The Rhine. No more salmon, stranding ships?

Looking for thresholds in management regimes

18-03-2013. Erik van Slobbe
From snow to rainfed?
Concerns about distant future

Figure 2: Average changes of the low water parameter NM7Q (lowest 7 day average value) at the Kaub gauge during the hydrological summer half-year (May–October). Ensemble of about 20 discharge projections (short lines) as well as the boundaries of scenario corridors (long lines) and the representative simulations.

source: KHR 2011, Projektbericht Rheinblick 2050
Thresholds in management regime?
Questions

1. When will thresholds in inland shipping and salmon reintroduction be crossed?

2. What options do water users have?

3. What methods are used?
Assessment: decision pathway

1. Are there studies on future impacts available?
   - Yes: Have the studies explored a representative range of uncertainty in climate and non-climate drivers?
     - Yes: Are the results of these studies ambiguous regarding impacts?
       - Yes: Seek expert consensus (Section 3.1.2.3)
       - No: Are impact models available that can be used to simulate future impacts?
         - Yes: Should adaptation be included in the projection?
           - Yes: Potential impact projection (Section 3.1.2.1)
           - No: Potential impact projection (Section 3.1.2.1)
         - No: Potential impact projection (Section 3.1.2.1)
   - No: Potential impact projection (Section 3.1.2.1)
Transient projection water temperature
Adaptation Options, Rhine Conference on Adaptation
## Timing of adaptation options

<table>
<thead>
<tr>
<th>2000</th>
<th>2100</th>
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</thead>
<tbody>
<tr>
<td>1. Accept extreme low flows</td>
<td>river basin</td>
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<tr>
<td>2. Reservoir management</td>
<td>Salmon</td>
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<tr>
<td>3. Ground water infiltration</td>
<td>Navigation</td>
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<td>4. Accept new ecosystem</td>
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<td>5. Water temperature policies</td>
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<td>6. Adapt morphology</td>
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<td>7. Alternative freight transport</td>
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<td>8. Canalization</td>
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<td>9. Innovations in inland shipping</td>
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</tbody>
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Option appraisal: decision pathway

Are there risks due to current climate variability?  

- No  
  - No need to decide.  
  - Given a scenario, can future outcomes of options be computed?  
    - No  
      - No  
        - Robust decision making on future outcomes  
        - Will more knowledge become available?  
          - No  
            - Real options analysis  
          - Yes  
            - Tipping/turning point analysis?  
    - Yes  
      - Yes

- Yes...
Discussion

- From linear planning to the garbage can
- From ‘predict and act’ to ‘monitor and adapt’
- Deep uncertainty; adaptation pathways