EBLU2012-02CMY(R)-TAKEUCHI

Critical Analysis of Effectiveness of REDD+ for Forest Communities and Shifting Cultivation Based on Lessons Learnt from Conservation Efforts in Lao PDR and Thailand

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ABSTRACT: This study aims to assess potential and options to achieve co-benefits of REED+ for carbon sequestration, biodiversity conservation and livelihood improvement in shifting and settled cultivation landscapes. Biophysical survey inventoried carbon stocks and biodiversity in different land use-land cover types at three study sites in Lao PDR, India and Thailand. Socio-economic survey compared economic benefits across different land uses in the landscapes. The integration of biophysical and socio-economic data provided a basis for identification of potential land-use practices to enhancing carbon stocks, biodiversity and economic benefits simultaneously.

KEYWORDS: *REDD+, co-benefits, landscape, Lao PDR, Thailand, India*

Introduction

The United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD) and Intergovernmental Panel on Climate Change (IPCC) laid down a global strategy of saving mankind from the threats posed by climate change and loss of biodiversity. These changes are coupled with other global changes in the biophysical environment (e.g., changes in atmospheric composition, land cover/use, desertification and biological invasion) and socio-economic-political environment (e.g., globalisation, free trade, acculturation, intellectual property regimes and bilateral/regional/international cooperation/alignments). Simultaneous solution to the environmental, economic and social development problems is the frontline agenda dealt as sustainable development framework in Agenda 21 and ecosystem services and human well-being framework in Millennium Ecosystem Assessment. Climate change is a potential threat to biodiversity conservation in the future. Nonetheless, human capacity to mitigate and adapt to climate change can be substantially enhanced by managing biodiversity (Heller and Zavaleta, 2009; McShane et al., 2011; Sutherland et al. 2015). The International Platform on Biodiversity and Ecosystem Services (IPBES) is the major international initiative of the decade targeting biodiversity management as a means of meeting the challenges posed by global climate change and poor state of human well-being in developing countries. Since UNFCCC COP 16 in Cancún, co-benefits and safeguards of the international initiative "Reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks (REDD+)" on the integrity of forest functions for biodiversity conservation, climate change adaptation, poverty reduction and respect for indigenous knowledge and rights has been advocated.

Successful REDD+ strategies are those that not only justify economic rationale for forest conservation versus alternative uses, but also provide positive incentives to those who live around forests and are dependent on forests for their livelihoods. This requires integrating and complementing traditional forest management and agro-forestry practices of many local and indigenous communities unlike the conventional approaches to treat the two land use systems as independent ones. In this article, we present the highlights of a collaborative initiative supported by APN to: (1) assess the potential social, economic and environmental challenges and opportunities of REDD+ for selected communities in Lao PDR and Thailand by drawing lessons from past/ongoing forest conservation policies; (2) provide much-needed scientific evidence on the potential co-benefits of traditional forest management and agroforestry practices by comparing it with alternative land uses; and (3) develop participatory community-based MRV mechanisms for REDD+ contributing to the improvement of the well-being of forest-dependent communities, climate change mitigation and biodiversity conservation.

Methodology

Study Sites

The project covered three mountain village landscapes, one each in Thailand, Lao PDR and India, with Indian site included as an associate site during the course of project development. While all the three sites represented mosaics of agricultural and forest land use types, specificities of these land uses varied. The Thailand site (Tee

HIGHLIGHTS

- » A landscape approach was applied to assess potential and options to achieve co-benefits of REED+ across different land uses in both shifting and settled cultivation landscapes.
- » In shifting cultivation, well managed forest fallows may restore significant amount of carbon stocks and biodiversity. On the other hand, plantations may recover carbon stocks only.
- » Settled cultivation may restore and maintain rich carbon stocks, especially below-ground through use of manure and development of agroforestry.

Cha village in Mae Hong Son Province in Northern Thailand) was characterised by both shifting cultivation and settled wet paddy cultivation, the Lao PDR site (Laksip village in Luang Prabang Province in Northern Lao PDR) by only shifting cultivation and the Indian site (Bhiri-Banswara, Uttarakhand) only settled cultivation on terraced slopes and flat valley lands. With increase in population pressure, length of shifting cultivation has been shortened from 20 years during the 1990s to seven years in 2012 and, if this trend continues, it will be reduced to two years by 2030 at the Thailand site. Plantation forests occurred only at the Lao PDR and India sites, with monoculture of teak established in shifting cultivation fallows in the former and mixed multi-purpose species plantations at the Indian site. Forests covered over 50% of the villages at the three sites but differed in terms of species composition, forest structure and management practices. More than 20% of forest as well as agricultural area were degraded in terms of biomass production. Only at the Indian site, a large amount of farmyard manure was incorporated in well-managed agricultural land and home gardens.

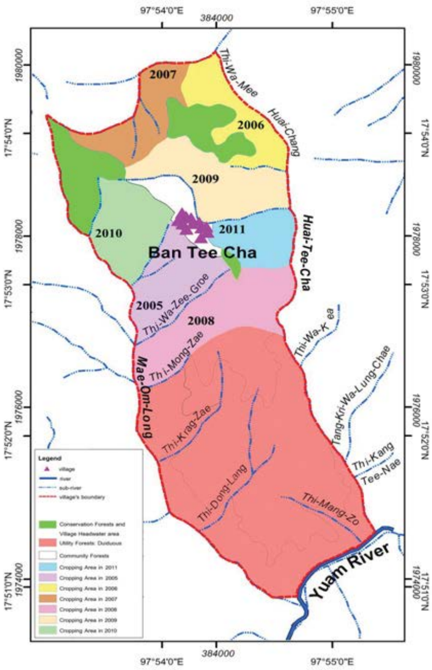

Figure 1. Existing land uses in Tee Cha Village in 2012, Thailand.

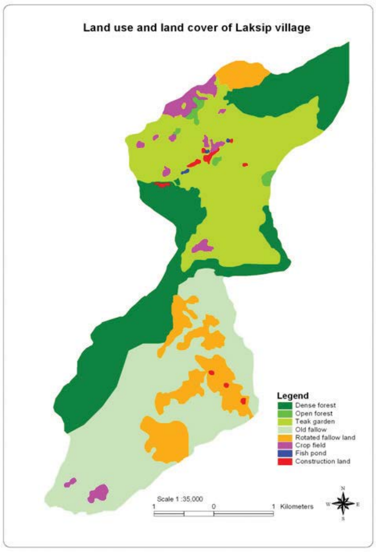

Figure 2. Land uses in Laksip Village in 2011, Lao PDR.

Study Components and Methods

The study took a landscape approach to assess carbon contents in all land use-land cover types in the study sites. The study comprised four activities: (1) biophysical survey and analysis through interviews, field mapping with the aid of remote sensing and collaboration with farmers determined land use-land cover types and investigated biodiversity. Carbon contents in different land use-land cover types were estimated, including above-ground, below-ground biomass through allometric equation or destructive method, and soil organic matter (at depth of 0-30 cm) through soil sampling and analysis. Land-use scenarios, carbon dynamics and reference levels were also analysed (the details of survey should be included: how the carbon content was measured, how many sample plots were laid, in which part destructive sampling was done, in which part allometric equations were used, etc.); (2) socio-economic survey through open-ended participatory discussions followed up by interviews and questionnaires assessed farmers' valuation of economic costs and benefits of different land use-land cover types, calculated Net Present Value (NPV), and estimated opportunity cost of REDD+ (focusing on forest conservation versus alternative land uses); (3) identification of good land-use practices to enhance co-benefits of carbon stocks, economic benefits as well as biodiversity through integration of biophysical and socio-economic assessments; and (4) good land-use practices were demonstrated to local farmers and officials, and relevant training programmes organised for local farmers and officials to appreciate, measure, monitor and manage forest carbon pools as a process of community-based MRV. The detailed methodology and results of the surveys can be found in the final report of the project (Takeuchi et al., 2014).

Results and Discussion

Forest degradation as well as deforestation from conversion of natural forests to agricultural land use resulted in loss of carbon stocks at both the Lao PDR and Thailand sites. However, the magnitude of these changes varied by site. At the Thailand site, community forests were more degraded than the protected headwater forests, with the former (172 Mg C/ha) having 37% lower carbon than the latter (273 Mg C/ha). Local farmers manage *Macaranga denticulata* to sustain their traditional shifting cultivation (Rerkasem et al., 2009). Carbon stock increased by 78% during the *Macaranga denticulata* dominant vegetation development during the fallow phase in shifting cultivation, but carbon stock in fallows (107 Mg C/ha) remained 38% lower than that of degraded community forests. Carbon stored in permanent mixed agroforestry systems or wet paddy lands (50-65 Mg C/ha) was almost equal to that in the crop phase of shifting cultivation (47 Mg C/ha) (Table 1).

At Lao PDR site, forest degradation resulted in around 47% loss in carbon stock, from 309 Mg C/ha in dense conservation forests to 128 Mg C/ha in open protection forests. Establishment of teak plantations in abandoned shifting cultivation land results in recovery of carbon stocks to degraded forest levels after 15-20 years of plantation, while stocks in the cropping phase of shifting cultivation (67 Mg C/ha) were slightly lower than that in 3- to 4-year old fallow fields (85 Mg C/ha) (Table 1).

Land cover-land use	Thailand site	Lao PDR site
Dense forest	273	308
Open forest	172	128
Abandoned shifting cultivation	-	90
5-year-old teak plantation	-	75
20-year-old teak plantation	-	109
Agroforestry system	65	-
Fallow fields in shifting cultivation	107	85
Crop fields in shifting cultivation	47	67
Wet paddy fields	50	-

Table 1. Carbon stocks (Mg C/ha) in different land cover-land use types differentiated in Thailand and Lao PDR village landscapes. "-" refers to absence of a given land cover-land use.

While land use in terms of relative coverage under agriculture and forest is stable at the Indian site due to policies like the ban on forest conversion since the 1950s and on cutting of green trees since the 1970s, deforestation continues at the Lao PDR and Thailand sites due largely to lack of effective conservation-development policies. In India, well managed agricultural land and home gardens resembling natural forests in vegetation structure but much smaller in size have carbon stocks equal to or greater than degraded forest land. At all the three sites, the predominant agricultural systems had lower carbon stocks but several fold higher incomes compared to the moderately disturbed forests. Conversion of secondary forests to teak plantations at the Lao PDR site and to coffee plantations at the Thailand site through the intermediate stages of shifting cultivation enabled more income as well as higher carbon stocks compared to forest conversion to paddy fields.

Degraded forest land, with proper treatment, could serve as carbon sinks and habitats for useful species offering new opportunities of income from REDD+ Programme. Biodiversity conservation is a co-benefit from maintenance and enhancement of carbon stocks. At the Indian site, fodder from farm land (6 Mg C household^{-1} year^{-1}; average land holding size: 0.5 ha) meets hardly 30% of livestock (average holding: 3 livestock units) feed. If agroforestry system is developed on degraded lands under the control of local people (0.4 ha degraded land household^{-1}), an average family would earn US$ 37 family^{-1} year^{-1} from carbon market (considering financial compensation of US$ 10 Mg CO_2 year^{-1} and mean carbon sequestration rate of 2.5 Mg C or 9.2 Mg CO_2^{-1} ha^{-1}), US$ 400-900 family^{-1} year^{-1} from understorey food crops and would reduce pressure on forests for fodder by 27%. Redeveloped agroforestry system sequestered carbon as much as the exclusive forest tree plantations over a period of 20 years. In biodiversity hotspots like the Indian Himalaya, where farm holdings as well as area of degraded land are quite small, income from timber trade is prohibited, natural recovery of forest cover is quite slow and people remain economically marginal, objectives of biodiversity conservation, climate change mitigation and enhancement of local livelihoods can be addressed simultaneously by: (a) encouraging tree-crop mixed farming in degraded land; (b) linking development grants with rehabilitation of degraded land and forest conservation (presently government grants are determined based on socio-economic status, e.g., one member of each family is guaranteed employment in government works irrespective of its role in environmental conservation in India); and (c) orienting programmes for payments for ecosystem services such that economic compensation is guided by the sum of contributions in reducing emissions from deforestation, reducing emissions from forest degradation, enhancement/conservation of carbon stocks in both farm and forest land, and sustainable management of both agricultural and forest ecosystems (Semwal et al., 2013).

Reconstruction of forests or agroforestry systems in degraded land as attempted at present is an expensive task and hence the area covered as well as the rate of success is quite low. Planting of 'nurse species' or 'keystone species' could reduce the cost but knowledge of such species is meager. Given the multiple problems of developing mountain regions, keystone species would be those which are socially valued, economically valuable to local people and enhance biodiversity and ecosystem services from degraded land.

With enormous variation in environmental and socio-economic conditions, location specific participatory landscape development models need to be developed, demonstrated and continuously improved. At all the three sites, improvements in provisioning services and carbon stocks through land rehabilitation enhanced local scale species richness. However, cultural landscapes did not harbour any rare and endangered species highlighting the importance of improvement in such landscapes together with protected area management. Further, it was also evident that a 20-year period following treatment was insufficient to recover biodiversity and carbon stocks in degraded forest land emphasising the need of long term rehabilitation trials (Bhadauria et al., 2012). Due attention should be paid to "transformative restoration", i.e., reconstructing communities adapted to the future climate in present degraded land or developing ecosystems resistant and/or resilient to climate change need to be developed (Heller & Zaveleta, 2012).

Conclusion

The landscape level study found that conversion from forests to agricultural fields led to loss of carbon stocks. The natural forest fallows, if managed well in shifting cultivation, can help recover a significant amount of carbon stocks, almost equal to 15–20 years of plantation. However, natural fallows are rich in biodiversity compared to plantations. Proper selection of keystone species for forest rehabilitation will be critical to provide cultural and economical benefits to local people, and enhance biodiversity and ecosystem services. The settled cultivation can also enhance below-ground carbon stocks through use of farmyard manure, and above-ground through development of agroforestry.

Acknowledgements

We are grateful to APN for financial support, to our colleagues for their collaboration, and to local communities at the study sites in Lao PDR, Thailand and India for their cooperation and participation in the project implementation.

PROJECT INFORMATION

Title:	Critical Analysis of Effectiveness of REDD+ for Forest Communities and Shifting Cultivation, based on Lessons Learnt from Conservation Efforts in Lao PDR and Thailand
Duration:	Three-year project
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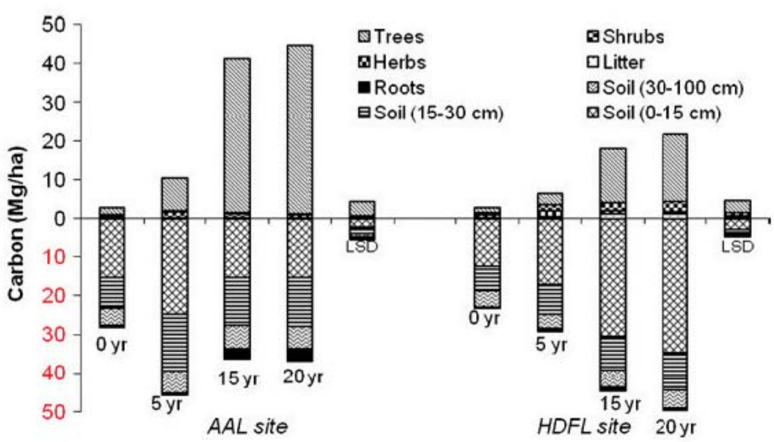

Figure 3. Carbon pools before (0 yr) and 5–20 years after tree planting with cropping at the abandoned agricultural land (AAL) site and without any cropping at the highly degraded forest land (HDFL) site in Bhiri-Banswara, Central Himalaya, India. The horizontal line crossing at '0' on y axis refers to the soil surface, with values above it depicting the aboveground biomass C pool (aboveground biomass C in trees, shrubs, herbs including crops at the AAL site and litter on ground) and below it is the belowground C pools (soil organic C in 0–15 cm, 15–30 cm and 30–100 cm soil layers and roots). Least significant differences (P=0.05) for carbon pools at different ages at the two sites are shown.