Flood Risk Management in EU – Case Study Finland

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MISSION:
To support and develop the wellbeing for the region’s inhabitants, enterprises and communities in a sustainable manner
Content

- The EU Floods Directive
- The Finnish water resources and flood risks in a nut shell
- Kokemäenjoki River Flood Risk Management Plan
- Recent floods in Finland
The EU Floods Directive
The framework for flood risk management: EU Floods Directive

- Over 213 major damaging floods in Europe 1998-2009


- The aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity

- 1126 deaths
- Displacement of about half a million people
- At least €52 billion in insured economic losses
Three main steps

- **Preliminary flood risk assessment** (maps, experience from past floods, predictions of future floods, identification areas of potential significant flood risk), *DL 2011*
- **Flood mapping** (for the areas of potential significant flood risk, different scenarios, flood hazard maps & flood risk maps), *DL 2013*
- **Flood Risk Management Plans** (= plans to reduce flood risks, covering all elements of the flood risk management cycle: prevention, protection and preparedness), *DL 2015*

*Review/update every 6 years thereafter*

- The directive is implemented into national legislation
- All types of floods – rivers, lakes, urban areas, coastal flooding...
- Strong link between flood risk and river basin management
The Finnish water resources and flood risks in a nut shell
Some basic information about meteorological and hydrological conditions in Finland

- Total land area of FI is roughly 340 000 km²
- There are 187 888 lakes in Finland (larger than 500 m²)
- The number of lakes larger than 1 hectares (10 000 m²) is 56 000
- Agricultural land 2,3 million ha
Some basic information about meteorological and hydrological conditions in Finland

- Mean annual precipitation 500-800 mm
  - (30-50 % of which is snowfall)
- Annual mean temperature:
  - Southern Finland from +3 °C to +5 °C
  - Northern Finland from 0 °C to -2 °C
Significant flood risk areas in Finland

- Average rainfall 600 – 800 mm/year
- Snowpack accumulation varies between 50 – 250 mm of water
  - Accumulation between November and April
  - Snowmelt floods between April and May
- 21 significant flood risk areas in Finland
In the areas of potential significant flood risk:

- 16,950 buildings
- 26,829 inhabitants
- 61 Cultural heritage sites
- 110 buildings difficult to evacuate
- 1,602 km traffic network
- 573 sites with potential damage to environment

Floods might occur in other places as well!

Do you live in a flood risk area? Look from flood map service!
www.environment.fi/floodmaps
Roles of different regional actors in Flood Risk Management

**STRATEGIC ROLES**

- **ELY Centre**
  - prepare proposals for flood risk management plans for river basins and coastal areas;
  - promote flood protection and other measures which improve flood risk management;

- **Regional Rescue Services**
  - participate in the planning of flood risk management in a river basin and in coastal areas;
  - flood preparedness planning

- **Municipality**
  - planning of stormwater and meltwater flood risk management;
  - participate in the planning of flood risk management in a river basin and in coastal areas
  - flood protection and other measures which improve flood risk management

- **Regional Council**
  - participate in the planning of flood risk management in a river basin and in coastal areas

- **National Flood Centre** (The Finnish Environment Institute and Finnish Meteorological Institute)
  - produce expert services

**OPERATIONAL ROLES**

- **Regional Rescue Services**
  - overall command during flood event;
  - protection and evacuation measures;

- **ELY Centre**
  - cooperation between authorities;
  - measures in the watercourse during flood threat and flood event;
  - hydrological monitoring, water situation and flood warning service together with the Finnish Environment Institute and Finnish Meteorological Institute;

- **Municipality**
  - Protect own properties;
  - help Rescue Services in protection and evacuation measures;

- **Regional Council**
  - participate in the planning of flood risk management in a river basin and in coastal areas

- **National Flood Centre** (The Finnish Environment Institute and Finnish Meteorological Institute)
  - produce flood predictions and warnings
Kokemäenjoki River Flood Risk Management Plan
The Kokemäenjoki River Basin

- Fourth largest river catchment in Finland, approx. 27 000 km$^2$
- Avg. flow 245 m$^3$/s
- High proportion of lakes in the catchment area, 11%
- Most of the largest lakes are regulated
- Eleven significant hydropower plants
- The ecological status is good in most of the lakes and mainly satisfactory in the main river
Flood Risk Management Plan (FRMP)

- The pilot FRMP was approved 2015
- Flood Group
- Several working groups
The Preliminary Flood Risk Assessment (PFRA)

- Historic data, climate change scenarios and GIS-based analysis
- Two significant flood risk areas
  - Cities of Pori and Huittinen
The Preliminary Flood Risk Assessment (PFRA)

Two areas of potential significant flood risk (APSFR)

1. The City of Pori
   - Direct damages 200-300 million € in serious ice jam flood, estimated probability 0.5 – 1 %
   - Objective is to avoid damages in the City center and industrial cites in these situations

2. The City of Huittinen
   - Direct damages 5-10 million € in 1 % probability open water flood and ice jam flood
   - Objective is to avoid damages for residential buildings and wastewater treatment plant in these situations
Flood Risk Mapping

Tulvariskikartta 1/1000 v toistuva tulva

Kartan selostus
Eriltäin harvinainen tulva, jonka laskennallinen toistuvuus on kerran 1000 vuodessa.

Tulvakartta on tuotettu SYKE:n yhtäpäivityksistä tulvakarttapalvelusta. Palveluntarjoaja pyrki tarjoamaan palvelua paremmasta ymmärtämisestä lähtien. Palvelun käyttäjät käyttävät kuitenkin palveluja ja sen sisältöä tärkeästi osalla omalla vastuullaan. Näin ottaen palveluntarjoaja ei vastaa minkään väittämistä tai vikkoista vaanjoista, jotka ehdottavat esimerkiksi palvella tai sen sisältöön liittyvät virheet, puutteet, aineiston käyttämisestä, kolmannen osapuolen vaatimustiloja, toimintakykyistä, palvenkaan sisällön muuttumisesta tai liikenteestä tai siitä, että palvelut eivät toimi tai että se ei sovi tiettyyn tarkoitukseen.

FRM Objectives

- **Objectives for the River Basin**
  - Minimize the overall damages
  - Increase water and ice retention above flood risk areas
  - The public are aware of the flood risk and can protect themselves and their properties
  - ...

- **Objectives for Cities of Pori and Huittinen**
  - Properties are protected against floods or prepared so that human lives are not in danger
  - Hospitals, cinder cards, etc. are protected and evacuation routes are secured
  - The environment and cultural heritage is not damaged so that they cannot be restored or recovered
  - ...

City of Pori

- 5,000 buildings damaged
- 20,000 people exposed
- Total damages 2 – 3 bill. €

9.12.2016 22
All types of measures, preventive, protective and preparedness, are needed
Natural water retention measures (NWRM)

- Controlled drainage, namely controlled subsurface drainage
  - recycling drainage water, subsurface irrigation
- Environmental river engineering and restoration
  - re-meandering, 2 stage channels
  - sedimentation ponds, bottom dams
- Wetlands
  - protection, restoration and creation
- Buffer zones, floodplains etc. areas that are prone to flooding or can be artificially flooded
- Runoff regulation and flooding of forest and peat land areas
- NWRMs in urban areas
Natural water retention measures

Controlled drainage

Environmental river engineering

Wetland

Temporarily flooded floodplain

Source: Finnish Drainage Association

Photo: SYKE

Photo: Anni Karhunen

Photo: EPO ELY-center
Summary and Conclusions

The Flood Risk Management Plan
- All types of measures, preventive, protective and preparedness, are needed
  - Prevention and preparedness measures are enough to tackle the “normal” floods
  - Protection is needed to avoid massive damages in the severe and rare flood events

The main challenges:
- Adaptation to the climate change – more ice jam floods in the future, more runoff during wintertime outside the growing season
- Adaptive lake regulations requires changes to regulation practices and legitimate regulation permits
- The reconciliation of flood risk management and other interests (e.g. hydropower, recreational use, nature conservation)
- Application of Natural Water Retention Measures requires changes to traditional agricultural water management practices and subsidies
  - 600 000 ha, 26% of total agricultural land (2,3 million ha), could be theoretically implemented
  - 50 000 ha implemented since 1995

Collaboration between authorities, municipalities and water body regulators is the key element to successful preventive flood risk management
Recent floods in Finland
2012 floods

- Wet year – the year was in parts of Finland wettest in 50 years
- Heavy rains in the beginning of October
  - 50 – 80 mm/day between 4th and 6th October
  - Soil, lakes, peatlands were already filled with water
- The return period of the floods were in some areas 1/150 years
Lapväärin-Isojoki

Toteutunut tulvahuippu

Ennustettu tulvahuippu
Lapväärin suojattuja kohteita, Kristiinankaupunki

Muovilla suojattu asuinrakennus

Asutuksen suojaksi rakennettu tilapäinen penger
Raju syystulva yllätti Kauhajoen

Uimahalli-urheilutalon koskipaikalla vesi virtaa korkealla. Virkun toiminta on tulvasta johtuen jo häiriöity. Uimahalli on suljettuna toistaiseksi.

Vesi saartoi tilan Kauhajoella: "Nyt karjaa suojaamaan"
Pluvial flood in the City of Pori

Photos: Jukka Kotiniemi
Pluvial flood in the City of Pori
16.8.2007
Things that went right and things that didn’t
Success stories

- No lives were lost and several houses were protected during the flood, even though the flood came suddenly and unpredicted.
- Online action to provide flood modelling and risk estimations was quick and prevented several flooding damages.
- Some flood protection structures were used first time in 30 years history to let the flood water spread into agricultural areas.
  → This saved the community of Ilmajoki from flooding.
Improvements needed

- **Common improvements**
  - The flood predictions needs to be improved
    - In 2012 the rain predictions underestimated the flood – Just couple of days before the floods everything seemed to be in control
  - More warning levels to raise awareness
  - Double check of the automatic water level meters (human check, parallel meters or live camera)
  - Improve stormwater flood risk management

- **Information flow and communication**
  - Establish **National Flood Center**
    - Shorten the gap between meteorological and hydrological expertise and information flow
    - Improve the information flow between authorities
  - Improve **early warning** to the municipalities, business properties and inhabitants