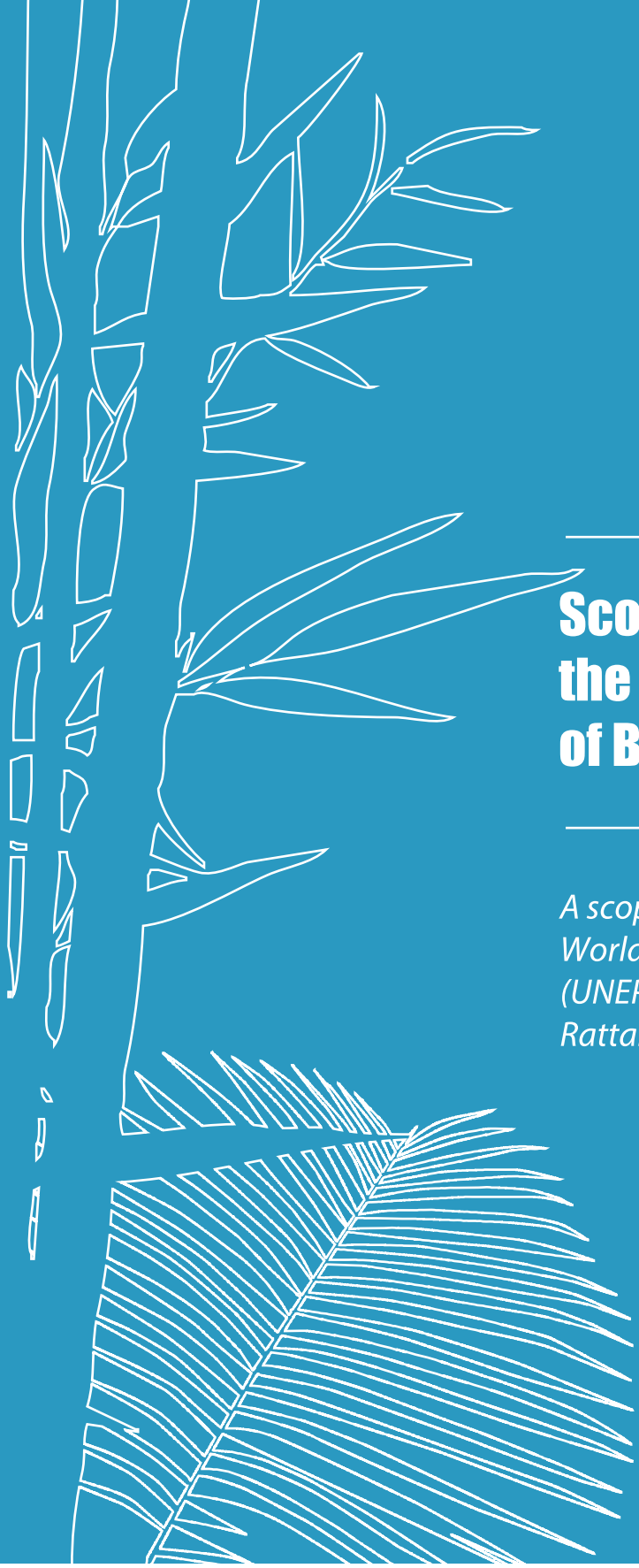

INBAR
INTERNATIONAL BAMBOO AND RATTAN ORGANISATION

Scoping study to inform the Global Assessment of Bamboo and Rattan (GABAR)

A scoping study prepared by UN Environment World Conservation Monitoring Centre (UNEP-WCMC) for the International Bamboo and Rattan Organisation

UN environment WCMC

Scoping study to inform the Global Assessment of Bamboo and Rattan (GABAR)

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Acronyms

ABTs	Aichi Biodiversity Targets
BIP	Biodiversity Indicators Partnership
BMEs	Bamboo Micro Enterprises
CABI	Centre for Agricultural Bioscience International
CBD	Convention on Biological Diversity
CIFOR	The Center for International Forestry Research
CO2	Carbon Dioxide
CSIRO	The Commonwealth Scientific and Industrial Research Organisation
DPSIR	Drivers, Pressures, States, Impacts, Responses
FAO	Food and Agriculture Organization of the United Nations
FRA	The Global Forest Resources Assessment
FSC	Forest Stewardship Council
GABAR	Global Assessment of Bamboo And Rattan
GBIF	Global Biodiversity Information Facility
GEO	Global Environment Outlook
GEO BON	Group on Earth Observations Biodiversity Observation Network
GIWA	Global International Waters Assessment
HFA	The Hyogo Framework for Action
IDB	Inter-American Development Bank
iDiv	German Centre for Integrative Biodiversity Research
IGO	Inter-Governmental Organisation
ILK	Indigenous and Local Knowledge
INBAR	International Network for Bamboo and Rattan
INDC	Intended Nationally Determined Contributions (to the UNFCCC)
IAEG-SDGs	Inter-agency Expert Group on SDG Indicators
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ISSG	Invasive Species Specialist Group (of IUCN)
ITC	International Trade Centre
IUCN	International Union for Conservation of Nature
LDCs	Least Developed Countries
M&MRV	Monitoring, and Measurement, Reporting and Verification

MA	Millennium Ecosystem Assessment
NBSAPs	National Biodiversity Strategies and Action Plans
NGO	Non-Governmental Organisation
NTFPs	Non-Timber Forest Products
OECD	Organisation for Economic Co-operation and Development
OECD DAC	Organisation for Economic Co-operation and Development - Development Assistance Committee
PBL	Netherlands Environmental Assessment Agency
PEFC	Programme for the Endorsement of Forest Certification
PSR	Pressure State Response
R&D	Research and Design
REDD+	The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SCP	Sustainable Consumption and Production
SDGs	Sustainable Development Goals
SE4ALL	Sustainable Energy for All
TEEB	The Economics of Ecosystems and Biodiversity
TEK	Traditional Ecological Knowledge
UK NEA	United Kingdom National Ecosystem Assessment
UK NEA FO	United Kingdom National Ecosystem Assessment Follow-On
UN	United Nations
UN Comtrade	United Nations Commodity Trade Statistics
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNCCD	United Nations Convention to Combat Desertification
UNISDR	United Nations International Strategy for Disaster Reduction
UNSD	United Nations Statistics Division
UNSTATS	United Nations Statistical Commission
US	United States of America
USD	United States Dollars
WHO	World Health Organization
WTO	World Trade Organization
WWF	World Wildlife Fund
ZSL	Zoological Society of London

Executive summary

Bamboo and rattan are hugely versatile plants with many documented uses and applications. Amongst these applications there is potential for these plants to contribute to actions under a number of global conservation, sustainability, and development goals and targets, for example the UN Sustainable Development Goals. As such, the International Network for Bamboo and Rattan (INBAR) have launched the Global Assessment of Bamboo and Rattan (GABAR) in order to quantify and qualify how bamboo and rattan currently contribute, and what their overall potential is, in terms of socio-economic and environmental development goals.

Assessments such as GABAR seek to inform, and respond to, decision makers' needs by synthesising and communicating complex information, and providing robust and credible information. This scoping study uses the term 'assessment' to mean the definition and establishment of an 'evidence base' to support decision making.

More than 1000 key stakeholders of GABAR were identified and surveyed in order to define the key, or policy-relevant, questions that GABAR should seek to address in the assessment. The stakeholders' survey elicited 219 responses from 53 countries with representatives from across different sectors, including economic and social development, research, natural resources management, advocacy, and the private sector. The responses of these key stakeholders were analysed to produce 22 policy-relevant questions and sub-questions. These were collated into several thematic groups (status and trends; biodiversity conservation; land restoration and climate change mitigation and adaptation; green economy and livelihoods; and, policy).

In combination with the results of the stakeholders' survey, a review of conceptual frameworks of relevance to GABAR was conducted to inform the development of a conceptual framework to aid the structuring of the GABAR programme. The Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) conceptual framework was found to have the most applicability to GABAR; as such it was used as a platform from which to develop the GABAR conceptual framework, incorporating the areas of importance highlighted through the stakeholders' survey.

An assessment of the published bamboo and rattan landscape was conducted by synthesising and analysing information gathered through a literature search and review. Specifically this analysis focused on several areas of importance and relevance to GABAR: the main GABAR themes (biodiversity conservation, climate change mitigation and adaptation, green economic development, and land restoration); the GABAR-relevant SDGs; scale and regionality; the focal plant type (bamboo, rattan, or bamboo and rattan); and where any notable knowledge gaps were perceived to exist.

This scoping study, through the survey of key GABAR stakeholders and the subsequent development of suggested policy-relevant questions and a draft GABAR conceptual framework, complemented by a review and analysis of the published bamboo and rattan landscape, provides the foundations for INBAR to fully scope and plan the approach for successfully conducting national to global level assessments of bamboo and rattan. This study demonstrates that sufficient information and data is available to support successful national (and sub-national) assessments of bamboo and rattan that can be subsequently up-scaled to the global level.

Building on the information and resources presented in this scoping study, in preparation for the full-scale GABAR programme, the INBAR Secretariat and Board of Trustees are encouraged to:

1. Define the proposed extent of the assessment – which countries will initially be included in the phased approach to national level assessments? Selection criteria could be used to prioritise initial pilot countries to involve in the first phase.
2. Assess the existing capacity in these countries for their ability and readiness to conduct national level assessments, through targeted stakeholder engagement. GABAR capacity assessments could be developed around existing tools such as the GBIF 'Capacity self-assessment guidelines'.
3. Develop guidance for conducting assessments of bamboo and rattan at the national (and/or sub-national scale).
4. Finalise and prioritise a list of approximately 10 policy-relevant questions, from those suggested in this study, to take forward through the full GABAR programme.
5. Agree and finalise a conceptual framework for GABAR, with further input and consultation from key stakeholders.
6. Form, or further develop, partnerships with data providers to include, or extract, bamboo and rattan relevant data, enabling indicator development and use. Key data holders which INBAR should seek to partner with include Global Forest Watch, the Forest Stewardship Council, the United Nations Food and Agriculture Organization, GEO BON, and the global Red List partners. Further insights into, and opportunities for, bamboo and rattan data inclusion or extraction from the UN SDG indicators and associated processes could come from working with the Inter-agency Expert Group on SDG Indicators (IAEG-SDGs) and the United Nations Statistical Commission, for example. As such, the INBAR Secretariat and Board of Trustees should seek to develop links to these groups.
7. Explore the methods and approaches to best engage with bamboo and rattan consuming countries as potential GABAR partners and beneficiaries of GABAR generated data.

The following reflections from the scoping study should also be taken into account by the INBAR Secretariat and Board of Trustees when establishing the full-scale GABAR assessment:

1. Species inventories need to be updated. Up-to-date information on populations and species ranges will be highly important in supporting national and global level assessments under GABAR to provide accurate assessments of status and trends over time, for example.
2. This scoping study only reviewed literature presented in the English language. However, potentially large amounts of literature in Asian languages (especially Chinese), Spanish (Latin American countries) and Portuguese (Brazil) exist, and should be included in the full GABAR programme.
3. Consider separate assessments for bamboo and rattan in the full-scale GABAR programme. Due to their very different characteristics, traits, potential, threats and pressures, and issues faced, bamboo and rattan may need to be assessed individually.
4. Ensure full consideration of indigenous and traditional knowledge in the scoping for the full-scale GABAR programme; use of case study materials being developed by IPBES can support this. The INBAR Secretariat should therefore develop links with the IPBES task force on indigenous and local knowledge.
5. Many of the bamboo and rattan resources available exist in the grey literature; this should be integrated alongside peer-reviewed literature when scoping and conducting the GABAR scoping and assessments, using the IPBES operating principles for guidance.

1 Introduction

1.1 Background and context of GABAR

Bamboo and rattan are recognised as having substantial potential to contribute to human well-being, not only in terms of estimated global market values (USD 60 billion) (INBAR, 2015a), but also due to their incredible versatility and application to a diversity of functions. Bamboo alone has in excess of 1,500 documented uses (Bystriakova et al., 2003), with estimates ranging to beyond 10,000 uses (INBAR, 2015b). For example, it can be used for housing and construction material, material for handicraft and tools, animal fodder, water/irrigation pipes and channels, fuel-wood, and fibre for fabrics. Rattan is also widely used for furniture and general construction, handicrafts, and as a food source and medicinal plant. In addition to these more traditional uses of bamboo and rattan, these plants are also unique in their capacity to meet a range of socio-economic, sustainability, and conservation focussed objectives, due to their rapidity of growth, ease of propagation, and the range of ecosystem services they provide.

In order to quantify and qualify the potential of bamboo and rattan to contribute to wide-ranging sustainability, development, and conservation objectives, the International Network for Bamboo and Rattan (INBAR) have launched the Global Assessment of Bamboo and Rattan (GABAR). It is anticipated that the first GABAR assessment will be published at the end of 2020, incorporating and building upon national level assessments. The scope of GABAR is expected to go beyond a standard species assessment approach, which typically focuses on distribution and extent, and population numbers and conservation status, to explore a range of socio-economic issues, using a primarily bottom-up national to global approach. Hence, given the size and scale of the proposed task at hand, it is imperative to fully consider the scope and modalities to ensure a comprehensive global assessment, built on a foundation of national assessments, is conducted.

In this study the term 'assessment' is presented as, and understood to mean, the definition and establishment of an 'evidence base' to support decision making. This includes the examination of appropriate tools, at different scales, and across sectors, in order to provide decision support.

The global assessment process, which INBAR has launched and begun fundraising for, is envisaged to build on previous work such as global distribution maps of bamboo and rattan (Bystriakova et al., 2003; Bystriakova et al., 2004), the 2005 Forest Resources Assessment (and updated figures in 2010) (FAO, 2006), and previous inventory practices (e.g. Nur Supardi et al., 1999; INBAR, 1999; and Nzooh Dongmo et al., 2000). The global assessment seeks to be ambitious in nature to include a set of analyses focussed on the potential contribution of bamboo and rattan to:

a) climate change mitigation and adaptation;
b) green economic development (The Green Economy) and rural development;
c) land restoration; and
d) biodiversity conservation.

In order to meet the desired ambitions and impact of GABAR, the scoping study set out here seeks to inform and shape the direction and approach of INBAR in fully scoping and planning their approach for successfully conducting national to global level assessments of bamboo and rattan.

With an ever increasing level of interest and market demand for using bamboo and rattan based products, the opportunity exists to assess the potential role of bamboo and rattan to contribute (positively and/or negatively) to climate change mitigation and adaptation, green economic development, rural development, biodiversity conservation, and land restoration. INBAR's 'Strategy 2015-2030' sets out to support their Members States to better understand how bamboo and rattan can be developed as strategic resources in line with broader green economy plans.

INBAR have identified the significant potential that bamboo and rattan have to contribute towards actions and processes in the achievement of the Sustainable Development Goals (SDGs). In so doing, the SDGs have been placed at the centre of INBAR's programme of work for the next 15 years. INBAR has identified six of the 17 SDGs as being directly relevant, with a collective contribution to a seventh goal (see Box 1 for full details). Specifically these are:

SDG 1 – End poverty in all its forms everywhere
SDG 7 – Ensure access to affordable, reliable, sustainable and modern energy for all
SDG 11 – Make cities and human settlements inclusive, safe, resilient, and sustainable
SDG 12 – Ensure sustainable consumption and production patterns
SDG 13 – Take urgent action to combat climate change and its impacts
SDG 15 – Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss
SDG 17 – Strengthen the means of implementation and revitalise the global partnership for sustainable development.

There is also scope for bamboo and rattan to contribute elsewhere to the achievement of other SDGs focussing on food security, women's equality and empowerment, economic growth, and technology. GABAR has a clear role in defining and setting out the process as to how these potential contributions to attaining the SDGs can be realised. Central to achieving this will be the identification of approaches, processes, and methods for GABAR to take, which are established and set out in this Scoping Study.

Box 1 GABAR and the United Nations Sustainable Development Goals (UN SDGs)

The United Nations Sustainable Development Goals (SDGs) constitute 17 goals and 169 targets, and are collectively known as 'Transforming our world: the 2030 Agenda for Sustainable Development'. The major challenge that the SDGs set out to achieve is the eradication of poverty in all its forms and dimensions, including extreme poverty (UN, 2015). In order to tackle these global challenges the goals balance the three dimensions, or pillars, of sustainable development – economic, social, and environmental. The SDGs, agreed upon by heads of states and governments, and high representatives, are set to shape the global sustainable development agenda for the coming 15 years.

INBAR has put the SDGs at the centre of its strategy for the period 2015-2030. In so doing, INBAR seeks to support its Members States to "better understand how they can develop bamboo and rattan as strategic resources in their green economy plans" (INBAR, 2015c). INBAR have defined the following seven SDGs as being those to which bamboo and rattan can contribute significantly.

- SDG 1 - End poverty in all its forms everywhere
  - Includes: equal rights to economic resources; access to basic services; ownership and control over land and

natural resources; and, efforts to build the resilience of the poor and vulnerable to climate-related extreme events and other economic, social, and environmental shocks and disasters.

INBAR comment: Bamboo cultivation helps to provide the poor with natural resources; bamboos (and rattans to a lesser extent) are resilient to climate changes and natural calamities; and, both bamboo and rattan supply income and job opportunities.

INBAR recommendation: Bamboos should be considered as an alternative crop in situations of marginal land restoration, disaster response, or for building resilience. Promotion of sustainable management and value addition for rattan should be considered to support job creation, especially for rural smallholders.

• SDG 7 - Ensure access to affordable, reliable, sustainable, and modern energy for all

o Includes: increase the share of renewable energy; and facilitate access to clean energy research and technology.

INBAR comment: Bamboo provides energy when it is burned as firewood, processed into chips or pellets, or carbonized as charcoal. Bamboo and rattan can also be used as the raw material in biogas systems, bioethanol, and biodiesel; bamboo provides a long-term, sustainable source of raw material for bio-energy that can contribute to deforestation reduction and avoidance.

INBAR recommendation: Countries should seek to evaluate the potential to establish bamboo plantations for energy related activities on land that is not productive, especially degraded or marginal lands that cannot be used for food-crops.

• SDG 11 - Make cities and human settlements inclusive, safe, resilient and sustainable

o Includes: access for all to adequate, safe and affordable housing; and supporting least developed countries in building sustainable and resilient buildings utilising local materials.

INBAR comment: Bamboo represents a good construction material for a wide range of uses, including housing and dwellings that can be erected rapidly following natural disasters. Bamboo is well documented as being more resilient than concrete structures during disasters such as earthquakes.

INBAR recommendation: Bamboo should be considered as a suitable alternative material for construction purposes for countries in the Global South. INBAR members are urged to modify their building practices in order to facilitate the incorporation of bamboo in the design and construction of new housing and dwellings.

• SDG 12 - Ensure sustainable consumption and production patterns

o Includes: the sustainable management and efficient use of natural resources; encouragement of companies to adopt sustainable practices; and, the promotion of sustainable public procurement processes.

INBAR comment: Bamboo and rattan can be used for most purposes and applications where timber is normally used. The harvesting of bamboo generally has low impact on the environment, and almost no waste is generated from its processing. Rattan is predominantly sourced from natural forests, therefore its management and harvesting necessitates sustainable forest management practices.

INBAR recommendation: Countries in the Global South are encouraged to use bamboo instead of tropical hard-woods or imported soft-woods. Sustainable management of forests should be integral to responsible and sustainable rattan management and harvesting.

• SDG 13 - Take urgent action to combat climate change and its impacts

o Includes: strengthening resilience and adaptation to climate related hazards and natural disasters, and promotion

of capacity development for effective climate change planning and management in least developed countries.

INBAR comment: Bamboo and rattan contribute to combatting climate change through the sequestering of atmospheric carbon dioxide. It has been shown that managed stands of bamboo absorb more CO_2 than equivalent softwood stands. Furthermore, bamboo harvesting does not remove the entire plant, therefore preventing CO_2 liberation post-harvest. Bamboo's rapid growth allows for frequent harvesting, in turn allowing vulnerable communities access to building materials and reducing their exposure and climatic vulnerability. Bamboo has a high degree of natural resilience. This gives farmers and land managers the opportunity to adapt and use it, providing resilience against climate change and increased or protected livelihood options.

INBAR recommendation: Countries with bamboo and rattan resources are encouraged to include both species in their national climate change and mitigation plans.

• SDG 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss

o Includes: the conservation, restoration and sustainable use of terrestrial ecosystems and their services; the implementation of sustainable management of all types of forests, restoring degraded forests, and substantially increasing afforestation and reforestation globally; restoration of degraded land and soil; reducing the degradation of natural habitats; and integrating ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies, and accounts.

INBAR comment: Bamboo establishes and grows quickly, both in clumping or running form. With extensive root system sit lends itself to soil stabilisation, reducing erosion, increasing slope stability, and contributing significantly to the restoration of degraded land. Such restorative potential can be utilised and exploited to combat desertification. In addition, where bamboo and rattan are sourced from sustainably managed forests, they contribute in a multitude of ways, including towards biodiversity conservation.

INBAR recommendation: Countries are encouraged to recognise and value the multiple services and goods provided by bamboo and rattan, and to capture their potential to contribute to processes such as forest, soil, and slope restoration.

• SDG 17 - Strengthen the means of implementation and revitalise the global partnership for sustainable development

o Includes: enhancing North-South, South-South and triangular regional and international cooperation.

INBAR comment: Implementing the above recommendations with respect to SDGs 1, 7, 11, 12, 13, and 15 will also contribute to achieving SDG 17, by focusing on building stronger implementation and partnerships. Through INBAR and its network of 42 member states and related partner organisations, there is much focus on, and engagement through, South-South collaboration.

INBAR recommendation: INBAR facilitates and promotes South-South and triangular collaboration, and encourages donors to support its Member States in achieving the 17 Sustainable Development Goals.

Source: modified from INBAR, 2015c

1.2 What the scoping study sets out to achieve and the approach taken

The scoping of the full-scale GABAR will utilise a multi-stakeholder approach and seek to:

1. Define the policy-relevant questions that GABAR shall seek to address;
2. Define a conceptual framework for GABAR;
3. Identify and review the existing and current bamboo and rattan assessment landscape;
4. Define the methods and approaches required to undertake GABAR; and
5. Define the required capacity to be developed to ensure delivery of GABAR.

The scoping study presented here focuses on points 1 – 3 above. The INBAR Secretariat and Board of Trustees should seek to build on and take forward the findings and recommendations of this study to address points 4 – 5.

1.3 GABAR and the separate considerationof bamboo and rattan

Bamboo and rattan are very different plants from different families of the plant kingdom, *Poaceae* (sub-family *Bambusoideae*), and *Arecaceae* (sub-family *Calamoideae*), respectively. Each has their own individual traits and characteristics, including associated threats, risks, and pressures. However, due to their similarities in terms of their versatility of use as a raw material in tools, objects, furniture, and buildings, and due to their similarity in regions of origin (the natural range of bamboo and rattan spans the tropical and sub-tropical regions of the world, with a limited number of species occurring naturally outside of this range), they are often grouped and considered together.

Because of the individual traits and characteristics of bamboo and rattan, it is recommended that the plants are disaggregated in the assessments carried out as part of the GABAR programme in order to fully assess the threats they face and the potential they have to contribute to various targets and goals. This should also extend to the analysis of any potential they have as drivers of threats and pressures in their own right. For example, bamboo tends to grow in large stands, sometimes forming huge monocultures of bamboo forest, and can sometimes become invasive, whereas rattan grows as individual plants in natural forests, and is reliant on healthy support structures and effective forest management.

The ways in which bamboo and rattan can be employed to contribute to various sustainable, conservation, and development targets and goals varies also, and this will need to be factored into their assessment. For example, bamboo grows rapidly and densely, and offers potential to be employed to stabilise degraded land, or for harvesting and use as a fuel wood, whereas rattan is not suitable for either of these functions, and has no potential to substantially contribute to land restoration or climate change mitigation and adaptation processes.

1.4 Limitations of this study

Within the scope and confines of this project it was only possible to conduct a rapid review and assessment of literature. It is acknowledged that more relevant information is available and accessible, and that this should be used to inform the full GABAR scoping. For example, through the 'INBAR publications center' (www.inbar.int/inbar-publications) many resources are available, including policy and annual reports, working papers, technical reports, proceedings, newsletters, and more. However, the predominant focus of the review of the bamboo and rattan landscape presented in Section 4 was to rapidly review and analyse information beyond that held by INBAR to demonstrate a cross section of information and activities taking place across the NGO, academic, public, and private sectors, amongst others.

This scoping study has considered material presented in the English language only. However, it is acknowledged that there are potentially large amounts of literature in Asian languages (especially Chinese), Spanish (Central and South American countries), and Portuguese (Brazil), which have not been included here, but should be considered in the full GABAR programme. This might have also acted as a factor in the stakeholder survey, as only four responses were received from China for example.

Where bamboo and rattan are referred to in this study, it is intended that this encompasses all naturally growing bamboo and rattan, and bamboo cultivated for agricultural, land management, and livelihoods issues. Whilst it is acknowledged that bamboo grown for ornamental and horticultural purposes represents a significant market, within this study it is excluded from the intended aim of the policy-relevant questions and conceptual framework.

2 Definition of policy questions which GABAR should seek to address

2.1 Purpose and approach taken

Defining the key questions, or policy-relevant questions, is an essential first step of any assessment. This activity, in the context of GABAR, will assist in defining the parameters of the assessment process as a whole.

The first step in setting or defining policy questions for any assessment is the identification of the key stakeholders. These are the individuals, parties, government departments or ministries, organisations, institutes, networks, and companies, which have vested interests in the assessment subject matter, in this case bamboo and rattan. For example, it might be that a furniture company is considering switching their supply chain from softwoods to engineered bamboo due to the accessibility of the material, the lower costs involved, and the associated community benefits that are believed to be associated with its sourcing and processing. As such, the company in this example has a direct interest in understanding more about bamboo. Or, for example, the Ministry of Environment in a country might want to more fully understand the potential range of co-benefits that could be achieved from establishing mixed species stands of bamboo on deforested hillsides.

Once a comprehensive list of key stakeholders has been identified, the second step towards defining the policy questions is gaining an understanding of the main interests, concerns, and policy contexts of the stakeholders. In order to distil the stakeholders' areas of interest it is commonplace for a process of surveys, questionnaires, workshops, and other means of stakeholder engagement to be conducted in order to map out the most important issues for the assessment to address.

The third step is to analyse the responses, collating together similar trends and themes in order to pull together and define questions, or sets of questions, which are designed to explore in relevant detail within the assessment, the area of interest or concern highlighted.

This scoping study employs a stakeholder survey as its means of engagement. The stakeholders' survey (Annex A GABAR stakeholders' survey) was developed in consultation with INBAR, providing insight into important focal areas for the survey to drill down into.

The survey (Annex A GABAR stakeholders' survey) asks 16 questions to the stakeholder to gain an understanding of:
- the individual respondent and their background
- areas and scale of interest
- the policy context they work in
- areas of concern
- perspectives on bamboo and rattan use and scope
- aspects to be addressed by GABAR

In collaboration and consultation with INBAR, 1060 key stakeholders were identified. The survey was shared with these key stakeholders as an online survey (www.surveymonkey.com), allowing: i) an inclusive approach (i.e. allowing as many stakeholders to respond as possible); and ii) a sophisticated analyses of the responses. This stakeholder engagement and consultation provided the means through which the draft policy-relevant questions for GABAR to address were developed. The survey was open between 29th June 2016 and 15th July 2016.

2.2 Key stakeholders

The key GABAR stakeholders identified are comprised of the following groups:

- INBAR country focal points
- INBAR partners
- INBAR contacts from the South Asia Regional Office
- INBAR donor and technical partner contacts
- INBAR expert contacts from China
- INBAR international taxonomy experts list
- INBAR bamboo and rattan scientists/experts – West and Central Africa
- INBAR workshop and study tour attendees
- INBAR contacts list in Latin America
- INBAR contacts from the 2016 Global Bamboo Summit
- Organisers, co-organisers, partners and supporters of the Global Bamboo Summit
- Organisers and sponsors of the World Bamboo Congress
- The World Bamboo Organisation and corporate partners
- Bamboo societies and interest groups
- Forestry and botanical societies, groups, departments, and institutes
- International conservation bodies, NGOs, and agencies
- Development banks and organisations
- Intergovernmental organisations

The full list of respondent organisations and institutes to the stakeholders' survey is presented in Annex B Stakeholders' survey respondent organisations and institutes.

2.2.1 Stakeholders' survey - results

Presented below is a summary of the Stakeholders' survey. The full results of the stakeholders' survey responses are presented in Annex C Stakeholders survey results tables.

Survey respondents:

- Responses were received from 219 of the recipients, representing a response rate of 20.7%.
- Responses were received from 53 distinct countries (and one respondent specifying only South East Asia) (Table 5).
- The most responses were submitted from India (20), followed by Ethiopia (19), and Ghana (15) (Table 5).
- The regional representation of the GABAR stakeholders' to the survey (Table 6) was predominated by Africa (35.16%), South East Asia (17.81%), Latin America and the Caribbean (16.9%), and Southern Asia (15.98%), as would be expected with these being the major bamboo and rattan growing regions. Notably, however, Eastern Asia, encapsulating China, only represented 3.2% of the total responses, and therefore suggests that this could be a significant information/data gap in this scoping study, and one which should receive adequate focus in the full GABAR programme. As the survey was conducted in English, this could be a factor in this result.
- Responses were received from all sectors detailed in the survey options (Table 7); the greatest proportion of respondents

(135) identified themselves as being from 'government' organisations or institutes. Notably, the second highest level of response came from those associating themselves as 'private sector' (25), and two responses were submitted from 'donors including philanthropic and development organisations (or others)'.

- 56.9% of respondents were aware of GABAR (Table 16).
- 22 respondents exited the survey without completing questions 7-16 on page 2. However, all 219 respondents answered questions 2-6 (N.B. Q.1 was optional). This is reflected in the analysis.
- 2.3% (5 responses) of 219 respondents had no interest in bamboo or rattan (Table 9).
- Respondents were most interested (≥ c.50%) in bamboo and/or rattan (Table 10):
  - As a construction material (71.6%)
  - For green economic development and rural development (66.5%)
  - Climate change mitigation and adaptation (61.9%)
  - For land restoration (53.8%)
  - For biodiversity conservation (49.7%)
- 48.7% of respondents' indicated that their interest in bamboo and or rattan is for industrial or commercial use (e.g. large-scale harvesting and processing for national or international market requirements), compared to 37.6% expressing interest for subsistence use (e.g. small-scale harvesting and use for personal or community functions and requirements) (Table 11).
- The most important properties of bamboo and/or rattan indicated by respondents are that it is sustainable (73.6%), it contributes to rural livelihoods (70.1%), and that it is fast growing (58.9%) (Table 12).
- Respondents indicated that development policies (48.2%), green economy policy (40.1%), and the SDGs (32.0%) were the specific policy drivers of most interest to them. However, 15.7% of respondents stated that their interest in bamboo and/or rattan was not related to any policy driver, with a further 23.4% stating that their interest and/or use is because of cultural connections (Table 13).
- The majority (94.5%) of respondents consider that there is scope to further develop societies' use and reliance upon bamboo and/or rattan in order to relieve pressure on tropical timber products and forests (Table 14).
- Lack of capacity to develop, implement, or increase utilisation (46.2%), and lack of awareness of the potential to contribute to societal and environmental goals (33.0%) were selected as the greatest limiting factors to more widespread use of bamboo and/or rattan (Table 15).
- Respondents indicated that the most important factors that GABAR should seek to address were the potential for bamboo and/or rattan to contribute to green economic development (including rural livelihoods) (31.5%), the total potential market value (18.3%), and the potential contribution to climate change mitigation and adaptation (15.2%). Only 2.0% of respondents selected land restoration as an area of importance to be addressed (Table 17).

Question 12 (*Do you think there is scope to further develop societies' use and reliance upon bamboo and/or rattan in order to relieve pressure on tropical timber products and forests?*) elicited more accompanying comments than any other, 124 in total. Comments submitted included references to 'how' and 'why' bamboo and rattan might be further used, exploited, and developed. Some of the main themes present in the comments included: bamboo processing techniques, particularly for traditionally bamboo-dependent communities; increased education, training and integration of traditional local and indigenous knowledge to provide the necessary skills and capacity at the local level to use bamboo and rattan more effectively; reduced pressure on natural woodlands; replacement of wood and wood products with NTFPs; traditional/cultural use; lack of awareness and technology; fast growth and fast recovery time after harvest, making bamboo appealing over timber use; developing the value added and the value chains of bamboo and rattan through the development of new products and new processes; and functions such as charcoal and fuel-wood, bamboo juice, pulp and paper. In addition, a number of specifically pertinent comments were submitted, which included:

- Multiple references to bamboo use preventing or reducing high rates of deforestation:
  - Had bamboo not been utilised in Malawi, there would have been a significantly higher volume of timber species (forests) lost through deforestation.
  - The rate of deforestation in Nigeria and Africa in general is alarming and bamboo, due to its versatility, could speedily be used as a substitute for wood and wood products, as well as an energy source for domestic and industrial needs.
  - Bamboo plantations will relieve pressure on tropical forests in Mozambique.
  - By promoting bamboo and bamboo-based rural economic development, there is scope for minimising pressure on local timber forests in India. Bamboo provides an alternative to fuel-wood (directly, or in the form of briquettes), fodder, small implements, and offers an additional source of income from local forests.
  - East Africa is facing a wood shortage crisis which bamboo can help solve.
  - In coastal Ecuador, bamboo is the best option to stop deforestation.
- More advocacy, promotion and awareness are required, including in regional and national level policies (India).
- Capacity building and transfer of technology is required for sustainable harvesting, processing, and marketing (Liberia).
- By linking bamboo to more of the goals mentioned in Q.11 [policy drivers, e.g. NBSAPs and SDGs], and through increased education and valuation of bamboo, and the development of standards and business opportunities, bamboo can be more widely used by society.
- In Bhutan the traditional design of house building entails heavy usage of timber. However, most rural houses could be constructed with bamboo instead. The same applies to furniture.
- Though bamboo use may reduce pressure on tropical timber, it will also help to avoid the use of more carbon intensive products, therefore contributing to climate change mitigation and adaptation.
- There is great scope through tertiary education and training to expand the reach and acceptability of bamboo and rattan use (Jamaica).
- Awareness raising, capacity development, and investment is needed to meet societies' need. It can then substitute tropical timber for furniture and fuel-wood use.
- At present bamboo productivity in India is low, resulting in restricted use. Increasing productivity will bring down production costs, increasing availability and its range of uses.
- There is a need for quality control and design principles to enable bamboo to provide a true substitute to timber in housing structures (India).
- Rattan is utilised in a very uneven way across the Indo-Pacific, e.g. highly sophisticated uses in Malaysia, and very basic uses in New Guinea. Knowledge transfer would help increase the potential of rattan in places like New Guinea.
- There is currently minimal use of bamboo in South Africa, which is a water-poor country with vast Eucalyptus plantations, exacerbating the water problems. Bamboo has the potential to replace a percentage of water-greedy timber plantations and protect valuable resources like topsoil.
- While India has the second largest bamboo resource in the world, its utilisation is largely limited to use as scaffolding and handicrafts. There is a need to identify new sources of sustainable growth, which bamboo could provide as an alternative fuel source or as an alternate to timber and plastics.
- In the Philippines bamboo is a key resource for the rural poor to access. It is therefore important to empower them to utilise it most effectively.
- Utilising wild bamboo and creating plantations on marginal land will relieve the demand for tree timber, which will help restore biodiversity.

However, concern was also expressed that further development and exploitation of bamboo should be done in a managed

and considered fashion to prevent the potential spread of invasive non-native species into natural and semi-natural areas.

Question 13 (*What, if any, do you think are the major factors preventing bamboo and rattan from contributing more to societal and environmental goals?*) also received a high number of comment responses (82). As a means to quickly identify the main trends in these comments the website 'Wordle.net' was used to build a 'word cloud'. This identifies the most frequent factors selected by respondents considered to be acting as barriers to the wider contribution of bamboo and rattan to societal and environmental goals (Figure 1). The most dominant themes are 'technical', 'financial', 'capacity', and 'institutional', accompanied by several regularly occurring descriptive terms including 'needs', 'lack', 'development', 'products', 'use', and 'policy' and 'policies'.

Figure 1 Word cloud representing the factors acting as barriers to wider contribution of bamboo and rattan to goals and targets from the comments submitted under Q. 13 (Source: www.wordle.net)

2.3 Development of suggested GABAR policy-relevant questions

Ash et al. (2010) state that a policy-relevant question is "one that is asked by a user group, audience, or decision maker or one where the answer to the question can be used to justify or support a decision or action". It is also stated that the most effective approach for identifying and defining policy-relevant questions is through a user's survey, which helps to determine and distil the user's needs (Ash et al., 2010). Therefore, the responses received through the GABAR stakeholders' survey provide the direction and content from which to develop policy-relevant questions for consideration within the assessment.

The policy-relevant questions were developed based on the most frequently selected themes and topics by respondents to the stakeholder survey. Sets of draft policy-relevant questions were developed around the top responses from the relevant survey questions in order to prioritise the main issues and themes identified by the stakeholders (Annex D GABAR Stakeholders' survey: top responses relevant to policy-relevant question development, and draft possible policy-relevant

questions) (N.B. the figures shown with the top responses are the counts of responses out of a total of 197, also presented in percentage terms). Setting out the main issues in this way provides a set of stakeholder-relevant, and stakeholder-led, questions to be addressed by the full GABAR programme.

To refine and distil this long-list of draft questions, this scoping study groups them into thematic areas of relevance to GABAR to produce a final set of draft proposed policy-relevant questions for INBAR to consider. These are presented below under each thematic grouping:

Status[1] and trends[2]

1. What are the status and trends of wild and cultivated bamboo and rattan? [3]*
2. What are the ecosystem services provided by bamboo and rattan and how are these impacted by their status and trends?*
3. What are the global drivers causing change to bamboo and rattan?*

a. What are the national drivers causing change to bamboo and rattan?

Biodiversity conservation

4. What is the total current contribution of bamboo and rattan to alleviating the use of tropical timber?*
5. What is the overall conservation value of bamboo and rattan?
6. What is the role of multi-species bamboo plantations on biodiversity?

Land restoration and climate change mitigation and adaptation

7. What is the total potential for bamboo[4] to contribute to land restoration?*

a. How can bamboo be employed most effectively at the national level for land restoration?

8. What are the multiple benefits of using bamboo for land restoration?
9. What is the potential for bamboo established for land restoration to contribute to climate change mitigation and adaptation?

a. How can bamboo be employed most effectively to contribute to national climate change mitigation and adaptation goals and targets?

10. What is the total potential for bamboo plantations to contribute to climate change mitigation and adaptation? *

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[1]'Status' or 'state' refers to a snapshot of condition of a defined entity or process in a defined area and at a defined time, usually the present or the recent past (Ash et al., 2010). In the context of GABAR, 'status' is used in reference to the condition of the total global resource or stock of bamboo and rattan.

[2]'Trend' is used in reference to an analysis of the change in state over time. It can be useful to assess trends over a period encapsulating the "relevant past to the predictable future" (Ash et al., 2010). The GABAR 'trend' will therefore assess and analyse any observed changes to the state of bamboo and rattan over time.

[3]Status and trends analysis in the context of GABAR should consider drivers of change on species distribution, natural ranges, invasive spread, and other such aspects. These features may need to be considered at the individual species level as well as at a complete family level.

[4]In the context of restoration and climate change mitigation and adaptation only bamboo is referred to, as rattan does not have a significant role to play in this regard.

Green economy and livelihoods

11. What is the contribution of bamboo and rattan to local livelihoods?
12. What is the role and total value of bamboo and rattan in contributing to a green economy?*
13. How can the use of bamboo and rattan be developed to most effectively contribute to green economic development (e.g. through their increased use as construction materials, increased trade etc.)?
14. What is the scope for sustainable market growth with increased uptake and use of bamboo and rattan?

Policy response

15. What are the barriers to greater uptake and use of bamboo and rattan?*
a. What national level incentives or disincentives are there to bamboo and rattan use?
16. How can we secure the ongoing sustainable use of bamboo and rattan?*
17. How can we secure and improve the delivery of ecosystem services from bamboo and rattan?
18. What is the potential role and use of bamboo and rattan in achieving global targets (e.g. SDGs, Aichi Biodiversity Targets (ABTs) etc.)?*
19. How can we measure the contribution of, or potential for, bamboo and rattan use in achieving global targets?

The questions indicated with an asterisk (*) above have been selected as it is considered that these might be of most relevance and interest to INBAR and the aims of GABAR. This subset of questions could be prioritised for inclusion in the GABAR assessments, but the final selection of policy-relevant questions to be taken forward in the GABAR assessments should be approved by the INBAR Secretariat and Board of Trustees.

The first policy-relevant question (1) set out above, in referring to cultivated bamboo, seeks to capture what the status and trends of bamboo produced as a commodity are. It is important that this is factored into an analysis of the status and trends of the total global pool of bamboo to determine levels of commercial production, harvest, and utilisation, and that being sourced from naturally occurring wild stocks. In addition, investment in renewable energy, material, and sustainable agriculture is central to the green economy concept, and as such, bamboo and rattan as commodities is captured in policy-relevant questions 11 – 14 above, focusing on green economy development and livelihoods.

3 Definition of the conceptual framework for GABAR

3.1 Purpose of the conceptual framework

Conceptual frameworks demonstrate, visually, how different factors are linked, or are distinct, and how they are organised. They tend to present highly simplified expressions of multiple components in single figures and seek to assist in the organisation and understanding of complex systems, with the intention to aid the structuring of work in an assessment process, for example. Conceptual frameworks used to understand ecosystem services and/or natural capital, demonstrate inter-linkages between different environmental elements and features, including the interaction with humans and their well-being, as well as accounting for any other internal or external drivers that affect the environment, positively or negatively. Bamboo and rattan have a wide range of complex interactions with people, transecting all levels of society and the environment, providing livelihoods and income to millions of people globally (INBAR, 2015d). The ability to simplify and graphically illustrate the complex processes and interactions occurring at different scales, from bamboo and rattan production systems, ensures that a shared common vision of stakeholders will provide the foundation for the consistency of outputs from GABAR.

Many conceptual frameworks have been developed in relation to ecosystems, ecosystem services, and natural capital for different assessment processes. These frameworks have been developed by research projects (e.g. Costanza al., 1997; Daily, 1999; de Groot et al., 2010; and Haines-Young & Potschin, 2013) and for defined assessment processes (e.g. MA, 2005a; TEEB, 2010; UK NEA, 2011; UK NEAFO, 2014; and IPBES, 2015). Some of the most prominent assessment conceptual framework approaches are reviewed in this scoping study to determine their suitability for supporting the framing and implementation of GABAR.

3.2 Review of existing conceptual frameworks and applicability to GABAR

The frameworks presented below demonstrate a clear succession of development and adaptation over time from one framework to the next. For example:

- the GEO 4 framework, while developed through three previous iterations prior to 2005, takes into account aspects of the Millennium Ecosystem Assessment (MA) framework (Ash et al., 2010);
- the TEEB framework further developed the MA framework, in particular looking to overcome the issues of double counting for the value of different benefits obtained from ecosystem services;
- the UK NEA incorporates elements of the MA and TEEB frameworks together; and
- the IPBES framework builds on these existing frameworks but also takes into consideration the scientific developments that have taken place around our understanding of ecosystem services and benefit flows, and incorporates different knowledge systems.

Whilst a number of conceptual frameworks exist in the literature that are explicit to bamboo and rattan, these generally address specific issues of interest rather than the broader overarching themes of relevance to GABAR. For example, these include: bamboo resources and sustainable livelihoods in Nepal (Ghimire, 2008); analysis of bamboo innovation and commercialisation in Ethiopia (Endalamaw, 2015); development interventions of the rattan industry in Ghana, and production to consumption flows of rattan in Cameroon (Johnson, 2011); valuation of forest ecosystem goods, services, and natural capital of the Beijing municipality (Wang, et al., 2011); supply chains of engineered bamboo products in the province of Iloilo, Philippines (Maroma, 2014); and the bamboo production to consumption system in Cameroon (Ingram et al., 2010). However, some of these cannot be considered as conceptual frameworks in the true sense, as several only depict material flows rather than conceptual linkages. The conceptual framework presented by Awadh (2010) sets out linkages from bamboo sources, through processing, employment, and poverty alleviation, and as such, is of most relevance to GABAR of the frameworks found in the literature (Figure 2).

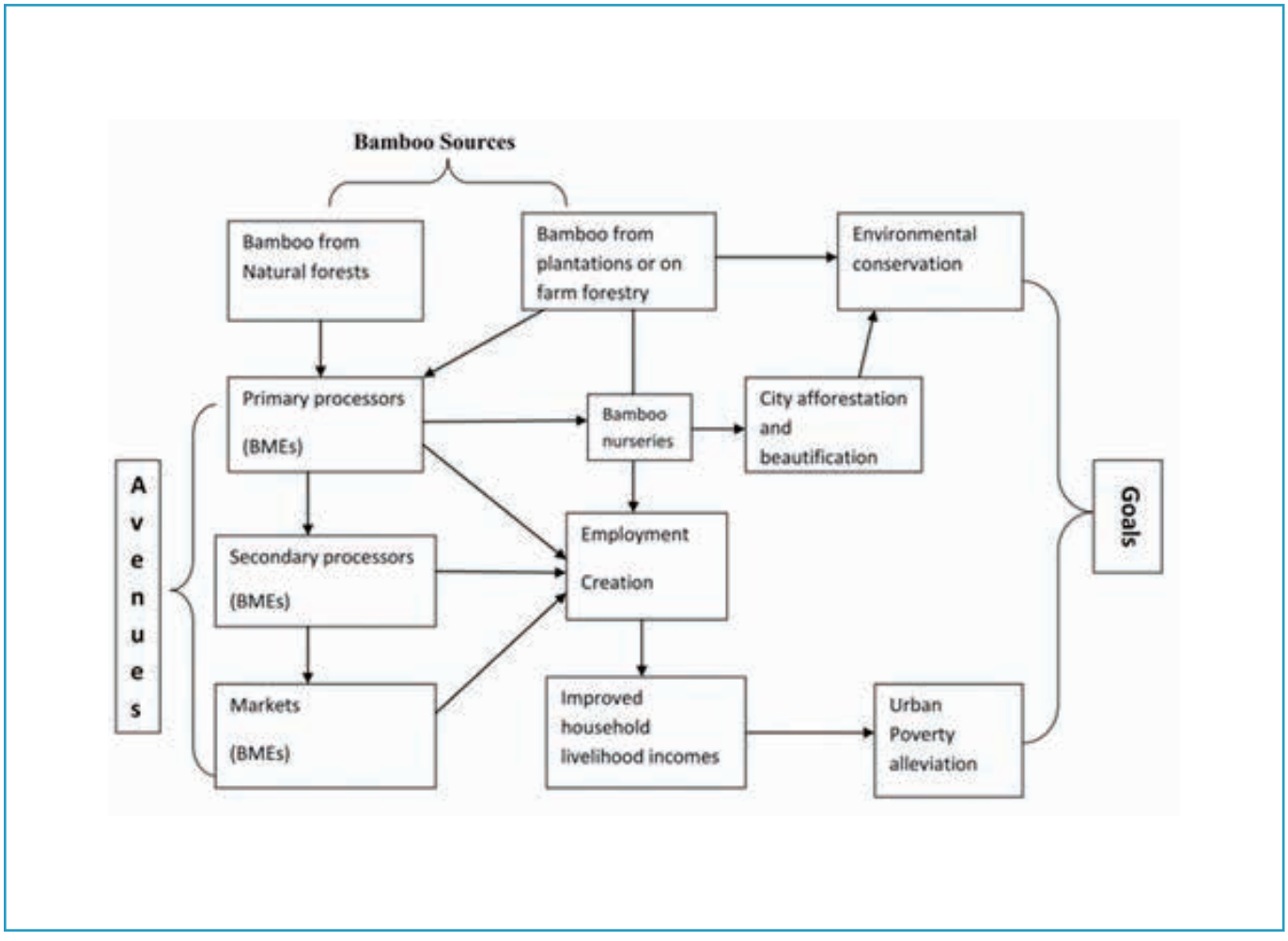


Figure 2 Conceptual framework of relationship between bamboo micro enterprises (BMEs), environmental conservation, and poverty alleviation (Awadh, 2010).

3.2.1 Millennium Ecosystem Assessment (MA) framework (2003)

The MA conceptual framework (Figure 3) represents the complex inter-linkages between ecosystem services, human well-being and poverty reduction, and the drivers of change (direct and indirect). The framework is dynamic, assuming no 'natural' state, but being responsive to changes in drivers (Ash et al., 2010). In recognising and integrating feedback loops to acknowledge multi-temporal and multi-spatial scales (local, regional, and global), the MA framework moved away from the classic DPSIR and PSR (Pressure State Response) frameworks that were more linear in nature (Ash et al., 2010). This framework has been influential to many subsequent ecosystem assessment processes, being adapted and built upon for specific and changing requirements, as outlined below.

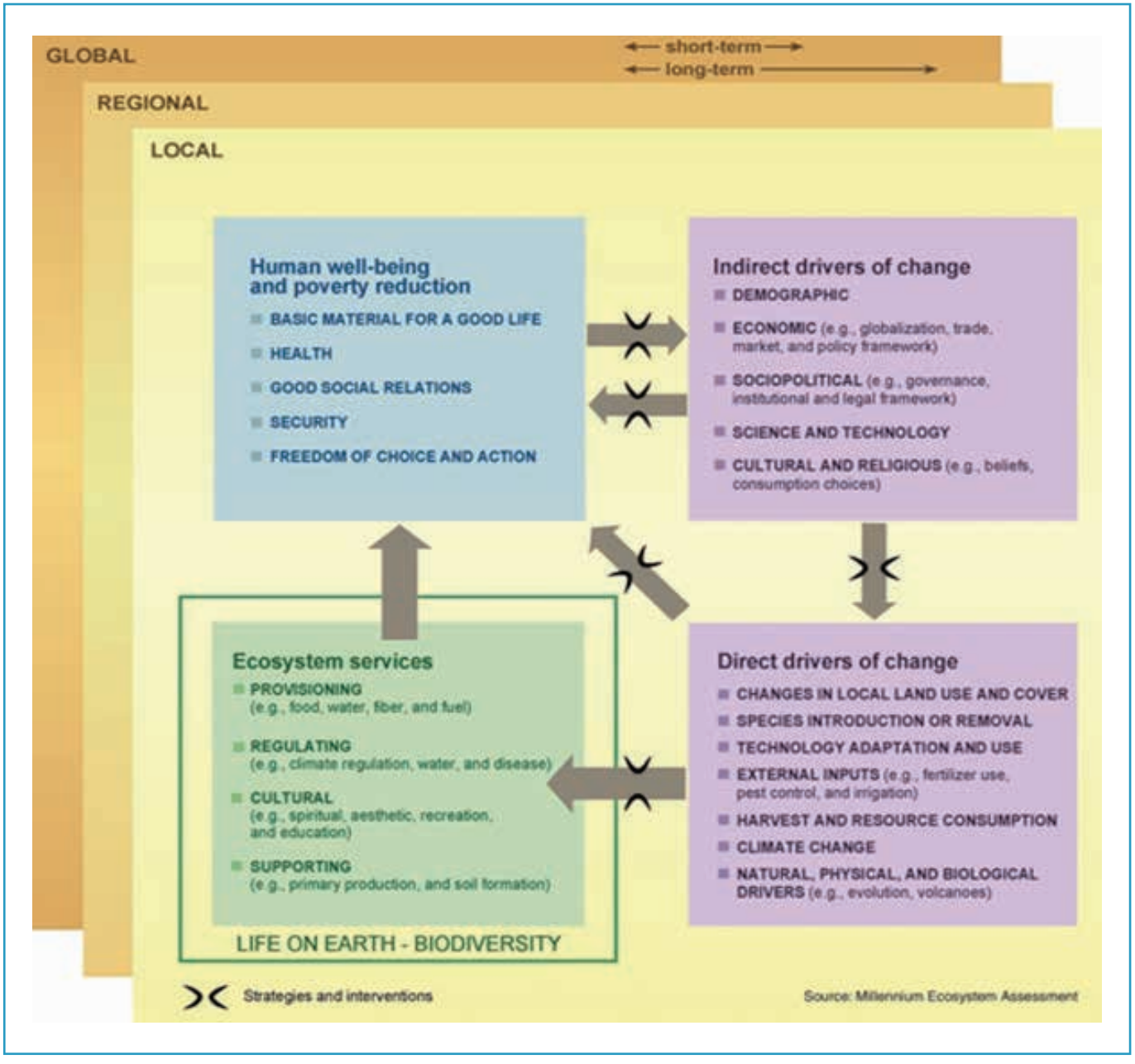


Figure 3 The Millennium Ecosystem Assessment conceptual framework (2003)

3.2.2 Global Environment Outlook 5 (GEO 5) framework (2012)

The GEO process, which has been produced by UN Environment since 1997, and which published the sixth iterations' regional assessments earlier this year, employs the Drivers, Pressures, States, Impacts, Responses (DPSIR) framework. Figure 4 presents the conceptual framework developed for GEO 5 (UNEP, 2012). This has been developed and adapted throughout the GEO process since 1997. The GEO framework builds on the PSR model jointly developed by the OECD and the European Environment Agency in the mid-1990's (UNEP, 2012). Notable developments to the GEO framework took place under GEO 4, whereby elements from the MA and IPCC frameworks were included (Ash et al., 2010). The DPSIR framework highlights how changes in pressures affect systems. The MA framework considers the feedback loop (how changes in the system affect pressures), and includes multi-temporal and multi-scale components. Whereas, the IPCC framework represents the division and inter-linkages between earth and human systems. The GEO 4 framework built a feedback loop into the DPSIR framework, integrating multi-temporal (retrospective, short-, medium-, and long-term) and multi-scale (local, medium, global) elements. It also represents the division and inter-linkages between human (in blue) and environment (in green) factors, seeking to frame the assessment process around how the environment contributes to development (Ash et al., 2010).

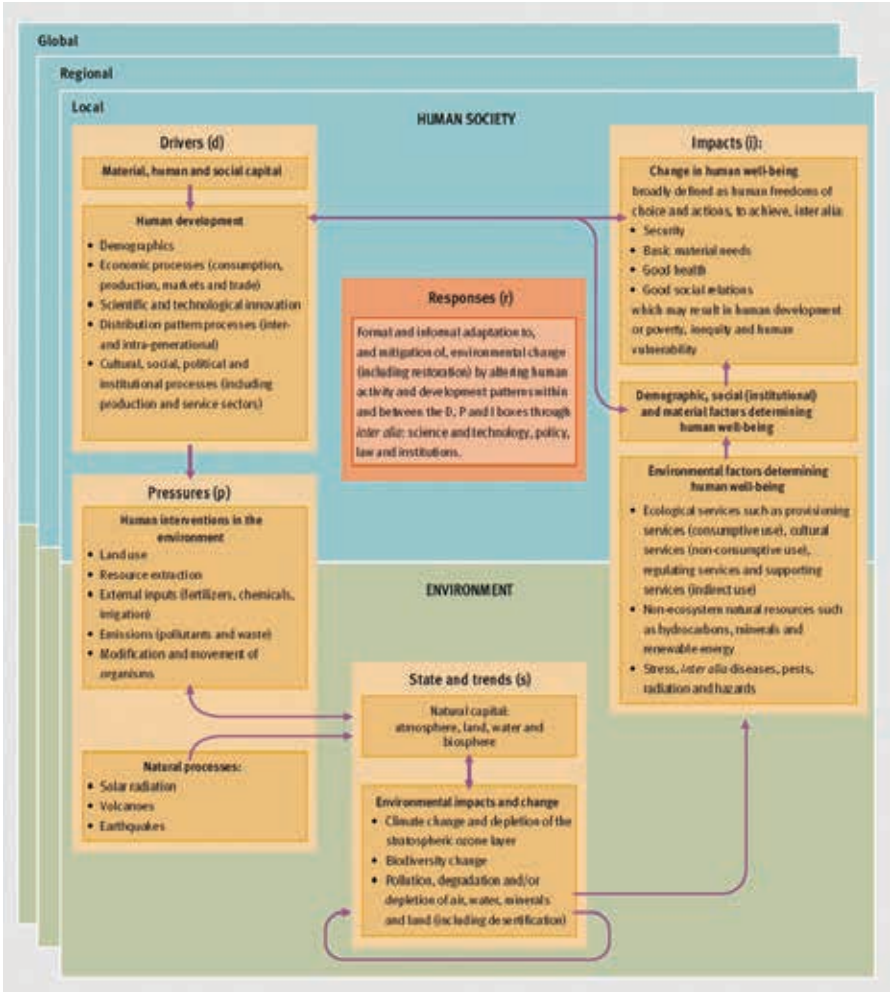


Figure 4 The Global Environment Outlook 5 conceptual framework (2012)

3.2.3 The Economics of Ecosystems and Biodiversity (TEEB) framework (2010)

The TEEB conceptual framework (Figure 5) integrates the four key components of the MA framework (human well-being, ecosystems, direct and indirect drivers), but makes a clear distinction between ecosystem functions, services, benefits and values, in order to address double counting issues and the flows of benefits and values. The TEEB framework uses ecological and economic elements for the valuation of biodiversity and ecosystem services to support decision-making. The framework highlights the linkages between governance and decision-making, the drivers of change (direct, indirect and external), ecosystems and biodiversity, the provision of ecosystem services, and the benefits for human well-being (economic, social, and ecological).

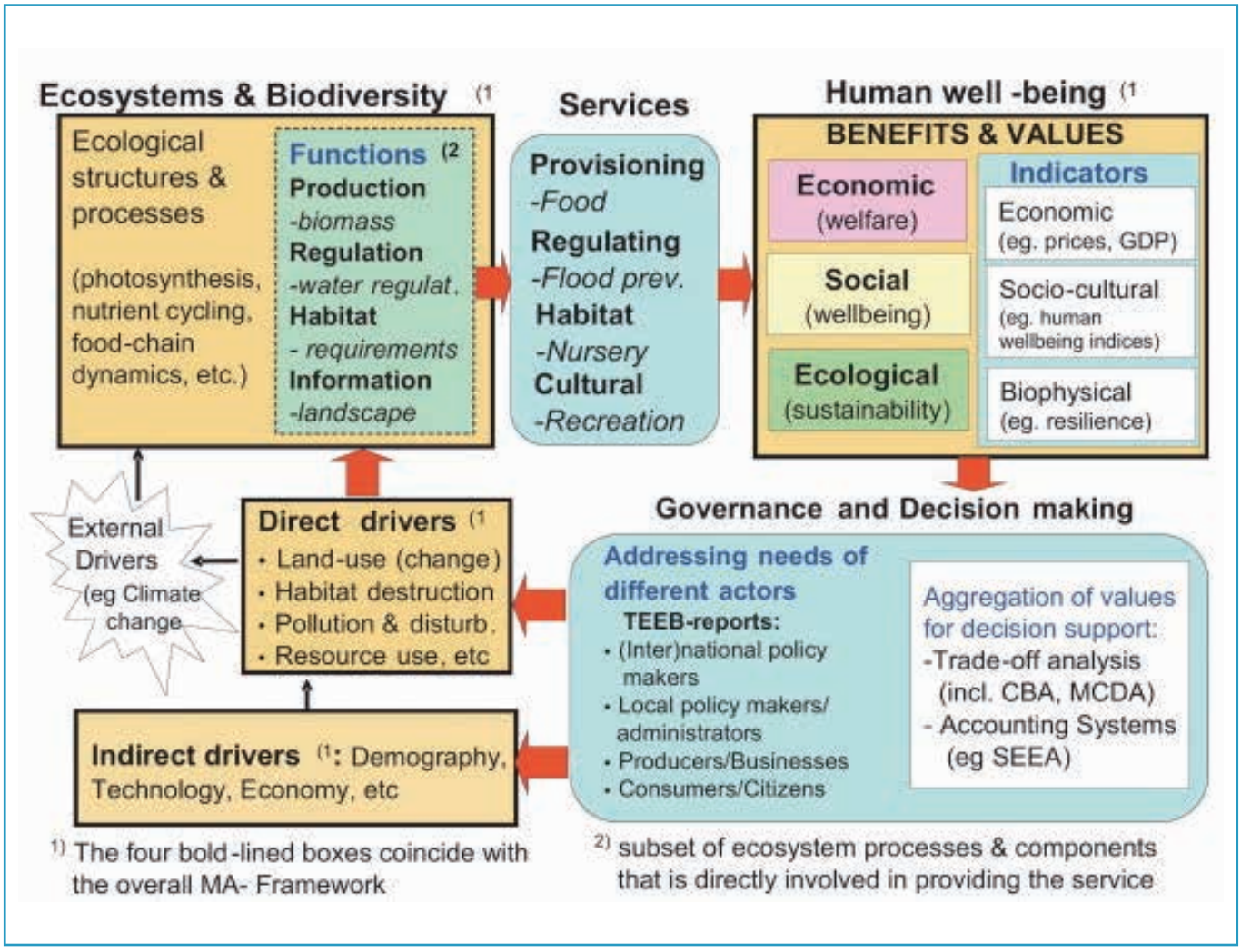


Figure 5 The Economics of Ecosystems and Biodiversity (TEEB) conceptual framework (2010)

3.2.4 UK National Ecosystem Assessment (UK NEA) (2011)

The UK NEA conceptual framework (Figure 6) builds on the MA and TEEB frameworks, visually representing the processes linking human societies and their well-being with the environment. Of particular importance in this framework is how the drivers of change which impact on ecosystems are explored, and the role of ecosystems in providing flows of services and goods, and how they are valued. Under the UK NEA Follow-on (UKNEA, 2014), the 2011 conceptual framework was further developed and adapted to include governance and institutions, reflecting the importance of these factors in decision-making processes (Figure 7). Further additions included natural capital and other types of capital (i.e. built, social, and human capital), reflecting the important role they play in transforming ecosystem services into ecosystem goods and benefits.

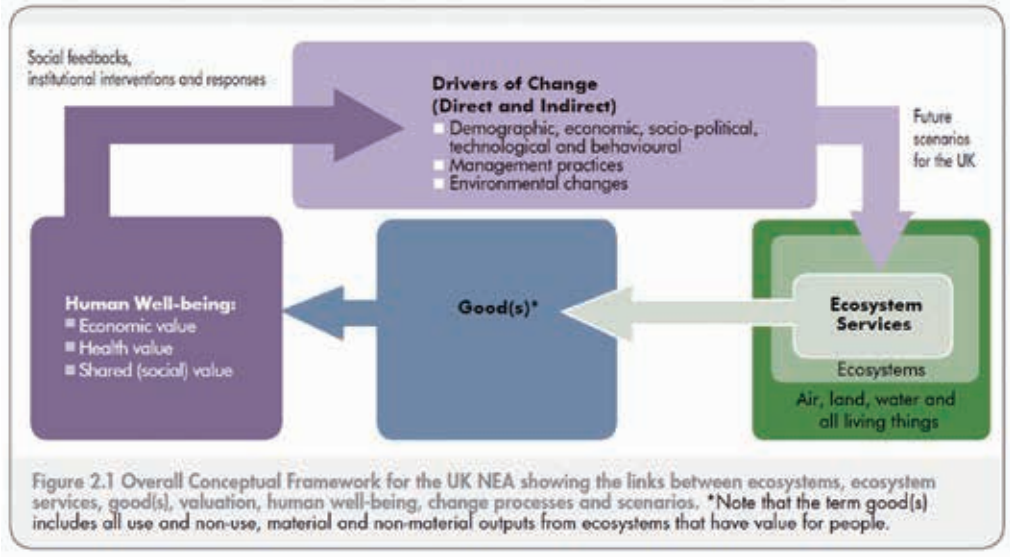


Figure 6 The UK National Ecosystem Assessment (NEA) conceptual framework (2011)

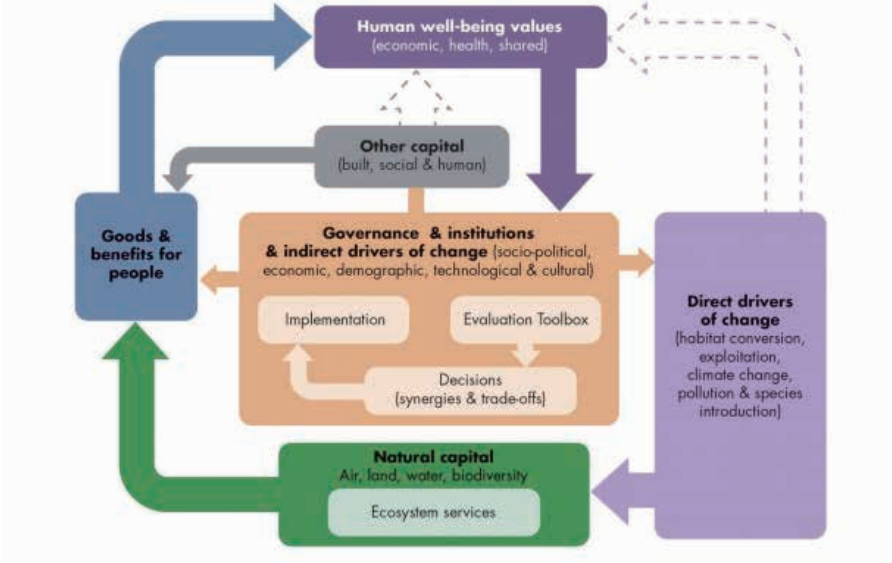
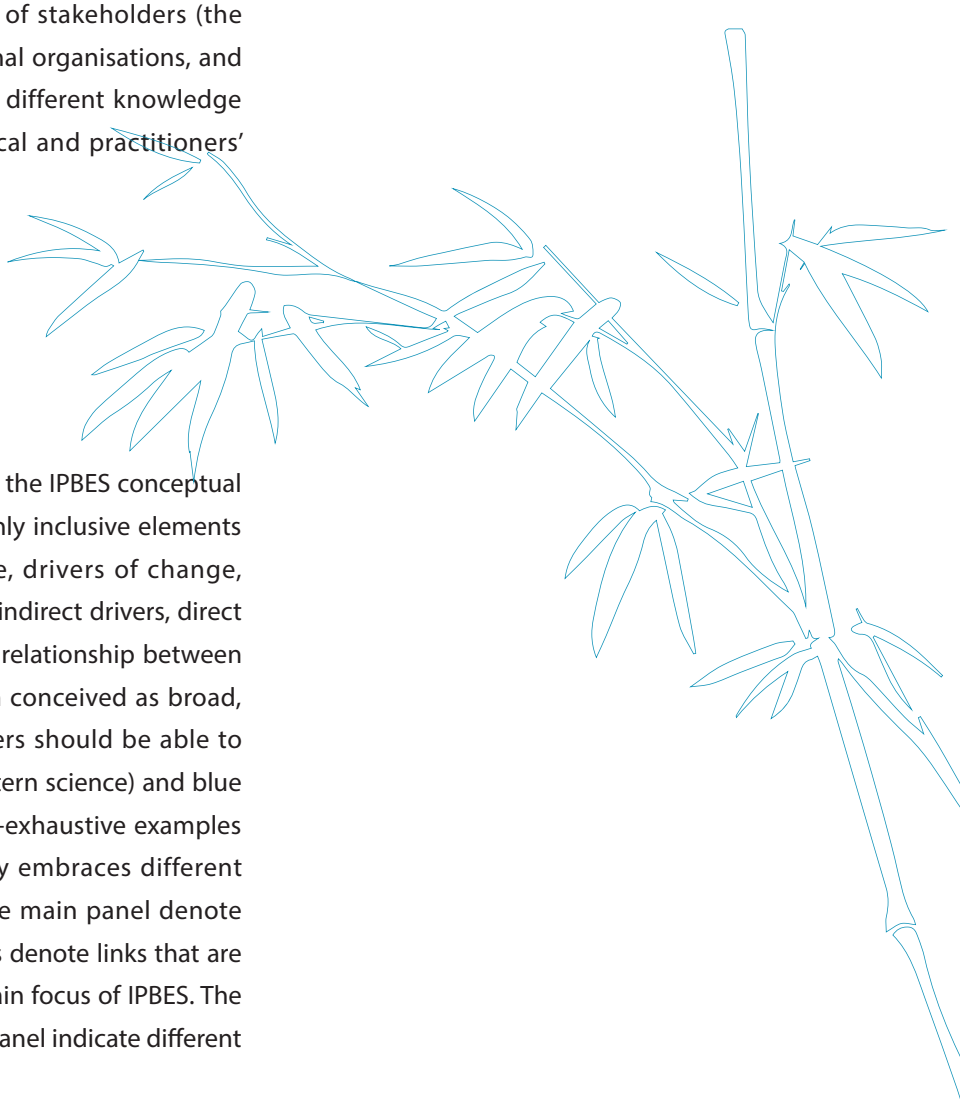


Figure 7 The UK National Ecosystem Assessment Follow-on (NEA FO) conceptual framework (2014)

3.2.5 IPBES conceptual framework (2015)

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) conceptual framework (Figure 8) builds on previous conceptual frameworks. It includes a graphic expression of the interrelationships between biodiversity and ecosystems, and human quality of life, at different temporal and spatial scales, and from the perspectives of different worldviews. This conceptual framework is innovative as it embraces different scientific disciplines (natural, social, and engineering sciences), includes a variety of stakeholders (the scientific community, governments, international organisations, and civil society at different levels), and integrates different knowledge systems (western science, indigenous, and local and practitioners' knowledge) (Díaz et al., 2015).



As presented graphically in Figure 8, the core of the IPBES conceptual framework is framed by six interlinked and highly inclusive elements (in bold) (nature, nature's benefits to people, drivers of change, institutions and governance systems and other indirect drivers, direct drivers, and good quality of life), depicting the relationship between people and nature. These elements have been conceived as broad, inclusive categories with which all stakeholders should be able to relate (Díaz et al., 2015). Denoted in green (western science) and blue (other knowledge systems) are illustrative, non-exhaustive examples of how the conceptual framework specifically embraces different disciplines and worldviews. Solid arrows in the main panel denote influence between elements; and dotted arrows denote links that are acknowledged as important, but are not the main focus of IPBES. The coloured arrows below and right of the central panel indicate different temporal and geographical scales.

Rather than representing a comprehensive model of human interaction with the natural world, the IPBES conceptual framework is a tool for achieving a shared understanding across disciplines, knowledge systems, and between stakeholders involved in the whole IPBES work programme, including the assessments and all of its outputs.

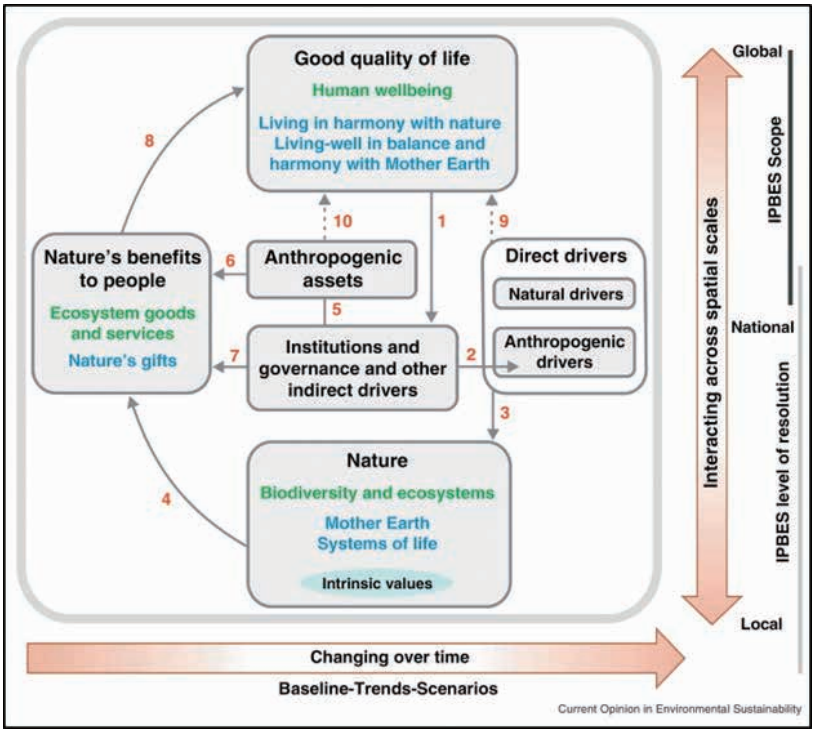


Figure 8 The IPBES conceptual framework (2015)

3.2.6 The relevance of these conceptual frameworks to GABAR

The MA and GEO frameworks are relevant to GABAR as both consider time-scales that may be useful for guiding assessments in the context of SDGs, climate change mitigation and adaptation, green economic development, land restoration, and biodiversity conservation. Both frameworks also consider spatial scales, which means that they can be adapted to guide national, regional, and global assessments. The MA framework can be useful in linking the diverse ecosystem services provided by bamboo and rattan (e.g. provisioning and regulating services), the indirect drivers of change (e.g. trade, markets, and consumption choices), the direct drivers of change (e.g. land-use change, harvest and resource consumption, and climate change), and human well-being. Whereas the GEO framework approach is useful in distinguishing between human and environment elements that are organised under Drivers, Pressures, States, Impacts and Responses. While, the TEEB and the UK NEA frameworks provide elements that could be useful for more formal valuation approaches (including monetary) of ecosystem services associated with bamboo and rattan, assisting decision-making at multiple geographic levels.

3.2.7 The IPBES conceptual framework and GABAR

The IPBES conceptual framework builds on the lessons learned from previous conceptual frameworks and offers the latest thinking in their development, therefore providing a suitable template for GABAR. Furthermore, its innovative approach is also relevant and applicable to GABAR. For example, through the inclusion of harmonised knowledge systems, recognising "that representations of human–nature relationships may vary across cultures" and "in relation to specific worldviews and cosmologies, including between scientific and indigenous knowledge systems, as well as among indigenous cultures" (Díaz et al., 2015). The IPBES conceptual framework aims to provide a common ground for cross disciplinary and cross-

cultural interoperability and understanding. As referred to in the introduction, bamboo and rattan have more than 1,500 documented uses, ranging from highly commercialised production systems in the construction materials industry, pulp and paper industry, textile industry, and bioenergy production, to a range of indigenous, cultural, local, and spiritual uses of its components, including as a material for weaving, as food, and for use in medicinal and ceremonial purposes. In acknowledging this diversity of use and function, it is vital to use not only an interdisciplinary approach to carry out an assessment of bamboo and rattan, but also to take into account different knowledge systems, including indigenous and local knowledge, appropriately integrating these primary stakeholders into the assessment process and the assessment team.

Due to the inclusive nature of the IPBES conceptual framework, in terms of benefits, knowledge systems, and worldviews, multiple value systems are considered, recognising various values among individuals within groups, across groups, and at various temporal and spatial scales (Díaz et al., 2015). In the IPBES conceptual framework, a distinction is made between intrinsic values (those inherent to nature and independent of human judgement, such as non-human species' inherent rights to exist), and anthropogenic values. Anthropogenic values in the context of the IPBES conceptual framework are sub-divided into instrumental and relationship values. Instrumental values are inherently linked to economic values, and contribute directly to human well-being and a good quality of life, whether it be through spiritual or aesthetic pleasure, or through production and consumption. Relational values depart from economic notions in the way that these refer to desirable relationships, including those between people and nature, regardless of whether those relationships imply trade-offs to obtain nature's benefits (Díaz et al., 2015). These attributes and considerations again make the IPBES conceptual framework approach very well suited for uptake and adaptation in the context of GABAR.

Another feature of the IPBES conceptual framework that sets it apart from most previous conceptual frameworks is its emphasis on human actions (institutions and governance systems) as the underlying cause for changes that are generated outside ecosystems (anthropogenic drivers that directly affect nature). In combination with other indirect drivers (e.g. population growth, changing consumer preferences, and technological development) they influence all aspects of the relationship between people and nature, whether negatively or positively (Díaz et al., 2015). They are coined indirect drivers as they do not affect nature directly, but rather through their effect on the drivers caused by anthropogenic impacts. Not only are institutions and governance systems the root cause of anthropogenic impacts on biodiversity and ecosystems, but they are also the key points of action to reverse negative trends. As such, they should be considered as a primary means to identify clear strategies for prioritisation and response interventions. Recognising the central role of governance systems, the IPBES conceptual framework is well placed as a framework for the identification of policy interventions relevant for bamboo and rattan, and thus GABAR.

3.2.8 Outcome of conceptual framework review

Whilst the conceptual frameworks developed and used for the MA, GEO, TEEB, and UK NEA assessment processes each have elements that are applicable and relevant to GABAR, they also have factors and characteristics which mean that are not the best suited frameworks to take forward. For example, the MA framework is largely built upon and superseded by more recently developed frameworks, the TEEB framework is best suited to assessments aiming to deal with specific policy actions, and the UK NEA frameworks were developed specifically for the UK context.

The IPBES framework incorporates, updates, and re-articulates many of the elements of relevance to GABAR from these previous frameworks. Therefore, taking into account alternative worldviews, diverse values systems, and the central role

of institutions and governance systems as a mediator of the relationship between people and nature, the IPBES conceptual framework provides an ideal platform from which to develop and framethe GABAR conceptual framework.

3.3 Development of the GABAR conceptual framework

Recognising the important elements of the IPBES conceptual framework and their relevance and applicability to GABAR, as set out above, and using the responses to the stakeholders' survey (section 2.2.1), a draft conceptual framework for GABAR was developed (Figure 9). This conceptual framework sets out how bamboo and rattan provide benefits to people, how these support good quality of life, and how anthropogenic assets and governance, and institutional factors impact upon and influence these. Also demonstrated are the range of direct drivers which act upon nature, providing some of the impetus for using and developing our reliance upon bamboo and rattan. This framework sets out a structure of the important elements and interactions which GABAR will need to consider, and indicates where and how the outcomes of GABAR will have impact and influence to stimulate positive change in terms of bamboo and rattan use and uptake.

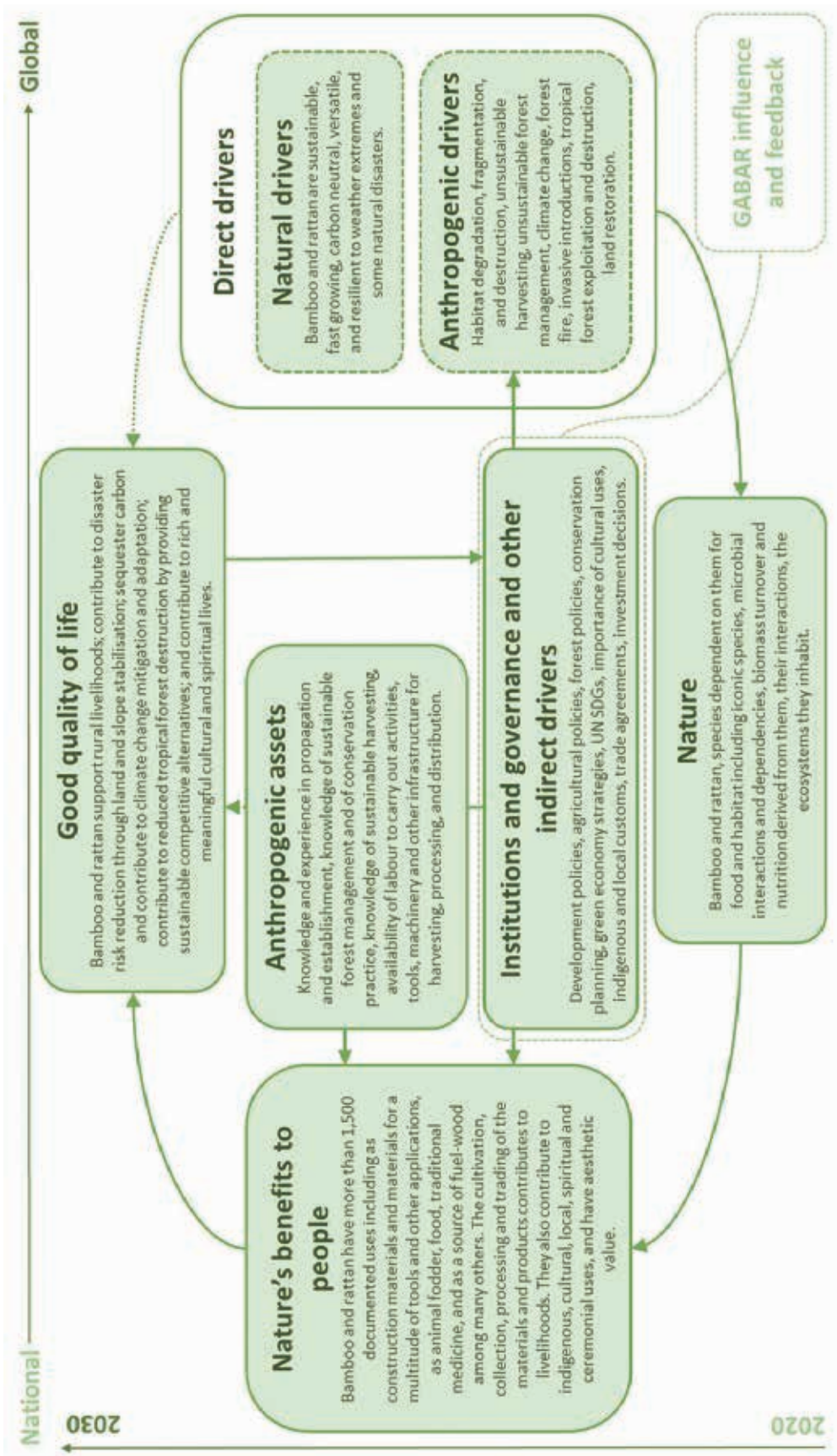


Figure 9 A draft conceptual framework for GABAR

3.3.1 Using the GABAR conceptual framework

In order to clearly demonstrate how the GABAR conceptual framework (Figure 9) can help to structure GABAR assessments, a worked example is provided below, using a hypothetical artisanal rattan furniture maker for context.

It is important to note that in this example only rattan is considered. As set out in Section 1.3, due to their different inherent properties, bamboo and rattan should be considered separately in assessments. This will ensure clarity of understanding and consideration of the important elements and processes specific to bamboo and rattan individually, without trying to fit non-related factors into the same framework.

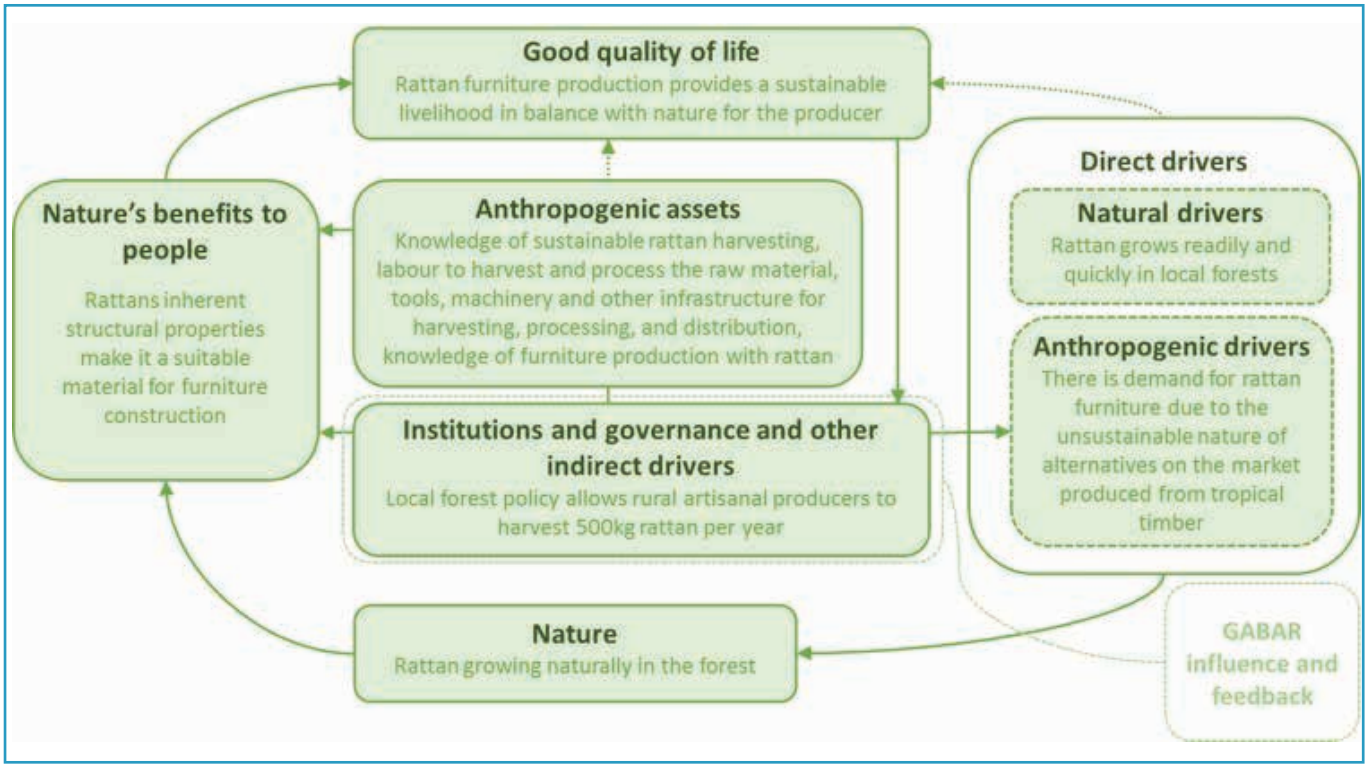


Figure 10 Worked example of how to interpret the GABAR conceptual framework

The features and linkages highlighted in this hypothetical situation (Figure 10) provide some of the core elements of importance that should be considered in an assessment in this context. This might include an analysis of how many furniture makers are harvesting material, what the impact of rattan harvesting is from local forests, how the market drivers are impacting this, and what are the likely maximum sustainable yields. As set out in the earlier sections, the GABAR conceptual framework is the conceptual and methodological scaffolding for all activities and products of GABAR; it should guide all aspects of the GABAR assessments in their scoping, analytical and synthesis work, and development of policy options. In practice, such a conceptual framework could be used and applied in the following fashion to conduct a GABAR assessment focussing on rattan:

Nature: Gathering, analysis, and review of information, knowledge, and data on the natural range of rattan species, an inventory of rattan populations and their conservation status, and any important dependencies with, on, and to, other forest species.

Nature's benefit to people: Identification and analysis of the total suite of benefits derived from rattan for people, including: productive uses, such as for furniture and crafts; traditional, medicinal, and cultural uses; livelihood opportunities; and any other uses such as food, fodder, and fuel.

Good quality of life: Analysis of how rattan contributes directly and indirectly to human well-being through: supporting rural livelihoods; its medicinal and nutritional values; any contributions it provides to carbon sequestration and climate change mitigation and adaptation; its potential to contribute to reduced tropical forest destruction by providing a sustainable competitive alternative or through sustainable management practices to support its growth and production; and any cultural and spiritual contributions it makes.

Anthropogenic assets: Identification and analysis of: the knowledge and experience possessed, required, or needed to sustainably manage forests for rattan propagation and harvesting, and knowledge of forest conservation practice; availability of labour to carry out management, harvesting, or manufacturing activities; and the tools, machinery and other infrastructure needed for harvesting, processing, and distribution of rattan in order to meet market requirements and demands.

Institutions and governance and other indirect drivers: Reviewing of the institutional and governance structures pertinent to the assessment being conducted, at a relevant scale. Included within this may be regional or global policies and strategies, land tenure and access rights, or local forest policy as in the example above. Other indirect drivers (i.e. those that operate diffusely, by altering direct drivers) should also be considered here; for example, population growth, changing market demands, and changing cultural or religious contexts.

Direct drivers: Identify and review drivers (natural and anthropogenic) that have a direct impact or influence on rattan and its interaction with human well-being. This might include drivers such as habitat change, over-exploitation through harvesting, poor habitat management, pollution and disease, and forest fires. Direct drivers can be both positive and negative; examples of positive drivers could include sustainable forest management, including propagation and planting, and sustainable harvesting practice, for example.

In each of the above stages of the conceptual framework a range of techniques and processes should be employed in order to gather and review information, data, and knowledge. For example, this might include literature reviews, expert interviews, stakeholder meetings, workshops, surveys, and community consultations. The aim of these processes is to elicit the relevant information and knowledge throughout the geographic range of the assessment to fully review and assess the roles and functions that rattan plays, and its importance, across different sectors and sections of society.

It is important to remember throughout the whole assessment process, during each phase and step, the aim should be to gather, review, and apply expert judgement to existing information, data, and knowledge; generally, assessments are not research processes that generate new data and information.

In both Figure 9 and Figure 10 above, the 'GABAR influence and feedback' box is included for illustrative purposes only, as it is not a component of the conceptual framework itself. This serves to highlight where the findings and outcomes of the GABAR assessments will feedback into the sustainable use and management of bamboo and rattan resources via monitoring, regulating, incentivising further use, and providing information to policy makers to bring about positive change where required, for example.

Beyond this scoping study, the GABAR conceptual framework will need to be validated and finalised through consultation with key stakeholders, and should be led by the INBAR Secretariat and Board of Trustees.

3.4 Identification of possible indicators for GABAR

Indicators are described as measures or metrics based on verifiable data conveying information about more than themselves (BIP, 2011). In the context of GABAR, this could be described as information on bamboo and/or rattan packaged to communicate something important (e.g. the conservation status of a particular bamboo species, plantation, or forest) to decision makers (e.g. the Minister for the environment). Indicators are also described as being 'purpose-dependent', whereby "the meaning given to the data depends on the purpose or issue of concern" (BIP, 2011). As an example, if the issue of concern is slope stabilisation, bamboo forest extent data could be used as an indicator for soil erosion. Indicators used within assessment processes use available data to answer key, or policy-relevant, questions. In so doing they can help to explain conditions and trends, act as measures of progress, or conversely to detect emerging problems, to raise awareness, and to create evidence-based storylines, summaries, or conclusions.

Below, a number of different indicators developed or used to support different processes are presented. These groups of indicators are presented due to their relevance and applicability to the major areas of interest and goals of GABAR.

The 2015 FAO Global Forest Resources Assessment (FRA) includes a number of sustainability indicators developed and used in the FRA in order to measure progress in three key areas, the 'three pillars of sustainability' (economic, social, and environmental). Ultimately, these indicators should provide a consistent approach to monitoring in order to allow the identification of suitable forest management practices required to achieve healthy forests (FAO, 2016). Although there is no direct or explicit reference to bamboo or rattan in any of these indicators, this scoping study has identified the following as having applicability and potential use in GABAR, and could contribute to informing the key elements presented in the GABAR conceptual framework (Figure 9). These indicators are set out in Table 1.

Table 1 2015 FAO Global Forest Resources Assessment (FRA) sustainability indicators with potential application and use for GABAR

Indicator		Scale	Data
Ecosystem condition and productivity	Changes in forest area	National	Global Forest Watch
	Natural and planted forest area change	National	Global Forest Watch
	Partial canopy cover loss – possible proxy for forest degradation	National	Global Forest Watch
Sustainable forest management	How much forest is intended to be kept in the long term?	Province/state & National	Governmental departments, offices, and agencies
	Forest management plans	Province/state & National	Governmental departments, offices, and agencies
	Forest management certification	Province/state & National	Forest Stewardship Council and Programme for the Endorsement of Forest Certification
	Forest monitoring and reporting	N/A	No data-set currently available

Indicator		Scale	Data
Maintaining ecological integrity and biodiversity	Conservation and protected areas	National	World Database on Protected Areas
	Biomass and carbon stock changes	National	National REDD+ data, Monitoring and Measurement, Reporting and Verification (M&MRV) data
Economic and social benefits	Trends in production, multiple-use forests and wood removals	N/A	No data-set currently available (N.B. Useful data on trade data which could support this indicator are available from UN Comtrade)
	Contribution of forestry to gross domestic product	National	Government department of trade or finance
	Employment in forestry	National	Government offices or departments of national statistics or employment
	Forest ownership and management rights	Province/state & National	Government land registry offices or departments

As part of assessing progress towards the attainment of the Aichi Biodiversity Targets (ABTs), the Convention on Biological Diversity (CBD) Conference of the Parities (CoP) have endorsed an updated list of indicators for the Strategic Plan for Biodiversity 2011-2020 (CBD Recommendation XX/13 (CBD, 2016)). This list of global indicators "provides a framework for assessing progress towards the Aichi Biodiversity Targets at the global level" and serves a multitude of purposes, including "mainstreaming the Aichi Biodiversity Targets within other international processes, including in particular, the Sustainable Development Goals" (CBD, undated a). While there are no specific bamboo and rattan indicators, the indicators set out in Table 2, could be usefully included within GABAR and provide information on the different elements in the proposed conceptual framework (Figure 9). Where reference is made to 'Non-specific but applicable to bamboo and rattan' in the table below, this signifies that the indicator potentially contains information on bamboo and rattan species (e.g. the Red List Index), or where they could be used as proxies for bamboo and/or rattan (e.g. GBIF species occurrence records).

Table 2 GABAR-relevant indicators identified for assessing progress in the attainment of the Aichi Biodiversity Targets, including an assessment of their main characteristics (Sources: CBD, undated b; CBD, undated c)

Aichi Biodiversity Target	Indicator	Partner	Scale	Bamboo or rattan specific?
5 (*By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.*)	Trends in forest extent (tree cover)	Hansen et al.	National	Non-specific but applicable to rattan
	Forest area as a percentage of total land area (indicator for SDG target 15.1)	FAO	National, Global	Non-specific but applicable to bamboo and rattan
	Progress towards sustainable forest management (indicator for SDG target 15.2)	*Not yet developed*	National	Non-specific but applicable to rattan
	Natural habitat extent (land area minus urban and agriculture)	Netherlands Environmental Assessment Agency (PBL)	National	Non-specific but applicable to bamboo and rattan

Aichi Biodiversity Target	Indicator	Partner	Scale	Bamboo or rattan specific?
5 (*By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.*)	Biodiversity Habitat Index	GEO BON/CSIRO	National, Global	Non-specific but applicable to bamboo and rattan
	Proportion of land that is degraded over total land area (indicator for SDG target 15.3)	UNCCD	National	Non-specific but applicable to bamboo
	Red List Index (forest specialists)	IUCN, BirdLife International and other Red List partners	National	Non-specific but applicable to rattan
	Living Planet Index (forest specialists)	WWF/ZSL	National	Non-specific but applicable to rattan
	Species Habitat Index	GEO BON/Map Of Life	National, Global	Non-specific but applicable to bamboo and rattan
9 (*By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.*)	Trends in identification and prioritisation of invasive alien species	*Not yet developed*	N/A	Non-specific but applicable to bamboo
	Trends in the distribution and populations of invasive alien species	*Not yet developed*	N/A	Non-specific but applicable to bamboo
	Red List Index (impacts of invasive alien species)	IUCN, BirdLife International and other Red List Partners	National	Non-specific but applicable to bamboo
	Trends in impacts of invasive alien species on ecosystems	*Not yet developed*	N/A	Non-specific but applicable to bamboo
	Trends in the numbers of invasive alien species introduction events	IUCN Invasive Species Specialist Group (ISSG)	National, Global	Non-specific but applicable to bamboo
	Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species	IUCN ISSG, Monash University, BirdLife International, Concordia University	National, Global	Non-specific but applicable to bamboo
11 (*By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.*)	Trends in areas of particular importance for ecosystem services conserved	*Not yet developed*	N/A	Non-specific but applicable to bamboo and rattan

Aichi Biodiversity Target	Indicator	Partner	Scale	Bamboo or rattan specific?
12 (*By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.*)	Number of species extinctions	IUCN, BirdLife International and other Red List partners	National	Non-specific but applicable to bamboo and rattan
	Number of extinctions prevented by conservation action	IUCN, BirdLife International and other Red List partners	National	Non-specific but applicable to bamboo and rattan
	Red List Index (indicator for SDG target 15.5)	IUCN, BirdLife International and other Red List partners	National	Non-specific but applicable to bamboo and rattan
	Living Planet Index	WWF/ZSL	National	Non-specific but applicable to bamboo and rattan
	Species Protection Index for species in decline	GEO BON/Map Of Life	National	Non-specific but applicable to bamboo and rattan
14 (*By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.*)	Red List Index (species used for food and medicine)	IUCN, BirdLife International and other Red List partners	National	Non-specific but applicable to bamboo
	Living Planet Index (utilised species)	WWF/ZSL	National	Non-specific but applicable to bamboo and rattan
	Species Habitat Index (species that provide essential services)	GEO BON/Map Of Life	National	Non-specific but applicable to bamboo and rattan
	Better Life Index	OECD	National	Non-specific but applicable to bamboo and rattan
	Mountain Green Cover Index (indicator for SDG target 15.4)	FAO	National	Non-specific but applicable to bamboo
	Trends in restoration of ecosystems that provide essential services	*Not yet developed*	N/A	Non-specific but applicable to bamboo
15 (*By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.*)	Trends in forest carbon stocks	FAO/Global Forest Watch	National	Non-specific but applicable to bamboo
	Global Ecosystem Restoration Index	GEO BON/iDiv	National	Non-specific but applicable to bamboo

Aichi Biodiversity Target	Indicator	Partner	Scale	Bamboo or rattan specific?
19 (*By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.*)	Species represented in the barcode of life data system	Barcode of Life Data Systems	National	Non-specific but applicable to bamboo and rattan
	Growth in species occurrence records accessible through GBIF	GBIF	National, Global	Non-specific but applicable to bamboo and rattan
	Species Status Information Index	GEO BON/Map Of Life	National	Non-specific but applicable to bamboo and rattan
	Proportion of known species assessed through the IUCN Red List	IUCN	National	Non-specific but applicable to bamboo and rattan

In March 2016 the UN Statistical Commission agreed on a set of proposed global indicators, as developed by the Inter-Agency and Expert Group on SDG Indicators, to monitor progress, inform policy, and ensure accountability of all stakeholders in the implementation of the 2030 Agenda for Sustainable Development (UN, 2016a). An initial review highlighted a number of indicators which could potentially be utilised within GABAR due to the possible contribution of bamboo and/or rattan in the attainment of the goal, or due to their potential impact on bamboo and/or rattan. These are presented below (Table 3).

Table 3 Global Indicators for monitoring progress towards the SDGs with potential relevance for GABAR (sources: UNEP, undated; UNSTATs, 2016; UN, 2016b)

SDG	Target	Indicator	Possible custodian agency/ies	Scale	Data
7	7.2 Increase share of renewable energy	7.2.1 Renewable energy share in the total final energy consumption	World Bank UNSD	National data collected for more than 180 countries and collated into the global level SE4ALL Global Tracking Framework	Data availability from World Bank on behalf of the SE4ALL Global Tracking Framework consortium
11	11.1 Ensure access to safe housing/ services	11.1.1 Proportion of urban population living in slums, informal settlements, or inadequate housing	UN Habitat	Data collected for nearly 400 cities around the world by UN Habitat	UN Habitat and World Bank
	11.b Increase adoption of city integrated policies	Number of countries with disaster risk reduction strategies	United Nations International Strategy for Disaster Reduction (UNISDR)	Based on national-level reporting from 140+ countries	The Hyogo Framework for Action (HFA) & Sendai Framework for Disaster Risk Reduction

SDG	Target	Indicator	Possible custodian agency/ies	Scale	Data
12	12.a Support developing countries to strengthen sustainable consumption and production (SCP)	12.a.1 Amount of support to developing countries on R&D for SCP and environmentally sound technologies	UN Environment UNESCO World Bank OECD (to confirm)	No data coverage information	UNSD
13	13.2 Integrate climate change measures in policy	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/ strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production	UNFCCC (to confirm)	No data coverage information	No metadata information
	13.a Implement UNFCCC commitment	13.a.1 Mobilised amount of US dollars per year starting in 2020 accountable towards the $100 billion commitment	OECD	National level in limited number of countries only (all countries in Europe and North America, several in Latin America and Caribbean; none in the remaining regions)	No information provided
15	15.1 Ensure conservation, restoration and sustainable use of ecosystems and their services	15.1.1 Forest area as a percentage of total land area	FAO	National	Food and Agriculture Organization of the United Nations Statistics Division
		15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	UNEP-WCMC UN Environment	National	www.protectedplanet.net/
		Coverage of protected areas	UNEP-WCMC UN Environment	National	www.protectedplanet.net/
	15.2 Promote sustainable management of forests	15.2.1 Progress towards sustainable forest management	FAO	National	This indicator is a Biodiversity Indicators Partnership indicator maintained by the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification
	15.3 Achieve land degradation neutrality	15.3.1 Proportion of land that is degraded over total land area	UNCCD	Many countries have data and information for this indicator from multiple sources at the global, regional and national levels	UNCCD

SDG	Target	Indicator	Possible custodian agency/ies	Scale	Data
15	15.4 Ensure conservation of mountain ecosystems	15.4.1 Coverage by protected areas of important sites for mountain biodiversity	UNEP-WCMC UN Environment	National	www.protectedplanet.net/
		15.4.2 Mountain Green Cover Index	FAO	National	UNSTATS & UN Environment
		Coverage of protected areas	UNEP-WCMC UN Environment	National	www.protectedplanet.net/
	15.5 Reduce degradation of natural habitats	15.5.1 Red List Index	IUCN	National	IUCN
	15.8 Reduce impact of invasive alien species	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species	UN Environment CBD	National	IUCN SSC Invasive Species Specialist Group, Monash University, Concordia University, BirdLife International
	15.a Mobilise financial resources for biodiversity	ODA and public expenditure on conservation and sustainable use of biodiversity and ecosystems	OECD UN Environment World Bank	National	OECD only has data on the ODA part of this indicator
	15.b Mobilise resources for forest management	ODA and public expenditure on conservation and sustainable use of biodiversity and ecosystems	OECD DAC	National	OECD DAC
17	17.11 Increase exports of developing countries	17.11.1 Developing countries' and LDCs' share of global exports	World Trade Organization (WTO) International Trade Centre (ITC) United Nations Conference on Trade and Development (UNCTAD)	National data is available for over 130 countries across all regions of the world	Data on goods trade is retrieved from ITC (Trade Map) (www.trademap.org), WTO (IDB) (http://tao.wto.org), UNSD (COMTRADE) (http://comtrade.un.org/), and UNCTADstat (http://unctadstat.unctad.org/EN/). For services trade, WTO, ITC, and UNCTAD.

Some of the indicators detailed in Table 1 - Table 3 above have the potential to yield specific information and data on bamboo and rattan, but do not currently do so. As such, INBAR, by developing partnerships with the data holders and indicator partners could seek to explore the data by doing bamboo and rattan cuts (e.g. of the Red List Index, or the Living Planet Index). This would reveal where data exists, and conversely, where the data gaps are that need filling in order to contribute to existing indicators or to develop new ones. This scoping study therefore recommends that the INBAR Secretariat should seek to develop or strengthen collaborative relationships with key data holders, including Global Forest Watch, the Forest Stewardship Council, the United Nations Food and Agriculture Organization, GEO BON, and the global Red List partners, specifically IUCN and BirdLife International.

In order to provide further guidance, Table 4 below presents a subset of the indicators included in Table 1 to Table 3. The indicators presented in this table have been selected as they are considered to be those most suited for supporting the GABAR policy-relevant questions of most interest and relevance to INBAR and the aims of GABAR. Once the final selection of policy-relevant questions to be taken forward in the GABAR assessments has been defined by the INBAR Secretariat and Board of Trustees, a process of reviewing and shortlisting the available indicators and datasets to be used and included in the assessment will also need to be undertaken by the INBAR Secretariat and Board of Trustees, and relevant stakeholders.

Table 4 Indicators with potential to support the suggested GABAR policy-relevant questions

Suggested GABAR policy-relevant questions[5]	Possible indicator	Data holder(s)
What are the status and trends of wild and cultivated bamboo and rattan?	Changes in forest area/ Trends in forest extent (tree cover)	Global Forest Watch/ Hansen et al.
	Natural and planted forest area change	Global Forest Watch
	Partial canopy cover loss – *possible proxy for forest degradation*	Global Forest Watch
	Forest management certification	Forest Stewardship Council
	Area of forest under sustainable forest management: total FSC and PEFC forest management certification	Forest Stewardship Council and Programme for the Endorsement of Forest Certification
	Conservation and protected areas/ Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	World Database on Protected Areas/UN-EP-WCMC
	Forest area as a percentage of total land area	FAO
	Natural habitat extent (land area minus urban and agriculture)	Netherlands Environmental Assessment Agency (PBL)
	Biodiversity Habitat Index	GEO BON/CSIRO
	Red List Index (forest specialists)	IUCN, BirdLife International and other Red List partners
	Living Planet Index (forest specialists)	WWF/ZSL
	Species Habitat Index	GEO BON/Map Of Life
	Number of species extinctions	IUCN, BirdLife International and other Red List partners
	Species Protection Index for species in decline	GEO BON/Map Of Life
	Species Status Information Index	GEO BON/Map Of Life
	Proportion of known species assessed through the IUCN Red List	IUCN
What are the ecosystem services provided by bamboo and rattan and how are these impacted by their status and trends?	Biomass and carbon stock changes	National REDD+ data, Monitoring and Measurement, Reporting and Verification (M&MRV) data
	How much forest is intended to be kept in the long term?	Governmental departments, offices, and agencies
	Trends in production, multiple-use forests and wood removals	*No data-set currently available (N.B. Useful data on trade data which could support this indicator are available from UN Comtrade)*
	Trends in areas of particular importance for ecosystem services conserved	*Not yet developed*
	Red List Index (species used for food and medicine)	IUCN, BirdLife International and other Red List partners

[5] Only those policy-relevant questions that were selected as likely being of most relevance and interest to INBAR and the aims of GABAR in Section 2.3 are included in this table.

Suggested GABAR policy-relevant questions[5]	Possible indicator	Data holder(s)
What are the ecosystem services provided by bamboo and rattan and how are these impacted by their status and trends?	Living Planet Index (utilised species)	WWF/ZSL
	Species Habitat Index (species that provide essential services)	GEO BON/Map Of Life
	Better Life Index	OECD
	Mountain Green Cover Index	FAO
	Trends in restoration of ecosystems that provide essential services	*Not yet developed*
	Trends in forest carbon stocks	FAO/Global Forest Watch
	Renewable energy share in the total final energy consumption	Data availability from World Bank on behalf of the SE4ALL Global Tracking Framework consortium
What are the global drivers causing change to bamboo and rattan?	Changes in forest area	Global Forest Watch
	Natural and planted forest area change	Global Forest Watch
	Forest monitoring and reporting	*No data-set currently available*
	Forest ownership and management rights	Government land registry offices or departments
	Proportion of land that is degraded over total land area	UNCCD
	Trends in identification and prioritisation of invasive alien species	*Not yet developed*
	Trends in the distribution and populations of invasive alien species	*Not yet developed*
	Red List Index (impacts of invasive alien species)	IUCN, BirdLife International and other Red List Partners
	Trends in impacts of invasive alien species on ecosystems	*Not yet developed*
	Trends in the numbers of invasive alien species introduction events	IUCN Invasive Species Specialist Group (ISSG)
	Number of species extinctions	IUCN, BirdLife International and other Red List partners
	Number of extinctions prevented by conservation action	IUCN, BirdLife International and other Red List partners
	Species Status Information Index	GEO BON/Map Of Life
	Proportion of known species assessed through the IUCN Red List	IUCN
	Progress towards sustainable forest management	This indicator is a Biodiversity Indicators Partnership indicator maintained by the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification
	Developing countries' and LDCs share of global exports	Data on goods trade is retrieved from ITC (Trade Map), WTO (IDB), UNSD (COMTRADE), and UNCTADstat. For services trade, WTO, ITC, UNCTAD.

Suggested GABAR policy-relevant questions[5]	Possible indicator	Data holder(s)
What is the total current contribution of bamboo and rattan to alleviating the use of tropical timber?	Changes in forest area/Trends in forest extent (tree cover)	Global Forest Watch/Hansen et al.
	Natural and planted forest area change	Global Forest Watch
	Partial canopy cover loss – *possible proxy for forest degradation*	Global Forest Watch
	How much forest is intended to be kept in the long term?	Governmental departments, offices, and agencies
	Forest management plans	Governmental departments, offices, and agencies
	Forest management certification	Forest Stewardship Council and Programme for Endorsement of Forest Certification
	Forest monitoring and reporting	*No data-set currently available*
	Biomass and carbon stock changes	National REDD+ data, Monitoring and Measurement, Reporting and Verification (M&MRV) data
	Trends in production, multiple-use forests and wood removals	*No data-set currently available (N.B. Useful data on trade data which could support this indicator are available from UN Comtrade)*
	Contribution of forestry to gross domestic product	Government department of trade or finance
	Red List Index (forest specialists)	IUCN, BirdLife International and other Red List partners
	Living Planet Index (forest specialists)	WWF/ZSL
	Trends in areas of particular importance for ecosystem services conserved	*Not yet developed*
	Number of species extinctions	IUCN, BirdLife International and other Red List partners
	Species Protection Index for species in decline	GEO BON/Map Of Life
	Trends in forest carbon stocks	FAO/Global Forest Watch
	Species Status Information Index	GEO BON/Map Of Life
	Forest area as a percentage of total land area	FAO
	Progress towards sustainable forest management	This indicator is a Biodiversity Indicators Partnership indicator maintained by the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification
	Developing countries' and LDCs share of global exports	Data on goods trade is retrieved from ITC (Trade Map), WTO (IDB), UNSD (COMTRADE), and UNCTADstat. For services trade, WTO, ITC, UNCTAD.
What is the total potential for bamboo to contribute to land restoration?	Partial canopy cover loss – *possible proxy for forest degradation*	Global Forest Watch
	Proportion of land that is degraded over total land area	UNCCD
	Mountain Green Cover Index	FAO
	Trends in restoration of ecosystems that provide essential services	*Not yet developed*
	Global Ecosystem Restoration Index	GEO BON/iDiv
What is the total potential for bamboo plantations to contribute to climate change mitigation and adaptation?	Changes in forest area	Global Forest Watch
	Natural and planted forest area change	Global Forest Watch
	Partial canopy cover loss – *possible proxy for forest degradation*	Global Forest Watch

Suggested GABAR policy-relevant questions[5]	Possible indicator	Data holder(s)
What is the total potential for bamboo plantations to contribute to climate change mitigation and adaptation?	Forest management plans	Governmental departments, offices, and agencies
	Forest monitoring and reporting	*No data-set currently available*
	Biomass and carbon stock changes	National REDD+ data, Monitoring and Measurement, Reporting and Verification (M&MRV) data
	Trends in forest carbon stocks	FAO/Global Forest Watch
	Renewable energy share in the total final energy consumption	Data availability from World Bank on behalf of the SE4ALL Global Tracking Framework consortium
	Amount of support to developing countries on R&D for SCP and environmentally sound technologies	UNSD
	Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production	No metadata information
	Proportion of land that is degraded over total land area	UNCCD
	Mountain Green Cover Index	UNSTATS & UN Environment
What is the role and total value of bamboo and rattan in contributing to a green economy?	Biomass and carbon stock changes	National REDD+ data, Monitoring and Measurement, Reporting and Verification (M&MRV) data
	Trends in production, multiple-use forests and wood removals	*No data-set currently available (N.B. Useful data on trade data which could support this indicator are available from UN Comtrade)*
	Contribution of forestry to gross domestic product	Government department of trade or finance
	Employment in forestry	Government offices or departments of national statistics or employment
	Trends in areas of particular importance for ecosystem services conserved	*Not yet developed*
	Red List Index (species used for food and medicine)	IUCN, BirdLife International and other Red List partners
	Living Planet Index (utilised species)	WWF/ZSL
	Trends in forest carbon stocks	FAO/Global Forest Watch
	Renewable energy share in the total final energy consumption	Data availability from World Bank on behalf of the SE4ALL Global Tracking Framework consortium
	Amount of support to developing countries on R&D for SCP and environmentally sound technologies	UNSD
	Developing countries' and LDCs share of global exports	Data on goods trade is retrieved from ITC (Trade Map), WTO (IDB), UNSD (COMTRADE), and UNCTADstat. For services trade, WTO, ITC, UNCTAD.
What are the barriers to greater uptake and use of bamboo and rattan?	How much forest is intended to be kept in the long term?	Governmental departments, offices, and agencies
	Forest management certification	Forest Stewardship Council and Programme for Endorsement of Forest Certification
	Forest ownership and management rights	Government land registry offices or departments
	Proportion of land that is degraded over total land area	UNCCD

Suggested GABAR policy-relevant questions[5]	Possible indicator	Data holder(s)
What are the barriers to greater uptake and use of bamboo and rattan?	Trends in identification and prioritisation of invasive alien species	*Not yet developed*
	Trends in the distribution and populations of invasive alien species	*Not yet developed*
	Red List Index (impacts of invasive alien species)	IUCN, BirdLife International and other Red List Partners
	Trends in impacts of invasive alien species on ecosystems	*Not yet developed*
	Trends in the numbers of invasive alien species introduction events	IUCN Invasive Species Specialist Group (ISSG) and Centre for Agricultural Bioscience International (CABI)
	Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species	IUCN ISSG, Monash University, BirdLife International, Concordia University
	Species Status Information Index	GEO BON/Map Of Life
	Amount of support to developing countries on R&D for SCP and environmentally sound technologies	UNSD
	ODA and public expenditure on conservation and sustainable use of biodiversity and ecosystems	OECD only has data on the ODA part of this indicator
How can we secure the ongoing sustainable use of bamboo and rattan?	How much forest is intended to be kept in the long term?	Governmental departments, offices, and agencies
	Forest management plans	Governmental departments, offices, and agencies
	Forest management certification	Forest Stewardship Council and Programme for the Endorsement of Forest Certification
	Forest monitoring and reporting	*No data-set currently available*
	Conservation and protected areas	World Database on Protected Areas
	Trends in production, multiple-use forests and wood removals	*No data-set currently available (N.B. Useful data on trade data which could support this indicator are available from UN Comtrade)*
	Contribution of forestry to gross domestic product	Government department of trade or finance
	Progress towards sustainable forest management	*Not yet developed*
	Red List Index (forest specialists)	IUCN, BirdLife International and other Red List partners
	Living Planet Index (forest specialists)	WWF/ZSL
	Trends in areas of particular importance for ecosystem services conserved	*Not yet developed*
	Species Protection Index for species in decline	GEO BON/Map Of Life
	Red List Index (species used for food and medicine)	IUCN, BirdLife International and other Red List partners
	Living Planet Index (utilised species)	WWF/ZSL
	Species Habitat Index (species that provide essential services)	GEO BON/Map Of Life
	Species Status Information Index	GEO BON/Map Of Life
	Proportion of known species assessed through the IUCN Red List	IUCN

Suggested GABAR policy-relevant questions[5]	Possible indicator	Data holder(s)
	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	www.protectedplanet.net/, UNEP-WCMC
How can we secure the ongoing sustainable use of bamboo and rattan?	Progress towards sustainable forest management	This indicator is a Biodiversity Indicators Partnership indicator maintained by the Forest Stewardship Council and the Programme for the Endorsement of Forest Certification
	ODA and public expenditure on conservation and sustainable use of biodiversity and ecosystems	OECD only has data on the ODA part of this indicator
What is the potential role and use of bamboo and rattan in achieving global targets (e.g. SDGs, Aichi Biodiversity Targets (ABTs) etc.)?	All indicators listed in Table 2 and Table 3	

3.5 Assessment scale and GABAR

Under the full-scale GABAR programme of work, INBAR proposes conducting a series of national level assessments (and where appropriate sub-national assessments) scaled up to the global level, with three sequential iterations in 2020, 2025, and 2030. INBAR are working with a number of partners globally to develop tools and products (informally these are collectively referred to by INBAR as the 'global knowledge products') which can be called upon at both the national and global levels to inform and support the GABAR assessments. These include:

- Global taxon list of rattan and bamboo with the Royal Botanic Gardens, Kew (Vorontsova et al., 2016)
- Invasiveness synthesis report on bamboo with IUCN (Pagad, 2016)
- Red list species risk studies for rattan with IUCN (Africa only at present (in prep.))
- Global trade data analysis with UN Comtrade (ongoing)
- Global bamboo land classification mapping system with Tsinghua University, China (in prep).

Global level assessments, by their nature, are broad processes which may rely mostly on low resolution data (IPBES, 2016), and as a result, might not detect and prioritise nationally or sub-nationally relevant features and processes of concern or interest.

National level assessments tend to focus on the identification of indicators from available datasets and the use of expert judgement. By doing so, the relationships between the assessment subject and any causes of change can be explored and explained. In so doing, and in response to the needs and requirements of stakeholders at the national and sub-national levels, valuable insight is generated allowing policies to be developed with accompanying actions implemented to address the underlying problems (IPBES, 2016).

Therefore, the approach proposed for GABAR, of a bottom-up national to global level assessment will be able to scrutinise issues of national and sub-national concern and relevance in multiple regions of the world, and will then be able to aggregate and synthesise these assessments to assess the global picture. This is important not only for policy development and setting at the national level, but also because changes to bamboo and rattan resources is of global interest. To achieve this effectively, consistent building blocks will be required, which in the context of GABAR, means consistency in the approach and application of national and sub-national assessment processes.

In order to successfully conduct assessments at the national scale INBAR will firstly need to gain an understanding of the level of capacity available within the intended assessment countries to carry out the assessment process. This may then necessitate follow-up capacity building activities prior to the commencement of, and during, any assessment work in some, or all of the intended assessment countries, and will need to be factored in and planned for accordingly.

Conducting capacity assessments generally involves the conducting of surveys in one form or another to establish what the level of understanding and experience is in the area of interest. In the context of GABAR, this would involve a survey of the individuals, institutions, or organisations that will be responsible for conducting or overseeing the assessment process at the national or sub-national level. The method of surveying could be through the use of questionnaires, one-to-one interviews, workshops, stakeholder meetings or consultations, or other platforms such as online surveys or polls. The ultimate aim of conducting a capacity assessment will be to build a detailed understanding of the capabilities to conduct or oversee an assessment by asking a series of structured questions. An example which INBAR could use in developing and undertaking capacity assessments for GABAR is provided by the Global Biodiversity Information Facility through their 'Capacity self-assessment guidelines for national biodiversity information facilities' (GBIF Secretariat, 2015).

Aligned with this analysis of capacity should be the development and roll-out of guidance for conducting an assessment of bamboo and rattan at the national (and/or sub-national scale). This should not be too rigid and prescriptive, as some flexibility will be required across the global range of the bamboo and rattan growing countries to account for unique variations, situations, and circumstances. However, a robust and standardised framework and approach, with corecomponents to guide the processes should be considered. This should include common policy-relevant questions, the GABAR conceptual framework, indicators, core datasets, and a defined description of uncertainty.

In the early phases of the full-scale GABAR programme of work, it is understood that a limited number of bamboo-producing countries from the 42 INBAR member countries will be engaged by INBAR to conduct national level assessments as part of a phased national assessment approach. When prioritising this limited number of countries in the first phase, the INBAR Secretariat could consider the following factors:

- level of interest expressed by member countries;
- level of need expressed by member countries;
- data known to exist and be available/accessible in countries;
- capacity to do an assessment based on INBAR's understanding;
- ability to fund the assessments or components thereof; and
- ability to establish assessment teams in member countries.

The assessments conducted at the national level could have two phases, firstly focusing on the status and trends of bamboo and rattan, and secondly focusing on policy options and responses in terms of their safeguarding, potential,

and exploitation. National level assessments could also be synthesised into regional level assessments. These sequential national level assessments could be carried out during 2020 and 2025. Following on from the national level assessments, a global assessment could then be undertaken in 2030, synthesising the national (and sub-national) findings into a single global level assessment.

An example of such a bottom-up and scalable assessment is the Global International Waters Assessment (GIWA). GIWA was a water programme led by UN Environment which aimed to produce a comprehensive and integrated global assessment of international waters, their ecological status, the causes of environmental problems, and a focus on the key issues and problems facing the aquatic environment in trans-boundary waters (UNEP, 2006). GIWA was divided into nine mega-regions and 66 trans-boundary water areas worldwide. These were then brought together, producing an integrated global assessment. GIWA is relevant to GABAR in setting out a process and approach which considers multiple factors, across multiple regions, which is up-scaled into an integrated global assessment; as such, this could be utilised by the INBAR Secretariat and Board of Trustees in scoping the full-scale GABAR programme.

Figure 11 illustrates the GIWA project work process. This sets out how, through a series of workshops, various project phases are informed and conducted, and in combination feed into the overall detailed assessment process (UNEP, 2002).

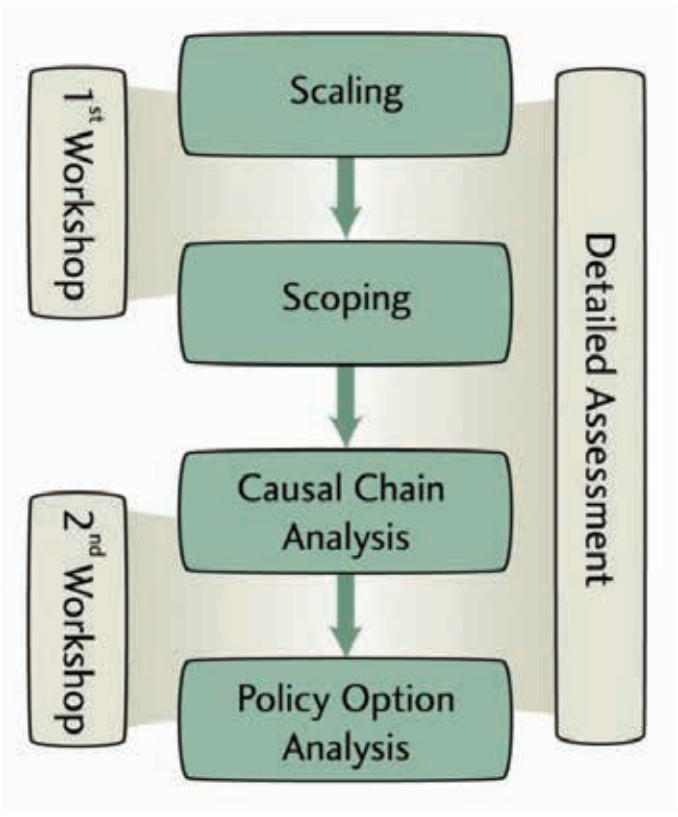


Figure 11 GIWA project process of work (UNEP, 2002)

Using an approach of visualising the work process, similar to that of the GIWA project, a suggested approach to the full scale GABAR programme is presented in Figure 12.

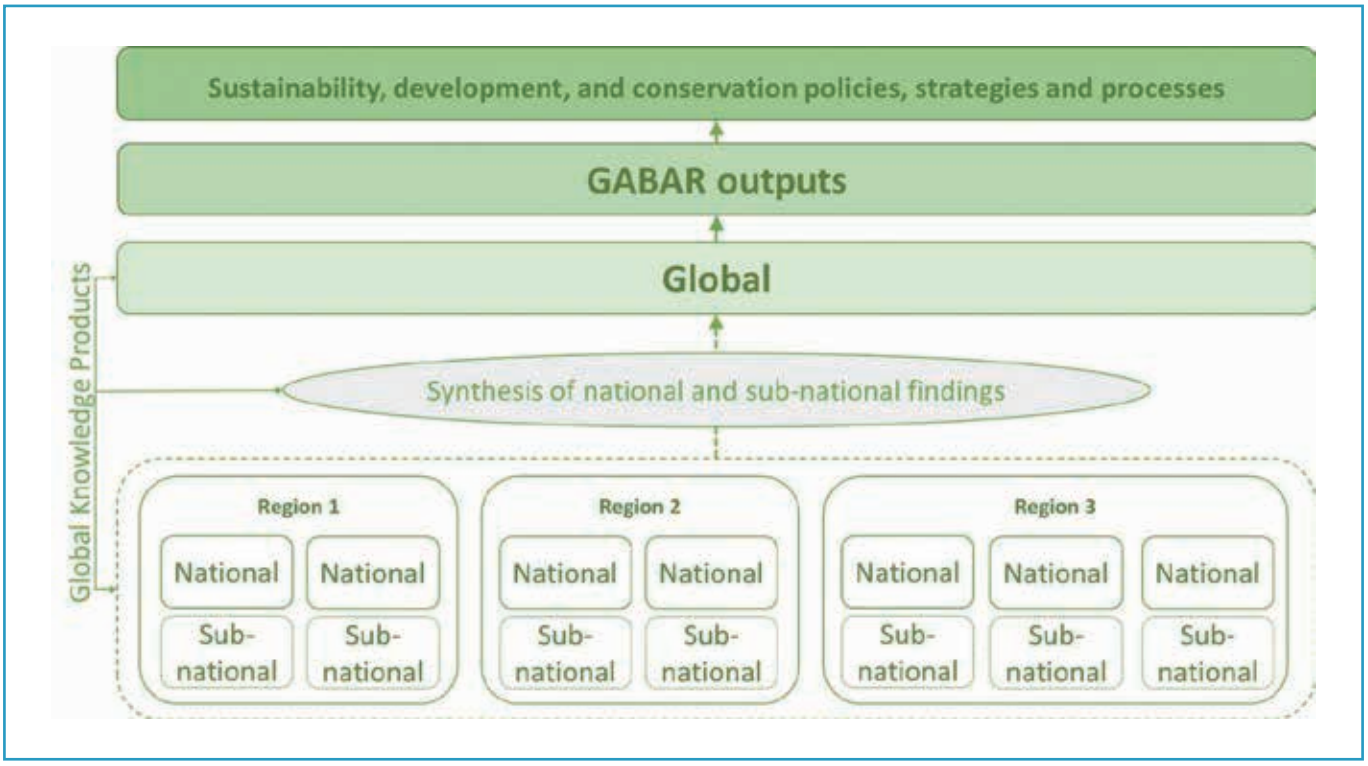


Figure 12 Representation of the bottom-up national to global approach of the full-scale GABAR programme

4 A review of the bamboo and rattan landscape

4.1 Purpose and approach

In order to conduct an efficient and effective review of the literature pertaining to bamboo and rattan, a methodical approach was employed to search for, and obtain, resources relevant to GABAR. Firstly, the four thematic areas identified in the introduction of this report (section 1.1) outlining the central areas of interest and relevance for this scoping study were used as a broad set of criteria for researching the bamboo and rattan landscape. These thematic areas are:

1. Climate change mitigation and adaptation;
2. Green economic development (The Green Economy) and rural development;
3. Land restoration; and
4. Biodiversity conservation.

Within each thematic area, relevant key phrases and words were identified to refine the search topics. For example, combinations of phrases such as 'carbon sequestration' and 'bamboo forests' were applied when searching for 'climate change mitigation and adaption' related resources.

Using these specific words and phrases enabled relevant literature to be found from a variety of online sources. These sources included academic search engines such as Google Scholar, Science Direct, and Web of Science to search the published academic literature. Additionally, search engines from a range of governmental agencies' and environmental NGO's webpages, such as the Food and Agriculture Organisation (FAO) and the Center for International Forestry Research (CIFOR) were used to search through grey literature and non-published web-based resources. Further resources were also found from viewing the reference lists within previously obtained literature.

4.2 Summary of literature searched

Employing the above approach to review the bamboo and rattan landscape resulted in the acquisition of over 160 individual online resources applicable to GABAR [6]. This literature comprised a variety of published and un-published resources including scientific research articles, technical reports, working papers and conference proceedings. The most numerous type of resources within the literature were reports (country assessments, technical reports, etc.) produced by the conservation and development sector (e.g. public and private sector organisations, NGOs, and research institutes). Of these reports, FAO and INBAR were the most prominent producers of bamboo and rattan related literature. Research articles (reviews, studies, assessments etc.) were also commonplace throughout the literature and were often published in forestry and socio-economic development focused journals (e.g. 'Forest Ecology and Management' and 'Journal of Economics and Sustainable Development').

[6] As outlined in Section 1.4, it is acknowledged that more information relevant to GABAR is available and accessible, for example, through the 'INBAR publications center' (www.inbar.int/inbar-publications). This study presents a rapid review and analysis predominantly of information beyond that held by INBAR.

The degree of focus on bamboo and rattan varied widely throughout the literature. Although the majority of resources focused solely on bamboo, the literature did also cover rattan individually, and both bamboo and rattan within the same article as well. For many of the resources found, bamboo and rattan were not the main focus, instead being a component within papers discussing numerous natural products, particularly literature assessing non-timber forest products (NTFPs).

Using the four broad thematic areas as search criteria for the literature review enabled a variety of bamboo and rattan related literature to be sourced. Within the 'climate change mitigation and adaption' theme, almost all literature found was related only to bamboo, including discussion of its potential to store carbon in bamboo forests, plantations and products, and as a source of biomass. This reflects the different growth habits between bamboo and rattan and highlights the different potential held by the two plants in terms of their potential cultivation and use. Searches under the theme 'green economic development (The Green Economy) and rural development' uncovered resources from a range of topics. Some of these included the roles bamboo and rattan play in poverty alleviation, the sustainable management and production of bamboo and rattan resources, and the potential value of the bamboo and rattan sectors. Again, searches under the theme 'land restoration' only revealed bamboo related literature, as rattan does not have suitable attributes to be used in this manner. These resources mostly covered how bamboo can be used to restore degraded landscapes through ecological restoration and agroforestry systems. Lastly, within the theme 'biodiversity conservation' there were many resources related to bamboo and rattan, including biodiversity status and species distribution, sustainable management and production, and the environmental impacts of overharvesting.

The majority of the literature referred to bamboo and rattan resources at a particular scale, for example at a global (multiple continents), regional (within a continent), national (country), or sub-national (region (i.e. county or district) within a country) scale. The remaining literature covered bamboo and rattan at a more general, non-specific scale. Of the resources that refer to bamboo and rattan at a specific scale, most of this literature focused on either a national or sub-national scale, especially in South East Asian and African countries.

The amount of published bamboo and rattan literature increases over time with the earliest paper sourced for this review being published in 1988. Of the literature acquired in this study, most of these resources were published within the last decade, with more than half over the past five years.

It is important to note that only literature published in English was reviewed as part of this scoping study.

4.3 Key studies and assessments of relevance/importance to GABAR

To identify key studies and assessments within the bamboo and rattan literature, these resources were categorised according to their relevance to GABAR. Applying a scale of relevance (1 – low to 4 – very high) enabled individual resources to be ranked based on several factors including what type of resource it was (assessment, key study, etc.), its relevance to the four thematic areas and seven SDGs, how recently it was published, and whether bamboo and/or rattan were the main focus of the resource. According to this scale, 29 of 163 resources found were identified as highly relevant to GABAR. Listed below are three examples of these 29 papers:

• 'Making forestry work for the poor. Assessment of the contribution of forestry to poverty alleviation in Asia and the Pacific', published by FAO (2012), is a collection of country reports assessing the extent of poverty reduction through

utilising bamboo, rattan, and other NTFPs in the Asia-Pacific.

• 'Viet Nam Country Assessment: report on the potential and unsustainability of the rattan sector in Viet Nam' is a country report produced by the World Wildlife Fund (WWF) assessing the rattan (and bamboo) sectors in Viet Nam and solutions for sustainable harvesting and cleaner production methods, as part of WWF's Sustainable Rattan Harvest and Production Project (WWF, 2010).

• 'A review of the ecological functions of reed bamboo, genus *Ochlandra* in the Western Ghats of India: implications for sustainable conservation' is a research article summarising the versatility and importance of reed bamboo in terms of its ecological benefits, carbon sequestration ability, soil and water management potential, and ecosystem services in the Western Ghats of India (SijiMol et al., 2016).

4.4 Analysis of the review of the bamboo and rattan landscape

To effectively collate and analyse the bamboo and rattan literature these resources were entered into a table to produce a complete metadata-set. This table sets out specific criteria to identify and highlight analysis parameters within the resources which are pertinent to GABAR's central interests and goals (Bamboo and rattan metadata tables available on request). These criteria included:

• Relevance to GABAR
• Type of resource
• The seven SDGS relevant to GABAR (Box 1)
• The four thematic areas
• Scale of the resource (e.g. global/national)

4.4.1 Key findings from the literature review and assessment

The results of the literature analysis are presented in Figure 13 to Figure 17 below.

• The majority of literature identified and reviewed in this study focuses on bamboo (60%), with only 18% focusing specifically on rattan (Figure 13).

• Predominantly the literature presents studies focused on national or sub-national scales (Figure 14). The resources identified as 'regional' typically feature groups of countries from within broader regions. For example, Sunderland and Profizi (2000) present a study on African rattans, the focal countries of this study being Republic of Congo, Cameroon, Zambia, and Ghana, therefore taking in the Southern, Central and West Africa regions. In some cases the literature presents studies and findings from countries from disparate continents entirely. This might reflect the degree to which South-South learning and exchange is important in the development and utilisation of bamboo and rattan resources.

• Of the resources categorised as being 'national' in scale (58 in total), 21 focus on China, 14 on India, and 11 on Colombia (sometimes in combination with other countries also). Given that China is the largest producer and exporter of bamboo products, with the biggest market share (INBAR, 2015d), and one of the greatest total resources, this is perhaps not a surprising finding. This finding also suggests that there is good availability of literature being published and made available in English, in both China and South America.

• Categorization of the literature into geographical regions (Figure15) shows that the majority (52%) of resources focus on the Asia-Pacific region. Given the widespread distribution of bamboo and rattan in this region, and its use by societies in

this region for hundreds of years (Seethalakshmi and Muktesh Kumar, 1998), this result is to be expected. Resources linked to Africa make up 27% of those identified in this study, all of which have been published in the period 1999-present. This perhaps reflects that the exploration and utilisation of bamboo and rattan as resources beyond small-scale and traditional use in Africa is becoming more prevalent.

• Categorisation of the literature resources identified in this study against the four broad themes of interest as in Section 4.1 reveals that 'biodiversity conservation' and 'green economic development (The Green Economy) and rural development' are consistent themes throughout the temporal range of the literature (1988-2016). 'Climate change mitigation and adaptation' and 'land restoration' related resources are both much less prevalent (13% and 7% respectively) and appear to be more contemporary in their nature. The earliest dated resource focusing on climate change in this study is from 2006, with all others being published after 2010. Similarly, the earliest dated resource focusing on land restoration is from 1996, otherwise the remaining resources in this category are published from 2002 onwards.

• Literature resources categorised by GABAR-relevant SDGs demonstrate that 30% are associated with SDG 1 (End poverty in all its forms everywhere) (Figure 17). It is likely that the many uses and connections of bamboo and rattan to rural livelihoods, green economy, and traditional and indigenous use, amongst others, is the reason for this.

• There are 17 references to the term 'rural' in the titles and descriptions of the literature resources reviewed in this study, all in reference to rural livelihoods.

• There are only two references to the term 'traditional'; one in context to traditional technologies, with a section exploring traditional knowledge and technology (Endalamaw, 2015); and one in context to traditional uses (Yuming et al., 2003). However, there is no reference to 'indigenous' in the context of Indigenous and Local Knowledge (ILK), nor explicitly 'traditional' in context to Traditional Ecological Knowledge (TEK).

• Of the 163 resources acquired in this study 43 are published in peer-reviewed journals or books. Therefore, more than 70% of the resources reviewed exist within the grey literature i.e. that made available through government departments, NGOs, IGOs, business, and industry, amongst others. It will be important for this information to be fully integrated alongside peer-reviewed literature when scoping and conducting the GABAR assessments. The following guidance on using such grey literature and other resources, as set out under the IPBES 'Operating principles of the Platform', is recommended for use throughout the GABAR assessments: "Use clear, transparent and scientifically credible processes for the exchange, sharing and use of data, information and technologies from all relevant sources, including non-peer-reviewed literature, as appropriate" (IPBES, 2012).

• Sufficient relevant information has been identified and assessed in this study, and is accompanied by the information holdings of INBAR, to recommend that national (and sub-national) assessments of bamboo and rattan can be conducted successfully, with subsequent up-scaling to the global level.

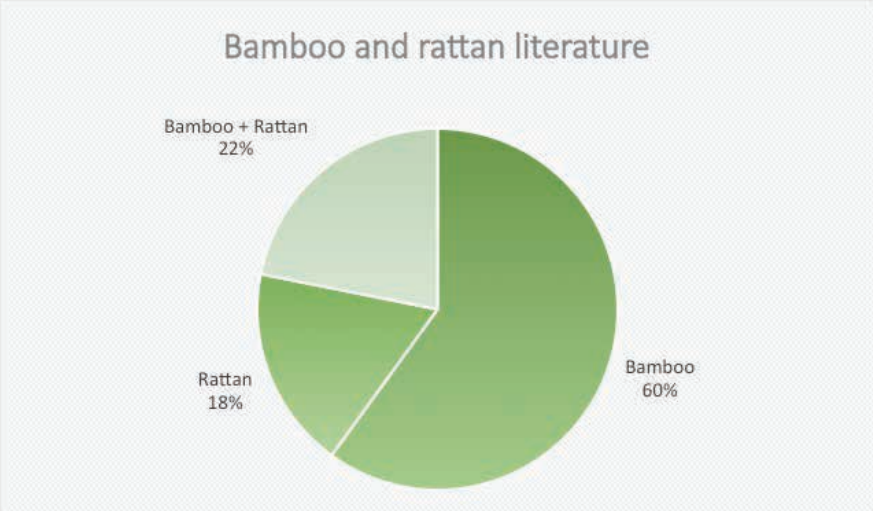


Figure 13 The relative distribution of literature reviewed in relation to bamboo and rattan

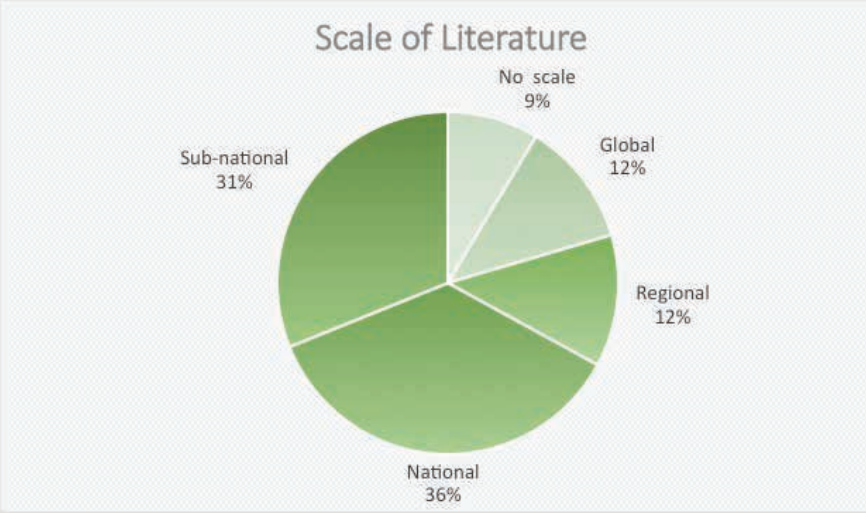


Figure 14 Geographical scale of the bamboo and rattan literature

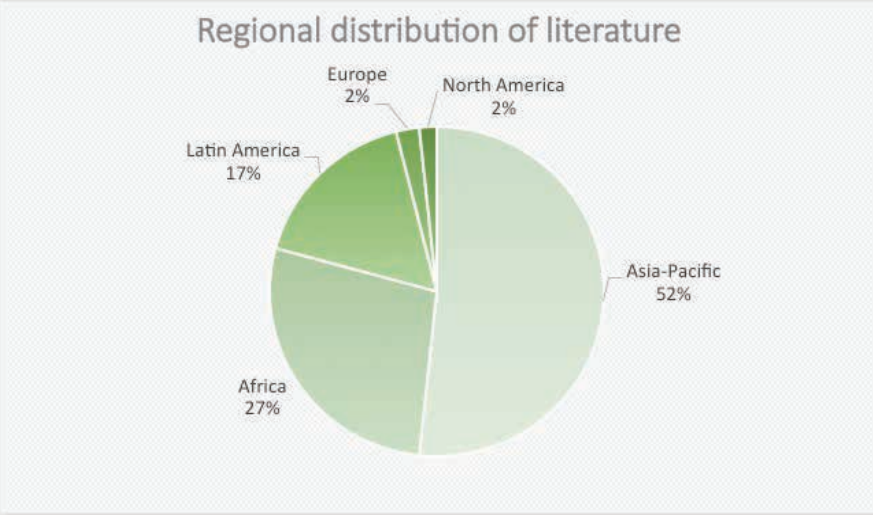


Figure 15 Regional distribution of the bamboo and rattan literature

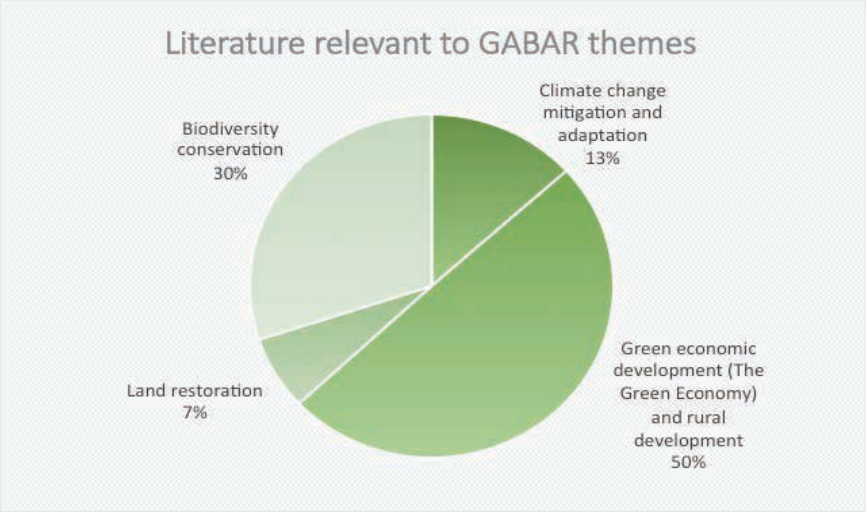


Figure 16 Relevance of the literature in relation to the main GABAR themes

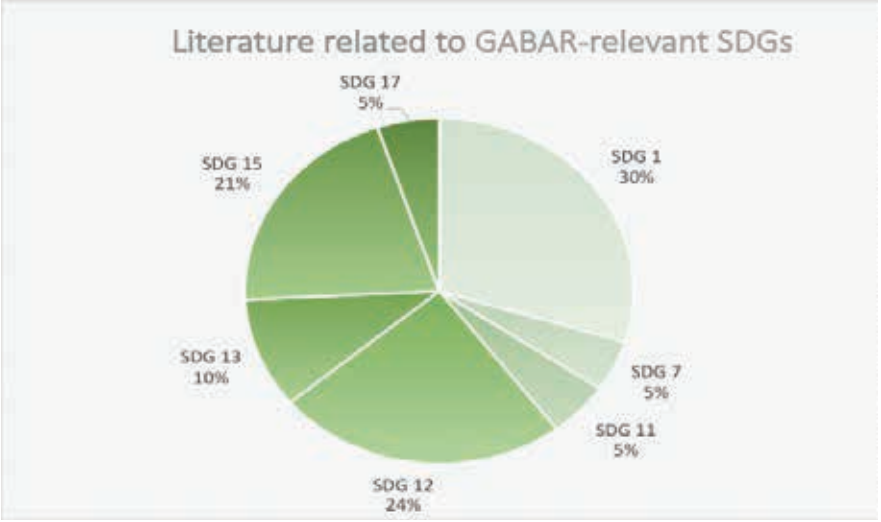
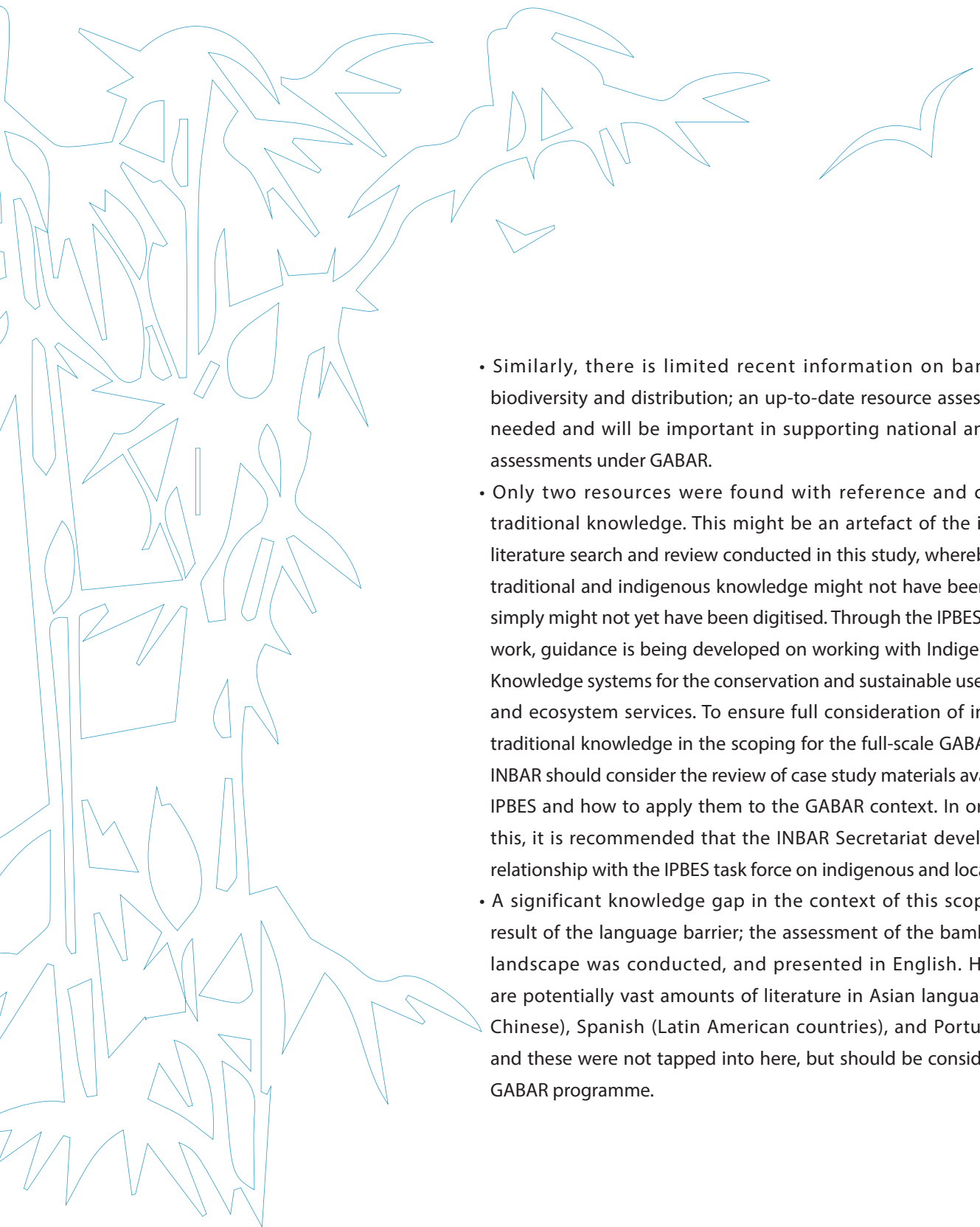


Figure 17 Relevance of the bamboo and rattan literature to the GABAR-relevant SDGs

4.5 Example knowledge gaps to be addressed by GABAR

Set out below is a non-exhaustive selection of example knowledge gaps that have been identified through the course of the literature review conducted as part of this scoping study. Whilst a significant amount of literature has been reviewed, within the confines of this scoping study it is not possible to define all major knowledge and data gaps, and those presented are a reflection only of the information accessed and reviewed. One role of an assessment process is to identify the gaps in the data and knowledge pertaining to the assessment subject matter. Therefore, as part of the full-scale GABAR programme of national (and sub-national) and global assessments, the significant gaps will be identified.

- GABAR themes:
  - Limited literature related to Land Restoration; it is possible that this finding is a result of the novelty of bamboo-based land restoration projects, and therefore few results and data exist upon which to report.
- SDGs:
  - Relatively few resources were identified that could be linked to SDG 7 (Affordable and clean energy) in the context of bamboo being utilised as a biomass resource for energy, possibly as a result of bamboo use as a biomass resource yet to see substantial uptake.
  - Limited information linking bamboo and rattan to SDG 11 (Sustainable cities and communities) was identified. Whilst there is a good resource of published materials (and even an ISO standard) for bamboo as a material for construction, few make the policy link. However, following consultation with the INBAR Secretariat it is likely that further published information in this area is available, but the search terms used in this study focussed on biodiversity and environment, not materials science, therefore resulting in the identification of limited resources.
  - Limited resources were identified linking bamboo and rattan to SDG 17 (Partnerships for the goals). Specifically little information regarding North-South, and triangular regional and international cooperation was identified. Reference to South-South cooperation was more prevalent.
- Scale:
  - Global and regional level studies of bamboo and rattan are limited in the literature, reflecting that current and past use and consideration of bamboo has been confined more to the sub-national and national levels.
  - Literature published out of, or linked to, Europe tends to focus on the review of western design and use of bamboo resources, i.e. structural properties. It is suspected that the limited literature is largely a result of Europe being outside of the natural range of bamboo and rattan.
  - North America is similarly limited in terms of its published material on bamboo and rattan, although America does have some natural bamboo resources. Again, most references are to the testing and recruitment of engineered bamboo and its properties.
  - Although there is quite a lot of literature based in Africa, much of it is restricted to several countries including Ethiopia, Cameroon and Ghana, despite its wide natural range in the region.
- Overall there is less literature available on rattan in comparison to bamboo. This is most likely as a result of it having fewer uses, especially in terms of contemporary engineering and structural functions. However, the Asian rattan handicraft and furniture trade is quite large, but perhaps does not lend itself naturally to published material and literature or research. More information could be available, but this might not be uploaded to the internet.
- There is an apparent lack of recent knowledge of rattan species biodiversity and resource distribution. Several experts in the field exist, but limited contemporary information is available.



- Similarly, there is limited recent information on bamboo species biodiversity and distribution; an up-to-date resource assessment is much needed and will be important in supporting national and global level assessments under GABAR.
- Only two resources were found with reference and connection to traditional knowledge. This might be an artefact of the internet-based literature search and review conducted in this study, whereby much of this traditional and indigenous knowledge might not have been published, or simply might not yet have been digitised. Through the IPBES programme of work, guidance is being developed on working with Indigenous and Local Knowledge systems for the conservation and sustainable use of biodiversity and ecosystem services. To ensure full consideration of indigenous and traditional knowledge in the scoping for the full-scale GABAR programme, INBAR should consider the review of case study materials available through IPBES and how to apply them to the GABAR context. In order to achieve this, it is recommended that the INBAR Secretariat develops a working relationship with the IPBES task force on indigenous and local knowledge.
- A significant knowledge gap in the context of this scoping study is a result of the language barrier; the assessment of the bamboo and rattan landscape was conducted, and presented in English. However, there are potentially vast amounts of literature in Asian languages (especially Chinese), Spanish (Latin American countries), and Portuguese (Brazil), and these were not tapped into here, but should be considered in the full GABAR programme.

5 Concluding summary

This scoping study presents a range of material to support INBAR in the further scoping, development, and implementation of the full-scale GABAR programme. By utilising a multi-stakeholder approach, a preliminary understanding of the interests and concerns of key GABAR stakeholders has been developed. This information has been analysed and prioritised in order to develop a range of suggested policy-relevant questions for GABAR. The GABAR stakeholders' survey responses have also been used, in combination with a review of relevant conceptual frameworks from other assessment processes, to develop a draft GABAR conceptual framework, to support the structuring of bamboo and rattan assessments at different scales. The potential for existing indicators to inform elements of this conceptual framework has also been reviewed.

In addition to stakeholder engagement and the development of draft policy-relevant questions and the conceptual framework, a comprehensive but non-exhaustive literature review was conducted in order to assess the current bamboo and rattan landscape. This process revealed the geographical and temporal spread of literature relevant to bamboo and rattan, the main areas of relevance to the central themes of importance to GABAR, and where notable knowledge gaps were perceived to exist.

The information identified and reviewed, and the resources developed and presented in this study provide the evidence to recommend that national (and sub-national) assessments of bamboo and rattan can be conducted successfully, with subsequent up-scaling to the global level. This study can be used to inform and support INBAR's approach to structuring and initiating the GABAR assessments. The INBAR Secretariat and Board of Trustees, should seek, potentially through the development of a GABAR task force or similar, to take this forward by:

1. Defining the proposed extent of the assessment i.e. which countries will initially be included in the phased approach to national level assessments? Using criteria such as those set out in Section 3.5, prioritisation of countries to be included in the initial phase or phases could be conducted.
2. Gaining an understanding of the level of capacity in these countries to conduct national level assessments, through targeted stakeholder engagement. Capacity assessments of proposed assessment countries could be conducted by using an approach similar to that outlined in GBIF's 'Capacity self-assessment guidelines', as set out in Section 3.5.
3. Developing guidance for conducting assessments of bamboo and rattan at the national (and/or sub-national scale), or utilising and adapting existing assessment guidance.
4. Further stakeholder engagement to finalise and prioritise a list of approximately 10 policy-relevant questions, from those suggested in this study, to take forward through the full GABAR programme. Ten questions which are considered by the authors as potentially being of most relevance and interest to INBAR and the aims of GABAR have been short-listed in Section 2.3; these could form the basis of finalisation and prioritisation by INBAR and the stakeholders.
5. Agreeing and finalising a conceptual framework for GABAR, with further input and consultation from key stakeholders.
6. Forming, or further developing, partnerships with data providers to include, or extract, bamboo and rattan relevant data, enabling indicator development and use. Table 4 links a number of indicators and data holders to the subset GABAR policy-relevant questions, providing an indication of those that are potentially able to provide support. As set out in Section 3.4, some of the key data holders which INBAR should seek to partner with include Global Forest Watch, the Forest Stewardship Council, the United Nations Food and Agriculture Organization, GEO BON, and the global Red List partners. Further insights into, and opportunities for, bamboo and rattan data inclusion or extraction from the UN SDG

indicators and associated processes could come from working with the Inter-agency Expert Group on SDG Indicators (IAEG-SDGs) and the United Nations Statistical Commission, for example. As such, the INBAR Secretariat and Board of Trustees should seek to develop links to these groups.

7. Exploring the methods and approaches to best engage with bamboo and rattan consuming countries as potential GABAR partners and beneficiaries of GABAR generated data.

This study has identified a number of key considerations that should be factored into the above processes by the INBAR Secretariat and Board of Trustees. These include:

1. Updating inventories to reflect current population ranges and extents. This will be highly important in supporting assessments at different scales under GABAR. Work in this area should be aligned with current work being led by the Royal Botanic Gardens, Kew and INBAR to develop a bamboo and rattan checklist, and should engage with national focal points.
2. Language barriers: this scoping study was conducted, and presented in, English. However, there is potentially large amounts of literature in Asian languages (especially Chinese), Spanish (Central and South American countries), and Portuguese (Brazil) which have not been included here, but should be considered in the full GABAR programme.
3. Potential disaggregation of bamboo and rattan in GABAR assessments due to the very different characteristics, traits, potential, threats and pressures, and issues faced and presented by these separate plants.
4. To ensure full consideration of indigenous and traditional knowledge in the scoping for the full-scale GABAR programme, INBAR should consider the review of case study materials being developed by IPBES and how to apply them to the GABAR context. To facilitate this, the INBAR Secretariat should seek to develop a working relationship with the IPBES task force on indigenous and local knowledge.
5. Many of the resources identified and reviewed in this study lay within the grey literature; this information will need to be fully integrated alongside peer-reviewed literature when scoping and conducting the GABAR assessments, using the IPBES operating principles for guidance.

6 References

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Annexes

Annex A GABAR stakeholders' survey

Scoping study to inform a Global Assessment of Bamboo and Rattan (GABAR)

In order to develop a series of key questions which will be answered and addressed by the Global Assessment of Bamboo and Rattan (GABAR), it is key that an understanding of what makes bamboo and rattan important to the people that work with it, that rely upon it, that process it, that trade it, and many more uses and purposes also. As such, we would very much like to gain an insight into your experience and interests in bamboo and/or rattan to help in the formulation of these key questions.

Please spare 5-10 minutes to complete the survey questions below to give us your valuable perspective on bamboo and rattan. Your answers will directly feed into the full-scale Global Assessment of Bamboo and Rattan, helping to shape its direction and approach.

Many thanks.

Q1. Name (leave blank if you wish to remain anonymous):

Q2. Affiliation (organisation, institute, etc.):

Q3. How would you best group or classify your organisation or institute?

Government
Non-Governmental Organisation (NGO)
Inter-governmental organisation (IGO)
Private sector
Other public sector
Donors including philanthropic and development organisations (or others - please specify)
Other (please specify):

Q4. How would you classify your professional occupation?

Research
Public sector policy making
Private sector
Land management
Advocacy
Communication
Other (please specify):

Q5. In which country are you located?

Q6. Do you have any significant interest in bamboo or rattan (please indicate as appropriate)?

Yes – Bamboo
Yes – Rattan
Yes – Bamboo and rattan
No
Other (please state):

If you have answered 'No' to Q6 above, you may now exit the survey by clicking 'Next' below, many thanks for your participation.

If you have answered 'Yes', please continue.

Q7: Is your interest in bamboo and/or rattan specific to a particular country/countries or region (e.g. 'West Africa' or 'Vietnam' etc.)?

Yes (please specify all relevant countries):
No
Other (please comment):

Q8: In what capacity or function does your interest in bamboo and/or rattan lay?

As a construction material (e.g. shelter, furniture, irrigation, other physical functions)
As a material for other purposes (e.g. clothing, disposable biodegradable sanitary products)
As a fuel source
As a food source
As animal fodder or bedding
Climate change mitigation and adaptation
Green economic development and rural development
As a trade commodity
Land restoration
Biodiversity conservation
From a taxonomic view point
As an invasive alien species
Other (please specify):

Q9: At what scale does your interest in bamboo and/or rattan lay?

Subsistence use (e.g. small-scale harvesting and use for personal or community functions and requirements)
Industrial or commercial use (e.g. large-scale harvesting and processing for national or international market

requirements)
Other (please specify):

Q10: What is the most important aspect/quality of bamboo and/or rattan in terms of its potential contribution to the function(s) you have indicated in Q8 above?

Sustainable
Fast growing
Carbon neutral
Versatility
Contribution to rural livelihoods
Other (please specify):

Q11: Is your interest in bamboo and/or rattan due to a particular policy driver?

Yes - Development policies
Yes - Agricultural policy
Yes - National Biodiversity Strategies and Action Plans (NBSAPs)
Yes - Green Economy policy
Yes - achieving the UN Sustainable Development Goals (SDGs)
Yes - achieving the Bonn Challenge
Yes, as a contributing factor to our/an Intended Nationally Determined Contribution (INDC) to the UN Framework Convention on Climate Change (UNFCCC)
Culturally we have always used bamboo and/or rattan – therefore there is no direct link to a formal policy driver
No
Other (please specify):

Q12: Do you think there is scope to further develop societies' use and reliance upon bamboo and/or rattan in order to relieve pressure on tropical timber products and forests?

Yes (please add justification in the 'Comments' box below if desired):
No (please add justification in the 'Comments' box below if desired):
Other (please add comment):

Q13: What, if any, do you think are the major factors preventing bamboo and rattan from contributing more to societal and environmental goals?

Lack of awareness of the potential for bamboo and/or rattan to contribute to societal and environmental goals
Lack of capacity to develop, implement, or increase bamboo and/or rattan utilisation (please specify in the comments box if capacity needs are technical, financial, and, or institutional in nature)
Competition from other timber or non-timber forest resources that are more abundantly available, lower in price,

and/or superior in physical and mechanical properties compared to bamboo and/or rattan for their intended use (please specify)
Physical barriers (e.g. geographically difficult to access bamboo and/or rattan resources) (please specify)
Policy barriers (please specify)
Social barriers (please specify)
Other barriers (please specify)

Q14: Are you aware of the planned Global Assessment of Bamboo and Rattan (GABAR)?

Yes
No
Other (please add comment):

Q15: If you are aware of the planned GABAR (and answered yes to Q. 13 above), how did you get to know of it, or hear about it?

Q16: What do you think would be the most important feature for the GABAR to address based on your interests in bamboo and/or rattan?

Total potential market value of bamboo and/or rattan
Total potential for contribution to SDGs
Total potential for contribution to other policy drivers (please specify those applicable in the 'Comments' box below)
Total potential for contribution to climate change mitigation and adaptation
Total potential for contribution to green economic development (inc. rural livelihoods)
Total potential for contribution to land restoration
Total potential for contribution to biodiversity value
Stock-take of the state of the world's bamboo and/or rattan
Updated inventory of bamboo and/or rattan
Updated assessment of the extent of bamboo and/or rattan distribution
Other (please specify):

Annex B Stakeholders' survey respondent organisations and institutes

Count	Organisation/Institute	Country
1	ABC	Hong Kong
2	Able Mart Limited	Hong Kong
3	Addis Ababa University (EiABC)	Ethiopia
4	AFRIAMERI Bamboo Development Ltd.	Nigeria
5	Agricultural Research Institute of Mozambique	Mozambique
6	Agroforestry Research Institute	Cuba
7	Ambacon Bamboo Farmers Cooperative	Philippines
8	Arunachal Pradesh Bamboo Resources and Development Agency, Government of Arunachal Pradesh	India
9	Bamboo Industry Association of Jamaica	Jamaica
10	FirstRate Consultancy	Jamaica
11	Bamboo of the Americas (BOTA)	USA
12	Bamboo Society of Australia	Australia
13	Bamboo Vishwa Pune	India
14	Bambu Maya	Mexico
15	Biology Department, Faculty of Mathematics and Natural Sciences, Lambung Mangkurat University	Indonesia
16	Biotechnology Centre, University of the West Indies	Jamaica
17	Broad-based Bamboo Solutions	South Africa
18	Buglas Bamboo Institute/Foundation University	Philippines
19	Bureau of Agriculture & Natural Resource, Sustainable Land Management Program	Ethiopia
20	Bureau of Standards Jamaica	Jamaica
21	Caribamboo Foundation	Suriname
22	CELOS	Suriname
23	Center for Forest Products Research and Development	Indonesia
24	Centre for Sustainable Development & Poverty Alleviation	India
25	China National Bamboo Research Center (CBRC)	China
26	CIFOR	France
27	Colombian Agricultural Research Corporation - Corpoica	Colombia
28	Colombian Bamboo Society	Colombia
29	Comisión Nacional Forestal	Mexico
30	CONAPE	Panama
31	Coventry University	UK
32	CSIR-Oil Palm Research Institute	Ghana
33	Department of Agriculture Sabah, Malaysia	Malaysia

34	Department of Forest and Park Services, Ministry of Agriculture and Forests	Bhutan
35	Department of Forest Research and Survey	Nepal
36	Department of Forestry	Malawi
37	Department of Forests and Park Services	Bhutan
38	Department of Integrated Design, Faculty of Architecture, University of Moratuwa	Sri Lanka
39	Department of Mechanical Engineering, Indian Institute of Technology Bombay	India
40	EiABC, Ethiopia Institute of Architecture, Building Construction and City Planning	Ethiopia
41	Eldorado Bambu/SustentarteBambu	Argentina
42	EMBRAPA ACRE	Brazil
43	Environment, Forest & Climate Change Department, Government of Mizoram & NABM	India
44	Faculty of Cooperatives and Community Development (FCCD) The Co-Operative University College of Kenya	Kenya
45	Faculty of Forestry, Bogor Agricultural University	Indonesia
46	FAO	Italy
47	Federal Ministry of Environment	Nigeria
48	Federal Ministry of Environment, Forestry Department	Nigeria
49	Federal Small-medium Manufacturing Industries Manufacturing Development Agency (FeSMMIDA)	Ethiopia
50	Filbamboo Exponents Inc.	Philippines
51	Forest Department	South East Asia
52	Forest Department, Madhya Pradesh	India
53	Forest Inventory and Planning Institute of the Ministry of Agriculture and Rural Development of Vietnam	Vietnam
54	Forest Products Research and Development Institute	Philippines
55	Forest Products Research and Development, Ministry of Environment and Forestry Indonesia	Indonesia
56	Forest Research Centre	Bhutan
57	Forest Research Institute	Myanmar
58	Forest Research Institute Malaysia (FRIM)	Malaysia
59	Forest, Social Forestry, Maharashtra	India
60	Forestry Administration	Cambodia
61	Forestry Commission	Ghana
62	Forestry Commission Ghana (timber industry development division)	Ghana
63	Forestry Department Peninsular Malaysia	Malaysia
64	Forestry Development Authority	Liberia
65	Forestry Research Institute of Ghana	Ghana

66	Forestry Research Institute of Malawi	Malawi
67	Generation 10	UK
68	Ghana Standards Authority (GSA)	Ghana
69	Global Bamboo Products Limited	Ghana
70	Government Organization	Nepal
71	Grow Fresh Urban Agricultural PlC	Ethiopia
72	Growmore Biotech Ltd.	India
73	ICFRE	India
74	ICRAF	Kenya
75	Idee Fixe Design SdnBhd	Malaysia
76	INBAR	Peru
77	INBAR	Ethiopia
78	INBAR	Canada
79	INRAB (Institut) GRAD-NGO, Group for Research and Actions for Sustainable Development	Benin
80	INRAB Benin/LABEF	Benin
81	Institute for Handicraft and Batik	Indonesia
82	Institute of Agricultural Research for Development (IRAD)	Cameroon
83	Institute of Regional Research and Development - Ministry of Science and Technology	Vietnam
84	Instituto de Botânica São Paulo, Brazil	Brazil
85	Interior Architecture & Furniture Production, Kumasi Polytechnic	Ghana
86	IUCN SSC Invasive Species Specialist Group/University of Auckland, New Zealand	New Zealand
87	Jawaharlal Nehru tropical Botanic Garden and Research Institute	India
88	Kenya Forest Service	Kenya
89	Kenya Forestry Research Institute (KEFRI)	Kenya
90	Kerala Forest Research Institute	India
91	Kwame Nkrumah University of Science & Technology, Faculty of Renewable Natural Resources, Department of Wood Science & Technology	Ghana
92	Land Use Policy Planning Department of the Ministry of Lands	Sri Lanka
93	Mariano Marcos State University	Philippines
94	Maseno University	Kenya
95	Mindanao Bamboo Initiatives	Philippines
96	Ministry of Productive Agriculture and Lands	Venezuela
97	Ministry of Agriculture and Fisheries	Samoa
98	Ministry of Agriculture and Natural Resource (Sustainable Land Management Program)	Ethiopia
99	Ministry of Agriculture, Food, and Forestry	Tonga

100	Ministry of Agriculture, Forestry and Fisheries	Cambodia
101	Ministry of Agriculture, Forestry and Food Security (MAFFS)	Sierra Leone
102	Ministry of Agriculture, Livestock and Fisheries, Ecuador	Ecuador
103	Ministry of Agroindustry	Argentina
104	Ministry of Environment	Panama
105	Ministry of Environment and Forestry and Climate Change	Ethiopia
106	Ministry Of Environment and Forestry of Indonesia	Indonesia
107	Ministry of Environment, Ecology and Forests	Madagascar
108	Ministry of Environment, Forest and Climate Change	Ethiopia
109	Ministry of Foreign Affairs	The Netherlands
110	Ministry of Forestry and Wildlife	Cameroon
111	Ministry of Higher Education and Highways	Sri Lanka
112	Ministry of Industry and Commerce	Sri Lanka
113	Ministry of Lands and Natural Resources	Ghana
114	Ministry of Life, Environment, and Forestry	Indonesia
115	Ministry of People Power for Productive Agriculture and Land	Venezuela
116	Ministry of Science, Technology and Innovation	Brazil
117	Ministry of Water, Irrigation and Electricity	Ethiopia
118	MOSO International BV	The Netherlands
119	MP Bamboo Mission Madhya Pradesh	India
120	National Association of Journalists, Chiriqui chapter	Panama
121	National Directorate of Forestry, Ministry of Land, Environment and Rural Development	Mozambique
122	National Forestry Authority	Uganda
123	Natural Resources Canada, Canadian Forest Service	Canada
124	Natureherit Design & Consult	The Netherlands
125	NBM	India
126	New Zealand Bamboo society	New Zealand
127	Nyaruguru District	Rwanda
128	ONG Foundation	Colombia
129	Philippine Bamboo Foundation, Incorporated	Philippines
130	PROGRESO	Peru
131	PROSPERER	Madagascar
132	Province Government of Santa Elena, Ecuador	Ecuador
133	PUSAKA	Malaysia
134	REBASP - São Paulo State Bamboo Network (RedePaulista do Bambu)	Brazil
135	Research Institute of Tropical Forestry, Chinese Academy of Forestry	China
136	Resource Fiber, LLC	USA
137	Rongmei Naga Baptist Association (RNBA)	India

138	Royal Botanic Gardens, Kew	UK
139	Royal Forest Department	Thailand
140	Rwanda Bamboo Organization (RBO)	Rwanda
141	São Paulo State Bamboo Net	Brazil
142	Sarawak Land Consolidation and Rehabilitation Authority (SALCRA)	Malaysia
143	Sarawak Timber Industry Development Corporation (STIDC)	Malaysia
144	SERFOR (National Forestry and Wildlife Service	Peru
145	Small Industries Development Organisation	Tanzania
146	Social Fund for Development	Egypt
147	South Asia Bamboo Foundation (SABF)	India
148	South China Botanical Garden, Chinese Academy of Sciences	China
149	South-west Forestry University	China
150	Sustainable Land Management Program	Ethiopia
151	Talent Food Forest – Nakaseke	Uganda
152	Tanzania Forest Service Agency (TFS) - North Ruvu Plantation	Tanzania
153	TECNOPEZ	Mexico
154	The Ministry of Environmental and Forestry	Indonesia
155	Tigray region Sustainable Land Management Program	Ethiopia
156	Toxicology unit, Department of Pharmacology, Faculty of Medicine, College of Health Sciences, Nnamdi Azikiwe University	Nigeria
157	Tripura Bamboo Mission - IL&FS Clusters	India
158	United Nations Industrial Development Organization, Food and Agriculture Organization, Sri Lanka Red cross, University of Colombo, University of Sri Jayewardenepura	Sri Lanka
159	Universidad de Panama	Panama
160	Universidad Nacional Autonoma de Mexico	Mexico
161	University of Pittsburgh	USA
162	University of Port Harcourt	Nigeria
163	University of the West Indies, Mona Campua, Jamaica	Jamaica
164	Uttarakhand CAMPA	India
165	Uzstandart Agency	Uzbekistan
166	Watershed and Water Resources Research Center (WWRRC) - Ecosystems Research and Development Bureau (ERDB)	Philippines
167	Waterstone Resource Fiber Ltd.	Kenya
168	Wood Science and Technology Division, Kerala Forest Research Institute	India
169	World Bamboo Organization	USA
170	World Resources Institute	USA
171	YES Bank Ltd.	India

Annex C Stakeholders survey results tables

Table 5 Country level responses to the GABAR stakeholders' survey

Country	No. of individual responses	Country	No. of individual responses
India	20	Peru	3
Ethiopia	19	Tanzania	3
Ghana	15	Uganda	3
Kenya	10	Argentina	2
Malaysia	10	Benin	2
Philippines	10	Cameroon	2
Indonesia	9	Canada	2
Jamaica	7	Mozambique	2
Bhutan	5	Myanmar	2
Brazil	5	New Zealand	2
Nepal	5	Rwanda	2
Nigeria	5	Suriname	2
Panama	5	Thailand	2
Sri Lanka	5	Venezuela	2
USA	5	Vietnam	2
China	4	Australia	1
México	4	Burundi	1
UK	4	Cuba	1
Cambodia	3	Egypt	1
Colombia	3	France	1
Ecuador	3	Nigeria	1
Hong Kong	3	Samoa	1
Italy	3	Sierra Leone	1
Liberia	3	South Africa	1
Madagascar	3	Tonga	1
Malawi	3	Uzbekistan	1
The Netherlands	3	South East Asia	1

Table 6 Regional responses to the GABAR stakeholders' survey

Region	Respondents	% of total responses
Africa	77	35.16
South-Eastern Asia	39	17.81
Latin America and the Caribbean	37	16.90
Southern Asia	35	15.98
Europe	11	5.02
Eastern Asia	7	3.20
North America	7	3.20
Oceania	5	2.28
Central Asia	1	0.46

Table 7 Organisational and institutional representation across the GABAR stakeholders' survey responses

Q.3: How would you best group or classify your organisation or institute?		
Answer Options	**Response Percent**	**Response Count**
Government	61.6%	135
Private sector	11.4%	25
Non-Governmental Organisation (NGO)	8.7%	19
Other	6.8%	15
Other public sector	5.5%	12
Inter-Governmental Organisation (IGO)	5.0%	11
Donors including philanthropic and development organisations (or others)	0.9%	2

Responses submitted as 'Other' under Q.3 were comprised of two groups: universities, academia, and research, and journalistic organisations.

Table 8 Occupational representation across the GABAR stakeholders' survey responses

Q.4: How would you classify your professional occupation?		
Answer Options	Response Percent	Response Count
Research	35.2%	77
Public sector policy making	22.8%	50
Other	18.3%	40
Private sector	9.6%	21
Land management	6.8%	15
Advocacy	4.6%	10
Communication	2.7%	6

Responses submitted as 'Other' for Q.4 included: development, spatial planning and architecture, law enforcement, education, forestry, human resources, furniture production, standards, and plant nurseries.

Table 9 GABAR stakeholders' level of interest in either bamboo and/or rattan

Q.6: Do you have any significant interest in bamboo or rattan (please indicate as appropriate)?		
Answer Options	**Response Percent**	**Response Count**
Yes, bamboo	58.0%	127
Yes, bamboo and rattan	34.7%	76
Other	3.7%	8
No	2.3%	5
Yes, rattan	1.4%	3

Responses submitted as 'Other' in Q.6 included: non-specific reference to 'Non-Timber Forest Products', and for educational use only.

Table 10 Mapping how and why GABAR stakeholders' have an interest in bamboo and/or rattan

Q.8: In what capacity or function does your interest in bamboo and/or rattan lay?		
Answer Options	**Response Percent**	**Response Count**
As a construction material (e.g. shelter, furniture, irrigation, other physical functions)	71.6%	141
Green economic development and rural development	66.5%	131
Climate change mitigation and adaptation	61.9%	122
Land restoration	53.8%	106
Biodiversity conservation	49.7%	98
As a fuel source	38.6%	76
As a food source	36.0%	71
As a trade commodity	33.5%	66
As a material for other purposes (e.g. clothing, disposable biodegradable sanitary products)	32.5%	64
As animal fodder or bedding	22.8%	45
From a taxonomic view point	14.2%	28
Other	8.1%	16
As an invasive alien species	3.6%	7

Responses submitted as 'Other' in Q. 8 include: education; source of income for poverty alleviation; peacebuilding initiatives, preservation of cultural heritage and living traditions; propagation; pharmaceutical research and development; evolutionary biology; and financing and supply chains.

Table 11 Scale at which GABAR stakeholders' are interested in bamboo and/or rattan

Q.9: At what scale does your interest in bamboo and/or rattan lay?		
Answer Options	**Response Percent**	**Response Count**
Industrial or commercial use (e.g. large-scale harvesting and processing for national or international market requirements)	48.7%	96
Subsistence use (e.g. small-scale harvesting and use for personal or community functions and requirements)	37.6%	74
Other	13.7%	27

Responses submitted as 'Other' under Q. 9 mostly included 'both' as an answer. Although many of the other responses were more thematic in nature rather than in reference to the scale focus of the question. Interesting responses included: research (including bamboo reproductive biology, flowering, breeding, and propagation); research and development; how private capital could play a role in strengthening their application; and site and landscape level conservation.

Table 12 Aspects and qualities of bamboo and/or rattan that are of importance to the GABAR stakeholders

Q.10: What is the most important aspect/quality of bamboo and/or rattan in terms of its potential contribution to the function(s) you have indicated in Q8 above?		
Answer Options	**Response Percent**	**Response Count**
Sustainable	73.6%	145
Contribution to rural livelihoods	70.1%	138
Fast growing	58.9%	116
Versatility	32.0%	63
Carbon neutral	30.5%	60
Other	6.1%	12

Responses submitted as 'Other' under Q. 10 include: cultural aspects; architectural applications; profitability; and 'all of the above'.

Table 13 GABAR stakeholders' interest in relation to specific drivers

Q.11: Is your interest in bamboo and/or rattan due to a particular policy driver?		
Answer Options	**Response Percent**	**Response Count**
Yes, development policies	48.2%	95
Yes, Green Economy policy	40.1%	79
Yes, achieving the UN Sustainable Development Goals (SDGs)	32.0%	63
Yes, agricultural policy	25.4%	50
Yes, National Biodiversity Strategies and Action Plans (NBSAPs)	24.4%	48
Yes, as a contributing factor to our/an Intended Nationally Determined Contribution (INDC) to the UN Framework Convention on Climate Change (UNFCCC)	24.4%	48
Culturally we have always used bamboo and/or rattan – therefore there is no direct link to a formal policy driver	23.4%	46
No	15.7%	31
Yes, achieving the Bonn Challenge	5.6%	11
Other	5.6%	11

Responses submitted as 'Other' for Q. 11 include: the WHO Framework Convention on Tobacco Control articles 17 [Provision of support for economically viable alternative activities] and 18 [Protection of the environment and the health of persons] (WHO, 2005); food security; standards; financial inclusion and small microfinance loans; and, sustainable forest management objectives.

Table 14 Respondents views on developing societies' use of bamboo and/or rattan

Q.12: Do you think there is scope to further develop societies' use and reliance upon bamboo and/or rattan in order to relieve pressure on tropical timber products and forests?		
Answer Options	**Response Percent**	**Response Count**
Yes	94.5%	186
No	3.0%	6
Other	2.5%	5

Table 15 Respondents' consideration of the limiting factors to more widespread use of bamboo and/or rattan

Q.13: What, if any, do you think are the major factors preventing bamboo and rattan from contributing more to societal and environmental goals?		
Answer Options	**Response Percent**	**Response Count**
Lack of capacity to develop, implement, or increase bamboo and/or rattan utilisation (please specify in the comments box if capacity needs are technical, financial, and, or institutional in nature)	46.2%	91
Lack of awareness of the potential for bamboo and/or rattan to contribute to societal and environmental goals	33.0%	65
Competition from other timber or non-timber forest resources that are more abundantly available, lower in price, and/or superior in physical and mechanical properties compared to bamboo and/or rattan for their intended use	10.2%	20
Policy barriers	6.1%	12
Other barriers	3.0%	6
Physical barriers (e.g. geographically difficult to access bamboo and/or rattan resources)	1.0%	2
Social barriers	0.5%	1

Table 16 Respondents' level of awareness of GABAR

Q.14: Are you aware of the planned Global Assessment of Bamboo and Rattan (GABAR)?		
Answer Options	**Response Percent**	**Response Count**
Yes	56.9%	112
No	37.6%	74
Other	5.6%	11

Of the 11 responses in the 'Other' category, the comments suggest that most of these respondents should have actually answered 'No' to Q.14. Taking this into consideration, a more accurate reflection of the results would be 57% answering 'Yes', and 43% answering 'No'. Question 15 explored from where the respondents answering 'yes' to Q.14 had heard about GABAR. The predominant themes were: workshops, conferences, seminars, congresses, meetings, and training; the internet and email; surveys; colleagues; and, INBAR.

Table 17 Identification of the GABAR stakeholders' most important features to be addressed by the assessment

Q.16: What do you think would be the most important feature for GABAR to address based on your interests in bamboo and/or rattan?		
Answer Options	**Response Percent**	**Response Count**
Total potential for contribution to green economic development (including rural livelihoods)	31.5%	62
Total potential market value of bamboo and/or rattan	18.3%	36
Total potential for contribution to climate change mitigation and adaptation	15.2%	30
Total potential for contribution to SDGs	9.1%	18
Updated inventory of bamboo and/or rattan	7.1%	14
Updated assessment of the extent of bamboo and/or rattan distribution	6.1%	12
Total potential for contribution to biodiversity value	4.6%	9
Stock-take of the state of the world's bamboo and/or rattan	2.5%	5
Total potential for contribution to land restoration	2.0%	4
Other	2.0%	4
Total potential for contribution to other policy drivers	1.5%	3

Responses submitted as 'Other' for Q. 16 include:

• Scaling-up of results of the trilateral cooperation of East Africa, China, and INBAR.

• Fundamental baselines of rattan diversity, distribution and relationships (including phylogenetic research) as rattan remains very poorly understood at the most basic biological level.

• Building public awareness about the properties and potential of bamboo.

• Capacity development in post-harvest processing to increase value-addition, allowing greater competition in the global market place.

• Focus on potential of bamboo to act as an alternative fuel-source, i.e. developing bamboo-based bio-fuel production including bio-oil and bio-coal.

• Specific reference to provenance/origin information, possibly through an updated inventory, demonstrating natural distribution and range, indicating species that are introduced and invasive where relevant.

Annex D GABAR Stakeholders' survey: top responses relevant to policy-relevant question development, and draft possible policy-relevant questions

Q.8: In what capacity or function does your interest in bamboo and/or rattan lay?

Top responses = *As a construction material (139, 71.3%)*
Green economic development and rural development (130, 66.7%)
Climate change mitigation and adaptation (121, 62.1%)
Land restoration (105, 53.8%)
Biodiversity conservation (98, 50.3%)

Possible policy-relevant questions:

What are the main barriers or constraints preventing more uptake and use of bamboo and/or rattan as a construction material?

What are the requirements to further exploit bamboo and/or rattan as a construction material globally?

How can the use and exploitation of bamboo and/or rattan most effectively contribute to green economic development and rural development in the global south?

What mechanisms need to be implemented or put in place to facilitate the most effective contribution of bamboo and/or rattan to green economic development and rural development in the global south?

How can bamboo be employed most effectively to significantly contribute to climate change mitigation and adaptation?

Where can bamboo plantations be established and exploited to achieve the most significant contributions to climate change mitigation and adaptation?

What is the potential of bamboo to contribute to global land restoration? [overarching/high-level Q?]

By establishing bamboo plantations on severely degraded and damaged land in countries of the global south, what is the potential for contribution to climate change mitigation and adaptation?

What specific contributions can the use of bamboo deliver to the achievement of Aichi Biodiversity Target 14, and how much?

What specific contributions can the use of bamboo deliver to the achievement of Aichi Biodiversity Target 15, and how much?

How much land (in thousands of hectares) in countries of the global south is regarded as severely degraded and could be restored by establishing bamboo plantations, and what would be the positive externalities of doing so?

What is the potential contribution of establishing bamboo plantations to biodiversity conservation – and what are the most important species/species compositions to achieve the maximum biodiversity conservation contributions per biogeographic region?

Q.10: What is the most important aspect/quality of bamboo and/or rattan in terms of its potential contribution to the function(s) you have indicated in Q8 above?

Top responses = *Sustainable (143, 73.3%)*
Contribution to rural livelihoods (137, 70.3%)
Fast growing (114, 58.5%)

Possible policy-relevant questions:

What is required to leverage the sustainable qualities of bamboo and/or rattan to make a transformative change to its uptake and use as a material for construction and other applications in order to lower society's reliance upon tropical timber products?

A key externality from greater establishment and use of bamboo and/or rattan is its contribution to rural livelihoods: what is the true scale of this contribution, and what is the total potential?

What is the best species or species composition of bamboo plantation to establish in each region to achieve multiple benefits of rapid biomass production, biodiversity conservation, land restoration, and climate change mitigation and adaptation?

Q.11: Is your interest in bamboo and/or rattan due to a particular policy driver?

Top responses = *Yes, development policies (94, 48.2%)*
Yes, green economy policy (78, 40.0%)
Yes, achieving the UN SDGs (62, 31.8%)

Possible policy-relevant questions:

How can bamboo and/or rattan be best employed to provide significant contributions to achieving development policies?

Where and how is it most important to focus efforts on establishing, developing, and utilising bamboo and/or rattan plantations and markets to achieve the most significant contributions towards achieving development policies?

What should be the main focus in terms of developing bamboo and/or rattan use to deliver the most significant returns in achieving green economy goals and targets in countries of the global south?

How can countries of the global south utilise and exploit bamboo and/or rattan most effectively to achieve or contribute to their green economy goals and targets?

How can we measure the contribution of, or potential for, bamboo and/or rattan use and exploitation to achieving the UN SDGs (specifically 1, 7, 11, 12, 13, and 15)?

Q.12: Do you think there is scope to further develop societies' use and reliance upon bamboo and/or rattan in order to relieve pressure on tropical timber products and forests?

Yes = *184, 94.4%*

Possible policy-relevant questions:

How can society most effectively and sustainably maximise its use of bamboo and/or rattan to reduce the over exploitation of tropical timber products and forests?

What are the resource and capacity, financial, institutional, and technological barriers that need to be overcome in the main bamboo growing regions in order for bamboo derived materials to replace the market share of unsustainably sourced tropical timber?

Q.13: What, if any, do you think are the major factors preventing bamboo and rattan from contributing more to societal and environmental goals?

Top responses = Lack of capacity to develop, implement, or increase bamboo and/or rattan utilisation (91, 46.7%)
Lack of awareness of the potential for bamboo and/or rattan to contribute to societal and environmental goals (65, 33.3%)
Competition from other timber or non-timber forest resources that are more abundantly available, lower in price, and/or superior in physical and mechanical properties compared to bamboo and/or rattan for their intended use (19, 9.7%)
However, numerous comments (82) were submitted in accompaniment of the answers to this question and some crude analysis reveals that the most dominant themes are 'technical', 'financial', 'capacity', and 'institutional', accompanied by several regularly occurring descriptive terms including 'needs', 'lack', 'development', 'products', 'use', and 'policy' and 'policies'.

Possible policy-relevant questions:

How and where can capacity to establish, harvest, and process bamboo and/or rattan be developed most effectively to contribute significantly to development and sustainability goals and targets?

How can market perception and opinion be won over by bamboo, and inso doing, move away from its reliance on, and demand for, tropical timber?

What incentives and/or disincentives are encouraging the continued use of tropical timber products, therefore preventing greater uptake and use of bamboo and/or rattan?

Are there sufficient co-benefits from the establishment and use of bamboo plantations to attract funding or subsidisation and make bamboo a more economically attractive product than cheap and/or illicit tropical timber?

Q.16: What do you think would be the most important feature for GABAR to address based on your interests in bamboo and/or rattan?

Top responses = *Total potential for contribution to green economic development (inc. rural livelihoods) (62, 31.8%)*
Total potential market value of bamboo and/or rattan (36, 18.5%)
Total potential for contribution to climate change mitigation and adaptation (28, 14.4%)

Possible policy-relevant questions:

What is the total potential for bamboo and rattan to contribute to green economic development?

What is the total actual versus potential market value of bamboo and/or rattan, and how can it be realised?

What is the total potential value of ES derived from bamboo and rattan and how can it be leveraged?

International Bamboo and Rattan Organisation established in 1997. INBAR is dedicated to improving the social, economic, and environmental benefits of bamboo and rattan. INBAR plays a unique role in finding and demonstrating innovative ways of using bamboo and rattan to protect environments and biodiversity, alleviate poverty, and facilitates fairer pro-poor trade. INBAR connects a global network of partners from the government, private, and not-for-profit sectors in over 50 countries to define and implement a global agenda for sustainable development through bamboo and rattan.

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