Case Study

11

Loksado Grassland Reforestation, Indonesia

Rizaldi Boer[1], James M. Roshetko[2], Hardjanto[1], Lala Kolopaking[1], Andri Akbar[3], Upik Rosalina Wasrin[1], Bambang Dwi Dasanto[1] and Sri Rahayu[1]

[1]Bogor Agriculture University, Bogor, Indonesia
[2]Winrock International and The World Agroforestry Centre (ICRAF)
[3]Green Law, Indonesia

Introduction

Loksado protection forest is located at Loksado subdistrict, Hulu Sungai Selatan district, South Kalimanatan province. Grasslands cover a wide area of this forest land. The grasslands developed as a result of traditional upland rice cultivation practices of the indigenous Dayak tribes. The Dayak community in the Loksado area open a patch of secondary forest or shrubland to cultivate upland rice for 1–2 years, with zero agricultural input (fertilizers, herbicides or insecticides). The land is then fallowed, and traditionally the fallow lasts for 20 or more years. Due to population and other modern pressures, however, the fallow cycle in most areas has been reduced to 5–15 years. As the fallow period shortens, soil fertility on these sites is unable to recover. This is particularly problematic in steep areas, where the soil is inherently less fertile and prone to erosion. The Dayak community sees the natural regeneration of woody perennials on fallowed land as a sign that soil fertility has recovered enough to support a few rotations of rice. Most steep sites have become so degraded that woody perennials no longer regenerate, regardless of the fallow period. Those steep sites are dominated by grasses that have become a climax landcover because of their tolerance of annual wildfires.

The Dayak have a unique traditional custom, *adat*. Every family is required to cultivate 2 ha of upland rice every year. If the family does not comply, they are excluded from the *adat* ceremonies, which are conducted three times a year. The *adat* custom is still strong in the Loksado area. Every family plants 2 ha of upland rice every year, even when the availability of fertile land is limited and stocks of stored rice are adequate. Rice stocks are usually stored in large containers made of thin slices of timber in traditional rice barns. Some stocks are large enough to meet family consumption needs for 15 years, even if they stopped growing rice. Every year the number of families in the community increases and much of the agricultural land must be fallowed to avoid degradation. To satisfy the *adat* 'land cultivation' custom the demand for agriculture land increases every year. It is estimated that 4–10 ha of primary forest are opened each year to fulfil the *adat* requirement.

The younger generation of the Dayak community is quite responsive to innovation as some of them are educated and a few members of *adat* leader families are university graduates. This young generation is eager to change the prevailing farming practices. This change may be a long process, and therefore it is strongly suggested that extension activities be done on a sustainable basis. In the past, extension activities normally ended when the project ended. Under the CDM project, a long-term program for training local people to become extension workers should be in place and farming practices introduced to the people should be in line with their needs.

Besides upland rice, the local Dayak community also cultivates perennial crops, particularly rubber trees (*Hevea brasiliensis*). Rubber trees are frequently planted in rice fields at the beginning of the fallow period. Rubber cultivation practices are nonintensive and no agricultural inputs are used. Trees only begin to produce latex at 8 years. Latex production begins to decrease at 25–30 years. The mature rubber trees are then harvested and rubber seedlings planted; upland rice may be grown during the first 1–2 years of the tree establishment period. Considering this condition, the reforestation project is designed to establish about 2,500 hectares of viable mixed rubber-cinnamon-timber plantations. The project activities are expected to increase incomes of poor communities through the sale of rubber and other tree products starting in the fifth year of the project and through carbon payments (CERs); to reduce pressure on the 'protection forest' in and around the project area by developing the commitment of local farmers to practice sustainable, permanent agriculture; and to reduce run-off, increase water storage capacity and improve water quality of the watershed.

Method

The project will be implemented in three villages, Desa Haratai, Desa Ulang and Desa Lumpangi, of Kecamatan Loksado subdistrict, Hulu Sungai Selatan district, South Kalimantan province (**Figure 11.1**). Project development consisted of a number of activities including establishment of institutional arrangement and technical design of the project, economic analysis, proving the eligibility of land for CDM, defining the additionality of the project and setting up baseline and monitoring methodologies.

The institutional arrangement was set up through focus group discussions and interviews with local communities, nongovernmental organisations (NGOs) and local government. The technical design of the project was based on surveys and interviews of the community and consultation with the District Forest Office. The technology employed was developed primarily by two sources: (i) natural resource

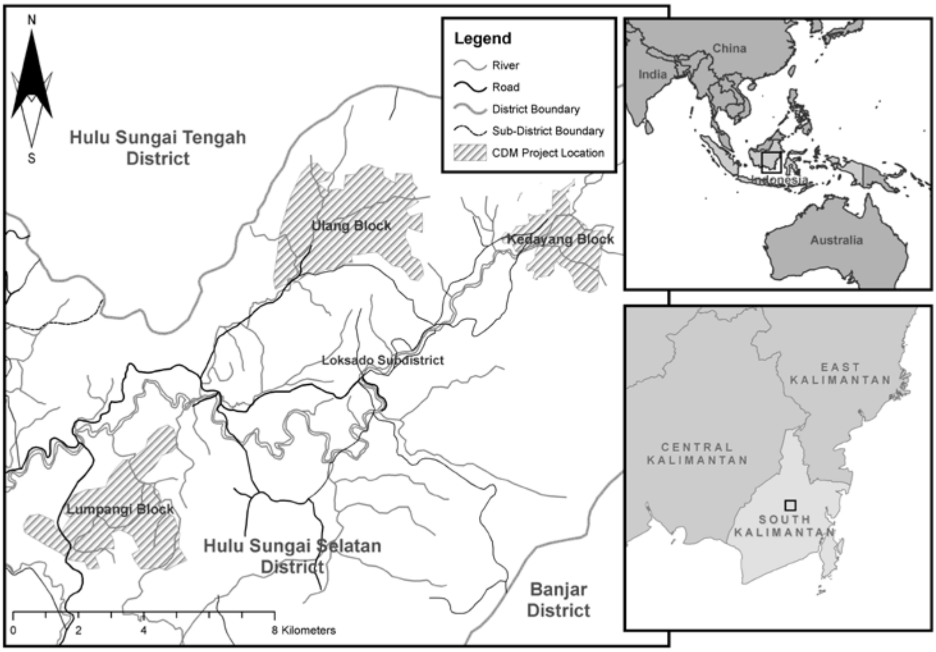

Figure 11.1. Location of AR CDM project in Loksado subdistrict

professionals and rural communities in Southeast Asia working to convert Imperata grasslands to more productive tree-based systems (Garrity 1997; Friday *et al.* 1999); and (ii) the World Agroforestry Centre working to develop rubber production systems that meet the needs and limitations of smallholder farmers in Indonesia. The conditions required for successful use of the technology are (i) secure land and/or tree use rights, (ii) community cooperation in fire prevention and suppression, and (iii) species selection that matches socioeconomic and biophysical conditions. These conditions exist or will develop through implementation of the project activity and technology described here. The economic analysis of the projects was assessed based on net present value (NPV) of benefits and internal rate of return (IRR).

Eligibility of land and project boundaries were assessed using remotely sensed data and a ground survey following steps defined by the CDM executive board. The analysis of the remotely sensed data followed the procedure described in Short (1982) and Sabins (1986). Similarly, the additionality of the project followed the tool for the demonstration and assessment of additonality for afforestation and reforestation (AR) CDM project activities agreed by the CDM executive board (Annex 16, EB21). Calculation of carbon benefits including baseline and monitoring methodologies followed the Approved Methodology 'reforestation of degraded land' (AM0001; can be downloaded from the UNFCCC website at http://cdm.unfccc.int/methodologies/ARmethodologies/approved_ar.html).

Results

Institutional Setting

Based on consultation and discussion with individual farmers, communities in the project areas, local *adat* institutions (*Lembaga Adat*), NGOs, and local government, implementation of the project will be conducted by the Amandit Cooperative. Thus the Emission Reduction Purchase Agreement with the carbon buyer will be made with this cooperative. The Amandit Cooperative will coordinate nine farmer groups. Under an agribusiness approach to the forestry sector (in which input, process, and marketing compose a system), Amandit will develop collaboration with other relevant institutions to strengthen the technical and market capacity of project farmer groups. Specifically, Amandit will develop collaboration with (i) local NGOs to provide technical assistant to farmers groups and (ii) commercial companies to provide marketing support for products. Amandit will manage all project activities including contract negotiations with carbon buyer. The CDM Steering Committee[1] will assist Amandit Cooperative in securing the necessary support from local government during the implementation of the projects, particularly providing all information needed to support extension programs. The Forestry and Estate Office will also have direct linkages with farmer groups to effectively implement technical support activities, such as training. With this arrangement, it was agreed that the project participants share CERs as follows: local government 15%, Amandit Cooperative 40% and farmers 45%. All products produced by the tree-based systems established through the project activity will be owned by the individual farmer producer. It is proposed that, to secure the best price available, those products are sold through the market linkages developed by Amandit Cooperative.

Project description

The proposed project activity will be implemented in an area officially designated as protected forest area, but which has been occupied and cultivated by Dayak tribes for an extensive period. The land was 'abandoned' for agriculture use by the Dayak community before 1990 because the soil fertility was very low and the land was dominated by grasses (**Figure 11.2**). The proposed area is located in three discrete areas (**Table 11.1**). The site of the proposed project activity is remote, 10 km from a main (paved) road. From the main road the villages can be reached only by motorcycle or foot. From the villages the project location can be reached only by foot.

Species selected for the project based on farmer preference are rubber *(Hevea brasiliensis),* cinnamon *(Cinnamomum burmanii*), gmelina (*Gmelina arborea),* and mahogany (*Swietenia macrophylla*). Farmers may plant or protect the natural regeneration of other species. The area allocated per species is 1000 ha (40%) for rubber, 500 ha (20%) for cinnamon, 250 ha (10%) for gmelina and 821 ha (30%) for mahogany. Recommended spacing at establishment is 4 × 6 m for rubber, 3 × 3 m for cinnamon, and 4 × 4 m for timber species. On steep areas farmers may

---

[1] The CDM Steering Committee was formed to implement CDM projects in the district through the support of Bupati (District Head) Decree Number 23.1/2005.

Table 11.1. Geographical positions of blocks and villages

Name of block	Geographical position		Name of Villages	Area (ha)
	Latitude	Longitude		
Blok Kedayang	2.74°–2.77°	115.53°–115.56°	Haratai	475
Blok Lumpangi	2.81°–2.85°	115.40°–115.45°	Lumpangi	945
Blok Ulang	2.74°–2.77°	115.47°–115.51°	Ulang	1,150
			Total	2,570

Note: The effective area for project implementation measures about 2,500 ha.

Figure 11.2. Current situation of Loksado grassland

choose to plant contour hedgerows to establish terraces. The actual species selection/allocation, tree spacing and plot design will vary according to farmers' objectives and site conditions. The decision to integrate or segregate the planting of the four species is also a decision to be made by individual farmers according to the management objectives. Based on agreement with the government, which will provide support for the seedlings, farmers will harvest only cinnamon. Other tree species will not be harvested until the end of crediting periods (20 years).

Carbon Benefits

Following approved methodology, the project will cumulatively result in 499,463 tons CO_2e of actual net greenhouse gas (GHG) removal by sinks. The baseline net GHG removal by sinks for the first four years is about 13,496 tCO_2e, 26,992 tCO_2e, 40,489 tCO_2e and 53,985 tCO_2e, respectively, and for year 5 and forward

67,481 tCO_2e. While leakage varies from year to year depending on types of activities conducted that contribute to GHG emissions, namely seedling transportation and project outputs and harvesting of cinnamon. On average the leakage is about 18,595 tCO_2e per year. Thus cumulatively, the net anthropogenic GHG removal by sinks is about 402,747 tCO_2e. Using temporary-CER (t-CER) system, the project will produce about 78,467 tCER in year 10, 207,474 tCER in year 15 and 401,784 tCER in year 20 (**Figure 11.3**).

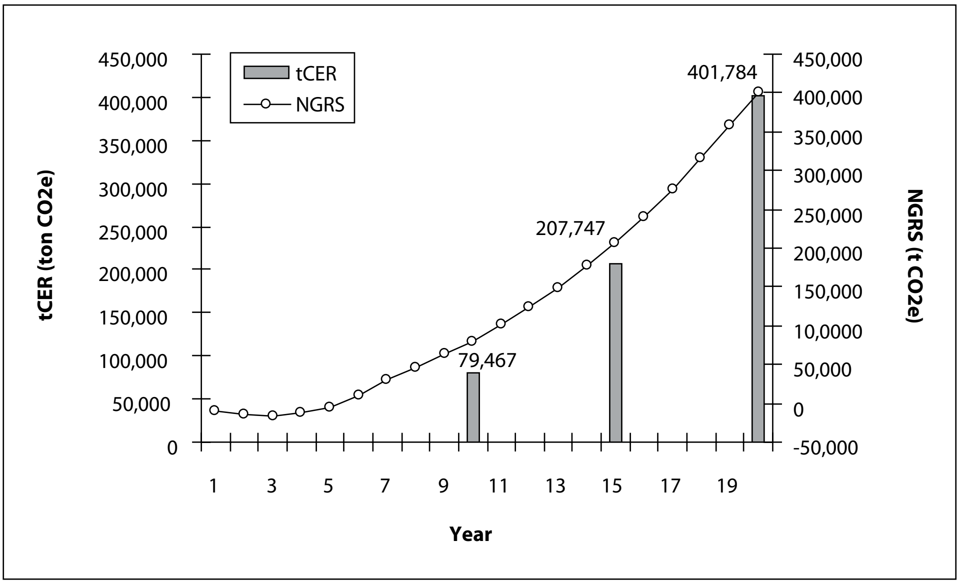

Figure 11.3. tCER and Net GHG removal by sinks

Socio-Economic Analysis

Results of the analysis indicate that the communities that will participate in the proposed AR CDM project activity have a great imbalance in income earnings among families due to unequal distribution of arable land. The majority of community members live below the poverty line and have monthly incomes of roughly US$100. This income is primarily agriculture-based and just sufficient to cover daily subsistence needs. Total monthly expenses are close to US$150, and families struggle to meet these costs. Most farm families may need to expand their land cultivation to meet livelihood needs by an average of 1 to 2 hectares per family. Therefore, with or without the proposed AR CDM project activity, the area of cultivated lands will expand as families try to meet their livelihood needs. Under existing conditions, without the AR CDM project, most of the agricultural expansion will involve traditional slash-and-burn techniques to produce annual crops and occur in forest areas, including the natural forests of Loksado protection forest. Farmers have not yet adapted permanent methods nor developed large areas of tree-based systems, although there is widespread interest. The main reasons why most farmers have not established tree-based systems are lack of capital and lack of technical knowledge (experience).

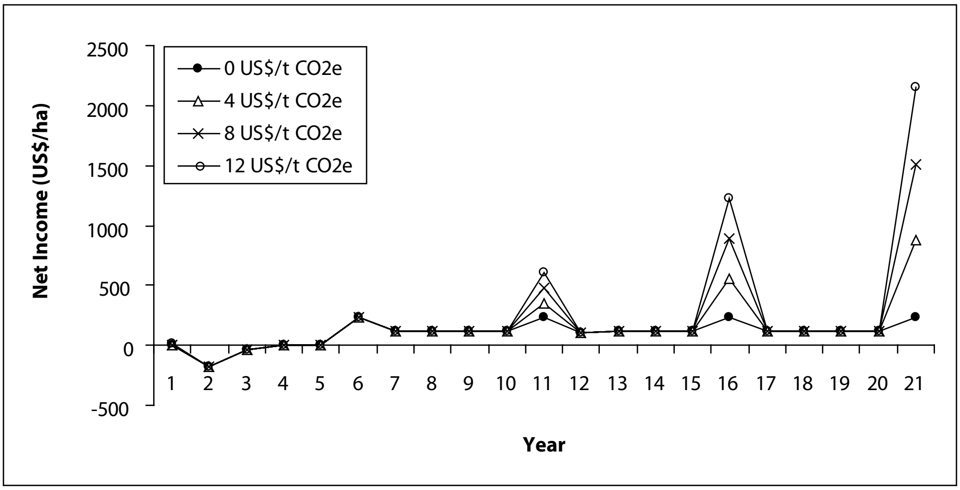

Figure 11.4. Annual cash flow with and without inclusion of income from sale of CER

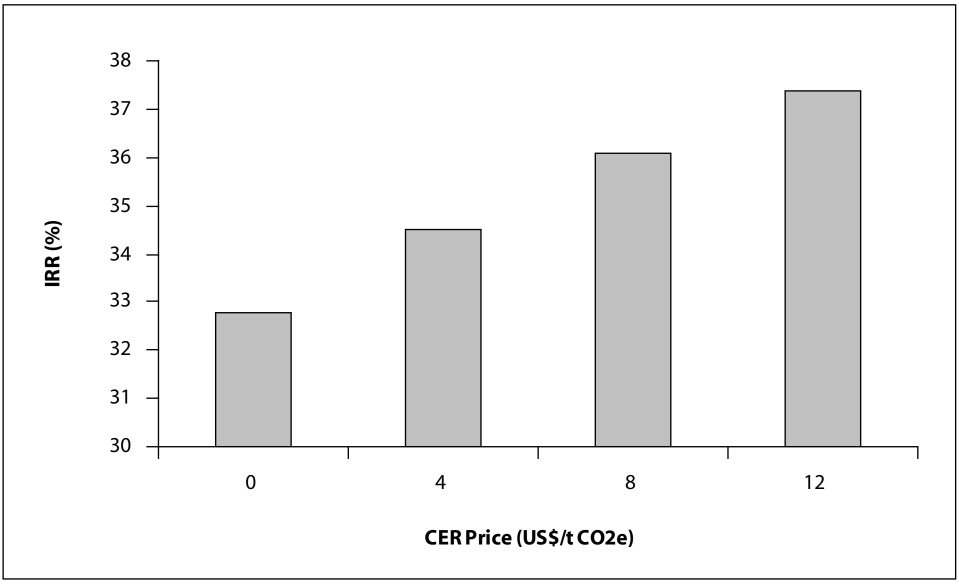

Figure 11.5. Internal rate of return at different CER prices

Under the AR CDM project scenario, agricultural expansion will occur in grasslands and involve mixed tree farming systems. This will be possible because the project activity will provide the necessary capital and technical backstopping to enable participating farmers to established viable mixed rubber systems, including the development of market linkages. Thus under the CDM, the expansion of agriculture area into protected forest is expected to decrease, which will secure the biodiversity of the protected forest. In the Loksado protected forest, there are a number of rare and endangered species of flora and fauna (District Forest Office 2005). The number of flora species is 71, consisting of 29 families including rattans, palms and bamboos. In addition, there are 34 types of medicinal plants. The number of fauna species is 64, consisting of 27 species of mammals, 6 species of reptile, and 29 species of aves. The project activity will expand the area of forest cover in the Loksado area and thus enhance the habitat for fauna—particularly those that are migratory.

From economic analysis, it was found that without considering the income from sale of CER, the project is economically attractive. The positive cash flow starts in year 5. When the sale of CER is taken into account, the benefit becomes even greater (**Figure 11.4**). Using a discount rate of 12.7% (interest rate for agriculture project long-term loan), without including the sale of CER, the NPV of the project is about US$441/ha and the IRR is 32.8%. With inclusion of CER sales, the IRR increases slightly depending on the price of the CER (**Figure 11.5**). The IRR increased by 1.7% at a CER price of US$4/t$CO_2$e, 3.3% at a CER price of US$8/t$CO_2$e and 4.6% at a CER price of US$12/t$CO_2$e. As previously mentioned, because of investment and technological barriers, the Dayak community will be unable to implement the project by themselves without financial and technical assistance. Therefore, for the implementation of the project, Amandit Cooperative expects the carbon buyer to provide part of the investment cost as upfront payment for the carbon credit. The amount of funding requested by Amandit as upfront payment is about US$380,000. The remaining cost of initial investment (US$660,000) is expected to come from various sources, particularly from government.

Conclusion

Without CDM, the Dayak community may be unable to reforest the grassland. The current practice will continue and the expansion of agriculture areas will cut into protected forest area. This means that the threat to the protected forest may increase in the future while the livelihood prospects of the Dayak community remain poor. With the CDM project, it is expected that the investment and technological barriers can be removed. The carbon buyer could provide upfront payment for covering part of the initial cost of establishing the project.

It is certain that the project will contribute positively to the incomes of poor communities through the sale of rubber and other tree products starting in the fifth year of the project and through carbon payments starting in year 10. Other benefits are that the project will reduce pressure on the protection forest in and around the project area by developing a commitment of local farmers to practice sustainable, permanent agriculture, reduce run-off, increase water storage capacity and increase water quality functions of the watershed.

Acknowledgements

The authors wish to acknowledge the Asian Development Bank and Canadian International Development Agency, which provided financial assistance for conducting this study under ADB Project TA No. 4137-INO, and the Ministry of Environment Republic of Indonesia, which gave the authors opportunity to conduct the study. The authors also wish to thank Udi, Yunida, Saeful, Delon Martinus, Indah Meilindawati and other staff of Land Management Grant College (LMGC) and Hulu Sungai Selatan Forest Office who have assisted the authors during the study.

References

District Forest Office. 2005 Master Plan of Loksado protection forest. Hulu Sungai Selatan, South Kalimantan (*in Indonesian*).

Friday, K.S., Drilling, M.E. and Garrity, D. 1999 Imperata grasslands rehabilitation using agroforestry and assisted natural regeneration. International Centre for Research in Agroforestry, Southeast Asia Regional Research Programme, Bogor, Indonesia. 167p.

Garrity, D.P. (ed.) 1997 Agroforestry innovations for imperata grasslands rehabilitation. Agroforestry Systems 36: 1–284.

Sabins, F.F. 1986 Remote sensing (principles and interpretation). W.H. Freeman, New York.

Short, N.M. 1982 The Landsat tutorial workbook (basic of satellite remote sensing). U.S. Government Printing Office, Washington, DC.