Integrated Mangrove Forest – Aquaculture Systems

A case study from Viet Nam combining mangrove conservation, climate change adaptation and sustainable aquatic food production
Global Status of Mangrove Forests

- Mangrove forest ecosystems provide food and other vital ecosystem services to some of the most densely populated coastal and deltaic regions of the world, e.g. the India–Bangladesh Sunderbans, Ayeyarwady & Mekong deltas.
- But mangrove forest cover has declined to only $\approx 156,000$ km$^2$ worldwide (2010 data), which is less than 1% of the total area of tropical forests.
- Global monitoring of mangroves indicates a loss of 29,000 km since 1997, or an annual rate of loss close to 1% and even higher in several Asian countries.
- And with only around 70 true mangrove plant species globally, already 11 species ($\approx 15\%$) are listed as critically endangered by IUCN.
Unsustainable coastal aquaculture, especially shrimp farming, has contributed to mangrove loss and degradation, leading to self-harming consequences (coastal erosion, water pollution, shrimp diseases, etc.)
Integrated mangrove-aquaculture culture in Viet Nam

Nhung Mien Forest Management Unit in Ca Mau Province
= 12,000 Ha of mangrove
Average 40% mangrove cover

This mangrove-aquaculture system has led to the production of high-value, organic black tiger shrimp
Integrated mangrove-aquaculture system: mangrove trees are grown on berms within the pond.

Central berm or platform with mangroves; a large pond may have several berms in parallel.
Chantaburi Farm: production analysis

Total harvest by income

- Black Tiger: 13%
- Banana shrimp: 13%
- Other shrimp species: 19%
- Mud crab: 39%
- All fish species: 16%

Monthly average harvest of all species in 2015
CONCLUSIONS: Integrated Mangrove−Aquaculture Systems

• Low cost approach to protecting coastal areas against climate change, especially SLR and storms while providing incomes for local communities

• Increases mangrove forest cover and improves forest protection (Organic shrimp certification, e.g. Naturland, requires minimum of 50% tree cover)

• Advantages over other aquaculture systems:
  – Lower input = higher profits (via polyculture + organic certification)
  – Superior attributes to adapt to increasing climate extremes: lower pond temperatures; lower pond salinity; no groundwater pumping/subsidence
  – Superior sediment trapping attribute to maintain/build land elevation (terra-forming)
CONCLUSIONS (cont.)

• Integrated mangrove−shrimp increases forest protection compliance on State land and increases forest cover on private land.

• Payment for Ecosystem Services (PES) is a further incentive for farmers to plant and protect mangroves @ VND 500,000/ha/yr.

• Replication is likely to be more challenging in areas a) with low existing mangrove cover; b) where both intensive shrimp and integrated mangrove−shrimp co-exist; and c) on privately owned land.

• More than one organic certification standard should be applied.

• Political will and enabling legislation are vital for upscaling.
• "..people must live with and adapt to new conditions [due to climate change and SLR], and thus need to transform these challenges into opportunities."
• "Establish ecological subzones..floodplain, freshwater ecosystem, brackishwater ecosystem and salt water ecosystem."
• "Prioritise investment to restore and grow mangrove forests, and riverside and coastal protection forests."
• "..shift from mere agriculture production of, mainly rice, to development of diversified agricultural industry…shift from quantity based to quality based development."
The way ahead:
Ecological zoning, coastal forest protection zone; mangrove-aquaculture in the brackishwater zone; intensive shrimp culture more inland using closed systems

Mekong Delta forest cover to be increased from 4.3 to 9%
PES mechanisms developed as further incentive for forest protection
Percentage mangrove deforestation 2000 to 2012, and dominant uses of deforested areas in 2012.

From: Daniel R. Richards, and Daniel A. Friess PNAS 2016;113:2:344-349
### Area and % conversion of deforested mangrove to other land uses

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Mangrove area (Ha)</th>
<th>Aquaculture*</th>
<th>Rice*</th>
<th>Oil Palm</th>
<th>Mangrove</th>
<th>Urban</th>
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</thead>
<tbody>
<tr>
<td>Cambodia</td>
<td>69,200</td>
<td>27.7</td>
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<td>8.9</td>
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<td>Indonesia</td>
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<td>15.7</td>
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<td>11.1</td>
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<td>40.0</td>
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<td>10.4</td>
<td>0.5</td>
<td>0.6</td>
<td>62.5</td>
</tr>
</tbody>
</table>

**Difference from 100% due to other conversion**

*Converted to Aquaculture + Rice combined ≈ 2,173,500 ha

*Based on: FAO (2007)
Richards and Freiss (2016)*
THANK YOU

- This presentation is based on results from Mangroves & Markets Project in Thailand and Viet Nam, as well as analysis of governmental legislation and policies on mangrove forests and other coastal resources in these countries.

- A video illustrating the integrated mangrove forest–aquaculture system is available @ https://www.iucn.org/regions/asia/our-work/regional-projects/mangroves-and-markets-mam

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