Integrated Flood Risk Management

– setting the scene

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Asia-Netherlands Water Learning week 2018

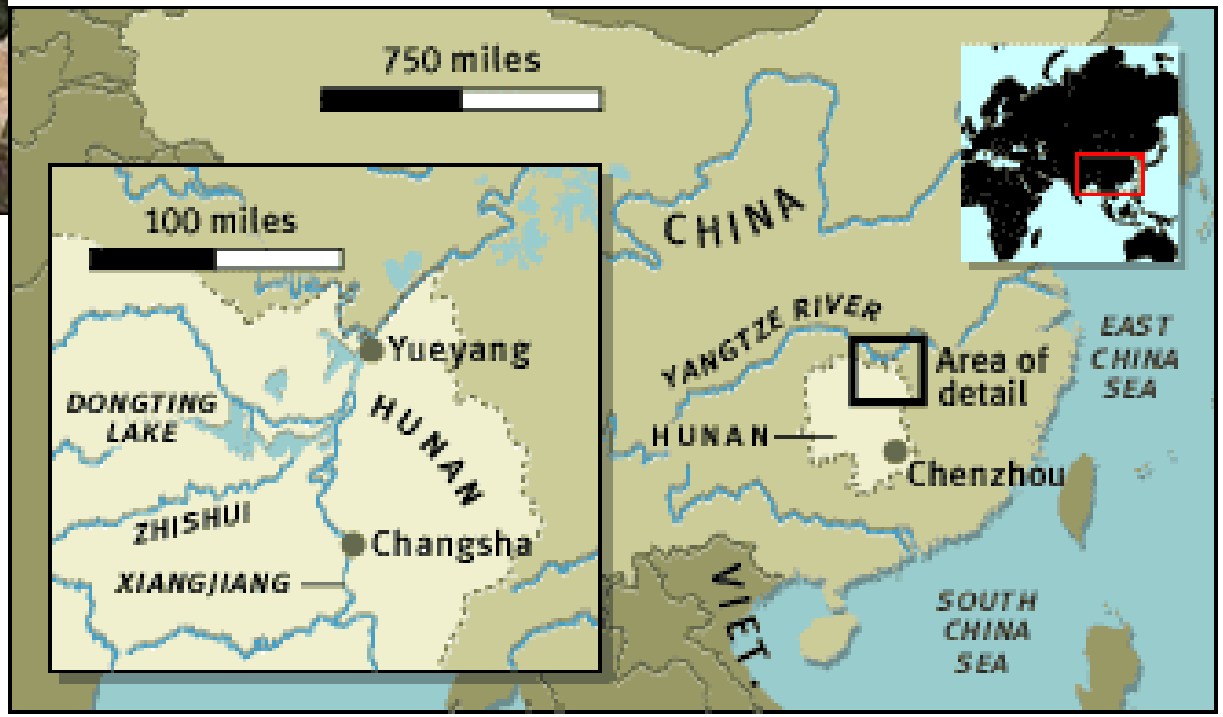
Content presentation

1. Flooding - causes
2. Integrated Flood Risk Management (IFRM)
3. Nature based solutions
4. How to deal with flooding
    A. Riverine flooding
    B. Flash floods
    C. Urban flooding
    D. Coastal flooding
5. Flooding in Asia

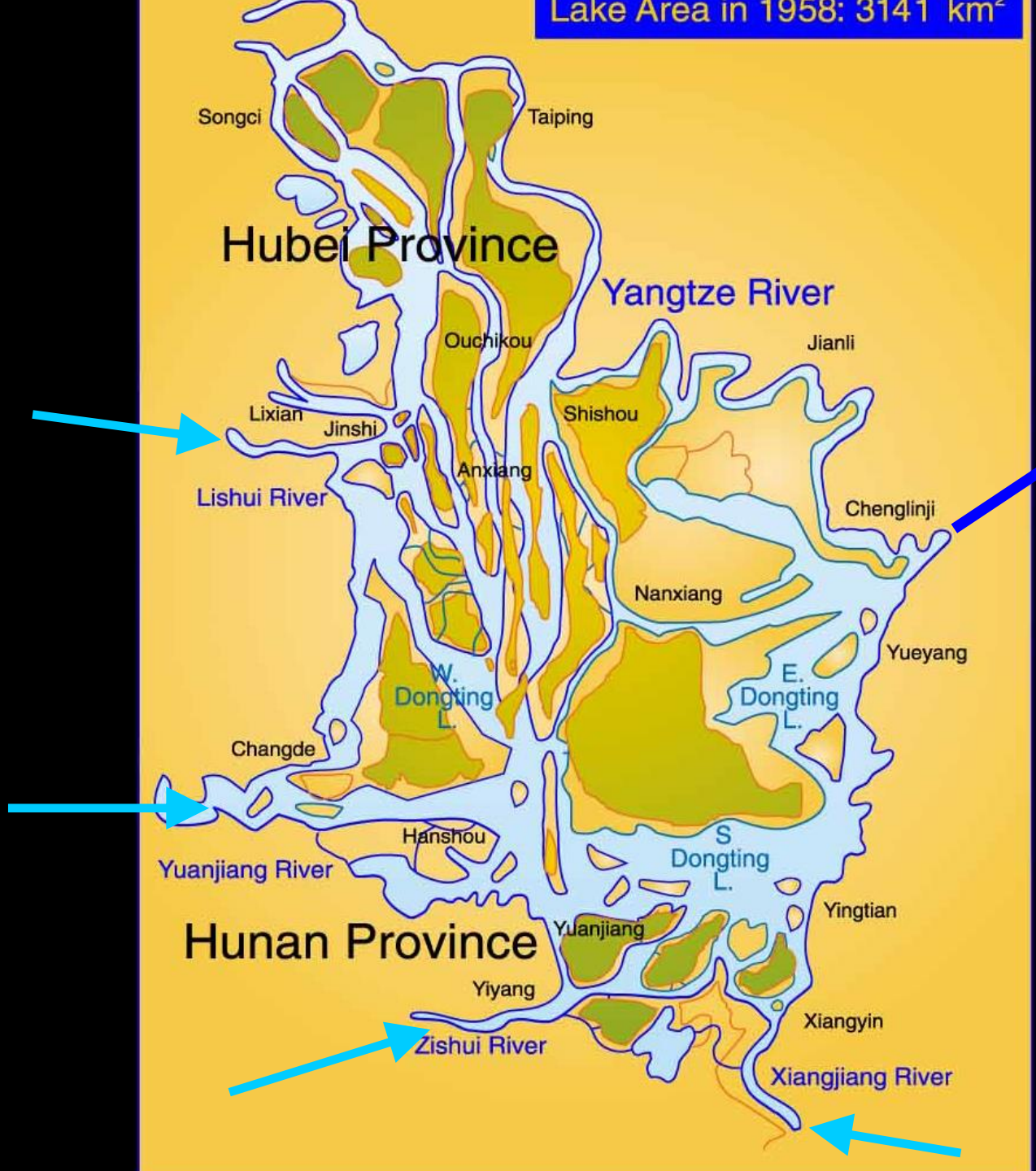
1. Flooding – a natural process

- Climate variability: dry and wet periods
- Floods can be beneficial:
  - fertilization of flooded area
  - recession agriculture
  - quite some old civilizations are based on the benefits brought by floods
  - river delta's are very productive, partly thanks to floods
- Why are floods bad?
  - because we decided to live in (low lying) areas where we better should not live
  - and we do things that make floods more dangerous

Dongting Lake (August 2002)

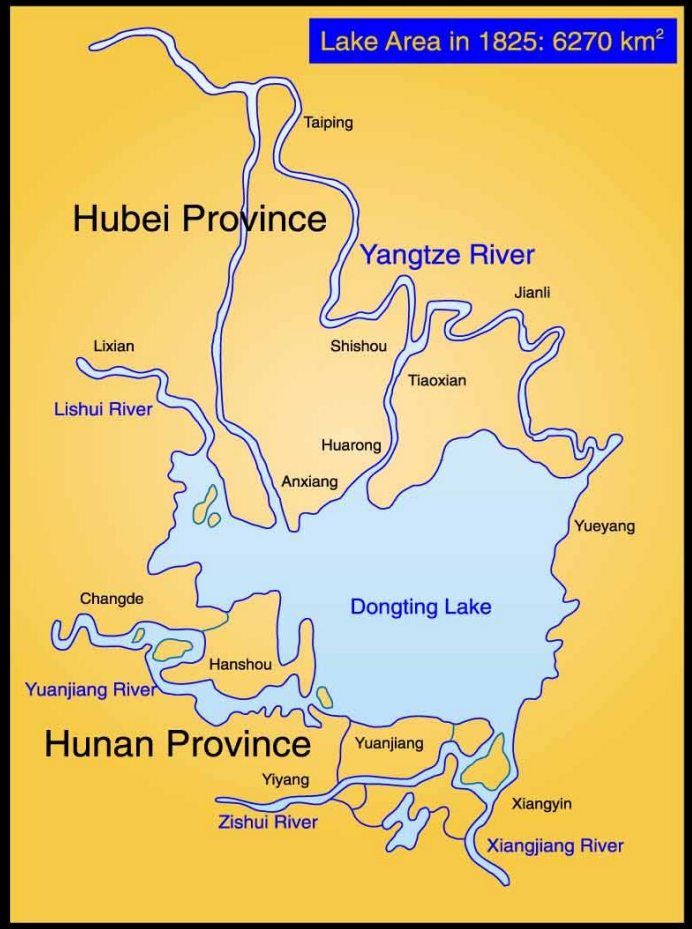



Lake Area in 1825: 6270 km²
Taiping
Hubei Province
Yangtze River
Jianli
Lixian
Shishou
Tiaoxian
Lishui River
Huarong
Anxiang
Yueyang
Changde
Dongting Lake
Hanshou
Yuanjiang River
Hunan Province
Yuanjiang
Yiyang
Xiangyin
Zishui River
Xiangjiang River


Lake Area in 1958: 3141 km²
Songci
Taiping
Hubei Province
Yangtze River
Ouchikou
Jianli
Lixian
Jinshi
Shishou
Anxiang
Lishui River
Chenglinji
Nanxiang
Yueyang
W. Dongting L.
E. Dongting L.
Changde
Hanshou
S Dongting L.
Yuanjiang River
Yingtian
Hunan Province
Yuanjiang
Yiyang
Xiangyin
Zishui River
Xiangjiang River

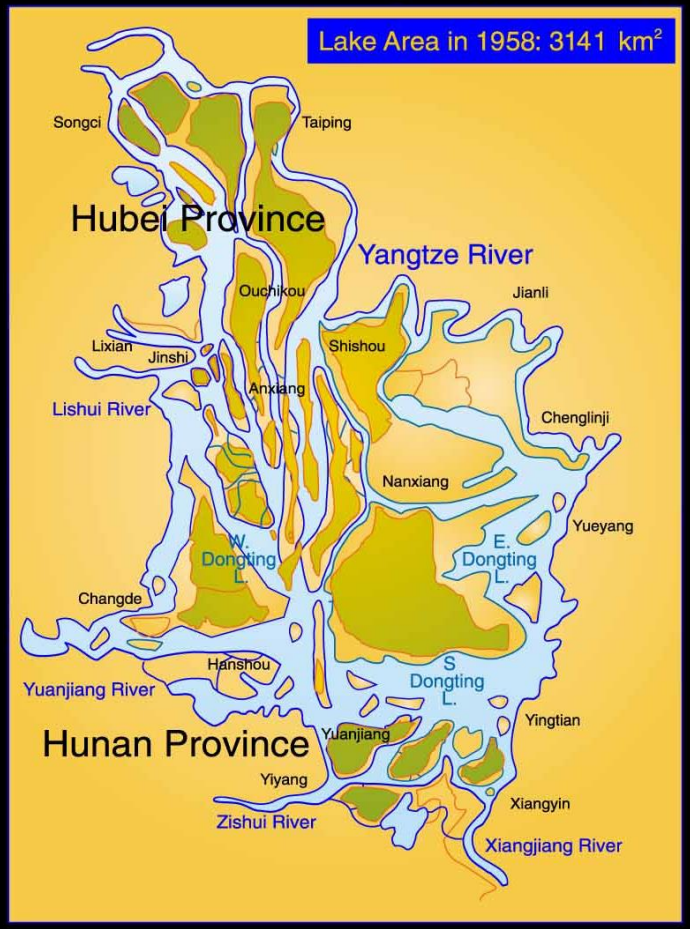
1825

Evolution Of Dongting Lake (1)



1958

Evolution Of Dongting Lake (4)



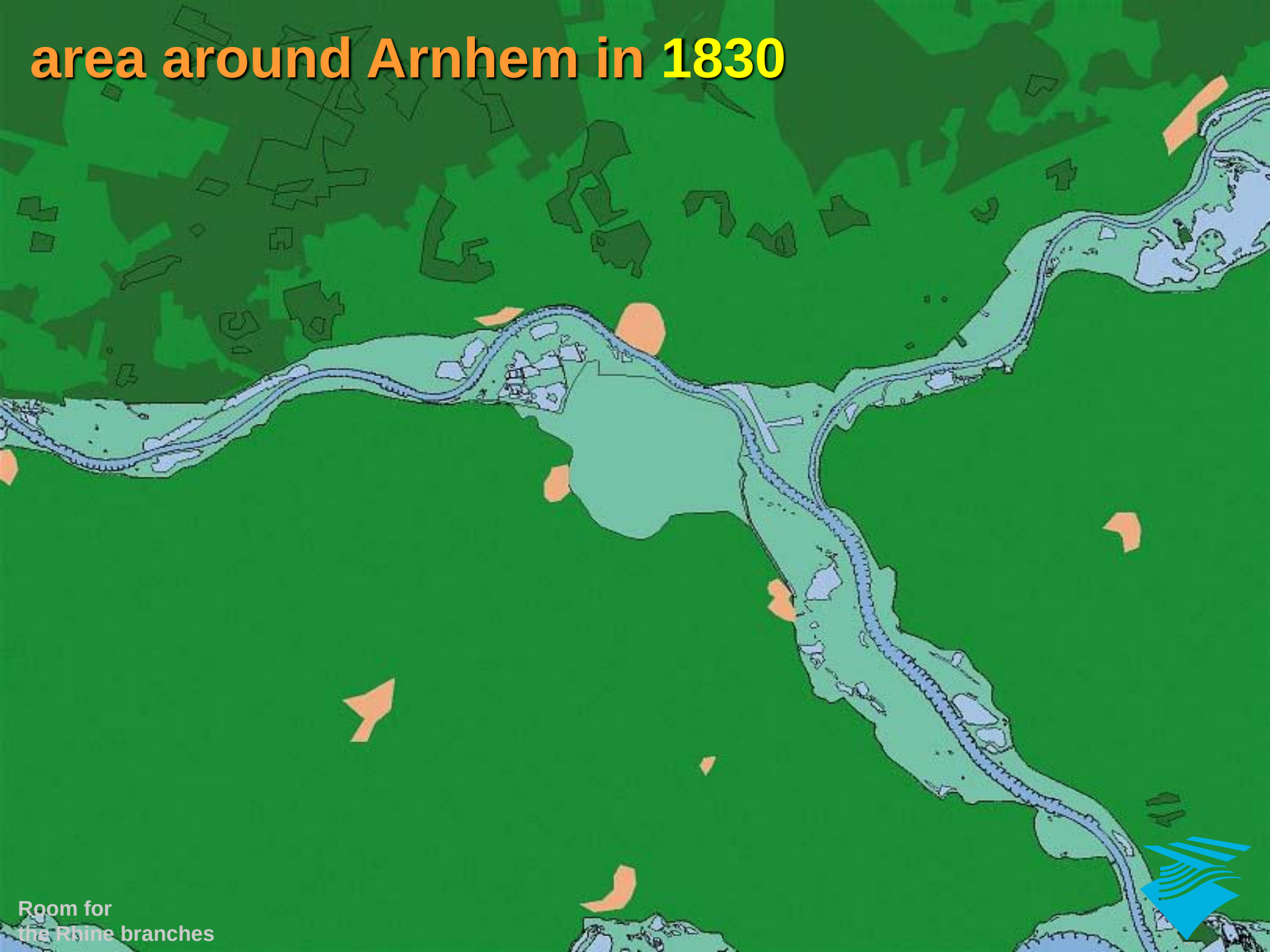
Source: WWF-China / KUN

Flooding Dongting Lakes

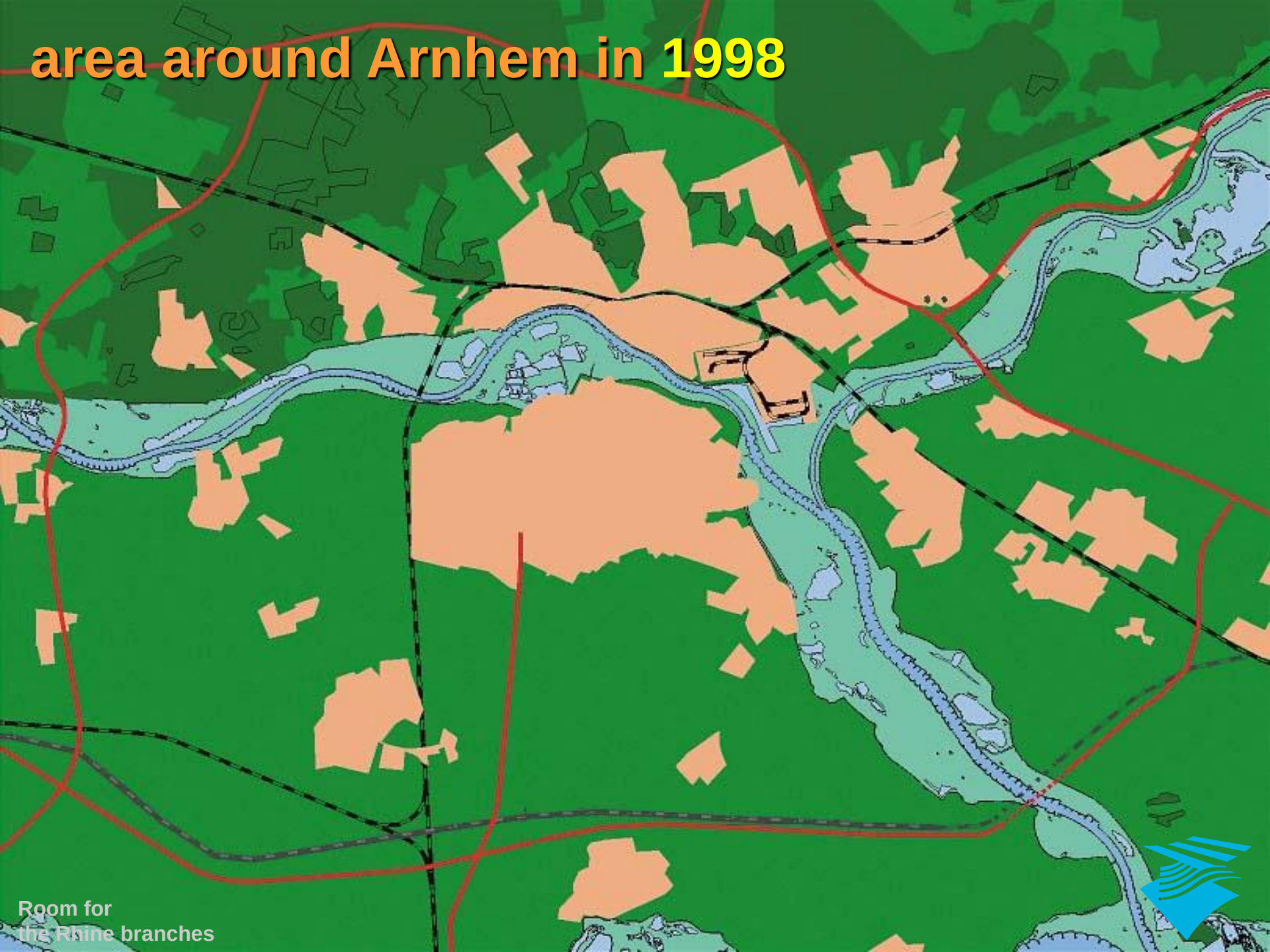
- Surface water area reduced till less then half
  - dikes, polders, etc
  - same discharge volume will lead to twice the water level rise
- More people and more value in ‘floodplain’ and polder areas
- Changes in land-use upstream ?
  - e.g. deforestation ?
- Changes in climate ?


NO ORDZEE
Amsterdam
DUITSLAND
BELGIE

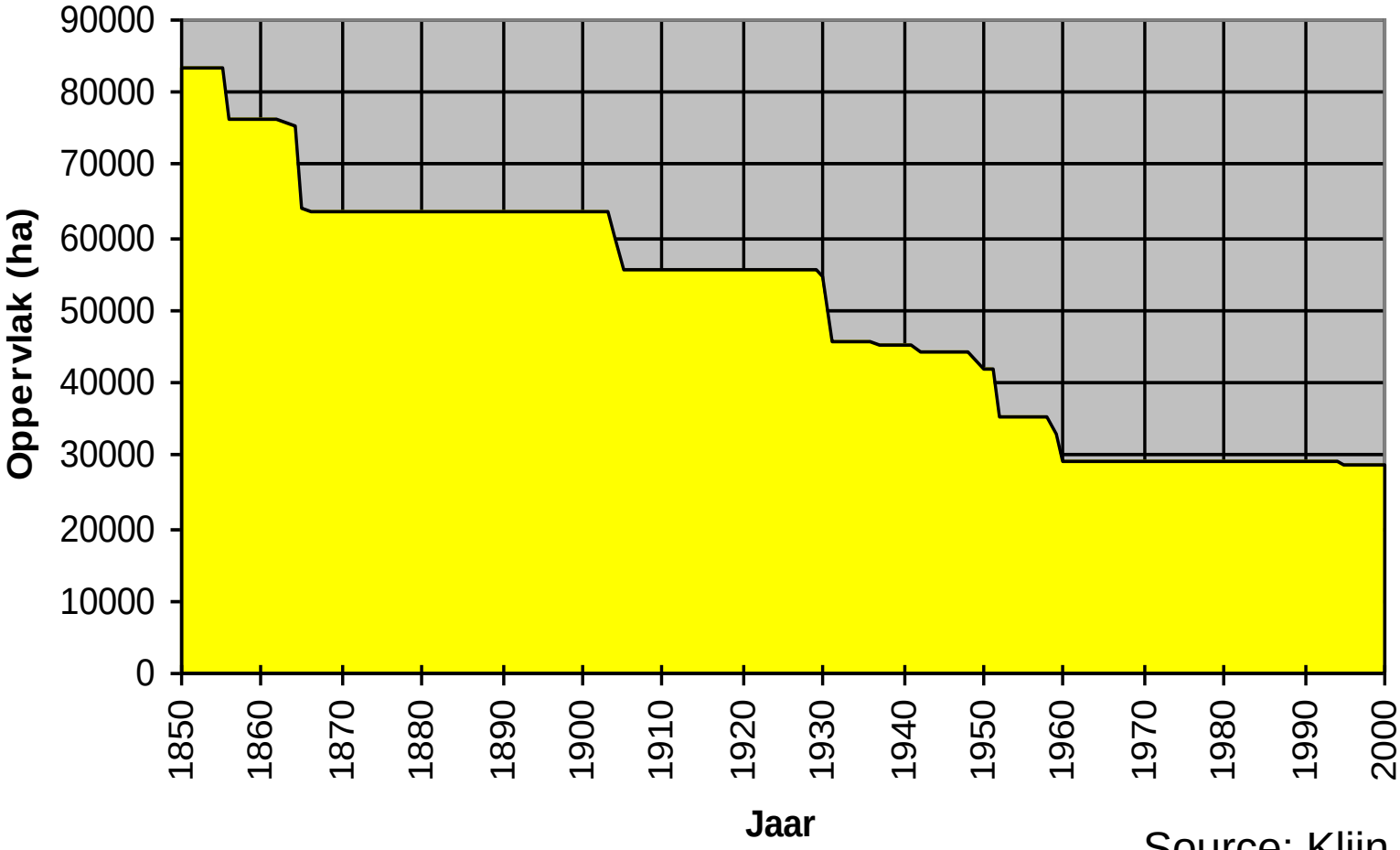
area around Arnhem in 1830



area around Arnhem in 1998



Floodplain area available for Rhine branches



Source: Klijn (WL)

Floods – the most frequent and damaging of all natural hazards

- 43% of all recorded natural events, affecting nearly 2.5 billion people, in some years (1998 and 2010) total losses exceeding $40 billion*
- High rainfall, high river discharges and storm surges and resulting flooding and inundation situations are natural processes – just Climate Variability (**CV**)
- Losses from flooding are increasing due to demographic and economic growth and urbanization (more people and value to be effected)
- Climate Change (**CC**) is not the cause but will most likely increase the risks and losses in coming decades

* Between 1994-2010 – UNISDR (2015) The human cost of natural disasters 2015: A global perspective

2. Flood management

- Flood management is century old
  - mostly practiced by avoiding (land-use) or protection (e.g. dikes)
- Last 30 years: shift to Flood **Risk** Management (FRM)
  - Emphasizing the probability of a flood event (and of extreme events
  - Including the full chain from source-pathway-reception
  - Involving many institutions (horizontal/sectors and vertical/levels)
  - Now called IFRM (Integrated Flood Risk Management)

What is risk?

- **Risk**: the combination of the probability of an event and its negative consequences
- **Risk = hazard * exposure * vulnerability**
- **Hazard**: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
- **Exposure**: People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
- **Vulnerability**: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard

Thinking in risk

- Principle of thinking in risk in general accepted by professionals and scientists
- Challenges:
  - Uncertainty in future hazards
  - Determining acceptable level of risk
  - Perceptions of risk differ
  - Explaining risks to decision makers and the public

Integrated Flood Risk Management

SOURCE → PATHWAY → RECEPTOR

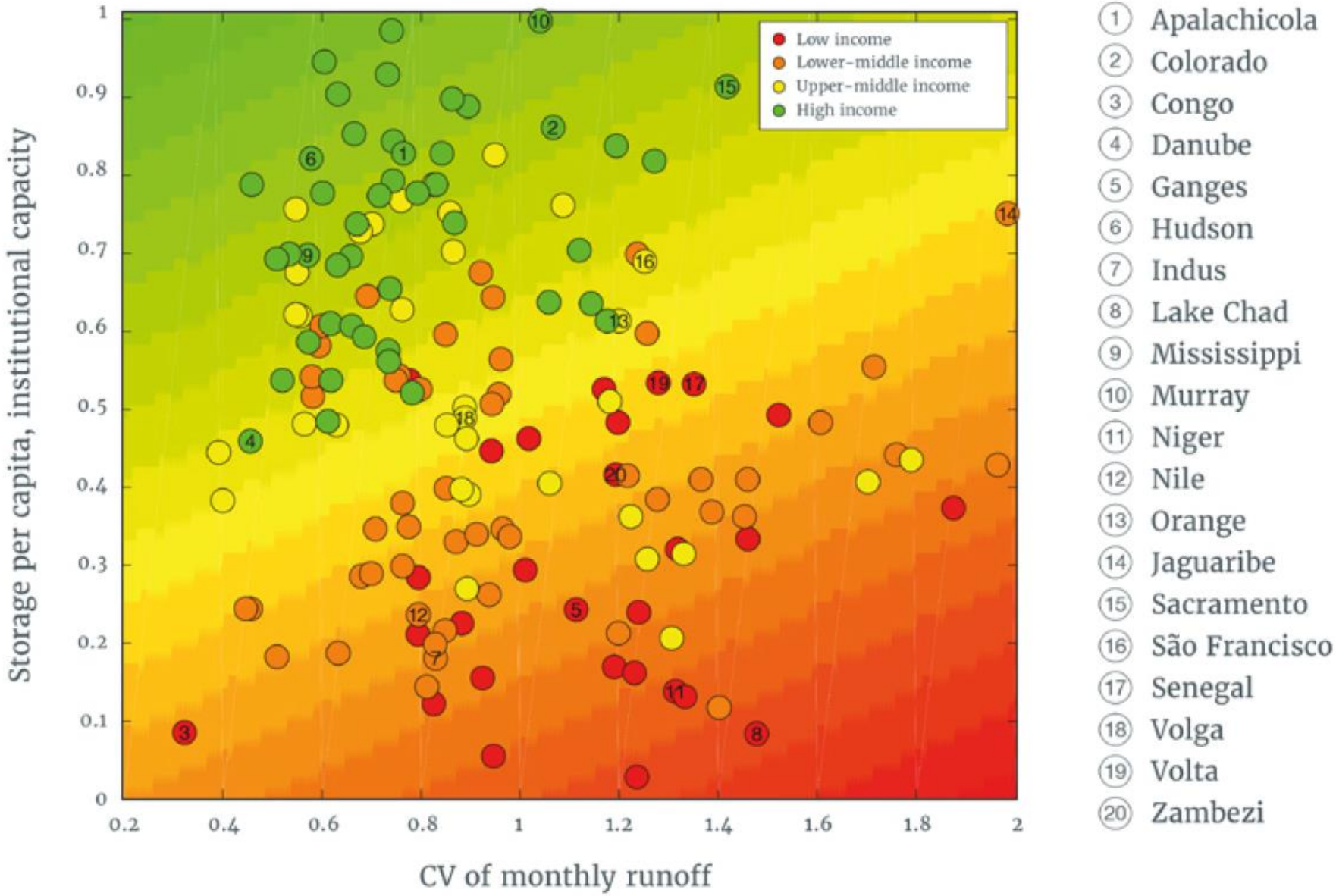
WORLD METEOROLOGICAL ORGANIZATION

ASSOCIATED PROGRAMME ON FLOOD MANAGEMENT
www.floodmanagement.info/guidance-document

Global Water Partnership

Key elements of IFRM

- Adopt a best mix of measures (grey, green, institutional, etc)
- Manage the water cycle as a whole, considering all types of possible floods
- Integrate land and water management
- FRM to be part of a wider risk-management system
- Ensure a participatory approach to develop ownership
- Investments to control variability of water systems remain an important condition for socio-economic development



Source: GWP/OECD report on Securing Water, Sustaining Growth (2015)

3. Nature based solutions

- Nature-based / green-based / ecosystem-based solutions / building with nature
- Why: legacy of grey infrastructure approaches
  - Inflexible to future changes
  - High maintenance and capital investment
  - Loss of ecosystem services and negative biodiversity impact
  - Loss of landscape value
  - Etc.
- Nature-based solutions for flood risk management make use of existing ecosystems and native species, and comply with basic principles of ecological restoration and conservation

Public and NGO's expect miracles

Typhoon Haiyan: Philippines to plant m mangroves

Published on Nov 24, 2013 6:37 PM

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Mangrove swamps along the the Poyu Philippines said it will plant more man during Super Typhoon Haiyan earlier t

Mangrove swamps along the the Poyuy Poyuy River in Sabang, on th Palawan in the Philippines. The Philippines said it will plant more ma prevent a repeat of the deadly storm surges that claimed hundreds o Typhoon Haiyan earlier this month. -- ST FILE PHOTO: LEE SIEW HU

MANILA (AFP) - The

4 December 2013, 5.31pm AEST

Mangroves, nature's shield against typhoons and tsunami

PRI LOG IN LISTEN

Science, Tech & Environment

Saved by the Mangroves? A Philippine town dodges Haiyan's storm surge

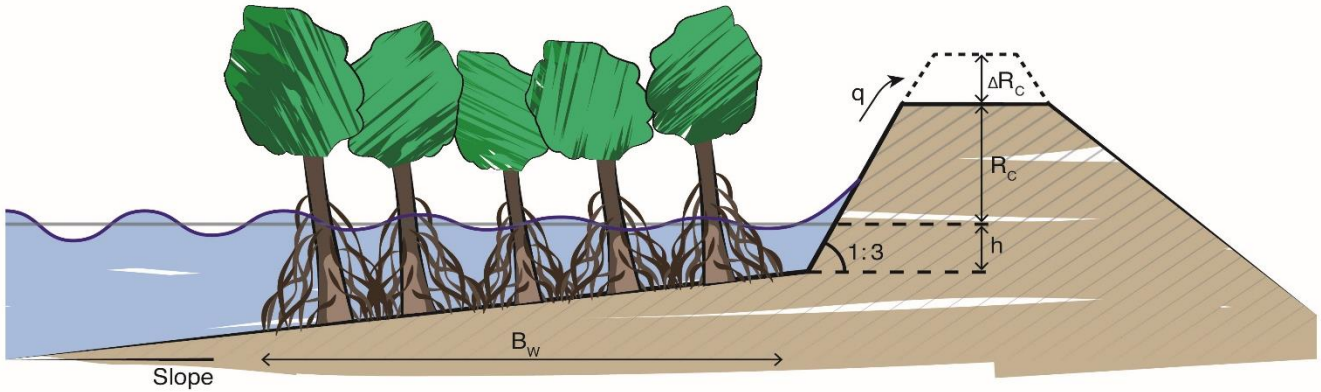
PRI's The World

Mangroves

In the last 20 years only 5-10 % of (USAid) plantings in Philippines survived

Do they sufficiently protect?

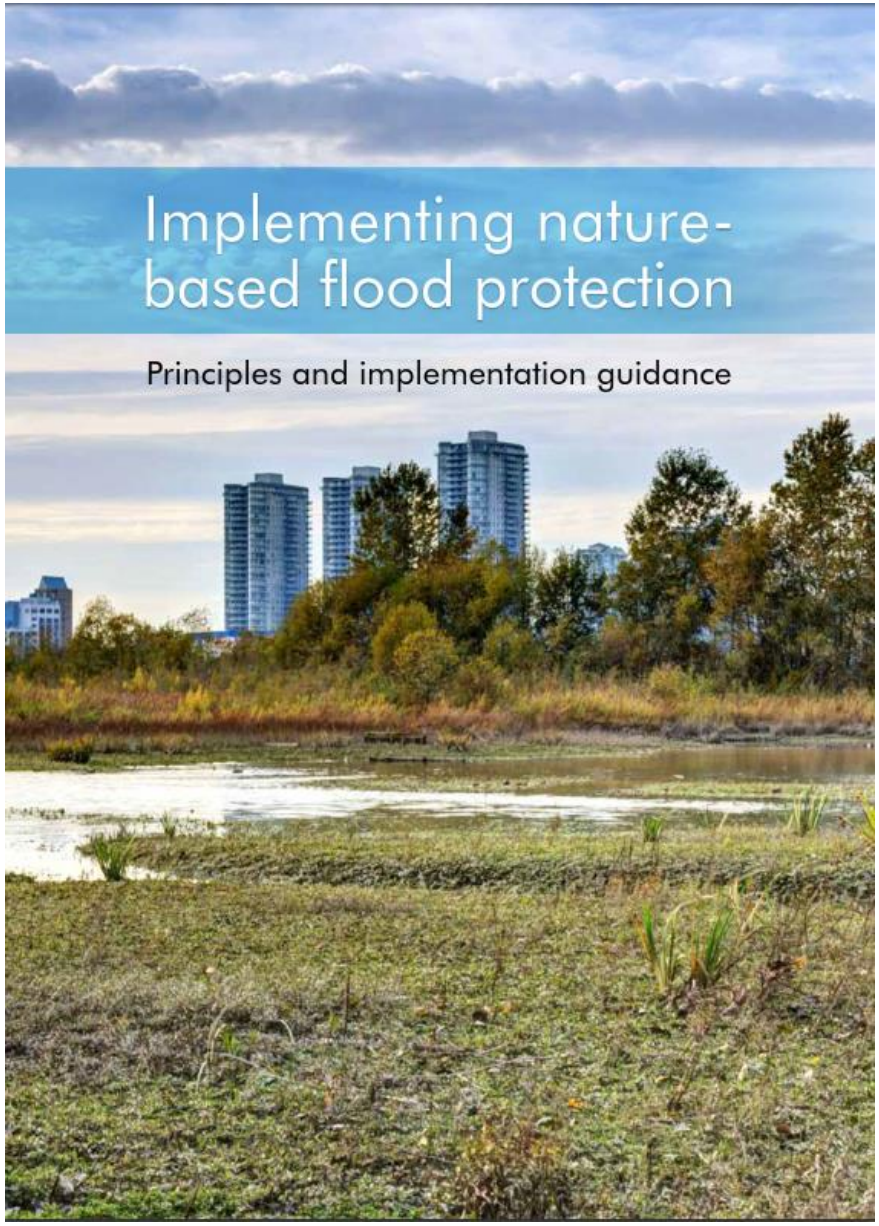
Complex: Strong relation with sediment exchange



Nature Based Solutions

WB guidelines describes five principles for applying NBS

1. System-scale perspective
2. Risk and benefit assessment of full range of solutions
3. Standardized performance evaluation
4. Integration with ecosystem conservation and restoration
5. Adaptive management

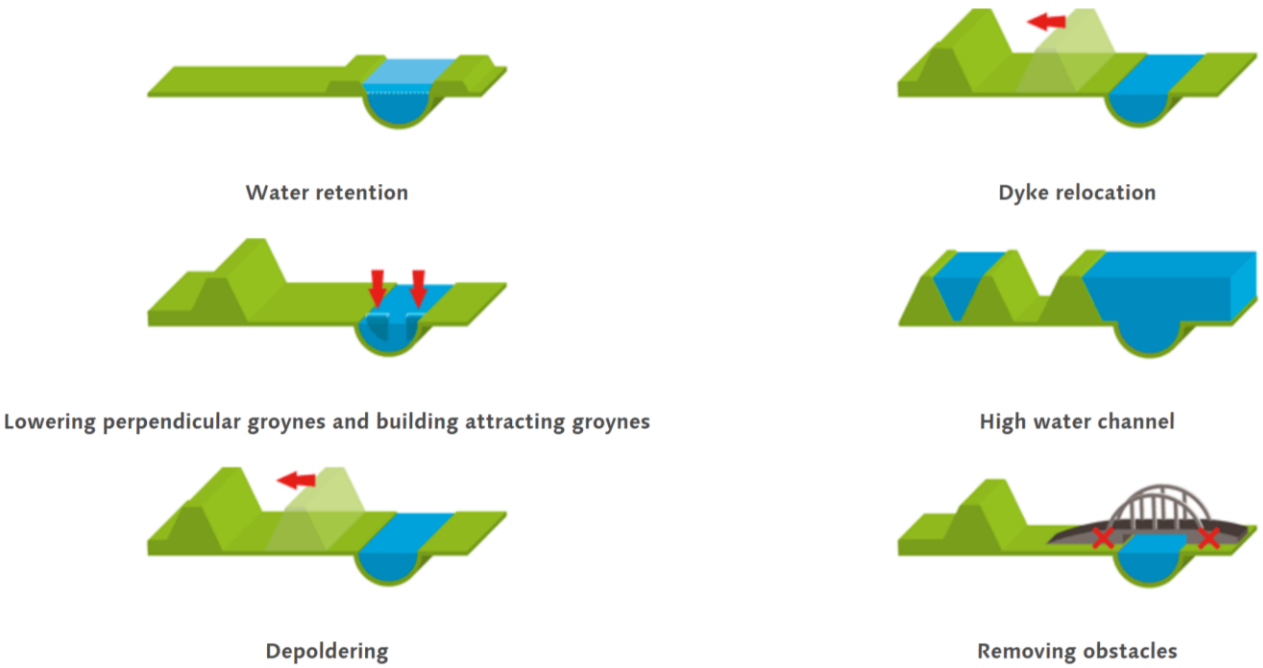


4. Dealing with flooding: no one-size-fits-all approach

- Understand your flooding
  - Distinguish between the types of hazard (flooding)
    A. Riverine floods (inundation of flood plains, overtopping dikes)
    B. Flash floods (small basins with steep gradients)
    C. Pluvial / urban floods (drainage congestion)
    D. Coastal floods (storm surge, typhoons, tsunamis)
  - Different kind of flooding require different approaches
- Quantify current *and future* flood hazard, exposure, vulnerability and risk

A. Riverine floods

- The ‘classical’ flood – high river discharges
  - flood plain inundation
  - in Delta’s aggravated by sea dynamics (tides, SLR)
- Typical case where mix of measures works best
- Room for the River



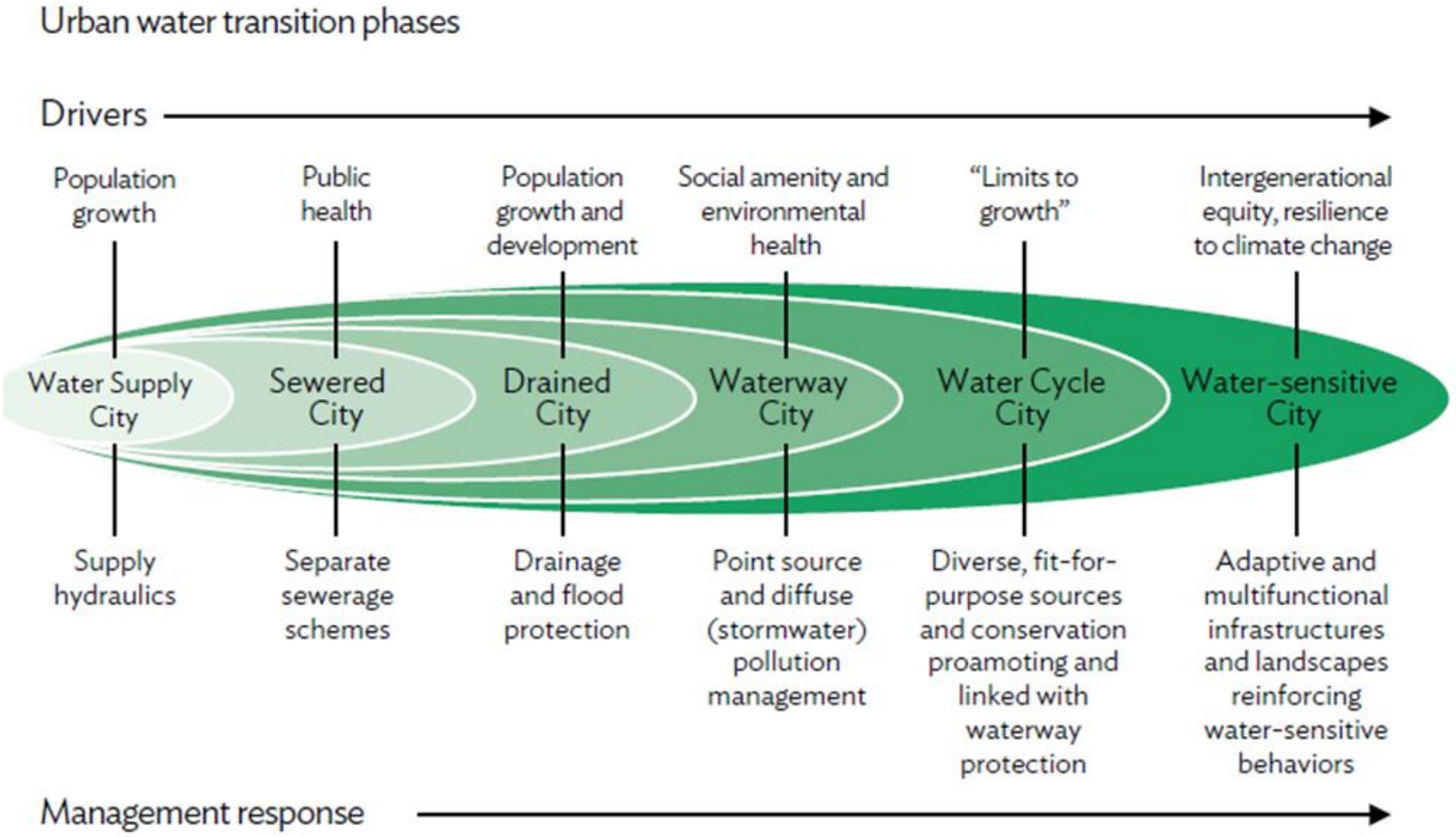
B. Flash floods

- Basically a riverine flood but
  - with small steep river basins
  - time scales involved are small
- Nature based measures are promising
  - but in combination with other measures
- Strong community involvement
- Early warning systems important

C. Urban flooding

- Integrated Urban Water Management has become a specialized field
  - Includes WASH, water quality and flooding
- Strong international cooperation and exchange of experience
  - E.g. **100 Resilient Cities** Network (Rockefeller Foundation)
    - Include major western cities such as Melbourne, Rotterdam, etc.
    - But also about 15 Asian cities in India, Indonesia, China, Vietnam, Myanmar, Georgia
    - Resilient (Cities) is more than climate adaptation !!
- Specific characteristics urban flood component
  - Combinations of many (sometimes small) measures
  - Spectrum of hard to soft solutions
  - Solutions with added spatial value (increase livability of city)

Water Sensitive Cities Framework

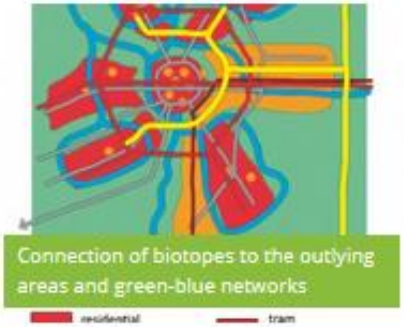


Source: Brown et al, 2009

Selection of adaptation measures – many, many options

Urban forests
Urban farms
Bioswales
Ground Infiltration
Rainwater ponds
Retention roof…


Urban forests and parks


Connection of biotopes to the outlying areas and green-blue networks


Urban wetlands


Retention roof


Grass fields and flower meadows


Urban farms

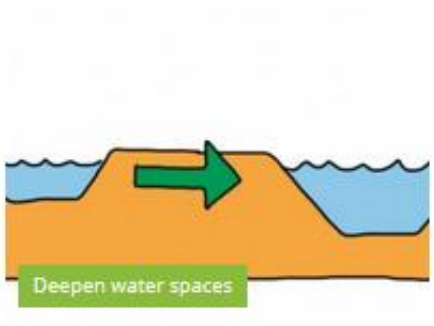

Rainwater ponds for buffering and purifying extremely polluted water


Bioswales


Green riparian zones and wet biotopes


Infiltration meadows and infiltration strips with above-ground storage

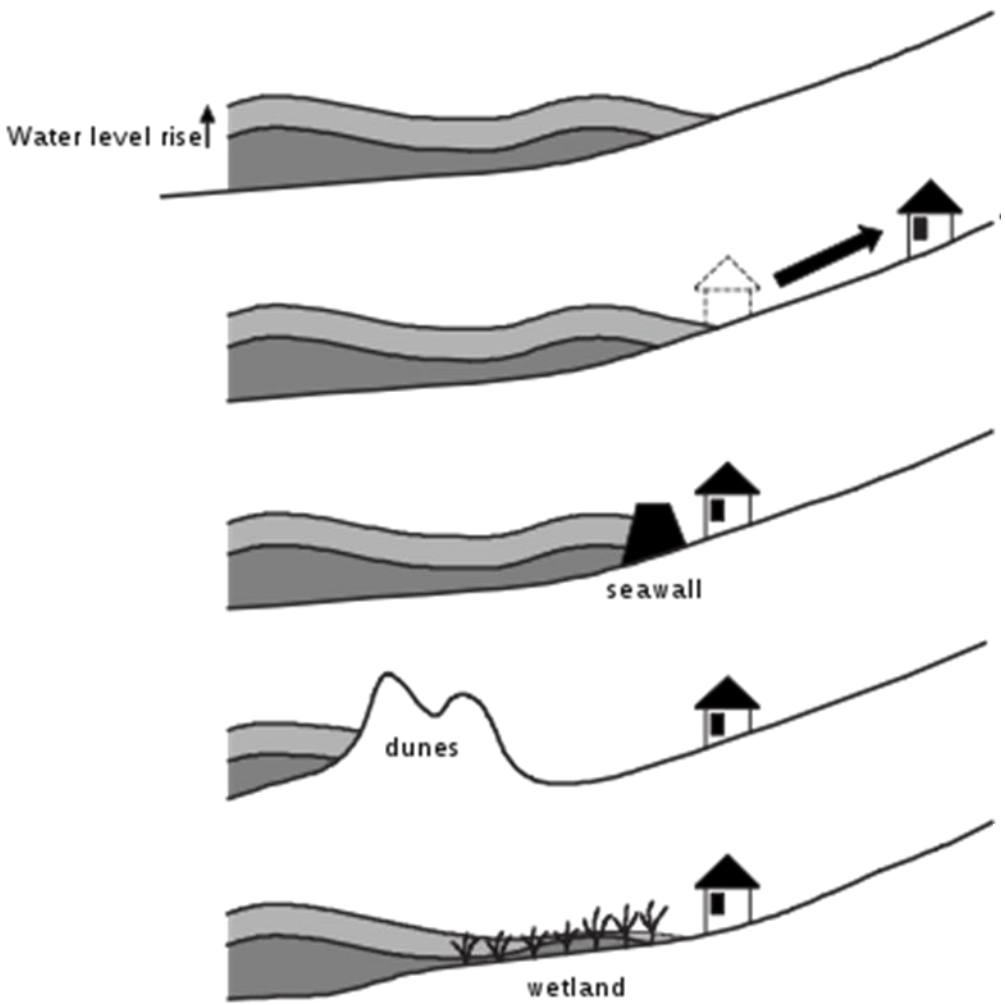

Ground infiltration


Deepen water spaces

D. Coastal Flooding

- Hazard: storm surge, sea level rise, soil subsidence (particularly due to groundwater withdrawal), increased rainfall and river discharges
- Natural processes play a major role in the natural protection of a coast
  - At the same time coasts (estuaries, lagoons) are often valuable ecological areas
  - ‘Building with nature’ is in particular based on coasts
- Measures: combination of hard (dikes, sea walls) with soft solutions (mangroves, corals)
  - Solutions should address hydraulics **and** morphology (sand and sediment) **and** ecology

Strategies for coastal management



Do nothing

Managed realignment

Hold the line

Move seaward

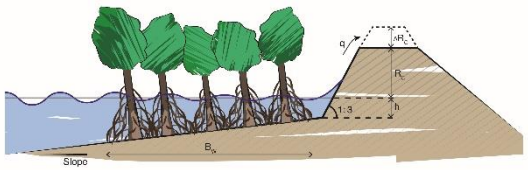
Limited intervention

The five generic policy options

Recommended approach: combination of soft, hybrid and hard measures

Soft solutions — Hybrid — Hard solutions

more space, more flexible → *less space, less flexible*



5. Flooding in Asia

- Already a problem
  - Human well-being
  - Socio-economic (e.g. Thailand flooding 2011)
- Will very likely increase because of CC
  - and increase of socio-economic pressure
- Flood risk management needs to rise to current (see recent flooding in South Asia) and future challenges

And it can (and is being) done in DMC's

- Some places it will be a challenge
  - Lack of open space
  - Resettlement of people is sensitive
- Good example: Pluit (Jakarta) Indonesia
  - Resettlement from floodplain, creation storage, improving livability of city
- General strong support of DMC's for NBS
  - E.g. Sponge city approach (China)