Floods and forest
Opening opportunities

Natural Hazards Risk Management Workshop

Assessing risk interactions and lessons learned

Solsona (Catalonia, Spain) 4th of October, 2017

ir. Bertram L. de Rooij –MSc

landscape architect | senior researcher

WAGENINGEN UNIVERSITY & RESEARCH

PLACARD interchange

net risk work

Flood risk

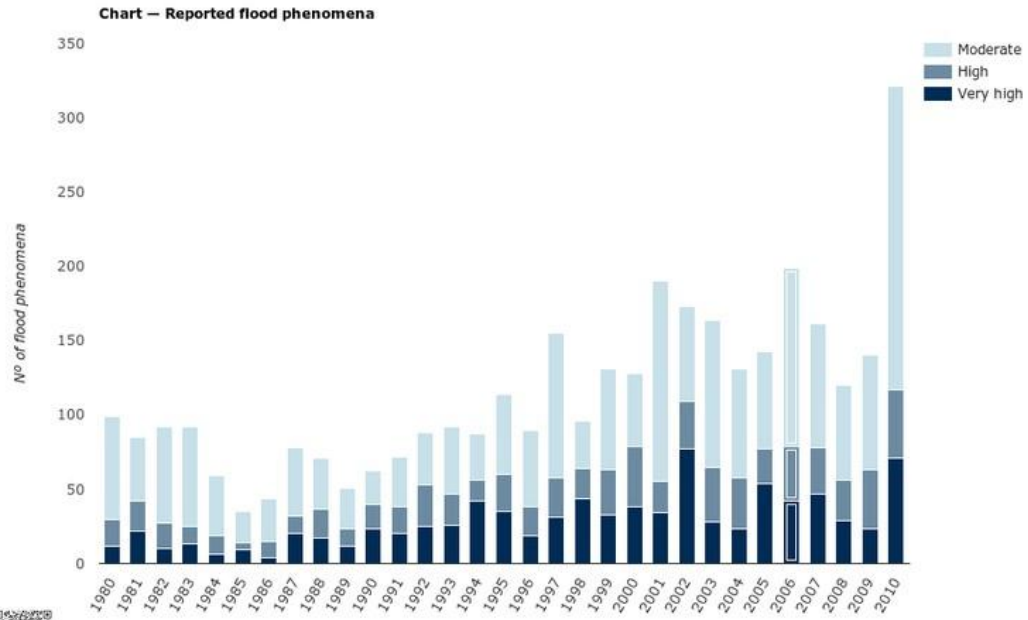
- Floods are natural phenomena which cannot be prevented
- **'Flood' means the temporary covering by water of land not normally covered by water.**
- 'Flood risk' means the combination of the **probability of a flood event** and of the **potential adverse consequences** for human health, the environment, cultural heritage and economic activity associated with a flood event. Some **human activities** (such as increasing human settlements and economic assets in floodplains and the reduction of the natural water retention by land use) and **climate change** contribute to an increase in the likelihood and adverse impacts of flood events.

The Floods Directive
Directive 2007/60/EC of the European Parliament
and of the Council of 23 October 2007 on the assessment and management of flood risks)

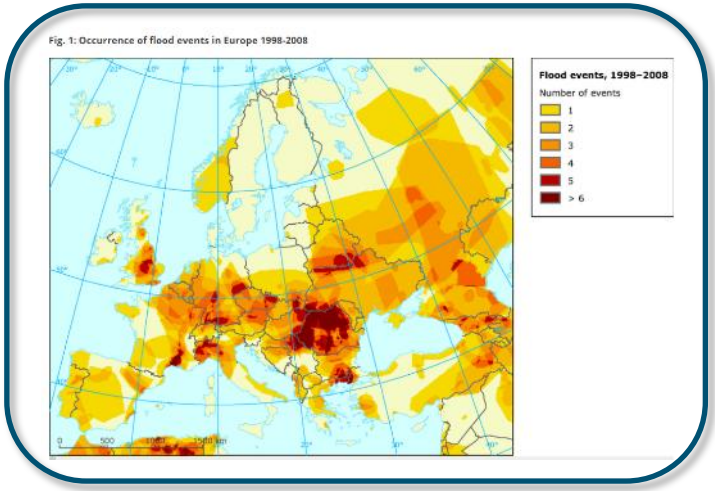
WAGENINGEN
UNIVERSITY & RESEARCH

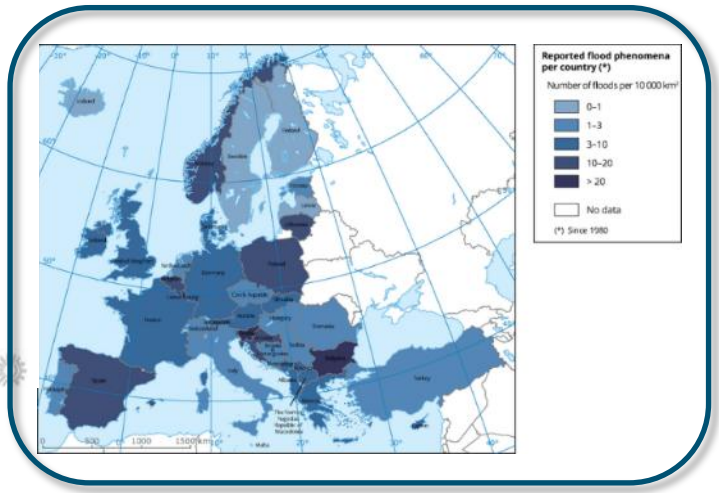
Flood risk

- Floods: trend and impact



Flood severity is an assessment of flood phenomena magnitude. It considers the reported values on frequency, reported total damage (in Euros and descriptive classes), number of flood events within one flood phenomena unit and severity classes as reported in the Dartmouth Flood Observatory database (ETC/ICM, 2015b). All phenomena with fatalities are in the 'very high' severity class.
Reported flood phenomena, EEA 2015





WAGENINGEN
UNIVERSITY & RESEARCH

Flood risk

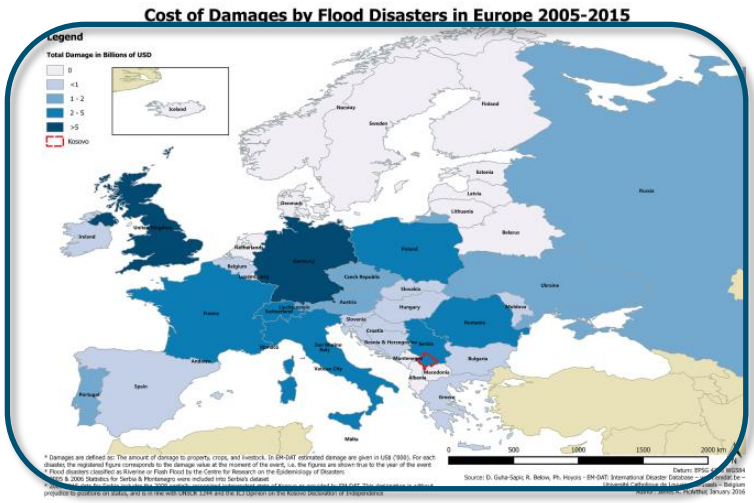
- 1500 floods since 1980 (half of it, since 2000!)
- global warming: increase occurrence and frequency in large parts of EU
- pluvial floods and flash floods, which are triggered **by intense local precipitation events**, are likely to become more frequent throughout Europe. However, quantitative projections of changes in flood frequency and magnitude remain highly uncertain.

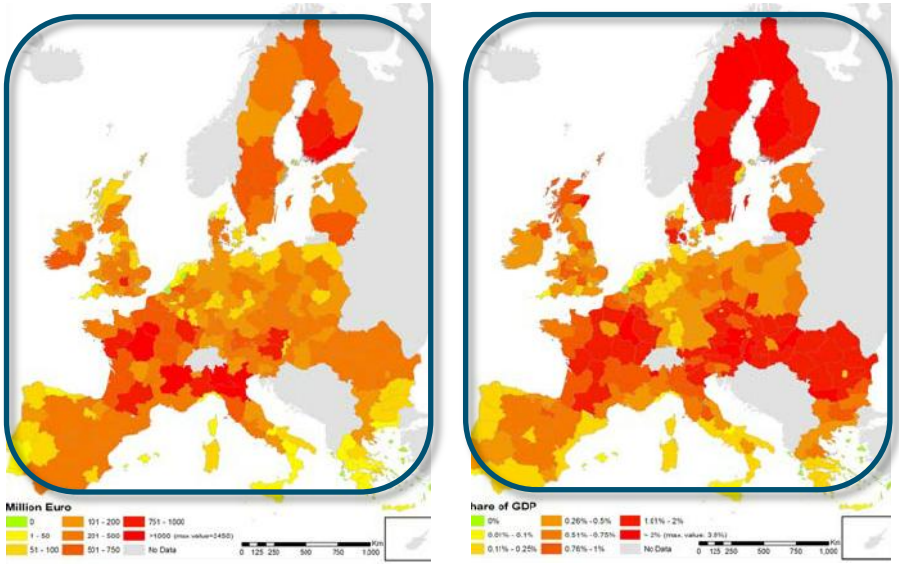
EEA Indicator assessment River Floods, December 2016

Flood risk

- Extreme floods 1/16 years > 1/10 years (2015)
- 2000-2012 4.6 billion damage
  2050 23.5 billion damage expected
  (2/3 because of socio-economic growth, 1/3 due climate change)

Jongman et al. (2014). Increasing stress on disaster-risk finance due to large floods. Nature Climate Change 4, 264–268.





Lugeri et al 2010, Annual-Average-Damage-AAD River Flood Risk and Adaptation in Europe – Assessment of the Present Status

WAGENINGEN
UNIVERSITY & RESEARCH

Flood risk

- Large efforts in risk reduction downstream

Expenditure Water safety Netherlands

Veessen-Wapenveld High water protection (picture by SWI.be)

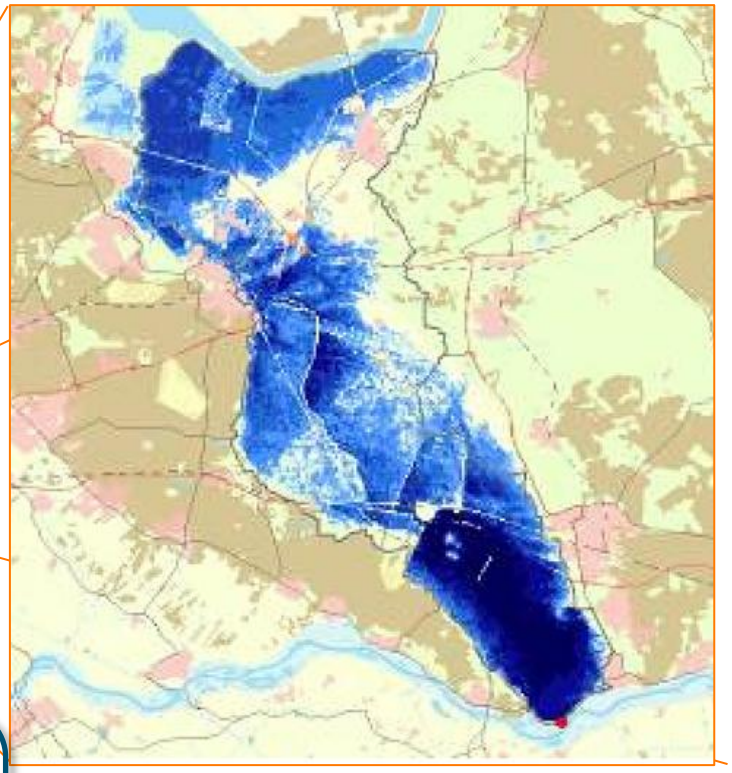
De Noordwaard

€1 billion per year

WAGENINGEN
UNIVERSITY & RESEARCH

Flood risk

- Risks are high



- Delta 4 river basisn
- 26% is below sea level
- 60% is vulnerableto flooding
- Most heavily urbanised country in EU (83%)

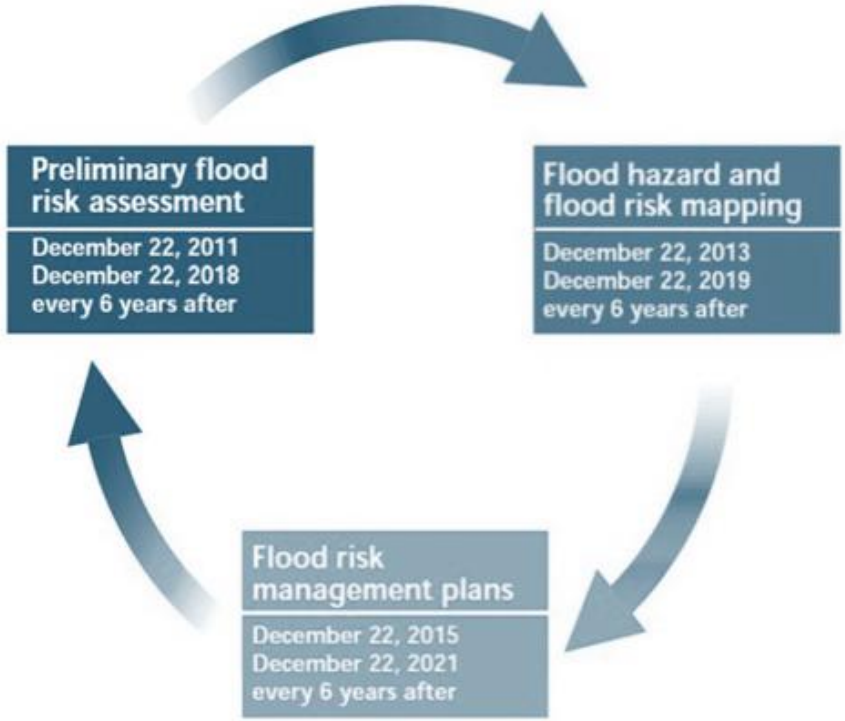
Example
Grebbedijk Wageningen
- 5 km length
- Below present norm

Risk= **250.000 people affected**
27 billion euro potential damage

WAGENINGEN
UNIVERSITY & RESEARCH

Flood risk management

→ Flood Directive (2007)



Flood risk management plans should focus on prevention, protection and preparedness. With a view to giving rivers more space, they should consider where possible the maintenance and/or restoration of floodplains, as well as measures to prevent and reduce damage to human health, the environment, cultural heritage and economic activity. The elements of flood risk management plans should be periodically reviewed and if necessary updated, taking into account the likely impacts of climate change on the occurrence of floods

Development of river basin management plans under Directive 2000/60/EC and of flood risk management plans under this Directive are elements of integrated river basin management. The two processes should therefore use the mutual potential for common synergies and benefits, having regard to the environmental objectives of Directive 2000/60/EC, ensuring efficiency and wise use of resources while recognizing that the competent authorities and management units might be different under this Directive and Directive 2000/60/EC.

Floods and forest

River and streams Europe,
Robbi Bishop-Taylor, University of New South Wales

Forest map Europe (EFI, 2011)

WAGENINGEN
UNIVERSITY & RESEARCH

Floods and forest

- Floods and forest: under pressure
- Floods and forest: the solution?
- Main gaps and difficulties: Opening opportunities

Floods and forest

- Floods and forest: under pressure

Flood plain forests

-Impact of river and flood management

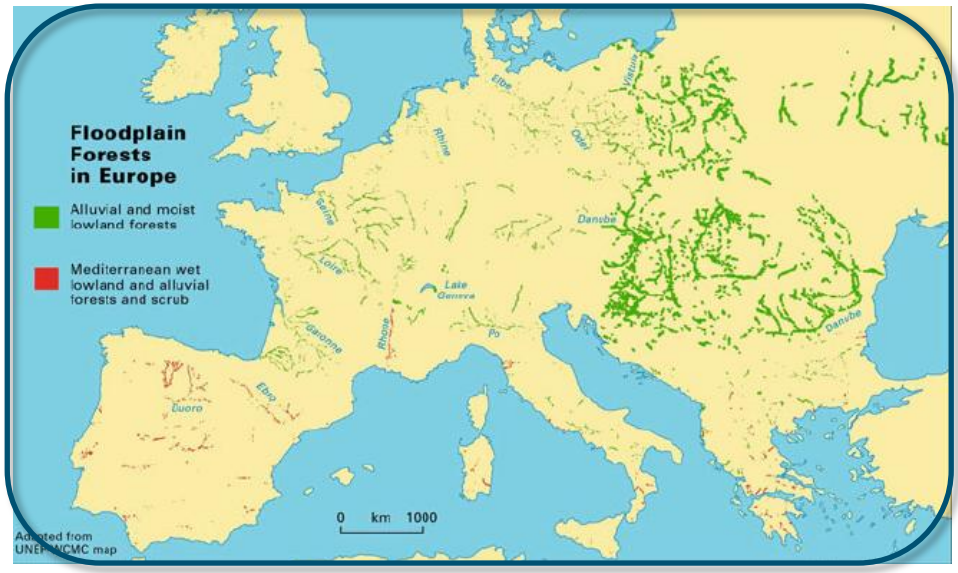
-Decreased water availability

-Sediment delivery patterns

-Reduction of connectivity

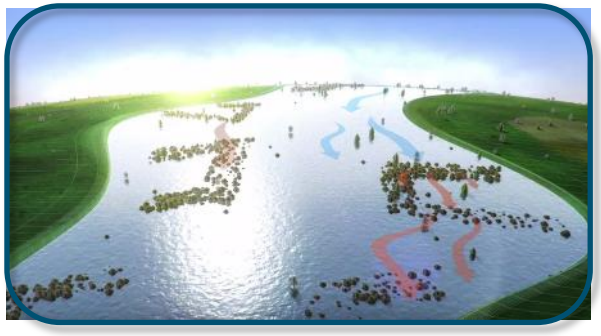
-Land use change

European floodplain forests, excluding northern Europe, (Hughes et al. 2008)



Floods and forest

- Floods and forest: under pressure



Images Project Stroomlijn NL

Floods and forest

- Floods and forest: under pressure

Forests upstream

- (In)direct damage trees
  > changing soil conditions, sedimentation, physical damage, insect and diseases

- Strongly depends on type of flood, duration and tree species

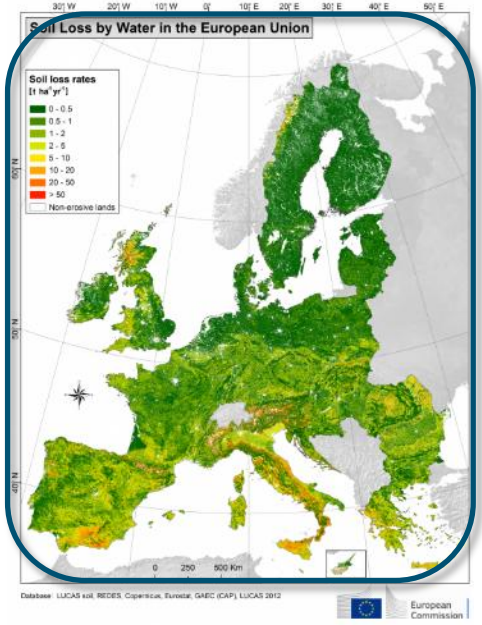
WAGENINGEN
UNIVERSITY & RESEARCH

Floods and forest

- Floods and forest: under pressure

Forests upstream

- Soil erosion
- Accessibility



Soil erosion by water (tonnes per ha per year)
Joint Research Centre

Floods and forest

- Floods and forest: the solution?

Water system approach: capturing, storing and draining
Peter Dauvellier

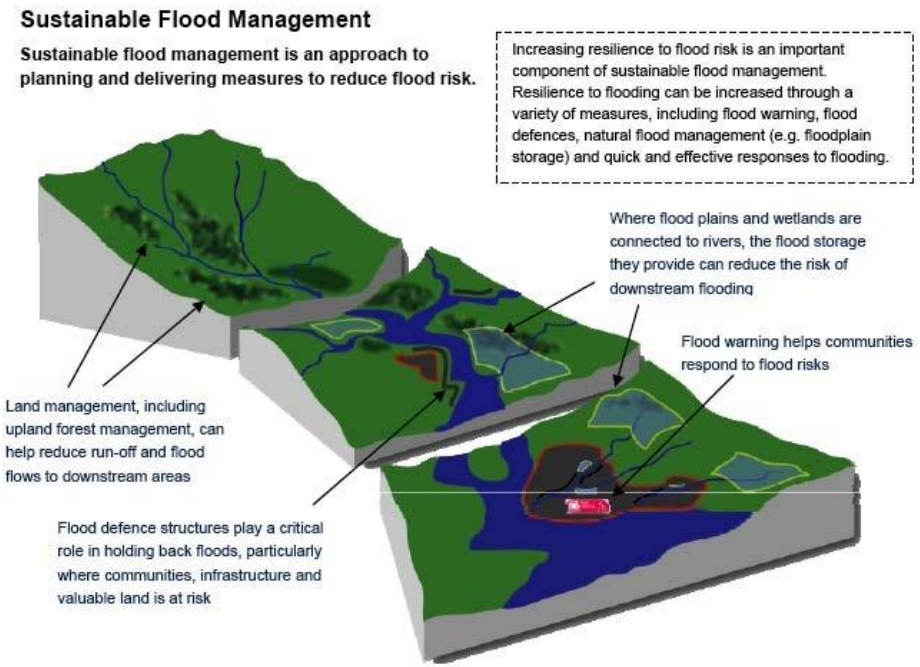
Floods and forest

- Floods and forest: the solution?

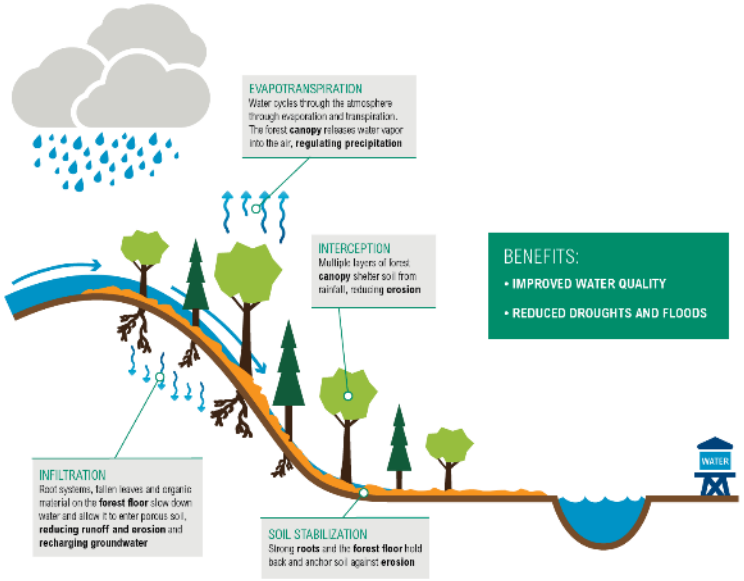
  Natural water-retention measures are measures implemented to prevent extreme hydrological events. Among the major ecosystem types, **forests have a large potential for water retention**. Forests retain excess rainwater, and help to moderate run-off patterns, preventing extreme run-offs. **This in turn reduces damage from flooding, and also helps to mitigate the effects of droughts.**

  Water-retention potential of Europe's forests, EEA Technical report No 13/2015

Floods and forest



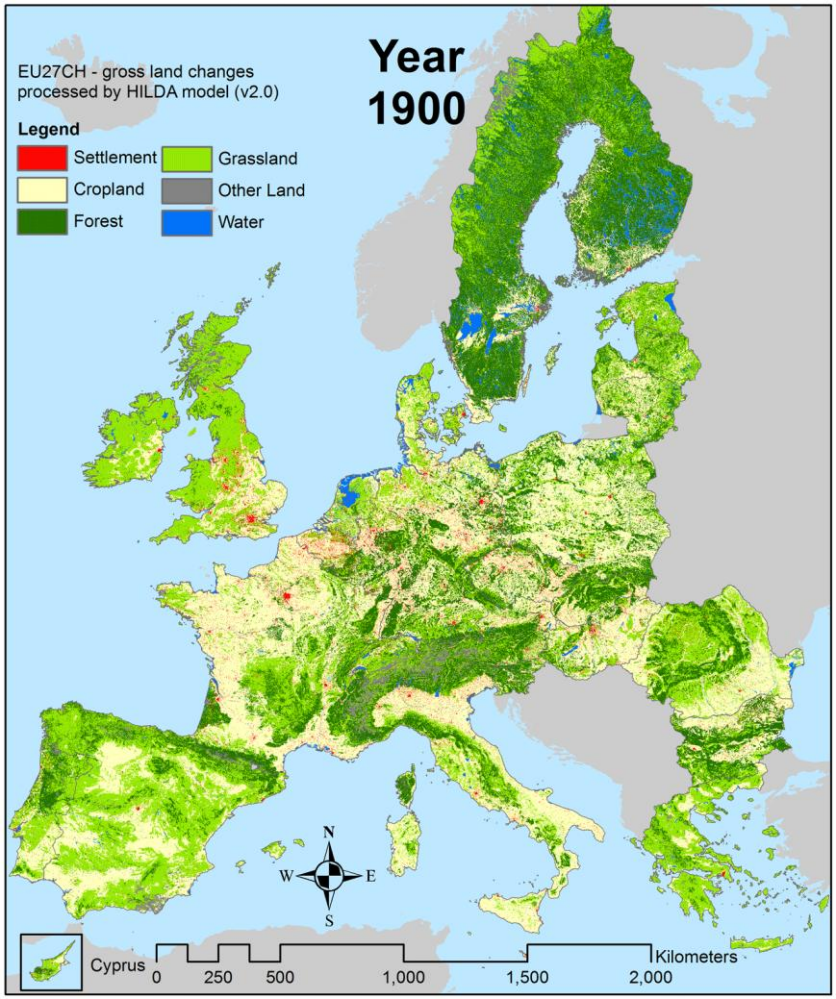
Sustainable Flood Management,
Scottish Government, SEPA and the Environment Agency
2011

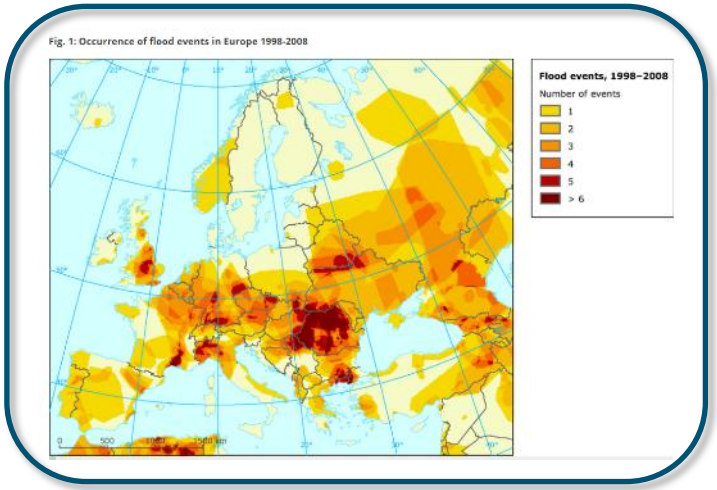


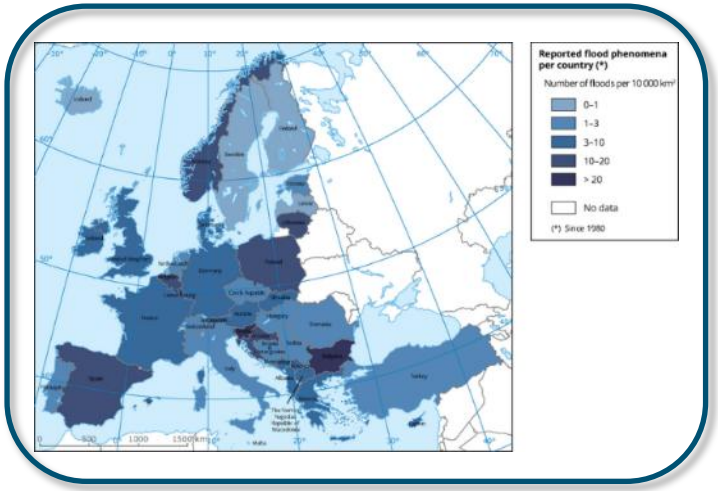
How Natural Infrastructure Supports Water security,
World Resources Institute, 2016

WAGENINGEN
UNIVERSITY & RESEARCH

Floods and forest







Floods and forest

- Forest hydrology and relations catchment complex
- Water retention capacity, reduction runoff and magnitude in flows highly depends on pre-event groundwater levels, site conditions and forest type
- Runoff coefficients of rainstorms increase with pre-event groundwater levels
- **Forest buffers have generally not provided substantial flood reduction**, and if so, only at very local scale

European Perspectives on Forest Hydrology, C. de Jong (in: *Forest Hydrology: Processes, Management and Assessment, September 2016)*

Floods and forest

- Floods and forest: the solution?

Flood plain forests

- Present focus on discharge and flow
- Reconstruction of wetlands and flood plains in practice not reconstruction of flood plain forest

WAGENINGEN
UNIVERSITY & RESEARCH

Floods and forest

- Main gaps and difficulties opening opportunities

Floods and forest

- Further improvement of full understanding complex system and influence of forest hydrology (at different scales)[1]
- Merge contradictory approaches of forest hydrology management with respect to droughts and floods[2]

> Towards integrative, evidence-based guidelines

Sources:
1. Water-retention potential of Europe's forests, EEA Technical report No 13/2015
2. European Perspectives on Forest Hydrology, C. de Jong (in: Forest Hydrology: Processes, Management and Assessment, September 2016)

WAGENINGEN
UNIVERSITY & RESEARCH

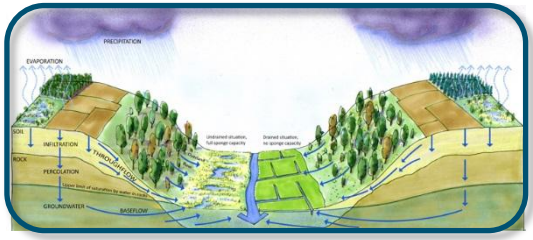
Floods and forest

- Bringing together existing recommendations

- ✓ Reduce density of stand of stocking
- ✓ Shorter length of cutting cycles
- ✓ Planting hardwoord species
- ✓ Regeneration from seedlings rather than sprout

- ✓ Towards water-sensitive forest management
- ✓ Benefits for the regulation of water flow, the maintenance of water quality and the severity of droughts

ClimWat Adapt 2010-2011



Retain in mountains to delay discharge
Van Winden et al., H2O Waternetwerk 2014

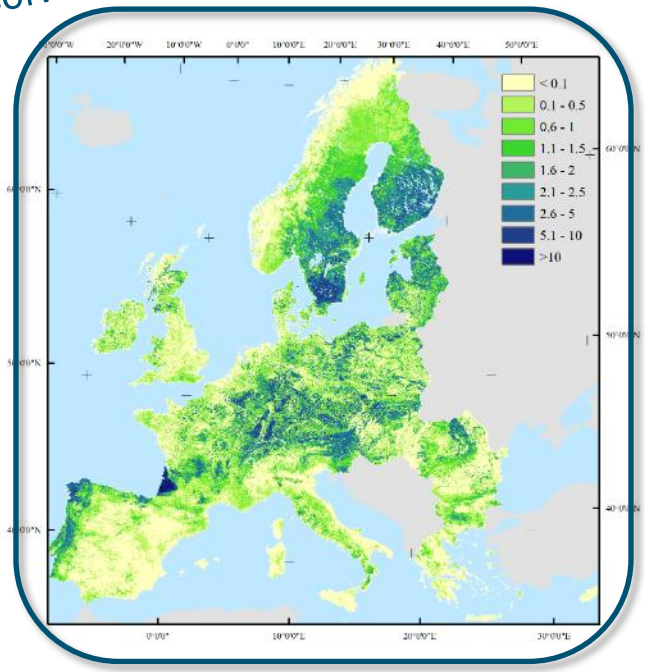
- ✓ Road orientation hydrological significant: aligned slope-parallel
- ✓ Logging trals that reduce soil permeability kept as short as possible
- ✓ Delay discharge as long as possible, focus on retaining in sufficiently large retention areas
- ✓ Water pathways, riverbed and bank structures and vegetation in the valleys should be kept as natural as possible
- ✓ If all small catchments in a larger watershed are managed with a view to water retention, the occurrence of damaging floods may be reduced

Water Retention by Land-use 2003-2006

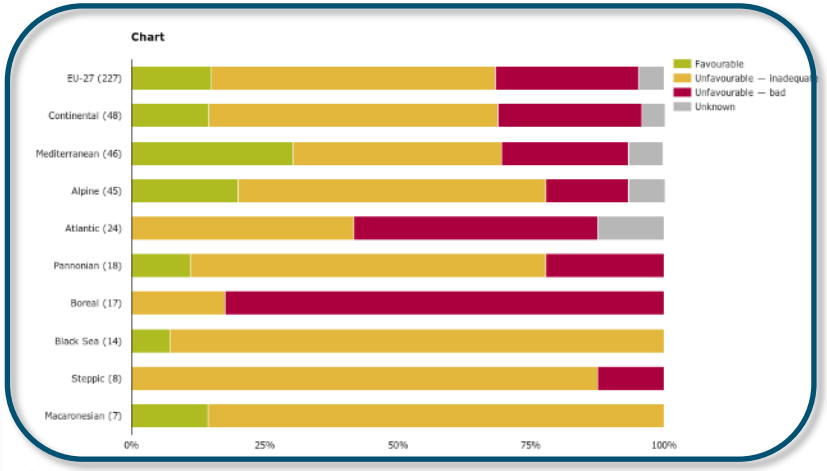
Floods and forest

- Bringing in full perspective...

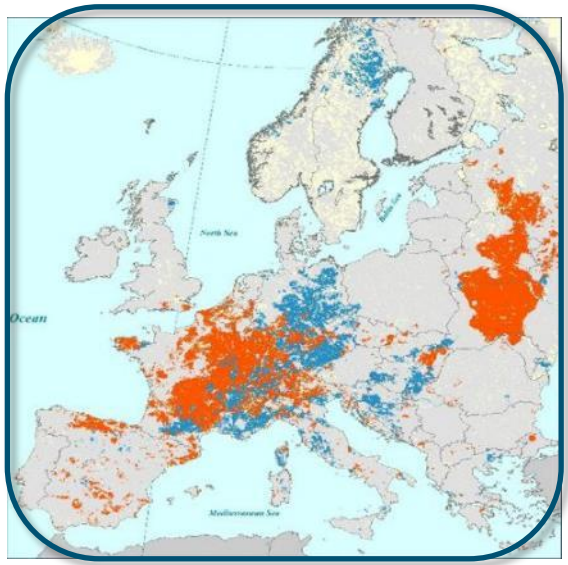
Not only problem solving...



Predicted wood production (in cubic meters per ha of land per year) in Europe averaged over the period 2000-2010 (2015 Elsevier B.V.)



Conservation status of forest habitat types by region SOER, EEA 2015



Areas with the lowest soil moisture content since 1990 in July 2015 (in red) and in July 2003 (in blue). Source: JRC-EDEA database (EDO), EU, 2015

WAGENINGEN
UNIVERSITY & RESEARCH

Floods and forest

...but also creating opportunities....

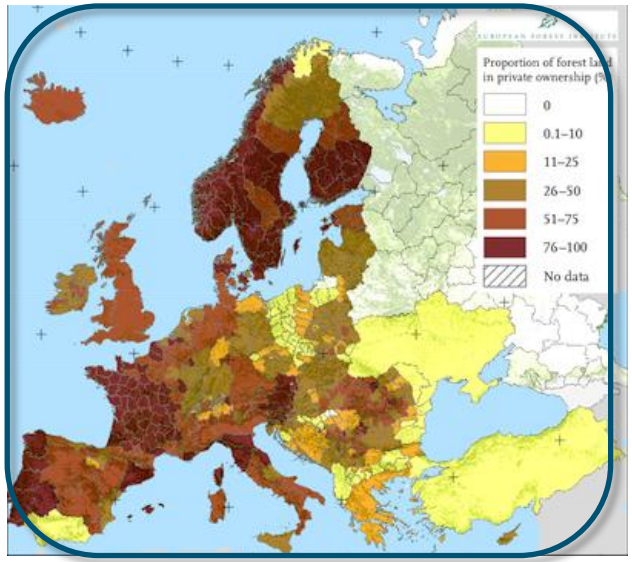
- ...generating robust, multiple value and 1 toolbox!

Examples combinations 'downstream':
Overdiepse Polder, Spiegelwaal Nijmegen, Zwakke Schakel Waterdunen

WAGENINGEN
UNIVERSITY & RESEARCH

Floods and forest

- ...and joint action! We all benefit...



It starts with:

... what story to tell,

... to who

...and how to get to shared action!

Floods and forest

Floods and forest=

Opening opportunities

Thanks for your attention

bertram.derooij@wur.nl

Let's Connect!

WAGENINGEN
UNIVERSITY & RESEARCH