Negotiation-support toolkit for learning landscapes

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25 | Rapid carbon stock appraisal (RaCSA)

Meine van Noordwijk and Kurniatun Hairiah

The Rapid Carbon Stock Appraisal (RaCSA) assesses the status of carbon stocks in a given geographical area and develops scenarios of carbon sequestration or restoration resulting from potential land-use and management changes. RaCSA integrates procedures for developing land-use scenarios that can enhance carbon sequestration, prevent land degradation, promote sustainable land productivity and increase people's livelihoods.

Introduction

At the time of writing, about 10% of the emissions of carbon dioxide (CO_2) that cause global climate change are due to land-use changes in the tropics (Le Quéré et al 2013). The contribution of agriculture to other greenhouse gasses is up to 30%. While most policies have so far focused, rightly so, on the fossil fuels that cause the bulk of the CO_2 emissions, the land-use change can no longer be ignored.This land-based emission is the major part of emissions for many developing countries. Global mechanisms for providing economic incentives for maintaining and restoring carbon stocks are taking shape. The United Nations Framework Convention on Climate Change (UNFCCC) regulates the Clean Development Mechanism (CDM) that includes afforestation and reforestation activities. Under discussion is an approach to reducing emissions from deforestation and degradation in developing countries (REDD). Voluntary market mechanisms, which are not included in country commitments to reduce emissions, target various combinations of landscape restoration and protection of tree cover and carbon stocks.

Objectives

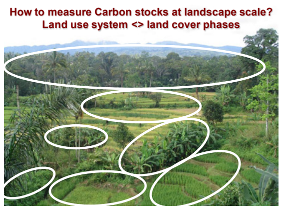
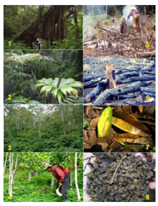
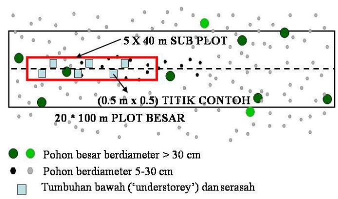
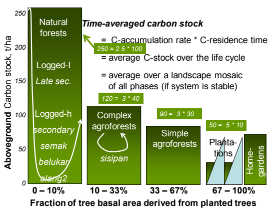
RaCSA is designed to provide a basic level of locally relevant knowledge to inform discussions on emissions reductions. It introduces a scientifically sound methodological framework of accounting for carbon sinks, while focusing on activities that can improve local livelihoods and alleviate rural poverty.

The purpose of RaCSA is to provide a cost-effective and time-bound (within 6 months) appraisal that:

- provides reliable data on carbon stocks in a defined landscape, historical changes and the impact of continuing land-use changes on projected emissions, with or without specific interventions to increase or retain carbon stocks;
- identifies the primary issues in the local trade-off between carbon stocks and livelihoods and the opportunities to achieve more sustainable development pathways; and
- enhances shared understanding between stakeholders as a step towards free, prior and informed consent in contracts to increase or retain carbon stocks.

Steps

Table 25.1. RaCSA activities and outputs

Activities	Objectives
1.  Initial appraisal of the landscape, focused on the dynamics of tree cover	To define the unit of assessment (integrated livelihoods/ landscape unit), its gradients in tree and forest cover, mineral and peat soils, land-use and land-cover types, major issues in the current debate
2.  Explore local ecological knowledge and the economics of local tree and forest management combined with a rapid household socio-economic survey	 To document livelihoods' strategies of the farmers pertaining to land-use practices and key drivers of change in the landscape
3.  Plot-level carbon data in representative land-cover units and; integrating from plot to time-averaged carbon stock of land-use types; an updated version of the ASB carbon stock protocol provides the tree and soil-level data	To assess the performance of existing land-use systems as carbon sinks and/or in preserving carbon stocks.
4. Combine remote-sensing imagery and ground-truthing data within a sufficiently sensitive 'legend' to provide spatial analysis of land-cover changes	To estimate carbon stocks of the main land-use practices at plot level as well as their integration at landscape level
5. Explore policy-makers' ecological knowledge of tree and forest management and spatial planning rules	To explore the opportunities to use or adjust existing policy frameworks to enhance carbon storage in the landscape
6.  Scenario studies of changes in carbon stocks and welfare through modelling land-use and carbon-stock dynamics in the landscape	To appraise landscape carbon-stock dynamics in relation to drivers of change as a basis for selecting interventions that enhance people's welfare and maintain or increase carbon stocks

The results need to be communicated in a simple format that focuses on the main trade-offs and decisions that can be made within a landscape. The primary data on carbon stocks can contribute to national databases and subsequently be used for national reporting. The ground-truthing and spatial analysis can similarly contribute to future analysis of the dynamics in larger areas, while the trade-off data and scenario models can be used for direct comparisons with other landscapes.

Case study of RaCSA application

RaCSA was applied in Nunukan district, East Kalimantan province, Indonesia, to monitor carbon stocks in an area where forest conversion, illegal logging and fire were causing substantial carbon emissions. Community-based forest management, such as agroforestry and low external input sustainable agriculture, were seen as options that could provide sustainable livelihoods for local farmers while increasing or maintaining carbon sequestration. Agriculture competed with logging as the most profitable activity.

According to a household survey, there were three main tree-based systems in the area: 1) smallholding plantations of oil palm and pepper; 2) 'jakaw' (an upland rice fallow rotation system); and 3) a fruit-based system where farmers planted fruit trees in logged-over forest between remnant trees of low-commercial value. These systems were estimated to store carbon as shown in Table 25.2.

Table 25.2. Mean aboveground carbon stocks of land-use systems sampled in Nunukan

Land-use systems	Carbon stock (Mg ha^{-1})
Primary forest	230
Logged-over forest aged 0–10 years	207
Logged-over forest aged 11–30 years	213
Logged-over forest aged 31–50 years	184
Jakaw aged 0–10 years	19
Jakaw aged more than 10 years	58
Agroforestry aged 0–10 years	38
Agroforestry aged 11–30 years	73
Imperata grass	4
Upland rice	5

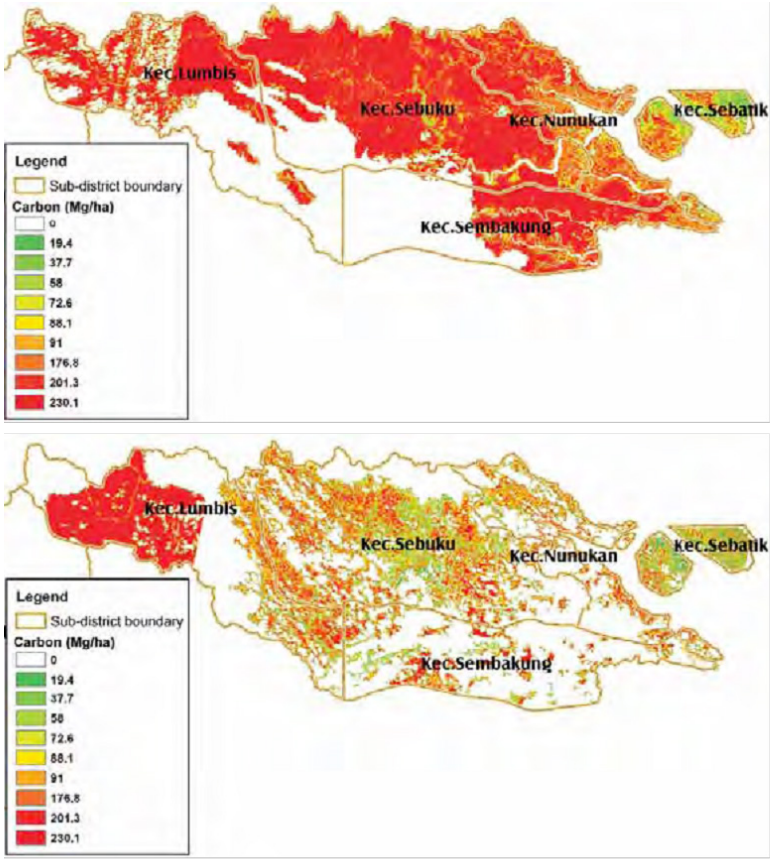


Figure 25.1. Distribution of land cover, Nunukan, 1996 (top) and 2003 (bottom)

An assessment of carbon stocks in the area estimated that carbon density in 1996 was 210 Mg ha^{-1}, while in 2003 it was 166 Mg ha^{-1}. During that period, primary forest was converted to other land uses at the rate of 3.9% year^{-1}. The estimated rate of carbon sequestration for the jakaw systems was 3.7 Mg ha^{-1} year^{-1} and for agroforestry systems it was 2 Mg ha^{-1} year^{-1}.

Modelling exercises suggested that both income and landscape-level carbon stocks in Nunukan were decreasing, as non-sustainable logging remained the most profitable land-use option (Figure 25.1). Efforts to improve the profitability of agroforestry through better market development did not result in a greater adoption of the practice, since logging activities continued to provide better income (Figure 25.2). Thus, both per capita income and carbon stocks remained similar to the current trend. Reducing the timber market price by 25–50% reduced income without changing existing carbon stocks. If the market price was decreased 75–100%, people adopted agriculture and agroforestry to compensate for the income lost from logging.

The recommendation for policy in Nunukan was for promoters of agroforestry and community-based natural resource management to work together to achieve global and local benefits. A substantial increase in the profitability of agroforestry was needed before this practice could be considered an attractive alternative to illegal logging.

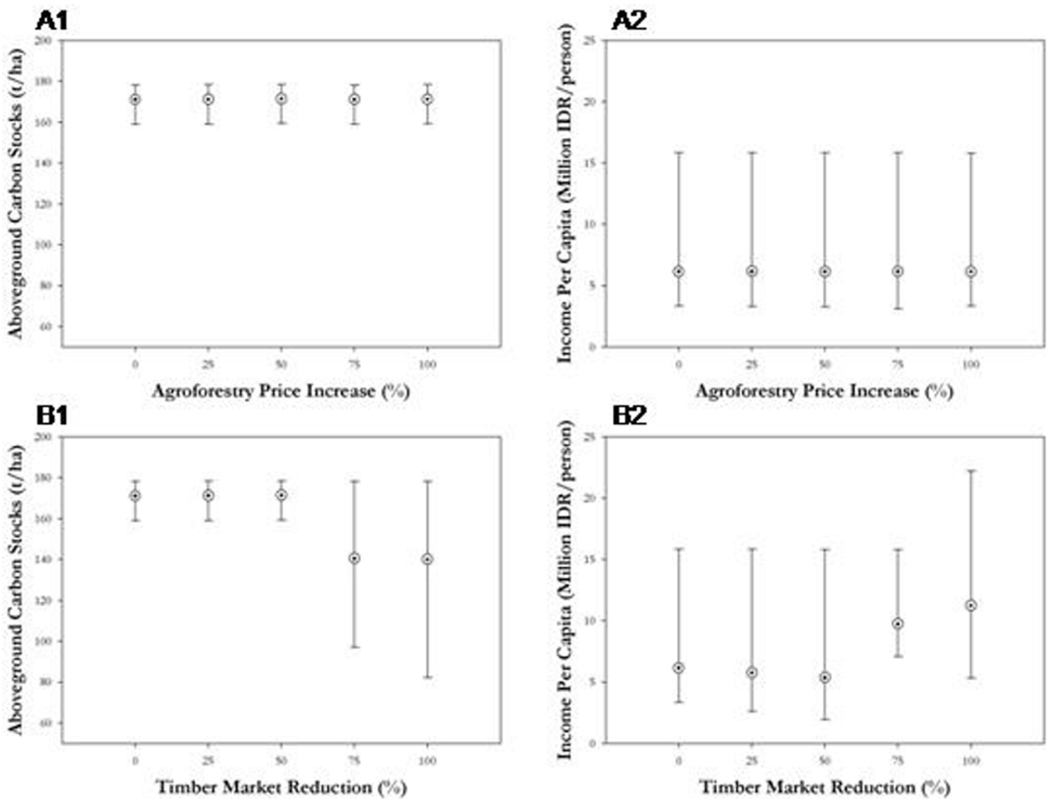


Figure 25.2 . Simulation results

Key references

Hairiah K, Dewi S, Agus F, Velarde SJ, Ekadinata A, Rahayu S and van Noordwijk M. 2011. *Measuring carbon stocks across land-use systems: a manual*. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.

Hairiah K, Rahayu S. 2007. *Pengukuran karbon tersimpan di berbagai macam penggunaan lahan*. Measuring carbon stocks across land-use systems. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.

Hairiah K, Sitompul SM, van Noordwijk M, Palm CA. 2001. *Methods for sampling carbon stocks above and below ground*. ASB Lecture Note 4B. Bogor, Indonesia: International Centre for Research in Agroforestry.

Lusiana B, van Noordwijk M, Rahayu S. 2005. *Carbon stocks in Nunukan, East Kalimantan: a spatial monitoring and modelling approach*. Report from the carbon monitoring team of the Forest Resources Management for Carbon Sequestration project. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.

The landscape scale is a meeting point for bottom–up local initiatives to secure and improve livelihoods from agriculture, agroforestry and forest management, and top–down concerns and incentives related to planetary boundaries to human resource use.

Sustainable development goals require a substantial change of direction from the past when economic growth was usually accompanied by environmental degradation, with the increase of atmospheric greenhouse gasses as a symptom, but also as an issue that needs to be managed as such.

In landscapes around the world, active learning takes place with experiments that involve changes in technology, farming systems, value chains, livelihoods' strategies and institutions. An overarching hypothesis that is being tested is:

> Investment in institutionalising rewards for the environmental services that are provided by multifunctional landscapes with trees is a cost-effective and fair way to reduce vulnerability of rural livelihoods to climate change and to avoid larger costs of specific 'adaptation' while enhancing carbon stocks in the landscape.

Such changes can't come overnight. A complex process of negotiations among stakeholders is usually needed. The divergence of knowledge and claims to knowledge is a major hurdle in the negotiation process.

The collection of tools—methods, approaches and computer models—presented here was shaped by over a decade of involvement in supporting such negotiations in landscapes where a lot is at stake. The tools are meant to support further learning and effectively sharing experience towards smarter landscape management.

World Agroforestry Centre
ASB Partnership for the Tropical Forest Margins
AARD
Federal Ministry for Economic Cooperation and Development
Norad
IFAD Enabling poor rural people to overcome poverty
CGIAR Research Program on Forests, Trees, and Agroforestry