Integration of Bamboo Forestry into Carbon Markets

King, Charlotte; van der Lugt, P.; Thang Long, Trinh ; Yanxia, Li

Publication date
2021

Document Version
Final published version

Citation (APA)
King, C., van der Lugt, P., Thang Long, T., & Yanxia, L. (2021). *Integration of Bamboo Forestry into Carbon Markets*. International Bamboo and Rattan Organisation (INBAR).

INBAR Working Paper

Policy Brief

Integration of Bamboo Forestry into Carbon Markets

Charlotte King[1], Pablo van der Lugt[2,3], Trinh Thang Long[1], Li Yanxia[1]

2021

[1] International Bamboo and Rattan Organisation (INBAR)

[2] Technical University Delft, the Netherlands

[2] Zhejiang A&F University, China

RESEARCH PROGRAM ON Forests, Trees and Agroforestry

About the International Bamboo and Rattan Organisation

The International Bamboo and Rattan Organisation, INBAR, is an intergovernmental organisation dedicated to the promotion of bamboo and rattan for sustainable development. For more information, please visit www.inbar.int.

About this Working Paper

This research was carried out by the International Bamboo and Rattan Organisation (INBAR) as part of the CGIAR Research Program on Forests, Trees And Agroforestry (FTA). FTA is the world's largest research for development programme to enhance the role of forests, trees and agroforestry in sustainable development and food security and to address climate change. CIFOR leads FTA in partnership with Bioversity International, CATIE, CIRAD, INBAR, ICRAF and TBI. FTA's work is supported by the CGIAR Trust Fund: http://www.cgiar/org/ funders.

International Bamboo and Rattan Organisation

P.O. Box 100102-86, Beijing 100102, China Tel: +86 10 64706161; Fax: +86 10 6470 2166; Email: info@inbar.int

List of Abbreviations

CDM	Clean Development Mechanism
FAO	Food and Agriculture Organization of the United Nations
INBAR	The International Bamboo and Rattan Organisation
REDD+	Reducing emissions from deforestation and forest degradation and foster conservation, sustainable management of forests and enhancement of forest carbon stocks
tC/ha	tonnes of carbon per hectare
TEC	Total Ecosystem Carbon
VCS	Verified Carbon Standard

Table of Contents

List of Figures

Introduction

This policy brief provides an introduction to how bamboo forestry projects can be integrated into carbon markets.

Bamboo, the fast-growing and versatile giant grass species, is distributed widely across some of the most biodiverse and carbon-rich areas of the tropics and subtropics. According to the Food and Agriculture Organization of the United Nations' (FAO) Forest Resource Assessment 2020, there are 35 million hectares of bamboo worldwide. Like trees, bamboo plants sequester carbon as they grow. Over time, and with the right management, bamboo plants and durable products can provide an important carbon 'sink', storing more carbon than many tree species. Bamboo forests could therefore contribute to international efforts to reduce carbon dioxide in the atmosphere and mitigate climate change.

Bamboo afforestation is already taking place around the world as a popular choice for restoring degraded land, protecting riverbanks and preventing landslides. According to an internal survey, the Member States of the International Bamboo and Rattan Organisation (INBAR) have committed to restoring 5.7 million hectares of degraded land with bamboo by 2030. With the right set-up, these bamboo forestry projects can be certified as contributing to a reduction in greenhouse gas emissions and may be included in carbon markets, making them a potentially lucrative source of income. However, to do this, projects must adhere to specific agreed-upon carbon accounting standards and emission reduction methodologies.

By explaining how to develop and register bamboo forestry projects for certification in carbon markets, this policy brief aims to support project developers and government actors to gain additional incomes from these projects and integrate bamboo more into national climate strategies.

1. Bamboo's carbon storage potential

Because of their fast growth, giant woody bamboos are very effective carbon dioxide absorbers. Studies of the total ecosystem carbon (TEC) of certain woody bamboo species show that bamboo forest ecosystems can store between 94 and 392 tonnes of carbon per hectare (tC/ha): that is, significantly less carbon than in natural forest ecosystems (126–699 tC/ha) but similar to tree plantation ecosystems (85–429 tC/ha) and more than grassland or pasture (70–237 tC/ha).

When considering the carbon lifecycle, it is important to consider the carbon stored in harvested wood products in addition to the carbon stored in the plant and the soil. If harvested and processed into durable products, bamboo can also:

- **Store carbon for a long period of time in durable products**. Because bamboo is a grass, not a tree, it can be harvested within three to seven years (based on annual selective cutting of approximately 20%–30% of culms), and it regrows quickly without the need to replant. This means that over time, bamboo can be used to create a large number of durable products. This is an advantage in comparison to many tree species, which require far longer to reach maturity and do not grow back after harvesting.
- **'Avoid' or 'displace' carbon** by replacing emissions-intensive materials such as concrete, steel, aluminium, PVC and unsustainably sourced hardwood with bamboo.

Over a period of time, then, an area of bamboo plants and their products can store more carbon than certain tree species. Figure 1 combines the TEC, the durable products carbon pool and 'avoided' emissions for different species of bamboo after a 30-year period.

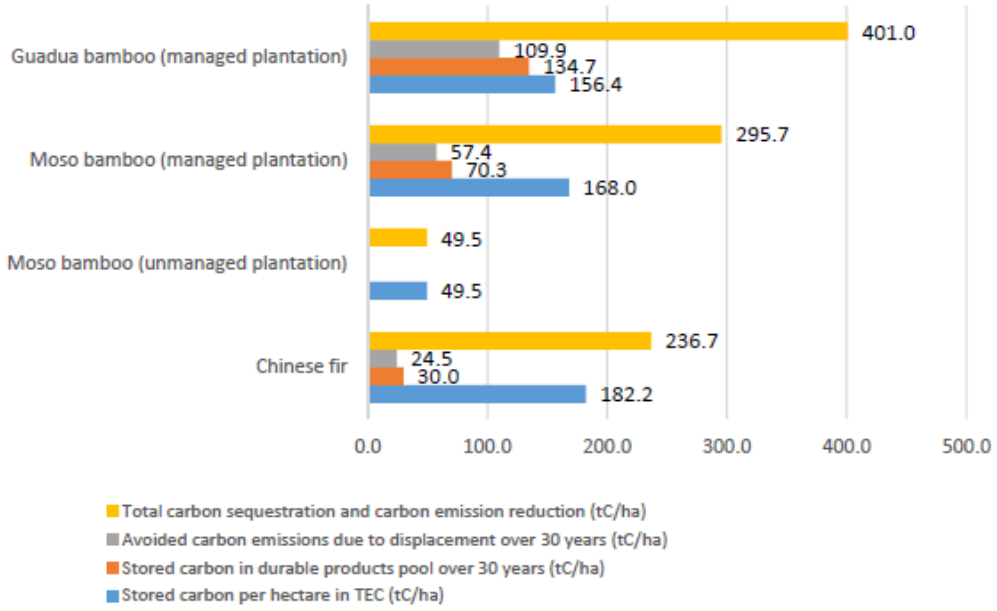

Figure 1: Carbon sequestration and carbon emissions reduction potential for bamboo (Moso, Guadua) and Chinese fir (tC/ha). The lifetime for durable products is assumed to be 30 years.

As Figure 1 shows, a plantation of a giant bamboo species such as Guadua can store and reduce 401 tC/ha in total and Moso bamboo 295.7 tC/ha. By contrast, a plantation of Chinese fir trees will store and reduce only 236.7 tC/ha.

It is important to note that, aside from species selection, the most significant factors affecting a bamboo forest or plantation's carbon storage potential are the local climate, the soil conditions and management. Proper management practices, such as selective harvesting, are critical for maximising the amount of carbon in bamboo forests and plantations. Conversely, if left unmanaged, bamboo forests will store significantly less carbon.

2. Available carbon methodologies for bamboo

2.1 Assessing bamboo carbon

Bamboo forestry projects can receive credits and be traded in carbon markets as carbon offsets, if they can show they have led to carbon being stored or emissions avoided. As with all carbon credits, forestry projects must have reduced emissions compared to a 'business-as-usual' scenario to qualify. In this case, the emission reductions achieved are considered an 'additionality'.

However, while many methodologies exist for measuring the carbon storage of trees in forests, they are not always applicable to bamboo, a giant grass. Bamboo culms are hollow, and the correlation between a culm's diameter and height with its biomass or net volume largely depends on the culm's age, the bamboo species and the site condition; tree-based measurements of biomass and related carbon do not apply. Furthermore, many clumping bamboo species are located in very dense plots, which, in many cases, make it impossible for surveyors to adequately measure the culms' diameters.

In 2020, INBAR published *A Manual for Bamboo Forest Biomass and Carbon Assessment,* with contributions from a task force from the Intergovernmental Panel on Climate Change. The manual provides detailed guidelines for assessing and monitoring biomass and carbon changes in bamboo forests and plantations.

2.2 Methodologies for quantifying emission reductions from bamboo-related activities

While the above manual can help project developers estimate the carbon storage potential of a bamboo area, such a calculation in itself is not sufficient to certify carbon emission reductions in a bamboo forestry project for a carbon market. To do this, project developers must also follow the specific guidelines and procedures laid out by a carbon market methodology.

Carbon market methodologies do more than quantify the amount of carbon stored in a bamboo plantation. They also guide project developers in determining project boundaries, setting baselines, assessing the additionality of carbon stored or removed and quantifying the overall greenhouse gas emissions reduced or removed under the project. Methodologies follow a specific

process, requiring the submission of specific information and approval by designated national and accredited authorities. Once a project has been formally approved, the project manager will be issued with carbon credits.

Currently, there are no methodologies for quantifying carbon emissions reduction/removal from sustainable management of bamboo forests, from the carbon stored in durable bamboo products and from the emissions 'avoided' by substituting more carbon-intensive materials with bamboo. Forest carbon methodologies described below can be used to quantify carbon emission reductions from bamboo forestry projects. These methodologies were developed for a number of compliance carbon markets, including the Clean Development Mechanism (CDM) and voluntary carbon markets (such as the Verra [formerly known as the Verified Carbon Standard], the Gold Standard and the Climate, Community and Biodiversity Standard), but are likely to be accepted by all voluntary carbon markets:

- **CDM AR-ACM 003**: Methodology for large-scale afforestation and reforestation of lands other than wetlands. This methodology quantifies the greenhouse gas reductions/removal from afforestation and reforestation on any land that does not fall into the wetland category. It can be downloaded at: https://cdm.unfccc.int/methodologies/ARmethodologies/approved
- **CDM AR-AMS 007**: Methodology for small-scale afforestation and reforestation project activities implemented on lands other than wetlands. This methodology quantifies the greenhouse gas reductions/removal from afforestation and reforestation on any land that does not fall into the wetland category. It can be downloaded at: https://cdm.unfccc.int/methodologies/SSCAR/approved
- **VCS VM 005**: Methodology for conversion of low-productive forest to high-productive forest. This methodology can be applied for quantifying greenhouse gas reductions/removal through avoiding re-logging and/or rehabilitating forests, such as thinning, weeding or enrichment-planting. It can be downloaded at: https://verra.org/methodology/vm0005-methodology-for-conversion-of-low-productive-forest-to-high-productive-forest-v1-2/
- **VCS 007 REDD+ methodology framework (REDD+MF) version 1.6**: Methodology for forestry activities, which include reducing deforestation, reducing forest degradation and

accelerating forest regeneration in forest lands, forested wetlands, forested peatlands and tidal wetlands. It can be downloaded at: https://verra.org/methodologies/

For trading bamboo carbon projects in national markets, China has already ratified the 'Methodology for producing carbon sinks through bamboo afforestation projects' and the 'Methodology for carbon sequestration projects from bamboo forest management', which have been accepted by the Chinese Certified Emission Reduction Scheme.

Currently, there are no methodologies for quantifying carbon emissions reduction/removal from sustainable management of bamboo forests, from the carbon stored in durable bamboo products and from the emissions 'avoided' by substituting more carbon-intensive materials with bamboo.

3. Conclusions and recommendations

As this policy brief shows, bamboo can be an important carbon sink with much potential for storing additional carbon on degraded land. Over 30 years, a plantation of giant bamboo can store and reduce 295–401 tC/ha, which is significantly more than certain types of trees.

A number of carbon methodologies can be used for quantifying carbon emission reductions from bamboo forestry projects and are formally recognised by several compliance and voluntary carbon markets.

The recommendations for international policymakers, governmental decision makers, and research institutes are as follows:

- Bamboo afforestation, reforestation and forest management projects should be developed for inclusion in carbon markets, using the methodologies outlined above: CDM AR-ACM 003, CDM AR-AMS 007, VCS VM 005, and VCS 007 REDD+MF version 1.6.
- Further research is needed to develop methodologies that account for carbon emissions reduction/removal from sustainable management of bamboo forests and the carbon stored in durable bamboo products and the emissions avoided by substituting more carbon-intensive materials with bamboo.
- Bamboo's contributions should be recognised in countries' Nationally Determined Contributions to the Paris Agreement on Climate Change.

Further Reading

Publications with asterisks (*) can be downloaded for free from the INBAR Resources Centre (www.inbar.int/resources/).

For an overview of bamboo reforestation and degraded land restoration:

- *FAO and INBAR. (2018) *Bamboo for land restoration.* INBAR Policy Synthesis Report #4. INBAR: Beijing, China.

To calculate the carbon stored in a bamboo plantation or forest:

- *Bao Huy and Trinh Thang Long (2020) *A manual for bamboo forest biomass and carbon assessment.* INBAR: Beijing, China.

For more information about the carbon stored or reduced by bamboo products:

- *van der Lugt, P., Thang Long, T. and King, C. (2018) *Carbon sequestration and carbon emissions reduction through bamboo forests and products.* INBAR: Beijing, China.
- *INBAR. (2010) *Bamboo and climate change mitigation: a comparative analysis of carbon sequestration*. INBAR Technical Report #32. INBAR: Beijing, China.

For information on sustainable management of clumping bamboo:

- *Jayaraman, D. and Thang Long, T. (2020) *Sustainable management of clumping bamboo forest.* INBAR: Beijing, China.

For an overview of carbon stored in bamboo forests around the world:

- Yuen, J.Q., Fung, T. and Ziegler, A.D. (2017) 'Carbon stocks in bamboo ecosystems worldwide: Estimates and uncertainties', *Forest Ecology and Management*, 393, p113–138.

www.inbar.int

@INBAROfficial