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**biodiversidade**

11

# GREEN INFRASTRUCTURES FOR BIODIVERSITY

28 DE SETEMBRO  
A 1 DE OUTUBRO DE 2011  
CENTRO DE CONGRESSOS DO ESTORIL

## Ecological Networks: Green infrastructure for Europe

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Organizaçãõ:



CASCAIS



APENA



Apoios:



FCT



ICN#B



Media Partner:

PLANEAMENTO



# Contents presentation

- Introduction
- Ecological networks in the Netherlands
- Experiences with the Dutch Ecological Network
- European corridors
- European processes and regional differences
- International challenges
- Conclusions

# Countdown 2010: stop decline biodiversity



- In 2010 it became obvious that the target 2010 (IUCN) won't be reached
- Europa develops the Natura2000 network
- The first phase: designating protected areas, is almost finalised
- The second phase (article 10 Habitats Directive) which guarantees development of connections of the network, is in most European countries still at an initial stage
- Connections are most urgent, in particular in strongly fragmented areas

# Introduction: the picture of Europe

In the past:

Large scale  
(semi-)natural  
ecosystems

Limited human  
impact

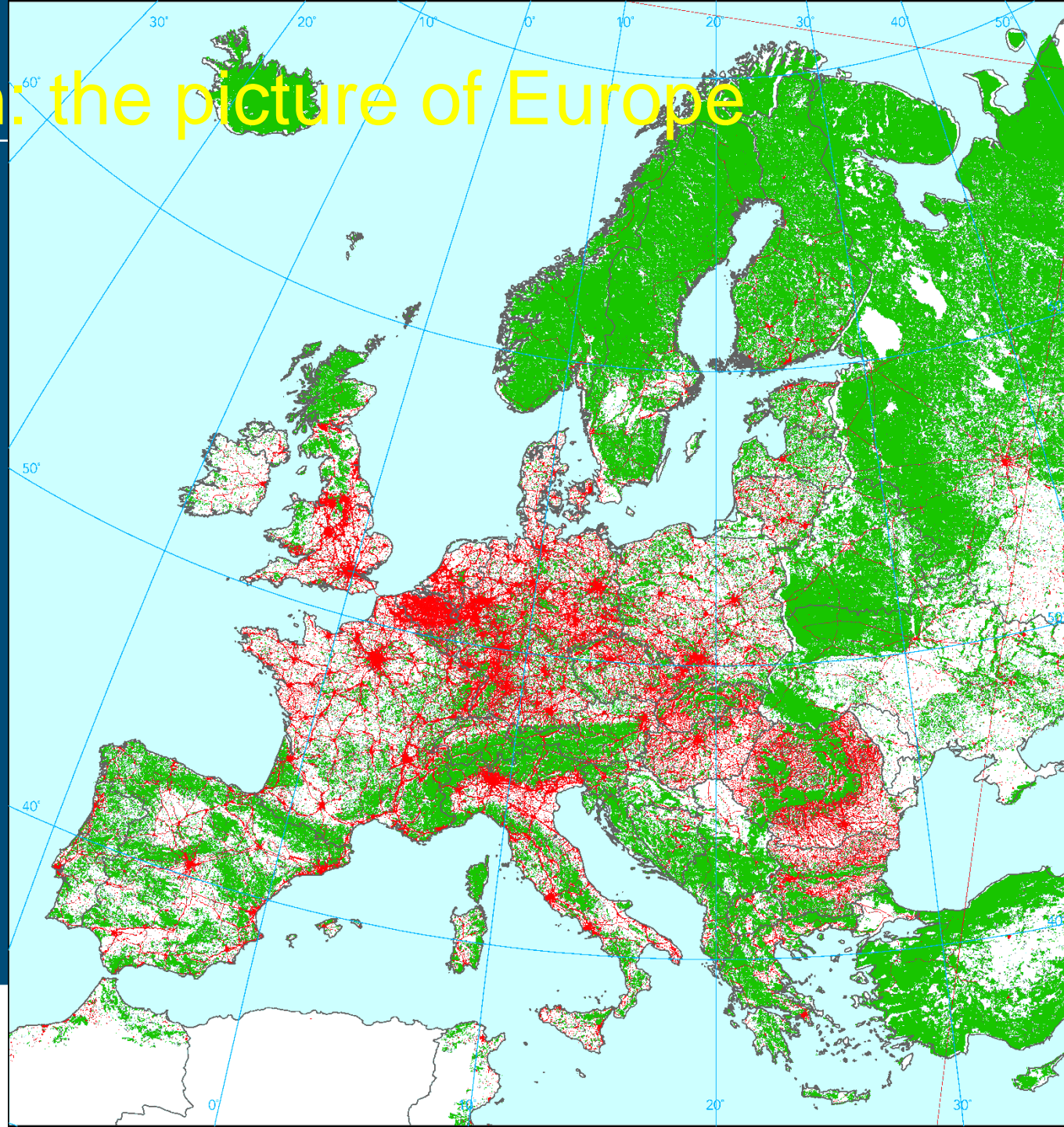


# Introduction: the picture of Europe

Europe at  
present:

Strongly  
Urbanised

Fragmented,  
physically and  
organisational



# Introduction: the picture of Europe



- 95% of the population is living in urban centres; an urbanising trend in central Europe;
- Growing urban mentality, disconnected from the rural;
- There is easy access to information (Internet, cell phone) and increasing mobility;
- Landscape homogenisation and fragmentation;
- Landscape consumers as the new stakeholders.

Organização:



Media Partner:



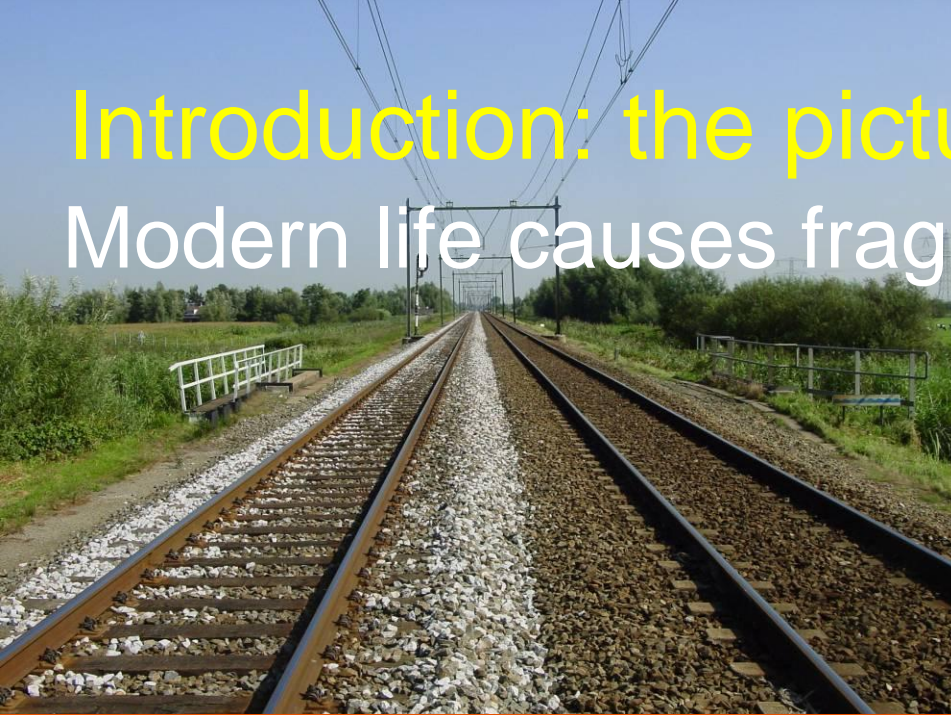
ALTERRA

WAGENINGEN UR



# Introduction: the picture of Europe

Modern life causes fragmentation of all kind



# We have to deal with fragmentation: Terrestrial wetlands in the Netherlands

- Of importance for 127 bird species
- International responsibility: 91 species
- 55 species: >10% world population
- 50.000 ha, 1500 sites

>80% is smaller than 10 ha

- Much of the areas that could be used are not used







## Model calculations:

- Even the “large” marshes are too small for most species, but:
- All marshes together are big enough

## Problem:

Marsh complexes are so far apart that even mobile species cannot bridge the gap

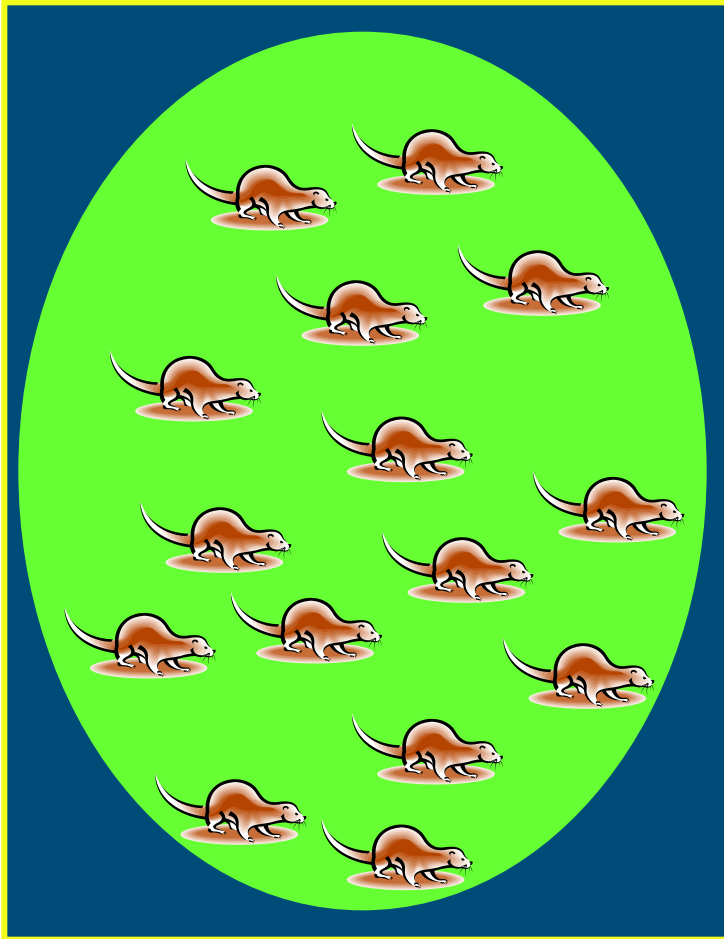


Solution?

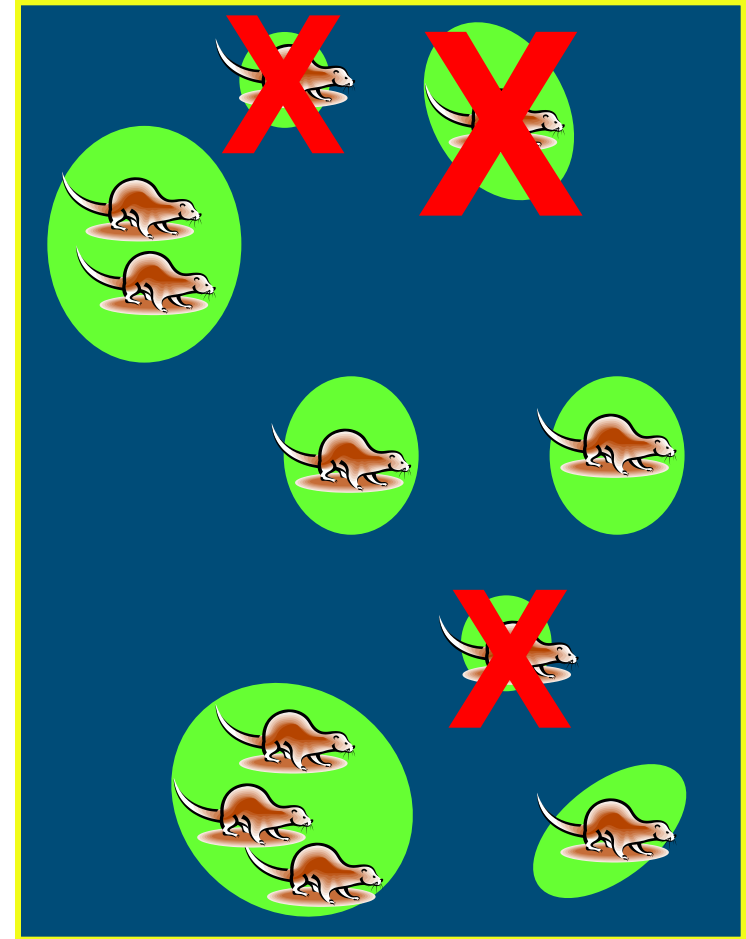
# Connecting Nature!

- Reinforce the spatial coherence of nature in rural and urban Europe
- Improve the effectiveness of investments in nature

# From fragmented...

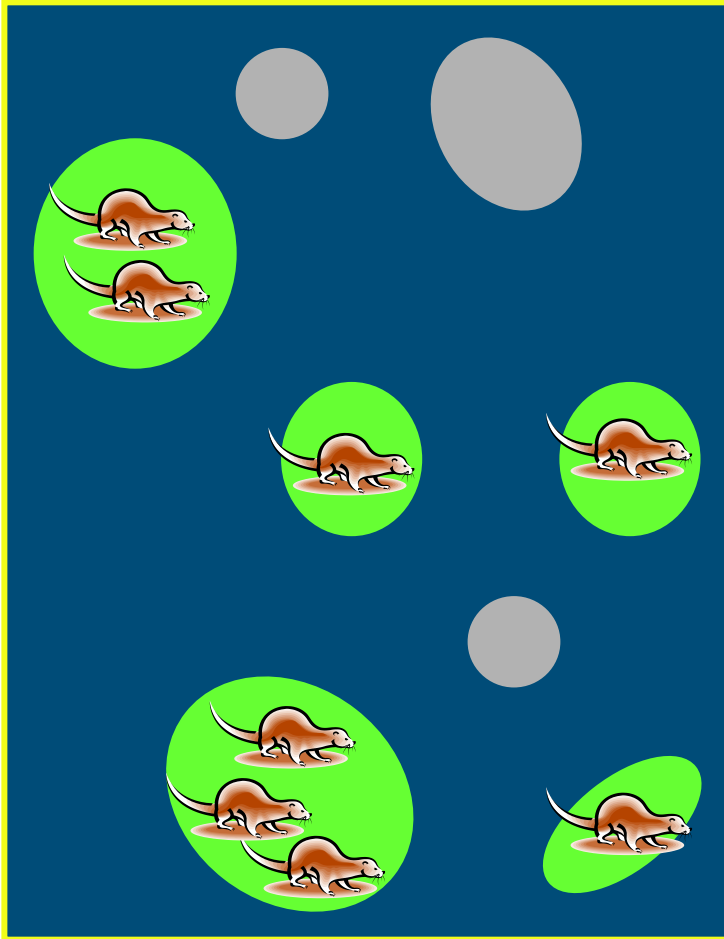


In the past



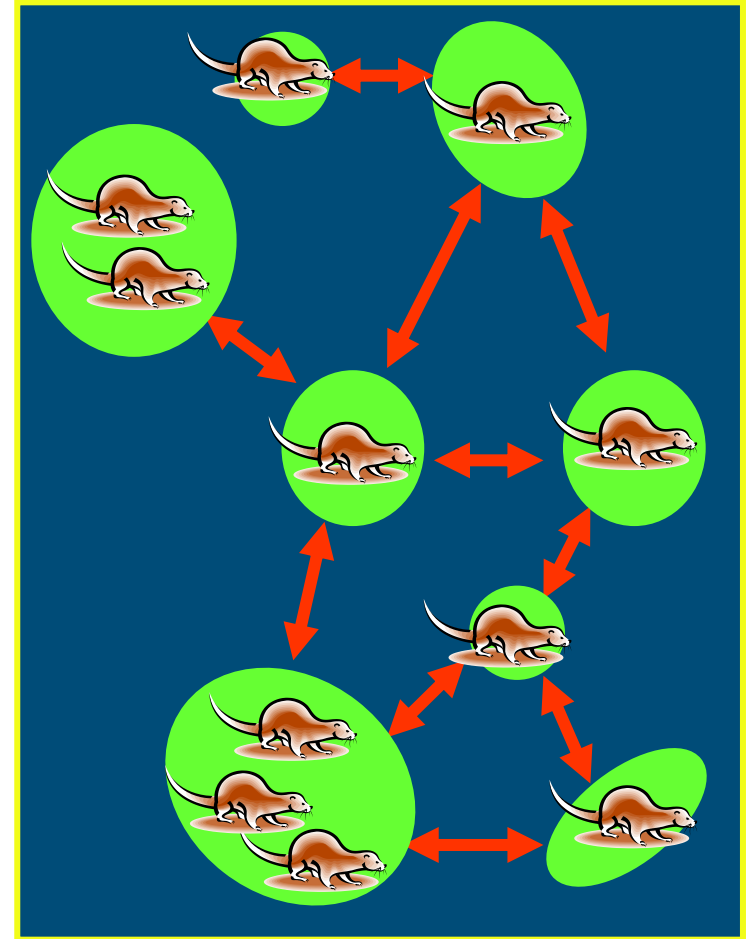
At present

# .... To defragmentated...



Not connected

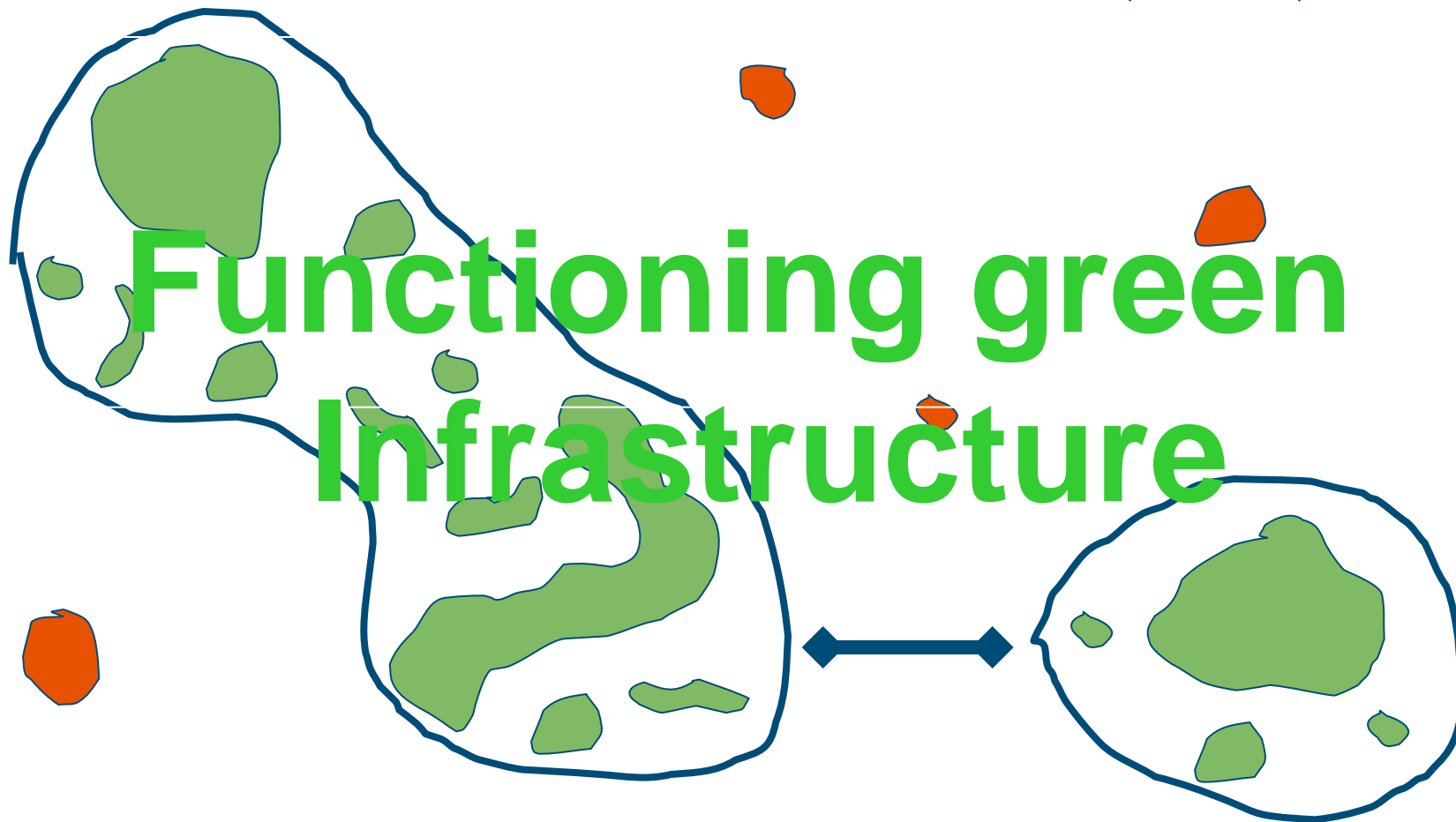
Networks  
&  
Greenway  
s Policy



Connected /  
'Defragmented'

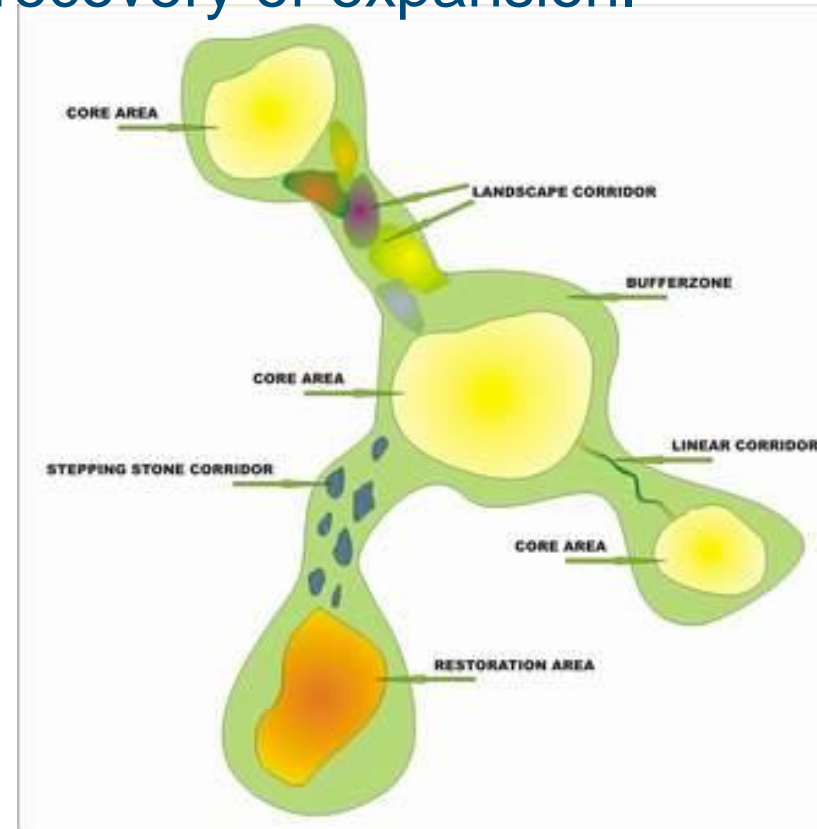
# ...to sustainable ecological networks!

Is this ecological network large enough for species 'X'?



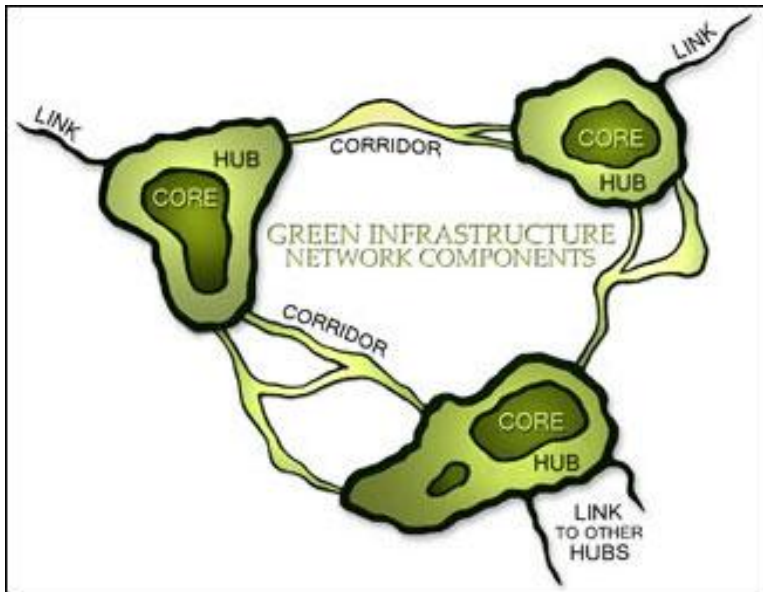
# From ecological networks...

An ecological network might consist of core areas, buffer zones, corridors, and in some cases restoration areas. The core areas might form the backbone of the ecological network, the corridors the veins, whereas the buffer zones form a protective layer and restoration areas the areas for recovery or expansion.



# From ecological networks... To green infrastructure

“Green infrastructure is strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations”



*‘GREEN INFRASTRUCTURE’ LINKS ECOLOGICAL NETWORKS WITH GREENWAYS.*

<http://greeninfrastructure.net/content/definition-green-infrastructure>

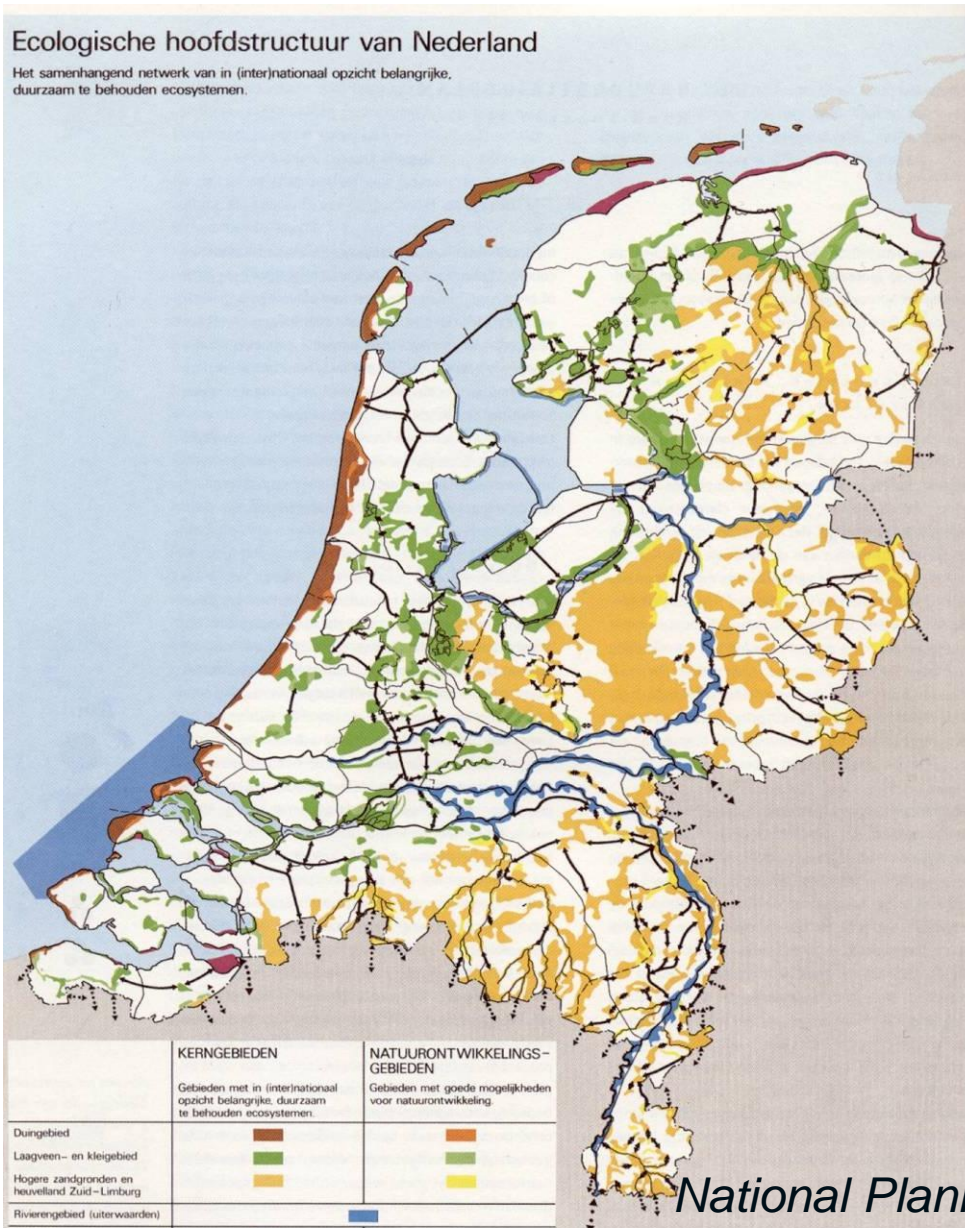
# The ecological network in the Netherlands

A theoretical concept in practice

National ecological network/ EHS 1990: work map

- Existing natural areas (core areas)
- Additional areas (expansion areas)
- Indicative connections

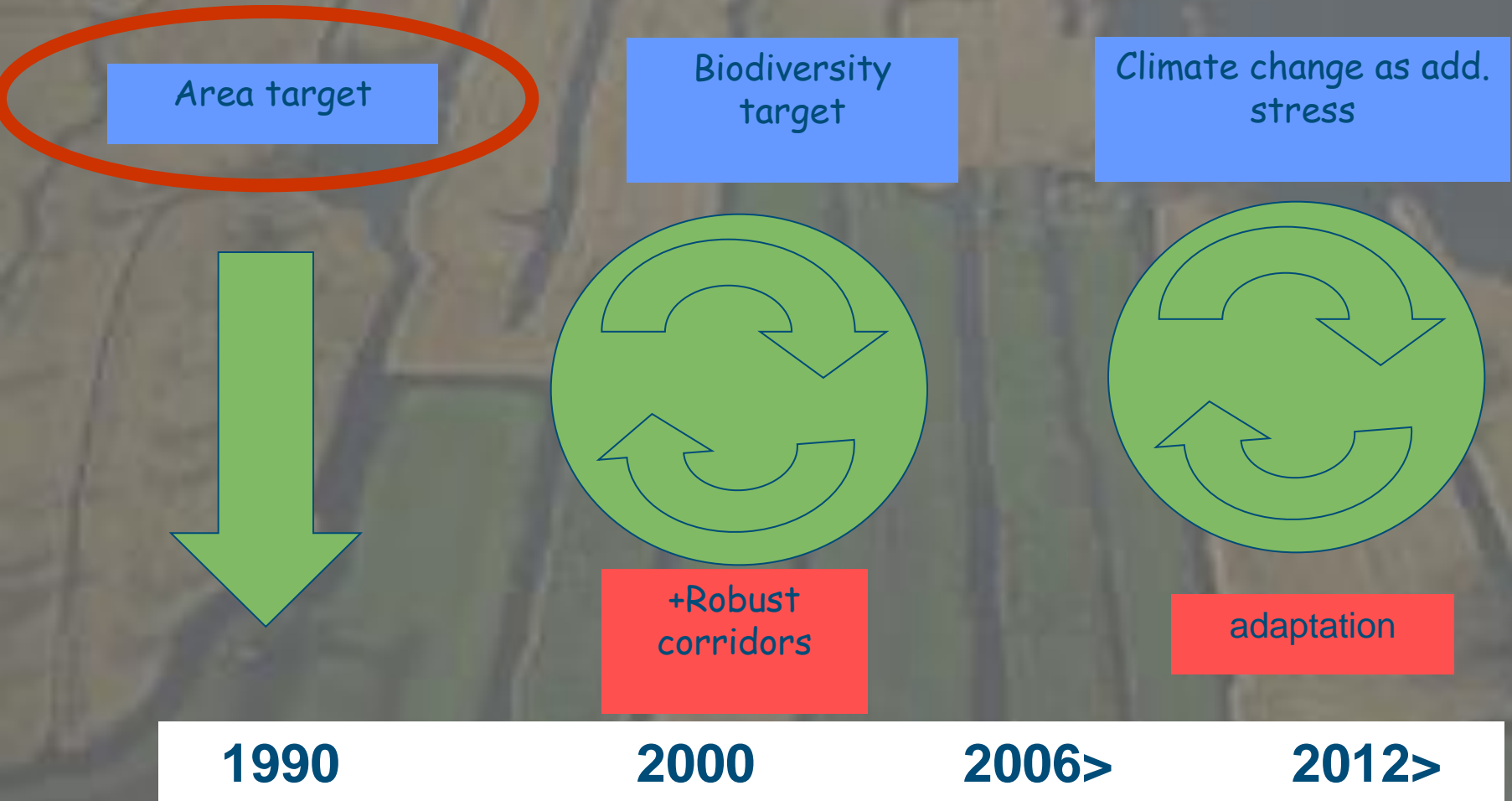
Realisation by 2018?



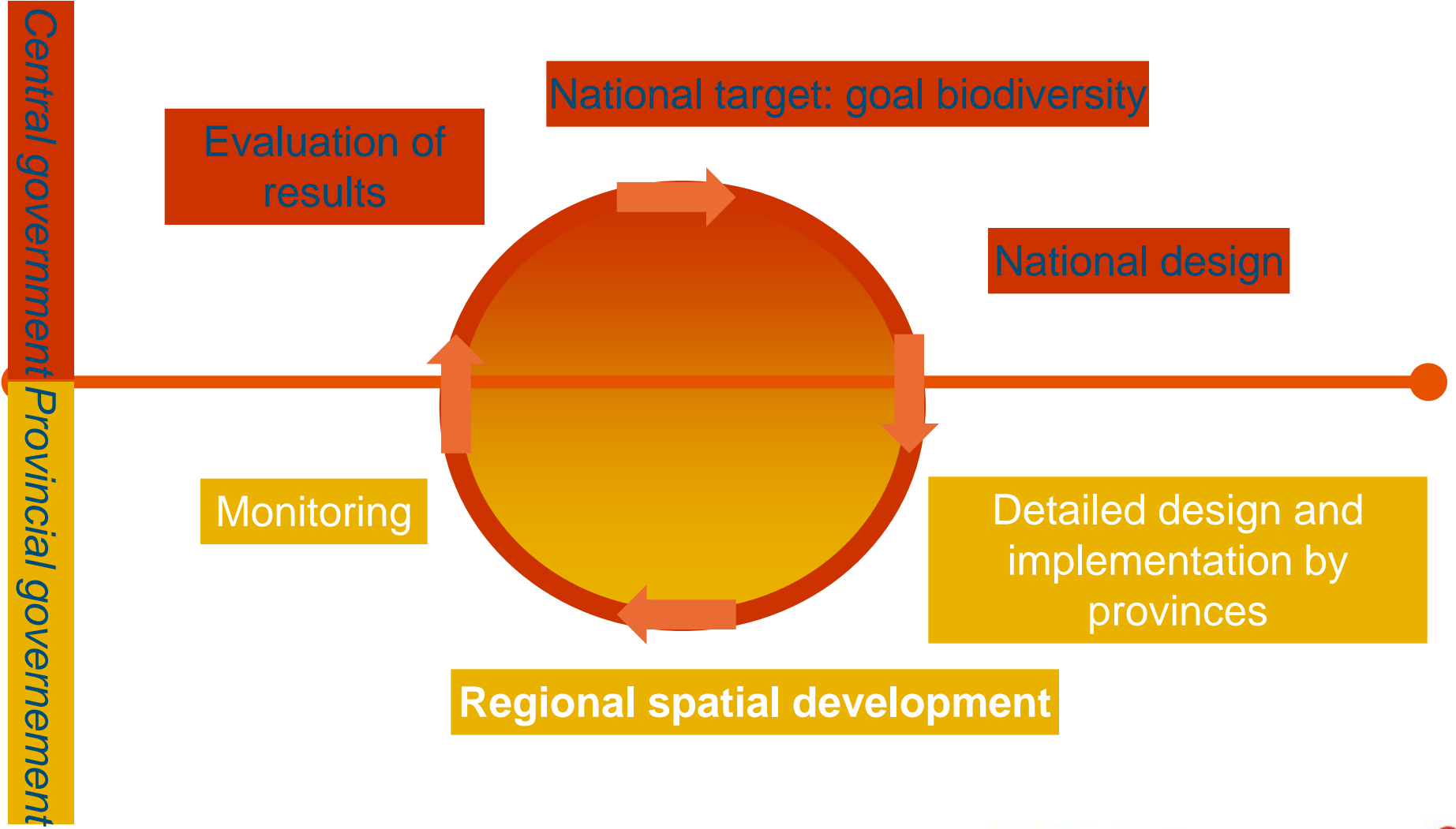
National Planning Framework 1990



# Planning the Dutch Ecological network



# Implementation as cyclic process at 2 levels



# Planning the Dutch national ecological network



## Targets!

- Area target
  - Biotopes / ecosystems
- Targets for corridors by the Provinces
- Restoring connectivity (de-fragmentation)
  - Capital

# Planning the Dutch national ecological network

## Example Dutch budget:

- Budget 2010 some 424 million €
- In addition funds from Ministry of infrastructure (400 million € until 2018)
- In addition funds from NGOs, etcetera
- Compensation funding



# Planning the Dutch national ecological network



Analysis Alterra  
LARCH model

Comprehensive national study Ministry of Roads & Infrastructure

*Van der Grift et al. 2009*



18. Ossendrecht (Brabantse wal)  
 19. Bergen op Zoom (Halstersche Laag)  
 20. Breda (Mastbosch)  
 21. Breda (KP Princenville)  
 22. Langeweg (Zonzeleische Polder)  
 23. Zevenbergen (Mark)  
 24. Werkendam (Kreken A27)  
 25. Gorinchem (Boven Merwede)  
 26. Liempde (Veldersbosch)

18. Budei (Weerter en Budebergen)  
 19. Cuijk (Dassentunnels A73)  
 20. Zevenbergen (Bloemendaalse Polder)  
 21. Steenberg (Steenbergsche Vliet, Roosendaalse Vliet)  
 22. Steenberg (Polder Oudland)  
 23. Wouw (Smalle Beek)  
 24. Bosschenhoofd (Kibbelvaart)  
 25. Dorst (Boswachterij Dorst)  
 26. Raamsdonksveer (Bergsche Maas)

# Planning the Dutch national ecological network

Restoring connectivity: Ecoducts Province of Gelderland



9 Ecoducts  
50 Mil. €  
2010-2012

# Also species need infrastructure

Eco-bridges to cross roads



# Also species need infrastructure



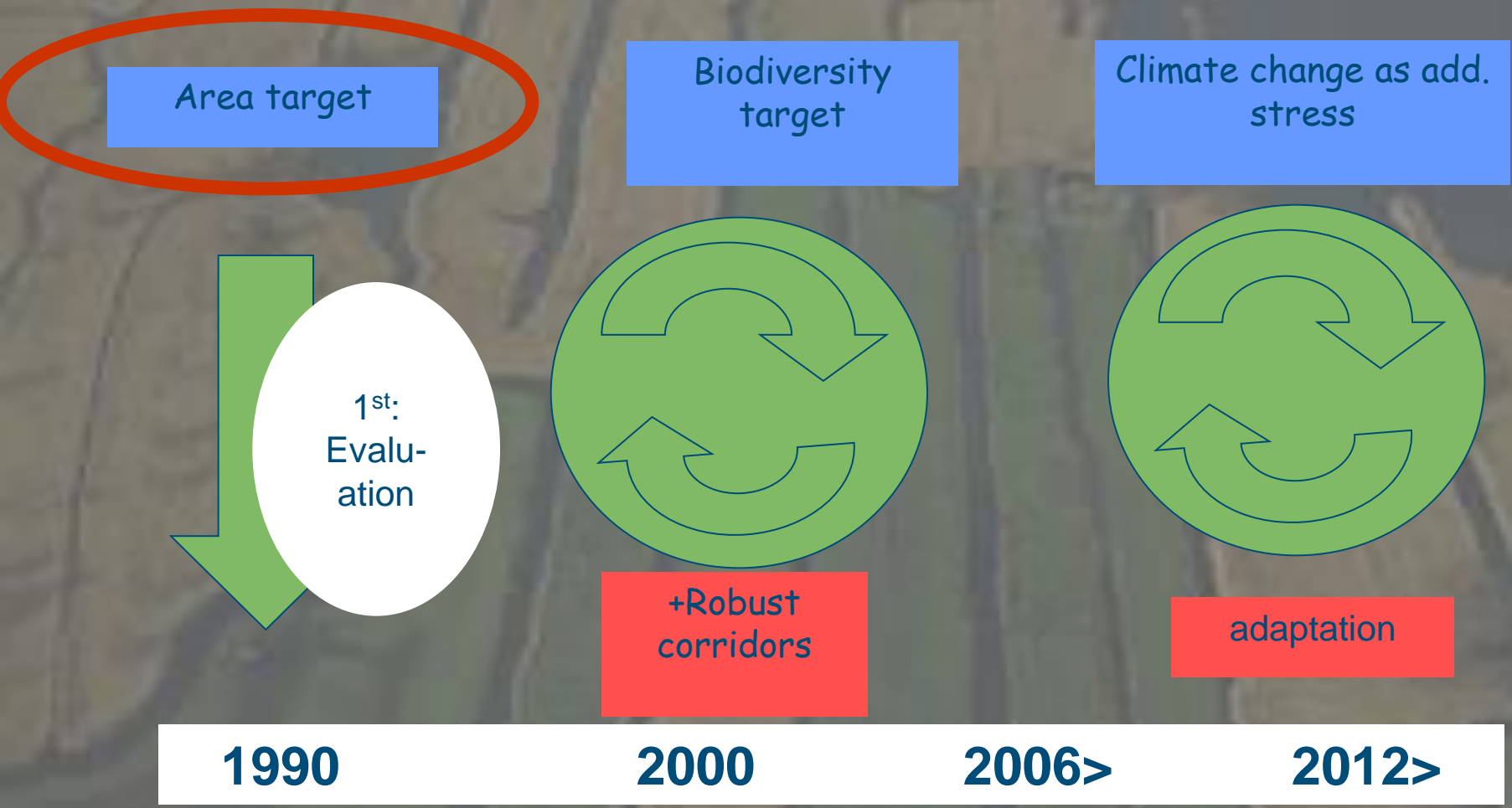


# Also species need infrastructure



Fish ladder: corridor between spawning and living area

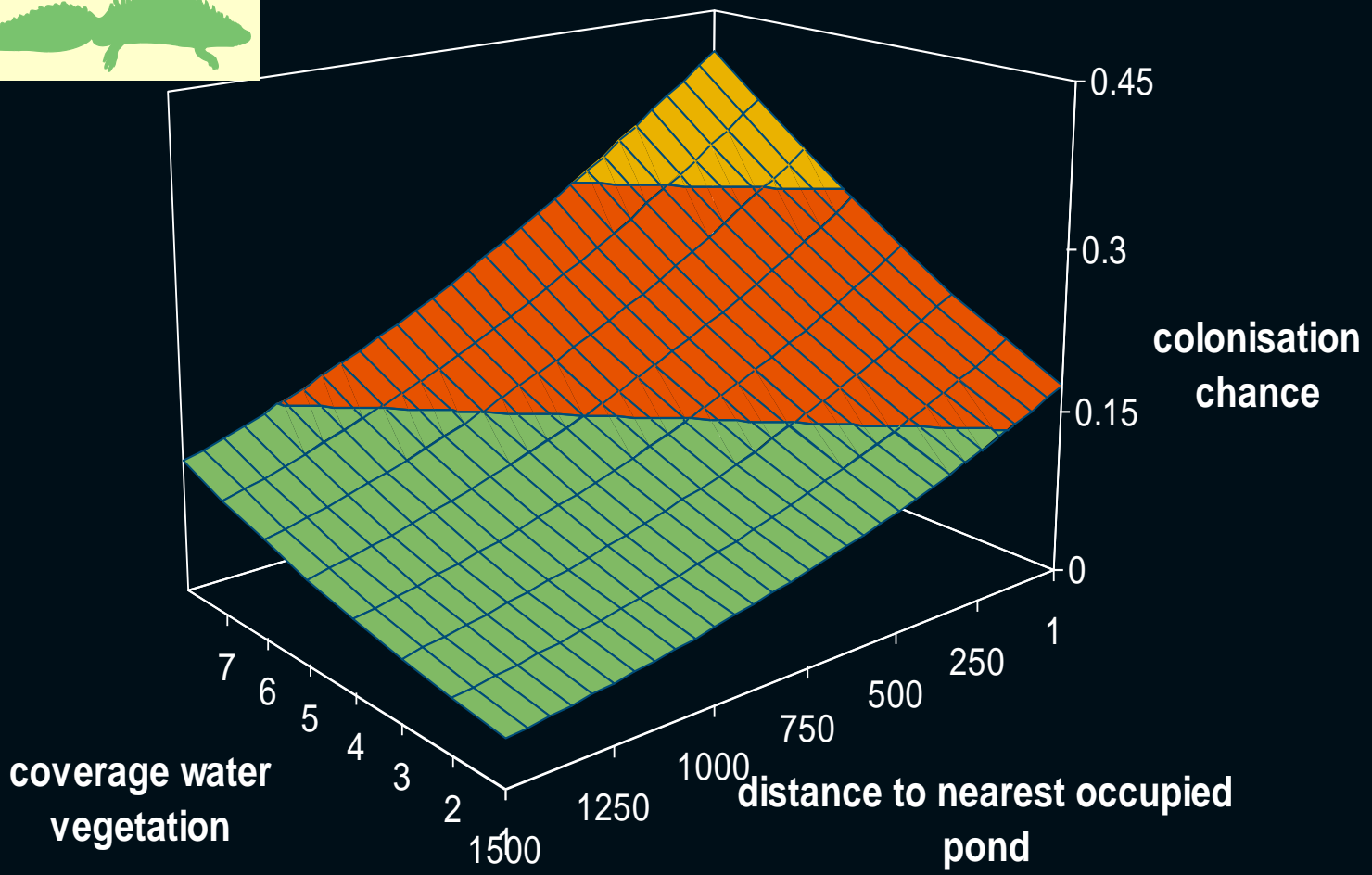
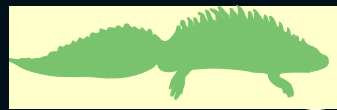
# 3 Lessons learned



# 1st Lesson: ecological conditions instead of species

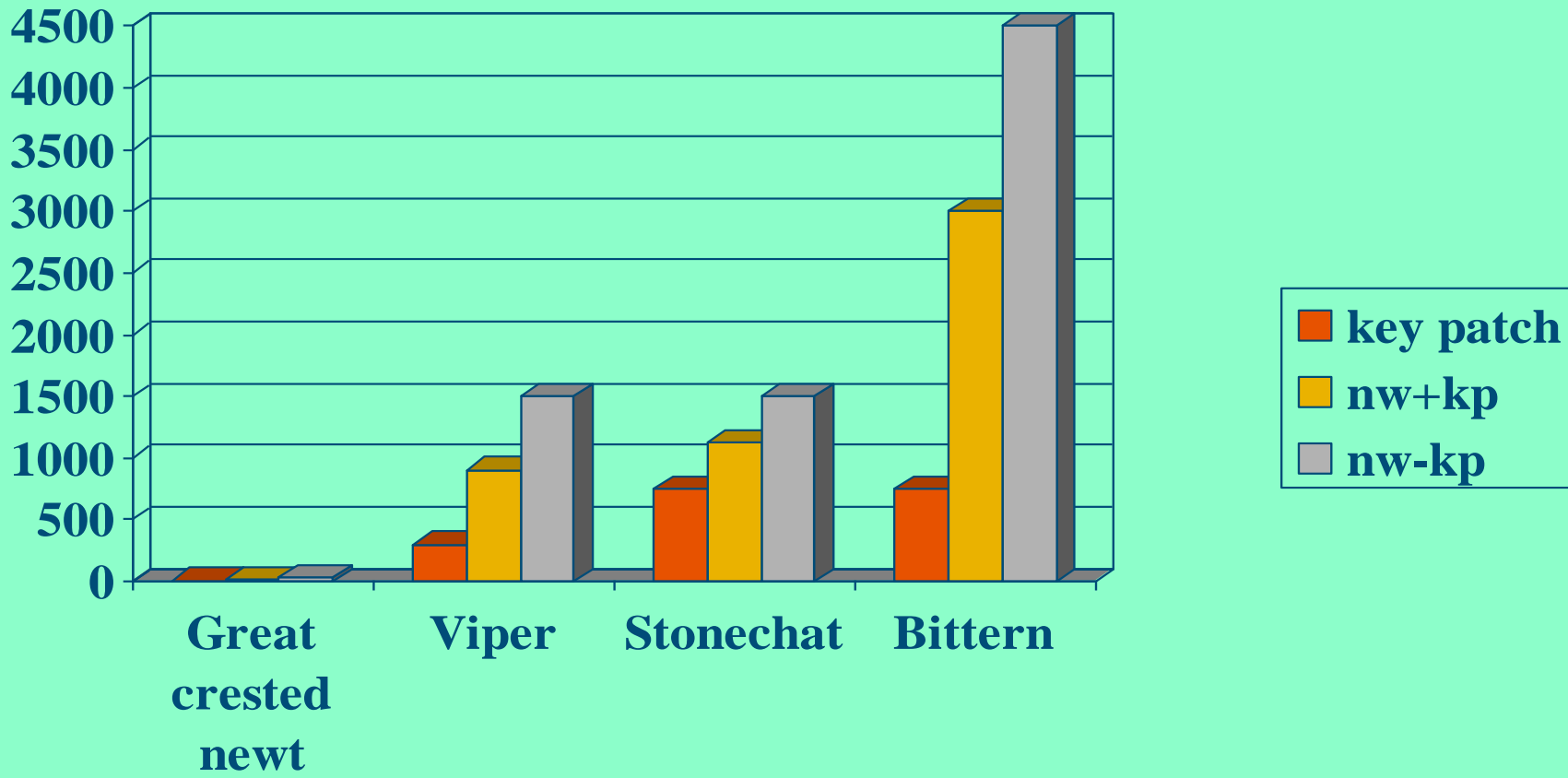
- Species are too dynamic and unpredictable to rely upon
- Because it is about land cover, change of spatial structures
- Spatial planners and decision makers can not handle technical information about species, but they work with areas, distances, landscape patterns, and groundwater tables
- Species legitimate planning though!

# 1st Lesson: ecological conditions instead of species



Van der Sluis et al. 1999

# 1st Lesson: ecological conditions instead of species



**Verboom et al. 2001**  
Landscape ecology

# 1st Lesson: ecological conditions instead of species

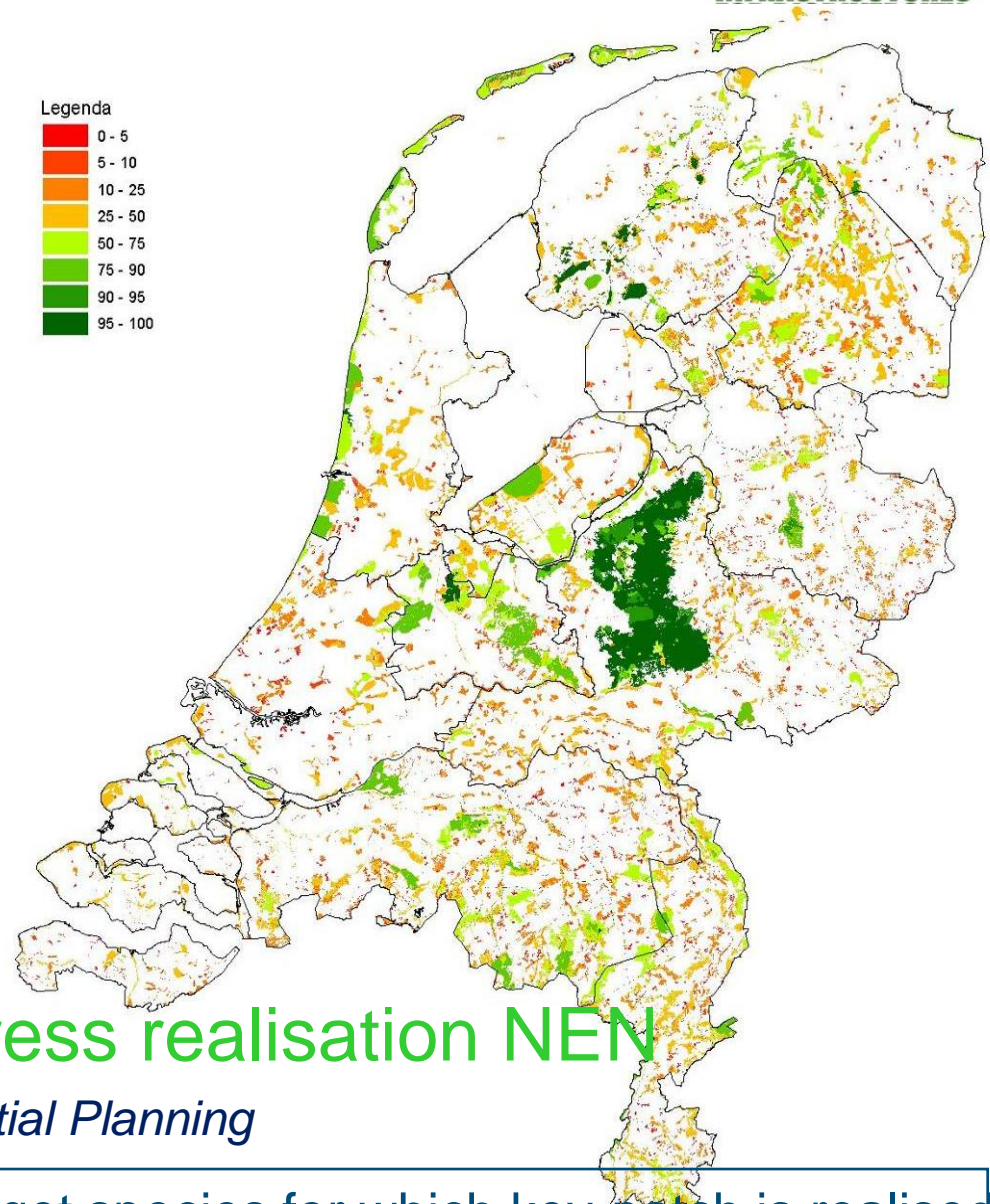
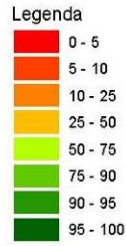
Target species



Required area



Expected area



Applied in evaluation progress realisation NEN

Bi-annual monitoring for the Dutch Spatial Planning Agency

Agency

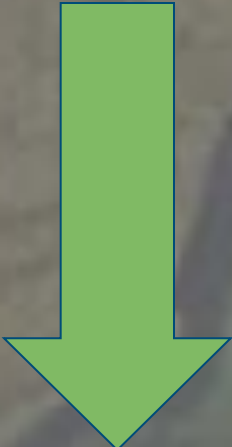
% target species for which key-patch is realised

# 3 Lessons learned

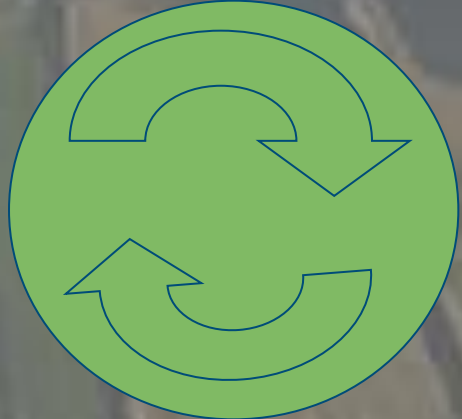
Area target

Biodiversity target

Climate change as add. stress



2<sup>nd</sup> :  
Planning  
& design



+Robust  
corridors

adaptation

1990                      2000                      2006>                      2012>

# Lesson 2: planning and design

- The ecological variability of species needs to be simplified to define targets in planning and design of ecosystem networks
- Spatial-ecological species groups, ‘traits’ or ‘guilds’, can be linked to ambition levels

➔ Allows for negotiations!



# Ecological guilds, species groups

- **Stress similarities in spatial requirements of species with regard to ecosystem networks:**
- Type of habitat
- Required area for a sustainable population
- Maximum dispersal distance

(Opdam et al. 2008, Ecol & Society)

# Ecological traits approach (Opdam et al Ecology & Society 2008)

More area needed for sustainable conditions

Larger spatial scales

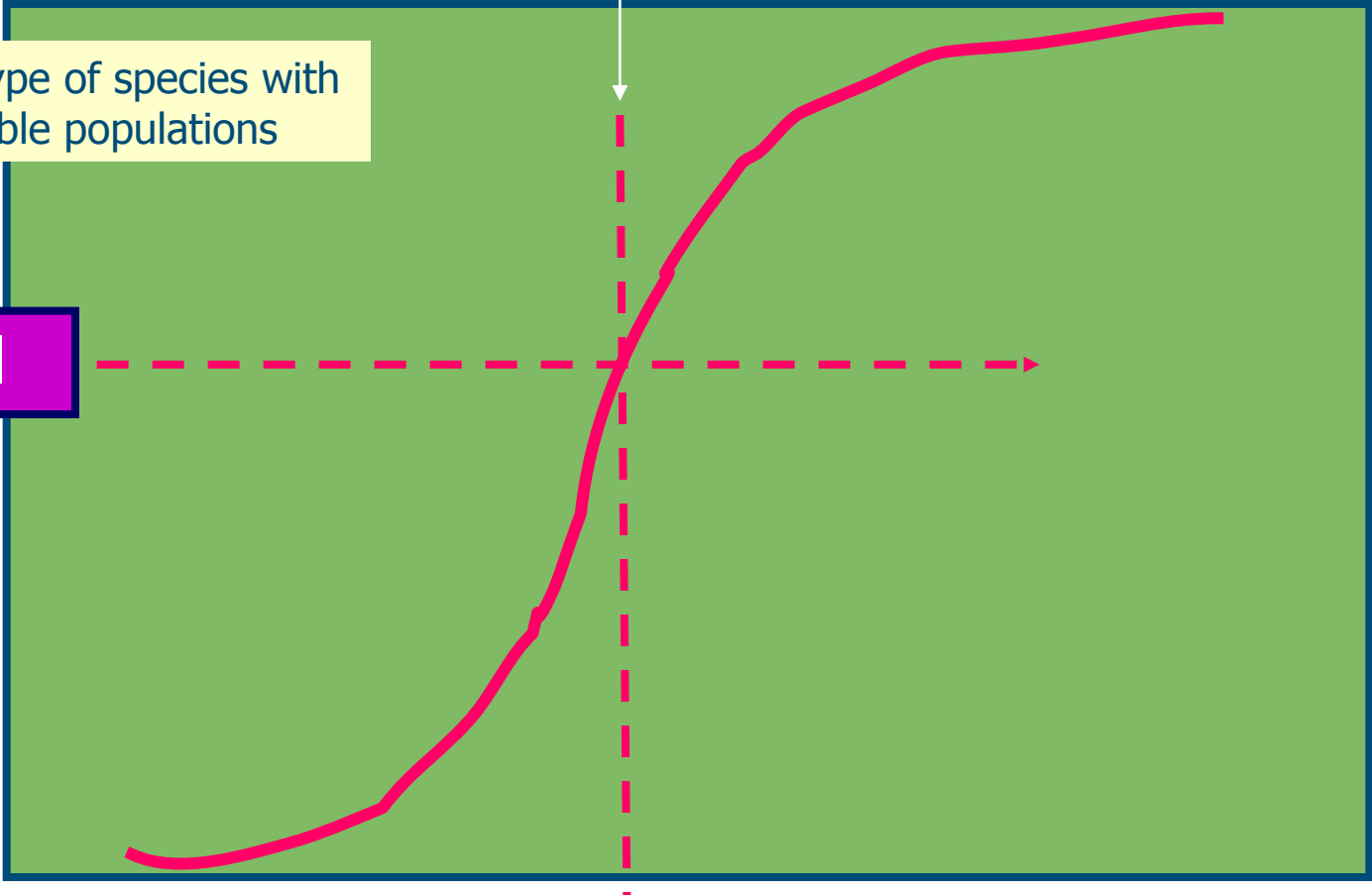


# Ecological traits: choose ambition level

Threshold value

Number / type of species with sustainable populations

Ambition level



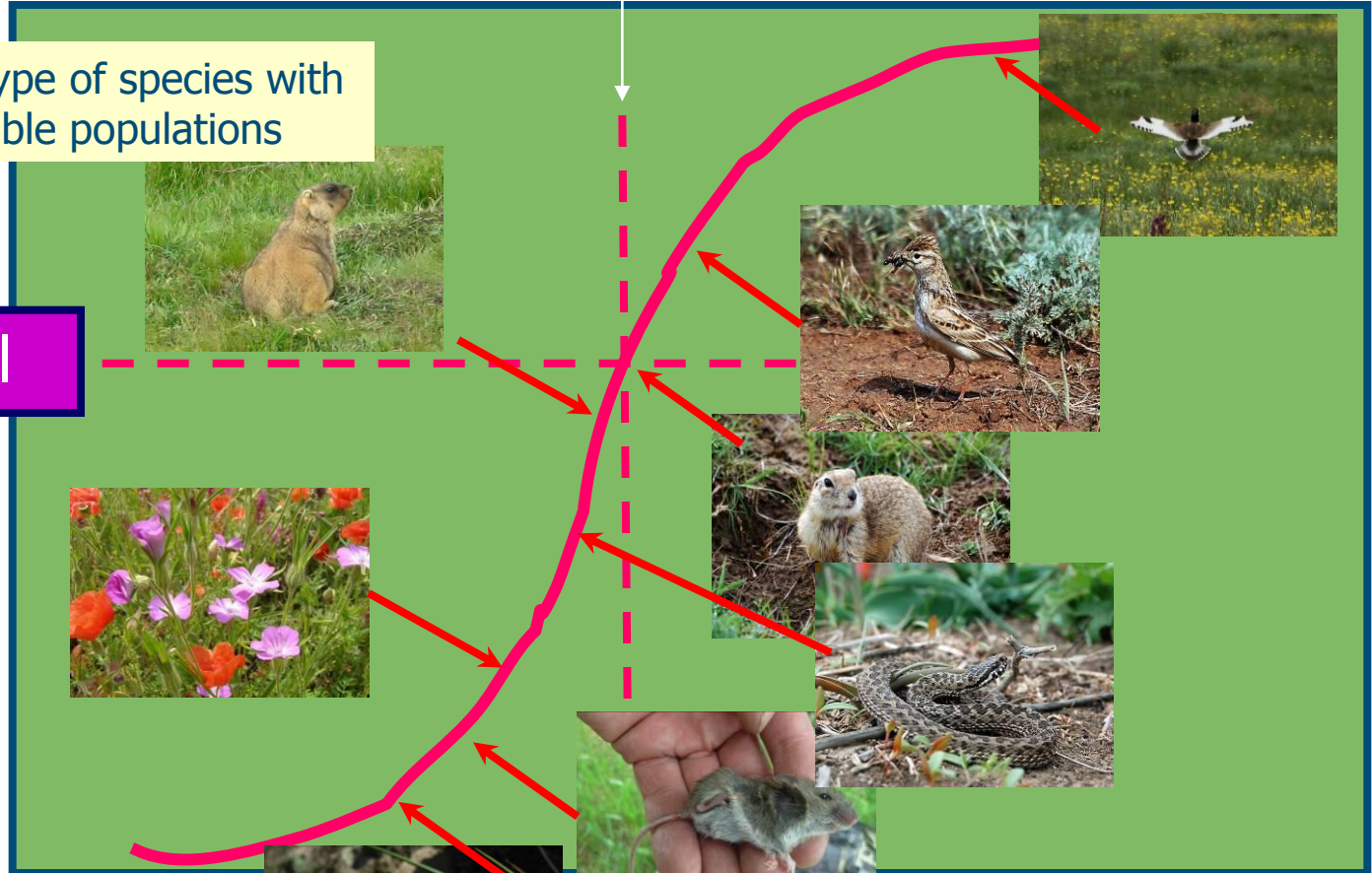
Network cohesion

# choose ambition level Ecological traits:

Threshold value

Number / type of species with sustainable populations

Ambition level



Network cohesion

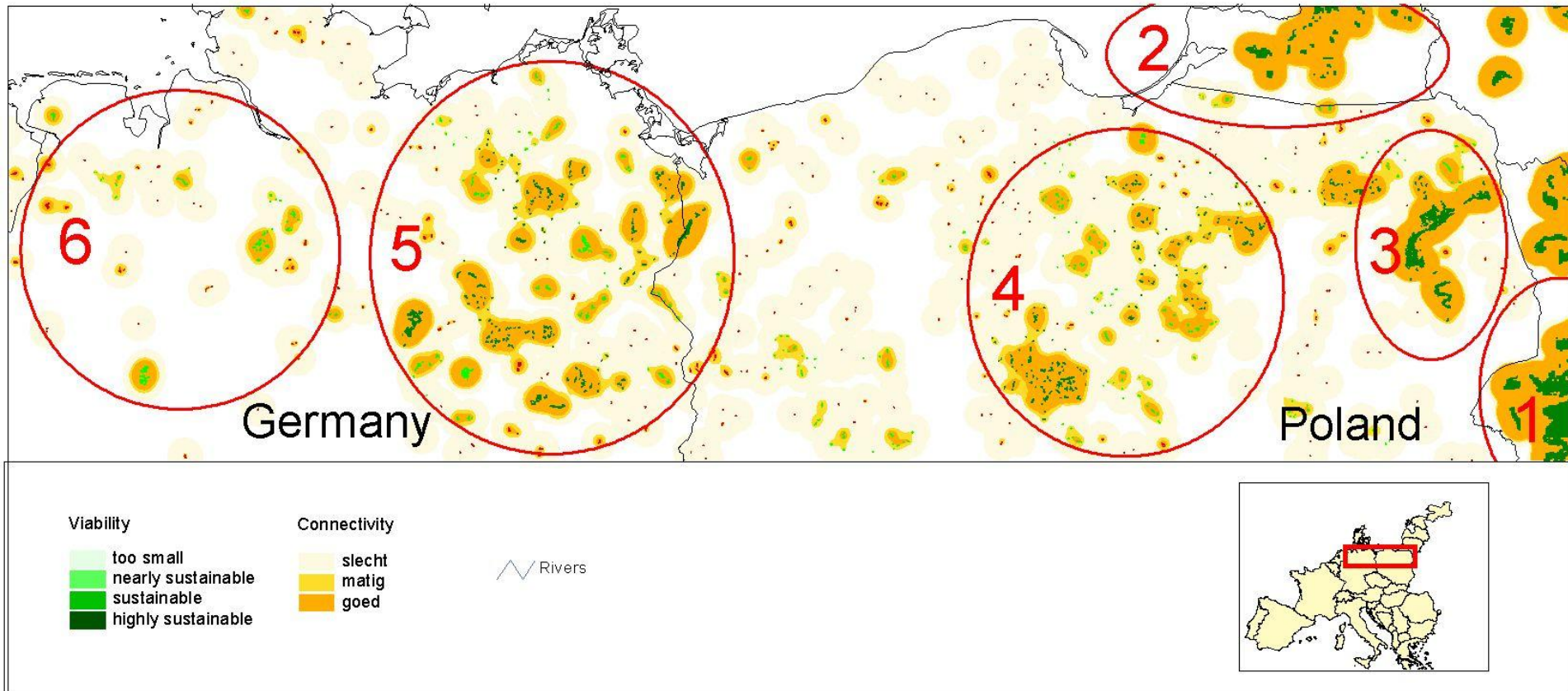
# Which species require cohesive networks most?

	Dispersal poor	Dispersal good
Small network area is enough	Habitat specialists, poor dispersers	
Large network area required		Large area requirements

# Which species require cohesive networks most?

## Network analysis with LARCH model

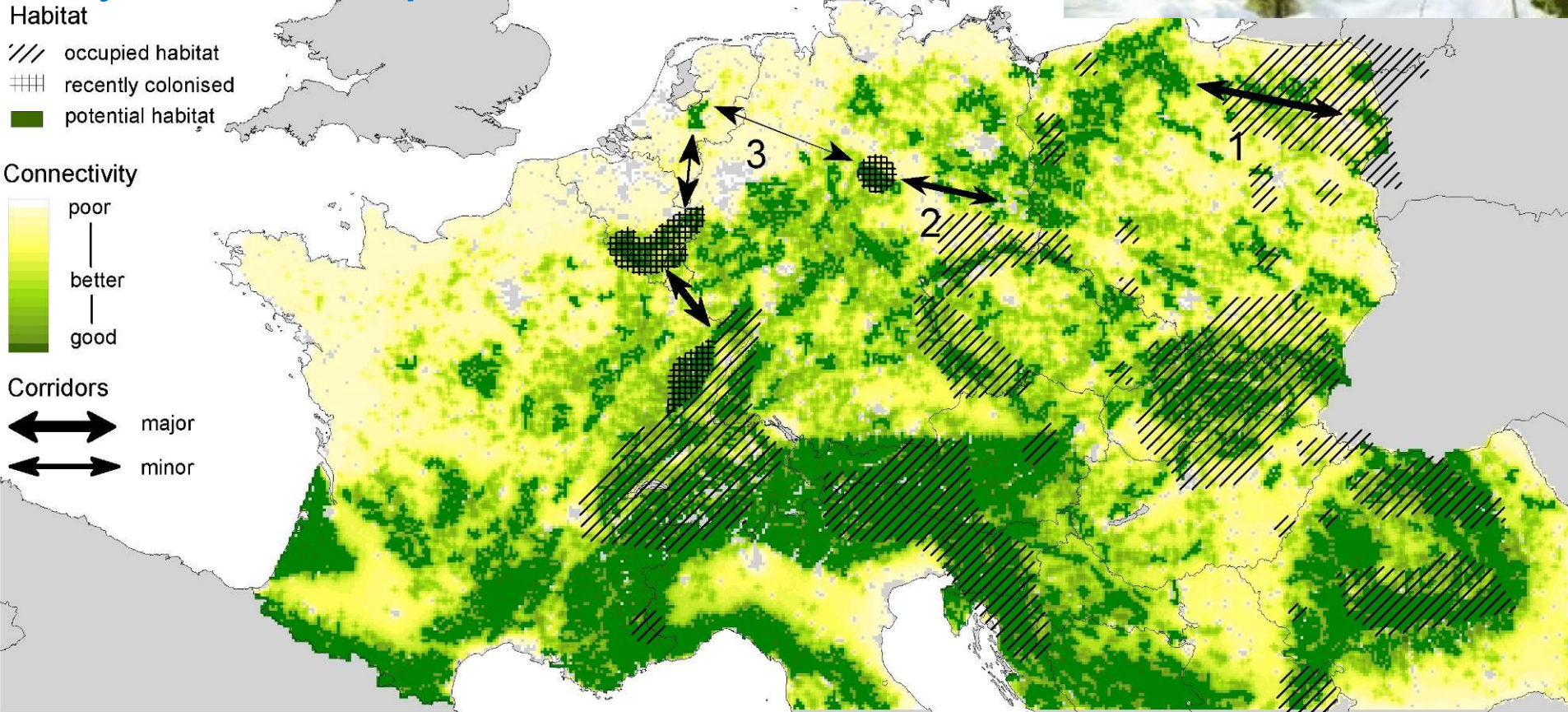
Red copper in Middle Europe



Van Swaay in: van der Sluis et al, 2004








# Which species require cohesive networks most?

## Network analysis with GRIDWALK model Lynx in Europe



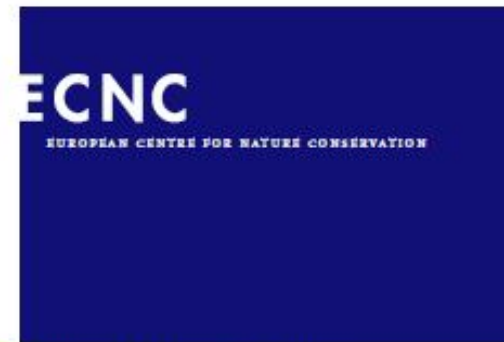
Groot-Bruinderink in: Van der Sluis et al, 2004

# Thinking about corridors....

Shape \ Function	Dispersal	Migration	Commuting
<b>linear corridor</b> 	 Atlantic salmon Sea lamprey	 Atlantic salmon Sea lamprey	
<b>linear corridor with attached nodes</b> 	Stag beetle Large copper Yellow-legged- Dragonfly		Large copper
<b>stepping stones</b> 	Lynx Yellow-legged- Dragonfly	Brant goose Eurasian crane Yellow-legged- Dragonfly	
<b>landscape mosaic</b> 	Brown bear Large copper	Brown bear	Brown bear

[http://www2.alterra.wur.nl/webdocs/internet/corporate/prodpubl/boekjesbrochures/ecnc\\_compleet.pdf](http://www2.alterra.wur.nl/webdocs/internet/corporate/prodpubl/boekjesbrochures/ecnc_compleet.pdf)

Van der Sluis et al, 2004



EUROPEAN CORRIDORS: STRATEGIES FOR CORRIDOR DEVELOPMENT FOR TARGET SPECIES





# Implementation of robust corridors



2001 – start of second planning cycle

# Implementation of robust corridors

## What are robust corridors?

- Connect cross-regional core areas
  - May contain different ecosystems
  - Consist of migration corridors, stepping stones and additional habitat (existing nature with new areas)
  - Often with adjusted infrastructure (ecoducts)
  - Multifunctional land use (farmers, tourism)
  - Length 1-30 km
  - Width 500 - 2000 m (average)
- Robust corridors are similar to Greenways**

# Implementation of robust corridors

- Extra ambition NEN (national level)
- More budget for the Provinces
- Negotiations central government-Provinces about aims and targets, ambition level
- Link ambition level, aims – area requirement and demand for spatial cohesion
- ‘Handbook Robust Corridors’ as tool for design
- Planning guidelines developed

# 5

## NATTE AS



## Ecoprofielen en ambitieniveau B3



## Ecosysteemtype

### Mee koppelen recreatie

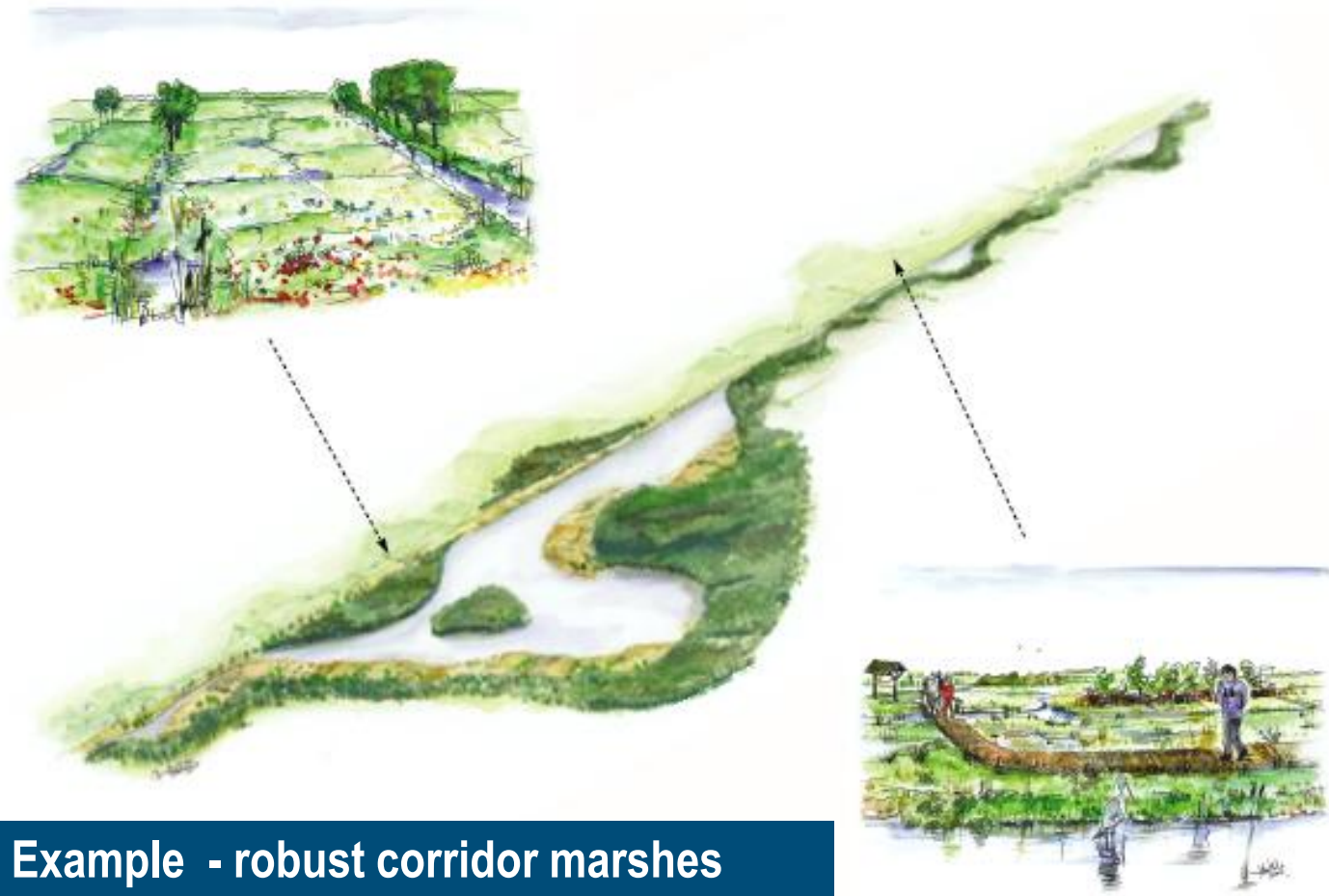
Ecosysteemtype	Bouwsteen				Type kruising		
	knop land	schotel land	knop water	schotel water	variant 1	variant 2	variant 3
Grasland met klein water	●	●	mit	mit	+	+	+
Moeras, struweel en groot water	●	●	●	●	+	+	+

## BOUWDOOS ROBUUSTE VERBINDING

### Ecosysteemtype-verbinding

	0 1 2 3 4 5 6 7 8 9 10 km
Grasland met klein water	
Moeras, struweel en groot water	

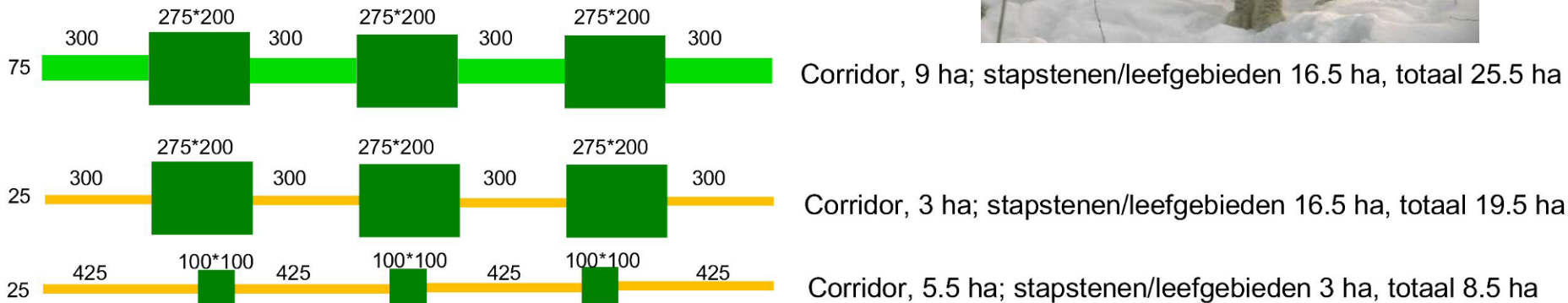
### Schematische robuuste verbinding (10 km)



**Example - robust corridor marshes (from Handbook)**

# Example: robust corridors, design with ecological traits

## Shrubs with some aquatic habitat



(Handbook Robust corridors, 2001)

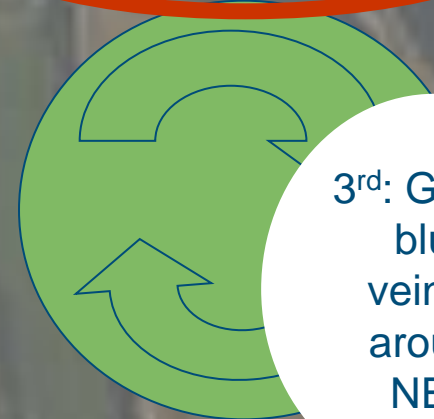
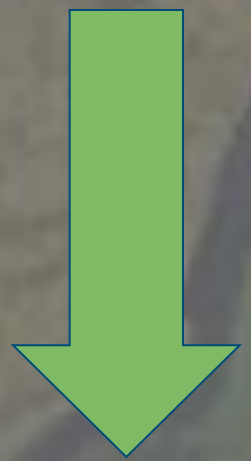


# 3 Lessons learned

Area target

Biodiversity target

Climate change as add. stress



3<sup>rd</sup>: Green-blue veining around NEN

+Robust corridors

adaptation

1990                      2000                      2006>                      2012>

# From the Netherlands to Europe....

Organização:



Apoios:

Media Partner:



# Changes in Western Europe

- Capital intensive agriculture
- More demand for recreational areas
- Demands from trade and industry
- Multi-purpose land use (the Netherlands, Germany England)





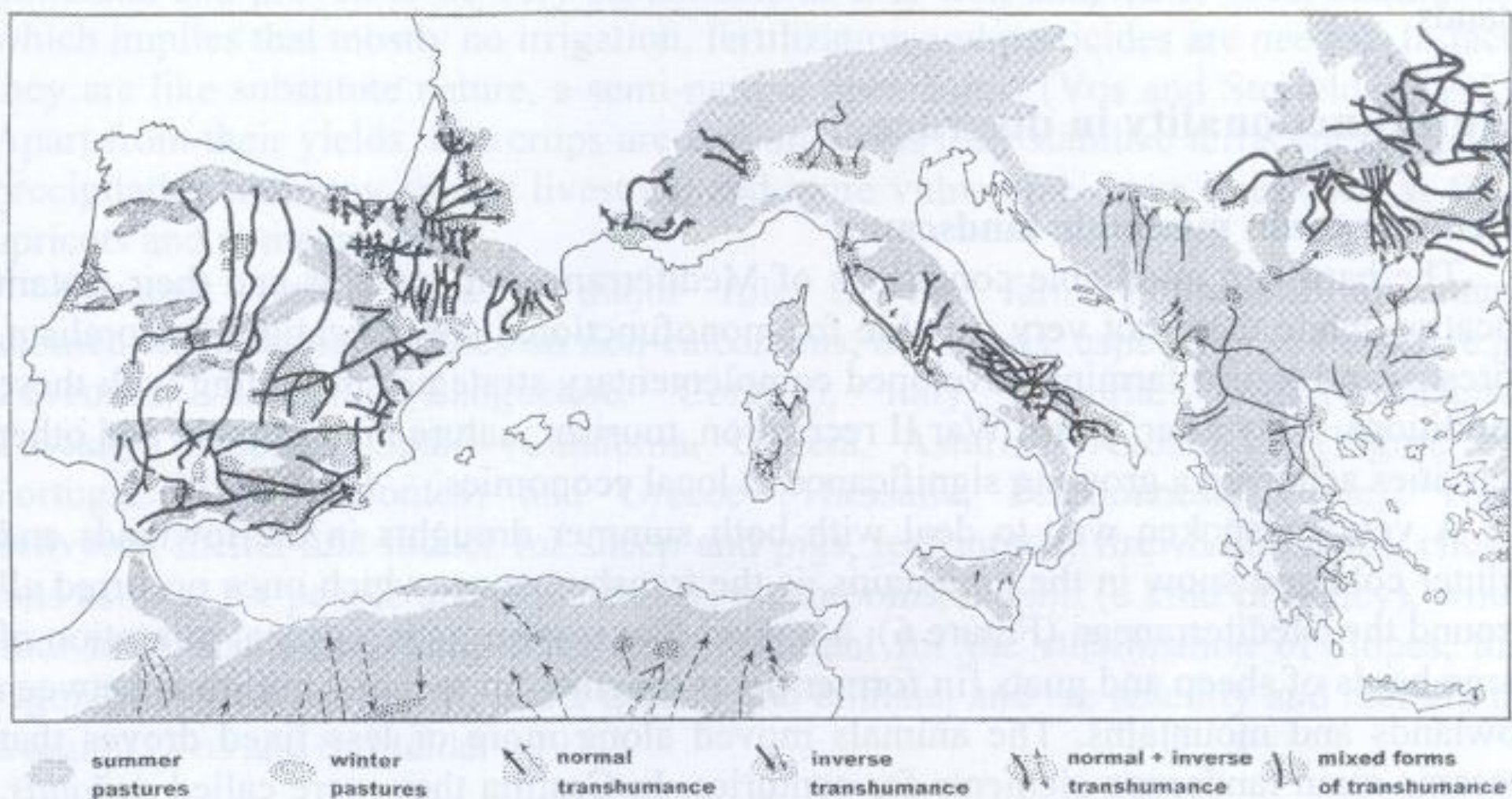
# Changes in Southern Europe

- Fast changing ecosystems
- Intensification versus...
- Extensification grazing land (Italy, Croatia, Portugal, Spain)
- Loss of traditional land use systems like Dehesas



# Changes in Southern Europe

## Transhumance in the Mediterranean



# Changes in Southern Europe

Driveways are disappearing



# Changes in Southern Europe

What remains: Isolated areas of nature



# Changes in Southern Europe

## Development of forested ecosystems



# Changes in Central and Eastern Europe

In the past:  
Small-scale  
agriculture  
Development  
of almost  
natural areas



# Changes in Central and Eastern Europe

- Intensification of agriculture
- Demand for recreational areas
- Scale enlargement (Germany, Poland, Ukraine)



# Changes in Northern Europe

In the past:

Extensive  
forests

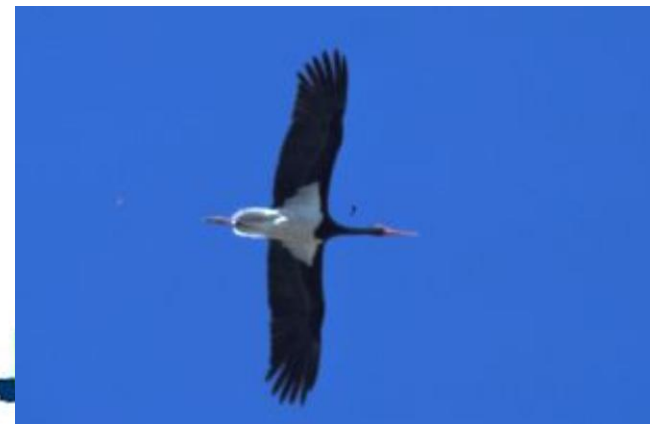
Loss of primary  
forests





# European Ecological networks

- 1992: EU: Natura 2000, Birds and Habitats Directive. Aim: international approach for protecting core areas biodiversity
- 1995: 55 countries decide to develop a European Ecological network (PEEN). Aim: stop further fragmentation, and improve landscape connectivity
- 1997: Expert Committee appointed  
 Secretariat: Council of Europe and European Centre for Nature Conservation (ECNC)



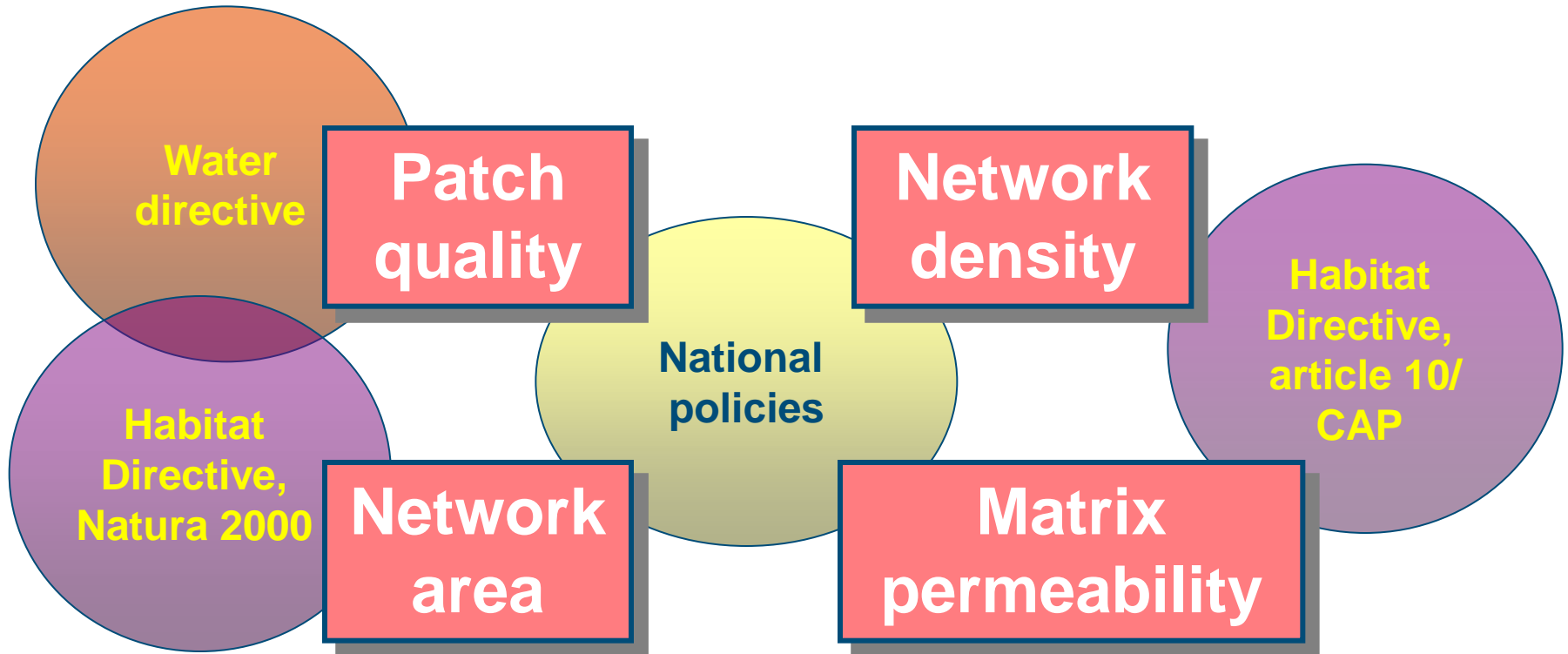
# European Ecological networks

## Natura 2000 – Birds and Habitats Directive habitat:

*The Habitat Directive of the European Union (1992) acknowledges in **Article 10 the importance of landscape elements that enhance connectivity ('corridors')**. The Directive encourages member states to include those landscape elements in their land-use planning and development policies which they consider appropriate. Furthermore, other global and European policies such as the Bonn and Bern Convention oblige contracting parties to take effective measures in conservation and management of the listed species and habitats.*

# European Ecological networks

Current policy supports different strategies



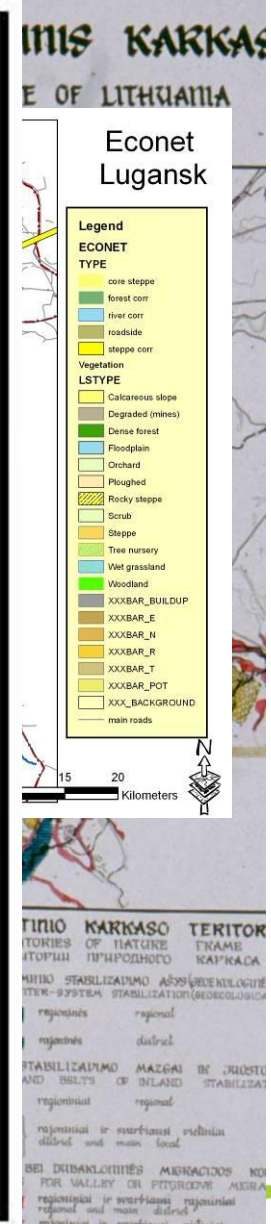
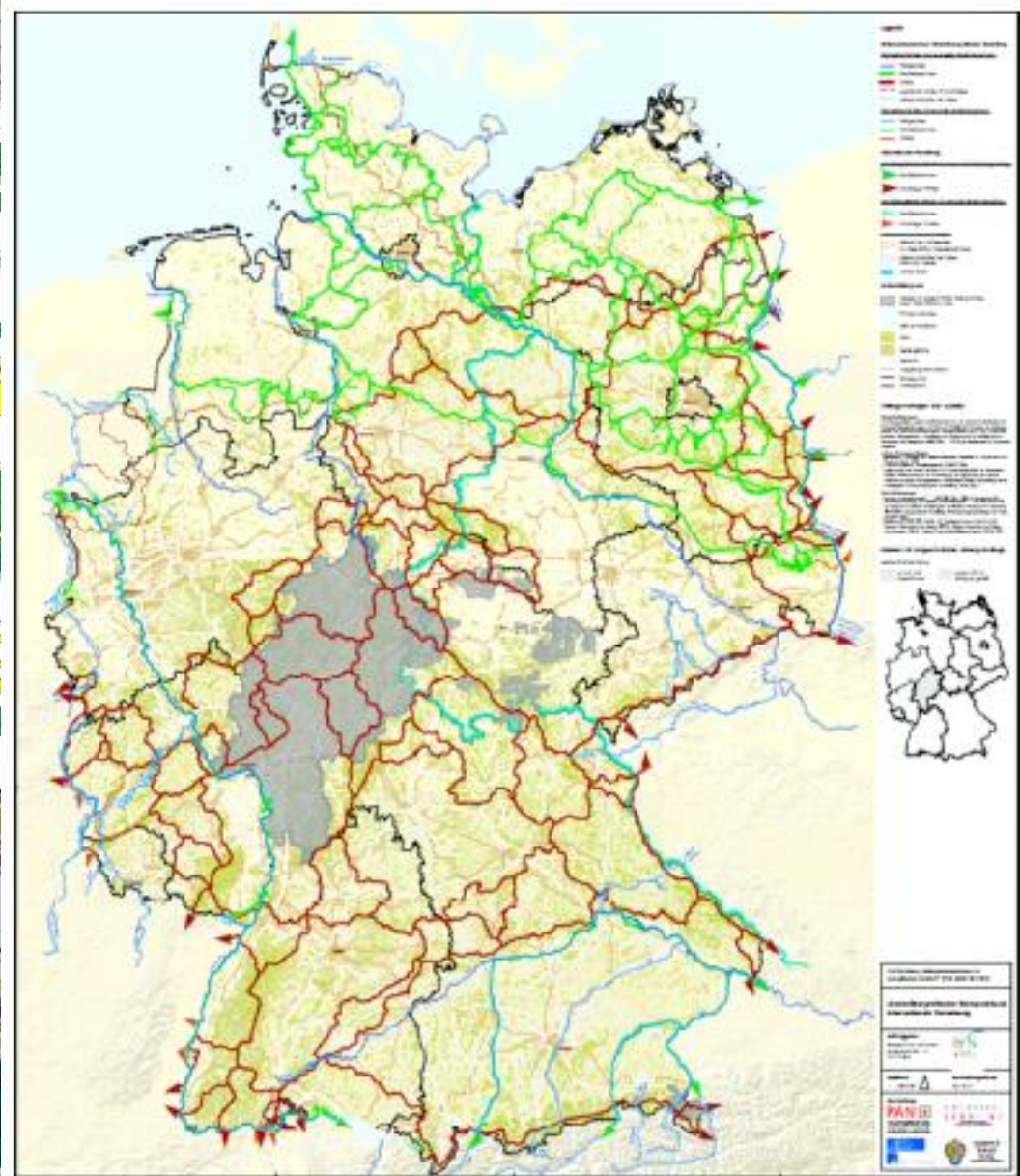
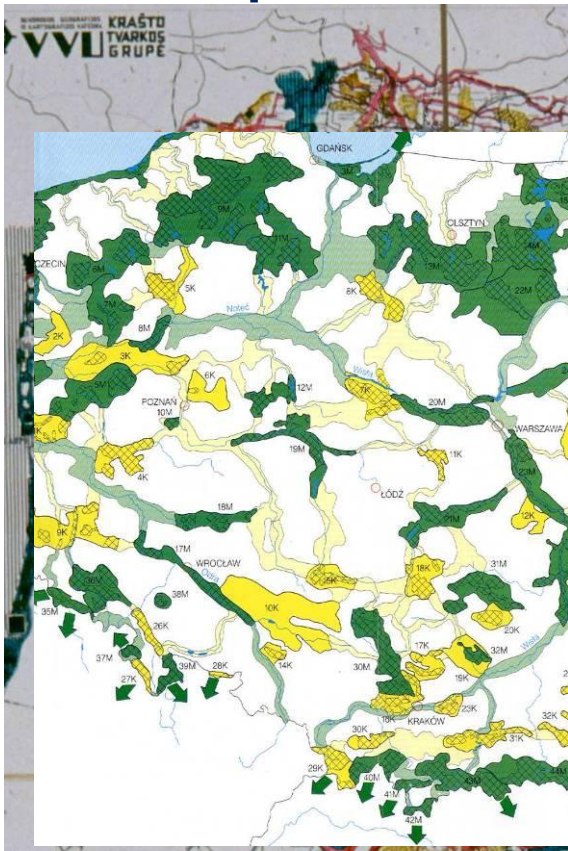
Opdam, Steingröver, Van Rooij 2006

# European Ecological networks

## Fragmentation?

- National legislation: 21 member states
- Regional but with national Guidelines: 4 Member states, Germany (16 Bundesländer), UK (4 countries), Spain (17 autonomous regions), Italy (21 regions) (Switzerland: 26 cantons)
- Regional: 2 Member states, Austria (9 Bundesländer), Belgium (3 regions),
- Totally: 21 countries + 73 regions (+ 26 cantons)

# European Ecological networks



# European Ecological networks



- National/regional Ecological Networks: 20 member states
- NGO proposals: 4 member states
- No ecological networks: 6 member states
- Implementation: several, The Netherlands, Czech Republic, Estonia Poland, Germany, but also: Switzerland, Croatia

Organizaçã:



Apoios:

Media Partner:



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# International challenges

- Climate change
- Development of ecological networks
- Acknowledge cultural differences
- Funding
- The financial crises, or financing in Eastern Europe (EU-27+)

Organização:



Apoios:

Media Partner:



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# International challenges: climate change



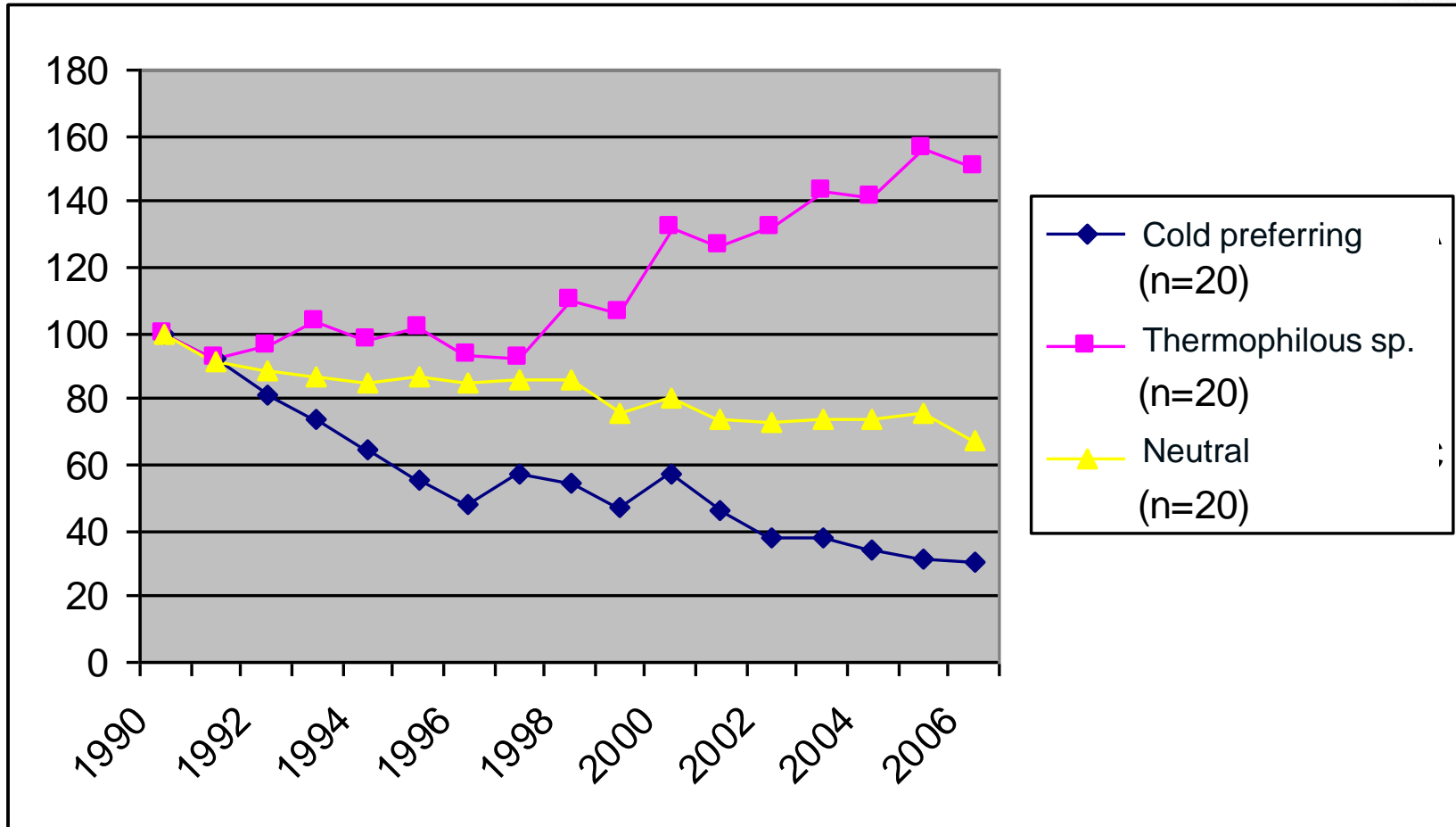
## Results:

- Shifting climate zone
- More weather extremes

Assumptions for critical thresholds are not valid anymore



# International challenges: climate change



# International challenges: climate change

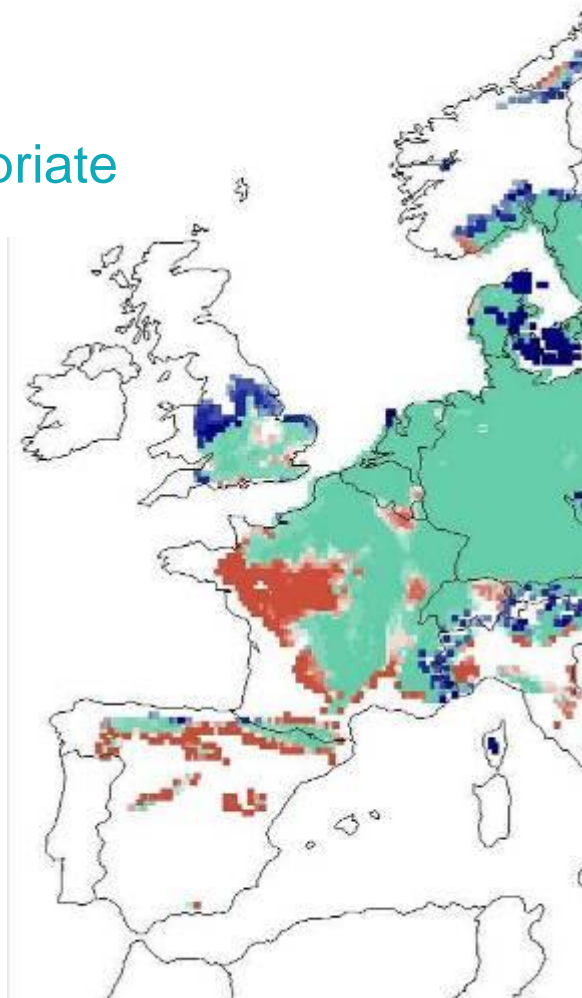
## Climate window is moving

Green – remains appropriate

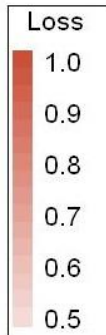
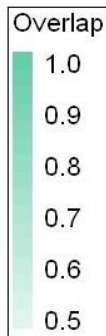
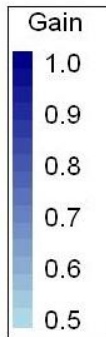
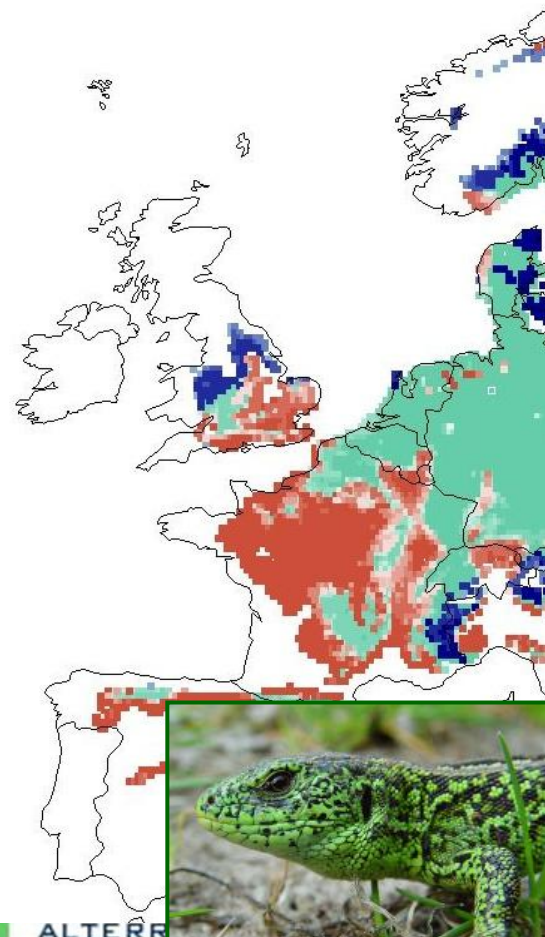
Red – will be inappropriate

Blue – will become appropriate

2020

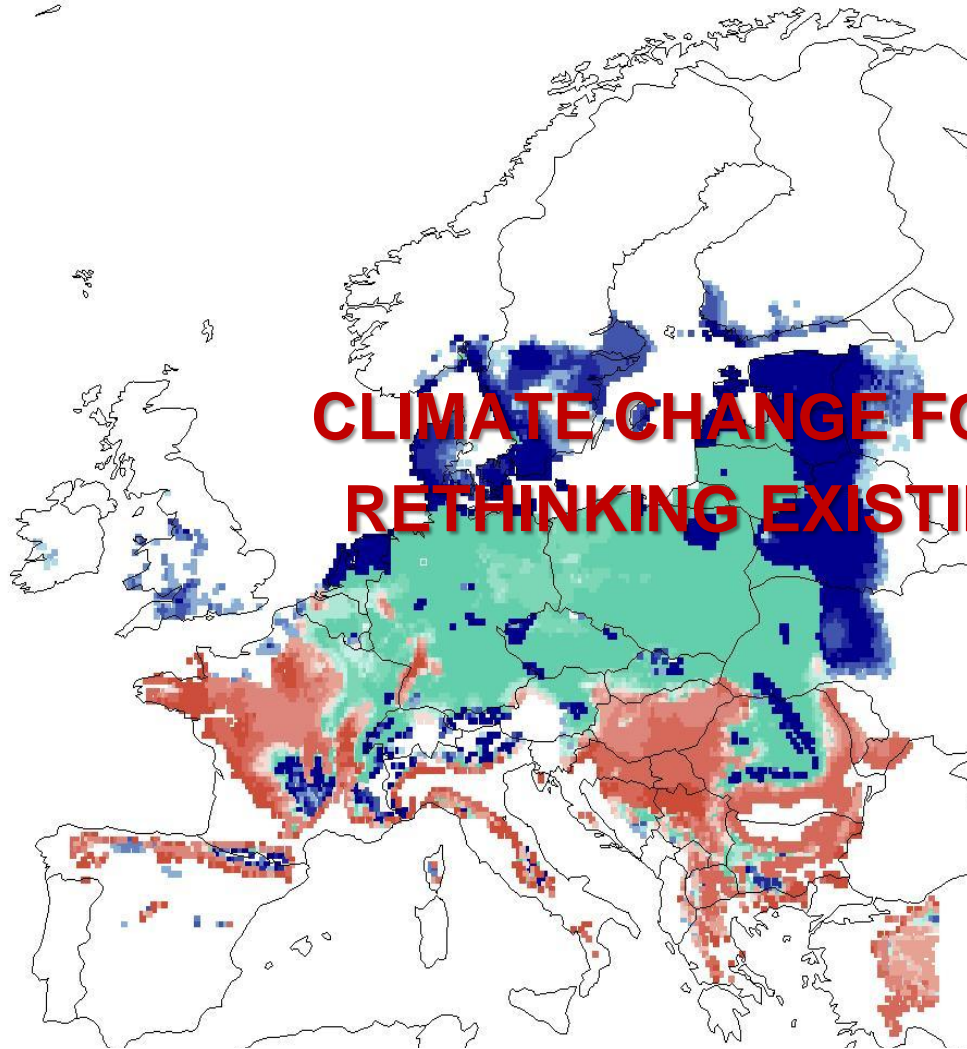
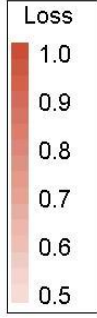
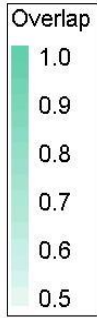
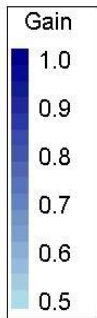


2050



# International challenges: climate change

Projected Change in Simulated Climate Space



**CLIMATE CHANGE FORCES us to  
 RETHINKING EXISTING POLICY**

Climate window is moving

Green – remains appropriate

Red – will be inappropriate

Bleu – will be appropriate

→ *Not the habitat but the climate window is on the map*



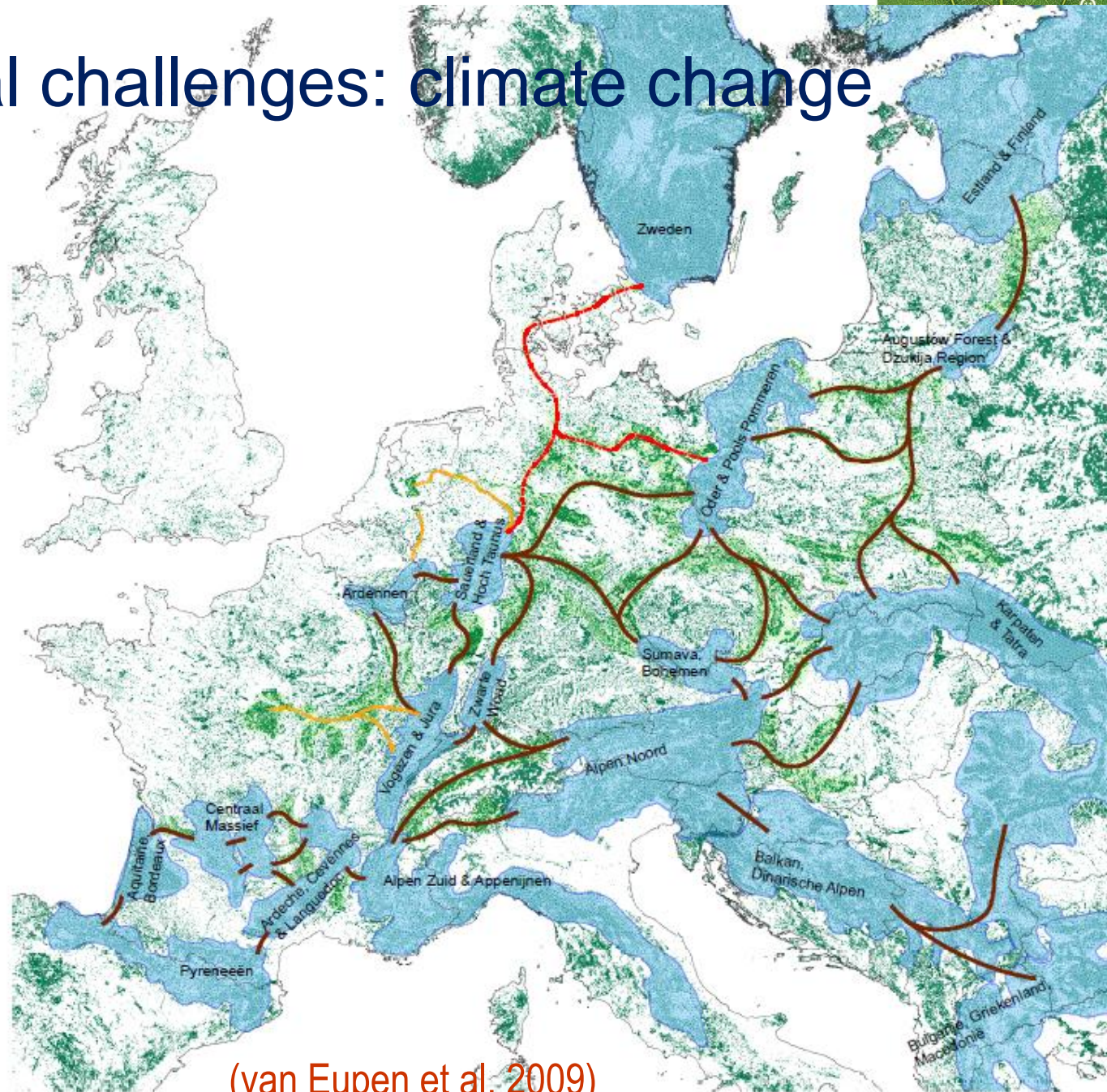
# International challenges: climate change

To acquire more land for nature is (politically) not feasible

- Our proposal: develop “climate buffer”:
- Strengthen the green-blue veining of the multifunctional landscape nearby the NEN
- Transboundary corridors!



# International challenges: climate change



## Legend

### EU Bos Corridor Typen

- Hoofd-corridor
- Potentiële-hoofd-corridor
- Zijtak-corridor

### Mega Bos Bolwerken

- EU\_Bolwerk
- EU\_Corridor
- Corine 2000/2006 Bos + Pelcom

(van Eupen et al, 2009)

# International challenges: development networks

- Develop ecological networks based on ecosystems and species requirements
- Set (feasible) targets
  - Biotopes, hectares, species groups
- Cross-boundary analysis



# International challenges: cultural differences

Strategy of major importance! The strategy defines whether you can achieve your targets or not....

- 'Flagship species' (Iberian lynx, otter, vulture)
- Different countries value different elements
  - Italy: no corridors for rabbits
  - England: no badgers
  - Germany: no red deer
  - Netherlands: no wetlands, for mosquitoes

# International challenges: cultural differences

- Instead: use something what connects people: slow food in Italy or Portugal, eco-tourism (Poland), new perspectives for agriculture (eastern Europe)
- Make ecological networks part of society, involve stakeholders in the process of green infrastructure
- Adjust communication towards ecological and cultural setting of the region



# International challenges: funding

- Develop better methods to value ecosystem services
- Financial valuation system for nature in regions with declining agriculture (Portugal, Italy, new neighboring states)
- Integrate ecological networks in other policy:
  - Common Agricultural Policy (less funds for agricultural production, more for landscape, after 2013)
  - Infrastructural policies: water, highways, railways
  - Measures to mitigate climate change

# International challenges: funding

## Chances

- Reform co
- Water man  
(landscape
- Agriculture
  - Enterpren
- Increase in  
increases t  
landscape



# Conclusions

- There are much more opportunities to realise ecological networks
- Greenways are a strong concept, reinforcing the role of communities and stakeholders
- Without realistic targets it is hard to develop a system of ecological networks
- Species form the foundation for the ecological network
- International cooperation is essential to build a bridge between theory and practice



**Thank you!**

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