Community-based adaptation to climate change

the adaptive capacity of the physical landscape

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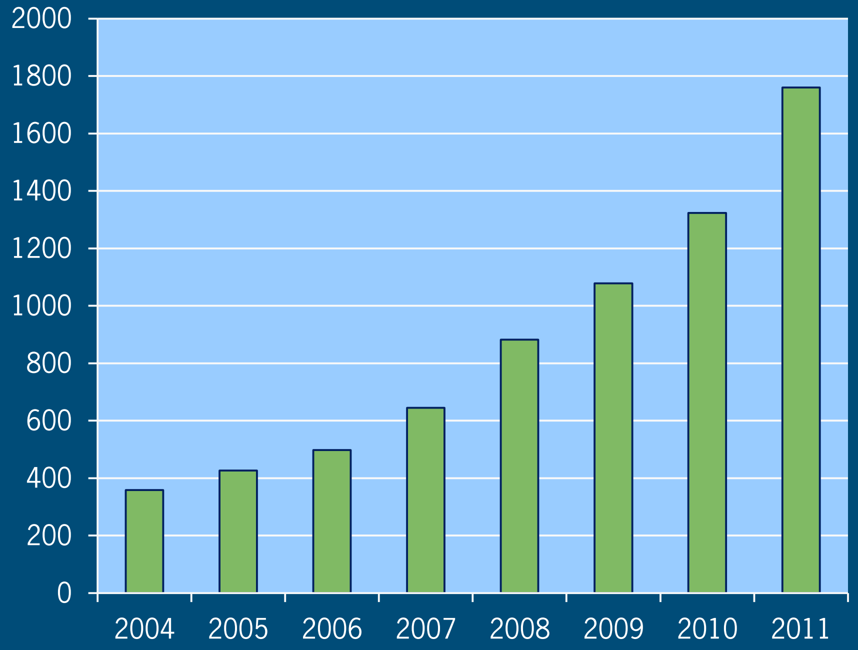
Knowledge for Climate

Content

- Implementation of climate adaptation measures lags behind
- Building adaptive capacity in social-ecological systems
- Principles to enhance the adaptive capacity of the physical landscape
- Case study example and Conclusions

Environmental adaptation measures

- Climate adaptation of the environment receives a growing attention in scientific papers



- Increase water holding capacity in river catchment areas (Cullis et al.2011)
- Connect ecological networks to facilitate range dynamics of species (Vos et al. 2008)

Implementation of scientific knowledge is limited

- Mismatch between sector-oriented measures and multifunctional landscapes (Tompkins et al. 2010)
- Institutional challenges are overlooked (Preston et al. 2011)

Connect the environmental focus with governance approaches: Social Ecological Systems (Holling 2001)

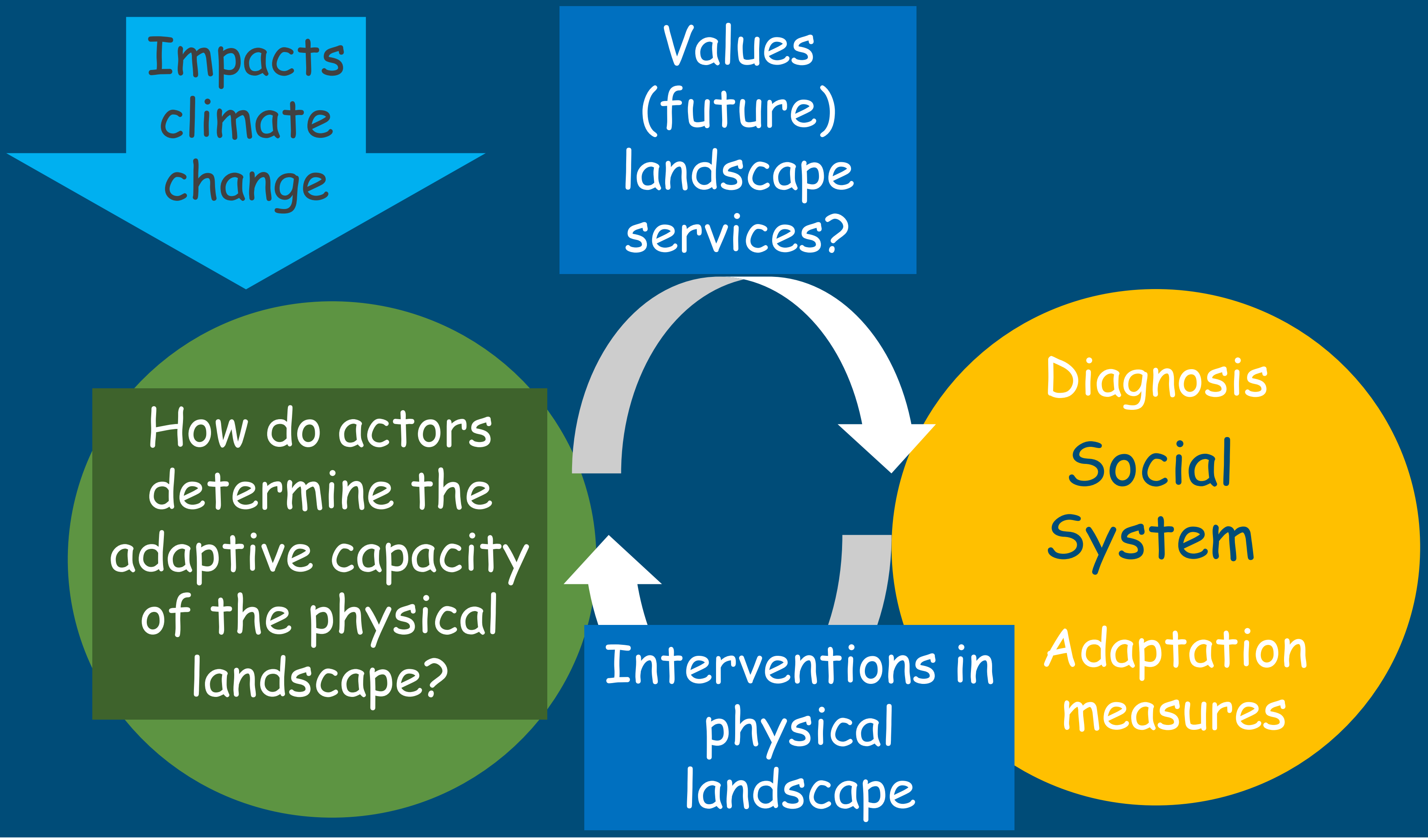
Social Ecological Systems (SES)

- Adaptive capacity in SES: The capacity to respond to changes ánd take measures to bring the physical system back into a desired state (e.g. Gunderson, 2000)

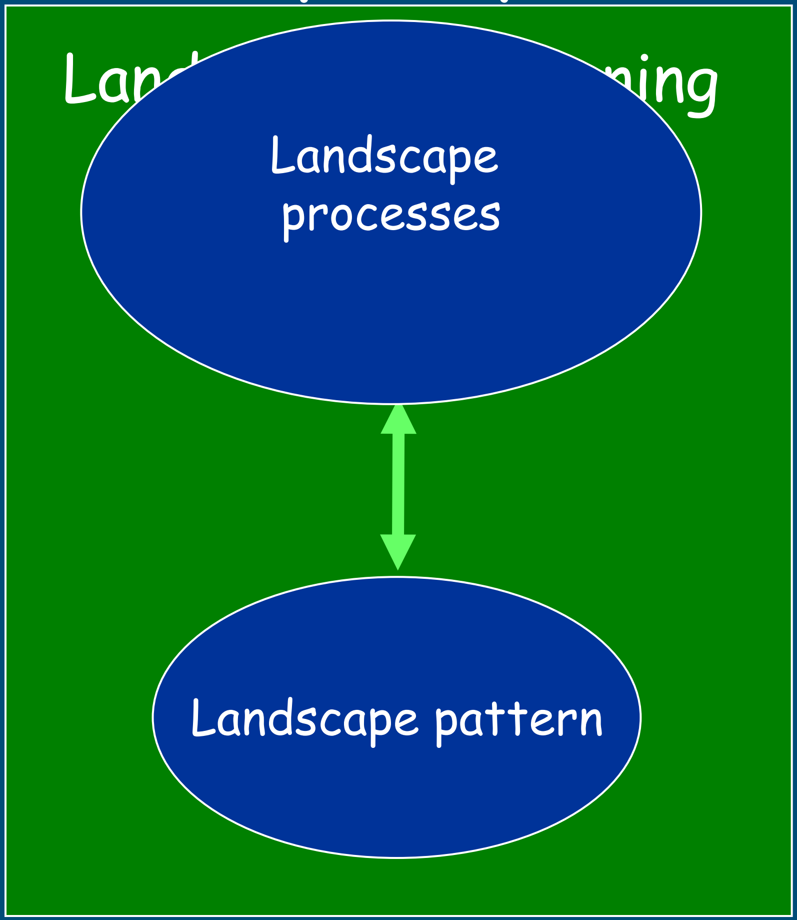
- In literature adaptive capacity is a characteristic of the human society only

→ Include adaptive capacity of the physical landscape in SES such a way that it is useful for local communities

Climate adaptation in SES



Principles that are linked to he adaptive capacity of the physical landscape



- Applicable in regional planning
- Applicable to multiple sectors
- Spatially explicit

Sources:

- Landscape ecology knowledge of the pattern-process interactions

Key principles 1. Size

- By enlarging a system's size it is better able to absorb weather extremes

Water management: increasing the physical dimensions of a river system to cope with increasing discharge (Cullis et al. 2011)

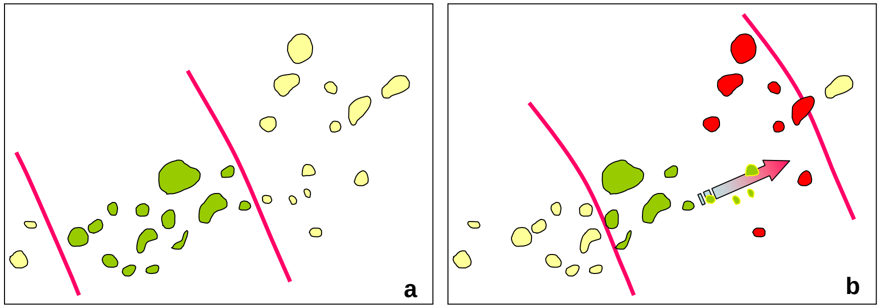
Nature management: enlarging the size of ecosystem networks to cope with increased extinction risks caused by weather extremes (Verboom et al. 2010)

Key principles 2: Heterogeneity

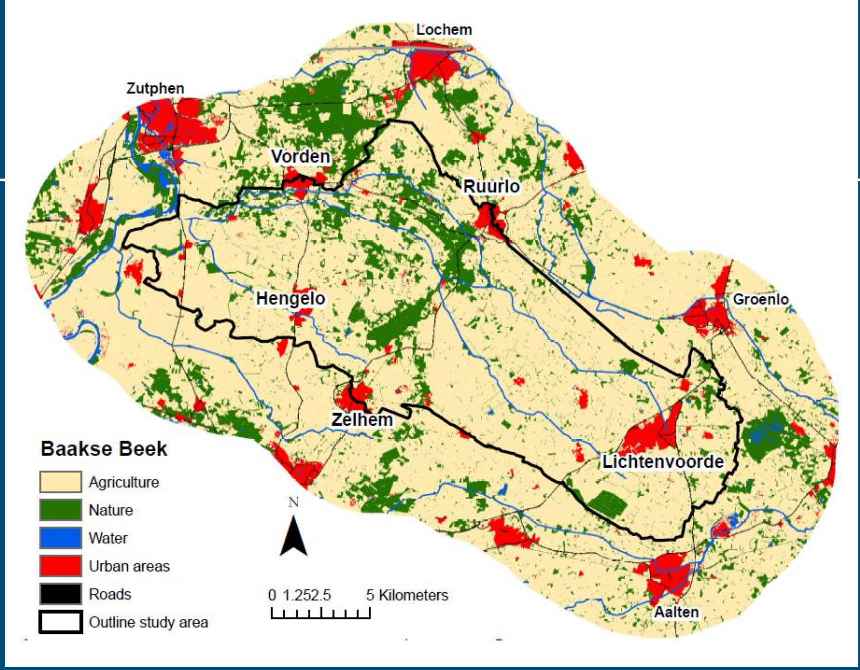
- Landscapes which differ in environmental conditions are better able to spread the risk of disturbances caused by increased weather variability.
- Examples
  - Water management: create regional heterogeneity in flood risk by designating specific areas where periodic flooding is allowed, thus reducing the risk in highly populated areas (Klijn et al 2004)
  - Nature management: increase heterogeneity in microclimate to generate more stable population dynamics (Hodgson et al. 2009)
  - City health management: increase heterogeneity in microclimate by replacing built surfaces with green areas to reduce heat island effect (Gill et al. 2007)

Key principle 3: Connectivity

- The spatial pattern that enhances flows of organisms or material. Adding a hierarchy of spatial scales leads to spreading of risk and recovery.
- Examples
  - Management of sea level rise: adaptation measures to avoid coastal erosion taken too locally might actually worsen erosion elsewhere (Milligan et al. 2009)
  - Nature conservation: connectivity stimulates recovery as it enables species to recolonize after local disturbances or
  - Nature conservation on a larger scale: it facilitates range expansion as an adaptation measure to shifting suitable climate zones (Vos et al. 2008)



Case study Baakse beek



* Sandy area, 30.000 ha

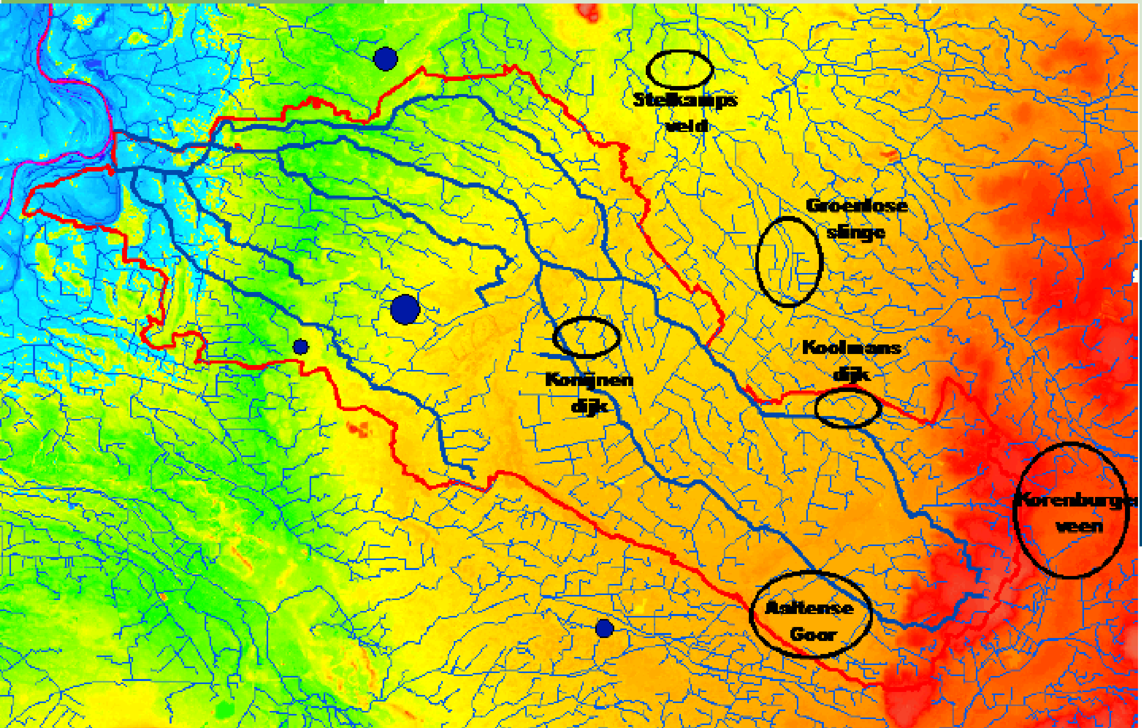
* Landuse: agriculture, nature, creek system for regional water cycle

- Aim: Improve regional ecological and economic sustainability and improve the climate robustness
- Problems climate change:
  - Increase in summer droughts
  - Increased risk of flooding
  - Fragmented ecological network

	Water	Agriculture	Nature
Size	Prevent water flooding by increasing the dimensions of water bodies		Enlarge existing nature areas

	Water	Agriculture	Nature
Heterogeneity	Designate specific locations for water retention after extreme rainfall to avoid damage elsewhere	Increase the variation in moist conditions on farms to dampen impacts of weather variability	Enhance heterogeneity and restore abiotic gradients in and around nature areas for wet heath lands and wet grass lands

	Water	Agriculture	Nature
Connectivity	Slow down water discharge from the area by taking measures in the stream valley of the Baakse Beek as a whole (e.g. by partly filling up the ditches)		Increase spatial cohesion of the ecosystem network by adding green infrastructure in the agricultural landscape between nature areas



Selected aims for adaptation

	Water	Agriculture	Nature
Other Measures		Apply new crop varieties that are better adapted to drier, warmer conditions. Apply cooling systems for animal farming during hot summers	

Conclusions

- We proposed key principles to enhance the adaptive capacity of the physical landscape
- Most measures could be categorized under one of the principles for building adaptive capacity of the landscape
- Measures that did not fit were technically focussed rather than ecologically.

→ The spatial principles have the potential that local planning groups will recognize them as significant and useful

Further research

- Are these spatial principles suitable for planning and design processes?
  - spatially explicit
  - connected to function
  - easy to visualize
  - flexible in application

➡ Stimulate learning feed-backs between science and practice

Thank You

Consortium partners CARE

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