Reduced Emission from Deforestation and Degradation in the Southern Cardamom Ecosystem, Cambodia

Decision makers summary

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Abstract[1]

The aim of this study is to estimate the potential for generating carbon credits from Reducing Emissions from Deforestation and Degradation (REDD) in a region known as the Southern Cardamoms Ecosystem, Southwest Cambodia. Through the last decade, the Southern Cardamom Ecosystem has seen increasing pressures on forest resources. The Royal government of Cambodia sought the assistance of the NGO Wildlife Alliance to control degrading forest activities in the area in 2002. The option to attain carbon credits from REDD now offers an opportunity to achieve various goals: to (1) conserve the forest, (2) reduce CO_2 emissions, (3) support and develop local communities; and (4) generate revenues for the Cambodian government and the NGO Wildlife Alliance.

The potential amount of carbon benefits that can be generated has been estimated through an analysis of what is technically possible given the conditions of the project area, such as carbon density and deforestation rate. This technical assessment was complimented by an analysis of the current institutional and social conditions/barriers that can affect the actual quantity of marketable carbon.

The technical potential for emission reductions lies between 0.4 and 1.3 million tCO_2/yr. However, the actual emission reduction that can be captured by REDD is dependent on how much deforestation can be reduced, and how effectively the project deals with the issues of permanence and leakage. These three aspects are in turn dependent on several institutional and social-economic factors. While the project is currently in the early phase of development, emphasis must be put on generating benefits for the local people who in reality bear the cost of reducing deforestation. Local people are a vital component to the overall success of the REDD project. Encouraging their participation and cooperation in the project can ensure long-term permanent emission reductions.

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[1]   This Decisions Maker Summary is based on the report Grogan, K., Hansfort, S.L., Beukering, P.J.H. van & Leeuw, K. van der (2009). *Reduced Emission from Deforestation and Degradation in the Southern Cardamom Ecosystem, Cambodia*. IVM Report (R-09/11). Institute for Environmental Studies, VU University, Amsterdam.

1. Introduction

Tropical forests provide a range of valuable goods and ecosystem services, both locally and globally. Despite its importance, tropical forest is disappearing rapidly, causing a range of problems. Deforestation not only has severe consequences for local conditions but also as a primary source of greenhouse gasses (GHG), makes a considerable contribution to global warming. With large profits to be made from agriculture, plantations and economic development, there has been little to outweigh the opportunity costs of forest conservation in tropical countries.

Recent developments in the international carbon market offer an unprecedented opportunity to challenge the norm. The market mechanism, which may provide these opportunities, is referred to as Reduced Emission from Deforestation (REDD), whereby the voluntary carbon market provides for REDD carbon trading. Many developing countries use this voluntary carbon market as a primer for establishing a national REDD accounting system. This has lead to a plethora of project-based REDD activities budding throughout countries in the developing world.

Due to an earlier period of war and internal conflict, Cambodia is one of the few countries in Southeast Asia with a relatively high percent of its forest cover remaining. REDD now presents the country with a challenging choice: continued conversion and exploitation of natural resources or forest conservation. The early signals from government seem to point at the latter option. The year 2008 has seen the launch of the country's first REDD pilot project and the government is encouraging the development of more REDD projects. One such REDD project in development is in the Southern Cardamoms, Southwest Cambodia. This ecosystem has been relatively isolated for many years, but like the rest of Cambodia, is experiencing increasing pressures from many fronts.

Wildlife Alliance is a non-governmental organisation (NGO) working in the region in collaboration with the Royal Government's ministries. As part of an overall vision for the region these two organisations jointly created a master plan centred upon sustainable development and forest conservation. REDD financing plays a critical role in making this plan become a reality.

The aim of this study is to estimate the potential for REDD carbon benefits in the Southern Cardamom ecosystem. The potential amount of carbon benefits that can be generated is dependent on several overarching and overlapping factors. In this study, three dimensions are of special interest: technical, institutional and socio-economic conditions.

The total physical volume of carbon benefits that can be generated by the REDD project is defined by the *technical potential*. This technical potential is in turn limited by several institutional and social conditions that may reduce the actual marketable amount of carbon credits significantly below what is technical possible. The analysis will therefore commence with a technical assessment, which includes an estimation of total forest carbon stocks, a prediction of future deforestation within the project boundary, and an

estimate of total carbon benefits by comparing "without" project to "with" project scenarios.

In the *institutional assessment,* actors, policies and legalities that can potentially affect the REDD project will be identified. The aim of this assessment is to get a better understanding of the potential institutional obstacles that need to be taken into account in developing a REDD project. Moreover, it helps to identify important actors and organisations that need to be involved in the design of the carbon activities.

The *socio-economic assessment* will identify social conditions, forest dependency and the effects on local livelihood from restricted forest use. Too often, exclusion of local communities from comparable projects has led to its failure. For the carbon project to be successful it is therefore important to address how the local people are affected, if they are in need of any type of compensation in return for the restricted forest use, and if it is possible to further increase restriction levels.

Before the main analysis, an introduction will be given to forestry and the global carbon markets, and to the Southern Cardamom Ecosystem and its drivers of deforestation.

2. Forestry and the global carbon markets

With general scientific consensus on global warming established, the aim for reducing global greenhouse gas emissions has led to carbon becoming a marketable commodity. Seen as a cost-effective means of reducing emissions, investment is now pouring into forest carbon mitigation projects.

Forests act as a natural carbon sink, removing CO_2 from the atmosphere through photosynthesis and capturing it in forest biomass. When forest is cleared or degraded, carbon stored in the sink is oxidised and released back to the atmosphere. It is estimated that approximately 20 percent of global emissions originate from this source (Chomitz *et al.* 2006). Therefore, Reducing Emissions from Deforestation projects (REDD) has attracted increasing attention in the emerging carbon markets as of late.

2.1   Generating marketable carbon from REDD

The global carbon markets comprise a legally binding, compliance market as well as a voluntary market outside of international agreements.

The global Compliance Carbon Market is regulated by the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC). The protocol has established a cap-and-trade system that imposes national caps on the GHG emissions of developed countries that have ratified the protocol (Annex B countries). While targeting developed countries, two mechanisms exist to increase the cost-effectiveness of emission mitigation; Joint Implementation (JI), and the Clean Development Mechanism (CDM) (UNFCCC 2008), the latter of which is most relevant for forestry projects. It allows Annex B countries to invest in carbon mitigation projects in developing countries to generate Certified Emission Reduction units (CERs). The CDM operates on a baseline-and-credit system. These CERs can in turn contribute to meeting the emission reduction commitments made by Annex B countries (UNFCCC 2008). The possibility to generate CERs through REDD activities is excluded from CDM, restricting eligible forestry projects to Afforestation and Reforestation (AR) activities only.

The Voluntary Carbon Market functions outside of international agreements and the compliance market. This parallel market enables individuals, companies, governments etc. without mandatory emission targets, to optionally offset some or all of their GHG emissions. In terms of forest carbon projects, the main difference between the voluntary and the compliance markets is that while both allow for AR, the voluntary market allows for additional forestry activities such as avoided deforestation, or REDD. Carbon credits generated for trade on the voluntary market are referred to as Verified or Voluntary Emission Reductions (VERs)

Reduced Deforestation operates on a baseline-and-credit system. Carbon credits are generated from REDD activities by comparing emission levels that would occur in the absence of REDD intervention (i.e. the baseline emission rate), with emissions levels under the "with REDD project" scenario. By implementing strategic activities aimed at reducing the core drivers of deforestation, the deforestation rate, and hence the emission rate, should inevitably fall. Figure 2.1 provides an illustration of the concept.
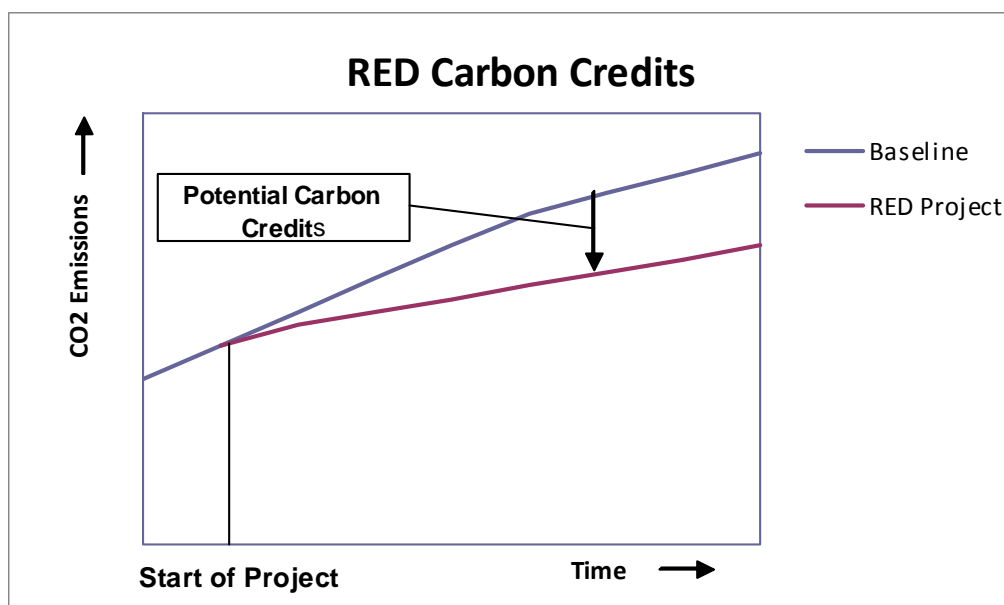
Figure 2.1   Baseline scenario of a REDD activity.

2.2   Quality of emission reduction issues

There are a number of issues that must be considered to ensure quality emission reductions from forestry carbon projects: *Additionality*, *Leakage* and *Permanence*.

Additionality addresses the question of whether the REDD project results in real CO_2 emission reductions, beyond what would have happened in the absence of project activities. For REDD purposes, this means that forest protection would not have taken place without the carbon credit generating project.

Leakage is often referred to as the "unanticipated loss of net carbon benefits of a project as a consequence of the implementation of project activities" (Brown *et al.*1997b). Two main forms are identified: (1) Activity Shifting, where activities that were causing deforestation in the project area are simply displaced to somewhere outside the project and (2) Outsourcing, when commodities that were previously obtained through deforestation in the project area (e.g. charcoal) are purchased from deforestation activity originating from outside the project boundary.

The term *Permanence* refers to the requirement that emission reductions generated through the REDD project activities last over time. REDD projects with a higher amount of permanence risk will generally produce fewer credits, and credits that demand a lower price (EcoSecurities 2007). Therefore it is necessary to invest in strategies that minimize risk early in the project design to maximize long-term benefits.

In order to address these issues in the voluntary market, the past two years have seen the rise of third party standards, increasing the legitimacy of VERs. There are two standards which have emerged as forerunners for REDD activities, the Voluntary Carbon Standard (VCS) and the Climate, Community and Biodiversity Standards (CCBS).

The Voluntary Carbon Standard (VCS)

Launched in 2007, the VCS is now the worlds' leading voluntary market standard (Hamilton *et al.* 2008). The standard has comprehensive measures to deal with additionality, leakage and permanence. The VCS also has a fully operational registry to register, transfer and retire credits from the marketplace, and ensures that double counting of credits is avoided.

The Climate, Community and Biodiversity Standards (CCBS)

The CCBS is a set of project-design standards that focus exclusively on land-based carbon mitigation projects, requiring local community and biodiversity co-benefits. The CCBS utilises existing methodologies of the Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance for GHG emission estimates. As the standard focuses on project-design, it does not provide its own carbon accounting system or registry. It is therefore recommended that the CCBS be combined with another carbon standard for certification and registration of credits such as the VCS.

2.3   Outlook for REDD and the carbon markets

From 2002 on, the voluntary market has seen a relatively healthy growth rate; however between 2006 and 2007 the market has expanded rapidly, with a 165 percent increase, and is set to further increase in the coming years (Carbon Trust 2006, Hamilton *et al.* 2008).

The total volume of credits traded on the voluntary market in 2007 amounted to 65 million tCO_2e. Of this total, forestry and land based credits accounted for 18 percent with avoided deforestation credits accounting for 28 percent of this share, or 5 percent of the overall market share (growing from 3 percent the previous year). The average price for avoided deforestation credits in 2007 was estimated to be $4.80 (Hamilton *et al.* 2008).

Although the voluntary market is growing rapidly, it still remains a small fraction of the regulatory market (2.2 percent). Recent developments concerning the regulatory market however, have sparked major interest in REDD activities, with anticipating countries opting to pilot REDD projects in the voluntary market in preparation for its inclusion in a post-Kyoto regime.

3. Forests and the Southern Cardamom ecosystem

3.1 Area and administration

Located in Koh Kong province, Southwest Cambodia, the Southern Cardamom eco-system constitutes one of the last relatively intact ecosystems in Southeast Asia. The region covers approximately 880,000 hectares, with 720,000 hectares (80%) under forest cover. This relatively remote landscape has provided refuge to a rich fauna and flora habitat: amongst others the endangered Asian elephant, the Indochinese tiger, the Malayan sun bear and the Siamese crocodile.
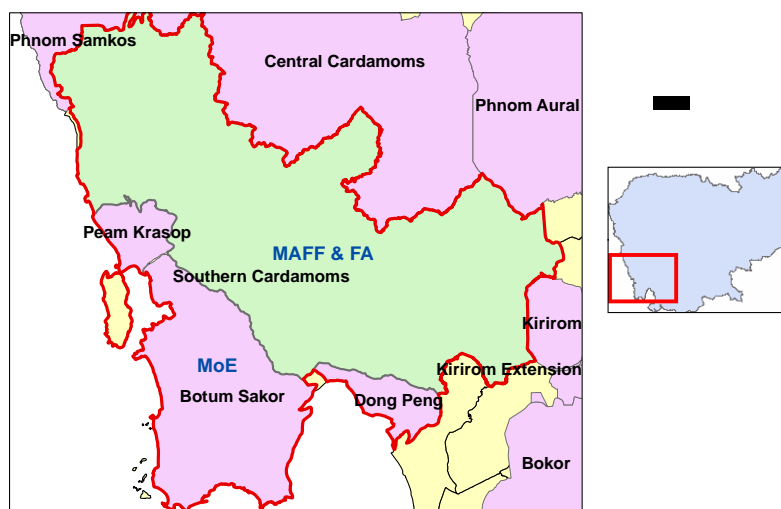

Figure 3.1   Map of the Southern Cardamom Ecosystem.

Administratively the Southern Cardamoms is divided between the Forestry Adminis-tration (FA) of the Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Ministry of Environment (MOE). Much of the FA controlled area was granted logging concessions throughout the 1990s. However, in 2002, all logging concessions were suspended.

The NGO Wildlife Alliance (WA) has been heavily involved in the Southern Cardamom ecosystem for the past six years. Measures to reduce deforestation and habitat destruct-tion have been implemented in cooperation with both the FA and MOE. The cooperation is based on three fundamental pillars: 1) ranger patrolling, 2) community outreach, and 3) wildlife monitoring. Within four years Wildlife Alliance assisted FA in establishing five ranger stations across the SWEC area with a total of 70 rangers patrolling against forest crime.

To further reduce deforestation, Wildlife Alliance developed a Master Plan that focuses on increased protection, reforestation and community development. Potential funding through a REDD project is fundamental for the implementation of this master plan. However, due to several institutional barriers present in the MOE area, the area is currently not suitable for a REDD project. Barriers include the non-inclusion of WA experts in patrolling teams, inadequate enforcement of forest protection and continuing development plans in the area.

3.2 Deforestation

The project area itself has, until now, had a relatively low deforestation rate, but mounting pressures mean that conditions are at a turning point and future deforestation rates are expected to increase. The main underlying drivers are:

1. 10% annual economic growth (UN 2008)
2. 14.4% increase in land prices in Koh Kong province
3. A high population growth of 4%
4. Agricultural development policies and large scale economic land concessions

Together these drivers put increasing pressure on the area in the form of infrastructure expansion, agriculture development and wood extraction. This presents a bleak outlook for the ecosystem as a whole if protective measures are not implemented. A full technical assessment of deforestation baselines is given later in this report.

3.3 Project activities for forest protection

The "Southern Cardamom Conservation for Development program – Master Plan" (Wildlife Alliance 2008) has been designed to implement sustainable development, enhance economic growth, while protecting natural resources and improving the livelihood of local communities. Carbon funding through REDD is an integrated part of this plan, built upon four main pillars: 1) agricultural support and development, 2) eco-tourism, 3) institutional development and 4) forest protection including several reforestation projects. Some details are described below.

- The agricultural program will focus on families dependent on slash & burn cultivation. Assistance will be given on agricultural know-how, together with modern agricultural equipment.

- There are extensive plans to develop sustainable eco-tourism in the region, including eco-lodges, visitor centres, infrastructure and several others measures. The planned eco-tourism development provides training for local communities to enable delivering necessary services, such as labour, guided tours, etc.

- Improving institutional capacity will take place by review of and guideline setting for MAFF and MOE policies, training and education of staff from governmental institutions and continued training of rangers. A park management advisory council also is to be created, consisting of local government members and non-governmental stakeholders.

- The forest protection component includes construction of five new ranger stations in the MAFF area and one new station in the MOE area. There are currently 12 sites proposed for Community Forestry. Furthermore, approximately 2,700 hectares of land around Chi Phat will be replanted with natural forest. This offers additional potential for generating carbon credits.

4. Technical assessment

The primary focus of the technical assessment is to estimate the quantity of carbon credits that could be generated by implementing a REDD project in the Southern Cardamoms. This will be done by comparing expected emissions in the "without" project scenario with expected emissions in the "with" project scenario. The difference in emissions between the two scenarios will represent the total technical potential. Figure 4.1 illustrates the methodology used.
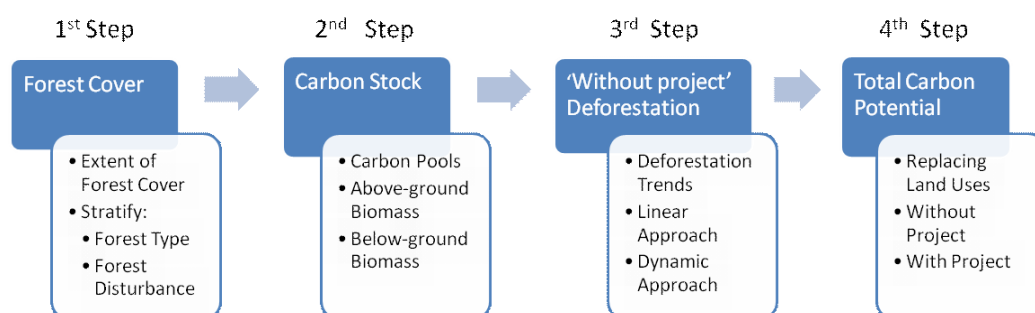

Figure 4.1   Flow diagram of the methodology for the technical assessment.

4.1   Forest cover & disturbance

The project area is dominated by large expanses of evergreen forest, making up almost 88% of the total forest cover. There are smaller pockets of semi-evergreen (3.1%) and deciduous (5.4%) forest contained mainly within the valleys to the north and northeast. Forest re-growth, stunted forest, inundated forest, mangrove, forest plantations and bamboo are predominantly found close to rivers, roads and villages, in areas of poor soil and drainage, and cover 3.8% of the total forested area.

Carbon densities in tropical Asia decline by 22-67% after logging disturbance (Lasco 2001). A GIS model was applied, using a similar approach to the forest disturbance model created by the IFSR (2004), to distinguish between disturbed patches around villages and roads, and intact forest. By combining land cover data with the disturbance model, Figure 4.2 provides an overview of the project area with forest cover classes.
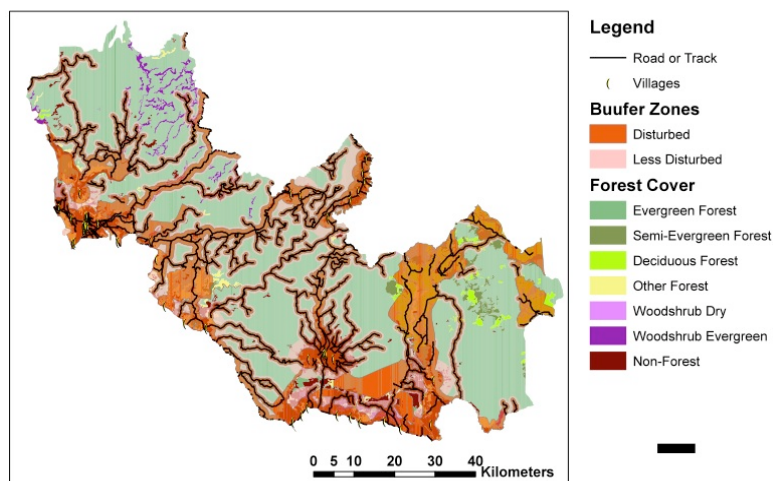
Figure 4.2 Forest cover and disturbance.

4.2 Carbon stock

In this study, two carbon pools are considered: (1) aboveground biomass and (2) below-ground biomass.

The aboveground biomass can be estimated with varying levels of detail and accuracy. IPCC guidelines range from tier 1 (lowest) to tier 3 (highest). Tier 1 assessments use default values (i.e. *biome-average approach*); Tier 2 focuses on country specific data, while Tier 3 requires highly disaggregated inventory data of carbon stocks (Project specific). The latter require complex models that are outside the scope of this research. We therefore focus on getting a sound tier 2 estimate.

A comprehensive literature review yielded four tier 1, and three tier 2 estimates. Consideration of these studies led to the adoption of the estimates provided by Top *et al.* (2006). Raw data was used from 540 individual plots, stratified into 4 distinct classifications, all of which exist within the project area. Table 4.1 shows the results.

Table 4.1 Aboveground biomass (AGB) estimate

Forest Type	AGB (t/ha)	AGB tC/ha	AGB (CO2/ha)
Evergreen	291	146	534
Semi-evergreen	265	133	486
Deciduous	235	118	431
Re-growth	39	20	72

Source: Top et al. 2006

The following regression model developed by Cairns *et al.* (1997) for tropical forests was used to calculate belowground biomass:

$$BBD = \exp(-1.0587 + 0.8336 \cdot \ln(ABD))$$

Where BBD = belowground biomass density (t/ha), and ABD = aboveground biomass density (t/ha). By using the weighted aboveground biomass density for each category, belowground biomass was estimated to be 40.4 t/ha. Using a carbon fraction of 0.5, and a C to CO_2 conversion factor of 3.667, this translates to a value of 20.2 tC/ha.

When the aboveground and belowground components of the carbon assessment are combined this results in a total carbon stock estimate of 71,434,476 tC for the project area, equalling a potential 261,950,222 tCO_2. The average carbon density is 135.6 tC/ha equalling a potential 497 tCO_2/ha.

4.3   Deforestation "without" project

To assess baseline deforestation "without" project implementation, a scenario approach was applied:

- *Linear Scenario*: the average deforestation rate estimated for the project area by Aruna will be projected as a conservative lower bound estimate using a constant rate of 0.19 percent/yr over the next 30 years;

- *Dynamic Scenario*: a dynamic deforestation rate that will increase steadily over the next 10 years. After reaching this point, it will level off and gradually decrease for the next 20 years due to the most favourable lands being already deforested. The average deforestation rate over the 30-year period will be 0.6 percent/yr.

An estimation of gross deforestation was made by analysing 4 LandSat (30 x 30 m resolution) images spanning 15 years. The minimum mapping unit (MMU) was 2 ha.

Based on figures in Table 4.2, the average gross deforestation rate for the project area is estimated to be 0.19 percent/yr. As mentioned, this will be considered the lower boundary, strongly conservative estimate. Table 4.3 provides forest cover statistics for the surrounding 5 provinces.

Table 4.2   Gross deforestation in Southern Cardamoms (in ha and ha/yr).

	1991-1998	1998-2002	2002-2005	Forest cover 2005
MAFF				526,608
Total Forest Cleared (ha)	6,859	3,457	2,830	
ha/yr	1,120	864	894	
MOE				138,948
Total Forest Cleared (ha)	2,017	1,153	1,726	
ha/yr	329	288	545	
MOE and MAFF				665,556
Total Forest Cleared (ha)	8,876	4,610	4,556	
ha/yr	1,449	1,153	1,439	

Source: Aruna 2008.

Table 4.3   Forest cover, change and net deforestation rates for a selection of Cambodian provinces.

Province	Total Area (ha)	Change 2002-2005/06 (ha)	Deforestation (%FC/yr)
Kampong Speu	696,471	14,911	1.21
Kampot	471,815	8,625	1.27
Pursat	1,158,591	2,787	0.10
Preah Sihanouk	149,205	2,575	1.04
Kampong Chhnang	529,461	4,583	0.73
Total	4,217,138	33,634	0.40

Note: Source data was taken from the FA – *Cambodia forest cover* (2008a) for the 2005/06 figures, and from a published Khmer FA document for the 2002 figures (FA 2004).

The average net deforestation for the entire region is approximately 0.6 percent/yr. This figure is considered a conservative estimate of gross deforestation. Deforestation will gradually increase from 0.19 percent/yr over the first 10 years. After this point the rate will level off and gradually decline due to the most favourable land being already cleared. Table 4.3 shows a graphical representation of both deforestation scenarios over an assumed 30-year project lifetime.
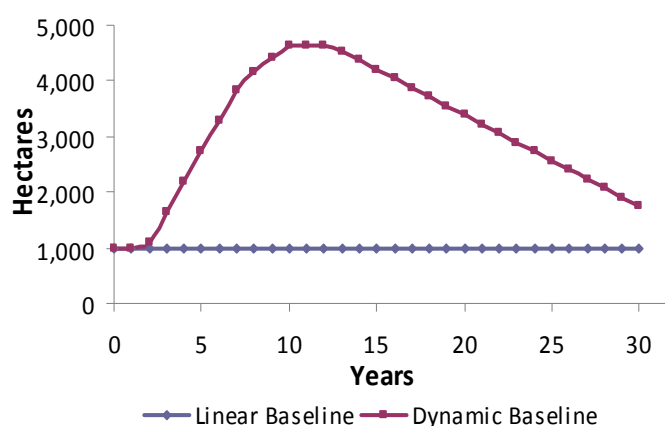

Figure 4.3   Baseline deforestation scenarios.

4.4   REDD carbon potential

Without Project Emissions: Consistent with IPCC default recommendations (IPCC 2006), once forest is cleared, all carbon in above- and belowground biomass is assumed to be released to the atmosphere in the form of CO_2. Table 4.4 provides the estimates of the amount of CO_2 emissions for both "without" project scenarios. The table displays the quantity of CO_2 emitted in 5-year intervals, over a 30-year time span.

Table 4.4   Baseline Emissions: Estimates of CO_2 emissions in 5 year intervals over a 30 year period for both "without" project scenarios (000, tCO2).

Year	1-5	6-10	11-15	16-20	21-25	26-30	**Total**
Linear Sc.	2,036	2,036	2,036	2,036	2,036	2,036	**12,215**
Dynamic Sc.	3,554	8,360	9,203	7,641	5,956	4,270	**38,984**

With Project Emissions: For the "with" project scenario it has been assumed that the REDD project will be fully implemented by year 2018, with a deforestation rate of around 0.01 percent/yr equalling approximately 50 ha/yr. as the minimum deforestation rate achievable. The current deforestation rate of 990 ha/yr will decrease linearly until year 10. The resulting emission reductions can be found in Table 4.5.

Table 4.5   RED Emission Reductions: CO_2 emission reductions in the "with" project scenario (000, tCO_2).

Year	1-5	6-10	11-15	16-20	21-25	26-30	**Total**
Linear Sc.	579	1,542	1,927	1,927	1,927	1,927	**9,828**
Dynamic Sc.	2,097	7,866	9,094	7,532	5,847	4,161	**36,597**

The conservative linear scenario is estimated to avoid almost 10 million tCO_2 over the 30-year period averaging approximately 330,000 tCO_2/yr. The dynamic scenario produces approximately 36.6 million tonnes of avoided CO_2 emissions over the 30-year period averaging 1,220,000 tCO_2/yr.

5. Institutional assessment

The aim of this chapter is to describe the main institutions, policies and laws that will set the framework for the REDD project. The chapter begins by introducing the relevant governing bodies and institution, and describing the current policy climate for REDD carbon projects. This will be followed by a description of the two major pieces of legislation that influence the forestry sector, the Land Law, and Forestry Law. The chapter also examines how the relevant institutions and laws affect the project area.

5.1 Institutions

On the national scale, Cambodia is governed in a traditional state-centred hierarchical structure. Therefore, forest management in Cambodia is dominated by the state. The most relevant national institutions include the following (see also Figure 5.1):

- *The Forestry Administration (FA):* Cambodian forested land falls under the general jurisdiction of the Ministry of Agriculture, Forestry and Fisheries (MAFF). FA was formed within this ministry in 2003. The FA and MAFF will be the key government institutions involved in the REDD project.

- *The Ministry of Environment (MOE):* While the FA holds the responsibility to manage the nation's forest estate, the management of protected areas has been delegated to the MOE. Protected areas include national parks and reserves, including those containing forest. MOE does not have any direct influence on the proposed REDD project area but are administrating the majority of the surrounding areas.

- *The Technical Working Group on Forestry and Environment (TWG-F&E):* TWG-F&E was established in 2004 to provide a mechanism for government-donor coordination to support and strengthen development activities within forestry and environment. The TWG-F&E recently developed a four-year action plan that aims to create and implement a long-term strategy for the nation's forest sector.

- *Wildlife Alliance*: Wildlife Alliance is an NGO operating in the Southern Cardamoms. Since 2002 they have been working with the FA in the project area, protecting the forest and its biodiversity, and establishing various programs for community development. The REDD carbon project will form an important part of an integrated Master Plan that Wildlife Alliance has developed for the area in collaboration with the FA.

5.2 Policies

The above-mentioned institutions are guided by the national policy on forestry. The forest policy provides a template for the future direction of the national forestry sector. The primary guidance document for the forestry sector is the "Statement of the Royal Government of Cambodia on National Forest Sector Policy" (RGC 2002b). This document outlines the national goals with regard to the management of forest resources, emphasizing that the need for maximizing the sectors' contribution towards poverty

reduction, food security, and equitable socio-economic development. One specific goal outlined is "to optimize the benefits to local populations from the use and management of forest resources", indicating that the benefits generated from REDD activities may not only contribute to government revenues but may also be channelled back into community development and poverty reduction.
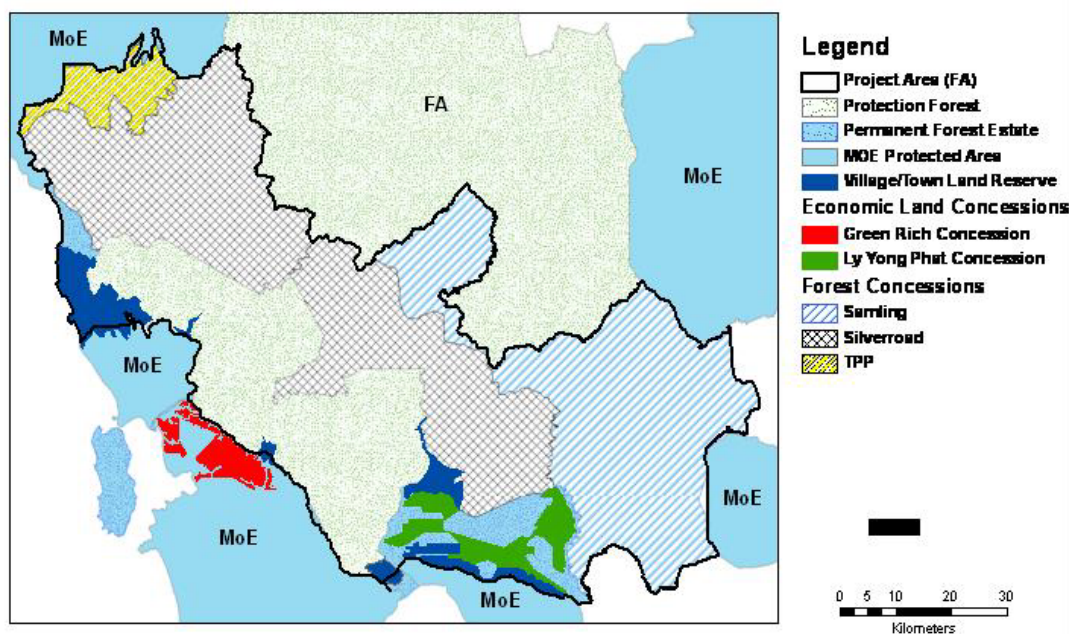

Figure 5.1   Forest classification, administration and concessions.

As part of the national policy, the government has committed to prepare a National Forest Programme to promote conservation and sustainable management and use of forests. This programme is the top priority of the TWG-F&E and is outlined in the four year TWG Action Plan 2007-2010. The programme encourages multi-stakeholder participation from local to international levels, aiming to streamline the forest sector, improving planning, programming, implementation, and evaluation of forest activities (RGC 2008b). The NFP focuses on six programmes that can each contribute to the success of future REDD activities: Forest Demarcation, Sustainable Forest Management, Community Forestry, Law Enforcement and Governance, Capacity development and research, and Forestry and Climate Change.

Although all of the above programs have an important role to play in the success of REDD projects, there are three programs worth discussing in more detail.

- *Forest Demarcation:* The boundaries of Cambodia's forest estate have never been properly demarcated or registered, leading to uncertainty when attempting to protect the forest against illegal land grabbing and encroachment from speculators and local villagers. The FA is currently running pilot demarcation projects in four provinces but aims to eventually scale up the programme to national level.

- *Community Forestry:* In an attempt to give local communities some control over their surrounding natural resources, the FA has developed a coherent Community Forestry programme over the past five years. There have been a number of pilot

Community Forest sites to date, and there is a strong growing demand for others. The FA is aiming to allocate 20% of the forest estate to Community Forestry agreements and attendant management plans by 2020. This programme will not only give locals much needed access to forest resources but also help protect the forest against excessive degradation and illegal activities.

- *Forestry and Climate Change:* With regard to political support and commitment to forest carbon programs, the Cambodian government is showing keen interest in developing REDD conservation projects. The government believes that the REDD framework can "contribute to alleviating poverty, improved governance, and sustainable forest management in Cambodia, as well as mitigating global climate change" (Forestry Administration 2008b). The first pilot REDD project has just been approved for a number of Community Forest sites in Oddar Meanchey Province, situated in the north-west Cambodia, in conjunction with Community Forestry International (CFI) and Danida. As part of the agreement made with the RGC, the FA is designated as the seller of forest carbon.

The Memorandum of Understanding (MOU) between CFI and the Cambodian government contains two important features (RGC 2008a):

- The FA allows CFI to identify buyers and explore terms and carbon prices.

- Revenues from carbon sales will be used to:
  a. Improve the quality of the forest;
  b. Maximize the benefits to local communities participating in the project; and
  c. Study potential sites for new forest carbon REDD projects.

Revenues generated by the project will be channelled through the TWG-F&E during the first five years of the project (RGC 2008a). The FA is also exploring future potential Afforestation and Reforestation pilots in collaboration with the MOE and the Cambodian Climate Change Office.

5.3   Institution challenges

The existing institutional set-up provides a solid platform upon which the REDD project can be developed. National policy is supportive of the REDD concept and the laws and regulations governing forests, land management and ownership provide the fundamental building blocks for REDD development. Despite this, there are several priority areas that need substantial improvements for overall project success and risk minimization. The issue of insecure property rights is one point of major concern. The lack of transparency and consistency in land concession system also needs attention. With regard to the basic institutional and legal arrangements for the REDD project the RGC are identified as the owner of the forest carbon with the FA acting as the seller. Early indications have shown that the RGC are willing to commit to recycling benefits back to the communities development, which is essential to the long-term success of the project.

6. Socio-economic assessment

The majority of rural communities in developing countries are highly dependent on forest resources and the services that forest provides. When a REDD project is developed to preserve forest carbon, it is therefore necessary to consider the locals' utility of the forest, so the project can ensure equity and social well being as well as an actual emission reduction. In this chapter, the result of a household survey on local dependency and forest use conducted in the Southern Cardamom Ecosystem will be described. The survey was carried out mid 2008, with a total of 436 respondents in 5 out of the 9 districts in the area, covering 25 villages. Special attention was paid to the willingness of local people in the Southern Cardamom Ecosystem to accept additional restrictions of the forest use.

6.1 People and the forest

With a population density of 19 persons per km^2 (compared 82 per km^2 nationally), the Southern Cardamoms is one of the least populated areas in Cambodia. People live in dispersed villages in houses built of natural materials, primarily wood, and with an average household size of 5 people. Of all the provinces in Cambodia, Koh Kong province is the region with the lowest average poverty rate. The average monthly income for a household is US$78. However, there are significant socio-economic differences between the communes in the Southern Cardamoms.

Especially in the 1990s, the region has attracted large numbers of immigrants seeking an improved livelihood. This is largely due to the province having a reputation as an area with high availability of land and as a good place to earn a living by fishing or cutting timber. Migration to the Southern Cardamoms has increased the pressure on the diverse natural resources, with charcoal production and logging spreading uncontrollably into the protected forest and mangroves.

Traditionally, people in the Southern Cardamoms depend on the natural resources supplied by the ecosystem. Most have been subsistence farmers surviving from chamka (swidden agriculture). For 91% of the households growing crops is the most important source of livelihood. Rain fed rice cultivation is the most prevailing crop production, but the yields are relatively low due to poor fertility of the soil. Other practices, such as fishing, hunting, logging, and non-timber-forest-products (NTFP), have also contributed to local livelihood.

Approximately 21% of households are dependent on forest resources. We had expected a higher percentage of local people to be dependent on the use of forest. However, the restricted forest use during the last five years, as well as the illegalisation of collecting forest products for commercial purpose may have made people apprehensive about revealing their true level of usage of the forest. Despite this low direct forest dependency, 72% are collecting products from the forest (e.g. firewood, charcoal, fruits, rattan, wild meat). The collected forest products are mainly used for own consumption (66%). The products used for selling are mainly collected during the dry season when the forest

is more accessible and substitute income when there are no crop yields. People having a high dependency on natural resources are among the poorest in the society.
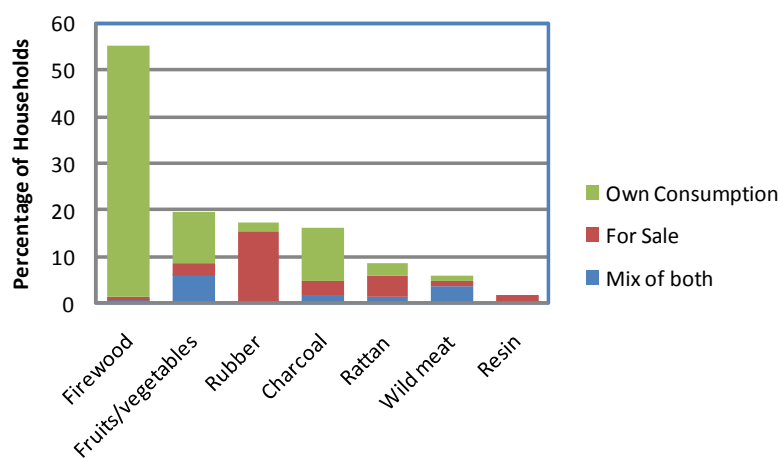

Figure 6.1   The percentage of households collecting forest products (only the main products are included) and the percentage that is used for own consumption, for sale and for both own consumption and sale.

According to the respondents' perception, the two main drivers of deforestation are small-scale agriculture and land encroachment. These deforestation drivers are caused by the demand for land and not on forest products. The high availability of accessible land in the Southern Cardamoms, together with insecure land tenure, has attracted land speculators, businessmen and immigration to the Southern Cardamoms. All have contributed to a growing pressure on the forest resources. Insecure land tenure not only contributes to deforestation directly but also indirectly, if local people have their land taken away, they may be forced into the forest to clear a new piece of land. At the current state, 50 percent of households in the Southern Cardamoms do not have a land title. Most likely this number is even higher. The importance of solving the land tenure issues is shown by the fact that 89 % share the opinion that clearly defined land titles would reduce deforestation. This again highlights the importance of securing property rights, not only for the livelihood of local people, but also for the forest.

6.2   People and forest policy

Legal restrictions have had a major impact on local people dependent on collecting products from the forest and on practicing chamka. The restrictions have clearly affected the level of deforestation as is shown in the *Technical Assessment* (see full report for more details). However, due to different style of administration in the North and in the South of the Southern Cardamoms (MAFF and MOE respectively), different restriction levels have been enforced in the two areas. In relation to the magnitude of deforestation and degradation, in the MOE area 90 percent of households have experienced deforestation and degradation of the forest during the last 5 years, while only 57 percent have experienced it in the MAFF area. Also, the share of households clearing land is significantly higher in the MOE area. Most of the clearings in the MAFF area happened before 2003, which was the year stricter law enforcement was introduced in the MAFF area.
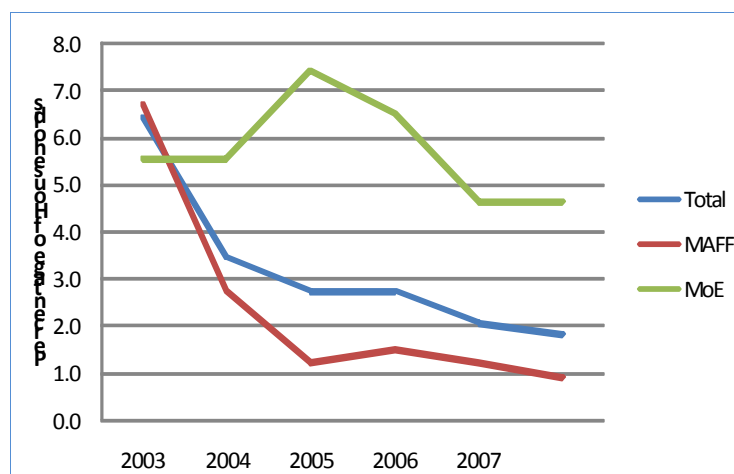
Figure 6.2   Share of households that cleared a patch of forest within the last five years.

When local people clear land, they do it out of necessity, because they are poor and because they need to sustain their livelihood. This survival strategy is confirmed by the fact that it is mainly the poorest fraction of the population that are clearing land. Therefore, the restricted forest use has primarily affected the poorer natural resource dependent communities. More than half of the population feel that the forest restriction has affected their livelihood negatively. Many locals feel unfairly treated by the law and share mistrust towards the government and Wildlife Alliance. Several villagers expressed frustration about the fact that there is no law stopping businessmen from clearing forest while local people are punished for it, echoing the harsh reality of elitism and unfair treatment of the poor. Another factor contributing to frustration is the blurred distinction between collecting forest products for own consumption (which is legal) and for commercial purposes (illegal).

6.3   Willingness to accept

Next, economic valuation methods were used to reveal the value of the forest local people attach to it, and find out if local people are in need of any type of compensation for the restricted forest use. The survey revealed a willingness to accept (WTA) of restricted use of forest ranging from US$100 to US$2,000 per household with an average annual WTA of US$656 and a median of US$600. Several variables proved to influence the level of WTA, such as the start bid presented to the respondent, forest dependency of the household, importance of selling forest products, household size, and the type of compensation preferred for a restricted forest use. The WTA level seems to be quite high compared to the average annual income of around US$700. However, in reality the household income is much higher because a high proportion of forest resources are used for domestic purpose, and the value of these are therefore not included in the income. In fact, the high WTA is also an indication of forest products being an important source of income. The literature shows that household collecting forest products can gain between US$280 and US$345 per year. The high inflation during the last year could have easily increased this number further. The importance of forest products as an income gene-rating asset is further emphasised by the fact that people *selling* collected forest products are found to have a significantly higher WTA than people collecting for domestic use.

Because the analysis clearly shows that local people's welfare is affected by forest use restrictions, some form of compensation is required. Figure 6.3 shows the preferred type of compensation indicated by local people. Land is the most desired type of compensation, followed by cash and agricultural machine. However, considerable differences exist between the communes. Land compensation is especially preferred by communities with a high degree of people without land titles, high population density and a high level of influx. Communities with a high degree of forest clearing prefer agricultural machines, indicating that this technical support helps them to improve land cultivation and prevents them from additional forest clearing.
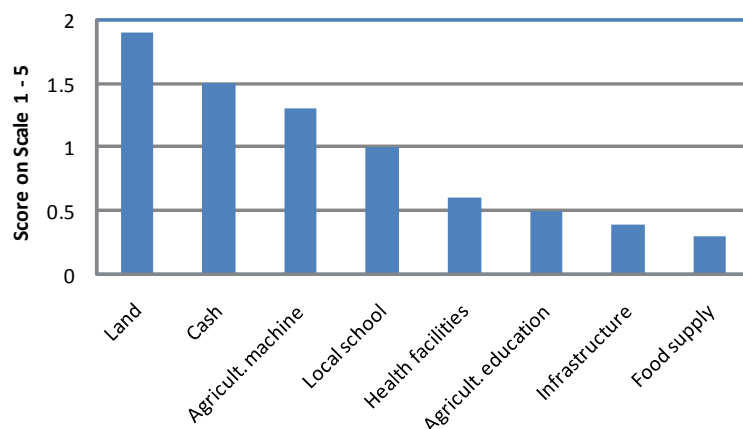

Figure 6.3   Preferred compensation for restricted forest use on a scale from 1 to 5.

6.4   Socio-economic challenges

The socio-economic assessment shows that local people in the Southern Cardamoms are dependent on natural resources, especially land and forest products. REDD activities will inevitably restrict these livelihood sources for local people, and compensating people in some form is therefore highly advisable. The local people in the Southern Cardamom have already been living under strict forest control during the last five years. This is a plus for the REDD project in the sense that the enforcement system is set-up and that it is already proven that the enforcement is reducing deforestation. But it is also a drawback that only little has been done to date to assist local people. This has resulted in a negative attitude towards Wildlife Alliance. To secure real low-risk emission reductions, it is of utmost importance that local people and their needs are in focus and that the short-term solution of enforcement is combined with long-term assistance to create alternative livelihoods and assure that local people are direct beneficiaries of forest protection. However, when considering compensation measures, it should be noted that the stated compensation by local people is quite high and considerably influenced by what is offered. Therefore, care must be taken when designing compensation schemes so that a balance is found between what compensation is acceptable for locals to reduce deforestation and what is affordable considering the financial carbon benefits.

REDD in the Southern Cardamom Ecosystem

7. Recommendations

In this section the necessary steps towards verification will be presented. Regarding the two available standards, the VCS standard is generally more demanding from the carbon accounting point of view and the more technical issues, while the CCBS is more demanding in project design and co-benefits for biodiversity and communities. Both standards have their differences, but also overlap in many circumstances and complement each other. While not crucial, a combination of the standards will make the carbon credits more robust, attracting more buyers and thus generate a higher price. There are a number of core actions that need to be undertaken for the project to qualify for the recognised standards. A general approach that will fulfil the carbon requirements of both VCS and CCBA will be given, assuring real and quantifiable emission reductions. This will be combined with recommendations on how to create a successful project that ensures benefits not only for the environment but also for local communities.

1. *Define the boundaries of the REDD project. This includes spatial boundaries, temporal boundaries and carbon pools.*

The spatial boundaries include: the project area, the reference region, and the leakage belt. The MAFF area should be established as the REDD project area. The reference region should be 5-7 times the size of the project area so must encompass the surrounding provinces. The leakage belt shall form a larger perimeter around the project area and include all areas where "without" project activities are likely to be shifted.

The temporal boundaries include; the historical reference period, the start date and end date of the project activity, the start date and end date of the crediting period, and the monitoring period. The historical reference period shall go back 10-15 years from present. The project start date should be as soon as possible since project activities are already underway. The project end date is optional, but can be no less than 20 years and no more than 100 years. The crediting and monitoring periods need to be further assessed to see which timeframe is most efficient.

Regarding carbon pools, the project is free to choose from the 5 pools mentioned in chapter 4 (see main report). The aboveground biomass is the only mandatory carbon pool, and the belowground biomass is recommended. While the remaining carbon pools will increase carbon stock, there is a trade-off between how much benefits they will provide and increase in costs of measurement. Therefore, it is recommended that only above- and belowground biomass is considered for project start-up.

2. *Analyse the historical land-use and land-cover change in the project area, reference region, and leakage belt over the defined historical reference period.*

To fulfil this requirement, GIS maps should be produced over the defined historical reference period for at least three points in time, 3-5 years apart. These maps will give vital information on deforestation trends and land-use/land cover-change needed for the establishment of a credible "without" project scenario and for future monitoring and adjustment of the "without" project scenario. The most recent map should be as close to

the project start date as possible. The BioCarbon Fund (2008) and Brown *et al.* (2007) provide guidance on how to produce these maps, and what standards should be followed.

3. *Analyse the agents, drivers and underlying causes of deforestation.*

The agents, drivers and underlying causes of deforestation in the project area are varied, overlapping and complex. Analysing these will help to estimate the quantity and location of deforestation and help design effective measures to combat against them. As Wildlife Alliance has been operating in the project area since 2002 they already have a good understanding of the dynamics of deforestation in the region. The BioCarbon Fund (2008) provides guidance and methodology for this analysis based on earlier work by Angelsen and Kaimowitz (1999) and Chomitz *et al.* (2006). While this report provides a basis for the analysis, it is recommended that further research is done to uncover how agents and drivers of deforestation are targeted effectively.

4. *Establish the deforestation rate "without" project.*

There are two approaches to establish the "without" project emission rate: the Linear Approach and the Modelling Approach. It is recommended to adopt the modelling approach as conditions within the project area are expected to change in the future. This approach relies on information gathered on the key drivers of deforestation and on land use/land use change observations made in the reference region over the historical reference period. This information can then be used as input for a spatial deforestation model. Geomod is a model that has been routinely used to establish "without" project deforestation for other similar projects (Pontius and Chen 2006).

5. *Increase the accuracy of carbon estimates.*

The carbon density estimate in study was limited by assumptions and aggregated data. Although the core carbon density data from Top *et al.* was most suitable, they may not truly reflect the carbon densities of the forest within the project area. Additionally, the forest disturbance model was designed to give the carbon estimate a more realistic and conservative figure, but it too is constrained by high levels of uncertainty. It is therefore recommended that a more detailed study be undertaken to produce more accurate carbon density estimates for the different strata of forest cover.

Estimations can be made using existing forest inventory data. The presence of logging concessions operating in the region in the past may well have produced inventoried forest stand or stock tables. Archard (2008) describes methods of estimating carbon stocks using these data sources. If however, there is no inventory data available, or that the data proves to be insufficient or unreliable, carbon densities can be measured by establishing sampling plots and measuring tree diameter at breast height (dbh). Methods of procedures for this are well established and can be found by referring to BioCarbon Fund (2008) or MacDicken (1997).

It should be noted that literature estimates can be used to attain validation from the carbon standards but the estimates used must adhere to conservative principles. This will be the most cost effective option in the short term but will more than likely underestimate carbon densities and therefore the overall carbon benefits.

6. Secure a successful environmental and equitable project

To secure environmental benefits, a REDD project must ensure real emission reductions. This is only done by assuring that the project is additional, that leakage and non-permanence are minimised and that the agents and drivers of deforestation in the region are addressed effectively. The first step is to prove additionality by passing an accepted additionality test. The most widely accepted additionality test for forestry projects is that of the CDM. The VCS (2007) provide alternative additionality tests that may also be considered. Leakage and non-permanence are closely related and minimising their effects will largely depend on the degree to which the agents and drivers of deforestation are addressed. There are a number of key issues identified in the institutional and socio-economic assessment, that need special attention to ensure that emission reduction are maximised and the effect of leakage and non-permanence minimised.

First of all, it should be recognised that it is the local communities that will bear the costs of reducing deforestation, and it is therefore important that the measures to support them are implemented early on. The main areas that should be in focus to assure a successful project are:

- FA and Wildlife Alliance should assist locals in securing land tenure;

- Development of a comprehensive alternative livelihood program covering the entire project area (beyond the three communities mentioned in the Master Plan);

- A financial plan should be developed defining the allocation of carbon benefits to the different parts of resource dependent communities;

- Ensure local user rights to forest resources are upheld. This should include a clear definition of what can legally be utilised from the forest, and local people should be made aware of these limitations;

- Communities should be made aware of REDD activities ensuring project transparency and made aware of benefit of protecting the forest to them;

- Set-up of community council who can participate in decision making surrounding REDD development and implementation as well as benefit distribution.

Second, the contractual agreements are of utmost importance. The REDD agreement with the Cambodian government could follow suit to the pilot REDD project established in Oddar Meanchey (RGC 2008a). As owners of the forest carbon, the RGC Forestry Administration should be designated the suppliers/sellers of carbon credits. Regarding the revenues generated from selling carbon credits, it should be made clear how these benefits are distributed among the stakeholders, and the Memorandum of Understanding should include provisions for benefits to be returned to local communities participating in the REDD project. Finally, it is also recommended that Wildlife Alliance work closer with the government/FA, as well as other NGO's involved in REDD projects in the region. For example, Wildlife Alliance could share map expenses with Conservation International, who are initiating a REDD project in the Central Cardamoms. Working together may not only increase interest in the REDD project but also induce innovation, reduce leakage and lower transaction costs.

References

Aruna (2008). *Southern Coastal Cardamoms (SCC) – Forest Cover Change Study 1991-2005*. Aruna Technologies, Phnom Penh, Cambodia.

BioCarbon Fund (2008). Methodology for Estimating Reductions of GHG emissions from Mosaic Deforestation. RED-NM-001, version 01, 4th of July 2008, Washington DC.

Brown, P., Livernash, R. & Cabarle, B. (1997b). *Carbon Counts: Estimating Climate Change mitigation in Forestry Projects*. World Resources Institute, Washington DC.

Cairns, M.A., Brown, S., Helmer, E.H. & Baumgardner, G.A. (1997). Root biomass allocation in the world's upland forests. *Oecologia, 111*, 1-11.

Chomitz, K.M. (2006). *At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests*. World Bank, Washington D.C.

EcoSecurities (2007). *Policy Brief: REDD Policy Scenarios and Carbon Markets*. EcoSecurities, Oxford, UK. Available at: www.ecosecurities.com.

Forestry Administration (2007). *The Southern Cardamom Forest Management Plan for Sustainable Development.* Forestry Administration, Wildlife Protection Office.

Forestry Administration (2008a). *Cambodia Forest Cover – Forest Cover Map Change 2002-2006*. Forestry Administration, Government of Cambodia, Phnom Penh, Cambodia.

Forestry Administration (2008b). *Country Paper on Forestry Outlook 2020*. Forestry Administration, Royal Government of Cambodia, June 2008.

Grogan, K., Hansfort, S.L., Beukering, P.J.H. van & Leeuw, K. van der (2009). *Reduced Emission from Deforestation and Degradation in the Southern Cardamom Ecosystem, Cambodia*. IVM Report (R-09/11). Institute for Environmental Studies, VU University, Amsterdam.

Hamilton, K., M. Sjardin, T. Marcello, G. Xu (2008). *Forging a Frontier – State of the Voluntary Carbon Markets 2008*. Ecosystem Market Place & New Carbon Finance, 8th of May 2008.

IFSR (2004). The Forest Sector in Cambodia. Cambodia Independent Forest Sector. Independent Forest Sector Review (IFSR). Available at: http://www.cambodia-forest-sector.net/.

Lasco, R.D. (2001). Carbon Budgets of Forest Ecosystems in Southeast Asia Following Disturbance and Restoration. In Canadell, J. (2001), *Land Use Change and the Terrestrial Carbon Cycle in Asia.*

MacDicken (1997). Project Specific Monitoring and Verification: State of the Art and Challenges. *Mitigation and Adaptation Strategies for Global Change, 2*(2-3), 191-202(12).

RGC (2002b). *Statement of the Royal Government on National Forest Sector Policy, Forestry Administration*. Royal Government of Cambodia (RGC), 126th of July 2002. Available at: http://www.forestry.gov.kh/Law/ForestPolicy.html.

RGC (2008a). *Support on Forestry Carbon Credit Project in the Kingdom of Cambodia*. Response letter to request from Community Forestry International, the 26th of May 2008, Phnom Penh, Cambodia.

Top, N, Mizoue, N., Ito, S., Kai, S., Nakao, T. & Ty, S. (2006). Re-assessment of woodfuel supply and demand relationships in Kampong Thom Province, Cambodia. *Biomass and Bioenergy, 30*(2); 134-143.

UN (2008). Cambodia's Economic Growth Expected to Reach 7.3% , 3rd of March 2008. http://www.un.int/cambodia/Bulletin_Files/March08/Cambodia_Economic.pdf.

UNFCCC (2001). *COP-7: The Marrakech accords*. (Bonn, Germany: UNFCCC Secretariat) available at http://www.unfccc.int.

UNFCCC (2007). *Procedures to Demonstrate the Eligibility of Lands for Afforestation and Reforestation CDM project Activities*. EB 35, Annex 18, CDM – Executive Board, UNFCCC. Available at: http://cdm.unfccc.int/EB/035/eb35_repan18.pdf.

UNFCCC (2008). Reducing emissions from deforestation in developing countries: approaches to stimulate action. GE.08-71309. Available at: http://unfccc.int/resource/docs/2008/sbsta/eng/l23.pdf.

VCS (2007). *Voluntary Carbon Standard – Guidance for Agriculture, Forestry and other Land Use Projects*. Voluntary Carbon Standard, 19th of November 2007. Available at: http://www.v-c-s.org/docs/AFOLU%20Guidance%20Document.pdf.

Wildlife Alliance (2008). *The Southern Cardamom Master Plan for Conservation and Development – DRAFT*. Wildlife Alliance, Phnom Penh, Cambodia, 11th of February 2008.