

Exploring the impacts of future global change on mangrove-fishery-community linkages



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Introduction

- Mangroves provide ecosystem services to coastal communities across 123 tropical and subtropical countries
- Support fisheries through nursery habitat provision, refugia and nutrient out-welling
- Mangrove loss by 1-2 % per year = potential loss of ecosystem service provision
- How will mangrove loss impact mangrove-fishery productivity?

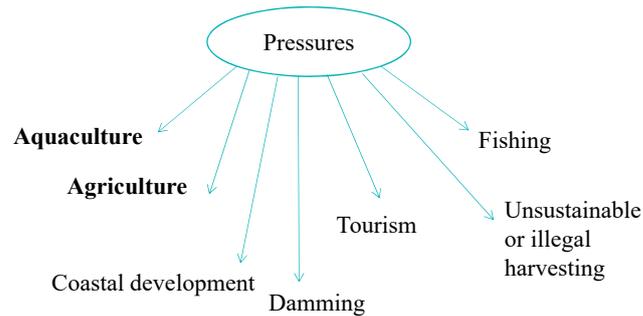


Myanmar mangrove fisheries
Photograph: Christopher Zockler from UNEP (2014)

Global change and future mangrove loss

Anthropogenic activities

- Human activities which lead to mangrove loss are well studied
- The impacts of human induced mangrove loss on fisheries productivity is less so



Global change and future mangrove loss

Climatic pressures:

- Expected to alter mangrove ecosystem function and distribution
- Projected 15 % loss by 2100 (Alongi, 2008)

Sea level rise

Vulnerability will depend on:

- Surface elevation rates
- Accommodation space
- Tidal setting
- Species composition

Changes to temperature, atmospheric CO₂ and precipitation

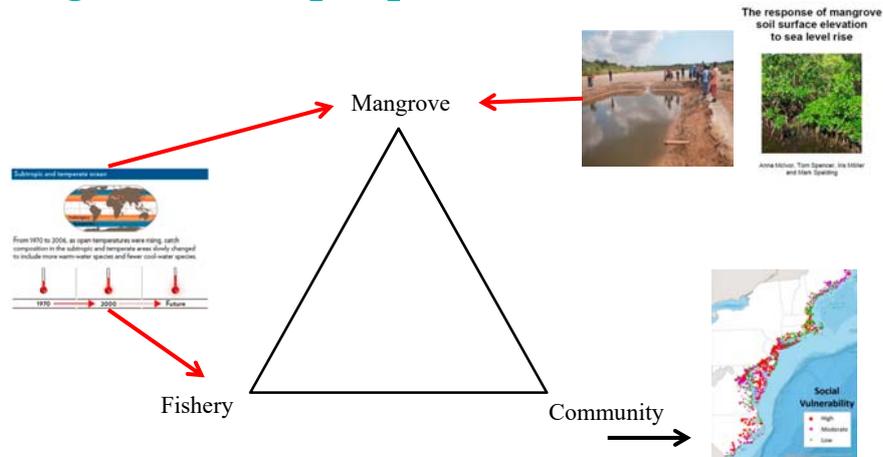
- Increased productivity
- Expansion to higher latitudinal range

Increased storminess

- Mangrove degradation
- Increased sediment supply

+ human adaptive responses

Mangroves and people



- > 100 million people within 10 km of a large mangrove forest
- Basic subsistence products have a role in poverty alleviation
- Mangrove degradation and loss = vulnerability for coastal communities

Mangroves and people

Drivers of fishing effort in mangroves

- Population size and proximity
- Cultural, political and economic conditions
- Access to alternative livelihoods or resources



Women carry fish nets made from mangrove products for catching small fish and prawns in Odisha mangroves, India. Photograph: Syed Hussain from UNEP (2014).



Mangrove crab from Picharavan Mangrove Forest, India. Photograph: Hanneke Van Lavieren from UNEP (2014)

- Dependence and access to alternative resources will be an indicator of vulnerability to future global change

Open questions

- Lack of large scale data means the importance of mangrove-fishery linkages is not understood in global context
- Are coastal fisheries actually dependent on mangroves?
- What makes one mangrove forest more suitable for fisheries production than another?
- How will mangroves respond to climate change and sea level rise?
- How will future mangrove change impact fisheries production and therefore communities reliant on them?

Aim

To investigate the potential impacts of future global change on mangrove-fisheries and therefore economies and food security from a community to global scale.

Objectives

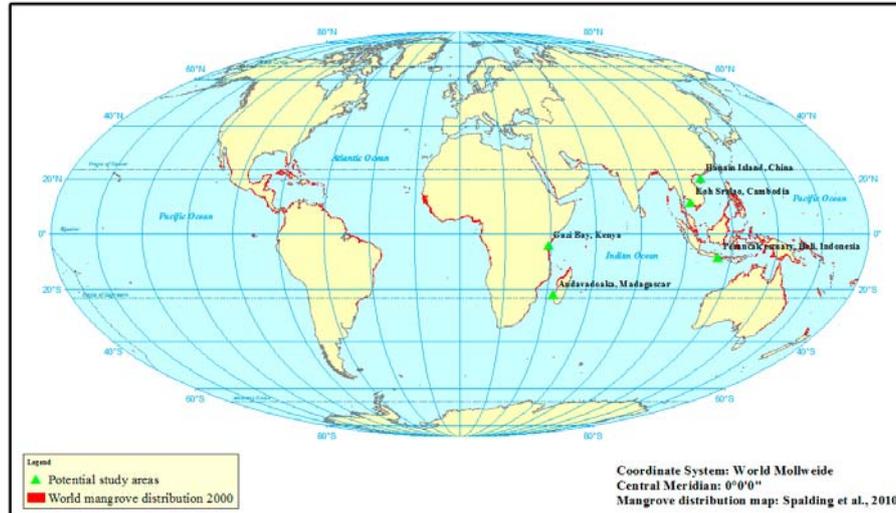
- 1) To understand current mangrove-fishery linkages and determine which attributes related to the presence of mangroves are important to fisheries.
- 2) To determine whether global and regional catch data suggests a link between mangrove presence and fisheries productivity.
- 3) To relate resulting conclusions to a number of fine-scale local case studies which investigate the link between mangrove attributes to local artisanal fisheries and community livelihoods.
- 4) To estimate the potential impacts of global change (including mangrove loss by climate related and anthropogenic impacts) over a range of spatial scales on artisanal fisheries and subsequently the communities dependent on them.

Data sources- Global to regional

- Sea Around Us (Nereus Program)
 - Large scale fisheries data
- World Mangrove Atlas (Spalding, 2010; Giri, 2011; Hamilton and Casey, 2016)
 - Mapped 99 % of worlds mangroves
 - Available through UNEP-WCMC
- Commercial species distribution models (Nereus Program)



Data sources - Local scale

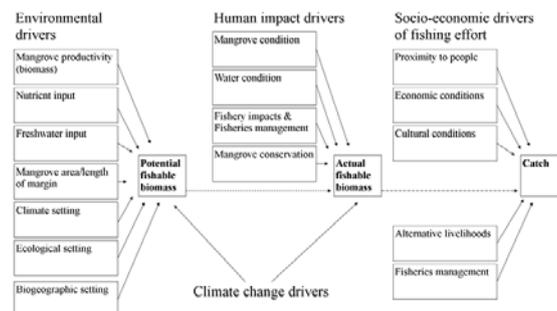


Methods – Preliminary work

• Literature review to investigate mangrove-fishery-linkages focused upon:

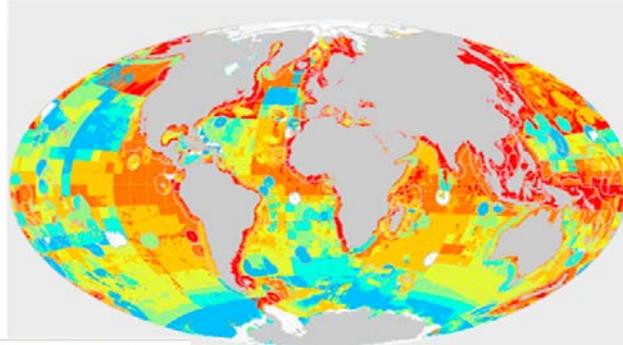
- 1) Drivers of potential fishable biomass
- 2) Human impacts on actual fishable biomass
- 3) Socioeconomic drivers of fishing effort in mangroves
- 4) Future climate change impacts on mangroves and subsequently fisheries

Following on from and modifying conceptual model by Hutchison et al. (2015) describing the drivers of mangrove-fishery productivity:



Methods – Global and regional analysis

- Use global catch data to look for simple correlations between mangrove presence/attributes and fisheries productivity
- Also look at regional correlations e.g. EEZ's or regional seas
- Model global mangrove vulnerability using DIVA Wetland Change Model



Global fishing in 2010 (Sea Around Us, 2016)

Methods – Vulnerability modelling The DIVA Wetland Change Model

- One module of the DIVA (Dynamic Interactive Vulnerability Assessment)
- Identify the vulnerability of coastal wetlands on a broad spatial and temporal scale
- Projects under a range of scenarios for sea level rise (SLR) and changes in accommodation space from human intervention
- Quantify vulnerability of mangrove areas based on forcing by SLR, tidal range, sediment supply and accommodation space
- Global or regional (EEZ's/Regional Seas)
- Map areas at risk
- Look into subsequent vulnerability of fisheries and communities

(McFadden et al., 2007, Spencer et al., 2016)

Methods – Community level

Table 1. Data required from case study sites.

Data required	Detail
Artisanal fisheries catch	Species caught Total catch weight* Fishing effort (time spent fishing)* Fishing mechanism Location of fishing (directly within mangrove forest or outside)
Socio-economic information	Local population size* Dominant occupations Dependence on mangrove products for subsistence* Dependence on mangroves for economy* Other non-fishery uses of mangroves
Mangrove attributes	Geographic setting (fringing/riverine/basin) Mangrove species composition Mangrove state (pristine to degraded) Tidal range Distance to adjacent habitats Within mangrove fish/invertebrate biodiversity

* Marked attributes are those which would be particularly valuable to the study.

Possible analysis: Agent-based modelling of mangrove-fishery-communities at the local scale

Conclusions

Proposed project outcomes

- Further knowledge on the linkages between mangroves, fisheries productivity and community livelihoods in a local and global context
- Provide quantitative validation for the paradigm of fisheries enhancement by mangroves
- Supporting argument for the sustainable use of mangroves vs. land reclamation
- Provide projections for the future vulnerability of mangrove forests and communities dependent on them in light of climate change and continued anthropogenic mangrove loss

Thank you



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