



# THE NEGLECTED RENEWABLE ENERGY SOURCE FROM BAMBOO IN INDONESIA

Elizabeth A. Widjaja

*PROSEA Association, Bogor, Indonesia  
& Botany Division, Research Centre for Biology – LIPI,  
Cibinong, Indonesia*

## INTRODUCTION

### INDONESIA

- ✓ megadiversity country
- ✓ 35,000 – 40,000 species
- ✓ 55% endemic
- ✓ BPPT : 62 species has prospect for biofuel
- ✓ Soerawidjaja, Brodjonegoro & Reksowardojo (2005) 50 species for biofuel
- ✓ PROSEA: published 38 species, documented 150 species prospect for biofuel



Neglected  
renewable energy  
resources such  
as:

- ❖ Metroxylon sago:  
bioethanol 4,000 –  
5,000 liter/ha/year
- ❖ Bamboo ???
- ❖ ????

**WHY Biofuel:** An effort to reduce  
energy burden  
dependence on fossil fuel  
Carbon emission levels  
Offering new income opportunities

Indonesian government issued

**President Decree no. 5/2006:** conduct investigation on  
the uses of plant resources for biofuel in order to secure  
short supplies of fossil oils.

**President Instruction No. 1/ 2006:** Act of Preparation  
and Uses of Plant Resources as biofuel

**President Instruction No. 2/2006:** the Preparations and  
the Utilization of coal which will transfer as another fuel.



- **Bamboo:**
- economic plant
- thousand uses
- widely spread
- fast growing plant
- sustainable resources

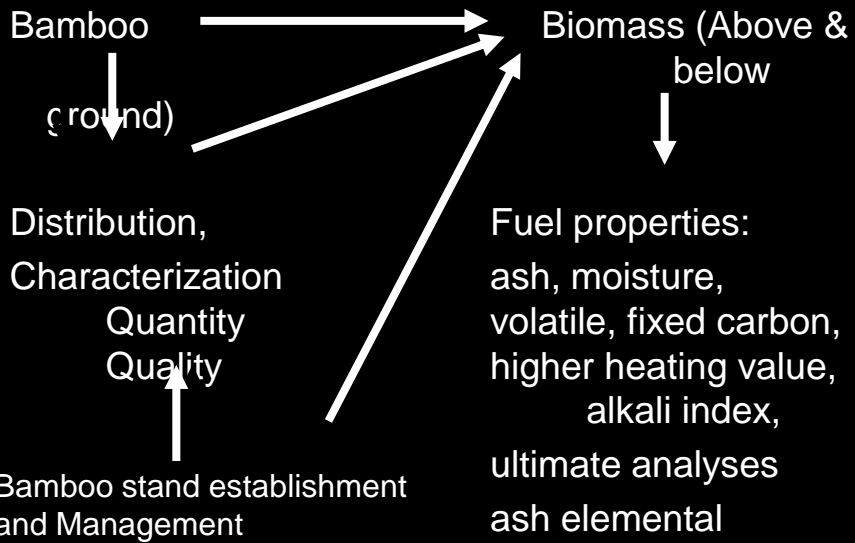
## SEVERAL STUDIES ON BAMBOO TOWARDS BIOFUEL

- Molini and Irizarry (1983): as a fuel for power generation in Puerto Rico
- Ram & Seenayya (1991): de-lignified bamboo pulp as a substrate for ethanolic fermentation
- Piatti (1947): diesel-like fuel
- Scurlock et al (2000): bamboo fuel with potential for electricity and fuel production,
- Dannenmanna et al. (2007) identified *Bambusa tulda*, *B. pallida* show the greatest potential as a biofuel.

- Azzini et al. (2002): the ethanol of *B. vulgaris*
  - 13.08 liter/100 kg chips – 1 year old
  - 14.79 liter/100 kg chips – 5 year old
    - So the average production from 1 ton of dry chips = 136 liter ethanol, 495 kg cellulosic fibre and 64 kg starch.
- El Bassam et al. (2002): bamboo produced
  - 7 tons of dry matter/hectare/year
  - 17.1 MJ/kg – 18.9 MJ/kg dry material energy content
  - 40% cellulose content
- Chen et. a. (1987): high calorific values (4 – 6 kcal/kg) compared to woods
- El Bassam et al. (2002): bamboo fractions
  - 57% oil
  - 21% gas
  - 22% charcoal.

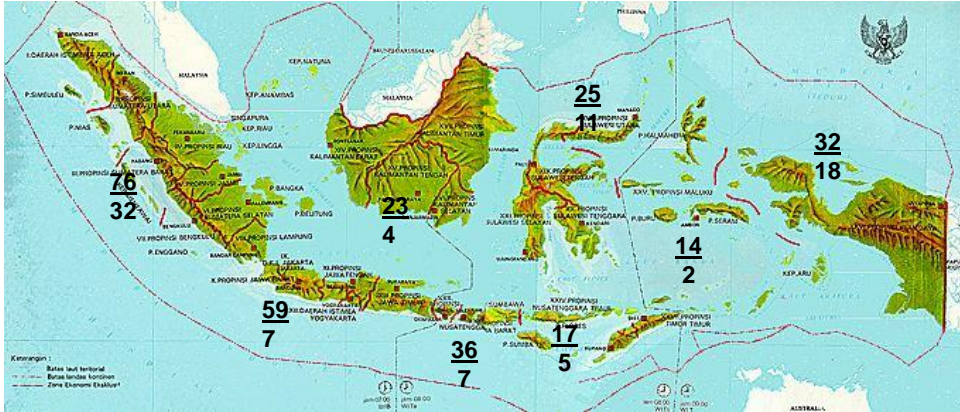


# MATERIAL AND METHODS



## CURRENT INDONESIAN BAMBOO STATUS

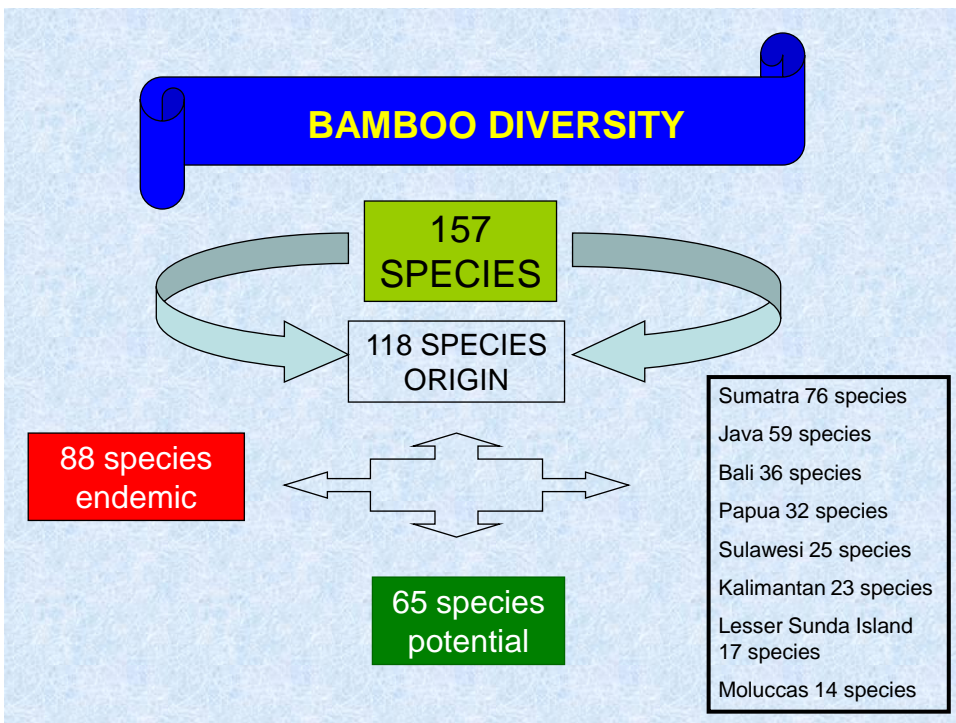




## Bamboo diversity in Indonesia

Notes: Value above the line is the total number of species

Value under the line is the total number of endemic species



- ❖ The most important species : *D. asper*, *G. apus*, *G. pseudoarundinacea*, *B. vulgaris*, *B. blumeana*, *G. atter*, *G. atroviolacea*, *G. hasskarliana*, *G. robusta*.
- ❖ In Sumatra: *G. kuring* used locally but there is no information on the characteristics of their physico-chemical properties.

## WHERE WE CAN GET BAMBOO

- Bamboo Forest: wild found in protected forest, national park, nature reserve etc.
  - Alas Purwo National Park
  - Meru Betiri National Park
  - Loksado Protected areas
  - G. Tilu Nature Reserve etc.
  - West Sumbawa Nature Reserve
- Bamboo Community Forest: planted
  - Found in their community garden such as:
    - ❖ Panglipuran village
    - ❖ Tempedak community forest
- Bamboo Plantation
  - Planted by local people in their gardens
  - Planted by business people e.g. Great Giant Pineapple factory
  - Under the forest product division

## How large bamboo forest in Indonesia

Based on Yudodibroto (1987):

50,000 ha bamboo forest

25,000 ha in Banyuwangi

24,000 ha in Gowa

----- these forests have been changed into Pine  
plantation)

30,616 ha bamboo plantation from:

Tanah Bumbu, S. Kalimantan

Amadit River, S.Kalimantan

30 km along the river side (Kandangan to Loksado

Bengkulu Province

Ongkak Doemoega, Bolaang Mongondow, N. Sulawesi

**Based on UGM (1991):**

Bamboo plantation in

C. Jawa = 7,672.7 ha.

Lombok = c. 23 ha

Bamboo forest in

Sumbawa Is. : 34,422.5 ha

**Based on IPB (1993)**

Bamboo plantation in Bali: 12,681.77 ha

**Data not recorded (plantation or forest) from:**

Seram (forest)  
West Sumatra (Forest & Plantation)  
West Kalimantan (Plantation & Forest)  
S. Kalimantan (Forest)  
Lampung (plantation 2000 ha+?)  
West Java (Plantation & Forest)  
S. Sulawesi (Plantation)  
Halmahera (Forest)  
Sangir – Talaud (Forest and Plantation)  
Timor (Forest)  
Sumba (Forest)  
Flores (plantation & Forest)

**Inventory is needed: an inventory has been done in Purwakarta as follows.**

community bamboo forest 2,955 ha  
production 3,430,800 culm/year which  
belongs to 20,713 family.

Selective cutting: Potential 7,425.6 culm/ha,  
whereas the total number of culm 5,486.8  
culm/ha. Population in 4 villages become  
1,044 clump/ha, 1 clump = 20 culm

- Widjaja et al. (2005) productivity *G. apus* in Purwakarta
  - Productivity 682 – 6053 bamboo/year/ha
  - Regeneration of this species is 33.18 – 224.91%.
- Astuti & Arinasa (2002) bamboo charcoal in Panglipuran, Bali: ironwork

## RESEARCH NEEDS

- Bamboo distribution
- Bamboo management
- Physico-chemical contains
- Seletion of adaptive genotypes
- biofuel properties: ash, moisture, volatile, fixed carbon, higher heating value, alkali index, ultimate analyses, ash elemental
- Bamboo physiology: measurement of plant height, counting of number of tillers
- Economic analysis and benefit

