU architecture supports a landscape approach consisting of several pillars addressing specific land uses and sectors and is based on fundamental principles linked to the ultimate goal of adaptive sustainable livelihoods and climate resilience.

The REALU proposes a definition that includes REDD+ as well as all transitions in land cover that affect carbon storage.

- REDD+ is seen as one of the pillars of such a REALU framework, together with efforts to:
- Reduce emissions from peatlands (REPeat),
- Restocking of degraded landscapes through trees and soil carbon (REStock),
- Reducing emissions from agricultural GHGs (REAGG).

Forest, agriculture, peatlands and intermediate agroforestry, reforestation and afforestation activities are considered key building blocks on which to develop emission reduction interventions. The REALU architecture can provide a good basis for understanding landscape approaches to REDD+ and the role of potentially more complete emission reduction mechanisms such as NAMAs, especially land-based NAMAs.

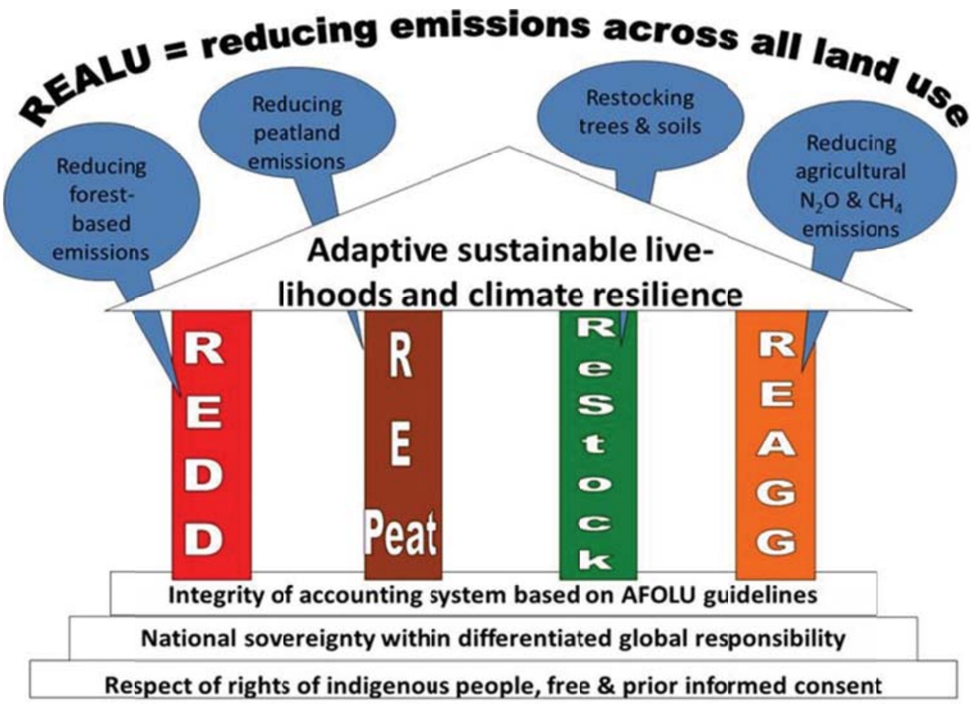


Figure 3 The four pillars above the three principles that support a landscape agenda for carbon management and emissions reduction.

The fundamental principles of the REALU framework lend credibility and legitimacy to the human and political dimensions in reducing emissions include:

- Respect of the rights of indigenous people through free, prior and informed consent (FPIC)
- Respect for national sovereignty within differentiated global responsibilities;
- Integrity of accounting systems based on AFOLU guidelines: national accounting systems of changes in aboveground and belowground carbon stocks across all land use types, plus emission estimates for methane and nitrous oxide are at the heart of a total anthropogenic emissions estimate.

Fairness, efficiency, effectiveness, social capital, trust, accounting principles, respect and rights are key elements of this framework for adaptive sustainable livelihoods and climate resilience. Within this framework, it is important to assess the relative context of each country for a greater buy-in in emission reduction strategies that are aligned with the country’s development and land use trajectories.

1.4 Landscape considerations in REALU

In this section the operational perspective of landscapes, on which this work is based, is presented reflecting how landscapes have been interpreted. First a number of key considerations of landscapes are presented and the four REALU landscapes are introduced.

The key considerations for understanding and operationalising landscape approaches in the project include, but are not limited to, heterogeneity, integration and interactions, multi-functionality, synergy and scale. Each of these concepts is briefly introduced below.

Heterogeneity: In most of the landscapes ASB has worked in over the last 20 years, heterogeneity in land uses and land use patterns has been a defining feature. Hence these complex overlapping patterns are understood as one inherent dimension in landscapes from a spatial point of view.

Interactions and integrations: Landscapes represent complex systems with sets of social, biophysical, human ecological and economic dimensions that interact with each other (Figure 4). Processes are thus important. Such interactions happen at multiple levels, e.g. the plot, farm, and field levels and beyond. Integration enables understanding of such cross-scale interactions which determine numerous landscape-level patterns and changes. Understanding and building on interactions and feedback loops is thus important for success.

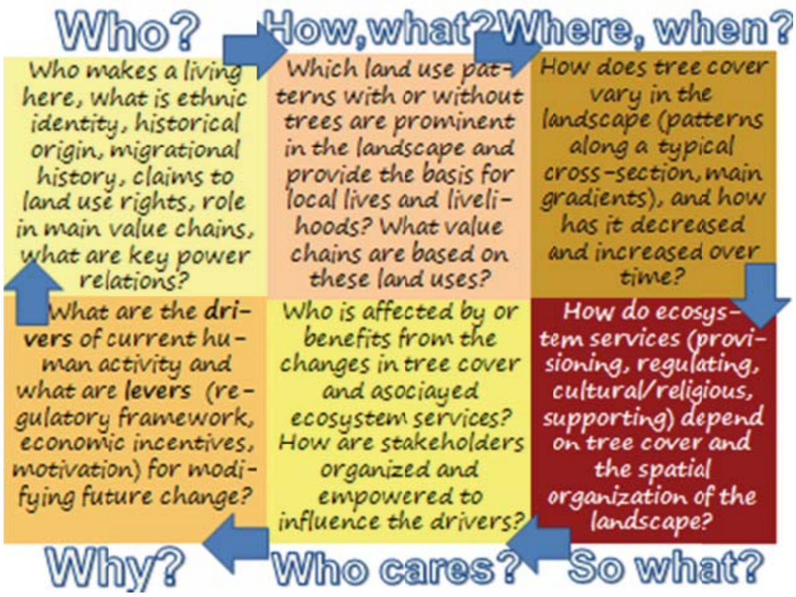


Figure 4 Landscapes can be characterized by the interactions between six aspects (groups of key questions), which jointly describe a feedback loop where the consequences of actions lead to leverage on the drivers of change.

***Multi-functionality*:** Landscapes have multiple functions, ecologically, socially, and economically. These include a range of ecosystem services including provisioning, regulating, supporting and cultural services. Balancing these functions is important for addressing both environmental and development objectives. Therefore understanding and managing trade-offs and synergies are paramount.

Working towards synergy: Moving towards synergy between emission reductions, climate change adaption and low emission development pathways has been an important guiding principle in ASB's work around landscapes. An important focus of this work on synergies has been the interface between agriculture and forest objectives in the context of emission reductions. In this context synergy is interpreted as moving towards higher order processes or effects beyond individual functions or objectives in the landscape. It is a move towards "combined" or "co-operative" effects -- literally, the effects produced by things that "operate together" (parts, elements or individuals)… in which "effects produced by the wholes are different from [the sum of] what the parts can produce alone" Corning, (1998). In ASB's work on synergies two types of synergies - superadditive value and subadditive costs synergy models (Conning1998; von Eye et al. 1998) are used.

Scale: Here scales are interpreted to mean nested scales, in which full understanding of any landscape scale implies understanding its interactions at scales within and beyond the landscape. For instance, to understand emissions reductions in a given community, one would need to understand behaviour of practices at plot, farm or forest management unit level as well as the driving forces such as markets and policies that are beyond the community boundary. In the understanding of nested processes, economic, social, political and cultural dimensions need to be taken into account as they have influences at different scales.

1.5 Project countries and landscapes

A specific set of criteria was used to identify both the project countries and landscapes. The four REALU countries, Cameroon, Indonesia, Peru and Vietnam, were selected for this project based geographic location and stage of forest transition, i.e. forest cover changes corresponding to industrialization and urbanization (Mather, 1992). The project aimed at having a geographic spread across the humid and sub-humid tropics so that a pantropical analysis could be done at national and landscape scales. Figure 5 shows the variation in forest cover in the four case study countries excluding "outliers" from the dominant trend lines. It shows three case study countries (Cameroon, Indonesia and Peru) before the forest transition and one (Vietnam) after the forest transition point. Vietnam is experiencing a net increase in forest cover, while Indonesia remains a high forest, high deforestation country. In contrast, Cameroon and Peru are forest countries and with low rates of deforestation.

This set of countries represents a good variation of different institutional, technological, demographic, economic and cultural conditions impacting deforestation and forest degradation across the humid and sub-humid tropics. This choice of countries along the forest transition continuum under varied deforestation and forest degradation pathways can help to understand landscape approaches within different contexts.

In turn each country chose a landscape largely based on previous knowledge and working history within the landscape. Each landscape is briefly presented in the ensuing sections (See Figure 6 for locations of landscape sites).

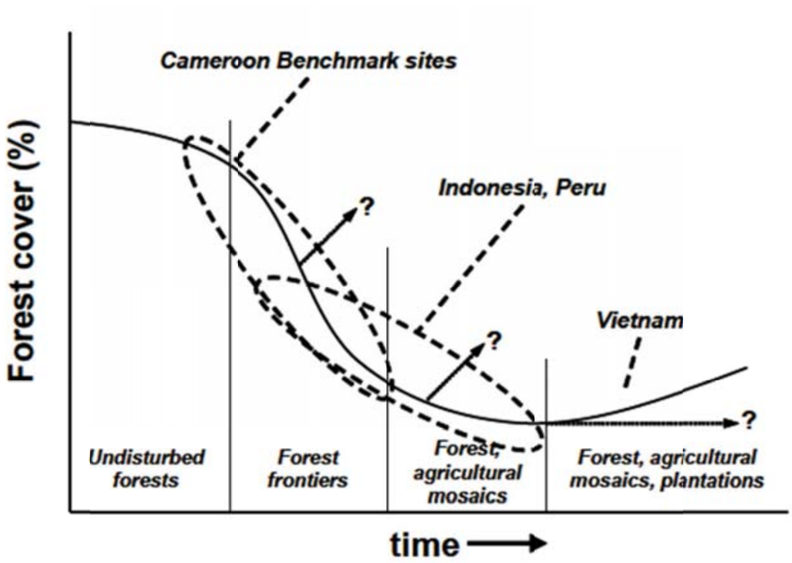


Figure 5 REALU project countries positioned along the forest/tree cover transition. Dotted lines represent possible deviations from the trend.

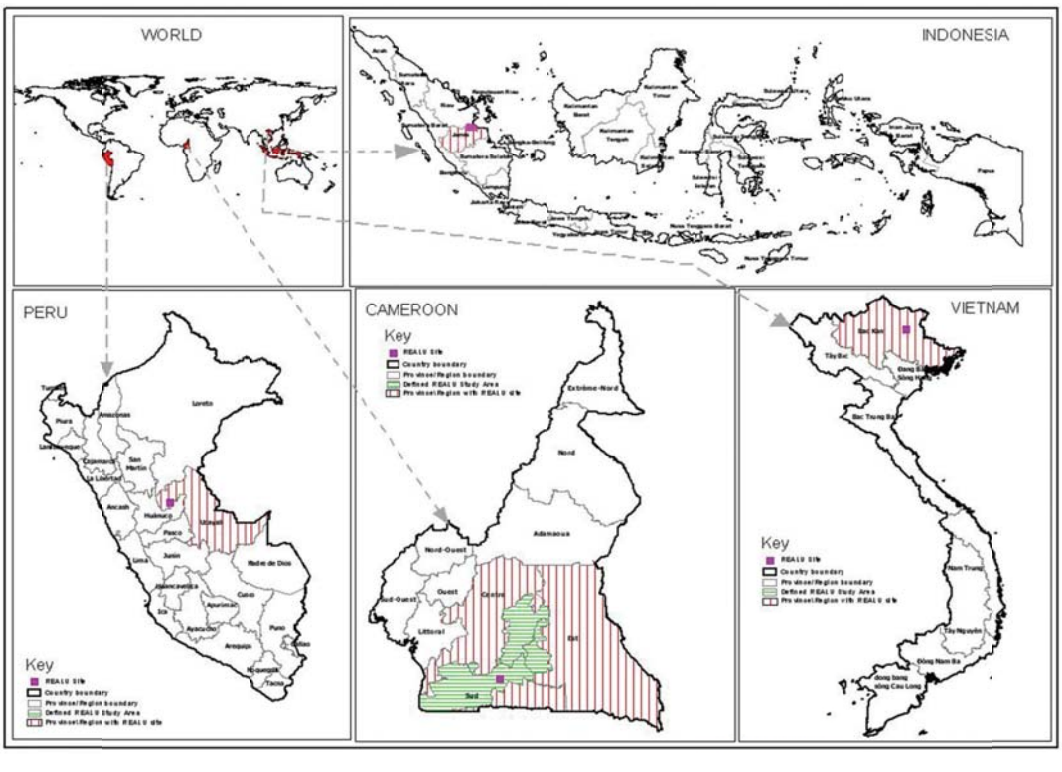


Figure 6 Location of the demonstration landscapes in the four project countries.

1.5.1 Efoulan Municipality in southern Cameroon

Adapted from Alemagi et al., 2011 (Feasibility Report)

The Efoulan landscape (Figure 7) is made of agricultural and forest lands including the Efoulan council forest which is one of the 17 classified council forests in Cameroon with a management system devolved to the council authority. It covers about 5,600 ha over the total surface area of 150,000 ha within the administrative boundaries. This forest belongs to a large landscape situated in the southern region of the country 32 km from Ebolowa town and 43 km from Lolodolf on the regional axis Ebolowa-Lolodolf.

The population density is rapidly increasing resulting in notable land use changes in the region over the past decades. The main driver of deforestation is slash and burn agriculture practiced by surrounding communities mainly for subsistence purposes. Forested lands are being cleared by slash and burn agriculture and converted to annual maize and groundnut mixed cropping systems. More limited land use change activities include clearing activities for cash crops such as cocoa farm plantations, palm oil plantations and cucumber, taking advantage of the new agricultural policy providing support for both economic growth and employment. The main threats for forest resources and associated carbons stocks in the Efoulan Municipality includes, planned road construction, forest conversion into agricultural farms within villages, increasing cash crop plantations and, to an extent, illegal logging.

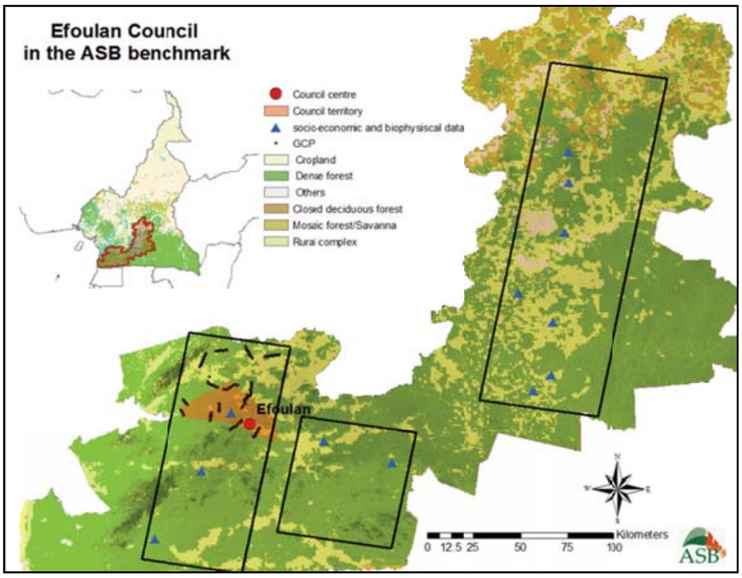


Figure 7 Location of the Efoulan landscape in Cameroon.

1.5.2 Tanjung Jabung Barat (Tanjabar) District in Indonesia

Adapted from Widayati, al., 2011 (Feasibility Report)

Tanjabar District is located on the eastcoast of the Jambi Province, bordering the province, Riau in the north and covers an area of approximately 500,000 ha (Figure 8).

The district population is around 280,000 people, with a population density of 56 residents per km^2. Local people dominate the district's south-western inland area, while migrants dominate the peat areas and coastal villages (in the northeast). In both inland and lowland areas, transmigration from Java began around 1980 and continued up until 2000.

The district comprises of approximately 40% peatland and 60% of mineral-enriched land, dominated by podsolic, alluvial and grey hydromorphic soil. About 48% or 240,000 ha of the district are classified as 'forest area'. About 71% of this forest area is classified as production forest, 6.65% as protected peat forest and 3.66% reserved for national parks. The proportion of 'non-forest area' in this district is very high and is dominated by coconut agroforestry, rubber agroforestry, rubber monocultures and, most recently, oil palm plantations.

Land change activities in Tanjabar includes active deforestation, conversion of peatlands, reforestation for the pulp and paper industry, oil palm plantations and smallholder agricultural, driven by active immigration. These numerous land-based activities has put pressure on both the peatland and forested areas.

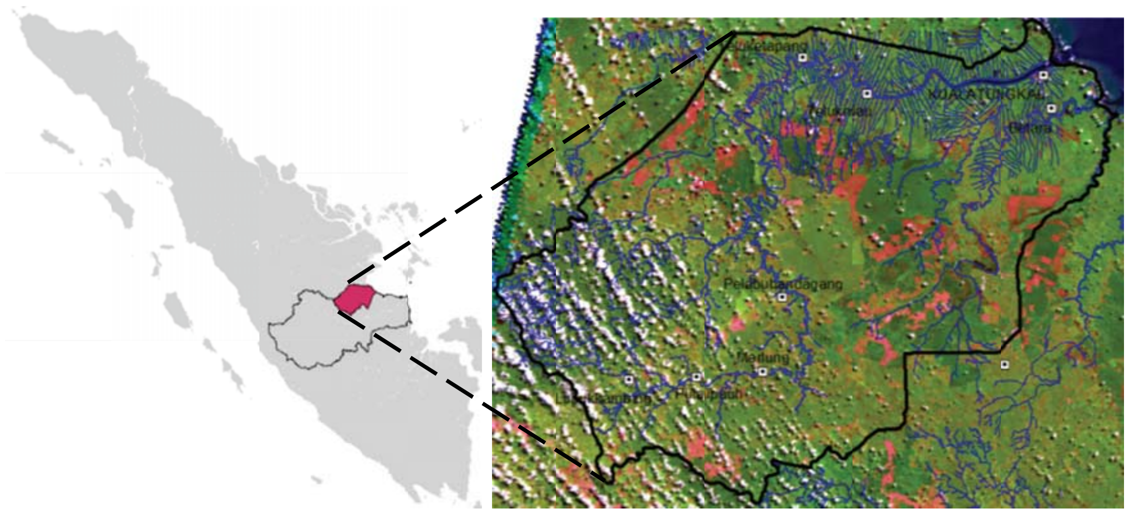


Figure 8 Location of Tanjabar District, Jambi Province, Sumatra, Indonesia.

1.5.3 Padre Abad Province in Peru

Adapted from Robiglio et al., 2012 (Feasibility Report)

The Padre Abad Province is located in the northwest of the Ucayali Region, one of the five Amazonian regions in Peru (Figure 9). It covers an area of 9,450 km^2 much of which is of flat topography.

The whole province is within Peru's humid tropic area with tropical evergreen rain forests and wet premontane tropical forests in transition to tropical rainforests located at higher altitudes in the Andean foothills. Permanent production concessions, protected areas and indigenous communities occupy most of the forest land. Unclassified land or land that has not yet been allocated or titled is found along the transport network and is the land where the most deforestation and degradation occurs. Pastures, annual and biannual crops, permanent tree crops, fallows, secondary forest and degraded forest remnants constitute the landscape mosaic.

The population in Padre Abad (63,892 people in 2007) is increasing and urbanizing. General population density is 6.33 people/km^2 with concentrated population around urban centres (52.82%) creating uneven distribution. Padre Abad is a relatively old deforestation frontier with population concentrated along the Federico Basadre Highway built around the 1940's and the first transport axis connecting the Amazon to the capital, Lima, along the banks of the water courses.

Settlement configuration is not yet stable with new hamlets (villages) in the process of registration. Increased accessibility by road or river is shaping settlement and land occupation strategies by settlers. Centres in the area are developing fast thanks to the role they play in the marketing of agricultural commodities such as papaya, plantain and more recently cacao and oil palm to supply Pucallpa, Tingo Maria and Lima.

Smallholder colonist farmers in Padre Abad are the major actors of deforestation and overall land use change in the agricultural mosaic. Both cacao and oil palm are booming commodities creating livelihood opportunities for smallholders to farm profitable legal crops allowing for the abandonment of illegal coca cultivation. Such shifts in cultivation are being supported nationally and internationally.

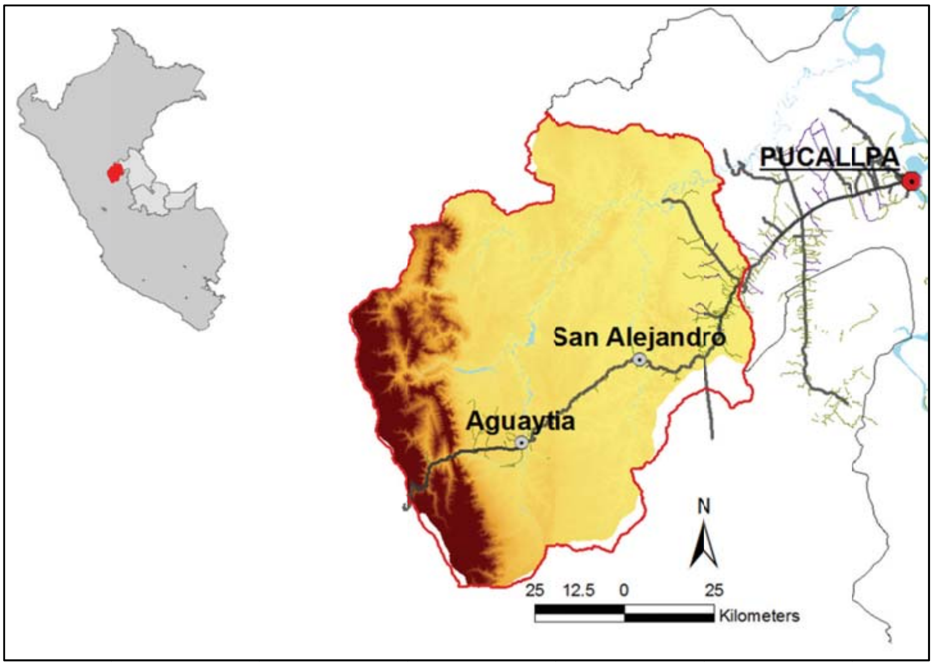


Figure 9 Location of the Padre Abad Province in Peru.

1.5.4 Bac Kan Province in Vietnam

Adapted from Do Trong Hoan et al., 2012 (Feasibility Report)

The province of Bac Kan is one of the most forested and poorest provinces in Vietnam (Figure 10), with 56.6% forest cover compared to country's average of 39.1% and around a 37% poverty rate in contrast to the 13.4% national average (Bac Kan Statistical Yearbooks, 2010).

According to Bac Kan Statistics Office (2010), the total population of the province is 293,628 people, occupying an area of 4,861 km^2 with an average density of 61people/km^2. Among the seven ethnic groups in the province, the 'Tay' group form 60.4% of the total population, followed by the Kinh (19.3%), the Dao (9.5%), and the Nung (7.4%).

The average annual income per capita in 2007 was 309 USD (~ 4.95 million VND). There has been a significant restructuring in the economy with the agriculture, forestry and fishing sectors contributing only 41.08% of the province's total gross domestic product (GDP) in 2010 compared to the more than 60% contribution ten years prior. Both the industrial and the service sector have undergone impressive growth now contributing to 60% of the province's GDP. Still, in rural areas, agriculture and forestry remain the main sources of livelihood. Out of the total crop area of 59,385 ha, a large proportion is food crops followed by industrial crops. Paddy rice and maize are the two main crops both for home consumption and cash income.

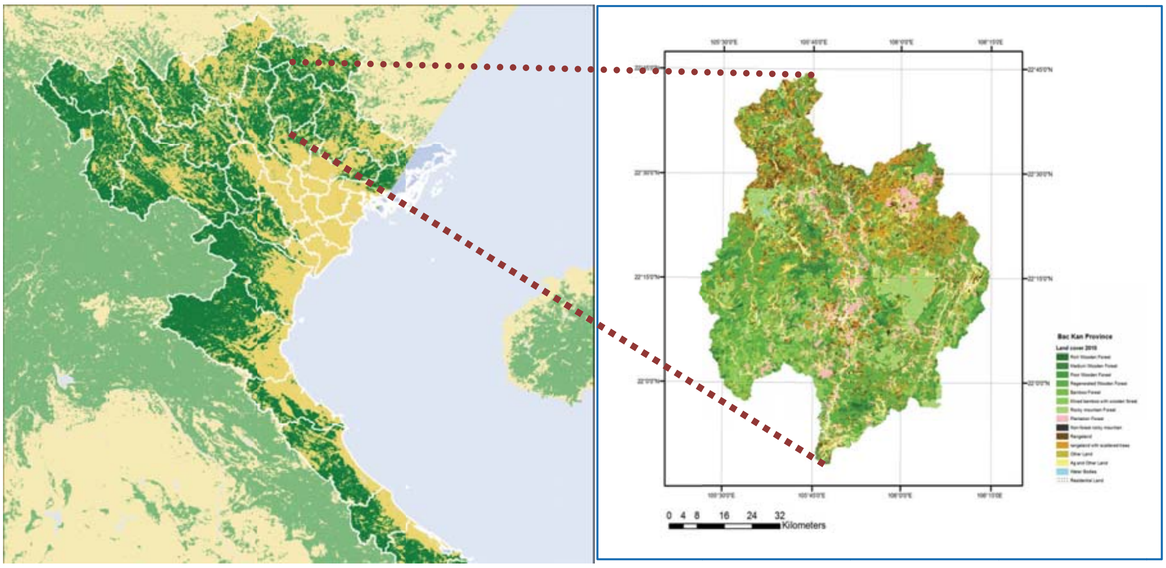
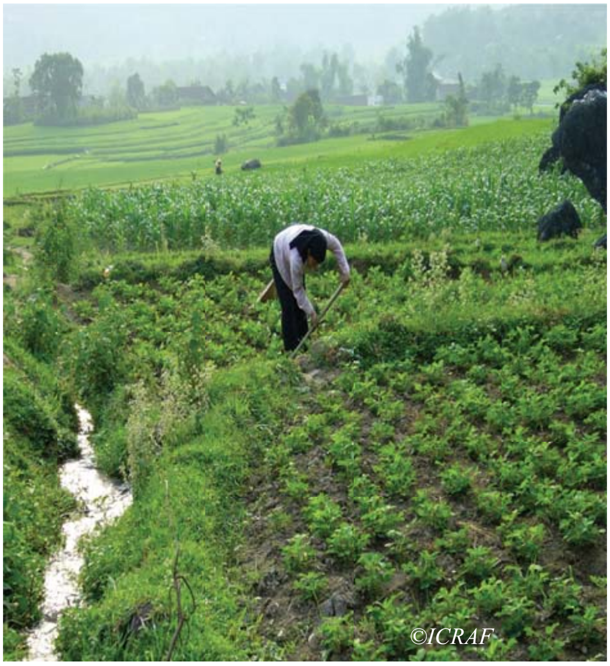


Figure 10 Location of Bac Kan Province. Left: Bac Kan Province as a part of Northeast Vietnam (source: JOFCA and JFTA, 2011); Right: Land use map of Bac Kan Province, 2010 (source: Samek, 2012, adapted from FIPI and NIAPP, 2011).

1. Pastures, cacao and fallow in the Amazon agricultural landscape.

2. Oil palm expansion in the Peruvian Amazon.

3. Erosion filling in Ba Be Lake, Bac Kan Province, turning part of the lake into crop area.



4. A farmer on her vegetable farm in Bac Kan Province.

5. Forest landscape in Efoulan, Cameroon.

6. Peatland –A low hanging fruit in Cameroon.

7. Oil palm and forest frontier in Tanjung Jabung Barat, Jambi Province.

8. Annual crop used for land preparation before planted with oil palm in the area of peat protection forest (KPHLG), Tanjung Jabung Barat District.

II REALU FEASIBILITY IN FOUR DIFFERENT LANDSCAPES

2.1 Rationale

2.1.1 Overarching goal

To assess the potential for emission reductions in the four selected landscapes, some feasibility studies have been conducted in each of the project countries. Each feasibility study includes some key components:

- **A general section on original conditions at the project site:** description of project site and of the biophysical, social, institutional and policy settings.
- **An assessment of past land use cover/land use changes:** This also includes assessment of carbon stocks for the different land use types and a retrospective analysis of opportunity costs for reducing emissions. This opportunity cost analysis enables comparison of the opportunity costs of different types of land-use change in USD per tonne carbon dioxide equivalent (tCO_2e) and shows the quantity of potential emissions reduction per type of land-use change.
- **Development of scenarios for emission reduction:** this includes development of a 'business as usual' (BAU) scenario, reflecting historical and/or current trends, and other scenarios which account for the views and plans of different stakeholders in the demonstration landscape; and simulation of future land use dynamics.
- **Feasibility of emission reductions under various scenarios**: assessment of profitability and standing carbon stocks owing to scenario implementation and trade-off analysis; and development of reference emission levels (RELs; amount of emissions from deforestation and forest degradation in a geographical area, estimated within a reference time period) for the different scenarios.
- **Conclusions on feasibility and best scenarios and options for emission reduction**

2.1.2 Methods and tools

The feasibility assessment employed a variety of data collection methods and analytical tools, including surveys, spatial analysis and land use simulation as outlined below. Some of the major tools used include:

- **Technical surveys** (e.g. carbon assessment, NPVs of different land uses, reference emission levels (RELs) and forest inventory).

- **Participatory rural appraisals** including participatory poverty assessments, transect walks, household interviews and village mapping.
- **National and provincial level workshops and consultations** with government officials, non-governmental organization (NGO) representatives, and researchers from national universities.
- **Interviews and discussions with key stakeholders**.
- **Opportunity cost analysis of past land use changes**: this is based on the manual for estimating the opportunity cost of REDD+ published by the World Bank Institute and the REDD-Abacus software developed by the World Agroforestry Centre. There are four steps in the analysis (1) clarification and description of major land uses; (2) calculation of time-averaged carbon stock for the major land uses; (3) calculation of the private profitability of the land uses in terms of discounted net present value; and (4) developing the opportunity cost curve using the REDD-Abacus software.
- **Land use simulation model** (FALLOW[1] - Forest, Agroforest, Low-value Landscape or Wasteland) to produce 30-year land cover map simulations and to estimate the impacts of possible land use strategies on economic returns (USD per capita) and standing carbon stock.
- **Land Use Planning for Low Emission Development Strategy (LUWES) tool**: this is a framework established by ICRAF Indonesia that integrates the processes of identifying emission sources, calculating historical emissions, predicting future emissions by considering historical emissions and local development plans, setting up RELs and mitigation action plans, and determining an implementation strategy.

2.2 Opportunities for reducing emissions from all land uses in the four demonstration landscapes

This section provides an overview of the feasibility plans in the four project countries and how they identified opportunities and alternatives for reducing emissions from all land uses in their specific context.

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[1] For information see < http://worldagroforestrycentre.org/regions/southeast_asia/resources/fallow-forest-agroforest-low-value-landscape-or-wasteland>.

2.2.1 Feasibility assessment in Efoulan Municipality in Cameroon

Adapted from Yemefack et al., 2013 (Policy Brief)

Land use changes between 2001 and 2007

Between 2001 and 2007, there has been a considerable decline in undisturbed forest area of around 194 ha/yr while there was a corresponding increase in cocoa plantations and crop fields of about 145 ha/yr and 45 ha/yr respectively. Logged forest area also decreased (63 ha/yr) indicative of forest degradation. All of these observations point to diminishing carbon stock from these land use changes within the municipality.

Table 1 Land use dynamics in Efoulan Municipality and the associated carbon stock changes.

Land use type	**Time averaged carbon stock (t C/ha)**	**Spatial coverage (ha)**		**Relative change (ha/yr)**	**Net impact of land use change on carbon stock (tC/ha)**
		2001	2007		
Mixed crop field	87	1,198	1,512	44.86	27,318
Crop field created by clearing primary forest	225	599	830	33.00	51,975
Cocoa farms	156	4,755	5,771	145.14	15,8496
Oil palm plantation	136	268	338	10.00	9,520
Young/bush fallow lands	142.5	2,031	2,199	24.00	23,940
Logged forest	267	8,126	7,683	-63.29	-118,281
Undisturbed forest	311	64,136	62,780	-193.71	-421,716

Note: for merged land use types e.g. young fallow and bush fallow, the carbon content is computed by averaging the per hectare values of the two.

Retrospective analysis of opportunity costs for emission reduction

The abatement cost curve for the land use system changes described for 2001-2007 showed an average emission of 12.84 tCO_2e/ha/yr. The annual net emissions that could have been compensated with a 5 USD carbon price are 10.83 tCO_2e/ha/yr. This price to emission sequestration ratio is possible due to the overall low profitability of the different land use systems related to the accessibility, the low population density and the lack of economic alternatives/opportunities. Based upon these findings it appears that the area of Efoulan would be suitable for establishing a cost-effective REDD+ program.

Development of land use scenarios

Four land use scenarios were developed for simulation:

1) **'BAU'** reflecting the current trend from the historical baseline if no measures are taken to reduce emissions at the landscape level. Here it is assumed that the rate of forestland conversion to other land uses continues at a similar pace as in the past due to lack of interventions;
2) **'Cacao Extension'** reflecting the current interest of the government and the local population to increase cacao production by extending the cocoa farms in the area. In the Cameroonian Government rural development strategy (SDSR, 2006), it is clearly stated that the government will promote the extension of cocoa farms by more than 50,000 ha from 2010 to 2015. Forest zones in different municipalities are the targets of this expansion plan;
3) **'Sustainable Forest Management'** involving the implementation of good forest management strategies (like reforestation and reduced impact logging) in production forest, community forest and communal forest; and
4) **'Sustainable Forest Management and Cacao Extension'** combining the two scenarios with both cocoa extension and sustainable forest management application whereby intensification using input and integration of timber and fruit trees are applied in the cacao plantations and afforestation/reforestation and reduced impact logging practices are applied in forested areas.

Feasibility of emission reductions under various scenarios

- **Trade-offs analysis between carbon sequestration and profitability**

It was found that cocoa farms with a high yield, stock less carbon which is likely related to the fact that they have a lower density of trees (with less shading) while those with a low yield have a higher density of large trees. Hence tree density in cocoa farms will need to balance both yield and carbon stock.

- **Reference emission levels**

The RELs were projected from the historic emission. Figure 7 shows the GHG emission potentials (in tCO2e) for the various development scenarios simulated over a 30-year period.

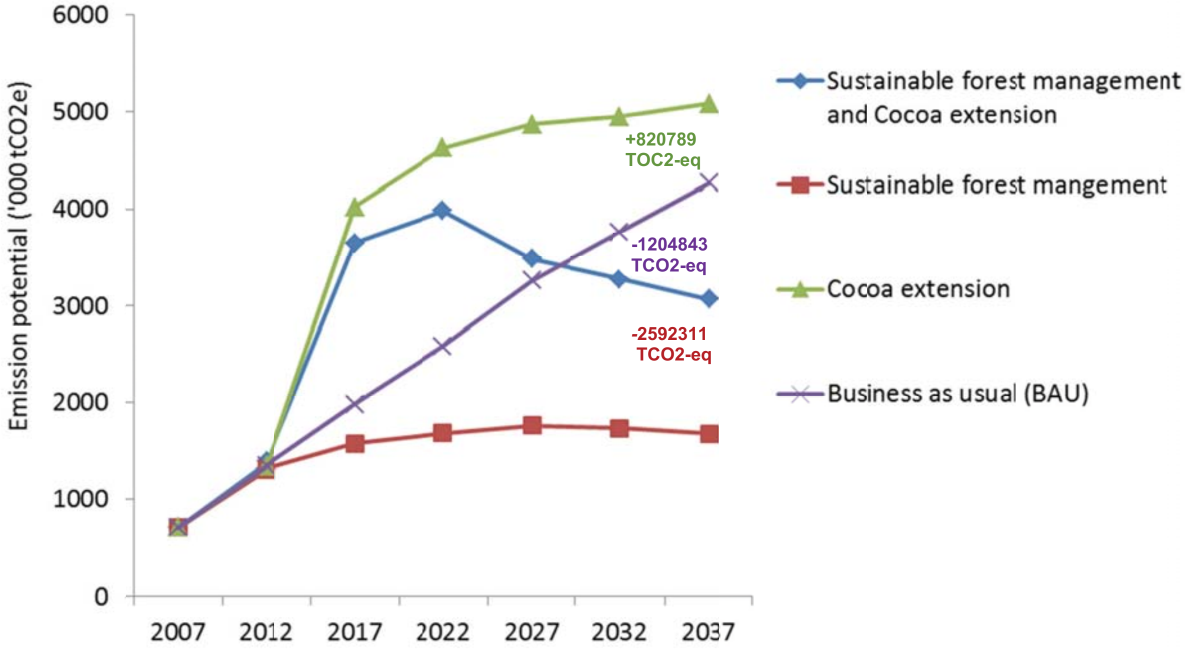

Figure 11 GHG emission potentials (in tCO_2e) for the various development scenarios simulated over a 30-year period in Efoulan Municipality

Conclusions on feasibility and best scenarios and options for emission reduction

The strongest potential for emission reductions in the Efoulan Municipality happens under the sustainable forest management scenario, as there is a high carbon sequestration potential in the municipality due to its forested areas (Figure 11). Still, providing development pathways to support livelihoods are needed. The fourth scenario, integrating cacao extension and sustainable forest management is the second strongest potential pathway for reducing emissions in the municipality which also providing development benefits.

In a cocoa farm, the pool that stocks the highest quantity of carbon is made up of aboveground trees. These trees include timber trees, non-timber forest products (e.g. honey, mushrooms or medicinal plants; NTFP) and fruits trees. Timber trees play the most important role in carbon stocking, encompassing about 69% of the overall total carbon system. The stock of carbon in a cocoa agroforest largely depends on the management model. Cocoa yields increase with lower tree density values. To define a REDD+ strategy, it is necessary to take into account this trade-off and the possibility of orienting interventions towards conservation/enrichment of systems with appropriate timber species in a suitable density. Cocoa farmers could exploit this option to increase their revenues and improve their livelihoods.

The following interventions can therefore, be explored:

- For old cocoa farms, tree density should be regulated (thinning and distance control) considering the main role of big timber trees species as carbon pools.
- Enrich young cocoa farms with timber species with good potential of carbon stock during the development of the system and, if necessary, eliminate some remnant trees in such a way that an optimal density is guaranteed.
- For new cocoa farms, proceed with a selective introduction of associated species with a preference for timber trees species, fruits species and other NTFPs.

Moreover, to increase the yield of the cocoa agroforestry system and its productivity, the following key conditions should be considered:

- Promote cocoa farm intensification through high quality seeds and application of modern techniques (treatment with pesticides and fertilizers, mechanization and regular weeding).
- Facilitate accessibility and availability of these farm inputs.
- Provide farmers with effective knowledge on cocoa farming through capacity building of cocoa farmers.

2.2.2 Feasibility assessment in Tanjabar District in Indonesia

Adapted from Widayati, al., 2011 (Feasibility Report)

Land use changes between 1990 and 2010

In 2009, the remaining forest cover in the Tanjabar District was approximately 110,872 ha (24% of district area), representing a marked decrease from 316,901 ha in 1990 (Figure 12). Within this area the forest is dominated by lowland to submontane forest (66%) located in the western part of the district towards Bukit Tiga Puluh National Park. The second major forest type in the district is eat forest (22%), including peat swamp forest, located in the northeastern lowland part of the district. The latter is mostly designated as peat forest protection areas (Hutan Lindung Gambut; HLG). Since the establishment of oil palm plantations in the 1990s, such activities have continued to be dominant within the landscape. Large plantations flourished, followed by extensive development of independent smallholder oil palm plantations. Industrial plantations (mostly Acacia) emerged in the 2000s, but are more limited in extent and are only owned by large-scale operators.

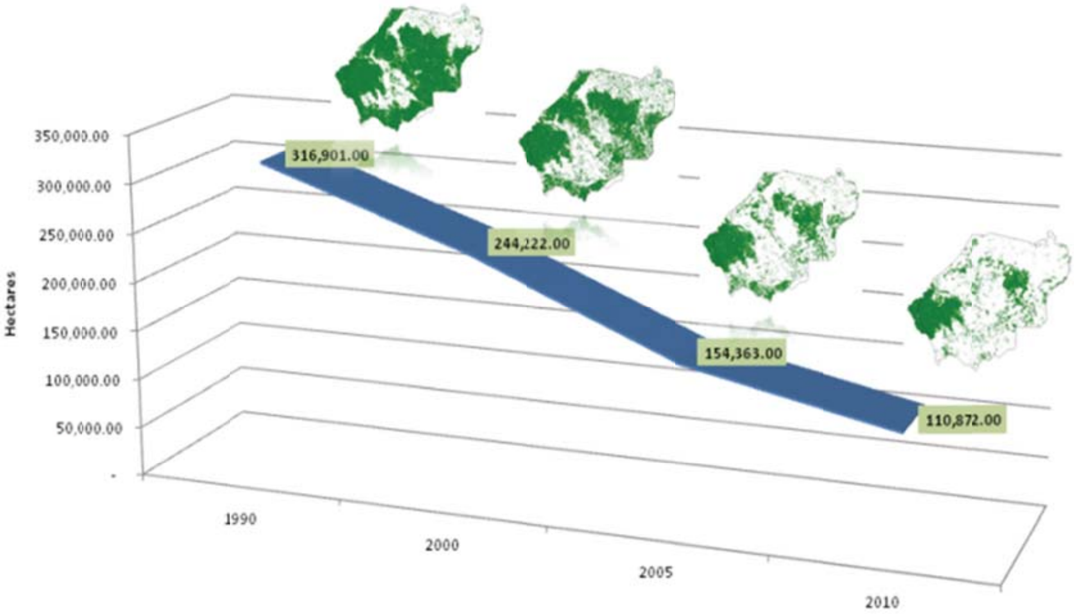

Figure 12 Forest loss in Tanjabar from 1990-2009.

In Tanjabar, aboveground carbon loss and related emissions had the highest rates in the early 2000s, after which emissions decreased, likely owing to the minimum stock available. Within peat protection forest areas in the recent years there have been high rates of emissions probably due to increasing encroachment for small-scale gardens and cultivation of cash crops such as oil palm.

On the other hand, the amount of carbon sequestration has been increasing, a reflection of increased vegetation densities in different tree-based systems, increased agroforestry, additional intercropping in different tree-based systems and to some extent, abandonment of the unproductive/low productivity farms.

Retrospective analysis of opportunity costs for emission reduction

Opportunity cost analyses in Tanjabar show that a 5 USD price of carbon in the global market could compensate emissions amounting to 4.49 tCO_2e/ha/yr for 1990-2000 and 10.28 tCO_2e/ha/yr for 2000–2005 (Figure 13-Figure 15). The increase of eligible emissions demonstrates the higher emissions from conversion to lower NPV land uses (Suyanto et al., in press). During 2005–2009, the amount of emissions below the 5 USD threshold decreased slightly to 9.53 tCO_2e/ha/year. From the total annual emissions, the proportion of emissions that could have been avoided increased throughout the three periods of observation, from 42% to 58% to 64%. These increasing figures demonstrate that emissions reduction efforts using the REDD+ mechanism could have been successful. However, in 2020, cumulative emission of Tanjabar is estimated at 61.91 tCO_2e/ha/yr and decreases to 51.71 tCO_2e/ha/year after excluding all land use conversion which could be abated with the 5 USD threshold. This means that the potential for emission reduction using 5 USD/tCO_2e incentive would account for 16% of the emissions and shows that a large proportion of emissions in Tanjabar cannot be compensated through the REDD+ incentive mechanism only in the future (Suyanto et al., in press).

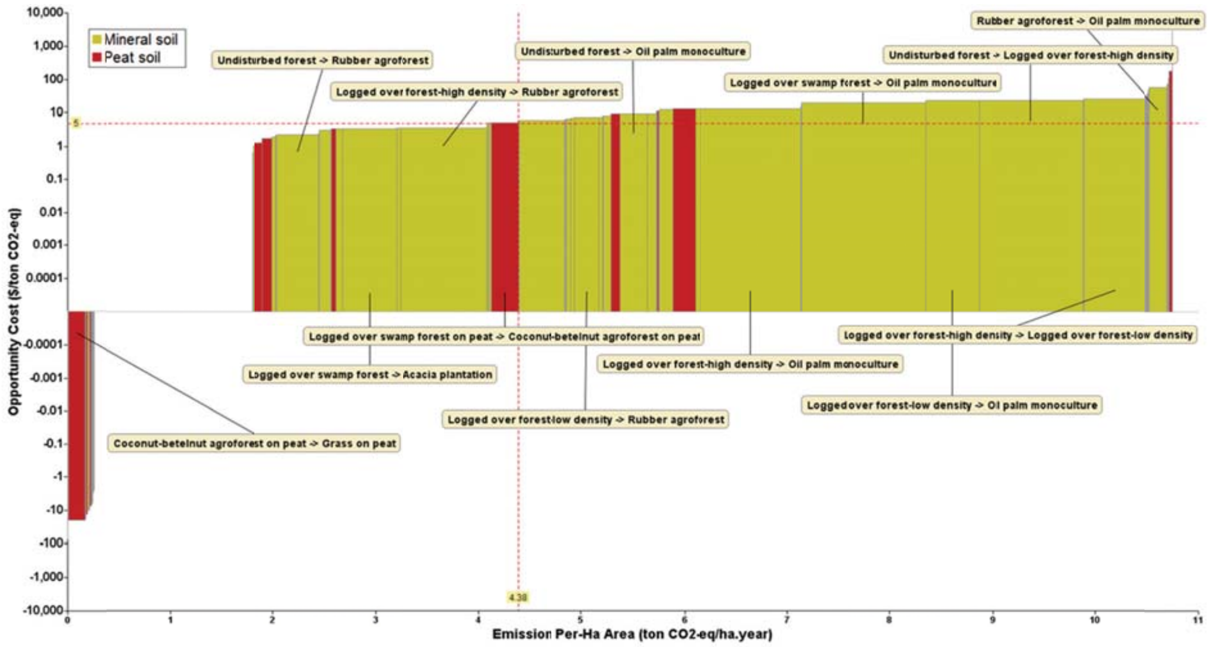

Figure 13 Opportunity cost curve for Tanjabar, 1990–2000.

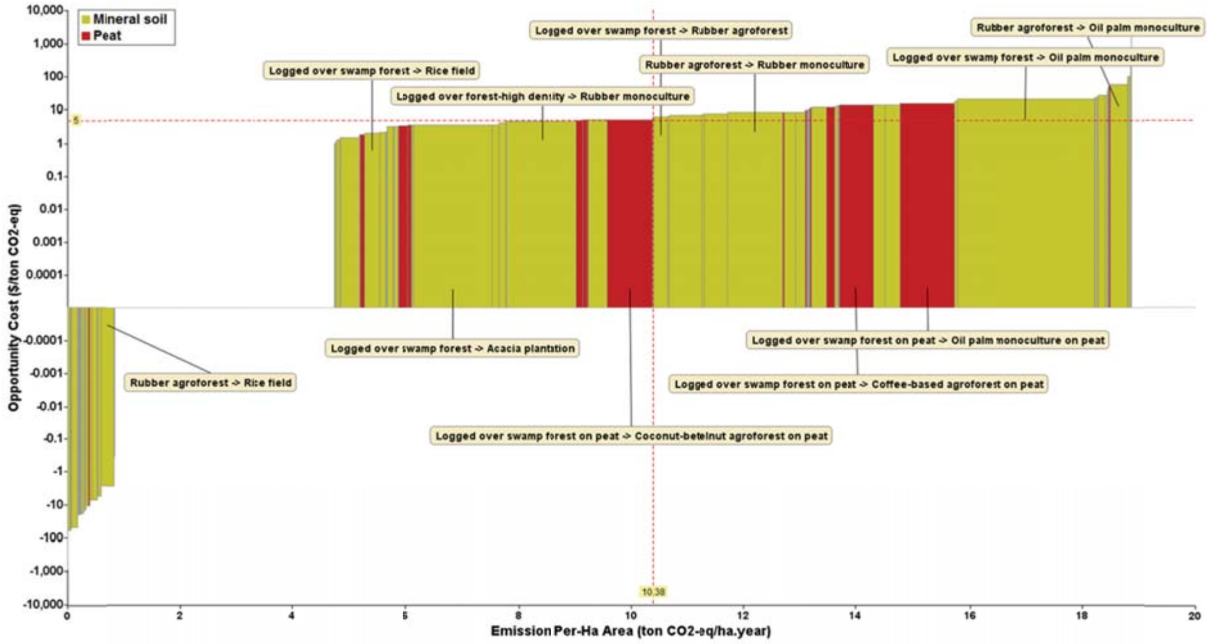

Figure 14 Opportunity cost curve for Tanjabar, 2000-2005.

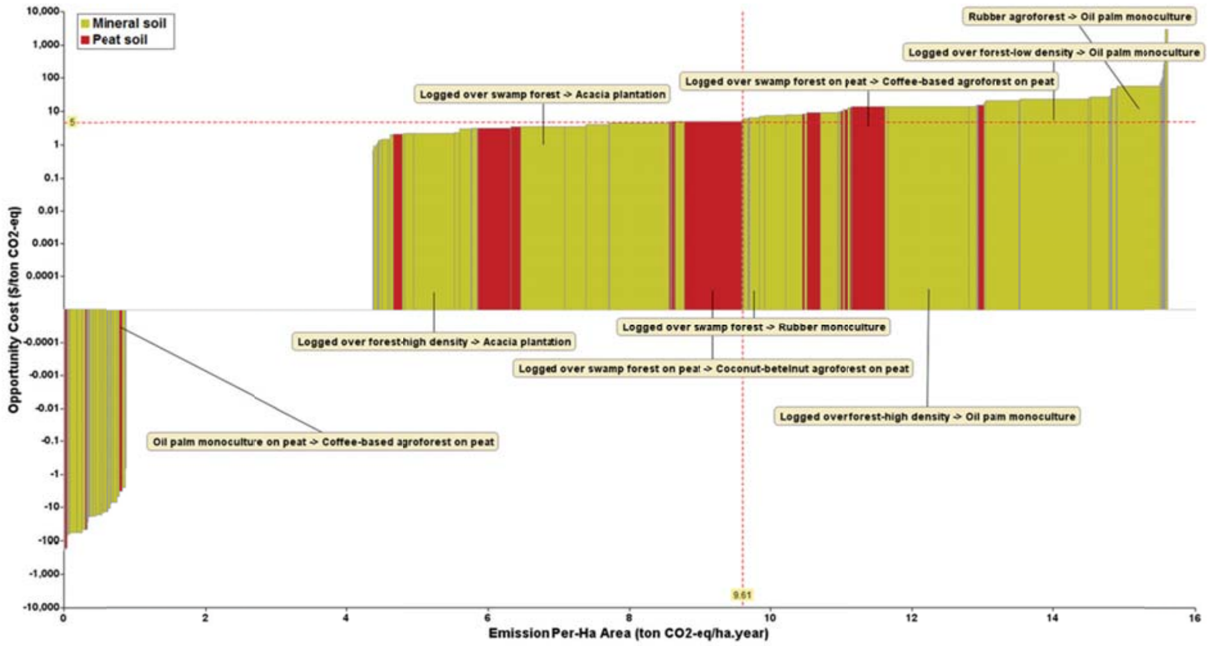

Figure 15 Opportunity cost curve for Tanjabar, 2005-2009.

Development of land use scenarios

Four land-use scenarios were developed:

1) 'BAU' scenario: this scenario reflects the current trend and a possibility that the remaining peat forest (HLG) is converted into smallholder plots. Under this scenario the only protected forest is the national park of Bukit 30. The rest of mineral forest in the southern part (ex-Production Forest Management Unit) is not legally protected;
2) 'HLG Protection' scenario: The remaining peat forest is protected from conversion into other land use types;
3) 'REALU' scenario: existing forests (peat forest, Bukit 30 national park, and also production forest management unit) are protected; rubber and coffee agroforestry systems are protected from conversion into another land use type. This also includes an effort to support product diversification by maintaining local agroforestry practices, excluding coconut agroforestry due to its relatively lower market price.
4) 'Green REALU' scenario: this scenario is similar to the REALU scenario, but allows new oil palm plantations only in non-productive mineral soils such as grass or shrub lands.

Feasibility of emission reductions under various scenarios

- **Land cover outputs maps**

Projected land use changes based on the historical trends show a clear indication towards monoculture plantations of oil palm and acacia (Figure 16). REALU and Green REALU scenarios still retain large tracks of such land uses under their respective scenarios, but additionally integrate more diverse land uses.

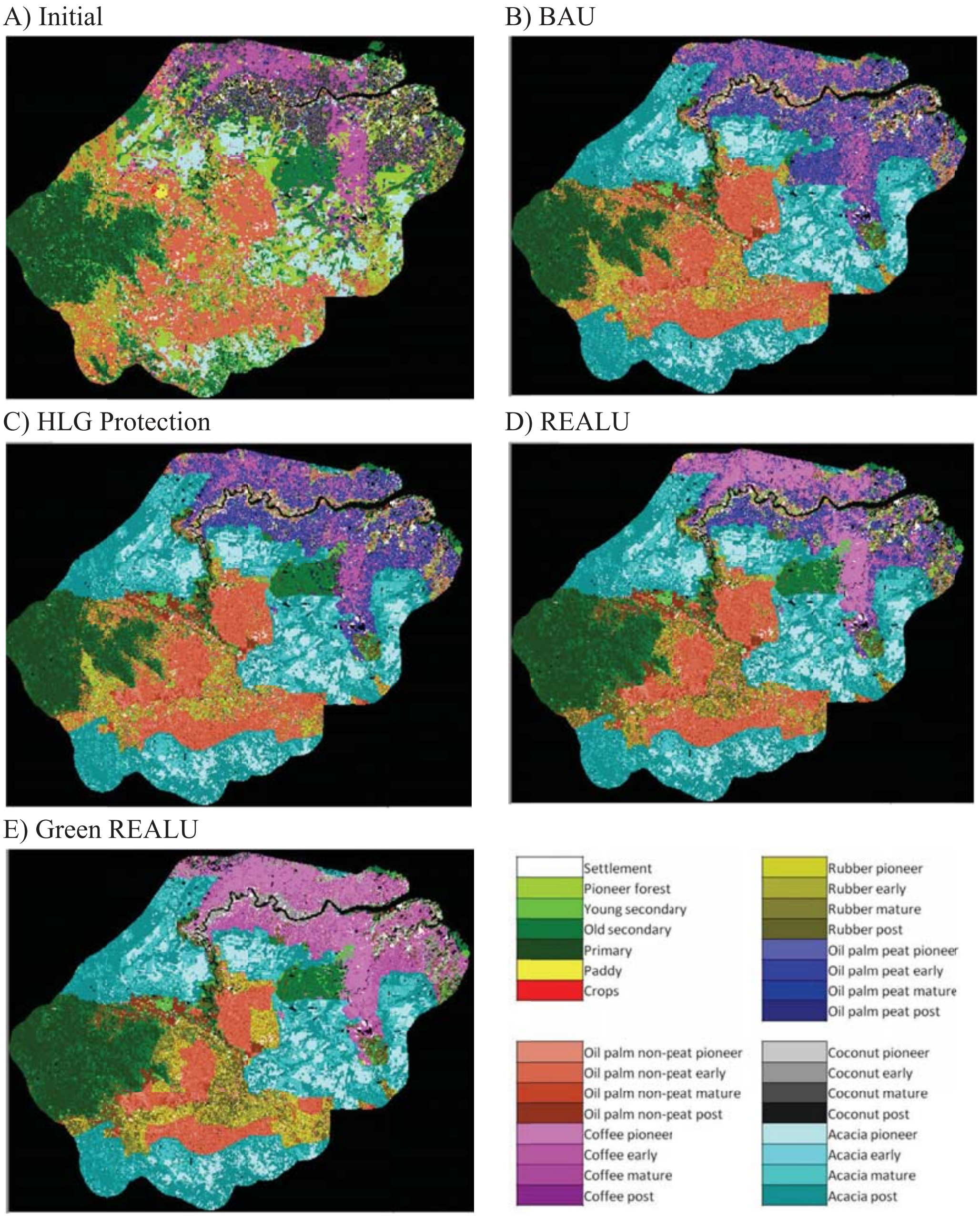

Figure 16 Land cover output maps of the five different scenarios for Tanjabar district

- **Trade-off analysis between carbon sequestration and profitability**

In terms of the trade-offs between carbon sequestration and profitability for the land-use scenarios, they all result in a lower income per capita compared to the BAU. On the other hand, higher carbon stocks are obtained mainly through conserving larger forest areas (i.e. the remaining peat forest, area of Bukit 30 national park and ex-production forest management unit). In the Green REALU, protection of old rubber systems contributes to increasing carbon stocks.

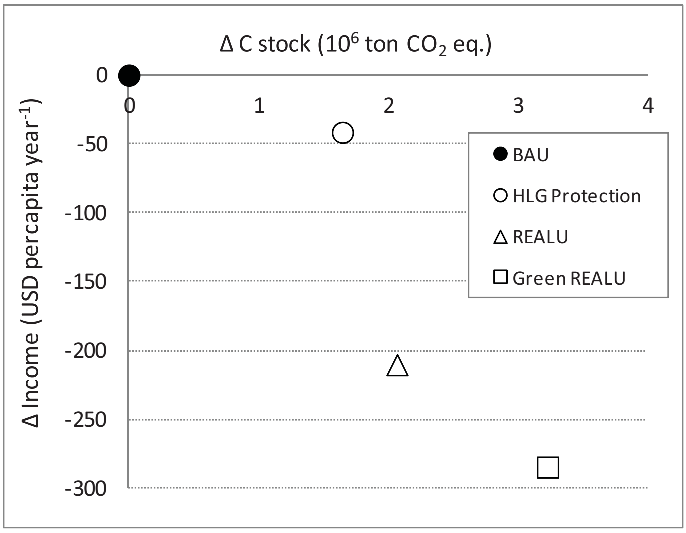

Figure 17 Impact of each scenario application relative to the BAU scenario on standing carbon stock in the landscape (10^6 tCO_2e) and economic impact by income (USD per capita) averaged over the 30-year simulation period in Tanjabar district

From the economic perspective however, there is a clear reduction of income when going from the HLG Protection to the Green REALU scenario. The decrease of income is well correlated with the percentage of oil palm area in the landscape, indicating that income from oil palm plantations largely determines total income at the district level. Therefore, there are two possible ways for reducing the potential income loss due to the conservation programs. First, getting compensation from external sources such as rewards for the carbon storage achieved and the level of carbon emissions avoided and second, introducing new technologies for managing agricultural crop lands in a less carbon intensive way and/or promotion of new profitable commodities which allow for the preservation of forest and more environment-friendly land uses.

- **Reference emission levels**

Forward-looking Reference Emission Levels were developed using FALLOW model. REL curves for BAU, HLG Protection and REALU scenario are shown in Figure 18.

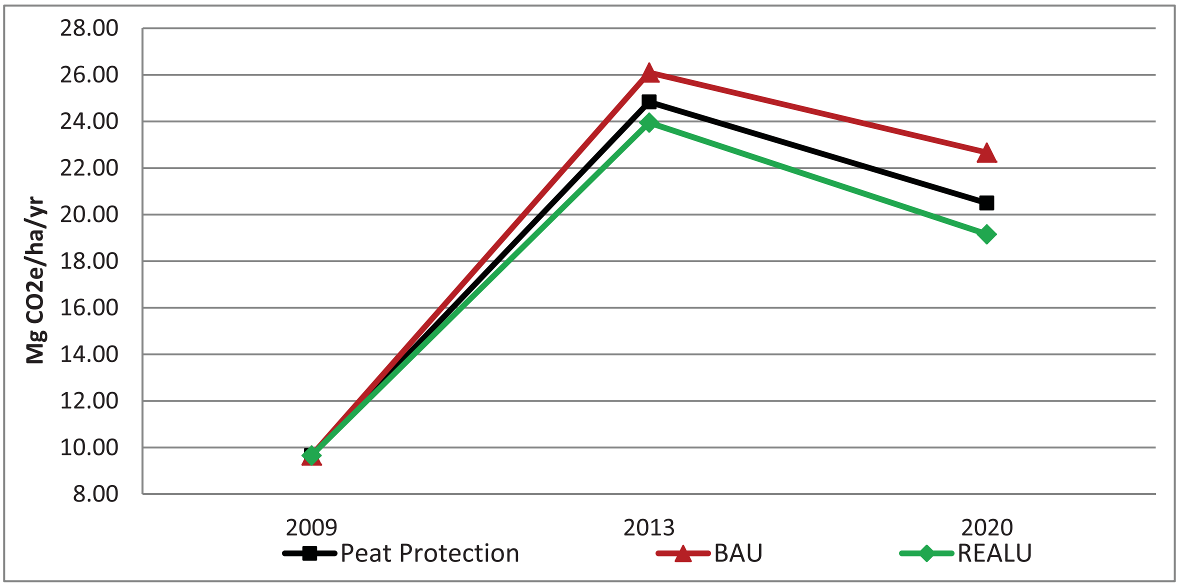

Figure 18 Estimated annual emissions in 2020 under various scenarios of reference emissions levels and emission reduction strategies in Tanjabar district

Conclusions on feasibility and best scenarios and options for emission reduction

In Tanjabar District, restricting the establishment of new oil palm plantations and maintaining the local agroforestry practices results in the two REALU scenarios having negative economic outcomes as compared to BAU. However, under BAU and HLG Protection scenarios, the landscape would be dominated by oil palm monoculture plantations, as oil palm is the most profitable land-use.

There are three possible ways to reduce the potential income loss in the REALU scenario: 1) getting compensation from external sources such as rewards for the carbon storage achieved and the level of carbon emissions avoided; 2) introducing new technologies and better management practices to increase the productivity level in the plots of local agricultural crops; and 3) promoting new profitable commodities which are environmentally-friendly and allow for the preservation of forests.

Emission reduction strategies that have been proposed include: 1) maintaining high carbon stock areas, in this case the forest remnants around the HLG and Bukit 30 national park; 2) enhancing carbon stock in forest areas through rehabilitation and preservation; and 3) enhancing carbon stock outside the forest area on smallholder farms, through intercropping and agroforestry. Two potential intervention sites were proposed: KPHLG (Peat Forest Protection Management Unit) in the vicinity of peat forest remnants and KPHP open access areas in the western part of the Tanjabar District.

2.2.3 Feasibility assessment in Padre Abad Province in Peru

Adapted from Robiglio, V.et al., 2012 (Feasibility Report)

Land use changes between 1990 and 2010

Figure 19 displays the top five land-use transitions that have been occurring between 1990 and 2007 in the Aguaytía watershed within Padre Abad Province. During this period overall 19% of the province of Padre Abad experienced some kind of land-use change. About 50% of the changes are represented by deforestation and conversion of long fallow-based systems into short-fallow systems.

Three transitions are directly associated with smallholder farmers' land uses. The first two corresponds to the process of converting relatively pristine forest into small plots for short fallow-based systems including pastures. The third is the transition from long fallow to short fallow-based rotations. The other two transitions shown in the figure suggest some intermediate categories of forest change and degradation. All these land-use activities are responsible for substantial carbon emissions, but also provide the main source of livelihoods for people working in the logging industry and for smallholder farmers.

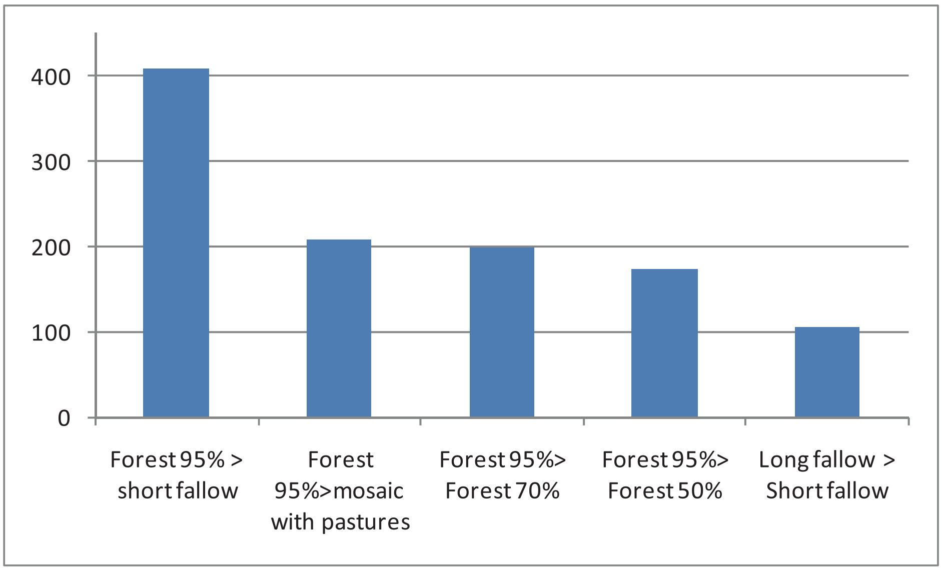

Figure 19 The top five land-use change transitions in the Aguaytía study area within Padre Abad. Estimated density of canopy cover (%) of forest under each scenario is indicated.

The rest of the analysis was conducted for a study area with 50 farmers belonging to a cocoa marketing association (ACATPA; Asociacion de cacaoteros tecnificados de Padre Abad).

Opportunity costs

The analysis assessing the opportunity costs by avoiding deforestation showed income forgone could likely be replaced by compensation provided through REDD+ programs within the international carbon market (Figure 20). The opportunity costs for avoiding approximately 85% of emissions would range between 0.95 - 3.50 USD per tCO_2e depending on the scenarios used, which in the case of the highest opportunity cost scenario assumed a 20% increase in crop prices.

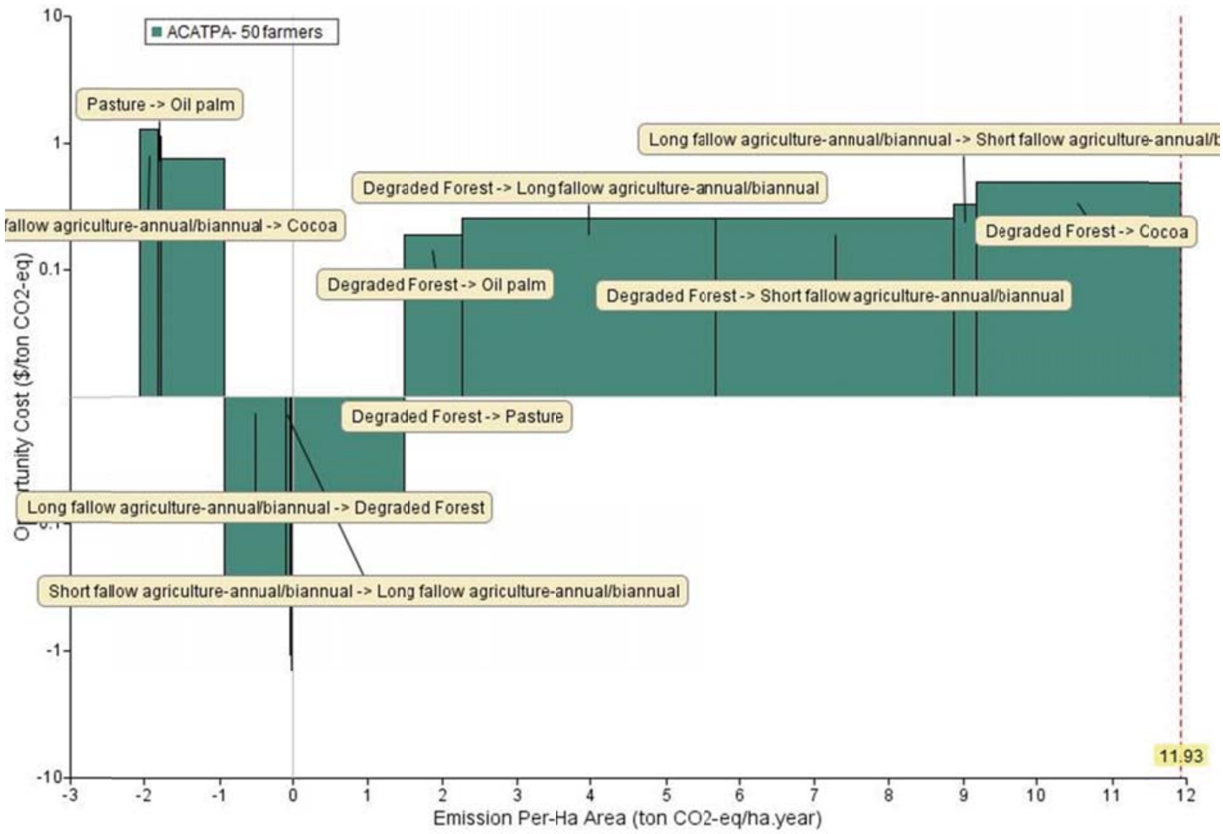

Figure 20 Opportunity costs of simple land use systems from a private perspective (15% discount rate) for the baseline scenario in ACATPA study site

Development of land use scenarios

Four different land use scenarios were developed:

1) An historical baseline ('Baseline'), based upon the prior five-year land use patterns
2) A 'BAU Declared' baseline, similar to the historical baseline, but taking into account changes in future degradation.
3) 'BAU-ADef' scenario focusing on improving carbon stock in cocoa farms through trees enrichment and avoided establishment of cocoa over the forest land (corresponding surface is allocated to forest conservation)
4) 'REALU' involving the improvement of carbon stock in all land uses and reduced deforestation (part of the forest is allocated to conservation).

Feasibility of emission reductions under various scenarios

- **Trade-offs analysis between carbon sequestration and profitability**

Land uses in the area of Padre Abad are located along a trade-off arc (green line) in Figure 21 ranging from high profitability - low carbon stock such as agricultural and ranching land uses, to low profitability - high carbon stock, exemplified by forest land uses. A few points in the lower left corner (red circle) represent low levels of profit and carbon, such as pasture systems. Converting these low carbon - low profit lands into more profitable and carbon-rich lands does not represent a trade-off, but a win-win result according to economic and environment criteria. Consequently, converting this land use could be considered a synergy between carbon and profits and could be a REDD+/REALU policy priority.

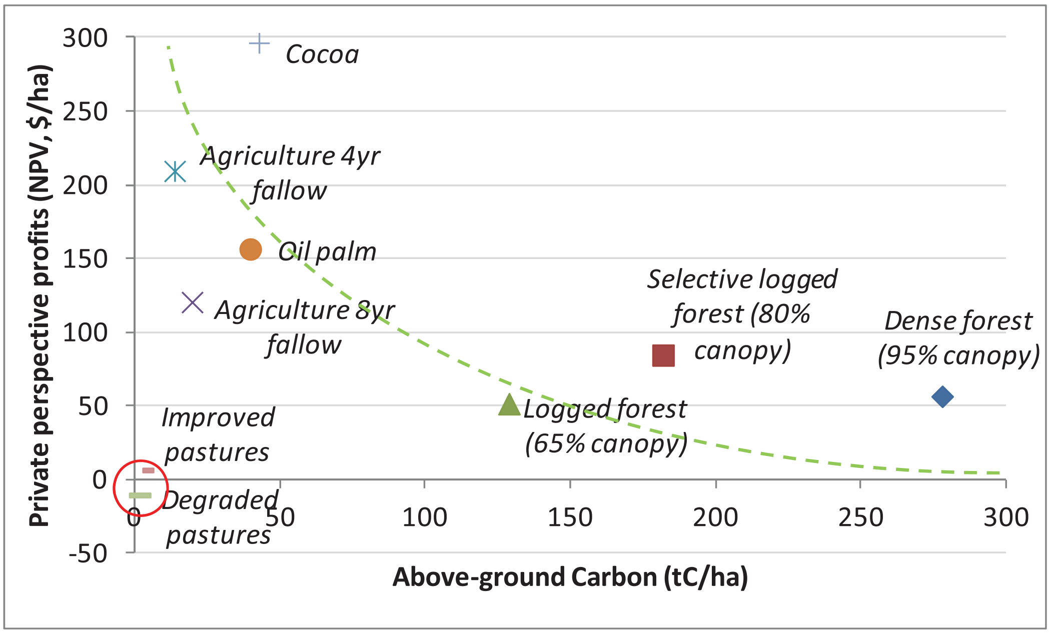

Figure 21 NPV and carbon stocks for the varying land use types in Padre Abad. The green-arced dotted line represents a trade-off trajectory between NPV and carbon stocks for the different land use types. The red circle represents land uses with both low NPV and low carbon stocks indicating the any improvement in land use in these areas could result in win-win outcomes.

- **Reference emission levels**

The four scenarios were compared over a 30-year period projecting each scenario's potential carbon emissions (Figure 22).

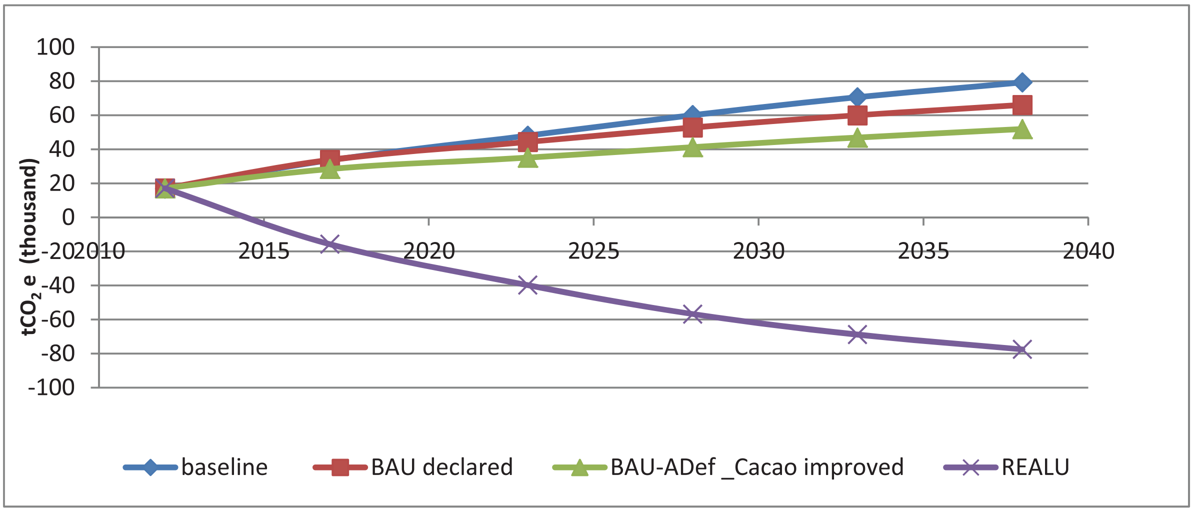

Figure 22 Projected emissions for the four scenarios over a 30-year period in ACATPA study site

Conclusions on feasibility and best scenarios and options for emission reduction

REALU is the only scenario resulting in net emission reduction over this time period. A series of options were evaluated and discussed in ACATPA farmer focus groups to identify possible schemes to enhance carbon stock over their landscapes and access carbon credits systems as compensation for their shift in land use. Cocoa was identified to be a good starting point, but a household approach accounting for the whole land use portfolio has a greater potential for increased carbon payments for smallholders. The amount of Verified Emission Reductions (VERs) to be sold will be determined by the carbon differential among the trajectories of the different land uses and the commitment the farmers are willing to fulfil in adopting richer carbon systems and practices.

Under such a scheme, a series of management options were presented to the farmers where low carbon land use systems are converted to high carbon production systems. Table 2 shows the current land uses of the farms, the carbon enriched land uses and the requisites for their conversion or adoption.

Table 2 Current land uses, alternative land uses and requisites for conversion

Land use	Carbon rich land use	Requisites
Cocoa	Carbon enriched cocoa	Minimum of 200 trees per ha with a 50% composition of timber trees
Pastures	Silvopastures	Minimum of 300 trees per ha with a 50% composition of timber trees
Forest	Conservation forest	No deforestation nor degradation of the forest (increase of stock)
Fallow	Enriched fallow	Fallow enriched with high density timber trees, minimum 200 trees per ha

The farmers had the possibility to decide how much of their land they wanted to convert to systems with more carbon and how much of their forest they were willing to preserve. Figure 23 is an example of a 26 ha farm where the farmer committed portions of his farm to carbon richer land uses.

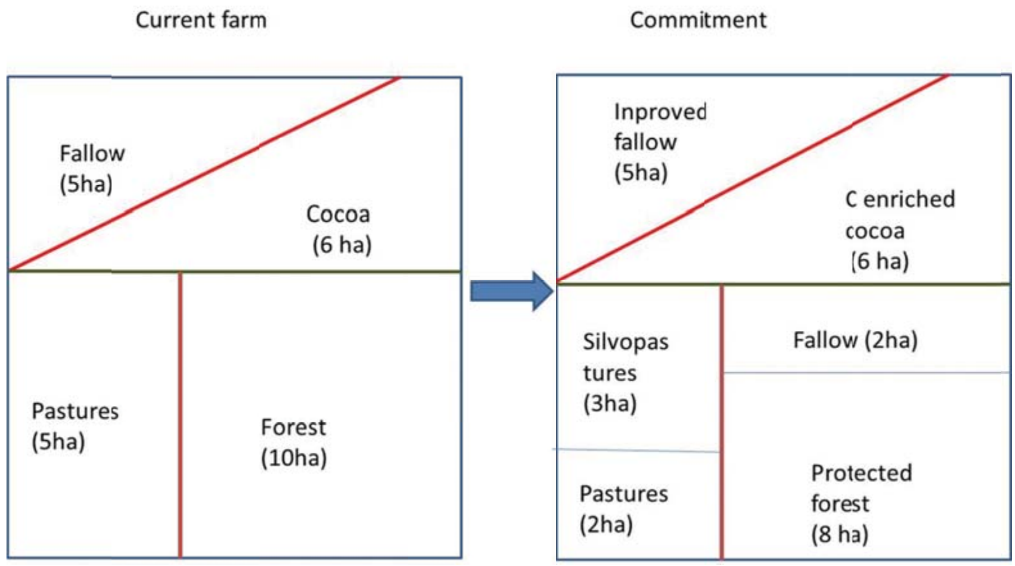

Figure 23 Sketch of the current land use portfolio of the farm and farmer's commitment to increase carbon stock within their farm.

The farmer would sign a contract with the ACATPA cooperative to fulfil this agreement and the cooperative will play the role of administrator and manager of the VERs coming from the different farms and add up all the carbon credits from different land uses in order to have the critical mass needed to be able to cover the transaction costs of the process.

2.2.4 Feasibility assessment in Bac Kan Province in Vietnam

Adapted from Do Trong Hoan et al., 2012 (Feasibility Report)

Land use changes between 1990 and 2010

Land use changes between 1990 and 2010 resulted in both carbon emission and sequestration (Figure 24). Net emission increased from 1990-1995 to 1995-2000, followed by a significant drop in 2000-2005. During 2005-2010, the net emission was -56,385 tCO_2e/yr, indicating that the landscape was sequestering carbon during this period, due to large-scale tree plantation activities. However, there were net emissions over the whole period from 1990-2010 with average emissions of 539,014 tCO_2e. Focused group discussions at village level revealed two reasons for the net emissions: (1) clear cut and/or heavily logged forests and (2) slash and burn practices for short periods on poor timber forestland. Correspondingly, forest plantations on bare land and natural forest regeneration were the two main carbon sequestering land uses.

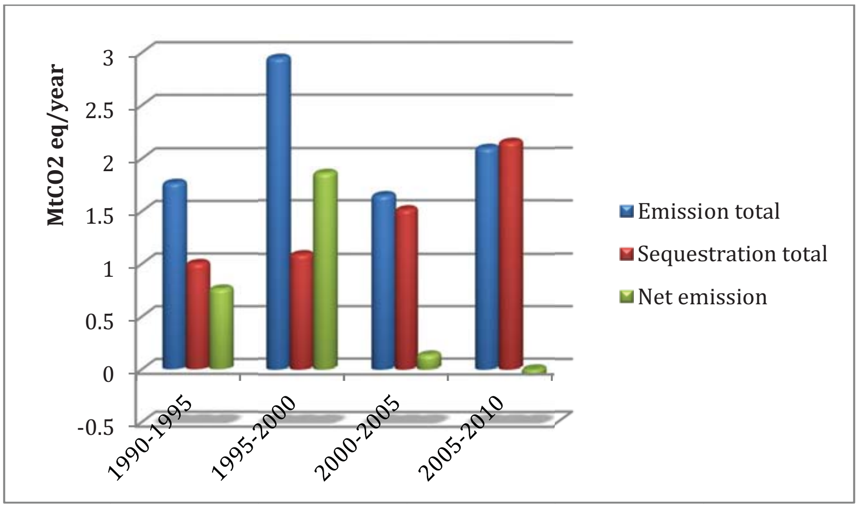

Figure 24 Emissions, sequestration and net emissions in the Bac Kan landscape from 1990 to 2010.

Retrospective analysis of opportunity costs for emission reduction

In terms of opportunity costs, almost all emissions were avoidable at a carbon price of 5 USD/tCO_2e (Figure 25-Figure 28). Emissions with positive opportunity costs were very small compared to negative opportunity cost emissions, mostly from conversion of poor timber forest to plantations or shifting cultivation demonstrating the potential for REDD+/REALU incentives in the province. However, the opportunity cost analysis was performed using time averaged above ground carbon stock of land uses only. Below ground and soil carbon pools were disregarded in the analysis due to limitation of data and methodologies.

It was also found that the opportunity cost for assisted natural forest regeneration is relatively higher than other options, thus bundling payments or benefits in combination with law enforcement may be needed. On the other hand, converting monocropped maize on sloping lands into agroforestry systems, *Acacia mangium* and maize (7 year) and *Melia azeradach* and maize (10 year), seems an interesting option due to relatively low opportunity cost and diversified products.

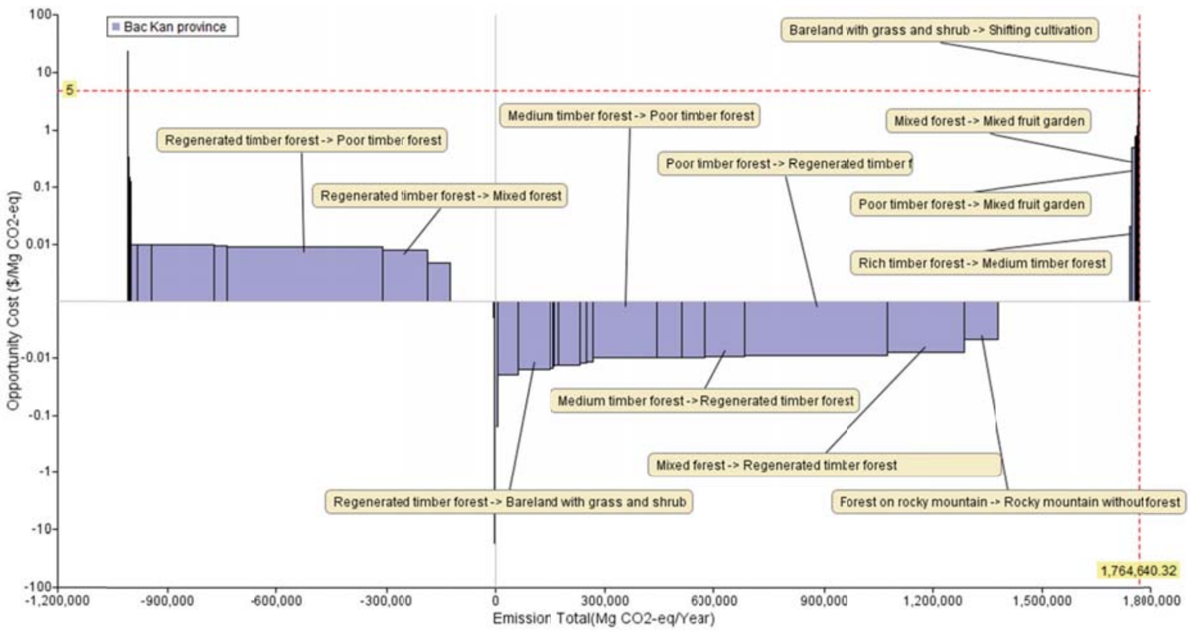

Figure 25 Opportunity cost curve for Bac Kan, 1990–1995 demonstrating the amount of compensation needed to promote different kinds of possible land uses changes and the corresponding amount of resulting emissions.

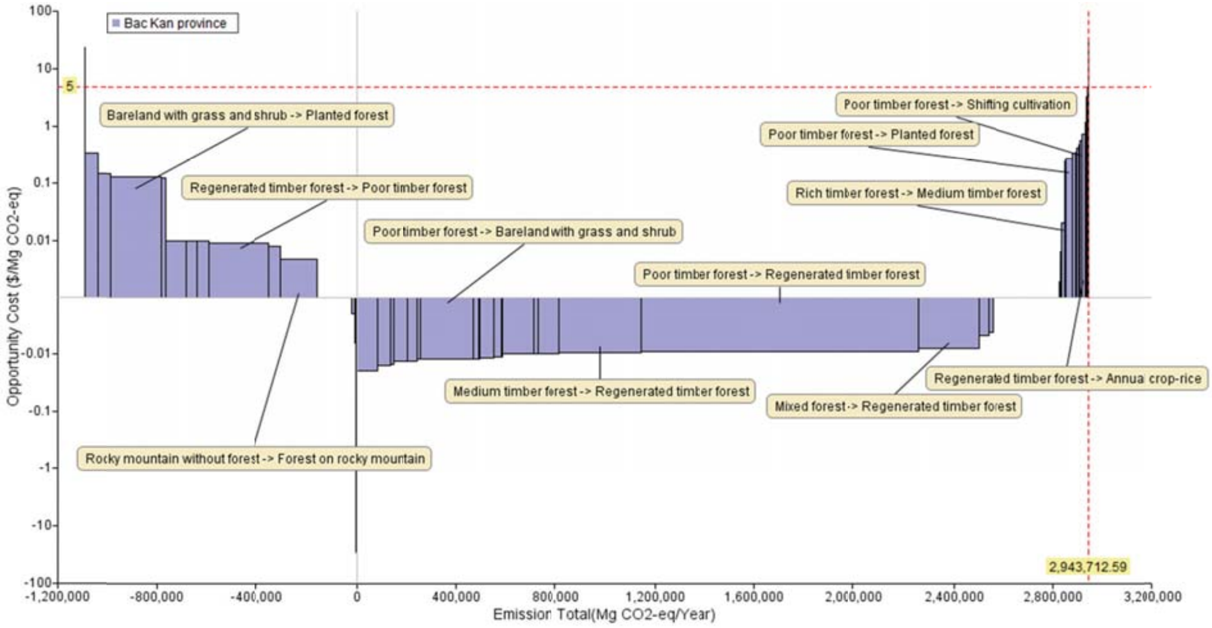

Figure 26 Opportunity cost curve for Bac Kan, 1995–2000.

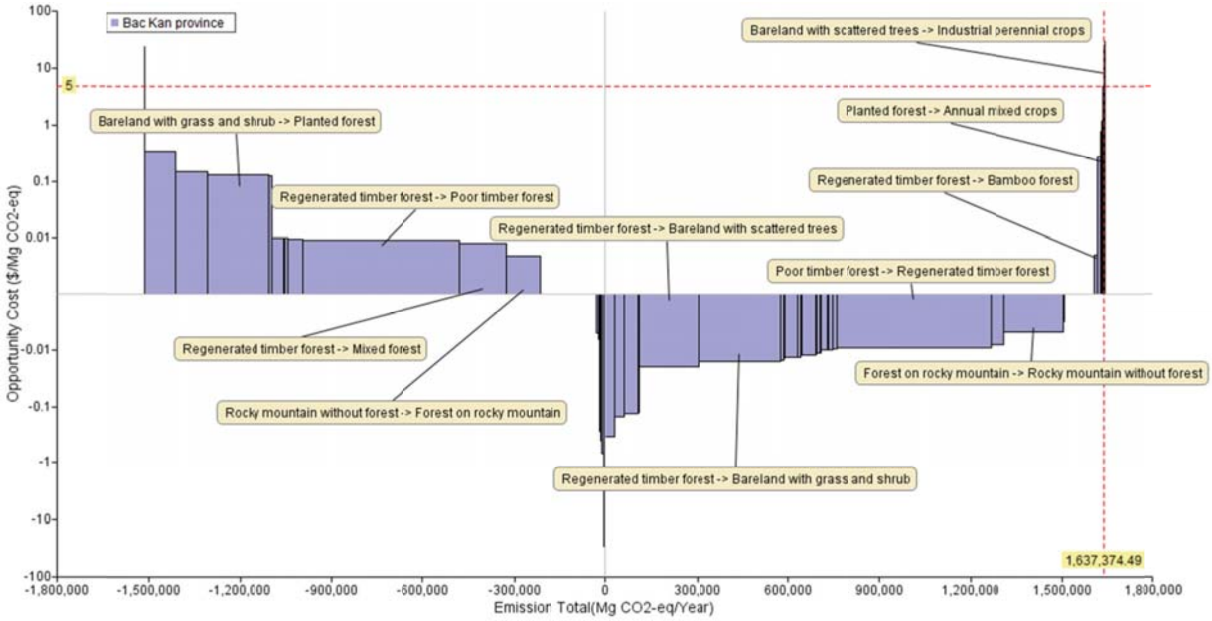

Figure 27 Opportunity cost curve for Bac Kan, 2000–2005.

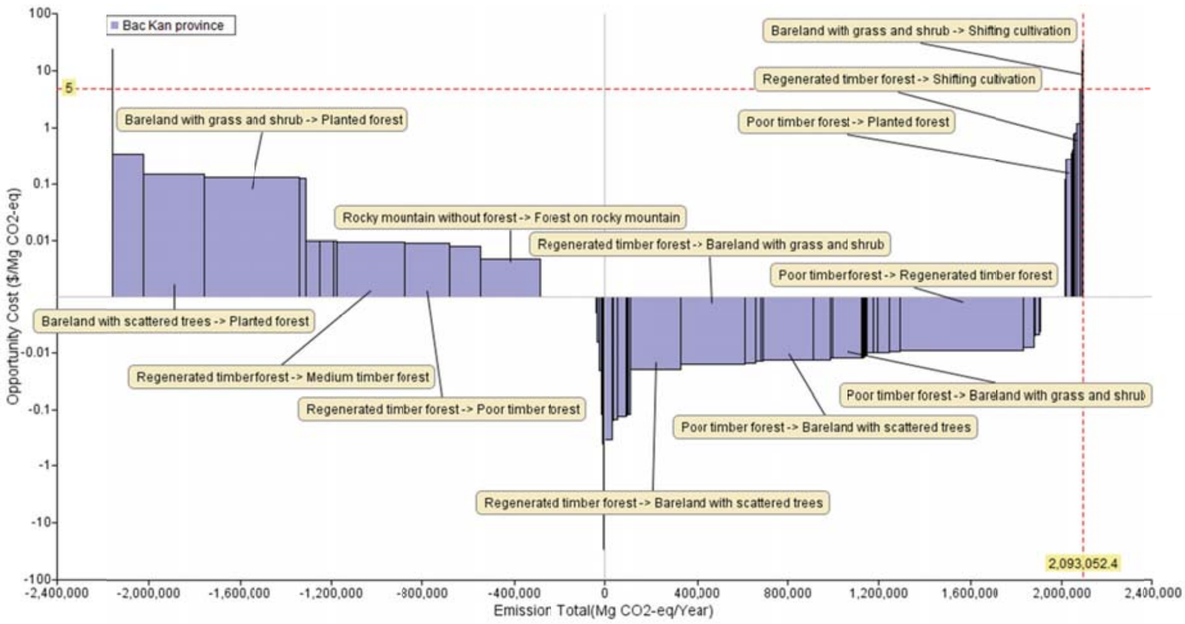

Figure 28 Opportunity cost curve for Bac Kan, 2005–2010.

Development of land use scenarios

Five scenarios were developed:

1) **'BAU'** with free competition of all land uses based on economic profit;
2) **'Acacia Forest Expansion'** where subsidies are given to smallholders for forest plantations;
3) **'Crop Expansion'** where subsidies are given to smallholders for annual crops;
4) **'REDD+'** where bare lands and specially used forest will be planted with forest tree species while illegal logging will be completely stopped; and
5) **'REALU'** stimulating a situation where unused lands outside forest areas are converted into smallholder acacia plantations, and trees introduced in agricultural croplands as part of an agroforestry system.

Land cover outputs maps

Figure 29 shows the five different land use scenarios compared to the initial year of 2010.

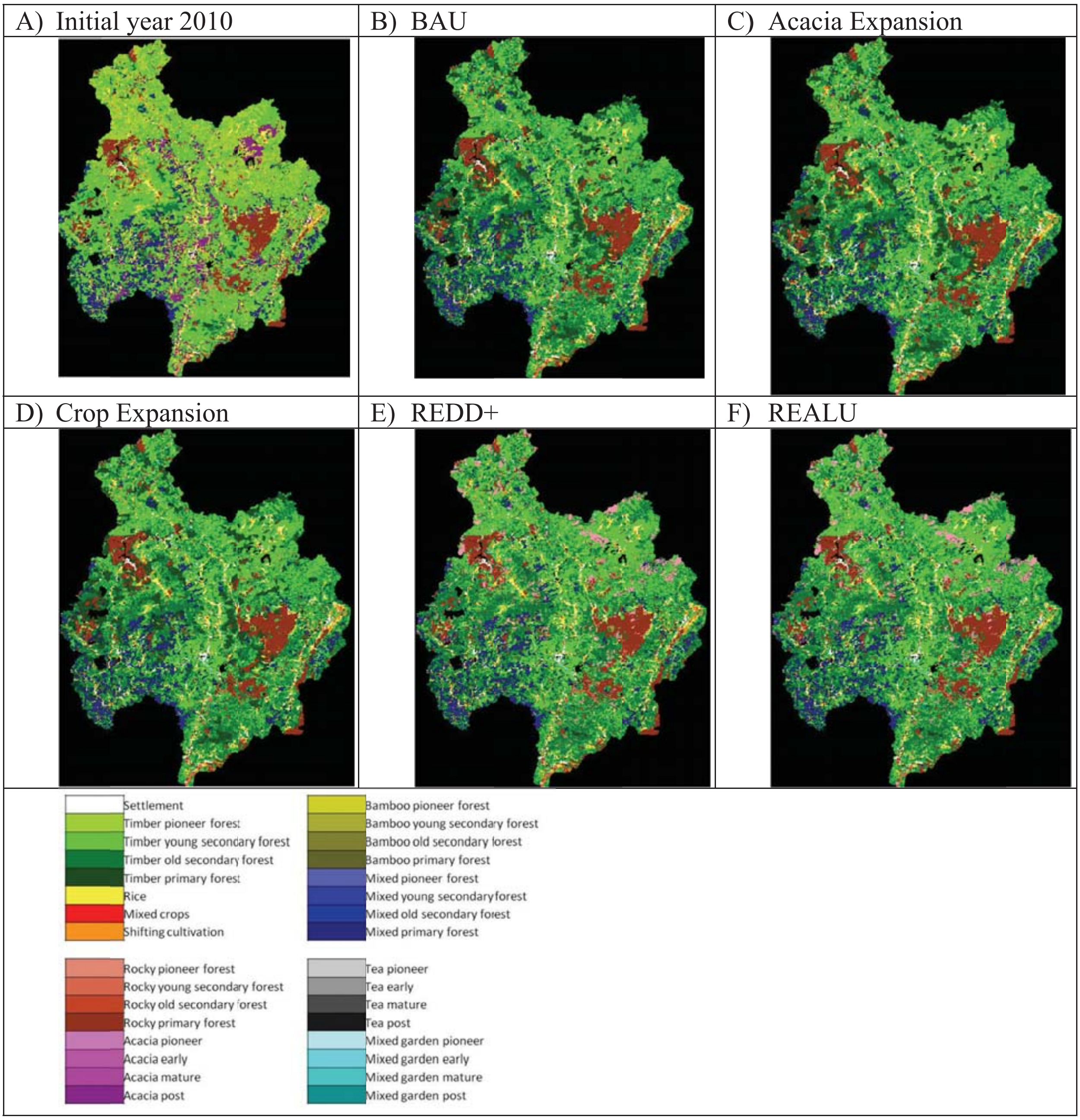

Figure 29 Land cover output maps for the different scenarios in Bac Kan

Feasibility of emission reductions under various scenarios

- **Trade-off analysis between carbon sequestration and profitability for the five scenarios**

Trade-off analyses between the different scenarios showed that both REDD+ and REALU scenarios resulted in carbon stock sequestration in the landscape, with the REALU scenario offering a much greater carbon sequestration potential than the REDD+ scenario (~30 Mt compared to ~12 Mt). However, REALU scenario cuts down income per capita compared to BAU and REDD+ scenarios. Introducing trees into shifting cultivation land thus brings carbon benefit to tree plantation within forest lands, but comes with greater economic costs to farmers.

Interestingly, expansion of crops will help increase both income and a little landscape carbon stock, while subsidies given for *Acacia mangium* plantations will help increase income per capita, but reduce landscape carbon stock at an alarming rate, since the landscape emits more carbon as acacia replaces natural production forest that has high carbon stock.

If payments for carbon stock (either forest and/or non-forest) were provided at 5 USD/tCO_2e, REDD+ and REALU would result in "win-win" scenarios, where both landscape carbon stock and income per capita increase significantly as compared to BAU and the other scenarios.

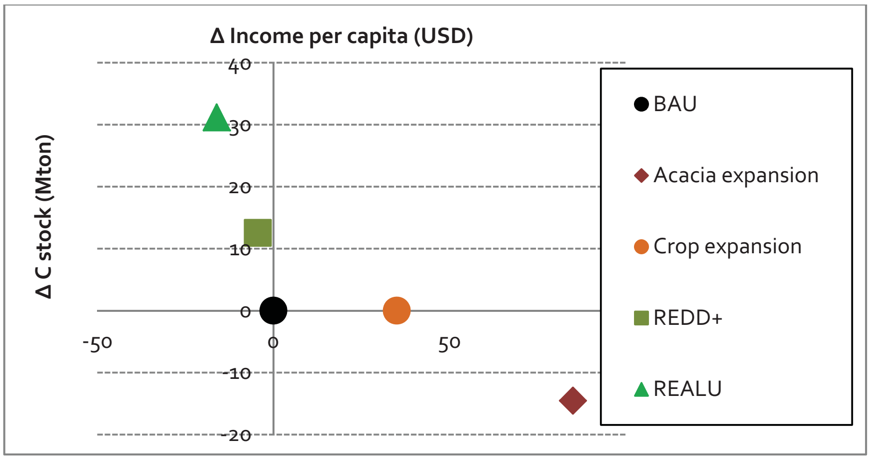

Figure 30 Average landscape carbon stock and income per capita for land use change scenarios in Bac Kan Province compared to the BAU scenario.

- **Reference emission levels**

Reference Emission Levels (RELs) for REDD+ and REALU in Bac Kan were estimated using both historical trends and forward-looking trends. Historical REL was developed using activity data from 1990 to 2010. Since 99.97% of landscape carbon emissions were from the forest sector, historical REDD+'s REL and REALU's REL of Bac Kan are identical. Forward looking REL calculated using the FALLOW model was found more appropriate to design emission reduction strategies. Following the forward-looking REL, the REDD+ scenario will contribute only 29% (1.82 MtC/6.37 MtC) carbon stock enhancement in the landscape. Therefore, emission reduction strategies should not only look at forestlands, but also other land uses.

Conclusions on feasibility and best scenarios and options for emission reduction

REALU will be feasible in Bac Kan Province if:

1. An incentive mechanism is in place to compensate for income loss from production.
2. A landscape approach to carbon accounting is applied.
3. A forward looking REL is used for carbon credit calculation.
4. Carbon rich land use practices such as agroforestry is widely promoted and incorporated in major development plans in the province.

If the province adopts REALU as its emissions reduction strategy, at least two following land use pathways should be considered:

- Enhancement of forest carbon stock (under both REDD+ and REALU) including activities such as planting forest tree species in forest areas and assisting with natural forest regeneration.
- Maintenance and enhancement of carbon rich land uses (under REALU, but not necessarily under REDD+) including promotion of high carbon stock land covers such as forest, agroforestry systems and other sustainable land use practices that aims at enhancing carbon stock (and, as much as possible, improving livelihoods). One such practice would involve introducing xoan (local name of *Melia azedarach*) onto slope land maize monocropping under the REALU scenario.

III POTENTIAL FOR EMISSION REDUCTION THROUGH PEATLAND MANAGEMENT

This chapter focuses on the second pillar of REALU, i.e. REPeat, and stresses the importance of peatlands, the largest terrestrial long-term sink of atmospheric carbon accounting for twice as much carbon as the biomass of the world's forests. Over the past 10,000 years, peatlands have absorbed around 1.2 tCO_2, with a net cooling effect on the earth climate. Here studies completed in each REALU country are presented to further understand functions and emission reduction potentials within peatlands occurring in tropical ecosystems.

3.1 Importance of peatlands as major carbon pool

Adapted from Tchienkoua, M. et al., 2011 (Peatland Report)

Peatlands are wetland ecosystems characterized by the accumulation of organic matter under cold and/or anaerobic conditions. They play a vital role in biosphere biogeochemical processes and their potential effect on global environmental change (Immirzi et al., 1992). Because they are estimated to actually represent between 25-30% of all terrestrial carbon, they are of growing concern in the global arena of international environment conventions, namely the deliberations of the UNFCCC and the Convention on Biological Diversity. The UNFCCC is primarily concerned with the implications of peatland loss and its impact on the global GHG emissions, as well as in possible mitigation and adaptation options.

Peatlands ecosystems have been comprehensively investigated in boreal zones, but in contrast there is limited data about such ecosystems within tropical areas. Tropical forest peatlands are essential terrestrial carbon pools with diverse direct environmental functions including water regulation, protection from natural geomorphic processes, and mitigation from flood and macroclimate stabilization (Page et al., 2006; Page et al., 2004; Rieley et al., 2008). They also provide diversity in terms of plant communities, wildlife, hydrological functions and many other environmental dimensions.

Since 1994, there has been a strong international effort to develop awareness around the importance and use of peatland resources. Today, with growing population and urbanization, these resources are endangered in front of expanding agricultural frontiers, illegal logging and poor management. In many tropical countries, controls and regulations on peatland resources have not yet been put in place due to the absence of essential information about their value and characterisation. Therefore their inventory and evaluation appears essential for formulating a national peatland policy.

3.2 Characterization of peatlands in the upper Nyong River basin, Central Southern Cameroon

Adapted from Tchienkoua M. et al., 2011 (Peatland Report)

This section provides information on carbon storage potentials of terrestrial peatlands in the upper part of the Nyong watershed (Central Cameroon), called the Ayos-Abong-Mbang peatlands and reports on peatland physicochemical characteristics, current use and prospects for sustainable use in the future, in order to support decision-making processes for integrated landscape planning and management options essential for balancing future demand for peatland resources and environmental concerns.

Peatland physicochemical characteristics and carbon storage potentials

The upper part of the Nyong watershed is characterized by relatively flat topography and extensive marshy land. The mapping process identified three mapping units differentiated by their hydrological characteristics, floodplains with grass (FPG), floodplains with swampy forest (FPF), and Nyong river tributaries with swampy forest (FRT). The study indicates that the soil carbon component of the Ayos-Abong-Mbang peatlands is an important carbon sink storing between 143.9 and 841.6 tC/ha. This represents between two and five times the average amount carbon stored in well-drained soils. Furthermore, this pool corresponds only to a fraction of the actual carbon storage since the study was confined to the 0-150 cm depth and did not account for any of the above ground stock of the swamp forests. The swampy forest is typified by *Sterculia subveola* and *Raphia lookeri* species. Mean thickness of peat horizons ranged from 20 cm to 300 cm increasing in the order of FPF≥FRT>FPG. Mean carbon stocks at 1.3 m depth was highest in FPG (470.9 tC) and FRT (446.1 tC) with values being at least 4 times the values found in well drained soils. The lowest value was under FPF (262.1 tC). Peats that occurred in FPG were two-layered with a hemic O layer darkened by recurrent bush fire. It was generally overlying sapric clayey substrata. Peats in FPF and FRT were water saturated all year round and exhibited fibric materials with bulk densities between 0.03 and 0.40 g/cm^3. The coefficient of variation of carbon stock within mapping units was high, ranging from 40% in FRT to 72.9% in FPF, indicating a greater heterogeneity imposed by hydrological and pedological attributes.

Current use and prospects for sustainable use in the future

In contrary to southeast Asian peatlands which are being rapidly converted into production systems for lucrative agribusiness purposes (Murdiyarso et al., 2010), the studied peatlands are undeveloped because of the low commercial value of dominant species, mainly *Sterculia subviolacea* and *Raphia lookeri,* and the low pressure on soil resources.

However, regional development strategies must be designed for preserving the sensitive ecosystems by putting in place management mechanisms that balance future demands on the resources and environmental preservation. To this extent, the potential of these peatlands for agricultural production is variable. In the floodplain where the soils are submerged under water for at least three months in the year, suitable agricultural systems that may conserve environmental benefits need to be implemented. Land use systems such as wetland rice will probably enhance carbon stocks while at the same time improving the economic livelihoods of local peoples. The floodplain under grassland covers about 6,127 ha that could be allocated to rice cultivation with irrigation schemes that could help reduce organic matter oxidation. Such a management scheme should be integrated into regional land use and socio-economic development planning on the basis of all stakeholders. It is also hoped that carbon markets may provide an opportunity for peat swamp forest conservation to generate income for local communities. This could put an economic value on these continental peat swamp forests and their globally important carbon stores by providing incentives for their protection. The FPF and FRT landscapes extending over roughly 70,000 ha offer great opportunities protection of endemic plant species, improvement of livelihoods and successful intervention for creating a carbon rich environment.

3.3 Characterization of CO_2 emissions in peatlands in Indonesia

3.3.1 Spatial variation of water table depth and CO_2 emission from a peat soil in Indonesia

Adapted from Fahmuddin Agus et al., 2011 (Peatland Report)

Peatland in Indonesia covers an area of about 20 million ha or approximately 10% of Indonesia's land area, mostly found in the three major islands, namely Sumatra, Kalimantan and Papua. Peatsoil has a very high carbon stock which is conserved under natural conditions, but is easily emitted under open and drained states. Disturbed peatlands which have been cleared and/or drained is considered one of the highest contributors of CO_2 emissions. The most likely determining factor for CO_2 emissions is the depth of water table and peat water content. Both are related to the volume of unsaturated peat; the portion more easily decomposed by aerobic micro-organisms. A clear fitted relationship between water table depth and CO_2 emissions is still lacking requiring further field measurements and research to better understand such processes. This calls for more intensive measurements in different land cover areas with different levels of peat maturity.

This study measured CO_2 emissions in relatively mature peat (sapric and hemic maturity) under rubber plantations with a 3 m drainage canal varying in water level from -0.7 to -2 m, depending on the season. The study captures the late rainy season (March-May 2011) with moderate water table depth within the said range. The objectives of this research were to (i) develop the relationship of CO_2 flux, water table depth and water content within the specific site, (ii) study spatial and temporal variations of the CO_2 gas flux and (iii) compare the CO_2 gas fluxes and peat properties of Aceh Province under rubber and oil palm with that of Central Kalimantan Province under rubber systems.

As water table depth correlated negatively with water content, the CO_2 flux in most cases increased with the decrease of water content, under which conditions the soil is more aerobic. It was found that in general, CO_2 flux decreases with the increase in water content for the range of water content between 40-57% during the research. Under more extreme, drier conditions, emissions tend to be lower but the results of this study do not have a wider range of data to demonstrate such a trend.

The research site at Jabiren in Central Kalimantan Province has a unique feature of thick enrichment of mineral soil resulting from flooding. Carbon density is relatively high, leading to the high carbon stock despite the moderate peat thickness. CO_2 emissions under the rubber plantation were much lower in Aceh than in Kalimatan because of the shallow water table and perhaps also because of low input management of the former versus the deep drainage and high fertilization of the latter. With the deep drainage of Kalimantan rubber plantation, it had comparable emissions with that of the oil palm plantation in Aceh. As rubber is relatively tolerant to shallow drainage, keeping the water table at a shallow level is expected to decrease the emission level in Kalimantan.

3.3.2 Peatland carbon emissions resulting from different forest conversions

Adapted from Khasanah et al. 2013 (Indonesia Substantive Report)

An additional study looked at different emission rates resulting from varying peatland forest conversions in Indonesia. The objectives of the study were to estimate peatland carbon emissions due to peat oxidation in relation to drainage management of 1) simple rubber agroforestry, 2) mixed coconut, 3) shaded coffee cultivation and 4) oil palm plantations by smallholder farms using the carbon stock difference approach (for 1−3) and the rate of subsidence approach (for 1−4). Further it aimed to estimate the effect of fertilizer application on the peat decomposition rates of three land cover types (simple rubber agroforestry, oil palm and logged-over forest) using rate of subsidence and microrelief approaches, for which only preliminary results were available.

Three types of smallholder farmland found commonly in Tanjabar peatland areas are: 1) simple rubber agroforestry (40 years old), 2) mixed coconut (50 years old) and 3) shaded coffee cultivation (25 years old). Belowground carbon stock of these land cover types were estimated by measuring soil bulk density and analysing soil carbon content. This was accomplished by taking soil samples using a peat auger throughout the entire soil depth at four measurement points in transects perpendicular to the drains (5, 15, 25 and 45 m from the drainage canal). Each type of land cover had three replications. The sample was then analysed in a laboratory at the Indonesian Soil Research Institute (ISRI), Ministry of Agriculture. The soil carbon content was analysed via the loss-on-ignition method. Depth of the groundwater table at each measurement point was also recorded. The same approach was also done in disturbed forest as a reference level of carbon stock representing initial condition before conversion. It was measured at three measurement points in transects perpendicular to the drains (50, 140, and 190 m from the drainage canal). Peat subsidence was monitored by installing metal rods at four measurement points in transects perpendicular to the drains.

The primary method for estimation of peat carbon emissions was observing the difference between carbon stocks of a certain land-use systems/farming systems and the carbon stock of forest when it was cleared and drained. Belowground carbon stock will become lower with closer proximity to the canal; conversely it will be higher with greater distance from the canal. The ‘broken stick’ relationship is normally used to describe this relationship as shown in Figure 31. In conditions with no emissions, carbon stock will be on the carbon stock maximum line; as drainage builds, the carbon stock declines following the sloping line (Figure 31). The total loss of carbon, or carbon emissions, can be estimated from the triangular area (identified with the arrow in Figure 31).

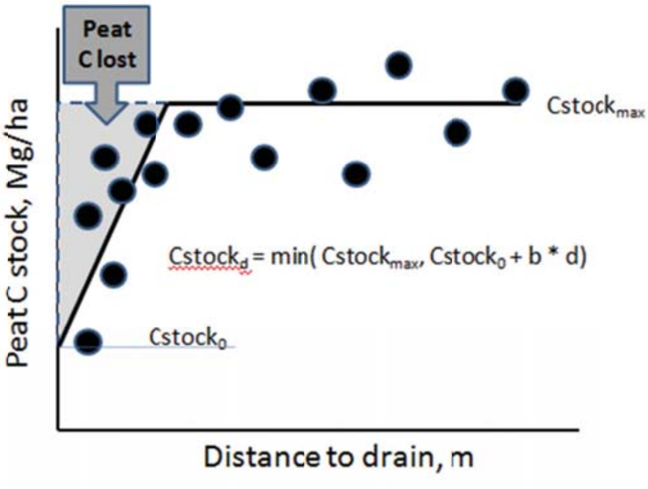

Figure 31 Cumulative peat carbon losses using the 'broken stick' relationship between peat profile carbon stock and distance to the drainage canal.

For Tanjabar, three assumptions were used for the analyses: 1) Disturbed forest was used as a reference level or initial condition of total belowground carbon stock for all land-use systems because forest conversions normally take place after forest logging or other disturbance; 2) That all land-use systems were located in the same peat dome (the same peat depth before conversion) with around 100 cm peat depth and with carbon stock of around 580 t/ha. This was used as the reference carbon stock; and 3) 100 m was used as a reference for distance between canals. This assumption was arbitrarily applied due to limitations in the field to measure the true distance between major canals.

Preliminary results of broken stick regression analysis showed that for the first 50 m to the canal, CO_2 emission from forest conversion was about 28.8, 13.6 and 9.5 tCO_2e/ha/yr for shaded coffee, simple rubber agroforestry and mixed coconut respectively. However, if land-use systems are not considered, forest conversion in Tanjabar potentially emitted about 15.8 tCO_2e/ha/yr. The variation of emissions between land uses can be linked to the type of land management or maintenance of the canals and age of the plots. The lowest emissions were found in the mixed coconut system, where the farmer maintained the water level of drainage canals besides the water level controlled by the flow of the river. The highest emissions were found in shaded coffee. Canopy cover that is expressed in aboveground biomass can also explain the variation of emissions from forest conversion in peatland areas. Aboveground biomass of shaded coffee is on average 26.0 t/ha. This value is lowest compared to simple rubber agroforestry (58.0 t/ha) and mixed coconut (48.3 t/ha). More open area may increase sunlight exposure and decomposition activity.

3.4 Characterization of Aguajales in the Aguaytia River basin, Peru

Adapted from Garcia, D. et al., 2012

Aguajales are forests made up of aguaje palm (*Mautitia flexuosa* L.f.), a species predominantly found in extensive flooded areas. Such aguajales ecosystems provide many benefits to Amazon inhabitants (Freitas et al., 2006) while also being an important part in the complex food chain providing nutritious fruit, key habitat for some species and playing a significant part in the carbon cycle. The deforestation and degradation of such systems is resulting in the loss of wildlife, increased decomposition of organic matter releasing net CO_2 emissions into the atmosphere and negative impacts on the livelihoods of local peoples. A distinction can be made between three different types of aguajales in the Aguytia River basin, dense aguajales, mixed aguajales and sacha aguajal (fake agujal). The objective of this work was to characterise the different types of aguajales based upon different carbon stock potentials while also exploring options for low-emission development.

The dense aguajales are palm groves/lowland aguajales that consist of communities of almost pure aguaje palms (*Mauritia flexuosa L.f.*), gigantic and single-stemmed, associated to the "huasaí" (*Euterpe precatoria*), *Virola sp*., *Symphonia globulifera*, *Hura crepitans* and others. All the species are adapted to swampy and hydromorphic soils from gently undulating to low terrace flats in both the interior areas and far from the banks of rivers. They are not exposed directly to seasonal flooding on account of the rise in the rivers. The accumulation of water occurs due to the drainage from the rains off adjacent lands, the rise in the river levels, the effect of filtration from the system of interconnecting channels and from waters filtered by the vegetation's foliage. Mixed aguajales are communities of aguaje palms associated with other medium and large caulinar and cespitosa palms, Virola (Myristicaceae), Moracae and Cecropiaceae trees, smaller cespitosa and thorny palms and/or abundant aquatic herbaceous plants in the intermediate shallow pools. All the species are adapted to swampy substrate, formed by recent or sub recent hydromorphic soils from the low terrace flats, partially exposed to seasonal flooding from the nearby rivers. Finally sacha agual are characterized for being associated with other, medium-sized cespitosa and caulinar palms, or with Moracea or Cecropiacea trees and other, smaller, cespitosa and thorny palms. All the species are adapted to the swampy substrate, although these sacha aguajales do not have hydromorphic soils and their topography is moderately undulating.

Dense aguajales had the highest average carbon stocks with a total average of 399.58 tC/ha. Mixed aguajales, the most wide-spread type of aguajales in the Aguaytia basin, had intermediate levels of carbon stocks with an average of 209.63 tC/ha. Finally sacha aguajales had the lowest levels of average carbon stocks, significantly lower to the other types, with an average of 61.56

tC/ha. Coverage of dense aguajales and mixed aguajales have been both decreasing between 1990 and 2010, where in contrast the area of sacha aguajales has been on the increase.

According to the content of organic matter, it was found that only the surface layer —at a depth of 0-20 cm with maximum averages of 22.31% carbon— meets the requirements to be considered peatland, and can be called organic soils, but as the depth increases to 200 cm, the carbon diminishes to maximum values of between 14.1% up to 0.7% because mineral soils are then mixed with the organic matter and the subsurface no longer qualifies as organic soils.

The sustainable management of aguajales ecosystems in the Amazon presents an opportunity to both utilize and value swamp forests (Khan, 1993; Peters et al., 1989), as is being done in a number of tropical countries with other types of palm that grow on flood plains, an example being the *Euterpe oleraceae* in Brazil (Anderson et al., 1987). Management plans have been developed with different techniques management techniques proposed such as: family nurseries, management of natural regeneration, agroforestry systems and management of natural stands (Bejarano and Piana, 2002). Management could be carried out individually or through community management with family allotments of aguajales belonging to the community. In all cases there must be technically substantiated management plans, with the active participation of the interested parties, reinforcing motivation and commitment and the consolidation of the organizations. The basic principle of using aguajales should be the harvesting of fruit without resorting to the cutting down of female palms using simple technologies and encouraging the use of climbers.

Other potential sustainable management strategies include a system of “beltways”, locating and joining the plants through a system of narrow trails, similar to those used in the harvesting of shiringa latex or Brazil nuts. The best palms should be chosen in each area for the quality of fruit, production and height, and these should be marked. Establishment of harvest rotations, plantations in already deforested areas and agroforestry systems containing both other fruit and nut trees as well as timber species all could enhance both ecosystem function within the aguajales systems as well as promote sustainable livelihoods. Sustainable production practices should complement those that seek to solve the problems of commercialization, transport and marketing of the product through different types of agreements. This includes the integrated use of the species, extending beyond simply fruit-related products.

3.5 Characterization of peatlands in Ca Mau and Kien Giang provinces, Vietnam

Adapted from Vu Tan Phuong et al., 2011 (Peatland Report)

Peatlands in Vietnam are located in the Red River Delta, the Mekong Delta, the Central Coastal Area and some southeast provinces. To date, data on peatland areas and its geographic volume have not been sufficiently inventoried. In 1985, the Vietnam National Coal Mineral Industries Corporation (Nguyen Trong Khiem, 1985), estimated national peatland resources were around 7,100 m^3, including 5,000 m^3 distributed in the Southern Region, 450 m^3 in Central Region and 1,650 m^3 in Red River Delta. Located in the Southern Region, the Mekong Delta has the largest amount of the country's peatlands, most of which are located within the two provinces of Ca Mau and Kien Giang, this study's area of focus.

The objective of this study was to assess the emission reduction potential from peatland management in Vietnam in U Minh Thuong (Kien Giang) and U Minh Ha (Ca Mau), the areas with the largest volume of peatland and highest amount of carbon stock. In doing so peatlands were mapped, characterized based upon use and land use change, carbon stock and emissions estimated and potential management options were evaluated.

Peatlands in Vietnam can be characterized into the following types: 1) old coastal swampy peatland mainly distributed in Mekong and Red River Delta; 2) new coastal swampy peatland in Mekong Delta; and 3) old riverbed peatland mainly distributed in Mekong, Red River Delta and other regions. Peatland in Kien Giang and Ca Mau is old riverbed peat (known as lung by local people) and swampy peat. Currently, Melaleuca Cajuputy, Melaleuca plantation after fire, Phragmites or Eleocharis in addition to various lianas, cover a large peatland area in the Mekong Delta along side a small area of mixed broad leaves forest.

Peatland exploitation and use is rather limited in Vietnam. A small number of peatland areas were fragmentally exploited for fuel meanwhile other areas were exploited for small-scale fertilizer processing in some provinces. It is estimated that annually around 100,000 tonnes of peatland per year is exploited for use mostly converted into agricultural production within the Red River Delta and Mekong Delta. A number of national and regional scientific workshops have been organized to discuss peatland management and use in Vietnam as an energy source, fertilizer and charcoal, but such uses are controversial due to the related high amounts of carbon emissions. Currently, main land use types in peatland are: i) intact peatlands located mainly in U Minh Thuong and U Minh Ha NP of Kien Giang and Ca Mau provinces; ii) agricultural production on peatland, growing mainly *Deris elliptical*; iii) Melaleuca forests with *Melaleuca* *cajuputy* as the main species; v) peatland exploitation for fertilizer production; and vi) unused peatland.

Three main activities that create the emission of GHGs (mainly CO_2) from peatland are 1) the burning of biomass and peat caused by fires, 2) the peatland groundwater table lowering resulting in peatland oxidization and 3) the production of fertilizer. Here the first two are the area of focus. Low peatland groundwater table is caused by peatland exploitation, agro-forestry production and canal digging within the peatland Mekong Delta area for transportation.

41 soil samples were taken from different depth and land uses in peatland areas for analysis. Bulk density and carbon content was analysed for each sample. Bulk density value for surface layer of peatland was between 0.25 to 0.26 g/cm^3. For the bottom layer, this value was from 0.15 to 0.20 g/cm^3. Some peatland samples at the surface had a significantly higher bulk density (0.32 and 0.38 g/cm^3 by peat fires or drying in agricultural production). Results of carbon content analysis indicated that carbon content in peatland in the upper layers to a depth of 50 cm usually ranges from 32-34% and about 28-30% in next layer. In the deep layer of the samples (over 100 cm) it is only about 16-20% depending on the quality of the peat.

Forest fires are seen as the main cause of the reduced peatland and carbon stock in Kien Giang and Ca Mau, mainly Melaleuca fire in U Minh. Over the last 33 years (1976-2009), annual average peatland area and stock has declined 530 ha/yr and 6.59 Mt/yr (3.29 MtC/yr) respectively. According to preliminary calculations of CO_2 emissions from peatlands resulting from different land uses within the two provinces 12.76 Mt CO_2/yr is emitted. Of this amount, the CO_2 emissions from forest fires (biomass burning and peat fire) is the largest, accounting for 95% (12.1 Mt/yr) with CO_2 emissions by oxidation of peat amounting to about 0.6 Mt/yr, while the agricultural and mining production is not large because of its small scale.

Peat soil management under the form of a national park or nature reserve is seen as the most effective solution to protect peatland and preserve carbon stock and can involve both wetland biodiversity conservation and ecotourism development. Forest fire management is also a focal task to protect peatland in UMinh. It is therefore, necessary to further study the harmonization between water storage during the dry season to minimize forest fires and supporting ecological diversity in Melaleuca Cajuputy.

Data on peatland areas and corresponding carbon stock is not consistent and assessments on peatland changes in Vietnam are rather limited. As such, it is crucial to have a comprehensive peatland area and stock assessment program, with a special focus on the Red River and Mekong Delta regions. It is necessary to have a scientific basis to identify sustainable peatland management and use, to move towards preserving the important role of peatlands in environmental protection (e.g. fresh water storage and salinity prevention) and reduction of GHG emissions from peatland use.

IV INCENTIVE SCHEMES FOR REALU

4.1 Rationale

Incentives are factors (financial or non-financial) that enable or motivate a particular course of action, or count as a reason for preferring one choice to other alternatives. In the context of REDD+/REALU, incentives seek to influence decisions by either making the carbon-intensive land conversions less profitable or, conversely, by increasing the profitability of establishing or maintaining forest. To work towards the operationalisation of the REALU landscape approach, incentive schemes in the four landscapes were assessed; each specifically tailored to the landscape's context. Potential incentive schemes were evaluated based on three main criteria: 1) emission reduction potentials, 2) opportunities for local participation and 3) the overall relative landscape impact. Whenever possible, incentives were identified that allowed for win-win approaches to reducing deforestation while also alleviating poverty. To assess the potential viability of the proposed incentive schemes, a set of enabling conditions were examined including the policy and institutional landscape, legal, market and investment limitations and opportunities, and lastly, potential leakage. For each incentive scheme, potential leakage was assessed. Options for stakeholder reward preferences, benefit sharing arrangements and MRV were also assessed.

Within the specific country landscapes, Cameroon focused on intensification of cocoa plantations while Peru focused on improving carbon stocks within land use units (including cocoa, pastures and forests). Indonesia focused on the potential for creating a community forest management mechanism that included provision for alternative livelihoods and on strengthening the value chain for *Dyera polyphylla* (Jelutong). Lastly Vietnam looked at the potential for payment for environmental services (PES) schemes based both on community forest management and agroforestry activities.

4.2 Incentives for the four landscapes

4.2.1 Cocoa intensification through tree improvement and domestication in Efoulan, Cameroon

Adapted from Alemagi, D. & Feudjio, M., 2013

Description of the incentive

To promote sustainable intensification pathways on tropical forest margins, ten forest-dependent communities within the Efoulan Municipality in Cameroon were used as a case study to examine opportunities to intensify cocoa agroforestry systems. Planting other tree species in cocoa plantations can generate many benefits. These include providing a source of wood for energy fuel and construction which can be an additional source of income and act as an adaptive measure in the case of crop failure, increasing cocoa productivity thereby reducing the motivations to clear more forests to expand plantations. Planting other tree species in cocoa plantations also improves the ecological system through increased nutrient cycling and increases emission reductions. Emission reductions were estimated to be around 499.8-507.8 tCO_2/yr for a farm of 2.71 ha with 20 yr old tree species planted within the agroforestry systems. To promote uptake of such agroforestry practices the biggest limiting factors were identified and then linked to a set of enabling conditions.

Enabling conditions

Area	**Case Specific Conditions**
Policies	To increase the use of fungicides, which were found to be an efficient, but expensive tool, some kind of subsidy scheme could be implemented. This could include providing fungicide to farmers tax-free.
Institutions	Improve governmental extension services to provide technical support and training to farmers. Creation of cooperative societies and/or farmer groups supported by the government. Currently there are very few in Cameroon.
Legal Framework	Improve rights of access to resources through 1) improving the process of legally recognizing customary land ownership and 2) giving customary land owners the legal ownership over the trees planted on land instead of being legally the State's resource.
Market Conditions	Improve infrastructural resources such as roads and other market infrastructure making it easier to access markets.
Investment Opportunities	Increased investment in cocoa agroforestry systems could be facilitated through improved access to financial capital resources. This could be done through State investment in the banking sector, which could then provide credit schemes for farmers.

Leakage potential

This could include over harvesting of wood in the agroforestry systems resulting in increased emissions and less emission reduction potential than calculated here.

Options for benefit-sharing and MRV

Applying for carbon finance could provide both a source of funding that could be included in a benefit-sharing scheme with the cocoa farmers as well as provide a structured monitoring and verification system.

4.2.2 Formalization of a community forestry mechanism in Tanjabar Indonesia

Adapted from Widayati, A. & Suyanto, 2013

Based upon the deforestation occurring within the peat forests in Tanjabar District in Indonesia,an incentive mechanism to stop such activities was explored. Within this area, governmental peat forest protection (HLG) status covers an area of 16,000 ha of which 4,000 ha have already been encroached upon and converted to oil palm plantations. Such land use changes are largely attributable to the influx of migrants looking to cultivate land to make land-based livelihoods.

Efforts to address the land-use change already occurring within the peat forest protection management unit (KPHLG) area included a government reforestation program involving intercropping Jelutong (*Dyera sp.*; i.e. latex) in oil palm plantations with the aim to help reforest some of the area, thereby reducing emissions within the landscape while at the same time providing an alternative form of livelihood for the local communities. These initiatives have been met with mixed success.

To provide an incentive mechanism for increased HLG stewardship and emission reductions, which also address local communities' needs, designing community-managed forests (HKm) has been identified. Part of this process is building a stronger relationship between the communities and the district forestry agency, increasing community awareness about the importance of HLG protection and providing them with alternatives to oil palm such as planning timber trees, fruit trees and/or Jelutong within the oil palm gardens. For communities to gain a HKm license to access these benefits they need to form farmer groups. Benefits of the HKm include legal rights for management schemes within the HLG area. Even if not owning land title, negotiations through farmer groups provide the opportunity to engage in management activities within the HLG area through legal agreements.

Enabling conditions

Area	Case Specific Conditions
Policies	HLG and KPHLG forest designation.
Institutions	Establishment of local community institutions to help establish farmer groups; HKm licenses and forest management agreements within the KPHLG area.
Legal Framework	Within HLG areas communities cannot get legal tenure, but under the HKm scheme they can engage in legal management activities to promote their livelihoods and this acts as a disincentive to perpetuate deforestation activities.
Market Conditions	There is local demand for latex, the commercial product of Jelutong, but local communities need support in both resources for production and access to markets to make this a viable economic livelihood means.
Investment Opportunities	See above *Market Conditions*. Also investment in seeds to plant in oil palm gardens such as fruit and timber trees will help to promote reforestation efforts.

Leakage Potential

Leakage potential could be attributable to HKm not providing a strong enough framework to stop illegal encroachment and deforestation activities.

Options for benefit-sharing and MRV

To monitor and evaluate the HKm efforts, there are three main areas to be examined: 1) institutional arrangement; 2) conservation (i.e. restoration of peat protection forest functions) and 3) impact of HKm activities on social, economic and ecology dimensions. As part of this, perceptions of local communities will need to be understood in order to design successful HKm schemes. More specific benefit sharing and MRV schemes are yet to be developed.

4.2.3 Strengthening *Dyera polyphylla* (Jelutong) value chain in Tanjabar, Indonesia

Adapted from Widayati, A. and Suyanto, 2013

Description of the incentive

The second incentive mechanism identified in Indonesia for further support in peat forestry protection is the increased production of Jelutong (latex). This was seen as a more sustainable alternative to the oil palm plantations/gardens resulting in less CO_2 emissions while also presenting a potential alternative for generating an economic livelihood. To create an incentive mechanism for the increased planting of Jelutong, the latex value chain was examined to assess demand and market potentials. It was found that there is a local demand for latex, but this market needs to be further developed increasing production and establishing market supply chains. This requires increased awareness about production and markets as well as access to financial capital required for initial investment to shift production systems.

Enabling conditions

Area	Case Specific Conditions
Policies	Local government policies around non-timber forest product use and harvesting need to facilitate ease of harvesting and access to markets. See *Legal Framework*.
Institutions	Coordination is needed between district and provincial forestry agencies, and the trade and industrial agencies to make it easier for Jelutong tappers to get their products to both domestic and international markets. Increasing capacity is needed within farmer groups, by providing knowledge about both production and market conditions. Access to micro credit through financial institutions or other sources will also be an enabling factor for farmer groups.
Legal Framework	Changing the regulations around Jelutong latex harvesting to make it less complicated and cumbersome is needed so that there are less barriers to sell legally harvested latex within Tanjabar. They could follow a model similar to that for the Central Kalimantan local government which is more flexible and accommodating.
Market Conditions	There is local and international demand for latex, the commercial product of Jelutong, but local communities need support in both resources for production and access to markets to make this a viable economic livelihood means.
Investment Opportunities	See above *Market Conditions*. There is the opportunity to create a Jelutong sap-processing industry at the provincial level.

Options for benefit-sharing and MRV

Farmer groups will directly benefit from increased production of latex through the resulting increases in household income. Ensuring that they get a fair price for their product will be important so that the main profits don't go simply to middlemen, reducing the incentive for Jelutong planting. MRV procedures are yet to be developed.

4.2.4 Improving carbon stock within land units including cocoa, pasture, forests in Padre Abad, Peru

Adapted from Silva, C. et al., 2013

Description of the incentive

Incentive design was explored with the major cocoa marketing association, ACATPA (Asociacion de cacaoteros tecnificados de Padre Abad) in Padre Abad, which connects farmers to markets and helps them to get better prices for their product by taking out intermediaries and using certification schemes. ACATPAalso provides technical assistance and other services to support farmers' production activities. Due to the many benefits associated with being a member, ACATPA continues to grow its member base increasing from 40 to 231 members between 2008 and 2011. Though cocoa production is the dominant income generating activity for the members, the majority (~64%) also relied on some form of off-farm income. This combined with scarce hired labour resulted in farm intensification creating high trade-offs for farmers.

Cocoa farms are located within mosaics made up of a combination of the following land uses: cocoa, forest, fallow, reforestation, oil palm, pasture and annual crops. To reduce emissions and increase carbon stock, two strategies were identified: 1) intensify cocoa farming by increasing the density of the cocoa trees and 2) improve the carbon stock across all land uses within the mosaic. Although such shifts in land use can result in a number of additional benefits such as additional food sources from fruit trees, increased income from timber trees planted, and other ecological benefits from improved soil quality and ecological resilience, transaction costs for such shifts in land uses are high.

However, carbon finance has been identified as one potential source to help fill this gap. One benefit that ACATPA provides to their members is their agreement with SUMAQAO, a Peruvian-based enterprise in the business of cocoa trading. SUMAQAO has a commercial agreement with a Swiss based company, PRONATEC, a cocoa buyer and processor to whom they sell all the raw material. In its path to become a sustainable enterprise, PRONATEC is aiming to be a carbon neutral company and therefore has decided to offset their carbon footprint by buying carbon credits from their associated suppliers in developing countries, the members of ACATAPA being one such group. Therefore even though recently the carbon markets have demonstrated less than optimal performance, the partnership with SUMAQAO provides a direct channel for ACATPA members to engage with carbon financed activities to generate additional income while also managing their land in a less carbon intensive way also resulting in additional livelihood benefits.

Enabling conditions

Area	Case Specific Conditions
Policies	Strong governmental and international support for cocoa production to displace illegal coca production.
Institutions	Improving technical assistance provided through ACATPA. ACATPA's exclusive agreement with SUMAQAO qualifying them to be beneficiaries of carbon financed schemes funded by PRONATEC.
Legal Framework	See *Policies*.
Market Conditions	Enabling factors to increase production include reducing production costs and increasing access to hired labour.
Investment Opportunities	Investment opportunities to increase cocoa farming are limited by scarce sources of hired labour. ACATPA financing scheme provided to members acts as an enabling mechanism. PRONATEC's interest in buying carbon credits from their producers, i.e. the ACTAPA farmers, creates the opportunity for farmers to gain additional income through carbon finance.

Leakage Potential

If dependent on carbon financing to provide emission reductions, there is risk that the carbon market can crash taking away the financial incentive for the low-carbon land management.

Options for benefit-sharing and MRV

Carbon finance can provide a direct financial benefit for farmers based upon their activities aimed to increase carbon stock within their landholding and this could be included in a benefit sharing mechanism. Other ways to increase benefits for production can occur through additional certifications and increased processing of cocoa products for both local and national markets. MRV processes will be built into the carbon certification scheme to ensure both livelihood benefits in addition to emission reductions are occurring.

4.2.5 Community forest management and agroforestry for increasing carbon stocks in the Bac Kan landscape, Vietnam

Adapted from Do Trong, H., 2013

Description of the incentive

To promote emission reductions as part of a REALU scheme within the Bac Kan Province, Vietnam two practices were identified 1) promotion and establishment of community forests to protect and assist natural forest regeneration and 2) promotion and establishment of agroforestry on sloping lands for enhancing carbon stock and sustaining livelihoods (Figure 32). Community forest management (CFM) includes issuance of land use right certification and a clear benefit distribution mechanism called 'village's regulations'. For the agroforestry, if converting private upland maize fields to agroforestry where maize is intercropped with Xoan trees (*Melia spp.*) this can increase above ground carbon stock by 10.70 tC/ha. To explore incentives for achieving both initiatives within the Bac Kan landscape, stakeholders preferences for benefit schemes based upon potential financial gains through a carbon financing scheme were explored.

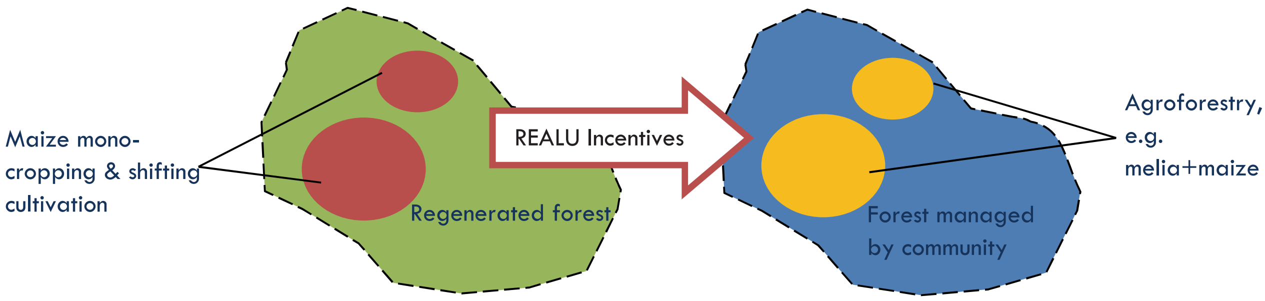

Figure 32 REALU incentives target at shifting current unsustainable land use practices to potential carbon rich land use options.

Enabling conditions

Area	Case Specific Conditions
Policies	17 existing policy decisions that are pre-conditions for REDD+ benefit-sharing to work in the country. Some policies around land tenure are conflicting and need to be clarified. See *Legal Framework*.
Institutions	For implementing a REDD+ PES scheme, there are many related institutions from the community levels to the international level. All will need to work together in order to develop a successful PES scheme.
Legal Framework	There are different designations of legal land use and access within the communities. Sometimes this legal designation can be weakly enforced and in some places tenure rights are overlapping. There will be need for clear legal land use designation to be enforced.
Market Conditions	The opportunity cost for one tCO_2e is less than 5 USD therefore a price equivalent to this or higher will be required to implement PES schemes. Another option is to bundle the ecosystem services provided when possible.
Investment Opportunities	See *Market Conditions*.

Leakage Potential

If carbon finance benefits are not as great as expected this may provide a disincentive to continue carbon enriching land use practices causing leakage and regression into previous practices.

Options for benefit-sharing and MRV

Stakeholder preferences were explored around benefit-sharing schemes for communities who engaged with emission reduction activities. The amount of potential financial awards is based around carbon finance for REDD+ related certification. Five main benefits types were presented. The top two benefits included cash for infrastructure and issuance of land use right certificates (LURC). This points to land use rights holding significant importance for communities. For MRV, remote-sensing based forest and carbon monitoring has been proposed using a GIS-Web application Carbon2Markets™ as well as participatory carbon measurements.

V ENABLING CONDITIONS FOR LANDSCAPE APPROACHES

There are a number of design questions/challenges emerging with regards to REDD+ such as issues of scale, nesting, leakage, benefit sharing strategies, and choices between which of the multiple policies and instruments to draw upon (e.g. between sparing and sharing for addressing drivers of deforestation, payments, rewards and or co-investments in the achievement of multiple benefits (Minang, PA. and van Noordwijk, M., 2012)). Enabling conditions are defined as conditions that will enable REDD+ and REALU to be effective and efficient land use policy approaches and to address the above challenges. In this section, three aspects are focused upon, namely the readiness levels of the four countries, an example of the benefit distribution system (BDS) in Vietnam and the need for a co-investment approach including the private sector.

5.1 REDD+ readiness

Adapted from Minang et al., in review

Readiness for REDD+ has been cited as the main prerequisite for countries to move towards implementing REDD+ projects in an effective manner. In order to explore the readiness level of countries for REDD+, drawing on a literature review, the FCPF readiness elements and a review of other relevant REDD+ documents, a readiness assessment framework was developed. This framework is based on six key functions and 29 corresponding indicators. The six functions are as follows: 1) planning and coordination, 2) policy, legal and institutional frameworks, 3) MRV and audit, 4) benefit sharing, 5) financing, and 6) demonstration and pilots. Countries were then given scores for each of the 29 indicators on a scale of 0 to 3 with the following designations: 0 - no evidence of readiness consideration, 1 - aware of it and being discussed, 2 - agreed in principle (or some draft document and or recommendations exists) and 3 - established rules exist in law and or are being implemented. Comparison of readiness was done by aggregating the values for the six functions with a maximum value of 18 (six functions each with maximum score of three).

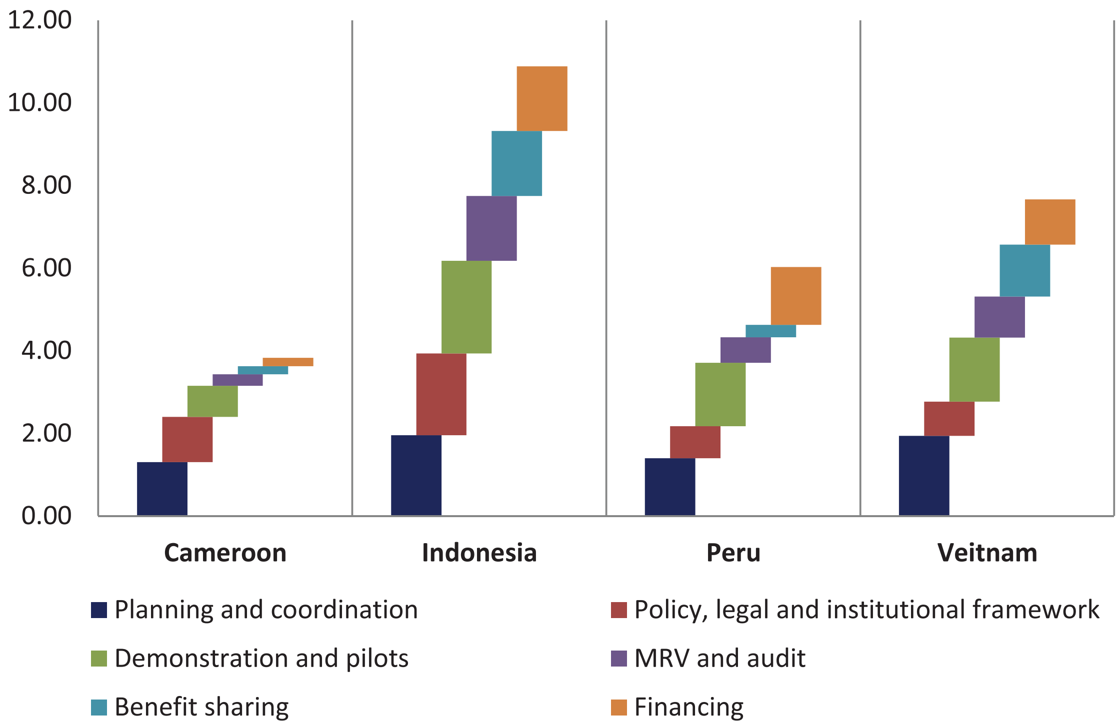

Figure 33 REDD+ readiness comparison across the four project countries using the six key functions identified. Note: the maximum a country can attain on the Y-axis is 18 (six functions each with maximum score of three).

The results revealed that the order of the level of readiness for each country is as follows Indonesia, Vietnam, Peru and finally, Cameroon (Figure 33). All the four countries were found to be doing well in terms of planning and coordination while performance for other functions varied among countries. Indonesia had the highest and most evenly distributed performance across the functions reflective of many advances in the readiness process. For example, it has a strong planning and coordination function, the R-PP is already in place and the REDD+ strategy is in a process of development. The country has also developed the national level abatement curves and completed an opportunity cost analysis. In contrast, the rest of the countries had only completed a subnational opportunity cost analysis at the time of the study. In Indonesia there is also a very strong coordination role where multiple institutions, e.g. the National REDD Task Force (Satgas REDD) in the President's Office, Ministry of Forestry, Ministry of Environment, National Council on Climate Change (DNPI) and National Planning Bureau, are working together in a coordinated manner. Indonesia is also leading in terms of policy, legal and institutional frameworks, for example, it has developed both a NAMA (Presidential Instruction

61 and 71 of 2011) and REDD+ policy (P 68/2008 and P 30/2009) and has enacted and implemented a moratorium on logging within the context of REDD+.

Benefit sharing as a function was strong in both Vietnam and Indonesia. Vietnam is exceptional in this regard as they have the strongest benefit sharing mechanisms in place compared to all other countries. This to some extent might be due to the fact that the country is building upon an existing system which initially had strong benefit sharing exercises. Peru, despite being among the Amazon basin countries where the rights issues (particularly with the indigenous communities) are strongly prominent, is doing poorly in the benefit sharing function. Moreover, the MRV and audit function which embraces the safeguards issues is still weak in Peru. This implies that with the rights issue being very critical in the Amazon, Peru needs to invest strongly in the benefit sharing and MRV and audit functions.

The financing function was found to be stronger in Indonesia, Vietnam and Peru as these countries are doing relatively better in securing finances for REDD+ related activities than Cameroon. Indonesia has secured one billion USD, Vietnam 100 million USD and Peru 60 million USD through bilateral and multilateral agreements. However, in all the countries serious engagements with governments and to some extent of the private sector in financing REDD+ activities are rarely reported. Cameroon from all aspects of financing is doing little.

Demonstration and pilot activities were among the key strengths within the four countries though relatively weaker in Cameroon. All the countries reported a considerable number of demonstrations and REDD+ pilots being implemented by NGOs, community groups and the private sector. However, the various REDD+ projects and pilots lack a standardized definition thus proving complex to compare. Indonesia is the only country that currently has regulations to standardized REDD+ demonstrations and pilots being carried out while Peru is developing modalities for projects registry. In total the number of REDD+ pilots in the four countries were 44-77 in Indonesia, 35 in Peru, 31 in Cameroon and 30 in Vietnam.

5.2 Benefit distribution

5.2.1 Lessons from benefit distribution across scales for REDD+ in Vietnam

Adapted from Hoang M H et al., 2012

Across the ASB REALU sites, Vietnam completed the most comprehensive study around the potentials of a REDD+ benefit sharing mechanism. Such a mechanism is part of a crucial foundation, which aims at respecting rights and sharing benefits with the ultimate beneficiaries who are the ones required to change their practices to facilitate land-based emission reduction activities. This section focuses on the work Vietnam did around developing such a mechanism based on a Payment for Forest Environmental Services (PFES) scheme and the corresponding results and insights.

REDD+ revenues aim at contributing to forest conservation as well as poverty reduction and, therefore, to sustainable development. The design of a comprehensive benefit distribution system (BDS) for REDD+ revenues is among the necessary steps in the readiness process. The main challenge lies in distributing the revenues to local partners and beneficiaries, in a transparent, equitable and cost-effective manner, while complying fully with government regulations, UNFCCC or other international requirements, and managing the risks of participants awaiting payment. There is currently no prescribed BDS for REDD+ within the UNFCCC and there are few existing benefit sharing systems for REDD+ at country level.

The features of a good BDS are defined as follows:

1. Engages the right stakeholders
2. Determines the right forms and level of incentives
3. Creates legitimate mechanisms for management of benefits
4. Enforces effective transparency provisions
5. Develops effective dispute settlement mechanisms

These features are shaped by different governance contexts and can be complicated by factors such as unclear tenure and rights, corruption, poor analytical capacity and poor enforcement of rules and laws.

In Bac Kan Province in Vietnam, incentives for local communities to contribute to REALU scenario (see section II) and facilitate the requested changes in the landscape included: 1) provision of under allocated land use right certificates (LURC) for the poor/regenerated forests or under community management without LURC and 2) financial and technical support to develop agroforestry models on maize mono-cropping plots and shifting cultivation plots within or around forest areas, and to assist forest regeneration through silvicultural interventions.

To assess stakeholders' preferences of incentives/benefits to compensate for changes in their land management practices, stakeholders were invited to participate in a theoretical game where they got to rank their preference of benefits. Their choice for benefit types included cash payments, cash for infrastructure provision (such as roads, schools, electricity, or water to households), agricultural inputs, land use rights certificates for 100 ha of the hypothetical forest, and other volunteered ideas. Ways to quantify the amounts of environmental services being created, the institutional landscape and methods for MRV were also analyzed to gain insights into both the challenges and opportunities for providing an effective benefit-sharing mechanism.

Preferences over benefit type varied by individual forest land tenure status. Majority of stakeholders holding LURCs for protection forest (83%) preferred to receive LURCs for production forest, while almost all stakeholders holding LURCs for production forest (90%) wanted cash. Preferences over LURC benefits indicate the importance to forest stakeholders of formalized resource access rights. LURC holders have the state-sanctioned power to use lands as collateral for loans and extract certain amounts or volumes of forest products both in production and protection forests. The state sanctions their power to exclude others from using the resource. As such, it is not surprising that stakeholders who already held production forest LURCs preferred cash, but it is notable that holders of protection forest LURCs preferred production forest LURCs over cash, indicating that use rights given in production forest LURCs have economic value to them.

Results from this study emphasize that full participation of stakeholders at all levels, by merging top–down with bottom–up approaches, is key to effective and equitable REDD+ at the landscape level. To operationalise a BDS, placing management at the lowest possible level with due consideration for efficiency, transparency and manageability was also identified as a potential enabling strategy. The greater the number of hierarchical levels at which revenues are managed, the less cost-effective the mechanism is likely to be, because of higher implementation costs and a greater risk of rent-seeking and corruption. On the other hand, fewer hierarchical levels make it harder to ensure efficiency and equity in disbursement because of the 'distance' between the source and target of the funds. Civil society organizations were identified to be the most effective intermediaries in PES and other conservation programs at the grass-root level in Vietnam. To further promote a transparent process, institutions responsible for implementation should be different from those tasked with determining the amount of benefits that should be allocated to participants.

Ideally, local farmers should be supported in shifting from unsustainable practices such as shifting cultivation and monocropping on steep slopes to carbon-rich land uses that can provide both PES for carbon and water as well as good income from land-use products. Since income from carbon-rich land uses may be less than that of status quo practices, especially in initial years, the incentives of a BDS system must at least compensate for the gap between status quo practices and carbon-rich land uses, which represents transaction and opportunity costs. On the other hand, although there is an expectation that carbon-rich land uses such as promoting community forests and agroforestry could generate relatively higher income to local farmers compared to current PES and conservation payments, there are no reliable estimates of how much income can actually be earned from them. Making farmers bear the initial investment costs and wait for payments may waver their commitment and create the risk of inadequate outcomes. Performance payments of PES are unlikely to be an effective instrument for REDD, unless certain prior conditions (economic, institutional, informational, and cultural) are met, as well as covering the upfront risks of farmers.

In this regard, two kinds of payments can be envisaged: 1) Participation payments to be made when participants deliver evidence of their participation to the MRV system and 2) Performance payments to be made periodically on the basis of verified net emission reductions. The challenge for both methods of payment is how to define the payment amount, obtain conditionality and conduct monitoring efficiently. A well-designed BDS should ensure that all beneficiaries, including village communities that successfully reduce emissions, receive equal performance payments per unit of net emission reductions. These payments also need to reflect social and other environmental goals through the application of carefully constructed coefficients to differentiate distribution levels.

At the community level in Vietnam, appropriate modes of payments, rewards or co-investment are required. These include Compensation for Opportunity Skipped (COS) and Co-Investment in Landscape Stewardship (CIS) paradigms. In both COS and CIS, the amount of REDD+ payments can be negotiated and contracted against the expended level of effort and opportunity costs. This can enhance conditionality and monitoring efficiency of the PES and a REDD+ BDS. The various PES paradigms can be combined in a REDD+ value chain linking local actions with global benefits. Bundling the income from land use ‘goods’, together with PES from those land uses will provide greater sustainability by creating additional funding for forest conservation and improvements in livelihoods of local people. It will help raise the compensation levels and reduce the risk of BDS failure.

Further lessons from the study include:

1. Effective forest protection requires more than REDD+ payments and non-cash incentives. Support for improved forest governance, and land tenure and rights for forest dependent communities, are also important for the success of a PES scheme and therefore for REDD+.
2. Compared to the first pathway of BDS, where communities receive payments for stopping their present activities, the second pathway of BDS promoting new ‘best practices’ may be more effective though more evidence is required.

3. In REDD+ mechanisms, there are additional considerations, for example, international investors who can influence the criteria used in benefit structuring.

This study of Bac Kan has demonstrated the multiple dimensions that need to be considered when developing a BDS. As this will be key to the success for REDD+ and/or REALU initiatives, the considerations highlighted here in this brief summary should be taking into account. Working across scales, ensuring participatory engagement of stakeholders and bundling of services can all be steps in the process to generate sustainable outcomes.

5.3 Promoting a co-investment approach including the private sector

Adapted from Bernard et al., 2012

In order to ensure a sustainable landscape approach to REDD+, co-investment is critical for addressing the costs of implementing REDD+/REALU, with private sector actors playing a potential important role.

Indeed, there is growing evidence that public finance alone is unlikely to meet the emission reduction investment requirements. Up-front investment of approximately 17–40 billion USD per year is needed to realize the climate change mitigation potential of forests (Eliasch, 2008; UNEP Financing Initiative, 2011), whereas cumulatively available public REDD+ funds from donor countries pledged since 2008 stand at approximately 7.2 billion USD (the actualized figures are much lower) (Simula Ardo, 2010). Therefore, the role of the private sector in financing and supporting emission reductions needs to be enhanced, their involvement absolutely critical to scaling up investment in REDD+. Presently, several pioneering investment banks seeking future investment opportunities are major players in the REDD+ investment arena and more efforts to engage with financial institutions have to be pursued. Private sector REDD+ investment is also undertaken by emissions-intensive industries searching for large volumes of offset credits and large multinational firms investing in the form of grants, which often directly implicate themselves in project activities as part of their corporate social responsibility (CSR) initiatives.

Additionally, several segments of the private sector are part of the problem, acting as drivers of deforestation, which need to be directly addressed. Export-oriented agribusiness and extractive industries such as logging, mining, oil and gas have been important drivers of deforestation and their contributions are both direct and indirect. Reassuringly, a number of those companies recognize the problems and are willing to become part of the solution. Such stakeholders also need to be the target of REDD+/REALU incentives to address the major drivers of deforestation.

Eventually, aside from the scale and speed at which investment needs to flow, the private sector has an enormous role to play in providing the expertise, technological innovation and adaptability that will encourage and facilitate REDD+. In many instances, the private sector has taken on a more active role by providing technical expertise, innovation and management skills and being fully or partly involved in project implementation. An example of national-level technological expertise and capacity includes GAF AG, a leading European firm for geographic information systems (GIS) that is providing institutional arrangements and stakeholder analysis, deforestation and degradation mapping via remote sensing analysis, mapping of degradation hotspots, and capacity-building services for a REDD+ pilot project in Cameroon. Additionally, many REDD+ projects are implemented by medium- to large-sized private firms as part of their core expertise and business niche. This is the case of Wildlife Works, a major leading private developer of REDD+, with the Kasigau Corridor REDD+ project in Kenya.

However, analysis of the policy and institutional environment show that some critical challenges hinder further private sector engagement in scale and scope in the REDD+ mechanism. This starts with the need to create long-term and robust demand for REDD+ credits as well as the need for a strong policy signal and further involvement of the private sector in REDD+ policy development. Furthermore, clarifying land tenure and carbon ownership in a manner that respects the rights of indigenous and forest-dependent communities, while also remaining attractive from the government and the private sector's perspectives, is a crucial precondition for successful implementation of REDD+ activities and a functioning market for tradable REDD+ credits. Further consultation between governments and the private sector is also required to establish the legal basis for private investment in REDD+, especially around issues of effective risk-sharing and risk-mitigation mechanisms, due diligence in the investment process, explicit arbitration procedures, and clear and fair benefit-sharing mechanisms.

Additionally, there is a need to go beyond the confines of carbon trading, especially in the context of REALU, and to actually identify relevant private sector segments to support investment in new sustainable land uses practices such as climate-smart agriculture and agroforestry that address diverse drivers of deforestation. This requires determining what other investable opportunities can produce sustainable land management outcomes and developing a mechanism or other similar approach through which these opportunities can be connected with optimal sources of investment.

Closer engagement between civil society, NGOs, government and private sector actors is also needed to build bridges and promote and facilitate public-private partnerships.

VI METHODS AND TOOLS FOR LANDSCAPE LEVEL ASSESSMENT AND PLANNING FOR REDD+ WITH SUSTAINABLE BENEFITS

6.1 Legitimacy versus validity: a dilemma for choosing the right tool kit for assessing, planning and decision making in landscapes

Adapted from Bernard, F. et al., 2011

In the context of planning emissions reductions projects across all land uses, governments, technical staff and local agents often lack the tools and methods to develop and implement area-specific REDD+ or REALU initiatives. Therefore, there is a need for improved access to useful and innovative tools to enable the implementation of REDD+ and REALU to support both the technical dimensions required and the planning and implementation process itself.

As much as there is a need for tools addressing technical issues such as assessment of carbon emission reduction potential and costs and MRV and for clear numerical performance targets, tools for a transparent participatory process are of equal importance. In particular, the process that one follows is as important as the results that are produced. Without understanding the underlying process, stakeholders cannot make relevant decisions, and it is difficult to understand how a certain set of results were achieved, or why they were positive or negative. Therefore, there is crucial need for process tools which can also allow for a comprehensive and sustained approach to sharing information and experiences between local and external stakeholders.

As Figure 34 shows, some tools primarily lead to 'extractive' information (above the diagonal) and target external stakeholders while other tools primarily support local learning and places emphasis on participatory appraisal steps (below the diagonal) towards Free, Prior and Informed Consent (FPIC) targeting local stakeholders.

The challenge is to have tools that are relevant for both sides of the negotiation table, external and local stakeholders. Some tools are now available to support simultaneous stakeholder learning curves along the main diagonal, but current methodologies may still have to be improved, with a focus on balancing technical and participatory interests. For instance, carbon stock measurements need to comply with all requirements of the scientific process while also needing to be comprehensible to local stakeholders. Tools that stimulate learning by and with stakeholders are important. Thanks to some of these tools, people in the landscape can increase their capacity to negotiate for themselves, leading to increased understanding and project ownership. Site-level experience with a set of tools suggests that a flexible toolbox is needed to allow the local context to be articulated.

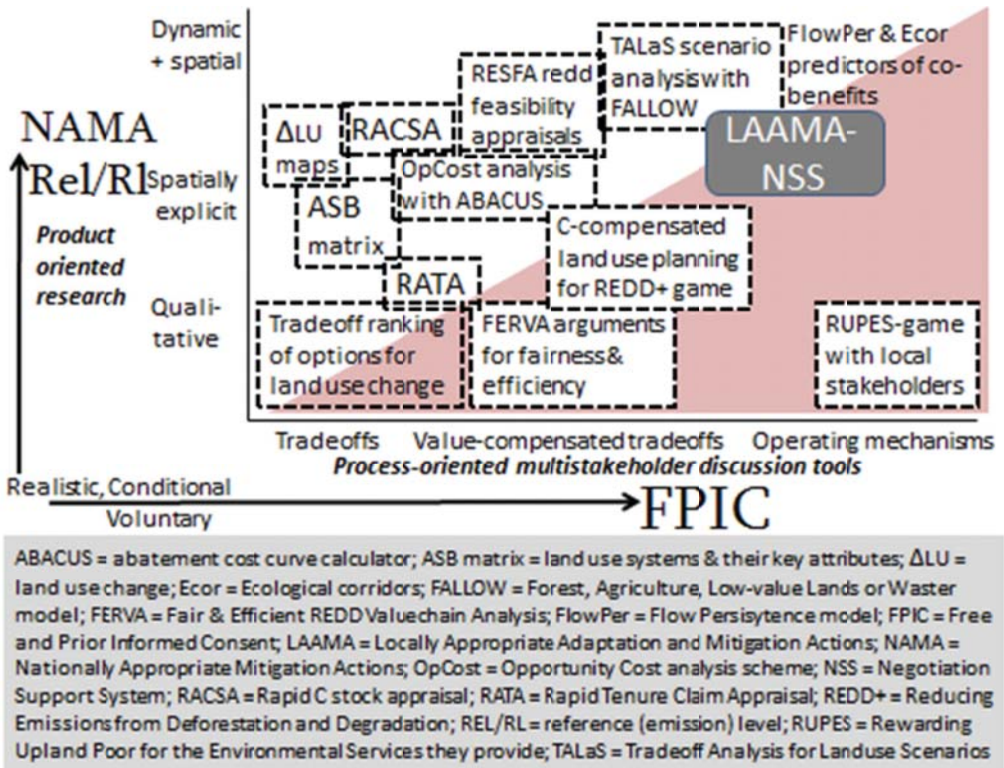

Figure 34 ICRAF/ASB Tools for REDD+/REALU readiness compared based upon how product oriented vs processed oriented each tool was.

ICRAF and ASB have developed a number of tools and methods (~26) relevant for planning REDD+/REALU projects. These tools and methods can be classified according to some main thematic areas which include:

1. Mapping (land use cover) tools;
2. Carbon accounting tools;
3. Economics of land–use tools;
4. Social guidance and community engagement tools;
5. Institutional setting/policy related tools;
6. Biodiversity and other ecosystem services impacts tools.

These thematic areas can be further distilled into three categories reflecting the nature of the tool. These include qualitative, spatially explicit and spatial and dynamic tools.

Table 3 provides a definition for each category of tool along with examples.

Most tools can be relevant for various scales, i.e., national and local or project-based activities. However, depending on the scale one is operating at, specific issues should be tackled accordingly as there are varying levels of accuracy for each tool at different levels.

Beyond the scope of ASB/ICRAF tools, there exist a variety of other resources and tools which can both complement and bridge gaps inherent in ICRAF and ASB's current set of tools. A wide range of guidelines, best practices and tools for REDD+ and REALU project assessment and development are currently available (Bernard et al., 2011).

Table 3 Category/nature of tools, how each category is defined and examples of tools that fall within the categories.

Nature of tool	Definition	Examples of tools
Qualitative	A tool that aims to an in-depth understanding of human behaviour and the reasons that govern such behaviour. The qualitative tool investigates the ''why'' and ''how'' of decision making, not just the ''what'', ''where'', ''when''.	FERVA, RUPES game, RATA
Spatially Explicit	A tool that demonstrates importance of "where" in addition to "what" and "how much".	OppCost analysis with ABACUS, Land use change
Spatial and Dynamic	A tool that captures dynamic feedbacks between existing population demographics, economics, labour, transport, land use, energy and environmental (energy, water, etc) models and presents dynamic changes in a two-dimensional spatial manner.	TALas scenario analysis with FALLOW, RESFA

6.2 Land-use planning for low-emission development strategies (LUWES)

Adapted from Agung et al. 2013

Here the LUWES tool is overviewed in detail, as it was one of the main outputs of the REALU Phase II work, and was used for identifying low-emission development strategies within the specific landscape contexts.

6.2.1 Why LUWES?

Land and forest-based activities that generate economic benefits and produce food often cause carbon loss from the landscape. If it is not properly planned, halting these activities to reduce emissions by conserving carbon stock can potentially have a negative impact on economic growth and food security. To explore the potentials of different high carbon stock rural development scenarios, emission reduction strategies should be part of development planning, and participation of district multistakeholders should be ensured in developing the strategies.

6.2.2 What can LUWES do?

Established by ICRAF Indonesia, the LUWES framework integrates the processes of identifying emission sources, calculating historical emissions, predicting future emissions and setting up RELs and mitigation action plans (Dewi et al 2012). Based upon such information, scenarios can be developed to explore land use options for supporting low carbon intensive development.

Figure 35 illustrates the different links and dimensions taken into consideration in the LUWES framework. Any land-use plan developed as a result of the application of the LUWES tool should designed within the local-specific context. This will require participation of local stakeholders as well as understanding the different competing land use interests within the specific landscape.

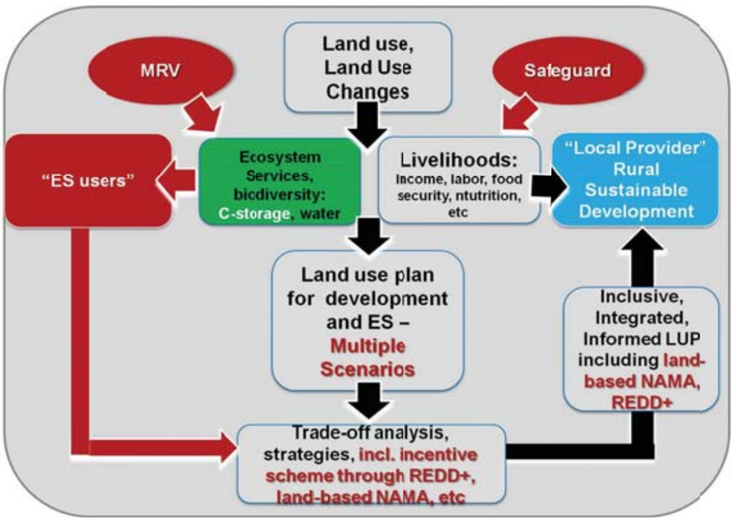

Figure 35 A land-use planning process that incorporates development plans and their consequences for ecosystem services, while internalizing the externalities (for acronym definitions, see van Noordwijk et al 2013).

6.2.3 LUWES in six steps

Material in this section has been taken directly from Agung et al. 2013.

LUWES focuses on the local decision-making process. It offers a method for producing an integrated form of land-use planning that connects development planning and land allocation in sustainable ways (Box 1). LUWES uses *ex ante* trade-off analysis to help establish a land-use plan for low-emissions development at the landscape level; this would be an economic system that minimizes GHG emissions while still generating appropriate economic benefits. Length of time necessary to implement each step was approximated from the experiences in conducting LUWES in several districts in Indonesia (Johana et al 2011, Ekadinata et al 2011) (Box 2). Emission estimation through carbon-stock differences from land use and land-use changes within steps 2 and 4 can be conducted through Rapid Carbon Stock Appraisal (RaCSA) (Hairiah et al 2011), which has been widely adopted. Step 3 is setting baseline scenarios and REL at sub-national level that are fair and efficient by using the forest transition stages as a basis, which suits large and heterogeneous countries, such as Indonesia.

Box 1. LUWES in six steps

Step 1: Integration of current socio-economic conditions, development and spatial planning, biophysical and functional zones to identify **planning units** through multistakeholder discussions and spatial analyses

Step 2: Estimation of historical land-use changes and their consequences for **carbon storage** through spatial analyses, carbon stock and carbon-stock differences appraisal

Step 3: **Baseline scenario** development of land-use and land-cover changes and estimation of REL through stakeholder discussions and modeling of the options

Box 2. Data, activities, approximate time requirement and outputs of each step in LUWES

Steps in LUWES	Data requirement	Activities	Approximate time length	Output
1. Zonation into planning units	Layers of biophysical characteristics, land designation, cultural-socio-economic conditions, land use plans, permits, development plan, land management, tenure regimes, potential interventions	- Data compilation - Identification and consolidation on conflict over tenures with local governments and local people	1 to 2 months	Map of planning unit
2. Estimation of past emissions	- Land use/cover changes - C-stock of each Land use system	- Data compilation - Plot level measurement - Allometric modelling - Upscaling	Depends on the landscape size, existing secondary data and uncertainty to be reached (1 day if all of the data is in place)	- Past Emissions at the landscape level - Past Emission share of each planning unit - Past Emission share of each driver and trajectories
3. Baseline scenario development and estimation of REL	Depending on methods in projecting land use/cover changes	- Projection of land use/cover changes - Discussions of options of baseline scenarios - Estimation of future emissions	Depends on the level of sophistication of land use/cover change modelling (2 weeks if all of the data is in place)	-Reference Emission Level up to a particular year at the landscape level - Projection of emission share of each planning unit
4. Emission reduction scenarios and estimation of projected emission	Scenario in each of the planning unit	- Identification of scenarios, what, where, how much - Projected land use/cover changes - Estimation of emission of each scenario - Iterations	Depends on how comprehensive and deep people would like to go (1-2 weeks of intensive discussions with multiple stakeholders)	- Ex-ante emission - Potential total emission reduction - Potential share of emission reduction from each planning unit
5. Trade-off analysis to select best scenarios	- Opportunity Cost of each scenarios - NPV of land use systems	- Estimation of trade-offs between OppCost and Emission Reductions - Stakeholder discussions and negotiations	Depends on the complexities on the ground (can be in a series of iterations between steps 4-6) (1-2 weeks of intensive discussions)	- Agreed scenario of future land use/land use changes for low emission development - Opportunity costs - Potential emission reductions and shares
6. Formulation of Action Plans	- Existing policies and regulations that supports or hinders the plans - Existing schemes or mechanisms can be used to provide the needs, cover implementation cost, transaction cost, opp cost (REDD+, carbon market, RAD GRK, etc)	- Policy analysis - Identification of the cost bearers - Identification of policies, supports, institutions, enabling conditions necessary - Stakeholder discussions and negotiations - Agreed Action Plan to be discussed and adopted as a local government decree for Action Plan for Reducing Emission	Depends on the complexities and political processes at the local level	Land Use Plan and Local Action Plan for Reducing Emission from land-based sector is enacted to be implemented

VII FROM REALU TO LANDSCAPE APPROACHES: LESSONS AND RECOMMENDATIONS

This report sets out to synthesize and share the lessons from the REALU project as well as provide recommendations for moving forward with landscape approaches in which emission reductions are an important component. So far, the experiences from various landscapes, countries, and specific themes have been presented. In this section the major lessons and recommendations are brought together from across the board (scales, themes, issues and stakeholder perspectives), based on the experiences reported in the publications (published and in-development) and summarized in the preceding sections. Below each major lesson is presented with corresponding recommendations.

Lesson 1: Incentives targeting non-forest high carbon stock land uses such as agroforestry, tree-based systems and peatlands were found to be attractive, potentially effective and efficient options for achieving REDD+, global climate change objectives and promoting sustainable livelihoods:

One of the assumptions at the beginning of this action research was that a landscape approach to emission reductions and managing carbon stocks can help address drivers of deforestation, reduce problems like leakage, and eliminate the need for a precise forest definition. The analyses in this project within the various landscapes suggest that non-forest land uses could potentially reduce more than forests (Section II, van Noordwijk M and Minang PA. 2009) and that targeting non-forest land uses was perceived to be potentially useful for achieving REDD+ (Minang et al., 2013; Minang et al., 2011). Compared to schemes currently under discussion for forest-based emissions mitigation, REALU will be more effective in bringing major leakage concerns into the accounting rules and allowing increased land use intensity outside forests as a contributor to net emission reductions (Minang & van Noordwijk, 2013). In this regard agroforestry and tree-based intensification systems emerged as preferred emissions reduction incentives alongside forests in all landscapes (See Section IV).

Recommendation 1: Further linkage of REDD+ discussions in the international arena with the emerging NAMAs framing is needed to create rules and incentives for landscape approaches and investments.

Lesson 2: Success in emissions reduction initiatives will need entry points beyond a sole emissions reduction focus given that carbon and its associated finance is unlikely to be a priority concern for local stakeholders:

In the landscapes in which ASB works and at other levels such as at the national level, emission reduction is not the primary concern of the majority of the people and governments. Figure 36 illustrates a typical hierarchy of needs across REALU's countries and sites. Basic concerns of food security and basic infrastructure (e.g. education and health) are considered priority. This implies that other benefits such as increased food productivity or other production interests are needed alongside emissions reduction. Demonstrating the value added of emission reductions in achieving wider economic, social and environmental interests is extremely important (Dewi et al., 2013; Feasibility studies in Section II). This lesson leads to two recommendations.

Recommendation 2: Emissions reduction planning and implementation needs to be integrated into the wider development aspirations of stakeholders if it is to succeed.

Recommendations 3: Landscape approaches would benefit from greater effectiveness and efficiency when synergy is sought between emission reductions and other environmental, social and economic objectives including climate change adaptation and green economy approaches.

Lesson 3: A co-investment approach is emerging as a necessary condition for achieving multiple landscape-level objectives:

From our analyses at the landscape level and other cost estimates, with the current carbon investment flows and a carbon price below 5 USD per tCO_2e, it is unlikely that cost of emissions will be met in many places. Cost of participation and negotiation of multiple objectives among many actors can be very high. Moreover, little evidence was found of direct government investments in emission reduction programmes in the project countries across all scales. In some cases taxes levied on electricity or water use institutions and allocated to watershed maintenance could be leveraged in such a co-investment mechanism. Therefore, the recommendation follows below.

Recommendation 4: Key frameworks and models should be developed to enable better private sector involvement (financing and sharing of technical expertise) in emission reductions and sustainable development schemes at the landscape level. This could allow and involve innovative financial mechanisms for public and private investments. Such a mechanism could allow integration and optimization between currently separated mitigation and adaptation funding streams for example.

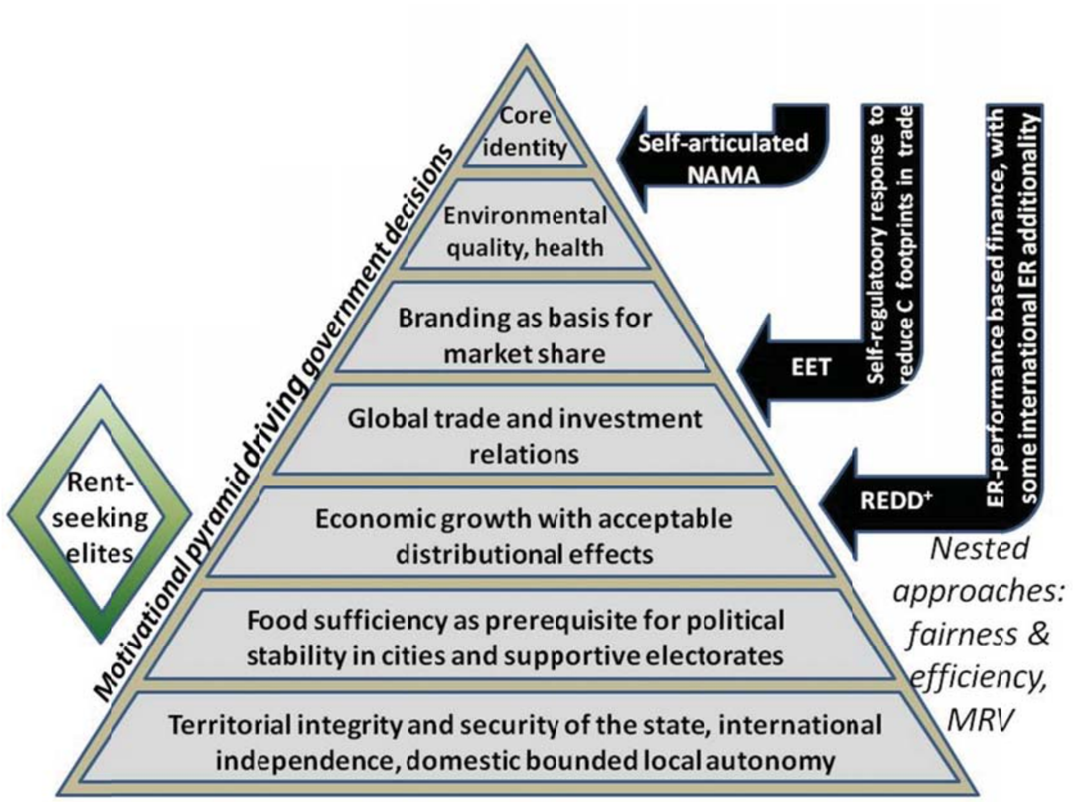

Figure 36 Typical hierarchy of needs across REALU's countries and sites (van Noordwijk et al., 2013).

Lesson 4: Landscape and jurisdictional approaches to emissions reduction can be complementary:

While landscapes can be interpreted as a biophysical space such as a watershed, a conservation area, or a political entity (jurisdiction such as a district or a province), it is often be important to have a very clear jurisdictional framework around a landscape with clear decision-making and policy responsibilities if emissions reduction is to be effective. For instance a REDD+ pilot with geographic boundaries defined by a protected area that transcends provincial boundaries will need clear working relationships between the two provinces and a framework for decision-making between both to manage the REDD+ project. The REALU landscapes in this project were largely built at various jurisdictional levels in various countries (see Section 1.5 on landscape considerations). But the potential effectiveness of emission reductions depends on the degree of decentralization and/or devolution of power to the jurisdictional level in terms of planning and for more specific issues of land management and natural resources management including REDD+. Still huge issues around political economy influence the potential for success of landscape approaches (See Section 5.1).

Recommendation 5: Better research is required to understand and identify potential options for landscapes and jurisdictional interactions under different political economy contexts.

Recommendation 6: REDD+ readiness (and indeed future climate change readiness –NAMA, climate smart agriculture and others) needs to invest more in sub-national level REDD+ designs in order to enable landscape approaches for emissions reduction to thrive. Current readiness focuses more on international accountability structures and national levels, which does not automatically translate to a nested-systems architecture required to address drivers of deforestation at the landscape level.

Lesson 5: Nesting landscapes to the national level is a necessary condition for success and scaling-up:

In principle emission reductions under REDD+ and/or NAMA will have to be accounted for at the national level, hence, reference levels and MRV approaches and methods will have to be integrated at both the landscape and at the national level. Beyond that, sharing the national emission reductions "burden" and benefits needs to be clarified across sub-national and national levels. These issues indicate that clearer nesting rules are required for landscape-level emission reductions to be successful in the long run (Minang & van Noordwijk, 2012). In Indonesia the REALU project is working with district and provincial government to determine references levels and realistic emission reduction targets that take into account their development aspirations using the LUWES methodology. These districts and provinces can thus use these in negotiations of their share of the national emission reduction target as a next step.

Recommendation 7: Rules and guidance for nesting landscapes to the national level are needed. These could include specifying among others issues related to ownership rights to carbon, duties and royalties to be paid on investments, crediting, distribution of national emission targets, benefit sharing, risk management, MRV and baselines.

Lesson 6: Identifying and understanding leverage points and potential levers of emissions beyond landscape boundaries is necessary to address drivers effectively:

Drivers of land use change and emissions reduction do not respect landscape boundaries hence landscape emission management analysis and planning should go beyond the physical boundary of a landscape. This also suggests working beyond the boundaries of the space referred to as a landscape. The analyses of drivers at landscape and national levels (largely reviews) with classic land use change and modelling approaches, though useful, were not sufficient to enable designs of incentives that target specific leverage points and relevant levers.

Recommendation 8: The design and use of approaches that aim at identifying leverage points and levers for addressing drivers, as opposed to the current identification of land uses responsible for most conversions and a description of the processes, is needed. Beyond this, leverage points, the potential effects of various levers and the chain of reactions that these levers can have in the reversal of drivers of emissions need to be identified and analysed.

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