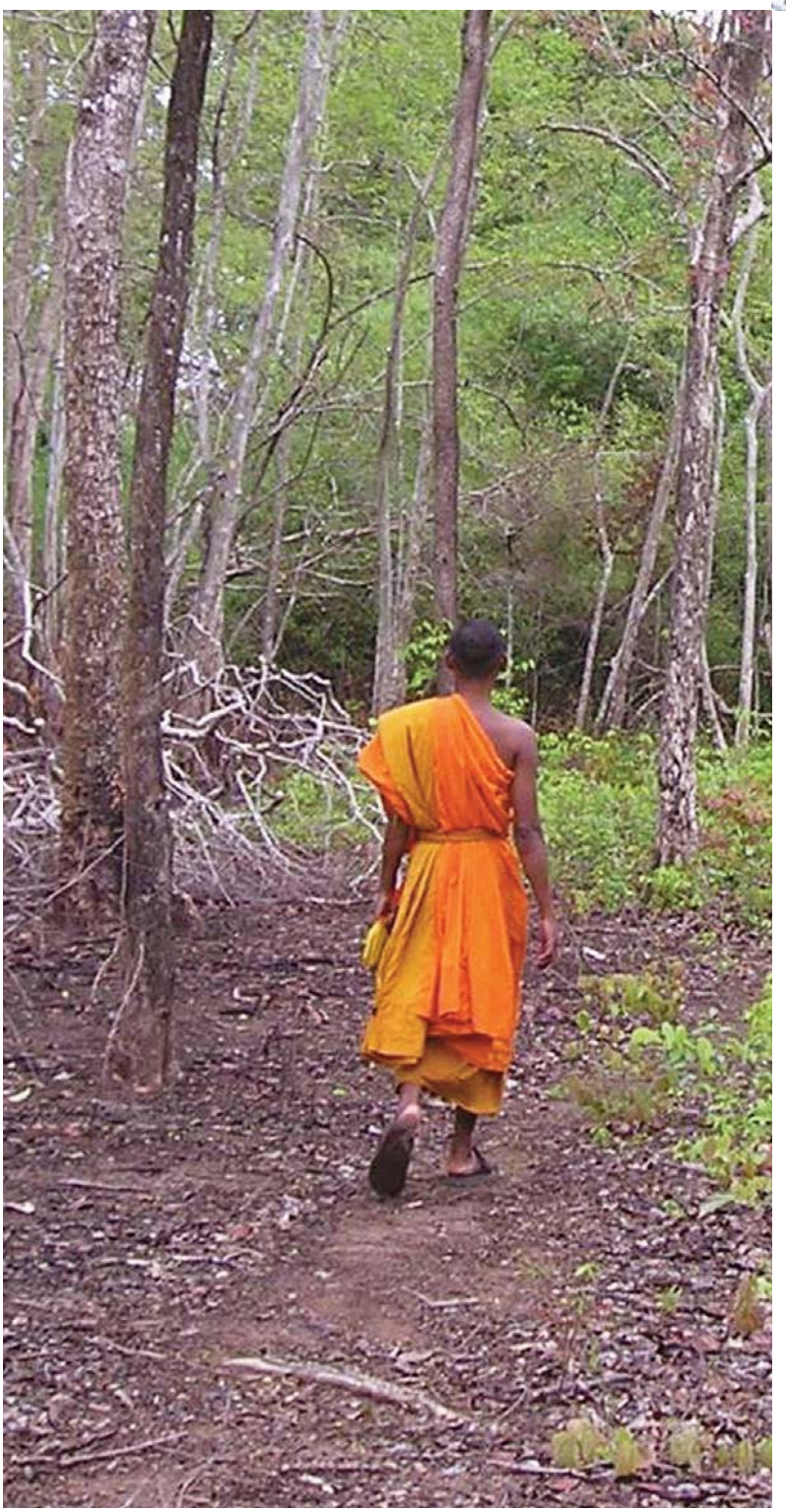

# DESIGNING COLLABORATIVE REDD PROJECTS

## A CASE STUDY FROM ODDAR MEANCHEY PROVINCE, CAMBODIA

Mark Poffenberger, Ph.D.
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Foreword by His Excellency Ty Sokhun,
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Community Forestry
INTERNATIONAL

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# EXECUTIVE SUMMARY

THE ROYAL GOVERNMENT OF CAMBODIA and the Forestry Administration, along with Community Forestry International and Terra Global Capital, have designed the first Cambodian REDD (Reducing Emissions from Deforestation and Degradation) carbon offset credit project. The project involves thirteen community forestry (CF) groups, comprised of fifty-eight villages, which protect 67,783 hectares of forestland in the northwestern province of Oddar Meanchey. This initiative will be one of the first to use a new methodology for submission under the Voluntary Carbon Standard (VCS), combined with the Climate Community and Biodiversity Alliance (CCBA) standards. It is expected to sequester 7.1 million metric tons of CO2 over thirty years[1], while reducing poverty among approximately ten thousand participating households, thereby demonstrating how developing countries can generate income from the carbon markets for the rural poor and positively impact climate change.

***Why was Oddar Meanchey selected?*** Oddar Meanchey Province provides an ideal site for developing a REDD project. The province's forests have been under intense pressure from commercial and illegal loggers, forest fire, economic land concessions and encroachment, losing 2.1 percent of its forests each year from 2002 to 2006. A growing number of communities in the province have been protecting the remaining natural forests as CF areas, including some of the largest community forests in the country. REDD project sites include larger tracts of healthy closed-canopy forests, as well as degraded forests suitable for restoration.

***What are the expected benefits?*** This project supports sustainable forest management and livelihood development in Oddar Meanchey Province by providing financing through carbon credits generated through forest protection. The REDD strategy not only assists rural people to gain legal tenure rights over local forests, it also creates a thirty-year income stream that will significantly enhance household livelihoods and natural resource management capacity. The project seeks to retain and increase carbon stocks in these areas, enhancing the hydrology in the upland watersheds of the Tonle Sap Basin, as well as conserving endangered biodiversity. Carbon financing will be used to support rural communities in developing a range of livelihood activities, including nontimber forest product enterprises, community-based ecotourism infrastructure, and water resource development. Participating forest communities will work with the Forestry Administration and commune, district, and provincial government to formulate long-term plans for sustainable natural resource management to foster economic growth.

***What is the commitment of the government of Cambodia?*** In May 2008, the project was officially endorsed by Samdech Prime Minister Hun Sen through Sar Chor Nor No. 699. The guiding principles ensure that carbon revenues are used to (1) improve forest quality, (2) provide maximum benefits to local communities that participate in project activities, and (3) identify new REDD projects in Cambodia. The Sar Chor Nor No. 699 confirms the high-level commitment of the Royal Government of Cambodia to make the project a success and use its revenues effectively. The success of the Oddar Meanchey project will open the door for long-

1. This is subject to change upon comments from VCS-accredited verifiers.

term financing for Cambodia's national community forestry program, which could eventually encompass and protect over two million hectares of forest, and conform to the government's stated goals under the Rectangular Development Strategy.

***What do avoided deforestation projects consist of?*** This initiative is based on a new framework called REDD (Reducing Emissions from Deforestation and Degradation), which received international support at the thirteenth Conference of the Parties to the United Nations Framework Convention on Climate Change (Decision CP.13) COP 13 in Bali, Indonesia, in December 2007. Under REDD, developed countries provide payments to compensate developing nations for forests that are sustainably managed. Currently, these payments are available through Voluntary Emissions Reduction markets. After 2012, a post-Kyoto agreement may see payments available through the official CDM (Clean Development Mechanism) market as well. REDD is a new approach to climate mitigation which gives greater recognition to the importance of protecting and sustainably managing tropical forest resources in developing countries. It is estimated that 17 percent of global CO2 emissions originate from the loss of forests associated with land use and land cover changes.

***What is the project strategy that is followed?*** Mobilizing communities to protect forests is already proving to be effective in halting deforestation and degradation in CF areas. Key activities supported under the project include:

- Strengthening CF groups, including the formulation and adoption of management resolution
- Networking with FA field staff and neighboring villages
- Raising awareness regarding the REDD project and REDD activities
- Strengthening community forest-tenure rights through management agreements, mapping, and boundary demarcation
- Saving fuel wood through the introduction of improved cooking stoves
- Controlling fire through fire line construction, fuel load reduction, and fire brigades
- Halting illegal logging through volunteer patrols and forest watchers
- Building stronger coordination with commune, district, and provincial representatives
- Creating financial incentives for successful protection
- Developing annual carbon stock monitoring systems
- Focusing on agricultural intensification

***How will degraded forests be regenerated?*** This REDD project provides assisted natural regeneration (ANR) activities involving all participating CF management committees (CFMCs) to restore their degraded forests through silvicultural treatments, including multiple shoot cutting, clearing around seedlings, enrichment planting, water harvesting, and other methods. ANR activities would be based on CFMC management plans, providing employment opportunities, materials, and funding to CFMC operations. Increases in carbon stocks in regenerating forests would provide additional income into commune and community funds that could be used for livelihood and infrastructure development activities.

# ACKNOWLEDGEMENTS

**THIS PROJECT WAS INSPIRED** by the communities of Oddar Meanchey Province that began protecting threatened forests over the past five years and to local FA staff, Buddhist monks, and local NGOs that supported their efforts. This pioneering REDD project would not have been possible without the support of His Excellency Ty Sokhun, chief of the Forestry Administration, Royal Government of Cambodia, who saw the potential of forest climate projects as a means to address poverty and support the national community forestry program.

The project is indebted to DANIDA, DFID, NZAID, and the Technical Working Group on Forests and Environment for their support, including Dr. Andrew Wardell, the co-chairman at that time. The project was also facilitated by support to CFI from the John D. and Catherine T. MacArthur Foundation, with special thanks to David Hulse and Chris Holtz. The William J. Clinton Foundation has also provided support under the Clinton Climate Change Initiative-Forestry. We appreciate Pact's interest in the project and in supporting any future development.

We thank Long Ratanakoma, deputy chief of the Community Forestry Office of the Forestry Administration, who has played an important role in guiding the development of the project. We are also grateful to the FA staff of the Siem Reap Cantonment and to Sona Long, formerly the OM provincial officer for the development of carbon offset credit projects with CFI, and now senior carbon program officer at Pact. Sona guided much of the fieldwork, including the forest plot inventory. Amanda Bradley, formerly country director of Community Forestry International in Cambodia. Ms. Bradley played a key role in the social appraisal and community capacity-building process for the project during the design phase, as well as coordinating activities with the Forestry Administration. In addition, we thank Kate Smith-Hannsen, CFI administrative director, for her invaluable editorial and organizational guidance. Finally, this project would not have been possible without the help of all of those above who have attempted to pioneer REDD project development in Cambodia.

# FOREWORD

Climate change is the defining challenge facing the world. Tropical deforestation continues to be a major source of greenhouse gas emissions, particularly in developing countries. The inclusion of forestry projects in the international compliance market has been dogged by political and technical delays. Concerns have centered on the potential for "leakage" and "permanence." Nevertheless, the Bali Road Map, agreed in December 2007, called on governments and civil society to take early action by including activities that reduce emissions from deforestation and degradation. REDD demonstration activities often start at a project or sub-national scale while progressively working towards national-level carbon accounting. New standards and initiatives that support the environmental integrity of the voluntary carbon market were introduced in 2007–08. A key risk in designing REDD demonstration projects with a narrow focus on climate change is that this may continue to reward poor governance and do little to alleviate poverty.

The Royal Government of Cambodia (RGC) has shown a strong interest in REDD which is seen as an effective mechanism to channel financing in support of national sustainable forest management efforts. The RGC, under the enabling leadership of Samdech Akka Moha Sena Padei Techo Hun Sen, shares the global concerns and has committed itself to addressing the challenges of climate change through win-win solutions. Cambodia fully supports the inclusion of REDD in a post-Kyoto climate regime. The Prime Minister has addressed clearly that ***we must protect our forest, by not only stopping logging for export, but protecting the forest for selling carbon credit and using these revenues for better forest management and rural poverty alleviation.*** The RGC has increased its efforts to reduce deforestation, create new forests and promoting forest carbon markets by assigning its Forestry Administration as the agency for selling forest carbon credits. In this connection, the Forestry Administration has undertaken a comprehensive forestry reform agenda to reverse deforestation and forest degradation through the National Forest Program (NFP) process, including REDD demonstration projects.

The importance of forests in climate mitigation also needs to be balanced by the need to ensure the effective participation of forest-dependent communities in developing sustainable REDD forest management and conservation initiatives. If forest-dependent communities do not directly benefit from REDD then they are unlikely to support it, and without such support many projects would not be able to proceed (and indeed should not). Past forest management systems have not contributed sufficiently to these broader policy objectives.

The Forestry Administration, together with Community Forestry International and other partners, has developed one of the world's first avoided deforestation projects in Oddar Meanchey Province with the goal of generating, registering and selling forest carbon credits. The project involves thirteen community forestry groups, covering fifty-eight villages, and will protect and manage approximately 67,783 hectares of forestland. The project has included the development of a new REDD mosaic deforestation methodology and Project Document for a bundled' community forestry project currently subject to third party validation using the Voluntary Carbon Standard (VCS), and the Climate, Community Biodiversity Alliance (CCB) Standards respectively. The project is expected to sequester 7.1 million metric tons of $CO_2$ over thirty years. The initiative aims to provide long-

term sustainable financing through the voluntary carbon market to prevent deforestation and forest degradation with maximum benefits flowing to local communities in order to improve livelihoods and ensure the sustainable management of Cambodia's forests.

This case study provides a detailed overview of the complex process of developing the Oddar Meanchey REDD project since the idea was first presented to the Technical Working Group on Forestry and Environment on 12 November 2007 by Community Forestry International. The case study is a welcome addition to the burgeoning literature on REDD. It provides some important lessons learned which will guide the design and development of other REDD projects in Cambodia, and perhaps the region. The development of nested and scaled-up approaches to REDD activities is necessary to demonstrate the multiple climatic, conservation and human development benefits for the following key reasons:

- Worldwide 240 million people live in, or are dependent on forest areas in developing countries of whom 60 million are indigenous peoples;
- Deforestation is the second largest source of anthropogenic $CO_2$ emissions after fossil fuel combustion (approximately 18 percent of total greenhouse gas emissions);
- REDD is a relatively low-cost mitigation option that would lower the economic costs for achieving global emissions reductions—it is a quickest and highly cost-effective way to reduce carbon dioxide emissions;
- Reducing deforestation rates by half by 2050 and maintaining these reductions thereafter would contribute up to 12 percent of the total emission reductions required to stabilize atmospheric $CO_2$ levels at 450 parts per million (ppm) through 2100 and encourage deeper emissions targets elsewhere to achieve UNFCCC's objectives;
- The carbon mitigation benefits of REDD over the short term exceed the benefits from afforestation and reforestation;
- REDD could encourage deeper emissions targets to achieve the UNFCCC's objectives of stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system;
- REDD+ could assist in promoting accountable and transparent forest governance, secure and equitable forest tenure and sustainable livelihoods for poor and vulnerable rural communities.

Carbon markets, both regulated and voluntary have grown rapidly and offer opportunities for new investment in rural areas of the Asia-Pacific region. Credits generated from compliance-based markets have the largest demand for regulated emitters and thus tend to attract a higher carbon price. It is now widely acknowledged that if dangerous climate change is to be avoided, reductions of emissions from deforestation must be a core component of the post-2012 climate regime. In addition, the United States, which has yet to participate in regulated climate change actions, has significant potential to influence demand for REDD activities as a mitigation option given the recent passing of the Waxman-Markey Bill in the lower house of Congress.

The extent to which REDD will result in either positive or negative outcomes for tropical forests, forest-dependent communities, national and subnational governments, and the world's

climatic conditions will depend on a number of critical issues, notably:

1. The international and national architecture of REDD including the modalities of the international financing mechanism(s), the levels at which carbon accounting take place, the reference scenarios used, the national distribution mechanisms of net REDD revenues and the question of who carries the burdens of risk and liability.
2. The practical mitigation options under REDD i.e. encompassing both avoided deforestation and forest degradation and the positive enhancement of forests through afforestation/reforestation, sustainable forest management as well as forest restoration and rehabilitation. A REDD approach would also create greater opportunities for linking to existing national community forestry/ participatory forest management efforts.
3. The national-level policies and institutional measures required to ensure an effective and pro-poor REDD approach including more fundamental reviews and revisions of existing forest and agricultural sector policies and governance frameworks, as well as the ability to strengthen cross-sectoral approaches to address the underlying drivers of deforestation.

The Oddar Meanchey REDD project case study has provided the Forestry Administration and its national and international partners with some important lessons learned that will guide and enrich the future development of new projects and a national REDD strategy. This will include the replication of the Oddar Meanchey model in Siem Reap and Kampong Thom Provinces. Cambodia was recently accepted by UN-REDD as an observer and will, during the coming months, prepare a REDD Readiness Roadmap. To this end, we would like to suggest that the following key challenges still need to be considered:

- How can REDD demonstration projects be scaled-up given the current technical and financial barriers of entry for project developers?
- How can the rights and interests of forest-dependent communities be protected in the design and implementation of REDD projects?
- How can REDD offer an equitable share in benefits to poor forest-dependent communities in terms of increased, stable and long-term financial and nonfinancial incentives for behavior change and opportunities to move out of poverty?
- How can the process of developing REDD projects be simplified, costs reduced and lead times shortened?

Despite the significant technical, methodological and policy challenges that still need to be met, it is likely that REDD will represent an important component of the post-2012 climate change agreement. This is supported by the decisions taken at COP-13 and COP-14, the ongoing work by the Subsidiary Body for Scientific and Technological Advice (notably the Ad Hoc Working Group on Long term Cooperative Action), the continued growth in voluntary carbon markets, and the decision on REDD to be introduced to Parties at the forthcoming COP-15. There is no more time to delay; now is the moment to act together. Instead of demanding concessions from others, we must ask how we can contribute to create a better world. A successful deal in Copenhagen will mean more security and greater shared prosperity for everyone.

**TY SOKHUN**, Advisor to the Prime Minister, Delegate of the Royal Government, Chief of the Forestry Administration of Cambodia

**DR. D. ANDREW WARDELL**, Regional Director, Clinton Climate Initiative-S.E.Asia, William J. Clinton Foundation

# TABLE OF CONTENTS

## List of Tables



## List of Figures



## List of Boxes

# LIST OF ACRONYMS

ANR . . . . . Assisted Natural Regeneration
A/R. . . . . Afforestation and Reforestation
CBNRM-LI . . . . Community-based Natural Resource Management Institute
CCI-Forestry. . . Clinton Climate Initiative-Forestry
CDA . . . . . Children's Development Association
CDM . . . . . Clean Development Mechanism
CF . . . . . Community Forestry
CFI . . . . . Community Forestry International
CFMC. . . . . Community Forest Management Committee
CITES . . . . . Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLUP . . . . . Commune Land-Use Planning
COP 15 . . . . . United Nations Climate Change Conference 2009
DANIDA. . . . . Danish International Development Agency
ELC . . . . . Economic Land Concessions
FA. . . . . Forestry Administration of the Royal Government of Cambodia
GIS . . . . . Geographic Information System
GRAS . . . . . Geographic Resource Analysis and Science
MAFF . . . . . Ministry of Agriculture, Forestry, and Fisheries
MOU . . . . . Memorandum of Understanding
NRM. . . . . Natural Resource Management
NTFP . . . . . Nontimber Forest Products
PFE. . . . . Permanent Forest Estate
PLUP . . . . . Participatory Land-Use Planning
PRA . . . . . Participatory Rural Appraisal
REDD . . . . . Reducing Emissions from Deforestation and Forest Degradation
REDD-plus . . . Reducing Emissions from Deforestation and Forest Degradation in Developing Countries; and Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries
RGC . . . . . Royal Government of Cambodia
SPA. . . . . Special Provincial Advisor
TGC . . . . . Terra Global Capital
TWG-FE . . . . . Technical Working Group for Forests and Environment
UNFCCC . . . . . United Nations Framework Convention on Climate Change
VCS . . . . . Voluntary Carbon Standard
VCU . . . . . Voluntary Carbon Unit
VLUP . . . . . Village-level Land-Use Plan

# INTRODUCTION

The Forestry Administration of the Royal Government of Cambodia (RGC), Community Forestry International (CFI), and other NGOs and donor organizations have been working together to develop a national community forestry program in an effort to halt the loss of forest cover and respond to the livelihood requirements of its predominantly poor, rural population. This task involved simultaneously designing a supportive national legal and policy framework, as well as facilitating the emergence of a grassroots forest protection movement. After a decade gaining experience with community forestry pilot projects, the CF Subdecree was approved in 2003 by the RGC after an intensive stakeholder consultation process. This was followed by the promulgation of implementation guidelines and a national CF program in 2006. The establishment of an enabling legal and policy framework at the national level is permitting the formal recognition of an increasing number of CF groups throughout the country. Yet, a major constraint to creating a decentralized, community-based management system for state forestlands is the absence of adequate financing for field staff, training programs, mapping and boundary demarcation, and community-implemented protection and restoration activities. REDD projects represent a potential source of financing for this larger forest management transition, through payments for avoided deforestation and forest restoration.

In November 2007, CFI presented a REDD project design concept for Oddar Meanchey Province to the Forestry Administration and the Technical Working Group on Forests and Environment (TWG-FE), a joint government-donor coordinating group. The initially proposed 60,245 hectares of forestland to be included in the project is located in the northwest corner of the country and is experiencing rapid forest loss. However, rural communities are mobilizing to protect these forests with assistance from local NGOs and Buddhist monks, providing a suitable environment for REDD project design. By developing a pilot project in Oddar Meanchey, the Forestry Administration would be able to conduct a "proof of concept" trial to assess whether this approach to forest management would work in a Cambodian context. Experience from this REDD pilot project would also respond to Decision 13/2 of the UNFCCC taken in Bali. The project received the endorsement from the Forestry Administration and the donor community, and project design work began in January 2008 by CFI, with support from the TWG-FE provided in April 2008 and formal authorization of the project issued by the Council of Ministers in May 2008.

This case study discusses the context in which the project was designed, the types of drivers of deforestation and degradation confronting the project, proposed mitigation activities, the methods and issues involved in carbon modeling, and the financial architecture of the project. Finally, the case study reviews the potential benefits and risks that the project faces as it is implemented over the next thirty years, and reflects on key lessons that emerged during the design phase.

# PART I: SETTING AND OBJECTIVES

**CAMBODIA POSSESSES SOME** of the best remaining lowland and hill forest ecosystems in mainland Southeast Asia. Over the past several decades, these unique environments have come under growing deforestation and degradation pressures. Throughout the 1990s, over 60 percent of Cambodia's forest estate was leased to large timber concessions, with many concessions spanning over 200,000 hectares. The World Bank developed supportive programs to assist the Royal Government of Cambodia (RGC) to guide the concessionaires to manage their leaseholds in a sustainable manner. Nonetheless, the industrial logging strategy incurred mounting criticism by the donor and international community for (1) unsustainable felling, (2) damaging the environment, (3) violating the resource rights of local populations, and (4) failing to generate revenues for the government. As a result, the RGC placed a moratorium on virtually all timber concessions in the late 1990s, canceling the majority of them. This generated a policy question regarding how the public forest estate would be managed in the future. In recent years, large and small social and economic land concessions, timber-bidding coups, and community forestry have emerged as some of the new management paradigms. The national Forestry Administration has sought to create a legal and policy environment for community forestry as a nationwide strategy for conservation and sustainable use of the country's forests.

## Enabling National Policy Environments for REDD

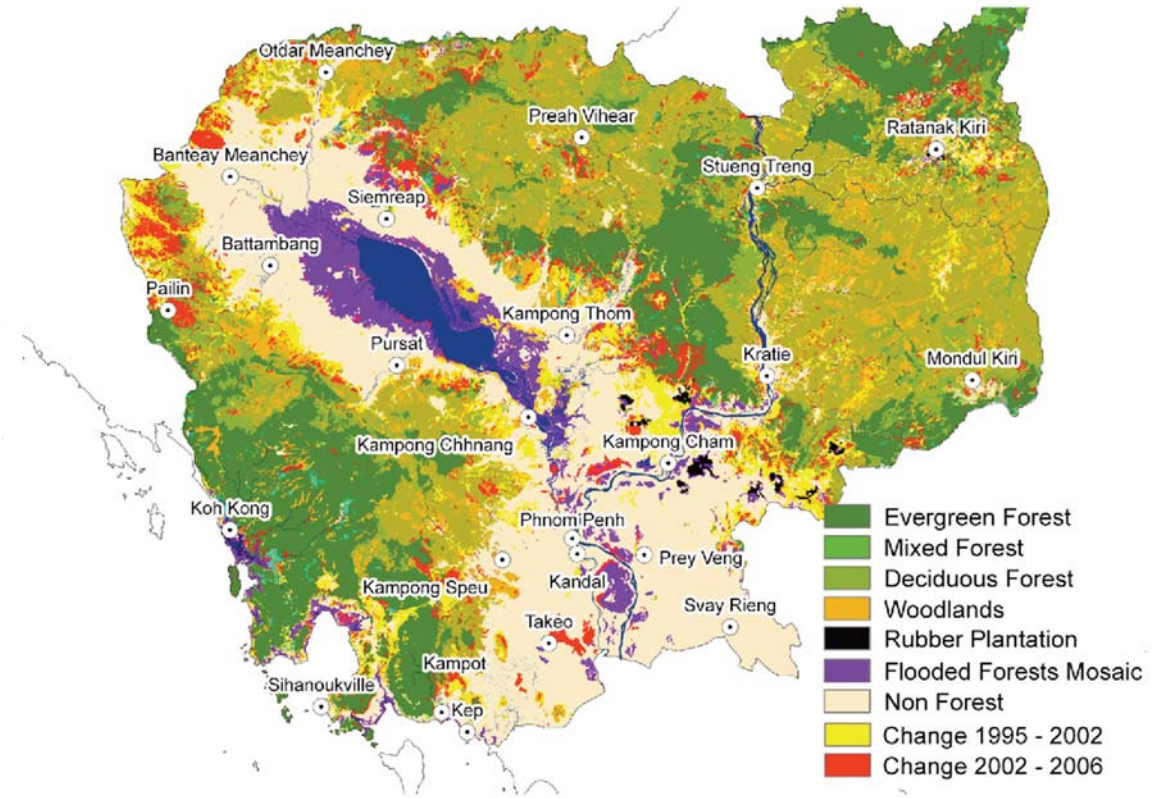
In developing a subnational REDD project supportive of community needs, the project designers recognized a national context that possessed a recent history of deforestation, as well as the need for a legal and policy framework that would support a community-oriented forest initiative. The key challenges in the sector were the need to ensure sustainable management and equitable use of forests, to improve rural livelihoods, and to promote a balanced socioeconomic development in Cambodia. Past forest management systems had not contributed sufficiently to these broad policy objectives.

While community forestry activities have been ongoing in Cambodia since the early 1990s, it is only recently that the first community forestry (CF) sites have received formal recognition under the established legal framework (2002 Forestry Law, 2003 CF Subdecree, 2006 CF Guidelines-Prakas). In terms of law and policy, between 2003 and 2007, CFI assisted the Forestry Administration to finalize its Community Forestry Subdecree (2003), CF Implementation Guidelines (2006), and the National Community Forestry Program Policy Document (2006). Throughout this process, CFI provided legal guidance and facilitated multistakeholder meetings, including input from forest-dependent communities. Over the past five years, the Royal Government of Cambodia has formulated a national law and policy framework supporting the role of communities to manage millions of hectares of state public forestland in the future. The Forestry Administration now has the authority to legally recognize hundreds of existing CF groups through fifteen-year renewable forest stewardship agreements, with

potential for further expansion.

Community-based forest carbon revenues are viewed as an important potential source of financing for the national community forestry program. In exploring this strategy, CFI proposed sparsely populated Oddar Meanchey Province, located in the northwest corner of Cambodia, for a REDD project due to its rapid rate of forest loss over the past decade and the emergence of a grassroots forest protection movement. Recent data from a Danish/RGC project had identified Oddar Meanchey Province as a "hot spot" of deforestation between 1995 and 2006, discovered while conducting a national assessment based on remotely sensed data (see Figure 1). CFI's team maintained strong working relationships with the local Forestry Administration officers in Siem Reap, as well as with communities and local NGOs in the province, and was able to play a facilitating role in linking stakeholders in the collaborative REDD project design process. The capacity to design the project was based on CFI's prior experience assisting forest-dependent communities in Cambodia to map over 200,000 hectares of threatened forests and provide capacity-building support to several hundred community forestry groups across the country.

**Figure 1: Cambodia Forest Cover and Forest Cover Change 1995–2006**

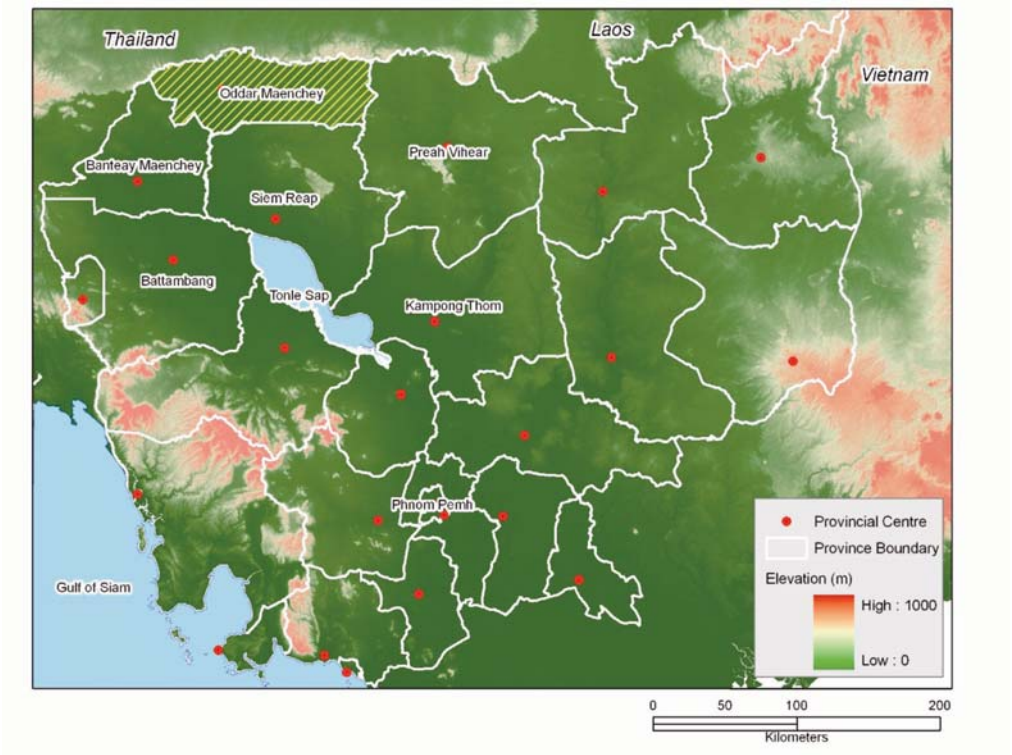



Source: Forestry Administration. 2008. Cambodia Forest Cover: Forest Cover Change Map 2002–2006. (Kingdom of Cambodia: Phnom Penh).

## Oddar Meanchey Province

Located in the northwestern corner of Cambodia, Oddar Meanchey Province has historically been rich in forest resources (latitude 14° 20′ to 13° 8′, longitude 102° 54′ to 104° 43′) (see Figure 2). The terrain in the province is lightly undulating, with sporadic wetland depressions and small hills varying from thirty-to-eighty meters elevation up to the border with Thailand to the north and west, which is characterized by a steep escarpment with higher hills of over four hundred meters. The climate is monsoonal tropical, with the rainy season extending between May and October and the dry season from November to April. Rainfall averages approximately 1300–1500 millimeters per year.

**Figure 2: Oddar Meanchey Province**




Forest loss and degradation are driven by illegal logging, fire, the military, and migrant settlers moving into the region to clear forests for agriculture, as well as by large economic concessions currently developing sugarcane production. In response to growing pressures on local forests, fifty-eight villages in Oddar Meanchey have formed community forestry groups to protect local forests, with the assistance of the Forestry Administration (FA), the Children's Development Association (CDA), the Buddhist Monks of Samraong Pagoda, and Community Forestry International (CFI). This project seeks to reduce deforestation and use carbon finance to support the work of local communities, NGOs, and forestry officials working in the province to stabilize forest cover.

The project site is covered by lowland evergreen, semi-evergreen, and dry deciduous forests. Semi-evergreen forests contain varying percentages of evergreen and deciduous trees, with the percentage of evergreen trees varying from 30 percent to 70 percent. Semi-evergreen forests appear evergreen throughout the year, despite a frequently high proportion of deciduous trees. Deciduous forests are comprised of mixed deciduous forests and dry *Dipterocarpaceae* forests, both of which drop most of their leaves during the dry season. The majority of forests in the plains of the northern provinces are dryland ecosystems. With around 1300 millimeters of rainfall and more than four months of dry conditions, the Oddar Meanchey Province is one of the drier regions in the country. The forests in the region are typically classified according to the proportion of evergreen species. Phat et al. (2002) distinguish three predominant forest types: deciduous (3.8 percent of Cambodian forests), mixed/semi-deciduous (4.3 percent of Cambodian forests), and evergreen (64.9 percent of Cambodian forests). The remaining 26.9 percent of forest area consists of inundated and regrowth forests. Mixed forests have deciduous and evergreen tree species, where deciduous species represent more than 50 percent of the land; deciduous forests usually have only a few evergreen species and are dominated by deciduous trees. Mixed and deciduous forests are predominantly located in the lowland areas ranging in elevation from nine meters above sea level along the shores of Tonle Sap Lake to one hundred meters on the northeastern plain. Evergreen forests are typically multistoried forests where trees maintain their leaves during the whole year. They comprise the lowland tropical rain forests, the hill evergreen forests and dry evergreen forests, and the area along streams and rivers (gallery forests). It is often difficult to distinguish between mixed and deciduous forest types in the forests of Oddar Meanchey Province. Therefore, in the analysis of the carbon stocks, any dryland forest system of which more than 50 percent of the trees are deciduous have been included as part of a combined "mixed and deciduous" forest class. They are widespread east of the Mekong River and north of the Great Lake, at altitudes below five hundred meters, and they develop under drier conditions than evergreen forests.

Deciduous forests are relatively open and have low crown covers. They only exhibit a closed canopy structure during the wet season. They are relatively species-poor (deciduous species are dominated by *Dipterocarps* and a few gregarious species such as *Lagerstroemia* and *Afzelia xylocarpa*, commonly called beng, a high-value deciduous, broad-leaved tree). A number of bamboo species are also present in these forests. In the dry season, this forest type is subject to fires. Although fire is a natural phenomenon in these systems, due to the extremely dry conditions during the dry season, human intervention has exacerbated the incidence of fire. Due to fires, the understory is nearly always sparse and dominated by grasses. One study estimated that the average growing stock varies between 52–60 $m3ha^{-1}$, with annual growth rates of 0.08–0.37 m3 $ha^{-1}$ $yr^{-1}$ (Phat et al. 2002).

The evergreen forests in Oddar Meanchey Province are mainly dryland evergreen forests (in contrast to highland forests or tropical rain forests). They are multistory forests with more than 80 percent of the trees made up of evergreen species, and a canopy cover of 80–90 percent. The average growing stock varies between 192–230 $m3ha^{-1}$ with annual growth rates varying from 0.21–0.67 $m3ha^{-1}$ $yr^{-1}$. (Phat et al. 2000). These floristically and structurally heterogeneous forests occur in humid to subhumid areas where the rainfall exceeds twelve hundred millimeters per year and the

dry season lasts from three to five months. Emergent trees may exceed forty meters in height. They possess cylindrical boles up to twenty meters long, which give the forest a majestic aspect.

Human impact such as fire is usually much higher in deciduous forests compared to other forest types. Dry *Dipterocarpaceae* forests naturally have a more open canopy structure, in contrast to the dense crown closure found in older-growth evergreen forests. Even in an undisturbed deciduous forest, crown cover may only have a 40 percent closure. Approximately 20 percent of the forest in the project area is degraded, containing less than 20 percent canopy closure, especially in areas with dry deciduous forest. Forest degradation has occurred over the past fifteen years, accelerating in the last five years. Annual ground fires contribute to this degradation, as they are common occurrences in the dry deciduous forest.

While historically the population density has been low, with most of the province covered in dense forest, rapid in-migration and forest exploitation that began in the 1990s is transforming Oddar Meanchey's landscape. From 1991 to 1995, Thai timber concessions felled high-value commercial hardwoods, including some in the proposed project sites, initiating a process of degradation that continues today. As hostilities between the Khmer Rouge and government forces subsided in the late 1990s, Oddar Meanchey's forests became a popular destination for migrants from more populated areas of Cambodia. Between 1998 and 2008, the rural population of Oddar Meanchey Province increased from 56,198 to 166,609, representing an annual growth of 9.23 percent. Assuming a natural increase of 3 percent, this data suggests that migrants increased the provincial population by over 6 percent annually during the past decade, representing an additional ten thousand people each year.

Recent analysis of remotely sensed images of Cambodia indicates that deforestation is most rapid in the northwestern parts of the country (see Figure 1). In Oddar Meanchey Province alone, over 38,594 hectares of forest were cleared between 2002 and 2006, representing approximately 8.4 percent of the province's forest area and an annual net forest loss rate of 2.1 percent (see Table 1) (TWG-F&E 2007). This rate is over three times Cambodia's national average deforestation rate of 0.6percent, well exceeding Indonesia's national rate of 1.6 percent per year (FAO 2003). In addition to the area deforested, much of the dry deciduous forests has experienced degradation through illegal logging, partial forest clearing, and fire. During the same four-year period, the amount of barren land in the province increased 27 percent, while the area of "open" forest expanded by 110 percent, representing the deterioration of "dense" forests (see Table 1).

Rural communities in Oddar Meanchey Province are concerned about rapid forest loss, which threatens an important source of non-timber forest products, fuel, timber, and water supplies. Over the past five years a grassroots forest protection movement has emerged in a number of villages in Oddar Meanchey, often encouraged and supported by the Forestry Administration staff, local NGOs, and Buddhist monks. Empowered by the Community Forestry Subdecree (2003), community forestry committees are applying for government approval and support in order to protect remaining evergreen and deciduous forests. Avoided deforesta-

**Table 1: Oddar Meanchey Forest Cover Change: 2002–2006**

| Forest type & condition | Forest cover in 2002 (ha) | Forest cover in 2006 (ha) | % Change | % Annual loss |
|---|---|---|---|---|
| Evergreen forest | 166,935 | 149,119 | -11% | -2.8% |
| Semi-evergreen forest | 71,319 | 55,138 | -23% | -5.8% |
| Deciduous forest | 251,728 | 240,824 | -4% | -1.0% |
| Open forest | 5,743 | 12,050 | 110% | 27.0% |
| Total forest | 495,725 | 457,131 | -8% | -2.1% |
| Barren land | 167,440 | 206,034 | 23% | 5.8% |
| Total land area | 663,165 | 663,165 | 0% | 0.0% |

Source: This data was prepared by the Forestry Administration and GRAS A/S (University of Copenhagen).

tion (REDD) projects provide a framework to finance these community-based initiatives (Kainnien 2006).

## Goals and Benefits

Consistent with the objectives of REDD, a primary goal of this project is to successfully enhance storage and sequestration of carbon in the natural forests of northwest Cambodia under emerging REDD project protocols. This will allow for the assessment of a climate-related payment mechanism for forest conservation. Ancillary goals include supporting the implementation of the national community forestry program, securing long-term tenure rights for forest-dependent communities, responding to rural livelihood needs, conserving biodiversity, and supporting hydrological regimes.

Cambodia has been experiencing a rapid loss of forest area in recent decades, declining from 73 percent of total land area in 1965 to 59 percent in 2006 (FA 2006).[2] This has resulted in an ongoing decline in environmental and socioeconomic services provided by natural forest ecosystems. The forces driving deforestation and forest degradation are operating at different scales, including the international, national, and local levels. For the project to achieve its goals and deliver benefits, it will need to substantially mitigate the impact of these drivers in the project areas. This, in turn, requires a series of actions at different levels of society, including national policies and programs, as well as initiatives at the village, commune, district, and province levels. Proposed specific project activities are discussed in Part III.

The project seeks to explore how new partnerships and alliances between national government planners, forestry agencies, and forest-dependent communities can be formed through REDD project development in order to control multitiered drivers of deforestation. Cambodia was selected as a REDD pilot project site due to the recent formulation of a national community forestry program, with supporting legislation allowing rural communities and the Forestry Administration to legalize management agreements. Endorsement from the Office of the Prime Minister and Council of Ministers provided the political support required to defend the project area from claims by other interest groups. Recognition of the rights of the thirteen CF groups under the community forestry subdecree ensured that the local forest managers

2. Sar. Chor. Nor. No. 699, Council of Ministers, Royal Government of Cambodia, Phnom Penh, May 2008.

would have the legal authority to protect the project area. While a range of additional activities will also be implemented over the next thirty years, the process of clarifying and securing legal control over the project area was considered both a benefit for communities, as well as a key strategic action in protecting forest sinks and sequestration.

**CARBON SINKS AND SEQUESTRATION:** The Oddar Meanchey project is designed to mobilize fifty-eight local communities in thirteen project areas to avoid further deforestation and degradation, as well as facilitate the natural regeneration of 67,783 hectares of local forests. The calculation of the climate benefits is based on a methodology submitted to the VCS. The methodology was developed specifically for this project and assumes that deforestation is of the mosaic type, with an uneven opening of the forest canopy across the landscape. The carbon credits that are generated by the project are comprehensive and contain all sources and sinks of greenhouse gases that the project may affect. For example, the calculation of the carbon credits includes the greenhouse gas (GHG) fluxes from deforestation, forest degradation, and forest regeneration, as well as a quantification of all project activity-related increases in GHG emissions and leakage, secondary emissions due to the project but outside of the project area. The climate benefits of the project are calculated by subtracting the forecasted changes in carbon stocks under the business-as-usual scenario—the baseline carbon stocks—from the true changes in carbon stocks in the project area, adding climate benefits from forest management, and adjusting this value for emissions from project activities and leakage.

Although the volume of voluntary carbon units (VCUs) that the REDD project realizes is estimated beforehand within the project documents (ex ante), this is only a provisional estimate. The actual VCU credits are only issued after they have been realized and demonstrated on the ground, some years after the project has started. Therefore, once the project starts, all activities are carefully logged and recorded. Forest assessments, interviews, and social appraisals must be periodically organized to quantify the adoption rates of the different project activities and their effect on the forest biomass. Note that baseline changes in carbon stocks must be measured and approved ex-ante, before the start of project activities, or before the period during which new REDD credits will be realized, once the project is ongoing.

The deforestation and forest degradation under baseline conditions are predicted using a land use change model, which is calibrated based on a series of historical Landsat satellite images for the reference region, a larger region outside of the project, and leakage areas. Since it is unrealistic to assume that project actions can completely eliminate deforestation, the reduction of deforestation under the project scenario is forecasted by modeling the effect of each project activity on a complex set of deforestation agents and drivers. The project also plans specific forest management activities to increase the carbon stock in existing degraded forests. Examples of such assisted natural regeneration activities include encouraging coppice shoot production, removing invasive species to let native species regenerate, and enrichment planting. Carbon sequestration from these activities is calculated using CDM-approved afforestation/reforestation methodologies. Activity-shifting leakage from local agents of deforestation is monitored and accounted for in the area im-

mediately adjacent to the project areas, the leakage belt. Activity-shifting leakage from nonlocal agents of deforestation and market leakage is accounted for by discounting the final credits with a leakage cancellation factor agreed to by the certifier.

If only avoided deforestation and natural regeneration is included, 7.1 million $MTCO_2$ (metric tons of $CO_2$ equivalents) will be generated over the thirty-year project period. If avoided forest degradation can also be included, around 8.5 million $MTCO_2$ will be generated. Due to methodological issues, it is still unclear whether the extra 1.4 million $MTCO_2$ credits from including avoided forest degradation can be included in the project. The project will develop and demonstrate a carbon finance mechanism to reduce greenhouse gas emissions, contribute to economic and social development, and conserve biodiversity over the next thirty years.

**FOREST TENURE SECURITY AND COMMUNITY LIVELIHOODS:** The project seeks to ensure the land tenure and security of families in project communities and to assist them by increasing employment and livelihood opportunities on a sustainable basis from their natural resources. The project will strengthen community leadership and organizational and financial capacities, improve relationships with local government, help resolve resource conflicts, and educate local communities on forest management and biodiversity. Community bookkeeping and project management skills will be developed as a major goal of the project, while project funds will be used to build capital reserves within the CFMCs. In addition, new microfinance groups will be created to help manage nontimber forest product enterprises. Training, technical support, and funding for forest-based livelihood activities (such as the extraction of nontimber forest products) and the extension and adoption of more productive and sustainable agricultural practices, will also be provided by the project.

**FORESTS AND BIODIVERSITY CONSERVATION:** This project would place under community conservation 67,783 hectares of some of mainland Southeast Asia's last lowland evergreen forests. These endangered forests provide a habitat for some of the region's leopards, jungle cats, gibbons, sun bears, gaur, and other endangered species. Hornbills inhabit the high forests, while migratory cranes visit wetland areas. The project forests are also important in the upper watershed of the Tonle Sap or Great Lake, regulating hydrological flows into one of Asia's largest freshwater aquatic systems. Project revenues would finance community forest patrols, and fire control activities would limit the impact of illegal logging, encroachment into the conservation area, poaching, and forest fire.

This project will contribute to the protection and conservation of Cambodia's endangered flora and fauna in tropical rainforests by supporting the engagement of rural communities as resident managers. Forest regeneration will be facilitated through fire protection and weeding, with enrichment planting of endangered species to increase the quantity and quality of available habitat. Project staff will facilitate community dialogues and provide technical guidance regarding effective practices for conserving flora and fauna. Project communities will also conduct regular monitoring of biodiversity with support from the project staff.

The Oddar Meanchey project has established 183 forest and farm monitoring plots, where inventories will be conducted every two to five years, depending on verification requirements. Data to be checked will include a description of each shrub

and tree species, which will allow for monitoring changes in forest flora over time. A number of community-based monitoring systems for animals and birds have been proposed. Interviews with community leaders and secondary data indicate that the following species are present in the project area: green peafowl, pangolin, long-tailed macaques, wild pigs, sun and moon bears, porcupine, palm civet, leopard, fishing cat, golden cat, banteng, flying fox, bats, dhole, jackal, otters, squirrels, martens, ferret badgers, mongoose, mouse deer, sambar, red muntjac, tree shrews, and slow lorus.

**LONG-TERM GOALS:** At the local level, the project's success depends on strengthening community capacity to protect local forests through legal recognition and technical and financial support. The institutional, logistical, and political support of the Forestry Administration will significantly enhance the effectiveness of community efforts to protect forests. Community-managed assisted natural regeneration and enrichment planting activities are planned to enhance carbon sequestration in degraded forests and reduce soil erosion, while improving forest livelihoods and local employment opportunities. Creating strong institutional and financial incentives that support community involvement in the project should reduce the risk of losing the carbon assets. Through supporting and documenting the role that communities play in forest carbon conservation and sustainable management, CFI seeks to provide "proof of concept" to the Royal Government of Cambodia and to the donor community that will encourage the replication of this strategy under the national CF program. In summary, the long-term goals of this project are to sequester carbon, contribute to the devolution of forest management rights to the poor, alleviate poverty, and demonstrate the viability of utilizing carbon offset credits to finance the national CF program.

H.E. Ty Sokhun, chief of the Forestry Administration, visits project site with Venerable Bun Suluth and villagers in August 2008.

# PART II: STRATEGY

The principle project strategy is to build the capacity of local villages to serve as primary managers of REDD project forests, creating a strong coalition of stakeholders committed to achieving the project goals, by including supporting villagers to improve the quality of forests, maximizing benefits to local communities participating in the project, and studying and developing new REDD projects.[3]

## Identification of Project Locations

The project includes thirteen forest blocks ranging in size from 18,262 hectares to 383 hectares, which are scattered across the central section of Oddar Meanchey Province (see Table 2 and Figure 3). The project was designed to include all existing CF groups and areas in Oddar Meanchey Province. It is anticipated that additional CF groups will be formed during the project period, and efforts will be made to incorporate these forest areas into the REDD project. Protection of the entire project area of 67,783 hectares will be one of the primary activities undertaken by the communities. Scattered patches of degraded forest in specifically demarcated areas with between 10 percent to 20 percent crown cover will be improved using assisted natural regeneration techniques (see Figure 3).

The area was selected for Cambodia's first REDD pilot project for five primary reasons:

- ***History of Deforestation***—Oddar Meanchey Province possesses one of the highest rates of forest loss in Cambodia, exceeding 2 percent per annum between 1995 and 2006. In terms of the historical reference period to be used in establishing a baseline for forest loss, the recent forest loss positions the project to justify a high level of carbon credits, provided the drivers of deforestation can be contained.
- ***Social Capital***—Local forest-dependent communities are concerned about the rapid loss of forests and are already demonstrating a commitment to conserve the area for subsistence use, water, biodiversity, and other functions. Provincial NGOs and Buddhist monks have shown a capacity to work with rural villagers, providing training and managing externally funded project activities. Equally important, these civil society organizations help provide an interface with local government agencies.
- ***Ecological Capital***—The forests in the project area have suffered considerable degradation over the past twenty years; however, much of this has occurred relatively recently. As a consequence, there are vigorous coppicing species, mother trees that can act as seed sources, reasonably good soil conditions, and plentiful rainfall that will allow for rapid regeneration if the forests are well-protected and some silvicultural activities are performed.
- ***Economies of Scale***—The project area was also selected because of its size. With some forest blocks exceeding 18,000 hectares and a total of over 67,000 hectares, the project area has sufficient space to generate adequate carbon credits to cover the costs of project implementation, monitoring, and livelihood activities. "Bundling" the thirteen forest blocks into a single project helped to economize on project design costs. The project also facilitated the formation of a provincial CF federation, enhancing communications among the fifty-eight participating villages.
- ***Logistical Access***—Oddar Meanchey Province is relatively accessible, with new hardtop roads linking many of the project areas. This allows reasonably easy access for project staff, but also opens the area to various drivers, creating greater risks.

3. Letter from the Council of Ministers, Sar. Chor. Nor. No. 699, Council of Ministers, Royal Government of Cambodia, Phnom Penh May 2008.

Oddar Meanchey Province was identified as the larger "Reference Area" for the project for several reasons (see Figure 4). First, it was approximately ten times the size of the project area, a ratio that generally reflects recommendations for REDD project design suggested by the World Bank's Carbon Finance Unit. Secondly, it allows the reference area to reflect a major administrative and governance unit in Cambodia for which substantial secondary data is available. This includes socioeconomic, demographic, and land cover information.

**Table 2: Project Sites and Communities**

| ID | CF group name | Commune | District | No. of villages | No. of households | CF membership percentage* | CF size (ha) |
|---|---|---|---|---|---|---|---|
| 1 | Anndoung Bor | Koksos | Banteay Ampil | 4 | 746 | 91% | 6,114 |
| 2 | Chhouk Meas | Koun Kriel | Samraong | 1 | 166 | 100% | 383 |
| 3 | Dung Beng | Koksos | Banteay Ampil | 4 | 558 | 85% | 1,843 |
| 4 | Ou Yeay Kaov | Koun Kriel | Samraong | 1 | 177 | 88% | 960 |
| 5 | Phaav | Phaav | Trapong Prasat | 4 | 429 | 100% | 2,025 |
| 6 | Prey Srorng | Lumtong | Anlong Veng | 5 | 662 | 71% | 6,344 |
| 7 | Prey Srors | Kouk Khpuos | Bantaey Ampil | 2 | 246 | 97% | 1,604 |
| 8 | Ratanak Ruka | Samraong & KounKriel | Samraong | 16 | 3,072 | 76% | 12,733 |
| 9 | Rolus Thom | Koun Kriel | Samraong | 4 | 906 | n/a | 6,376 |
| 10 | Romdoul Veasna | Bansay Rak | Samraong | 4 | 878 | 88% | 6,007 |
| 11 | Samaky | Trapeang Tav | Anlong Veng | 4 | 686 | 75% | 1,079 |
| 12 | Sangkrous Preychheu | Anlong Veng | Anlong Veng | 3 | 633 | 82% | 4,151 |
| 13 | Sorng Roka Vorn | Koun Krail | Samraong | 6 | 877 | 100% | 18,164 |
| | | | **TOTAL** | 58 | 10,036 | 88% | 67,783 |

*Percentage of households that are members of the community forestry management committee (CFMC)

†Coordinates are in a UTM48N projection with WGS1984 datum

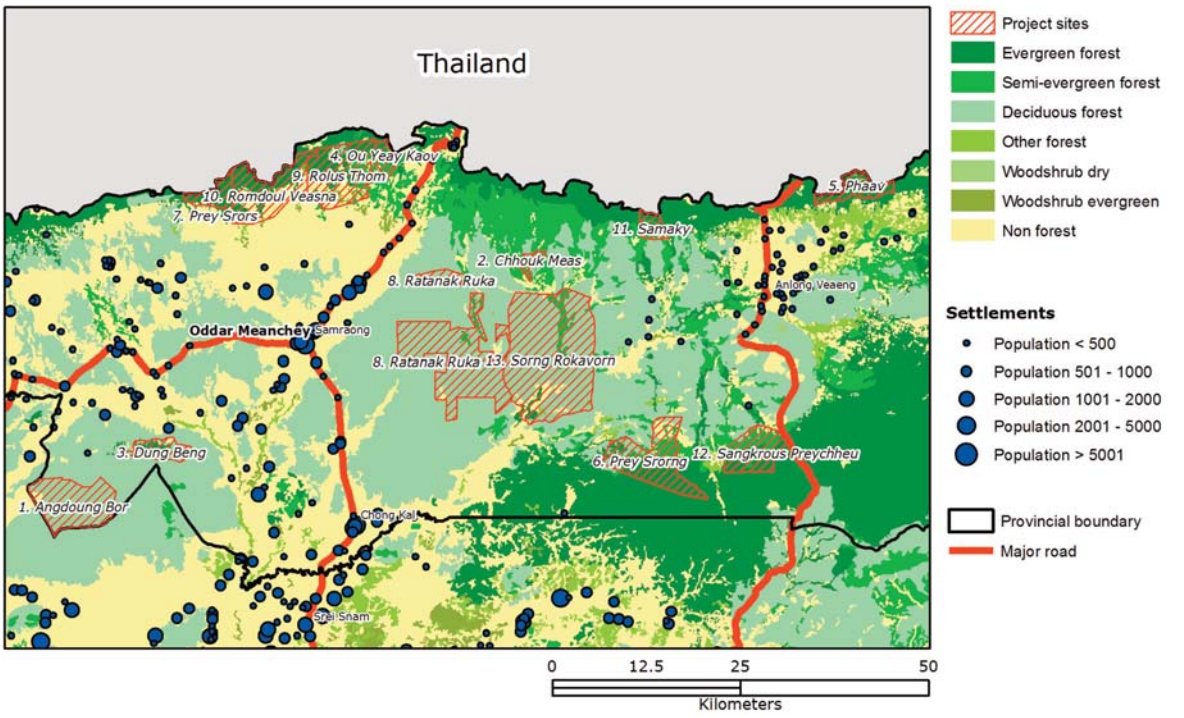
## Project Duration

The project's lifetime is thirty years, excluding the twelve-month project preparation period (year 0) that involves stakeholder consultations, PRAs, mapping, boundary demarcation, community training and initial livelihood activities, and negotiations with the Royal Government of Cambodia, brokers, and buyers. The first five years of the project (i.e., years 1–5) represent the project establishment period, during which time implementation will be managed by an international NGO.

The goal of this period includes:

- Establish project boundaries
- Control drivers of deforestation and degradation in the project areas

Figure 3: Map of Oddar Meanchey Province with the Community Forestry Sites




- Develop community project management institutions
- Build REDD and A/R project development and management capacity in the Forestry Administration
- Regenerate degraded forest lands within the project boundaries
- Institute monitoring and measurement systems for carbon accounting, biodiversity, and livelihood generation

During years 6–30, the project will move into the maintenance period, and management responsibilities will be supported by the project communities, the Forestry Administration, and local NGOs. Net revenues from carbon payments during this period will be used to benefit local communities, enhancing livelihoods and improving the quality of the forest. The project start date is July 1, 2008, ending on June 30, 2043. The accounting period and the project period are contiguous.

The project lifetime was designed to allow sufficient time to:

- Stabilize and conserve threatened forest cover
- Restore degraded forests
- Build enduring community forest management institutions that encourage livelihood activities supporting the long-term conservation of the area

## Understanding Underlying Causes and Identifying Drivers of Deforestation and Forest Degradation

A key to designing effective REDD projects involves an accurate and insightful understanding of the underlying causes of deforestation and degradation (D & D) and the operational drivers and actors. The dynamics of D & D are complex in terms of operational time frames, agents, supporting political and economic factors, scale, and technology. While conversion of forests to other land cover types can be a dramatic and rapid process, as in the case of catastrophic forest fires and industrial forest clearing for plantation crops, it is often a more gradual process, defined by a series of activities. Activities that sequentially degrade the forest may be performed by different actors taking decades, or may occur rapidly. Understanding both the agents of D & D and the forces that support their actions is important for project development, especially in guiding the design of mitigation strategies. It is also important in terms of REDD methodology, as some drivers are beyond the scope of the project actions.

Deforestation and degradation can be distinguished between those that are driven by "market effects" beyond the control of project communities and activities, and those that project activities could impact, resulting in "activity shifting." "It would be good policy to attribute activity shifting to project activities and market effects to government. The methodology justifies this position by noting that projects can control activity shifting through project design, but cannot control market effects and should not be penalized for something that only governments can control through policies and regulations (Pedroni 2007)." The authors go on to note, "Leakage due to market effects is not considered attributable to a project activity in a nested approach context (Pedroni et al. 2007), where national governments should improve policies and regulate markets so as to reduce deforestation and forest degradation."

Without the project, it is likely that deforestation in the province will continue at the current rate over the next decade, slowing gradually as the remaining forests are cleared. Project assessments identified eleven distinct drivers of deforestation and degradation that are operating in the province (see Table 3) (CFI 2008a). The issuance of large economic land concessions, the encroachment of the military, forest clearing for land speculation, and the influx of migrants are the four drivers believed to have the largest impact on forest loss based on field observations. During the 2007 to 2008 period, the Royal Government of Cambodia leased approximately 36,000 hectares of forestland to private companies, representing nearly 6 percent of the province's land area. These concessions are currently being cleared of forest for sugar cane. Without the project, there is a reasonable likelihood that a large proportion of the community forestry project areas would be leased to economic land concessions (ELCs), cleared by land speculators, or claimed by soldiers, migrants, or local communities within the next five years. While Cambodia has passed laws to protect forests (Forestry Law 2002), support biodiversity and conservation (Law on Environmental Protection and Natural Resources Management 1996), and enhance the livelihoods of rural peoples (Community Forestry Subdecree, 2003) (Oberndorf 2006), it has also adopted policies to accelerate economic growth

and encourage private sector investment. In a scenario without REDD, with no carbon credits to act as a financial incentive, the latter forces would likely prevail, resulting in rapid deforestation, biodiversity loss, and social marginalization of rural peoples.

While the FA seeks to achieve the national goal of retaining 60 percent of the country's land area as forest, other government ministries and policy-makers see economic development opportunities in converting the province's forest to uses that might generate revenues for the state and the private sector. To that extent, forest conservation policies may compete with other national goals, including ELC development and additional government programs. The Ministry of Interior, for

### Box 1. Protecting the Forest: Lessons from Sorng Rokavorn CF (Monk's Forest)

The Venerable Bun Saluth at the Pagoda in Samraongis an influential leader of Oddar Meanchey's forest conservation movement and the person who established the Sorng Rokavorn CFor "Monk's Forest." Bun Saluth oversees 130 monks, many of whom are now involved in forest protection activities. Bun Saluth believes that management is improving with increased participation from the surrounding communities. With support from the project, two hundred boundary pillars were installed in 2008 along the northern boundary of the 18,261-hectares CF area. He also secured separate funding for a five-kilometers-long trench that was built at a cost of $1 per meter to prevent illegal logging.

The biggest current threat to the forest is occurring on the southeastern boundary. The problem is made more difficult as the CF area is divided between three districts (Samraong, Chong Kal, and Anlong Veng) with different administrations. According to Bun Saluth, one local commune council is supporting encroachment up to three kilometers into the interior of the Monk's Forest. Villagers are being hired to chop down trees for $100 per hectare by businessmen who seek to claim and resell the forestland. This process started in July 2008. Bun Saluth has tried to form a CFMC in the communities located in the southern section of the CF area where the problems are taking place, but the chief of the commune has been blocking this effort; the chief claims five hundred hectares of forest in the southeast corner. Despite his resistance, a CFMC has been formed and completed all steps for approval and training last month.

There are also problems with illegal logging carried out by soldiers from Samraong. Bun Saluth sent a group of monks to prevent illegal logging, but the soldiers caught the monks and would not release them until Bun Saluth intervened with their commander. Bun Saluth has requested that the FA take action to resolve the conflicts occurring in the southern section of the CF.

The Monk's Forest has some of the best dense evergreen and dry deciduous forests in the project area and, consequently, has high-value biodiversity. The monks have positively identified an adult male and female tiger and cub. There are also bears, deer, wild boar, monkeys, and crocodiles. Poaching, usually done by soldiers, is a problem in the area. A wild boar was recently killed, and the tiger was reported to have been injured. The degraded dry deciduous forest is reported to be rapidly regenerating in a number of areas under protection. Bun Saluth wants to establish more fire lines with a width of five meters in two kilometer blocks. The monks want to establish regular fire patrols, suggesting that two villagers from each of the seven sub-CFMCs be involved.

example, is interested in allocating forestlands for social concessions that can provide settlement and agricultural lands. The military views the settlement of borderlands as a territorial imperative. Some stakeholders view migrant relocation as a means of increasing the local labor force and clearing forests for agriculture. Oddar Meanchey may also be seen by some politicians as a good environment to resettle retired soldiers, police, and civil servants. A number of the thirteen proposed project sites have already been targeted for ELC leasing, but community and FA protests and the prospect of a REDD project have blocked the issuance of land concessions in the project area. Without a REDD project, it is unlikely that the CFMCs responsible for protecting the project area will have the financial, technical, or political support required.

Over the past decade, it has been estimated that between eight thousand and nine thousand migrants move into Oddar Meanchey each year in search of agricultural land, due, in part, to the province's substantial forest tracts, as well as its rapidly increasing land values. During that period, the population increased nearly threefold, from 68,279 in 1998 to 185,443 in 2008. In contrast to Lower Mekong provinces like Prey Veng and Svey Rieng, where the population was unchanged over the past decade, in Oddar Meanchey and Palin in the northwest, the rural population expanded by 9.23 percent and 12.27 percent per year, respectively (RGC 2008).

Cambodia and its local government offices have limited resources for controlling immigration effectively or demarcating the Permanent Forest Estate. As a consequence, without the project to establish control over "contested domain," migrants, often financed by land speculators, would likely continue clearing forests. Illegal logging contributes to forest degradation as well, along with forest fires, which are often induced by hunters or local communities aiming to "clean" the land. High-value luxury wood is selectively felled for the booming hotel market in Siem Reap, a destination for over two million foreign tourists annually. Illegal timber felling and smuggling is widespread, often organized by private sector operators who obtain support from the local military and police. Without project intervention, it is likely that forests throughout the province, including those targeted for inclusion in the proposed project, will continue to be lost at a rate of at least 1.5 percent to 2 percent per year.

Aside from forest loss, without the project many groups will increasingly lose control over their community forests. These communities depend on these forests for a wide range of products, including forest foods, fodder, fuel wood, timber, honey, rattan, bamboo, and resin oils (among others). Most rural families face seasonal food shortages that are often met through the safety net provided by forest resources, including the consumption of "famine foods" from the woods—edible leaves, bamboo shoots, tubers, fruits, etc. Loss of access to these resources will create economic hardships and undermine the achievements of the Millennium Development Goals. The social and economic marginalization and possible displacement of thousands of rural families could create conflict between concessionaires, migrants, and local populations.

In the absence of the project it is likely that forests will decrease in quantity and quality resulting in a loss of key habitat and refugia and placing pressure on flora and fauna, which are

already in jeopardy. Without the project, community efforts to control illegal logging and regulate hunting will not be implemented with the same level of effectiveness. Many of the highest-value tree species are already listed on the International Union for Conservation of Nature (IUCN) threatened species list. As these trees and forests are depleted, so too are important indigenous sources of seed, reducing the potential for regeneration (Cambodia Tree Seed Project. 2004). Without the forest fragments that comprise the project area, the last habitat for tigers, bears, and other species will disappear. This would almost certainly contribute to the extinction of the last tiger population in northwest Cambodia.

The province has experienced severe erosion as forest cover has been removed. Erosion problems have accelerated over the past decade. This region experiences an extended dry season and often torrential wet season. This mosaic of open, dry, deciduous forest, combined with lowland evergreen or semi-evergreen forest, transforms into extensive wetlands and swampy areas during the annual monsoon. The lowland forests of Oddar Meanchey supply the Tonle Sap (Great Lake) with water, helping regulate the annual hydrological cycle of the greater Mekong basin. The clearing of forests from the upper watersheds of Oddar Meanchey Province accelerates the erosion of soil and promotes the sedimentation of the Tonle Sap, currently estimated at twenty to forty millimeters per year (Bailleux 2003). Forest conservation is a key element in any strategy to preserve Cambodia's complex hydrological systems and avoid further loss of soil through erosion.

During the extended dry season, many rural communities in the Oddar Meanchey province experience water shortages. Forest loss exacerbates these drought conditions by creating a hotter microclimate and accelerating water runoff rates. Without the project, land degradation will be more extensive; there will be greater soil erosion and reduced water infiltration and aquifer recharge. Also, it is expected that existing water tanks will silt up rapidly since there is no financing mechanism to desilt water tanks or build new water storage facilities.

A number of deforestation drivers have been identified (see Table 3). The drivers are broadly divided between those that operate at a national policy level and require higher-level political interventions to mitigate their impact and those that are local drivers involving communities and migrants. The latter can often be addressed by the community itself, sometimes with assistance from local NGOs and forestry field staff. Without a coordinated effort by local communities and national planners, the complex, multitiered interaction of deforestation drivers cannot be effectively addressed. This creates a clear opportunity to link national REDD initiatives with local REDD projects. National REDD initiatives could be structured as enabling mechanisms that provide legal, technical, and financial support to local project activities. National REDD initiatives would shelter projects from national drivers of deforestation, nurturing the development of local projects and gradually populating the countrywide REDD strategy. Technical support to CF groups for carbon monitoring, certification, and verification could be included as key roles for national REDD managers. Such a relationship could dramatically reduce transaction costs, improve the quality of monitoring data, better coordinate mitigation activities, and accelerate the replication of projects. This case study illustrates Cambodia's emerging strategy to mitigate a diverse range of forces operating in Oddar Meanchey Province.

Table 3: Underlying Causes of Deforestation and Potential Mitigation Strategies

| UNDERLYING CAUSES OF DEFORESTATION AND FOREST DEGRADATION | POTENTIAL MITIGATION STRATEGIES |
|---|---|
| **INTERNATIONAL** | |
| **Commodity markets**—rapidly rising prices of sugar, rubber, and palm oil | Controlling commodity prices is beyond the national and subnational project capacity. |
| **Investment capital**—for commercial plantations and land speculation | Transboundary capital flowing into forestland development may be subject to national government control, especially related to policies on issuing concessions to foreign firms or investors. |
| **NATIONAL** | |
| **Military**—bases and roads for legitimate defense purposes, as well as support to illegal logging and encroachment on forests by soldiers | National defense needs will likely trump forest conservation, though more routine military demands on forests may be negotiated at the national level. A dialogue between forestry officials and military commanders may be required to resolve illegal activities. |
| **Government officials**—local government officials engaged in illegal land sales and forest clearing | Transparent and public meetings between national government planners and local government officials can communicate the importance of protecting project areas from manipulation and illegal activities. |
| **Economic Land Concessions**—large tracts of forestland allocated to private sector firms displace local residents and stimulate social conflict | Senior forestry staff and national REDD project directors need to be in close dialogue with the technical committees operating under the Ministry of Agriculture, Forestry and Fisheries that are involved in issuing Economic Land Concessions, as well as long-term public land-planning processes. |
| **SUB-NATIONAL** | |
| **Forest fires**—suppress natural regeneration of degraded forests, create carbon emissions from burning | Advise and monitor hunters, gatherers, farmers, and other forest users who often start fires. Fire control strategies require funding, tools, and capacity building to maintain fire lines and suppress fires. |
| **Migrant encroachment**—migrants seeking forestland to farm or resell | Educate migrants regarding community-protected forest territory, combined with patrolling, demarcating boundaries, and imposing sanctions for land clearing. |
| **Land speculation**—forests are felled to establish a claim on land that is later sold, or resold as land prices increase | Identify middlemen financing forestland grabs and report forest crimes to the police, local government, and forestry agency. Monitor areas. Patrols, boundary demarcation, and signage are also required throughout the project area. |
| **Agricultural expansion**—population growth drives additional forest clearing for agricultural land creation | Develop plan, maps, and implementation strategy for community-based land use. Design and implement sustainable agricultural intensification project to raise productivity. |
| **Illegal logging**—"high grading" of luxury woods causes ongoing forest degradation and loss of biomass | Limit access of illegal loggers with small tractors through patrolling, trenching along boundary access points, identifying agents, and gaining support of forestry agency, police, and military. |
| **Firewood consumption**—90 percent of fuel use derives from wood, with increasing demands from subsistence and commercial users | Introduce fuel-efficient wood stoves in early project phase, with gradual transition to liquid petroleum gas and solar. |

## National Drivers of Deforestation

Oddar Meanchey has been contested domain since the mid-1970s, when it was first occupied by the Khmer Rouge and continued to be used as a guerilla base until the mid-1990s (Brinkley 2009). More recently, tensions with neighboring Thailand have made the province a sensitive area, and, consequently, the presence of the military is widespread. As in other parts of Asia, in Oddar Meanchey the military has often used forests and forestland as a source of income. According to senior officials of the FA's Siem Reap Inspectorate, the most immediate and damaging driver is military encroachment into CF areas, with over twenty cases reported. Since defense strategies are classified, it is difficult to get information from the military regarding its operations in the area. In some cases, soldiers are involved in illegal logging, forest clearing for agriculture, and land sales, while in other situations, their presence is part of an effort to establish approved "camps."

According to FA senior staff, each CF area has a unique set of issues and social hierarchy that needs a special approach. In one of the twelve forest blocks, where the military is clearing several hundred hectares of forest in the southwest corner, the local FA has trouble responding to the problem. A senior officer notes that:

> *The FA's field staff lives and interacts with the military, and this may prevent their ability to confront the soldiers, due to their friendships and existing local relationships. Also, the local FA officials may not have the status to gain the attention of senior military officials. The level of FA response needs to reflect the status of the actor*

**GOVERNMENT OFFICIALS:** In a number of CF areas, commune chiefs and district and provincial government officials are reported to be involved in encroaching on forests within the CF areas. Local government officials have some authority to legitimize forest occupancy by issuing letters and documents, although these are often reversed by judicial courts and higher levels of government. Community forestry groups are reluctant to challenge their authority, however, and often need to appeal to higher authorities in order to control encroachments that have the endorsement of local government officials. In northeast Cambodia, recent studies indicate that local government officials are frequently involved in land sales taking place in forest areas (Fox et al. 2008).

My Li Heng Sugar concession neighboring REDD project site. (2008)

**ECONOMIC LAND CONCESSIONS (ELCS):** As a major driver of deforestation, it is important to understand the economic and political dynamics driving the issuance of concessions. Some government planners maintain that underutilized lands need to be developed to generate revenues for the state; however, critics argue that past timber and other leases have produced minimal income for the country.

Large ELCs are criticized for a failure to follow through on their commitment to implement management plans. There is some speculation that

## Box 2. Economic Land Concessions: Lessons from Ratanak Ruka CFMC

The Ratanak Ruka Community Forest Management Committee (CFMC), comprised of sixteen neighboring villages, is currently protecting a 11,642-hectare forest in the middle of Oddar Meanchey Province. With the exception on one small Kui community, the area has largely been settled by Khmer migrants over the past fifteen years. There are two extensive areas of better-stock forest in the center of the CF area which contain significant populations of deer, wild boar, and leopards. Primarily comprised of dry deciduous forest with scattered evergreen forests, the project area has experienced significant disturbances over the past twenty years. The forests were selectively logged by Thai timber companies in the 1990s and continue to be subject to illegal felling and land encroachment by the military and migrants. The biggest threat to Ratanak Ruka's forests are business interests that seek to convert this forest fragment into sugar plantations. In 2007, the original 20,000-hectare CF area lost over 9,000 hectares to three economic land concessions (ELCs) established on the western, northern, and eastern sides after MAFF determined that the CF area was "too large" to be managed by the sixteen neighboring villages. Despite protests by these forest-dependent communities, the ELCs quickly established control of the area and began clearing the forest and, in some cases, encroaching further into the CF area.

A local NGO, the Children's Development Association (CDA), has been working with the CFMC and participating villages to strengthen patrols and build organizational capacity to protect local forests. CDA staff feel that Ratanak Ruka CFMC is gaining capacity to deal with migrants, forest fires, and illegal logging. They are developing strategies to control these drivers of deforestation and appear to be establishing tighter controls over their community members, including forbidding any expansion of agricultural land in the forest area. Bat Nim's CFMC leader said:

> *In the past, we might allow five new migrant families to come to the village each year, but last year we did not allow any. With the forest closed for new farms, we do not have any additional land. In the pas,t we cleared five hectares each year; last year there was no new land opened.*

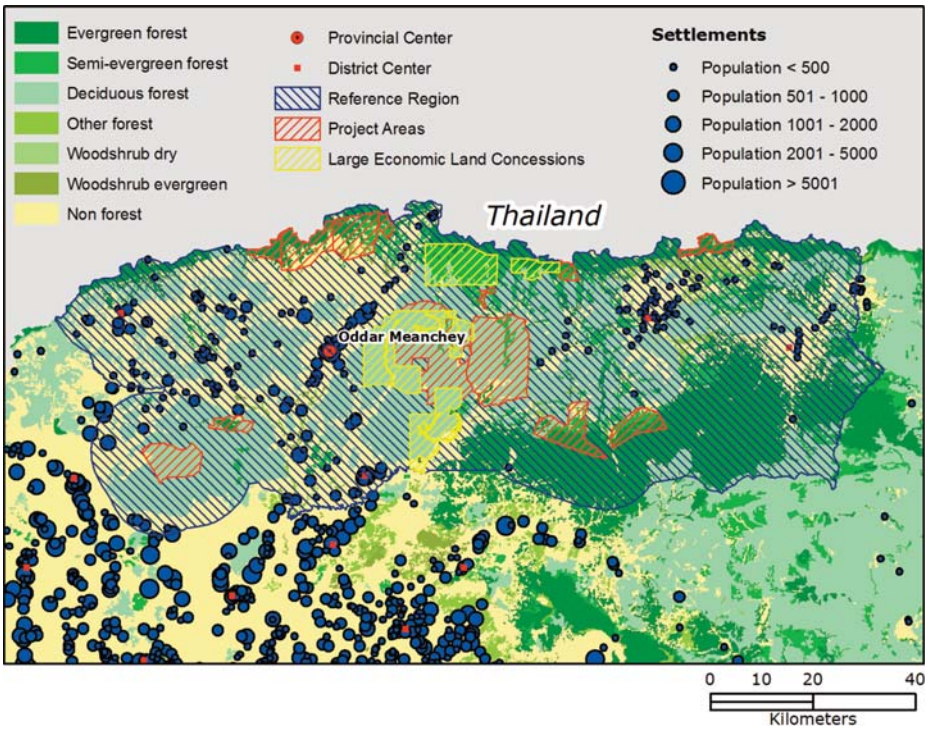
Water resource development remains a priority within the community, given their dependence on one water tank in the center of the village. The village has little access to cash income and, consequently, depends on the forests to generate products for sale, subsistence goods, food, and medicines. As noted by forty-one-year-old Sokh Smit, a CFMC member:

> *The people with money in our village go to Samraong town when they are sick; the poor people go to the forest to collect traditional medicine. For us, the most important NTFP (nontimber forest products) are resin oil, mushrooms, ginger, and honey. Forest fires are a problem as they chase the bees away. The best places for most NTFP are the big forests.*

At the same time, the CFMC is powerless in dealing with more influential forces. According to the head of Ko Num Rai Village: *The biggest threat to our forest is the powerful people and the military. There is nothing we can do to stop them; we can't even look them in the face.*

According to a CFMC member from Bos Village, the northern section of the CF area is under pressure from the Angkor Sugar ELC, which controls a 10,573-hectare concession neighboring Ratanak Ruka. Angkor Sugar is reported to have evicted 139 families from their concession area in April 2008 without compensation or any resettlement plan. These communities have lodged a complaint with the Human Rights Committee, and the National Assembly supported the community's claim. On the eastern side of the CF area, the My Li Heng Sugar concession has dammed the river that flows by Bat Nim and cleared 3,000 hectares of forest in 2008, with some reported encroachment into the CF area. Mitigating the impact of powerful drivers of deforestation such as economic land concessions requires high-level policy decisions within the Ministry of Agriculture, Forestry, and Fisheries.

Figure 4: Project Areas, Reference Areas, and Large Economic Concessions

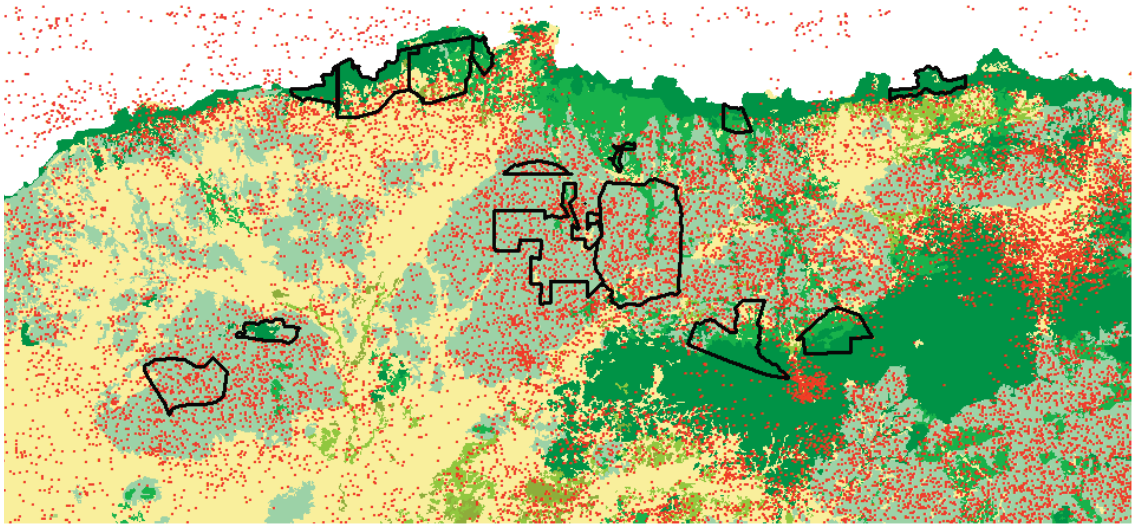



some business interests seek ELCs simply to harvest high-value luxury wood, with no intention or financial capacity to invest in the development of their land. Performance reviews by the central government have resulted in the cancellation of a number of ELCs. In the case of Oddar Meanchey, the FA sought the support of the prime minister to conduct the pilot project as a test case. Without this support, it is unclear if the project would have had the political backing needed to secure the 60,000 hectare project site in a region that was actively sought by a company operating nearby. Figure 4 indicates the close proximity of ELCs to the CF project areas, while Box 2 illustrates the problems ELCs pose for nascent CF groups.

## Sub-National Drivers of Deforestation

**FOREST FIRES:** Forest fires are natural events in dry deciduous forests in Oddar Meanchey Province. The frequency of fires, however, is greatly increased by human activity. Perhaps 90 percent of dry season forest fires are caused by people, including hunters, children, careless smokers, and farmers burning agricultural residue. In the case of degraded dry deciduous forests, natural regeneration is suppressed due to almost annual ground fires that destroy or damage coppice shoots and saplings. As a result, biomass is lost and regrowth is slowed.At the same time, fuel wood and timber are extracted, leading to a gradual erosion of vegetative material and forest health. MODIS satellite data taken over the past decade indicates the prevalence of fire throughout Oddar Meanchey Province (see Figure 5).

Figure 5: Incidence of Fires in Oddar Meanchey Province: 1998-2008*




**MIGRANT ENCROACHMENT:** Migration into Oddar Meanchey has been very rapid over the past decade. The increase of the rural population is estimated to be over 12 percent per annum between 1998 and 2008, of which around 9 percent is due to in-migration. Migrants from the Lower Mekong provinces, where land is scarce, have heard by word of mouth that the frontier forests of the northwest offer opportunities to secure land. One person from Svey Rieng noted that in recent years, "Over twenty people from my extended family have moved to Oddar Meanchey. They opened three to five hectares of forestland to establish a farm and house yard. They also buy additional plots of land and then sell them within a few months or years."

While some migrants come from distant, land-poor provinces like Svey Rieng and Takeo, it appears that many families are also coming from neighboring Banteay Meanchey and Siem Reap Province. Usually, migrants follow other family members who have already established a "base" in the province. News is sent by word of mouth when opportunities emerge for establishing land claims through forest clearing. In 2008, this process appears to have slowed, possibly due to the global economic recession and the decrease in buyers for cleared forestland. It is also apparent that as an increasing amount of the frontier (unoccupied) forest is claimed by local villages settled by earlier migrants and ELCs, as well as designated as CF areas, the "word of mouth" message is changing from "come, there's land here" to "no land available." A number of villagers noted that migrants were no longer welcomed to their communities, and that even local families have no "free" land to expand their agricultural operations. Over the past decade, Oddar Meanchey Province has transitioned rapidly from an "open frontier" environment to an increasingly "claimed domain" context.

Ground fire in dry deciduous forest suppresses forest regeneration.

Migrant encroachment in forestland creates an impression that new settlements are being created; however, often they are abandoned by migrants or the migrants are evicted.

**LAND SPECULATION:** While migrants may participate in forest clearing for future land sales, land speculation is often driven by businessmen, officials, and local villagers who seek to claim and clear forestland for sale. According to reports, "power men" hire migrants or local villagers to fell and burn off forest for $50 to $100 per hectare. Small huts are constructed to indicate residence, although these are frequently not occupied. This pattern reflects attempts to grab available public forest land and hold it until it can be resold at a higher price. While these actions are usually illegal, letters from local officials are used to create an appearance of legitimacy. Once one plot is opened it appears to encourage other migrants to open forests in neighboring areas. In some cases, poor migrants may sit on the plot for one to two years waiting for land values to rise. These plots are then sold to a "consolidator," a businessman who buys a number of them to form a larger plot. In 2007, the prime minister ordered all provincial governors to confiscate illegal encroachments of forest areas. In Oddar Meanchey, the provincial governor reclaimed over 20,000 hectares of occupied forestland. Since the province has no budget to protect, rehabilitate, or develop, these lands are either leased by MAFF as large economic land concessions or reclaimed by migrants.

**AGRICULTURAL EXPANSION:** With the rural population expanding at a rate of 15,000 per year, demand for farmland will require an additional 5,000 to 6,000 hectares annually, based on two hectares for each household. Aside from migrant pressures on forest clearing, local communities also require an increasing amount of farmland as children marry and establish independent farms. In the past, village elders were responsible for identifying forest areas suitable for rain-fed paddy fields. Young families or migrants requiring land approached the elders to request a farmland allo-

cation. Usually a two-to-five hectares plot with good soil moisture was selected within the forest. For the most part, these were created before the formation of the CFMCs, and it is difficult for the poor farmers that own them to be evicted. Many committees are accepting these plots on the basis that the "owner" agrees not to expand the existing fields.

**ILLEGAL LOGGING:** Illegal logging remains an important driver of forest degradation. Due to the presence of high-value "luxury" timber, popular for furniture and buildings in cities and tourist areas, timber smuggling is profitable and widespread. Armed soldiers are often involved in these activities, presenting control problems for weaker community forestry committees. In some cases, forest patrols, including a group of Buddhist monks, have been captured and held hostage after they confronted soldiers involved in illegal logging.

**FUEL WOOD CONSUMPTION:** In Cambodia 95 percent of the population is dependent on fuel wood for cooking (NIS 1998). A study in the neighboring province of Kampong Thom found that the per capita fuel wood consumption rate was approximately 200 kilograms per year (Top Neth 2004). A typical household might consume between one-to-two metric tons of fuel wood annually, reflecting 10,000-to-20,000 metric tons of fuel wood used in the project area each year. Some households also burn biomass to create smoke that inhibits mosquito attacks on livestock.

In summary, there are diverse forces that are causing deforestation and degradation in Oddar Meanchey Province, operating at multiple levels and scales, driven by a diverse group of actors. Land markets and economic land concessions are linked to international markets. In the case of Oddar Meanchey, Thai investors play an important role as well, given the province's proximity to northeastern Thailand, as they engage in negotiating with senior Cambodian government officials regarding long-term investments. Over the past few years, Cambodia and Thailand have experienced border disputes that have raised awareness of military operations in this border province, as well as the allocation of military bases and construction of roads and other installations. The Ministry of Interior has also proposed that social concessions be established in the province to resettle the rural poor from other provinces. All such decisions are made at high levels of government. The project participants, design team, and even the national FA sponsoring the initiative may have limited capacity to impact these drivers. Nonetheless, such international and national drivers may have the greatest impact on long-term forest cover in the province and the ultimate success of the REDD project.

## Mitigating Drivers of Deforestation

The Oddar Meanchey project will undertake ten different activities to reduce degradation and deforestation. Each of these activities targets one or more of the above identified deforestation drivers. In Table 4, below, the project design team has attempted to estimate the relative impact of the different drivers on deforestation. Note that the impact of ELCs, small economic land concessions, and timber concessions are not calculated, as they are beyond the scope of the project to mitigate. Although reinforcing land-tenure rights only indirectly affects migrant encroachment and the concession-type deforestation drivers, it is clear from the previous analysis that the community forestry land-

tenure status, and community respect and acceptance of that status and relevant forest laws, are absolutely essential to the success of the project. Other project activities may be highly inefficient if the communities involved do not have legal rights to the land. To optimize the efficiency of the project activities, they are to be incrementally implemented, with reinforcement of the land-tenure status as the first project activity. As a consequence, the sum benefit of the project activities will increase gradually over time. This is explicitly taken into account in the calculations. While the initial project activities conducted in 2007 and 2008 were absolutely essential (reinforcing land-tenure status, empowering and educating local communities, and consulting with all stakeholders), their impact on carbon emissions was not considered in the project calculations. Over the next thirty years, however, the project will undertake ten activities to achieve its goals, including the following:

Long Ratanakoma, Deputy Chief of Community Forestry, inspects placement of boundary pillar demarcating a new community forestry area in project site.

**STRENGTHENING LAND-TENURE SECURITY:** Land is the single most important asset for most Cambodians, whose lives are intricately tied to the use of natural resources. Transparently assuring land-tenure rights is of upmost importance both to the livelihoods of local populations and the prevention of unregulated and unsustainable land use. Conventional land tenure for forest areas does not always extend to tenure over housing and agricultural lands, and a lack of protection for agricultural lands can lead to families moving deeper into forest areas to clear new patches. In the project areas, local communities do not legally own the forestland, and the land-tenure status is unclear, as most of the forest estate in Cambodia has not been formally demarcated. By establishing legally binding forest management agreements under the Community Forestry Subdecree, project communities will have secured management rights from the Ministry of Agriculture, Forestry, and Fisheries (MAFF), the operational administrator for the national Permanent Forest Estate (PFE).

This action provides exclusive management rights and responsibilities to the CFMCs over the project area for a fifteen-year period that can be renewed, greatly enhancing their ability to protect and conserve these resources. Without legal reinforcement, maintaining tenure over land against migrants or concessionaires is extremely difficult. The establishment of these agreements often requires financial resources to implement, which can be generated by sale of carbon credits from the project. These financial resources can be used for forest monitoring and patrolling programs, as well as forest boundary demarcation, to ensure that migrant populations do not encroach on forestlands belonging to local populations.

Maintaining formal land-tenure rights is also important in ensuring that agricultural lands are not granted to large corporations as ELCs or as timber concessions to harvest luxury woods. One of the benefits of ELCs, as described by MAFF, is to gen-

erate capital to develop agricultural land and increase rural employment. The creation and reinforcement of land-tenure rights can effectively accomplish this by granting land rights to local rural populations and ensuring this land is not taken through ELC or exploited by in-migration. CFMCs will also be responsible for meeting with new migrant communities and leaders, as well as with local governments, to clarify boundaries of the project area, resolve any existing conflicts, and emphasize the intention of the CFMCs to secure the area.

The Royal Government of Cambodia has demonstrated a commitment to this project by expediting the approval of community forestry agreements for all villagers participating in this project. The potential of the proposed REDD project to generate carbon revenues for forest management has been instrumental in generating an action plan to resolve tenure conflicts in the project area through meetings, workshops, site visits, as well as higher-level policy discussions. In the first quarter of 2009, a series of meetings between senior FA officials and the military commanders operating in Oddar Meanchey gained the support of senior officers to move soldiers out of all unauthorized forest bases. Further, no ELCs have been issued for the province in the past twelve months, reflecting a shift in national policy.

**Table 4: Estimated Relative Impact of Drivers on Deforestation**

| PROJECT ACTIVITY / DRIVERS OF DEFORESTATION | 1. Strengthening land-tenure security | 2. Land-use plans | 3. Forest protection | 4. ANR | 5. Fuel-efficient stoves | 6. Mosquito nets | 7. Agricultural intensification | 8. NRM Projects | 9. NTFP development | 10. Fire prevention | Total impact reduction |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Forest clearing for land sales | | | 100% | | | | | | | | **100%** |
| 2. Conversion to cropland | | 25% | | 5% | | | 25% | | 5% | | **60%** |
| 3. Conversion to settlements | | 50% | | | | | | | | | **50%** |
| 4. Wood fuel gathering | | | 25% | | 25% | 25% | | | | | **75%** |
| 5. Annual forest fires set to "clean" land | | 20% | 20% | | | | | 20% | | 20% | **80%** |
| 6. Hunters inducing forest fires | | | 50% | | | | | | | 25% | **75%** |
| 7. Illegal logging for commercial on-sale | | | 90% | | | | | | | | **90%** |
| 8. Timber harvesting for local use | | 20% | 50% | 20% | | | | | | | **90%** |
| 9. Large economic land concessions | 100% | | | | | | | | | | **100%** |
| 10. Small economic land concessions | 100% | | | | | | | | | | **100%** |
| 11. Timber concessions | 100% | | | | | | | | | | **100%** |
| **Total reduction in forest degradation** | **0%** | **5%** | **49%** | **1%** | **8%** | **8%** | **0%** | **4%** | **0%** | **9%** | |
| **Total reduction in deforestation** | **0%** | **14.5%** | **43%** | **3%** | **3%** | **3%** | **8%** | **1%** | **2%** | **2%** | |

Source: CFI. CCBA Project Design Document (2009)

### Project Action 1: Strengthening land tenure

Land tenure is enforced through community forestry agreements. These were signed in May 2009, the second year of the crediting period. Therefore, a rate of 50 percent was assumed for 2009. Land-tenure rights are automatically renewed for thirty years after fifteen years, unless the land is not managed according to the agreement.

#### Maximal reduction in driver-induced deforestation

- **Driver 9 (large economic land concessions)** 100%. Creating legally binding community forestry agreements which establish land rights will provide proof of land ownership and prevent 100 percent of the deforestation associated with granting ELCs. The MAFF will have a map clearly showing the location of rural land ownership, and can avoid these areas when assigning large ELCs.
- **Driver 10 (small economic land concessions)** 100%. Same as above
- **Driver 11 (timber concessions)** 100%. Same as above. Backed by the Forestry Administration, community forestry agreements restrict all harvesting of timber in the project area; therefore, no timber concessions will be granted.

**LAND-USE PLANS:** While commune council members and village leaders and elders are consulted in land allocation activities, the Commune Land-Use Planning (CLUP) process adopted by Cambodia has not been fully implemented. A transparent, participatory land-use planning activity at the hamlet level would contribute to more sustainable resource management. The project will support communities in developing natural resource development (NRM) plans for the community forestry area in a participatory and democratic manner. Village-level land-use plans (VLUPs) will be used to provide an overall management strategy for each of the thirteen forest blocks in the REDD project, as well as inform future CLUPs. The plans will include information stipulating how much land within the project sites can be converted in the future for expansion of settlements and cropland. The VLUPs will also identify areas for assisted natural regeneration and enrichment planning. Areas of high biodiversity or hydrological value are identified for special management. The VLUPs increase the efficiency of current land use and take into account the increased need for land for settlements and agriculture in the future. By planning for future needs and avoiding the random conversion of forest patches, forest degradation along settlement and cropland edges is reduced.

The development of VLUPs requires community-wide discussion on how to best manage natural resources, emphasizing the inclusion of all stakeholders. This policy of inclusion cultivates a feeling of resource ownership, motivating sustainable land-use practices. The project will guide communities in identifying appropriate areas for future settlement and agricultural expansion, while clarifying and demarcating areas for permanent forest conservation. Often the need for new settlement or agricultural space leads to the degradation of forestlands. The involvement of knowledgeable

local stakeholders and outside experts allows for the realization of technical and sustainable methods of expansion. During the stakeholder meetings, there will also be a discussion on how the forest should be managed with respect to the use of fire to "clean" the land. Additionally, participatory land-use planning can also provide guidance and rules in case of disputes or conflict over land or resources.

Land-use planning procedures will include the preparation of large-scale maps (1:25,000) of the project area, along with zoning information that will be posted in community meeting halls. The resource management planning maps will be used for resource-related discussions, annual workplan development, fire management, and other spatial monitoring needs. Data from maps of each CF block will be transferred into the project GIS database on an annual basis.

### Project Action 2: Land-use plans

Land-use plans have been fully supported by project proponents from the first year of the project. However, it is expected that a period of five years is necessary before the full effect (rate) of land-use plans is reached due to the often challenging negotiations to design a broadly accepted land-use plan.

#### Maximal reduction in driver-induced deforestation

- **Driver 2 (Conversion to cropland)**
  25%. Combined with an effective forest protection and patrolling efforts, land-use plans can stipulate where local people are allowed to convert forests into cropland. If this conversion occurs in a pre-determined and planned order, the random destruction of forest resources is avoided, and the total deforestation rate due to conversion to cropland will decrease. Avoiding random conversion will reduce deforestation by 25 percent.
- **Driver 3 (Conversion to settlements)**
  50%. Same as above. The effect of random conversion of existing forest resources to settlements is more destructive than to cropland. Forests around settlements degrade rapidly due to grazing and fuel wood collection. Therefore, if the conversion to cropland occurs in an ordered fashion, deforestation can be reduced by 50 percent.
- **Driver 5 (Annual forest fires induced to "clean" the land)**
  25%. Management and land-use plans explicitly restrict the use of intentional forest fires within the project area. In addition, during discussions of the management plans, the dangers of fires will be further explained. Some intentional fires will remain unavoidable. Therefore, land-use plans will reduce forest fires by 25 percent.
- **Driver 8 (Timber harvesting for local use)**
  25%. Same as above.

**FOREST PROTECTION:** Improving forest protection is a key element to conserving carbon sinks in the area. This strategy involves supporting local community forestry committees and members as they demarcate forest boundaries, construct and maintain fire lines (which will increase forest stocks by sustaining forest regeneration), and patrol/protect forest areas. Project support provides training in management planning and organization; equipment in the form of uniforms, patrol vehicles, cell phones and walkie-talkies, boundary markers, and signage; and substantial employment opportunities. These actions increase the legitimacy of patrol groups in the eyes of outsiders and enhance the status of CFMC members in their local communities. In addition, the project seeks to strengthen cooperative relationships among the local Forestry Administration staff, police, and military in order to create a unified group of stakeholders who can prevent further forest encroachment, illegal logging, forest fires set by humans, and poaching. Similarly, forest-protection activities prevent the unsustainable harvesting of fuel wood and timber for local use. The project will provide financial support to local Forestry Administration staff to develop a rapid-response mobile unit to react to illegal forest activities, as well as contracts with local government, police, and military groups to facilitate their involvement in the project.

Illegal logging risks will be mitigated through a number of measures, including demarcating boundaries and posting signage, blocking tractor access through trenching and other methods, patrolling regularly, developing a network of patrol huts and fire roads to facilitate rapid response, and confiscating chainsaws and other equipment. Support would also be provided to track illegal logging cases and prosecute major offenders. The project would support the CFMCs, the local FA, NGOs, and other partners in creating a cell phone network to act as an early warning system to control illegal forest activities. Cell phone communications provide a low-cost way to strengthen coordination among the inter-organizational enforcement team. Workshops and meetings would be held to build team relationships. Support for enhanced mobility through the financing of motorcycles would reduce response time. Previous work with communities has already increased their awareness and sensitivity to their land rights. This has led to a number of chainsaw confiscations during 2007 and 2008.

**ASSISTED NATURAL REGENERATION AND ENRICHMENT PLANTING:** The project will also rely on forest restoration utilizing low-cost assisted natural regeneration (ANR) techniques to restore forest cover and accelerate carbon sequestration rates. Community members will be employed to clear degraded forests of weeds, clean healthy tree stumps and thin shoots to encourage growth, and plant tree saplings in gaps. These activities will be conducted on approximately 10,000 hectares over the twenty years of the project. This activity is designed to generate approximately twenty days of employment per project household during the agricultural off-season (February through April).

A key to forest restoration will be fire control in the dry deciduous forests. The fire control activities will include community identification of high-potential regrowth areas, based on biological assessments reflected in the density and health coppicing shoots and seedlings, soil moisture, and location. Fire lines of five meters width will be established around the regeneration areas, with priority given to fire control for at least five years (see “fire prevention” section).

## Project Action 3: Forest Protection

Forest protection measures are fully funded for the whole project period. It is assumed that full effect, or rate, of forest protection will be reached after 3 years, when all participating communities will have acquired experience to protect the forests most effectively.

### Maximal reduction in driver-induced deforestation

- **Driver 1 (Forest clearing for land sales)** 100%. Migrant encroachers require a minimum amount of time, at least one week, to clear the forest to establish a settlement on encroached land. Routine weekly forest patrols and increased monitoring activity will ensure migrant encroachers are unable to settle, or are removed quickly. Forest protection activities will be able to prevent 100 percent of migrant encroachment.
- **Driver 4 (Fuel wood gathering)** 25%. Without enforcing the rules in the management and land-use plans, it can be expected that some community members will still collect fuel wood in the forests. An effective patrolling system will reduce the fuel wood gathering by discouraging people to collect fuel wood. However, some fuel wood gathering will be unavoidable. Therefore, the reduction is predicted to be around 25 percent.
- **Driver 5 (Annual forest fires induced to "clean" the land)** 20%. Forest patrolling will increase the awareness of the communities to fire, and patrolling teams will be able to alarm the communities and the voluntary fire brigades sooner after a forest fire starts. Forest fires are far from avoidable, and therefore, this measure is projected to only reduce intentional fires with 25 percent.
- **Driver 6 (Hunters inducing forest fires)** 50%. Forest patrolling will discourage hunters from trespassing in the project areas and inducing forest fires. Hunters usually operate alone and within a timeframe of one or more days. Therefore, similar to the previous driver, it is assume that forest fires induced can only be avoided for 25 percent.
- **Driver 7 (Illegal logging for commercial on-sale)** 90%. Cooperation between local communities, police, and Forestry Administration staff and the distribution of equipment to aid in patrols should be able to reduce 90 percent of deforestation associated with illegal logging. Illegal logging operations require large amounts of equipment and sufficient time to fell trees. Frequent patrols will eventually persuade illegal loggers to discontinue operating in the project area. For example, in 2007, with project support, the Samaky CFMC has been successful in reducing illegal logging from an estimated 100 m3 per year to 20-30 m3 per year in the first year of implementation. This has largely been accomplished through implementation of community patrols. Community based monitoring is often the most effective way to prevent illegal logging as local stakeholders are most familiar with their forestlands and can directly report illegal logging operations to authorities. It is expected that the patrolling will be able to reduce illegal logging by 90 percent once fully operational.
- **Driver 8 (Timber harvesting for local use)** 50%. Timber harvesting is severely restricted in the management plan. Forest patrolling will effectively enforce this rule. Some minimal timber harvesting will still be allowed, at a rate of about 50 percent of pre-project conditions.

Apart from the fire control, the CFMCs will plant approximately 60,000 tree seedlings each year in gaps between areas being treated with ANR. The planting is planned to begin in year 3 and continue through year 30, with a budget allocation of $30,000 per year. During the first two years of the project, an assessment of where natural regeneration potential is lowest, and where the need for enrichment planting is greatest, will be undertaken. Trees to be planted will include the unique endemic species *Afzelia xylocarpa* (beng), a high-value deciduous, broad-leaved tree which coppices well. Coppicing species allow for the harvesting of wood from the same stumps, preventing the need to fell new sections of forest. Enrichment planting will be done in gaps with indigenous companion species. Communities are eager to regenerate the high-value beng species and other indigenous trees, as well as to incorporate cashews, jackfruit, mangoes, and other fruit trees around their households. Harvesting these crops will help reduce the need to clear land for agricultural subsistence purposes, and they can eventually be sold at market as cash crops.

The locations of the ANR activities will be selected using a three-step process. (1) Using a GIS, areas will be selected that were forest in 2000, but deforested in 2008; that are within five kilometers of settlements, and that are land mine–free. (2) This map of potential ANR areas will be presented to the local communities so that they can select areas of highest potential in sketch-mapping meetings. (3) The sketch maps will be digitized in a GIS, and concrete management plans will be developed. If the demand for fuel wood increases beyond the production of dead wood in the protected forests, the planting of fuel wood–generating small woodlots will be stimulated.

### Project Action 4: ANR

Assisted natural regeneration activities consist of (1) silvicultural activities, such as thinning, removal of exotic and invasive species, and coppicing; and (2) enrichment planting. Silvicultural activities are planned for years 3-20, while enrichment planting is planned for years 3-30. During the first year, a number of pilot activities are planned to find out the most effective way to optimize the regeneration. Therefore, the rate of the first year is set at 50 percent.

### Maximal reduction in driver-induced deforestation

- **Driver 2 (Conversion to cropland)** 5%. Assisted natural regeneration will provide a significant source of income for many households that are dependent on subsistence farming for their food. It is expected that the employment from ANR will reduce the need to clear forestland for subsistence farming with about 5 percent.
- **Driver 8 (Timber harvesting for local use)** 20%. ANR activities will reduce deforestation from local timber harvesting another 20 percent by providing a sustainable source of wood, thus reducing the burden on forestlands in the project area.

**FUEL-EFFICIENT STOVES:** The project will work with local NGOs to distribute approximately eight thousand fuel-efficient stoves to all households in the project area. In other parts of mainland Southeast Asia, such fuel-efficient stove programs are reported to have a 70 percent adoption rate and reduce consumption by up to 45 percent.[4] More than 90 percent of Cambodians use biomass as cooking fuel, typically composed of fuel wood gathered from the forest in rural areas and charcoal in urban areas. While harvesting of fuel wood provides the benefit of clearing ground detritus, which can help prevent forest fires, fuel wood is often harvested unsustainably and can lead to land degradation. Reducing the demand for fuel will lead to a direct reduction in the unsustainable harvesting of fuel wood. The stoves will cost approximately $20 each and will reduce fuel wood consumption by 2.5 to 2.8 metric tons per stove per year, reducing the annual CO2 emission per stove by approximately 4 metric tons.[5] These fuel wood savings will be achieved through the redesign of the Lao bucket stove, including improved insulation and airflow.

### Project Action 5: Introduction of fuel-efficient stoves

The project plans to distribute 500 fuel-efficient stoves annually for years 3–10. It is assumed that a fuel-efficient stove has a lifetime of about 3 years. Therefore, from year 5 onwards, when the project activity has the greatest effect, 1500 stoves on average will be active. During years 3–10, 500 stoves are anticipated to become defunct, while another 500 stoves are introduced by the project. After 10 years, no more stoves will be distributed, and the activity rate will go down to 500 per year. However, at 10 years, it is assumed that 33 percent of people who have used a fuel-efficient stove will purchase or maintain one, due to its higher efficiencies and the time saved in gathering fuel wood. This represents around 5 percent of all households in the project area.

#### Maximal reduction in driver-induced deforestation

- **Driver 4 (Fuel wood gathering)** 7.5%. Fuel wood is primarily used in communities as cooking fuel. In total, 5000 stoves will be distributed over 10 years. However, at the maximal rate, 1500 out of 8000 households will be using a fuel-efficient stove that uses 45 percent of the wood used by a conventional stove. With 10,000 households expected around year 10, the introduction of fuel-efficient woodstoves is anticipated to reduce deforestation from fuel-wood at a maximal rate of 0.45*1500/9000 = 7.5 percent.

4. Sam Vitou and Ouch Ngak. Dissemination of New Lao Bucket Stove. Undated newsletter.
5. Based on an analysis of data provided by Valerie-Anne Taillandier, "Cambodia Fuel wood Saving Project Phase 2".

### Project Action 6: Introduction of mosquito nets

Analogously to fuel-efficient stoves, mosquito nets will be introduced from years 3–10. About 700 mosquito nets per year will be distributed. Like fuel-efficient stoves, a lifetime of 3 years is anticipated; no mosquito nets will remain in use after subsidies from the project have terminated.

#### Maximal reduction in driver-induced deforestation

- **Driver 4 (Fuel wood gathering)** 25%. Mosquito netting can completely replace the use of wood smoke to repel mosquitoes. At a maximal rate of 2,000 households per year, deforestation from fuel wood collection for mosquito repelling will be reduced by 2000/8000 = 25 percent.

**MOSQUITO NETS:** One of the largest contributors to fuel wood consumption is to generate smoke for the purpose of repelling mosquitoes around cattle and water buffalo enclosures. Livestock are the most valuable possessions rural farmers have, often worth years of wages. Protecting these animals from malaria is of utmost importance, and is often achieved by the lowest-cost option of generating wood smoke to repel mosquitoes. This project will provide large mosquito nets treated with insecticide at a reduced price to local households to cover livestock pens. The use of netting will dramatically reduce the amount of fuel wood consumed by rural families, and will help to decrease the burden on forestland. The nets will be sold through project-sponsored microfinance groups, as they are often too expensive for farmers to purchase outright. The project will also explore supporting the distribution of malaria prophylaxes in the project area.

**AGRICULTURAL INTENSIFICATION:** Extensive tracts of forestland are being cleared around the project area to create additional farmland. While additional agricultural land is being created, crop yields remain very low when compared with neighboring countries in Asia (e.g., Thailand and Vietnam). In order to take pressure off further forest clearing for agriculture, the project would provide technical and financial support to local farmers to develop sustainable techniques to increase productivity. Techniques would include organic fertilizers, vermiculture, and access to better seed. The project would also provide communities with the resources needed to develop better water sources for irrigation. Project support would target innovative local farmers who are willing to demonstrate the new techniques to their neighbors. Training local farmers to improve efficiency, instead of moving to new land in search of better soil, will significantly decrease the amount of forestland needed for agriculture, and provide teachable and demonstrable techniques that can be passed between communities.

### Project Action 7: Agricultural intensification

Agricultural intensification measures are planned from years 3–20. Every year, 60 new farmers will be introduced to the system. In addition, it will take time to develop marketing networks for alternative crops and commodities. Therefore, the effect of agricultural intensification will increase linearly until year 20.

#### Maximal reduction in driver-induced deforestation

- **Driver 2 (Conversion to cropland)**
  30%. Intensifying agriculture from the current subsistence level by using higher-input sustainable practices can reduce the need of future households to deforest the land. The project plans to introduce high-input farming practices to 60 farmers per year during years 3–20. At year 20, around 1,000 (60 x 18) households will be affected. It is expected that yields can increase by 300 percent due to optimized practices, and that for every participating household, another will spontaneously adopt due to the inherent financial advantages. The 2,000 households using optimized practices will increase production to 130 percent. This increase in production will result in less need to convert forestland to cropland, and lead to a deforestation rate of the same magnitude.

### Project Action 8: NRM projects

Natural resource management practices are fully planned from year 3 until the end of the project. Due to the nature of the projects, measures will be instantly effective.

#### Maximal reduction in driver-induced deforestation

- **Driver 5 (Annual forest fires induced to "clean" the land)**
  20%. Natural resource management projects will include the establishment of water impoundments within the forest for firefighting, which are expected to reduce carbon emissions from forest fires about 20 percent.

**NRM DEVELOPMENT PROJECTS:** Many project communities have requested assistance to develop their domestic water resources, especially the desilting of tanks. Under the project, communities can submit applications for small grants to develop water resources. Small grants would range in size from $1,000 to $2,000, based on community project requirements. Proposals will be evaluated on both the immediate and long-term benefits of the natural resource management (NRM) developments, as well as the feasibility of implementation. Projects could include desilting tanks, tube well drilling, drinking water system development, and installation of purification technologies. Additionally, the project will also consider the use of irrigation and other agricultural water-distribution technologies, to both decrease the amount of water needed for agriculture and improve the productivity of farmland. The sustainable clearing of land to use for settlements and other purposes will also be considered, as the alternative is often the use of fire, which can spread to other forest areas and cause degradation.

Local villager collects and transports rattan.

**NTFP DEVELOPMENT ACTIVITIES:** The project plans several livelihood-enhancement activities to boost the incomes of project households. These include enhancing production, processing, and marketing of nontimber forest products, including honey, rattan, and bamboo and resin oil. The sale of these products will help to increase rural incomes, shifting the burden from the sale of agricultural and timber products and reducing the need for cropland. The project will also assist communities in establishing microfinance accounts that can receive small grants from carbon income, allowing capital formation to be used for revolving loans for education, health, and small-enterprise development. Small grants will be awarded to farmer-innovators who wish to perform trials of new sustainable and intensive farming system techniques.

**Table 5. Key Components in the REDD Design Process**

1. Project Design and Launching
2. REDD Methodology Development
3. Field Measurements
4. Preparation of Project Document
5. Submission to VCS and CCBA
6. Project Negotiations and Agreements
7. Project Awareness Raising
8. Training and Field Implementation
9. Design Efficient Monitoring Protocol
10. Implement Carbon
11. Monitoring/Verification/ Validation
12. Emission Reduction Purchase Agreement

### Project Action 9: NTFP development

Nontimber forest product development activities are supported during years 3–20. Similar to agricultural intensification measures, a period of 10 years is assumed before these will be fully effective because marketing networks must be developed, etc. A final adoption rate of 50 percent is assumed after terminating the project's support for these activities.

#### Maximal reduction in driver-induced deforestation

- **Driver 2 (Conversion to cropland)** 10%. The development of nontimber forest product enterprises will supplement the income of households that are mainly dependent on subsistence agriculture for food. In the end, the REDD project will support 40 enterprises in total. Each enterprise provides employment for about 15 households, or 600 households in total at year 20. Since 5,000 new households are expected from the project start until year 20, this will reduce the need for cropland expansion by about 600/5000 = 10 percent

**FIRE PREVENTION:** The project would also facilitate the implementation of fire-prevention techniques in forestlands. These techniques include the creation of fire breaks, five-meter-wide fire lines and buffer areas surrounding forests and agricultural lands; removal of dead forest debris; regulation of the use of forest fires for hunting and "cleaning" the land; and education about preventing fires from cooking stoves. CFMC will facilitate the annual clearing of fire lines and, concurrently, forest patrolling. They will also be responsible for forming volunteer fire brigades of village youth who are trained in fire control and equipped with tools. Fires used for hunting game, cleaning forestland for settlements, shifting cultivation, and collecting tree resin often grow into larger forest fires.

Education about the effects of these practices, as well as implementation of fire-management measures (e.g., controlled forest fires every five years early in the dry season, instead of the current practice of annual fires), will be organized during the stakeholder meetings and discussions around the village land-use plans. Education and prevention can markedly reduce deforestation and forest degradation from fires. However, there is a lack of information on the ideal forest management plan. Data from the participatory forest biomass inventories (which includes a quantification of dead wood) will be very helpful to discuss fire-prevention measures and support management decisions. Depending on the adoption rates of propane stoves and the degree of urbanization, demand for charcoal might increase. Charcoal prices and usage will be monitored during the project period. The dead wood in the forest systems that is now removed by annual fires can be collected for fuel wood.

### Box 3. Fire Control and Assisted Natural Regeneration: Lessons from Dung Beng CF

Dung Beng (Beng Forest) is a 1,843-hectare forest located twenty-five kilometers to the southwest of Samraong town. On the northern side of the forest there are four villages, including the original settlements of Pou Chas, Beng, and Yeay Teb, which have been present in the area for over sixty years, and a fourth village, Ta Ma (New Village), which was formed in 1998 next to Beng. The villagers began protecting the forest in 2004 with support from CDA, a local NGO. Dung Beng CF has fewer management problems when compared with other CF areas in Oddar Meanchey.Few migrants have come in recent years. Last year, no new families came to this area. The CFMC members noted that no one in the village is inviting extended family members from outside to come and settle since the area has no land reserves for agricultural expansion. As the head of the CFMC reports:

*Our children must rely on their parent's land or earn money to buy new land.* —Pon Sok Phorn

The forest has a dense, hilly evergreen forest as a core area. The fringe of the CF area is largely open dry deciduous forest where dry season forest fires are common events. The forest possesses wild boar, deer, monkeys, and bears. With project support, twenty-seven community members spent five days and nights in the forest constructing fire lines in February 2009. The CFMC members felt that the degraded dry deciduous forest has the greatest potential for rapid regeneration if protected from fire. They said priority should be given to healthy patches of open forest that are located near the moister evergreen forest. They are especially interested in the potential of coppicing beng trees, which could recover quickly if fires were halted for at least four to five years. The villagers collect poaching traps when visiting the forest for nontimber forest products. An appraisal conducted in February 2008 noted that the area had been "high graded" for beng trees ten to fifteen years ago, but that regeneration since protection began in 2004 has allowed very healthy beng regrowth, which comprised approximately 40 percent of the standing stock in the dry deciduous forests.

The CFMC organizes three forest patrols each month, which follow the road along the southern boundary of the forest. While there are only occasional cases of illegal logging within the CF, the forest area to the south outside of the CF forest (within the leakage belt) has been rapidly felled over the past three years. Land speculators from outside and within the village are hiring local villagers, who are paid Baht 2,000 ($57) per hectare to cut down all trees with chainsaws. Over 1,000 hectares have been cleared by the villagers for businessmen. Felled trees are often left in place as the land speculator awaits an opportunity to sell. According to CFMC members, a "dealer" within the village will package the land and process it through the commune council. While no title is issued, the commune council approves occupancy, allowing the land to be sold. Last year, this type of land was selling for $150 per hectare, but no one is currently buying due to the recession and felling has slowed, though this process is likely to start again once the economy recovers. In 2009, the national government reiterated that action would be taken against illegal land sales.

### Project Action 10: Fire prevention

Fire-prevention activities are planned from year 4 of the crediting period until the end of the project. A learning period of 5 years is assumed until fire prevention activities are fully effective.

#### Maximal reduction in driver-induced deforestation

- **Driver 5 (Annual forest fires induced to "clean" the land)**
  25%. Fire-prevention measures, including the clearing of some dead wood and the construction of fire lines, will help prevent the spread of intentional and natural forest fires. It is expected that the occurrence of fires will reduce by about 25 percent.
- **Driver 6 (Hunters inducing forest fires)**
  25%. Same as above.

.TGC scientist Dr. Emilio Laca and CFI's Senior Carbon Program Officer Sona Long take tree measurements in Sorng Rokavan CF, one of 183 forestry and farm inventory plots established for monitoring project carbon. stocks.

CFMC representatives and community leaders drawing sketch map to discuss forest boundary issues.

# PART III: DESIGN PROCESS

The design process took approximately twenty-four months, from early 2008 to 2009, when the project design documents (PDD) were submitted to the Climate, Community, and Biodiversity Alliance (CCBA) and the Voluntary Carbon Standard (VCS) program for certification. The development and approval of the REDD methodology used in the project were also completed during this period. Designing a REDD project is a complex process involving a diverse set of activities with a wide range of actors, often occurring simultaneously. Many other activities take place in the forest and the community, while others happen at the local government, national, and international levels. The activities and skills required to complete the design of a project are diverse, including developing REDD methodology; measuring forest stocks; preparing PDD and submitting them to the CCBA and VCS; handling project negotiations and agreements; designing efficient project monitoring protocols; setting up carbon monitoring systems and preparing for validation; and verifying, marketing, and securing carbon sales agreements (ERPA). While specific actions taken to design Cambodia's first REDD project have taken place since 2008, the foundation for the project has been established over the past decade.

At the field level, in the two years leading up to REDD project identification, fifty-eight project communities were organized by a local Cambodian NGO and the Buddhist monks of the Samraong Pagoda, with support from Community Forestry International (CFI) and the encouragement of the Forestry Administration (FA). Community interest in protecting local forests provided the organizational basis for the project. The project CFMCs were formed through the active participation of the majority of households in the community. As Table 2 indicates, between 70 percent and 100percent of village households are participating in their respective community forestry groups, with an average participation rate of 85percent. High levels of community participation in CFMC activities and meetings helps ensure that decision making is done transparently and with the consensus of group members. The existence of CFMCs allowed the design team to interact easily with the project participants.

The following discussion focuses on the actors and their roles, project identification and government approval, CF support activities, and project design document preparation. Project design activities related to carbon calculations and project financing are addressed in Part V and Part VI respectively. Key components of the design process are summarized in Table 5.

## The Actors

The project design team is comprised of a diverse group of actors, including community forestry specialists from nonprofit organizations, government policymakers and foresters, donors, carbon brokers, remote sensing experts and carbon modelers, local NGOs, Buddhist monks, and forest-dependent communities (see Table 6). This collaborative approach to REDD project design was approved and funded through the Technical Working Group on Forests and Environment (TWG-FE). The TWG-FE brought together FA leadership with a broad-based donor group that sanctioned the project design, with one year of project support provided by DANIDA, DFID, NZAID, and the Clinton Climate Initiative–Forestry. Community Forestry International (CFI) brought both its extensive experience designing and implementing community forestry projects in rural Cambodia with its ongoing work on CF carbon project development.

The Forestry Administration, which has a remote sensing and GIS unit, a climate change section, a community forestry office, and forest management division was a key component of the project design team. In addition, the Forestry Administration staff of Siem Reap Inspectorate provided technical and custodial support to local community forestry groups. Project communities also receive support from the Children's Development Association (CDA) and the Buddhist Monk's Association, who have been working with project communities for the past five years and are well-positioned to provide organizational and technical backing.

Terra Global Capital, a private firm specializing in the development and marketing of community forest carbon credits, has supported the development of all carbon market documentation and will ensure that buyer-seller negotiations are conducted in an efficient manner and that carbon measurement and submission to registries are successfully completed. CFI will complete the project design. The FA is currently in negotiations with Pact, an experienced international organization that is considering acting as implementing partner over the next five years.

## Project Identification and Government Approval

The project area was identified in the original CFI project identification note (PIN) in early 2007 (CFI 2007) due to the presence of fifty-eight active community forestry groups, supportive civil society, and the interest of the Forestry Administration (FA). The project design process required a series of meetings with the communities and the FA to confirm eligibility. The initial selection of the province of Oddar Meanchey for the spatial reference area was accepted by the design team due to the availability of secondary data and the appropriate scale relative to the project area. The historic reference period was determined, in part, by the availability of remotely sensed imagery, though the intention of the design team was to establish this approximately ten years from the start date of the project. Determining the start date was also a process dependent on satellite image availability and the initiation of project activities.

**Table 6: Project Actors and Roles**

| ACTOR | ROLE |
|---|---|
| Community Forestry International (CFI) | Project identification—REDD strategy design—design team coordinator |
| Forestry Administration | Carbon seller—Lead agency representing the Royal Government of Cambodia; co-implementing agency |
| Terra Global Capital | Carbon calculator—carbon broker—technical adviser |
| PACT | Proposed implementing agency |
| Technical Working Group on Forests and Environment/ DANIDA | Funding agency for project design and monitoring body |
| Clinton Climate Initiative | Funding agency for project certification |
| Children's Development Association | CFMC training and field project management activities |
| Buddhist Monks of Samraong Pagoda | Organizers of monk's conservation forests (Sorng Rokavorn, 18,600 hectares) |
| 13 CFMCs from Oddar Meanchey Province | Local implementing organizations for forest patrolling, restoration, activity planning |

At the national level, the project concept was presented to the Technical Working Group on Forests and Environment in November 2007. The TWG-FE includes senior government policymakers and planner and donor representatives. The project received the endorsement of the TWG-FE. The Council of Ministers gave formal approval to CFI to proceed with project design in May 2008. Key project documents, including the initial concept note, memorandum of understanding (MOU), and field reports, have been widely shared, and some have been translated into Khmer. This process is detailed in a recent case study published by Pact, entitled "REDD Working for the Poor in Cambodia" (Bradley 2009).

## Support to Community Forestry Groups

CFI began supporting local communities and NGOs operating in the province in 2005, relying on a mix of capacity building, technical training, and financial support. Communities engaged in forest-protection activities were encouraged to submit applications for up to $500. By 2008, with REDD project design support, CFI sought to provide further support to communities that were already engaged in protecting forest areas and that requested assistance in strengthening their conservation efforts. These included funding and training to demarcate forest areas with boundary posts and signage, improving communication through cell phones and handheld radios, enhancing mobility with motor scooters, and identifying and authorizing forest users through identify cards. A total of twenty-one microgrants were distributed in 2008, primarily to support requests for patrolling materials, patrol posts, and petrol for mobile patrolling (Bradley 2009). Aside from providing badly needed financial support, the microgrants were designed to build community capacity to manage project funds in a transparent and effective manner in anticipation of future funding from REDD. Communities were especially concerned about establishing control over their CF areas, and they also requested FA assistance in formalizing their claims to these areas. CFI organized a series of meetings among the CF management committees, local government, and the FA in order to resolve boundary conflicts and reach a consensus on the project area. CFI provided small grants to a local NGO, the Children's Development Association, to finance training activities for CF management committees in Oddar Meanchey Province beginning in 2005. Training included guidance on the eight-step process required for CFMCs to receive formal approval from the Forestry Administration under the CF subdecree.

Given high levels of illiteracy in project communities and the complexity of carbon project modalities, the project development team communicated and shared project concepts with communities through a series of village meetings and simple extension material. The Children's Development Association (CDA) and the Buddhist monks from Samraong Pagoda have met repeatedly with local village members and leaders to discuss community forestry management issues and guidelines for participating in a carbon project. The Forestry Administration has held specific meetings with local provincial and district government officials, community members, and regional military commanders to discuss the program and explain how it will operate. At the local government level, CFI sponsored and facilitated a series of meetings with local communes, districts, and provincial government representatives in order to share program design ideas and explore interest.

In early 2009, a Cambodian-language color brochure was produced describing the project, goals, benefits, risks, and project strategy. This brochure is being

distributed to all project communities, and follow-up discussion meetings are being scheduled. During village meetings, the team will distribute Khmer-language pamphlets describing the REDD carbon project. This will be followed by a question-and-answer period and discussion. Many CFMC members were already aware of the new project and excited about its implementation. While knowledge of climate change and greenhouse gases is limited, some understanding has been apparent. Ms. Samnang explained it by saying:

> ***We are going to sell the air to the people who are polluting in the city.***

The project will continue to provide opportunities for participating communities and households to understand more regarding the goals of the REDD project and how they can improve the effectiveness of the REDD strategy. The project will work with the FA's Climate Change Team to develop Khmer-language extension materials, organize workshops and meetings, and train NGO facilitators.

The project also supports the development of a provincial-level CF Federation that can better represent forest-dependent communities and CFMCs. The CF Federation can facilitate communications with local government and the Forestry Administration, while providing a focal point for data collection and feedback from participating communities. Cell phones are providing a low-cost, efficient technology for maintaining communications among forest patrols, villages, CFMCs, the CF Federation, and the local FA.

In summary, providing support and engaging forest communities in the design process has increased local knowledge regarding REDD, encouraged communities to strengthen their forest-protection efforts, and established stronger linkages between the communities themselves, as well as with the FA. Much of the community efforts during the project planning phase focused on establishing clearer forest boundaries through demarcation and mapping, increasing the frequency and effectiveness of patrols, identifying problems and needs, and completing the CF process, leading to an agreement with the FA. The combination of formal recognition of management rights combined with small grant support provided significant benefits to the CFMCs during the design phase.

## Project Design Document Preparation

In preparing the PDD for submission to the certifying agencies, the project design team needed to collect a range of information on the socioeconomic, biodiversity, and carbon aspects of the project. This process required approximately eighteen months to complete.

**SOCIAL APPRAISALS:** An initial social appraisal was conducted in January 2008 to assess the capacity of proposed project communities to implement a REDD project, as well as to identify important drivers of deforestation and forest degradation. This was followed by a second appraisal in February and March to create opportunities for exchange with all proposed project areas and communities. The visits also provided an opportunity to introduce the REDD project concept and understand villagers perceptions of forest management problems and priorities. Social appraisals also provided insight into local government operations, FA field staff capacities, and the role being played by civil society institutions. Social appraisals were conducted again in February 2009. Data from the

social appraisals was important in PDD development. It was used in informing proposed mitigation strategies, providing cost data, and suggesting implementing roles and agencies (see Part 3).

Subsequent community meetings and field visits identified both new CF groups that wished to be included in the REDD project, as well as proposed project sites that had to be released due to community forest management problems that could not be resolved at the time the PDD was being finalized.

**FOREST INVENTORY:** The project required the establishment of long-term forest and farm monitoring plots, both to provide data for ex ante estimates of carbon stocks and to create a baseline for long-term carbon accounting. Initially, eighty 50 x 50–meter forest and farm inventory plots were laid out by a collaborative team from CFI, the FA, CDA, Buddhist monks, and community members (see description in Part 3), with 103 additional plots added at the recommendation of the methodology validation body. The methodology for ground sampling was designed by TGC, with guidance of staff from the University of California at Davis, using TGC's standard operating procedures (SOP) translated into Khmer. Forest inventory data was coded by CFI design team members and sent to TGC for analysis. Ground data was analyzed in conjunction with satellite imagery, providing an integrated assessment of biomass and carbon stocks. Details of the carbon calculation process are presented in Part 5.

**SOCIOECONOMIC BASELINE:** The project design requires the establishment of a socioeconomic baseline that can be used to monitor changes in livelihood and other quality of life indicators over the life of the project. A number of in-depth interviews conducted during the social appraisal generated a preliminary picture of the household economy of families in the project area. Interview guidelines and questionnaires for a quantitative baseline survey of the economic conditions of households are planned for late 2009. It is proposed that a resurvey be conducted every five years.

**BIODIVERSITY BASELINE:** Community interviews and secondary data sources were used to identify important species of flora and fauna. Forest plot inventories provided additional data on tree and shrub species found during the field survey. CFI contacted several environmental organizations to seek their help in establishing a biodiversity baseline and monitoring system. Negotiations are underway to contract one of the groups to provide the methodology, training, and supervision for a community-based biodiversity monitoring system.

**SUMMARY:** The project design process has taken longer than the design team originally anticipated. In part, this reflects the additional time required to develop new methods and secure validation from certifying bodies. It also reflects uncertainty regarding the emerging rules governing REDD. Team building and reaching agreements among key project partners also required additional time. Inadequate funding to cover initial design and implementation costs has also slowed project development. Despite these constraints, the project has made remarkable progress in supporting community forest-protection efforts, linking them to the national CF program, modeling the impact of this strategy on carbon stocks, creating financial tools pro forma to evaluate the project's fiscal viability, and preparing the project for certification. Learning from this experience indicates that a strong coalition of partners, government support, active community participation, sophisticated technical capacity, and adequate start-up financing may all be important components for successful REDD project design.

# PART IV: CARBON CALCULATIONS

## Setting the Stage: Overview and Definitions

The climate benefits of a REDD project are calculated by evaluating all potentially positive effects on global warming against the potential negative effects. A distinction is often made between primary and secondary effects. Primary effects refer to the positive impacts of project activities on the environment, biodiversity, or the project communities, most importantly, the impact on avoiding deforestation. Secondary effects refer to the negative consequences of some of the project actions. Patrolling the forest to reduce illegal logging may have a positive impact on reducing deforestation, while the motorbikes used on the patrol emit carbon dioxide from fuel use, resulting in a negative impact on greenhouse gas emissions. The idea behind the carbon accounting from REDD projects is that both the primary and negative effects of project actions are taken into account in a way that is as comprehensive as possible. The carbon benefits from a REDD project consider five factors:

1. Carbon stock changes under the baseline scenario
2. Carbon stock changes under the project scenario
3. Secondary emissions from project activities
4. Secondary emissions from leakage
5. Increases in carbon stocks from assisting the natural regeneration

Once these values are available for every year of the project, the climate benefits can be easily calculated by adding and subtracting the values as follows: [2] – [1] – [3] – [4] + [5], and adjusting for uncertainty (see next section). The Oddar Meanchey project is submitted under the Voluntary Carbon Standard (VCS) program, which requires that some of the credits be held in a buffer account. Therefore, the voluntary carbon units (VCUs) that are brought to market can be calculated by adjusting the climate benefits with the buffer withholding percentage, which can be from 10 percent to 30 percent of the gross climate benefits, depending on the certifier's assessment of project risk.

Before each of these individual values are explained in detail, a number of important issues are discussed.

**THE CALCULATION OF CARBON CREDITS DOES NOT HAVE TO BE PERFECT, IT HAS TO BE CONSERVATIVE:** All measurements are imperfect. As a consequence, all calculations of climate benefits have some degree of uncertainty associated with them. However, the mere existence of uncertainty does not mean that a calculation and monitoring system is useless. Only when the uncertainty cannot be quantified accurately or is quantified incorrectly does a calculation and monitoring system become problematic. Once the uncertainty is correctly quantified, a discounting factor can reduce the average volume of carbon credits to an amount above the true carbon credits in at least 95 percent of the cases, if the measurements and calculations are repeated multiple times. If this is the case, the buyer would purchase an amount of credits that will probably be smaller than the true amount of credits that are generated to avoid the risk that nonexistent credits, also called "hot air," are sold. A decision on the exact level of confidence (i.e., the relative number of cases in which the carbon credits that are

issued remain, in fact, conservative) is subject to negotiation at a political level. In our calculations, a confidence level of 95 percent was used.

**LAND CLASSES AND CARBON POOLS:** Land-use dynamics are extremely complex. To simplify land-use dynamics for the sake of calculation and monitoring, land use and land cover are divided into classes. There is an inherent trade-off in the definition of the number of classes. On the one hand, all land classes must be detectable based on remote sensing techniques. On the other hand, land classes must be granular enough so that they can be assumed to have a homogeneous carbon density. In addition, the land classification system follows the minimal Intergovernmental Panel on Climate Change (IPCC) land classes: forestland, cropland, grassland, settlements, wetland, and other land. Forests within this project follow the Food and Agriculture Organization (FAO) forest definition, which states that forestland should have at least 10 percent forest cover, an area of more than 0.5 hectares, and trees that should be able to reach a minimum height of five meters. The main forest class is divided according to the two forest types: evergreen forest and dry deciduous forest (see photos). Each of the two forest types was further subdivided into three biomass density classes: well-stocked, medium-stocked, and poorly stocked. Unfortunately, we were not able to distinguish among the stock densities using available Landsat 5 data, and will report only average carbon stock densities of evergreen forest, mixed forest, and nonforest (see Table 7).

Now that a classification system is available, deforestation can simply be defined as a shift from one forest class to another. This transition is associated with a decrease in carbon stocks and an emission of carbon dioxide which equals the difference in carbon stocks between the two classes. This decrease in carbon stocks on a per hectare basis is often referred to as activity data. Table 8 contains the two emission factors for deforestation from the two forest types within the project area. The effect of deforestation on carbon stock changes can now be assessed by calculating the deforestation rates, expressed in hectares per year, with the activity data, expressed in MTCO2e per hectare, resulting in emission changes per year, expressed in MTCO2e per year. In all subsequent calculations, we have discounted the emission factors with the half-width of the 95 percent confidence interval around the mean.

**Table 7: Basic Statistical Measures of the Field Measurements per Forest Type**

| Carbon density class | Actual average | Standard deviation | Maximum | No. of observations |
|---|---|---|---|---|
| Evergreen forest | 244.8 | 165.0 | 975.6 | 65 |
| Mixed forest | 125.6 | 67.4 | 451.9 | 92 |
| Nonforest | 5.3 | 12.4 | 77.5 | 49 |
| SUM | NR | NR | NR | 206 |

Mg DM $ha^{-1}$ = Megagram (i.e., metric ton) of dry matter per hectare; based on a network of around 150 permanent sampling plots and 50 non-permanent sampling plots.

### Table 8: Emission Factors for the Two Forest Types in the Project Area

| | Average emission factor | Uncertainty | Relative uncertainty (*) |
|---|---|---|---|
| From evergreen forest to non-forest | 439 | 75 | 17% |
| From mixed forest to non-forest | 221 | 27 | 12% |

(*) The uncertainty is calculated using standard error propagation formulas and taking the half-width of the 95 percent confidence interval around the mean as the uncertainty for carbon stocks.

The total carbon within the landscape is divided into discrete reservoirs, or carbon pools, according to the turnover time or dynamics of the pool. In a forest system, carbon can be stored within the aboveground tree biomass, aboveground non-tree biomass (i.e., understory, shrubs, and grasses), belowground biomass, dead tree biomass, the forest litter layer, and soil organic carbon, sometimes referred to as humus. The forest litter layer consists of decaying plant material on the soil surface. Ideally, all carbon pools are included in the calculation of the total carbon stock of the landscape. However, since measurements are time-consuming and costly, one or more of the carbon pools can be omitted when the change in carbon pools is small or conservative. What counts at the end of the day is that changes in carbon stocks can be conservatively estimated, rather than a perfect measure of the absolute stocks. The Oddar Meanchey REDD project is based on aboveground tree biomass, belowground tree biomass, and dead tree biomass. All other carbon pools are either insignificant or are expected to remain constant or increase upon deforestation.

Evergreen forest in project area

Mixed deciduous forest in project area

## Greenhouse Gases and Emission Sources

Although carbon dioxide ( $CO_2$) is the best-known greenhouse gas, there are two other greenhouse gases produced or consumed by land-use changes and natural landscapes: methane ($CH_4$) and nitrous oxide ($N_2O$). Since biological systems can emit or absorb these three greenhouse gases, they are referred to as the biogenic greenhouse gases. Within the context of biological systems, the non-$CO_2$ gases $CH_4$ and $N_2O$ are referred to as trace gases. The three biogenic greenhouse gases differ quite drastically in the effect they have on global warming. More specifically, 1 gram of nitrous oxide gas has the same global warming effect as 289 grams of carbon dioxide, while 1 gram of methane has the same global warming effect as 25 grams of carbon dioxide. When taking into account these variations in the ability to cause global warming, the total combined potential of a mixture of the three greenhouse gases is called "global warming potential" (GWP) and expressed in so-called "carbon dioxide equivalents." The concept of carbon dioxide equivalents makes it possible to adjust the gross climate benefits of avoiding deforestation and forest degradation with the smaller negative secondary effects from leakage or project-related emissions. Secondary carbon dioxide emissions include (1) emissions from the loss of biomass from fire prevention measures and (2) emissions from fuel used for forest patrolling. Secondary trace gas emissions include:

1. Methane and nitrous oxide emissions from forest fires, and also from controlled burning.
2. Methane emitted by increased rice production as an agricultural intensification measure. Methane is primarily produced in rice systems by so-called methanogenic bacteria that live in close proximity to the fine roots of the rice plant.
3. In addition, project activities may increase nitrous oxide emissions from increased fertilizer use for agricultural intensification or assisted forest regeneration.

Microorganisms in the soil produce nitrous oxide if excess mineral nitrogen, readily decomposable carbon, and moisture are simultaneously present; the processes involved are called nitrification and denitrification, and they are very sensitive to the moisture content of soil. The IPCC guidelines assumed that a fixed percentage of all fertilizer is converted into nitrous oxide. Therefore, increasing the use of fertilizer will increase nitrous oxide emissions.

## The Five Pillars of Carbon Accounting

**1. CARBON STOCK CHANGES UNDER THE BASELINE SCENARIO:** Carbon stock changes under the baseline scenario are calculated based on historical deforestation and forest degradation rates from a reference region that is similar to the project area. A series of historical remote sensing images is used to follow the speed at which forests disappeared in the ten years before the project start (Figure 7). The average deforestation rate within the mixed forests of the project area is 1443 $ha^{-1}$ $yr^{-1}$, while it is 758 $ha^{-1}$ $yr^{-1}$ within the evergreen forests of the project area. This represents a relative deforestation rate of 4.2 percent in the areas of mixed forests, and 2.9 percent in the areas of evergreen forests, which is very close to the values reported by a previous study conducted by the University of Copenhagen and the Forestry Administration (FA) in 2008. We assumed that in the next two years, deforestation will occur at at least the same rate as the average rate of the past ten years. We will revise this assumption two years

after the project start, when the baseline will be updated, and every two to five years thereafter. In addition, by relating the location of where deforestation was observed with spatial driving variables such as distance to roads, villages, or the forest edge, it is possible to predict where future deforestation will take place.

If more and more forest disappeared under the baseline scenario, people would most likely value forests more, and forest cover would stabilize. It is well-documented that deforestation rates decrease when forest areas are gradually disappearing. The "forest transition" theory (Mather and Needle 1998) explains how areas with vast forests, which are initially characterized by rapid deforestation rates, stabilize after some time. To incorporate a decrease in deforestation rates upon a gradual depletion of forest resources, these initial deforestation rates were multiplied with a forest scarcity factor, which is initially 1, but gradually decreases as the proportion of remaining forest decreases (Figure 6). This scarcity factor was calibrated in a conservative way by using a land-use change model. According to the calculation, deforestation will start to decrease when around 50 percent of the current forest area in the project area is deforested, and completely stops when around 80 percent of the forest area has disappeared. A very similar pattern was reported by Meyfroidt and Lambin (2008) in neighboring Vietnam. Deforestation rates started decreasing when 50 percent of forest cover remained, and halted in 1991–1993 at around 25 percent forest cover. Due to its cultural and ecological similarity to Cambodia, the forest transition trends observed in Vietnam may be a valid reference for the situation in Cambodia, although Vietnam's timber demands have been met, in part, through illegal wood imports from Cambodia and Laos. The deforestation rates, expressed as hectares per year, can be converted into tons of carbon dioxide per year by multiplying the rate with the appropriate emission factor, as explained in a previous section. The resulting carbon stock changes under the baseline scenario for each year of the project duration are summarized in column [1] of Table 9.

**Figure 6: Relative Deforestation Rate as a Function of Proportion of Initial Forest Area That Is Deforested**

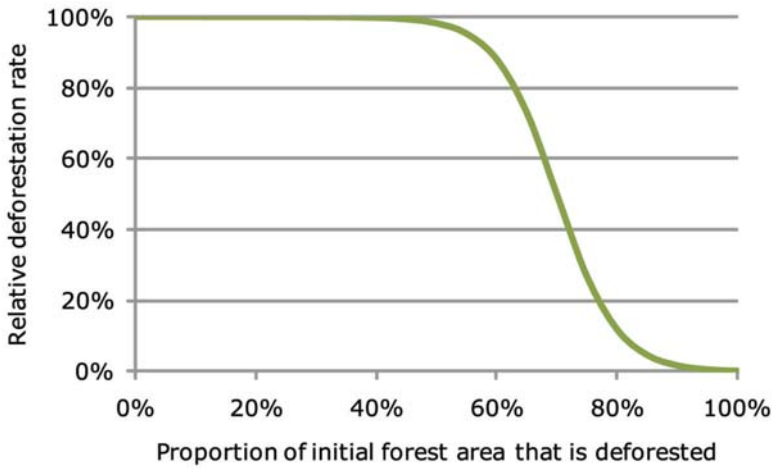
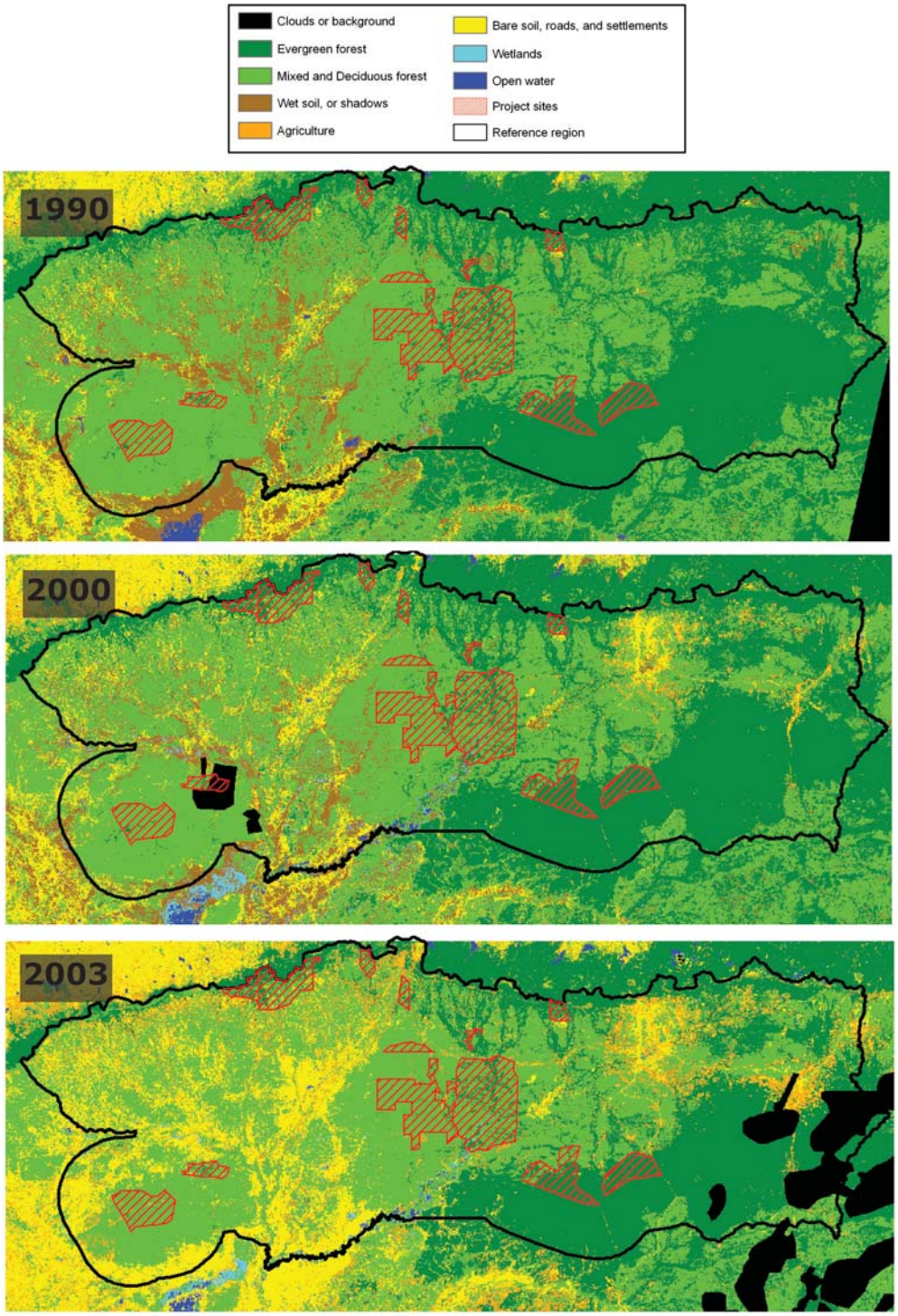


Figure 7: Recent Evolution of Land Use and Land Cover in Oddar Meanchey Province, Based on Landsat Images: 2000–2006



**2. CARBON STOCK CHANGES UNDER THE PROJECT SCENARIO:** Deforestation in the project area is caused by over ten drivers identified during the social appraisals and the interviews with local communities. Ten project activities, from forest patrolling to agricultural intensification, were designed to address these drivers, with the goal of reducing the total deforestation rate. To predict how much deforestation can be decreased based on a large number of project actions, we developed a simple model strategy based on (1) the relative importance of the deforestation drivers, and (2) the extent to which each of the project actions affect every driver. For example, forest patrolling will reduce illegal logging almost completely, while agricultural intensification will mainly reduce the need of local communities to clear land for subsistence agriculture. The relative decrease in deforestation predicted using this approach is shown as the grey bars in Figure 8. We predict that when all project activities are implemented at full rate, deforestation will not be fully eliminated, but the deforestation rate within the project area will be reduced to around 20 percent of the rate under baseline conditions. A start-up period of around five years is needed before this maximal reduction in the deforestation rates is reached due to the phased allocation of funds and the time required for gaining experience and building capacity. These are only gross reductions, and should be adjusted for increases in deforestation outside of the project area due to leakage, which is covered further on.

Absolute deforestation rates are calculated by multiplying the relative deforestation rates with the baseline carbon emissions. The resulting carbon stock changes under the project scenario for each year of the project duration are summarized in column 2 of Table 9.

**3. SECONDARY EMISSIONS FROM PROJECT ACTIVITIES:** The climate benefits are discounted for secondary emissions from controlled biomass burning for fire prevention, e.g. for fire breaks, fuel emissions from forest patrolling, and nitrous oxide emissions from increased fertilizer use. $N_2O$ emissions from forest fires in the baseline scenario have been conservatively omitted.

- Standard IPCC equations are used to calculate emissions from patrolling. For forest patrolling, 17 motorcycles and 1 mobile unit will be operated during the project period. These will use an estimated total 5,556 litres of fuel per year. Using standard values for vehicle gasoline, an annual total of 13,442 MTCO2e $yr^{-1}$ is emitted due to fuel use during forest patrolling.
- It is anticipated that, in total, 60 hectares per year will be treated for fire prevention measures. This comprises the installation of fire breaks (30 hectares per year) and some thinning of fire-sensitive forest areas (30 hectares per year). In total, 5,006 MTCO2e $yr^{-1}$ emissions from fire-prevention measures are expected.
- The project plans to install pilot projects to educate local communities on some agricultural practices which can increase yields and decrease the pressure on forestland to be converted to agricultural land. Among other things, this will involve an increase in the use of fertilizer, both from organic and chemical sources. We estimate that maximally around 7,000 hectares will be affected. Application rates are 100 kilogram nitrogen of chemical fertilizer and

80 kilogram nitrogen for organic fertilizer, and, if standard emission factors are used, the maximal total annual emissions are 7,000 MTCO2e $yr^{-1}$.

- Assisting natural regeneration measures include removing invasive plants, coppicing, thinning, and enrichment planting. Some of these measures will decrease the carbon stocks in the project area and, therefore, must be accounted for as a secondary emission. About 500 hectares are treated from years 3–20, and 250 hectares from years 21–30. About half of the decrease in carbon stocks will be executed using controlled burning, which will emit some nitrous oxide. Therefore, annual emissions from the ANR treatments are 11,555 MTCO2 $yr^{-1}$ during years 3–20, and 5,778 $yr^{-1}$ during years 21–30.

According to the clean development mechanism (CDM) test, the emissions from fire-prevention measures and fertilization are insignificant and, thus, were omitted from the calculations. The sum of the remaining significant emissions, which include emissions from fuel use and emissions from clearing of biomass for assisted natural regeneration, are summarized in column 3 of Table 9.

**4. SECONDARY EMISSIONS FROM LEAKAGE:** Leakage has been cited as being a major obstacle for the development of avoided deforestation projects (Schlamadinger et al. 2005, Miles and Kapos 2008). If the project is able to successfully reduce deforestation in the project areas, solely by transferring deforestation to areas outside the project boundaries, this would not achieve the desired environmental benefits. However, only in cases where potential leakage cannot be identified and quantified does leakage pose a fundamental barrier. In designing the Oddar Meanchey REDD project, the leakage-risk was minimized by planning leakage prevention activities that are designed to make communities less dependent on deforestation for their livelihoods. Such measures include agricultural intensification, the introduction of fuel-efficient woodstoves, and assisted natural regeneration. This project recognizes three different leakage types: (1) activity-shifting leakage within the "leakage belt," a predefined area immediately adjacent to the project sites, (2) activity-shifting leakage outside of this leakage belt, and (3) market leakage.

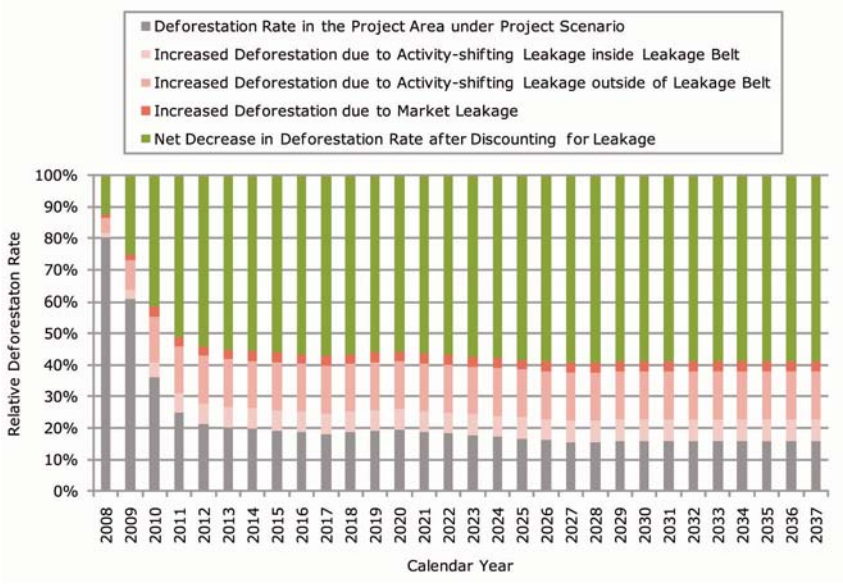
Activity-shifting leakage refers to the increased deforestation outside of the project area due to the displacement of agents of deforestation from within the project area. Market-effect leakage occurs when prices and market forces are affected by project activities, influencing the economic attractiveness of deforestation. This may occur, for example, by reducing the rate of illegal logging. The reduction can increase the price of illegally logged wood in the area, which will make illegal logging in other areas more attractive (Aukland et al. 2003). The conservative quantification of market leakage is based on coefficients set in the VCS AFOLU guidance.

Some drivers are acting at a local level and are geographically constrained. Mitigating these drivers will shift pressure from the project area to the abutting area, which is referred to as the leakage belt. However, other drivers are geographically unconstrained and might shift pressures to areas far outside the project area. Examples of geographically constrained drivers are fuel wood collection or collection of timber for local use. The range of action by local agents of deforestation is constrained by the time it takes to move from a dwelling to the place of deforestation. An example of a geographically unconstrained driver is migrant encroachment. Only activity-shifting leak-

age within the leakage belt can be monitored. Activity-shifting leakage outside of the project area cannot be monitored as it can happen in completely different and distant areas. As a consequence, whereas the actual loss of carbon credits from activity-shifting leakage can be monitored within the leakage belt, leakage outside of the leakage belt can only be conservatively accounting for using standard factors for each of the deforestation drivers. The assumptions made while assigning these factors must be monitored during the crediting period. Figure 8 contains magnitudes of each of the three sources of leakage relative to the total deforestation under baseline conditions. The annual sum of all leakage sources is summarized in column 4 of Table 9.

**5. INCREASES IN CARBON STOCKS FROM ASSISTING THE NATURAL REGENERATION:** Assisted natural regeneration activities consist of a combination of silvicultural activities, such as removal of invasive species, coppicing, thinning and enrichment planting. The project will implement the removal of species, thinning, and coppicing on 500 ha $yr^{-1}$ during years 3–20 of the project. Half of this area will be subjected to enrichment planting. During years 21–30, enrichment planting will be continued on 250 ha $yr^{-1}$. Based on a literature review, the natural regeneration rate in absence of any regeneration activities is 10 Mg AG+BG DM $ha^{-1}$ $yr^{-1}$. Assisted natural regeneration activities can increase this regeneration rate by 30 percent to around 13 Mg AG+BG DM $ha^{-1}$ $yr^{-1}$. Most of this increase will take place right after the assisted natural regeneration procedure, and will slowly fall back to the natural regeneration rate of 10 Mg AG+BG DM $ha^{-1}$ $yr^{-1}$. Only the increases in biomass during the project period can be accounted for. The sequestration benefits from the areas that will be treated later in the project period are only partially accounted for. The net increase in carbon stocks due to assisted natural regeneration activities is summarized in column 5 of Table 9.

**Figure 8: Impact of the Project on Deforestation Rates Inside and Outside the Project Area (Leakage)**



## Calculate Current Carbon Stocks and Based on Custom Land Classes

Table 9 contains each of the five sources of carbon accounting used to arrive at the total climate benefits. To account for uncertainty in the remote – sensing–based classification and modeling, the difference between project and baseline carbon stocks is multiplied with a discounting factor of 0.9. This factor was calculated based on the inaccuracy of remote sensing analysis, 5 percent, and multiplied by 2 to account for the subsequent errors during modeling. The final accounting formula for determining climate benefits is:

$$0.9 \cdot ([1] - [2]) - [3] - [4] + [5]$$

**Table 9: Summary of the Five Pillars of Carbon Accounting and the Final Climate Benefits (all values are expressed as $MTCO2\ yr^{-1}$)**

| Project year | Calendar year | C stock change (baseline) [1] | C stock change (project) [2] | Secondary emissions [3] | Leakage [4] | Forest regeneration [5] | Climate benefits |
|---|---|---|---|---|---|---|---|
| 1 | 2008 | 557,000 | 448,000 | 13,000 | 7,000 | 0 | 78,000 |
| 2 | 2009 | 557,000 | 339,000 | 13,000 | 28,000 | 0 | 155,000 |
| 3 | 2010 | 557,000 | 202,000 | 13,000 | 71,000 | 9,000 | 244,000 |
| 4 | 2011 | 557,000 | 139,000 | 25,000 | 90,000 | 17,000 | 278,000 |
| 5 | 2012 | 557,000 | 120,000 | 25,000 | 97,000 | 24,000 | 296,000 |
| 6 | 2013 | 557,000 | 113,000 | 25,000 | 99,000 | 30,000 | 306,000 |
| 7 | 2014 | 557,000 | 110,000 | 25,000 | 100,000 | 35,000 | 312,000 |
| 8 | 2015 | 557,000 | 107,000 | 25,000 | 101,000 | 39,000 | 319,000 |
| 9 | 2016 | 557,000 | 104,000 | 25,000 | 102,000 | 43,000 | 324,000 |
| 10 | 2017 | 557,000 | 100,000 | 25,000 | 102,000 | 46,000 | 329,000 |
| 11 | 2018 | 556,000 | 103,000 | 25,000 | 101,000 | 49,000 | 330,000 |
| 12 | 2019 | 555,000 | 106,000 | 25,000 | 100,000 | 51,000 | 330,000 |
| 13 | 2020 | 551,000 | 107,000 | 25,000 | 99,000 | 53,000 | 329,000 |
| 14 | 2021 | 545,000 | 103,000 | 25,000 | 99,000 | 55,000 | 329,000 |
| 15 | 2022 | 531,000 | 97,000 | 25,000 | 97,000 | 56,000 | 324,000 |
| 16 | 2023 | 506,000 | 90,000 | 25,000 | 94,000 | 58,000 | 314,000 |
| 17 | 2024 | 470,000 | 81,000 | 25,000 | 88,000 | 59,000 | 297,000 |
| 18 | 2025 | 430,000 | 71,000 | 25,000 | 81,000 | 60,000 | 277,000 |
| 19 | 2026 | 393,000 | 63,000 | 25,000 | 75,000 | 61,000 | 258,000 |
| 20 | 2027 | 362,000 | 56,000 | 19,000 | 69,000 | 61,000 | 248,000 |
| 21 | 2028 | 334,000 | 52,000 | 19,000 | 64,000 | 57,000 | 228,000 |
| 22 | 2029 | 306,000 | 49,000 | 19,000 | 58,000 | 54,000 | 208,000 |
| 23 | 2030 | 277,000 | 44,000 | 19,000 | 52,000 | 51,000 | 189,000 |
| 24 | 2031 | 245,000 | 39,000 | 19,000 | 46,000 | 49,000 | 168,000 |
| 25 | 2032 | 213,000 | 34,000 | 19,000 | 40,000 | 46,000 | 148,000 |
| 26 | 2033 | 184,000 | 29,000 | 19,000 | 35,000 | 44,000 | 130,000 |
| 27 | 2034 | 159,000 | 25,000 | 19,000 | 30,000 | 43,000 | 114,000 |
| 28 | 2035 | 139,000 | 22,000 | 19,000 | 26,000 | 41,000 | 101,000 |
| 29 | 2036 | 122,000 | 19,000 | 19,000 | 23,000 | 40,000 | 90,000 |
| 30 | 2037 | 108,000 | 17,000 | 22,000 | 20,000 | 35,000 | 74,000 |
| **SUM** | | | | **654,000** | **2,096,000** | **1,266,000** | **7,125,000** |

# PART V: FINANCING

This section describes the commercial development of the Oddar Meanchey project and steps taken to ensure the financial viability of the carbon credits generated. The ultimate goal of the commercialization process is to develop, manage, and measure the carbon assets in a way that will maximize their value for the stakeholders, within the constraints of the nascent market. This required innovation on the part of project participants, the adoption of commercial standards by all participants (many of whom were unaccustomed to these standards), and the integration of diverse skill sets across international borders. The underlying theme that defined the work performed for the project was how the risks of carbon credits could be reduced while asset values could be maximized. Reducing and managing risks as they related to the commercial and financial aspects of the project had a number of key components discussed earlier in the paper, including: establishing land-tenure security, effectively designing the project to mitigate the impact of deforestation and degradation, gaining the support of national government, and using the highest carbon accounting standards (VCS), with a strong focus on ex-ante modeling of the credits and financial requirements. The key risk-reducing measures for the commercial aspects of the project are detailed in this section, including:

- Selecting strong project and collaborating partners
- Executing legal agreements between parties
- Developing a collaborative work plan
- Estimating financial projections
- Identifying funding sources
- Approaching the sale of credits
- Devising benefit-sharing mechanisms

## Selecting Strong Project and Collaborating Partners

The process of developing this REDD project is proving to be challenging and complex. CFI, as the organization responsible for project identification and design, recognized the need to involve a diverse set of actors, including: communities, civil society, and the Royal Government of Cambodia, as well as reputable international companies and validation organizations. Terra Global, a dedicated land-use carbon development company with expertise in commoditizing community forest carbon and marketing, provided the skill sets needed in Cambodia to sell future credits to an international buyer. Establishing this international partnership was an essential and strategic action. The process of partnership creation presented challenges, as not all partners initially understood the need to involve different types of organizations and the unique roles that each played. After extensive discussion, a collaboration was established that linked poor, forest-dependent communities with the national FA and, finally, to U.S. firms with the scientific expertise and marketing experience needed to bring community forestry carbon credits to market. Local and international NGOs and donor agencies played a facilitating role throughout this process.

This experience demonstrated the need for villagers, officials, and professionals to come together to provide the diverse skills and knowledge essential for the development of a

REDD project in the Oddar Meanchey context. In addition, many of the unique disciplines required to develop a REDD project were interrelated with other aspects of the project, requiring close coordination between project team members. The absence of comparable REDD development experiences from other parts of the world presented the project development team with additional challenges. With no prior REDD projects to draw upon, the team had to design its own approaches to methodology development, managing multiple partners, and structuring carbon related agreements, as well as financing project activities and distributing future income. As with any commercial project, stakeholders require legal agreements and contracts to clarify the terms of their partnership. The formal project agreements are discussed below, but it is important to note that trust building was a key element in establishing project agreements and will remain a successful component to the long-term success of the project. The project team worked through conference calls, visits, and meetings to build trust between key stakeholders from the community and international partners. Physical distance, cultural and linguistic barriers, and the lack of shared experiences created constraints to trust building which are gradually being overcome.

## Executing Legal Agreements between Parties

Like most countries, Cambodia does not have a policy or set of laws to recognize and govern carbon credits from forestry projects. For the Oddar Meanchey project to meet international standards, it was necessary to ensure that the rights to carbon credits were properly secured and that the roles of the respective participants in carbon credit generation where contractually agreed. To achieve these goals Terra Global Capital (TGC) developed an overarching carbon agreement to be signed by the government that would serve four purposes:

1. Establish the FA (as directed by the prime minster) as the legal seller of the credits under the Emission Reduction Purchase Agreement (ERPA)
2. Define the responsibilities that the FA had to support the project and complete legal agreements with the communities and the implementing partners to ensure rights to carbon were secured and the responsibilities were enforceable
3. Recognize TGC as the carbon developer and marketer and define deliverables and terms for compensation
4. Require the FA to share carbon benefits as defined in the Sar Chor Nor No. 699 and to create a mechanism to administer these benefits.

The carbon agreement between the Forestry Administration (FA) and Terra Global was the legal foundation required to develop the carbon assets and ensure that a successful transfer of ownership could occur when the emission reduction purchase agreement (ERPA) was completed. For the FA, it was the first time that they had been involved in the development of such an agreement, and, while they were completely supportive of the project, reaching an agreement on the precise language and its legal implications presented challenges on both sides. As the FA increasingly understood the significance of their role as a carbon seller and the commercial nature of creating carbon credits, they exercised considerable caution in finalizing the agreement. The FA realized that as they negotiated the terms of the agreement, they were likely establishing precedents that would influence future REDD projects in their country. Ultimately, the carbon agreement signed between the FA and TGC represents a groundbreaking agreement that allows

CF groups, with the support of the FA, to bring their carbon to market.

In addition to the carbon agreement between the FA and TGC, several other agreements and documents were required by the project. These included: (a) the CF agreement, which is used to secure land tenure and recognition under the CF subdecree, (b) a CF management plan agreement that will specify how the forest may be utilized (consistent with the REDD project design), and (c) a community carbon agreement. The CF agreement and the management plan are both required elements under the CF subdecree. Each of the participating communities will also be required to sign agreements to support the carbon credit generation and to ensure there is no implied dual ownership of the carbon credits. The community carbon agreement outlines their responsibilities under the project and recognizes the government as the seller of the carbon. The document also stipulates that community land and timber usage rights are consistent with the CF management plan and REDD project design. In addition, it specifies the benefits the communities will receive from participating in the REDD project. In the absence of the development of carbon laws and regulations in Cambodia, the terms of some of these agreements overlap, though it was imperative that they be consistent and enforceable under the laws of Cambodia and internationally.

Besides the initial memorandum of agreement between CFI and the FA to design and develop the project, a long-term (five-year) agreement has been formed with a proposed implementing partner, Pact. This agreement clearly delineates the responsibility of Pact in managing the project.

## Developing a Collaborative Work Plan

One of the central elements of the agreement between the FA and TGC described the deliverables required by each party during the carbon development phase. This covered a range of elements, including project design components, REDD methodology development, design of standard operating procedures for biomass sampling, training for field measurements, preparation of the project design document, management of the validation process, structuring project agreements and negotiations, project training and field implementation, project monitoring, financial analysis and funding options, and marketing of credits. It further outlined the role that each party would play in developing the final work product for each of the deliverables. In this manner, all parties clearly understood and were contractually obligated to provide the support for each step required to bring the credits to market.

This work plan provided extremely valuable guidance that allowed all partners to understand the process of development from start to finish, defined the requirements of project design, and clarified the roles of all team members. The work plan also included a time schedule. While delays were encountered in completing certain phases of project development, the schedule did provide a general road map and time frame.

## Estimating Financial Projections

Developing the initial financial projections involved a collaborative process where CFI and TGC worked together to estimate the thirty-year project costs, carbon costs, and the carbon revenue. In project finance, financial projections

are prepared in advance of any new capital investment. The financial projection provides a model of the anticipated results from the project, with particular emphasis on the projected net income, cash flows, and, thus, funding requirements. The project costs detailed the estimated expenses involved in each project activity included in the project design for each year during the thirty-year crediting period. The carbon costs included the costs associated with developing the carbon asset and maintaining it during the crediting period and beyond. Without a detailed multiyear work plan and experience to estimate realistic implementation costs across of broad array of in-country activities, this would not have been possible. The project costs were broken down into categories support the budgeting process.

## Project Costs

Project design costs included provincial meetings and community workshops to engage and educate the participating communities. These also included the costs for CFI to design the project and gain initial government support. Project implementation costs included support to the implementing NGO in managing the project, providing ongoing oversight of local project partners, and supporting further community communication and education. These costs were estimated for the first five years of the project, with the goal of transferring oversight responsibilities to local partners after the project was smoothly running. Establishment and equipment costs are defined as those project actions that were prerequisites for beginning the project (for example, the purchase of motorcycles to support community patrolling of the areas). The last category of project costs was the ongoing expenses of direct project actions for the life of the project. Examples of these include support for community forest protection activities, incremental support for local law enforcement to support community patrolling efforts, and costs for assisted natural regeneration and enrichment planting.

## Carbon Development Costs

The carbon development costs were also detailed in the financial projections and broken down into categories. These included the carbon preparation costs, which reflect the expenses incurred for activities such as up-front social assessments for documentation of the drivers, agents, and underlying causes of deforestation and degradation; biomass inventories; remote sensing data; and methodology development and PD development. These are costs that would be incurred regardless of whether the project was actually validated under the VCS or CCB. The up-front validation and registration costs provided estimates associated with validating the project and setting it up in an authorized registry, including VCS registration, TZ1 costs, third-party VCS dual methodology validation, third-party validation of the VCS PD, third-party validation of the CCB PD, and dual validation of two components of the VCS PD, as required by the VCS guidelines. Transaction-related costs covered the expenses associated with the selling of carbon credits, including brokerage fees, legal costs for ERPA preparation, and any seller costs associated with buyer due diligence.

While the costs associated with developing and gaining validation under VCS and CCB are incurred up front, there are ongoing carbon monitoring and maintenance costs which are needed to secure carbon credits over the life of the project. Ongoing maintenance costs include the costs of monitoring all the data required under the methodology and the project design document, an annual biomass inventory, remote sensing data, preparation costs for verification report, costs to

reset the baseline as required by the methodology, and the third-party verification costs.

For the project costs and carbon costs, the projections identified which partner was responsible for managing the expenses. In this way, the model could support an overall project budget, but also identify the costs that would be managed by each partner.

## Net Carbon Estimates

The third section of financial projections covered the estimation of revenue potential from selling carbon credits from the project. This required creating estimates of the net annual project carbon credits over the thirty-year crediting period. These are referred to as ex ante project credits. As part of the registration, the VCS requires a portion of the credits to be placed in a VCS reserve pool which is not available for sale. The amount of credits held in the pool is based on the third-party assessment of project risks. An estimate was made that 30 percent of the Oddar Meanchey REDD project credits would be held in the VCS reserve pool, and these were deducted from the credits available for sale. By taking the ex ante estimated credits and subtracting the reserve and the percentage of credits allocated to the government and the carbon developer, the net credits from the project could be calculated. Once complete, projections were set up to allow modeling of various carbon prices and transaction structures, which took into account the timing of carbon payments to deliver both a net income and cash flow analysis for the project over thirty years.

The estimates in financial projections were refined over time as more accurate carbon-relevant data became available (see Table 10). The financial components of the project was revised as the estimates became more certain during the development process. Most notably, the tons of carbon estimated from the project were recalculated at various stages of project development, including (1) initial feasibility based on scientific literature, (2) field assessment based on the first set of ground sampling and remote sensing data, (3) preliminary method-based carbon calculations using the exact specifications according to the methodology first submitted for validation, and (4) revised method-based carbon calculations after revisions to the methodology were made and additional samples and remote data analyzed. Carbon estimates will be revised prior to the final submission of the project design document to the VCS.

The financial projections served as the foundation for managing all the financial aspects of the project. The projections identified the additional funding required for the project, guided the formulation of the work plan and the coordination of budgets between all the implementing partners, and provided a realistic basis for discussion of the benefits sharing agreement.

## Identifying Funding Sources

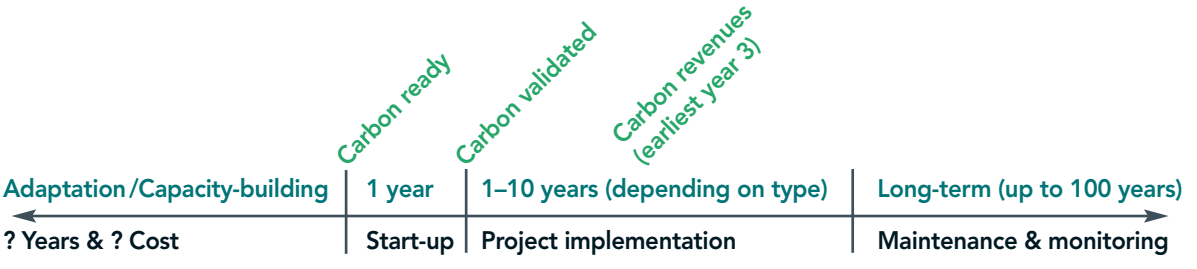
Financing project start-up presented an initial challenge to the development of the OM project. While the project design team initially sought to support the project through carbon sales, it was recognized that this initial project development period would require grant funding and other types of non-market support. The OM project was typical of the funding profiles of other REDD projects, where payments from carbon sales generally do not start flowing until credits have been validated starting in year two or three at the earliest.

## Table 10: Financial Projections without Carbon Sales

| CATEGORY | CUMULATIVE TOTAL PER PERIOD | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0-5yrs (with start-up) | 6-10yrs | 11-15yrs | 16-20yrs | 21-25yrs | 26-30yrs | Total |
| **Project Costs** | | | | | | | |
| Project Design and Prep Costs | $100,850 | $0 | $0 | $0 | $0 | $0 | $100,850 |
| Project Implementation Oversight | $1,412,038 | $0 | $0 | $0 | $0 | $0 | $1,412,038 |
| Establishment and Equipment–Project Actions | $373,116 | $181,800 | $177,200 | $177,800 | $162,200 | $196,800 | $1,268,916 |
| Ongoing Project Costs | $921,000 | $1,165,000 | $1,115,000 | $1,115,000 | $780,000 | $780,000 | $5,876,000 |
| Total Project Costs | $2,807,004 | $1,346,800 | $1,292,200 | $1,292,800 | $942,200 | **$976,800** | **$8,657,804** |
| Inflation on Project Expenses | $121,713 | $103,875 | $83,213 | $82,480 | $65,927 | $59,900 | $517,108 |
| Total Project Costs with inflation | $2,928,716 | $1,450,675 | $1,375,413 | $1,375,280 | $1,008,127 | **$1,036,700** | **$9,174,912** |
| | | | | | | | |
| **Carbon Monetization Costs** | | | | | | | |
| Carbon Preparation Costs[1] | $36,000 | $0 | $0 | $0 | $0 | $0 | $36,000 |
| Up-front Validation, Registration Registry Costs[1] | $189,277 | $157,060 | $162,151 | $137,648 | $93,022 | $50,265 | $789,422 |
| Transaction-Related Costs[1] | $15,000 | $0 | $0 | $0 | $57,675 | $31,165 | $103,840 |
| Ongoing Carbon Monitoring and Verification Costs[1] | $144,173 | $264,260 | $219,173 | $264,260 | $219,173 | $264,260 | $1,375,298 |
| Total Carbon-Related Costs[1] | $384,450 | $421,320 | $381,324 | $401,908 | $369,870 | **$345,689** | **$2,304,560** |
| | | | | | | | |
| Total Project and Carbon Costs | $3,313,166 | $1,871,995 | $1,756,737 | $1,777,188 | $1,377,997 | **$1,382,389** | **$11,479,471** |

1. The carbon monetization costs excluded: methodology development, standard operating procedures for biomass inventories, PD development for VCS and CCB, support for development of monitoring systems, structuring of in-country agreements, development of financial projections, marketing of credits as these were provided in exchange for carbon credits.

## Figure 9: Funding Pattern for REDD Carbon Projects



For the OM project, the start-up costs, as well as most of the carbon development and some registration and validation costs, were supported by donor funds or project partners providing services in exchange for a share of the carbon. This enabled the project to start implementation and begin the carbon development work. However, this did not provide adequate funding over the medium term to cover cash flow needs. At this time, other options were evaluated as to which sources of funding could be attracted to meet project funding needs. There were four types of funding sources under consideration: (1) donor, (2) carbon sales with pre-payment, (3) equity, and (4) loans or debt issuance. Each of these sources comes with its unique set of opportunities and constraints, but there is potential for combining funding sources which can be helpful.

The ability to rely on private capital in the form of carbon sales with pre-payment, equity, loans, and debt is limited, given the current state of development for these sources in the land-use carbon market. For these sources to come to the Oddar Meanchey project or other REDD projects of any scale, governments and regulations must create enabling conditions and provide attractive risk return for investors. Investors are used to evaluating and taking the risks involved in price uncertainties, project implementation, catastrophic risk, and delivery risk. However, without the certainty that they are dealing with the recognized owner of carbon credits, and that these credits will not be "taken" from them through government actions, they will not invest. Investors may also be reluctant to invest in government controlled/centralized offset schemes. Thus, they are looking closely at how project-based versus national REDD schemes are developing. Further, investors will need to have legal certainty that when they enter into transactions to acquire carbon offsets (or invest in projects generating them), the ownership will be honored by local governments and international bodies. Regardless of the nascent state of the private capital for land-use carbon projects, all funding sources were investigated for Oddar Meanchey and are still being considered as future funding sources.

## Donor Funding

Donor and multilateral institutions can provide valuable early funding for capacity building and project design, as they did for the OM project, and the benefits of donor funding are clear. They generally do not require an investment return or return of principal; thus, they reduce the amount of capital that must be attracted through carbon sales, equity, loans, or debt. They are also critical in developing the project and institutional capacity. For example, in Cambodia valuable donor funding was used to support the establishment of the CF subdecree and the national CF program, both of which provided the legal and policy instruments necessary to secure community land tenure as part of the REDD project actions. Often this type of funding is relatively short-term in nature and may not cover the carbon development costs. Additionally, over the last three years, the availability of donor funding to support REDD projects has been limited, as donor support has shifted towards regulatory development and national capacity building. The project was successful in the early stages in securing a one-year project development grant for capacity building and project design; unfortunately, follow-up funding became more difficult to find as the project moved into the implementation stage. As the absence of donor support for innovative

project development became increasingly clear, the project was forced to consider forms of private finance as a way to cover the negative cash flow. The limited donor funding and the greater need to attract private investment impacted the portion of the net income that is available for project participants, most notably, participating communities.

## Carbon Sales with Pre-payment

The typical carbon sale is based on a forward purchase at a fixed price for five to twenty years, with payment upon delivery of verified credits under the contracted standard (e.g., CDM or VCS); this is referred to as a spot purchase or payment–upon delivery. This form of sale reduces the risk to the buyer and should ultimately lead to the highest price for the seller. However, it does not provide the project any cash flow until the first verification is completed. While still relatively undeveloped in the marketplace, there are buyers who will consider pre-payment on a small portion of the credits in exchange for buying at a lower price to compensate for their risk. There are many structures that can be developed to support pre-payment, the most straightforward is an agreement where the buyer commits to purchase forward vintages (for example, ten years at a pre-agreed price, while paying for the first two or three years upfront). In most cases, the seller would not receive any additional payments until the number of tons that had been paid for upfront had been verified and delivered.

Today, most of the buyers willing to provide pre-payment are either corporate social-responsibility buyers, who generally purchase small quantities, or institutional buyers, who require some form of collateral or guarantee to secure their pre-payment. For sizable REDD projects like OM that generate over seven million tons of carbon over the project's lifetime, working with multiple small buyers is not a feasible or cost-effective way to acquire pre-payment on credits. In terms of collateral needed by institutional buyers, many REDD projects do not have the land-tenure arrangements to effectively pledge land or timber assets as collateral for a pre-payment. The only asset for many REDD projects is carbon, which cannot act as an effective collateral for pre-payment. As the market for pre-payment develops, especially for REDD projects that are developed for dual VCS and CCB registration, the project participants believe that there will be adequate demand for credits and the possibility to secure an attractive set of pre-payment terms for the Oddar Meanchey project.

## Equity Funding

A potential funding option for REDD involves raising equity capital to support the project. This is another form of financing like a carbon sale with pre-payment. With equity funding, investors provide up-front capital to a dedicated legal entity that controls the project assets and financial management. This gives them an equity stake or percentage interest in the net income of the project. There are still very few transactions where equity has been used to fund REDD activities. Equity investment has been more common in improved forest management projects, where start-up costs are higher and two revenue streams (timber and carbon) are available to generate returns for investors and provide collateral. The market is only just beginning to develop for equity investment in REDD projects, and it is unclear what level of return equity investors will require. However, early indications are that an IRR target range of 25 percent to 35 percent, with break-even within three to six years, would be required, depending on the specific project risk. When evaluating the economic profile of the OM project in the financial projections, it was determined to be impossible to

provide equity investors with the target 25 percent to 35 percent IRR and still provide 50 percent of the net income to communities, as required under the Sar Chor Nor No. 699. If additional donor funds can be attracted to support some of the costs, the situation could change significantly. Equity investors could also provide a valuable source of funds if the pre-payment options are not sufficiently attractive, allowing the project to meet the Royal Government of Cambodia's objectives of maximizing revenue flows to participating communities.

## Loans and Debt

The market for providing loans or debt to support the development of REDD projects is even less developed than equity investments. If these sources of funds could be attracted, the loans would be provided by banks to support the project and carbon costs in the early years. The banks could be international, but are more likely to be regional or local banks with experience in providing loans for agricultural or timber-related projects in developing countries. Additionally, there are direct loan programs and load guarantees provided by multilateral development agencies that are being explored for Oddar Meanchey and, over time, could be developed to support REDD. The challenge thus far has been that the size of the funding required by REDD projects like OM is generally too small to warrant the work involved in processing the loan. In addition, the use of carbon as collateral is not well-accepted, particularly as REDD carbon projects are still at an early stage of development. Once such projects possess verified carbon, it may be easier to use as collateral.

Debt is another form of loan, but instead of being provided by a bank, it is issued in the capital markets and purchased by institutional investors. Due to the risk and the small size, the ability to attract funding through a debt issuance for a single REDD project is extremely unlikely. If available, both loans and debt could be a valuable source of funding for REDD, although they do add costs to the project in the form of interest and fees. If loans or debt could be attracted, these are often combined with equity within the dedicated legal entity to provide leveraged returns for investors. In the case of OM, given the requirements of the Royal Government of Cambodia to provide at least 50 percent of the net revenues to community forest managers, it would be necessary to combine equity and loans/debt to meet the returns expected by investors.

## Interaction between Funding Sources and Participant Benefits

The capital structure used to fund a REDD project—or how sources of donor and private funds are combined to meet the project's financial requirements—will have significant impact on the benefit sharing and the availability of income for communities beyond that which directly flows through project costs. For the OM project, four funding scenarios were evaluated, and the impact on income available for communities under the Sar Chor Nor No. 699 was calculated. Not all of these funding scenarios may be feasible, but as the market develops the ability to design and attract innovative funding mechanisms, their impact on benefits sharing should be understood.

The scenarios above were developed to illustrate the impact that various funding options can have on the benefits available to project participants other that those who are directly funding the project costs. These options have been researched in the market and discussed with potential investors, but do not represent actual

**Table 11: Comparison of Different Capital Structures for OM REDD Project and Impact on Benefits Available to Communities and Other Project Participants**

### SCENARIO 1—100% DONOR FUNDED

| | |
|---|---|
| Total Funding Required: | $1,350,000 |
| Community Share of Carbon Income: | 100% |

Community Income

| | Incremental | Cumulative |
|---|---|---|
| 5yr | -$60,943 | -$60,943 |
| 10yr | $6,258,742 | $6,197,799 |
| 20yr | $9,491,047 | $15,749,790 |
| 30yr | $10,214,647 | $19,705,694 |

### SCENARIO 2—PRE-PAID CARBON SALES

| | |
|---|---|
| Total Pre-paid Sales Required: | $3,735,570 |
| Years of Forward Sale to Break Even: | 6 |
| Community Share of Carbon Income: | 100% |

Community Income

| | Incremental | Cumulative |
|---|---|---|
| 5yr | $422,404 | $422,404 |
| 10yr | $2,305,324 | $2,727,728 |
| 20yr | $9,974,395 | $12,279,719 |
| 30yr | $6,261,228 | $16,235,623 |

### SCENARIO 3—EQUITY FUNDED

| | |
|---|---|
| Total Funding Required: | $1,350,000 |
| Rate of Return on Investment | 30% |
| Community Share of Carbon Income: | 33% |

Community Income

| | Incremental | Cumulative |
|---|---|---|
| 5yr | -$20,111 | -$20,111 |
| 10yr | $2,065,385 | $2,045,274 |
| 20yr | $3,132,046 | $5,197,431 |
| 30yr | $3,370,833 | $6,502,879 |

### SCENARIO 4—EQUITY AND DEBT FUNDED

| | |
|---|---|
| Total Equity Required: | $275,000 |
| Total Loans Required: | $1,075,000 |
| Rate of Return on Investment | 35% |
| Community Share of Carbon Income: | 50% |

Community Income

| | Incremental | Cumulative |
|---|---|---|
| 5yr | -$286,597 | -$286,597 |
| 10yr | $3,129,371 | $2,842,775 |
| 20yr | $4,489,399 | $7,618,770 |
| 30yr | $5,107,323 | $9,596,722 |

Model Assumptions: Spot price $7 per ton, forward pre-paid price $3.50 per ton, verification every two years, forward sale scenario with two rolling pre-payments vintages 1 to 4 and 5 and 6, equity investor return requirement 30% to 35%, equity debt scenario 25% equity required.

transactions that have occurred. They do, however, provide valuable insight into the impact that each type of funding can have on the income available to the project participants over the life of the project. Clearly, scenario no. 1, the fully donor-funded option, provides the greatest benefit to participants. They are able to sell carbon as it is verified at the spot price of $7 per ton, and they retain 100 percent of the carbon benefits, thus providing a projected $19.7 million over thirty years. Scenario no. 2 relies on the pre-payment market, which is undeveloped and may not provide ready buyers for pre-verified carbon at an attractive price relative to spot buyers. Funding with pre-payment sales would generate up-front payment for the first four vintages, and another up-front payment in year four for vintages five and six. Afterward, all sales would be made on a spot basis. Based on a pre-payment price of $3.50 per ton and the assumption that the first two vintages, 2008 and 2009, are delivered at the spot price of $7 per ton because the sales will occur in 2010, the benefit to participants is $16.2 million.

The other two scenarios evaluated the use of equity and loans as a way to finance the project. This may be necessary if the market does not support pre-paid carbon sales at a reasonable price. It also allows the project to rely on spot sales of carbon at higher prices than would be received under the pre-payment scenario. For equity scenario no. 3, funding would be provided by an equity investor in the project. The investor would receive a percentage of the net income from the project, and the remainder would be available to the participants. Equity investors take risk in that they provide up-front funding with the assumption that the project will generate returns. Their return requirements will be commensurate with the project risk. In the case of REDD investment today, the risks are perceived as high, given the regulatory uncertainty and limited number of successful REDD projects that have delivered the target carbon credits. In the equity-only scenario, the required return, or IRR, was set at 30 percent and the percentage equity ownership for the investor was calculated at 67 percent, which would leave 33 percent for project participants, equal to $6.5 million over the life of the project. This scenario with current price and return assumptions cannot be pursued if the Sar Chor Nor No. 699 is taken to mean that all net income before payments to equity investors must be at least 50 percent. Given the lack of details in the Sar Chor Nor No. 699, this will need to be clarified.

The final scenario, no. 4, models a combination of equity and loans, where $275,000 would be provided by the equity investor and $1,075,000 from a loan. In many cases lenders will require a certain amount of equity to support the loan. The loan program evaluated for Oddar Meanchey required 25 percent equity investment to qualify. The result of combining equity and loans is that the required equity investment can be much lower than the all-equity capital structure, which lowers the percentage of income provided to the equity investor. However, the project will incur the incremental costs for interest and loan fees, in addition to the existing project costs. The returns to equity investors for a capital structure that includes loans will need to be higher than the equity-only scenario because the lenders will be paid back before any payments are made to equity investors, thus making their risk higher. For the equity loan scenario no. 4, the return to investors was set at 34 percent and the equity percentage was 50 percent, leaving 50 percent for the participants, or $9.5 million over the life of the project.

## Approaching the Sale of Credits

There have been a few highly publicized REDD projects that have either sold or attempted to sell credits prior to even having secured the required government approvals or the initial groundwork or methodological work done to support VCS registration. Because OM project proponents believed that publicizing and selling credits too early in the process could have an adverse effect of the price, the decision was made to start to market credits after all agreements were completed and the VCS methodology and PD were well under way. Because the VCS validation process for the methodology took far longer than expected due to the capacity constraints of the validating organization, the project is only now positioning itself to sell credits after the submission of the CCB PD in October 2009.

## Devising Benefit-Sharing Mechanisms

During the early project identification phase, CFI, the FA, and the Technical Working Group

agreed in principle that the proposed REDD project should emphasize benefits for local communities. This principle was endorsed by the Royal Government of Cambodia's initial guidelines that require the project to "maximize benefits to local communities" under Sar Chor Nor No. 699. The FA agreed to include terms in the FA-TGC agreement that a minimum of 50 percent of net income would be directed to local communities. The reference to net income reflects the funds that remain after project costs are met. The project is also designed to ensure that a large proportion of costs directly benefit local communities, who will manage many of the project activities.

The REDD project was designed to support the stabilization of forest cover in Oddar Meanchey Province through the empowerment of forest-dependent communities as resident managers. Early discussions with local communities indicated that their primary concern was establishing clear tenure rights over local forests and, secondarily, gaining technical and financial support to carry out key protection and resource development activities.

## Securing Forest Tenure Rights

Securing tenure rights was viewed as both a benefit for participating communities and a required action needed to reduce risk and position the project for carbon markets. As discussed earlier in this case study, the FA endorsed this action on May 4, 2009, when it approved nine of the thirteen CFMCs and issued fifteen-year renewable CF agreements. The standard format for the CF agreement, as outlined in the 2003 CF guidelines, was revised to reflect the terms related to the REDD project, noting that: "The Community Forestry Committee provides the Forestry Administration with the right to act as the seller of forest carbon on behalf of the community." It further states that the community agrees not to "attempt to sell or transfer ownership of forest carbon credits generated from the CF to any third party." In addition to securing forest tenure rights, the REDD project will provide benefits in the following forms: (a) employment in forest management activities, (b) institutional capacity building, (c) support for livelihood activities, and (d) grants for community-based natural resource development activities. The first two benefits are considered components of project implementation and would be supported by grants and gross revenues from carbon sales. The latter two benefit types would be supported through "net revenues" that would be generated by the project.

## Employment for Forest Management and Enrichment Activities

Project communities play a lead role in implementing the management activities that are designed to control local drivers of deforestation and degradation. A substantial proportion of the project implementation budget is allocated to support these activities. Aside from material costs, a considerable amount of financing is targeted to cover labor costs from community participants. An initial analysis of the budget estimates that these activities will generate approximately twenty days of labor each year for project households, primarily during the off-agricultural season. Activities will include employment for forest fire watchers, work in assisted natural regeneration and enrichment planting projects, and possibly patrolling and other actions related to enforcement.

## Institutional Capacity Building

Building leadership and technical skills among participating communities is an ongoing part of the project strategy. Capacity development includes enhancing the operations of CFMCs in terms of their organizational, technical, and financial management abilities. This will allow the

CFMCs to play a larger role in project management over the course of the REDD project. Skill sets to be developed include community governance at the hamlet and CFMC level, including formulation of elections and by-laws, as well as relationships with commune, district, and provincial governments. Technical skills involve natural resource management planning, forest inventorying and stock monitoring, biodiversity and socioeconomic assessments, s well as ANR and silviculture management. Finally, financial skills include bookkeeping, fiscal planning, and livelihood project management. Capacity building benefits the community directly in terms of their capacity to implement the project, and also provides them with the ability to transfer this learning to nonproject enterprises.

## Support for Livelihood Activities

Specific livelihood activities to be supported by the net income generated by the project will be identified through a dialogue with the participating communities. One proposal recommends that these activities be funded through community-administered self-help groups (SHGs) that manage small grants from the net income pool maintained through a community development fund (see Figure 9). As an example, SHGs have functioned effectively in India as microfinance organizations that also nurture small enterprises.

## Sustainable Agriculture and Natural Resource Development Projects

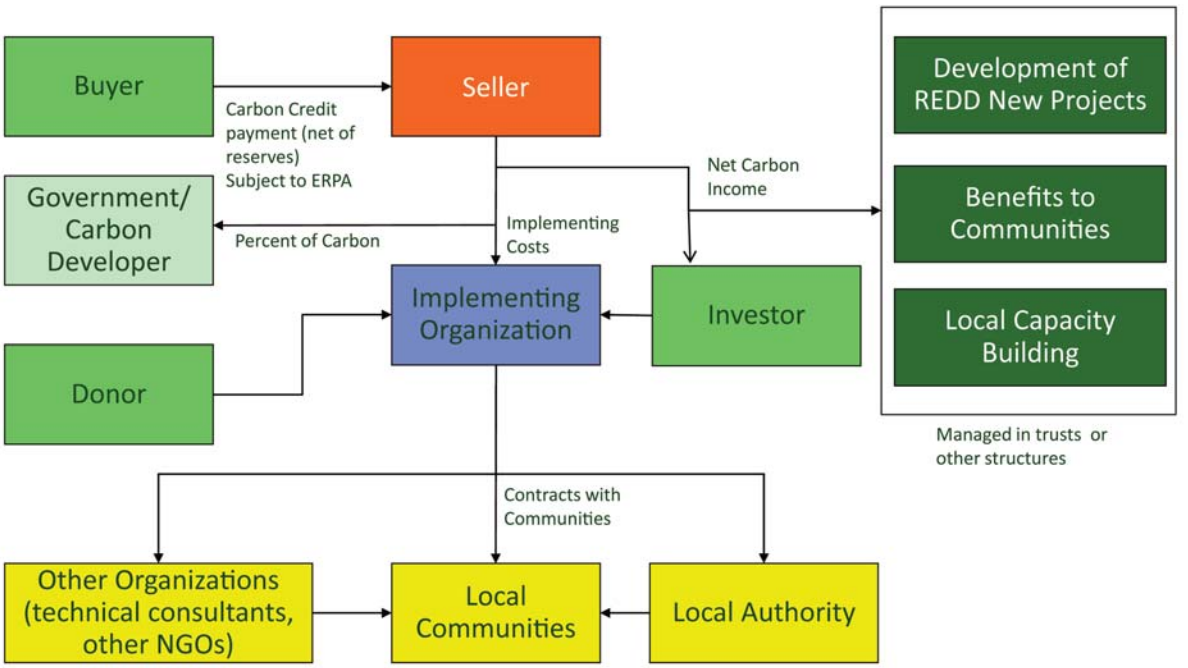
The project seeks to provide benefits to communities while addressing the drivers of deforestation by supporting farm families to adopt more sustainable agricultural techniques. By developing water resources, selecting crops more knowledgeably, intensifying cropping patterns, and improving storage and marketing, agricultural productivity and income will increase, reducing the need for further forest conversion for farmland. Agricultural extension services and financial support would be provided by the project, along with small hamlet-level grants for water resource development, including water tank desilting, small reservoir construction, tube wells, and drinking water systems. As a result of the project design, participating communities will benefit in numerous direct and indirect ways.

## Benefit-Sharing Mechanisms

Many of the operational mechanisms and programs that will guide the distribution of REDD project benefits are still in an early stage of development. Significant finances from carbon credit sales will likely not begin to flow until 2013. Consequently, the project design team and community participants have sufficient time to develop the benefit-sharing strategy.

It is already apparent, however, that the project will bring a diverse range of benefits in terms of more secure resource rights, employment, capacity building, and support for agriculture and livelihood enterprises. Some of these benefits will be extended broadly to all fifty-eight communities, while others will target key hamlets and households that have special or strategic relationships with the forests in the project area. The project design team has determined that project revenues need to fund activities that respond to the concerns of local villages and households. This argues for a menu of resource management and livelihood projects, rather than a simple cash distribution.

Figure 10: Proposed Benefit Sharing Mechanism for the Oddar Meanchey REDD Project



# PART VI: RISKS

The project design team has attempted to identify significant risks faced by this REDD activity in the future in order to develop strategies to mitigate their impact. Some of the risks are internal to local project dynamics while others will be influenced by policies and practices operating at the national level. In addition, the project confronts significant risks imposed by international climate negotiations and carbon markets, many of which are well beyond the scope of the project to address.

## Internal Risks

**COMMUNITY LACK OF EFFECTIVENESS TO CONTROL THE CF AREA:** A primary threat to the project would be the failure of communities to control local drivers of deforestation. Fires, illegal logging, and agricultural land encroachment all represent forces driving degradation and loss of forests. Resident communities are best positioned to control these activities through their CFMCs and hamlet-level subcommittees; however, they require political, financial, and technical support from the project. Failure to provide these supportive services would erode community motivation and capacity to implement key mitigation activities, thus seriously impacting the project's carbon benefits.

At the local project level, this REDD initiative faces a number of challenges, especially in building the capacity of fifty-eight forest-dependent communities with 10,000 households to protect and regenerate over 67,000 hectares of forest. This requires the project to support the emergence of strong, representative leadership and active and broad-based community participation, with effective support from civil society and local government. The inability of the project to build and finance community capacity presents an important risk (Box 4 illustrates this risk).

The project seeks to sustain the authority of the CFMCs over the project forests by facilitating MAFF approval of their legal status and formalizing CF agreements as a condition for project implementation. The project will also bring together a provincial-level working group with the cantonment-level Forestry Administration and local government officials to monitor project implementation. This will include the special provincial advisor (SPA), the deputy cantonment chief in charge of community forestry, as well as relevant district governors. The project seeks to provide special support to local public agencies and governments to build their capacity to partner with project communities in forest protection. As one consultancy report concludes: "The main stakeholders among the public sector institutions, especially at the provincial and district level, lack the logistic means and human capacity needed to meet the challenges of sustainable natural resource management" (Van Acker 2003). The project intends to address these weaknesses by supporting a coalition of public institutions and community groups that can develop and implement longer-term NRM plans and strategies.

In addition, a Provincial Community Forestry Federation will be established with representatives from project areas to coordinate CFMC activities. The project also builds support and visibility within national government and the donor community by designating the Technical Working Group for Forests and Environment (TWG-FE) to monitor and administer carbon rev-

enues. The TWG-FE is a multidonor committee established to coordinate donor activities in Cambodia. The project provides for institutional strengthening of the CFMCs and activities to engage the project communities, such as assisted natural regeneration (ANR) and forest protection. Uniforms, identification cards, equipment, and financial support for the CFMCs will help formalize forest-protection activities and enhance the status of CFMC members in their communities. These actions will also increase their legitimacy in the eyes of outsiders. Regular meetings of the CFMCs and community members are scheduled to discuss management issues and project priorities. Finally, the project will monitor benefits flowing to community members every two years to ensure equity in access to employment and development activities.

This project proposes to reduce risk of carbon leakage from land clearing, illegal felling, and fire by building strong partnerships between the Forestry Administration, community forestry groups, and local NGOs at the field (triage) and provincial level. The Forestry Administration's Siem Reap Cantonment will be funded to undertake special protective activities within the project areas. A project support team comprised of the implementing organization, the local FA, NGOs, and civil society organizations will support a process of building community management capacity, clarifying and formalizing community management rights and duties, and providing support to communities for enhanced patrolling and organized fire control.

Fire risk will be mitigated by the CFMCs through the clearing of fire lines that can also be used for forest patrolling. Fire lines will be cleared annually before the fire season in January and February. CFMCs will be responsible for forming volunteer fire brigades of village youth who are trained in fire control and equipped with tools. Fire brigades may be linked to sports clubs or other youth associations, which will be supported with sports equipment as an incentive for participation. Illegal logging risks will be mitigated through a number of measures, including demarcating boundaries and posting signage, blocking tractor access through trenching and other methods, regular patrolling, developing of a network of patrol huts and fire roads to facilitate rapid movement, confiscating chainsaws and other equipment, and improving communications with FA through two-way radios and cell phones.

Land encroachment will be addressed in three ways. First, the CFMCs will take responsibility for meeting with new migrant communities and leaders, as well as local government, to clarify the boundaries of the project area, resolve any existing conflicts, and emphasize the intention of the CFMCs to secure the area. Communities will be encouraged to tell prospective migrants that the forests are protected and that there are no opportunities for new migrants in the area. This message is already being sent by word –of mouth to more densely populated provinces, and immigration appears to be slowing. Second, the CFMCs will demarcate boundaries with pillars and signage, maintain regular patrols, and call in the support of the local FA, police, and military as needed. These actions will be coordinated with commune chiefs and district governors. Third, villagers who established inholdings within the CF areas prior to the project will be asked to sign contractual agreements with the CFMC that will allow them to continue farming provided that they do not expand further into the forest area. They will also be forbidden from selling their inholdings to any outside person.

### Box 4. The Collapse of a CFMC: Lessons from Prasat Phaong

Prasat Phaong is located twenty kilometers north of Samraong and five kilometers from the Thai border. The CF area totals 854 hectares of degraded dry deciduous forest. The CFMC is comprised of two villages: Pha Ong to the north and Kuk Prasat on the south, both located along the main road on the western side of the forest, which is approximately three-to-four kilometers from the village.

The CFMC was established in 2006 with help from the FA and CDA. Our team met with Yeng Sokha, chief of the CFMC, and Tim Samnang, an articulate women leader from Kuk Prasat village. Unfortunately, the CFMC is collapsing due to conflicts between the two villages and the absence of support from the CDA in 2007, when the organization faced a shortage of funds. According to Ms. Tim Samnang: *"Our village wants the CFMC to move forward, but we need support. We haven't submitted any report as we are afraid of the powerful people."* Presently, the CFMC at Kuk Prasat has ceased all forest-management activities, with 80 percent of the CF area degraded. Still, they report good root stocks and opportunities to restore the forests if protection from land clearing and fires can be provided.

In 2007 and 2008, villagers from Pha Ong village began clearing forests in the northern section of the CF area. Seven of the eight CFMC members left the village to seek work across the border in Thailand. Since many of the families in Pha Ong are members of the military, the soldiers advised their wives not to participate in the CFMC. Apparently, these families felt there was better opportunity to acquire farmland in the CF area than to protect it as forest. The Kuk Prasat CFMC members noted that it is difficult to identify who has cleared the forest and claimed the land in the CF area. They suspect there are village officials involved in the process who claim the land is not CF area and are trying to sell it to outsiders. Ms. Samnang says: *"If you want to find out the owners, take action on the land by establishing boundary posts, then the owners will show their faces."*

Currently, no one is challenging the encroachers, so they are acting freely in clearing the CF area. Yeng Sokha, the CFMC chief, says: *"We want to organize boundary patrols. We want to take the forestland back and regenerate it. We need to clarify the boundary. We want CFI staff to come every month and provide support."*

When asked about the people who grabbed the land, Mr. Sokha replied: *"They are just speculators; there are no houses or new farms there. They are just grabbing the land to sell."*

Mr. Boreth, head of the NGO Children's Development Association, suggested: *"We need the FA's Siem Reap inspectorate chief to come and clean up all these issues. If Pha Ong village wants to come back into the CFMC, that is good. In Pha Ong most of the CFMC members were the wives of soldiers, and their commander ordered them not to participate in the CFMC."*

## External Risks

External risks include those events that are not under the control of the project communities and may be more difficult to address. These include the following:

**POPULATION GROWTH FORCES AGRICULTURAL EXPANSION IN PROJECT AREA:** It is estimated that the population density will increase from seventeen per square kilometer in 2006 to twenty-eight per square kilometer in 2021 in the Oddar Meanchey Province. While this is still only 10 percent of the density in provinces in the Lower Mekong basin, it represents a 60 percent increase in population over a fifteen-year period and an annual growth rate of 2.74 percent. This value may double or triple depending on immigration rates that are influenced by government development, land allocation and resettlement policies (Save Cambodia's Wildlife 2006); however, as available forestlands are claimed by CFMCs, economic land concessions, and other actors and management/tenure systems, it is anticipated that migration into the province will slow. The project will work with the participating communities to assist them in developing long-term resource management plans for their CF areas, as well as other natural resources in the leakage belt under their control. This process has been effective in communities in Ratanakiri Province in stabilizing land-use patterns for extended periods (1989–2008) (Fox et al. 2008). In one case, Krala village was able to retain virtually its entire protected forest over a twenty-year period. A review of participatory land-use planning (PLUP) in Cambodia conducted by the Community-based Natural Resource Management Institute (CBNRM-LI) concludes that "PLUP is particularly useful in areas with many land-use conflicts or high degradation of natural resources…and prepares the ground for the creation of community forestry groups." (Min Bunara et al. 2005). The key is to involve the entire community in a land-use planning process that clearly demarcates conservation forests, as well as anticipates future agricultural land resource needs based on community priorities. This includes ensuring that forest and land resource management regulations are formulated by the community and sanctions are put in place. The project will guide communities in identifying appropriate areas for future settlement and agricultural expansion, while clarifying and demarcating areas for permanent forest conservation.

The project will also actively promote and support agricultural intensification rather than further forest clearing. Most families have sufficient land in terms of their labor availability, and, consequently, the amount of arable land is less of a constraint than the availability of farm inputs or water for irrigation. As a result, increasing yields is likely the best way to enhance food security and farm income. A study in Mondulkiri of similar forest-dependent communities found that overall rice sufficiency ranges from 2.6–6.1 months per year. Low productivity was related to poor soil, irregular rainfall, and low input techniques (Evan et al. 2003), with rain-fed paddy yield averaging around 2 Mg $ha^{-1}$. Paddy yields could double, reflecting averages across the border in Thailand, through the adoption of improved farming practices and better irrigation access. The project will also provide communities with extension information on sustainably productive farming systems and offer small grants to innovative local farmers willing to conduct cropping trials.

**INSUFFICIENT FUNDING:** Project planning and implementation costs were funded through an initial one-year grant from the Technical Working Group on Forests and Environment (TWG-FE). Long-term project financing costs are anticipated

to be completely funded through the sale of carbon credits on the voluntary market. Project costs have been estimated and budgeted for the thirty-year life of the project, and, while the long-term financial viability of the project appears strong, it is anticipated that financing the first five years of implementation will present challenges. Depending on the price of carbon and possible pre-payments on sales, project costs will need to be covered by grants in the early years of the project. Once the project is registered, any potential funding gap can be identified and additional funding sources can be secured.

The project is developing a mechanism for the allocation of revenue from carbon that will be acceptable to participating communities, the Forestry Administration, the provincial government, the implementing organization, and the buyer. The goal of allocation will be to direct revenues from carbon credits to benefit participating communities, restore the health of forests, and develop new REDD projects ac-

**Table 12: Risk Assessment for CFMCs Participating in the Oddar Meanchey REDD Project**

| CF Area | CF area (ha) | No. of villages | ELC pressure/ social concession | Land clearing | Illegal logging | Fuel wood & charcoal | CFMC sustainability rating 2/2008 | CFMC sustainability rating 2/2009 |
|---|---|---|---|---|---|---|---|---|
| Roetanak Rukha | 12,872 | 16 | V. High | High | Low | Moderate | Strong | Increasing |
| Prasat Ong (Russey Srosh Samros) | 850 | 2 | Moderate | Very High | ? | Moderate | Low | Decreasing |
| Chhouk Meas | 383 | 1 | Low to Moderate | High | Low | Low | Moderate | Increasing |
| O Yeay Kaov | 960 | 1 | Low | Low | Low to Moderate | Low | Low | Decreasing |
| Rumduol Veasna | 6,016 | 4 | High | High | High | Low | Strong | Decreasing |
| Prei Srors | 1,604 | 2 | Low | Low to Moderate | Low to Moderate | Low | Strong | Unchanged |
| Andong Bor | 6114 | 8 | High | High | Moderate | | Moderate | Moderate |
| Dung Beng Increasing | 1843 | 4 | Low | Low | Low | Low | Strong | Increasing |
| Samaky | 1,079 | 4 | Moderate | Low | Low | Low | Strong | Increasing |
| Ou Korki Kiry Prei Srorng | 6,344 | 5 | Moderate to High | Low | Low | Low | Strong | Increasing |
| Samaki Sang Kruos Prei Chheu | 4,151 | 3 | Moderate to High | Moderate | Low | Low | Strong | Decreasing |
| Sorng Sahakum Rukha Voan (Monk Forest) | 18,261 | 5 | Low | Low to Moderate | Low | Low to Moderate | Strong | Increasing |
| Total | 60,477 | 55 | | | | | | |

cording to the directions of the Council of Ministers of the Royal Government of Cambodia (Sar Chor Nor No. 699 2008), after project development and management costs for the implementing agency and the FA are covered. It is proposed that the carbon revenues be managed by the TWG-FE, with allocations made annually for project implementation costs based on the approved annual work plans. Any net revenues generated after project costs are covered would be placed initially in a project income fund managed by the TWG. Net carbon revenues may be channeled into CFMC accounts that will support livelihood activities for project communities, NRM development activities (especially water-related), and the development of new REDD and A/R projects. The allocation plan will also assess how community carbon payment funds are managed in terms of technical support, institutional capacity building, reinvestment in forest restoration and economically productive forest enterprises, etc. Annual audits on project funds will be completed at the end of each year.

## CF Group Risk Assessment

Aside from the external drivers of deforestation that generate risks for the REDD project, each of the thirteen forest blocks and respective CF groups participating faces a unique blend of challenges, with differing levels of exposure and capacity to respond. Leadership, organizational strength, social solidarity, relationships with local government, as well as logistical factors such as the size of the forest block and access to it, may influence the ability of forest communities to protect their resources. Table 7 presents a relative assessment of how each of the CF groups is responding to local risks, based on recent field reports from community members, NGOs, monks, FA field staff, and other actors closely involved with the project. The assessments are subjective, so caution should be used in interpreting the results. They do, however, present some perceptions of relative levels of risk by driver and changes in risk levels between 2008 and 2009. It is proposed that annual risk assessment exercises be conducted in February of each year. In the case of Prasat Phaong, it is apparent that the risks were so high that the CF group was in the process of dissolving and, as a consequence, had to be dropped from the REDD project and two new CF groups added.

It is anticipated that over the thirty-year project period, some of the other CF groups may restructure, bifurcate, merge, and also fail to survive due to risk factors. There is also a strong likelihood that the project area will decrease due to risks impacting CF groups, even though they are able to sustain parts of the project area. These risk assumptions and their impacts are built into the carbon calculations and projections.

# PART VII: PROSPECTS FOR THE FUTURE

The Oddar Meanchey REDD project has made substantial progress since design work began in early 2008 in terms of securing the support of the Royal Government of Cambodia (RGC), DANIDA, and other development agencies and forest-dependent communities. Communities have already received training and technical and financial support to build their organizational capacity, implement boundary demarcation and patrolling activities, and strengthen their relationships with local FA staff and government officials. Equally important, nine of the thirteen CF groups participating in the project have received approval from the Ministry of Agriculture, Forestry and Fisheries (MAFF) to protect the project areas under fifteen-year renewable CF agreements, legally empowering them to oversee local forests.

At the national level, the REDD project received high-level support from the RGC, which has deterred efforts of competing agencies to secure the forest area for other initiatives, including economic land concessions. While the project has made substantial progress, it will face considerable challenges as implementation progresses. As one of the remaining sparsely populated national boundary areas in the country, migration will likely continue to place considerable pressure on forest areas. Community patrols should increasingly reinforce clear tenurial rights for participating villages and deter encroachment from migrants. As village populations grow, demand for land for agricultural and settlement expansion will continue to place pressure on the project area. Communities will need to follow their land-use plans, intensify cropping systems, and develop off-farm activities to compensate for demographic expansion.

Nonlocal drivers of deforestation, including national land-allocation policies and global markets, also pose threats to the project. Structured to respond to the development of an international voluntary market in forest carbon, the project is dependent on the rapid emergence of new carbon project certification, registration, and commodity trading systems. Steep declines in forest carbon market prices will decrease returns for conservation, causing planners to rethink the economic viability of the project. At the national level, demands for access to project land by the military, migrants, or large private sector developments could impact REDD project forests over the next thirty years. Finally, delayed financial support for key project activities and livelihood development strategies could frustrate implementation of the REDD strategy. This, in turn, could negatively impact projected carbon credit deliveries. This problem could be addressed through co-financing of the project with grant funds.

In Cambodia, there is an emerging national policy supporting the transfer of two million hectares (20 percent) of the national forest estate to community management. Such an initiative could ensure the sequestration of a vast pool of carbon, while responding to the needs of millions of rural poor. This will require both political will and financial resources. The establishment of a Cambodian national carbon accounting system, based on remotely sensed data, would enhance national civil society awareness regarding the importance of forest conservation, as well as create a framework for monitoring land-use change. Such a monitoring system could also increase transparency in

the current economic land concession process.

In Cambodia, insecure title over forested land and lack of de facto open-access rights to use forest resources constrain efforts to maintain the forest cover. This situation reflects a lack of coherence in rural land management policies, weak capacities of subnational sector line agency departments, poor service delivery mechanisms, and the limited involvement of rural land and resource users in formalized natural resource management procedures. The national community forestry program and the supporting CF subdecree have created an opportunity to clarify forest tenure and reduce conflicts generated by the current “contested domain” situation that leads to unsustainable forest management.

If the project validation is completed and carbon sales move forward, it is likely this “proof of concept” pilot project will be replicated in other CF areas in Cambodia. The Forestry Administration is already in the process of identifying other potential REDD project sites. If one million hectares of CF area were developed as REDD and A/R projects, it could generate millions of dollars annually for Cambodia's forest communities, NGOs, and government agencies, creating powerful new incentives to conserve not only carbon, but also biodiversity and the unique hydrological functions of the Mekong Basin. Aside from payments for environmental services, new methods of agroforestry and nontimber forest product generation and processing could greatly enhance income streams to the rural poor. Cambodia is an ideal context to pioneer developing country strategies that address problems of uncontrolled deforestation and land alienation, leading to sustainable and socially equitable natural resource management. Cambodia has a legal and policy framework to empower rural communities that is endorsed by political leaders and the donor community. The relatively small size of the country and presence of local and international NGOs permits a rapid expansion of the strategy, which would provide further "proof of concept" at a national level that REDD and A/R projects present an alternative to landscape-level deforestation and forest degradation.

REDD and other forest carbon projects could energize this grassroots movement, providing governments and communities with financial incentives to facilitate transitions to community-based forest stewardship. Restrictive rules on project eligibility and additionality, such as those currently operating under the CDM, as well as high transaction cost methodologies, certification, and marketing requirements, could limit the participation of hundreds of millions of poor, forest-dependent and indigenous peoples in future REDD forest carbon projects. If the REDD initiative is to succeed, the rules and programs emerging from COP 15 will need flexibility and financing to support community forestry initiatives in diverse contexts around the world. REDD presents potential opportunities and incentives to recognize forest tenure and stewardship rights, both to slow deforestation by clarifying domain claims and to provide tenure security that will allow forest managers to invest in conservation and restoration. Creating an enabling global environment for community-based forest conservation initiatives is an essential step in stabilizing forest ecosystems and addressing global warming.

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