WETLAND ASSESSMENT AND MONITORING

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THE SUB-COMPONENT FOR COASTAL WETLANDS IN THE SOUTH CHINA SEA PROJECT

• Peatswamps
• Non-peatswamps
• Lagoons
• Estuaries
• Tidal flats

THE LECTURE FOCUSES ON THE COASTAL WETLANDS ONLY
CONCEPTS

Assessment is the process of documenting, usually in measurable terms, knowledge, skills, attitudes and beliefs (Wikipedia); or to judge or decide the amount, value, quality or importance of something (Cambridge Advanced Learner's Dictionary)

Habitat Assessment (scientific and technical activities)

- Provision of knowledge on habitats and ecosystems, and resources, and their inter-connectivity with ambient environments
- Understanding of threats and impact by human activities
- Linkages between natural and socio-economic systems
CONCEPTS (cont.)

To monitor or monitoring generally means to be aware of the state of a system (Wikipedia); or to watch and check a situation carefully for a period of time in order to discover something about it (Cambridge Advanced Learner's Dictionary)

Habitat Monitoring (possible resources management activities)

Records evidences of changes in physical, biological, conditions, environment quality and related socio-economic activities

Do not confuse with Project/Programme Monitoring that includes collecting information that will help to answer questions about the project. This information is collected in a planned, organised and routine way and used to report on a project achievement and to help in evaluation of whether the project achieves its objectives
PURPOSES

Assessment: Measurement of state, providing knowledge and understanding on natural and socio-economic characteristics and processes

Monitoring: Sequential measurement of state, that enables “change” to be detected; possible used to evaluate effectiveness of a certain management action and/or implementation of a management plan for adaptive management

ASSESSMENT IS REQUIRED IN THE BEGINNING OF ANY MANAGEMENT ACTION OR/AND PLAN TO DEFINE THE BASELINE FOR PLANNING; AND AGAINST WHICH MONITORING IS UNDERTaken

MONITORING IS CONTINUOUS PRACTICES IN ADVANCE OF, DURING AND AFTER ACTIONS FOR ADAPTIVE MANAGEMENT
METHODOLOGY FOR ASSESSMENT AND MONITORING

Field surveys and/or establishment of permanent measure stations

Laboratory work

Secondary data collection and analysis

Participatory Rural Appraisal*

Mapping and GIS

Application of Remote Sensing

Trace tracking

Others

METHODOLOGY USED FOR AN ASSESSMENT OR MONITORING SHOULD BE BASED ON LEVELS OF REQUIREMENT FOR SCIENTIFICALLY SOUND DATA AND INFORMATION; AND HUMAN AND FINANCIAL CAPACITY
METHODOLOGY (Cont.)

Assessment

Utilisation of appropriate methodologies that help to observe a number of parameters related to purposes of an assessment at a certain time and in a certain area.

Monitoring

Utilisation of a standard methodology for repeated records of limited indicators in a defined location at a defined time.

METHODS USED FOR ASSESSMENT AND MONITORING
MAYBE THE SAME BUT STRATEGIES (PLANNING AND PRACTICE) SHOULD BE DIFFERENT
WHAT TO BE ASSESSED AND WHAT FOR?

Distribution & Area (ha, sq. km)
Physical conditions
Hydrological processes
Biochemistry processes
Biodiversity & Ecological processes
Living and non-living resources
Impacts and degradation
Socio-economy and economic valuation
Management status

SELECTED AREAS AND PARAMETERS FOR EACH ASSESSMENT DEPEND ON WHAT THE PURPOSES ARE

Provision of fundamental knowledge
Development of management plan
Planning for socio-economic projects
Environment Impact Assessment of development projects
Others
CASE STUDY 1*. ECOLOGICAL SIGNIFICANCE AND POTENTIAL FOR DEVELOPMENT OF THE WETLAND OF THE LOWER BARITO BASIN (SOUTH KALIMANTAN, INDONESIA)

Hydrology
Rainfall, temperature, evaporation
Swamp water levels and flows
Tidal regime
Water quality
Soil
Habitats & Flora and fauna
Bird and wildlife
Fisheries
Fish culture and other livestock
Social and economic Situation

CONCLUSION

Loss of natural resources due to development without consideration of environment impacts

Proposed options for sustainable development:

• Carefully executed extension of traditional utilisation;
• Better management of forestry & Rattan cultivation;
• Formalised and extended protection of fish resources; and
• Intensification of existing irrigation scheme
CASE STUDY 2. ASSESSMENT FOR DEVELOPMENT OF THE PLAN FOR ECOLOGICAL RESTORATION AND SUSTAINABLE USE OF CON CHIM AREA, THI NAI LAGOON, VIETNAM
CASE STUDY 2: WHAT WERE ASSESSED IN THE SURVEY

- Habitat distribution and characteristics (mangroves, seagrass, soft bottom)
- Topography and sediment (changes following culture development)
- Natural living resources (fish, mud crab, oysters and clam)
- Larvae and juvenile of living resources (Oysters & Mud crab)
- Composition and abundance of bird communities
- Water and sediment quality (Micro-biological pollution, fresh water inputs)
- Status of fisheries (overfishing, over-capacity, destructive fishing)
- Experiments for mangrove rehabilitation (physical and environment conditions related to mangrove ecology)

These groups of parameters were selected based on data required for planning of restoration and sustainable use of the lagoon.
Nine zones designed for:

Seagrass conservation (1)

Intensive culture mixed with mangroves (2)

Bird grounds and Office (3)

Re-planting (4,5)

Experiments for resource recruitment (6)

Models of aquaculture (7)

Molluscs culture (8)

Reasonable fishing (9)
DEVELOPMENT OF MONITORING STRATEGY

Selection of indicators:

Location

Time and Frequency

Consideration of space and time frame of natural process

Measurable
Quantifiable
Realistic
Actually related to what needs to be evaluated

Human capacity

Facilities & equipment

Financial demand

Realistic and adaptive
Local involvement
STEPS IN DEVELOPMENT AND IMPLEMENTATION OF A MONITORING STRATEGY

1. Identification of purpose(s)
2. Preliminary surveys
3. Selection of indicators
4. Selection of sampling sites and time arrangement
5. Standardisation of monitoring methods (collection, transportation and store of samples, analytical methods)
6. Preparation of equipment, human capacity & budget
7. Monitoring practices
8. Data analysis and reporting
9. Interpretation of data and information to management

RELATIONSHIP AMONG STEPS AND WITH REAL CONDITIONS
SELECTION OF INDICATORS FOR MONITORING DEPENDS ON WHAT MANAGEMENT ACTION NEEDS TO BE EVALUATED

Specialised management of:
- Aquaculture
- Fisheries
- Biodiversity
- Migrating species
- Pollution
- Others

Integrated wetland management

1. Area of habitats (mangroves, tidal flats, seagrass beds, swamps)
2. Water budget
3. Water and sediment quality
4. Species richness
5. Appearance & density of migrating species
6. Resource uses (No. boats, tourists…)
7. Resource production (total and per unit)
8. Socio-economic benefits & cost (income, labours)
SPACE AND TIME FRAMES OF NATURAL PROCESSES

(Modified from Pernetta, 1992)

Day
Month
Year
Century

Benthic Organisms

Coastal wetland
Erosion

Zooplankton
Pelagic fish

Microorganisms & phytoplankton
Tide

Meter Km 1000 Km

SPACE AND TIME FRAMES SHOULD BE CONSIDERED IN DECIDING NUMBER & LOCATIONS OF MONITORING SITES AND SAMPLING FREQUENCY FOR EACH INDICATOR
COMMUNITY INVOLVEMENT AND LOCAL INDICATORS

Why?

• Dependence on and interests of local people on their resources
• Knowledge and experiences at locations for a long time
• Human capacity at locations
• Also improvement of public awareness

How?

• Interpretation of local to scientific knowledge in selecting indicators
• Training standard methods
• Learning by doing following training
• Records of occasional events
### EXAMPLES IN DEVELOPING MONITORING STRATEGIES

**Monitoring of impacts from and to brackish aquaculture**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Frequency</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area &amp; % per total area</td>
<td>Once per year</td>
<td>Entire waters</td>
</tr>
<tr>
<td>Nutrient (NO\textsubscript{3}, NO\textsubscript{2}, NH\textsubscript{3}, PO\textsubscript{4}, …)</td>
<td>Four times per year (Dry, rainy &amp; trans seasons; at low &amp; high tide, considering crops arranged by local farmers)</td>
<td>In, close, far from ponds</td>
</tr>
<tr>
<td>Bacteria contamination</td>
<td>Before, during &amp; after crops</td>
<td>In, close, far from ponds</td>
</tr>
<tr>
<td>Harmful algae (cell/l)</td>
<td>Every month or 3 months</td>
<td>At discharging sources and impacted area</td>
</tr>
<tr>
<td>Antibiotic substances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollutants from other activities (Heavy metals, Hydrocarbon, …)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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*Images:* Examples of monitoring locations and procedures.
EXAMPLES IN DEVELOPING MONITORING STRATEGIES

Monitoring of impacts from and to brackish aquaculture (cont.)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Frequency</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case of diseases</td>
<td>Every crop</td>
<td>Entire culture area</td>
</tr>
<tr>
<td>Culture productivity (ton/ha)</td>
<td>Every crop</td>
<td>Entire culture area</td>
</tr>
<tr>
<td>Net benefit per ha</td>
<td>Every year</td>
<td>Entire culture area</td>
</tr>
<tr>
<td>Total income</td>
<td>Every year</td>
<td>All farmers involved</td>
</tr>
<tr>
<td>Social problems</td>
<td>Every year</td>
<td>Villages involved</td>
</tr>
<tr>
<td>Others ????</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
## EXAMPLES IN DEVELOPING MONITORING STRATEGIES
Monitoring impacts of a industry park to a certain coastal lagoon

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Frequency</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality (nutrients &amp; heavy metals)</td>
<td>Four times per year (Dry, rainy &amp; trans seasons; at low &amp; high tide, considering reality of production &amp; impact</td>
<td>At discharging sources, aquaculture areas, fishing grounds, spawning areas.</td>
</tr>
<tr>
<td><strong>What parameters?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sediment quality (nutrient &amp; heavy metals)</td>
<td>Twice per year (dry and rainy seasons), considering reality of production &amp; impact</td>
<td>At discharging sources, aquaculture areas, fishing grounds, spawning areas.</td>
</tr>
<tr>
<td><strong>What parameters?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bio-accumulation in living resources</td>
<td>Once or twice per year</td>
<td>At target habitats and fishing grounds</td>
</tr>
<tr>
<td>Fisheries production</td>
<td>Depending on how many fishing season (2 – 3 / year)</td>
<td>Coastal waters around an industry park</td>
</tr>
<tr>
<td>Human disease related to pollution</td>
<td>Every year</td>
<td>Communities living around the park</td>
</tr>
<tr>
<td>Income and social problems</td>
<td>Every year</td>
<td>Communities living around the park</td>
</tr>
</tbody>
</table>
Ecological/Environmental Indicators/Groups of Indicators suggested in Sustainable Management Indicators Matrixes (developed by the RWGs on Mangroves, Seagrass and Coral Reefs)

<table>
<thead>
<tr>
<th>Mangroves</th>
<th>Seagrass</th>
<th>Coral Reefs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest cover</td>
<td>Percent seagrass cover</td>
<td>Live coral cover</td>
</tr>
<tr>
<td>Population structure of dominant mangrove species</td>
<td>Shoot density per sq m</td>
<td>Organism abundance</td>
</tr>
<tr>
<td>Tree density (trees over 1.5m)</td>
<td>Abundance of sea urchin <em>Tripneustes gratilla</em></td>
<td>Biodiversity</td>
</tr>
<tr>
<td>Number of true mangrove species</td>
<td>Abundance of sea cucumber <em>Stichopus chloronotus</em></td>
<td>Indicator (ecological) species</td>
</tr>
<tr>
<td>Mud crab (<em>Scylla serrata</em>) size and abundance</td>
<td>Abundance of rabbitfish <em>Siganus</em> spp.</td>
<td>Target (commercial) species</td>
</tr>
<tr>
<td>Anything else?</td>
<td>Anything else?</td>
<td>Water quality</td>
</tr>
</tbody>
</table>
**SUSTAINABLE MANAGEMENT INDICATOR MATRIX FOR WETLAND** (developed by the Regional Working Group on Wetlands)

<table>
<thead>
<tr>
<th>Management Indicators</th>
<th>Ecological/Environmental Indicators</th>
<th>Socio-Economic Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MANAGEMENT CAPACITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Formal Management framework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Trained Man-power (No./levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Facilities and equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sustainable Financing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Regional wetland information system operational</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MANAGEMENT APPROACH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sectoral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Integrated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Community-based</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Multiple-use</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MANAGEMENT TOOLS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Monitoring system established</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Regulations and agreements (e.g. seasonal closures, zoning, licensing, and permits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FISHERIES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Catch per unit effort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Total landing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Catch composition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOURISM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Number of visitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Number of tourism operators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FORESTRY (Peat Swamp)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Volume of timber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OTHER ACTIVITIES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Numbers of people involved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Per capita income</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OVERALL LIVING STANDARD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Population density</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Level of education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Health of the community</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cultural aspects</td>
<td></td>
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</tr>
</tbody>
</table>

**What are indicators for monitoring?**
QUESTIONS AND DISCUSSION

PERSPECTIVES AND GAPS IN WETLAND ASSESSMENT & MONITORING IN YOUR COUNTRIES?
INPUTS FROM THE PARTICIPANTS