BAMBOO

For the 21st century

By Martin Tam


HONG KONG
WORLDSBE
2017
WORLD Sustainable Built Environment Conference

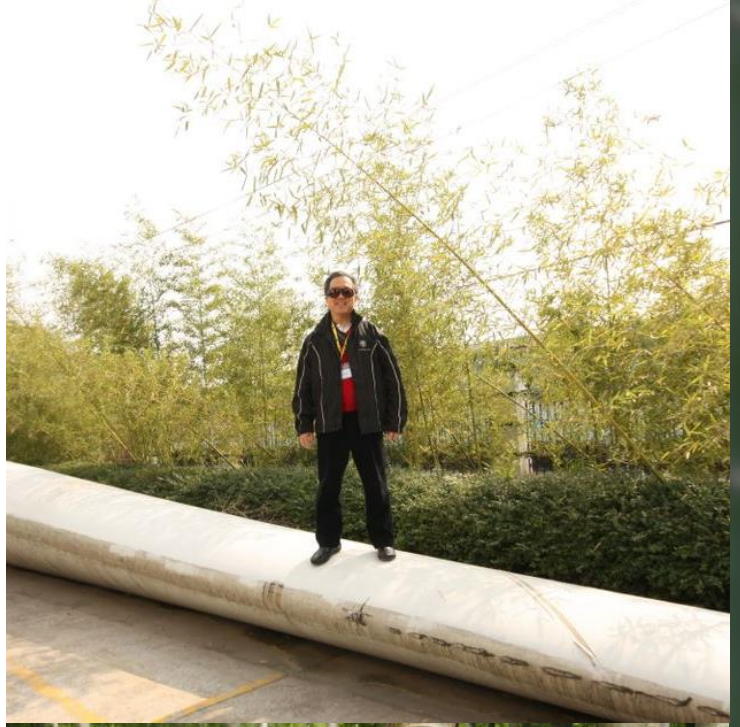
Speaker:

Mr. Martin T. F. Tam

B.Arch, FHKIA, RIBA, ASC
Registered Architect, Authorized Person
OUHK Hon University of Fellowship
PRC Class I Registered Architect Qualification
Buildings Department Registered Inspector
Shenzhen Registered Architects Association
WBO/INBAR Global Bamboo and Rattan Professionals Directory
INBAR Task Force Expert Member – Bamboo Construction

Mr. Martin Tam is an experienced architect who has worked in this field for **over 47 years.** His expertise includes **development management** and **construction management** in a variety of building types such as residential, commercial, industrial, public and private institutions, hospitals, schools and universities.

Bamboo Factory in Hangzhou



Mr. Tam has a high degree of sensitivity to society and **advocates zero carbon emissions** and **sustainable development**.

He is concerned about the global ecology as well as the indoor air quality of our built environment, hence **strongly promotes** the use of the innovative materials, such as **bamboo products**.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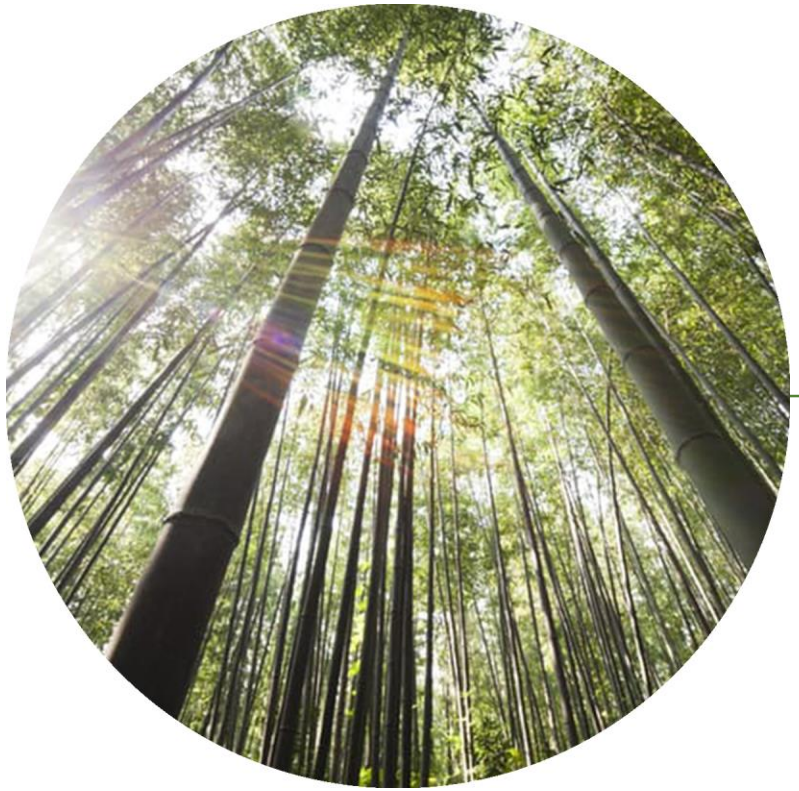
HKGBC
BELT and ROAD
一帶一路

Organisers

Bamboo

Green Vision for the Belt & Road International Initiatives

Bamboo and rattan could be key tools to help realize – and 'green' – China's 'Belt and Road' policy. This was the theme of a topical event held in Beijing alongside the Belt and Road Forum for International Cooperation, which featured speakers from the UN as well as country ministers and ambassadors.



Overview

International Trade of Bamboo

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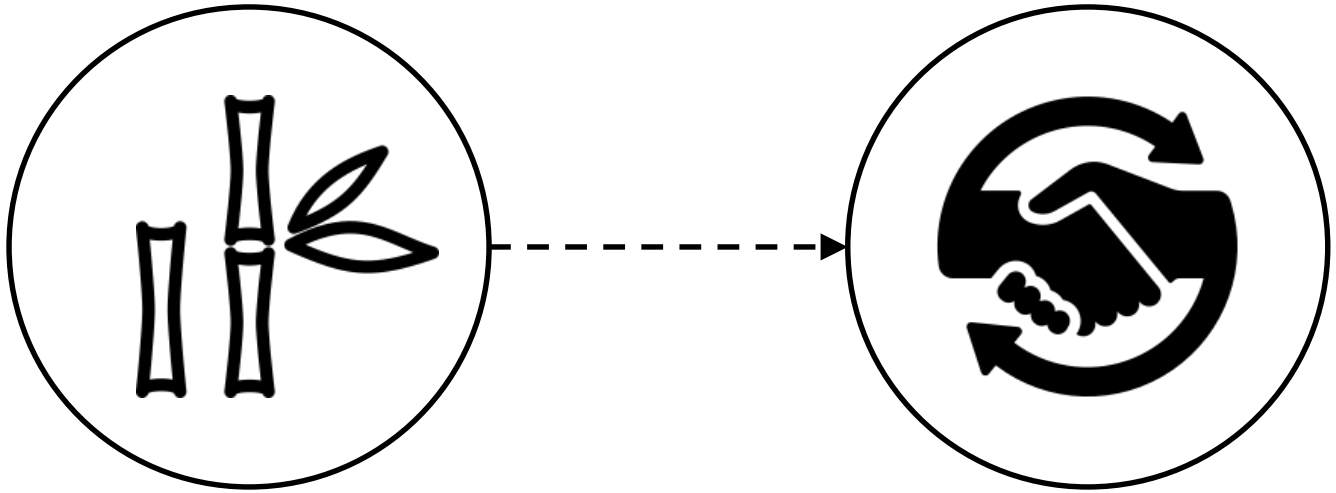
CCSI / HSMC / UNESCO
Sustainable Development in Higher Education 2017 in conjunction with
The 2nd UNPRME Colloquium on Higher Education 2017

Overview of International Trade of Bamboo



International Trade of Bamboo

The total world market value (domestic and international) for bamboo and rattan products is estimated to be about US$60 billion, according to the available data sources from UN Comtrade database and National Statistics Authorities. The international trade of Bamboo and rattan products – the majority is conducted in domestic markets. China's domestic market for bamboo products was, for example, almost US$ 20 billion in 2012, more than ten times that of world's International trade.

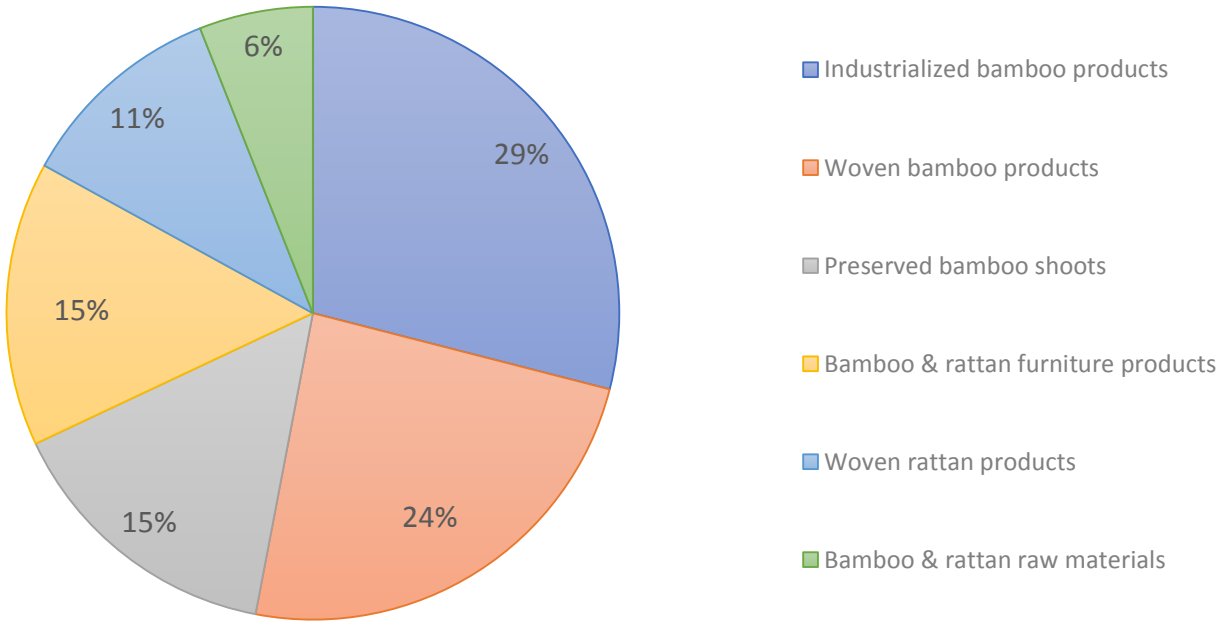
This pamphlet provides an overview of the international trade of bamboo and rattan products in 2013, based on data in the UN Comtrade database. The main bamboo and rattan products currently recognized in the International market include raw materials, preserved bamboo shoots, woven products, furniture and seats, and industrialized bamboo products (see table in back cover).

World Exports of Bamboo and Rattan Products in 2013

Based on the UN Comtrade database, the world exports of bamboo and rattan products are estimated at US$ 1,860 million in 2013. Woven bamboo and rattan woven products were the major products exported in 2013, with an export value of US$ 647 million, accounting for 35% of the total. US$ 547 million of industrialized bamboo products were exported, 29% of the world total, and just US$ 103 millions of bamboo and rattan raw materials, 6% of the total, were exported (Figure 1).

World total 2013: USD 1860 million

Figure 1 World exports of bamboo and rattan products in 2013



Trends in the Trade of Bamboo and Rattan Products 2007-2013

International trade of bamboo and rattan has remained relatively stable since 2009, following a major drop in 2008. This drop is thought to have been due to the global financial crisis – similar falls are seen in other wood product categories (figures 2-1, 2-2).

Major trends

- The proportion of the total of industrialized bamboo products exported rose from 23% in 2009 to 28% in 2013, as did the value, from US$ 414 million in 2009 to US$ 547 million in 2013 - of these products, only bamboo flooring showed an increase, from 14% in 2007 to 19% in 2013.
- The proportion of bamboo and rattan furniture products decreased from 26% in 2007 to 15% in 2013 - likely a direct result of “belt-tightening” in the USA and EU-27, the main international markets for furniture, due to the global economic downturn in 2008 and with the market yet to recover.
- The proportions of bamboo and rattan woven products remained steady, around 35% - they have traditional, long term, stable markets.
- The proportions of bamboo shoots increased despite the total overall reduction in value – the demand for shorts in Japan and South Korea remained steady.
- The proportion of raw resources exported remained stable – this is to be expected as resources are fixed, or increase slightly each year.

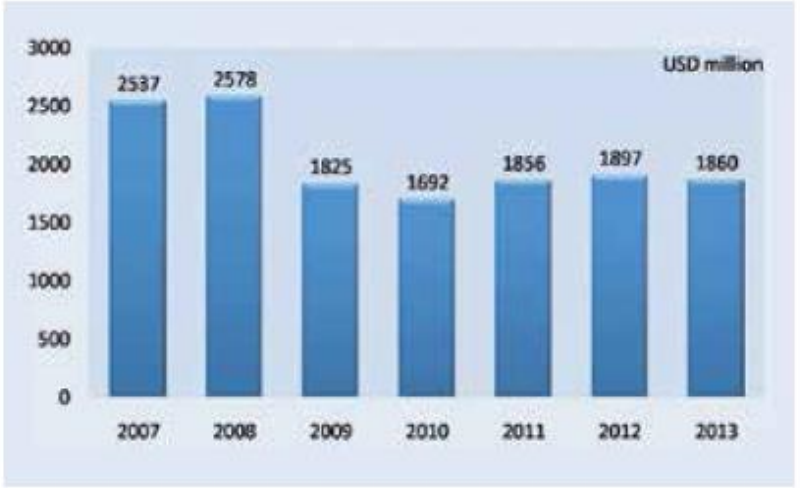


Figure 2-1 World exports of bamboo and rattan products 2007-2013

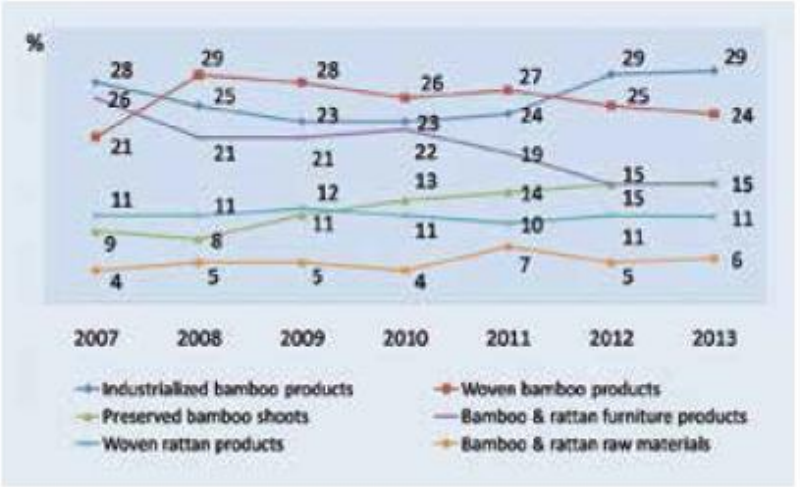


Figure 2-2 World exports of bamboo and rattan products in 2007-2013

Main Traders of Bamboo and Rattan Products in 2013

By region

Bamboo and rattan are mostly traded within and between Asia and Europe. As shown in figure 3, Asia is the main source of bamboo and rattan products, while Europe, Asia and North America are the major importing markets. In 2013, the export value of bamboo and rattan products from Asia reached US$ 1,565 million, meaning that the continent accounted for 84% of world exports. Europe is the second largest exporter, with US$ 202 million worth, roughly equivalent to 11% of the world total. In addition, with a value of US$ 616 million, Europe accounted for 38% of world imports of bamboo and rattan, making it the world's largest import market. Imports from Asia and North America contributed 29% and 21% to the world imports. Europe, Asia, and North America collectively account for 89% of the world imports by value.

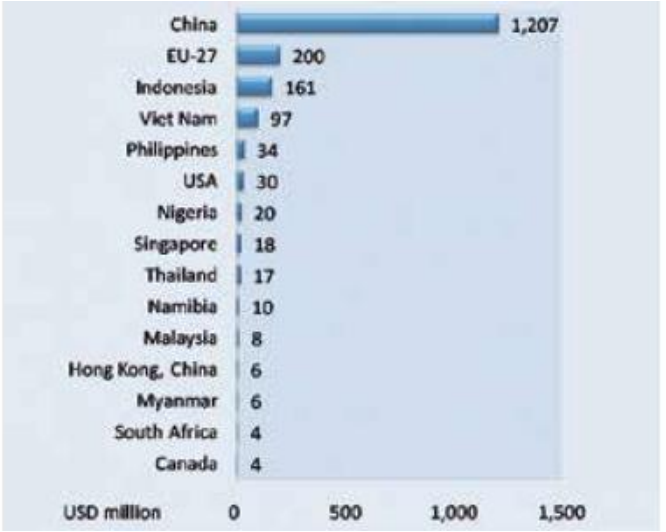


Figure 3-1 Major exporters of bamboo and rattan products in 2013

By country / trading block

China is the largest producer and exporter of bamboo and rattan products in the world. As shown in figure 3-1, China accounted for 65% of the world exports of bamboo and rattan products in 2013, with a value of US$ 1,207 million. In second place, the EU-27 contributed US$ 200 million, or 11% of world exports. The third largest exporter was Indonesia, with a market share of 9%, followed by Viet Nam and the Philippines. As the largest importer of bamboo and rattan products, the EU imported about US$ 547 million of bamboo and rattan products in 2013, which accounted for 34% of the world import of bamboo and rattan, as shown in figure 3-2. The USA imported US$ 295 million of bamboo and rattan products from the world in 2013, 18% of world imports. Japan is the third largest importer of bamboo and rattan products, with a market share of 15%.

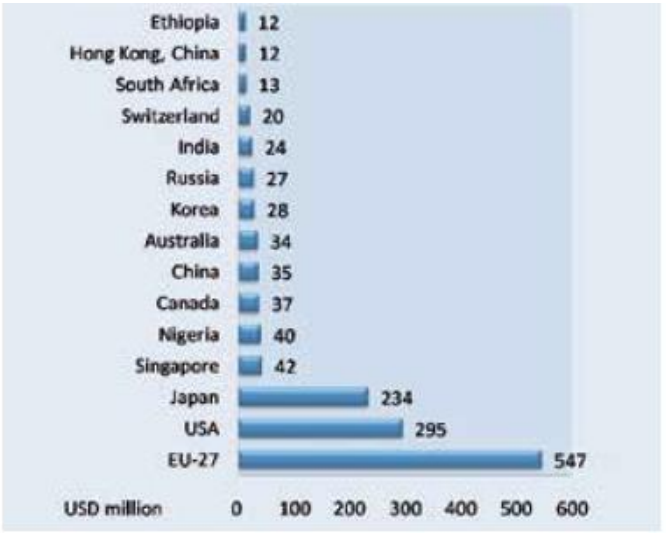


Figure 3-2 Major importers of bamboo and rattan products in 2013

Bamboo and rattan trade by INBAR's Member Countries

At the end of 2015, INBAR had 41 member countries, 40 of which are traditional bamboo and rattan producers and exporters from the developing areas in Asia, Africa and Latin-America. Eight members are listed in the top exporters of bamboo and rattan products, and are mostly from key bamboo and rattan resource and industry areas. As shown in Figure 4, INBAR members collectively contributed about US$ 1,542 million of bamboo and rattan products to the international market in 2013, 83% of the world exports. The member's market shares of preserved bamboo shoots, bamboo and rattan woven products and the industrialized bamboo products were over 80% of the world total in each category. The import value to INBAR members reached only US$ 196 million, accounting for only 12% of world imports. This is because most of producers and exporters of bamboo and rattan in the world are INBAR members, particularly China, Indonesia and Vietnam.

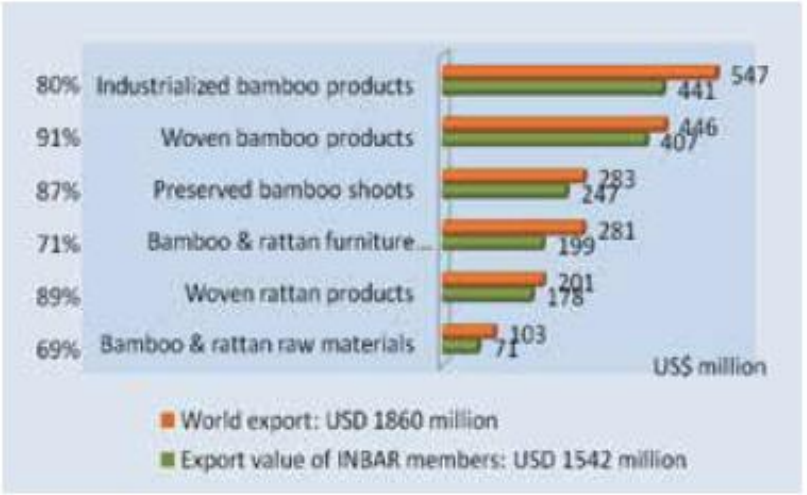


Figure 4 Export of bamboo and rattan from INBAR members in 2013

Overall, international trade in bamboo and rattan products continued to remain stable in 2013, with changes in the proportions of product types traded reflecting changes in market demand.

As two of the world's most important non-timber forest resources, bamboo and rattan are not only integrally linked to the livelihoods of millions of people, but also provide a range of environmental services. They can provide multiple uses with a large range of products in a remarkable range of value chains, including food, handicrafts, daily utensils, energy, fiber and textile, plywood, furniture, construction, paper and pulp. Bamboo and rattan industries contribute significantly to livelihood and economic development of rural people in mountain
areas from the producing countries in the tropics and sub-tropics, which is so essential for poverty alleviation in rural areas.

With the cooperation of INBAR, FAO and China's Customs, the World Customs Organisation has so far approved 24 HS codes in all for bamboo and rattan products that will provide greater clarity on the types, value and quantity of products traded internationally. With China alone predicting a doubling of its domestic bamboo and rattan market by 2020, and increasing international awareness of the "green" credential of bamboo in particular, it is highly likely that trade of bamboo and rattan will continue to hold stable, and very probably grow, in the years to come.

Table: Bamboo and rattan products recognized in the international market with the individual codes of the UN Harmonised Description and Coding System (HS)

HS code	Product	Category
140110	Bamboo raw materials	Bamboo and rattan raw materials
140120	Rattan raw materials	
200591	Preserved bamboo shoots	Preserved bamboo shoots
460121	Bamboo mats/screens	
460192	Bamboo plaits and plaiting materials	Bamboo woven products
460211	Bamboo basketwork	
460122	Rattan mats/screens	
460193	Rattan plaits and plaiting materials	Rattan woven products
460212	Rattan basketwork	
440210	Bamboo charcoal	
440921	Bamboo flooring	
441210	Bamboo plywood	Industrialized bamboo products
470630	Bamboo pulp	
482361	Bamboo paper-based articles	
940151	Bamboo and rattan seats	Bamboo and rattan furniture/seats
940381	Bamboo and rattan furniture	

INBAR's Member Countries

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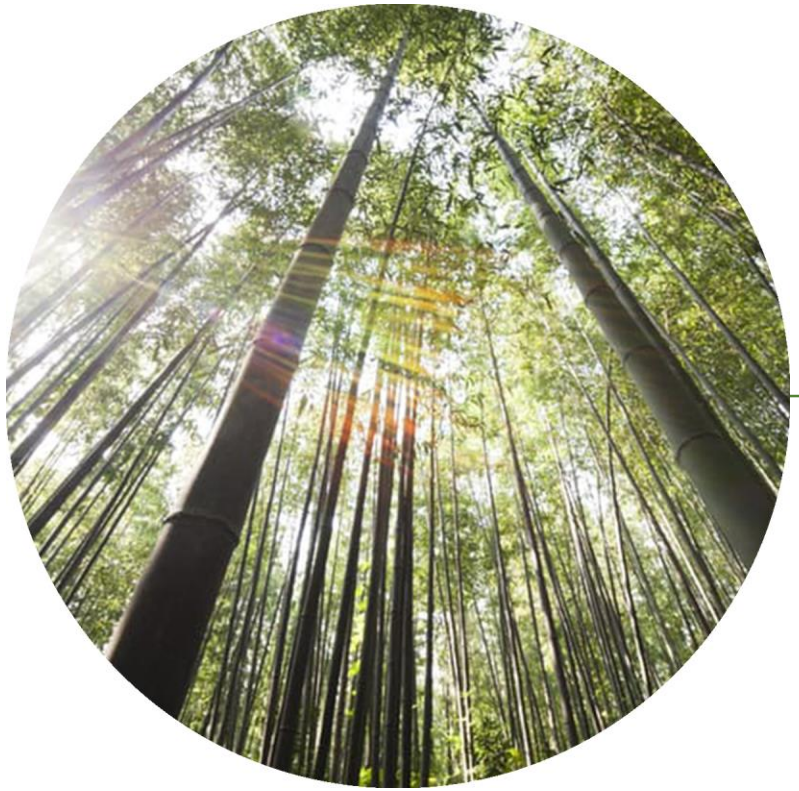


Contents

Prologue

1. What is Bamboo?
2. Geography & Distribution
3. Bamboo & the Environment
4. Bamboo Architecture
    - Why use Bamboo?
5. Interior Design
6. Others Products
    - Textiles, food, etc.
7. Bamboo Industrial Development

Epilogue


Prologue

Organisers


Universe
Father: Space & Time
The Universe is derived from nature’s law
Between Universe and Earth there goes our building structures
Mother: Earth
Earth

Organisers

MORALITY & ETHICS

are the
Keys To Success
Humankind To Stand Tall
between **Heaven** & **Earth**

或問勝天下之道，曰：「在德。」何從勝德？曰：「大德勝小德，小德勝無德；大德勝大力，小德敵大力。力生敵，德生力；力生於德，天下無敵。故力者勝，一時者也，德愈久而愈勝者也。夫力非吾力也，人各力其力也，惟大德為能得群力，是故德不可窮，而力可困。」

《德勝》節錄《鬱離子》

做人要面對天地，做人要頂天立地

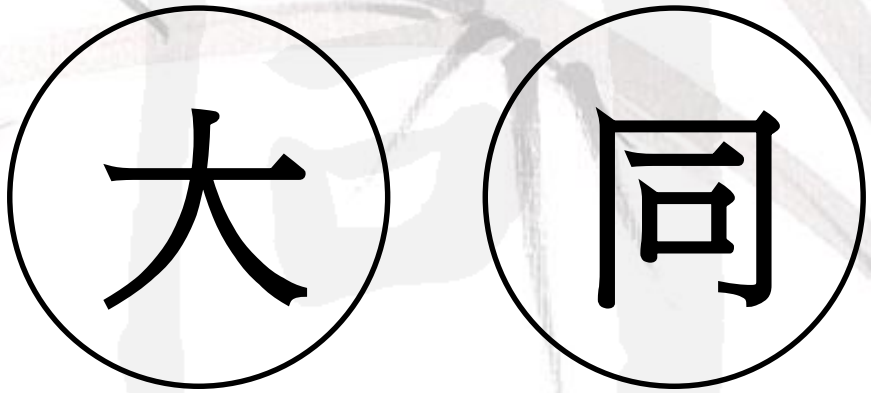
Sustainable Civilization

straddles the **Past**, the **Present**
into the **Future**

一個真正的建築物，是一個有生命力，跨時空性的藝術品，能夠讓人

承傳昨天，照亮今天，成就明天

Utopian Values



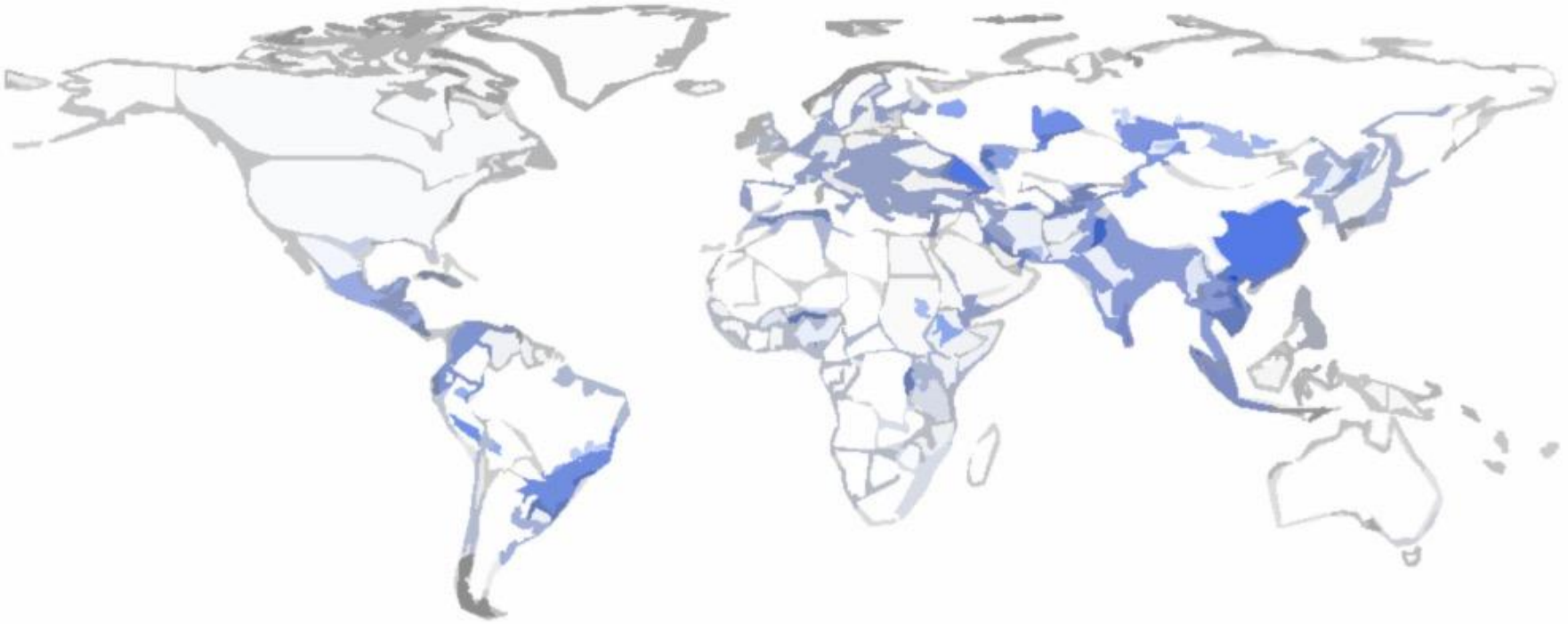
Bamboo is unique

獨 特

無肉令人瘦，無竹令人俗。人瘦尚可肥，士俗不可醫

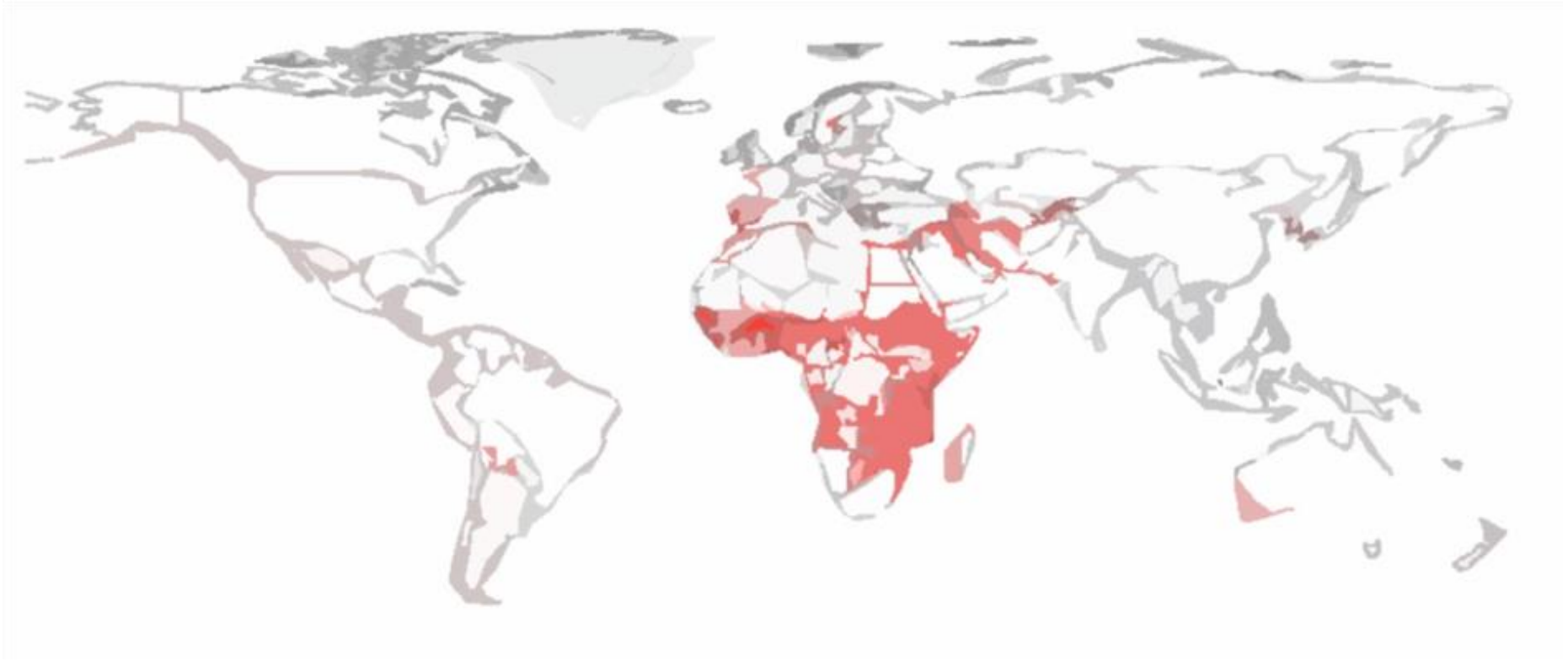
寧可食無肉，不可居無竹

Areas most affected by flooding



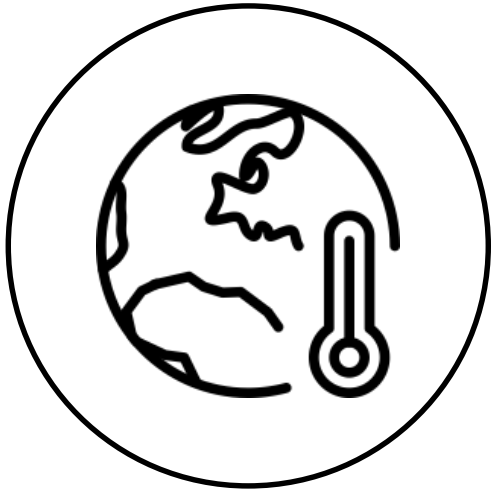
Source: Center for International Forestry Research. 2012. Adapting forests and people to climate change – Conserving ecosystem services that reduce risk to the world's poorest. A framework proposal

Areas most affected by drought



Source: Center for International Forestry Research. 2012. Adapting forests and people to climate change – Conserving ecosystem services that reduce risk to the world's poorest. A framework proposal

Green House Gas – CO_2

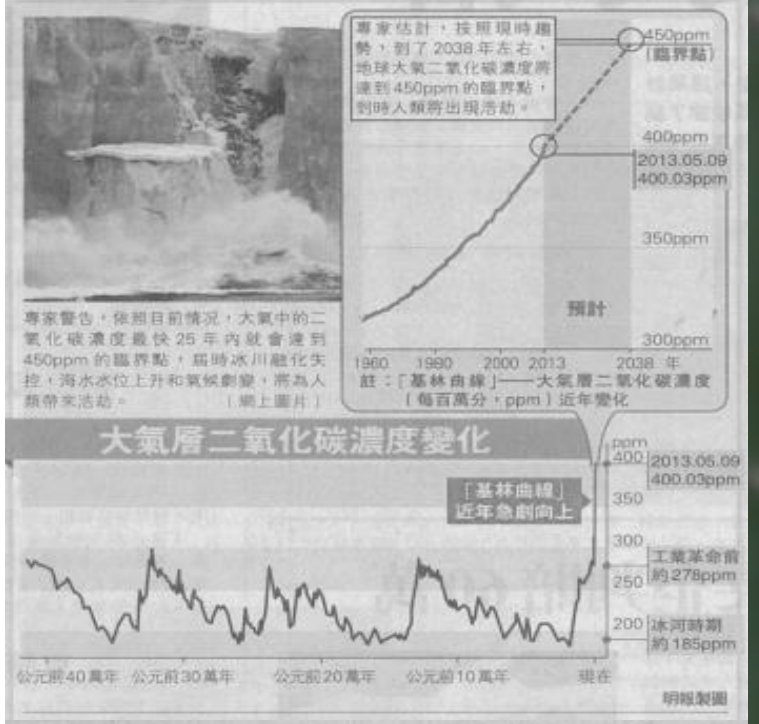


Carbon dioxide level at new record high in 25 years for the pass 3 million years

Source: Ming Pao, 12-5-2013

Carbon dioxide level passes grim milestone

Source: SCMP, 12-5-2013



2016 Bangladesh

Windstorm
風災

2016 Fiji

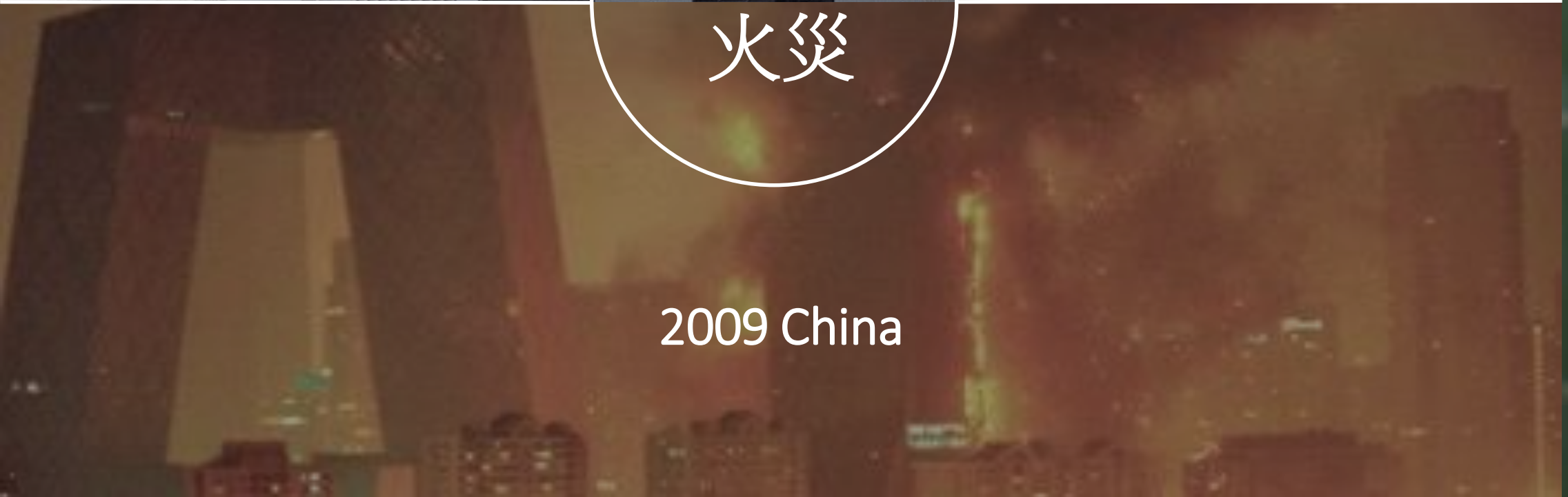
2012 China

Snow
雪災

2016 USA

2001 USA

Fire
火災



2009 China

2011 Japan

Earthquake
地震

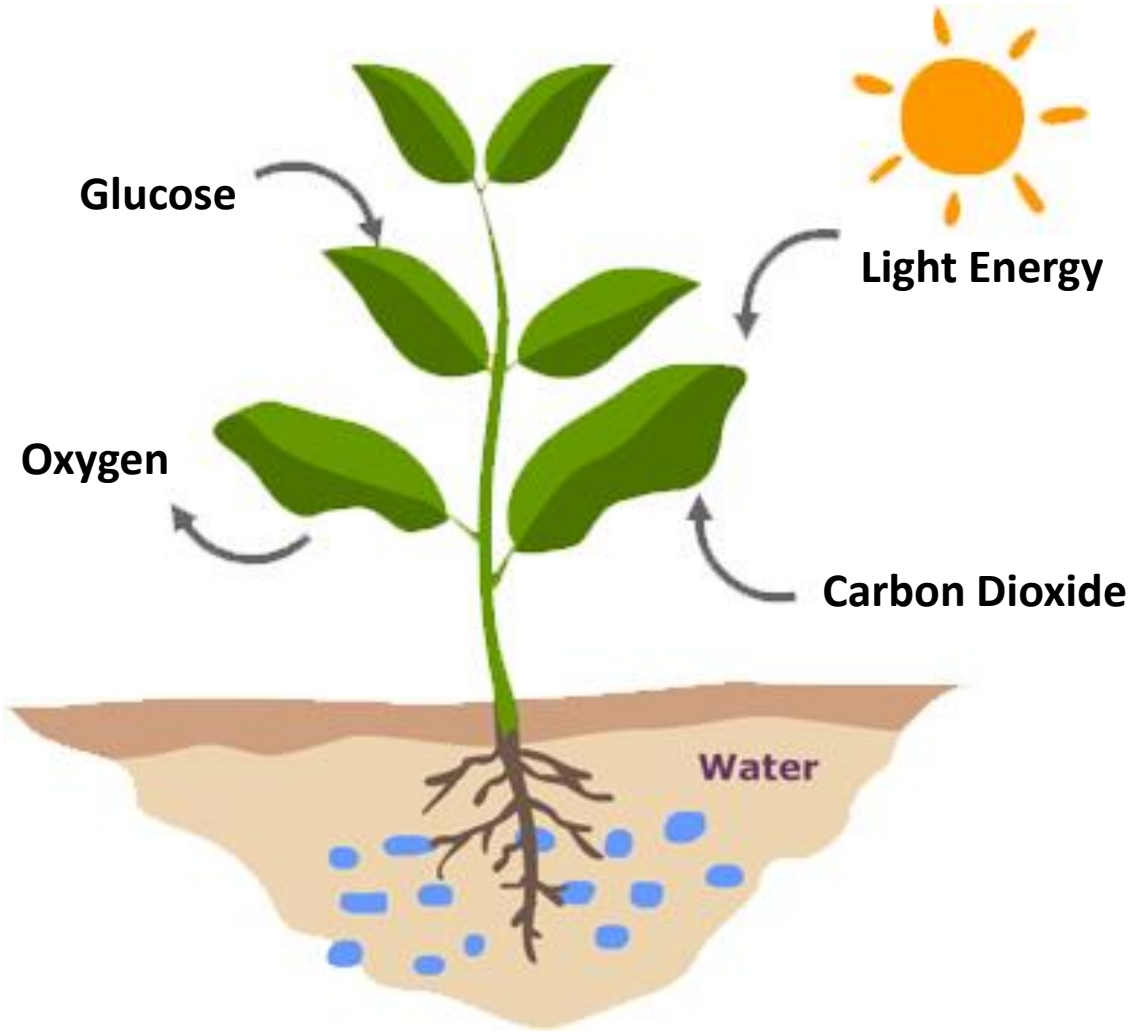
311


2004 Southern Asia
Tsunami
海嘯
2011 Japan
MIYAKO

Conform to Universe and Earth

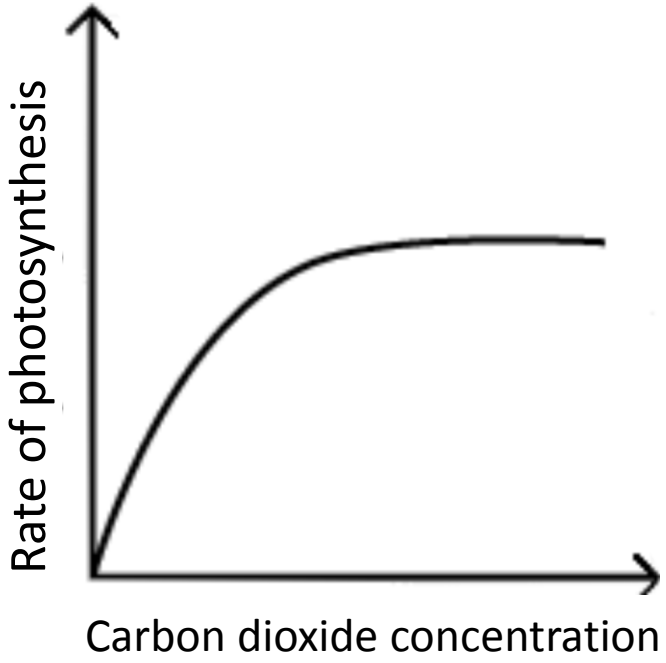
It’s a sin for human to damage our **Mother (Earth)**
in the presence of **Father (Space & Time)**.

Photosynthesis



Photosynthesis

O^2 production



CO^2 content

OXYGENERATOR

- Every human needs 280 Kgs of oxygen every year, whereas one tissue culture bamboo is able to produce more than 280 Kgs of oxygen per tree per year
- Shall we plant an evergrowing oxygenator tissue culture bamboo for us and for our future generation to breathe clean air which is rich in oxygen confidently
- Shall we leave and live in carbon neutral city

Quality of CO_2 absorption and productivity of O_2 by one tissue culture bamboo tree every year

Material	1st Year	2nd Year	3rd Year	4th Year	5th Year
Biomass (Kgs)	25	100	250	300	300
CO_2 (Kgs)	42	169	422	506	506
O_2 (Kgs)	31	123	307	368	368

OXYGENERATOR

Grow Bamboo – Grow Life

Bamboo Plantation is for overall Sustainable Development. Beyond anything it has an effective **Carbon Negative Footprint**.

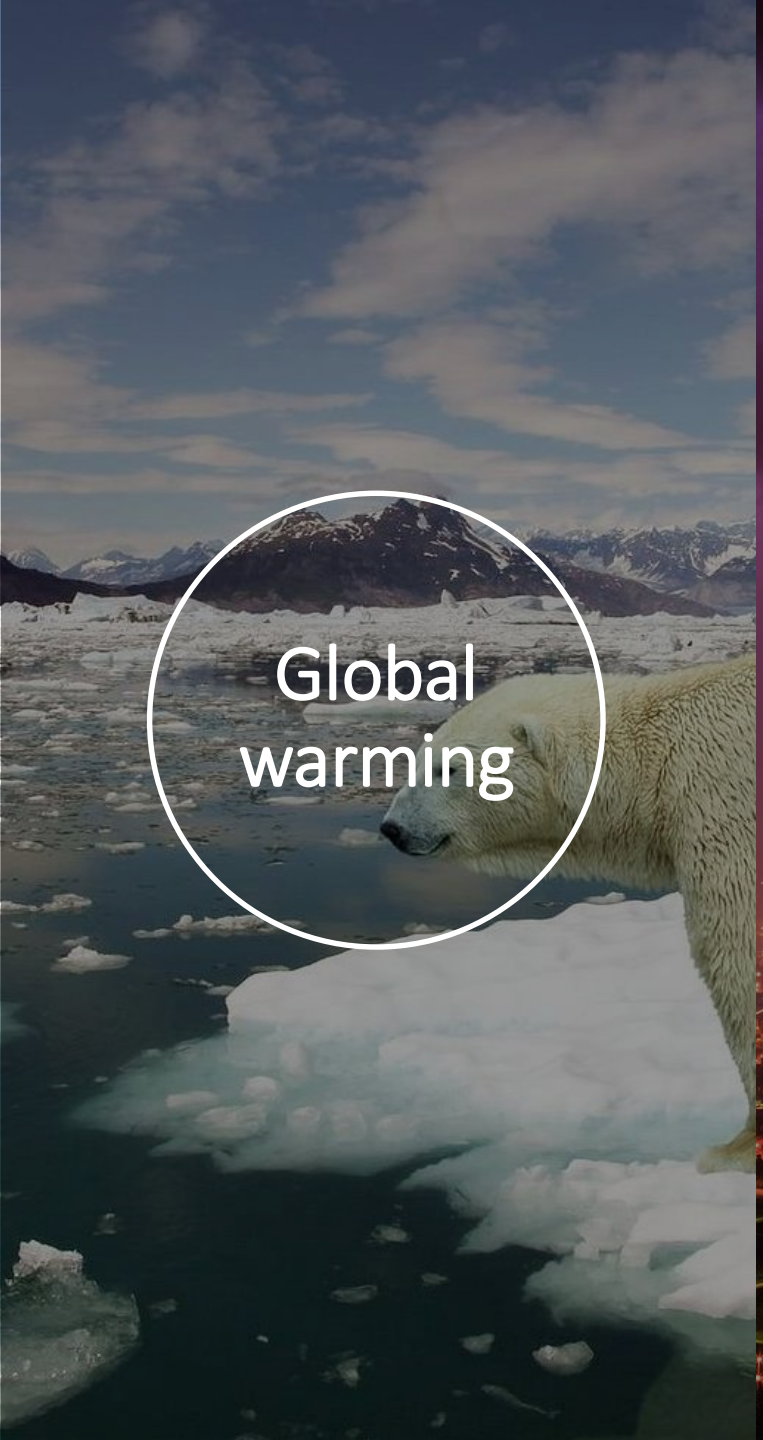
OXYGENERATOR

Comprehensive Benefits Now From Bamboo (Summarised)

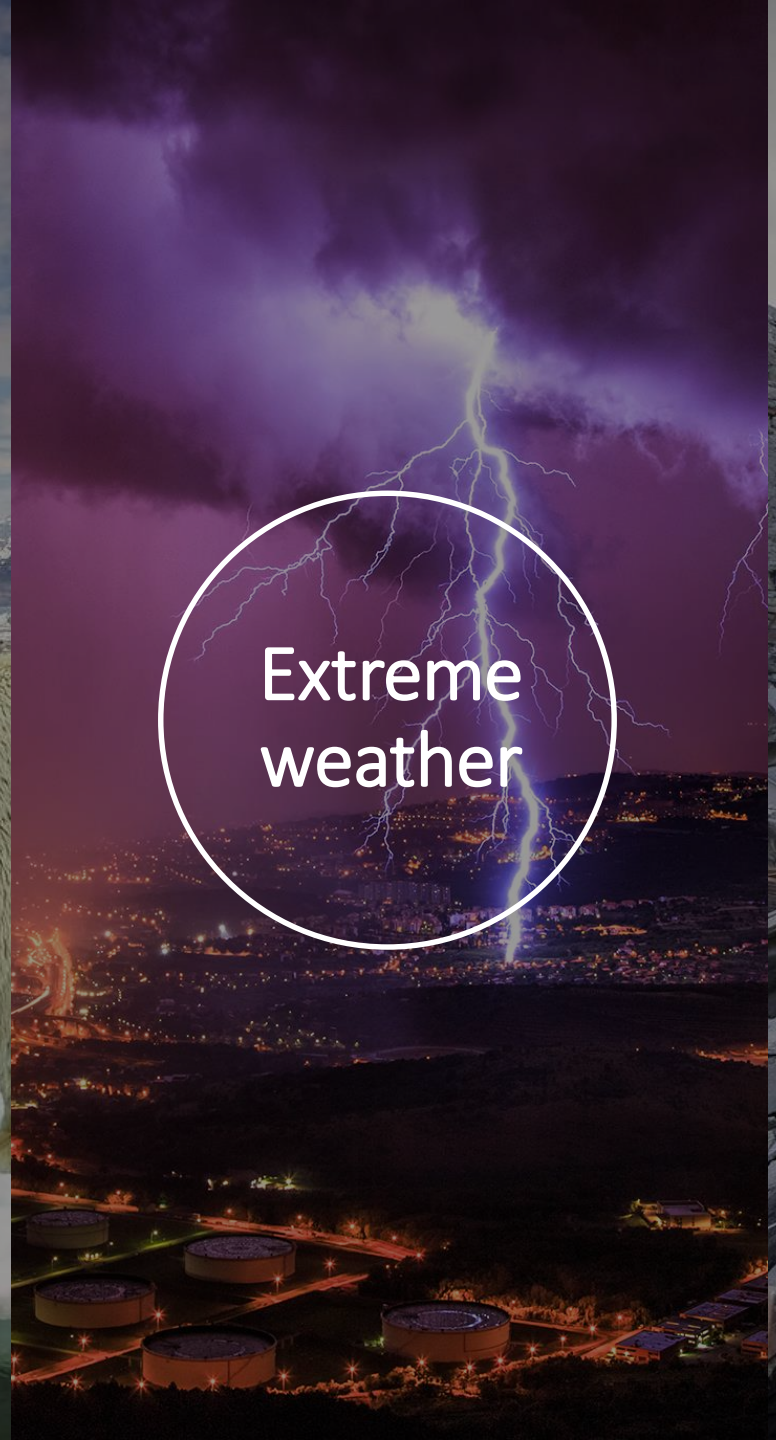
1. Energy Securities
2. Food Securities
3. Zero waste Discharge
4. Effective use of ETP water for bamboo plantation
5. Power Generations
6. Thermal Applications
7. Carbon Negative Foot-print
8. Ethanol Extractions
9. Bio crude, Charcoal, Gas extractions through Pyrolysis method
10. Bio-CNG

Bio-CNG

Recently, We got success in recovering Bio-CNG from Bamboo



Global warming



Extreme weather

Natural ecological crisis

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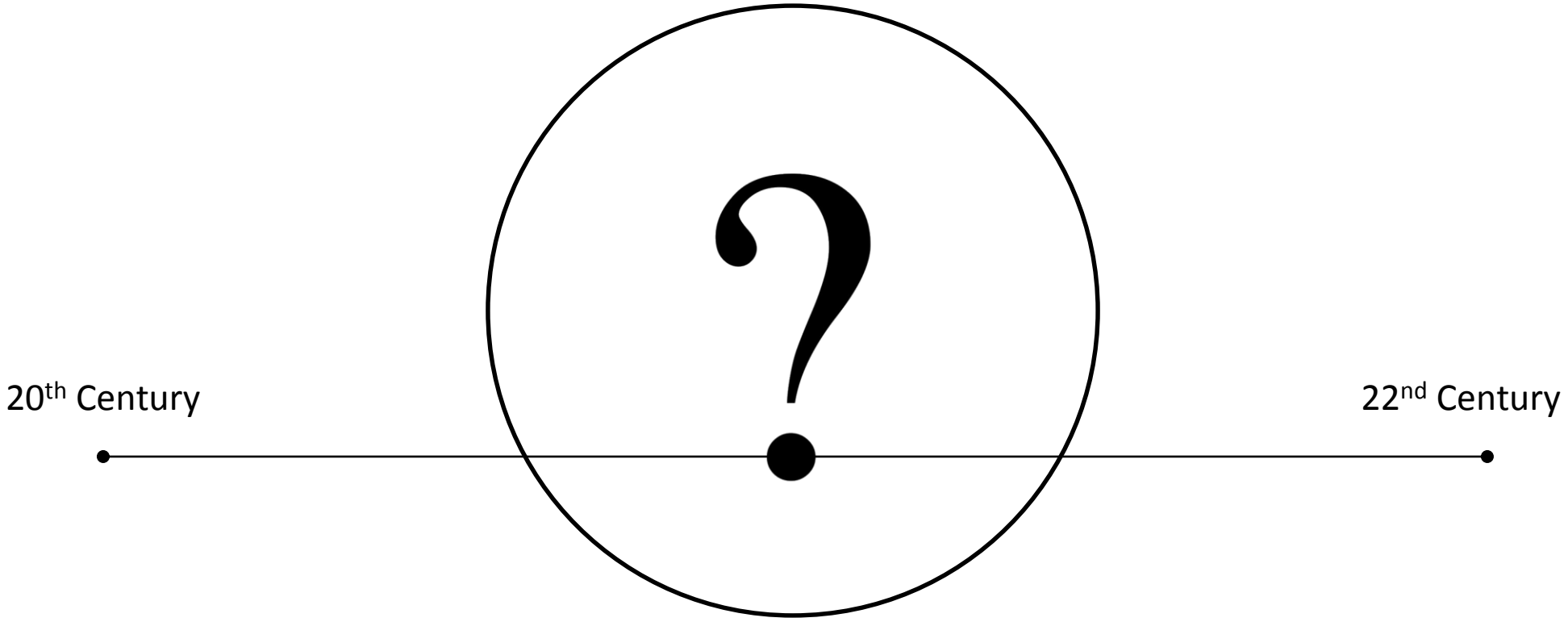
HKGBC 香港綠色建築議會

21st Century



What must we do?

Bamboo Age

The COP 20 in Peru, Dec 2014

Dawning of Bamboo Age

Tacking climate change on a global scale

A United Nation's global climate summit in Lima, Peru, that could start tackling greenhouse gas emissions.

The UN framework convention on climate change (COP 20), under way in in the Peruvian capital Lima, could pave the way for treaty being signed in the future that will be seen as a turning point in reducing global warming.

COP20: The Twentieth session of the Conference of Parties United Nations Framework Convention on Climate Change

A call to include bamboo as a strategic resource against climate change
www.inbar.int/, Dec 2014

The COP 21 in Paris, Dec 2015

Dawning of Bamboo Age continues

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Keeping the rise in temperature below 2°C

The Paris Climate Change Agreement signed by 196 countries, is the first time developing and developed countries have agreed on a common agenda to reduce greenhouse gases, limit temperature rises to two degrees (or 1.5 degrees) of pre-industrial levels, and achieve a zero-carbon future.

COP21: the Conference of Parties United Nations Framework on Climate Change Convention

The COP 22 in Marrakech, Nov 2016

Dawning of Bamboo Age
continues

The conference agreed to work out a rule book by December 2018 at the latest

COP22: the Conference of Parties United Nations Framework Convention on Climate Change

Donald Trump confirms withdrawal from Paris Climate Change Agreement

Protesters gather outside the White House in Washington, Thursday, 1st June 2017, to protest President Donald Trump's decision to withdraw the Unites States from the Paris climate change accord.

Donald Trump has announced the withdrawal of the US from the Paris agreement on climate change, saying he wants to "renegotiate" a fairer deal that would not disadvantage US businesses and workers.

Mr. Trump, who has made pulling out of the pact which has been signed by almost 200 nations – a central plank of his run for the presidency, said that in withdrawing he was keeping his campaign promise to put American workers first.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Dawning of Bamboo Age continues
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14 goals

easily achievable

Organisers

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS

SUSTAINABLE DEVELOPMENT GOALS

Dawning of Bamboo Age

The 70th Session of the United Nations General Assembly, and adopted the Sustainable Development Goals (SDGs). These represent a universal, ambitious, sustainable development agenda, an agenda “of the people, by the people and for the people,” crafted with UNESCO’s active involvement.

World Sustainable Built Environment Conference 2017 Hong Kong


Basics

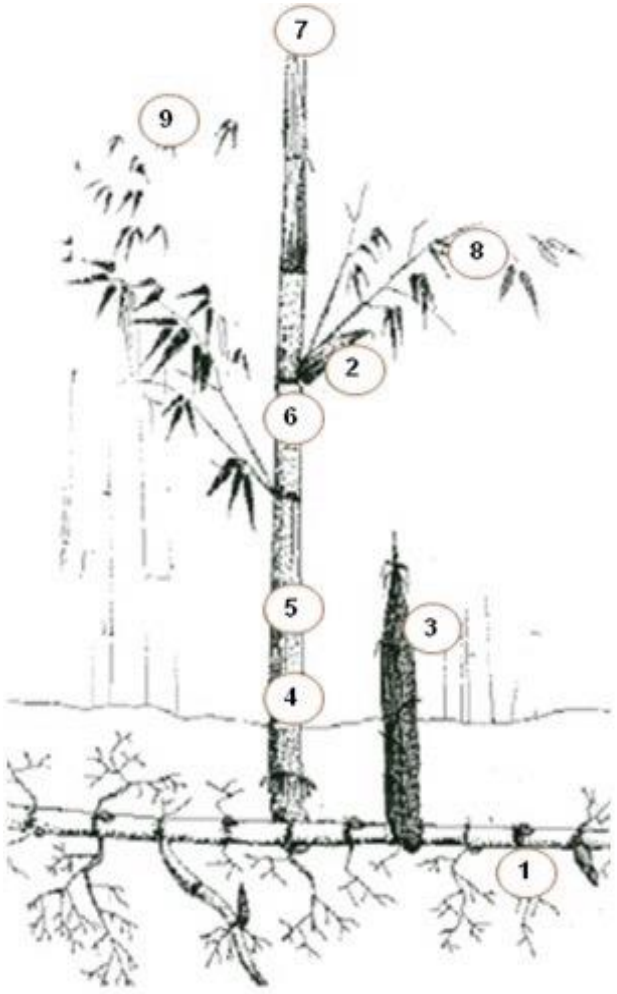
What is bamboo?

Arborescent (treelike) Grass (wheat)?
Flowering perennial evergreen plant
Family Poaceae, Subfamily Bambusoideae

Bamboo Botany

竹子的結構

Bamboo



9	Leaves	Manure, Fodder Extracts, Medicine
8	Twigs	Brooms, Cloths
7	Top	Chopsticks, Toothpicks Bamboo poles Scaffoldings
6	Middle upper	Blinds, Mats, Carpet Chopsticks, Toothpicks Handicrafts
5	Middle lower	Flooring Laminated furniture
4	Base	Charcoal, Pulp
3	Shoots	Vegetable
2	Sheath & Rhizome	Handicrafts
1		
	Leftovers & processing waste	Fiber boards Charcoal Pulp Lumber Fuels

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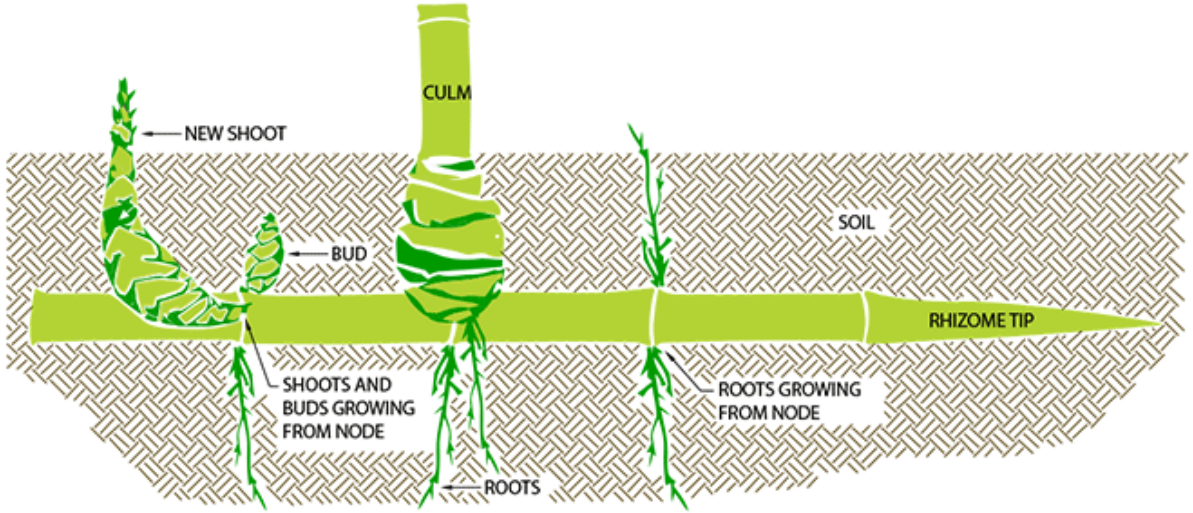
Around 50 genera and over 1200 species

Sorted according to root system (Zhang et al, 2002)

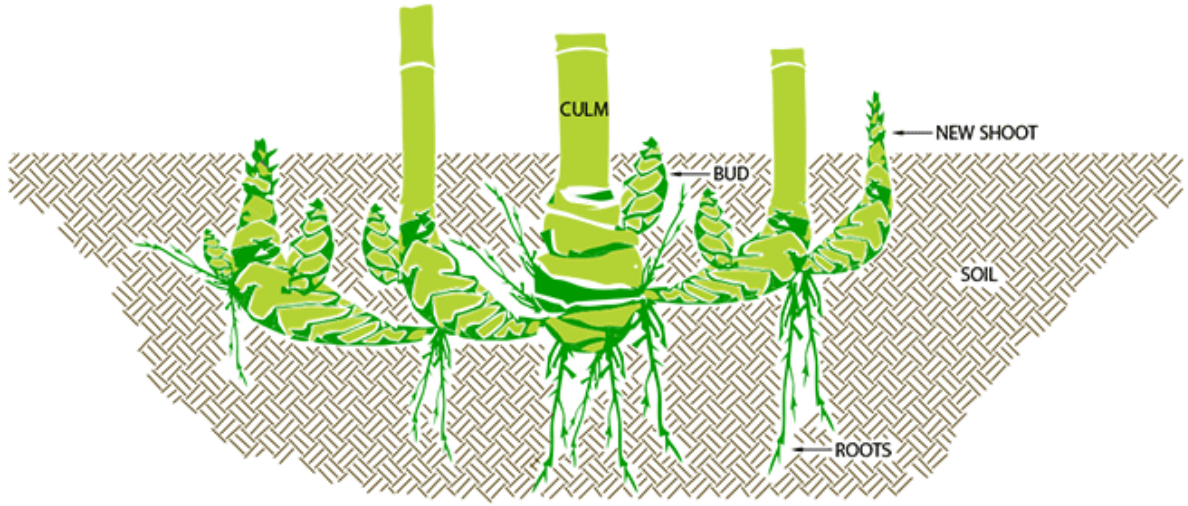


Monopodial (Running Bamboo 散生竹)

Send out a number of long heavily rooter underground rhizomes each year

單軸型

每年稈柄在地下有較明顯的延長生長



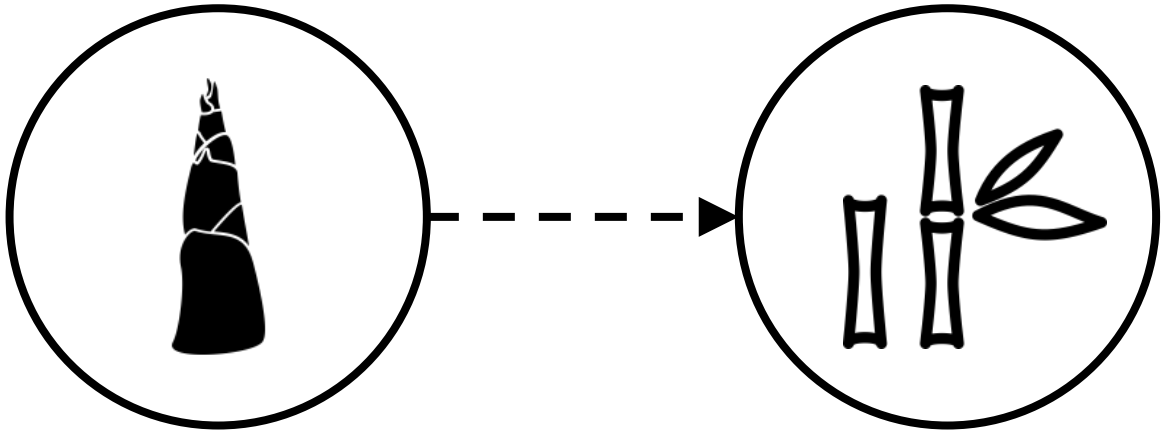
Sympodial (Clumping Bamboo 叢生竹)

Produce only a single culm, a vertical growing shoot, from each new rhizome

合軸型

竹子新稈由稈上的茅眼發育而成

Characteristics



- One of the **fastest** growing plants in the world
- Grows **1030mm per day** & reaches full height in **4-6 months** (Aminuddin, & Abd. Latif, 1991)
- Unique rhizome-dependent system
- Root system can extend up to 100km/ha and live for a hundred years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Back to Nature
Less is more
竹

Fast Growing Bamboo (BBC)

Geography & Distribution

Geography & Distribution

- About 32 million hectares worldwide
- 3.2% of the total forest area (target 5%?)
- Commonly found in Asia, Africa, Latin America and Oceania

Geography & Distribution

- About 32 million hectares worldwide
- 3.2% of the total forest area (target 5%?)
- Commonly found in Asia, Africa, Latin America and Oceania

World Bamboo Resources

Asia and Oceania

- 65% of total world bamboo resources
- Approximately 24 million hectares
- 1,250 species and about 40-50 genera
- 80% of bamboo species in the world (Jiang, 2007)

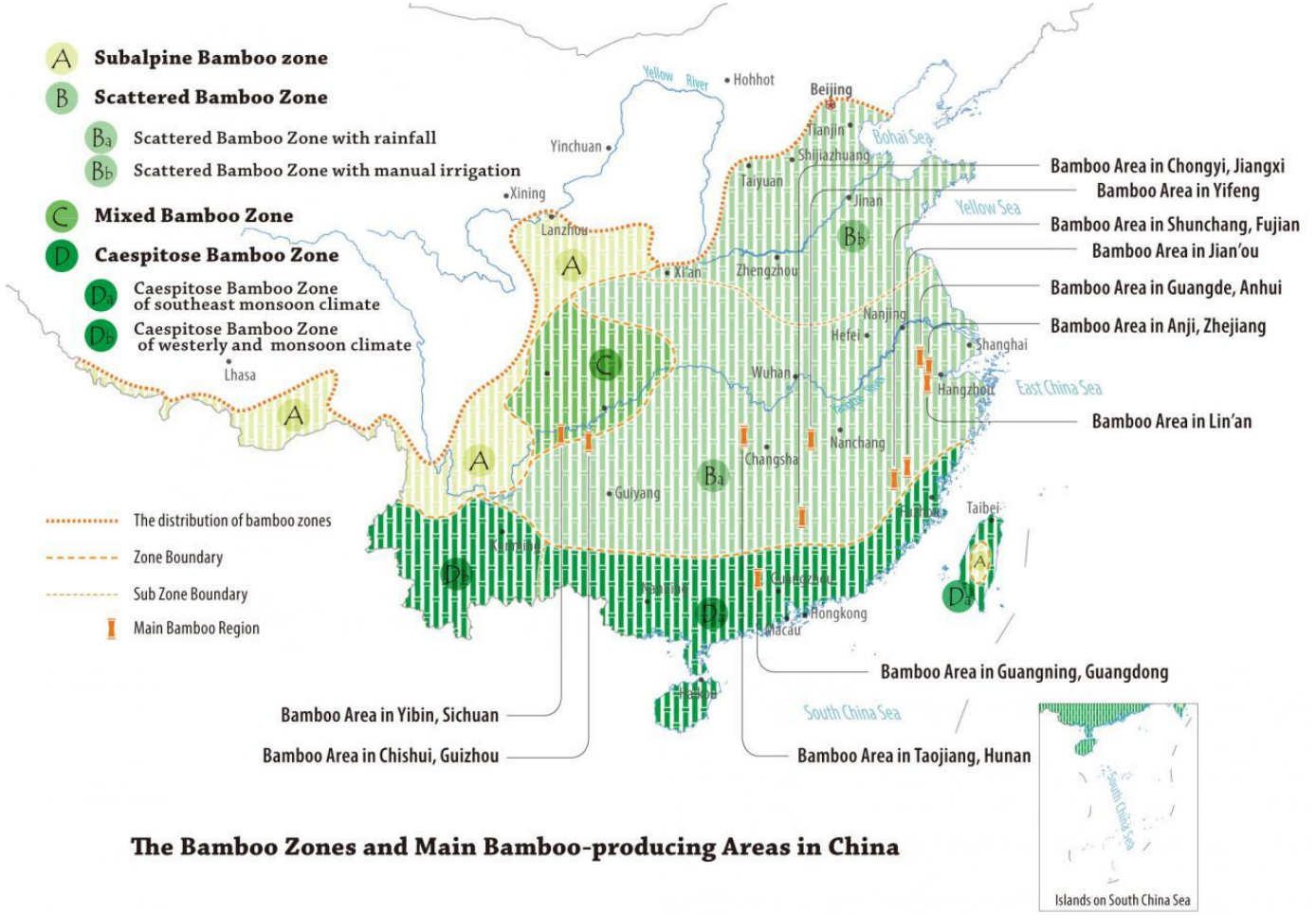
China

- Highest biodiversity with 39 genera and over 500 species
- 6.01 million ha forest area is bamboo in the 16 main bamboo provinces
- From 2008-2010, rapidly increasing of about 1.35 million ha/year

World Bamboo Resources

The Distribution of bamboos in the world

Distribution in China



The Bamboo Zones and Main Bamboo-producing Areas in China

Bamboo in China are distributed **near Yellow River** – Yangtze bamboo area and Yangtze River – Nanling bamboo area and at South China bamboo area and Southwest alpine bamboo area.

Top 10 Bamboo Counties in China

1) Anji County, Zhejiang Province
2) Linan County, Zhejiang Province
3) JianOu County, Fujian Province
4) Shunchang County, Fujian Province
5) Yifeng County, Jianxi Province
6) Chongyi County, Jiangxi Province
7) Taojiang County, Hunan Province
8) Guangning County, Guangdong Province
9) Guangde County, Anhui Province
10) Zhishui City, Guizhou Province

Anji County, Zhejiang Province

Bamboo species in Hong Kong

Phyllostachys bambusoides
f. lacrima-deae
桂竹,亦稱斑竹

Bambusa ventricosa
佛肚竹

Phyllostachys iridescins
紅竹,亦稱紅哺雞竹

Bamboo species in Hong Kong

Bambusa multiplex cv
琴絲竹

Bambusa vulgaris
金絲竹

P. Nigra Munro
毛金竹

Hang Seng Management College

Hyllostachys aurea
A.&C.Riviere
羅漢竹, 人面竹

竹

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Bambusa vulgaris
Schrad. ex J.C. Wendl
黃金間碧竹

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Bambusa
Glaucescens (Wild.)
Sieb.ex Munro
孝順竹

竹

Hang Seng Management College

Phyllostachys Bambusoides Tanakae
斑竹, 湘妃竹

竹

Hang Seng Management College

Bambusa Glaucescens (Wild.) Sieb.ex Munro var. riviereorum (R.Maire) Chia & Fung

觀音竹

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Environment

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Bamboo & Biodiversity

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Bamboo & Biodiversity

What is biodiversity?

- variation of life forms within a given ecosystem

Planting of bamboo as priority action

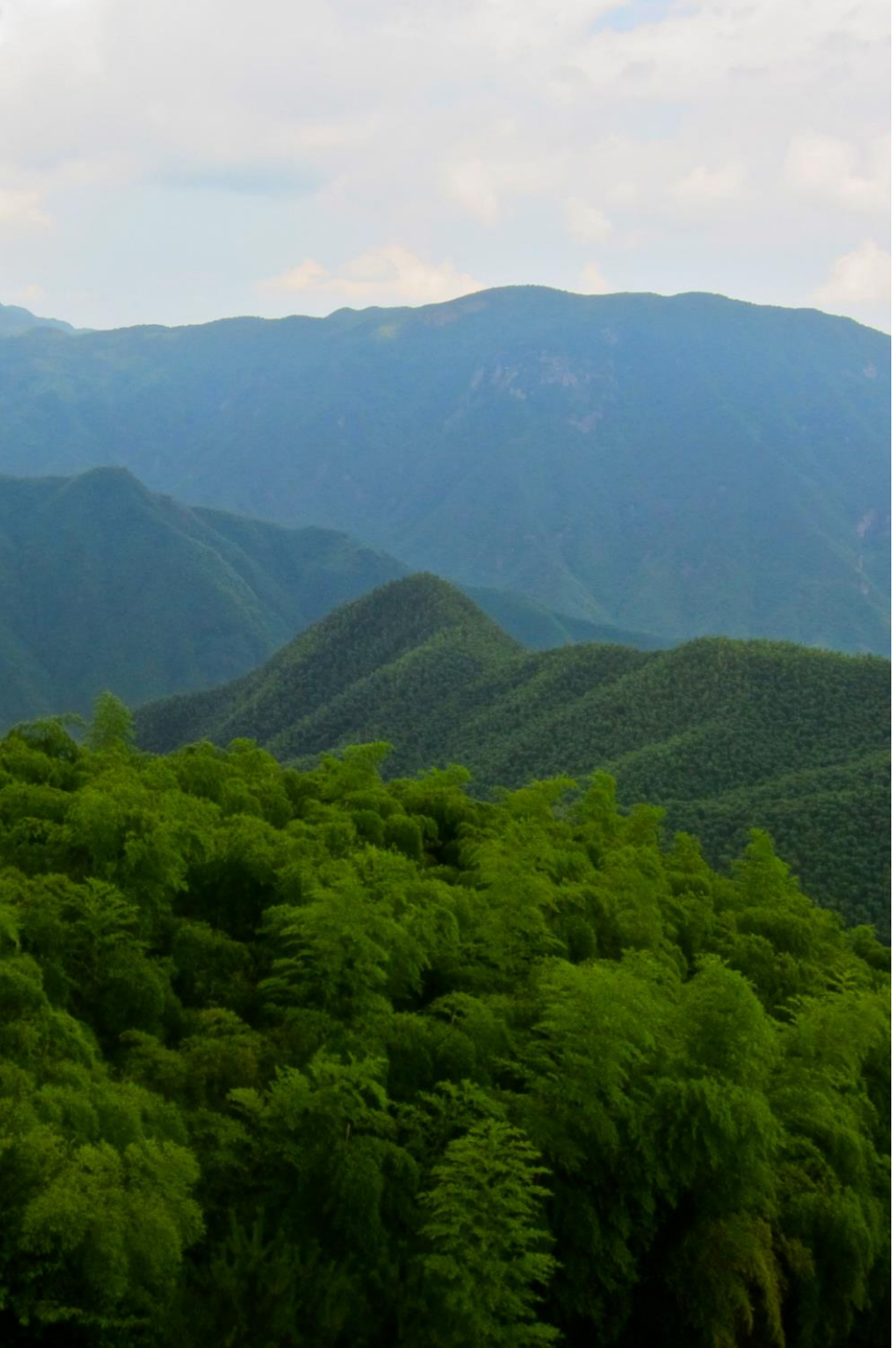
Bamboo forests are important for biodiversity

- Rhizome systems are intermixed with tree shrub and herbaceous layer of vegetation
- Habitats for insects, birds and other animals
- Food for mammals and birds e.g. Giant Pandas and Mountain Gorillas

Bamboo & Biodiversity

Case for multi culture

- A mix of plant species is important
- Intermixed of bamboo with broad leaved trees exhibited higher amounts of desirable soil qualities
  - Porosity, aeration, and bulk density
  - Maintaining high levels of nutrients in the soil
  - Increase the resilience to adverse weather conditions



Bamboo & Biodiversity

Tuen Mun Road Eastern Section

Convert the hills into bamboo ocean

Through sustainable management and utilization of bamboo resources, the international community can significantly reduce pressure on fast depleting forest resources conserve biodiversity & fight climate change.

1 Forests for adaptation

2 **Sustainable** management for sustainable provision of services + **Adaptation for forest** if sustainable management is in place

Source: Center for International Forestry Research. 2012. Adapting forests and people to climate change – Conserving ecosystem services that reduce risk to the world's poorest. A framework proposal

Soil & Water Conservation

River bank stabilization

Reduce 90% soil erosion

- ROOTS remain in place after harvesting
  - Prevent erosion
  - Help retain nutrients for the next crop
- High capacity landslide prevention, protection of riverbanks, and windbreak and shelterbelt potential
- **Recommended to consider for civil engineering applications**

Soil & Water Conservation

Researches and studies

- **>** 90% of Chinese bamboo forests are located along riverbanks in source of major rivers and lakes and, where they play an important role in regulating water flows, protecting water sources, and reducing water erosion (Xiao, 2001)
- Water conservation function in Moso bamboo is 30-45% > Chinese fir forest (Huang et al., 2010)
- Bamboo helps to retain water in the soil and benefit the microorganisms that are essential to soil health
- Bamboo is an alternative to fossil fuels, both for burning and for use as a fertilizer to restore and sustain soil health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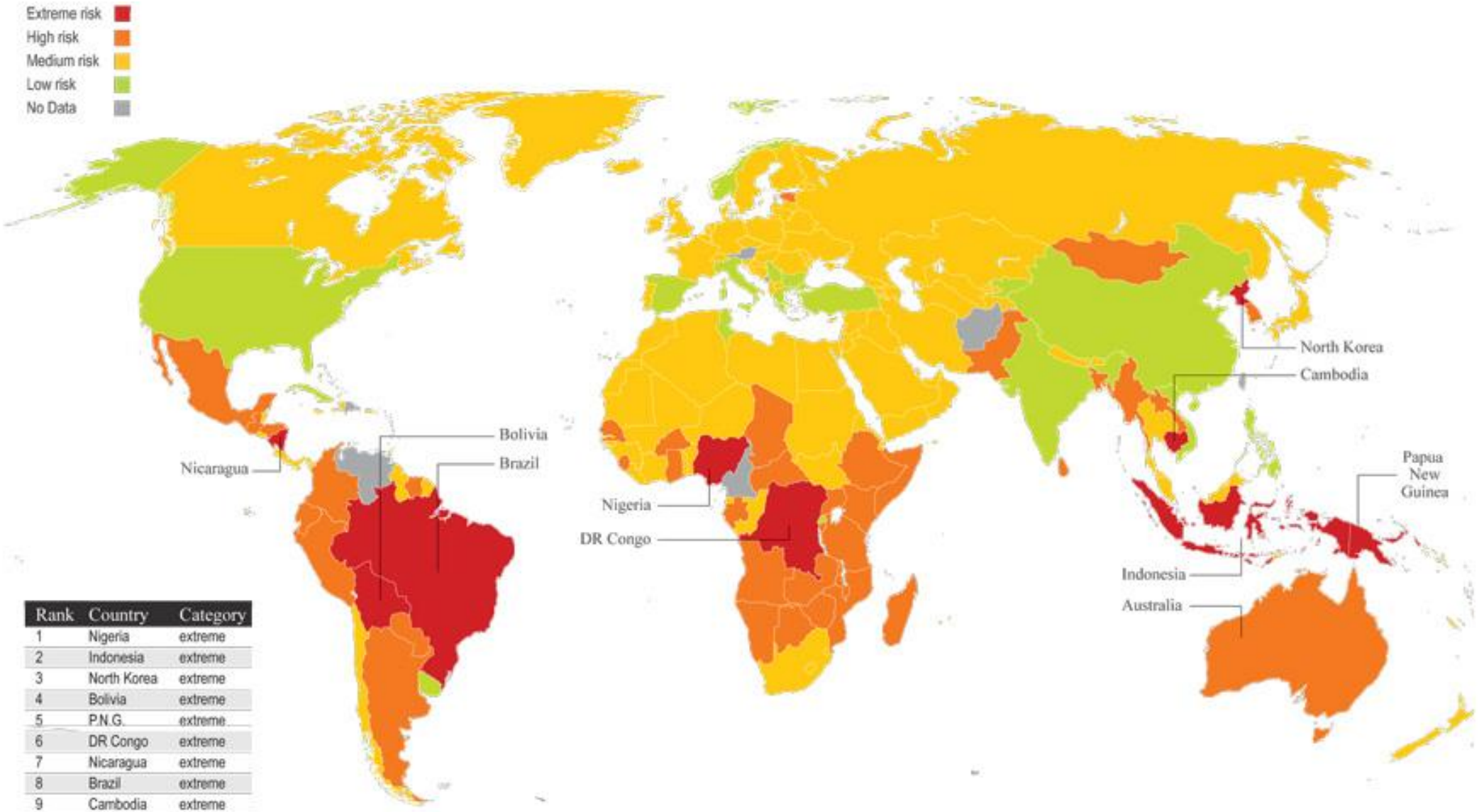
Deforestation



Rank	Country	Category
1	Nigeria	extreme
2	Indonesia	extreme
3	North Korea	extreme
4	Bolivia	extreme
5	P.N.G.	extreme
6	DR Congo	extreme
7	Nicaragua	extreme
8	Brazil	extreme
9	Cambodia	extreme
10	Australia	high

Deforestation = Solution: A Forest Station

INBAR Conservation Project in China

Reduce 90% Soil Erosion

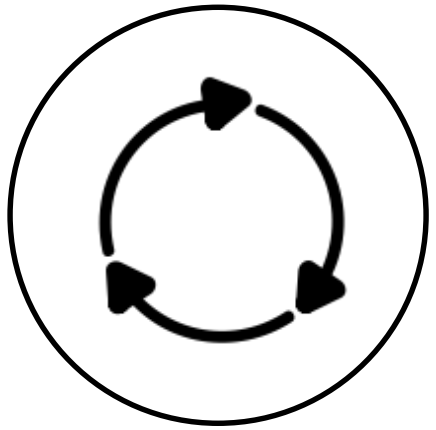
River bank stabilization

E.g. Sponge City 海綿城市

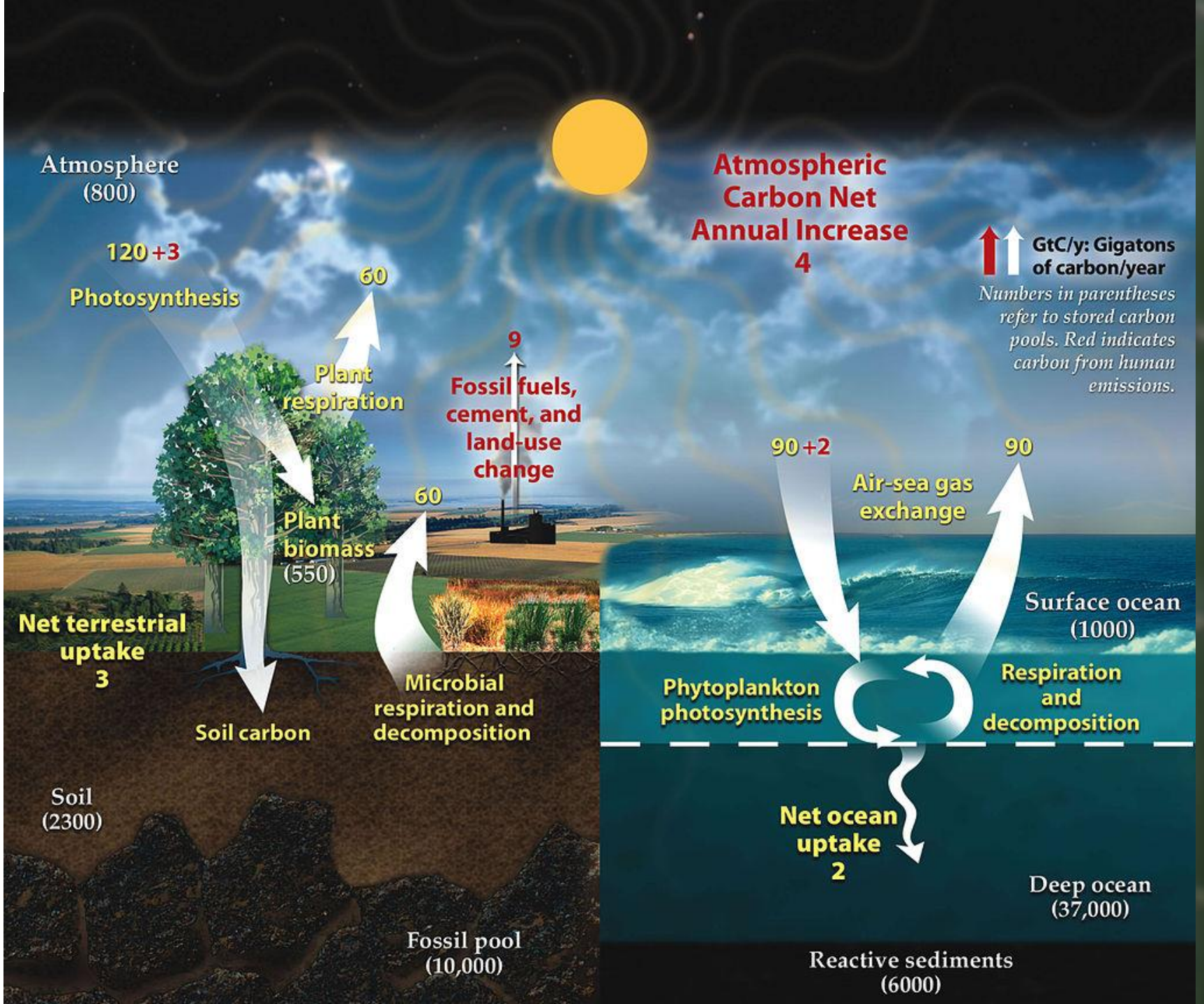
- Bamboo grows quickly
  - Can take pressure off other forest resources
- Other uses of Bamboo against deforestation
  - Use of bamboo charcoal and firewood as an alternative source of energy in Africa
  - Bamboo coffins in northeastern India, an eco-friendly method of burial for the state's Christians (UCA News, 2013)

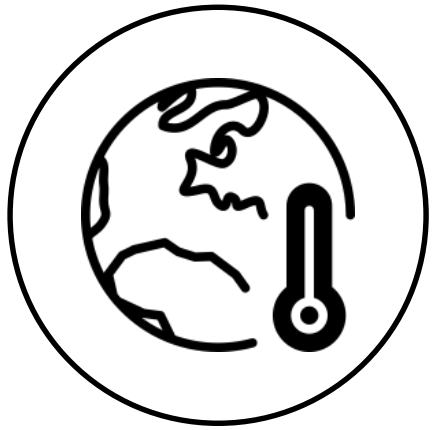
Fight the Climate change!

Via A Forest Station



Carbon cycle



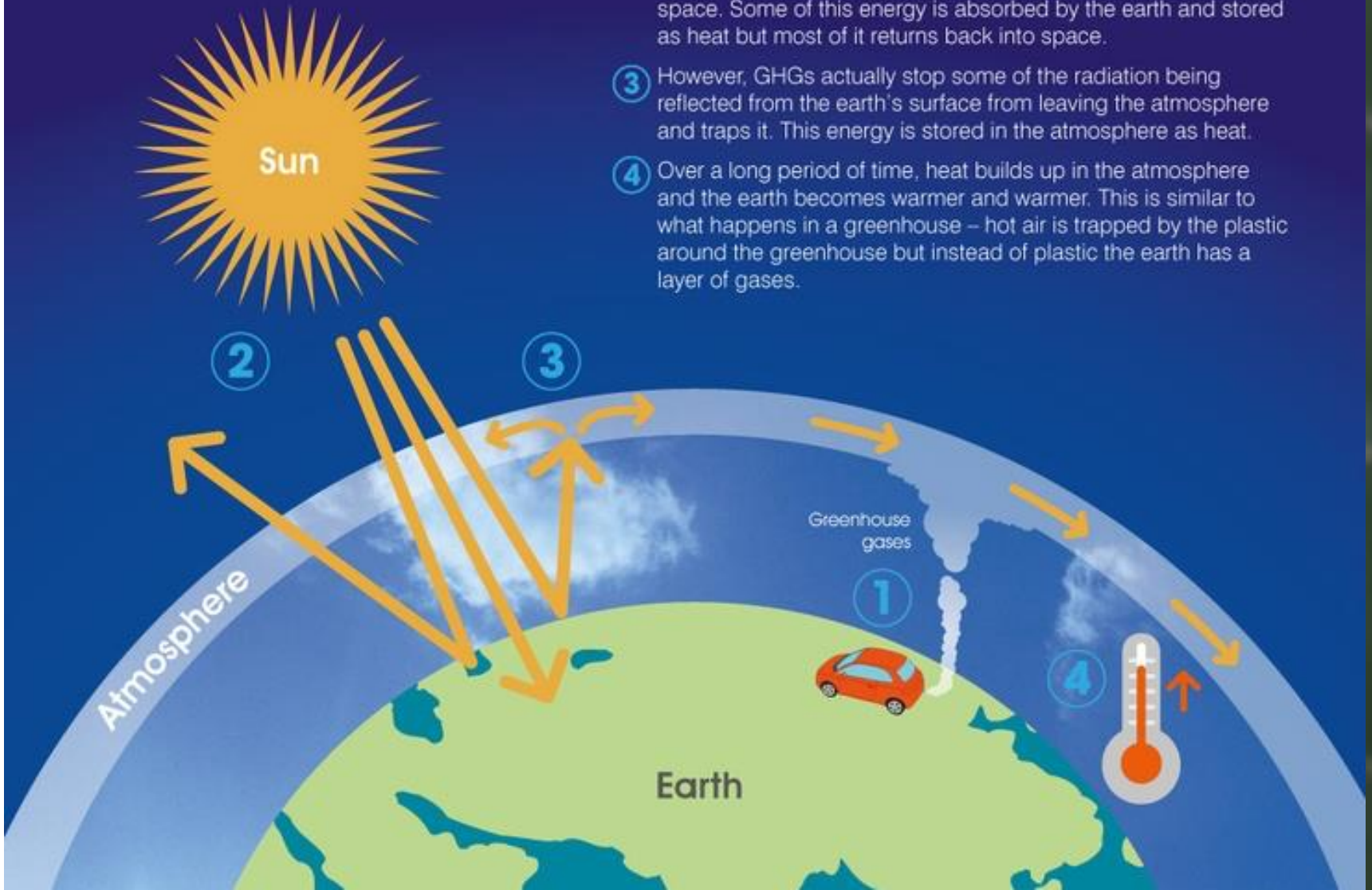


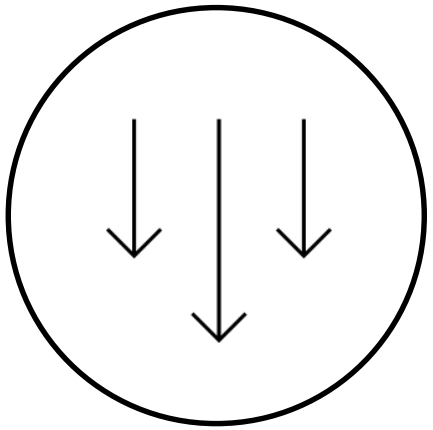
Global Warming

The enhanced Greenhouse Effect

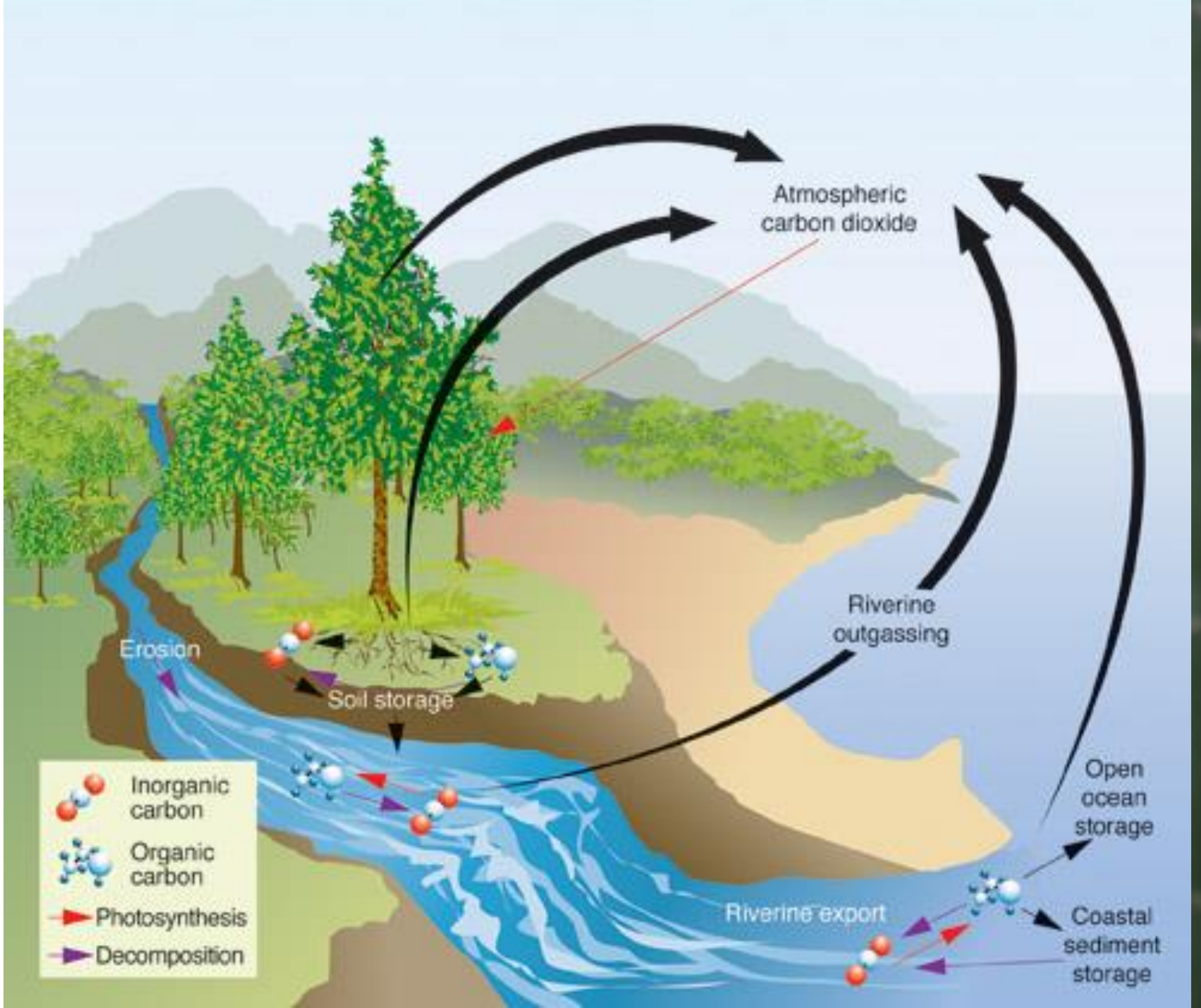
Too much GHG emissions can lead to a problem called the Greenhouse Effect.

1. When GHGs are released into the air from sources such as cars, they are trapped around the earth in the atmosphere.
2. As energy from the sun (radiation) comes through the atmosphere to earth, it bounces off the earth's surface and goes back out into space. Some of this energy is absorbed by the earth and stored as heat but most of it returns back into space.
3. However, GHGs actually stop some of the radiation being reflected from the earth's surface from leaving the atmosphere and traps it. This energy is stored in the atmosphere as heat.
4. Over a long period of time, heat builds up in the atmosphere and the earth becomes warmer and warmer. This is similar to what happens in a greenhouse – hot air is trapped by the plastic around the greenhouse but instead of plastic the earth has a layer of gases.

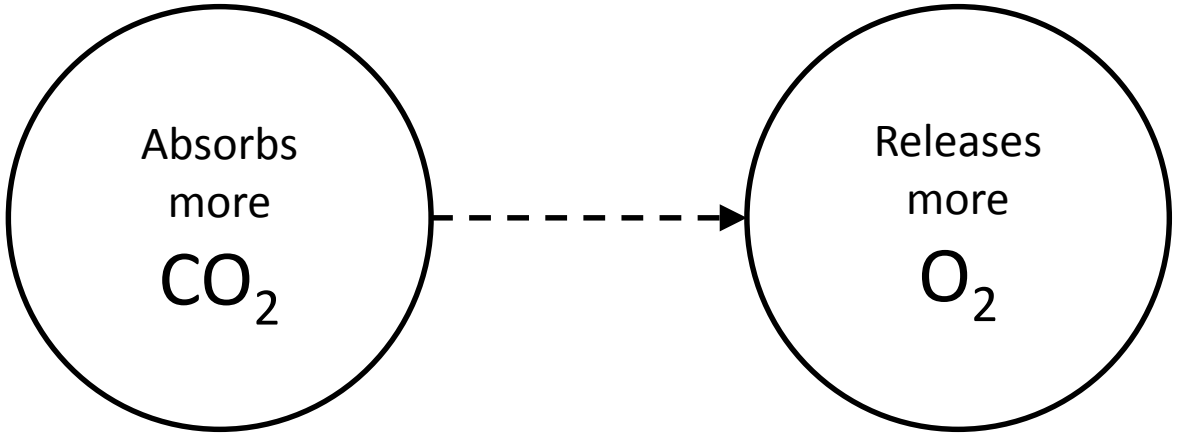




Carbon Sink

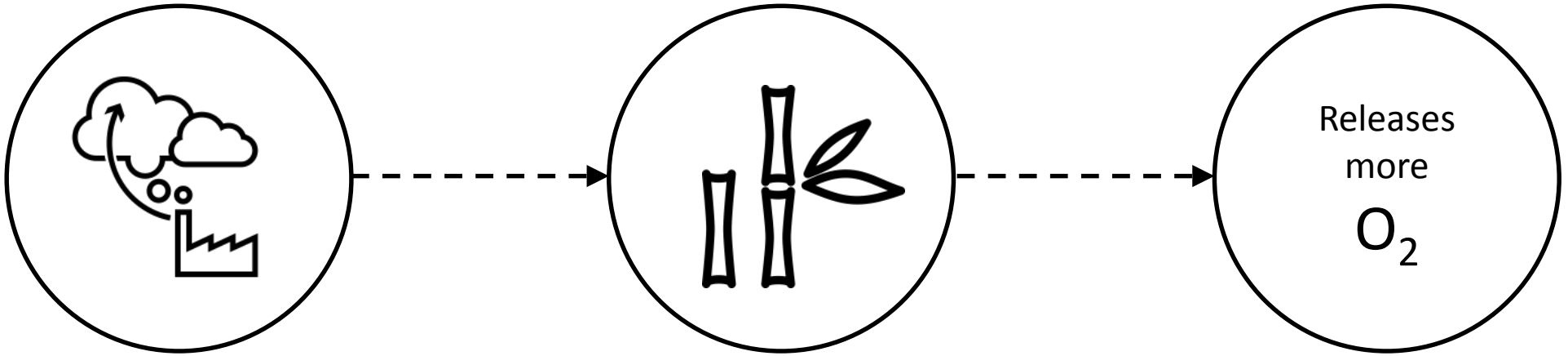

Atmospheric carbon dioxide
Riverine outgassing
Erosion
Soil storage
Inorganic carbon
Organic carbon
Photosynthesis
Decomposition
Riverine export
Open ocean storage
Coastal sediment storage

Bamboo



- **Absorbs relatively more CO_2 than trees, thereby**
- **Releases relatively more O_2 than trees**
- Great natural carbon sink → Fast biomass generation
- Fast re-growth even after regular harvesting

Bamboo

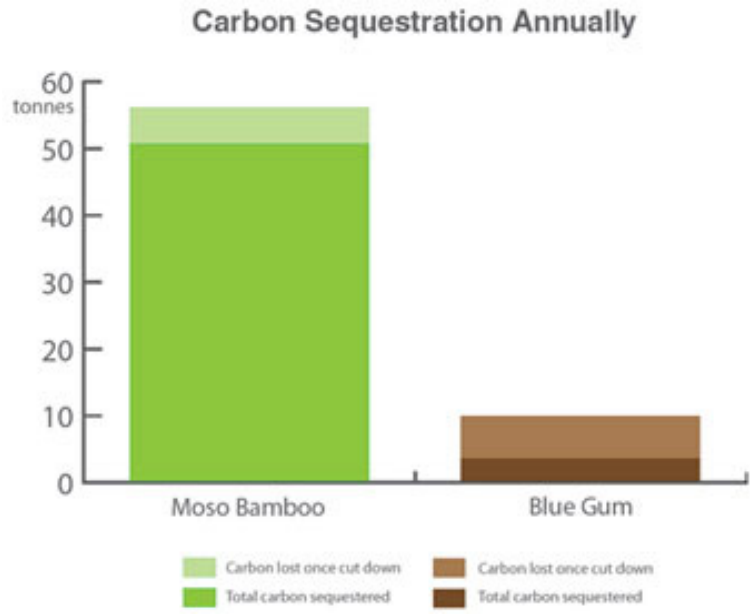


↓ Greenhouse Gas

Bamboo indirectly ↓ greenhouse gas emissions by:

1. Producing bamboo products usually requires < energy than comparable fossil-fuel based produce
2. Selectively harvested bamboo provides woody biomass
3. Transformed into durable products with long life spans ↑ terrestrial carbon sink
4. Produce both bamboo fuel & charcoal for cooking and heating
5. Generate electricity via biomass gasification technology
6. Bamboo charcoal has a calorific value similar to that of wood charcoal but is much less polluting

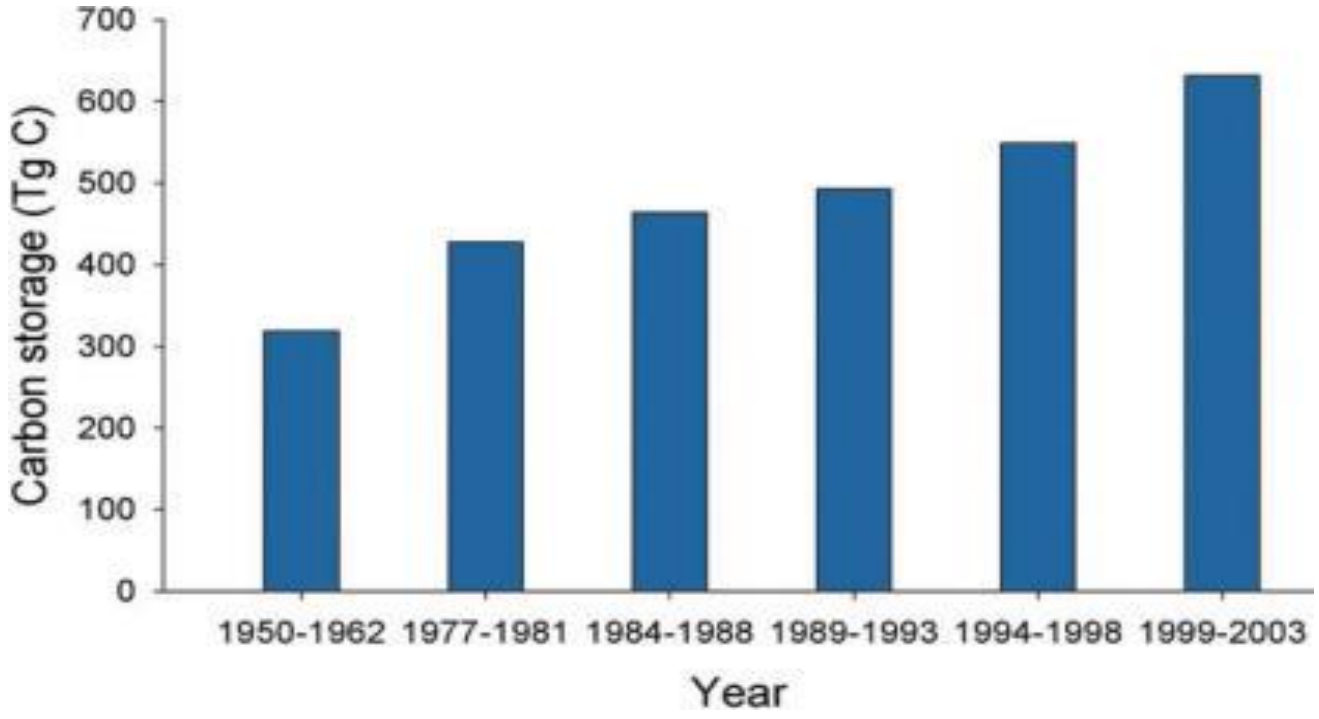
Carbon Sequestration



Researches and studies:

- Annual carbon fixation of the tree layer in a Moso bamboo forest was 5.10 t/ha
  - 1.33 times the value for a tropical mountain rainforest
  - 1.41 times the value for Chinese fir *Cunninghamia lanceolata* at 5 years old (Zhou and Jiang 2004)
- One of the most efficient types of forest vegetation for carbon fixation
- Estimates of the total carbon storage in Chinese bamboo forests from 1999 to 2003 ranging from 605.5 to 1425 Tg C (Lou et al. 2010)

Carbon Sequestration



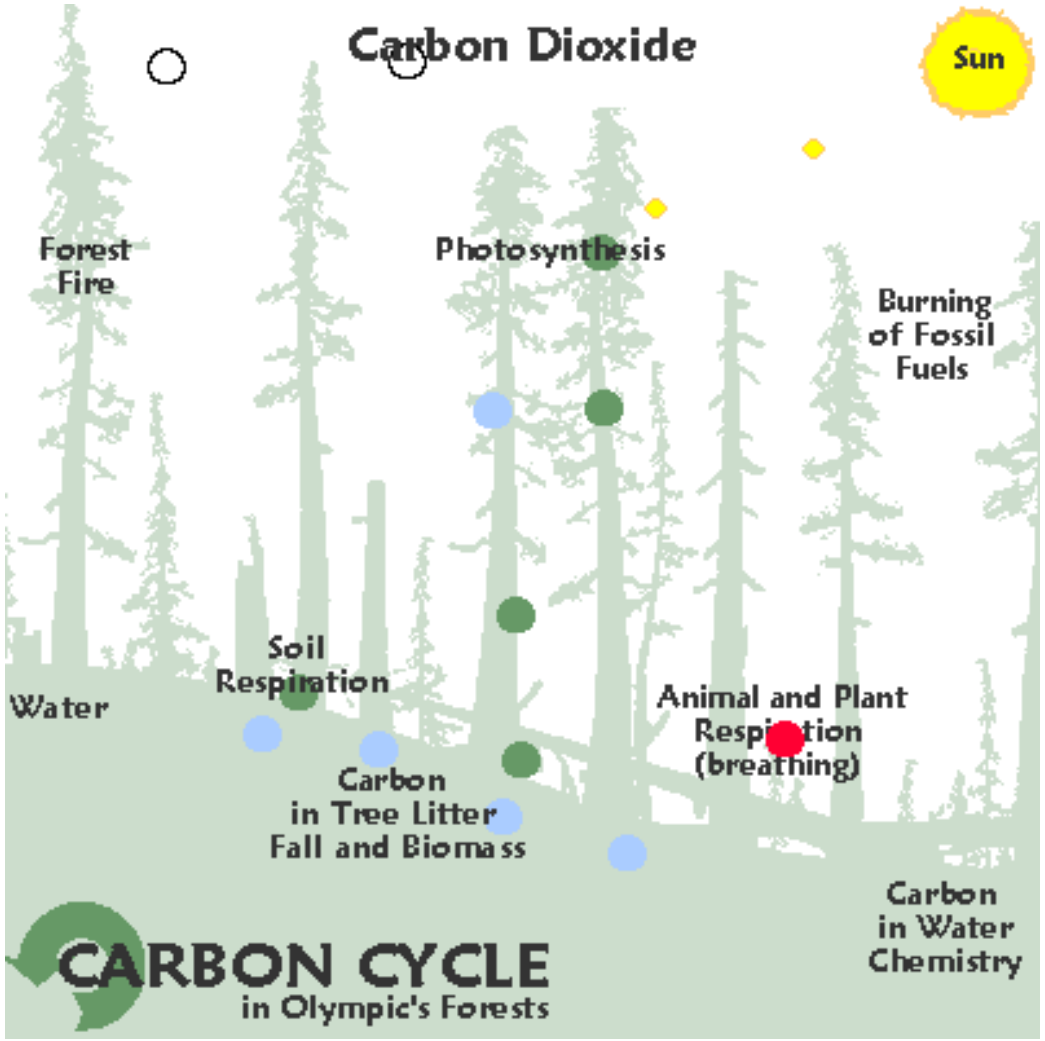
Changes in carbon storage by bamboo forests in China since 1950 (Chen et al. 2009)

Carbon Cycle

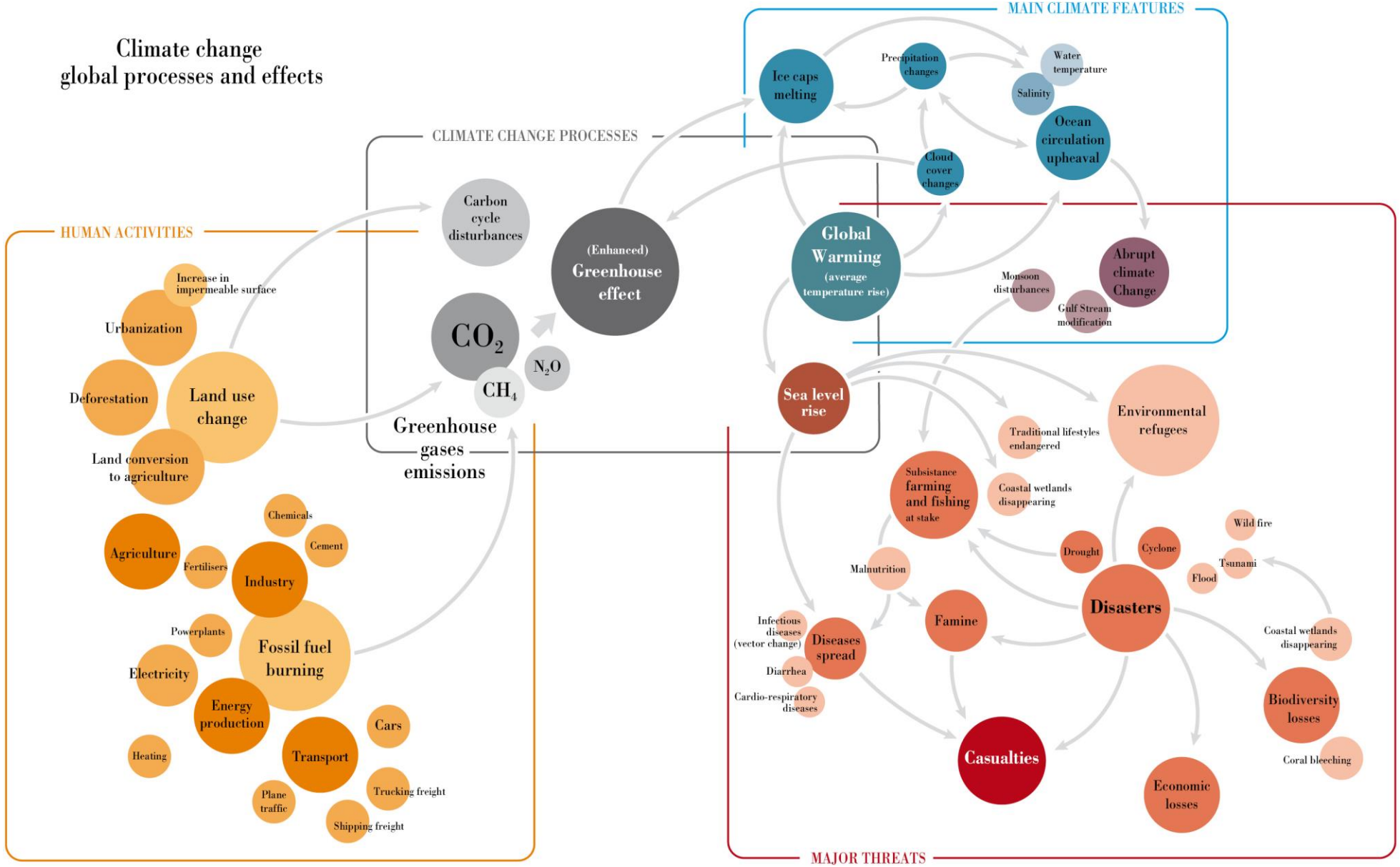
Bamboo might be the best carbon sequestrating plant in isolation, but in nature the picture is made up of a larger design and hence the importance of well-designed multi-cropped agroforestry solutions, as recognised as best practice for African small scale farming conditions by the Food & Agriculture Organisations.

Not recommended:

Mono cropping attracts pests, stifles biodiversity and is done at high density draining our water resources.



Fight the climate change!



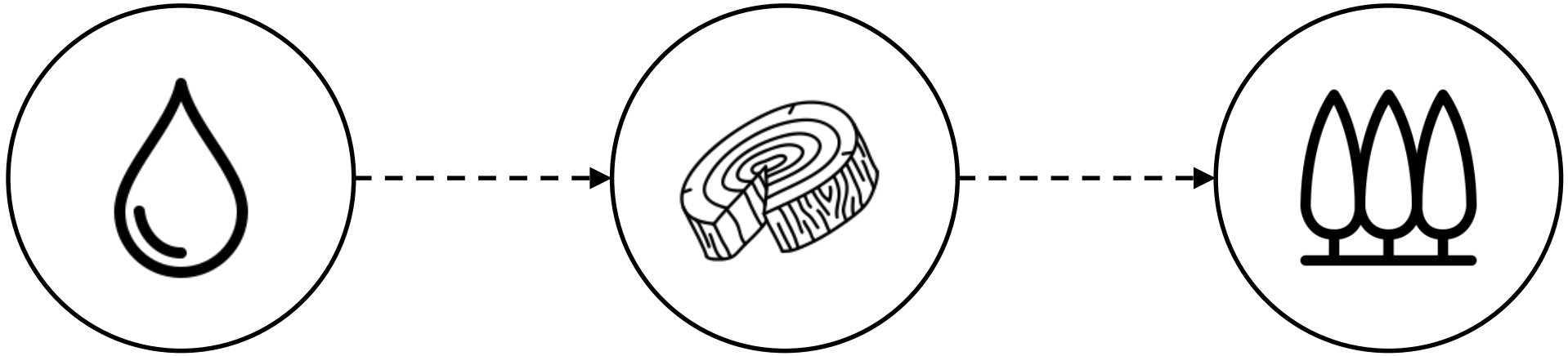
Fight the climate change!

Minimize CO_2

Generates more O_2

Solution for Global Warming

Fight the climate change!

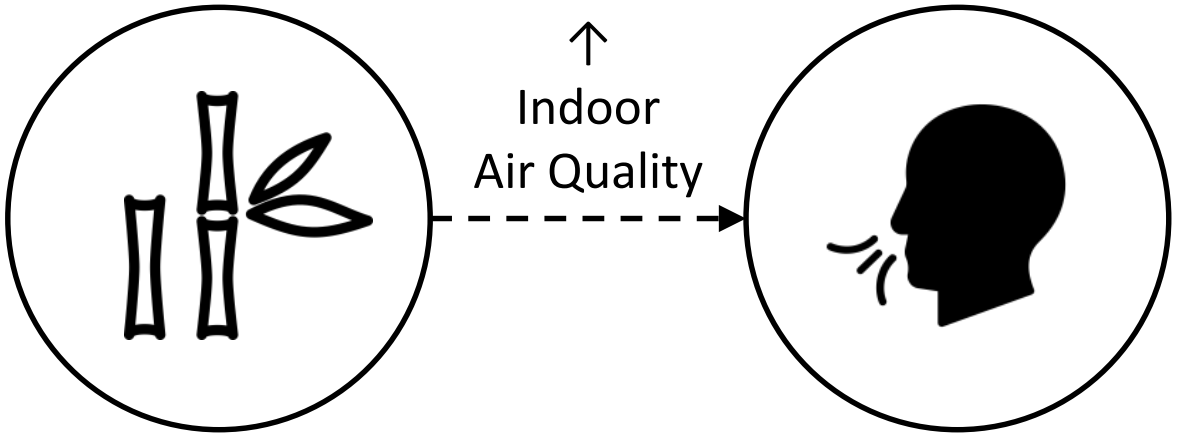


Sponge city
海綿城市

Alternate from timber to bamboo
以竹代木

A Forest Station

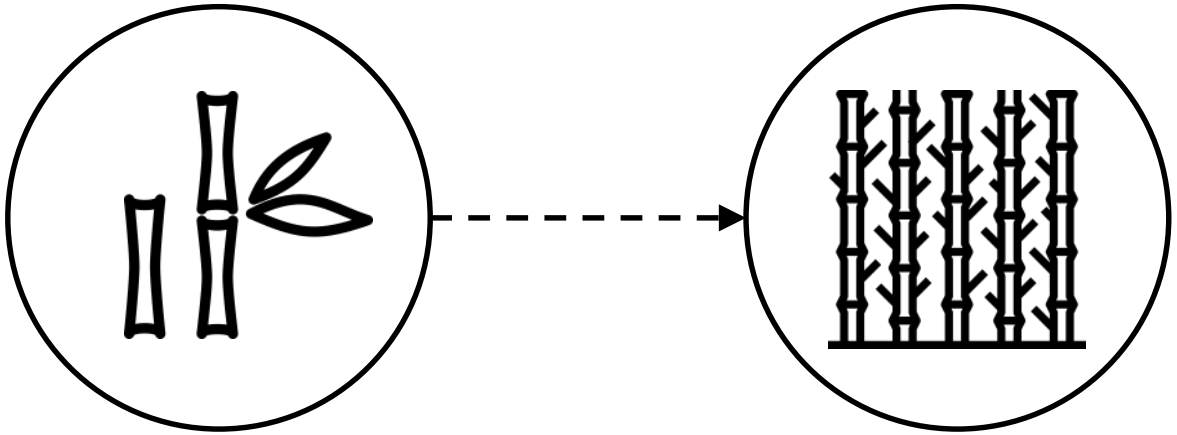
Other Benefits of Bamboo



Bamboo is a GREEN material to save our planet

- Improves the **Indoor Air Quality (IAQ)** within and around buildings and structures, especially as it relates to the health and comfort of building occupants
- Positive impacts on natural environment and human health
- Uses renewable resources more efficiently and wisely
- Reducing the pace of deforestation
- Relieving global warming and natural ecological crisis
- “Natural Oxygen Bars”
- 2 times negative oxygen ions concentration comparing to evergreen broad-leaved forest (Cha Shan Zhu Hai National Forest Park in Chongqing city)
- Bamboo leaf can capture 4 to 8 g/m of dust
- Bamboo belt reduce noise (10 to 15 dB by 40m wide belt)

Bamboo



For climate change mitigation

- Rapidly sequesters carbon, avoids fossil fuel use
- Offers a highly renewable source of biomass energy – as a substitute for wood fuel and fossil fuels

For landscape restoration

- Rapidly restores degraded lands in the tropics
- Thrives on problem soils and steep slopes that are unsuitable for other crops, eg Tuen Mun highway.
- To date, millions of hectares of degraded lands have been restored with bamboo, many millions more can benefit

For adaptation

- Protects communities from natural disasters as a part of sustainable forestry & agro-forestry systems
- Rapid growth allows frequent harvesting, helping farmers respond adapt changing weather patterns

Why use bamboo?

- Bamboo can be harvested within 5-7 years
- Extraordinary physical characteristics
  - Suitable for all types of structures and constructions
- Light building material for easy transportation & storage

Facts to be noted

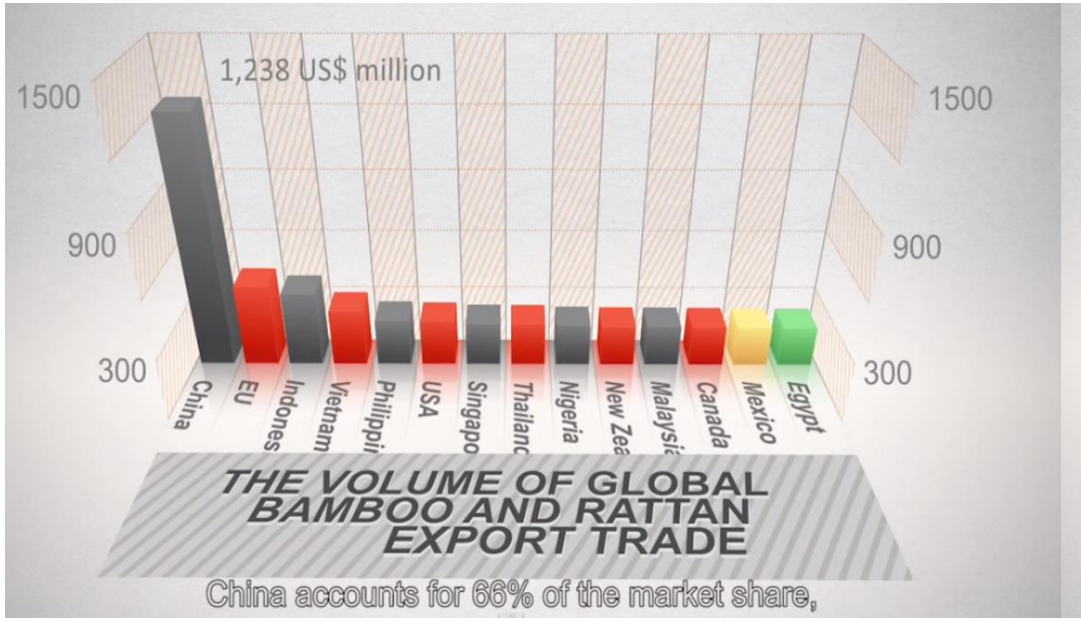
- Are processed and compressed with chemical-based glue
  - Formaldehyde out-gassing, esp bamboo product made with low quality glue
- Durability
  - Bamboo flooring last 30–50 years (while some solid hardwood last 125 years or longer)

Economical

Bamboo also widely known as resources that empower the poor. They already play a critical role in supporting poverty alleviation contributing to livelihoods of millions for people worldwide.

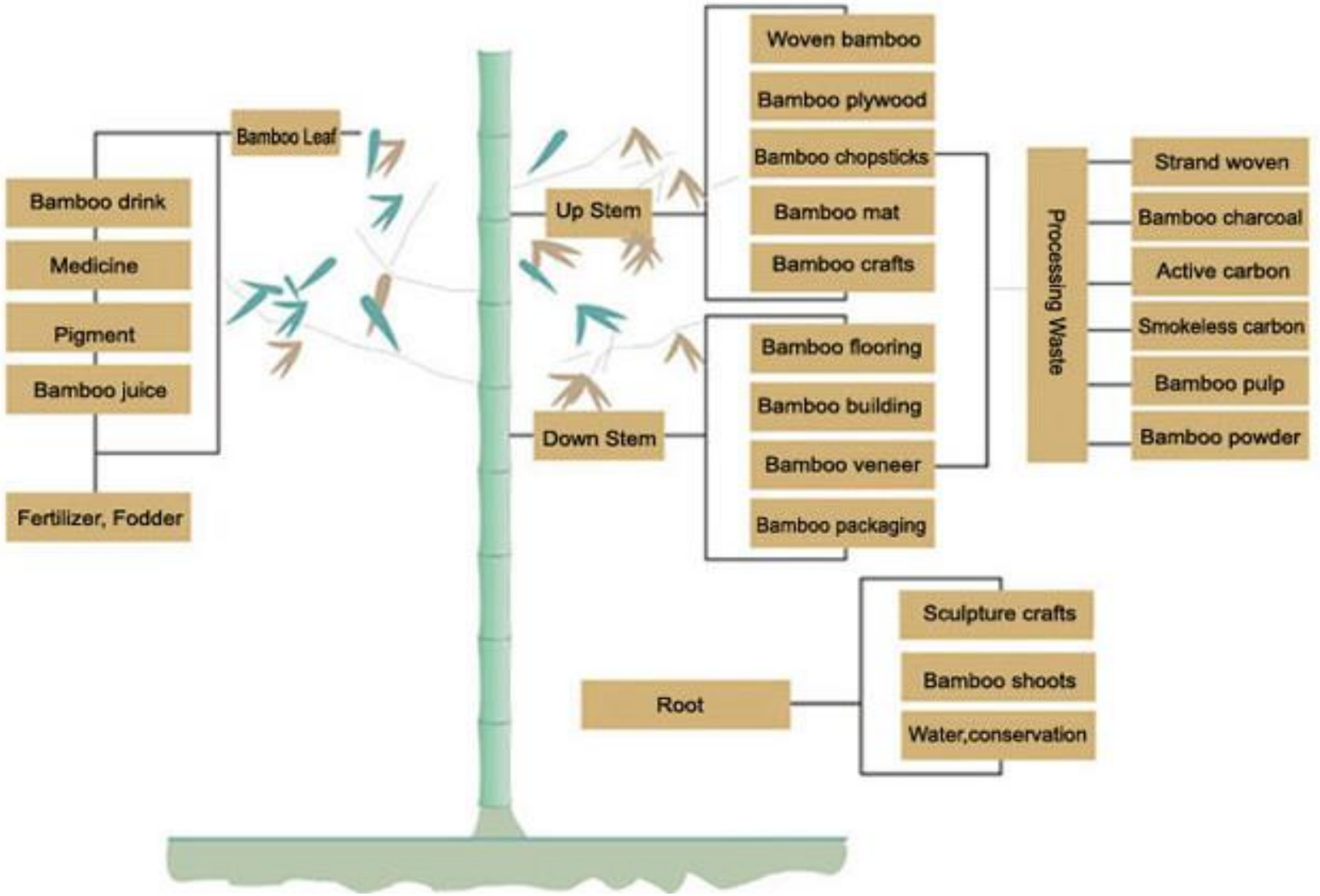
Source: INBAR Proposing an International Standards Organisation Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

The Global trade in bamboo product across 120 countries



Source: INBAR Proposing an International Standards Organisation Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

Bamboo Comprehensive Utilization





Despite this progress the present lack of uniform international standards for the vast majority of bamboo products has long stood in the way of further rapid growth in international trade. The need and imperative for establishing an international platform to set standards on bamboo is now more pressing than ever.

Source: INBAR Proposing an International Standards Organization Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

1. Combining state of art knowledge on current research Industry processes & trade

Basic standards

Source: INBAR Proposing an International Standards Organization Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

The newly proposed ISO Technical Committee for Bamboo will provide the bamboo sector with valuable guidance on terminology, methods and stands for major internationally traded products. The technical committee will firstly focus on publishing basic stands, covering terminology and classification criteria of bamboo and their related products.

Source: INBAR Proposing an International Standards Organization Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

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2. Provide scientific & unified approach for evaluating bamboo properties

Source: INBAR Proposing an International Standards Organization Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg




The committee will establish standards for methods, covering test methods on the physical, mechanical and chemical properties of bamboo.

Source: INBAR Proposing an International Standards Organisation Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

3. Committee to define standards for internationally traded bamboo products

Source: INBAR Proposing an International Standards Organisation Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

These standards will guide industry globally, with small and medium-sized enterprises in developing nations being among the main beneficiaries. This will lead o improvements in the processing and quality of bamboo products, enhancing their value and competitiveness in the global market.

Source: INBAR Proposing an International Standards Organisation Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

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Bamboo Industrialization

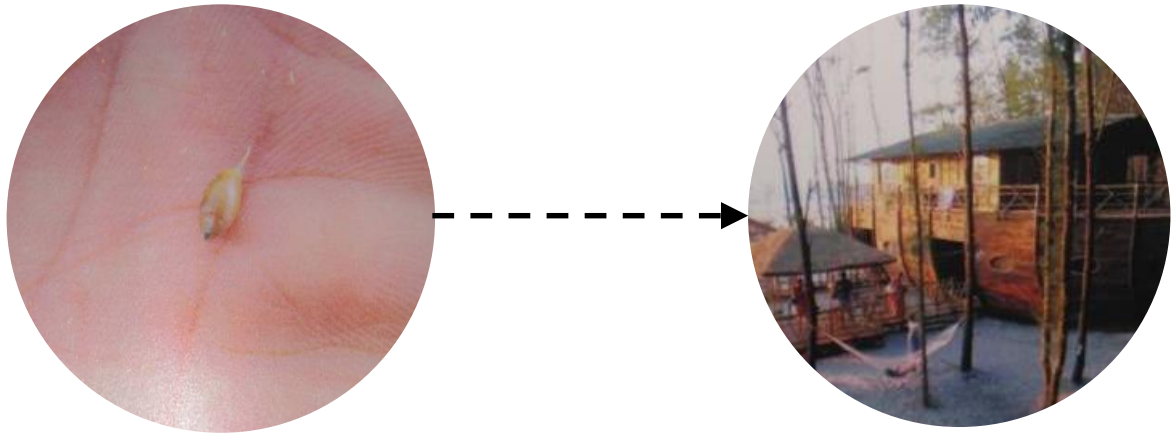
Bamboo Seed

Bamboo Resources

Bamboo Industrialization

Bamboo
Architecture / Products

Bamboo Industrialization



From the seed

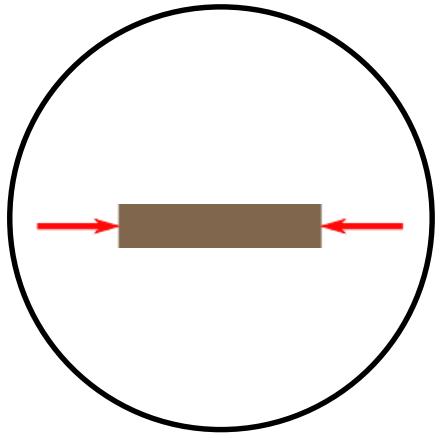
Final assembly

Architecture

As a Building Material

- Often referred to as the poor man's timber
- Becoming increasingly popular among Western architects and engineers
- A major building material in many countries, particularly in Asia, Africa and South America
- Well Known for its strong characteristics, light weight and flexible properties
- Can be used for almost all parts of houses, including posts, roofs, walls, floors, beams, and trusses

Mechanical Properties



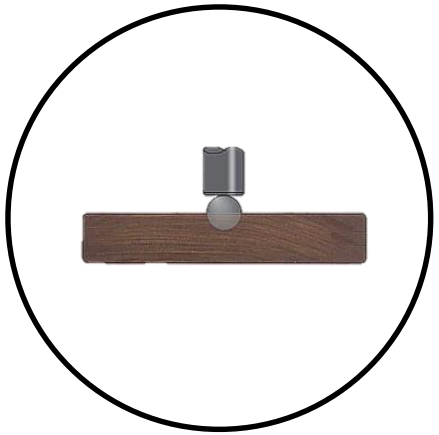
Compression Strength

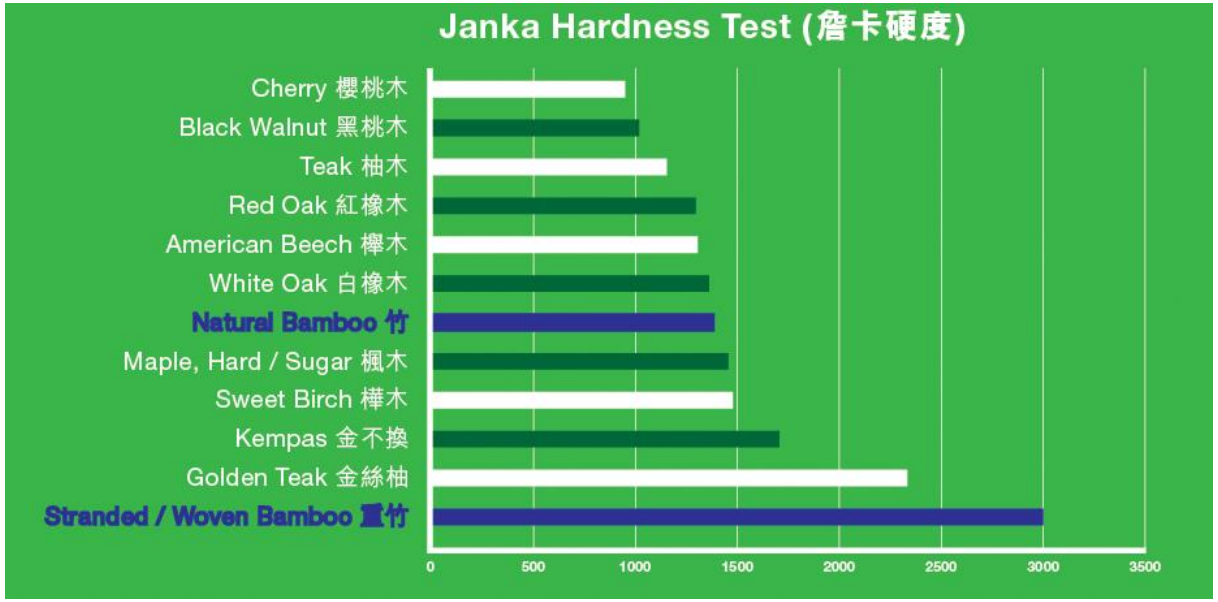
The capacity of a material or structure to withstand loads tending to reduce size

Material	MPa
Bambusa blumeana	24.0
Bambusa vulgaris	25.3
Gigantochloa scortechinii	27.0
Red Oak	46.5
Douglas Fir	49.8
White Pine	33.0
Western Cedar	31.5

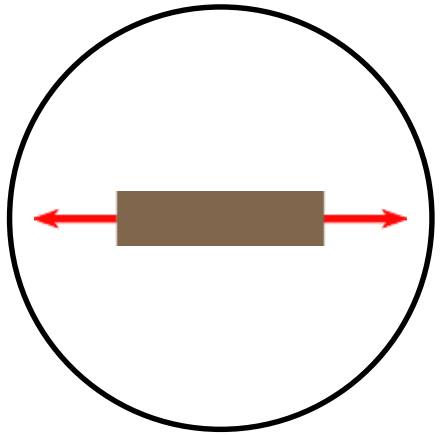
Liese (1985)

Mechanical Properties





Mechanical Properties



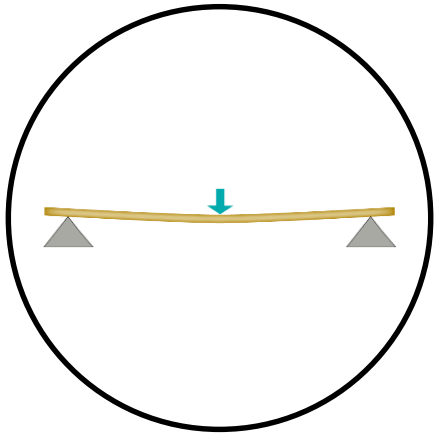
Ultimate Tensile Strength

The maximum stress that a material can withstand while being pulled before breaking

Material	MPa
Bamboo	350 – 500
Red Oak	48 – 63
Pine	21-32
Concrete	3
Structural Steel A36	400
Silicon	7000

(David W. Green et al., 2008)

Mechanical Properties



Flexural Strength (Modulus of Rupture)

The highest stress experienced within the material at its moment of rupture

Material	MPa
Bambusa blumeana	99.8
Bambusa vulgaris	62.3
Gigantochloa scortechinii	52.4
Red Oak	98.5
Douglas Fir	85.5
White Pine	59.3
Western Cedar	51.7

Liese (1985)

Mechanical Properties

Modulus of Elasticity

An object's tendency to be deformed (non-permanently) when a force is applied to it

A measurement of stiffness

Material	MPa
Bambusa blumeana	4,100
Bambusa vulgaris	6,100
Gigantochloa scortechinii	4,800
Pine (along grain)	9,000
Oak (along grain)	11,000
Douglas Fir	13,000
Steel	200,000

Liese (1985)

Mechanical Properties

- In general, bamboo is stronger than wood in bending strength, compression strength parallel to grain and is similar in shear strength parallel to grain
- The strength of bamboo in grain direction is extremely high, especially MOR and MOE. It might be suitable as the raw material for such products as oriented structural boards which bears unidirectional load (Febrianto et al., 2012)
- Bamboos have low shear strength parallel to grain. The bamboo veneers can be peeled from straight culms of a thick-walled bamboo species

Mechanical Properties

1.Bamboo Forest

Cutting

2.

Skin knot removal

3.

Slicing

4.

Inside knot removal

5.

Rough planning

6.

Carbonization

7.

Drying

8.

Fine planning

9.

Selection

10.

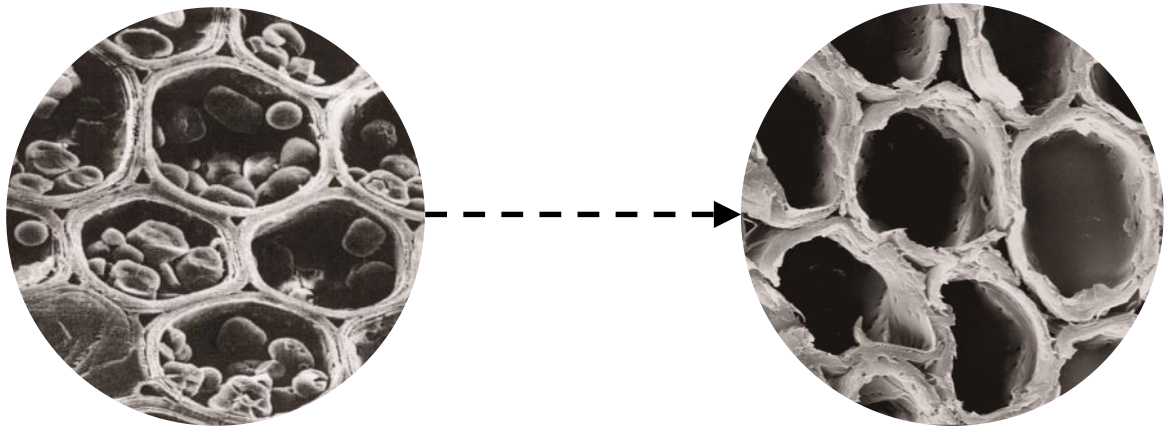
Gluing

11.

12. Lamination

12-Steps Production Process

When NOT handled correctly

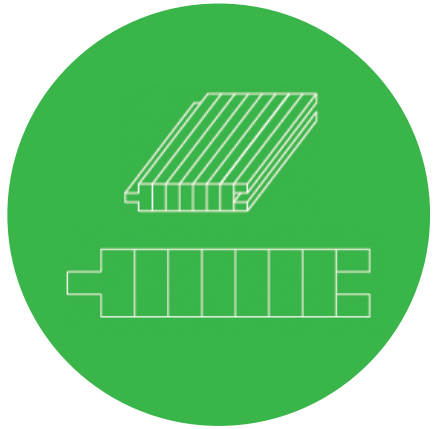


Before Treatment

After Treatment

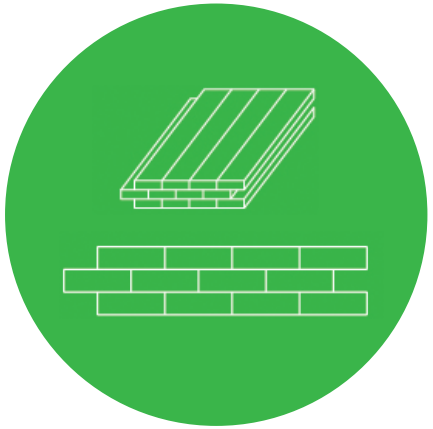
- Starchy interior is attractive to insects and pests
  - Proper immunization techniques and drying processes will prevent this from occurring
- Diameter of the bamboo diminishes when drying
  - Dried in advance of construction
- Special techniques for joints and terminals
  - nails into bamboo can result in splitting
  - Variation in thickness of the internal walls

Structure & Colour



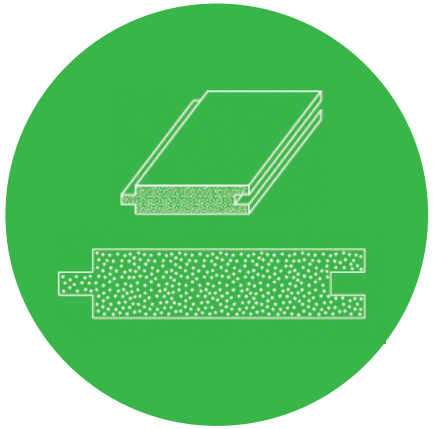
Vertical

Bamboo strips are stood vertically on their narrowest edge and then laminated from side to side. The effect is a lined, almost uniform look to the surface of the finished floor plank.



Horizontal

Bamboo slats are arranged in a horizontal direction, on their widest edge, and then joined side by side with adjacent pieces using a high-pressure laminate system. The characteristic nodes of the bamboo are visible on the finished horizontal surface.



Strand Woven

Bamboo strips are thrashed into thing strips and then being compressed under high pressure.

Structure & Colour

Horizontal
Natural

Horizontal
Carbonized

Vertical
Natural

Vertical
Carbonized

With proper management and building techniques, bamboo can be a better alternative to wood

Structure & Colour

HONG KONG 2017
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HKGBC 香港綠色建築議會

竹

First International Bamboo Architecture Biennale

Baoxi

China 2016

Organisers

First International Bamboo Architecture Biennale

Baoxi, China 2016

Last fall the very first International Bamboo Architecture Biennale premiered in the small village of Baoxi, China, placing eighteen permanent works by twelve international architects within the traditionally agriculture-centered town. The biennale, curated by artist Ge Qiantao and architect George Kunihiro, reveals how the traditional material can be incorporated into contemporary design. The plant serves as the base to new buildings in the village including a youth hostel and a ceramics museum, which Baoxi hopes to draw tourism to through supplementary infrastructures such as a visitors building, hotel, and learning center.


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First International Bamboo Architecture Biennale
竹

First International Bamboo Architecture Biennale

Baoxi, China 2016








Setouchi Triennale 2016 (Japan)

Dream of Olive by Wang Wen Chih (Taiwan)
2016 瀨戶內國際藝術祭 (日本)
橄欖之夢

A massive dome constructed from over **4,000 pieces of locally-grown bamboo** becomes a stage for the third time, this time on the theme of olives. The interior becomes a stage on which visitors can wander around. The dome's presence transforms the feel of the surrounding landscape.

Source: http://setouchi-artfest.jp/en/artworks-artists/artworks/shodoshima/125.html/

Expo Milano 2015
China Pavilion

Organisers

Expo Milano 2015 China Pavilion

The roof located in the top of the China Pavilion, is made of bamboo, shade bamboo mosaic composed of sheet - by a computer parameterization "write" out of the roof. Angle texture down on the roof, "floating" in the northern Italian sunshine covered, warm of the China Pavilion. China Pavilion inside, diffuse light into the interior through the bamboo skin, mottled projected on PVC cloth under the skin, with the seasons and time changes.

Great (Bamboo) Wall in Beijing

By Kengo Kuma & Associates

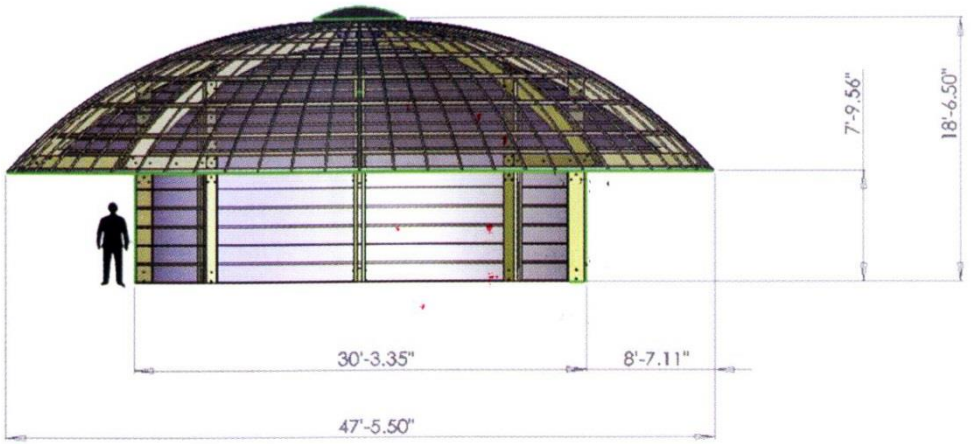
As for the material, they used bamboo as much as possible, since it's considered as having a significant meaning among Chinese and Japanese cultures. Depending on density of bamboo and its each diameter, it offers a variety of partitioning of space. Making the most of that characteristics, we decided to place a bamboo WALL, a layer of bamboo along the site's inclination just like the Great Wall. The Great Wall in the past partitioned off two cultures, but this BAMBOO WALL would not only partition but also unite life and culture in various manners as the Great Wall in particles.

Address: The Great Wall Exit No.53 at Shuiguan G6 Jingzang Highway, Beijing, China
Source: http://kkaa.co.jp/works/architecture/great-bamboo-wall/

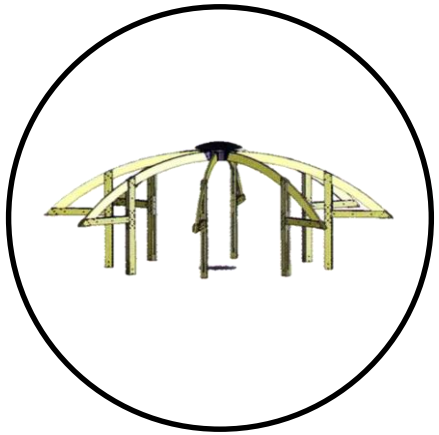
Low income
bamboo housing

Organisers

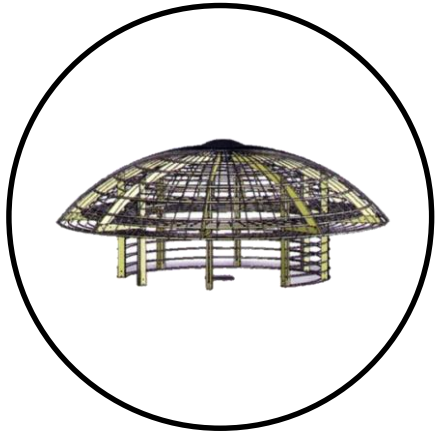
Affordable Housing



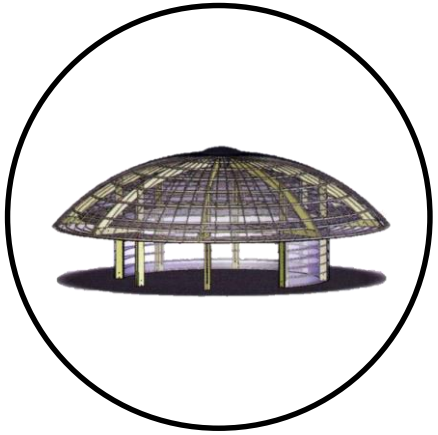
"We come spinning out of nothingness, scattering stars...
the stars form a circle, and in the center we dance."
-Rumi



Step 1



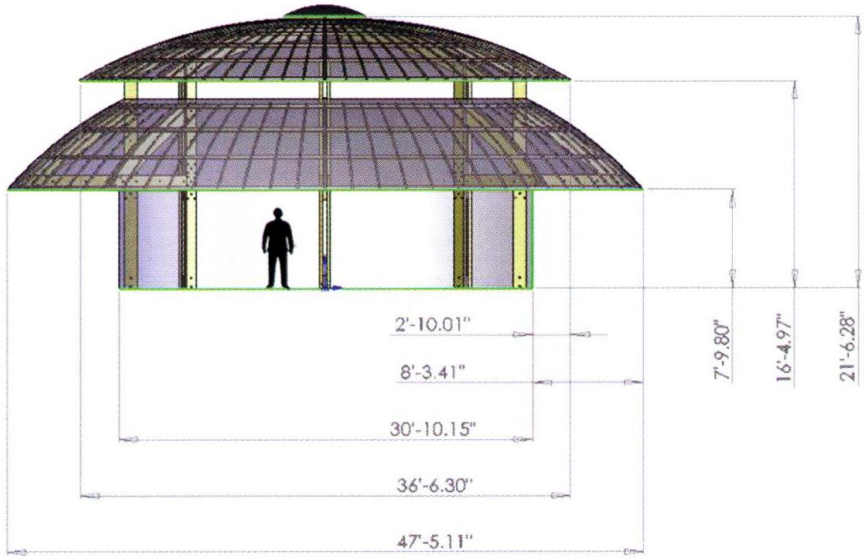
Step 2



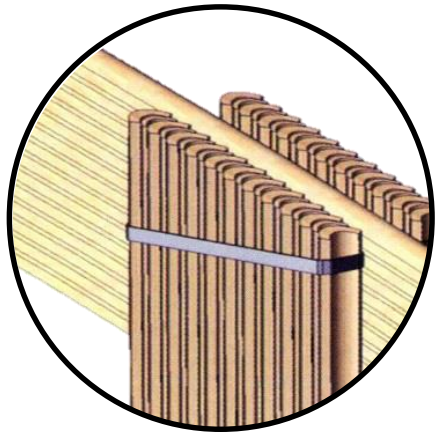
Step 3

Step 4

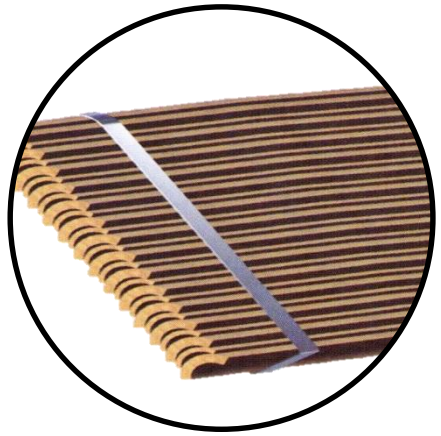
Affordable Housing



Detail 1

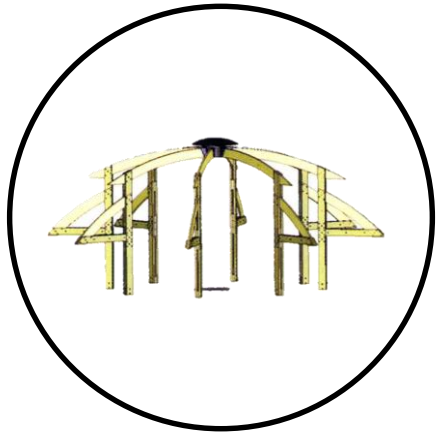


Detail 2

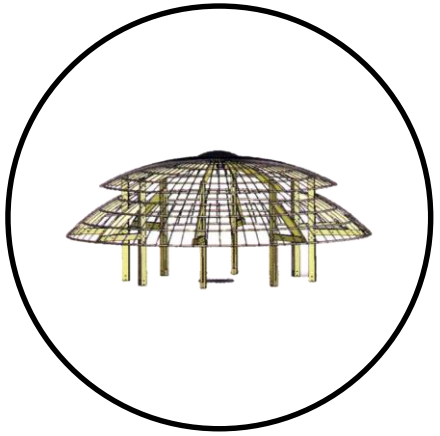


Detail 3

Affordable Housing



Step 1



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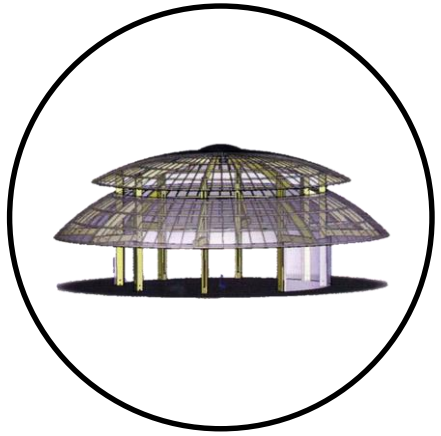
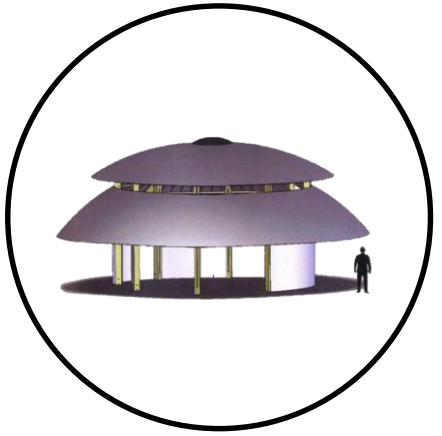


Step 3



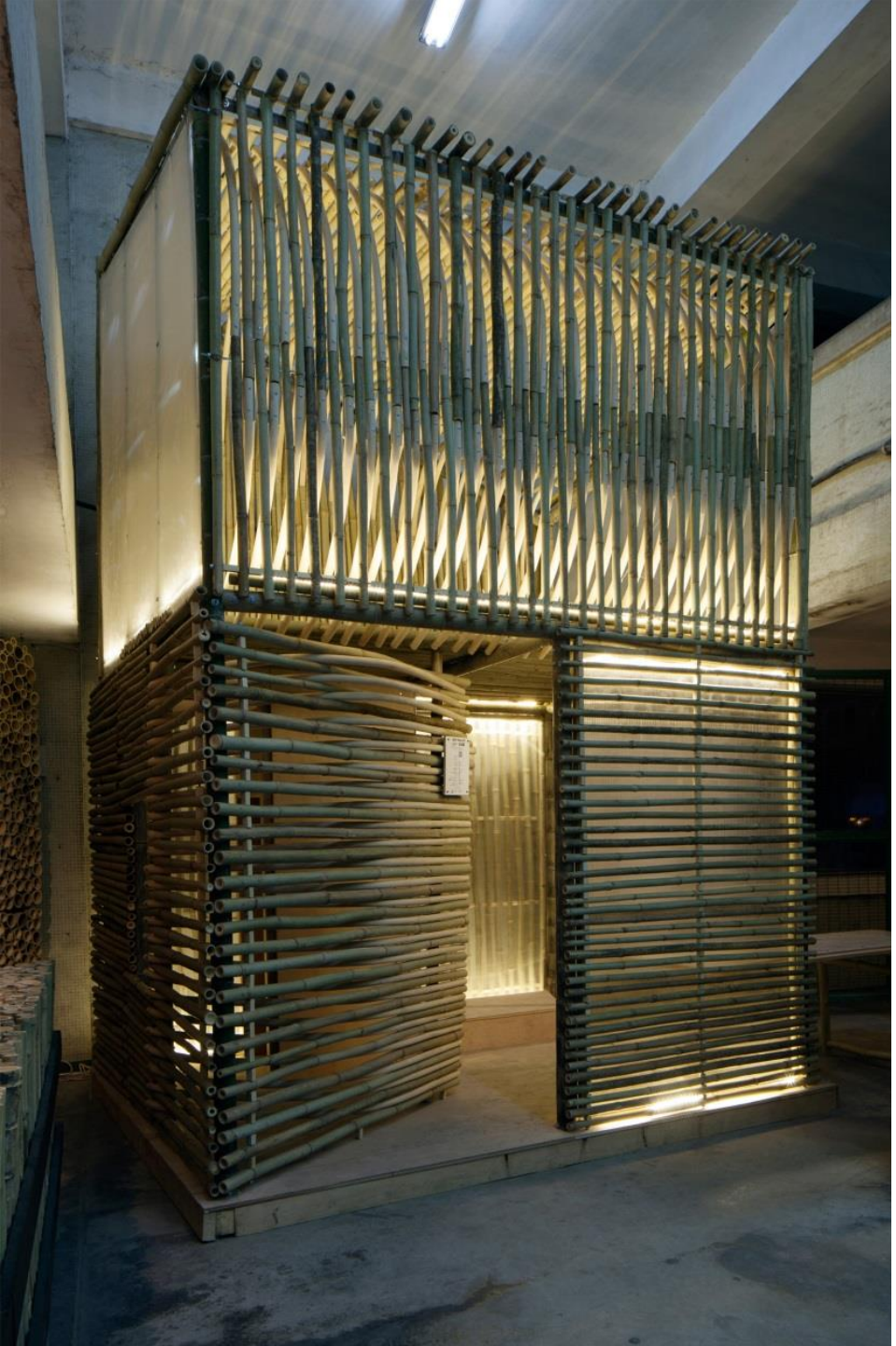
Step 4

1420 affordable housing

Team: Joshua Doolittle, Glenn Schmierer, Zak Rosser, Garth Goldstein, Tony Birkholz

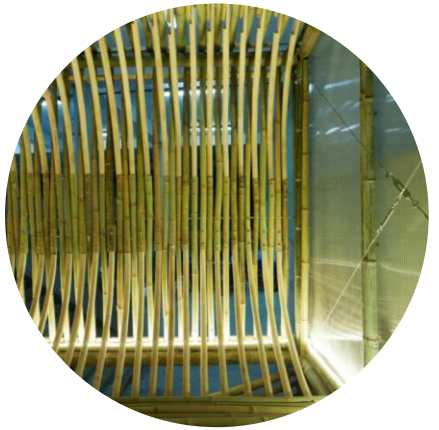
Organisers

Low-cost Bamboo House, Ecuador

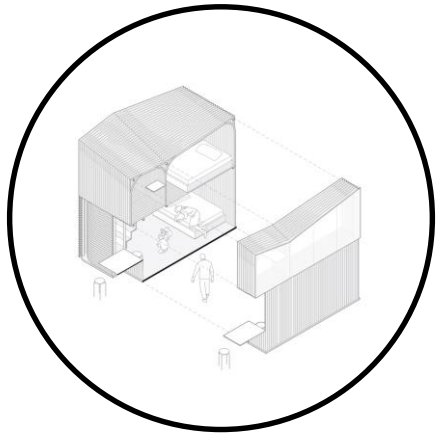


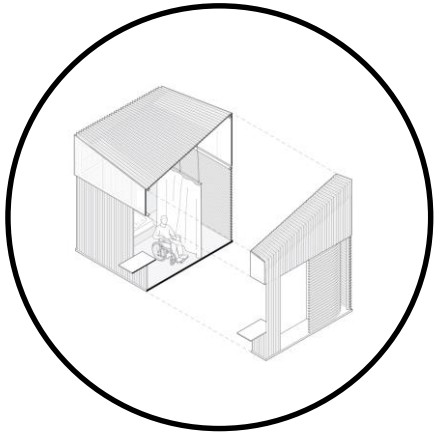
Organisers

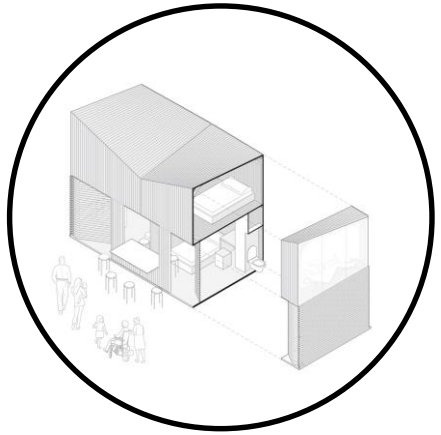
Bamboo Micro Housing, Proposal

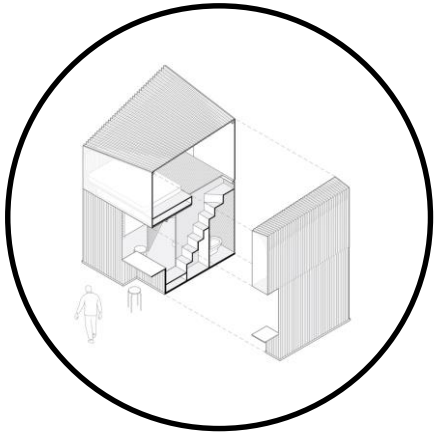


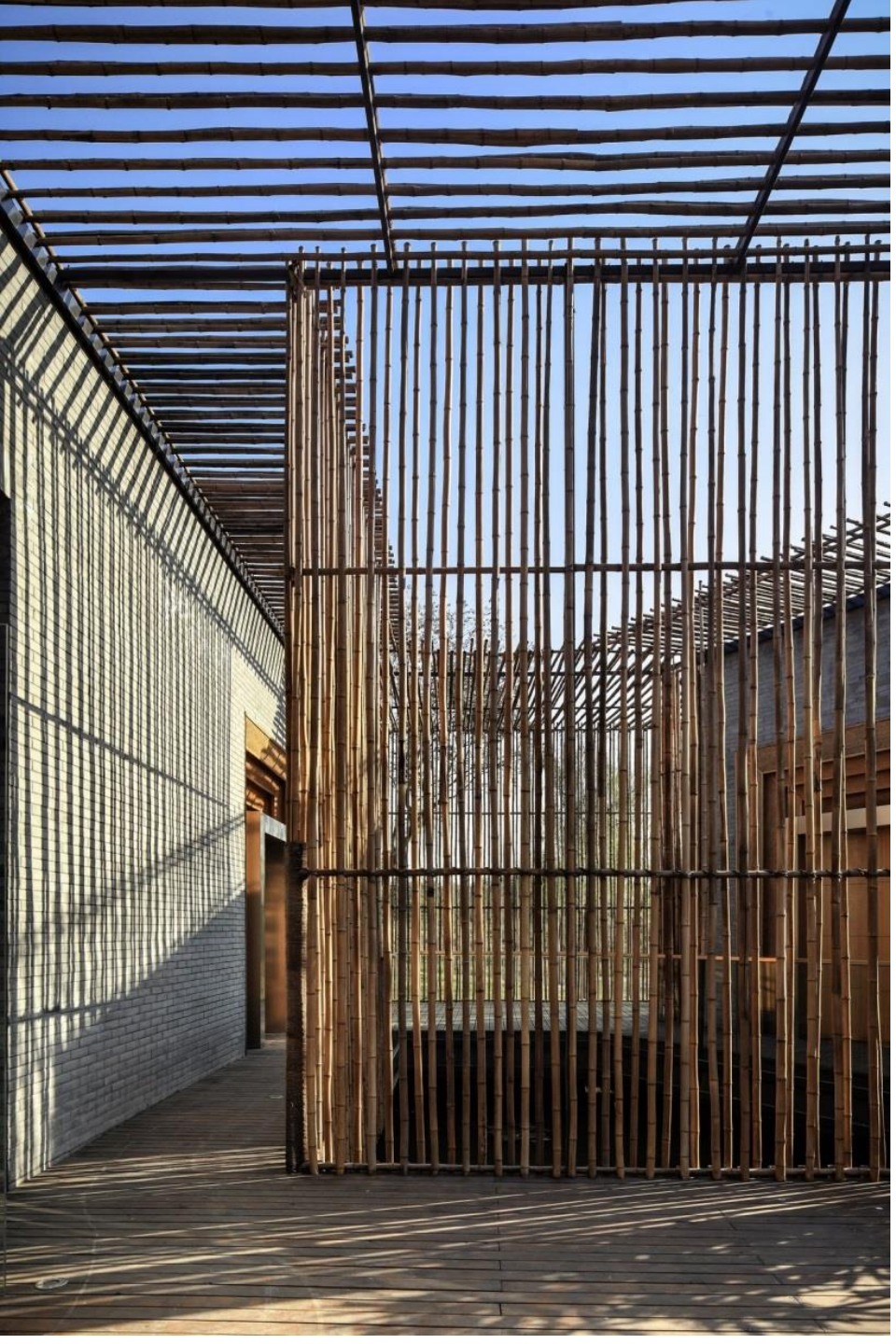
Bamboo Micro Housing Proposal





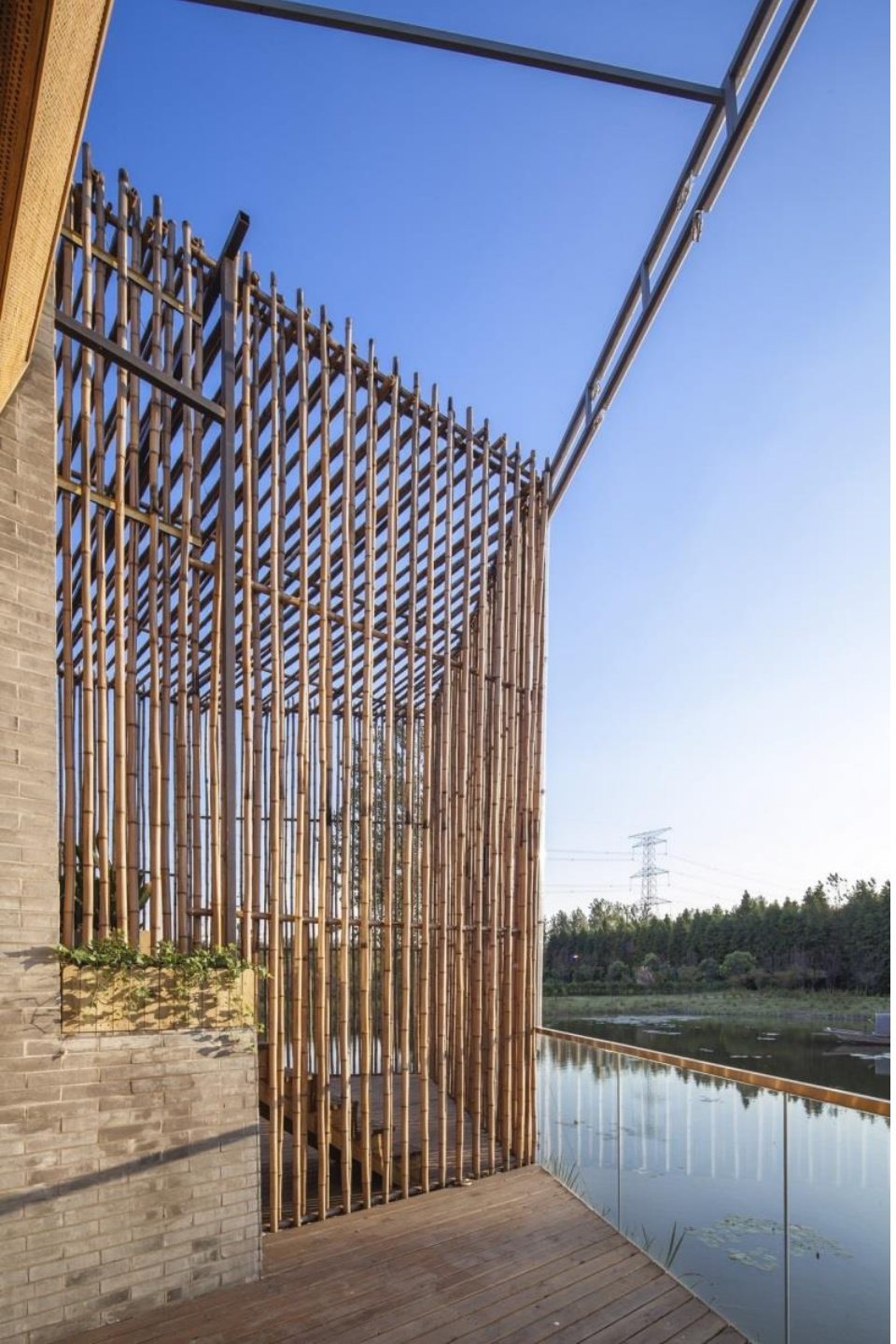






Organisers

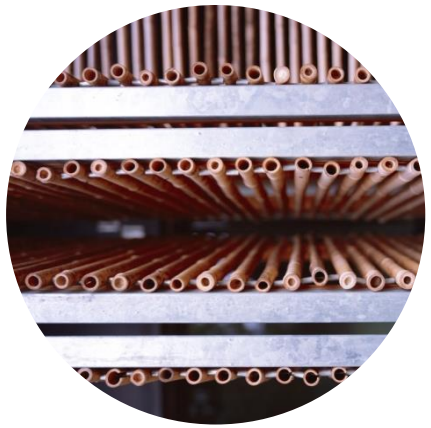
Bamboo Courtyard Teahouse, Yangzhou, China



Organisers

Bamboo Courtyard Teahouse, Yangzhou, China

Passive House, France



Bamboo Spa Resort in Vietnam

by Vo Trong Nghia Architects

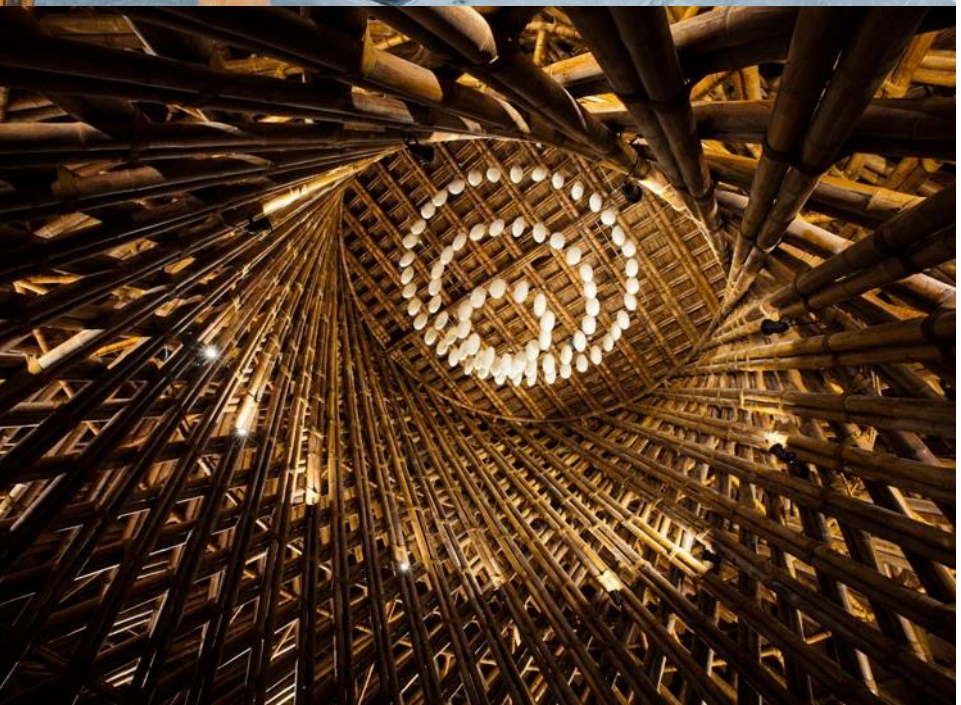
Source:
http://mp.weixin.qq.com/s?__biz=MjM5OTEyMjgyOA==&mid=2652084665&idx=3&sn=9d7e27fa7828bf1902beb7f9d53d150d&chksm=bd277b5a8a50f24c86b4807c63241dd82f3e4523aa1c8791890b9793e785f5071ce25be348e5&mpshare=1&scene=5&srcid=1020VgKv35fPoUft2K7aksWw#rd

Bamboo restaurant and beach bar to spa resort in Vietnam

by Vo Trong Nghia Architects

The beach bar lies adjacent to the infinity pool along the coastal front of the resort complex. visualized as a semi-open space –allowing a constant breeze to flow through– **the structure is composed of bamboo, stone and finished with a thatch roof.** the process in which the robust, natural material was formed was through a method of using fire, soaking and fumigation. approached as a simple, pitched roof structure, the unobtrusive building blends with its tropical setting where the naturally treated bamboo frame reflects the region's characteristics.

Address: Truong Sa Road, Ngu Hanh Son District, Danang
Source: http://kkaa.co.jp/works/architecture/great-bamboo-wall/



Bamboo restaurant and beach bar to spa resort in Vietnam

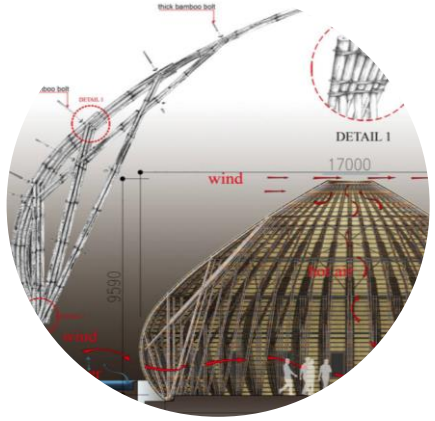
by Vo Trong Nghia Architects

The structure is made using bamboo, stone and has a thatch roof

Under the bamboo dome

Address: Truong Sa Road, Ngu Hanh Son District, Danang
Source: http://kkaa.co.jp/works/architecture/great-bamboo-wall/

Wind and Water Bar, Vietnam



Organisers

Wind and Water Bar, Vietnam

Kontum Indochine Café, Vietnam

The roof of the structure is clad with bamboo but also contains layers of thatch and fiber-reinforced plastic.

In some places the plastic panels are exposed, allowing natural light to permeate the canopy.

Restaurant without any walls, allowing uninterrupted views across the surrounding shallow pools of water.

Diamond Island Community Hall

(Bamboo Domes), Vietnam

Once bamboo has been soaked in mud and smoked,
It can be stronger than timber

Rising Poles

Source:
http://share.iclient.ifeng.com/sharenews.f?aid=cmpp_04074004443991
1&from=timeline&isappinstalled=0

Organisers

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HKGBC 香港綠色建築議會

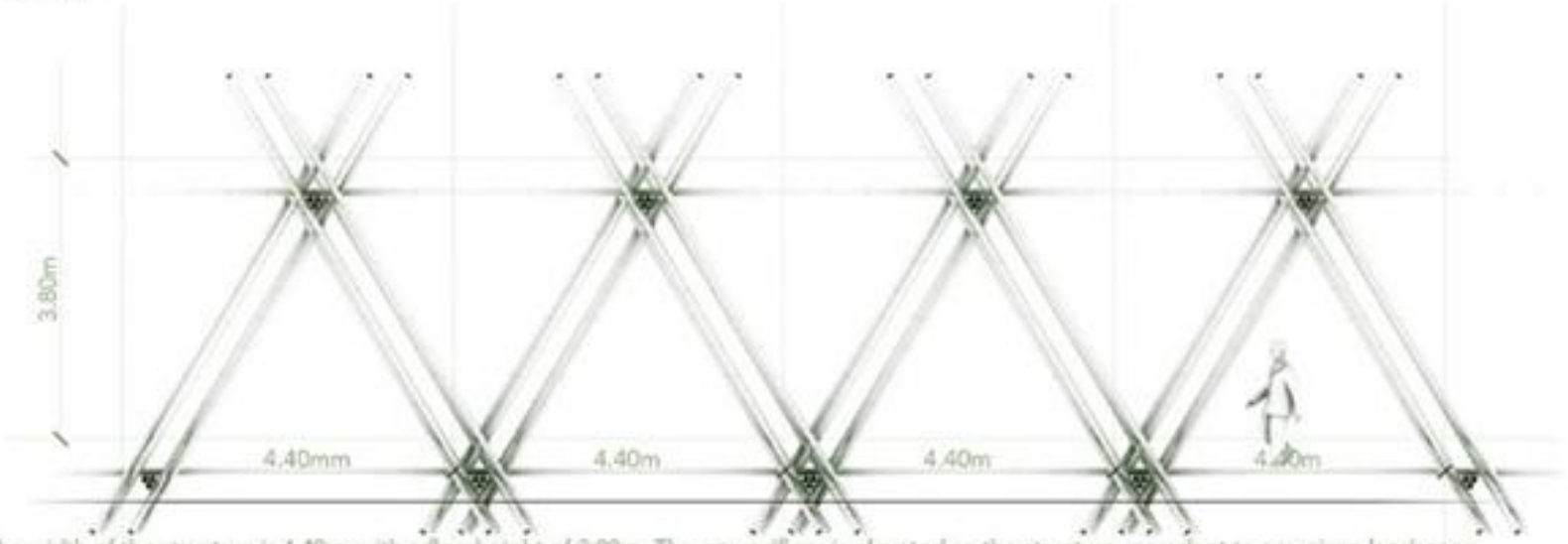
The Joint
节点

One stick of bamboo is tilted... ...rotated...
单一竹子固定，旋转

...and tied with a rope to a pre-manufactured 'rising cane'- joint.
多个竹子捆扎成一个标准节点

This joint is doubled to add stability and connected with a horizontal beam.
两个标准节点组合，固定横梁。

The Structure
结构



The width of the structure is 4.40m, with a floorheight of 3.80m. The groundfloor is elevated so the structure can adapt to any given landscape.
结构单元宽度4.4米，层高3.8米。底层架空使结构可以适应不同的地形条件。

竹

Low Energy Bamboo House

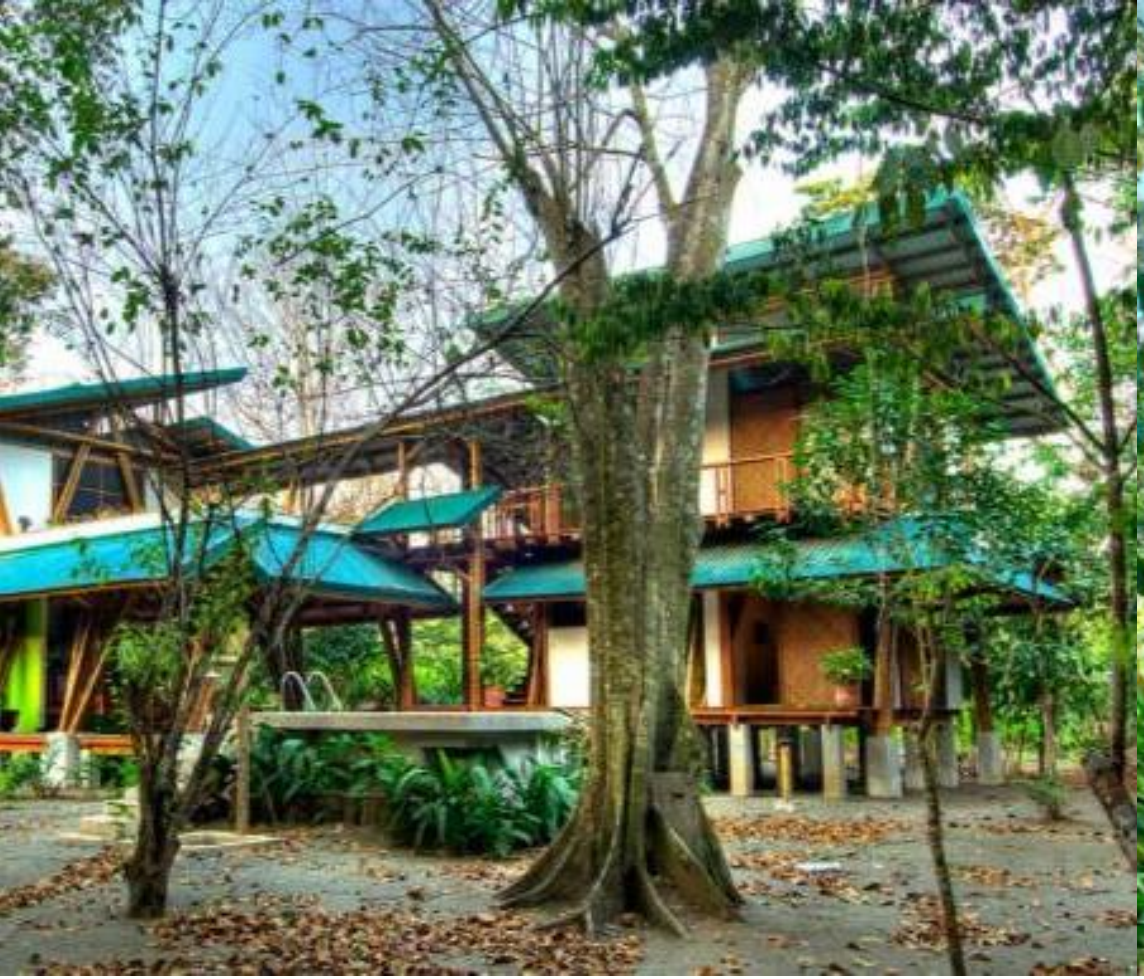
Belgium

Handmade School

Bangladesh

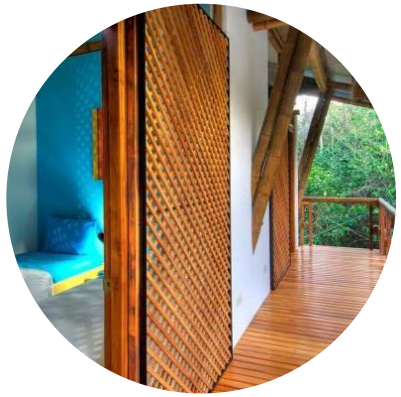
Timarai Bamboo Beach Resort Costa Rica

1st place in the 2005
National Architectural Contest



Bamboo Vacation Home Casa Atrevida

Earthquake and flood resistant



Bamboo House in Costa Rica

Designed and build by Martin Coto

Guadua Bamboo House

It took 12 people to built this bamboo project from scratch

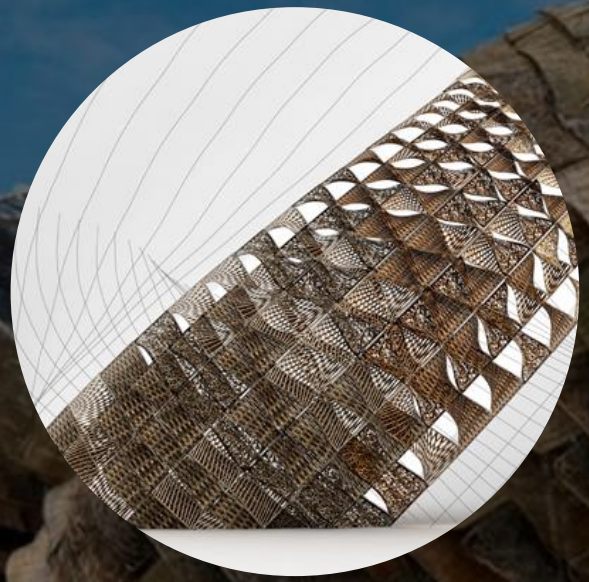
竹

Crosswaters Ecology & Spa

Nankun, Guangzhou, China

Indian Pavilion

2010 Shanghai World Expo



Spain Pavillion

2010 Shanghai World Expo

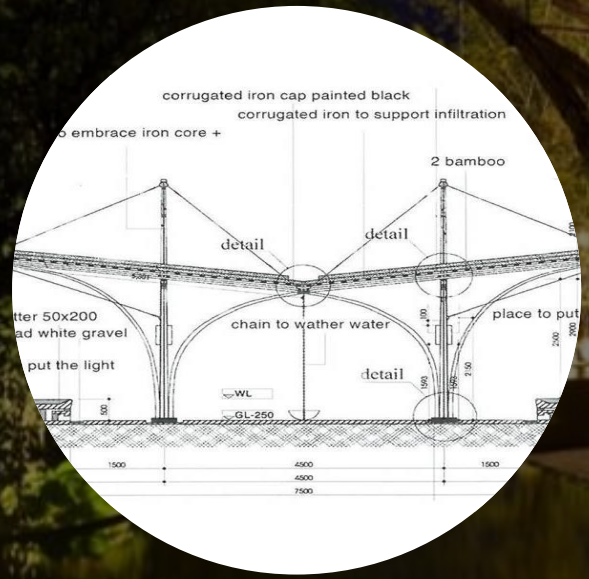
Spain Pavillion

2010 Shanghai World Expo

Organisers

Vietnam Pavillion

2010 Shanghai World Expo



Bird-shaped Coliseum

Honoi Vietnam

Organisers

Soneva Kiri Resort

Koh Kood Island Thailand

Organisers

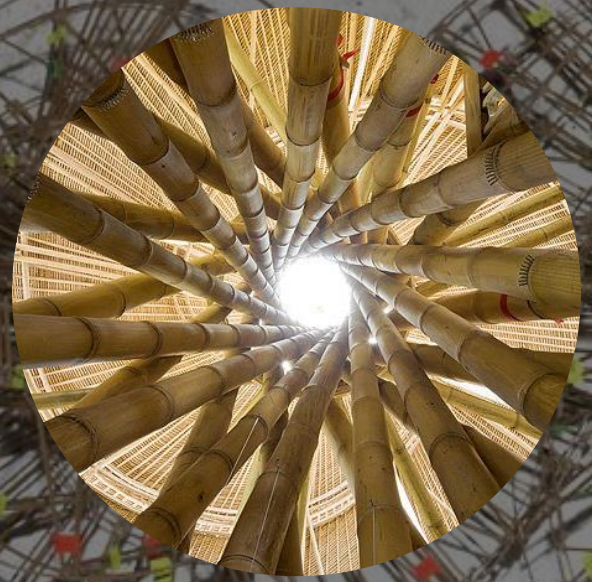
CONSTRUCTION INDUSTRY COUNCIL 建造業議會

HKGBC 香港綠色建築議會

Bamboo Design Competition

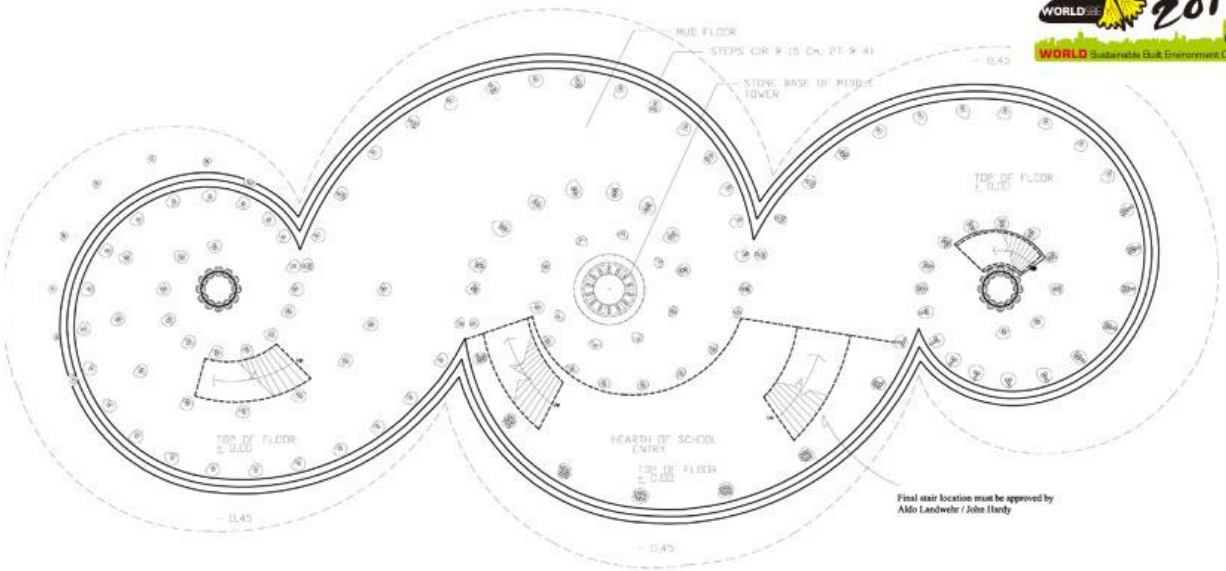
2010

Organisers



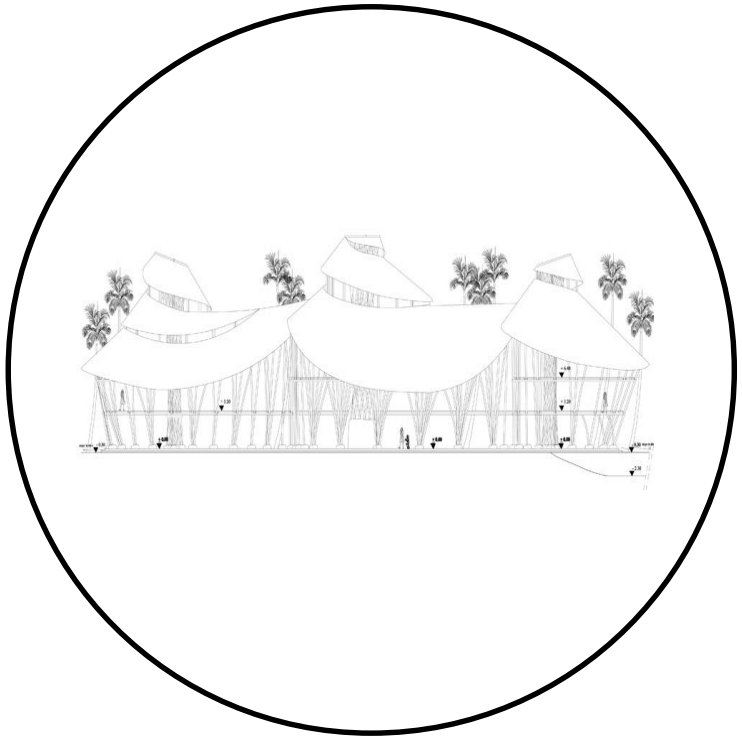
“Green School”

Bali



“Green School”

Bali

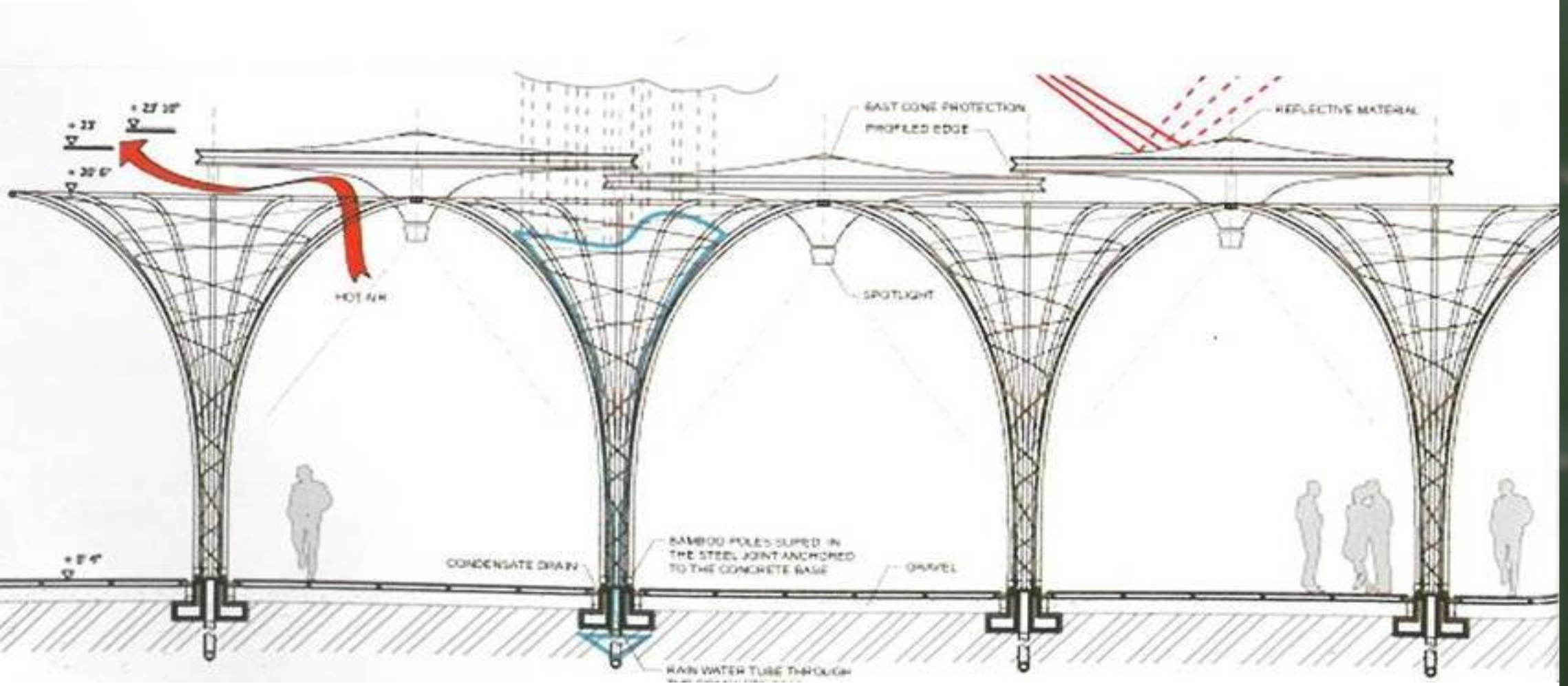


“Green School”

Bali

“Green School”

Bali


EAST CONE PROTECTION
PROFILED EDGE
REFLECTIVE MATERIAL
HOT AIR
SPOTLIGHT
CONDENSATE DRAIN
BAMBOO POLES SUPED IN THE STEEL JOINT ANCHORED TO THE CONCRETE BASE
GRAVEL
RAIN WATER TUBE THROUGH

Zero Carbon Building

Bamboo Pavilion Hong Kong

Organisers

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

HKGBC 香港綠色建築議會

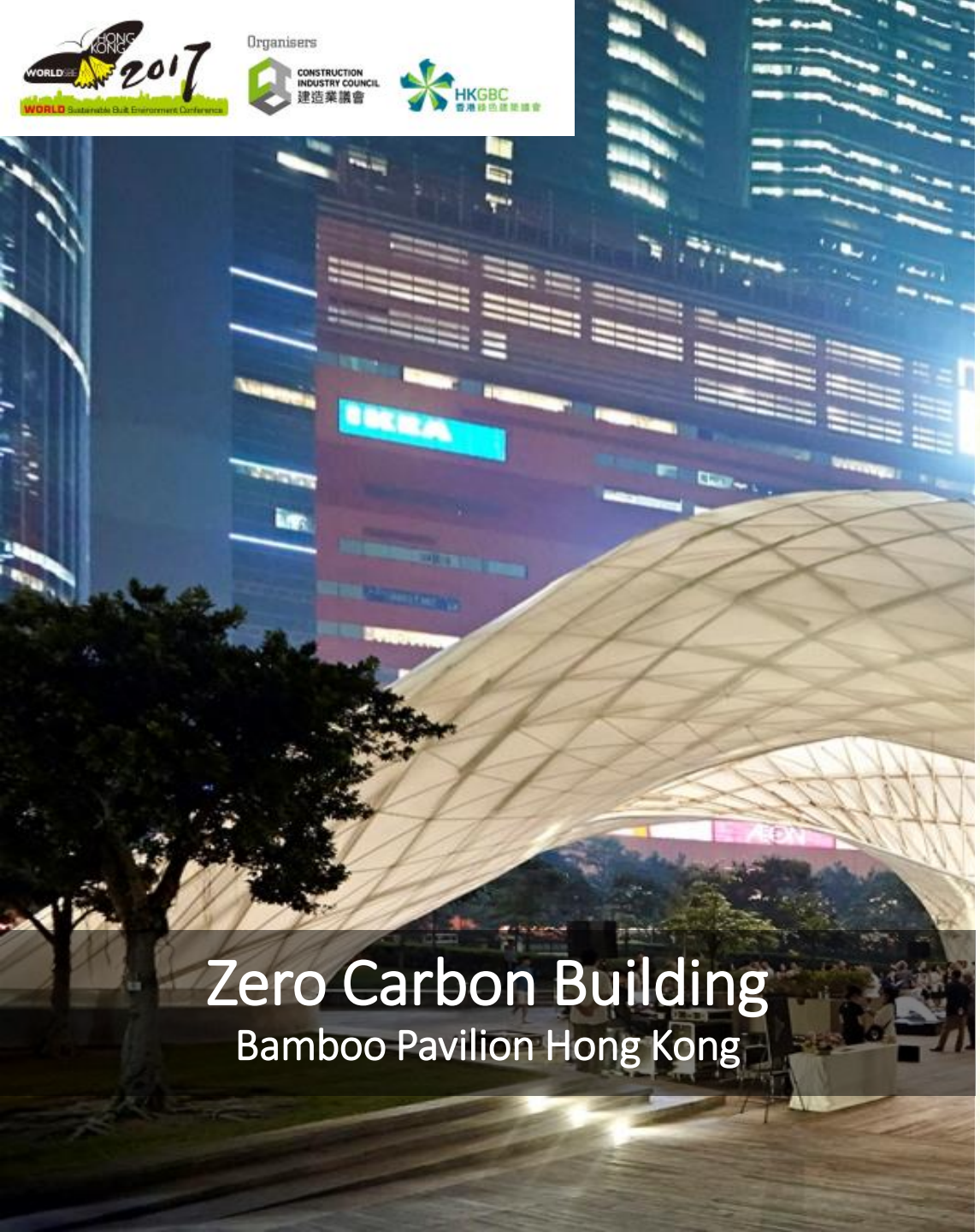
Zero Carbon Building

Bamboo Pavilion Hong Kong

Organisers

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

HKGBC 香港綠色建築議會



Zero Carbon Building

Bamboo Pavilion Hong Kong

Organisers

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

HKGBC 香港綠色建築議會

green building award 2016
環保建築大獎

MERIT AWARD 優異獎

Research & Planning Category 研究及規劃類別

ZCB Bamboo Pavilion
零碳天地竹亭

Client / Developer
Construction Industry Council / Zero Carbon Building

Design Research Consultant
The Chinese University of Hong Kong, School of Architecture

Civil & Structural Engineers
Goman HO / Alfred FONG / George CHUNG

Authorised Person
Martin TAM

Bamboo Consultant
Vinc MATH

Main Contractor
W. M. Construction Limited

Bamboo Construction
Sun Hip Scaffolding Eng. Co., Limited

Fabric Contractor
Ladden Engineering Limited

Lighting
CONA Technology Co. Limited / Brandston Partnership Inc.

Photography
Michael Law Studio / Grandy LUI

Photography & Project Documentation
Kevin Ng Camera Person Advisory & Film Services

Drone photography
Ramon VAN DER HEIJDEN

Ir Prof. CHOY Kin-kuen
Chairman
GBA 2016 Organising Committee

Organisers:

HKGBC 香港綠色建築議會

竹

Interior Design

Federation of Hong Kong Industries

Organisers

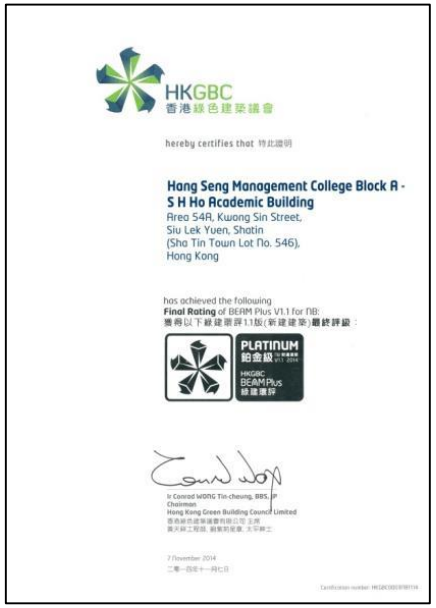
Hang Seng Management College

Organisers

Hang Seng Management College

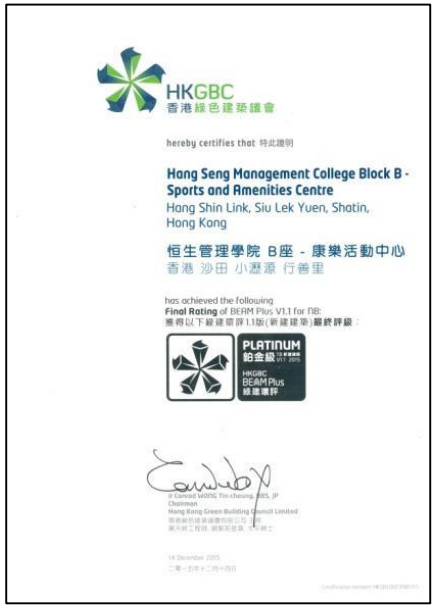
Hang Seng Management College

Awards and Recognition



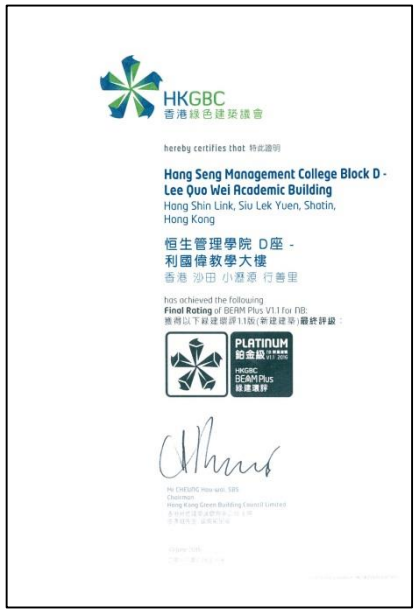
S H Ho Academic Building

Final Platinum



Sports and Amenities Centre

Final Platinum



Lee Quo Wei Academic Building

Final Platinum

Jockey Club Residential Colleges

Final Platinum

Sydney's SCAF Gallery
By Vietnamese architect
Vo Trong Nghia

CCSI / HSMC / UNESCO
Sustainable Development in Higher Education 2017 in conjunction with
The 2nd UNPRME Colloquium on Higher Education 2017

Source:: https://www.dezeen.com/2016/07/28/vo-trong-nghia-architects-green-ladder-pavilion-sherman-contemporary-art-foundation-scaf-sydney-fugitive-structures-series/

Food Centre

Shanghai

CCSI / HSMC / UNESCO

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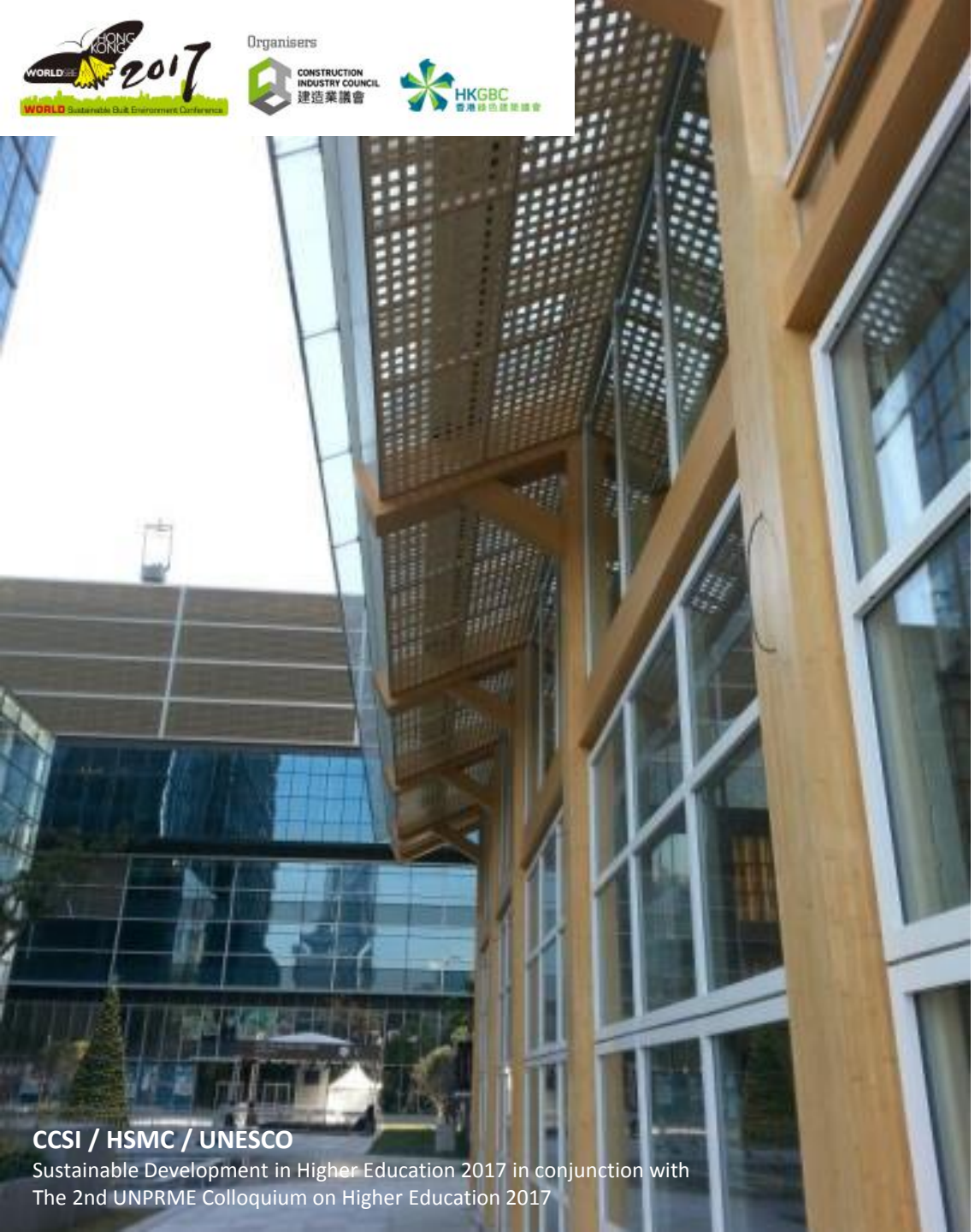
Organisers

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

HKGBC 香港綠色建築議會



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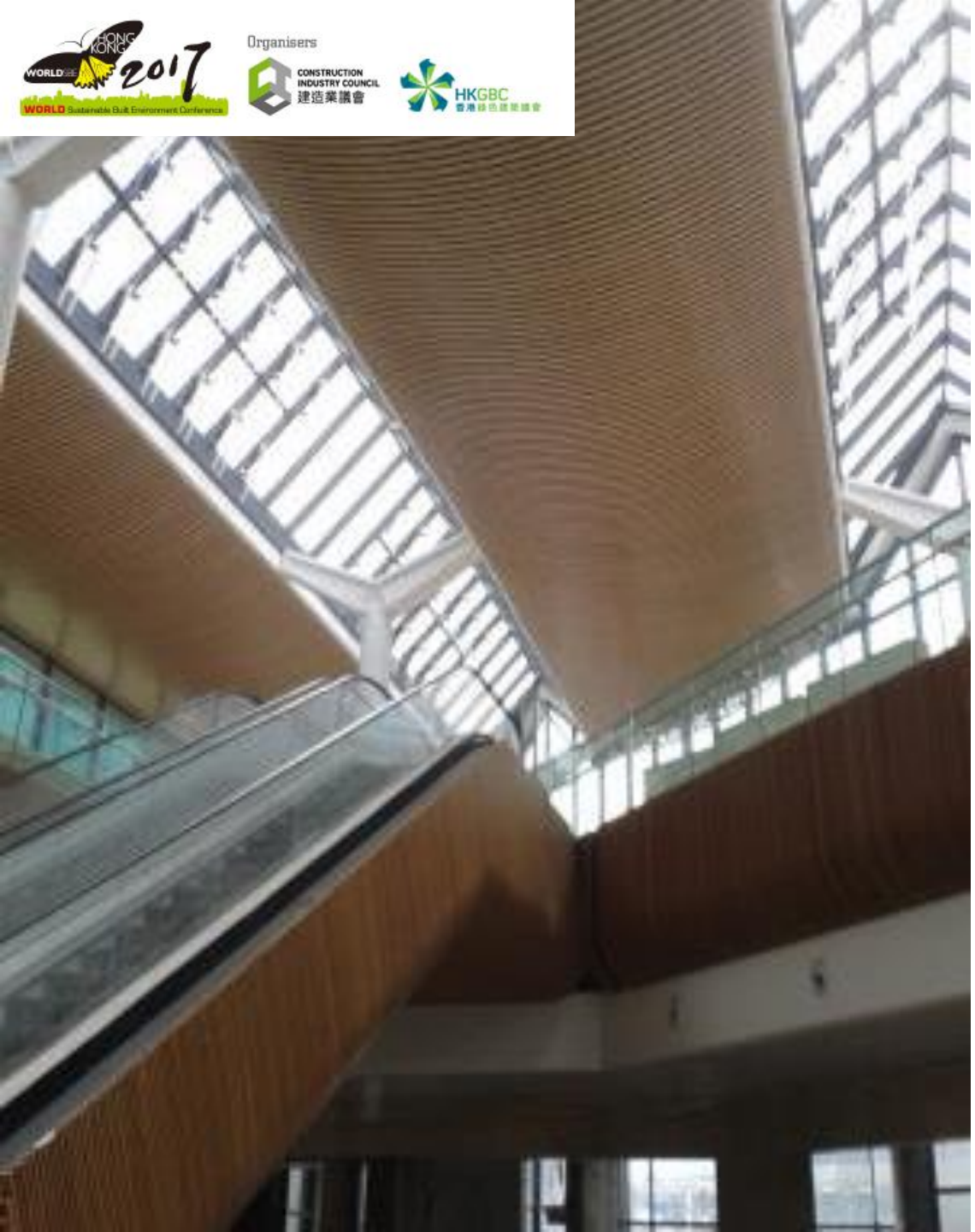

Shopping Mall Hong Kong

Wuxi Grand Theatre Jiangsu Province China

Jinan Grand Theatre

Shandong Province China

On Tu Long Shan Stadium

Zhejiang Province China

Madrid International Airport

Barajas Spain

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West Kowloon Bamboo Theatre

West Kowloon Bamboo Theatre

Use of bamboo wall

France

Use of bamboo wall

France

Use of bamboo screen

Geneva Switzerland

Organisers

Cathedral in structural bamboo

Pereira, Colombia

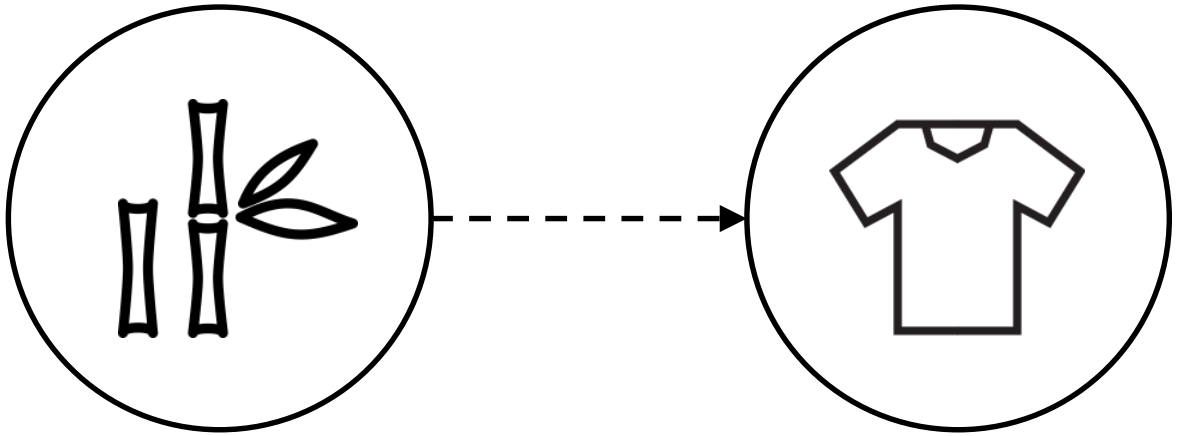
by Simone Velez

Bamboo Furniture & Decoration


Products

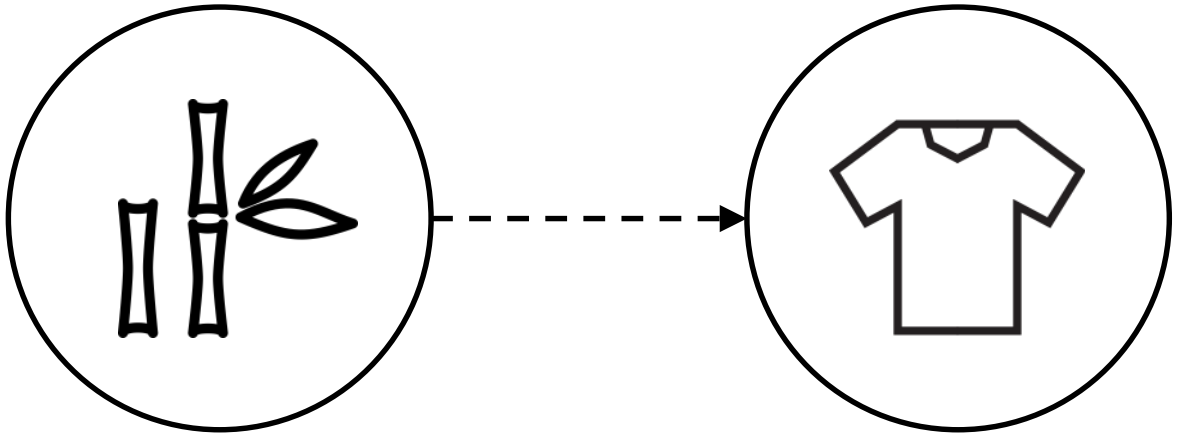
Clothing	Food	Living		Transport
Fabric	Alcohol	Incense	Bamboo blinds	Bicycle
Textile	Vinegar	Furniture	Upholstery carpets curtains	Car
Baby diapers	Juice	Thin film	Kitchen utensils	Yacht
Socks	Shoots	Bamboo basket	Containers	
Underwear		Paper	Bamboo charcoal	

Textiles



- Bamboo fabric is a natural textile made from the pulp of the bamboo grass
- Bamboo fabric has been growing in popularity because it has many unique properties and is more sustainable than most textile fibers
- Bamboo fabric is light and strong, has excellent wicking properties, and is to some extent antibacterial
- Bamboo fiber resembles cotton in its unspun form, a puffball of light, airy fibers

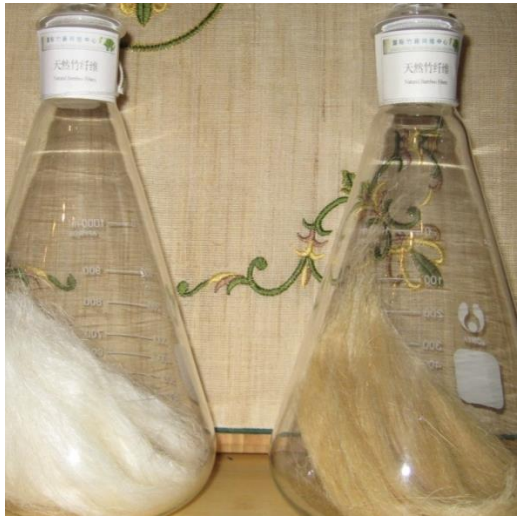
Textiles



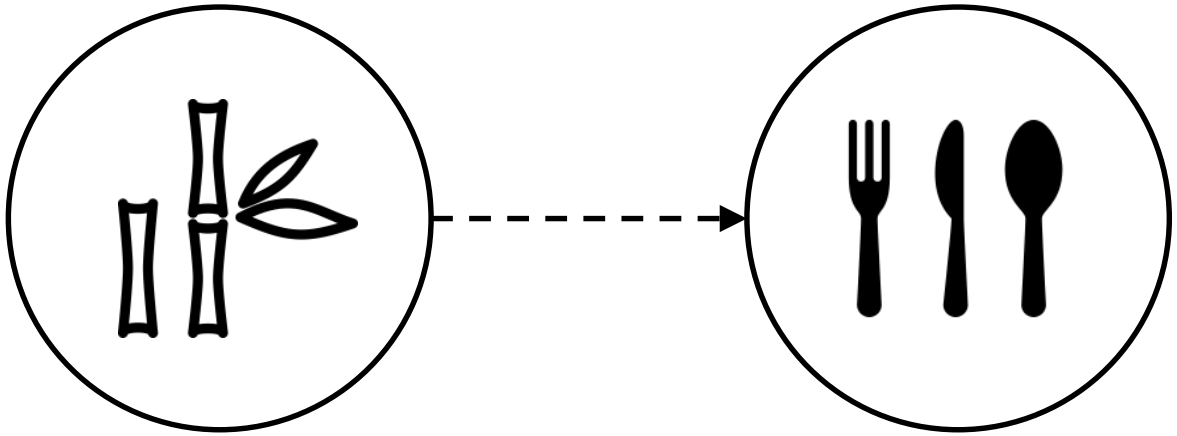
- To make bamboo fiber, bamboo is heavily pulped until it separates into thin component threads of fiber, which can be spun and dyed for weaving into cloth
- Bamboo fabric is very soft and can be worn directly next to the skin
- Many people who experience allergic reactions to other natural fibers, such as wool or hemp, do not complain of this issue with bamboo
- The fiber is naturally smooth and round without chemical treatment, meaning that there are no sharp spurs to irritate the skin

Clothing

Bamboo fibers and textiles



Bamboo as Culinary



- Bamboo is rich in minerals & high in fiber, which can be a great addition to any nutritious, well balanced diet
- Most food center on the bamboo shoots, which are tender and delicious vegetables, used in numerous Asian dishes and broths
- Frequently used for cooking utensils within many cultures, and is used in the manufacture of chopsticks, yakatori sticks etc.

Delicious Bamboo - Dumpling and Shoots








Delicious Bamboo

Bamboo Utensils

Bamboo Utensils

Bamboo Utensils



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Bamboo as 行
衣食住行

Transportation

Transportation

Rattan and bamboo concept car

The Phoenix Roadster by designed by Kenneth Cobonpue

Bamboo Fashion

Gucci Bamboo Handbag Spring 2010

Bamboo Fashion

GUCCI Bamboo Watch for Women by Frida Giannini 2012

Bamboo Veneer application in luxury yacht




Groove Bamboo iPad case (wool felt)

Bamboo smartphone

by Kieron-Scott Woodhouse
A design student from England

Bamboo Accessories

Bamboo Accessories

Miscellaneous Products

Biodegradable Products

Art

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雕刻艺术
竹

Mine Kafon

Mine Kafon, a sphere device invented by an Afghanistan designer Massoud Hassani. The core of the Kafon is a 17kg iron casing surrounded by dozens of radiating bamboo legs that each has a round plastic "foot" at its tip. It is heavy enough to roll across the ground and trigger the landmines. The modular legs make the cost of replacement and reproduction lower. The built-in GPS chip can output the mine-cleared zones, so it creates a safe area.

WarkaWater

This odd looking tower is called WarkaWater. It creates 25 gallons of drinking water per day from thin air. It's basically an atmospheric water collector which gathers dew from the air. The 9-metre bamboo framework has a special fabric hanging inside capable of collecting potable water from the air through condensation

Bamboo water storage tanks by INBAR


Industrial Development
竹

Organisers

International Network for Bamboo and Rattan

INBAR

The International Network for Bamboo and Rattan (INBAR) is an intergovernmental 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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INBAR

International Network for Bamboo and Rattan

Printed on recycled paper

www.inbar.int

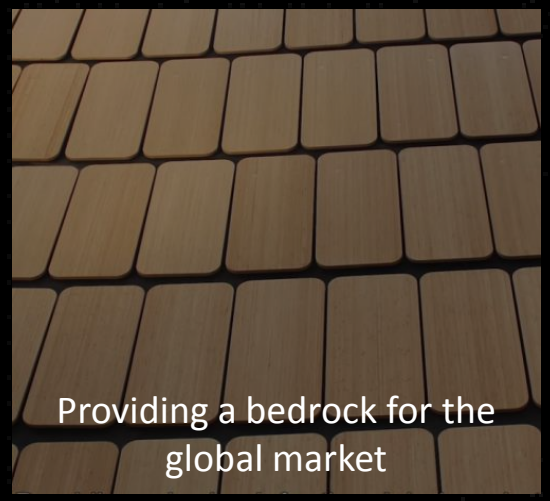
INBAR

Organisers

- INBAR is an intergovernmental organization established by treaty deposited with the United Nations
- Sovereign states become members
- INBAR works with Governments, Industry partners, Development Partners, NGOs, Universities, etc.
- As of November 2016, 41 member states

Carbon Accounting Methodology for Afforestation with Bamboo

- Developed in partnership by INBAR, China Green Carbon Foundation and Zhejiang A&F University in 2012
- Recognizing bamboo as an official carbon offset and a tool for climate change mitigation, thus enabling Chinese companies to buy bamboo carbon credits on the voluntary market
- Contribute to the goal of optimizing the potential for carbon finance through bamboo carbon sinks and bamboo harvested wood products (HWP)



Source: INBAR Proposing an International Standards Organization Technical Committee for Bamboo and Rattan
https://www.youtube.com/watch?v=sw7qBKR9GIg

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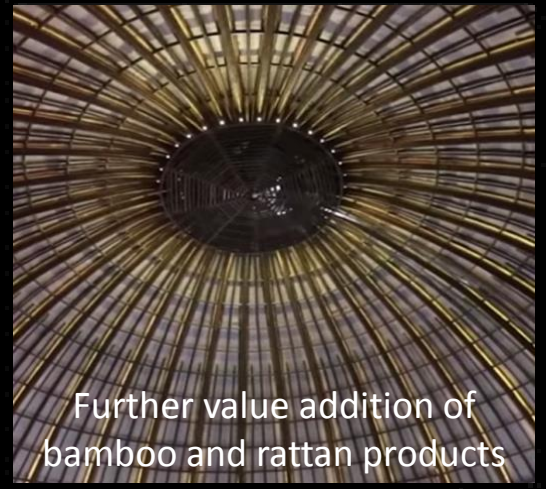

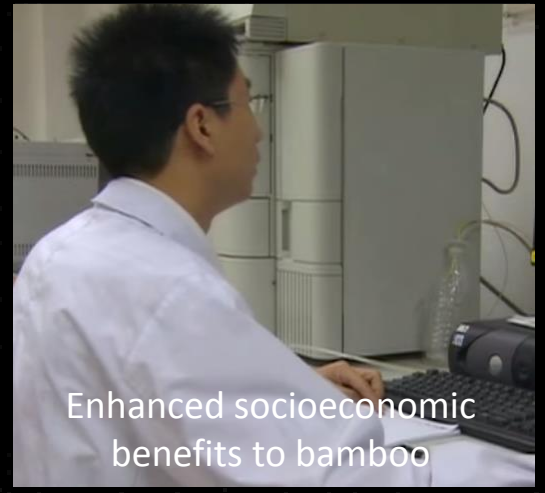

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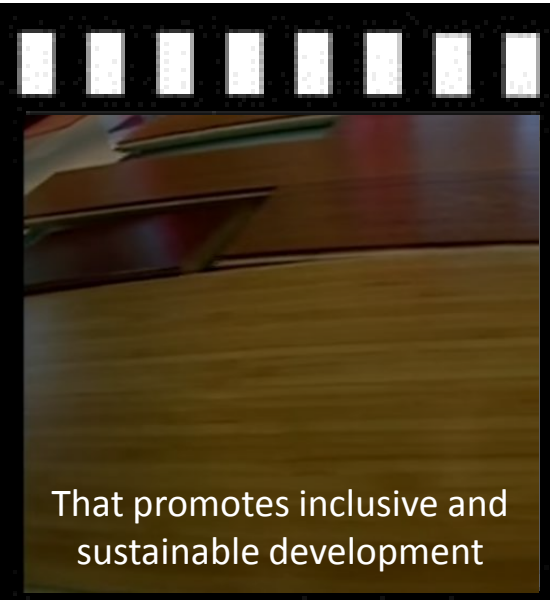

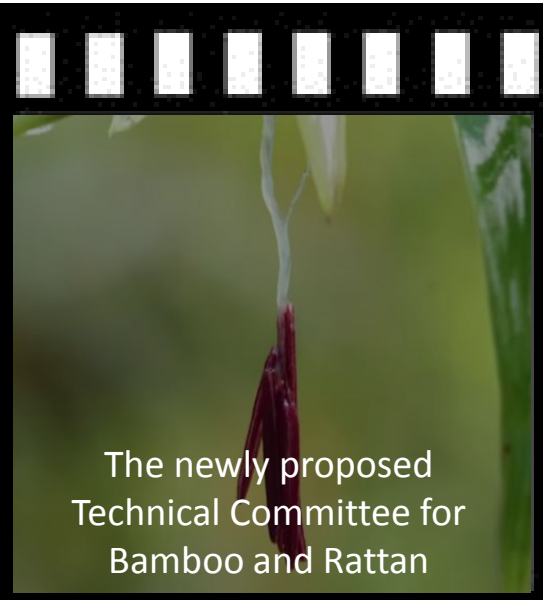

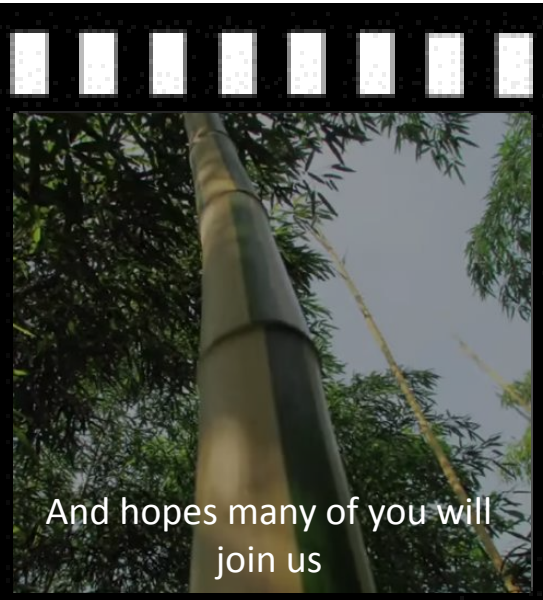

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Epilogue

Bamboo

is a truly unique
non-timber forest resource

Organisers

Organisers

Bamboo

is nature's gift to Humanity


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HKGBC
Bamboo
sustains future for humankind
Bamboo
can save our world for humanity
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The Bamboo Age
is now back with us
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HKGBC 香港綠色建築議會
竹

Reform necessary this decade for bamboo development

- Improve the policy framework
- Proactive fiscal policy
- Prudent monetary policy
- Ensure the economy develops appropriately
- Economic reform to focus on breakthroughs to build an open economy & enhance global interchange
- Promote agricultural modernization, rural reform & human-centered urbanization
- Implement education via bamboo planting to schools & institutions
- Improve people's living standard & quality
- Further promote the ecological & environmental protection & pollution prevention & strive to build a beautiful countryside with ecological civilization
- Bamboo research for healthcare


Urgent Call by Younger Generations

江苏一考生用古文写高考作文，批改老师自称惭愧

以古諷今鑑明

對於環境保護之工作

Yesterday/Today/Tomorrow

Advocates sustainability via archaic classical Chinese

高考青年正在鞭策成年及老人輩

the Y generation whipping the senior & elderly generations


Sponge City
竹

海绵城市
Sponge City

海绵城市是指城市能够像海绵一样，在适应环境变化和应对自然灾害等方面具有良好的“弹性”，下雨时吸水、蓄水、渗水、净水，需要时将蓄存的水“释放”或加以利用。

A"Sponge city" refers to a city where its urban underground water system operates like a sponge to absorb, store, leak and purify rainwater, and release it for reuse when necessary.


打造海綿城市
屋頂
新建物屋頂漏水頭提高10公分蓄水，暴雨過後排出
鋪面
採用透水鋪面連結雨撲滿貯留雨水
滯洪池
廣設埤塘、人工濕地等滯洪池留住雨水調節洪峰、儲水
公園綠地
下凹式設計及雨撲滿貯留雨水
海綿道路構造
建蔽率
降建蔽率增加透水鋪面綠化保水
淨化空氣
雨水滲透
導水管架結合混凝土的硬式透水鋪面
滯留塵埃
水氣蒸散調節氣溫
碎石保水層
土壤層
吸收
筏式基礎
利用筏基等位置儲存雨水再利用，建物成為小水庫
滲透雨水補注地下水


Specialist, Generalist, Versatilist
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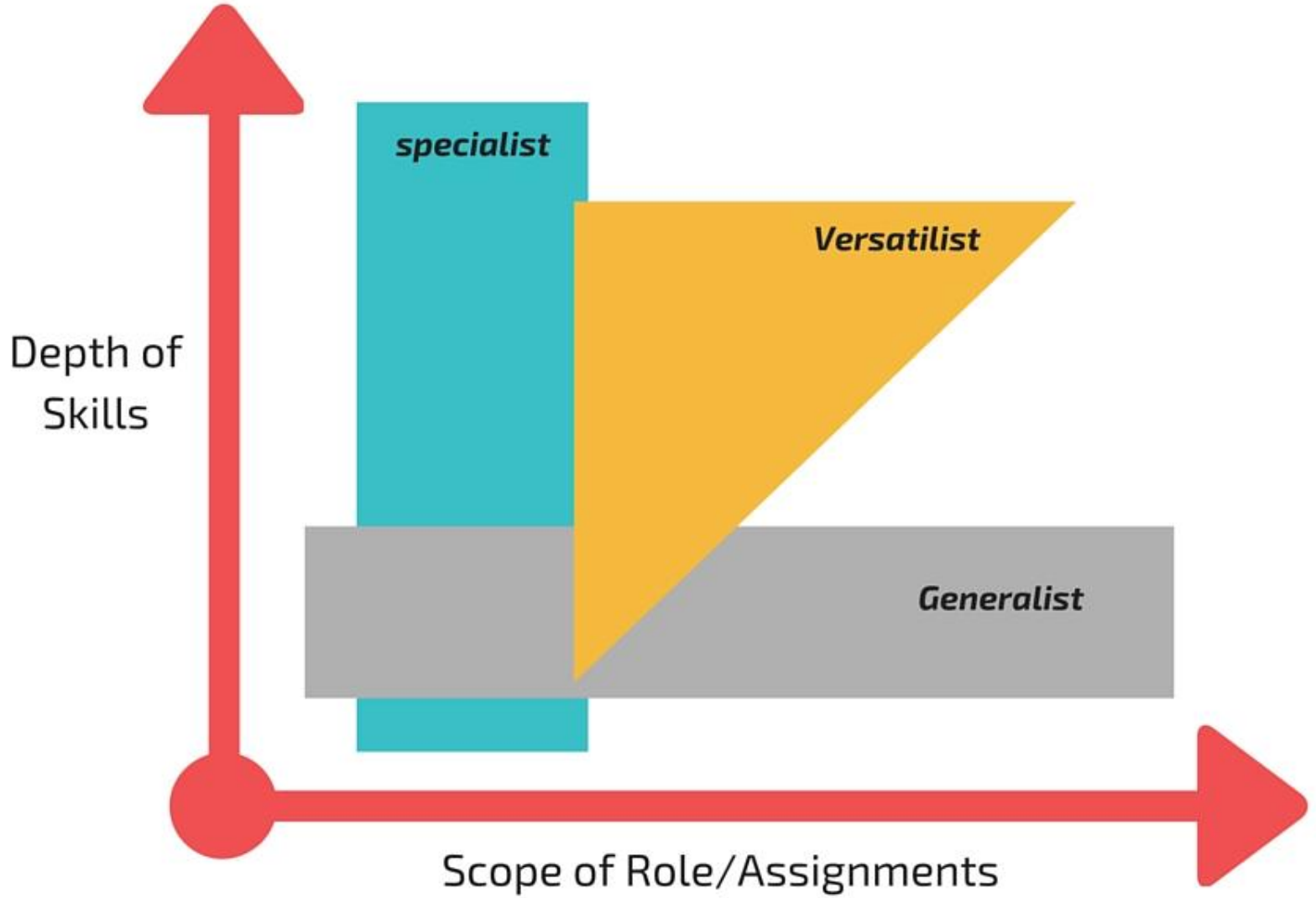
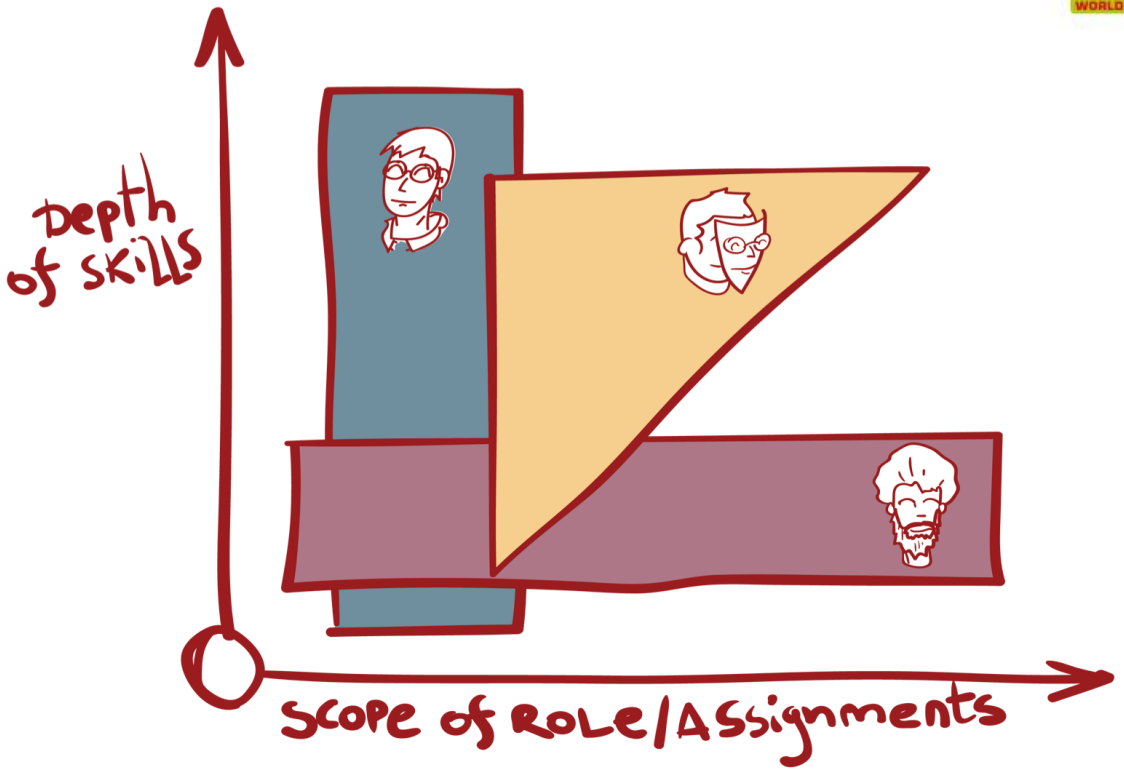


Graphic Adapted from Gartner

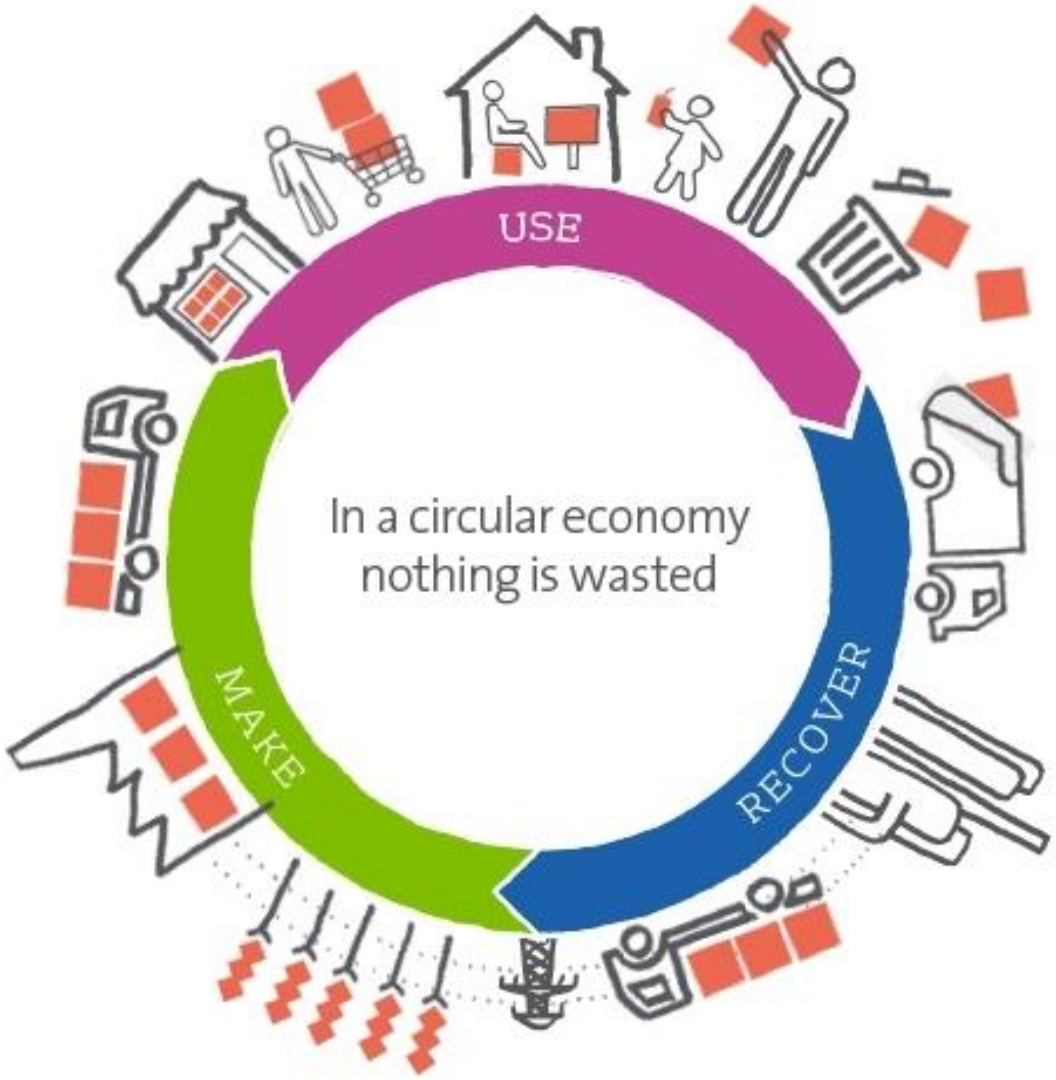


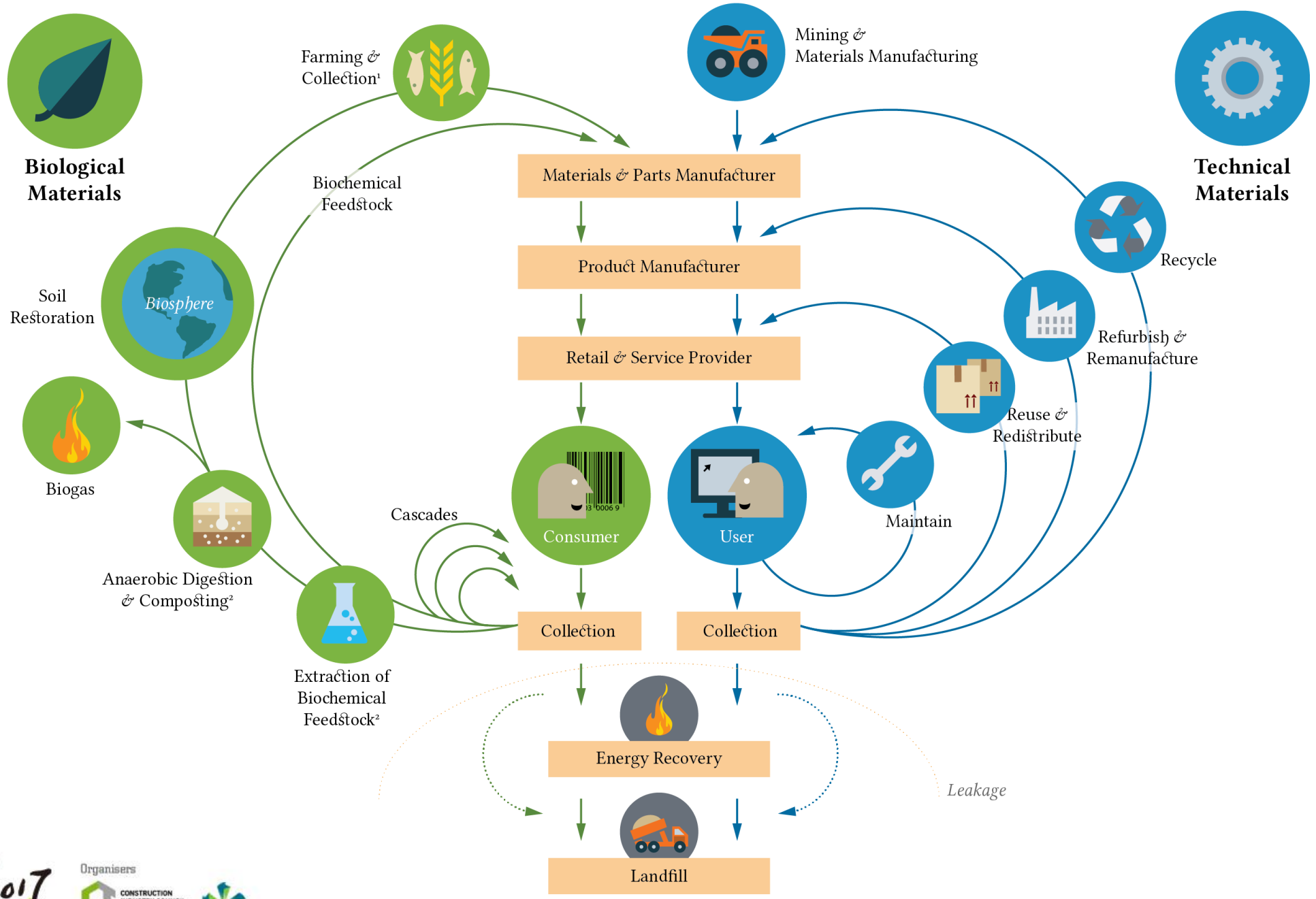
Specialist
Deep Skills
Narrow Scope
Peer-Recognized
Unknown Outside Domain

Generalist
Board Scope
Shallow Skills
Quick Response
Others Lack Confidence

Versatilist
Deep Skills
Wide Scope of Roles
Broad Experience
Recognized in Other Domains


Circular Economy
竹


USE
RECOVER
MAKE
In a circular economy
nothing is wasted


Biological Materials
Farming & Collection¹
Mining & Materials Manufacturing
Technical Materials
Biochemical Feedstock
Materials & Parts Manufacturer
Product Manufacturer
Retail & Service Provider
Recycle
Refurbish & Remanufacture
Reuse & Redistribute
Soil Restoration
Biosphere
Biogas
Anaerobic Digestion & Composting²
Cascades
Consumer
User
Maintain
Extraction of Biochemical Feedstock²
Collection
Collection
Energy Recovery
Landfill
Leakage

THANK YOU

Bamboo

By Martin Tam