INBAR Working Paper 71

Carbon Off-setting with Bamboo

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INBAR

Foreword

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Bamboo's biological characteristics – fast growth and high renewability – make it an excellent tool for combating climate change. Furthermore, the more recent high market demand for bamboo-based carbon sequestration measures has driven INBAR, our partners and many other initiatives across the globe to further explore bamboos' role in climate change. This work has illustrated that bamboos can be a versatile and useful resource in climate change mitigation and adaptation, and at the same time help build livelihoods.

However, until recently, quantification methodologies and bamboo-specific examples in climate change mitigation were limited. To harness the untapped potential of bamboo for mitigation, INBAR and partners have made significant progress in developing methodologies for bamboo carbon accounting in afforestation projects, which allow interested stakeholders to formally purchase carbon offsets through bamboo-based projects. Now, bamboo represents a viable option in climate change mitigation—through the generation of carbon credits.

In this publication, we build on our previous work by introducing some of the latest developments in bamboo carbon accounting methodology and climate change mitigation, and outline INBAR's future plans to continue to enhance bamboo's role in the generation of carbon credits.

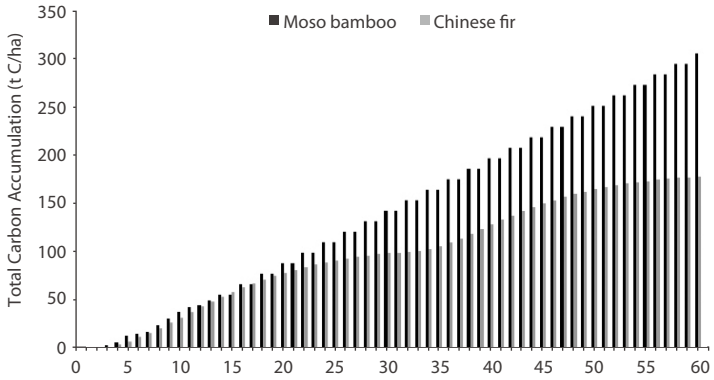
1

Biological characteristics of bamboo and its management

During recent years, INBAR and partners have been studying bamboo to develop the necessary scientific foundation to assess its potential function in climate change mitigation. These efforts have shown that bamboo is "similar but different" to other types and patterns of forest-based carbon sequestration activities. As can be seen in the bamboo carbon cycle, bamboo works similarly to trees with regard to photosynthesis and carbon storage in biomass.

However, bamboo also holds unique characteristics and opportunities as a tool to mitigate climate change. These characteristics are highlighted in the following pages.

The Bamboo Carbon Cycle



Comparison of total carbon accumulation of Moso bamboo and Chinese fir – managed stand

a. Fast growth

Bamboos are fast-growing woody grasses that grow mostly in the tropics and subtropics in mixed forests or as pure stands, and are cultivated in plantations, on homesteads and on farms. Bamboos are amongst the fastest-growing plants, growing at up to a meter per day. The biomass of newly planted bamboo forests increases rapidly for ten or more years before reaching a plateau, at which point emergence and death of culms each year is approximately equal. The biomass of underground rhizome systems follows a similar pattern.

Compared with unmanaged stands, in managed stands, cultivation and harvesting practices enable much higher biomass production per unit area, at least doubling productivity. For example, INBAR's modeling shows that a managed Moso[1] bamboo forest accumulates about 300 tonnes of carbon per hectare after 60 years. Bamboos also produce the most biomass when managed - by cultivation and selective, regular harvesting of mature culms. If harvested culms are turned into durable products, a managed bamboo forest sequesters more carbon than fast growing tree species, such as Chinese Fir.

Bamboos sequester more carbon in the early years of a plantation than comparable forest trees. Unmanaged bamboo stands do not store high levels of carbon, as their productivity is low and the accumulated carbon returns quickly to the atmosphere as the older culms decompose.

[1] Moso bamboo *(Phyllostachys pubescens)* is the commercially most important bamboo species in China.

b. Renewability: harvesting and management

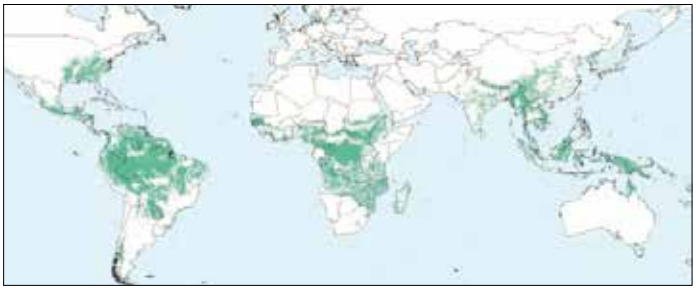
Unlike trees, bamboos form extensive rhizome and root systems which can extend up to 100 km/ha and live for a hundred years. Culms that emerge from the rhizomes die naturally after about 10 years if not harvested before. The rhizome system, however, survives the harvesting of individual culms, so the bamboo ecosystem can be productive whilst continuing to store carbon, as new culms will replace the harvested ones. The lost biomass is usually replaced within a year. This implies that bamboo ecosystems can be highly renewable, as they allow regular extraction of biomass without threatening the sustainability of the ecosystem.

As management of bamboo forests results in greater removal of greenhouse gases compared to unmanaged stands, managing bamboos has potential to help mitigate climate change while also increasing yields and quality of culms and, thereby, generating benefits for both the environment and farmers.

Bamboo culms can be harvested regularly and used to make many different types of durable products, such as houses, floorboards or furniture, so the potential for the forest to sequester carbon also depends on the use, lifetime and durability of the harvested material or the products it is used to make.

a. Possible global potential area of bamboo

It is estimated that bamboos cover 36 million hectares today – representing 3.2% of the total forest areas of countries which grow bamboo[5]. Studies show that bamboo could be grown on many millions more hectares of degraded land in the tropics and subtropics, where it could provide additional incomes to farmers without affecting their existing crops.



Global distribution of bamboo

Over the past 15 years, the bamboo area in Asia grew by 10%[6]. China, for example, plans to continue to plant more bamboos over the next years. Studies have estimated that the carbon stored in Chinese bamboo forests will increase from 727.08 Tg C in 2010 to 1,017.54 Tg C in 2050, which equates to an increase of nearly 40% in 40 years[7]. This represents a significant contribution to the Chinese forest carbon stock and a range that shows that policies aiming at combating climate change with bamboo can indeed have leverage.

[5] Lobovikov M, Paudel S, Piazza M, Ren H, Wu J. 2007. World Bamboo Resources. Non-Wood Forest Products 18. FAO.
[6] Lobovikov M, Paudel S, Piazza M, Ren H, Wu J. 2007. World Bamboo Resources. Non-Wood Forest Products 18. FAO.
[7] Chen X, Zhang X, Zhang Y, Booth T, He X. 2009.Changes of carbon stocks in bamboo stands in China during 100 years. Forest Ecology and Management. 258:1489-1496.
[8] See: Kuehl Y, Henley G, Lou Y. 2011. The Climate Change Challenge and Bamboo: Mitigation and Adaptation. INBAR Working Paper 65.

Bamboo and Climate Change Adaptation

Bamboos are a versatile and useful resource to deal with the effects of climate change. INBAR demonstrated that growing and utilizing bamboos can represent an effective tool in climate change adaptation measures[8]. Bamboos can be integrated into a wide range of local climate change adaptation strategies. Common examples for bamboos function in climate change adaptation include the following:

— **Reducing soil erosion**: Erosion can destroy ecosystems and livelihoods. Bamboos' extensive roots and rhizomes bind the soil, and as they can grow on poor soils, bamboos are most effective in areas prone to runoff such as steep slopes, river banks or degraded lands. Bamboos are evergreen plants and the thick canopy and soil cover provided by dead leaves reduces direct and splash erosion and enhances infiltration.

— **Windbreaks and shelterbelts**: Bamboo culms bend in high winds, but usually do not break – therefore, they are often used as windbreaks to protect cash crops, particularly in coastal areas where high winds are frequent.

— **Decreasing sensitivity**: Bamboos grow very fast - productive stands can be established within a few years and individual culms can be harvested after 3-6 years, depending upon species. This rapid establishment reduces exposure to outside risks such as fire or extreme weather events, and increases flexibility to adapt management and harvesting practices in the face of climatic change.

— **Helping to rehabilitate degraded lands**: Bamboos are very productive on fertile soil, but most bamboos can also grow on marginal lands, such as degraded land and steep slopes, leaving better land for more demanding crops. Bamboos are tolerant of a range of soil conditions, such as low pH values, so can grow on lands which would otherwise be unsuitable for productive ecosystems. Additionally, Bamboos can be used to (re-) establish additional functioning and productive ecosystems to reduce pressure on lands to meet food and biomass demands.

— **Regular provision of renewable energy and sustainable biomass**: Deforestation for household energy is a major driver of climate change in many developing countries. Bamboos can help reduce deforestation by replacing trees for firewood and charcoal, providing a more renewable source of energy. Bamboo based firewood and charcoal are being recognized as sustainable alternatives to meet the energy demands of rural and urban dwellers.

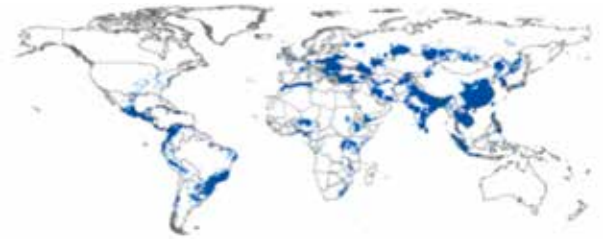
— **Reducing deforestation**: Using bamboos instead of trees can reduce pressure on other woody forest resources and help avoid deforestation. In this way bamboos can contribute simultaneously to adaptation and mitigation of climate change.

— **Provision of a regular source of income**: The fast growth and early maturation of bamboo culms means that a bamboo stand can be selectively harvested just a few years after planting. Regular selective harvesting of bamboos generates a regular income stream that provides bamboo farmers with a quick return on their investment and an important financial safety net.

— **Provision of a low-energy resource for construction and infrastructure**: The use of energy intensive construction and infrastructure needs to be reduced. Bamboos are a light and strong material for construction and infrastructure. Modern high quality bamboo houses that combine safety with durability and aesthetics are now available.

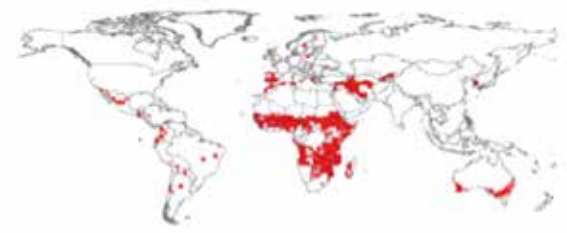
— **Wide range of uses**: Bamboos' versatility and unique characteristics provides communities with options to diversify their and build livelihoods.

On the other hand, climate changes can also threaten the sustainability of bamboo resources; even though first studies indicate that bamboos are comparatively resilient to climate change[9]. Many areas where bamboos grow will most likely be severely impacted from climate change. (See maps below)



Areas most affected by flooding[10]

INBAR, and partners are working to carry out vulnerability and impact studies to assess the effects of climate change on bamboo resources. Based on these studies, specific local adaptation strategies can be developed to ensure sustained livelihood and environmental services of bamboo resources.



Areas most affected by drought[11]

[9] He D, Huang H, Qian X, Qiu Q, Qian S. 2009. Analysis on Recovery from Snow Disaster of Phyllostachys heterocycla var. pubescens Stands for Shoot Production. Journal of Zhejiang Forestry Science & Techonology 29(6): 61-63. (in Chinese)

[10] CIFOR. 2012. Adapting forests and people to climate change – Conserving ecosystem services that reduce risk to the world's poorest. A framework proposal.

[11] CIFOR. 2012. Adapting forests and people to climate change – Conserving ecosystem services that reduce risk to the world's poorest. A framework proposal.

b. Challenges

Despite significant advancements in the field of bamboo-based climate change mitigation, several challenges to further leveraging these advances include the following:

- Limited species specific growth and biomass data (mainly for species which are not popular in East Asia)
- Limited growth models (mainly for species which are not popular in East Asia)
- Limited knowledge regarding bamboo's response to management measures (to develop specific management schemes)
- Limited knowledge on existing bamboo resources (existing and potential bamboo growth areas need to be quantified)
- The definition of a 'bamboo forest' is inconsistent and incompatible across different countries[12], complicating the assessment of existing bamboo resources and bamboos' potential contribution to mitigating climate change.
- Limited awareness (rural communities are at times not aware that bamboo can be processed into high-value durable products; policy makers are not sufficiently aware of the potential of bamboo in climate change mitigation and adaptation)

INBAR is working to meet the above challenges and the high market demand for bamboo-based carbon sequestration measures through new research partnerships and other initiatives.

Species-site matching tool

INBAR developed a species-site matching tool which allows users to identify adequate bamboo species for their specific site (or vice versa). As of November 2012, the tool includes around 200 bamboo species. This tool is especially useful for stakeholders who wish to establish bamboo plantations in areas where bamboo is not yet very common. INBAR plans to extend the database and to make this tool available online on the INBAR website.

[12] Lobovikov M, Paudel S, Piazza M, Ren H, Wu J. 2007. World Bamboo Resources. Non-Wood Forest Products 18. FAO.

3

Recent developments: carbon accounting methodologies for bamboo

The last couple of years represent a breakthrough for carbon off-setting schemes for afforestation with bamboo. INBAR and partners, as well as other initiatives, worked to capitalize on bamboo's potential as a fast-growing, renewable and highly productive carbon sink by developing methodologies that allow stakeholders to integrate bamboo into carbon crediting schemes. The following are examples of selected initiatives.

Voluntary Carbon Credits for Afforestation with Bamboo in China

In order to address the growing demand for carbon forestry practices and carbon trade, as well as leverage the potential of bamboo stands in addressing climate change issues, INBAR, Zhejiang A & F University (ZAFU), the China Green Carbon Foundation (CGCF), and the Research Institute of Subtropical Forestry of the Chinese Academy of Forestry (RISF-CAF), developed a "Carbon Accounting Methodology for Afforestation with Bamboo in China". The methodology provides the underlying principles and guidelines on the applied range, design, eligibility, silvicultural practices, selection of carbon pools, GHG emission sources, leakage, baseline scenarios, project scenarios and project monitoring planning for bamboo afforestation projects, which are to be included in a carbon trading or offsetting scheme in China.

The development of this methodology was based on technical documents formulated by the Chinese State Forestry Administration (SFA) coupled with previous INBAR, ZAFU and RISF-CAF experiences, and lessons learned from a CGCF-funded Moso bamboo carbon afforestation pilot project in Lin'an County, Zhejiang Province, China. In addition, the methodology also draws on relevant international standards and regulations, such as CDM and VCS, and is built upon INBAR research.

During the drafting of the methodology, INBAR and our partners also held consultations at both the 2nd Asia-Pacific Forestry Week and the UNFCCC COP 17. CGCF also organized a Chinese national consultation meeting in April 2011, while the State Forestry Administration of China (SFA) organized a consultation through correspondence during the same month.

The resultant methodology aims to be relevant both domestically in China and internationally, to meet principles of scientific rationality, easy operability and the requirements of the carbon market. However, as bamboo-specific carbon accounting methodologies are still in a nascent stage, it is expected that this methodology will be further developed and extended through future research and practice.

The SFA officially accepted and endorsed the "Carbon Accounting Methodology for Afforestation with bamboo in China". Therefore, the methodology will guide all bamboo carbon plantation projects by the Chinese government. In addition, the methodology will qualify bamboo for afforestation projects in China and will quantify respective carbon credits.

Based on the unique and specific methodology, 46.7 ha of Phyllostachys pubescens (commonly known as Moso bamboo) were planted in March 2009 in Lin'an to generate off-sets on the voluntary Chinese carbon market. This represents the world's first bamboo plantation for afforestation and carbon credit purposes. The Chinese carbon market has responded positively to this novel opportunity to off-set emissions with bamboo. As of 2012, more than 10 Chinese companies have already pre-ordered 8155 t CO_2e on the Chinese voluntary carbon market through CGCF.

Before and after: Site in Lin'an at planting and after 3 years

VCS accredited Bamboo Carbon Credits in South Africa

The South African NGO "Food & Trees for Africa" launched its "Bamboo for Africa" programme in March 2010. The "Bamboo for Africa" programme addresses voluntary and accredited carbon credits, enterprise development and corporate social investment. It represents the world's first bamboo project which is verified through the Verified Carbon Standard (VCS).

The project works on 4 sites across South Africa that are all at least 200ha. The sites are all located in deprived communities with at least 50% unemployment. Bamboo planting is carried out in line with capacity building activities for the local communities, for planting and maintaining bamboo, as well as related value addition or bio energy processes.

The first bamboos were planted in April 2010. Throughout a 7 year period, 313.41 t CO_2e will be accumulated per ha. The awareness of bamboo's benefits and unique role is increasing, so the response from the carbon market is positive: a total of 165 ha of bamboo will be planted by early 2013. The interest from eligible communities to extend the project is overwhelming: over 300 communities approached "Food & Trees for Africa" to become part of the programme.

FTFA planting event *photo credit: FTFA*

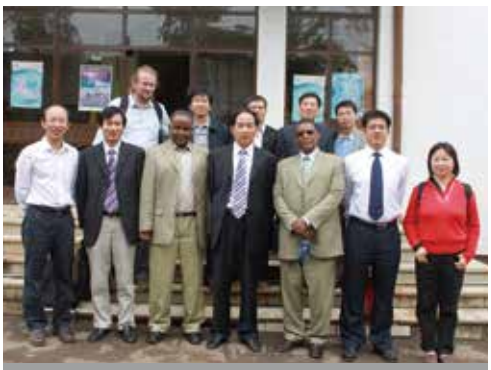
4

Expansion: pilot sites for testing and verification

In order to meet the objective of implementing bamboo carbon sequestration projects in all 38 INBAR member countries, INBAR and partners (CGCF, ZAFU and RISF-CAF) are in the process of developing a global version of the existing and accredited "Carbon Accounting Methodology for Afforestation with Bamboo in China".

A pilot and verification phase will test and adapt the global version of the carbon accounting methodology for afforestation with bamboo in several countries. This process includes ensuring that carbon accounting methodologies comply with national forest definitions and other national laws and regulations in the respective countries. The pilot phase will also serve to gather more scientific data on additional bamboo species and different management types. During this phase, small to medium sized pilot plantations will be established in selected countries. After the initial pilot and testing phase, global stakeholders will be able to implement large scale projects based on the methodology. The pilot phase will also be used to demonstrate the functionality of bamboo plantations for carbon sequestration purposes and interested partners will be able to visit the pilot sites to gather information. Through transparency, complimentary experiences of project partners and the abidance to scientific principles, the project partners aim to minimize risks related to the establishment of bamboo plantations for carbon sequestration purposes.

In June 2012 a joint delegation of INBAR, ZAFU and CGCF experts visited Kenya, Ethiopia and Ghana to assess potential sites and identify local partners. The planting of nursery operations is expected to commence soon.



Meeting partners in Ethiopia

Site assessment and baseline definition in Kenya

5

Future plans

Developing a carbon accounting methodology for afforestation with bamboo in China is only the first step in a longer process - INBAR will explore carbon off-setting options beyond aforestation and reforestation. The next phase of the work involves adapting the methodology for more countries and further advancing it through verification, testing, partnerships and the inclusion of additional bamboo species. INBAR will continue to focus on developing new means and mechanisms for bamboo to contribute to climate change mitigation, and plans to address the following main issues.

a. HWP module:

Given bamboos can sequester significantly more carbon when they are regularly managed and harvested. Post-harvest processes and uses of the harvested biomass - the so-called harvested wood products (HWP), are expecially important. The carbon storage in HWP might even have more relevance for bamboos than for trees due to the fast growth rate and renewability of bamboo. During COP17, the importance of the HWP carbon pool was emphasized by the UNFCCC. However, the related carbon accounting methodologies remain unclear and require further development, especially for the voluntary carbon market. Currently the most common approach is to account HWP as "instant oxidation", in order to discourage the harvest of forest biomass.

Like most carbon pools in LULUCF activities, carbon in HWP is also not infinitely stored. However, many bamboo products (such as houses, floorboards or furniture) are durable and can, thus, store carbon for a long time. Considering that many land use carbon credits are issued for 20-30 years, it can be assumed that many bamboo products have similar lifespans. Therefore the HWP carbon pool can play a significant role for certain durable bamboo products. Thus,INBAR and its partners are aiming to develop methodologies that will allow investors to generate voluntary carbon credits for durable and long-term bamboo products, in the form of HWP.

b. Sustainable bamboo forest management

Recent studies in China, highlight that knowledge on management and optimization of bamboo stands is still lacking[13]. However, in order to utilize bamboos as an efficient tool in climate change mitigation, the focus should not only be limited to (re-)establishing new plantations (in the form of afforestation or reforestation activities), but should also include the optimized management of existing bamboo resources targeted for increasing both productivity and the carbon sink function of managed bamboo forests. This broader approach can help ensure that bamboo groves provide both effective climate change mitigation and adaptation services.

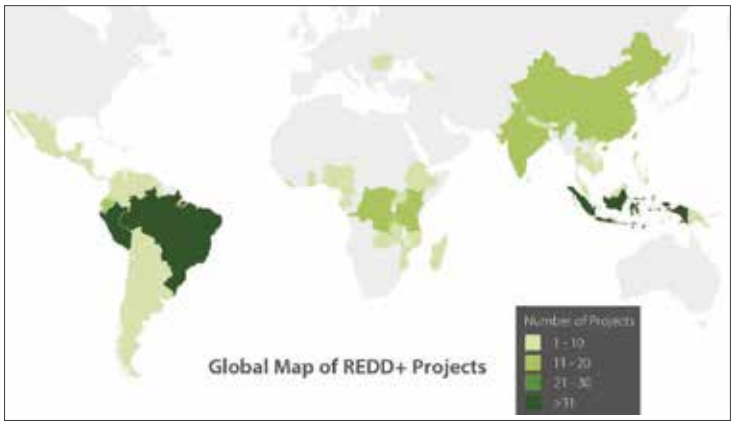
Therefore, relevant stakeholders also need guidelines to manage their bamboo resources sustainably. Moreover, management systems which aim to optimize carbon sequestration of bamboo stands need to be developed. Data and methodologies for quantifying the impacts of sustainable forest management also have clear links to REDD+. Sustainable management practices can also ensure that local communities can utilize bamboos efficiently to support livelihoods. INBAR aims to generate related data and

[13]Qi L, Liu G, Fan S, Yue X, Zhang H, Du M. 2009. Effects of different tending measures on carbon density, storage, and allocation pattern of Phyllostachyedulis forests in western Fujian province. Chinese Journal of Ecology 28(8):1482-1488. (In Chinese with English summary)

knowledge in order to be able to provide respective recommendations. In addition, a respective methodology should be developed, which allows stakeholder to generate carbon credits for sustainable management activities of bamboo groves. Moreover, such a methodology will facilitate the integration of bamboo in related global climate change mechanisms.

c. REDD+

Global mechanisms, such as REDD+ (Reducing Emissions from Deforestation and Forest Degradation), are evolving. Including bamboo in these mechanisms enables countries to generate income for related forestry projects which involve bamboo. Moreover, the inclusion provides access to global carbon funds and incentives to grow more bamboo. Botanically, bamboo is defined as a grass and not as a tree. Nevertheless it typically grows in forests and shares many characteristics with trees. That is why several, but not all, forest definitions include bamboo. For example, according to the FAO forests include "areas with bamboo (…) provided that land use, height and canopy cover criteria are met[14]". In many countries, there are no institutional limitations to include bamboo in REDD+ activities.



(REDD+ projects around the world) [15]

[14]FAO. 2010. Global Forest Resources Assessment 2010. Terms and Definitions
[15]CIFOR. 2012. Climate change mitigation – Avoiding deforestation and greenhouse gas emissions, enhancing forest carbon stock. A framework proposal.

Bamboos grow in many countries that are already implementing REDD+ projects. Therefore, INBAR will work on an increased integration of bamboo in REDD+. REDD+ related activities are complex and multifaceted, but bamboo can be integrated or can contribute to all main aspects of REDD+: Reducing Emissions from Deforestation, Reducing Emissions from Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks. INBAR and our partners aim at defining the role bamboo can play in each of these aspects and in related activities more narrowly. In addition, INBAR can offer technical support to member countries wishing to integrate bamboo in their REDD+ activities.

Future mechanisms (such as REALU – Reducing Emissions from All Land Uses) might include a wider range of land uses that are eligible for climate change mitigation activities. Bamboos can be grown on a wide range of soils and can be integrated into many productive systems. Bamboo's versatility expands its options beyond forestry into agro-forestry and even agriculture, where it might fit into future climate change mitigation schemes.

d. Agriculture

Agriculture, as a land use option for climate change mitigation, has recently received increasing attention. Bamboos' potential contribution to mitigating climate change is probably the most effective when it is grown in agroforestry systems or as managed plantations – these land-use systems have a lot in common with agriculture. This is particularly true of bamboo edible shoot production, which shares a lot of characteristics with perennial agricultural crops: it is harvested regularly and a large share of the biomass and carbon (standing culms, below-ground and soil) remains within the ecosystem as only a fraction of the bamboo biomass is harvested. Like most agricultural crops in developing countries, bamboo is commonly grown by smallholders.

Moreover, agro-forestry systems which include bamboos are very common in many countries, e.g. in India and Bangladesh. By growing bamboos, farmers can reduce risks through an increased resilience against climatic events and diversified income options. Studies have also shown that besides providing a useable material, agricultural rotations with bamboos can improve soil characteristics, increase yields and support livelihoods.

INBAR will monitor the developments in this field and contribute to the international discussions to support adequate policy development.

e. Avoided deforestation

Deforestation continues to be a main driver of climate change. Bamboos can provide an annual and sustainable supply of woody biomass. Using bamboos instead of tress can reduce pressure on other woody forest resources and as such it can help avoid deforestation. As such, bamboos can contribute to avoided deforestation in the following ways:

- Substitution of energy intensive products with bamboo can indirectly reduce greenhouse gas emissions. These substitution processes not only reduce emissions indirectly, but can also contribute directly to climate change mitigation – the use of bamboo products with long lifespans increases the terrestrial carbon sink, through the long-term additional storage of sequestered carbon.

- Bamboos are commonly used for windbreaks and shelterbelts, and protecting young or degraded forest – and also cash crops – from extreme winds. Bamboos can reduce soil erosion; their extensive root and rhizome systems bind the soil and – as bamboos can grow on poor soils – bamboos are most effective in areas prone to runoff, such as steep slopes, river banks or degraded lands. As such they can contribute to protecting existing forest.

- The demand for biomass for energy is a major driver for deforestation (especially in Africa). By using bamboo biomass (i.e. in the form of charcoal) which needs short time to re-grow, instead of tree biomass, pressure on forest resources can be reduced.

The quantification of bamboo's respective roles in avoided deforestation is a challenging and crucial task for INBAR, i.e. defining how much forest can be protected through the use of bamboo charcoal as a sustainable alternative for tree charcoal? An increased knowledge base will enable INBAR to support member countries to develop respective measures which use renewable and sustainable bamboo resources for avoided deforestation.

f. Rural economic development

Bamboo has the potential to simultaneously contribute to climate change mitigation and adaptation, while supporting livelihood development. INBAR aims at emphasizing the comprehensive role that bamboo can play in climate change, by looking for benefits beyond only generating carbon credits. So, where possible, INBAR and its partners will try to combine the carbon project work with rural economic development for marginalized poor communities around the world. An important part will also be the development and inclusion of mechanisms which allow poor and small holder farmers to access bamboo carbon off-setting schemes.

6

Outlook:

INBAR's vision is that bamboo stakeholders contribute to climate change mitigation through off-setting with bamboo and that the stakeholders can choose between several methodologies and approaches. INBAR also aims to extend bamboos' potential contribution to climate change mitigation beyond afforestation and re-forestation and to integrate related activities in rural development initiatives. Consequently, the development of additional and innovative methodologies and approaches (such as sustainable forest management, HWP, avoided deforestation) will be a focus of INBAR's work.

INBAR pursues a comprehensive approach to climate change, including mitigation, adaptation and rural development. This inclusive approach is, on the one hand a consequence of bamboo's natural benefits, and on the other hand, a result of the fact that bamboos are mostly grown in developing countries where the resource has been successfully demonstrated as a sustainable and effective tool in rural development. INBAR will continue to work on developing the options to utilize bamboos in climate change focusing on the following fields:

- Bamboos as alternatives for energy intensive products
- Bamboos as low-cost, local and sustainable infrastructure/construction materials
- Bamboos as part of biomass or food production systems
- Sustainable bamboo resource management as a means to increase carbon sequestration and to generate carbon credits
- Life cycle assessments of economically important durable bamboo products and development of carbon crediting mechanisms for harvested bamboo biomass, in the form of durable products
- Advanced integration of bamboos into global climate change mechanisms
- Advanced integration of poor and small holder farmers in bamboo off-setting schemes
- Uniform definition for "bamboo forests" and increased reporting

In conclusion, INBAR aims to enable policy makers and stakeholders to utilize bamboos as a comprehensive tool in climate change mitigation and adaptation as well as in rural development. INBAR will continue to emphasize and promote bamboos' benefits as a multifunctional tool for climate change mitigation and adaptation measures.

Acknowledgements

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Photo credit: Anji Bamboo Society

Bamboo's biological characteristics – fast growth and high renewability – make it an excellent tool for combating climate change. This publication highlights recent achievements in the development and application of bamboo-specific carbon off-setting methodologies. It also outlines bamboos' role in and future opportunities for climate change mitigation.

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