Adaptation Planning in the Transboundary Rhine River Delta and UN/ECE Pilot Projects

Cees van de Guchte
The Netherlands
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Setting:

Small country, Population 17 Million
Delta of 4 transboundary river basins
   Rhine, Meuse, Scheldt, Eems
26% below sea level
60% susceptible to flooding
Flood-sensitive area is densely populated, generates 60% of GDP
High level of flood protection
Changing boundary conditions > Delta scenarios

Living and working

nature

navigation

recreation

agriculture

energy
I: Flood Risk Management

**Problem:** Rising sea level, increasing river discharges, subsidence
Hotspot: Rotterdam – The Hague area

**Challenge:** A safer and less vulnerable Netherlands, and safe to invest in!

Risk = probability  x  effect  (present policies focus on probability)

**Response:** more attention needed for ‘reducing the effects’, through spatial planning and development (long term processes), and the implementation of delta dykes (= unbreachable)

- Strong decrease in casualties (50-80%)
- Strong reduction in economic losses
- Efforts for adjusting built-up area reduced
- Less vulnerable to unexpected extremes caused by climate change
Disadvantage: Delta dykes are costly

Indication of investment costs and damage risk related to flooding, 2020 – 2050

- Present policy
- Delta dykes (1500 km)

Safety options:
- Primary prevention
  - Unchanged policy
  - Policy with norm adjustments
  - Policy with Delta Committee norms
- Prevention and limited consequences
  - Policy with adjusted new housing, from 2010 onwards
  - Policy with dykes that can be overtopped and limited consequences
  - Policy with unbreachable dykes

Damage risk (million euros per year)
Investment costs (billion euros)
Effective approach: Implementation at hot spots only

Lower investment costs by
- Selective use at hot spots: 200 km Delta dyke reduces flood risks by 50%
- Multifunctional design and shared costs

In addition:
- Retain water in designated areas e.g. on flood plains
II: Freshwater availability

(ref. drinking water, agriculture, industry, and salinisation, shipping)

Problem: under most dry scenario a tipping point occurs near 2050 if water demand increases, even before 2050

Challenge: Enough fresh water in extremely dry summers

Response: Improve the balance between water supply ↔ water demand

- Increase flexibility in management and use of water systems
- Improve water efficient use in both national and local waters

Central Lake IJsselmeer could serve as an extra buffer for freshwater storage

90 % of Rhine water is being used for preventing salt intrusion

Low discharge may impact ship transport and industrial cooling capacity

Biodiversity may be impacted, Agricultural practices may need to be adapted more rigorously
Problem: Urban Flood Risks, increasing water nuisances, heat risks

Challenge: A climate-proof development of urban areas

Response: Knowledge, expertise and effective measures are available. Flexibility in urban infrastructure should be enhanced. Integration of adaptation measures in new urban development, redevelopment or maintenance programme today is needed to reduce additional costs in the future.

Potential measures:
Use of buildings, Insulation of buildings, Adjust threshold height, Water retention in streets, Street vegetation, ...

Water retention under streets, Upgrade sewerage system, Create ponds and parks, Thermal storage systems, ...

Green networks, Blue networks
Summarizing Statements

Unbreachable dykes and managing new development in the Rhine-Meuse floodplain will make the Netherlands safer and more climate-resilient.

Climate-proofing freshwater supply will require a more flexible water system and a better use of the water in the river Rhine.

Implementation of climate-proof measures in urban development requires urgent integration in planning and decision making and flexibility in financing mechanisms.

Climate adaptation is all about governance & policy development, adaptive management and associated costs, and securing an enabling environment for an uncertain future
Preparing NL for Climate Change Impacts
>> Delta Programme II, some transboundary aspects
Standard design discharge estimation for the Rhine by Frequency Analysis using discharge records 1901-2004

Recurrence time 1.250  
Pearson-III 14.954  
Log-normal 14.842  
Gumbel; Q0=7000 16.609  
Exponentieel 16.964  
Pareto 15.746  

Central estimate discharge 15.680  
  95% low 13.060  
  95% high 18.370
Additional info through hydrological modeling and a discharge generator, ensemble modeling jointly with neighbour countries.

Recorded rainfall series:

\[
\begin{array}{ccccccc}
5 & 1 & 0 & 10 & 20 & 5 & 1 & 0 & 40 & 3
\end{array}
\]

Largest 4-day amount: 46 mm

Rainfall series produced by resampling:

\[
\begin{array}{ccccccc}
0 & 5 & 1 & 10 & 40 & 10 & 20 & 0 & 0 & 0 & \ldots
\end{array}
\]

Largest 4-day amount: 80 mm
Future Rhine discharges according to the KNMI Scenario’s
### Extrapolated to design discharges
(KNMI report ~2008)

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<th>2050</th>
<th>2100</th>
<th>2200</th>
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<td>Peak discharge</td>
<td>16000</td>
<td>16500 – 19000</td>
<td>17000 – 22000</td>
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<td>(m³/s)</td>
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<td>3 – 19</td>
<td>6 – 38</td>
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<td>Change in %</td>
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Regions where flooding may occur (Lammersen, 2008)
Effect of flooding in the Upper Rhine and Lower Rhine Valley in Germany

- Dikes infinitely high
- With dike overflow resp. flooding at the Oberrhein and the Niederrhein (Lammersen, 2004)
- With dike overflow resp. flooding only at the Niederrhein (Gudden, unpublished)
Changes in extreme discharges cannot be assessed from an envisaged climate change only.

Currently rare high discharge events will become normal events.

Under the current conditions the maximum Rhine discharge that can reach NL at Lobith is not $> 17,500$ m$^3$/s, and probably much less.

Under the climate scenario’s evaluated, flood protection measures in the lower Rhine in Germany may lead to more changes in the probability of the most extreme discharges ($> 15,000$ m$^3$/s) than climatic change itself.

For the Netherlands, the relevance of joint transboundary analysis, the sharing of data, models and experiences, and a joint development of policies and measures to cope with high discharges is obvious.
UN/ECE Guidance on water and adaptation to climate change

Developed in 2007-2009 by Task Force led by Netherlands and Germany

General roadmap towards adaptation of water management to climate change

Guidance adopted in 2009, widely used

Enables effective and efficient transboundary adaptation through:

- a wider knowledge base, and a larger planning space, so as to take measures in a basin where they have optimum effect
- the possibility to share costs and benefits

=> Cooperation reduces uncertainty and costs!
Cooperation needs in every step of developing an adaptation strategy

- Policy, legal and institutional framework
  - Understand the vulnerability
    - Information needs
    - Impact assessment
  - Evaluate
    - Vulnerability assessment
  - Development of measures
    - Financial arrangements

- Need for flexible agreements, possibly for revision of existing agreements and procedures
- Sharing of data, joint monitoring of climate change impacts
- Elaboration of common scenarios
- Basin-wide joint vulnerability assessment
- Agreement on adaptation strategy and measures likely to have transboundary impacts
- Sharing benefits and risks
UN/ECE Pilot Projects

Pilot projects on adaptation to climate change in transboundary basins

- Projects directly supported by the UNECE Water Convention and ENVSEC
- Projects in the programme, implemented by other organizations

Map produced by ZE Environment Network, February 2012.
UN E C E pilots: some first lessons learnt

In most basins climate change impact assessments had been done nationally, but using different methodologies. >> importance of joint scenarios, modelling and vulnerability assessment, however, the extent of harmonization depends on resources and time available.

Importance of a thorough baseline study to identify completed or ongoing projects and relevant partners to be involved.

Importance of the link between political and experts’ level, e.g. through creation of a joint working group and regular meetings.

Institutional and cultural differences can be overcome through facilitated focusing on common interests, expert cooperation etc.

Importance of concrete activities and involving stakeholders & public.
Towards a global platform to share experiences on climate change adaptation in transboundary basins