Sustainable Agro-Forestry Development Practices

[as Regional Climate-Environmental Observatories]

Bamboo

Territorial Landscape Ecosystems

K@T

Knowledge@Terra Classrooms

Sustainable Agro-Forestry Development Practices

Green Gold Dialogues

Exchange Interface

Developing Territorial Agro-Forestry Practices and Green Sectors with Bamboo

Territorial Landscape-Eco Systems are important contributors to the worldwide evolution towards sustainable development, green-circular economic transition and carbon neutrality. **Bamboo-Rattan Integrated Agro-Forestry Solutions and Related Green Sectors** are among the highest potentials, providing energy, food and resources for a wide range of products and ecosystem services. As many solutions are unknown for regional spatial planners, designers, innovators, managers, investors, financiers, policy makers and the public, the International Bamboo and Rattan Organisation (INBAR) plans to introduce a set of innovative programs to build more transparent and effective knowledge-sharing among all stakeholders:

In order to incorporate bamboo- and rattan-related territorial solutions better into spatial land-use planning, carbon-neutrality plans, green-tech innovation and sustainable investment-finance mechanism and facilitating regional exchanges on policy practices, INBAR is working with **Knowledge@Terra Classrooms (K@T)** on a series of information exchange interfaces that are based on local solutions and spatial planning cases. These capacity-building tools will become part of the INBAR's E-learning Programme and K@T and will be showcased and discussed in **Green Gold Dialogue (GGD)** sessions. This joint project will help regional and local stakeholders discover and communicate bamboo- and rattan- related territorial landscape ecosystems and solutions in agro-forestry practices and nature-based green sectors. It will provide them with integrated development capacity evaluation tools, with which they can better target and present local development plans to potential investors and co-operators at national and international levels.

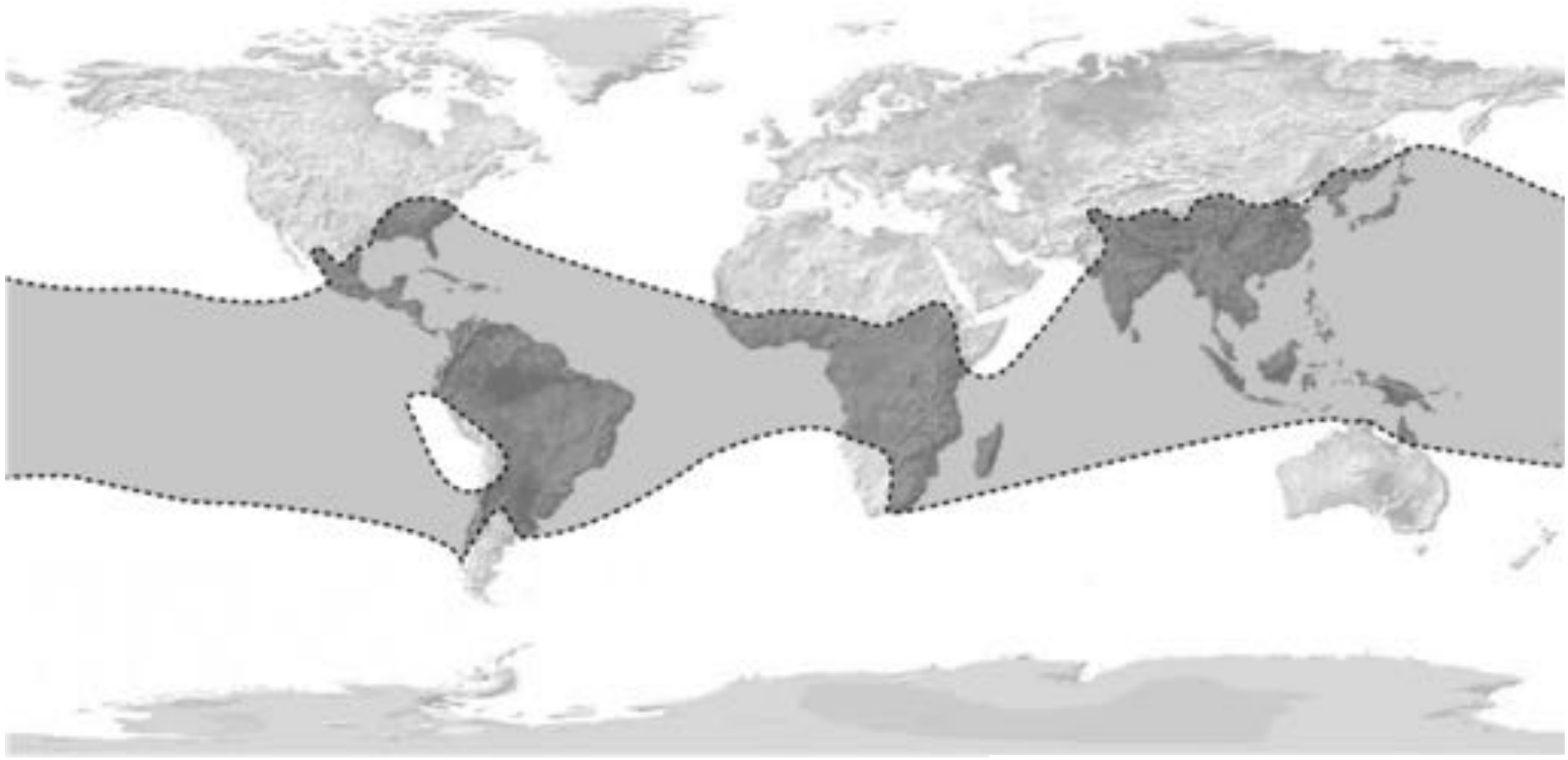
Knowledge@Terra Classrooms and Green Gold Dialogues are designed and developed by NATUREHERIT DC.

NATURE HERIT 自然颖源 ®

Contact: training@inbar.int, xyliu@natureheritage.com

Sustainable Agro-Forestry Development Practices
[as Regional Climate-Environmental Observatories]

Bamboo in Global Regions



Global bamboo distribution | Source: INBAR

Fastest Growing Plant Species

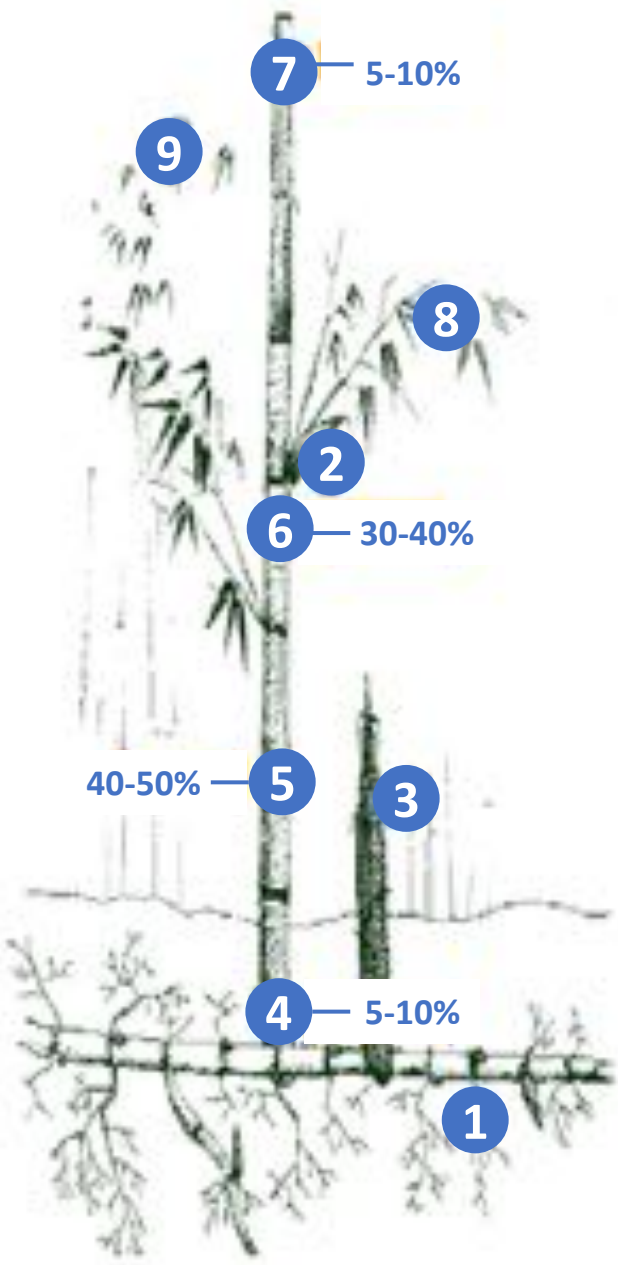
Fast-growing bamboo forests and plantation groups are integrated in local agro-forestry systems (including forestry, agricultural and protected areas), supporting a wide range of forest products. The main barrier to bamboo industrial development is the lack of technical knowledge and demonstration, as cultivation and processing knowledge (artisanal and industrial) is more localised in rural areas. Trans-regional exchanges of policy-practice framework ought to be set up to replicate and upscale bamboo industry more rapidly and sustainably.

❊ Since 1978 over 750,000 km2 of the Amazon rainforest have been destroyed across Bolivia Brazil, Colombia, French Guiana, Guyana, Peru, Suriname and Venezuela. [https://rainforests.mongabay.com]

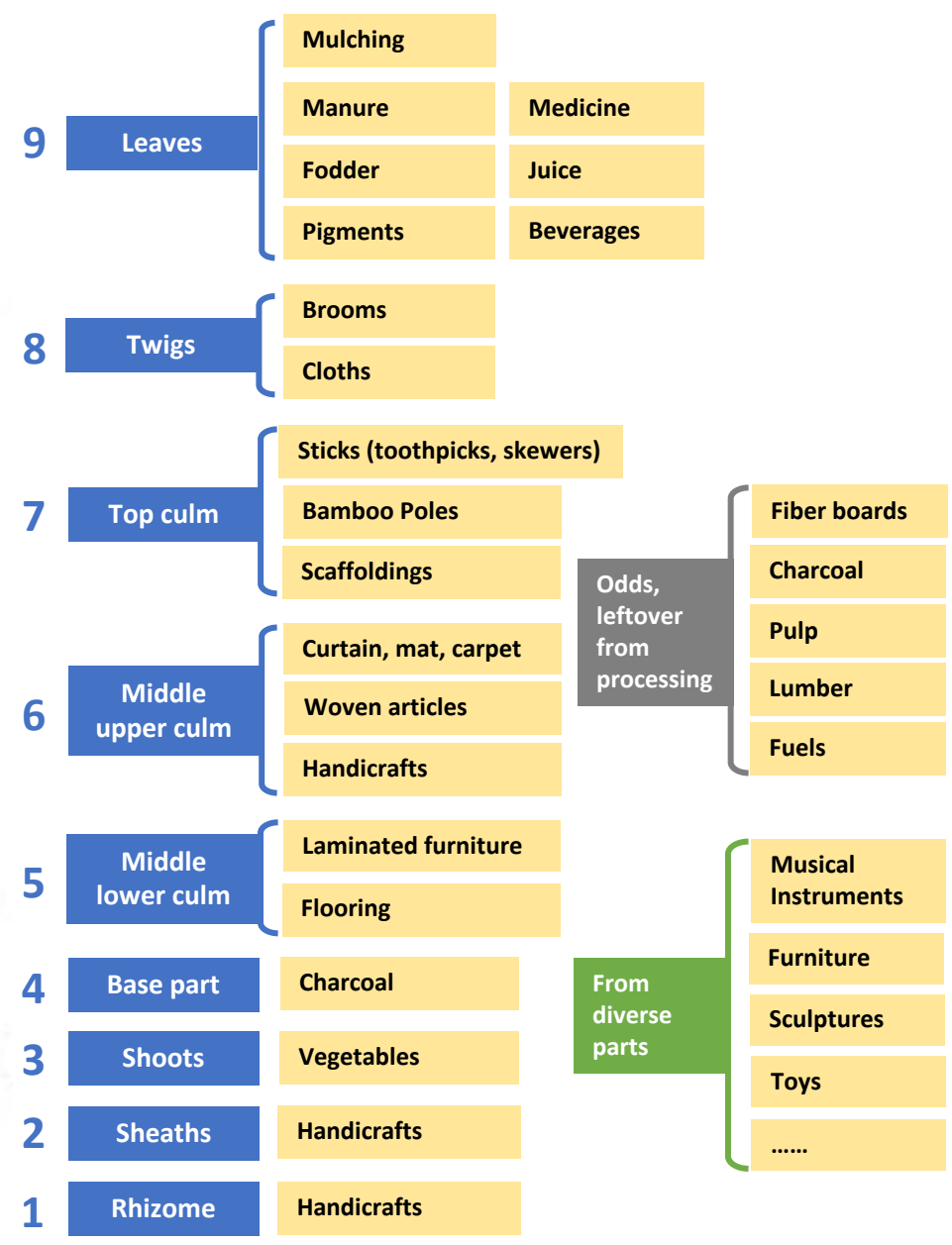
❊ Bamboo has been measured to grow 1.21 m (47.6 inches) in a 24-hour period. Most bamboo (used for gardening) will grow closer to 3-5 cm (1-2 inches) in a day. [David Farrelly, The Book of Bamboo, Wikipedia]

Different Functions of Bamboo Components

At least 3,000 products made of bamboo exist in global regions. To achieve flourishing livelihoods and Green Deals, highly efficient bamboo biomass utilization and effective carbon storage in the products needs to be realized as a joint effort in the near future.



2021 edition. Credit: Jin Wei, INBAR



Sustainable Agro-Forestry Development Practices
[as Regional Climate-Environmental Observatories]

Link Global Bamboo Cultivation and Territorial Landscape-Eco Systems, as well as Bamboo Sectors and Carbon Storage

As a giant woody grass, bamboo is a diverse group of evergreen plant that grows mainly in more than 80 tropical, sub-tropical and temperate (partial) countries worldwide. The 2016 World Checklist of Bamboo and Rattan of the International Bamboo and Rattan Organisation (INBAR) notes that, there are over 1600 identified bamboo species. According to the 2020 Forest Resources Assessment (FRA) of the Food and Agricultural Organization of United Nations (UN-FAO), bamboo covers 35 million hectares across the world.

Bamboo cultivation is an essential part of the global bamboo coverage, as well as related agro-forestry management and territorial landscape ecosystems. Adapting to local conditions and establishing suitable bamboo integrated agro-forestry management systems is the basis to introducing sustainable cultivation, increasing carbon storage and obtain carbon credits, enabling technology and knowledge transfer and developing suitable projects, programmes and plans. Based on bamboo cultivation to sustain raw materials as well as agreeable environment and practice knowledge, more bamboo sectors for local livelihoods can be established. This will contribute to extra carbon storage in bamboo products besides that within the cultivation environment.
Following the worldwide crisis caused by the Covid-19 pandemic and increasing effects of climate change, increased use of diverse bamboo functions and sectors in local agro-forestry management, sustainable production-consumption, carbon emission reduction etc. is highly recommended. Multi-actor learning of successful bamboo-related solutions to cultivation, production and livelihood in territorial landscape ecosystems will lead to improved agriculture, forestry, protected areas, more water resource and biodiversity.

Bamboo

Bamboo forest and farms contribute to land restoration, erosion prevention and bio-diversity support. The cultivation and harvest provide construction material, alternative timber, bio-materials, fibre, energy, food, feed and fodder.

Territorial Landscape Ecosystems

Bamboo-Integrated Territorial Landscape Ecosystems include forest, agroforestry, farmland, gardens, protected areas and water-wetland eco systems with bamboo species in tropical, sub-tropical and temperate (partial) regions. These systems provide a wide range of natural products (from food, timber, fibre to energy) and ecosystem services (erosion, floods and drought prevention, carbon storage, climate regulation, climate-resilient agriculture supports, bio-diversity, cultural landscape and healthy environment etc.).

Image Source INBAR | https://www.chinasage.info/bamboo.htm | Internet | Luc Boeraeve

Features ❋ Values

Features of Bamboo:
- Grows fast
- Renewable and annually harvestable resource
- Fibrous roots, holds fertile topsoil
- Strength and elasticity higher than steel
- Aesthetic, educational, cultural heritage
- Bamboo shoots are edible, healthy;
- Bamboo leaves can be used for medicinal products, tea and animal fodder.

Values of Bamboo Cultivation:
- Substitute for wood, steel, cement, plastic and other high-pollution, high-energy materials
- Alternative sustainable biomass energy
- Disaster prevention and rehabilitation (erosion, landslide, flood, windbreak)
- Healthy food & green manure (bamboo leaf, biochar etc.)
- Employment creation and poverty reduction
- Versatile uses, 3000+ products & applications
- Carbon storage / sequestration

Features of Bamboo-Integrated Territorial Landscape-Eco Systems:
- Involvement of one of the fastest growing plants
- Annual regeneration and harvesting possibility
- Bio-diversity, soil and water management
- Many varieties for timber, energy, food, feed and fodder
- Aesthetic, educational, cultural heritage
- Huge CO_2 sequestration potential

Values of Bamboo & Agro-Forestry Cultivation:
- Nature conservation for regional environment, supports organic-sustainable agriculture, link cultivation and livestock systems
- Renewable energy (bio energy from bamboo & wood)
- Bamboo and integrated forestry for disaster prevention and rehabilitation (erosion, landslide, flood, windbreak)
- Healthy food (NTFP products etc.) & green manure (varied leaves, biochar etc.)
- Serene environment, quality of life
- Versatile and widely used nature-based architecture and construction
- Carbon storage / sequestration

Sustainable Agro-Forestry Development Practices
[as Regional Climate-Environmental Observatories]

INBAR

Bamboo & Rattan for Sustainable Development Goals

SDG 1: End Poverty

Grown locally in some of the poorest communities in the tropical and sub-tropical belt, bamboo and rattan have a long history of use in many societies. The processing of new products can build on existing skills and is more likely to be chosen by stakeholders than an entirely new technology. Therefore, bamboo and rattan can generate new income streams and a better quality of life for rural people through creation of small businesses, social enterprises and women's and community groups. Bamboo and rattan production and trade create pro-poor, non-timber forest products from territorial agro-forestry systems.

SDG 7: Affordable & Clean Energy

Bamboo is a strategic but often overlooked resource to achieve clean and sustainable energy access for all. Being a globally important bio energy resource, bamboo biomass can be used directly as fuelwood, turned into charcoal or pellets for cooking and heating or converted into gas for thermal and electrical energy generation. Bamboo cultivation and conversion into charcoal also offers great potential for income generating options. In Africa (e.g. Tanzania), a rural household can earn over USD 1000 a year from producing bamboo charcoal.

SDG 11: Sustainable Cities and Communities

Bamboo offers millions of households across the world employment and building materials, reducing pressure on forest resources and replacing cement and plastic in drainage pipes, housing and storage facilities. It is also used to create resilient structures that can withstand earthquakes. Engineered construction products, such as prefabricated bamboo housing, allow bamboo to transform into standardised dimensions, enabling its easy use in modern structures. Bamboo panels and flooring often outperform their wooden counterparts by certain technological measures of strength and rigidity.

SDG 12: Sustainable Consumption & Production

Bamboo is an excellent renewable resource, often used as a fast-growing alternative to timber. Although taxonomically bamboo is a grass species, some kinds of bamboo grow over a metre a day and mature rapidly, becoming hard and wood-like within a small number of years. Besides being renewable, bamboo products are versatile and have a low or negative carbon footprint across the lifecycle. Bamboo has thousands of uses, and can replace timber resources and high-carbon-emission materials, including PVC, steel and concrete. It creates useful products in public infrastructure, such as pipes, housing and storage facilities.

SDG 13: Climate Change

Bamboo is an extremely strategic – yet largely untapped – resource for countries to combat the negative effects of climate change. With an extraordinary growth speed and versatile features, bamboo is an excellent tool for large-scale carbon storage. Well-managed bamboo plants and products can sequester more carbon than many trees. Bamboo is also gradually being recognised as a globally important source of bioenergy to accelerate the progress of carbon neutrality. Including bamboo in climate change policies and rural development investments makes countries' Sustainable Development Goals more achievable.

SDG 15: Life on Land

Bamboo and rattan are a key part of biodiverse landscapes and systems in all continents where they grow, with many mammal, insect and fungal species dependent on bamboo and rattan for their survival.
Bamboo and rattan provide a direct source of nutrition for many primates, such as the giant panda, mountain gorilla, the bale monkey, ancient reptiles, the greater bamboo lemur and Angonoka, the world's rarest tortoise. They also provide shelter, dwelling and habitats for many primates across the world. By enriching and protecting forests, they are key for the protection of endangered species.

Image & info Source: INBAR

Sustainable Agro-Forestry Development Practices

[as Regional Climate-Environmental Observatories]

INBAR

Key Bamboo Functions with Integrated Agro-Forestry

to Fight Disasters & Threats

Globally: *Asia, Africa, North America, South America, Europe, Oceania*

= Combined Risks

Disasters & Threats | ***Bamboo Functions***

+ Integrated Agro-Forestry

Extreme Weather, Flood, Drought, Landslide, Soil-Water & Coastal Erosion

Land Restoration, Soil-Water Management & Coastal Defence

Climate change and extreme weather cause natural disasters in all continents. Bamboo forests work to efficiently safeguard against floods, droughts, landslides and soil-water and coastal erosion. To restore land, ecosystems and climate resilience, sustainable bamboo cultivation can be widely used in mountains, farmlands, river- and lakesides, etc. Coastal defence structures with bamboo have been used in different countries. [Image: Kerala floods: The ghost of past environment policy returns, Mongabay | INBAR]

Deforestation for Agriculture and Industry

Agro-Forestry Practices & Food Production

Land value is the key driver of deforestation. Commercial interest groups are continuously looking for cheap land and, after destroying the forest, use it for a wide range of agricultural and industrial development. Agro-forestry solutions, including bamboo shoot harvesting, can encourage people to manage forests as sustainable income resources and stop mass deforestation. [Source & Image: Statistic of the Decade: The Massive Deforestation of the Amazon, by Liberty Vittert, The Conversation | Wechat: Zhejiangsheng Nonglintong]

Deforestation for Construction & Furniture

Construction, Building & Furniture

Rapid urbanisation growth has driven the global demand for wooden building materials and furniture, which has led to massive deforestation and illegal logging to satisfy the demands of the local and export markets. Bamboo is an excellent wood substitute product. Innovative technologies and technical improvement have given rise to new products for prefabricated bamboo buildings, infrastructural facilities and more. [Image: 15 Strategies How to Reduce and Prevent Deforestation by Sara Poescu Slavikova, Green Tumble | ICBR, China]

Deforestation for Fuelwood

Bioenergy & Carbon Scheme

Deforestation for fuelwood is still threatening forests in poor regions in the world. Small-scaled bamboo-fuelled cooking equipment and bamboo bioenergy plantation are effective ways to use fuelwood while increasing sustainable forestry management. Carbon trade has been explored for wide application, reducing emission in bamboo plantation areas and across global regions. [Image right: https://www.bambooindustry.com]

Overuse of Wood, Cotton and Plastic Resources

3000+ Bamboo-Products

Overuse of wood, cotton and plastic resources results in various environmental problems. More than 1000 bamboo products, from laminated bamboo composites to bamboo fibre and household utilities, can replace a great variety of them. Bamboo commodity trade is just emerging, supporting sustainable development of poor and developing regions. [Image: https://theplasticchallenge.org | www.bamboodiapersonline.com | Relationship of structure and stiffness in laminated bamboo composites, Penellum et al 2017]

6

Loss of Traditions & Rural Poverty

Art & Culture, Health Care & Tourism

Loss of traditions and rural poverty, accompanied by loss of “genius loci” (Latin: sense of place), are threats resulting from urbanisation and commercial plot development. With historical values and appealing features to city and rural residents, bamboo’s artistic and values and potential for healthcare and tourism can be explored and integrated in rural development in many regions. [Image: www.fao.org | https://www.1688.com]

Sustainable Agro-Forestry Development Practices

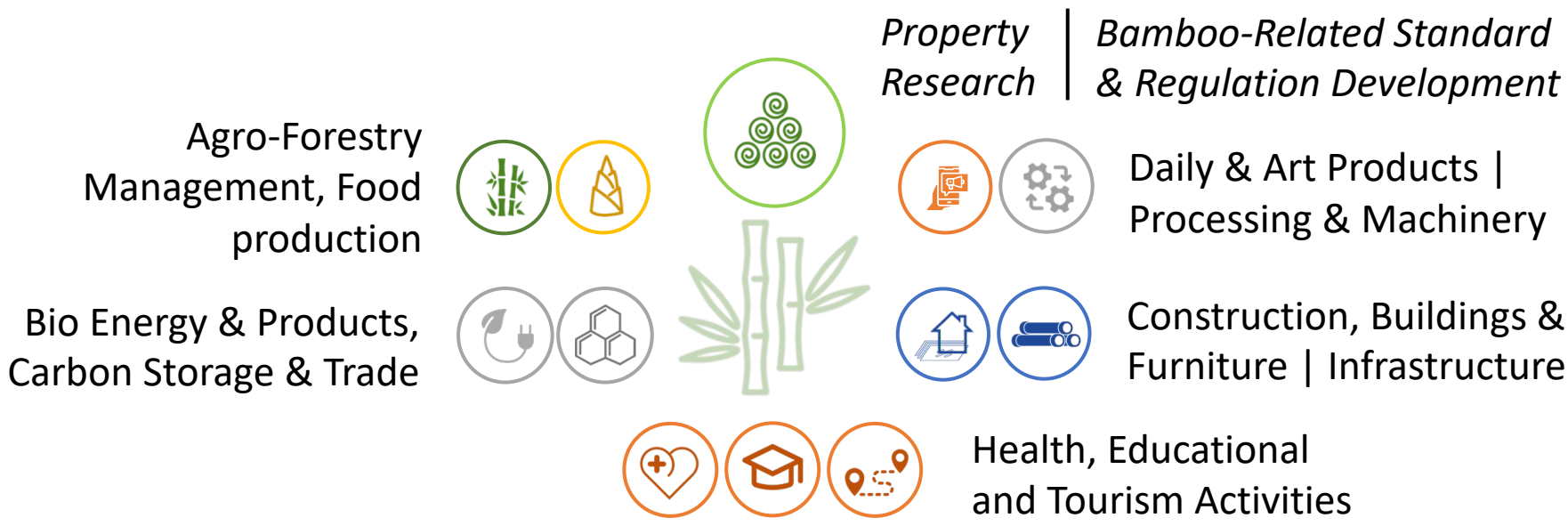
[as Regional Climate-Environmental Observatories]

Covering more than 80 countries, **Bamboo-Rattan Integrated Territorial Landscape Ecosystems** are important contributors of the worldwide evolution towards sustainable development, green-circular economic transition and carbon neutrality.

Image Source https://www.chinasage.info/bamboo.htm | Luc Boeraeve | Internet | INBAR |https://www.nomadicmatt.com

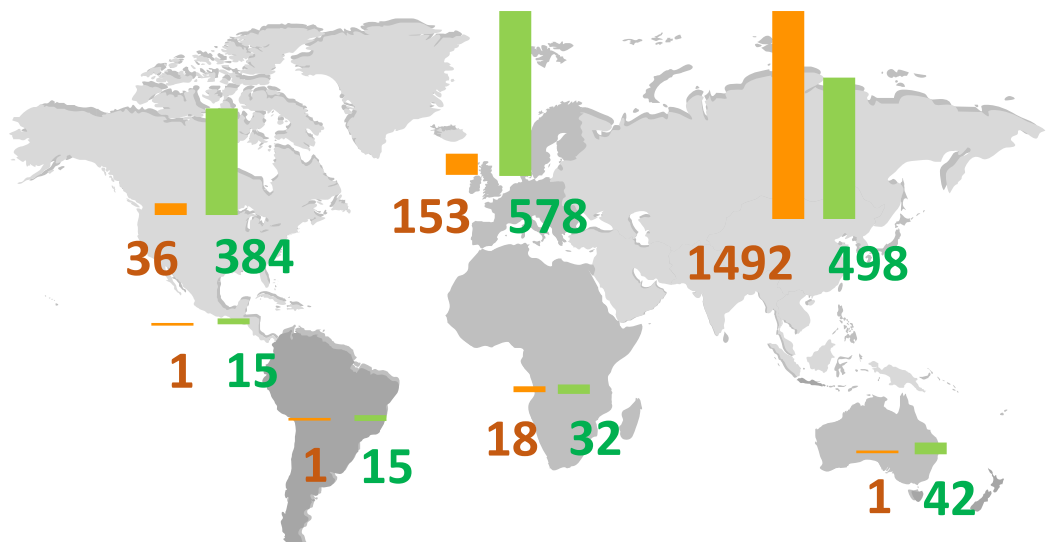
Bamboo-Related Sectors and Industries

Bamboo-related sectors and industries cover an enormous range, from land restoration, eco cultivation, manufacturing and energy, to services and open innovation. | Source: NATUREHERIT



Bamboo & Rattan Commodities in the International Market, Trade Overview 2017

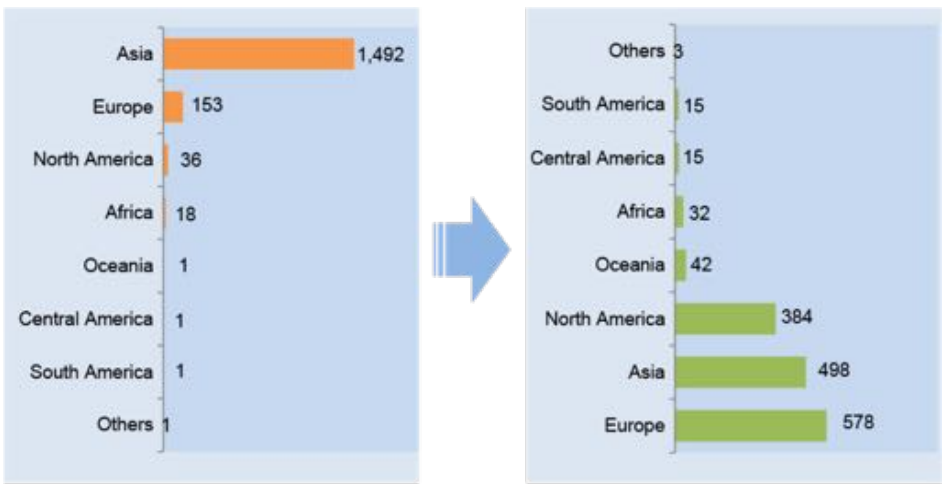
(Unit: USD million) | Source: INBAR



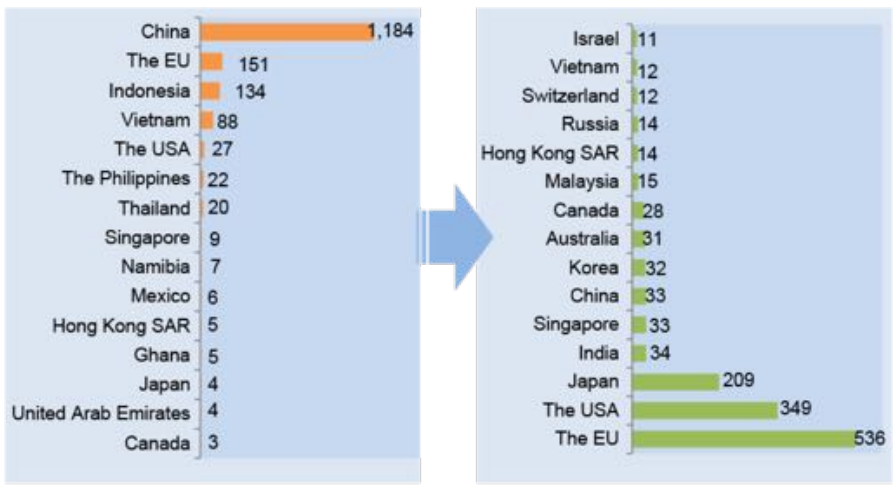
The world map above shows bamboo and rattan trade in continents (drafted by Natureherit according to the INBAR report)

An important note from the Introduction of the report:

"The trade figures quoted in this report, including the overall figure of USD 1.7 billion, may well be an underestimate. In fact, it is likely that a large amount of the international trade in bamboo and rattan products is not reported in the Harmonized Commodity Description and Coding Systems (HS), as products are often mis-classified as timber products."



Bamboo and rattan trade in continents



Bamboo and rattan trade in countries

Sustainable Agro-Forestry Development Practices

[as Regional Climate-Environmental Observatories]

Key Bamboo Standards & Regulations

in Process of Development

Globally: *Asia, Africa, North America, South America, Europe, Oceania*

International trade of all types of bamboo products, from whole culms to technologically advanced products, requires internationally accepted standards and product conformity.
As an important aspect of knowledge and industrial promotion, various endeavours for bamboo-related standards and regulations need to be integrated and carried out at an international level, leading to internationally accepted standards and technical product descriptions. Presently, INBAR and various bamboo-producing and trading countries are main drivers. Various workgroups for bamboo-related standards are meeting and discussing to establish appropriate technical standards for bamboo features, construction and products, which needs to be accelerated.
The framework overview for standards and regulations related to bamboo is provided below:

Image Source https://www.chinasage.info/bamboo.htm | INBAR | ICBR | Asian-Pacific Model Forest Network | Zhejiang Province Forestry Technology Promotion Station, China | Internet

National and Regional Standards (Partial)

Agro-Forestry Management

Bamboo & Forest Management

Food Production

Bamboo shoot cultivation [China], Green Food Standard [China]

Property Research

ISO: Determination of physical and mechanical properties of bamboo materials

Daily & Art Products

ISO, CE Standard of different products; Bamboo product import and export regulation [China]

Processing & Machinery

Complex materials of bamboo and plastic; Bamboo material for gardening; Anticorrosion bamboo material [China]

Building, Construction & Furniture

Bamboo Structural Design, Anti-Earthquake Building Standard [Columbia]; Bamboo-Wood Wall Construction, Bamboo floor plate, Bamboo-made scaffold standard [China]

Carbon Storage & Trade

Bamboo forest carbon accounting method for Chinese Certified Emission Reduction CCER [China]

Infrastructural Construction

Bamboo Winding Composite Standard [China]

International Standards (Partial)

Property Research

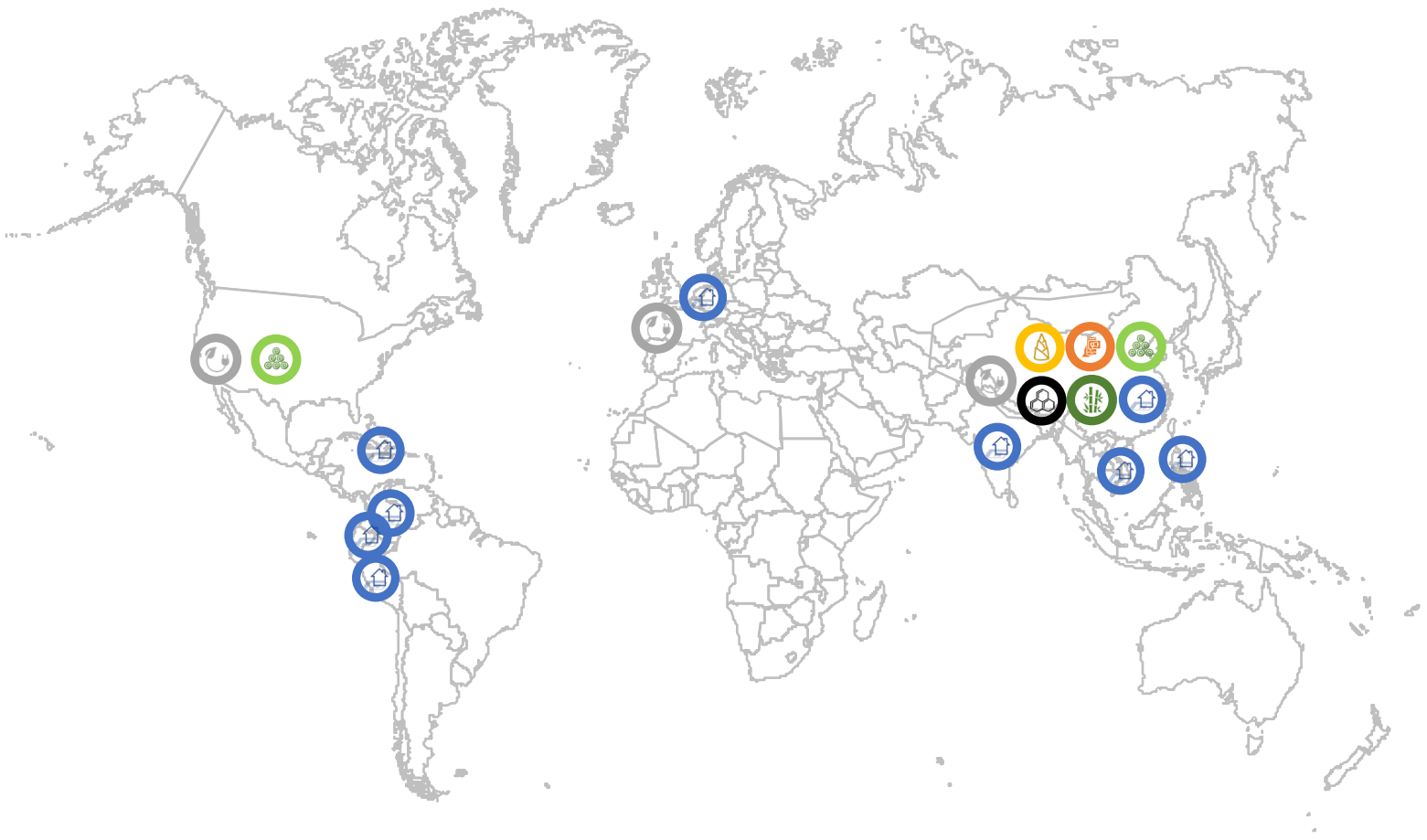
ISO 22157:2019: Bamboo structures — Determination of physical and mechanical properties of bamboo culms — Test methods

Bio Energy & Products,

Bamboo charcoal: Generalities (ISO 21626-1:2020), fuel applications (ISO 21626-2:2020), and purification applications (ISO 21626-3:2020).

Building, Construction & Furniture

Bamboo Building Construction (in process)



Sustainable Agro-Forestry Development Practices

[as Regional Climate-Environmental Observatories]

International Bamboo and Rattan Organisation (INBAR)

www.inbar.int

Bamboo, the fast-growing grass plant, and rattan, the climbing palm, are important nature-based solutions to a number of pressing global challenges pertaining to carbon storage, land restoration, poverty alleviation, green trade, climate change mitigation and adaptation, resilient construction and environmental protection.

The **International Bamboo and Rattan Organisation (INBAR)** is an intergovernmental development organisation that promotes environmentally sustainable development using bamboo and rattan, as well as sustainable development of bamboo and rattan resources. It combines, coordinates and supports strategic and adaptive research and development of bamboo and rattan resources; enhances the welfare of bamboo and rattan producers and consumers and promotes inclusive and green development of bamboo and rattan sectors. Established in 1997, INBAR currently has 47 Member States. In addition to its Secretariat Headquarters in China, INBAR has five Regional Offices in Cameroon, Ecuador, Ethiopia, Ghana and India. INBAR is an observer of the general assembly of the United Nations. At present, with its member countries being mainly from developing regions, INBAR is an important platform for South-South cooperation.

The **47 INBAR Member States** lie mostly in East, South & South-East Asia, South, Central Middle & North America, Africa and Pacific Islands, that have bamboo and/or rattan as natural resources, products and services, are in need of inclusive and green development of bamboo and rattan sectors. As part of the INBAR E-Learning Programme, **Knowledge@Terra Classrooms and Green Gold Dialogues** promote bamboo-rattan integrated agro-forestry practices and green sector solutions worldwide, aiming at solution-based exchange with key stakeholders on national and regional levels, local and regional development plans, as well as production, market and trade chains, research, innovation and investment-financial platforms.

Map Source: INBAR

47 Member States of INBAR (by Feb. 2021)

1. Argentina
2. Bangladesh
3. Benin
4. Bhutan
5. Brazil
6. Burundi
7. Cambodia
8. Cameroon
9. Canada
10. Chile
11. China
12. Central Africa Republic
13. Colombia
14. Republic of the Congo
15. Cuba
16. Ecuador
17. Eritrea
18. Ethiopia
19. Fiji
20. Ghana
21. India
22. Indonesia
23. Jamaica
24. Kenya
25. Liberia
26. Madagascar
27. Malawi
28. Malaysia
29. Mozambique
30. Myanmar
31. Nepal
32. Nigeria
33. ✧Panama
34. Peru
35. Philippines
36. Rwanda
37. Senegal
38. Sierra Leone
39. Sri Lanka
40. Suriname
41. Tanzania
42. Thailand
43. Togo
44. Tonga
45. Uganda
46. Venezuela
47. Viet Nam

Sustainable Agro-Forestry Development Practices
[as Regional Climate-Environmental Observatories]

CAPACITY BUILDING AND TRAINING of INBAR

SDG 17: Partnerships for the goals

Bamboo and rattan grow in all continents and have been used in some countries for thousands of years. Therefore, it is common to want to vigorously develop the bamboo and rattan industry and share successful experiences. INBAR is the only intergovernmental organisation that promotes the use of bamboo and rattan for environmentally sustainable rural development in cities and rural areas. With professional information and technology in the field of bamboo and rattan, it provides a platform and media for member countries to share their knowledge, technology and strategy in the management and use of bamboo and rattan resources.
(see South-South Cooperation Report, in corperation with UN)

Capacity Building and Training Activities in Partnership with Donors and Partners

Image Source: INBAR

One particularly important area of INBAR's work is its capacity-building and training activities, carried out over the years in partnership with a wide range of donors and partners. So far, INBAR has trained between 15,000 and 25,000 people across the world, making a significant contribution to the application of global bamboo and rattan knowledge for sustainable development. As policy decision makers, many trainees have gone on to influence bamboo and rattan development at regional, national and international levels. *(Left: A high-level delegation from Pakistan visits INBAR headquarter.)*

From technical workshops and delegation visits to on-site and e-learning courses, the training covers a wide range of topics: Biodiversity conservation, ecological reconstruction, sustainable agro-forestry management (including cultivation and propagation for non-timber forestry products), bamboo-engineered product development, bamboo charcoal and fibre product technologies, bamboo for climate actions, etc. *(Left: An INBAR-led workshop on selective bamboo harvesting took place in Ghana.)*

To carry out bamboo-rattan related practices and development in more places in the world, INBAR is keen on supporting regional initiatives from regional governments, local NGOs and leading local communities, including capacity-building and training cooperation; for example, on land restoration projects using bamboo. (*Left: The pilot land restoration project in Allahabad, India, was initiated by the local NGO Utthan and greatly supported by INBAR.)*

Moving Ahead

INBAR E-Learning Programme

INBAR WEBINARS

K@T **Knowledge@Terra Classrooms**

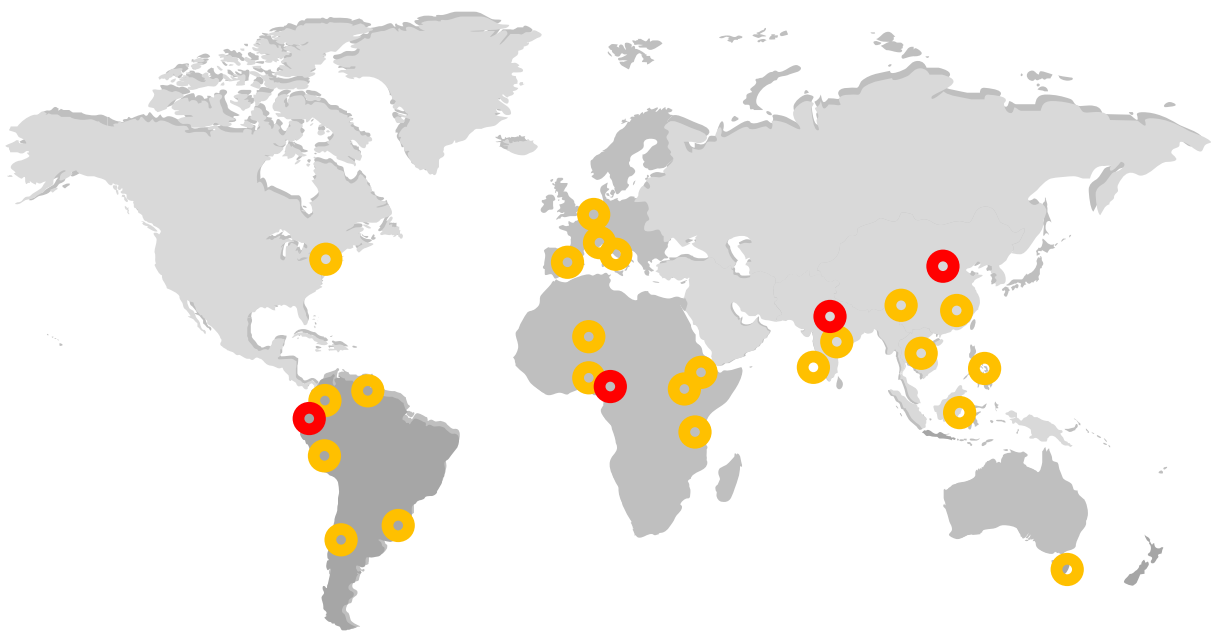
Green Gold Dialogues

When global social and economic development became seriously impaired in 2020, INBAR successfully launched the **webinar series of its E-learning Programme** in order to support green transition and pragmatic nature-based solutions. Based on this, INBAR expects to use **Knowledge@Terra Classrooms (K@T) and Green Gold Dialogues (GGD)** to partner with local governments, enterprises and academies to showcase and communicate territorial landscape ecosystems, agro-forestry practices and green sectoral solutions with bamboo and rattan, training local policy makers, agroforestry management practitioners, technical innovators, investors & financiers etc. The emphasis will be on **how to design and narrate territorial transition pathways and bankable green projects, to use green management, investment and finance tools that flourish ecology and economy**. This will accelerate the empowerment of bamboo and rattan in environment-climate policies and financing practices at international, regional and local levels.

Global Distribution Map of Invited Speakers of the INBAR Webinar Series in 2020:

- Hosting locations
- Invited Speakers

From countries across the globe:
Australia, Cameroon, Chile, China, Colombia, Ecuador, Ethiopia, Ghana, India, Indonesia, Italy, Mexico, The Netherlands, Nigeria, Peru, Philippines, Spain, Switzerland, Tanzania, Uganda, Uruguay, Venezuela, Vietnam, UK, USA etc.



Info Source: INBAR