Adapting to climate change: a landscape approach

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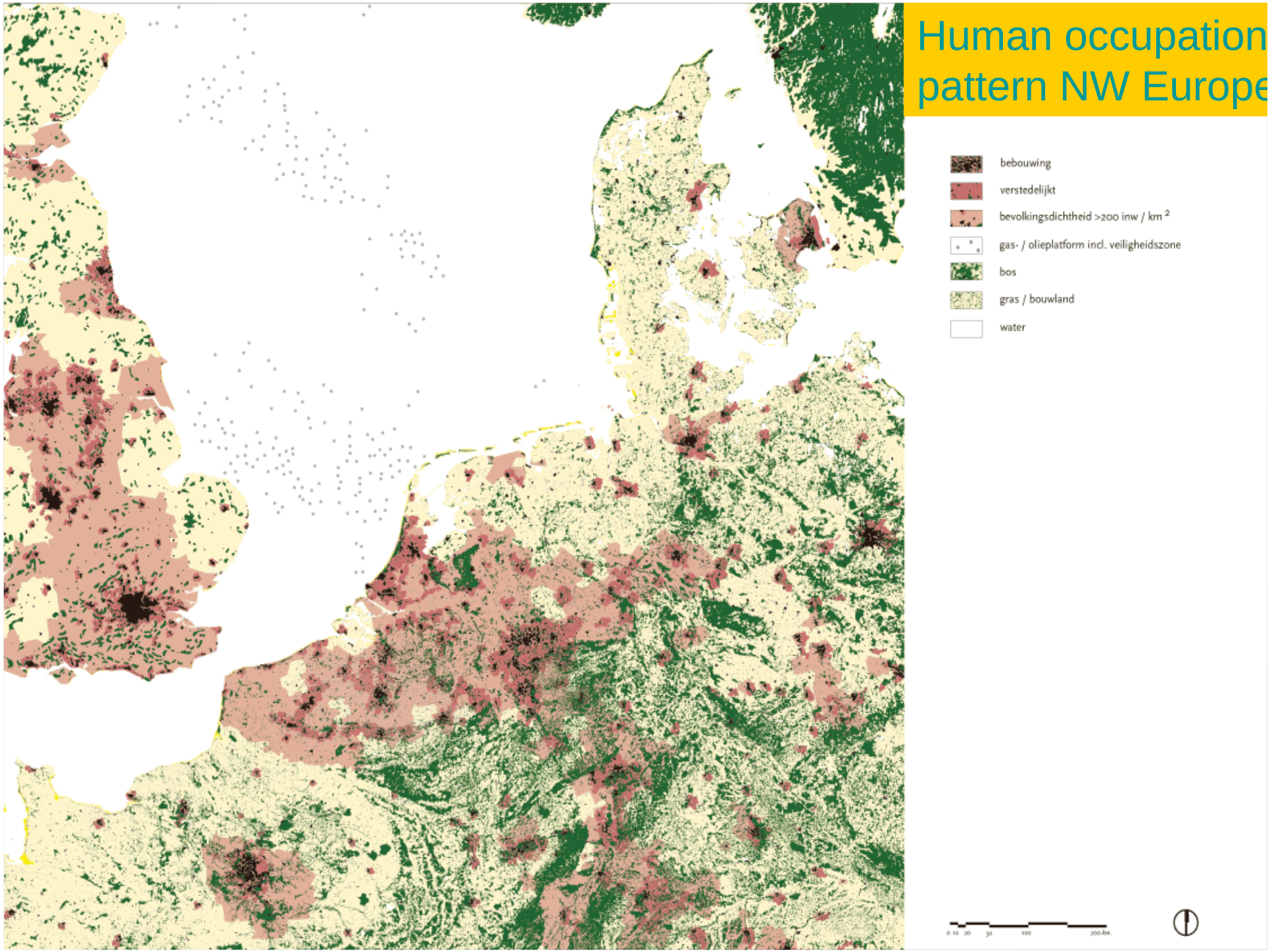
WAGENINGEN UR

ALTERRA
GREEN WORLD RESEARCH

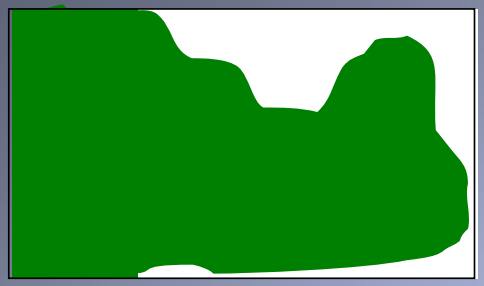
Content

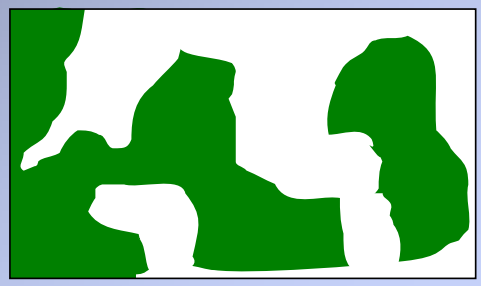
- Main impacts of climate change on biodiversity
- Effects stronger because of habitat fragmentation
- Adaptation strategies

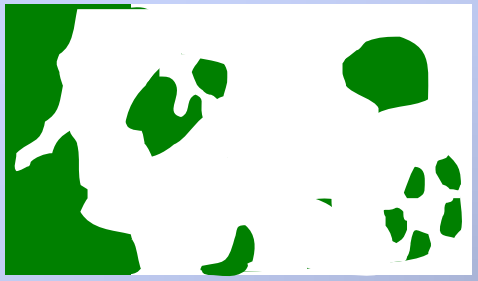
Human occupation pattern NW Europe

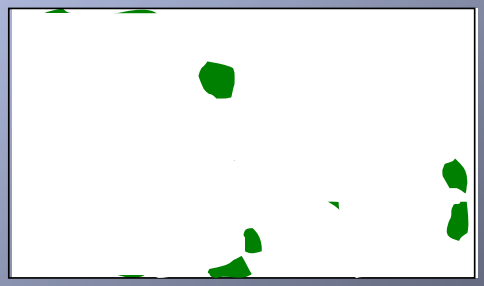


Habitat Fragmentation









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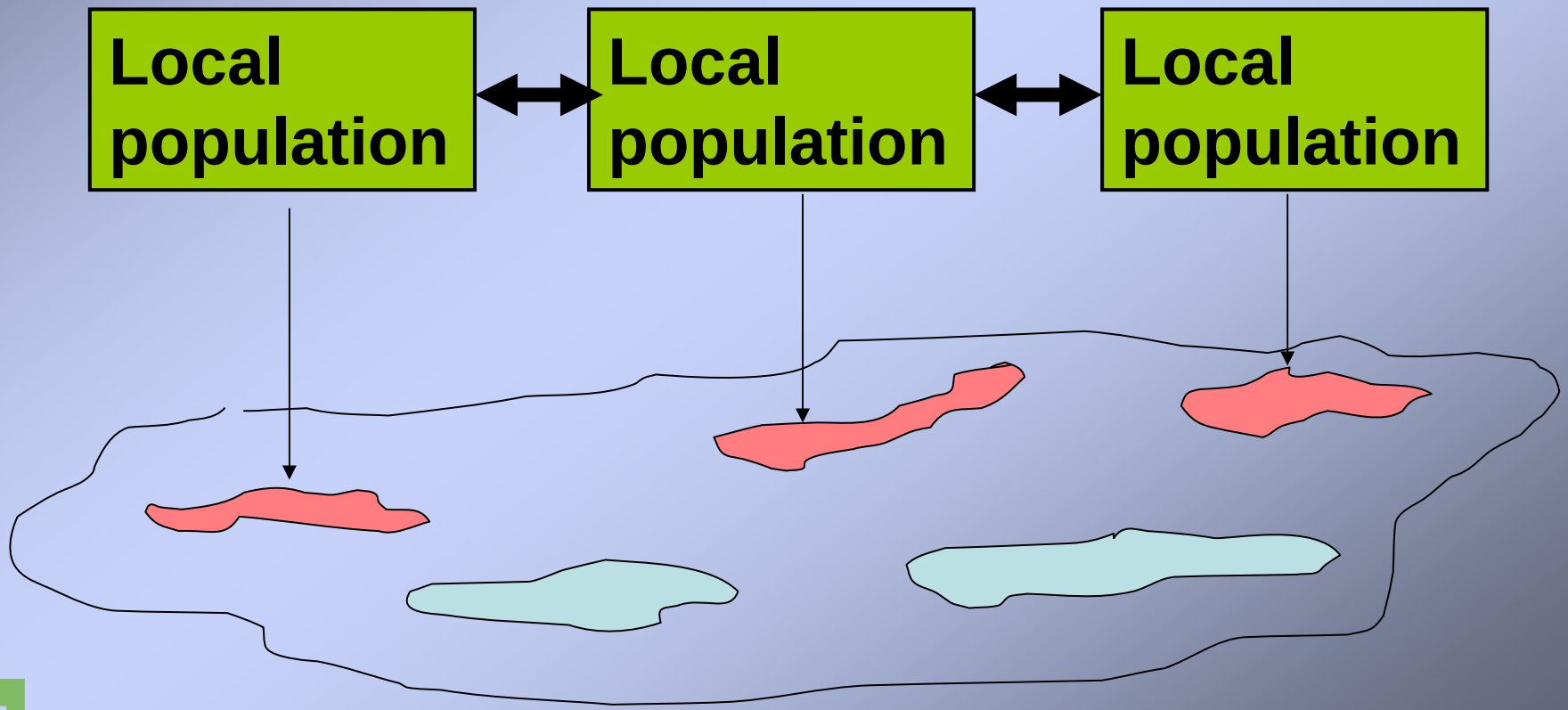
Persistence in ecological networks: the **local** extinction risk spread over the network



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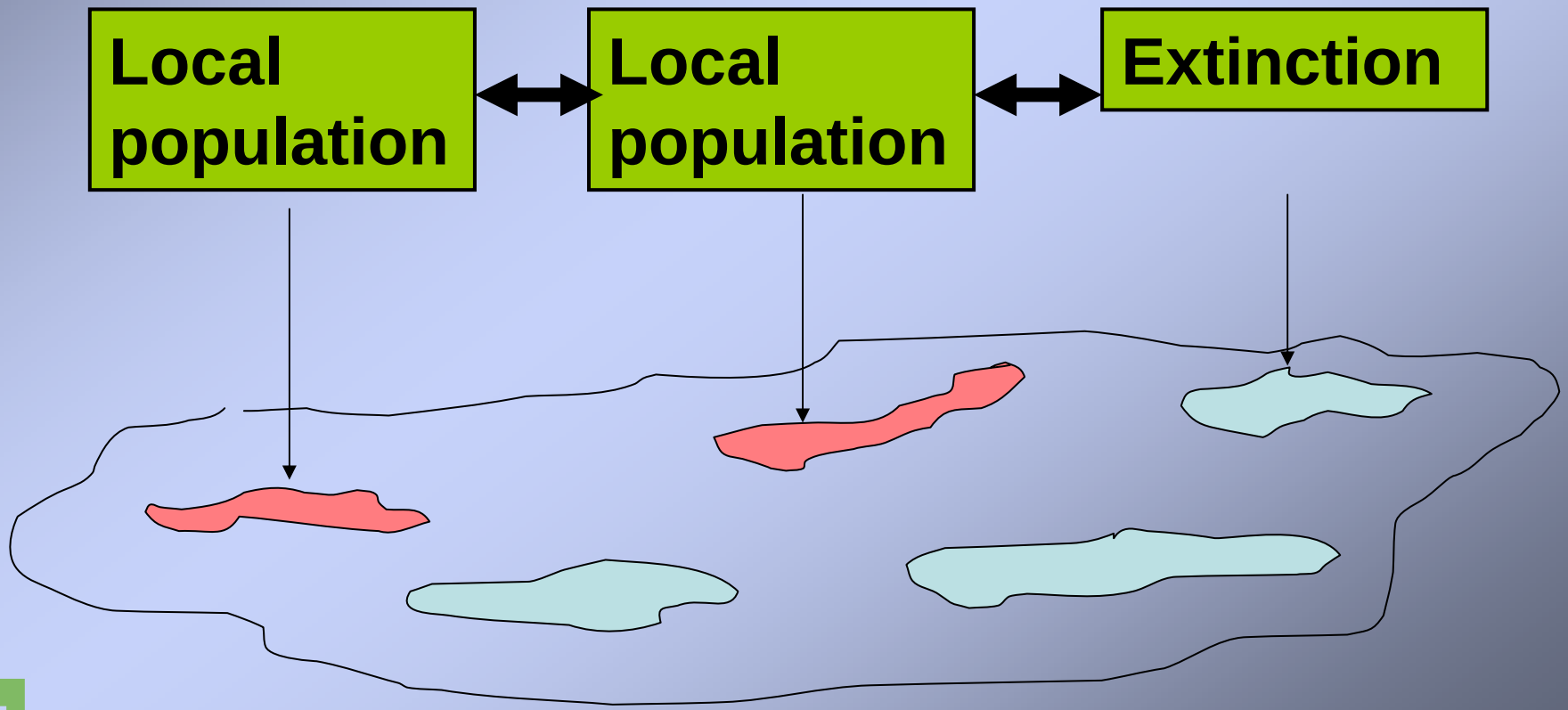
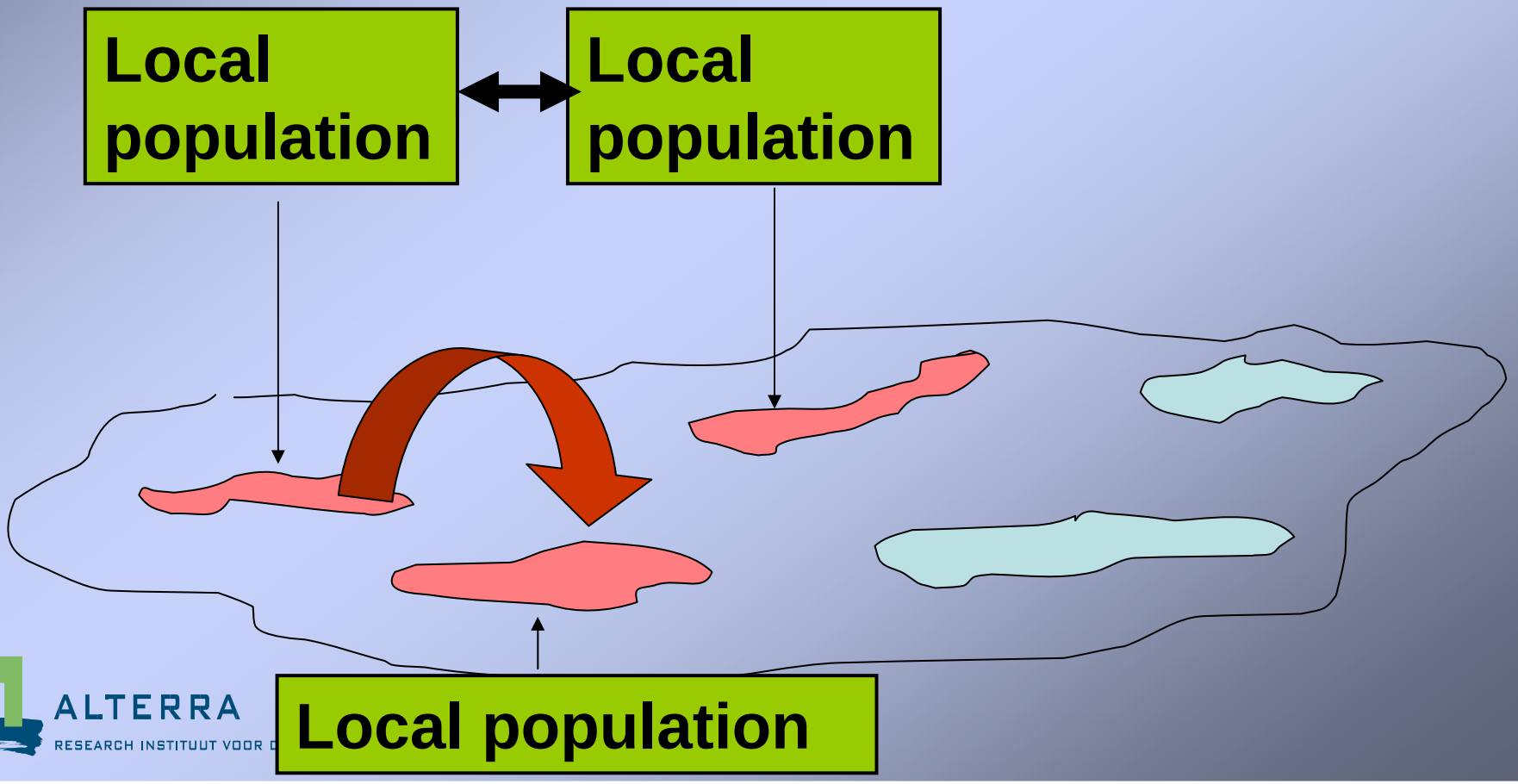


Persistence in ecological networks: the **local** extinction risk spread over the network



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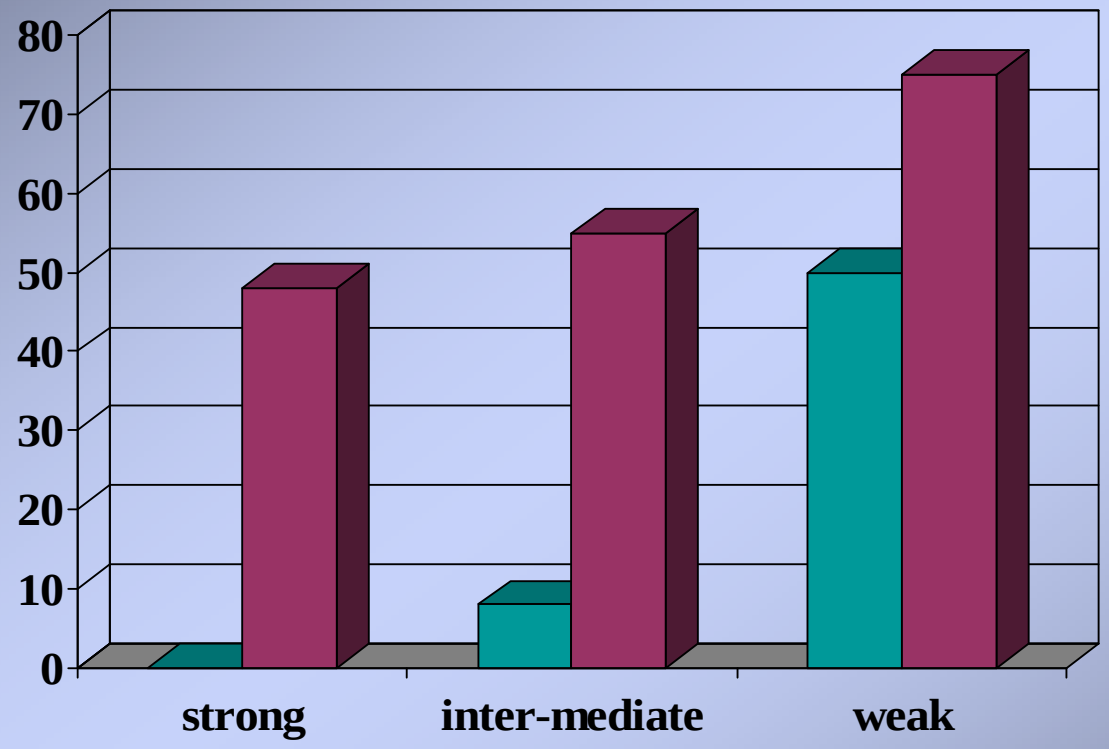
Weather extremes more frequent and stronger

- Population fluctuations will increase because of weather extremes

Population crash less in stronger habitat networks

% declined pops

% extinct populations



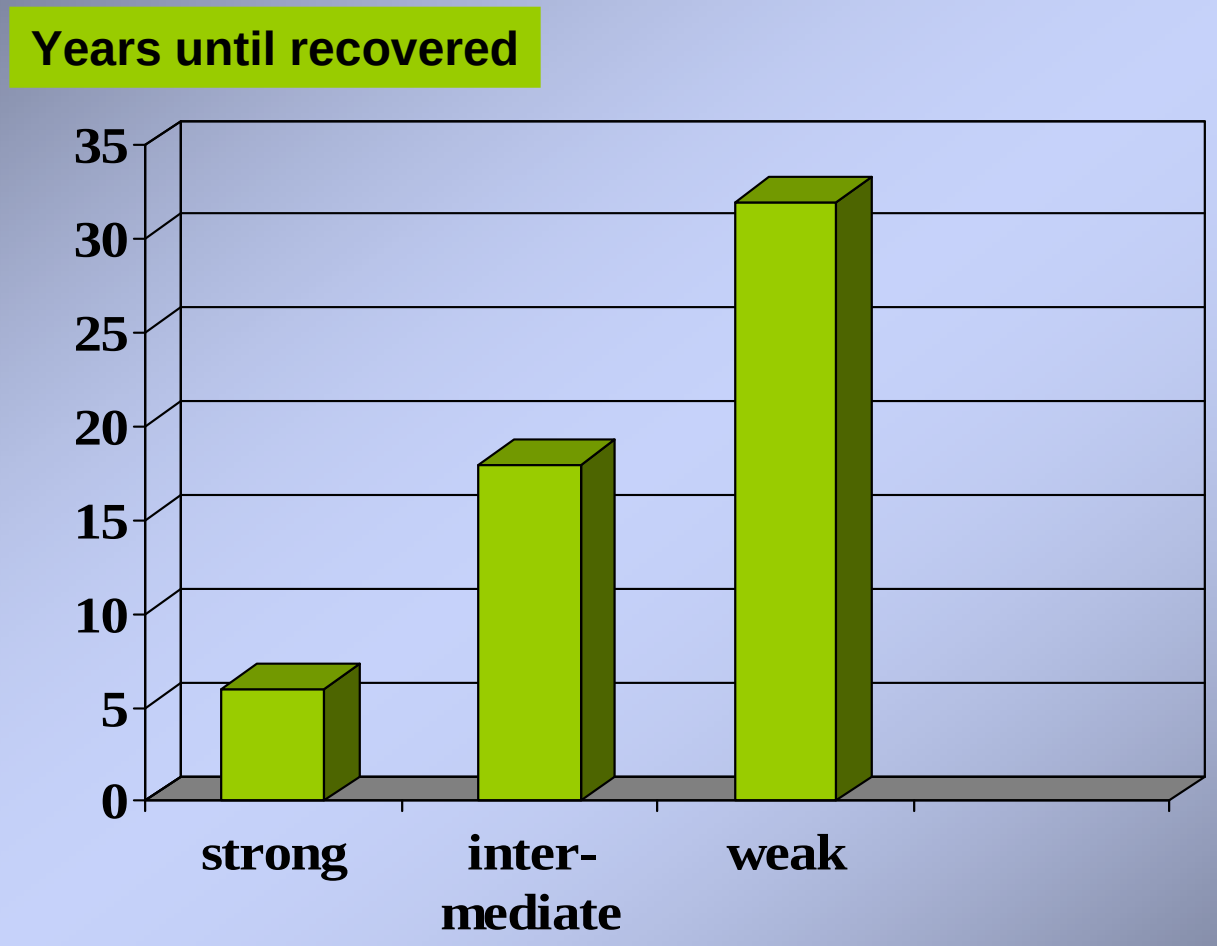
Network cohesion

Sedge warbler

Acrocephalus schoenobaenus

Foppen et al. 1999

Recovery faster in strong habitat networks



Foppen et al. 1999

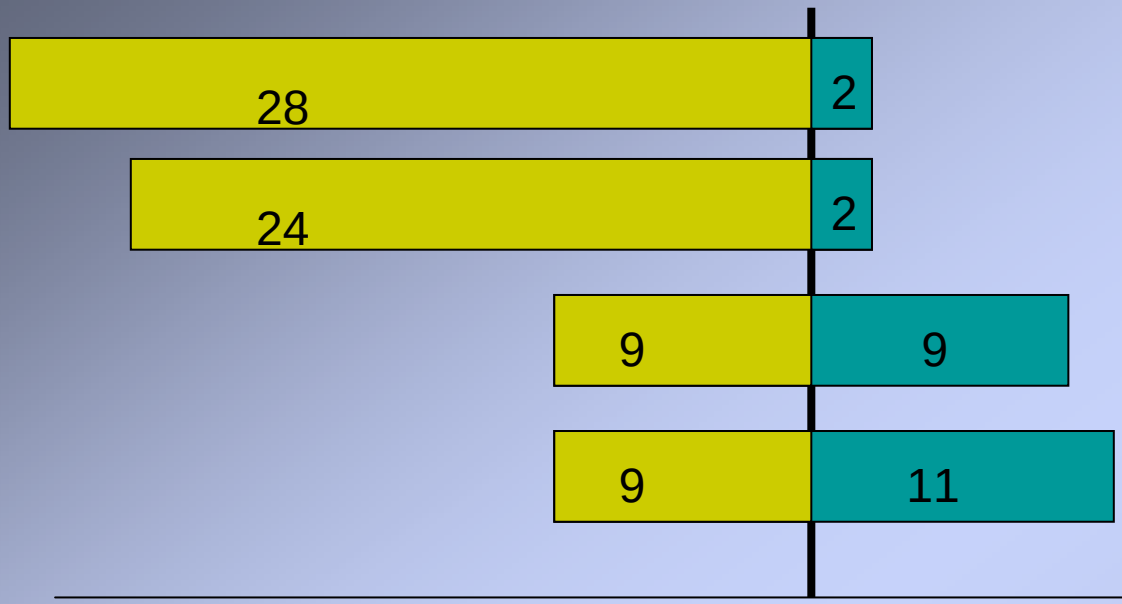
Interaction weather extremes and habitat fragmentation

- Species in fragmented habitat recover more slowly after disturbance
- Regional extinction risk increased

Temperature rise

- Range shifts of species
- (Phenology - food chain mismatching)

Warren et al 2001



Habitat specialists

Small dispersal capacity

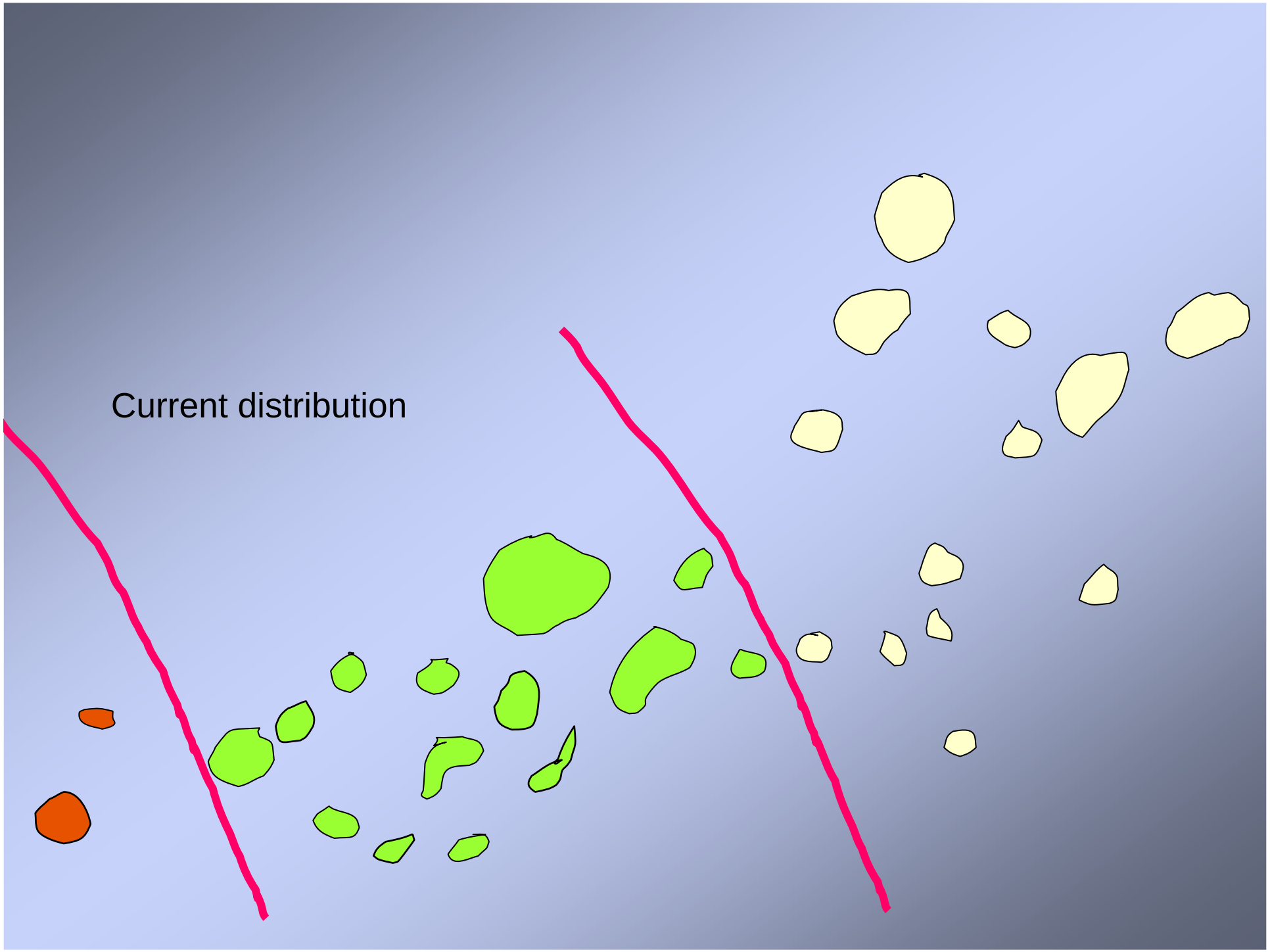
Habitat generalists

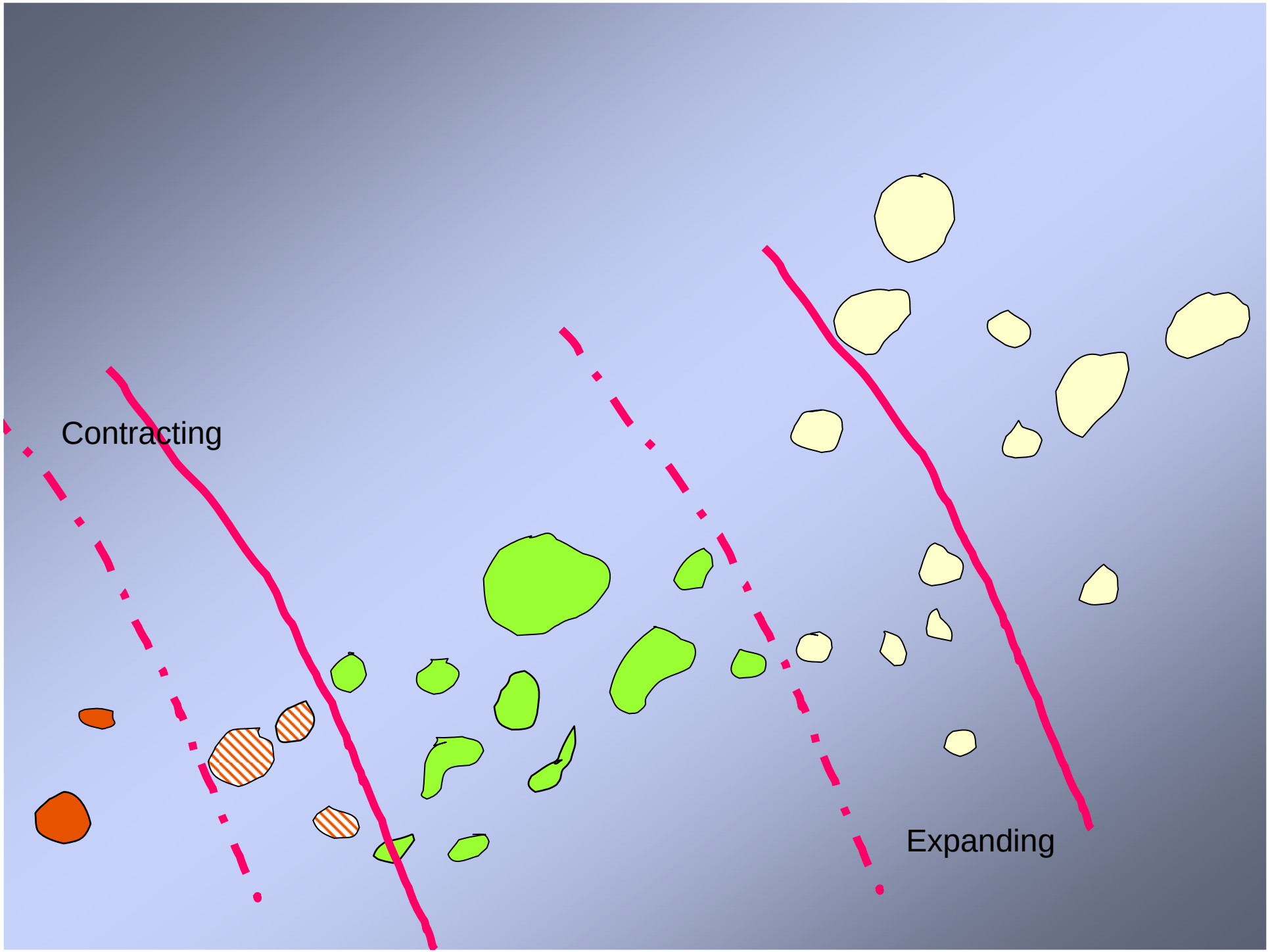
Large dispersal capacity

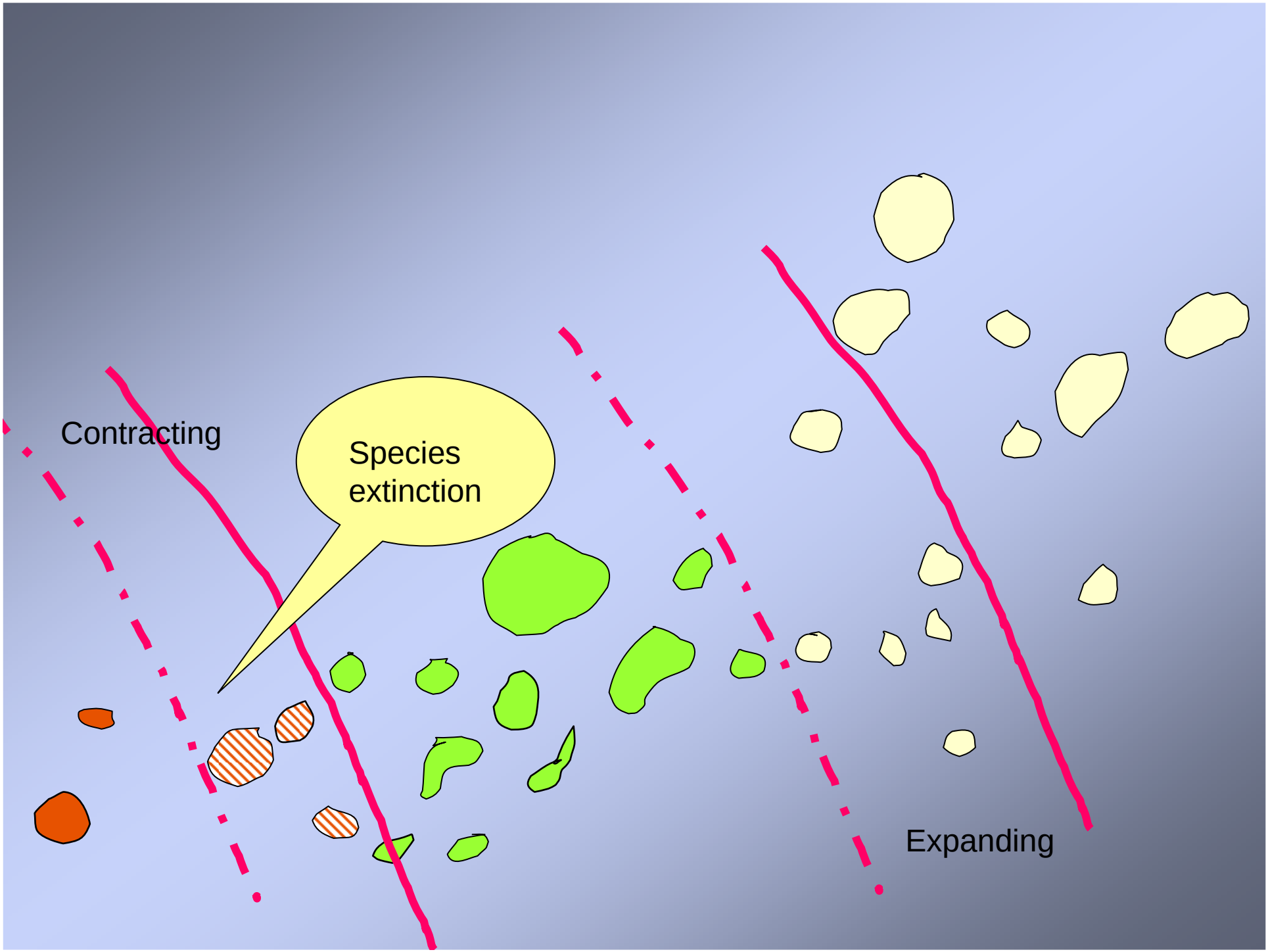
Declining **Expanding**

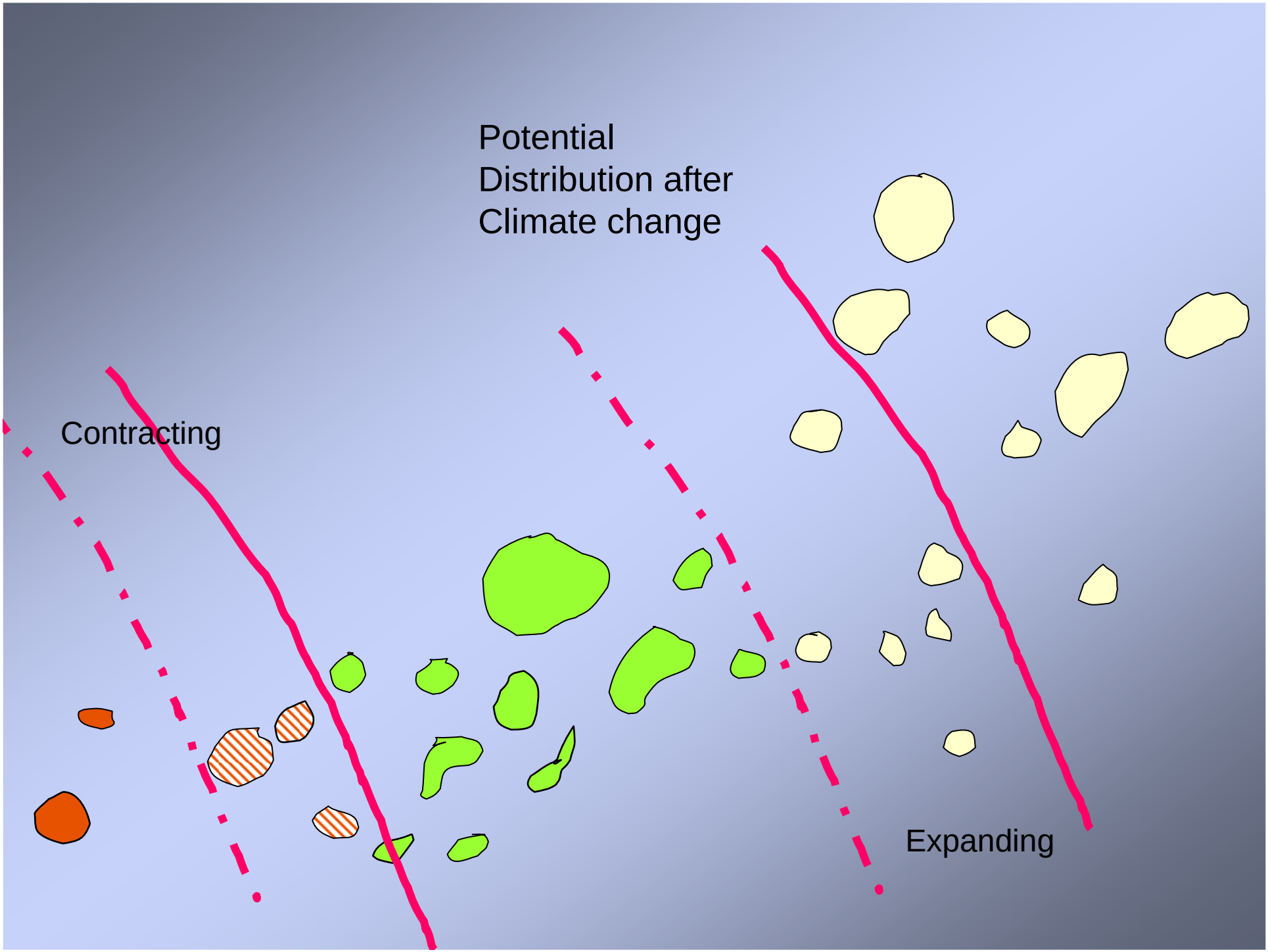
Short-distance disperser

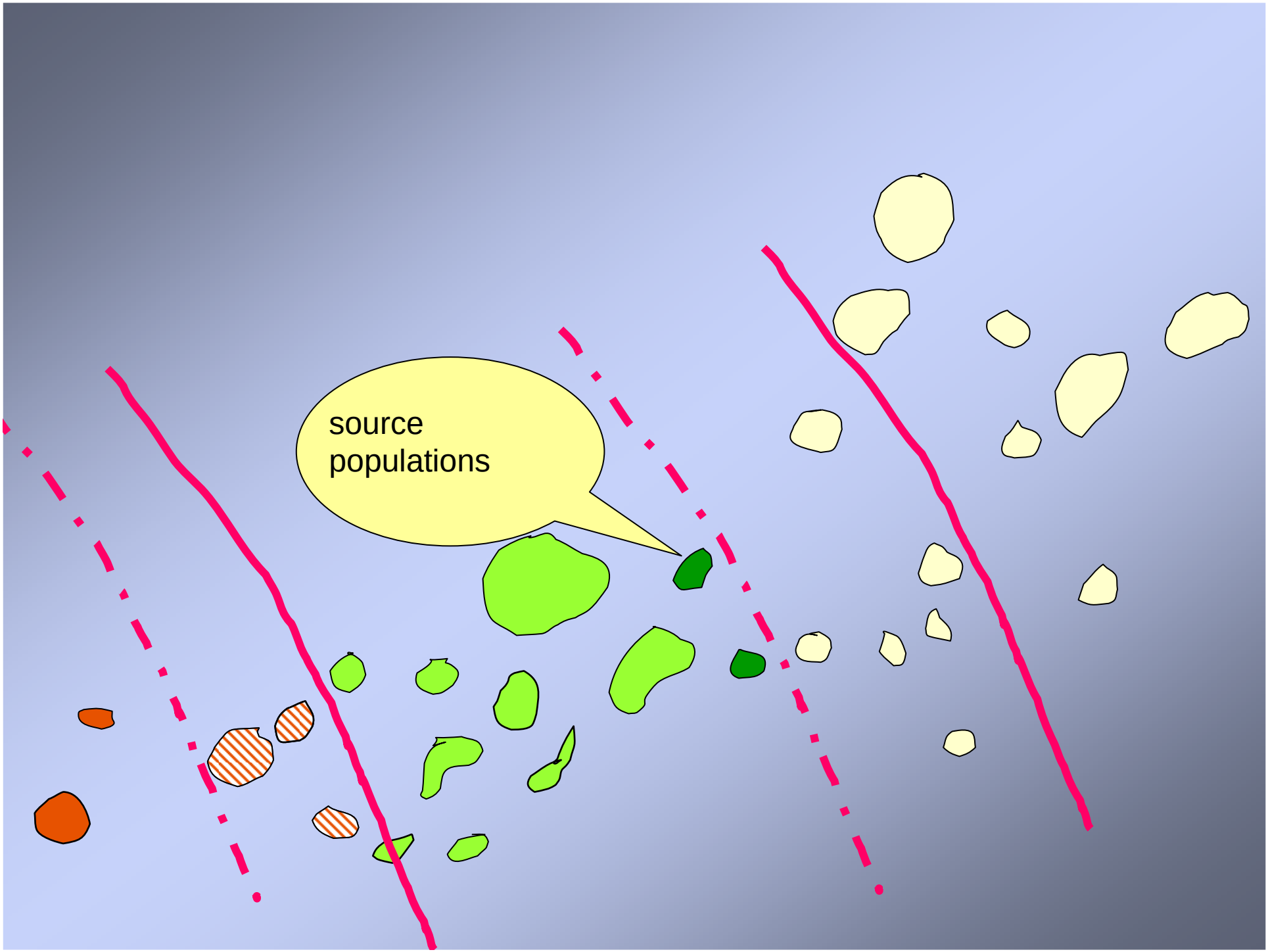
Long-distance disperser

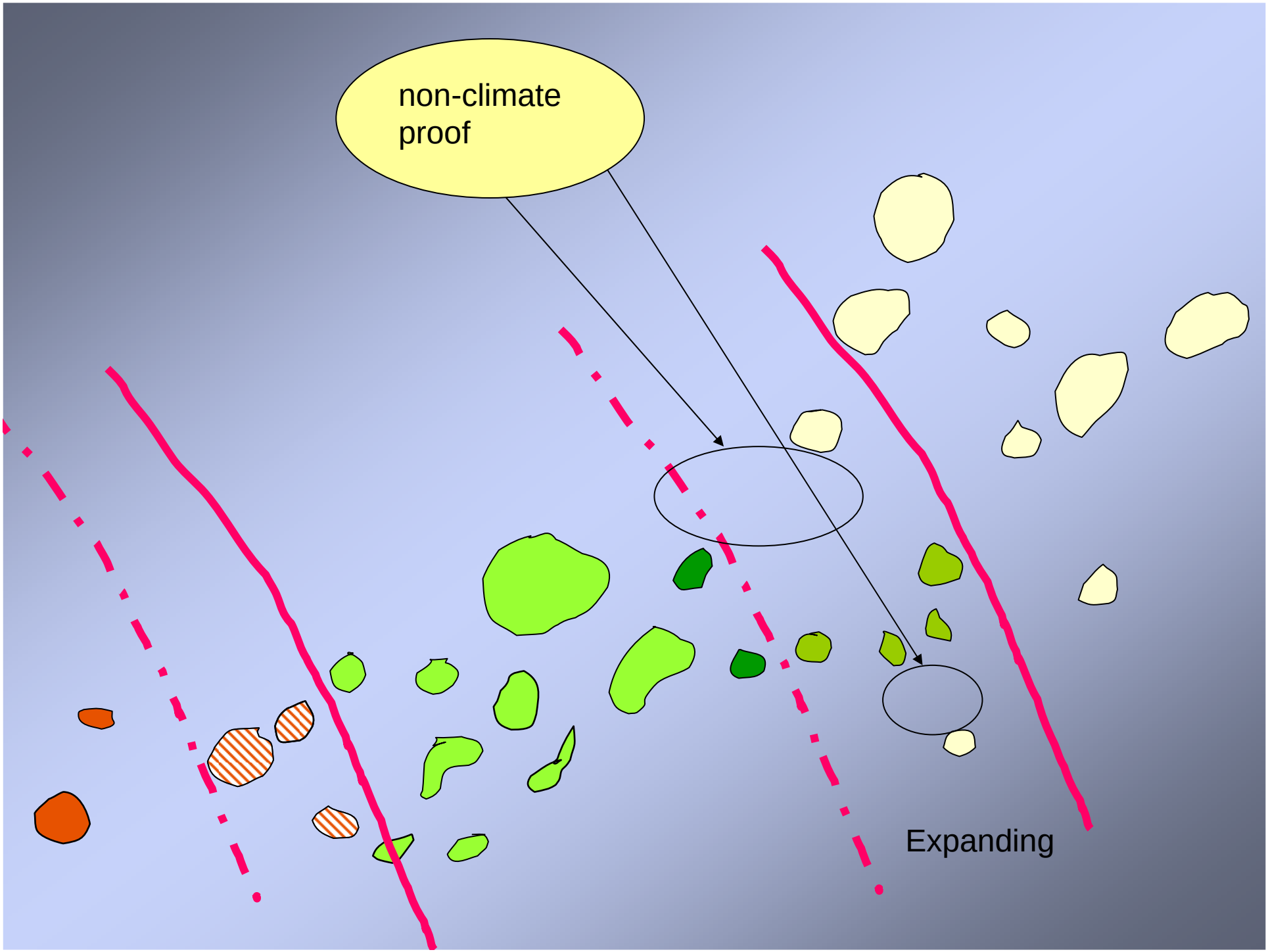

Current distribution


Contracting
Expanding


Contracting
Species extinction
Expanding


Potential
Distribution after
Climate change
Contracting
Expanding


source
populations

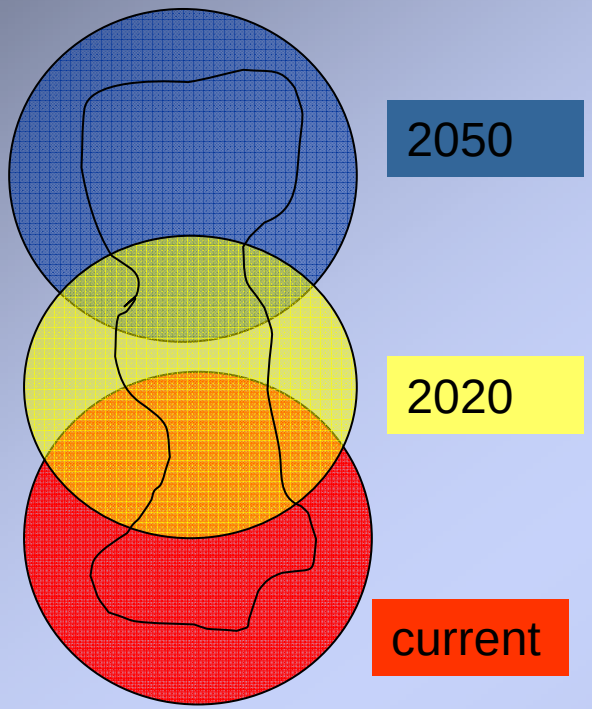

non-climate
proof
Expanding

Interaction temperature rise and habitat fragmentation

- Species with fragmented habitat are not able to follow shifting suitable climate zones
- lower biodiversity levels

BRANCH project - EU Interreg project

Adaptation: Climate proof networks

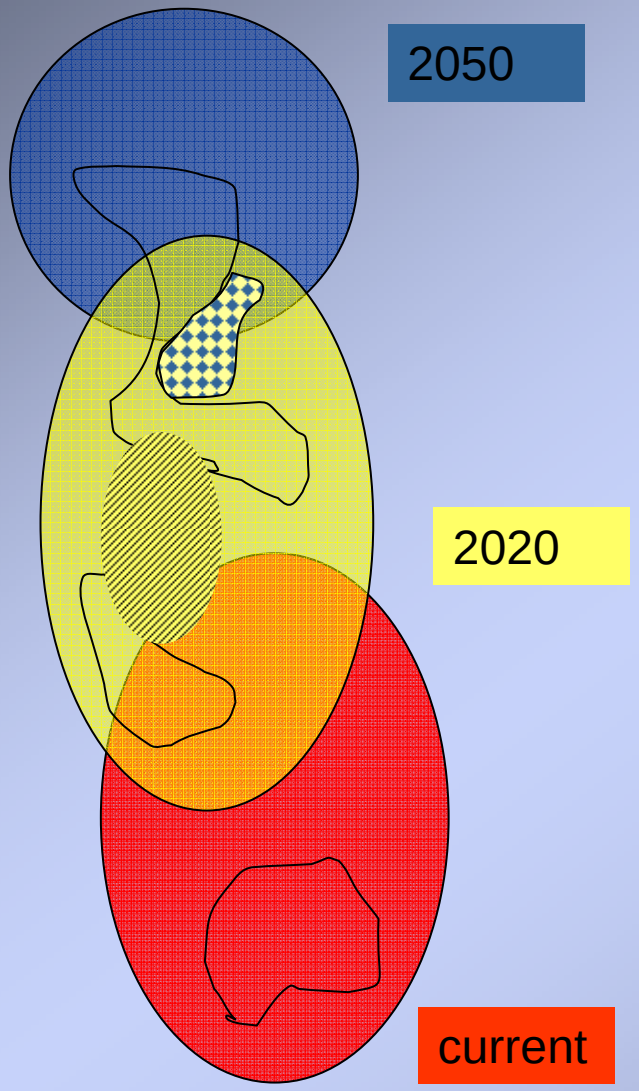


Project aims

- Identify climate proof networks and non-climate proof networks after climate change
- Recommend adaptation strategies
- Regional case studies

Consortium
UK English Nature (Lead partner), Tyndall Centre, Environmental Change Institute, County Council Hampshire and Kent
FR Conservatoire du Littoral
NL Province Limburg, Alterra

Adaptation Non Climate proof network



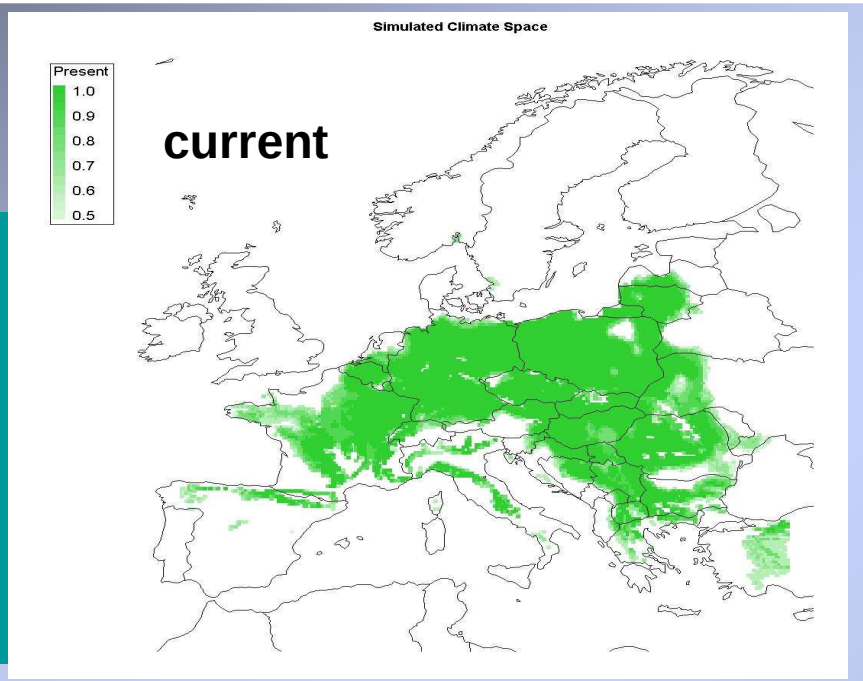
Adaptation strategies:

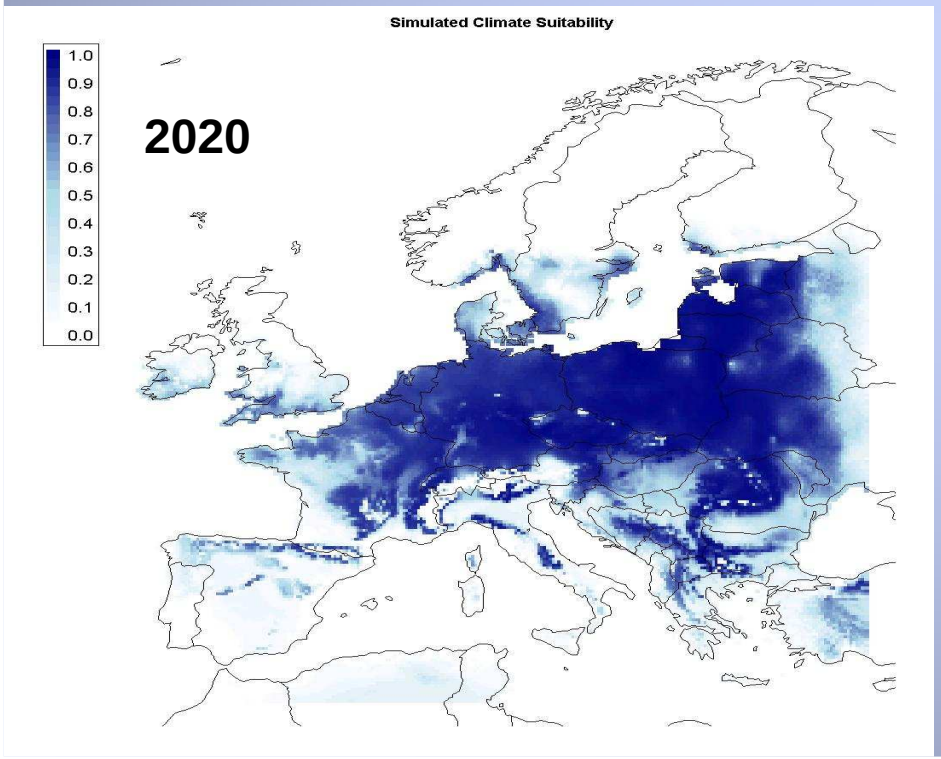
- Mitigate to slow CC process
- Link separate networks
- Create extra habitat in colonization/overlap zone

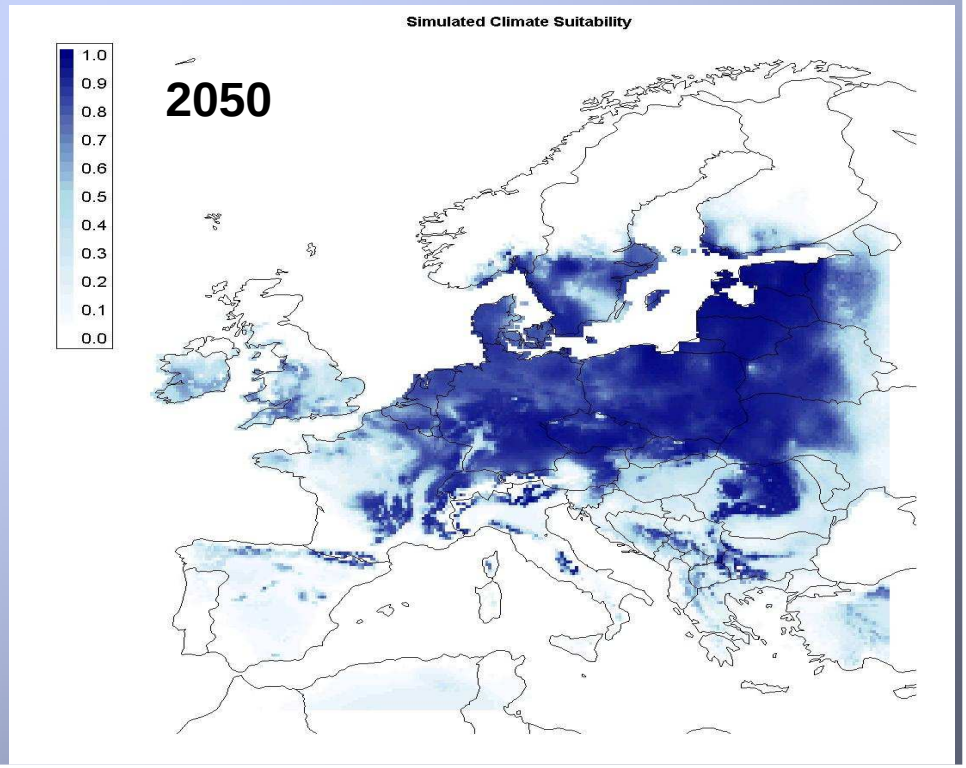
Shifting potential ranges

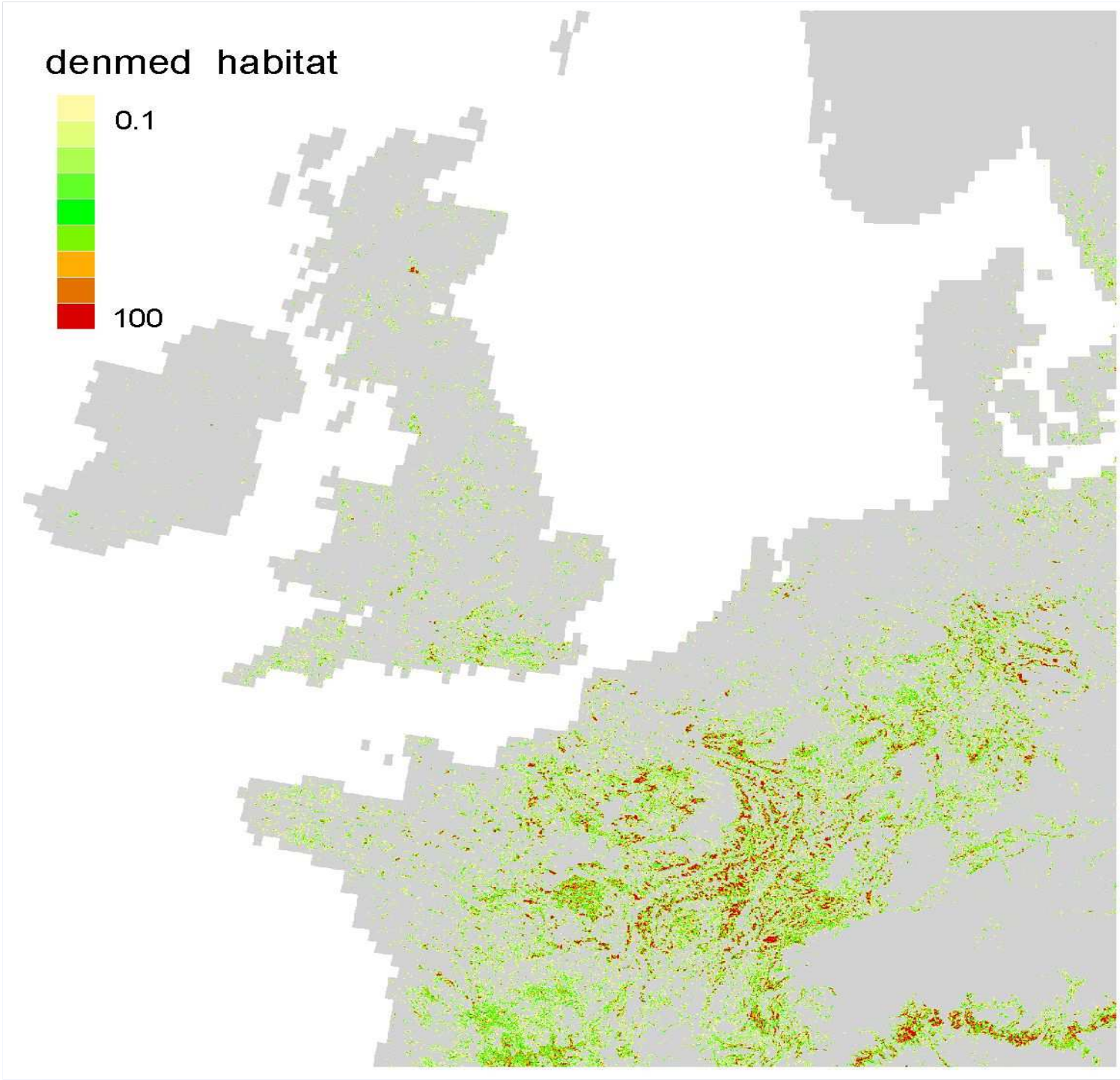
Middle spotted woodpecker

SPECIES Model (Environmental Change Institute)

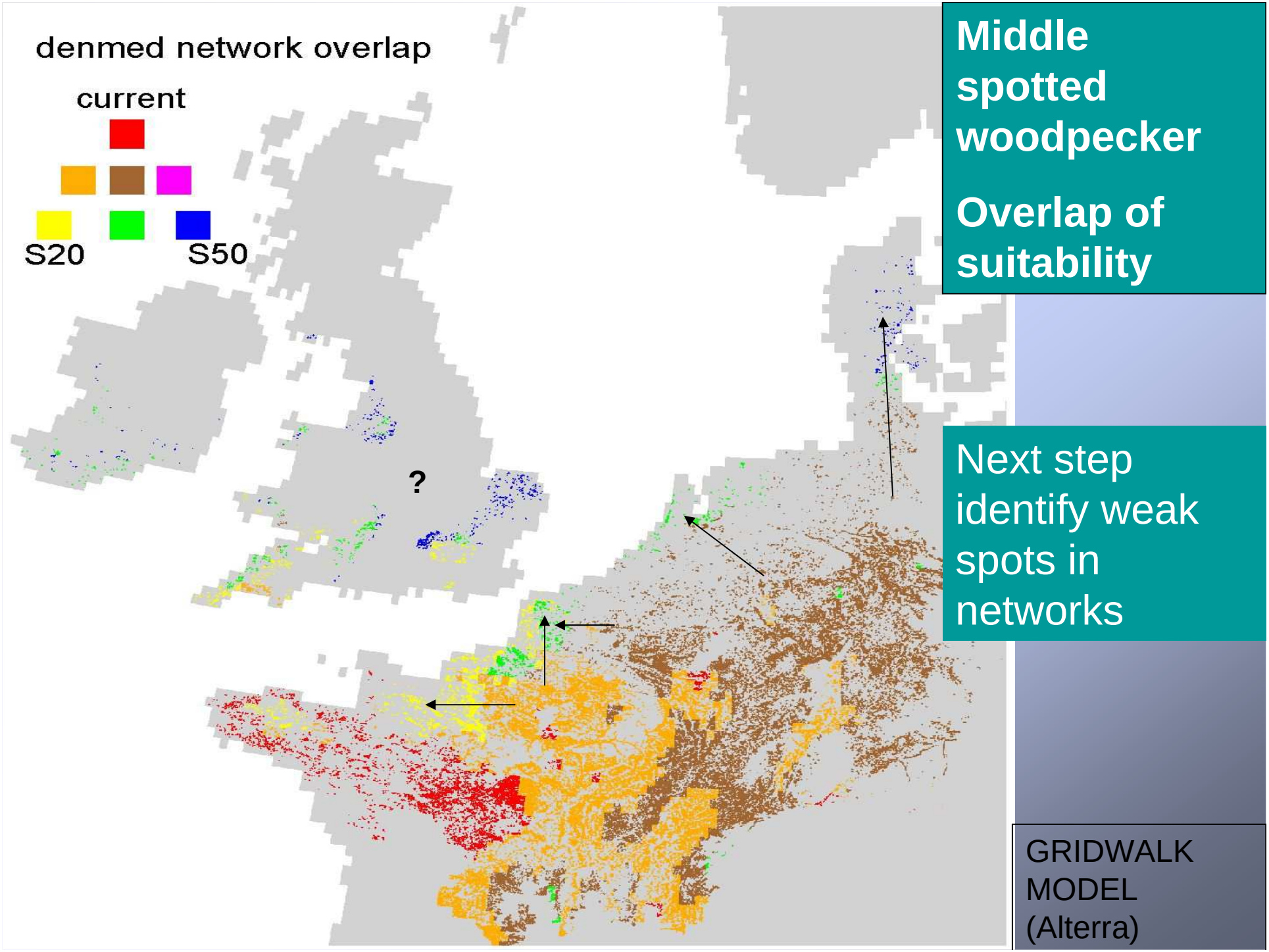








Suitable habitat Middle spotted woodpecker



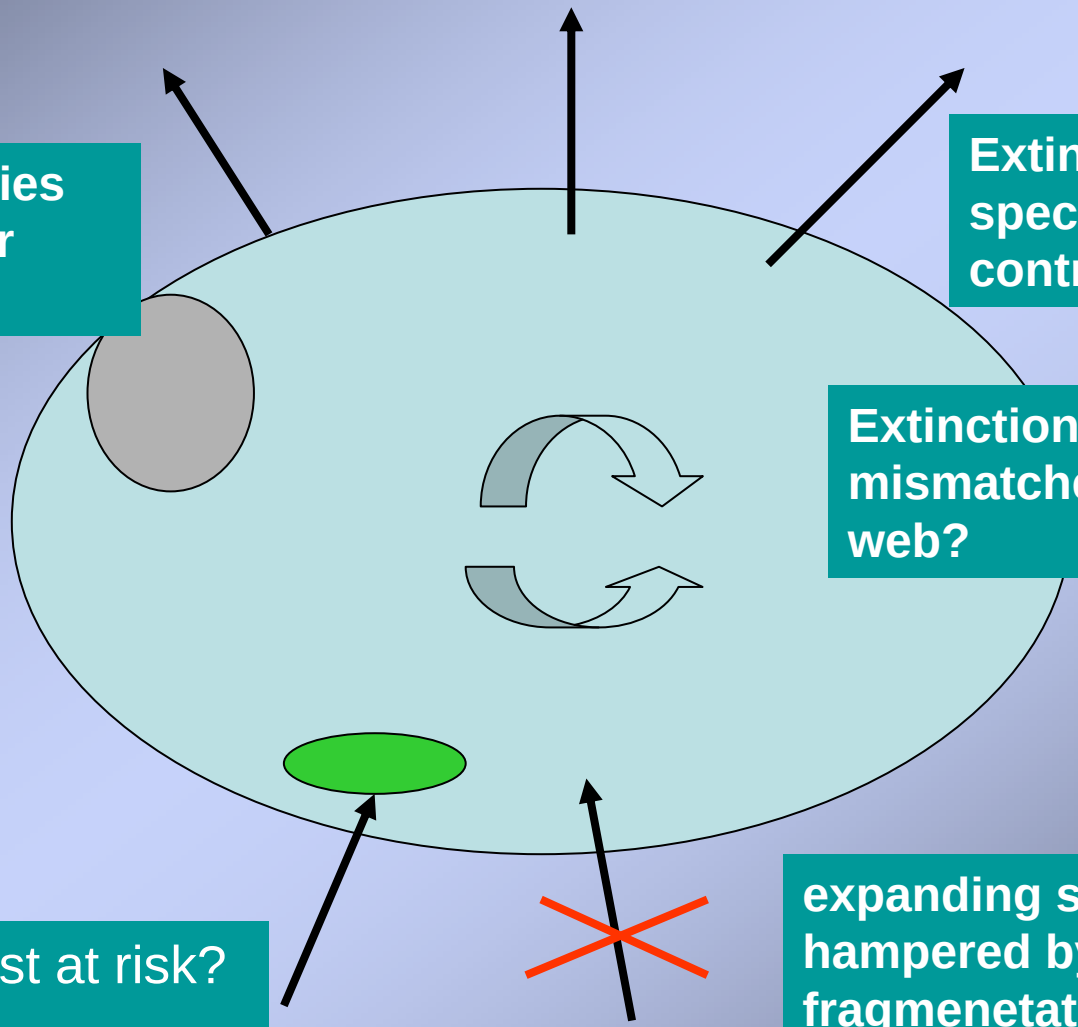
Middle spotted woodpecker

Overlap of suitability

Next step identify weak spots in networks

GRIDWALK MODEL (Alterra)

Loss of biodiversity in ecosystems



Extinction of species caused by weather extremes

Extinction of species with contracting ranges

Extinctions because of mismatches in food web?

Ecosystems most at risk?

Fragmented systems

Wetlands

expanding species hampered by fragmenetation

Adapting the landscape to climate change : defining a strategy

Go for conditions for **ecosystem resilience** in stead of trying to control a steady state

1. Spreading of risk in ecosystems with high level of biodiversity
   - more alternatives in food chain species interactions

2 Spreading of risk by creating spatial cohesion on a large spatial scale
   - Facilitate range expansion,
   - Speed up recovery time after disturbances

Adaptation strategies

	Change spatial structure of network	Improve surrounding landscape	Management of existing nature
Network quality		- Diminish flow of nutrients - Lower recreation pressure	- Increase heterogeneity of vegetation of critical ecosystems
Total network area	-Extend large areas and merge smaller areas to get one large - Develop robust corridors	- Create new habitat patches	Change distribution of ecosystem types in favor of most critical ones
Network density	Increase stepping stones	Develop habitat patches	
Matrix permeability	Increase density of corridors	Improve matrix permeability	

Increase spatial cohesion within and between habitat networks

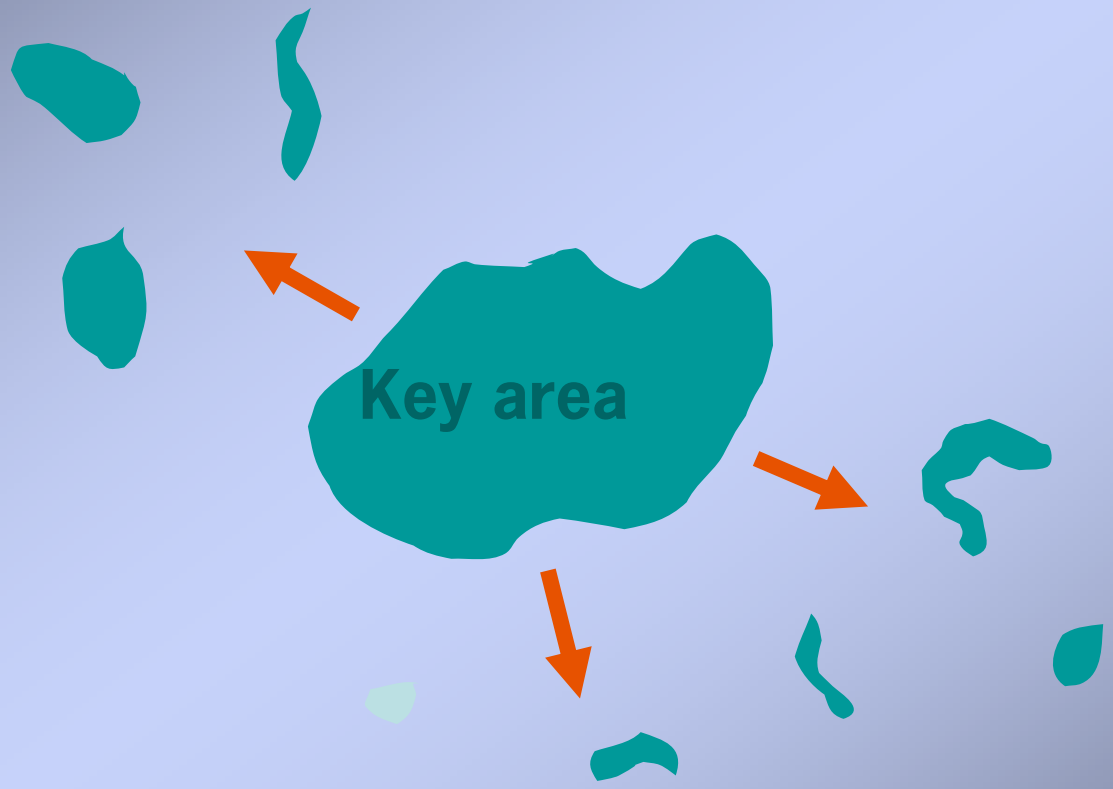
Available strategies:

- Patch area
- Patch quality

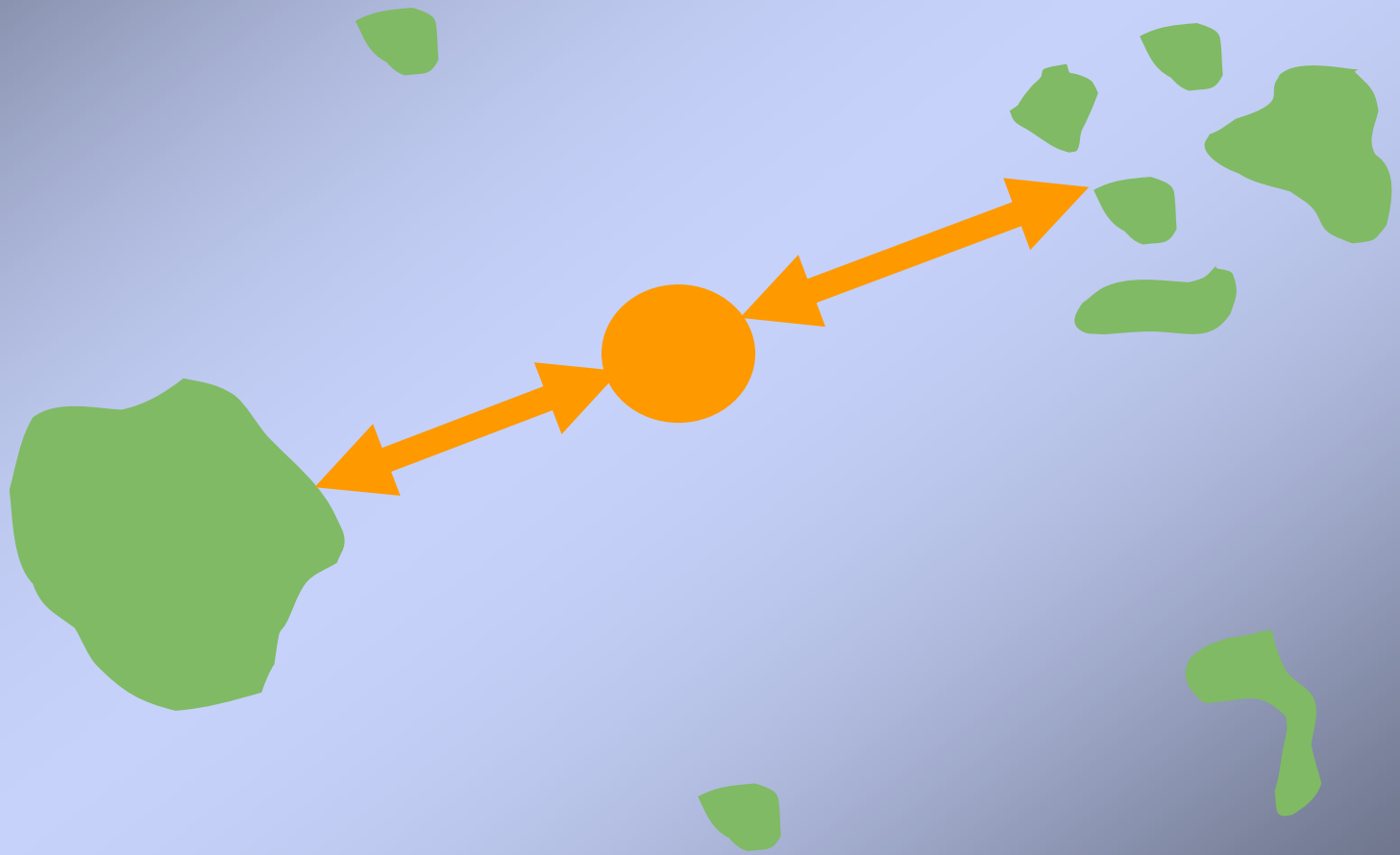
- Patch density

- Landscape permeability
- Connectivity

Enlarge nature areas to compensate for fluctuations



Add Robust Corridors linking networks to facilitate species range shifts



on a European scale

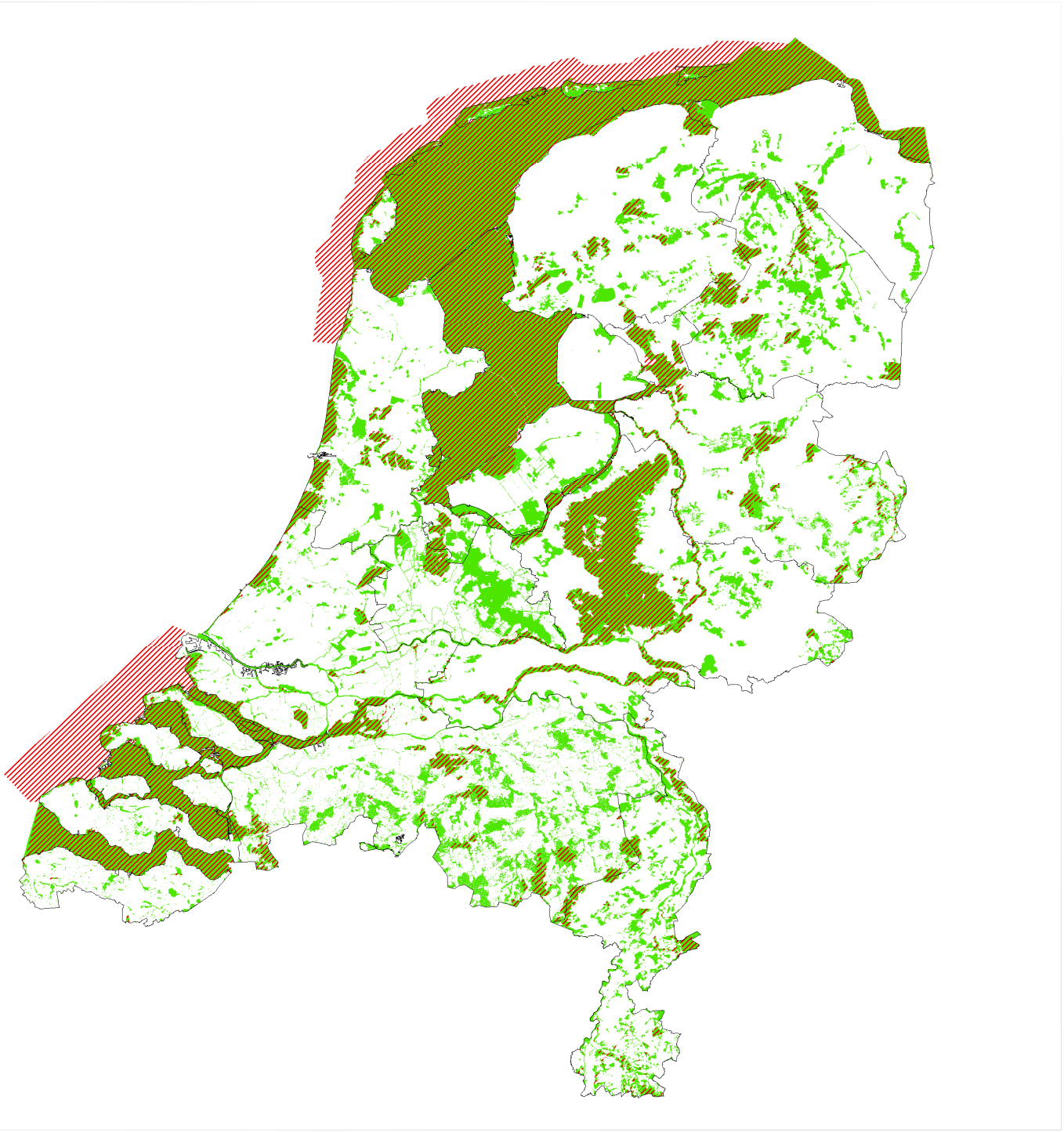
Natura 2000 areas

Additional measures are needed to function as ecological networks

Dutch Nature Policy Plan 1990

Habitat fragmentation as threat to biodiversity

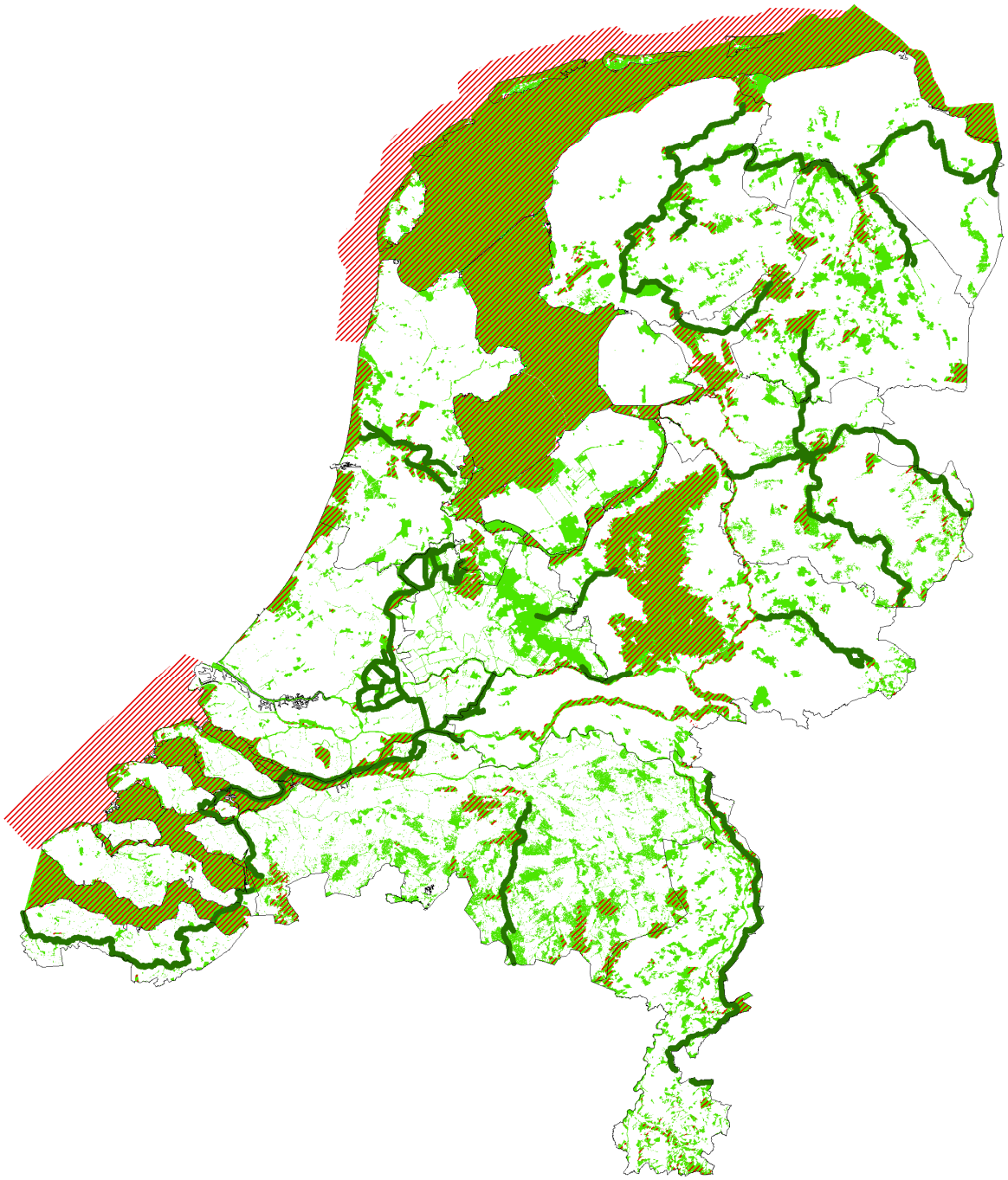
National Ecological Network



Nature Policy Plan 2000

Large scale spatial Cohesion

Robust Ecological Corridors

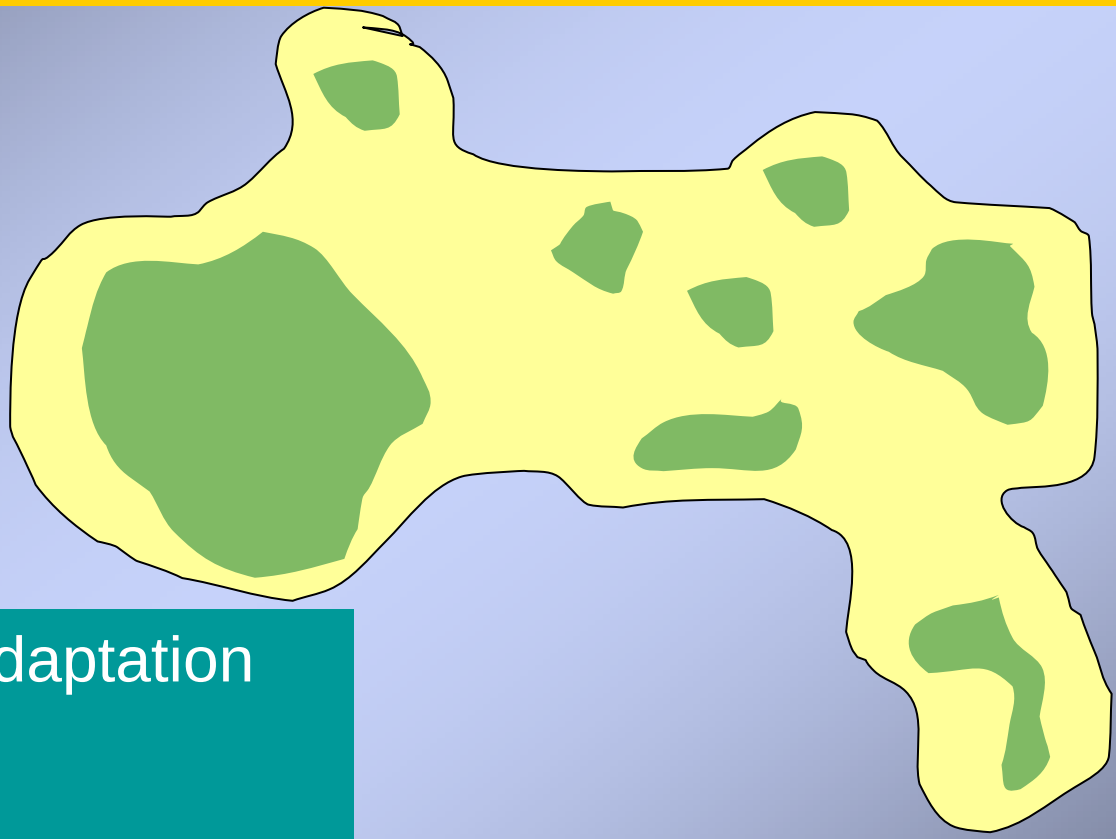


These strategies are only effective when implemented on an international level

Spatial adaptation strategies

	Change spatial structure of network	Improve surrounding landscape	Management of existing nature
Network quality		- Improve water management Diminish flow of nutrients - Lower recreation pressure	- Increase heterogeneity of vegetation of critical ecosystems
Total network area	-Extend large areas and merge smaller areas to get one large - Develop robust corridors	- Create new habitat patches	Change distribution of ecosystem types in favor of most critical ones
Network density	Increase stepping stones	Develop habitat patches	
Matrix	Increase density of	Improve matrix	

Create buffer zones surrounding nature areas



Mutifunctional adaptation

Biodiversity

Water safety

Agriculture

Recreation

Avoid irreversible land use surrounding nature areas

Green veining - natural elements in the agricultural landscape

Biodiversity

- Improve connectivity

Multifunctional benefits

- Recreation quality
- Economic value pest control

Water management

Biodiversity

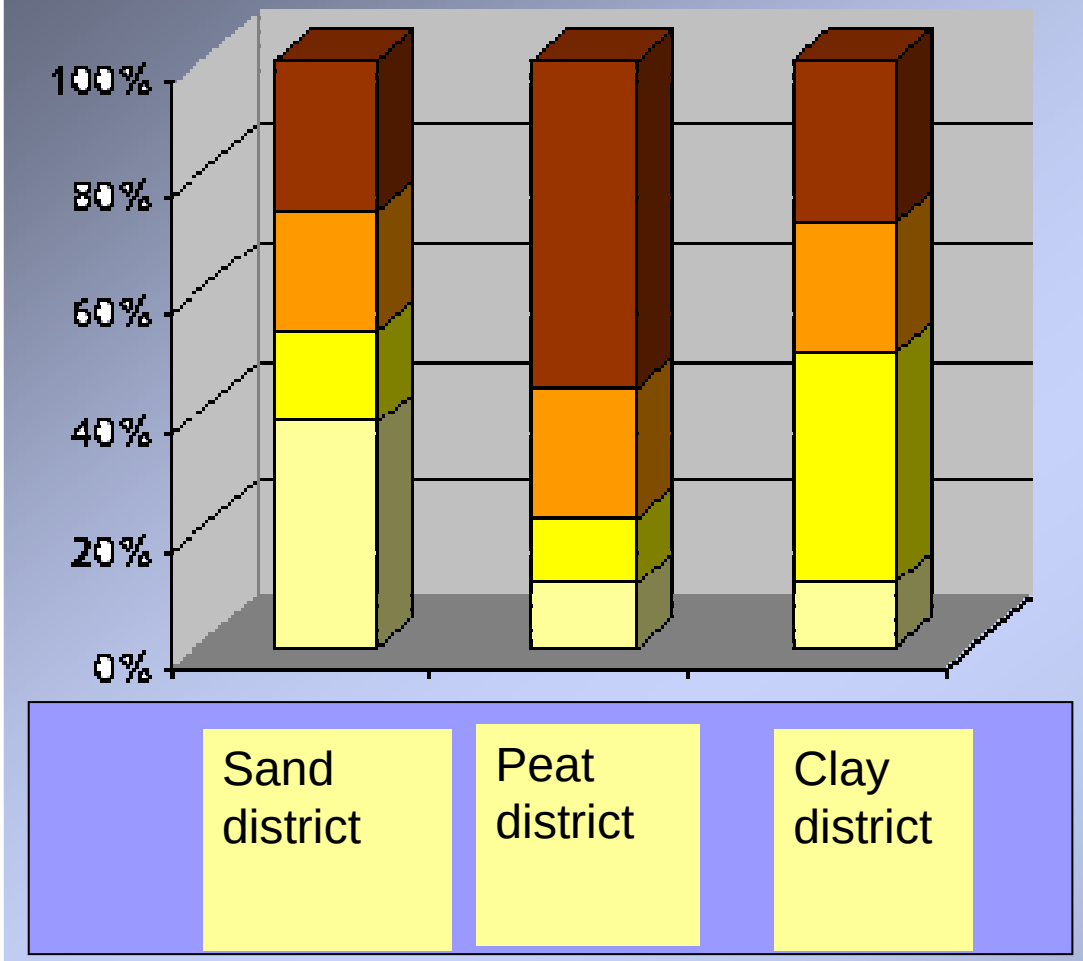
- Regional water retention
- Improve abiotic conditions for wetlands on regional level
- Enlarge existing networks by creating new habitats

Multifunctional benefits

Safety - flooding

Agriculture- flooding, retention

Already > 100 water retention projects



Large ambitions:

e.g. Dommel Catchment area

- In 2050 retention areas for 60.000.000 m 3 needed
- ca 6000 ha

Summarising

- Increase spatial cohesion within and between habitat networks
- Implement robust corridors on an international level
- Create bufferzones of multifunctional adaptation surrounding nature areas.

Thank you