



7th Framework Programme
Regions of Knowledge
FP-Regions-2012-2013-1
Project n:o 319923



Water Management: An Economists Perspective

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Agenda

1. Motivation
2. Consequences of flooding
3. Flood protection
4. Incentives in the water sector
5. Hamburg
6. Some conclusions



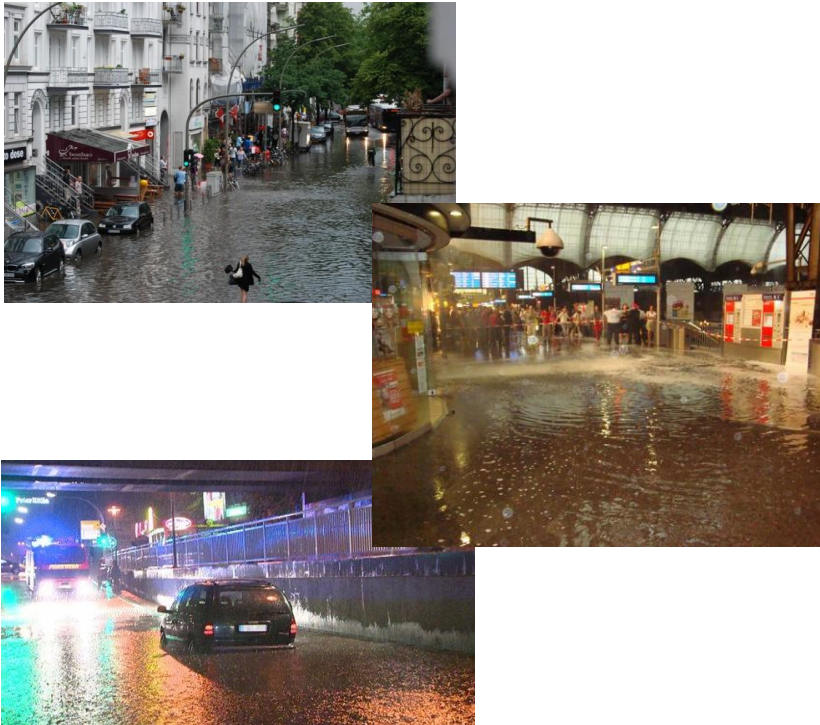
1. Motivation

- Flooding occurs frequently, due to heavy precipitation, overflowing of rivers etc.
- Flooding already poses problems in many areas, but consequences will probably become more severe with a changing climate.
- Cities are especially prone to water-related extreme events.
- Water management also offers chances for regions:
 - Competitive advantage in adaptation compared to other regions (i.e. lower vulnerability).
 - Business opportunities in technologies & services for protection and use.



2. Consequences

Hamburg, June 2011 & 2013:



Riga, January 2005 & July 2010:





2. Determinants of severity

Density

- Global urbanization trend:
Over 50% of the world's population lives in cities (2050: about 70%)
- Most of the urban world population will soon live in deltas, estuaries or coastal areas.
- Due to climate change about 2/3 of the world's largest cities will have to deal with new challenges such as flood hazards.
- Some rates of urbanization:
Europe: 72%, Germany 74%, Latvia 66%.
- In smaller countries assets and population are often concentrated in a few large cities, e.g. in Riga 35% of Latvia's population resides (Berlin: 4,3% of the German population).



2. Determinants of severity

Land-use and concentration of assets

- Geographical concentration of assets, e.g. cities vs. countryside
- Degree of soil-sealing: Structures vs. green areas
- Quantity and quality of the sewer network and other installations
- Quality and type of structure, building etc.
- Concentration (of valuables) in buildings

Level of protection

- Implemented measures
- Preparedness

Management

- Planning
- Information about potential risks
- Early-warning systems



3. Flood protection: Classification of measures

- **Grey**
 - Technical, e.g. expanding the sewer system (limited option)
 - Protecting buildings and infrastructure
 - Unsealing
- **Green**
 - Retention areas
 - Green roofs
- **Soft**
 - Land-use planning
 - Information
 - Insurances



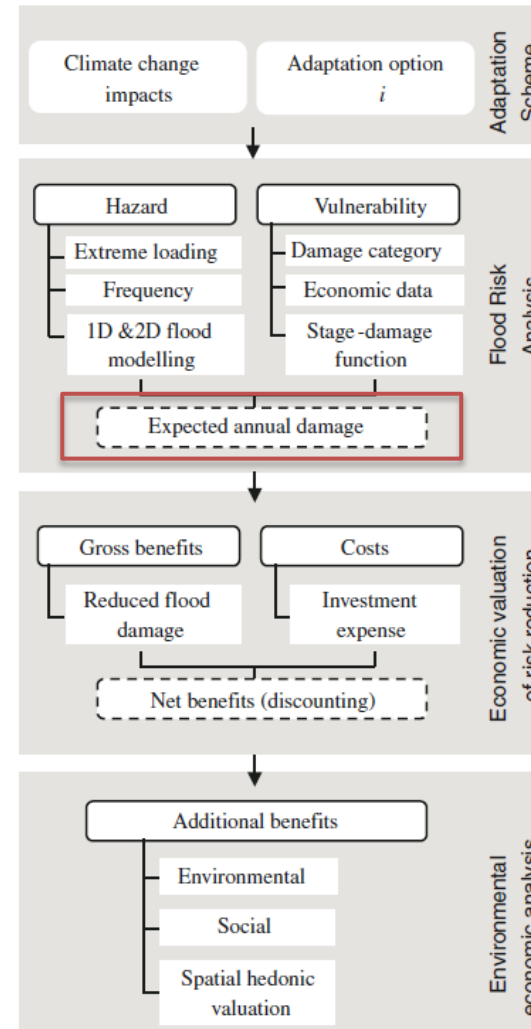
3. Choosing measures: Project appraisal

- Cost-Benefit-Analysis
 - Do the benefits (avoidance of expected damages) outweigh the costs (investment, maintenance, ...)?
- Multi-Criteria-Analysis
 - Do the benefits outweigh the costs under special consideration of non-market goods?
- Cost-Effectiveness-Analysis
 - Either “How can a certain (environmental) goal be achieved at the least costs?” or “How much does the achievement of a certain (environmental) goal cost?”
- Choice of the appropriate method
 - is case-dependent and
 - depends on the required accuracy, planning time, etc.



3. Choosing measures: An integrated approach

- Requirements
 - Information and data
 - Adequate modelling tools
 - Interdisciplinary work
- Problems
 - Accuracy vs. adequacy
 - Necessity vs. constraints (time, money)
 - ...



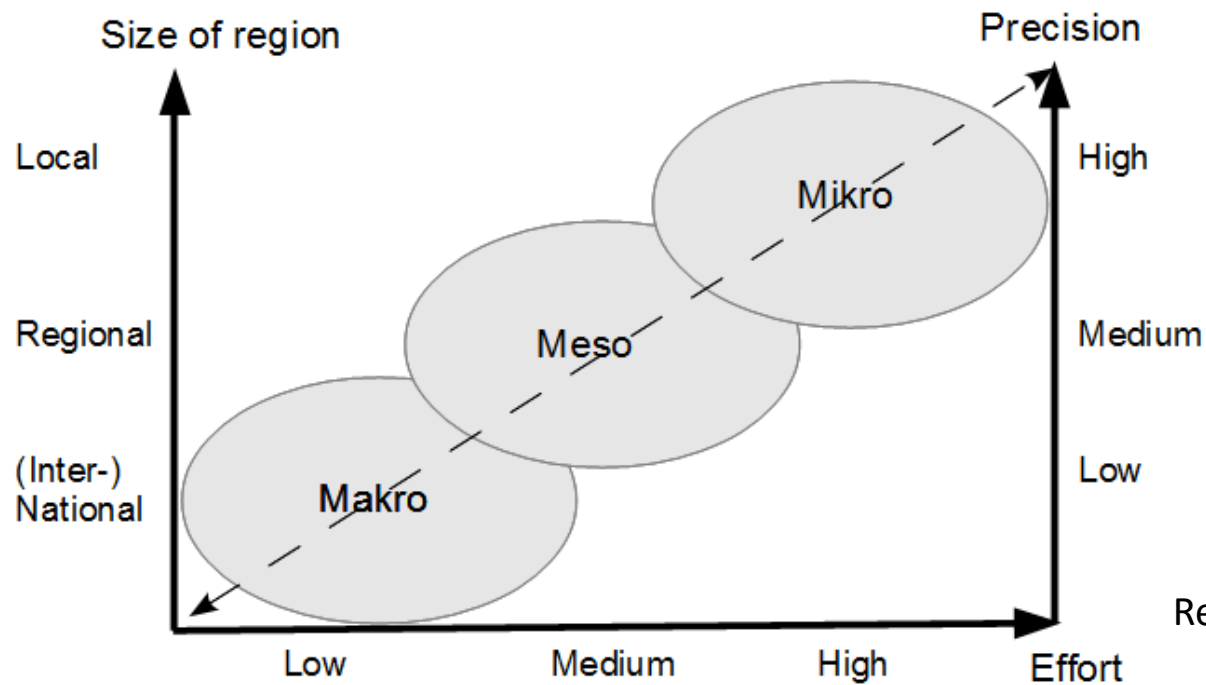
Zhou et al. (2013)





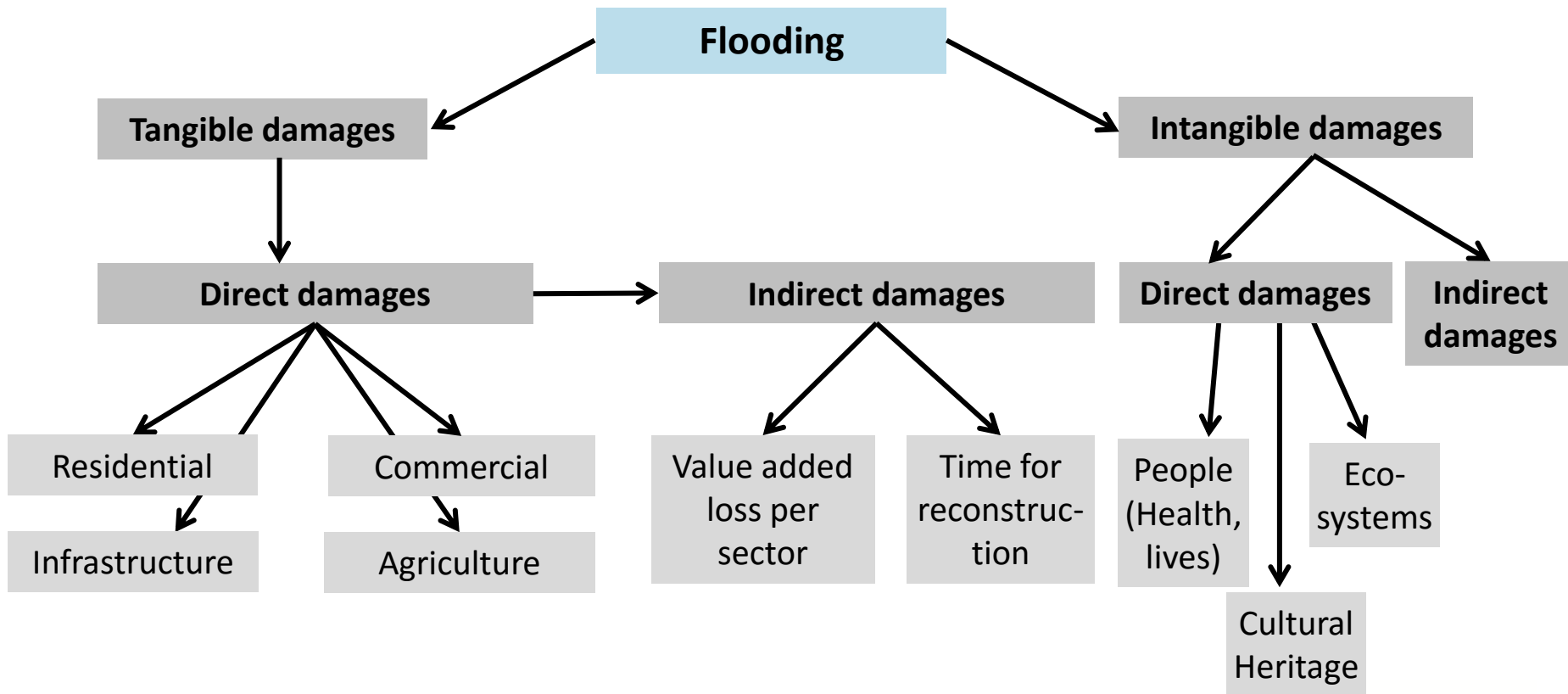
3. Estimating damages

- The effort (and costs) of estimating damages mainly depends on the geographical scale and the required accuracy:





3. Estimating damages





3. Estimating damages

Case study: Heavy rain in Hamburg in June 2011

- Public
 - Buildings **33.606 – 151.233 €**
 - Infrastructure **114.000 €**
- Private
 - Direct
 - Buildings **9,4 Mio. – 28. Mio. €**
 - Business **15 Mio. €**
 - Supply of Energy and Water **2,7 Mio. €**
 - Indirect (Loss of value added)
 - Loss of production (Retail industry) **20.500 €**
 - Loss of production (Hotel and restaurant industry) **105.600€**
- **Interval of overall damages** **27,3 Mio. – 46,1 Mio. €**



3. Responsibilities in flood protection

- Hypothesis: The beneficiary should pay.
- Thus
 - The state (e.g. federal state, city, municipality)
 - finances those measures, which (mainly) benefit the general public.
 - implements these measures either via public, private or hybrid organizations/companies.
 - The private sector
 - finances those measures, which mainly benefit private property.
 - implements these measures at its own disposal (e.g. technical, insurance).
- But in some instances state interventions are necessary to induce private actions.
 - Regulations (e.g. building codes), fees (see split tariffs), etc.
 - Information campaigns
 - R&D to reduce costs or to invent new technologies



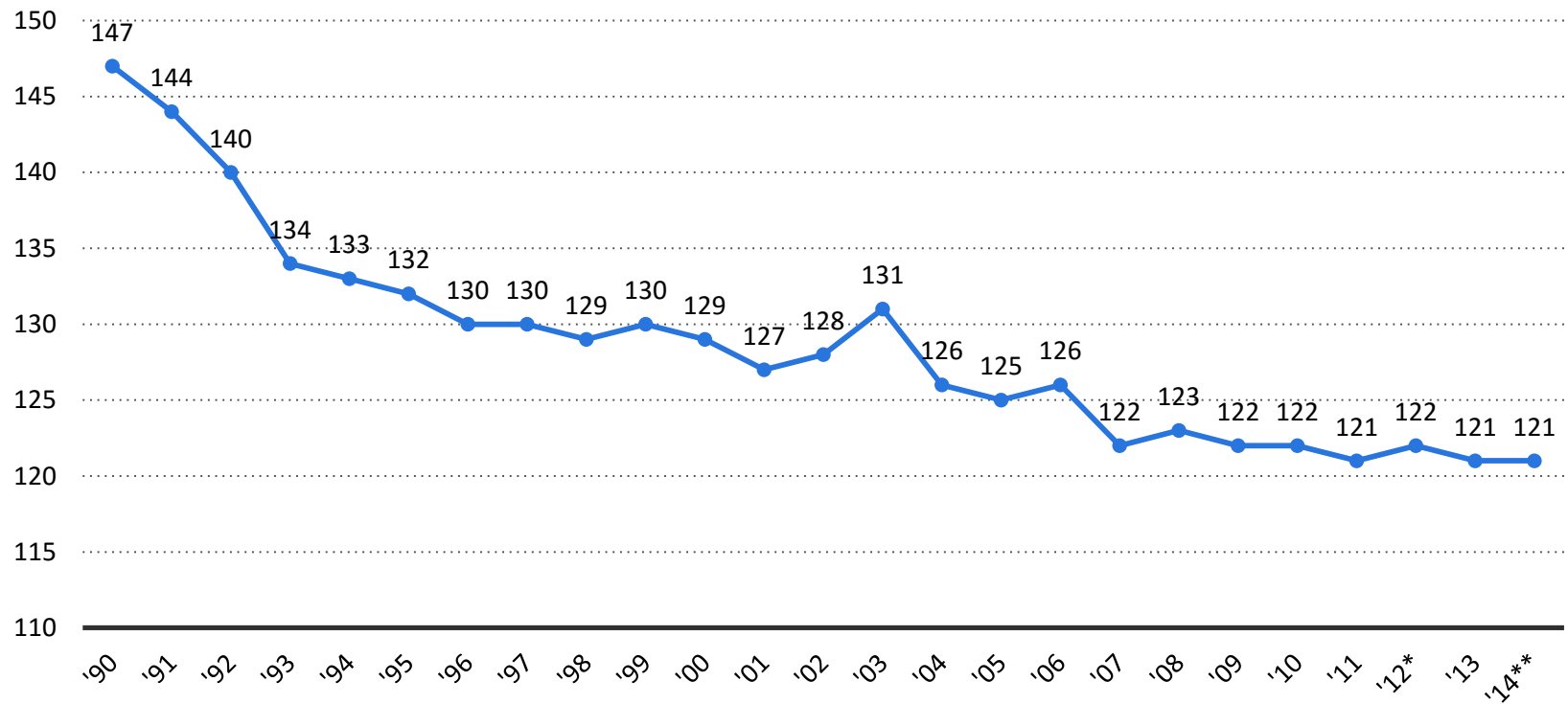
4. Financing in the water sector

- Purposes of tariffs
 1. Setting incentives for water use and water discharge
 2. Financing of water infrastructure
 - Tariff systems
 1. Standard approach
 - Amount of freshwater used (Euro/m³)
 2. Split tariffs
 - a. Sewage water: Discharge and cleaning of used freshwater
 - b. Rainwater: Discharge of precipitation
- Measurement:
- a. Amount of freshwater used (Euro/m³)
 - b. Amount of sealed surface (Euro/m²)



4. Financing in the water sector

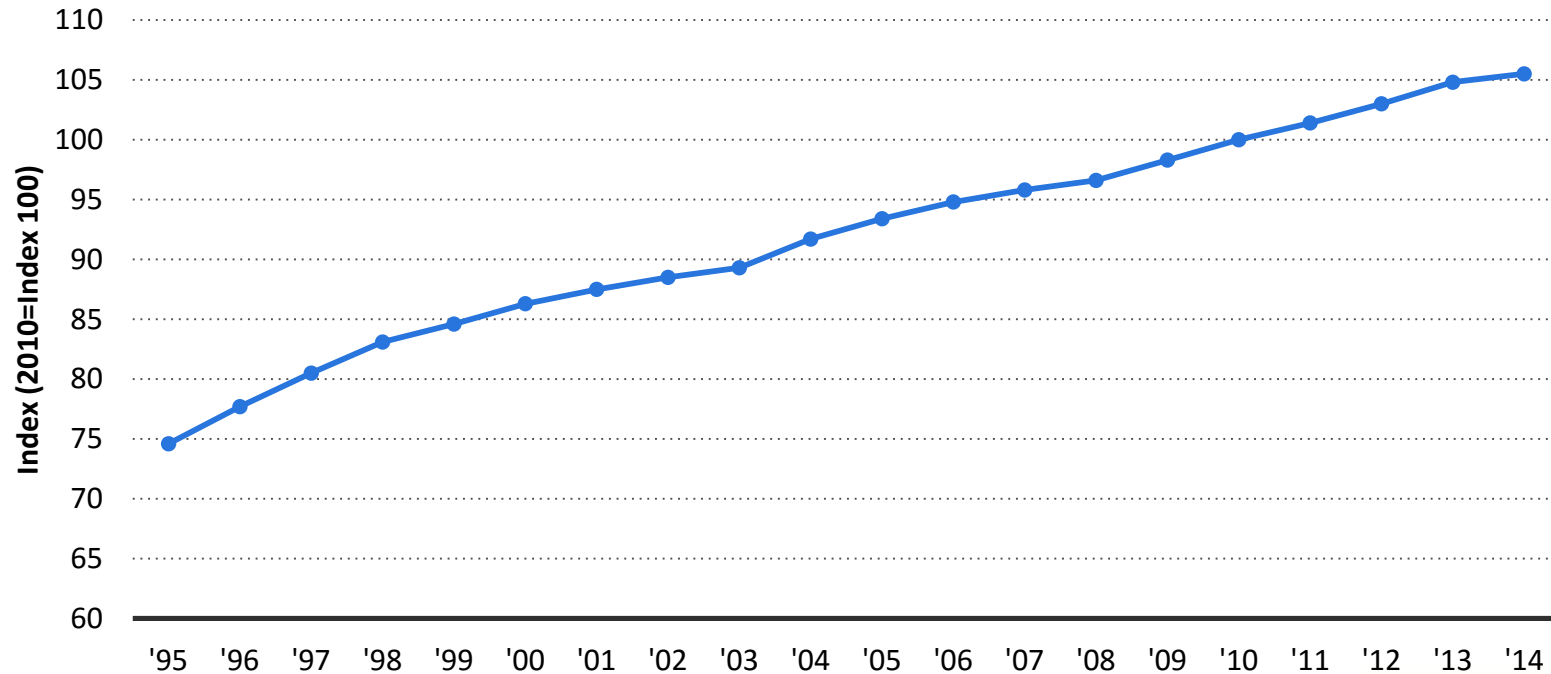
Water use in Germany (Liter per capita per day 1990-2014)





4. Financing in the water sector

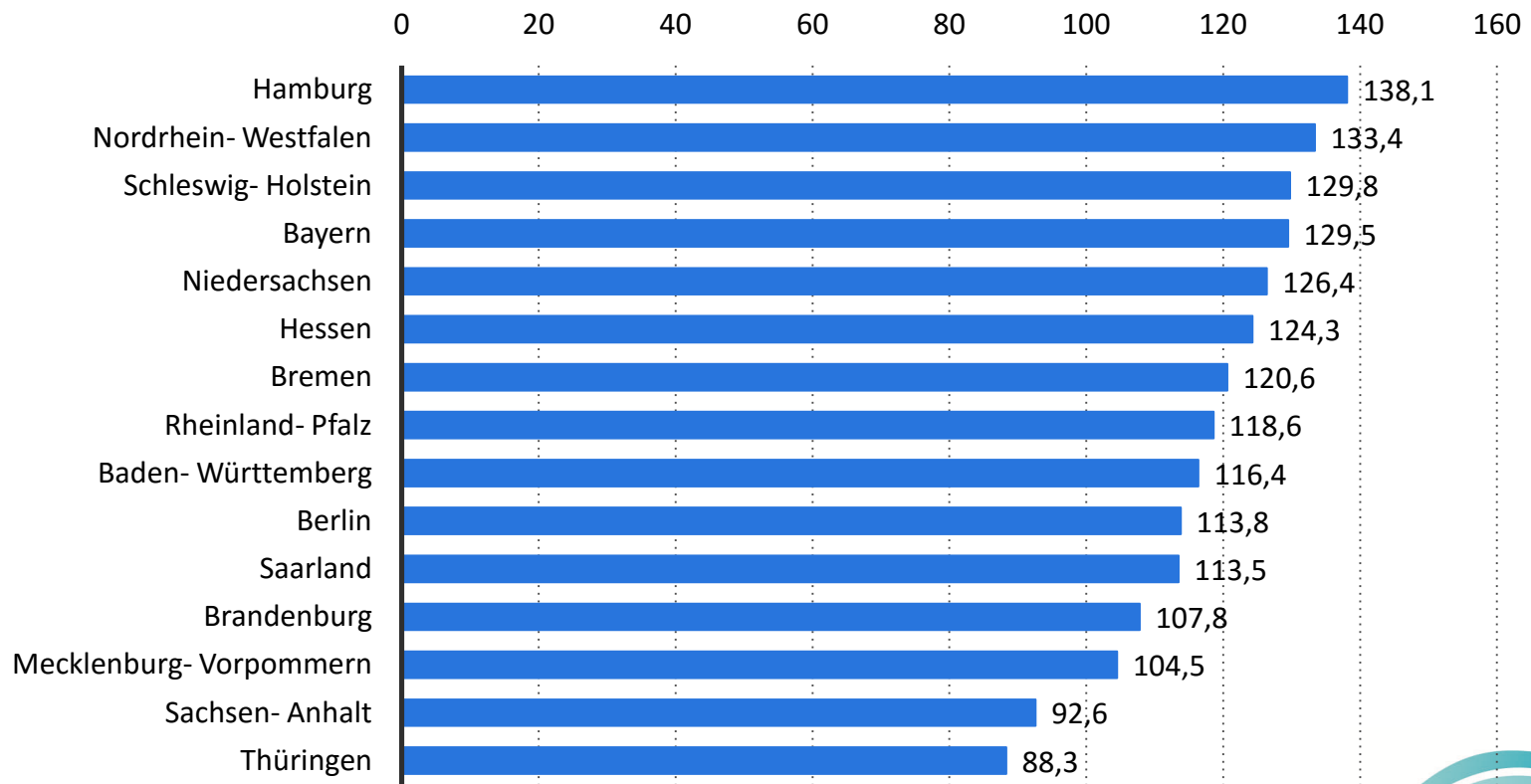
Water-prices in Germany (1995-2014, Index 2010=100)





4. Financing in the water sector

Daily water-use per federal state in Germany in 2013 (Liter per capita)

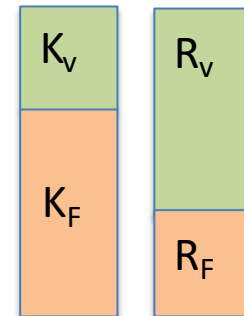




4. Financing in the water sector

Water use

- Reduction of water use in Germany due to
 - Change in behavior (prices, attitudes)
 - Substantial water saving in the commercial sector (i.e. the share of households in consumption has increased)
 - Demographic change (in some regions)
- Costs in the water sector are largely fixed (K_F).
Problem: - Less water-use erodes the revenues of water utilities.
Solutions: - Increase of the fixed component in the tariff.
- System Development Charges for new installations
- Potential rate structures
 - Flat (€/month)
 - Uniform (€/m³)
 - Seasonal (€/m³ summer > €/m³ winter)
 - Inclining (tiered) (stepwise €/m³)





5. Hamburg

- Some data
 - 1,77 mio. inhabitants (metro-region: 5,0 mio.)
 - City is still growing:
50-100.000 new residents by 2030 expected
 - 75.522ha of space
 - Population density: 2.330 inhabitants/km²
 - Soil sealing still going on:
Currently around 100ha per year
- Challenge:
From rainwater disposal to
decentralised rainwater management

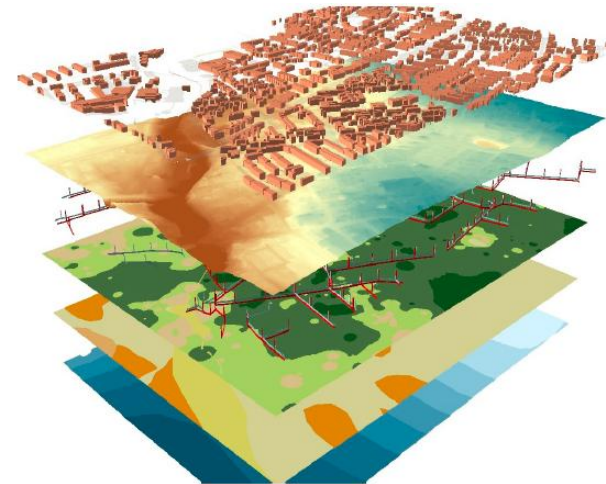




5. Hamburg

RISA (**R**ain-**I**nfra**S**tructure-**A**daptation)

- Project running from 2009-2014
- Initiated and conducted by public authorities and administration, supported by external consultants.
- Result: Sophisticated structural plan on rainwater management in Hamburg
- Goals:
 - Flood risk management
 - Foster resilience against climate change
 - Realize co-benefits

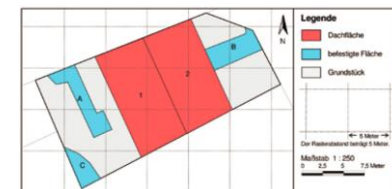


- For more on the project: <http://www.risa-hamburg.de/>



5. Hamburg

- **Green roof strategy**
 - Implemented in July 2015
 - Promotes voluntary installation of green roofs on private buildings (households and commercial) with up to 60% of the material costs and with a maximum amount of 50.000€ per building
- **Split water-tariffs**
 - Implemented in May 2012
 - Differentiation between sewage water and rainwater
 - No additional net revenues for the water utility (HamburgWasser)
 - Main challenge: Management of adjustment, because each area had to be recorded (google maps + questionnaire)





6. Some conclusions

- Rainwater management becomes more important with increasing urbanization and a changing climate.
- This poses problems for a number of regions, but also offers chances for well-adapted regions or those offering solutions for the problems at hand.
- Solutions require (among others) mindful planning and implementation as well as properly devised regulations.



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BALTIC FLOWS

Thank you for your attention.