The Flanders case: challenges and opportunities for the ecosystem approach in a highly fragmented and urbanised area

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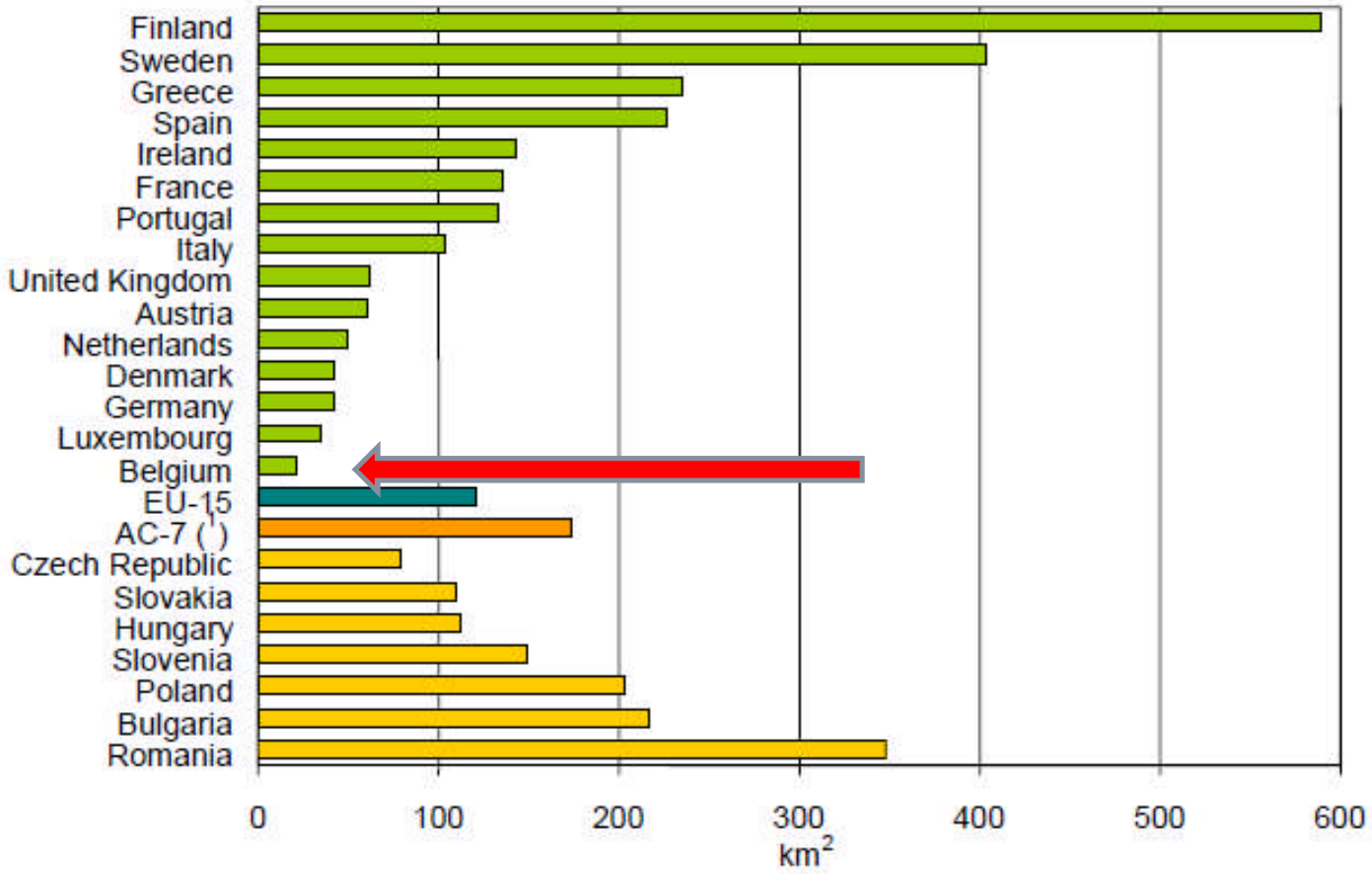
The challenge

- Make the ecosystem approach work in highly urbanised areas!

Flanders is highly fragmented

Figure 1: Average size of non-fragmented land parcels



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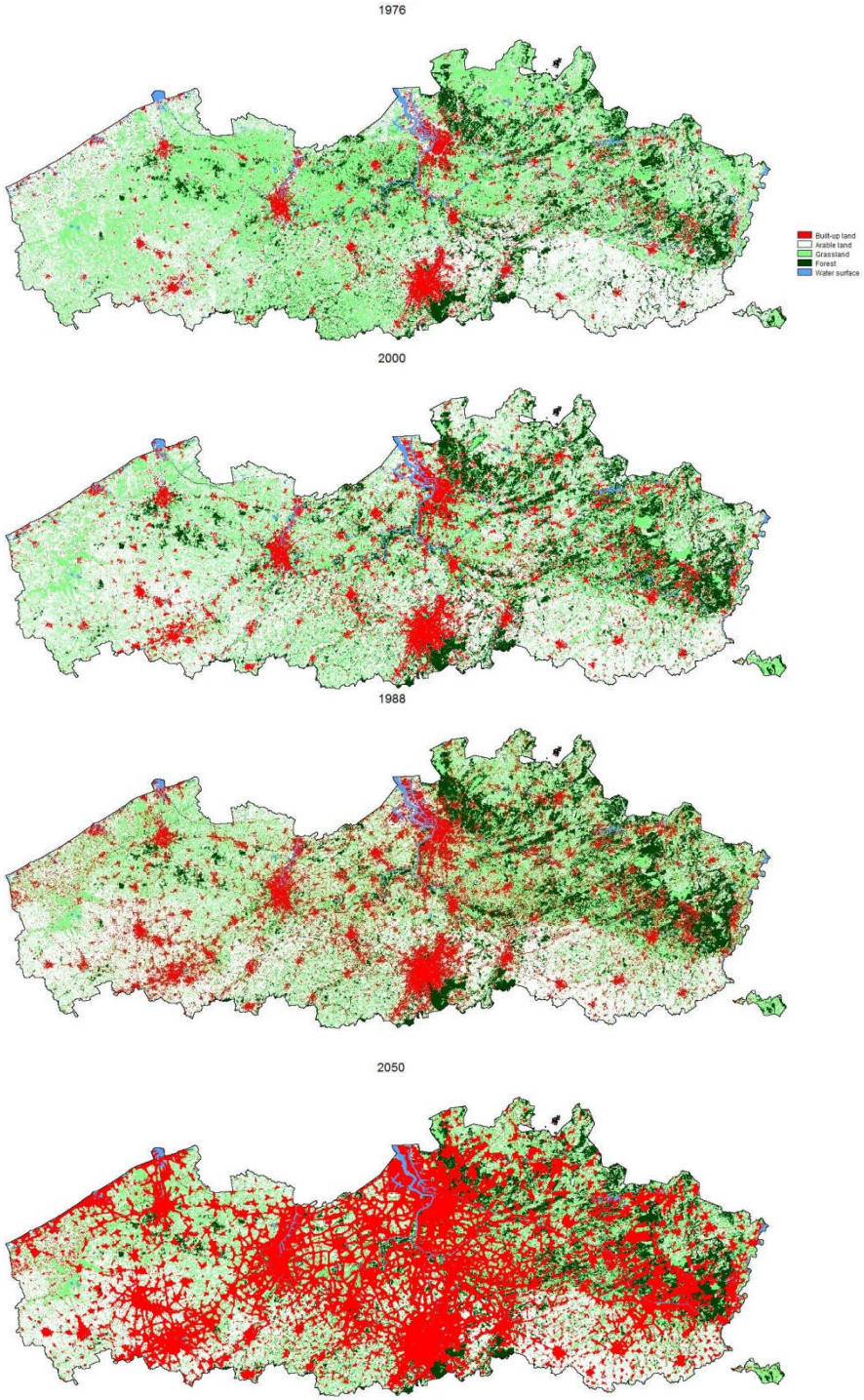


Increasing pressure of urbanisation and intensification of agriculture

"in 1976, **7,**2 procent was build up area;

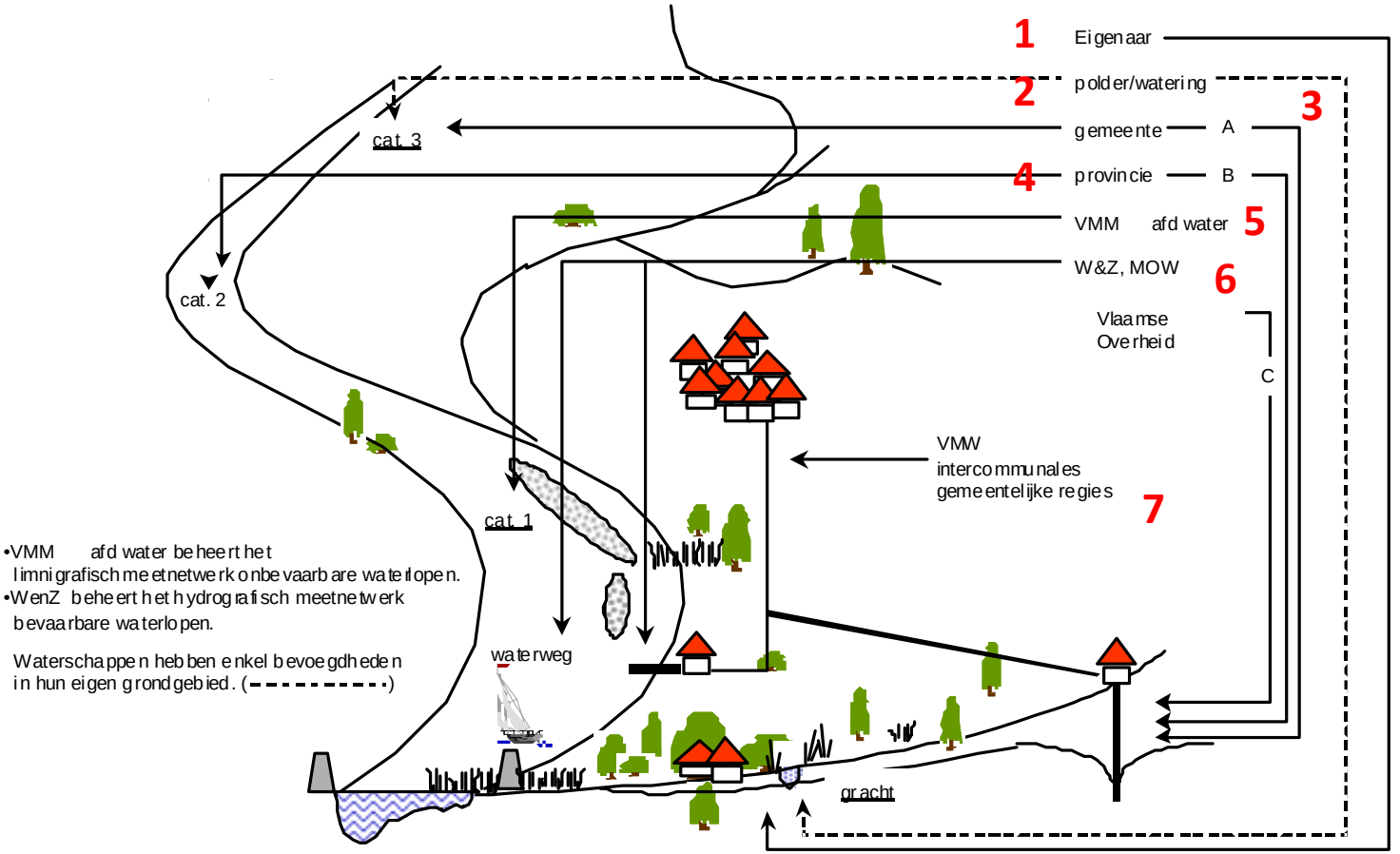
in 1988 this was **11,7** procent.

in 2000 it was **18,3** procent (+ 56% in 10 year!)

For 2050 a model, based on the averge building intensity, predicts **41,5** procent build up areas."

Organisatorische integratie

Bevoegdheden waterkwantiteitsbeheer



(Bergmans et al. 1999)

- Major problems:
  - Flooding
  - Water shortage
  - Pollution
  - Biodiversity loss
  - ……..

dinsdag 29 september 2009 om 08u51

"Ergste droogte in 26 jaar in Vlaanderen, ramp voor landbouw"

De aanhoudende droogte heeft mogelijk zware gevolgen voor de landbouw.

Dat schrijft Het Laatste Nieuws dinsdag. Tot dusver viel in september slechts 29,1 liter neerslag, normaal is dat 69,8 liter. Hetzelfde geldt voor augustus: 34,7 liter tegenover 74,4 liter.

"Ergste droogte in 26 jaar in Vlaanderen, ramp voor landbouw"

Het is al van 1983 geleden dat het in beide maanden samen zo weinig geregend heeft. "Het gevolg van een 'blokkade' in de atmosfeer", zegt weerman Eddy De Mey in de krant.

De aanhoudende droogte heeft zware gevolgen voor de landbouw. "De aardappelopbrengst zal 20 procent lager uitvallen, voor koolgewassen verwacht ik een daling tot 35 procent", waarschuwt landbouwexpert Luc Busschaert.

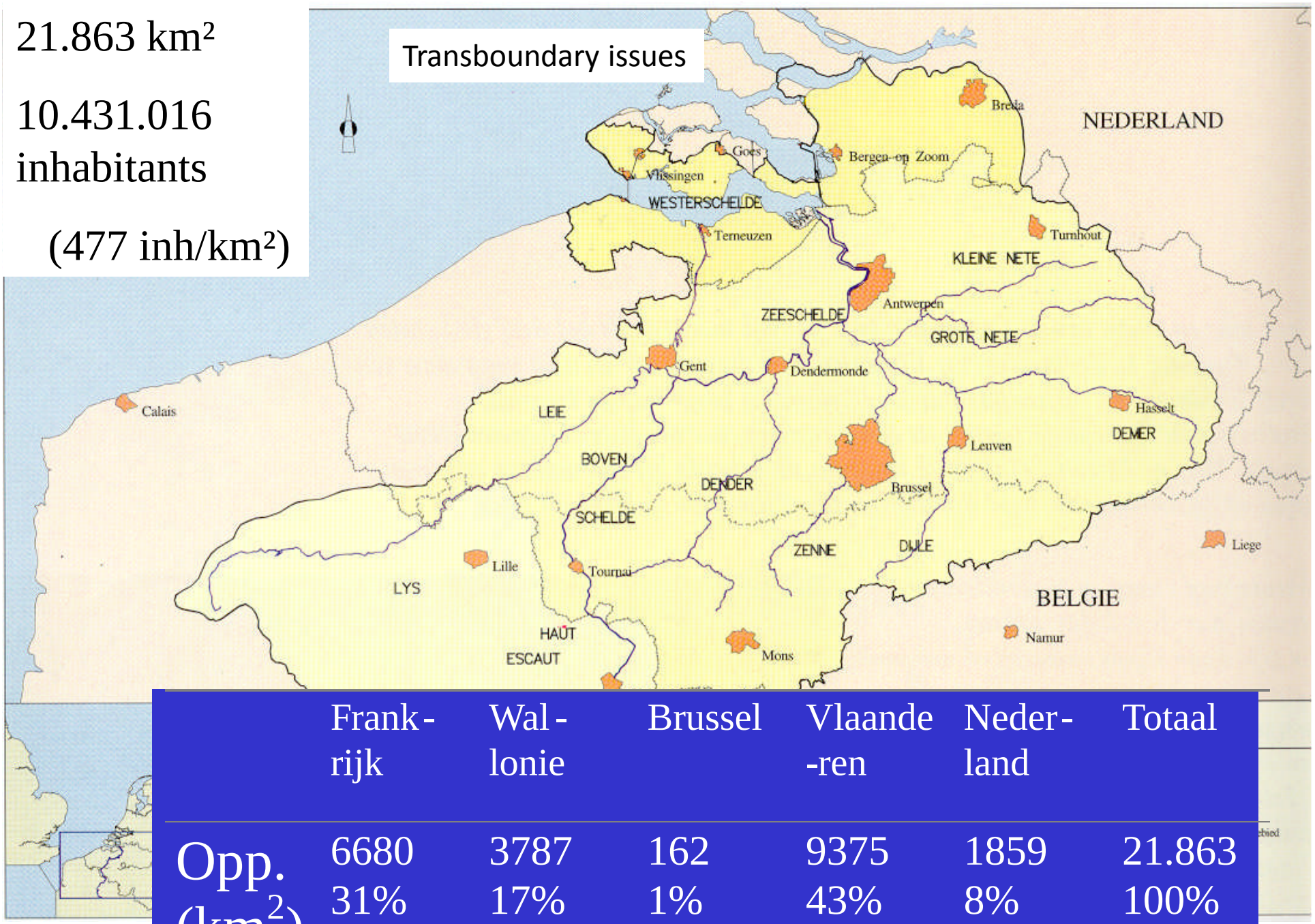
Ook andere gewassen lijden onder de droogte. "Op 1 oktober start het zaaien van wintertarwe en -gerst. Maar men kan gewoon niet met de ploeg in de grond", aldus Busschaert.

21.863 km²

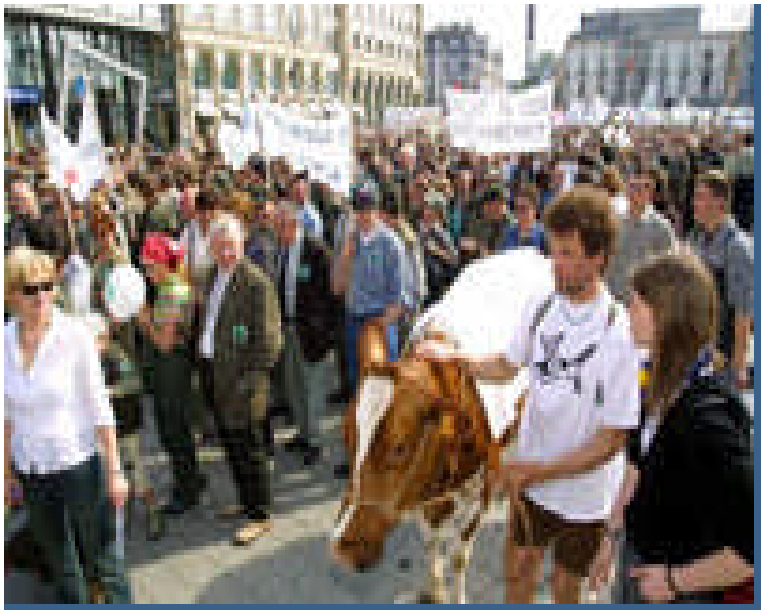
10.431.016 inhabitants

(477 inh/km²)

Transboundary issues



	Frank-rijk	Wal-lonie	Brussel	Vlaande-ren	Neder-land	Totaal
Opp. (km^2)	6680 31%	3787 17%	162 1%	9375 43%	1859 8%	21.863 100%



GENT 11 may 2003-

20.000 farmers, fishermen, hunters and general public gathered for a manifestation AGAINST the Flemish ecological network and nature conservation measures!

HOWEVER

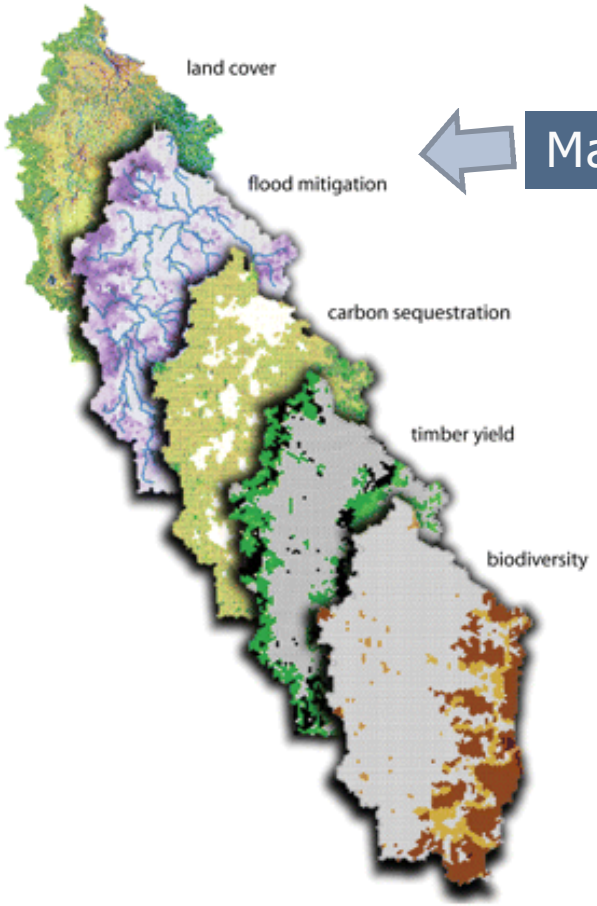
An ecosystem approach is more than urgent to face all the problems due to the loss of ES resulting in ever bigger costs

What do we know and not (yet)

An integrated strategy

- Understanding and quantification of ES
  - The biophysical basis
- Formulation of objectives
- The calculation of habitats surface needed
- Measures to maintain or restore habitats

Mapping services



Mapping individual services

Hot spots of

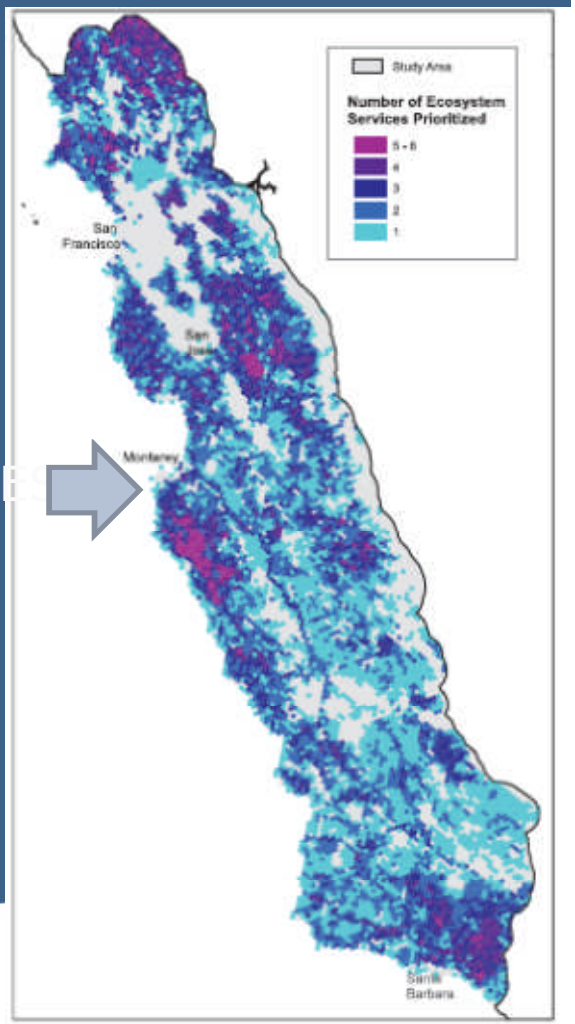


Figure 4. Ecosystem Service and Biodiversity Hotspots

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- Do we map potential or actual ecosystem services?
- Due to:
  - Lost connectivity
  - Weak link between proxy and ES

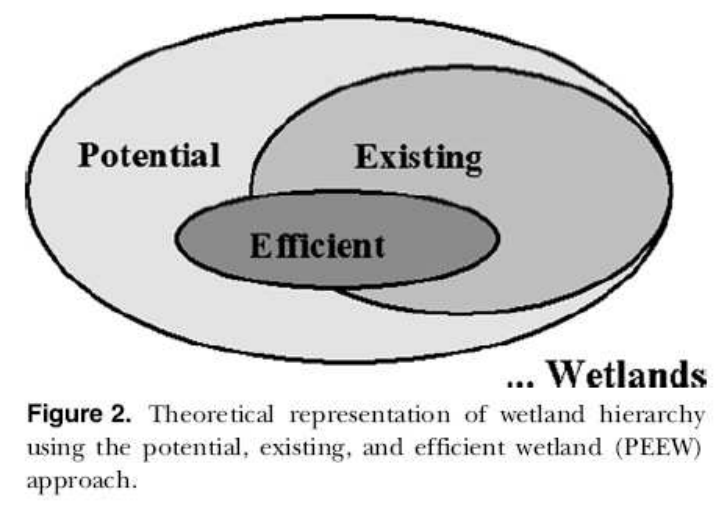
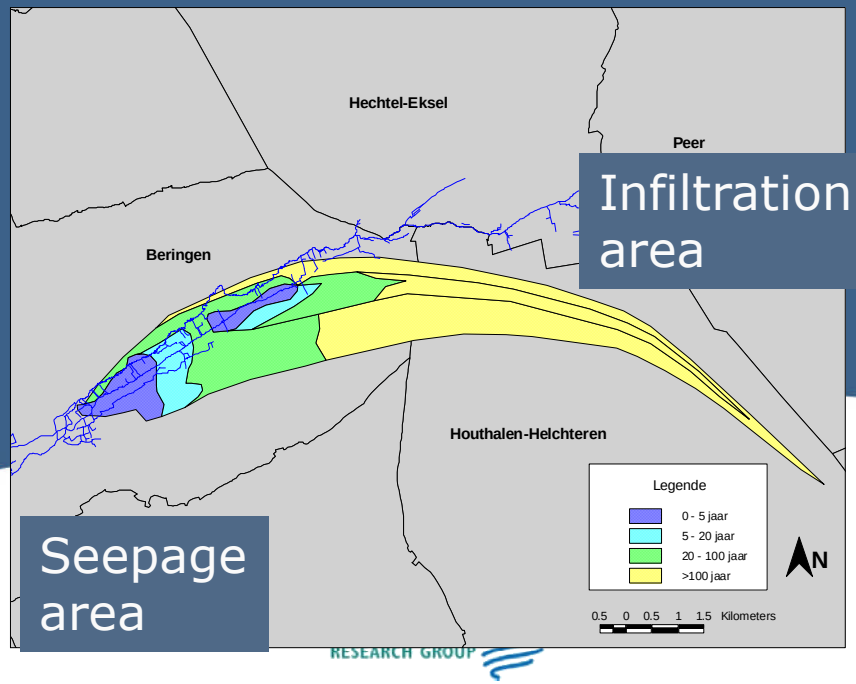


Figure 2. Theoretical representation of wetland hierarchy using the potential, existing, and efficient wetland (PEEW) approach.



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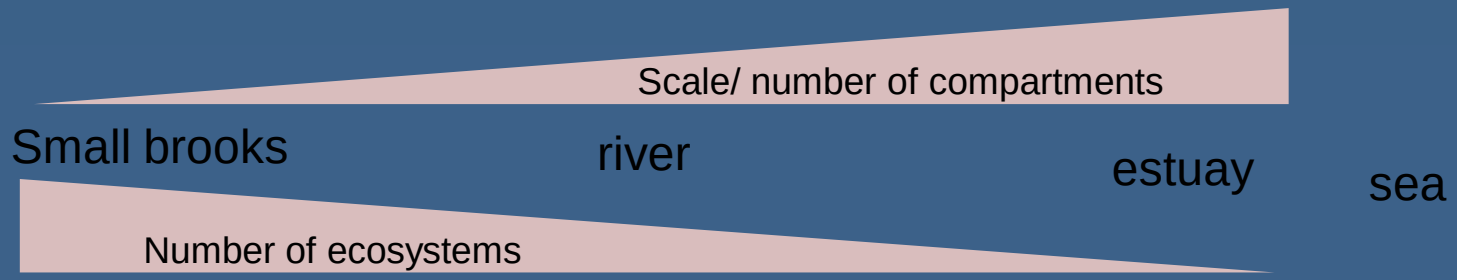
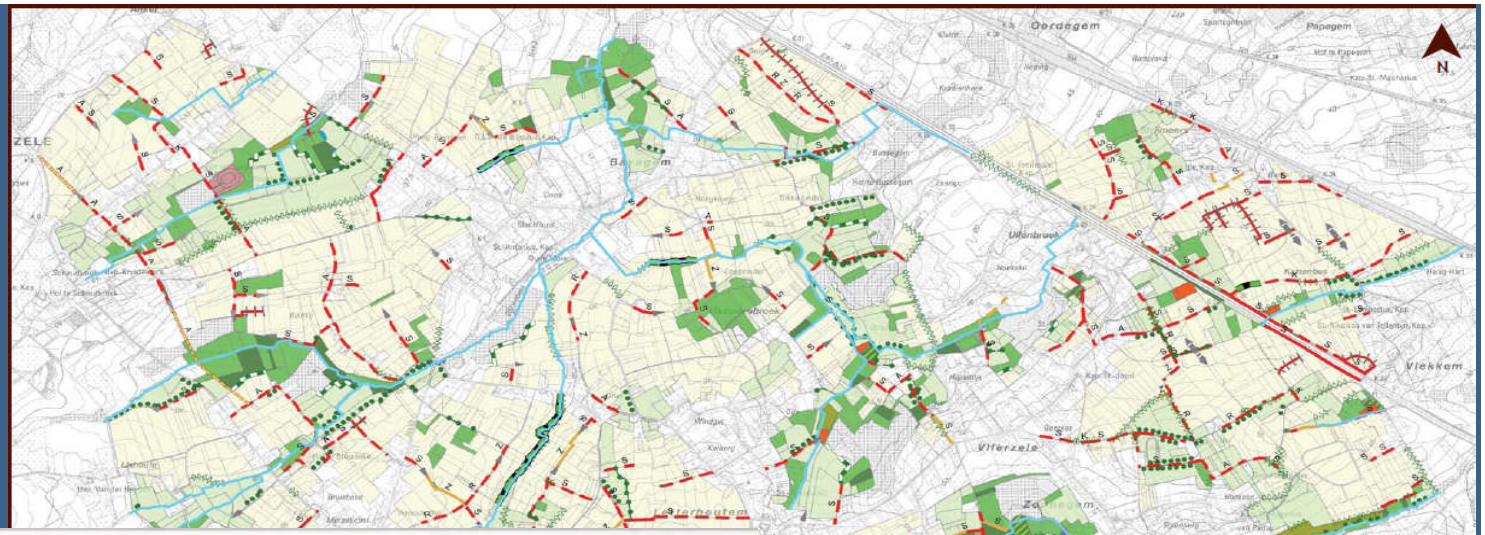
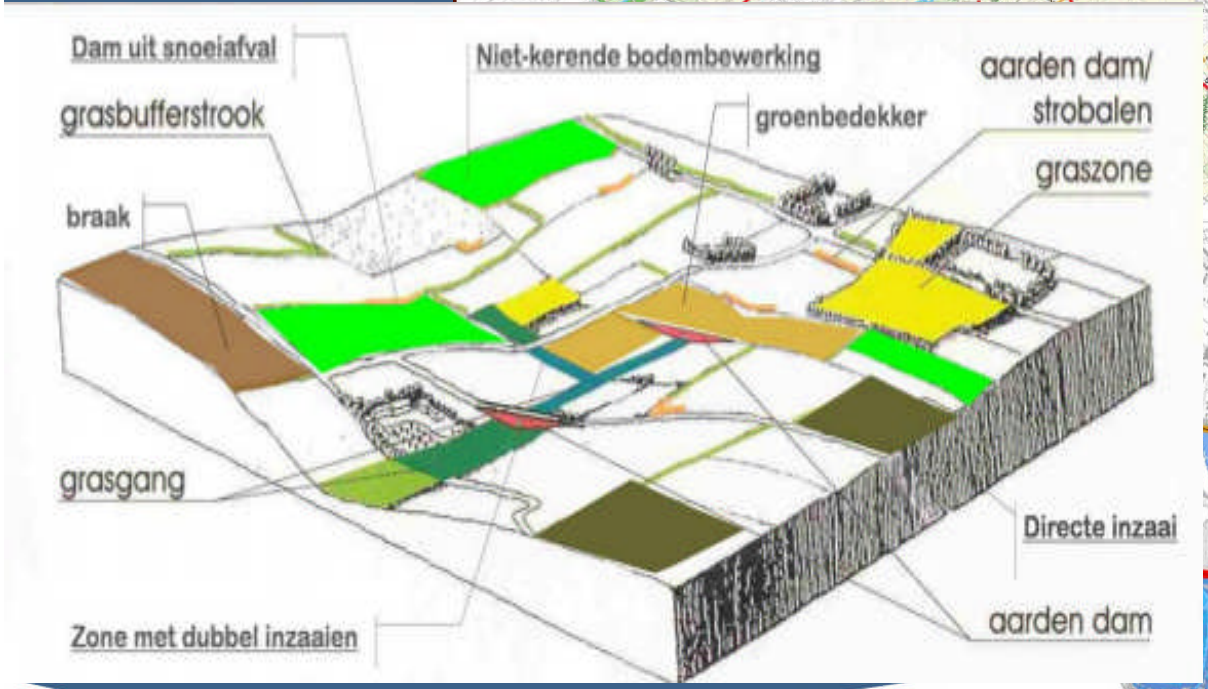
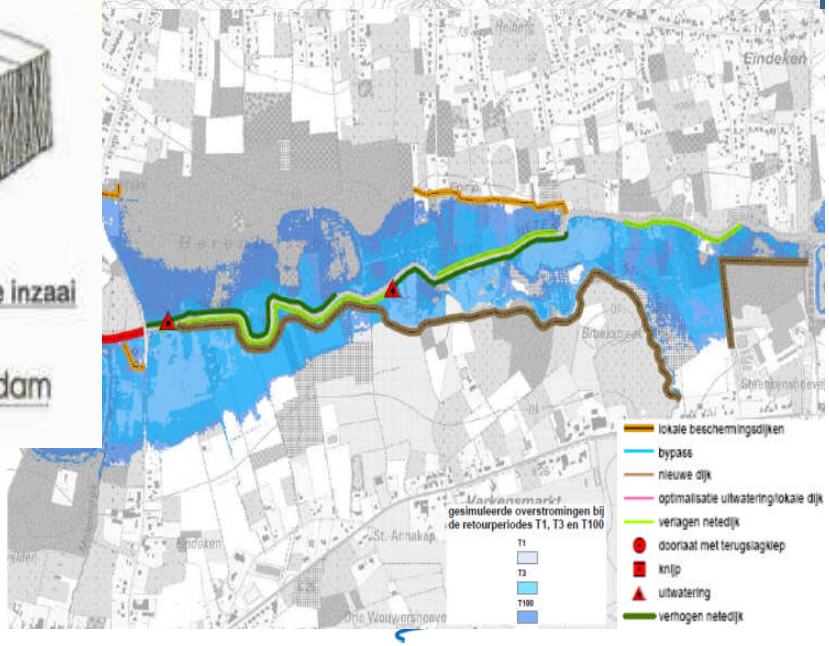
- Proxy-based maps of ecosystem services
  - can be adequate to map the broad distribution of services for which primary data is not available
- But..
  - Are not suitable for finer-scale conservation prioritization
- And..
  - Are REALLY not suitable for projections into the future
- (Eigenbrod et al., 2010)
- 2/3 of the studies in review of Seppelt et al. 2011 are based on secondary information!

- Need for mechanistic understanding and numerical modelling but:
  - Complexity of the system
    - Processes
    - Compartments









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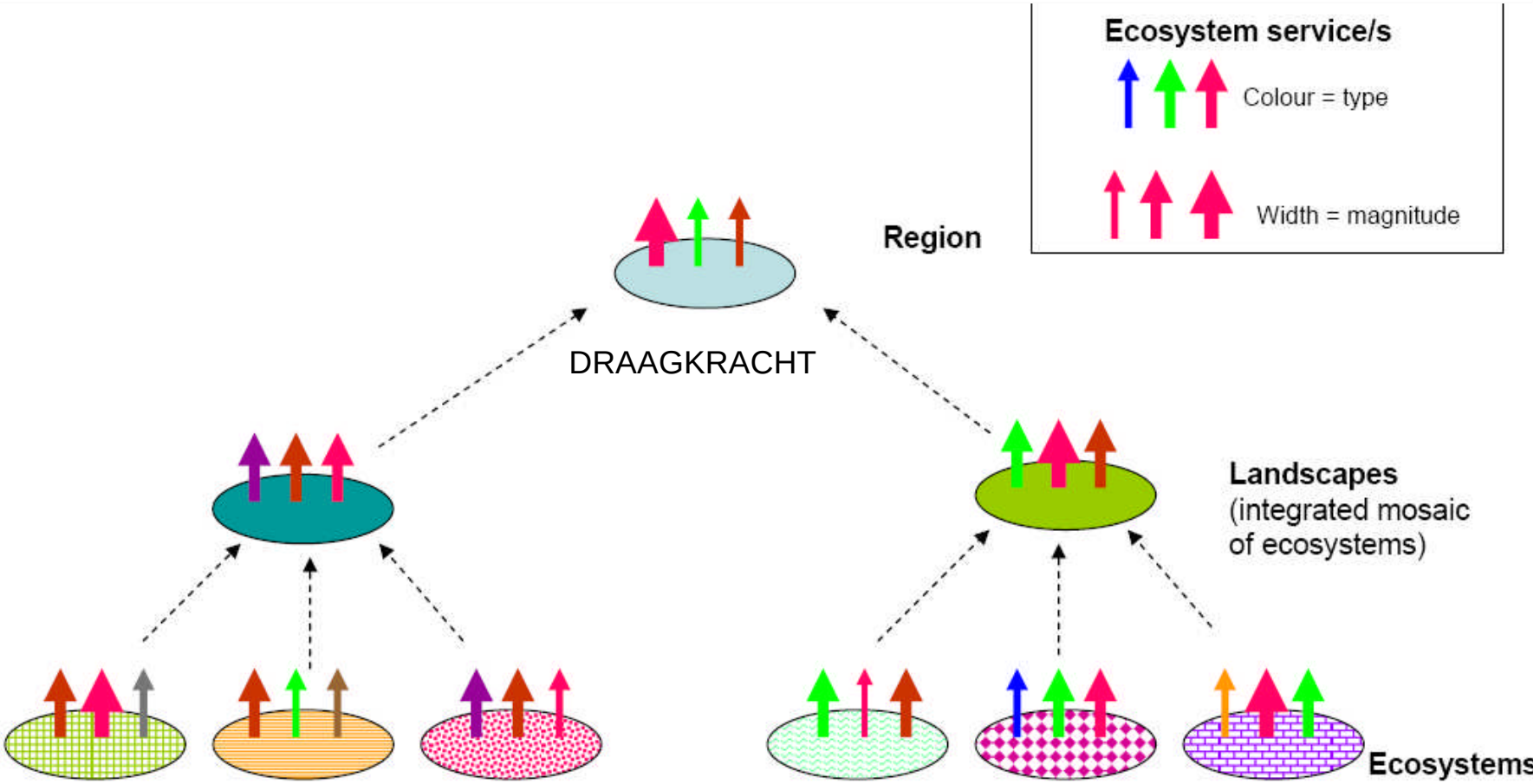
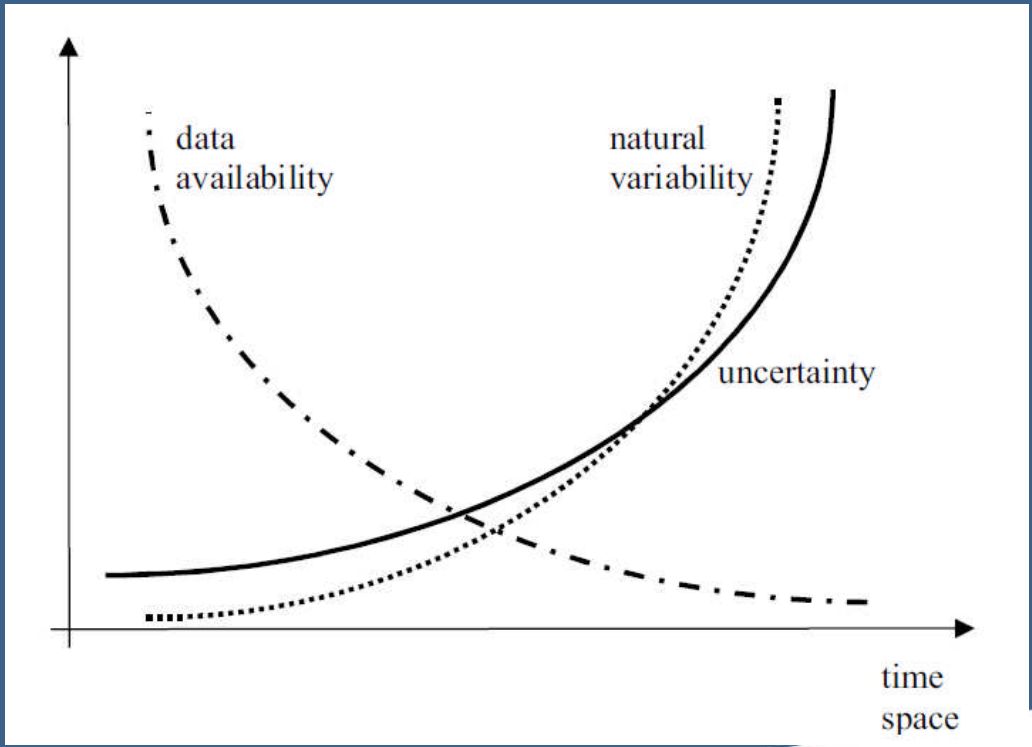

Ecosystem service/s
Colour = type
Width = magnitude
Region
DRAAGKRACHT
Landscapes
(integrated mosaic
of ecosystems)
Ecosystems

- Need for mechanistic understanding and numerical modelling but:
  - Data



- Way out:
  - Improved integrated modeling at the right scale!
  - Baeysian belief networks and similar statistical methods, as an alternative, but with important limitations
  - Pragmatic approaches at smaller scales such as the functional analysis of wetlands

  - Research in key processes
  - Integrated monitoring, especially of restoration project

- RISKS due to lack of knowledge/data:
  - Basis for valuation
  - Problem for PES
  - Goals not achieved ➔ decrease of credibility
  - Gap between conceptual development of the concepts and the application to case studies

An integrated strategy

- Basin management plans can be a unifying planning instrument integrating land use and water management

An integrated strategy

- Understanding and quantification of ES
  - The biophysical basis
- Formulation of objectives
- The calculation of habitats surface needed
- Measures to maintain or restore habitats

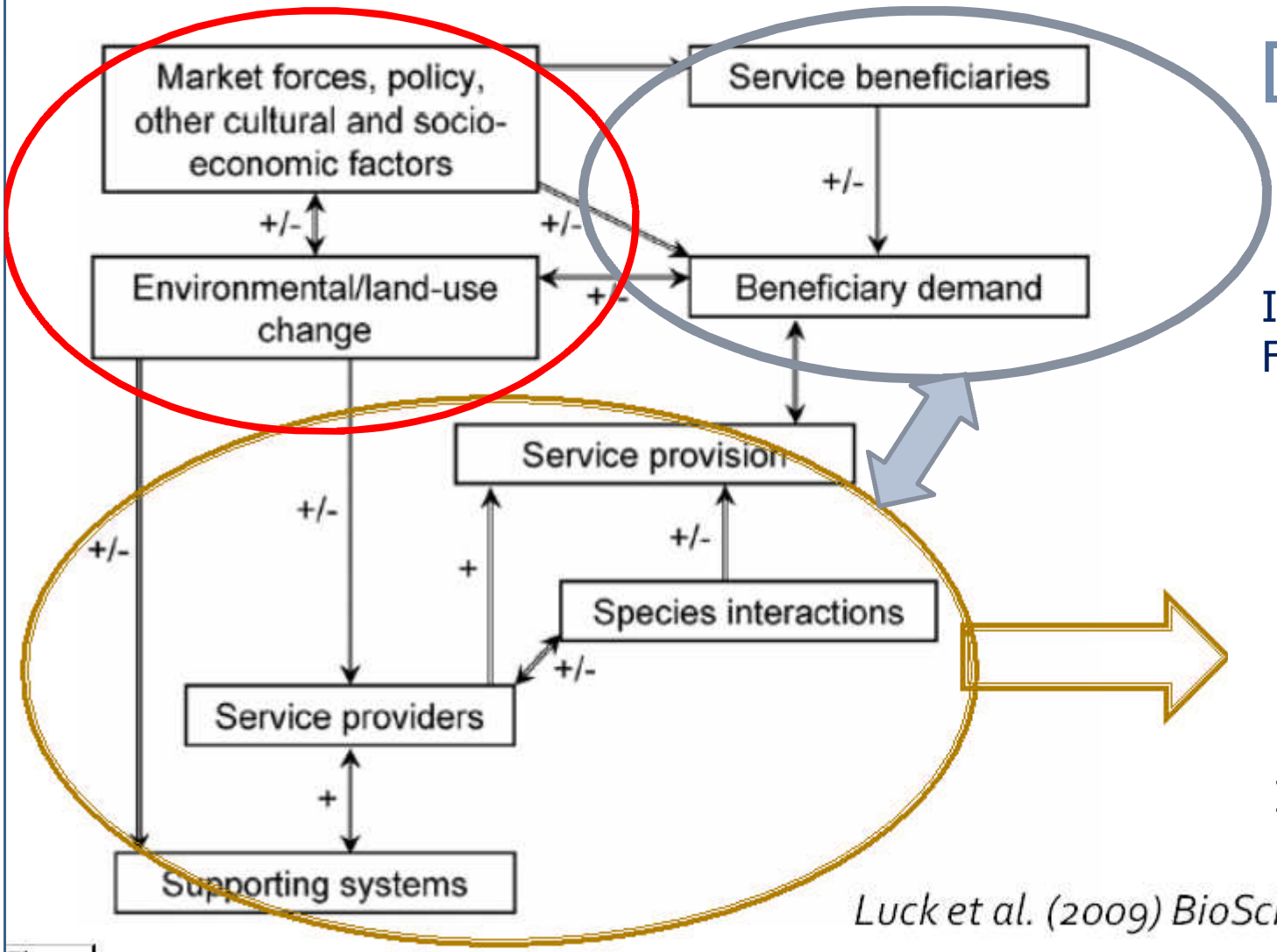
Defining objectives

- Scattered responsibilities lead to many different types of often incompatible objectives
- Integrated objectives, covering not only water quality or quantity,… but also delivery of ecosystem services is necessary

Zone of estuary

Services doelstelling	01 VlRaa	02 VlHan	03 HanGr	04 GrBur	05 BurTm	06 TmDem	07 DemGt	08 Durme	09 ZeDNe	10 strSc
maximaliseren buffer bovenstroomse afvoer	0	0	0	0	+	+	++	++	++	+
maximaliseren tidale energiedissipatie	+	++	++	.	.	.	.	+	+	0
uitbreiden meergeulenstelsel	0	++	++	0	0	0	0	0	0	0
optimaliseren natuurlijk habitatprocesse	++	++	++	++	++	++	++	++	++	0
maximaliseren turbiditeit	0	+	+	++	++	++	+	++	+	0
optimaliseren koolstofhuishouding	0	0	0	0	0	0	0	0	0	++
optimaliseren stikstofhuishouding	0	0	+	+	+	++	++	++	++	++
optimaliseren zuurstofhuishouding	0	0	0	+	++	++	+	++	+	++
optimaliseren fosforhuishouding	0	0	0	0	0	0	+	+	+	++
optimaliseren siliciumhuishouding	+					++	++	++		0
optimaliseren primaire productie	0	+	+	++	++	++	+	++	+	0
optimaliseren condities voor zoöplankton	0	+	+	+	++	++	++	++	++	0
optimaliseren condities voor benthos	+	++	++	++	++	++	++	++	++	0
optimaliseren vismigratie	0	+	+	+	+	+	++	++	++	++
uitbreiden areaal ondiep laagdynamisch water	+	++	++	++	++	++	++	++	++	0
uitbreiden areaal slik	+	++	++	++	++	++	++	++	++	0
verhogen dynamiek slik	0	++	++	0	0	0	0	0	0	0
uitbreiden areaal schor	+	++	+	+	++	+	++	+	++	0
verjongen schor	+	++	++	++	++	++	++	0	0	0
uitbreiden areaal wetland	0	0	0	+	+	+	++	+	++	0

- Diagnosis of the system:
- Where did delivery of which ES decline?



DEMAND

Identify demand For ES

SUPPLY

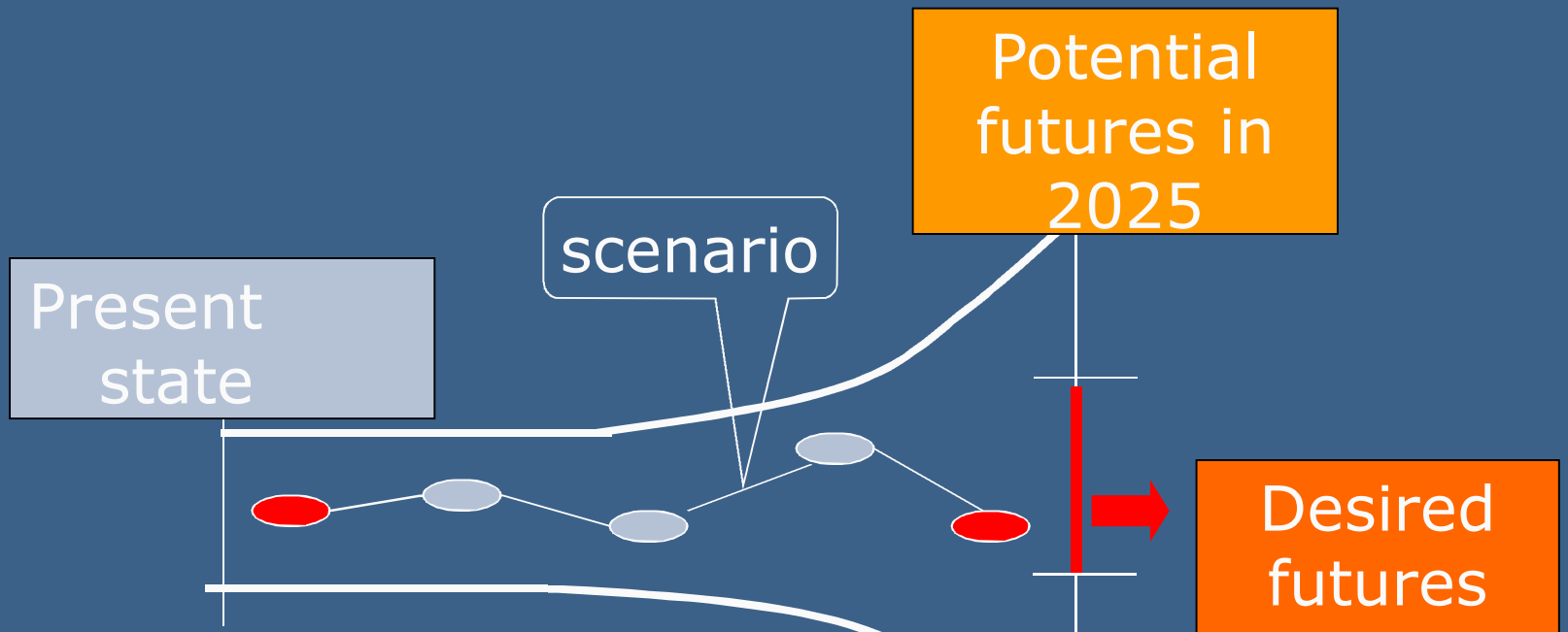
Increase supply

Luck et al. (2009) BioScience 59: 223–235

Defining goals for ES

- Reducing increase of tidal energy (eg high waters in estuary may not increase more than x cm)
- Amount of nutrients that must be removed in estuary to reach a given load to the coastal sea
- Amount of recycling of dissolved silica to maintain diatom production
- Amount of storm water to be stored
- ……..

- Coupling the formulation of objectives to an overall vision of the development of the catchment/system
- ➔ link with communication

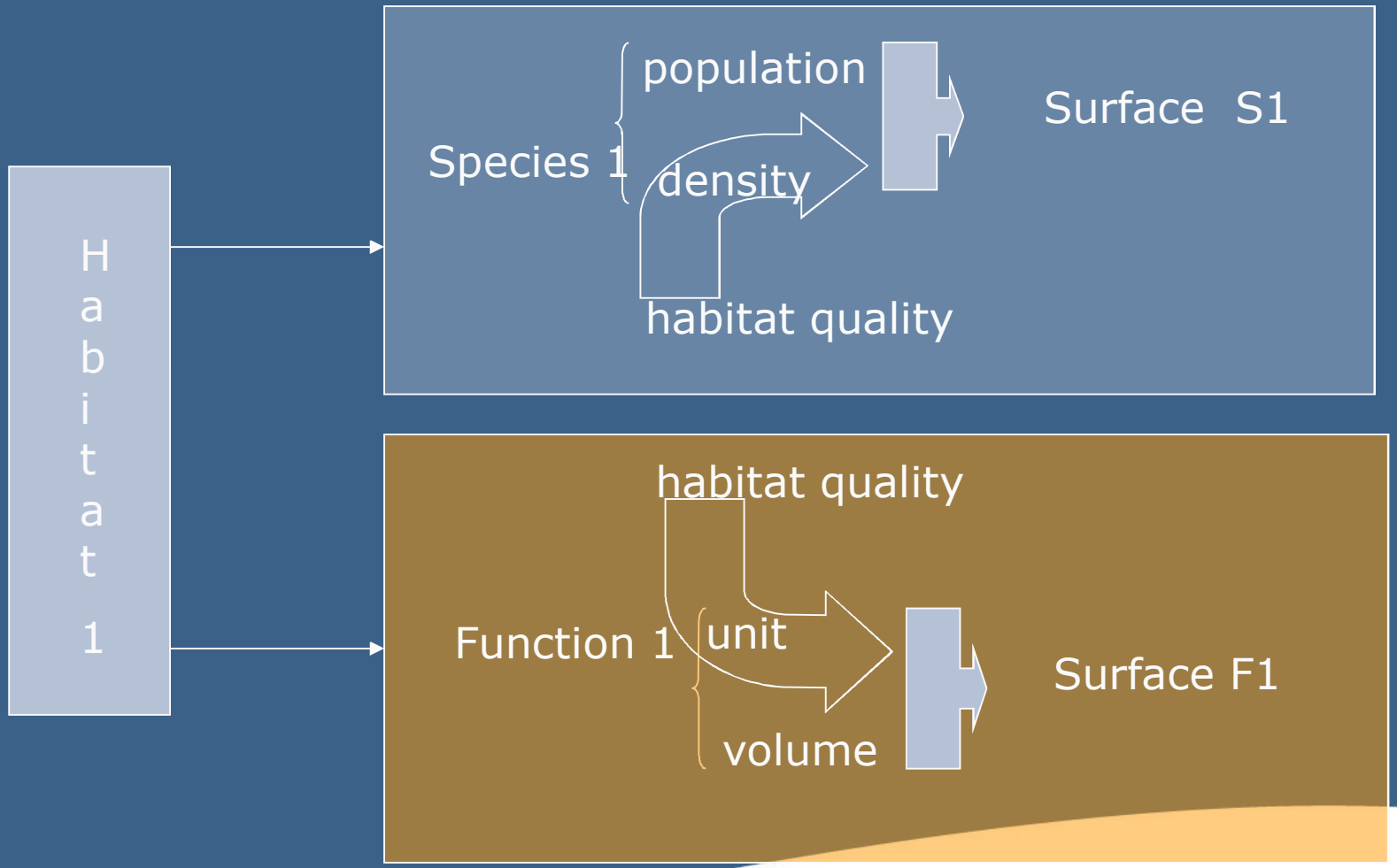


Trumpet of uncertainty and targets (M.Meijer)

An integrated strategy

- Understanding and quantification of ES
- Formulation of objectives
- The calculation of habitats surface needed
- Measures to maintain or restore habitats

"Conservation" Objectives (CO)

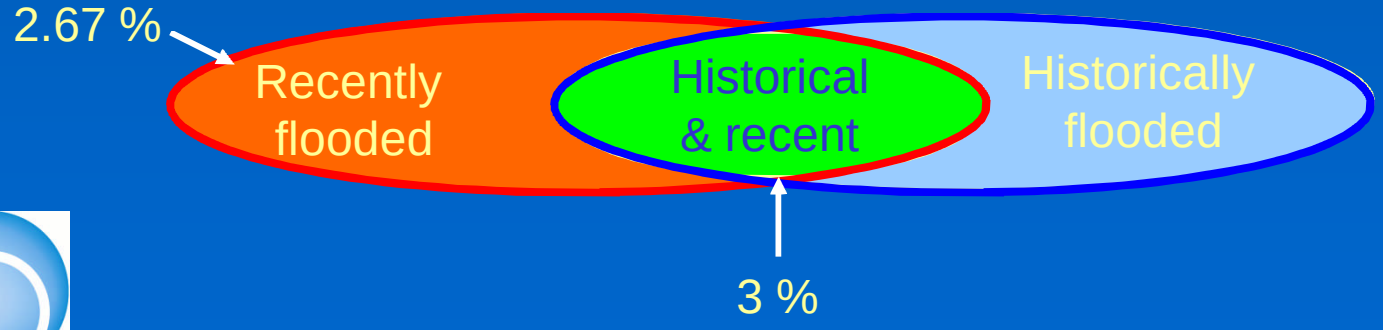


	Habitat 1	Habitat 2	Habitat 3
Service 1	X	Y	
Service 2	A		B
Habitat needed	max (X,A)	Y	B

An integrated strategy

- Understanding and quantification of ES
- Formulation of objectives
- The calculation of habitats surface needed
- Which measures to take where to realize the necessary habitats?

System was adapted to our needs
➔ Loss of services



Leerstoel Integraal Waterbeheer

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Subcatchment modeling

Classic hydrological model:
upstream to downstream > 1 direct line

→ Upstream generation of ES, downstream delivery of ES

→ *e.g.* How do human activities influence downstream ES?

Challenging model improvement:
downstream to upstream > network of possibilities

→ Possibility to analyze ES on subcatchment scale

→ *e.g.* How does the generation of aquatic ES depend on upstream catchment properties?

➢ *Upstream – downstream evaluation of catchment characteristics, ES generation ánd demand on subcatchment level.*

Leerstoel Integraal Waterbeheer

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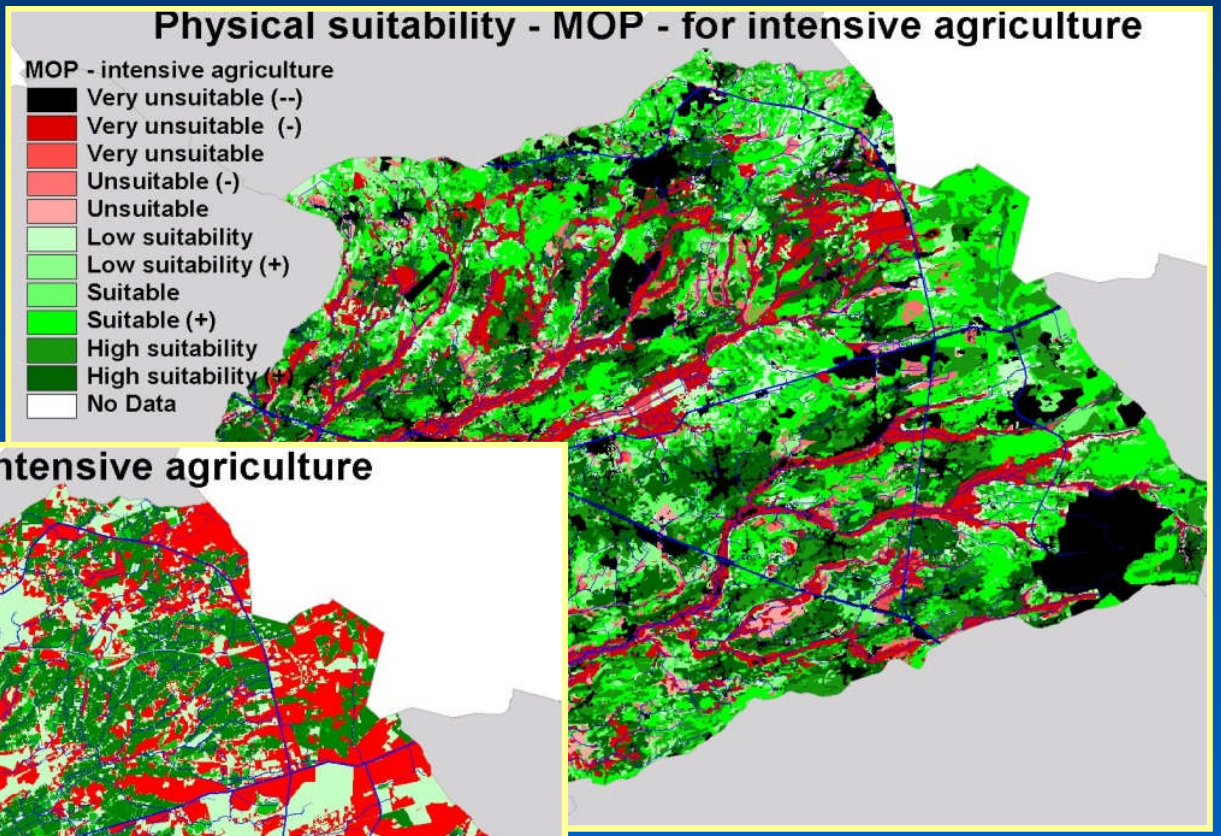
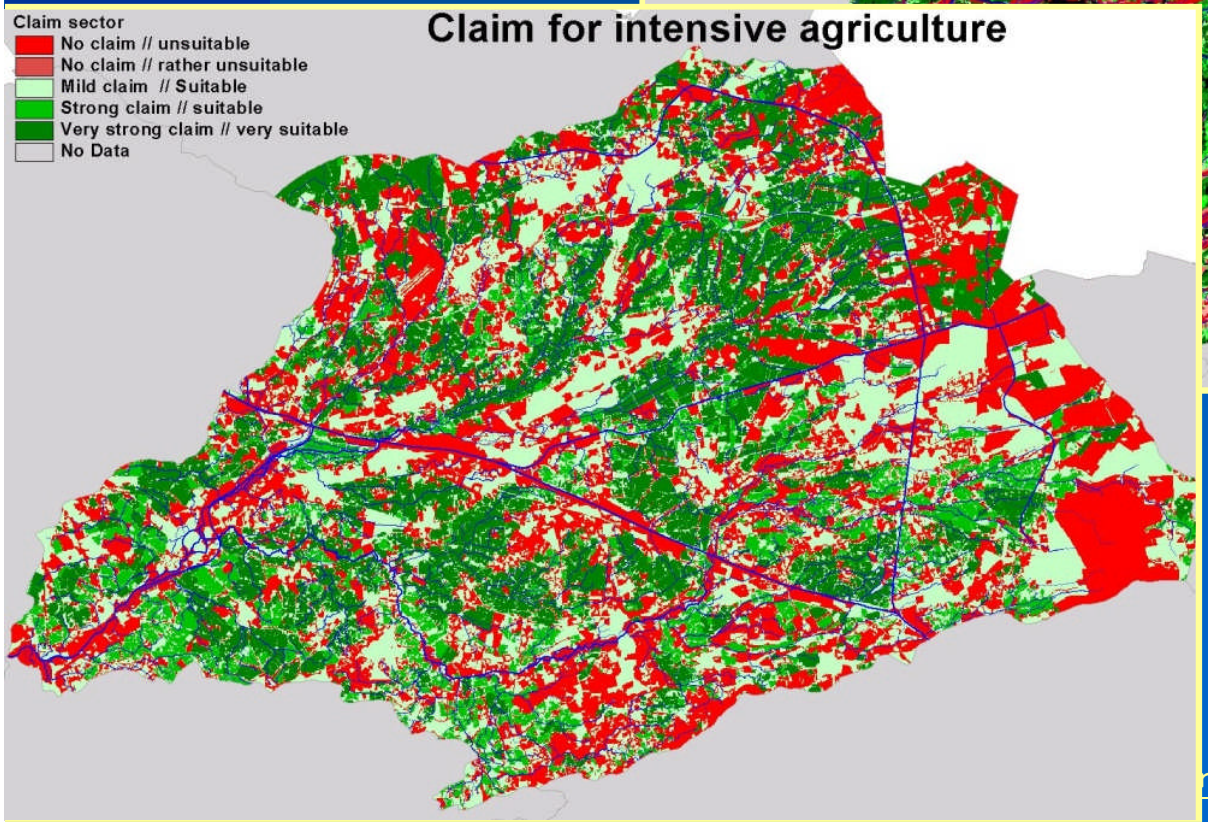
Examples: Physical suitability & sectorclaim





rzba

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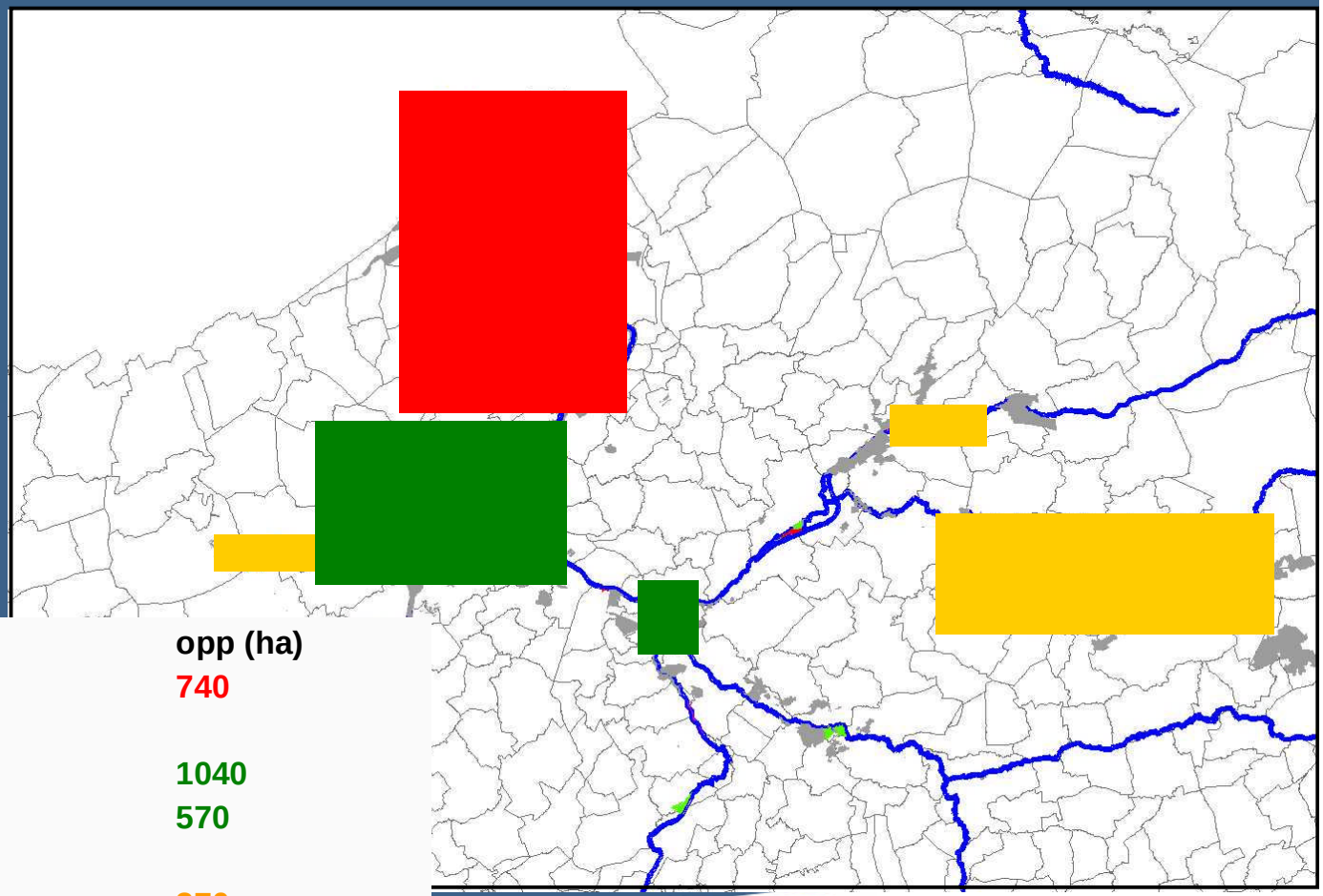
Spatial distribution of CO-Schelde:



Habitattype	opp (ha)
Buitendijks brak	740
Buitendijks zoet	1040
Binnendijks bos alluviaal	570
Binnendijks anderen	370
Binnendijks grasland dotter (RBB)	840
Binnendijks grasland anderen	910
Binnendijks riet/ruigte	560
Binnendijks plas/oever	240

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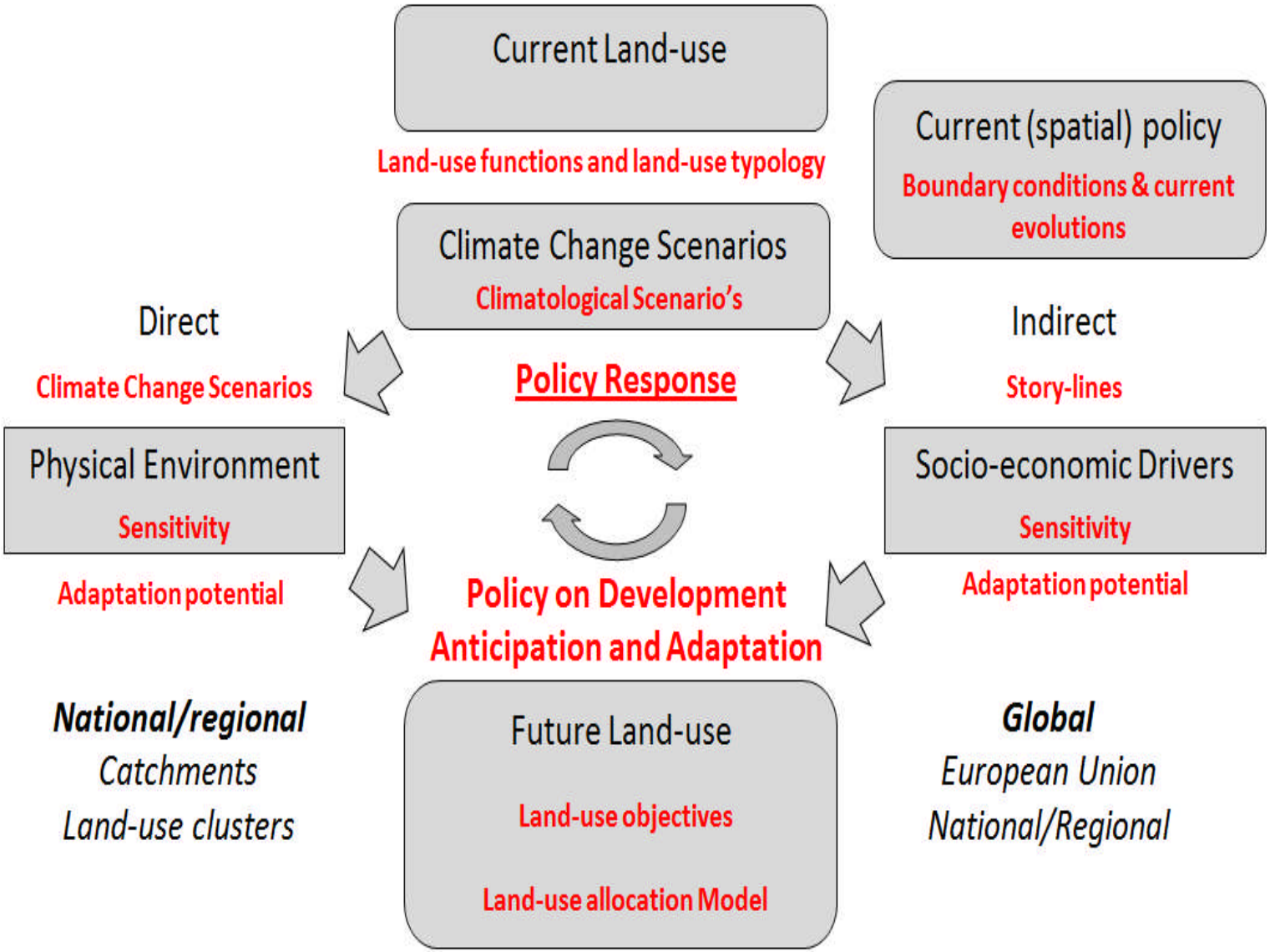
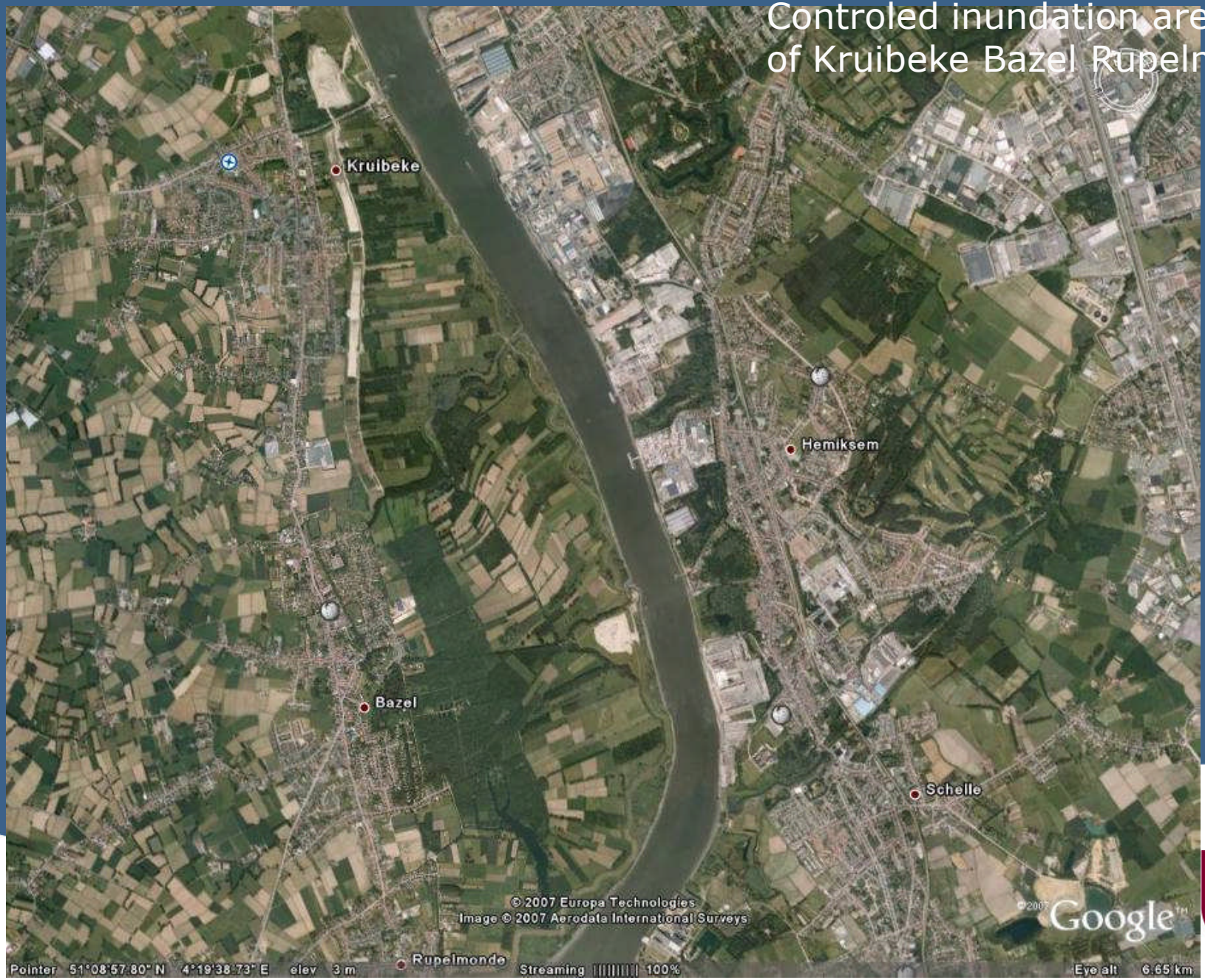
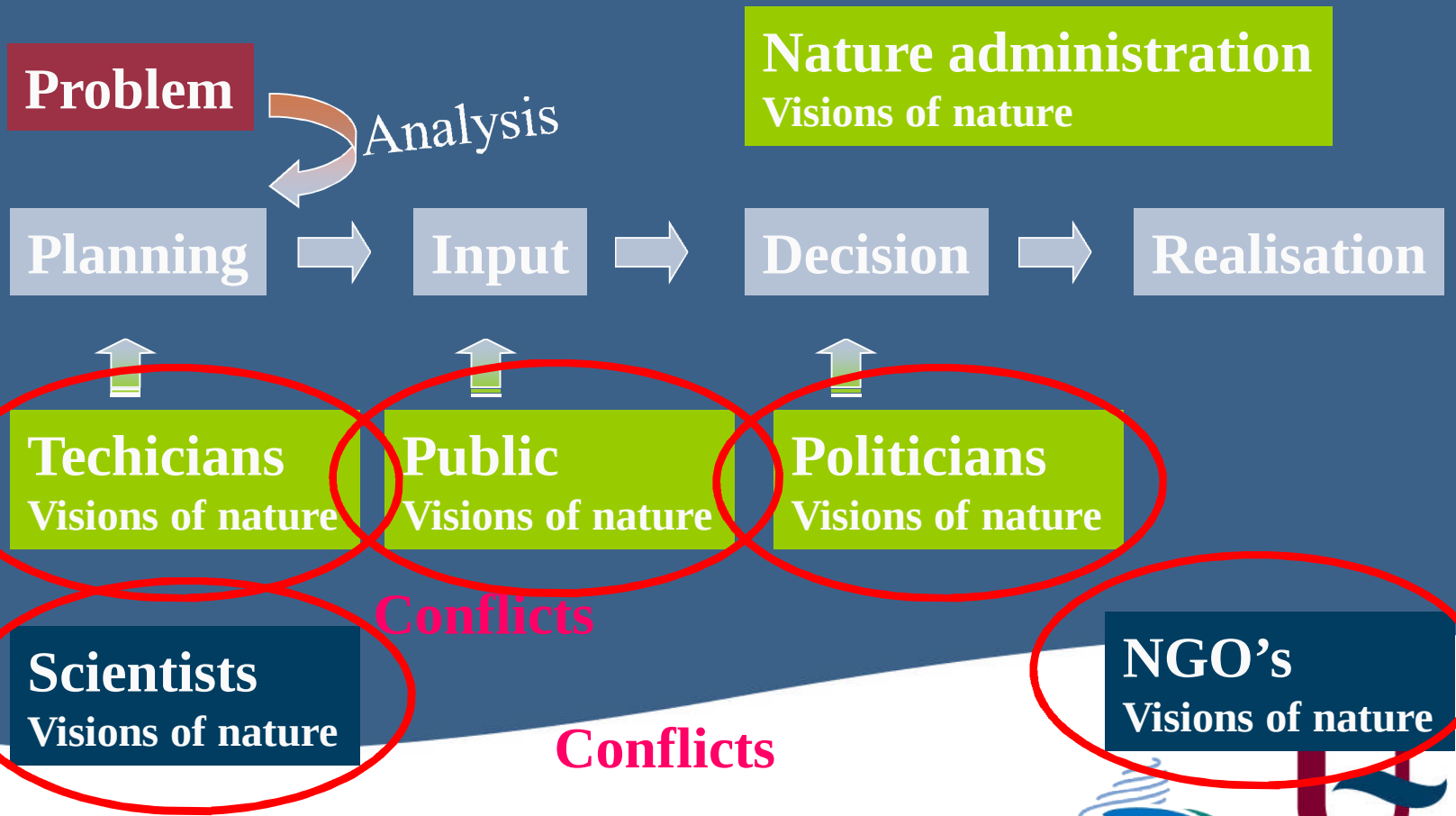

Current Land-use
Land-use functions and land-use typology
Current (spatial) policy
Boundary conditions & current evolutions
Climate Change Scenarios
Climatological Scenario's
Direct
Climate Change Scenarios
Indirect
Story-lines
Policy Response
Physical Environment
Sensitivity
Adaptation potential
Socio-economic Drivers
Sensitivity
Adaptation potential
Policy on Development
Anticipation and Adaptation
National/regional
Catchments
Land-use clusters
Future Land-use
Land-use objectives
Land-use allocation Model
Global
European Union
National/Regional

How to implement?

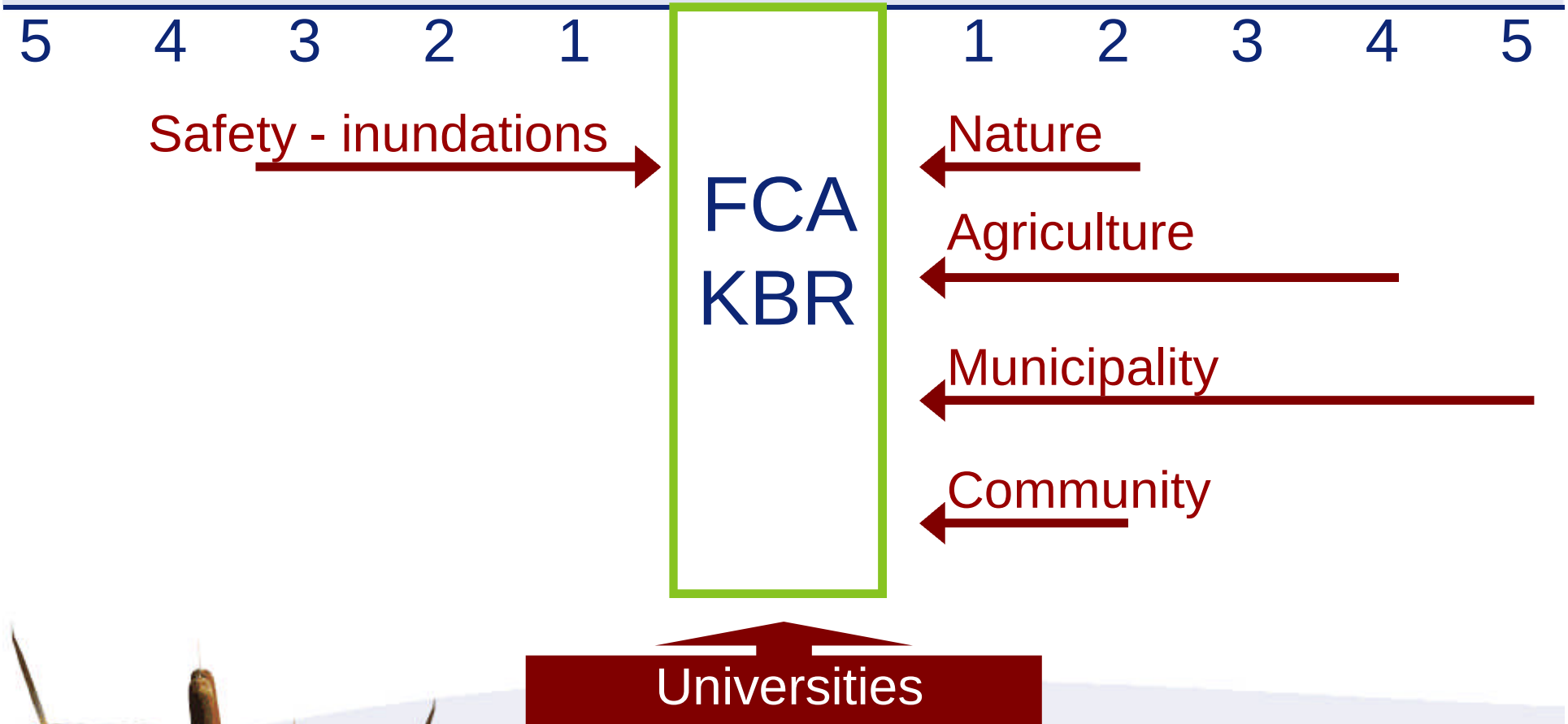
Controled inundation area of Kruibeke Bazel Rupelmonde



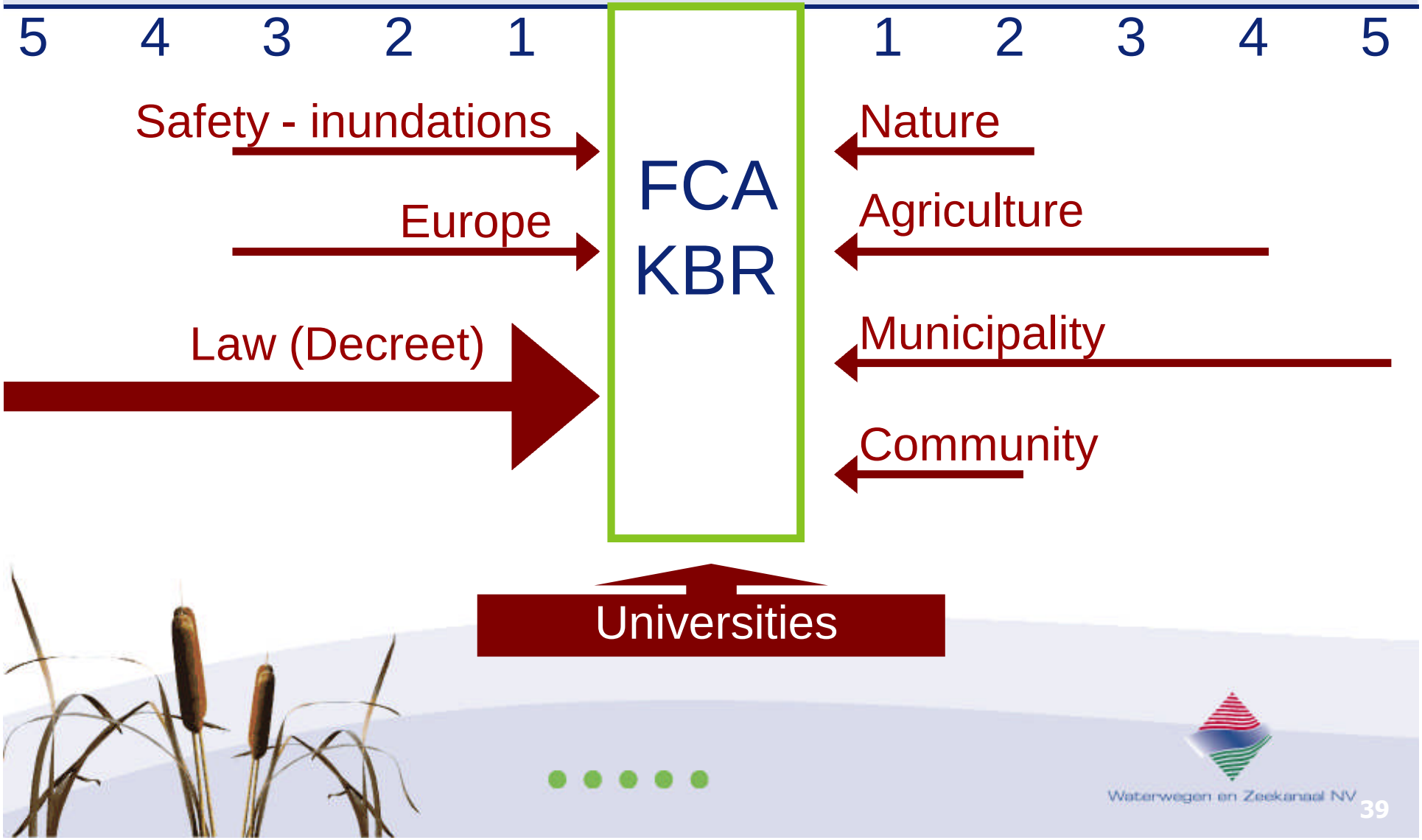
History of water management



Forcefield analysis



Forcefield analysis



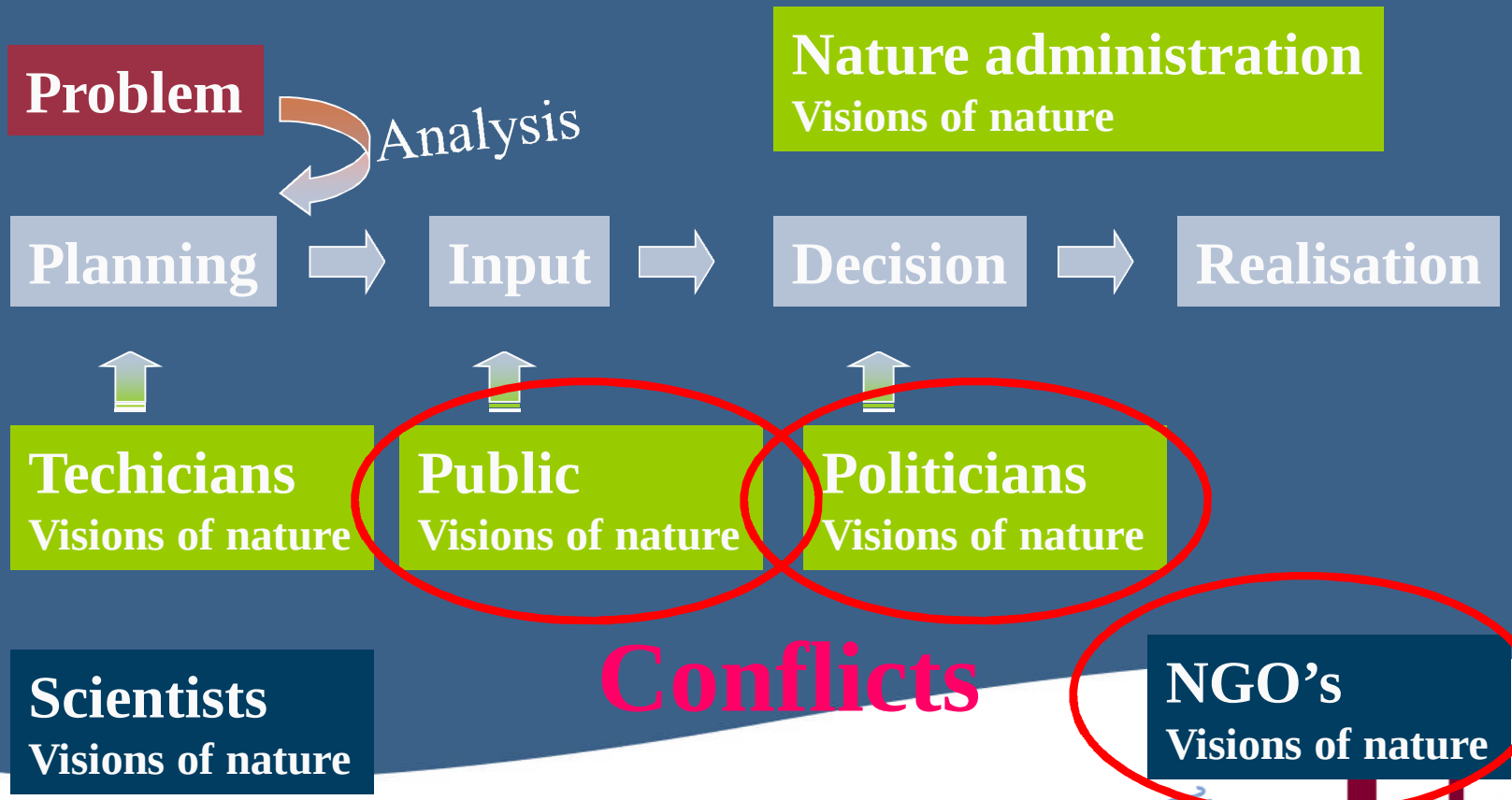
System theory

- Option of nature development creates the possibility of solving local conflicts
- System functioning and analysis became a common language
- Insights into 'goods and services' of the ecosystem

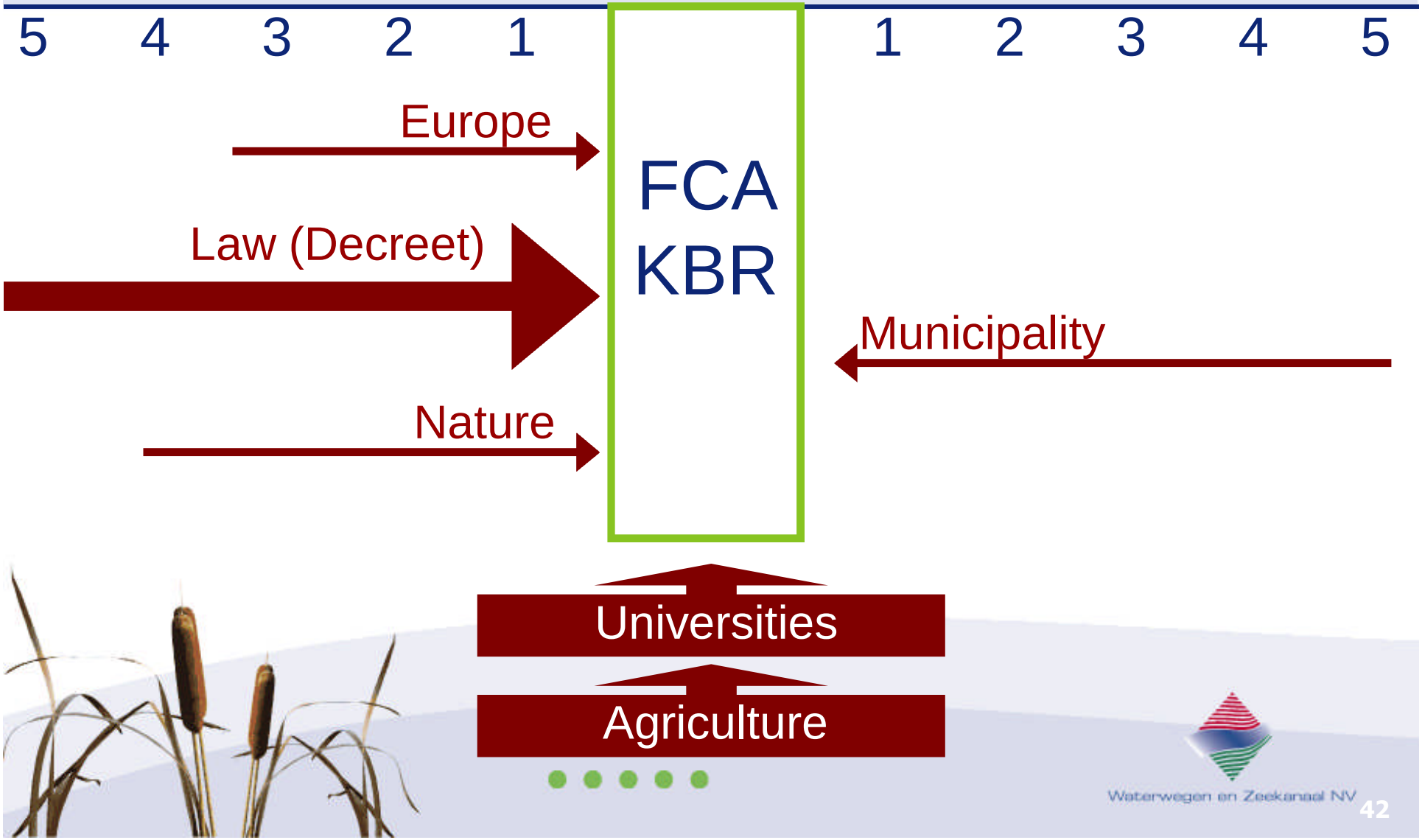
- Fundamental change of vision of technicians

History of nature management

After adoption of ES concept and restoration plan



Isolate opponents



Stay alert

GOG
gecontroleerd overstromingsgebied
Kruibeke - Bazel - Rupelmonde

5 4 3 2 1 1 2 3 4 5

Europe

Law (Decreet)

Nature

FCA
KBR

Neighbours

Municipality

Universities

Agriculture

Community

Waterwegen en Zeekanaal NV

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- To deal with the diversity of visions:
- Common language between the different groups: Ecosystem services is a good candidate

Techicians
Visions of nature

Public
Visions of nature

Politicians
Visions of nature

Scientists
Visions of nature

NGO's
Visions of nature

The keys to implementation involve recognition of:

- Biodiversity as both the driver and the insurance policy
- Multiple ecosystem services of habitat/sites
- Role of the wider landscape scale and spatial arrangements
  - Go beyond the traditional network of protected sites
  - Deal with issues of trade offs among services and potential beneficiaries

Major new developments can improve implementation

- Opportunities in current environmental legislation
  - > habitat and bird directive, … but also in Water framework directive,…..
  - > but:
    - need for more interpretation guidelines (art. 10 on connectivity),
    - research needs (Property rights (private property versus public goods)
- Need to mainstream alongside the environmental impact assessment to the wider policy framework

Way forward

- Key issues:
  - Scale and mapping, quantification
  - Interactions/trade offs between ecosystem services
  - Highlight and analyze experiences from case-studies
  - Awareness and involvement local communities (realisation of self- and community wide interest)
  - Further enabling legislation
  - Valuation and financial instruments

Way forward

- Key issues:
  - Incoroporate system thinking in education from primary school onwards and certainly at the university!

- In conclusion, land-use patterns that reckon with the physical properties of soil and hydrology cause less interaction with the water system whilst a high discrepancy between actual land-use and physical suitability urges a more intense adaptation of the system and thus to a higher impact of land-use on the water system.

Challenge

The key challenge of modern policy making in the domain of ecosystem management is to prevent or reduce the degradation of ecosystems and their services while meeting increasing demands.

Integrated and multi-disciplinary tools are required that give clear insights in the ecosystems ability to supply services, that estimate the size of these services and its impact on human welfare and that predict the consequences of human transformations on its future ability to deliver these services.

Conclusion

- Using the ES concept, allowed to:
  - Improve the communication between different managers
  - Work out integrated solutions
  - Formulate conservation objectives for different ES
  - Translate these CO into a surface of habitat necessary
  - Make a cost benefit analysis
  - Significantly change the approach
- Restoration is the most profitable scenario!!

- Succesfull examples of integrated plan design and implementation are often dependent on certain people…
  - ES are created and restored
  - But, it is not embedded in a methodological framework
  - Or even recognised as such

- Our role as scientists is to generate knowledge that allows to create frameworks that are adapted to:
  - The scale of the application
  - The different phases of planning processes
  - The institutional setting (power and authority)
  - The existing instruments

- Unfortunately these aspect do not match in time and space…