

moso[®]

**bamboo
products**



Benefits of the bio-cycle

Case: MOSO bamboe

Dr. ir. Pablo van der Lugt

MOSO International BV | TU Delft

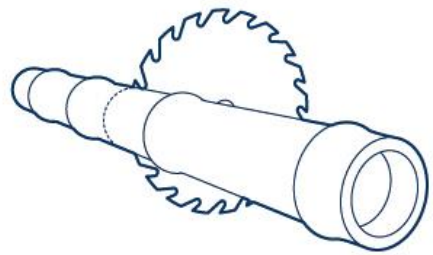
pvanderlugt@moso.eu

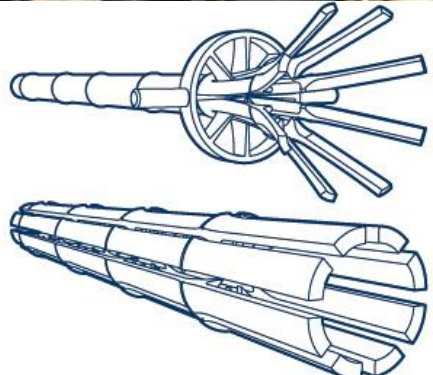
p.vanderlugt@tudelft.nl

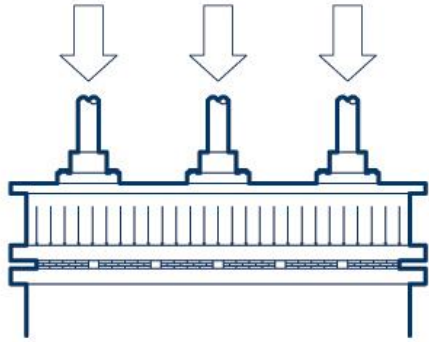
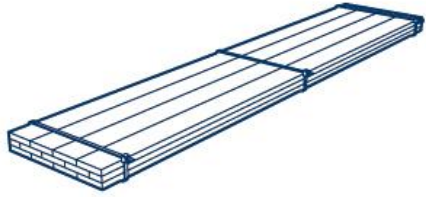
Plenaire bijeenkomst CE-markering - 10 november 2016











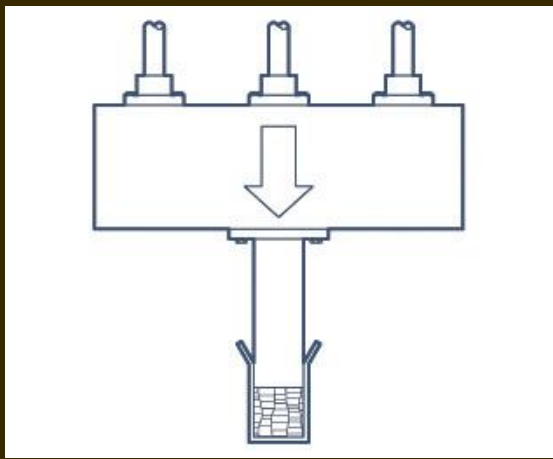
械有限公司
TEL: 0532-88313105

规范操作
小心压伤

4



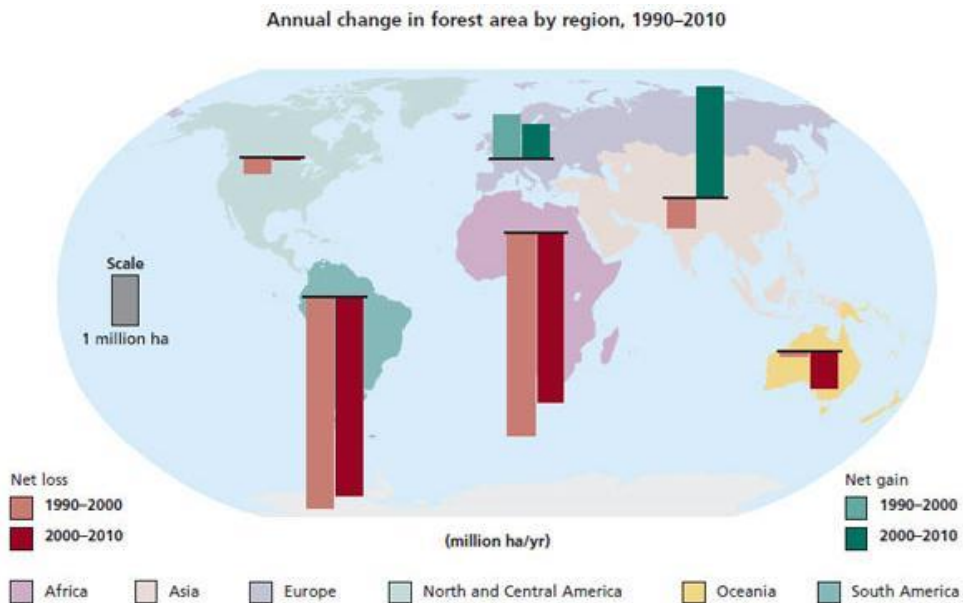






Continuous Deforestation

- Mostly in tropical regions, severe effect on
 - Biodiversity
 - Carbon sink degradation – climate change
 - Erosion



Source: FAO Global Forest Resources Assessment 2010







Chinese bamboo reforestation

0,3 mio hectares / year

= 300 mio. tons CO₂

= Annual energy consumption 75 mio. households

Low durability in outdoor circumstances







Thermally modified bamboo strips





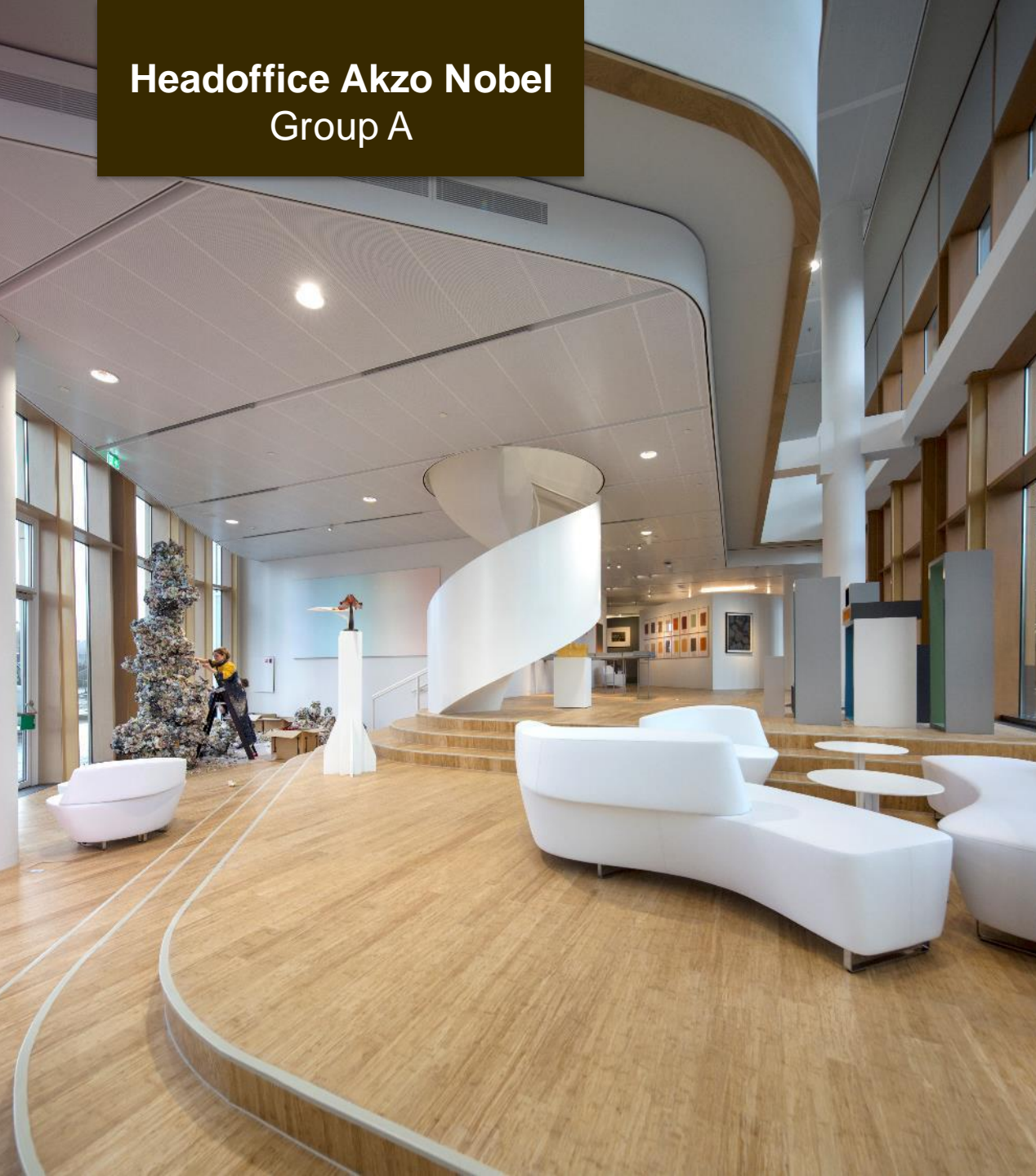
MOSO Product Groups



Rabobank Breda
Ilse Winthagen



Headoffice Akzo Nobel Group A



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PWC Barcelona
BAAS design



Stadskantoor Utrecht
Kraaijvanger architects



Schiphol Lounge 2

Kossmann de Jong



m^oso[®]

Rijkswaterstaat
Paul de Ruiter



m^oso[®]

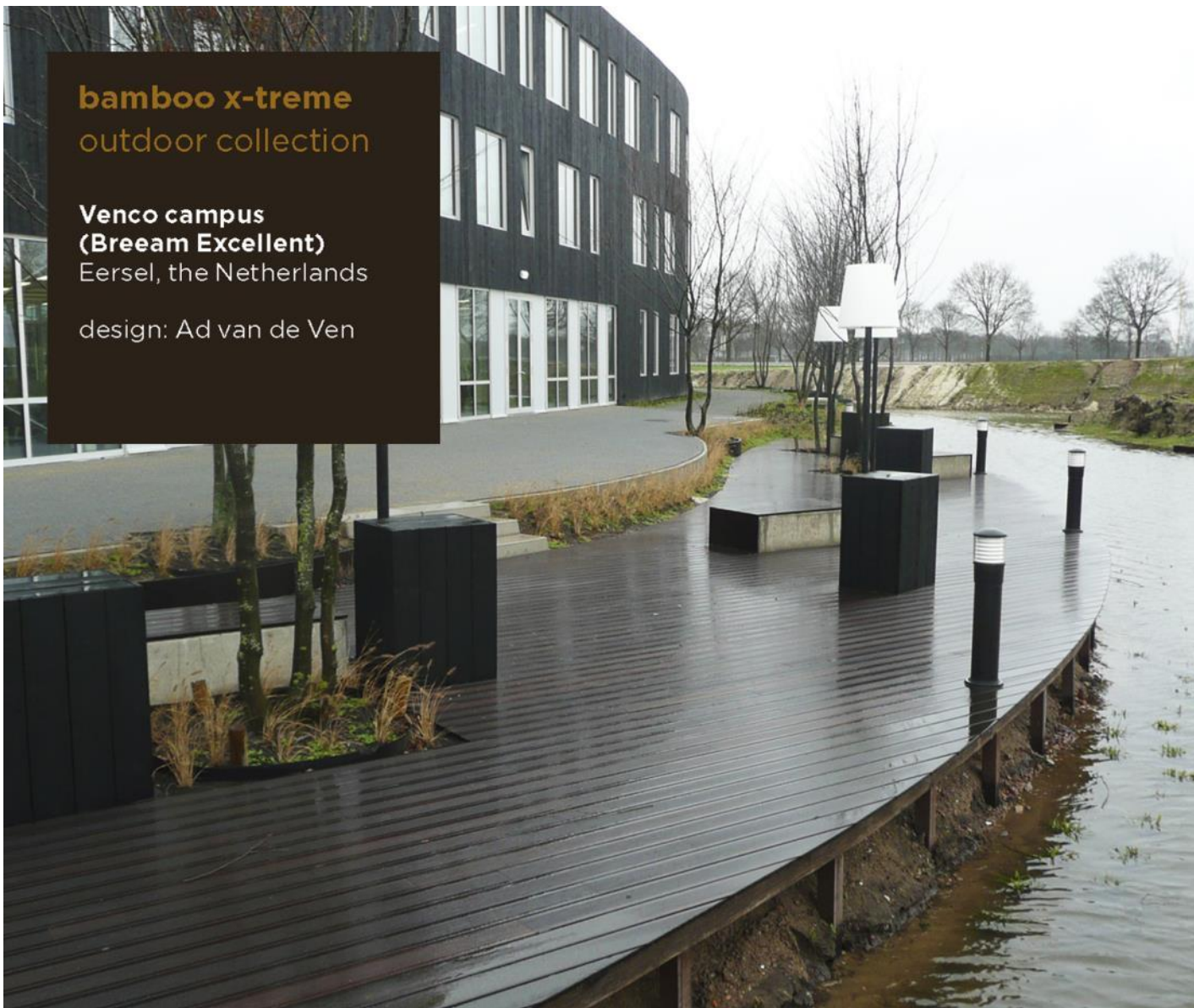
**AGC Glass Head Office,
Belgium
BREEAM Excellent**



bamboo x-treme
outdoor collection

Venco campus
(Breeam Excellent)
Eersel, the Netherlands

design: Ad van de Ven



**Madrid International
Airport, Spain
Richard Rogers**



Solar Carport BMW



BMW Dashboard



Green Credentials over Life Cycle

- For full picture of environmental impact:
- Analyse complete life cycle from 'Cradle till Grave':



Measuring Environmental Impact: LCA

- INBAR Technical Report no. 35 → presented at COP 21
- moso.eu/lca



INBAR Technical Report No. 35

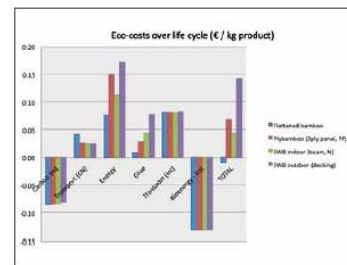


Figure 14: Eco-costs over life cycle (kgCO₂e / kg product), for various industrial bamboo products based on different production technologies.

If we look at the process categories we can make the following conclusions from an environmental point of view:

- **Energy consumption** in processing the industrial bamboo products provides the largest contribution to the environmental impact, being responsible for 36 – 53% (eco-costs) and 52-63% (carbon footprint) of the total eco-burden. Since the bamboo processing facilities in general use biomass (bamboo waste) for heat, the energy is only electricity from the local grid. This electricity from the grid might be replaced by electricity from a combined power generator (bamboo waste is abundantly available) at the production facility, or on-site production of solar energy.

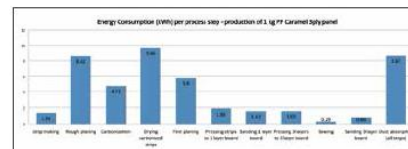
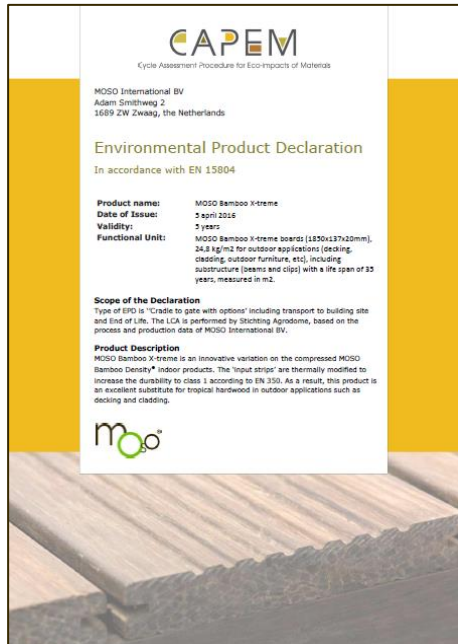


Figure 15: Carbon footprint for electricity consumption over life cycle (kgCO₂e / kg product), in this case for a 3ply carbonized solid bamboo panel.



Environmental Product Declaration - EPD

- EPD's (EN 15804) available for MOSO Bamboo Products:
 - MOSO Bamboo X-treme
 - MOSO Density® products
 - MOSO laminated bamboo products
- www.moso.eu/epd



CAPEM
Cycle Assessment Procedure for Eco-impacts of Materials

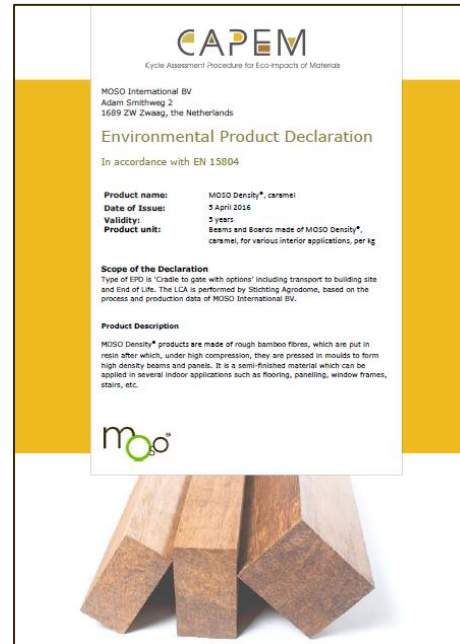
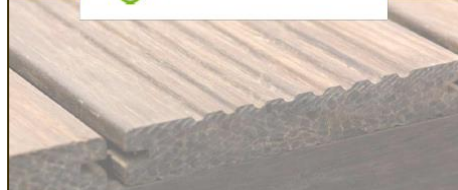

MOSO International BV
Adam Smithweg 2
1689 ZW Zwaag, the Netherlands

Environmental Product Declaration
In accordance with EN 15804

Product name: MOSO Bamboo X-treme
Date of Issue: 5 April 2016
Validity: 5 years
Functional Unit: MOSO Bamboo X-treme boards (1850x137x25mm), 24.8 kg/m² for outdoor applications (decking, cladding, outdoor furniture, etc.) including substructure (beams and clips) with a life span of 35 years, measured in m².

Scope of the Declaration
Type of EPD is 'Cradle to gate with options' including transport to building site and End of Life. The LCA is performed by Stichting Agrodome, based on the process and production data of MOSO International BV.

Product Description
MOSO Bamboo X-treme is an innovative variation on the compressed MOSO Bamboo Density® indoor products. The 'input strips' are thermally modified to increase the durability to class 1 according to EN 350. As a result, this product is an excellent substitute for tropical hardwood in outdoor applications such as decking and cladding.



CAPEM
Cycle Assessment Procedure for Eco-impacts of Materials



MOSO International BV
Adam Smithweg 2
1689 ZW Zwaag, the Netherlands

Environmental Product Declaration
In accordance with EN 15804

Product name: MOSO Density®, caramel
Date of Issue: 5 April 2016
Validity: 5 years
Product unit: Beams and Boards made of MOSO Density®, caramel, for various interior applications, per kg

Scope of the Declaration
Type of EPD is 'Cradle to gate with options' including transport to building site and End of Life. The LCA is performed by Stichting Agrodome, based on the process and production data of MOSO International BV.

Product Description
MOSO Density® products are made of rough bamboo fibres, which are put in resin after which, under high compression, they are pressed in moulds to form high density beams and panels. It is a semi-finished material which can be applied in several indoor applications such as flooring, paneling, window frames, stairs, etc.



CAPEM
Cycle Assessment Procedure for Eco-impacts of Materials

MOSO International BV
Adam Smithweg 2
1689 ZW Zwaag, the Netherlands

Environmental Product Declaration
In accordance with EN 15804

Product name: MOSO solid panel and beam, caramel
Date of Issue: 5 April 2016
Validity: 5 years
Product unit: MOSO solid panel and beam made from laminated bamboo (side pressed / plain pressed), caramel, for various interior applications, per kg

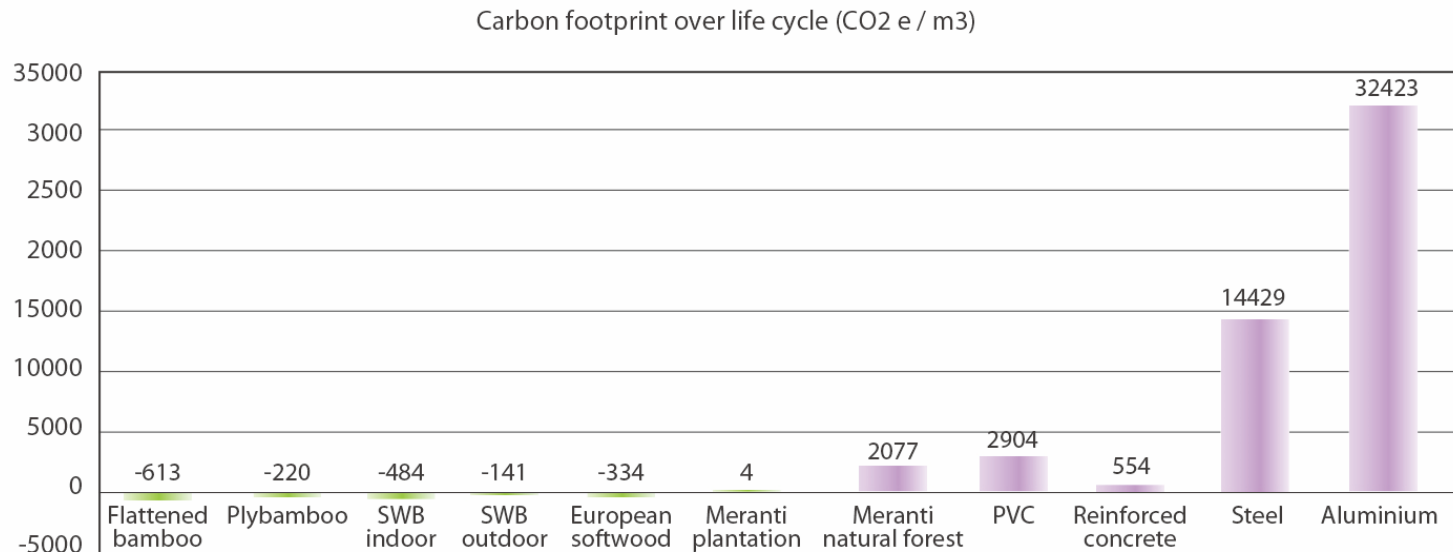
Scope of the Declaration
Type of EPD is 'Cradle to gate with options' including transport to building site and End of Life. The LCA is performed by Stichting Agrodome, based on the process and production data of MOSO International BV.

Product Description
MOSO® solid panel and beam is a visually appealing product (semi-finished material) that consists of multiple layers of bamboo, available in multiple variations with respect to size, thickness, configuration, style and colour. The solid panel can be used in various interior applications such as work tops, walls, ceilings, stairs and furniture. The beam is mainly used in semi structure indoor applications such as window and door frames.



LCA & Carbon Footprint - Results

- Compared to other commonly used building materials
- Carbon footprint per cubic meter material

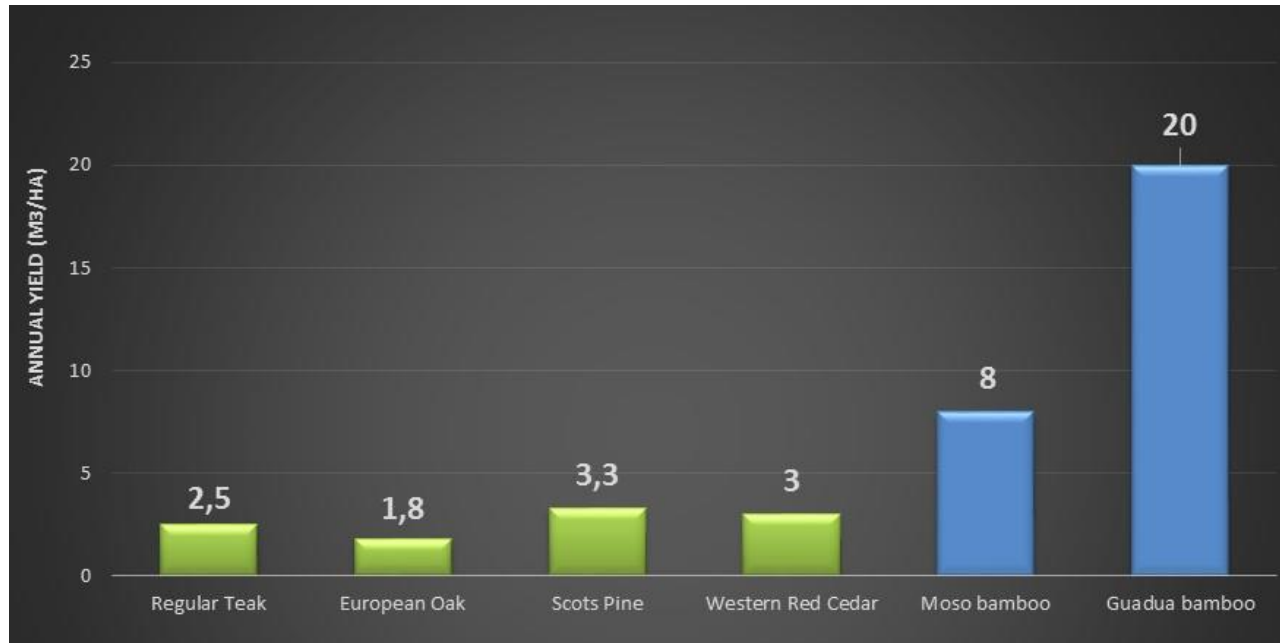


- MOSO materials & softwood outperform hardwood, plastics & metals
- MOSO Bamboo Forest most sustainable option available



Not even taking into account:

- Annual yield



- Additional growth related environmental benefits vs wood:
 - annual harvesting provides better growth > no deforestation
 - reforestation on degraded land possible
 - short establishment time

Bamboo and the Circular Economy



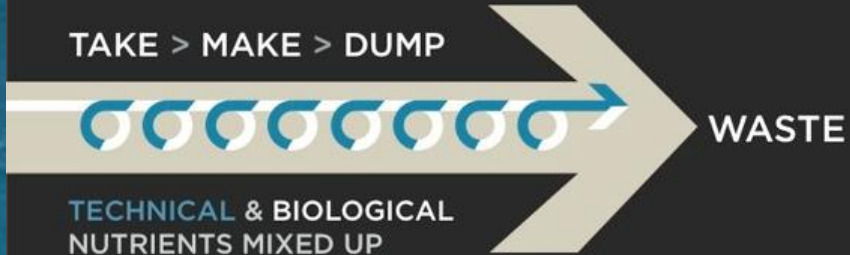
**bamboo
products**

Circular Economy

Source: Ellen MacArthur Foundation

LINEAR ECONOMY

TAKE > MAKE > DUMP



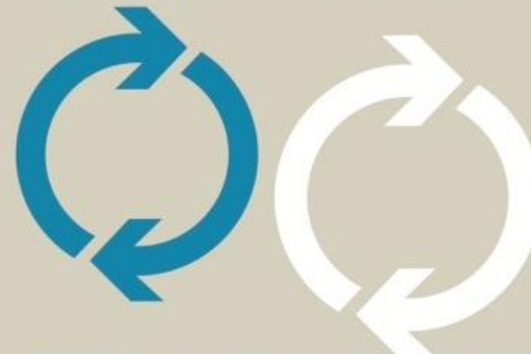
TECHNICAL & BIOLOGICAL
NUTRIENTS MIXED UP

ENERGY FROM FINITE SOURCES

CIRCULAR ECONOMY

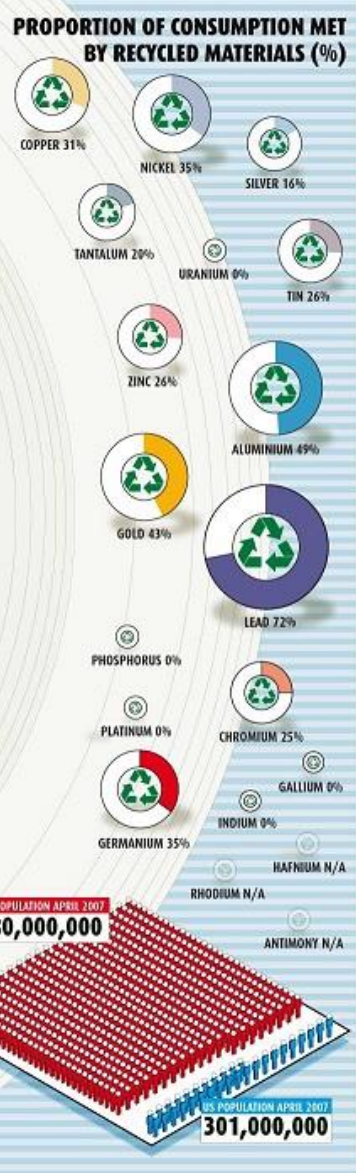
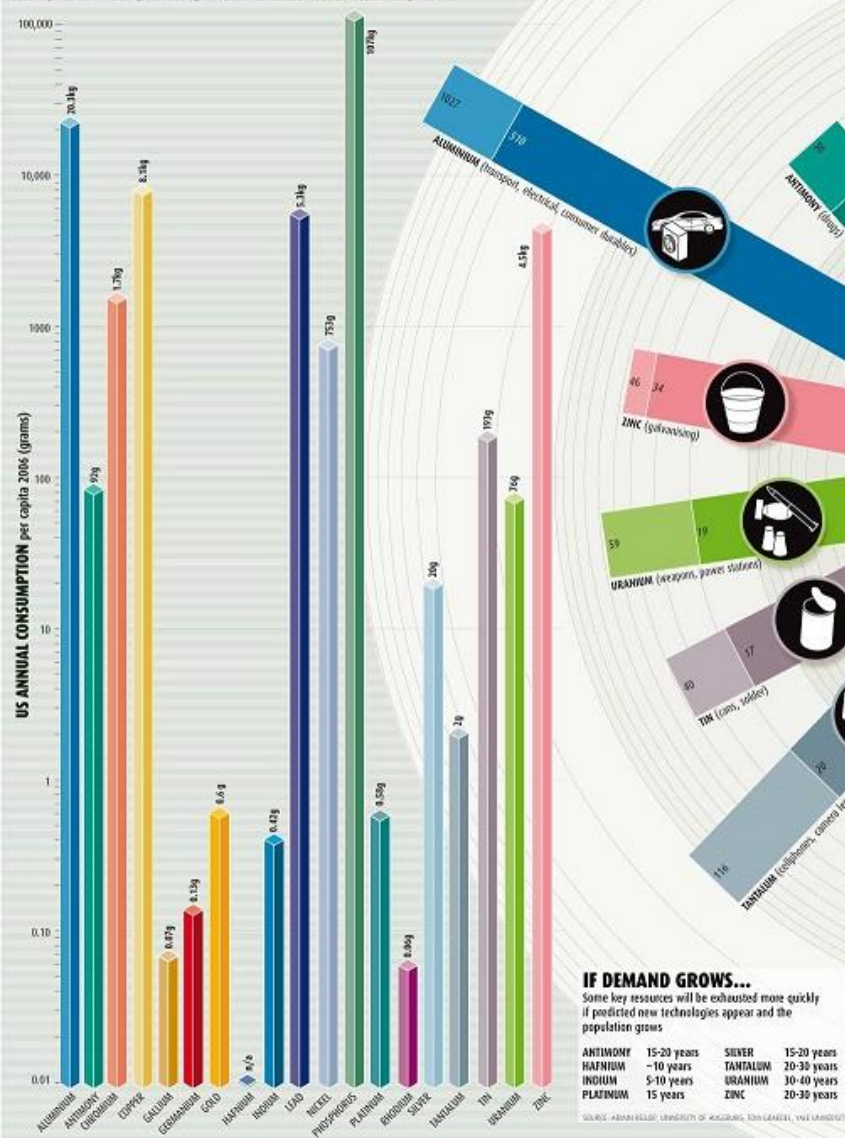
TECHNICAL
NUTRIENTS

BIOLOGICAL
NUTRIENTS



ENERGY FROM RENEWABLE SOURCES

HOW LONG WILL IT LAST?



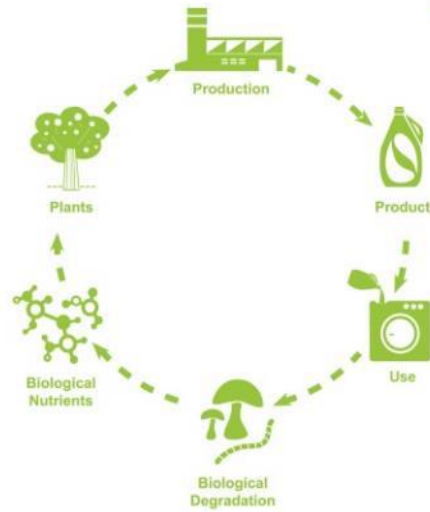
Abiotic Resources: Reserves

- Copper: ~60 years
- Zinc: ~45 years
- Tin: ~30 years

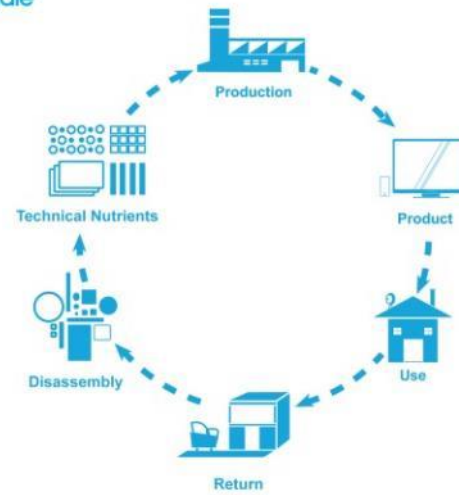
1-4-2025



Benefits of the biocycle



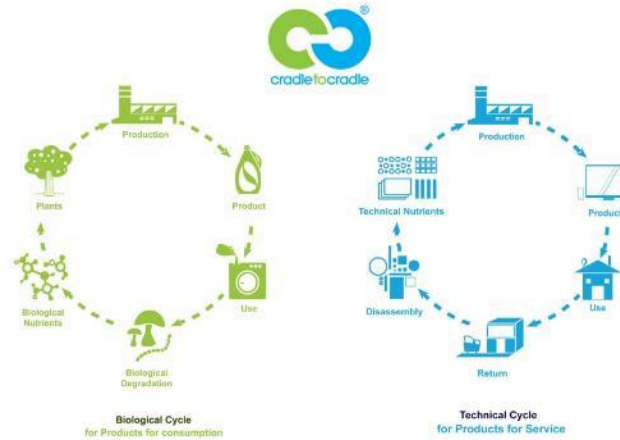
Biological Cycle
for Products for consumption



Technical Cycle
for Products for Service

Benefits of the biocycle

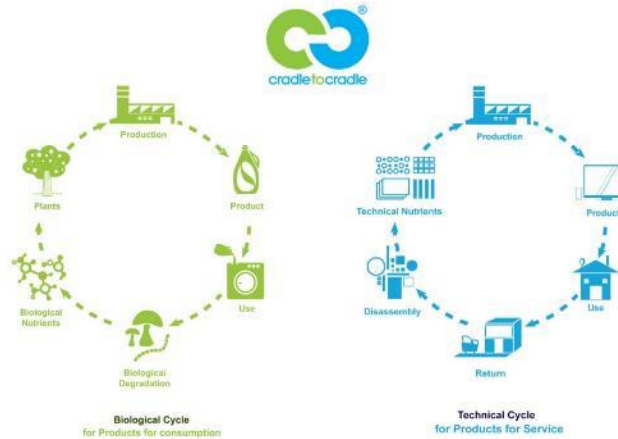
- Low embodied energy



- High embodied energy

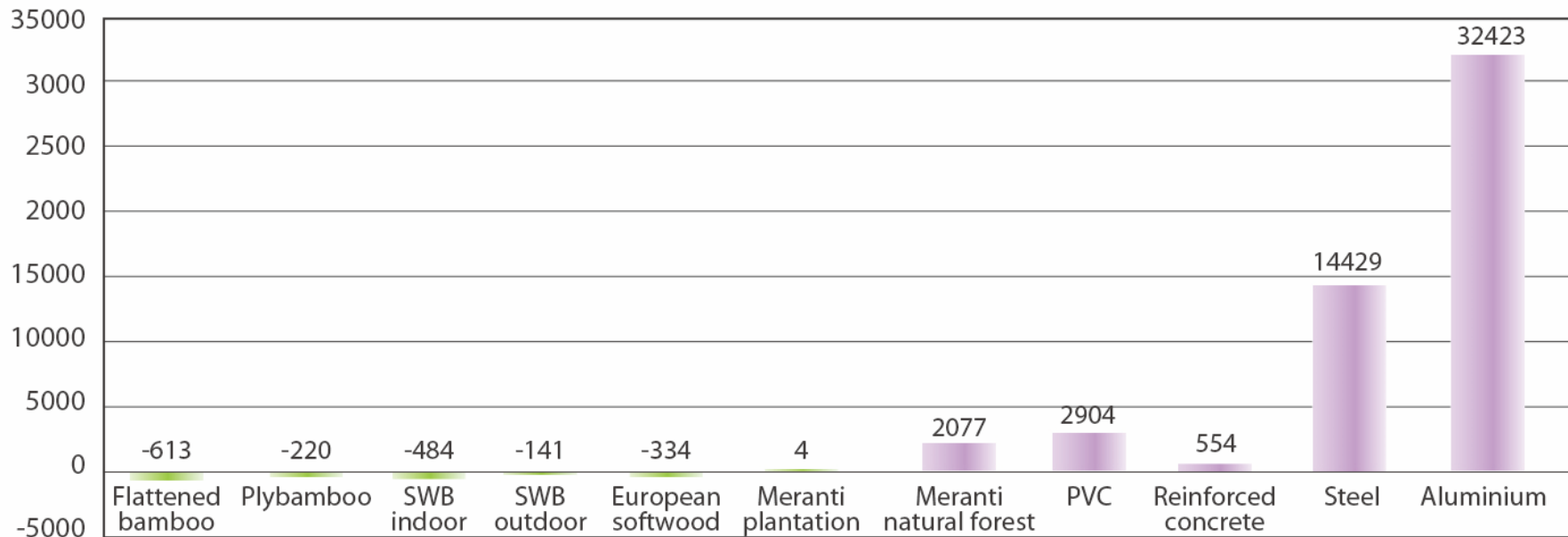
Benefits of the biocycle

- Low embodied energy



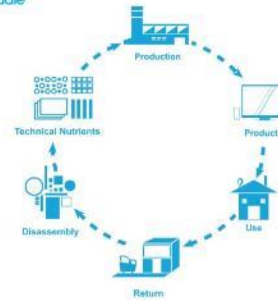
- High embodied energy

Carbon footprint over life cycle (CO2 e / m3)

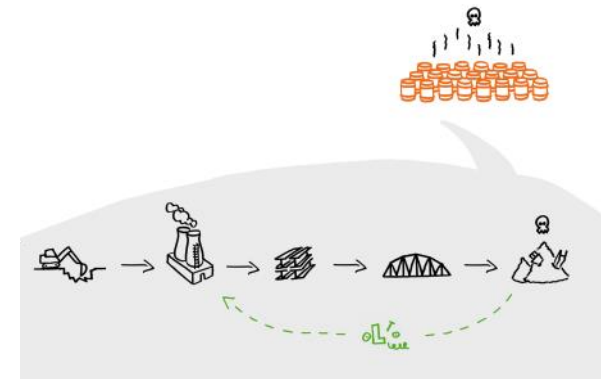


Benefits of the biocycle

- Low embodied energy
- No waste problem



- High embodied energy
- Not bio-degradable – if recycled considerable energy demand



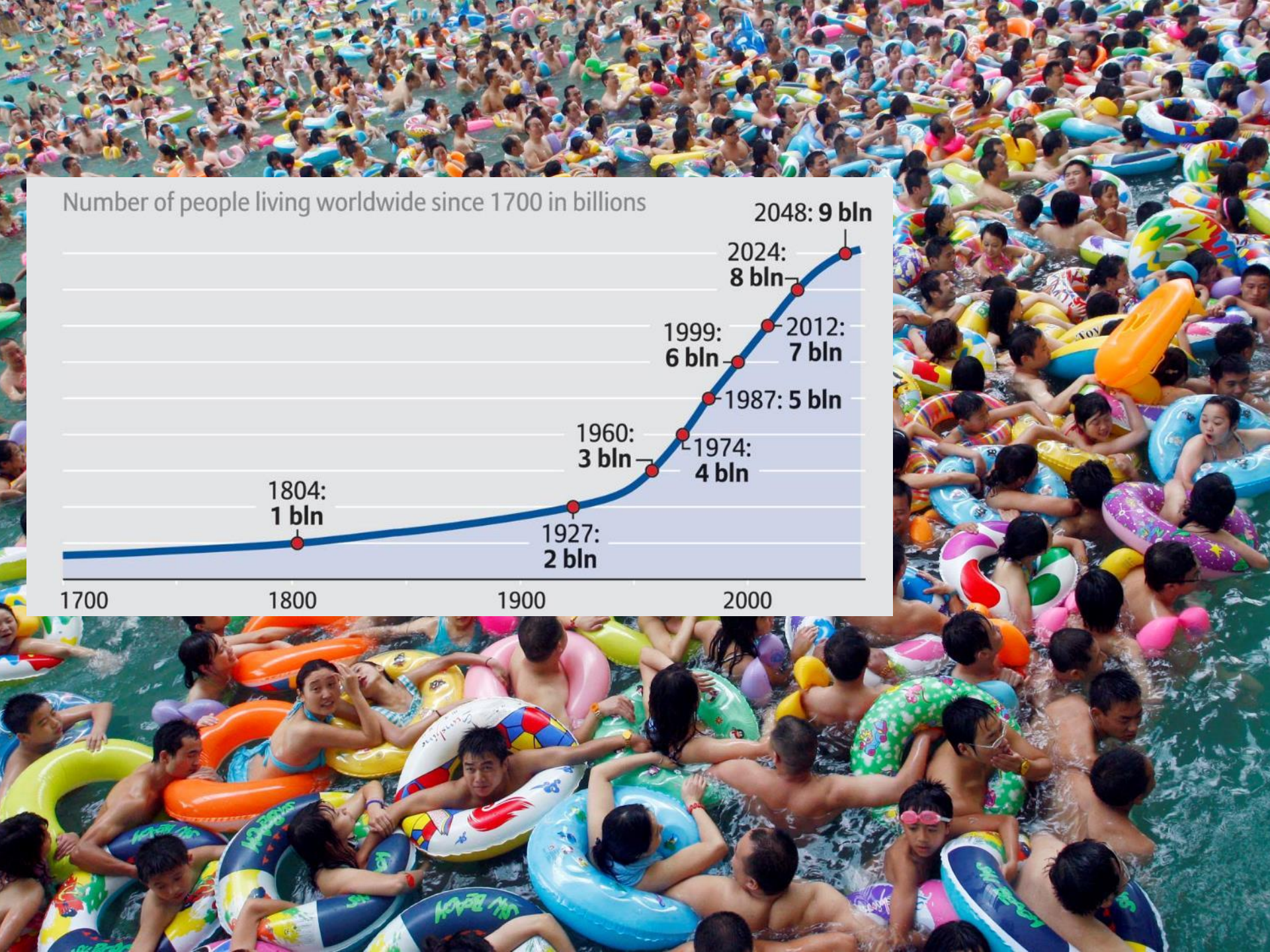
Benefits of the biocycle

- Low embodied energy
- No waste problem
- (Rapidly) renewable

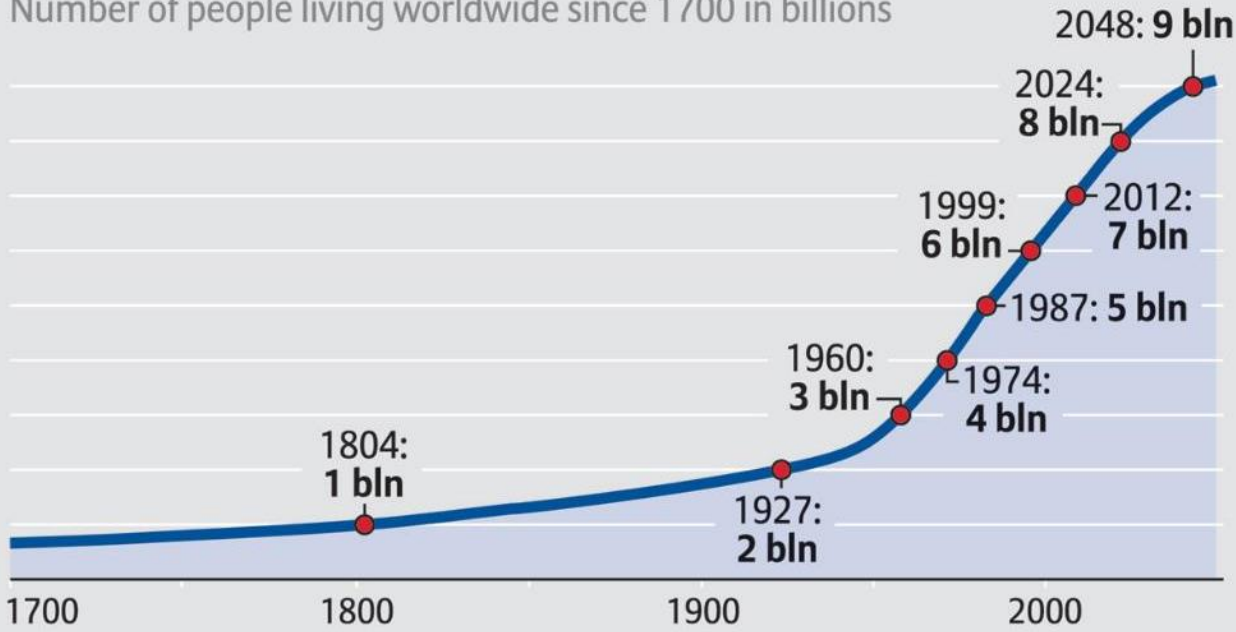


- High embodied energy
- Not bio-degradable – if recycled considerable energy demand
- Non renewable

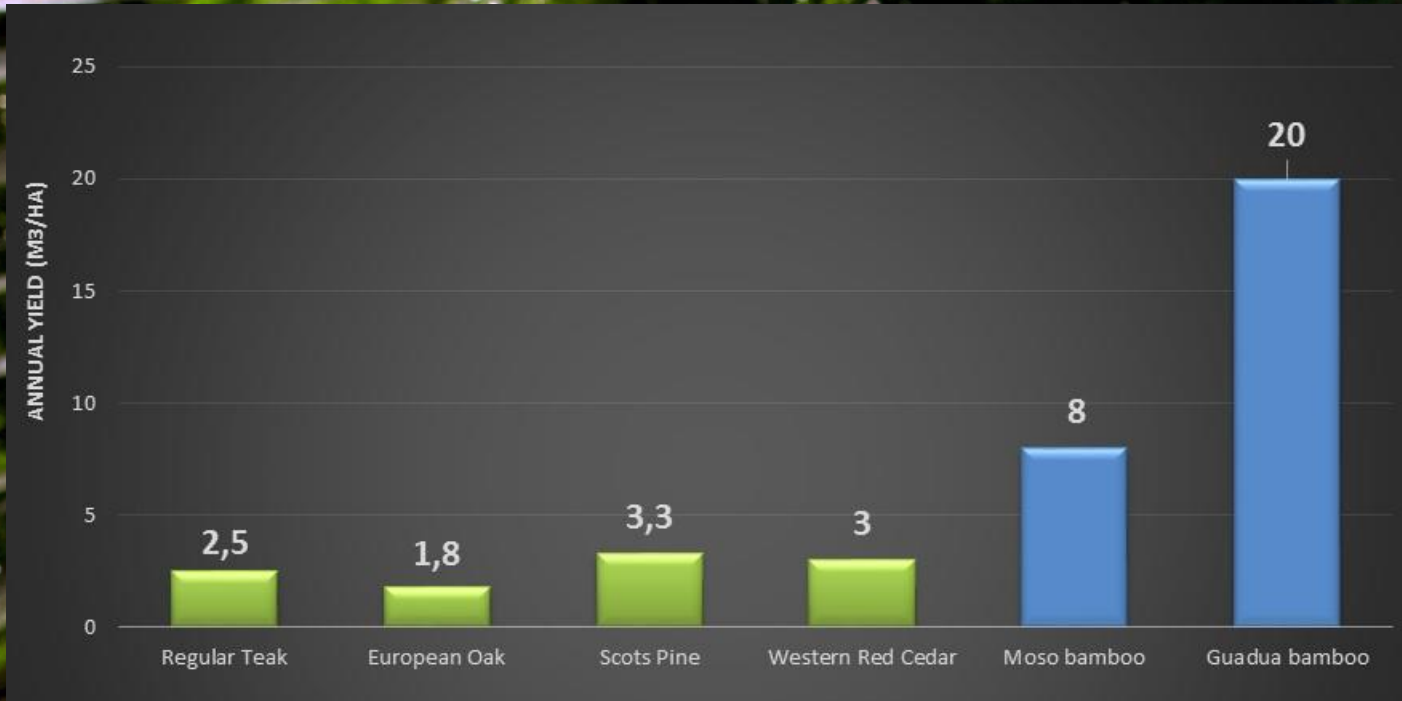




Number of people living worldwide since 1700 in billions



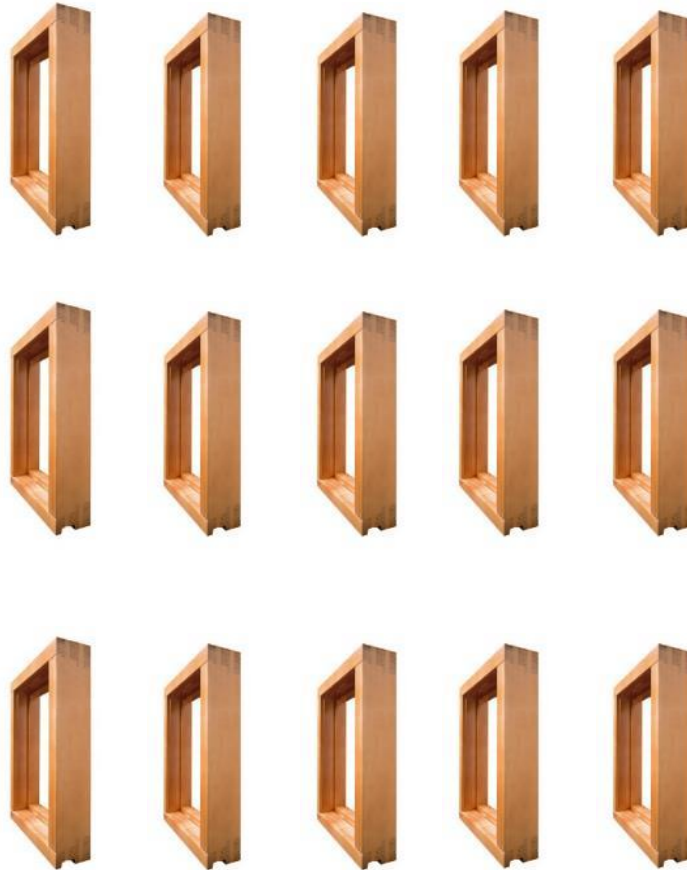
Power of Renewability



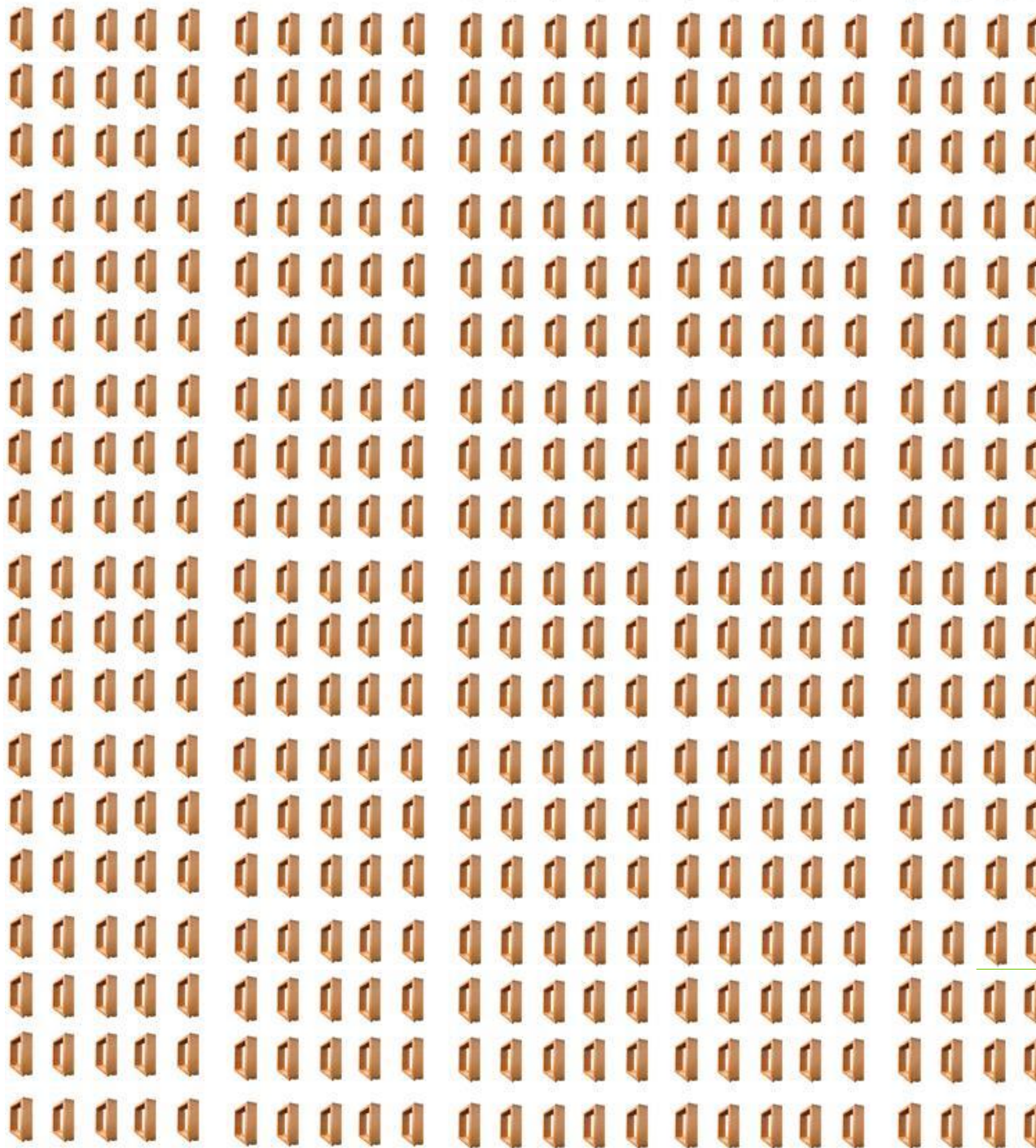
m^oso[®]



1 m3 of bamboo =
15 window frames

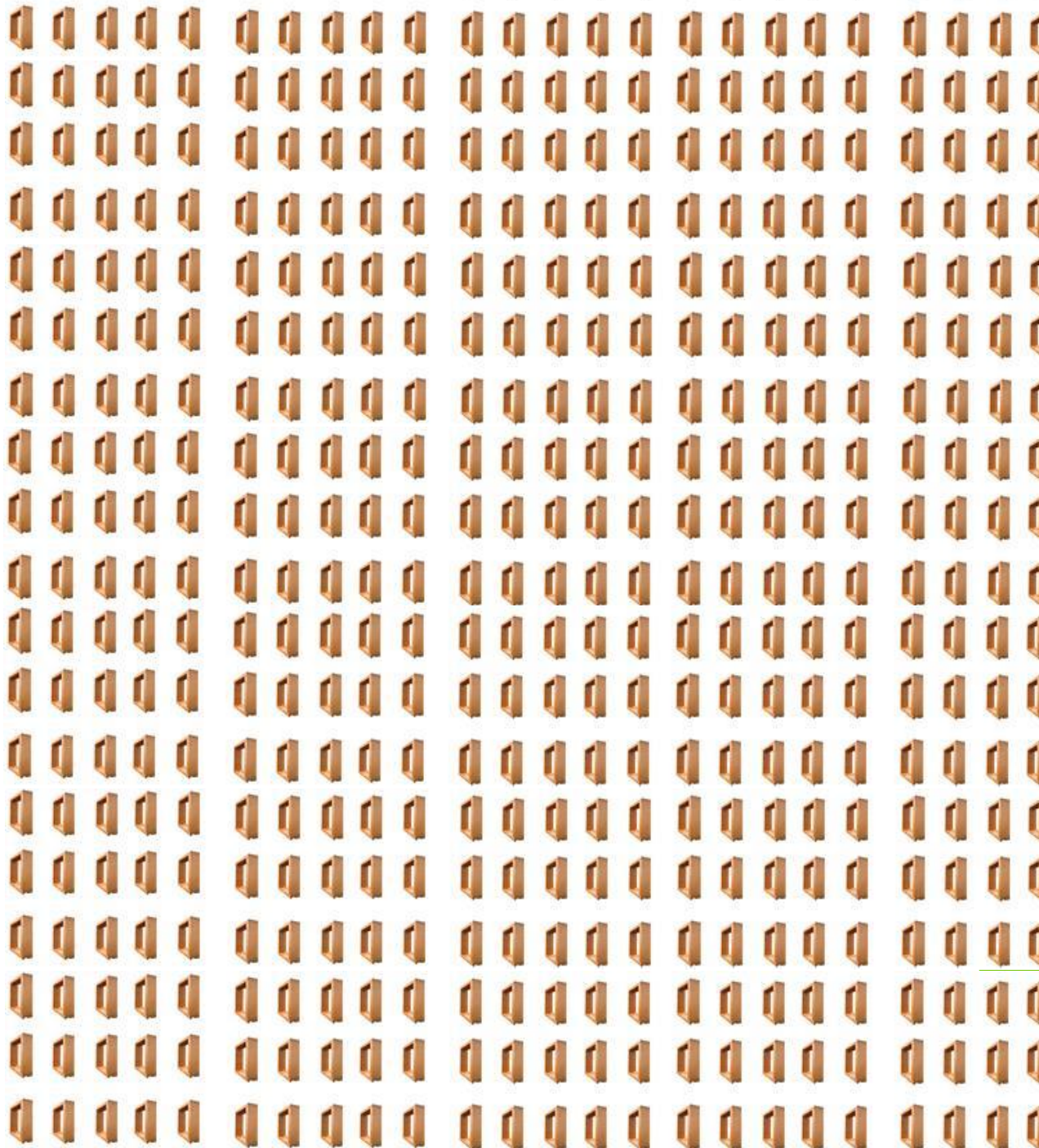


20 m³ of bamboo =
300 window frames



20 m³ of bamboo =
300 window frames

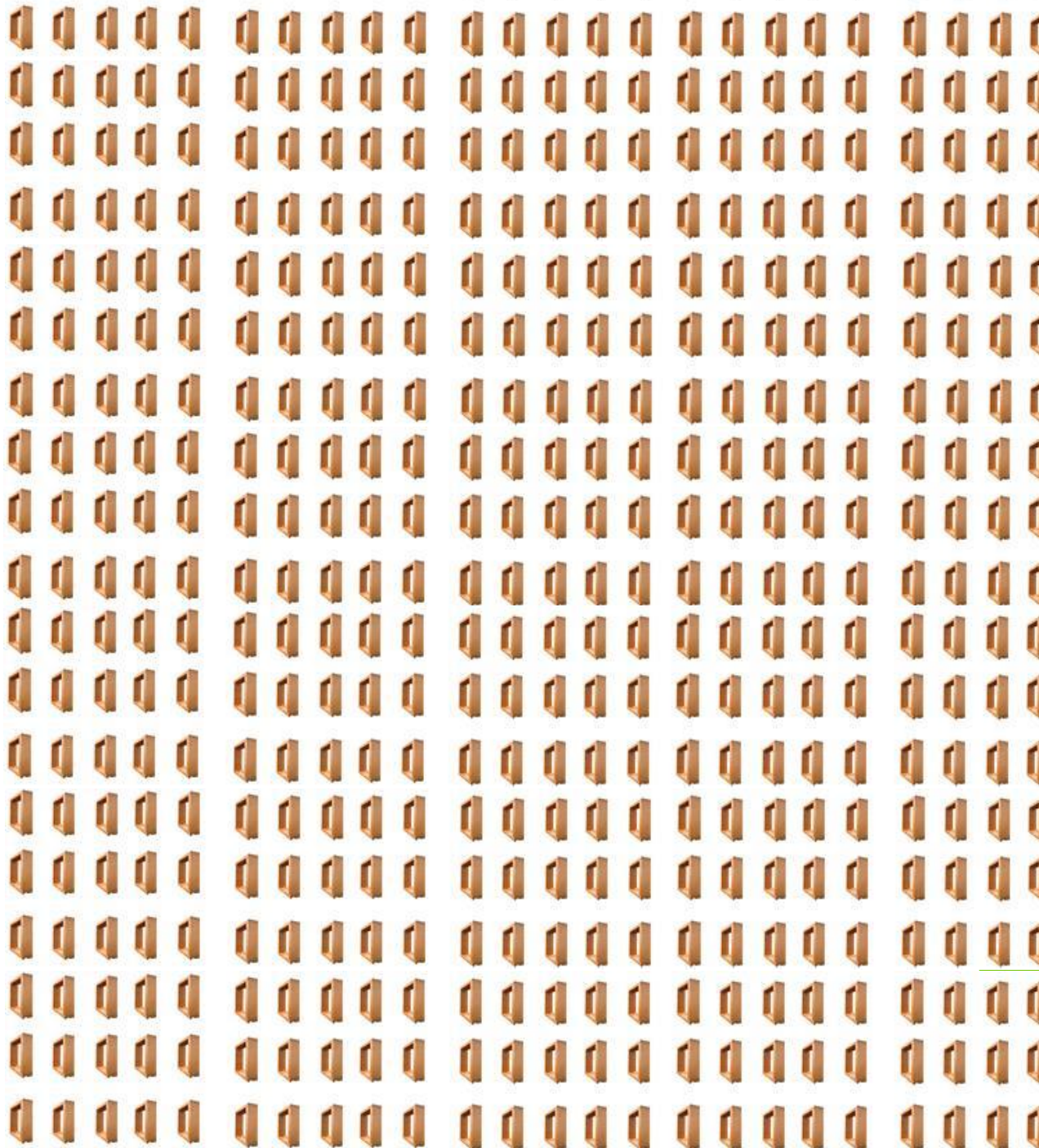
Sustainably grown on
1 hectare per year!



**20 m³ of bamboo =
300 window frames**

**Sustainably grown on
1 hectare per year!**

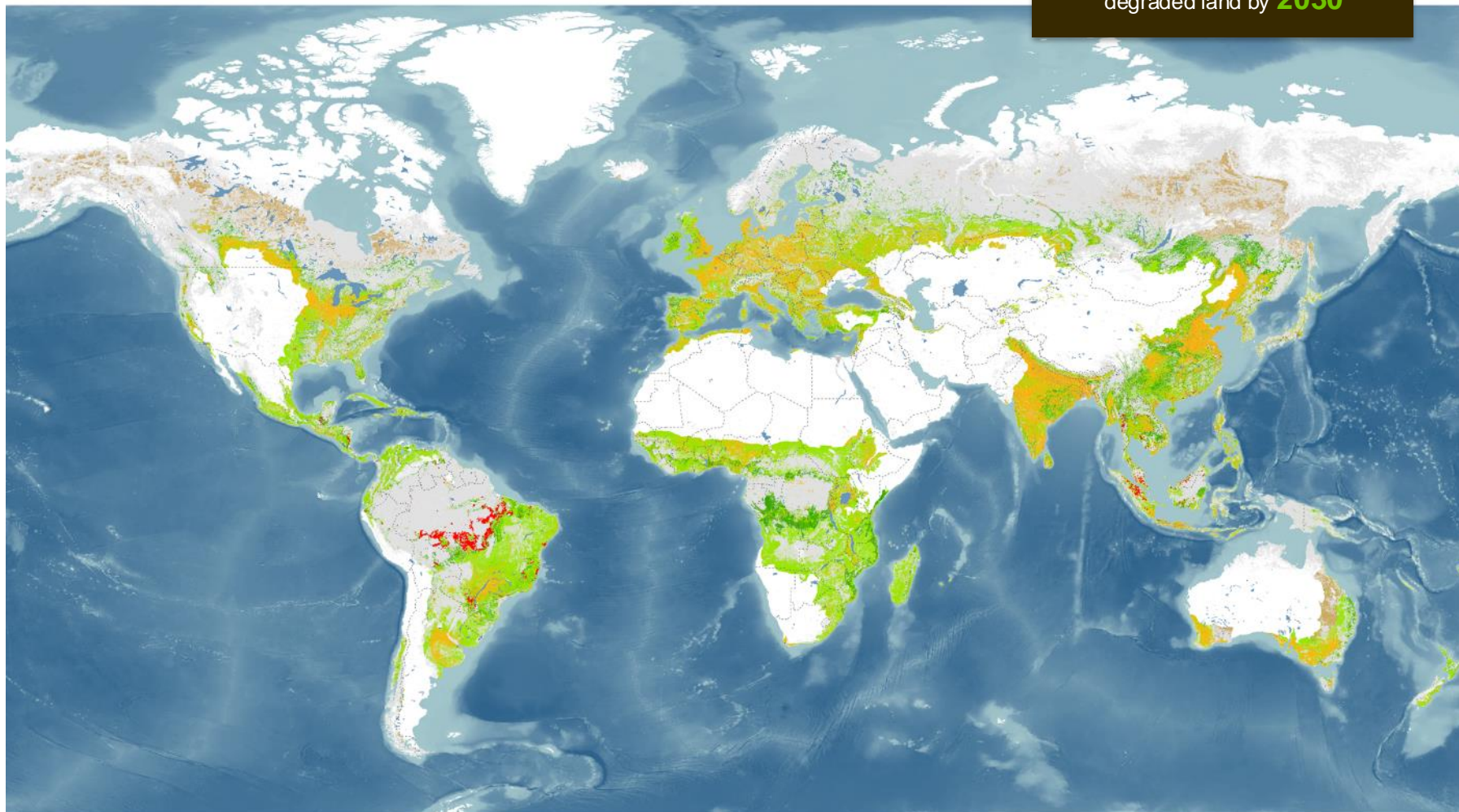
= only 2 soccer fields!



A World of Opportunity for Forest and Landscape Restoration

Bonn Challenge

Reforest **500 million ha** of
degraded land by **2030**



FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES

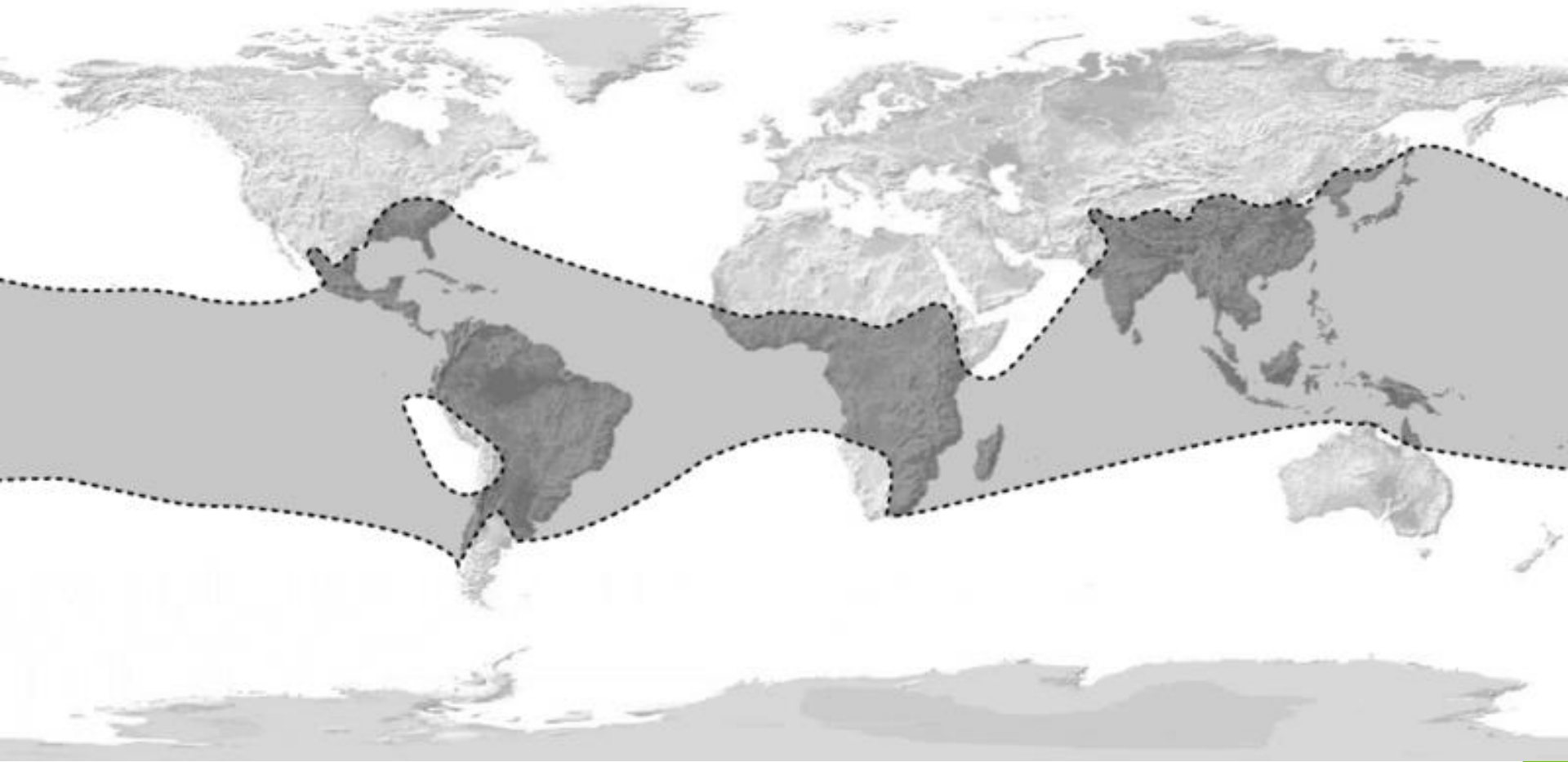
- Wide-scale restoration
- Mosaic restoration
- Remote restoration

OTHER AREAS

- Agricultural lands
- Recent tropical deforestation
- Urban areas
- Forest without restoration needs



Bamboo Growing Area







Home

Projects

VCUs

Buffer

Pipeline

JNR

JNR Buffer

Search For Projects

Keyword Name, ID or Proponent

Country

- All
- Argentina
- Australia
- Belize
- Bolivia

Sectoral Scope

- All
- 1. Energy (renewable/non-renew)
- 2. Energy distribution
- 3. Energy demand
- 4. Manufacturing industries
- 5. Chemical industry

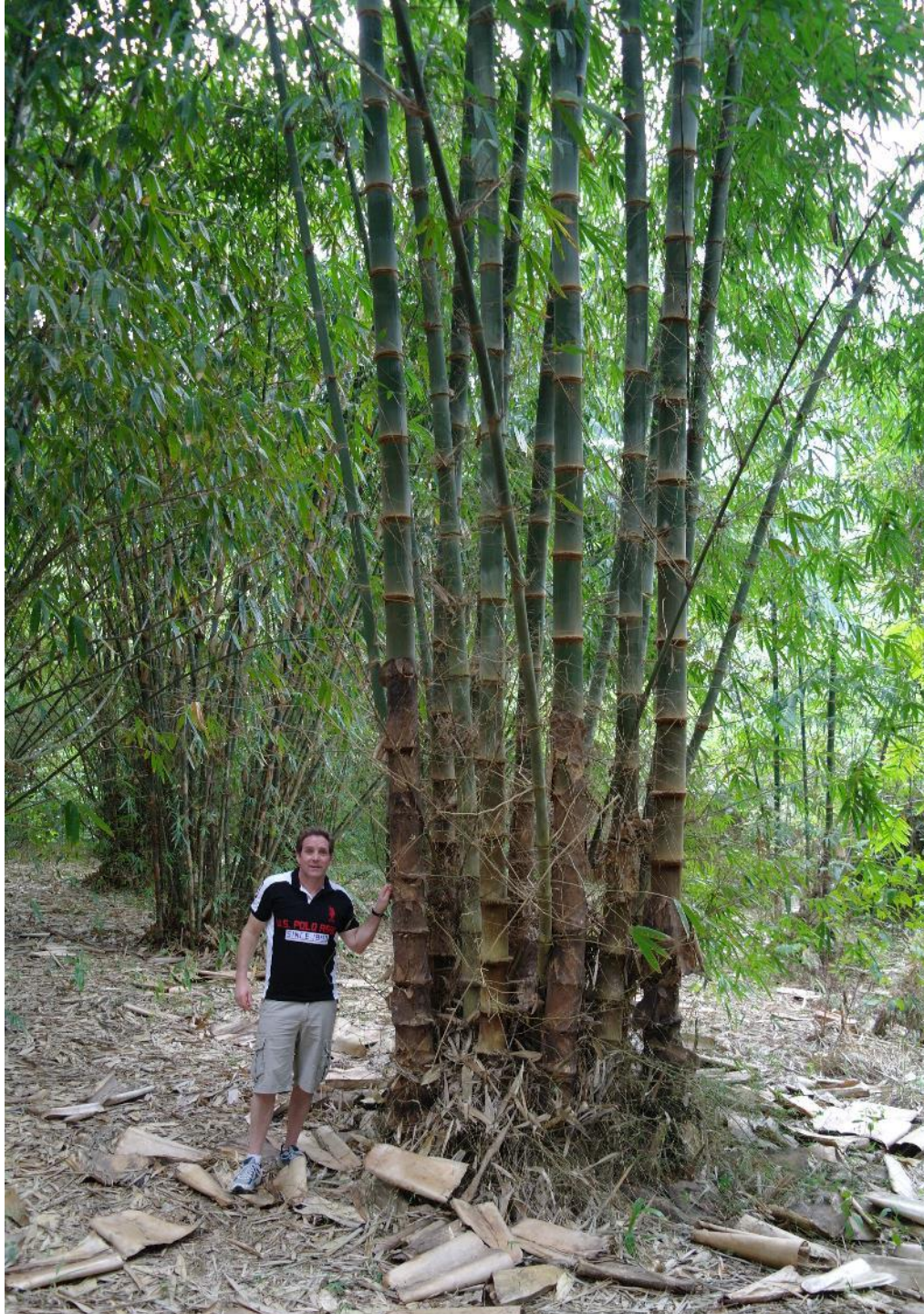
SEARCH ▶

ECOPLANET BAMBOO CENTRAL AMERICA, NICARAGUA



EcoPlanet Bamboo's project is a reforestation project,utilizing native bamboo, *Guadua aculeata*, for the regeneration of degraded pasture lands on the Atlantic coast of Nicaragua. The project has already reforested 1,365ha of degraded land, with another 1,855 underway. The project is designed to provide timber manufacturing industries with a sustainable alternative fiber, thereby further reducing pressure on natural forests. In addition to VCS and CCBA, the project is certified under the FSC for sustainable forest management.

1-4-2025




m^oso[®]

A World of Opportunity for Forest and Landscape Restoration

Bonn Challenge

Reforest **500 million ha** of
degraded land by **2030**


10.000 million m3
bamboo / year



3,6 million
high rise buildings
5000 m2
(2750 m3 bamboo)



100 million
residential villas
170 m2
(100 m3 bamboo)



500 million
social housing
40 m2
(20 m3 bamboo)



Bamboo reforestation

1 ha ~ 1000 tons CO2

500 mio hectares = **500.000.000 ktons CO2**

* Worldwide CO2 emissons 2014 = 35.669.000 ktons CO2
(15 times less)

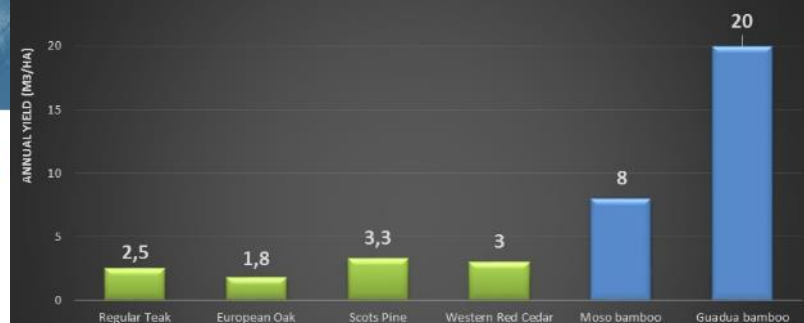
Country	CO ₂ emissions (kt) in 2014 ^[2]	Emission per capita (t) in 2014 ^[3]
World	35.669.000	5.0
China	10.540.000	7.6
United States	5.334.000	16.5
European Union	3.415.000	6.7

FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES

- Wide-scale restoration
- Mosaic restoration
- Remote restoration

OTHER AREAS

- Agricultural lands
- Recent tropical deforestation
- Urban areas
- Forest without restoration needs



In the future, we will grow
a new world economy.



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In the future, we will be planting cities.

A new world is emerging. Be a part of it.

Share your photos using #BambooCity. Watch the making-of at www.hsbc.ca/future.

HSBC 

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**bamboo
products**