Towards an integrated decision tool for adaptation measures - Case study: floods

Ecological aspects
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Follow up committee
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Tasks for ecological aspects

• **WP1. General study and evaluation**
  – Identification of potential secondary impacts of climate change in Belgium
  – Conclusions towards WP2

• **WP2. Case study Flooding (Scheldt & Meuse)**
  – A. Identification and evaluation of secondary impacts
    • WP2.2 Impacts of flooding on vulnerable sectors in rivers basin (Ecological aspects)
  – B. Adaptation measures
    • WP2.3 Determination of adaptation measures
    • WP.2.4 Evaluating adaptation measures
  – C. Contribution to the Cost-benefit analysis
    • WP.2.5 Cost-benefit analysis
WP1: Identification of potential secondary impacts of climate change in Belgium

We focused on the biodiversity and functionality of the freshwater ecosystems in Belgium: High socio-economical and ecological values; Sensitive early indicators of climate change

Freshwater ecosystems: Wetlands, stream& rivers, and estuary ecosystems

- Impact on biodiversity
  - Changes in temperature
  - Changes in hydrology, precipitation & runoff
- Impact on functionality of wetland
- Impact on functionality of streams & rivers
- Impact on functionality of estuary ecosystems
- Greenhouse gasses

Loss of habitat
Inundation
Erosion
Salinity intrusion
Nutrient fluxes
Plant and animal species disappear today by approximately 1,000 x the natural speed of extinction.
WP1: Identification of potential secondary impacts of climate change in Belgium

Habitat loss

Lienne vallei, Lierneux

1775

1973

(Le Boulangé, 2002)
WP1. Conclusions towards WP2

- Freshwater ecosystems are the most vulnerable to climate change in Belgium.
- From those ecosystems the estuary ecosystems (Scheldt) are the most sensitive (due to their connectivity with the sea and the highly anthropogenic pressure).
- Impacts of CC are multiple, complexes and incompletely studied, they may differ from local, regional and national levels. However, in Belgium the most important impact is the sea level rise that affect directly coastal and estuary ecosystems.
- For adaptation measures, models and scenarios at detailed regional level are needed, where socio-economical and ecological aspects can be closely integrated.
- Case study-flooding at local scale along the Scheldt & the Meuse.
A. Identification and evaluation of secondary impacts
WP2 a. Impacts of flooding on E-G&S along the Scheldt and the Meuse Basins

- Description of the Ecosystem Good and Services (ecological functions) for the Scheldt and the Meuse
  Literature
  Previous and ongoing research activities of ECOBE along the Scheldt
- Determination of the Ecological Indicators for the different ecological functions
  Literature
  Previous and ongoing research activities of ECOBE along the Scheldt

- Selection of the case-study areas (all partners) and assess the impact of flooding

  Driving forces
  Pressures
  State
  Impacts of flooding on the ecosystems of those areas (using the ecological Indicator)
  Responses (adaptation measures)
Methodology for Ecological aspects

- Ecosystem approach (MA 2005),
- Drivers-Pressures-State-Impact-Responses (DPSIR) framework

Criteria

- Literature
- Expert Judgement
- Area specific knowledge

Determination of relevant E-G&S for the area

Pressures

Driving forces

State

Table of actual E-G&S + Ecological Indicators

Impact

Changes in surf. E-G&S

Senario’s flooding maps

Climate change

Actual surf. E-G&S

Climate change
### Example of the table showing impact on E-G&S

<table>
<thead>
<tr>
<th>Good and services</th>
<th>Zones of the selected area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone1</td>
</tr>
<tr>
<td>buffer capacity discharge</td>
<td></td>
</tr>
<tr>
<td>tidal energy dissipation</td>
<td>+</td>
</tr>
<tr>
<td>multichannel system</td>
<td>++</td>
</tr>
<tr>
<td>natural habitat processes</td>
<td>++</td>
</tr>
<tr>
<td>minimise turbidity</td>
<td></td>
</tr>
<tr>
<td>C flux</td>
<td>0</td>
</tr>
<tr>
<td>N flux</td>
<td>0</td>
</tr>
<tr>
<td>O2</td>
<td>0</td>
</tr>
<tr>
<td>P flux</td>
<td>0</td>
</tr>
<tr>
<td>Si flux</td>
<td></td>
</tr>
<tr>
<td>Primary production</td>
<td>0</td>
</tr>
<tr>
<td>Conditions for zooplankton</td>
<td>0</td>
</tr>
<tr>
<td>Conditions for benthos</td>
<td>++</td>
</tr>
<tr>
<td>Fish migration</td>
<td>++</td>
</tr>
<tr>
<td>surface shallow low dynamic water</td>
<td>++</td>
</tr>
<tr>
<td>surface tidal flats</td>
<td>++</td>
</tr>
<tr>
<td>high dynamic areas</td>
<td>++</td>
</tr>
<tr>
<td>surface marsh</td>
<td>+</td>
</tr>
<tr>
<td>young marsh</td>
<td>+</td>
</tr>
<tr>
<td>surface wetland</td>
<td>+</td>
</tr>
</tbody>
</table>
Flooding

- Inundation of terrestrial ecosystems
- Oxygen lack
- Dead of organisms
- Drowning
- Anaerobic condition
- Sulfate reduction
- HS formation
- Dead of organisms
- Toxicity
- Sulfate input by surface water
- Nutrient input (N,P,K) with surface water
- Nutrient input (N,P,K) with sediment
- P immobilisation
- Increase in vegetation productivity
- Eutrophication
- Decomposition organic material
- Increase pH
- Alcalinity
- Base-rich sediment
- Bicarbonate input with surface water
- Input/output salt
- Salinity / desalinity

Processes dealing with the effect of flooding on the biodiversity of an ecosystem

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B. Adaptation measures

Adaptation measures to minimise effect of flooding: combining nature with safety

Contribution to the evaluation of adaptation measures (Comparative analysis with socio-economical aspects)

C. Cost-benefit analysis

Contribution to the assessment of the cost and benefits of the different risk management
Thank you!