What's This?

Mangrove propagules – they float naturally in the ocean for periods of many months.
FLOATING MANGROVES

Open Ocean Biomass Production
UNESCO’s Natural Sciences Sector mobilizes sciences for sustainable human living in reconciliation with nature conservation in support of achieving the 2030 SDGs
GLOBAL IMPORTANCE

Primary productivity

Carbon storage & ecosystem functioning

Ecosystem services & development prospects
**ECOSYSTEM SERVICES**

- **CO2 Capture**
  - 50x Higher than tropical rainforests

- **Wood Products**
  - Biomass
  - Fast Growing
    - Freshwater independent
    - No competition for land against agriculture

- **Coastal Protection**
  - Minimize
    - Erosion & extreme weather damage

- **Water Quality**
  - Filter
    - Sediment & pollutants

- **Biodiversity**
  - Intertidal
    - Land & marine habitats
THREATS TO NATURAL MANGROVES

HABITAT LOSS due to land conversion
Aquaculture & Agriculture

OVERHARVESTING
Fuelwood, charcoal, wood pulp, & animal fodder
Can floating mangroves offset illegal deforestation?

HABITAT LOSS due to urbanization
Hotels, marinas, tourist damage & pollution

CLIMATE CHANGE
Extreme weather events & sea level rise
Global Losses

Worldwide
Half of the world’s original mangroves have been lost

Current
Since 1980, a fifth of total mangrove area has been lost

Future
16% of global mangrove species now at elevated risk of extinction

Asia
Half of mangrove losses in the last decade occurred in Asia alone

Source: FAO Mangrove Statistics
MANGROVES WORLDWIDE
Mangroves only occur along the inter-tidal zone in the tropics. Mangroves do not occur inland and in the oceans — why?

Source: UNEP World Conservation Monitoring Center and International Society for Mangrove Ecosystems NRM Maps
FLOATING MANGROVE CONCEPT

DESIGN
Floating container diagram

SEEDING
Planted in 2012 into these boxes

GROWTH
Maturity reached in only a few years

No need for IRRIGATION
Semi-permeable membrane for seawater
Floating Mangroves - FEASIBILITY STUDY – experimental plot
BENEFITS & INCENTIVES

**Ecological**
- Less pressure on natural systems
- Rapid biomass production
- Potential floating habitats

**Social**
- Freshwater independent
- Fast growing fuelwood
- Community engagement
- Income & poverty alleviation

**Environment**
- Carbon storage (REDD+)
- Pollutant absorption
- Water filtration

**Economic**
- Cash crop for biomass
- Biomass for biofuel
- Biomass as a fodder
- Business & jobs
OFFSET BIOMASS IRRIGATION

Source: WWDR 2018
RESEARCH QUESTIONS

**ENGINEERING & ECONOMIC**
1. What design & what materials?
2. Transport methods; production costs?
3. Durability of the system?
4. Economic profitability?

**ECOLOGICAL**
1. Site selection?
2. Species performance?
3. Ecological impact?
4. Biomass productivity?

**ENVIRONMENTAL & SOCIAL**
1. Carbon storage capacity?
2. Carbon footprint of the system?
3. Uptake of land-based pollution (N; P; K) ?
4. Local community benefits?
Academic research needed – Enterprise potentialities

How much biomass can be produced?

What kind of biomass: wood, bark, leaves, flowers, seeds?

What can be done with the biomass?

- Charcoal: 750 – 1650 $ / ton (2021)
- Fuel wood: beech 107-250 € / m³ (2021); fir 80 €

Can we convert the woody biomass into ethanol via gasification, hydrolysis, enzymes?

There are existing technologies of hydrolysis:

- The Bergius method
- The Scholler method
- The Madison method

Use HCl, water, high pressure and heat to convert wood into sugar

Switzerland covered 30% of its liquid-fuel demand with this method from 1936 – 1945 (Hovag)

Enzymatic processes using cellulase-enzymes also exist
Scientific Data Are Needed

Research Needed

Floating Solution
Do you want to try?

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