APN Project
Coastal Ecosystems and Changing Economic Activities: Challenges for Sustainability Transition

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with
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The backdrop

- **Coastal Ecosystems** contributing to welfare of large population but anthropogenic and natural threats are increasing

- **Coastal ecosystem services:**

<table>
<thead>
<tr>
<th>Provisioning Services</th>
<th>e.g.- Production of fish, seaweed etc. for both human and animal consumption, commerce</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulating Services</td>
<td>e.g.- Water quality maintenance, flood control, shoreline stabilization</td>
</tr>
<tr>
<td>Cultural/Recreational Services</td>
<td>e.g.- Tourism, Aesthetic services</td>
</tr>
<tr>
<td>Supporting Services</td>
<td>e.g.- Nutrient storage and cycling, sediment trapping</td>
</tr>
</tbody>
</table>

(IUCN, 2007; Burke et al, 2001; UNEP, 2006)
Economic Wellbeing, Ecosystem Diversity and Economy’s Resilience

Sustainability of Economic wellbeing of coastal community

Coastal Economy’s Resilience

State of Coastal Ecosystem Diversity

Source: APN “Coastal Ecosystem and Changing Economic Activities: Challenges for Sustainability Transition along Chinese and South Asian Coasts” project report 2015
Study Objectives

To study the Risks of *anthropogenic and natural threats* on the socio-economic system parameters

Specific goals

1. coastal ecosystems: typification

2. Inventory of economic activities, identifying: threats, changing economic activities

3. identifying vulnerabilities

4. opportunities for reducing risks
Two main criteria for site selection

1. highly vulnerable to anthropogenic actions (both direct and indirect), and natural phenomenon impacting the flow of ecological services

2. sites drawing current policy attention
<table>
<thead>
<tr>
<th>Country Study Sites</th>
<th>Ecosystem Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bangladesh: Cox's Bazar Sadar-Moheshkhali</strong>, It covers an area of 512.8 km$^2$, 887 persons per km$^2$</td>
<td>Mangrove, Coastal mudflats, Estuaries, Sandy beaches, Sand dunes, Forest</td>
</tr>
<tr>
<td><strong>India: Digha-Sankarpur coastal area</strong>, Covers an area of around 69 km$^2$, 517 persons per km$^2$</td>
<td>Sand dunes, Sandy and muddy beach, Estuaries, forest plantation: Casurina, Cashewnut, Screw Pine, Date, Coconut</td>
</tr>
<tr>
<td><strong>Sri Lanka: Koggala area in the Habaraduwa Divisional Secretariat (DS) division</strong>, land area of 39 km$^2$, 1250 persons per km$^2$</td>
<td>Mangroves, Salt marshes, Dunes, Beaches, Barrier beaches, Spits, Lagoons Basin estuaries, Other water bodies, Marshes</td>
</tr>
</tbody>
</table>
Conceptual framework

- Hazard
  - Natural Threats
  - Anthropogenic Threats
  - Exposure
  - Adaptive Capacity
  - Sensitivity

- Vulnerability
- Risk
Risk Assessment

• **Risks associated with various threats** to different socio-economic activities

• **Risk assessed in terms of**
  - Asset loss
  - Income loss
  - Crop loss
  - Occupational change
  - Migration
  - Health risk
  - Loss of lives
  - Loss of Public property
Study Outcomes
Bangladesh
Shift in Activities from Traditional to New

New Economic Activities

1. Tourism
2. Shrimp farming and salt production
3. Hawking on beach
4. Photography on beach
5. Horse riding on beach
6. Bike riding on beach
7. Shop business in beach
8. Crab collection

Traditional Economic Activity

Agriculture
- Unprofitability of crop cultivation (mainly single crop- Aman rice) compared to shrimp farming and salt production
- Decline in crop yield due to salinity, lack of sweet water for dry season irrigation and incidence of pest and diseases
- Unfavorable climate and uncertainty of crop production
- Rapid expansion of growth of tourism leading to landuse change
- Market drivers resulting in profitability of new economic activities
- Transformation of agricultural land to non-agricultural purposes

Fishing
- Decline in availability of fish resources; changes in species composition of catches; the high proportion of juvenile fish in the catch
- Risk of cyclone and tidal surges and lack of security for the fishermen during fishing in sea from pirates
- High price of electricity leading to increase costs of fish processing and marketing
- Market drivers resulting in profitability of new economic activities
- Shrimp farming provides more economic growth compared to fishing from sea
Shift in Activities from Traditional to New Economic Activities

1. Tourism
2. Shrimp farming and salt production
3. Hawking on beach
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5. Horse riding on beach
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8. Crab collection
Identification of Threats to Economic Activities in Cox’s Bazar-Moheshkhali, Bangladesh

Natural Threats

Coastal erosion
Inadequate rainfall
Flooding due to heavy rainfall
Sea water intrusion during high tide
Coastal storms

Anthropogenic Threats

Wastewater from hotels and restaurants polluting the coast and the seawater
Running of petrol or diesel vehicles on the beach resulting in the pollution of the beach
Sand mining
Economic activities at risk

- People engaged in agriculture and fishery consider coastal storm as very significant risk.

- Inadequate rainfall is also a considerable risk for agriculture and flooding due to heavy rainfall is medium risk for salt-shrimp farming.

- Coastal storm is also exhibited as medium risks for salt-shrimp farming, hotel industry, fish drying and small traders.

- Risk perception from anthropogenic threats were very minimum.
Study Outcomes

India
Shift in Activities from Traditional to New

Traditional Economic Activities

- Reduction in Provisioning Service
- Decline in Supporting and Regulatory Services
- Market drivers resulting in unprofitability of cultivation
- Labour market drivers (lack of human capital)
- Economy wide drivers (urbanisation and tourism development) leading to landuse change
- Market drivers resulting in profitability of new economic activities

Fishing

- Reduction in Provisioning Service
- Lack of Regulatory Services
- Market and non-market drivers resulting in Unprofitability of fishing
- External factors like rising competition with local and non-local fishermen
- Market drivers resulting in profitability of new economic activities

Fish Business

- Reduction in Provisioning Service
- Market and non-market drivers resulting in unprofitability of fish business
- Market drivers resulting in profitability of new economic activities
- Improved govt. assistance for new economic activity

Emerging Economic Activities

1. Manual Van Driving
2. Motorised Van Driving
3. Motorbike riding on beach
4. Photography on beach
5. Horse riding on beach
6. Shell crafting
7. Hawking on and near beach
Shift in Activities from Traditional to New

Traditional Economic Activities

- Small businesses (e.g. tea stall, betel leaves trading etc.)
  - Economic driver (fall in demand) leading to decline in profit in traditional economic activity
  - Laboriousness of traditional economic activity
  - Market drivers leading to profitability of the new economic activity

Fishing Net Business
- Reduction in provisioning service
- Market and non-market drivers leading to unprofitability of fishing net business, Market drivers resulting in profitability of the new economic activity

Salt making
- Lesser input cost and profitability of New Economic Activity
- Market and non-market drivers leading to unprofitability of traditional economic activity

Emerging Economic Activities

1. Manual Van Driving
2. Motorised Van Driving
3. Motorbike riding on beach
4. Photography on beach
5. Horse riding on beach
6. Shell crafting
7. Hawking on and near beach

Joyashree Roy; EMECS'11 SeaCoasts XXVI
Identification of Threats to Economic Activities in Digha-Sankarpur, India

**Natural Threats**
- Coastal erosion
- Inadequate rainfall
- Flooding due to heavy rainfall
- Sea water intrusion during high tide
- Coastal storms

**Percentage of Respondents reporting Natural Threats**

**Anthropogenic Threats**
- Sand mining
- Running of petrol or diesel vehicles on the beach resulting in the pollution of the beach
- Wastewater from hotels and restaurants polluting the coast and the seawater

**Percentage of Respondents reporting Anthropogenic Threats**
Economic activities at risk

- Sea water intrusion is a major threat for activities like photography and horse-riding, fish drying
- Coastal storms impacts aquaculture the most
- After factoring in risk in vulnerability assessment, people engaged in horse-riding and fishing using manual boats are relatively more vulnerable
- A major share of the respondents from economic activities: agriculture, fish drying, fishing using manual boats, and horse riding on beach have experienced significant monetary losses due to coastal storms and that for the respondents engaged in shell-crafting and aquaculture is a little lesser
Study Outcomes
Sri Lanka
### Shift in Activities from Traditional to New

#### Traditional Economic Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Drivers for Change</th>
<th>Changes to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>• Decline in supporting ecosystem services of land</td>
<td>1, 2, 4, 5, 6</td>
</tr>
<tr>
<td></td>
<td>• Decline in provisional ecosystem services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Market drivers resulting in unprofitability of cultivation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Decline in regulating ecosystem services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Labour market drivers constraining agriculture</td>
<td></td>
</tr>
<tr>
<td>Lagoon Fishing</td>
<td>• Decline in supporting ecosystem services</td>
<td>1, 2, 4, 5, 6</td>
</tr>
<tr>
<td></td>
<td>• Human activities resulting in decline in provisioning services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Market and non-market drivers resulting in unprofitability of Lagoon Fishing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Economic and socio-economic drivers</td>
<td></td>
</tr>
<tr>
<td>Coastal Fishing</td>
<td>• Market and economic drivers constraining commercial production</td>
<td>1, 2, 6</td>
</tr>
<tr>
<td></td>
<td>• Market drivers resulting in unprofitability of Coastal Fishing</td>
<td></td>
</tr>
</tbody>
</table>

#### New Economic Activities

1. Export Industry
2. Hotel Industry
3. Tourist Guest House
4. Cinnamon Industry
5. Souvenir shop for Tourists
6. Tourist Transport Service
Shift in Activities from Traditional to New

Fish Trading
- Market drivers resulting in higher competition
- Economic drivers constraining fish trading

Cottage Industries
- Economic drivers
- External factors unfavourable to Cottage industries

Carpentry
- External factors resulting in lack of access to raw materials
- Economic drivers constraining carpentry
- Market drivers (increased competition)
- External factors unfavourable to Carpentry

Small Businesses
- Economic drivers unfavourable to small businesses
- Market drivers constraining small business

New Economic Activities
1. Export Industry
2. Hotel Industry
3. Tourist Guest House
4. Cinnamon Industry
5. Souvenir shop for Tourists
6. Tourist Transport Service
Identification of Threats to Economic Activities in Koggala area, Sri Lanka

Natural and Anthropogenic Threats

- Storms during rains
- Storms during other seasons
- Flooding and sea water intrusion during high tide
- Flooding due to heavy rainfall
- Inadequate rainfall
- Coastal erosion and sea approaching closer
- Wastewater from hotels and restaurants polluting the coast and the seawater

Percentage of Respondents reporting Natural and Anthropogenic Threats
Economic activities: risk

- Sea water intrusion was identified as a major threat in the fisheries, hospitality and agriculture sectors

- Flooding due to heavy rainfall and inadequate rainfall were considered a major threat in the agriculture sector and coir industry

- Coastal erosion was considered as a major threat by fishers, hotels and restaurants

- The new economic activities including both 3-wheel vehicle driving and handicraft sales are less risky

- Agriculture, fishery are most risky to natural threats like coastal storm
Summary

• Traditional economic activities of coastal communities are moving away from fisheries and agriculture.

• The change is due to declining fish stock, cyclones, storm surges, soil water intrusion and water stress.

• Low income from traditional livelihood, competition for land, and pollution load has also contributed to the change.

• Related policies are creating short-term alternative livelihood options.

• Threats to current coastal economic activities will be exacerbated in the region due to climate change.
Thank you

For more research findings from the APN project

Special session on BRICS countries on 26th August in the same room from 9 am