Low CO\textsubscript{2} construction using Bamboo-Guadua in Colombia
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Outline

- Background
- Case study: The Bohio project
- Pros & Cons
- Current work
- Prospects of Future
Background

Case study: The Bohio project

Pros & Cons

Current work

Prospects of Future
Bamboo-Guadua

Anatomy & Morphology

Distribution, growth and renewability

Environmental services
Water conservation, Land slides, Erosion

NWFP: FRA 2010-FAO
Reduce pressure on wood forests
Wood substitute

Construction material

CO2 sequestration
Anatomy & Morphology

Bamboo is a giant grass. Angiosperm plant from Gramineae family.

Hollow, tapered tube. Anatomical and morphological features.

- Ground tissue: 40% Fibre + 40% Parenchyma + 6% Cork. Tissue
- Wall thickness
- Nodes
- Internodes

Guadua angustifolia Kunth
Distribution, growth and renewability

Bamboo Worldwide distribution.

Asia 55% (1)

South America 33% (1)

Africa 11% (1)

Rest of the world 1% (1)

Colombia = 51,000 ha (2)

Base diam. +/- 22 cm

6 months

5.00 m

Rapid biomass production & high CO2 storage.

3.5 cm/year

Fast growth rate.

11-14 cm per day

Renews itself.

Grows at least to the size of a pencil

Mechanical properties.

Roller lubricated when used in construction

Bamboo Worldwide distribution.

Asia 55% (1)

South America 33% (1)

Africa 11% (1)

Rest of the world 1% (1)

Colombia = 51,000 ha (2)

Fast growth rate. 11-15 cm per day

Renews itself. Without need to be re-planted.

Rapid biomass production & high CO2 storage. Values of 50 & 150 ton CO2 stored per hectare per year tropical Eucalypt = 115 ton CO2

Mechanical properties. Better appreciated when used in construction.

Environmental services

Water conservation
Land slides
Erosion
NWFP: FRA 2010-FAO

Reduce pressure on wood forests

Wood substitute
CO₂ sequestration

CO₂ fixation in a 50 years period

Moso bamboo = 3.1 tons C/ha/year* (subtropical)
Ma bamboo = 12.8 tons C/ha/year* (Dendrocalamus latiflorus -tropical)
Guadua = 9.08 tons C/ha/year

* Calculated

* Information extracted from Thompson, D. & Matthews, R. (1989) and Riaño, N. et al. (2002), INBAR’s report: Bamboo and climate change mitigation (Lou, et al., 2010),
Construction material

Structures
For commercial, institutional, educational and residential uses.

Bahareque encementado
One & two storey guadua frame dwellings.
REGLAMENTO COLOMBIANO DE CONSTRUCCIÓN SISMO RESISTENTE

NSR-10

Bogotá D.C., Colombia
Enero de 2010
Structures

For commercial, institutional, educational and residential uses.
Bahareque encementado

One & two storey guadua frame dwellings.
Guadua structure.

2000 sq meters, Warehouse in Bogotá D.C., Colombia
Bahareque + Structures system

Frame

Sheathing
- Riven Guadua
- Steel mesh
- Cement

Foundations
But...
CO2...?

85% wall mass = cement + steel*

95% negative impact = other materials*

*Murphy et al., 2004
The Bohio Project

Low CO₂ construction using
The concept

Vernacular architecture - Local materials - Communal space - Structure
Location, views & Landscape
Plan & section
Functional - Structural

First floor
Materials
Result

Beautiful
Inspirational
Full of identity
Meaningful
Challenging
Handcraft
Prestige
"Cheap"
But...
Challenges
Irregularity
(diameter, linearity, waste)
Intensive handicraft process
(Verticality & Horizontality)
Incompatibility with building elements
Bracing with *Guadua* culms
Thick cement renders = Negative environmental impact
Biodeterioration (plagues, weather exposure and humidity)
Time
Eco-cost (straw)
Non-fire proofing
Increased maintenance
Restricted (height & capacity)
Rudimentary appeal
Proposal

Less aesthetic focused

Bamboo as a conventional material

Appropriate technology

Efficient use

Long lasting

Incentive / good example
Development of structural panels with riven Guadua boards
Appropriate Technology

Splitting with developed mechanism
Incompatibility with building elements

Irregularity (diameter, linearity, waste)
Self-binding

Epoxy
Lime
Reduce CO2
nothing new...!

Not the only way...
Future prospects

Nano-coatings
Steam explosion
Acetylation
THM Modifications
Foster research

Stop seeing it as the material for the poor..

Add value

Push the boundaries

Balance technical & natural materials
Thanks...!

Questions...?

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