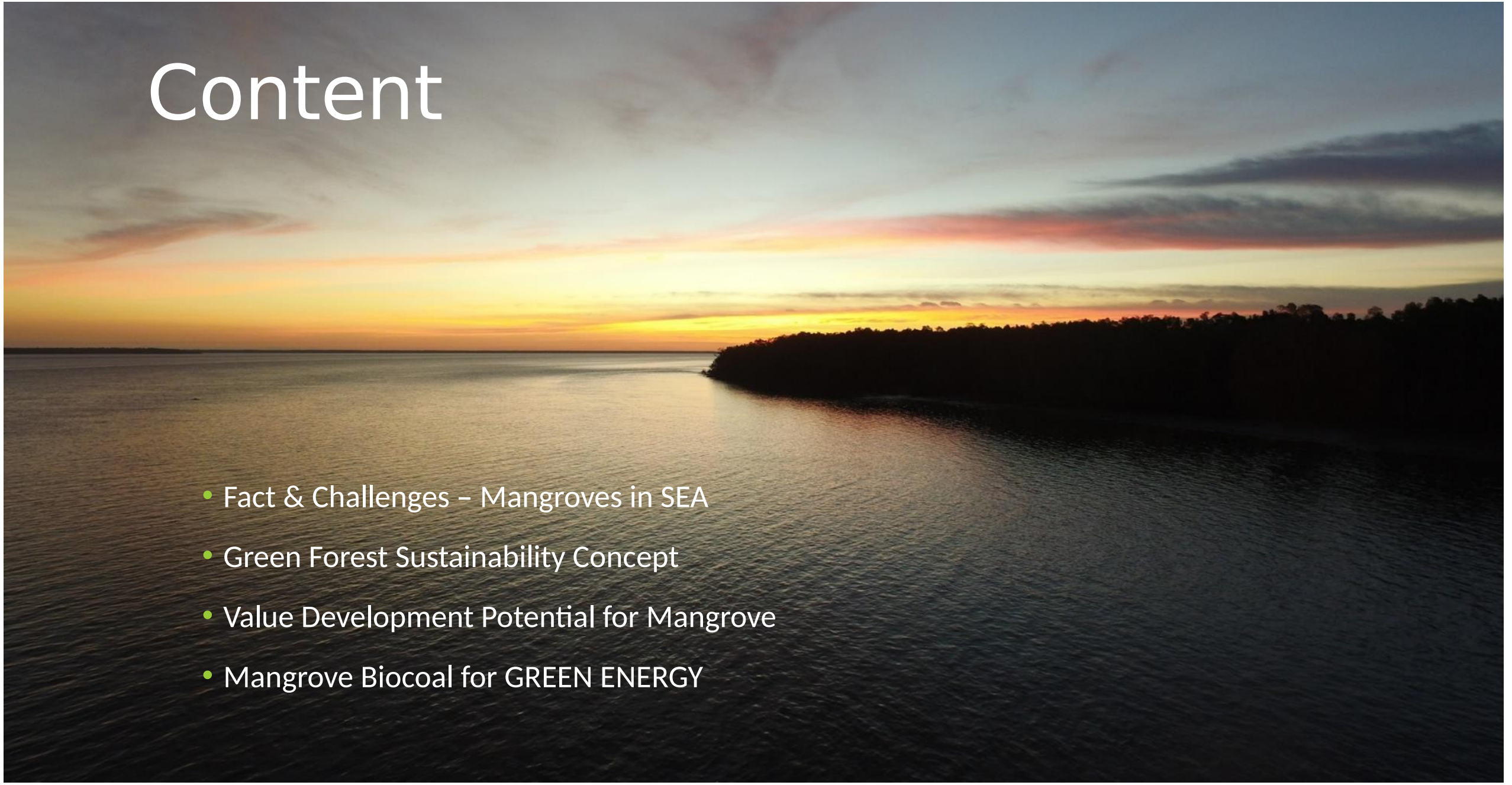
Value Development of Mangrove Forest in South East Asia

GREEN FOREST PRODUCT & TECHNOLOGY PTE. LTD.

FOR THE INTERNATIONAL CONFERENCE ON SUSTAINABLE MANGROVE ECOSYSTEMS

MULJADI TANTRA

Content



- Fact & Challenges – Mangroves in SEA
- Green Forest Sustainability Concept
- Value Development Potential for Mangrove
- Mangrove Biocoal for GREEN ENERGY

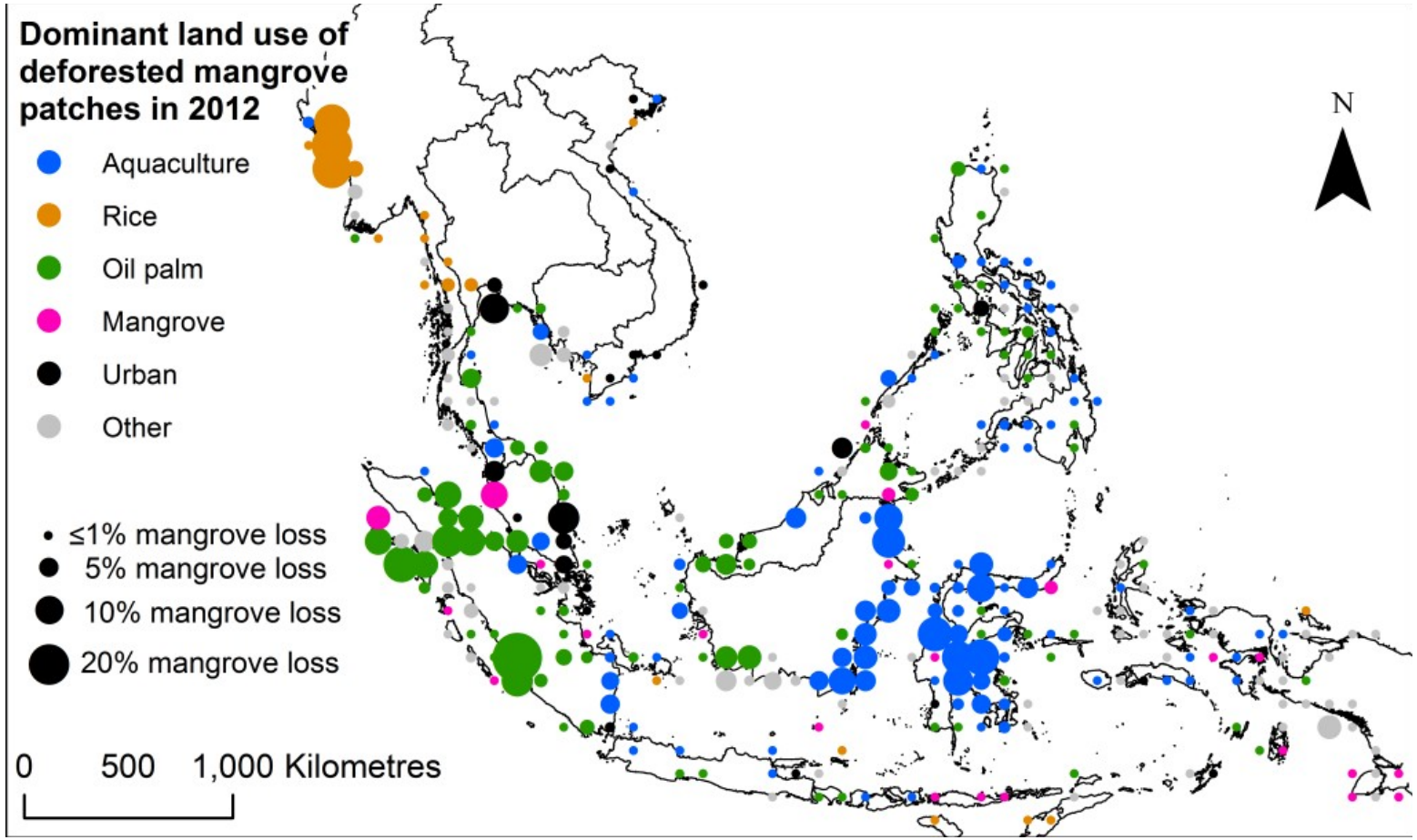
Facts and Challenges – SEA Mangrove

- SEA mangrove is considered one of the most productive forest in the world[1]
  - But… the loss of mangrove forest in the region is the highest in the world[2]
- Two mangrove products represent the bulk of revenue for direct uses:
  - Woodchips: market for pulp & paper is stagnant, trending toward the use of homogeneous plantation forest (Acacia or Eucalyptus), government policy favors plantation
  - Charcoal: illegal sources are rampant, reducing the overall value of mangrove charcoal
- Policy favors mangrove protection and conservation, but…
  - No use => loss (not conservation, but conversion) – true in most SEA countries
  - "Protected" mangrove forest are among the most degraded area (outside of Papua) in Indonesia
- Sustainable utilization of mangrove is under-developed, not encouraged, and delegated to NGOs and communities

1 *Hutchison, J., Manica, A., Swetnam, R., Balmford, A. and Spalding, M. (2014), Predicting Global Patterns in Mangrove Forest Biomass. Conservation Letters, 7: 233–240. doi: 10.1111/conl.12060*

2 *Richards & Friess. 2016. Proceedings of the National Academy of Sciences 113, 344-349.*

Mangrove Deforestation in SEA



Richards & Friess. 2016. **Proceedings of the National Academy of Sciences** 113, 344-349.

Mangrove utilization is NOT the cause for deforestation

CONVERSION IS BY FAR THE PRIMARY CAUSE

Forecasted Mangrove Loss in Indonesia

CONVERSION IS PROJECTED TO BE THE PRIMARY CAUSE OF FUTURE DEGRADATION

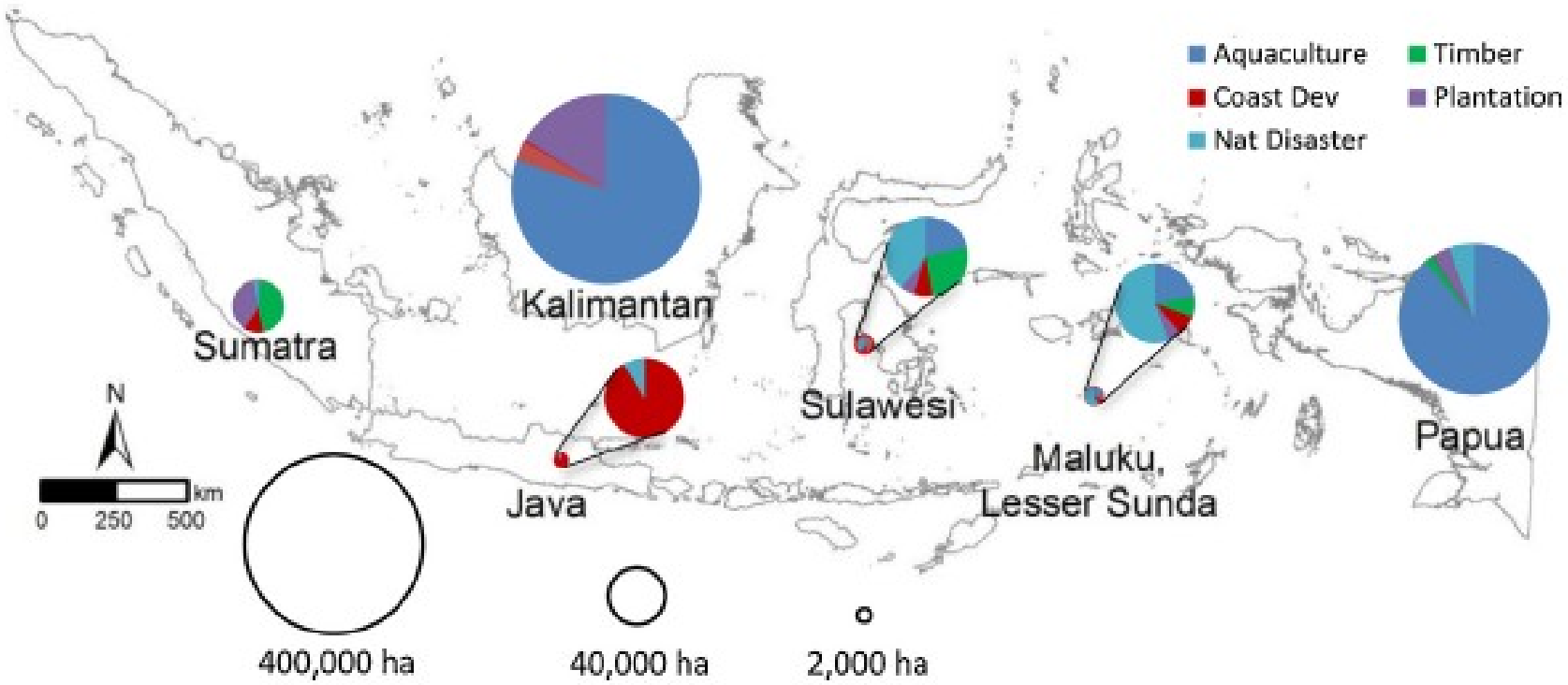
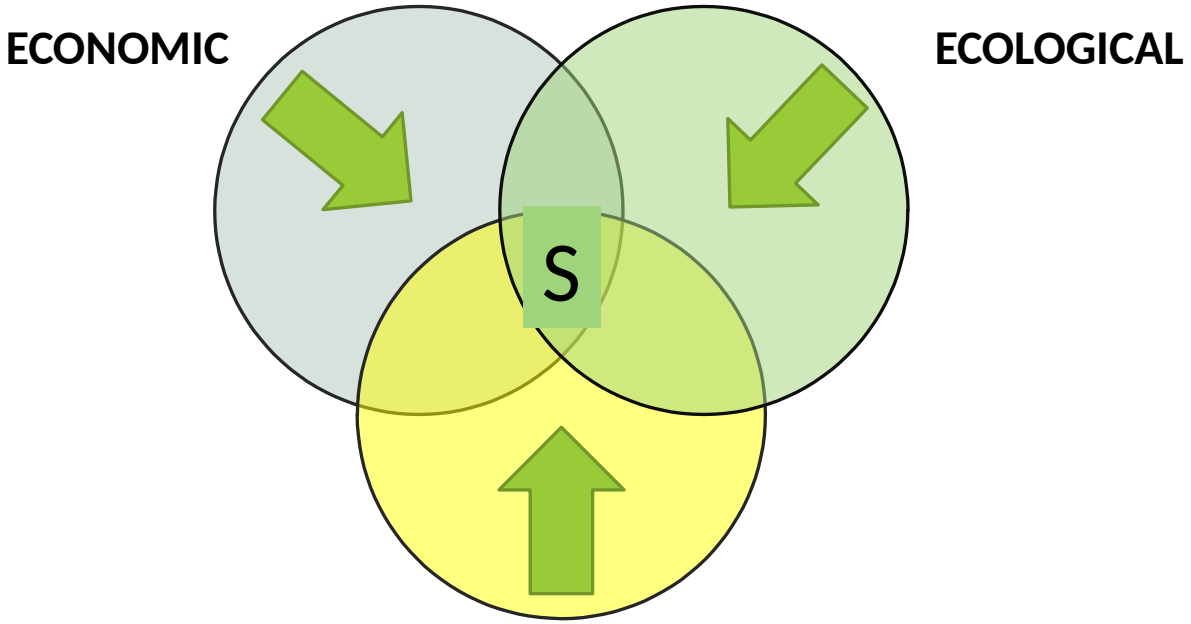


Fig. 3. Forecasted mangrove loss at six mangrove regions in Indonesia in the next two decades due to land use change under pessimistic scenario (see Table 4 for details). Circle size indicates potential loss areas in Sumatra, Kalimantan, and Papua; as for Java, Sulawesi and Maluku potential loss areas are represented by the smaller circles.

Ilman et. al. 2016. *A historical analysis of the drivers of loss and degration of Indonesia's mangrove, Land Use Policy 54, 448-459*.

Sustainable Development MINDSET

BENEFITS

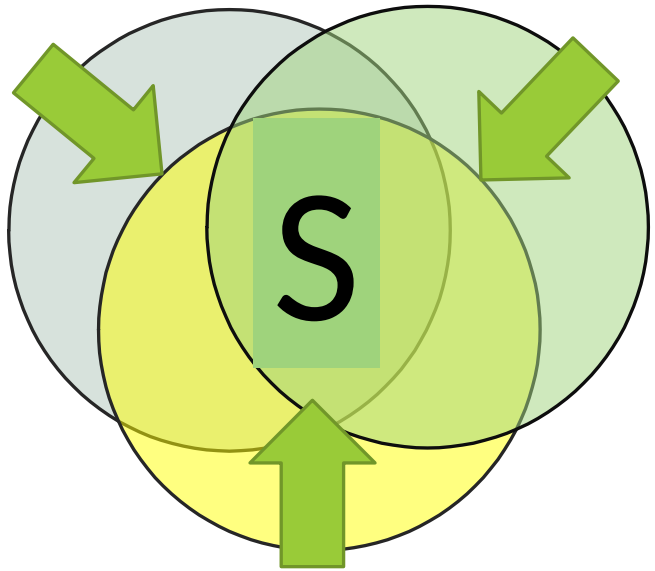


<u>PUSHING</u> TO THE MIDDLE WHILE ENLARGING EACH CIRCLE THE SUSTAINABLE WAYS

Push-In to Create More Sustainable Benefits

SUSTAINABLE BENEFITS

ECONOMIC

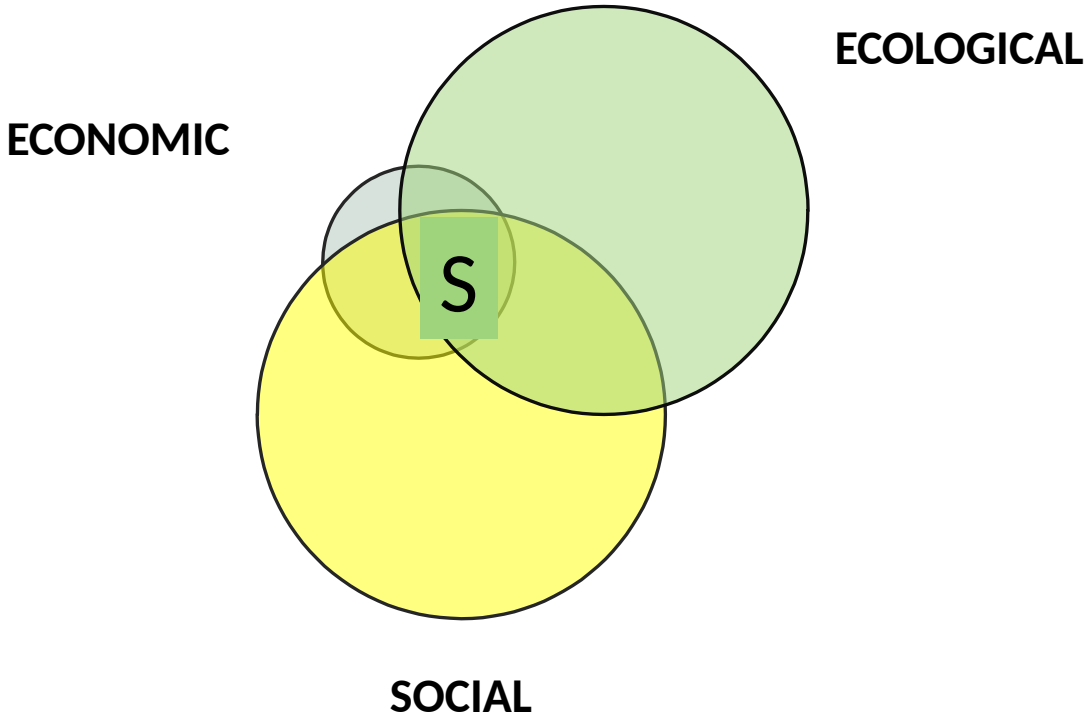


ECOLOGICAL

SOCIAL

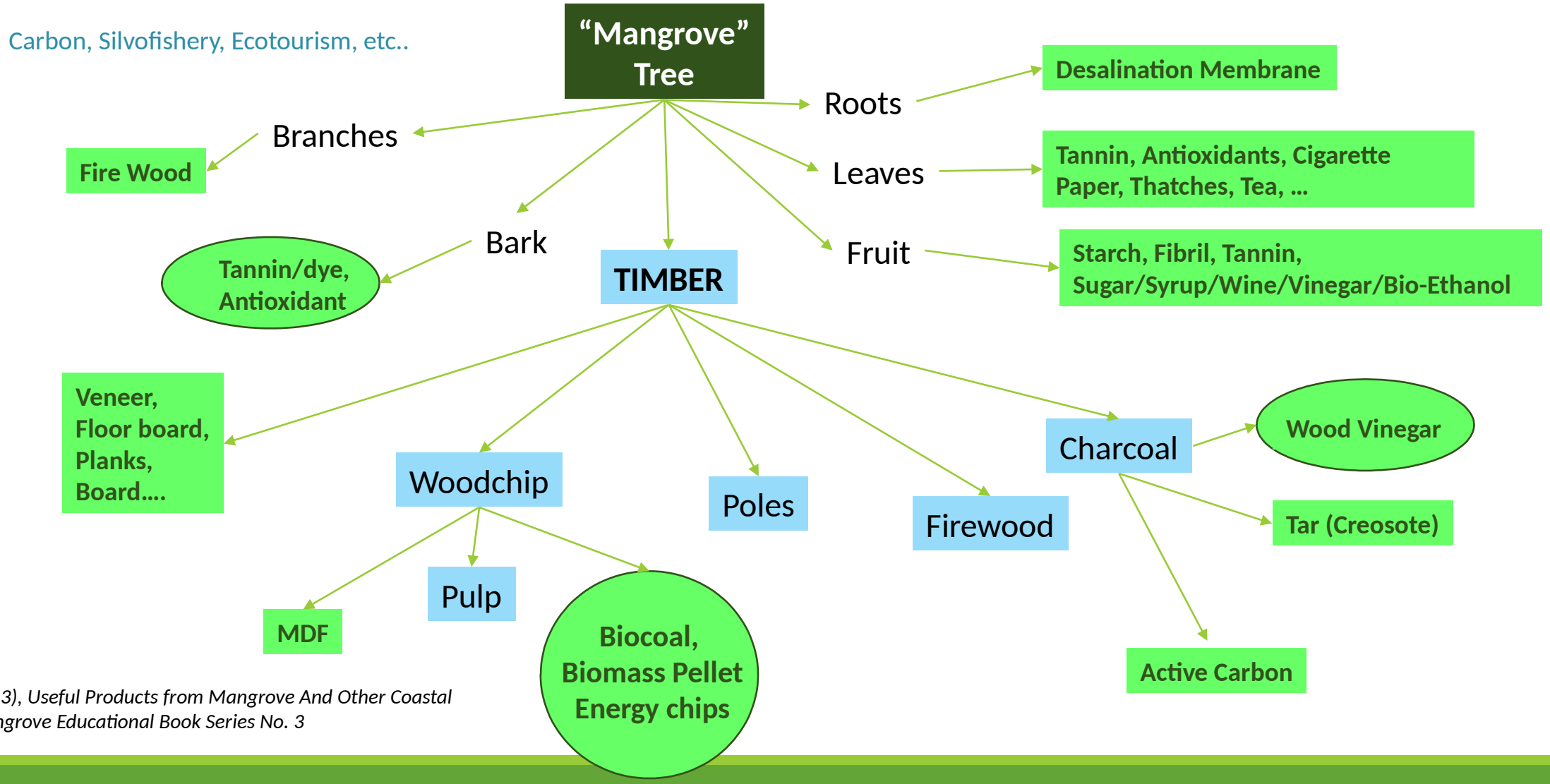
FINDING AND DEVELOPING MORE ECONOMIC BENEFITS THAT ARE EQUALLY POSITIVE TO ECOLOGY AND SOCIAL

Is Mangrove Sustainable in this Case?



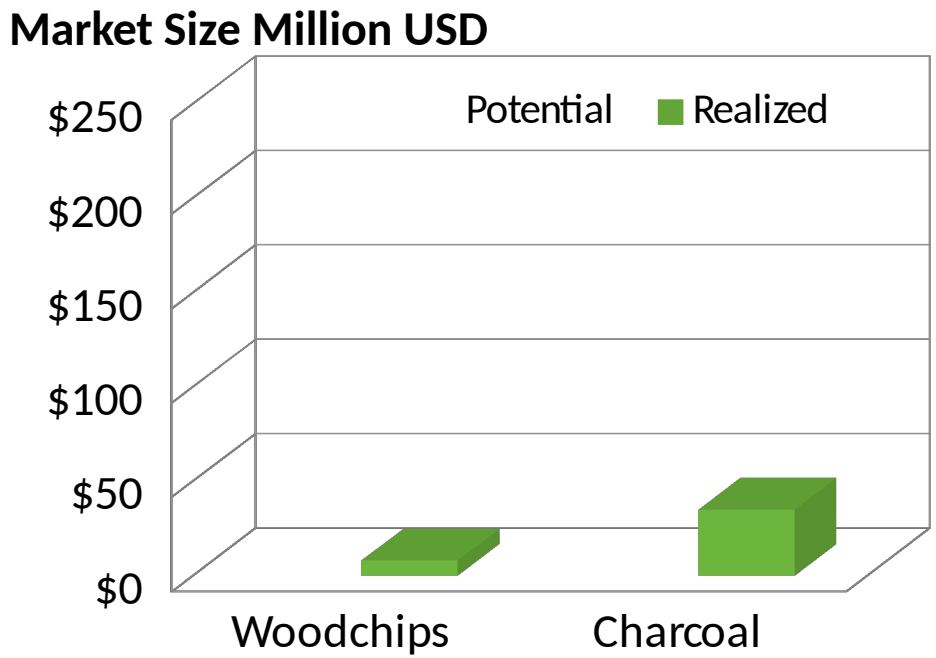
WITH ONLY ECOTOURISM AND FISHERY

New Products Opportunities[3] (in Green)



3. *Baba, et. Al. (2013), Useful Products from Mangrove And Other Coastal Plants, ISME Mangrove Educational Book Series No. 3*

Mangrove Potential are much Bigger than Realized



Assumptions:
There are about 4.5 million ha of mangrove forest in SEA, of which we believe 1 million could be utilized in a 30 years rotation SFM, thus about 25,000 ha harvested per year with 150 GMT ha^{-1}. This could produce an annual output of 3.75 million GMT. If 2/3 is allocated to woodchips, and 1/3 to charcoal, the potential revenue is $215 million USD and $175 million USD respectively

Woodchips / log in 1978[4,5]

- Approximately 750,000 MT exported from Sabah/Sarawak/Indonesia
- Valued today at ~USD $40-50 million

Mangrove Woodchip / log suppliers circa 1978

***Indonesia**: PT Bakau Selat Malaka, PT Kabindi Langsa (Aceh); PT Bina Lestari, PT Sylva Saki, PT Thai Rayvithi (Riau), PT Bakau Indah Jaya (South Sumatra), PT Bumi Indah Jaya, PT Pelita K.A. (West Kalimantan); PN Perhutani (76) (South Kalimantan); PT Berau Timber, PT Karyasa Kencana (East Kalimantan), PT Henrison (West Papua)*

***Sabah**: Syarikat Bakau Sabah Sdn. Bhd. (Tawau); Jaya Chip Sdn. Bhd. (Sandakan)*

***Sarawak**: Sarawak Woodchip Company (Rejang Delta)*

4. *Burbridge and Koesoebiono (1984), Management of Mangrove Exploitation in Indonesia, Proceedings: Asia Symposium on Mangrove Environment Research & Management, 740-760*
5. *Sabah Forestry Department (2006), History of Mangrove Management in Sabah (Part II), Annual Report, 143-145*

Reference from FAO – 1994 – for “bioenergy”

Food and Agriculture Organization of the United Nations

for a world without hunger

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Forestry

About

Distribution and extent

Global mangrove statistics

Flora

Mangrove management

send by em

Wood products

Mangrove forests have favourable silvicultural characteristics which lend themselves to intensive forest management for wood products. Some of these characteristics are as follows:

- Rapid growth: mature stands under suitable conditions may yield over 270 m^3/ha within 30 years, equivalent to an MAI of 9-10 m^3/ha.
- Good regeneration potential: most mangrove species flower and fruit regularly and the propagules are dispersed by tides. Thus, mangrove stands can recover rapidly from natural or man-made disturbances, including intensive logging.
- Tendency to form homogeneous/even-aged stands: pure stands of Rhizophoras or Avicennias are not uncommon and even in mixed stands, the principal components are restricted to a handful of species.
- Diversity of forest products: a wide range of products are produced and as bioenergy plantations even the smaller thinnings may be used as firewood.

Timber

Under favourable conditions, mangrove trees can grow to large sizes. Rhizophoras over 40 m tall are not uncommon and individuals over 62.5 m have been reported (Sukardjo, 1978). However, large trees are becoming scarce, especially in South East Asia, as most of them are removed before they can attain such sizes.

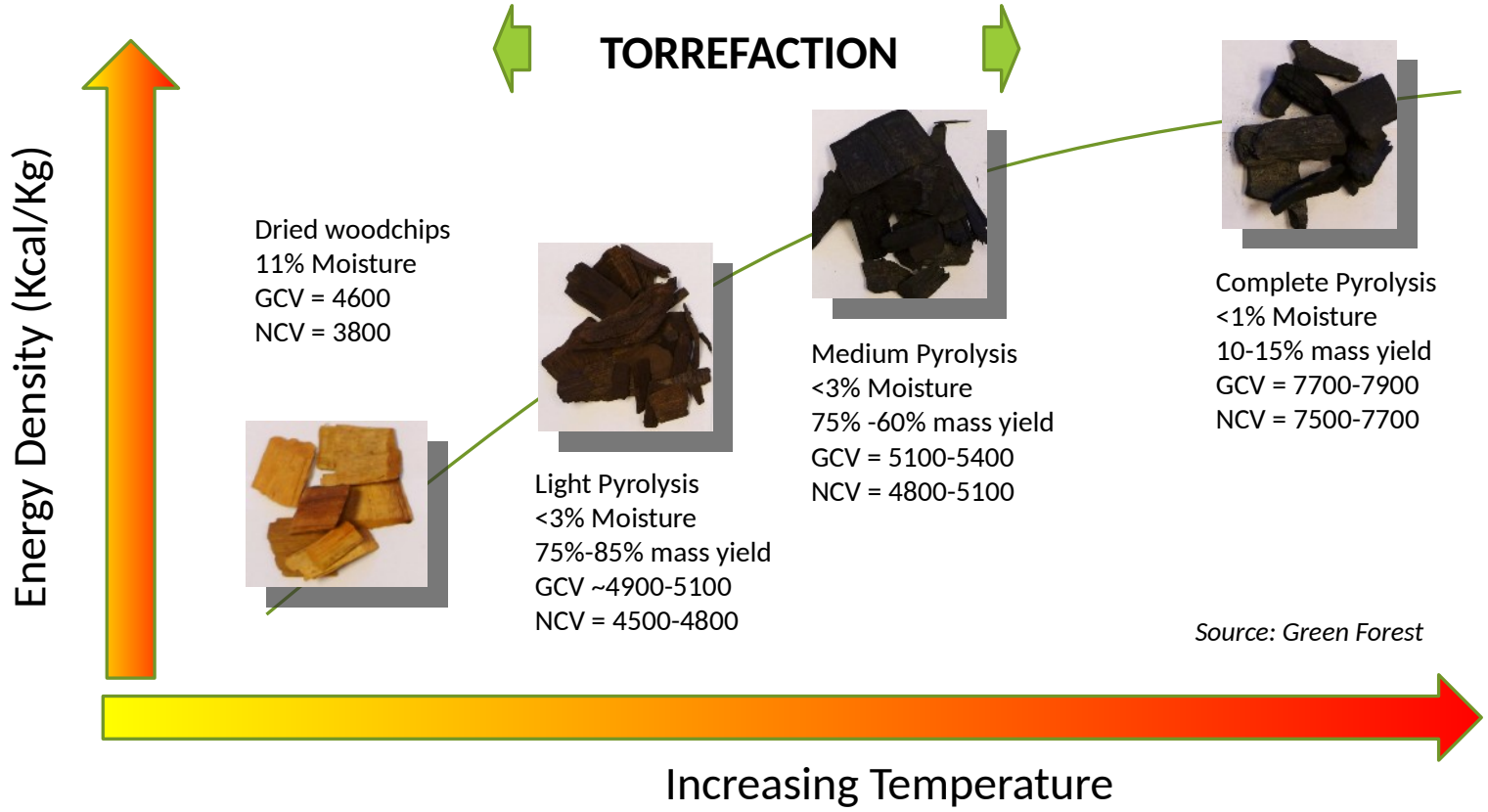
Why Biocoal?

- SUSTAINABILITY MINDSET; Pushing to the middle and enlarging ALL circles
- Ecology:
  - Biocoal is a carbon-neutral / renewable energy that can replace COAL
- Social Development:
  - Sustainable revenue stream with STABLE and LONG-TERM market enable strategic social development programs that addresses key SDGs*
- Economy:
  - A growing market – in Japan and Korea – with potentially higher realized value (profit) than pulp woodchips or charcoal

**United Nation Sustainable Development Goals*

Making Biocoal Through Pyrolysis

Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen. It involves the simultaneous change of chemical composition and physical phase.

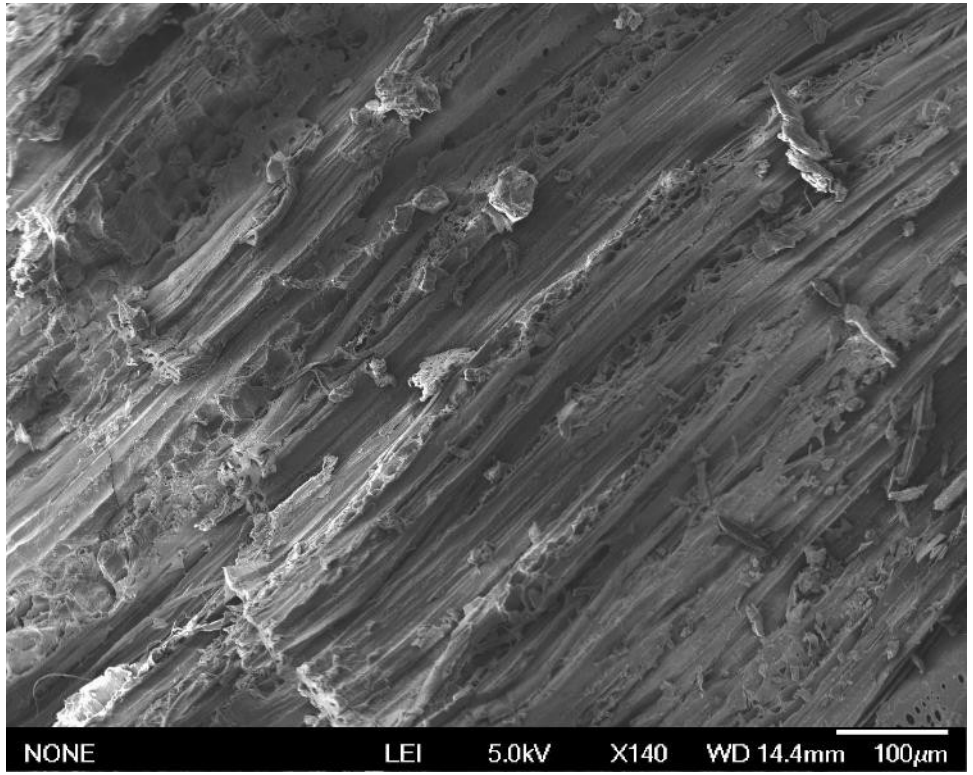


Mass Yield = Mass / Dry Mass

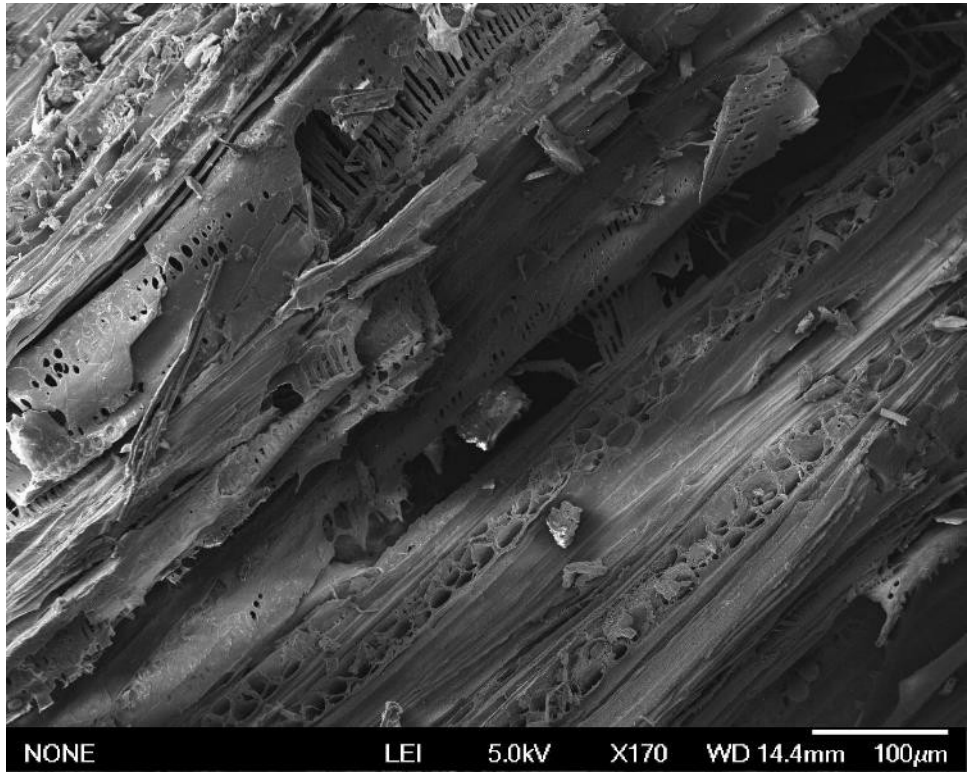
GCV = Gross Calorific Value
NCV = Net Calorific Value = GCV – Heat of vaporization of water

Electron Micrograph of Mangrove Wood Before and After Torrefaction

Raw Mangrove

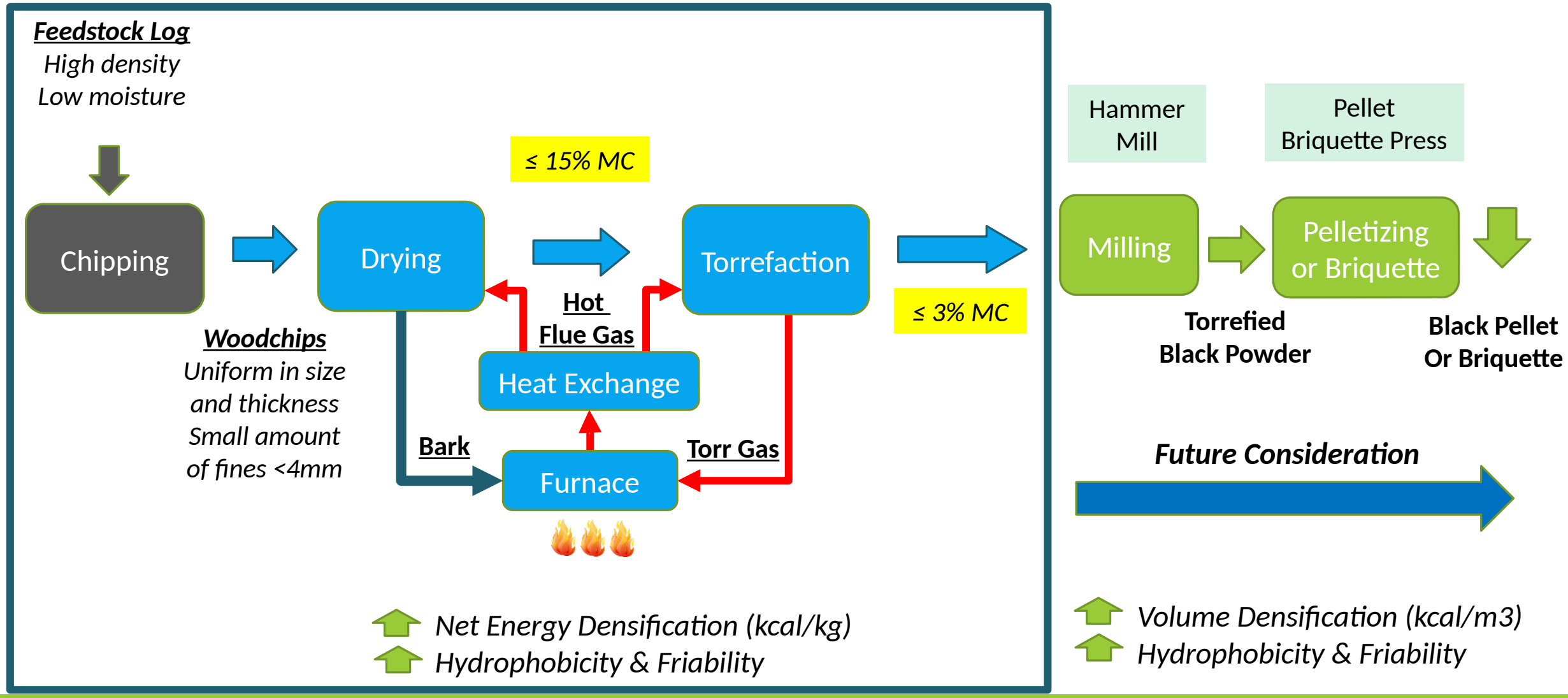


Torrefied Mangrove

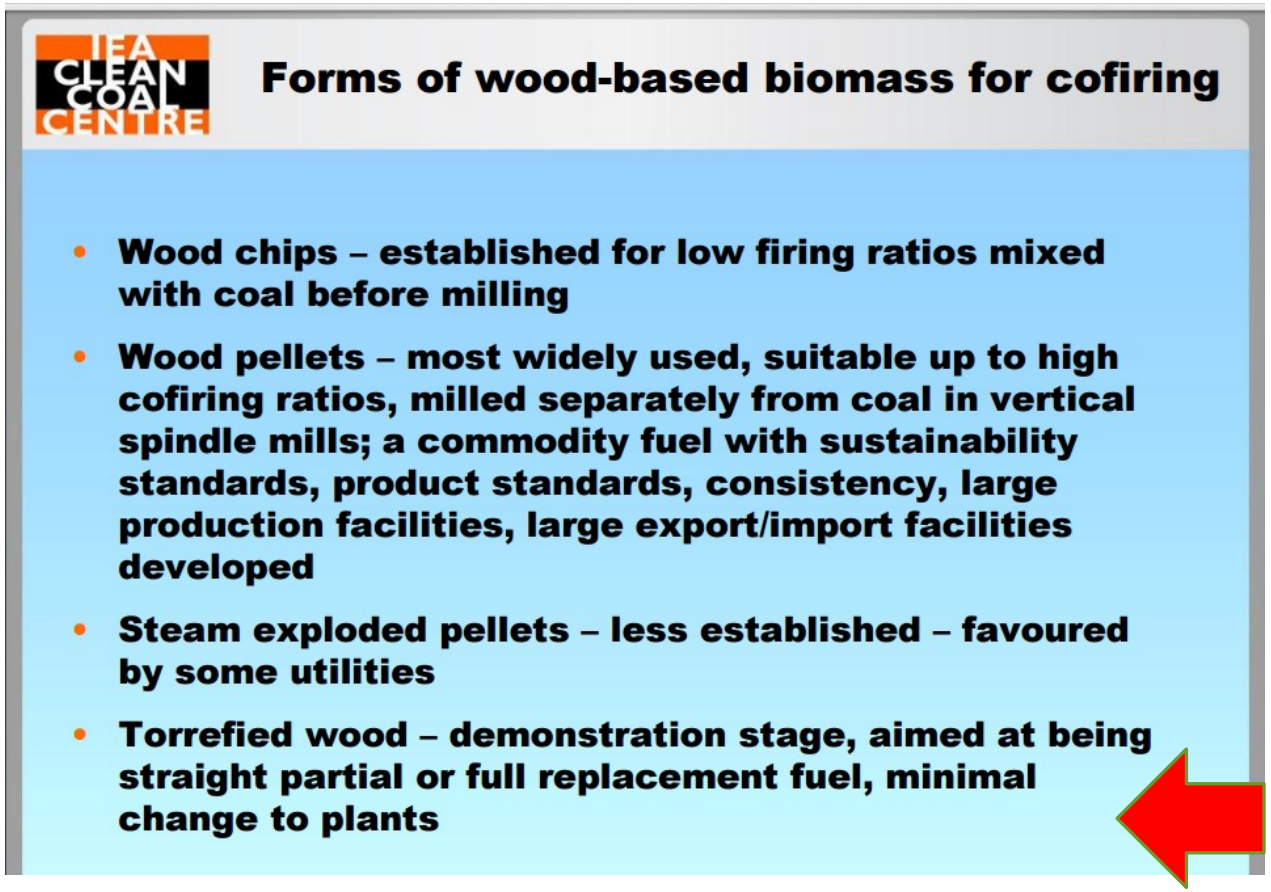


Source: Republic Polytechnic / Green Forest

Torrefaction Plant Value Chain Process



Co-Firing Benefit with Torrefied Wood



Source: Henderson, C (2015), Cofiring of biomass in coal-fired power plants – European experience, IEA Clean Coal Center

There has been considerable interest among utilities in generating renewable energy through co-firing biomass such as wood together with coal in existing coal-fired generating units. Unfortunately, biomass is very different from coal, which limits the amount of co-firing to about 10 percent. However, torrefaction, a low oxygen process that roasts biomass such as wood and reduces its moisture while preserving its high-energy content, produces a fuel with an energy volumetric density approaching that of coal. This report describes a series of field tests that evaluated firing blends of pelletized torrefied wood (TW) with coal at percentages up to 100% torrefied wood in a coal-fired unit at Gulf Power Company's Plant Scholz.

The study concluded that TW could be a relatively easy way to generate large quantities of renewable energy using existing pulverized coal power plants. Blends of up to 100 percent TW were successfully fired in a pulverized coal boiler. NO_x, SO_2, other emissions were greatly reduced with TW; and adding TW to the fuel blend reduced unburned carbon losses. However, it is important to treat TW like Powder River Basin coal because the fuel dust is potentially explosive; and efficiency was reduced due to high fuel moisture, the result of high levels of TW fines combined with heavy precipitation.

Torrefied wood appears to be a viable option for generating large quantities of renewable energy in a power plant designed to burn coal, especially one designed for sub-bituminous fuel. Further testing is proposed to evaluate other similar fuels, in particular, pellets formed from torrefied wood.

Source: EPRI, Apr 2014, 3002003268

Hydrophobicity Test on Regular Woodchips

Woodchips

Add 5 drops
Of Water

Weight W1
+0.14 g
Time: 15:50

Weight
+0.16 g
Time: 15:55

Weight
+0.17 g
Time: 16:00

Biocoal is Hydrophobic

Mangrove Biocoal

Add 5 drops Of Water

Weight W1
+0.28 g
Time: 12:18

Weight
+0.19 g
Time: 13:40

Weight
+0.10 g
Time: 15:25

Why Mangrove?

- **Proven sustainability** with 30 years rotation
- Under good management, mean annual increment (MAI/ha) of >9 MT/ha/yr
- Basic Specific Gravity (bone dry) of 0.85 (vs Gaboon Ebony at 0.82)
- Low in “fresh cut” moisture content of ~35%, reducing cost / energy to dry
- SMALLEST environmental impact foot-print with harvest yield of >200 MT/ha
- Gross Calorific Value of 4,630 kcal/kg when air dried, with Net Calorific Value of 3,800 kcal/kg
- Naturally homogeneous with >75%, can be “selectively” harvested while maintaining natural bio-diversity
- SUSTAINABLE, LESS-KNOWN, UNDER-VALUED, FSC FM certified! And… IT WILL PREVENT FURTHER CONVERSION!

Biggest Threat: the Plantation Mindset (conversion to man-made homogeneous forest)

- “… currently the ministry of forestry and environment that she lead is in the middle of developing **PLANTATION FOREST** for energy. …’The plants that will be utilized are those that can be used as biofuel and biomass energy. For example Eucalyptus, Sengon, Nyamplung, Akasia, Kalaindra and Kemiri’” (CNN Indonesia, March 22, 2017)







management models, it is clear that Chip Production based on the Selective Cutting and Reforestation System is feasible in a High Growth Site and it contributes to sustainable forest management. <u>It has become obvious that mangrove forest constitute an excellent recyclable economic resource</u>."

YASUKO INOUE ET. AL. (1999)

SUSTAINABLE MANAGEMENT MODELS FOR MANGROVE FORESTS

JICA AND THE MINISTRY OF FORESTRY AND ESTATE CORPS IN INDONESIA