Climate change resilience in flood risk management in Hungary

Zoltan Balint PhD
Five questions

1. Where?
2. What?
3. Why?
4. How?
5. What?
1. Where?
2. What are the facts, what is the history?

- Floods are created outside the frontiers
- 28-36 hour flood accumulation
- 8-10 m rise of water level in 1-1.5 days
- Long duration

Danube River Basin

- Downstream country
- Flat area
- Significant flood vulnerability

The Hungarian territory is highly vulnerable to floods
2. What is the history?

Inundations before 1846
2. What is the history?

The original (old) Vasarhelyi Plan

First Tisza Law: 1884
Length reduced from 1419 km to 966 km
Number of river cuts: 112

Flood duration reduced from 5 months to 2.5 months
Slope of the river increased from 3.7 cm/km to 6 cm/km
Floodplains and defences in Hungary

Length of primary defences 4200 km, protected fluvial floodplain 21200 km², 23% of the territory of the country, which is unique in Europe.
2. What are the facts?

Firm legal basis: Act on Implementation of the Vásárhelyi Plan

Complex programme, not just flood safety improvement
2. What are the facts?

Complex flood management

- 11 retention area selected from 30 possible locations
  * 75 thousand ha → 3.5 * that of IRMA
- 1,5 bln m³ capacity → 7.0 * that of IRMA
- with controlled inundation
- Involvement of oxbows, wetland development
- Landuse adaptation to risks
- Improvement of living conditions of the population affected

Cost: HUF 130 billion (€ 520 M)

Result:

-- Flood crest reduction by ~ 0.6-1.0 m;

Source: A. LOVAS: NEW APPROACH IN SUSTAINABLE FLOOD MANAGEMENT IN THE TISZA VALLEY
2. What are the facts?

Flood levels are still rising in Hungary

Duna – Nagymaros (1695 fkm); In 50 years: + 69 cm

Tisza – Tiszabecs (744 fkm); In 50 years: + 166 cm
3. Why?

- upstream dike building?
- flood conveying capacity?
- land use change?
- climate change?

What percentage?
Combined effect?

169 km dikes and 85 km of other infrastructure built between 2002-2012 on the Upper-Tisza.
3. Why?

Climate change (examples)

- Summer rainfall intensity 1901-2010
  - Trend = 1 mm/day/110 years
- Number of very hot days 1901-2010
  - Trend = 5 day/110 years

Source: HREX report (Hungary)
3. Why?

Climate change

Mean temperature (°C) changes between 1983 and 2012
3. Why?

Rainfall amount in the run-length

10-15 days

15-20 days

Distribution of rainfall run-length

Period: 1981-2011

Period: 2020-2050

Above 20 days

How to incorporate climate change adaptations into the projects?
4. How?

Impact of Climate Change factors on the original assumptions and goals of the Plan based on expected climate change in Hungary (2021-2050)

- **Rainfall amount**
  - Summer: down
  - Winter: up

- **Rainfall intensity**
  - Up

- **Temperature**
  - Up

Further parameters to consider:
- Run-length of rainy periods shortens
- Landuse changes
- Ice cover changes

Time of rain separate from the time of snowmelt

- Earlier snowmelt
- Higher flood? Lower flood?

Further analysis is needed
New approach: flood risk assessment

To include climate scenarios

Factors included:
- Flood height
- Week points in dikes
- Economic risks

4. How?

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JASPERS Networking Platform Workshop
21-22/10/2014
FLOOD RISK MANAGEMENT – PHASE II

DATA COLLECTION, BASE STUDIES

2013-2014

DATA COLLECTION AND CREATION FOR THE GENERATION OF FLOOD RISK MAPS

STORING DATA IN DATABASES AND OTHER INFORMATION MANAGEMENT RELATED TASKS

PREPARATION OF THE TECHNICAL TASKS FOR PHASE III
What to do?

Methodology development:
• Regional reflections of the global climate models
• Identification of extreme events (including drought: What is drought?)
• Further develop trend analysis
• Risk management to be part of the final plan

Study causes of floods:
• upstream development of flood control infrastructure
• flow carrying capacity of flood beds
• increased runoff (land use change, development of settlements, deforestation)
• climate change
• combined effects
5. What to do?

Non-structural measures
- Further develop flood monitoring systems
- Further develop rainfall and flood forecasts
- Enable quicker response of flood defence forces
- Reinforce international cooperation

152 stations in the Hungarian-Ukrainian monitoring system

Flood accumulation: less than a day
Response time required: less than a day

Source: Upper-Tisza Water Directorate Hungary
5. What to do?

Harmonized optimise operation of the flood retention reservoirs based on climate scenarios

90-100 cm
5. What to do?

Identification of adaptation options

Structural measures

Flood retention - in flood retention reservoirs
  - on the fields
  - for irrigation

Flood dikes
  - Increasing the height if possible
  - relocation of dikes
  - demolishing summer dikes

Increase carrying capacity of flood beds

Land use change - retaining as much water on the field as possible

Reforestation
5. What to do?

Incorporate climate change analysis into reassessing and re-planning of projects.

Rainfall prediction area 1
Rainfall prediction area 2

Varying factors:
- Rainfall amount, duration, intensity
- Snowmelt and its timing
- Land use

Factors to incorporate:
- Conveying capacity of flood bed
- Flood reduction by retention reservoirs
- Flood diversion

Output analysis incl. risk analysis (we might take higher risks than expensive measures)

Re-planning the system
(e.g. number of retention reservoirs, re-allocation of dikes, cleaning the floodway)
5. What to do?

Follow EU Guidelines

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Thank you for your attention
For info or further questions on this presentation, or on the activities of the JASPERS Networking Platform please contact:

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