Extent of world mangroves

165,000 to 198,800 km²

(varies by source)

- Shares less than 1.5% of world tropical natural forest
- Wraps coastal line as skin
  - Importance must be emphasized
Quick disappearance
1,000 km² annually

- Lasts less than 2 centuries if no measure will be taken
- Countermeasure is urged
The mangrove forest rehabilitation in Southeast Asia

1. Nature and values of mangroves
2. Present status in SE-Asia
3. Thai case
4. Efforts for rehabilitation,
   • Its practice and reality
   • TABUCHI Ryuichi (FFPRI)
Mangrove nature appeared in names

- **Appear Species composition/ Habitat/ Ecology meaning**
  - Hirugi leech tree (form) Japan
  - 紅樹林 Red wood tree \((\text{Rhizophora spp.})\) China
  - Pa Kongkan Kongkan forest (‘‘) Thai
  - Utan Bakau Bakau forest (‘‘) Indonesia
  - ป่าชายเลน (Pa Chai Len) Mud Beach Forest Thai
  - Utan Pasang Serut Tidal forest Indonesia
  - Ahk What’s that? Pohnpei
    (Micronesia)
Mangrove is

the vegetation often consists of *Rhizophoraceae* spp., growing on mud coast at where tidal fluctuation exists.

It sometime establishes quickly by floating seeds carried by tide.

Since mangrove habitat is on the flat mud beach and so called species zonation can be observed.
- **Species zonation**
- **Specific ecology + less undulate topographical gradient**
- **Simple species composition + wide extent**
- **Attracts mass use**
Development of mangroves

After 12 years
less obvious →

Ex) Developed natural stand’s biomass:
400 t/ha (above ground), 500 t/ha belowground (south Thai)
6 years old plantation
Quick growth
29 years old stand
Values of mangroves

- Small scale wood use, etc.

Outrigger parts made of *Rhizophora* stilt roots
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>TIMBER</th>
<th>FUEL</th>
<th>FOD AND DRINK</th>
<th>MEDICINE</th>
<th>OTHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acanthus ilicifolius</em></td>
<td></td>
<td></td>
<td><strong>MAIN USE</strong></td>
<td>Fruits pounded and used as blood purifier and dressing for boils; preparation of leaves for rheumatism; poultice of fruits or roots used for snakebite or arrow poisoning</td>
<td></td>
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<tr>
<td><em>Acrostichum aureum</em></td>
<td></td>
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<td></td>
<td></td>
<td>Litter for cattle; roofing</td>
</tr>
<tr>
<td><em>Avicennia alba</em></td>
<td>Inferior timber; better</td>
<td>Inferior firewood;</td>
<td></td>
<td>Ointment from seeds applied to tumors and smallpox ulcers; sap used for birth control</td>
<td></td>
</tr>
<tr>
<td><em>A. lanata</em></td>
<td>heartwood; resembles</td>
<td>smoking fish and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>A. marina</em></td>
<td>oak; rice mortars,</td>
<td>rubber</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>A. officinalis</em></td>
<td>cabinets, water pipes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bruguiera cylindrica</em></td>
<td>Timber, pillars, rafrets</td>
<td>Firewood</td>
<td>Young radicets boiled and eaten as vegetable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>B. gymnorhiza</em></td>
<td>Timber, durable, hard,</td>
<td>Firewood; charcoal</td>
<td>Radicets eaten as vegetable; GIS chewed</td>
<td>Medicine for sore eyes from fruits; scent from pneumatophores; condiment from bark</td>
<td></td>
</tr>
<tr>
<td><em>B. sexangula</em></td>
<td>heavy; cracks with</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>B. parviflora</em></td>
<td>seasoning</td>
<td></td>
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</tr>
<tr>
<td><em>Cerbera manghas</em></td>
<td>Timber, timber for</td>
<td>Firewood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. odollam</em></td>
<td>mining</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ceriops tagal</em></td>
<td>Timber for mining,</td>
<td>Firewood</td>
<td>Calyx chewed</td>
<td>Dye and tan from bark; decoction of bark as hemostatic agent in obstetrical cases</td>
<td></td>
</tr>
<tr>
<td><em>Cycas rumphii</em></td>
<td>boat ribs, pillars,</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>Daemonorops leptopus</em></td>
<td>durable</td>
<td></td>
<td></td>
<td></td>
<td>Tying</td>
</tr>
<tr>
<td><em>Derris heterophylla</em></td>
<td></td>
<td></td>
<td></td>
<td>Weak fish poison</td>
<td></td>
</tr>
<tr>
<td><em>Excoecarua agallocha</em></td>
<td></td>
<td></td>
<td></td>
<td>Skin deseases; purgative from sap and wood; fish poison from sap</td>
<td>Incense wood</td>
</tr>
<tr>
<td><em>Heritiera littoralis</em></td>
<td>Good timber, pestles</td>
<td>Firewood</td>
<td></td>
<td>Ground seeds for diarrhea</td>
<td></td>
</tr>
<tr>
<td>Uses of Mangrove SPECIES</td>
<td>TIMBER</td>
<td>MAIN USE</td>
<td>FOD AND DRINK</td>
<td>MEDICINE</td>
<td>OTHERS</td>
</tr>
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</tr>
<tr>
<td>Hibiscus riliaceus</td>
<td>Young leaves eaten as vegetable</td>
<td>Leaves ground in water used as hair restorer, expectorant, and to relieve retention of urine</td>
<td></td>
<td></td>
<td>Rope from blast fiber</td>
</tr>
<tr>
<td>Intsia bijuga</td>
<td>Good timber, but rare</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kandelia candel</td>
<td>Timber, fence posts, most useful timber, bridge piers, durability comparable to rosewood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limnitzera littorea L. racemosa</td>
<td>Piles; houseposts, flooring, fishtraps, shuttles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nypa fruticans</td>
<td>Fruit for preserve; sap for sugar; Alcohol</td>
<td>Leaves for thatch; young leaves for cigarette wrappers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oncosperma filamentosum</td>
<td>Timber, piles</td>
<td>Firewood, charcoal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pluchea indica</td>
<td>Timber, piles</td>
<td>Firewood, charcoal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhizophora apiculata</td>
<td>Timber, piles</td>
<td>Firewood, charcoal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. mucronata</td>
<td>Timber, piles</td>
<td>Light wine from juice of fruit</td>
<td></td>
<td>Tanbark; decoction of bark for hematuria</td>
<td>Anchors for small boats</td>
</tr>
<tr>
<td>Scyphiphora hydrophyllacea</td>
<td>Hard timber, tool handles, fence posts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sonneratia alba</td>
<td>Hard but contains salt; piles, boat timber, bridges</td>
<td>Firewood</td>
<td>Fruit not edible</td>
<td>Fruit used in potions for sprins; fermented juice for hemorrhage</td>
<td>Pneumatophores as fishing floats and substitute for cork</td>
</tr>
<tr>
<td>S. caseolaris</td>
<td>Not suitable as timber</td>
<td>Firewood, charcoal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. ovata</td>
<td>Not suitable as timber</td>
<td>Firewood, charcoal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thespesia populuea</td>
<td>Good quality timber</td>
<td>Firewood, charcoal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylocarpus granatum</td>
<td>Cabinets; pins for boat building; use in quarrying</td>
<td>Firewood</td>
<td>Decoction from bark for cholera and dysentery</td>
<td></td>
<td>Oil from seeds as illuminant and hair oil</td>
</tr>
<tr>
<td>X. moluccensis</td>
<td>Firewood</td>
<td>Decoction from bark for cholera and dysentery</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Charcoal making (Kiln)

Operation with regeneration is still ongoing in Malaysia
Fishery site
good nursery
(Food chain)
Fisherman
at Fish market
Coastal protection
Site of carbon sequestration

• Biomass: aboveground – site dependent but up to 400 t/ha order with belowground root up to 500 t/ha order

• Mangrove peat accumulation:
  – 1,300 t C/ha to 1,900 t C/ha down to 3 m depth
  – Pohnpei, Micronesia (Fujimoto et al. 1999)
Present status in SE Asia

- Extent; SE Asia ca. 60,000 km² (shares world’s 35 %)
- Philippines 4,000 km² decreased to 1,600 km²
- Thailand 1961/ 5,500 to 1986/ 2,470 (less than half)
- Indonesia 42,550 km² (Loss unclear)
- Malaysia 595 km² (out of 5,053; 12 %) was lost during 1980-1990
- Vietnam lost a lot during war time
- SE Asian loss 4% of world mangroves acreage
Decrease 1900 km² (1961-1991)

Shrimp culture shares 65%

Kongsanchai (1994)

Thai case

Aksornkoae (1993)
Shrimp farm encroaching both mangroves and lands

South Thailand; Ranong Prov.
Marine shrimp culture in Thailand

• Recent high growth in SE and Peninsula regions
• Small scale:
  – High productivity at good mangrove sites?
  – Poor invest?
• Reached to last frontier
Thus need for mangrove renovation arise
Who organizes mangrove rehabilitation?

- **Government / GO**
  - Rehabilitation of deteriorated mangrove
  - Re-greening
  - Vietnam, Thailand

- **Concessionaire of charcoal kiln**
  - Supporting natural regeneration at harvest over mangrove site.
  - Malaysia, Thailand

- **NGO / local community / local investor**
  - Re-greening, Silvo fishery
  - Indonesia

- **Charcoal kiln owner / non-concession. Private forest**
  - Mangrove plantation management for charcoal production
  - Thailand

Variation by form, region
Efforts made for rehabilitation

• Plenty (so far)
• For developing plantation techniques,
• e.g. Nursery
  Site selection by species
Example: JICA’s project in Bali

Specific site preference test

Nursery technique development
Techniques are well developed
Karawang’s case (west java)

• 10 years old *Rhizophora mucronata* plantation

Beautifully established in 1991

GO organized
Karawang’s case (west java)

Some years later --- What happened on them?
Karawang’s case (west java)

• Organizer allowed local people
  – To harvest **branches** as fuel wood
• They began it with collecting branched **stems**
  – Number of stems decreased
  – Finally --- no stem, no stilt root, no stand
Vietnamese case (nation led)

- Known as the frontrunner in mangrove rehabilitation
- Planted mangroves (Mekhong delta 1978 - 1997)
  - 20,638 ha
- New shrimp-farm
  - 249,349 ha in 1998 (from 96,060 ha in 1990)
- Expansion of shrimp-farm far larger
What shall we learn from those lessons?

- **Present problem** may exist
  - at after establishing plantation

- **The success of renovation** depends on
  - Whether if organizer can direct the way how to use it as the sustainable forest or not

- **Issue of Incentive balance** between
  - Forest vs. Alternative
  - Long term vs. Temporarily
    - Forestry, NTFP, fishery and environmental resources etc.