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# Bamboo

A Safe, Affordable and Sustainable  
Housing Solution



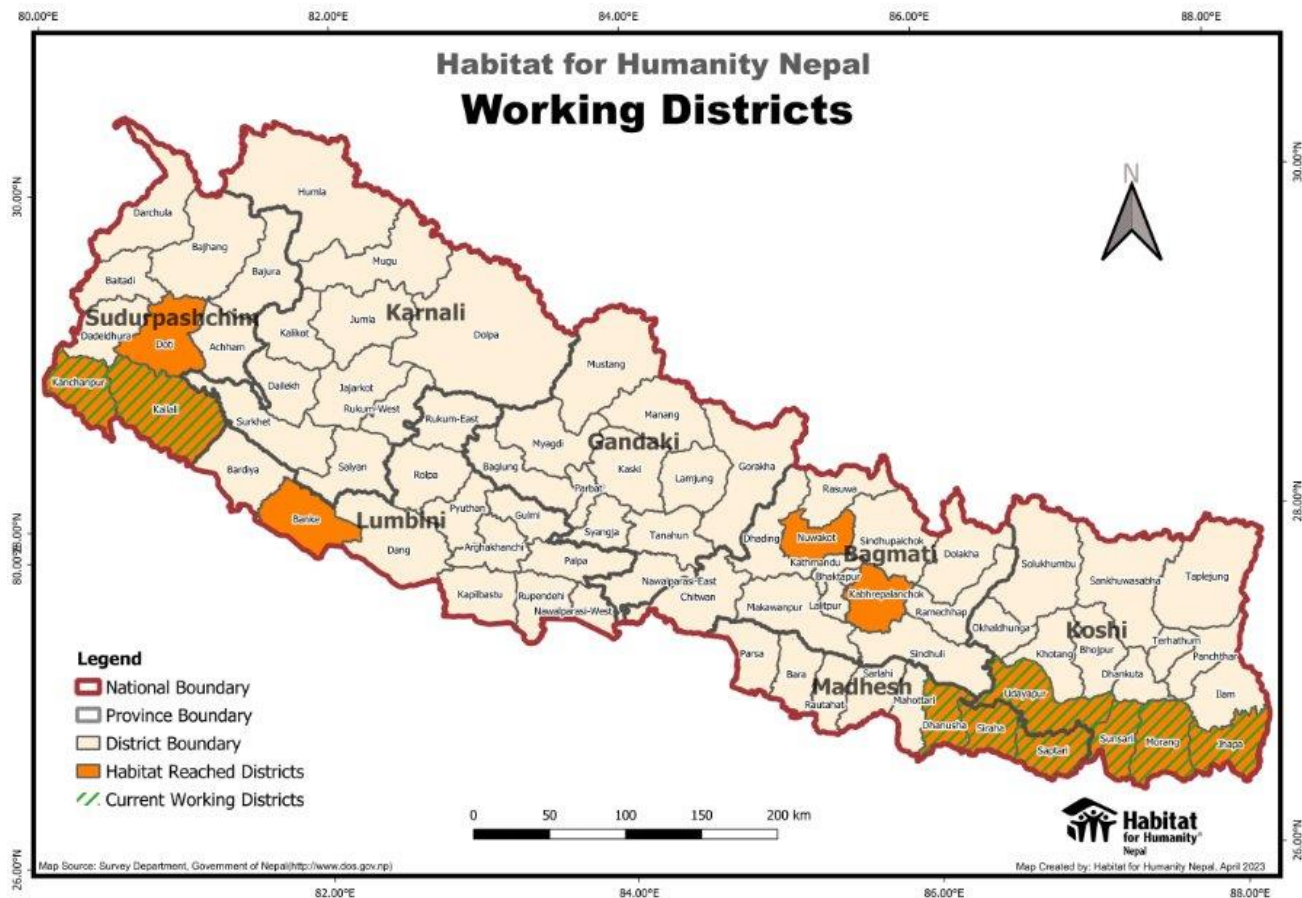
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Presenter: Abhishek Shrestha, Manager- Housing & Construction Technologies

# Brief Introduction of Habitat for Humanity Nepal

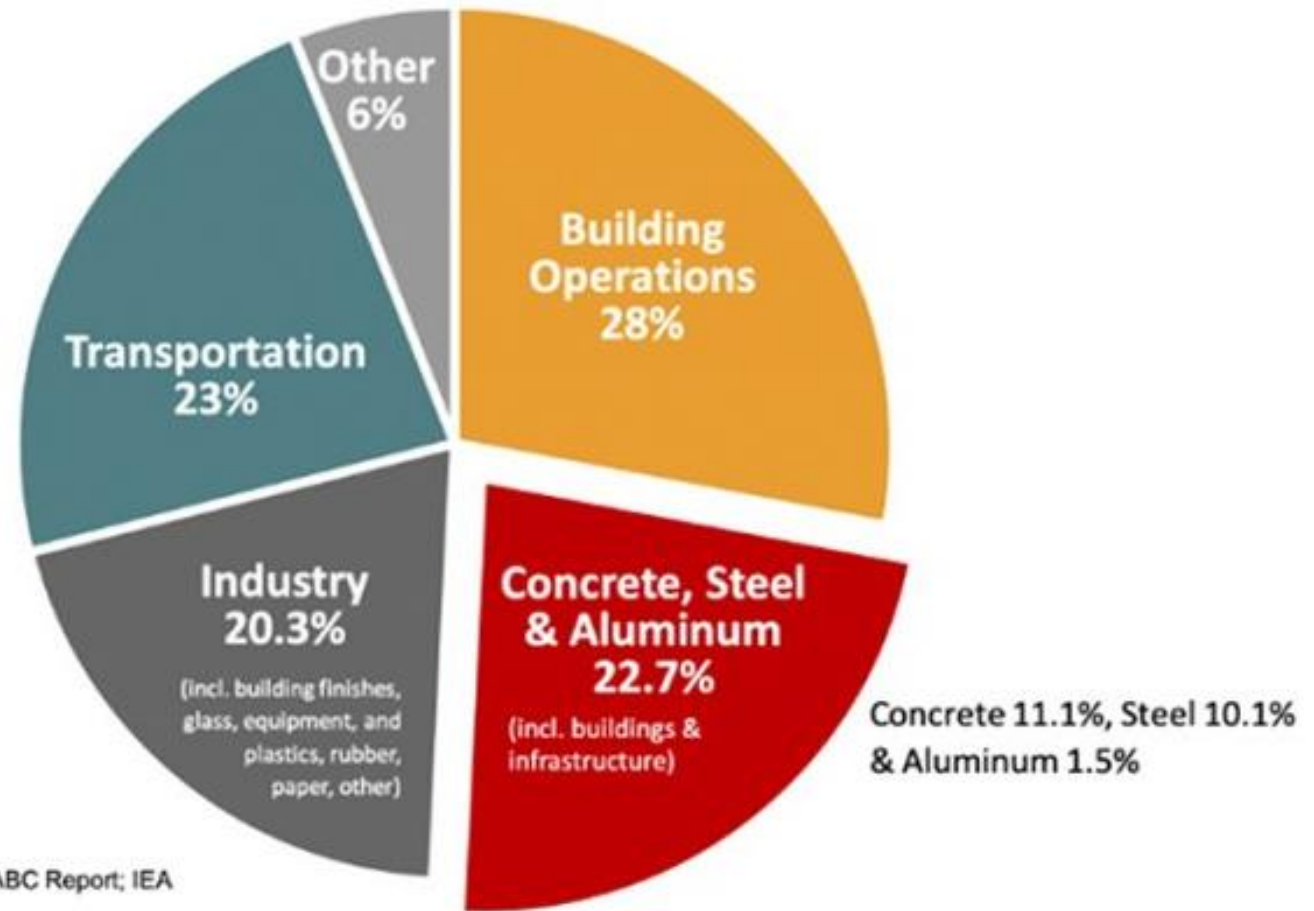


Established in 1997, Habitat for Humanity Nepal (Habitat Nepal) works to support poor, marginalized and vulnerable families who live in substandard housing condition and get most affected in the times of disaster. In partnership with the government, it provides safe and affordable houses promoting sustainable and environment friendly technologies and materials, such as using **Bamboo** to build houses.



- Green, safe, and climate-smart Technologies
- DRR/ Emergency Response
- Financial Inclusion
- Land Rights
- Youth Engagement/Empowerment
- Global Volunteers

# GLOBAL CO2 EMISSIONS BY SECTOR



# Bamboo Construction in Nepal

- **Popularity** : In its most recent census (2011) Nepal's Central Bureau of Statistics reported a total of 799,526 households in the Eastern Terai , 58% had walls built of bamboo.



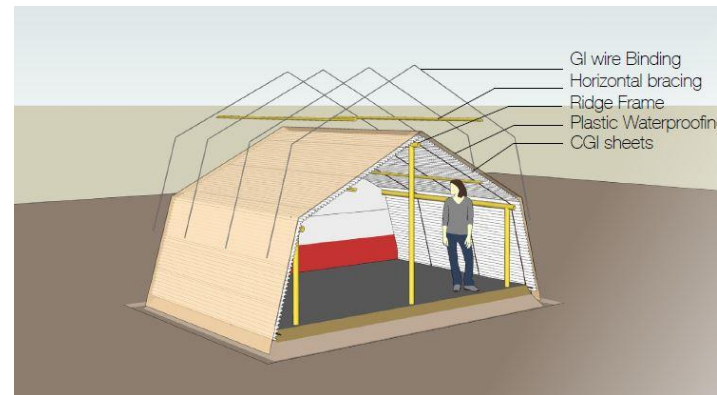
- **Temporary Shelters** : Bamboo popularly used all over the world to build emergency shelters-Temporary & Transitional



woven bamboo wall cover



tarpaulin wall cover



# Bamboo Construction in Nepal

- **Residential Houses:** Different improved, safe and affordable Bamboo House models designed and implemented in Eastern Terai and other different parts of the country



Full Bamboo House- Habitat



RC Post & Bamboo Hybrid House-Habitat



Bamboo House with mud plaster-Habitat



Prefab Bamboo House- Himalayan Bamboo



Inclusive Bamboo House Design by Habitat



Popular L Shaped Bamboo House Design by Habitat

# Bamboo Construction in Nepal

- **Bamboo Constructions** : Use and construction of full bamboo buildings range from rural low-income groups to high end resorts restaurants , libraries and community centers done by different bamboo private builders in Nepal



Dhulikhel Learning center –(Bamboo Rammed Earth)  
Abari



Madan Pustakalaya –(Bamboo Rammed Earth) Abari



Kopila School Surkhet –(Bamboo  
Rammed Earth) Abari



Community Hall Chitwan-Green Bamboo



Kundalini school Hall , Sundarijal-Green Bamboo



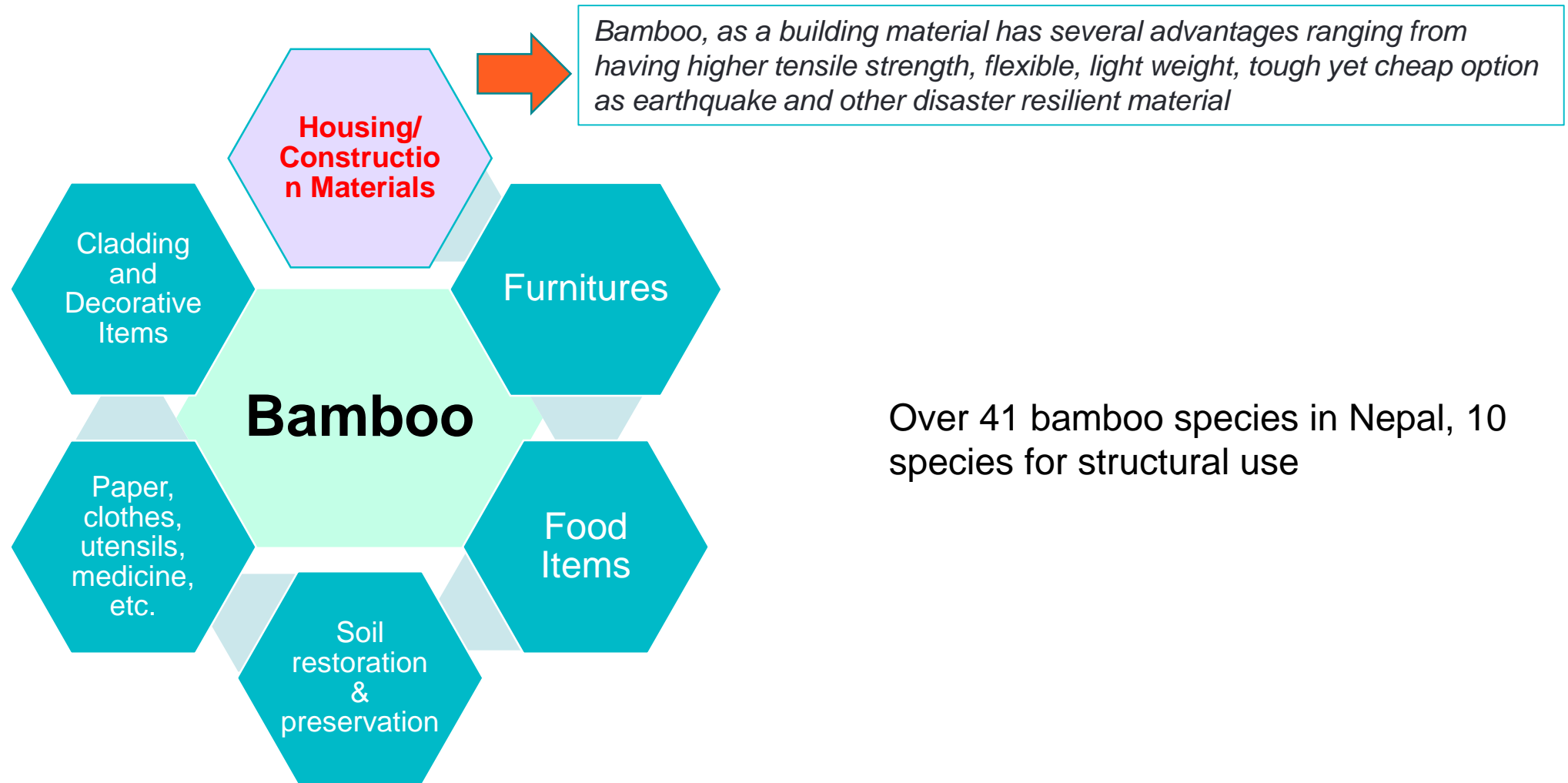
Learning Center Janakpur, CARE Nepal

# Green and resilient solutions- Bamboo

- **Fastest-growing** plants on earth – can grow upto 1m in a day, only 3-5 years growth for structural grade bamboo
- **Substitution to Timber** –timber which takes more years to grow, hence control depletion of forest and environments
- **Sustainable green material**- highly renewable, biodegradable, and green material that provides livelihoods to farmers
- **Strong root network**- enables soil stabilization
- **Produces 35 % more oxygen** than other trees. A hectare of bamboo plantation can absorb 12 tons of carbon dioxide from the air annually. So considered carbon negative
- **High strength and flexible**
- **Very light weight**
- **Local Skill & Technology** : practiced traditionally or the skills can be transferred easily using local tools and materials



# Bamboo- Usages and circularity



# treatment

## बाँस कटान तथा उपचार प्रक्रिया



### चरण १

बाँस कटान तथा आपूर्ति

३-५ वर्ष उमेरका बाँस कटान गर्ने ।  
कटानको एक हप्ता भित्रमा उपचार  
केन्द्रमा पुऱ्याउने ।



### चरण २

सफाई तथा वर्गीकरण

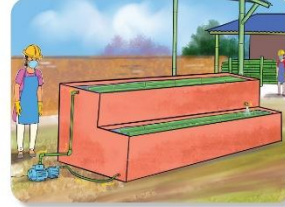
बाँसलाई सफा गरी चाहिएको  
लम्बाईमा काट्ने । काटिएको  
बाँसलाई आवश्यकता  
अनुसार वर्गीकरण गर्ने ।



### चरण ३

बाँस प्वाल पार्ने

बाँसलाई १० मि. मि. व्यासको  
डण्डीको सहायताले भित्रबाट  
आँख्ना आँख्ना गरी एक छेउदेखि  
अर्को छेउसम्म प्वाल पार्ने ।



### चरण ४

बाँसलाई धुने

बगीरहेको पानीमा  
बाँसलाई ५ दिनसम्म  
पूर्णरूपमा ढुवाएर धुने ।



### चरण ५

बाँसलाई सुकाउने

पानीमा सफा गरिएको  
बाँसलाई २४ घण्टासम्म  
छाँयामा सुकाउने ।



### चरण ६

रसायनमा ढुवाउने

बाँसको उपचार गर्ने रसायनिक घोलको  
मिश्रणको मात्रा : १०० लि. पानीमा १ के.  
जी. Boric acid + १.५ के. जी. Borax  
को अनुपात हुनेगरी घोल बनाउने ।  
बाँसलाई तयार पारिएको रसायनिक  
घोलमा ७ दिनसम्म ढुवाउने ।



### चरण ७

रसायन तर्काउने

बाँसलाई रसायनिक घोलबाट  
फिर्कने र बाँसमा बाँकि रहेको  
अधिक रसायनलाई २-३  
घण्टासम्म तर्किने दिने ।



### चरण ८

भाण्डारण गर्ने

उपचार गरिएको बाँसलाई  
छाँयामा सुकाउने र हावा  
पस्ने गरि भण्डारण गर्ने ।

# bamboo design

INTERNATIONAL  
STANDARD

ISO  
22157

First edition  
2019-01

**Bamboo structures — Determination  
of physical and mechanical properties  
of bamboo culms — Test methods**

*Structures en bambou — Détermination des propriétés physiques et  
mécaniques des tiges de bambou — Méthodes d'essais*



## experimental testing

needed for structural  
analysis + design

for safety

as per  
ISO22157:2019

material level

element level

connections



# Cement Bamboo Frame Technology (CBFT)



Alternative , affordable,  
eco-friendly technology

Protection from  
moisture and rain



Protection from sun



Disaster Resistant

Well researched  
and tested



Fire Resistant

Durable



Insect Resistant

# Construction Process

Government Funding -40%  
HFHN- technical & financial- 40%  
Homeowners- Sweat Equity- 20%



## Low cost and affordable



Average Area= 375 sqft  
Toilet Area = 25 sqft  
Cost=4.30 Lakhs  
Per sqft cost = NPR 1100

CSEB house cost: NPR 6 lakhs

Over 25 % cheaper



## Challenges

- Informal / Non-regulated bamboo construction market
- Bamboo culms are of unknown/unverifiable quality (lack of grading)
- lack of knowledge and data – creates the idea of deficiencies in safety, reliability, and performance
- Uncertainty in Validation and Endorsement by the government

# Way forwards

- National Bamboo Guideline (MoU:May 2022)



## National Bamboo Guideline for Housing

Edition : First Draft  
Only for review



- Bamboo Market system development
  - Private sector engagement ( farming, treatment, construction, other products)
- - Research on more bamboo species
  - MoU and collaboration with Academia ( MBUST, IOE)



## Some pics from Field



Can be an ideal solution  
for EQ safety



End of Presentation

Thank YOU !!