# EVALUATION OF PHYSICAL/MECHANICAL PROPERTIES AND EFFECTIVENESS OF ECOLOGICAL PRESERVATION METHODS FOR TROPICAL BAMBOOS CULTIVATED IN PUERTO RICO

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## BACKGROUND

### Poverty, Depletion of Natural Resources, and Relation to Construction and Development

15% of the global population lives in **extreme poverty** (Mundial 2014) and more than 15% of the earth's land surface has suffered severe environmental damage (Alimentación 1996). **Traditional construction methods account for globally** (Carrera et al. 2009):

- 50% of natural resource consumption
-40% of electricity consumption
-50% waste products generated
-33% of carbon emissions

### Sustainable Development, Bioconstruction, and Appropriate Technology

• We adopt a holistic definition of **sustainability** that considers three main components: community, economy, and ecology (Calvente 2007).

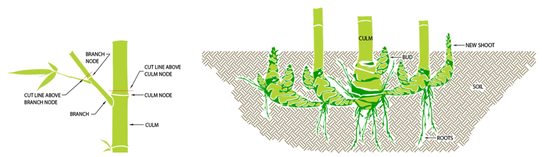
• **Bioconstruction** is a method of building houses, shelters, and other structures using materials that that have low ecological impact, including those that are recycled or extracted from simple and low energy processes. (Wikipedia 2014).

•**Bamboo** is a highly renewable natural resource that does not require intensive industrial processing for use as a construction material, able to last decades with benign preservatives. Moreover, bamboo offers new opportunities for cooperative businesses and it also can be used to control erosion, soil formation and protection of water resources . As such, the development of industrial bamboo provides an ideal bioconstruction material and practice of **appropriate technology**.

## OVERVIEW OF RESOURCE

### Material Description

• Bamboo is a giant perennial grass that grows rapidly.




• Bamboo is classified in the tribe *Bambuseae*, belonging to the family of *Poacea*.

• Bamboo has evolved as a construction material from traditional construction to modern and ultramodern construction (Stamm 2008).

• Today through organizations such as INBAR (International Network of Bamboo and Rattan), bamboo is being utilized in projects that seek to reduce poverty in communities in an ecological sustainable manner. It provides job opportunities for building construction, consumer goods, agriculture, and others.
• International codes exist to specify methods for using bamboo in construction.

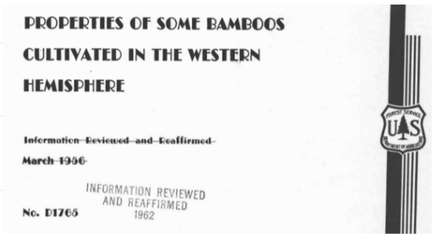
INBAR ISO ICONTEC REGLAMENTO COLOMBIANO DE CONSTRUCCIÓN SISMO RESISTENTE NSR-10

• Bamboo was first introduced to Puerto Rico by the Spanish to mitigate the deforestation and also for stabilization of soil in new rural road (Database, 2013).
• In the 1930s, the USDA introduced a collection of more than 20 tropical species and some sub-tropical bamboos to Puerto Rico. (Knudsen 2000)

## PROJECT

### Justification

• This project represents a continuation of the first study of physical and mechanical properties of bamboos cultivated in Puerto Rico (1956).


PROPERTIES OF SOME BAMBOOS CULTIVATED IN THE WESTERN HEMISPHERE

Information Reviewed and Reaffirmed March 1956

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•Despite its availability and many economic and environmental benefits, bamboo has not yet become widely used construction material in Puerto Rico. Introducing local bamboo as a construction material requires research to catalog its physical and mechanical properties.

### Objectives

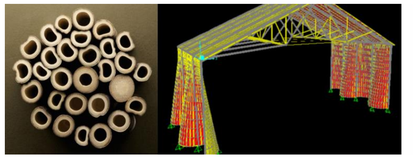
1. Promote bamboo as a material that is suited for bioconstruction and environmental conservation.
2. Develop an inventory of the tropical adult species of bamboo in Puerto Rico that are suited for construction.
3. Using the standards ISO-22157 y NTC-5525, determine the physical and mechanical properties of the selected species.
4. Compare differences in bamboo properties as a function of geographic conditions.
5. Compare the effectiveness of different ecological preservatives to protect against insects attack.

**Bending** **Compression** **Tension** **Shear**

## PROJECT

• The study includes bamboos sampled from seven locations in Puerto Rico:

• As a result of this study, the Civil Engineering labs at UPRM now function as a full service bamboo testing facility. The results of this research will form a base for further research and codes for bamboo construction in Puerto Rico.



### Engaged Teaching and Research

We promote common wellbeing, social and ecological justice through engaged teaching and research, such as a new course "Structural Properties and uses of Bamboo", the project **Graduate Research and Education for Appropriate Technology: Inspiring Direct Engagement and Agency** (GREAT IDEA), and the local bamboo plantation **Tierra Unida**.

NSF GREAT IDEA TIERRA UNIDA

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