MRC Council Study – Assessing Impacts on the Environment: Ecosystems and Bioresources
Outlines of Presentation

1. **Review of subjects from last Stakeholder Forum**
   - How water-resource developments affect rivers
   - BioRA process:
     - focus areas/zones
     - indicators

2. **BioRA results**
   - Main development scenarios
   - Sub-scenarios

3. **Key messages and recommendations**
Water-resource developments can affect river ecosystems by changing

- flow regimes
- sediment regimes
- water chemistry and temperature regimes
- erosion rates and habitats
- migration paths (dams act as barriers)
- abundance and diversity of plants and animals
- ecosystem services (fisheries and OAAs)
Task of BioRA

CAUSE

• flow regimes
• sediment regimes
• water chemistry and temperature regimes
• barriers

EFFECT

• habitats
• fauna and flora (biodiversity)
• ecosystem services on which people depend.
BioRA Zones and Focus Areas

- Eight BioRA Zones, each with one or more Focus Areas
- MT provided scenario outputs at Focus Area
- BioRA Results reported by Zone
BioRA: 47 Indicators

**Geomorphology (6)**
- Erosion
- Bed sediment size
- Sandy habitat
- Rocky habitat
- Depth of bedrock pools
- Water clarity

**Macroinvertebrates (8)**
- Burrowing mayflies
- Snail abundance
- Neotricula aperta abundance
- Bivalve abundance
- Polychaete worms
- Shrimps and crabs
- Diversity
- Emergence

**Fish (11)**
- Rithron residents
- Main channel residents
- Main channel spawner
- Floodplain spawner
- Generalist species
- Floodplain resident (black)
- Estuarine species
- Anadromous species
- Catadromous species
- Marine visitor species
- Non-native species

**Herpetofauna (4)**
- Ranid amphibians
- Aquatic serpents
- Aquatic turtles
- Semi-aquatic turtles

**Vegetation (6)**
- Riparian trees
- Bank vegetation cover
- Herbaceous marsh
- Weeds and grasses
- Flooded forest
- Grassland vegetation

**Birds (9)**
- Medium/large ground-nesting channel species
- Tree-nesting large waterbirds
- Bank/-hole-nesting species
- Flocking non-aerial passerine of graminoid beds
- Large ground-nesting species of floodplains
- Large species using bank-side forest
- Rocky-crevice nester in channels
- Dense woody vegetation / water interface
- Small non-flocking using seasonally-flooded plants

**Mammals (3)**
- Mekong dolphin
- Hog Deer
- Otters
Scenarios assessed

• Four main development scenarios:
  • 2007, 2020, 2040, 2040CC

• Thirteen sub-scenarios
  • Variations in climate change, agriculture and land use, irrigation, flood protection, navigation and hydropower

• For each Focus Area

• Change reported relative to 2007 Baseline
Summary of main results

• Impacts driven by:
  • Reduced floodplains
  • Very reduced sediments
  • Barriers to fish and prawn migration
  • Inundation of mainstream river

• Predictions for every indicator:
  • Only summaries shown here
Change in key indicators

- Increased:
  - Channel erosion
  - OAAs

- Decreased:
  - FP sedimentation
  - Vegetation biomass
  - Fish biomass
  - Biodiversity
FISHERIES

Fish biomass drops
White fish lost
Alien fish dominate
Fish biomass – whole LMB

- Fish biomass drops
- White fish lost
- Alien fish dominate
Overall ecosystem condition

Fish biomass drops
White fish lost
Alien fish dominate

A Natural
Moderately modified
Completely modified
A/B
B
B/C
C
C/D
D
D/E
E
Reservoir

2007
2020
2040
2040CC
### Thematic sub-scenarios

<table>
<thead>
<tr>
<th>Designation</th>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>Climate change</td>
<td>C2_2040Wet</td>
<td>2040CC with wetter climate</td>
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<tr>
<td></td>
<td>C3_2040Dry</td>
<td>2040CC with drier climate</td>
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<tr>
<td>Agricultural landuse</td>
<td>A1_noALU</td>
<td>2040CC with agriculture development at 2007 levels</td>
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<tr>
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<td>A2_ALU</td>
<td>2040CC with more agriculture development</td>
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<tr>
<td>Irrigation</td>
<td>I1_noIRR</td>
<td>2040CC with irrigation development at 2007 levels</td>
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<td>I2_IRR</td>
<td>2040CC with more agriculture development</td>
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<tr>
<td>Flood protection infrastructure</td>
<td>F1_noFPI</td>
<td>2040CC with FPI at 2007</td>
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<tr>
<td></td>
<td>F2_FPI</td>
<td>2040CC with FPI at ‘Level 2’</td>
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<tr>
<td></td>
<td>F3_FPI</td>
<td>2040CC with FPI at 2020 levels and joint operation among dams to reduce flooding</td>
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<tr>
<td>Hydropower</td>
<td>H1a_noHPP</td>
<td>2040CC with LMB hydropower development at 2007</td>
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<tr>
<td></td>
<td>H1b_nomainHPP</td>
<td>2040CC with Lancang HPPs plus 2040 tributary HPPs</td>
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<td></td>
<td>H2_HPP</td>
<td>Same as 2040CC</td>
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<tr>
<td></td>
<td>H3_HPP</td>
<td>2040CC but with consideration of mitigation</td>
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</tbody>
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Thematic sub-scenarios (2)

Impacts of most sub-scenarios similar to those for 2040

Changing hydropower developments significantly affects impacts

Excellent health
Poor health

2007 Baseline

No HPP
No mainstream dams
HPP with mitigation
Key messages

• Significant loss of biodiversity and biomass (fisheries and OAAs) with 2040 developments

• Hydropower impacts overshadow those of all other planned water-resource developments in the LMB.

• Wetter climate will mitigate some of the ecological impacts associated with the Scenario 2040, but only slightly

• Drier climate future will exacerbate the ecological impacts especially in the Tonle Sap System

• Resilience of the LMB aquatic ecosystems to climate change reduced by the developments in Scenario 2040.
Key recommendations (2)

• Use the BioRA DSS to assist in guiding broad-scale planning and management of the aquatic ecosystems of the LMB, including:
  • the location of new infrastructure,
  • adaptation and mitigation measures;
  • design and evaluation of mitigation options
• Establish guidelines for transparent decision-making on developments based on outcomes of the Council Study.