

Landscape degradation and restoration an animal's perspective



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Stichting **Bargerveen**

Overview

Degradation

Fauna

Bottlenecks

Restoration

Recommendations



Degradation

Degradation

Fauna

Bottlenecks

Restoration

Recommendations

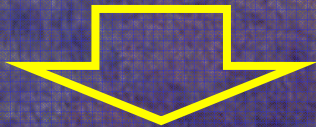
The Netherlands



Degradation

Local conditions
(microscale $\sim m^2$)

Acidification
Eutrophication
Desiccation



Degradation of
Site conditions

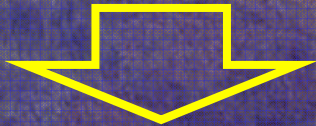
Degradation



Degradation

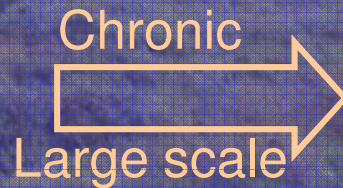
Site conditions
(microscale $\sim m^2$)

Acidification
Eutrophication
Desiccation



Degradation of
site conditions

Degradation



Landscape conditions
(mesoscale: $\sim ha$
macroscale: $\sim km^2$)

Fragmentation
Homogenisation

Degradation

Nitrogen deposition along the baltic coast



Ameland, The Netherlands



Skagen, Denmark

Degradation

Nitrogen deposition along the baltic coast



Degradation

Nitrogen deposition along the baltic coast



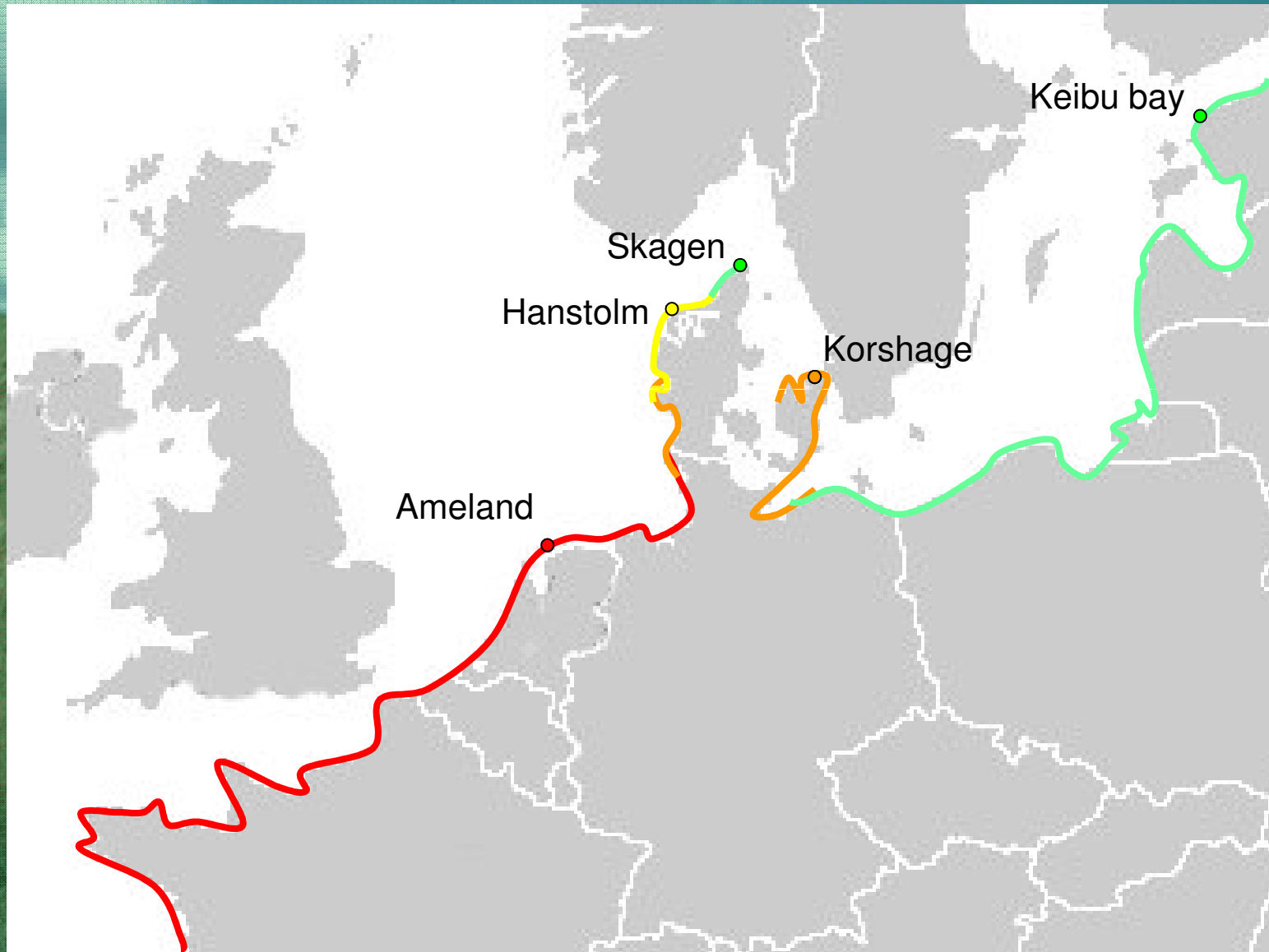
Keibu bay, NW Estonia



Korshage, NE Denmark

Degradation

Nitrogen deposition along the baltic coast





Degradation

Nitrogen deposition along the baltic coast



Degradation

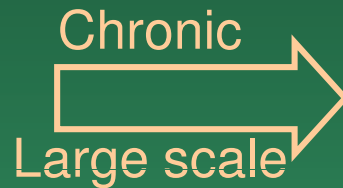
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Degradation of
site conditions

Degradation



Landscape conditions
(mesoscale: $\sim ha$
macroscale: $\sim km^2$)

Fragmentation
Homogenisation



Degradation of
landscape

Fauna

Degradation

Fauna

Bottlenecks

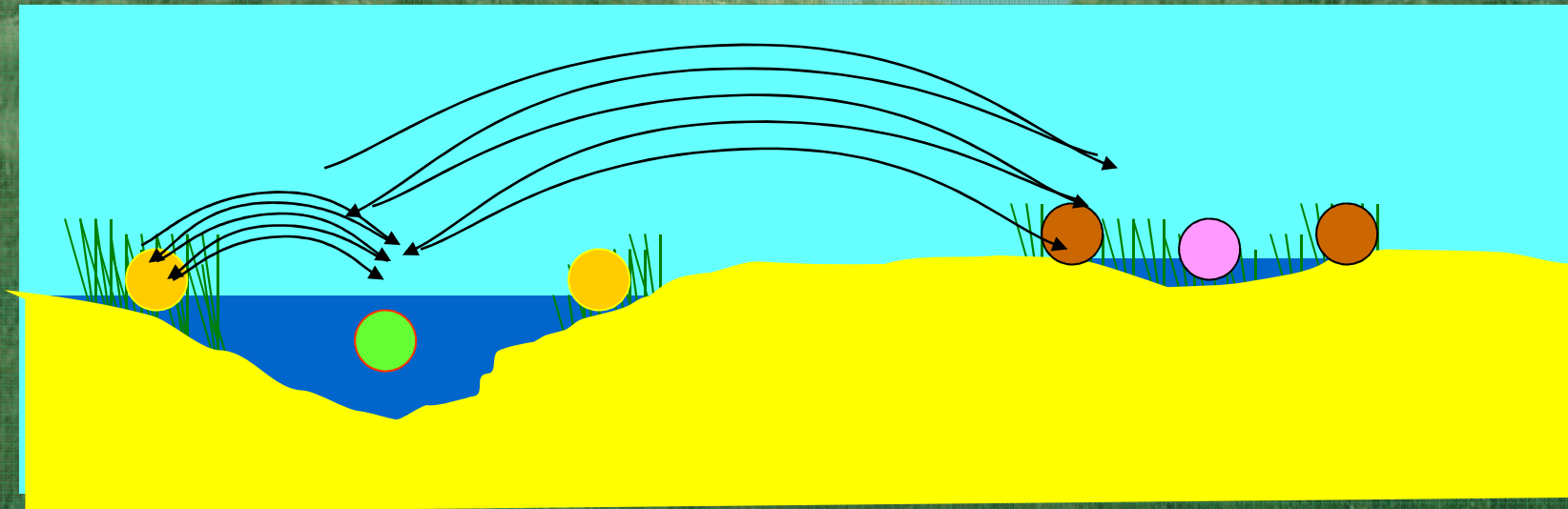
Restoration

Recommendations



Fauna

- food
- shelter
- reproduce
- pupate



Importance of landscape connectivity and heterogeneity!

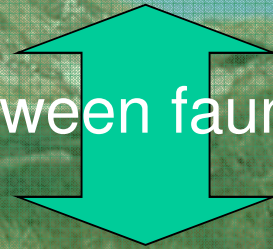
Fauna

Species use landscape specifically



Ready flyer
Good swimmer
Longevity >1 year
Selective oviposition

‘match’ between fauna and landscape

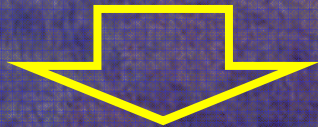


watertypes
configuration

Fauna

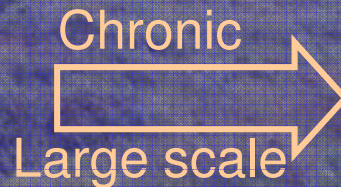
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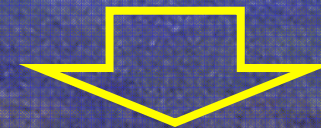
Degradation of
site conditions

Degradation



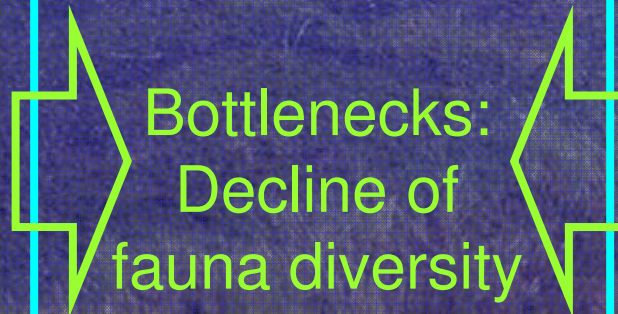
Landscape conditions
(mesoscale: $\sim ha$
macroscale: $\sim km^2$)

Fragmentation
Homogenisation



Degradation of
landscape

Bottlenecks:
Decline of
fauna diversity



Bottlenecks

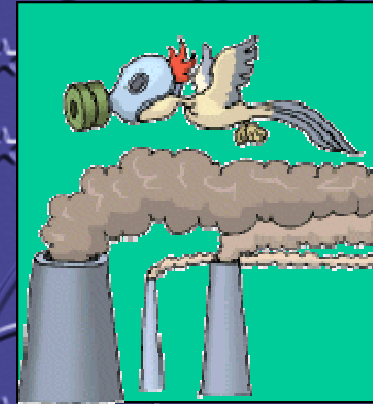
Degradation

Fauna

Bottlenecks

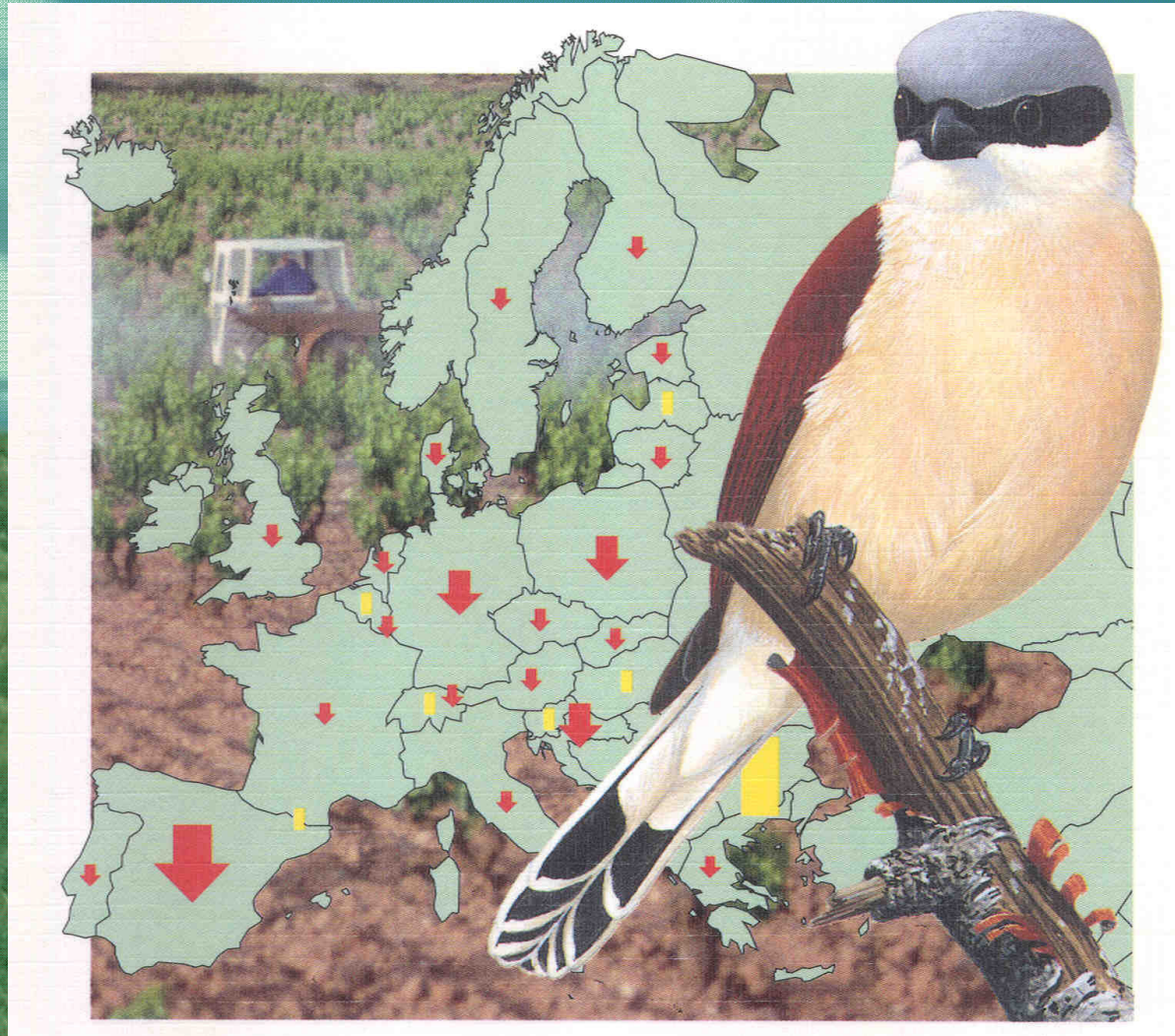
Restoration

Recommendations



Bottlenecks

Red-backed Shrike as indicator for biodiversity



Status of Red-Backed Shrike (*Lanius collurio*) in Europe Tucker & Heath (1994)

Bottlenecks

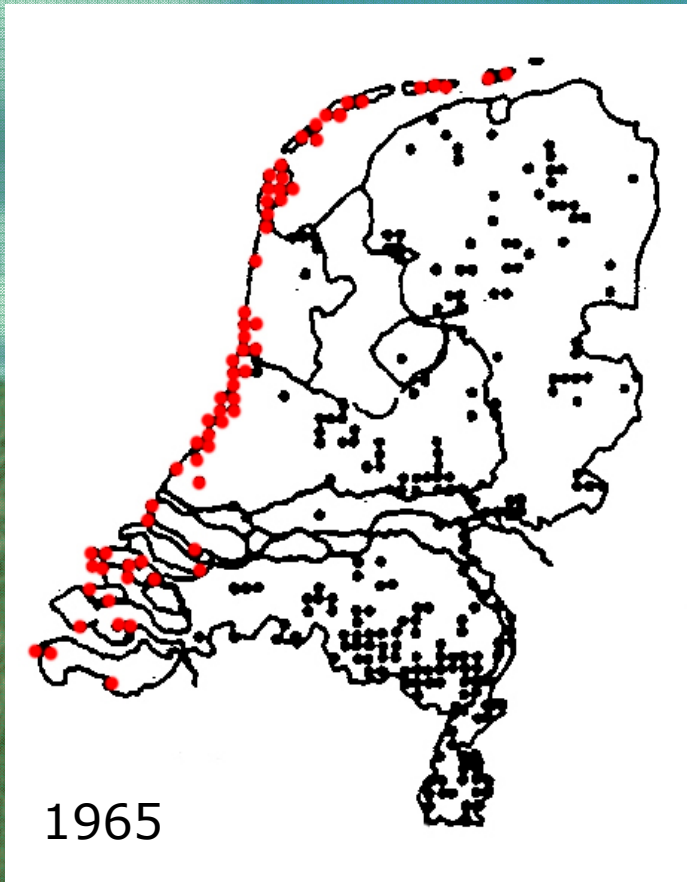
Red-backed Shrike as indicator for biodiversity

- seasonal migrating
- single prey
- large insects & small vertebrates



Bottlenecks

Red-backed Shrike as indicator for biodiversity



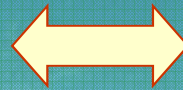
Decline of Red-Backed Shrike
in Dutch coastal dunes

Bottlenecks

Red-backed Shrike as indicator for biodiversity

Degraded

Ameland, Netherlands



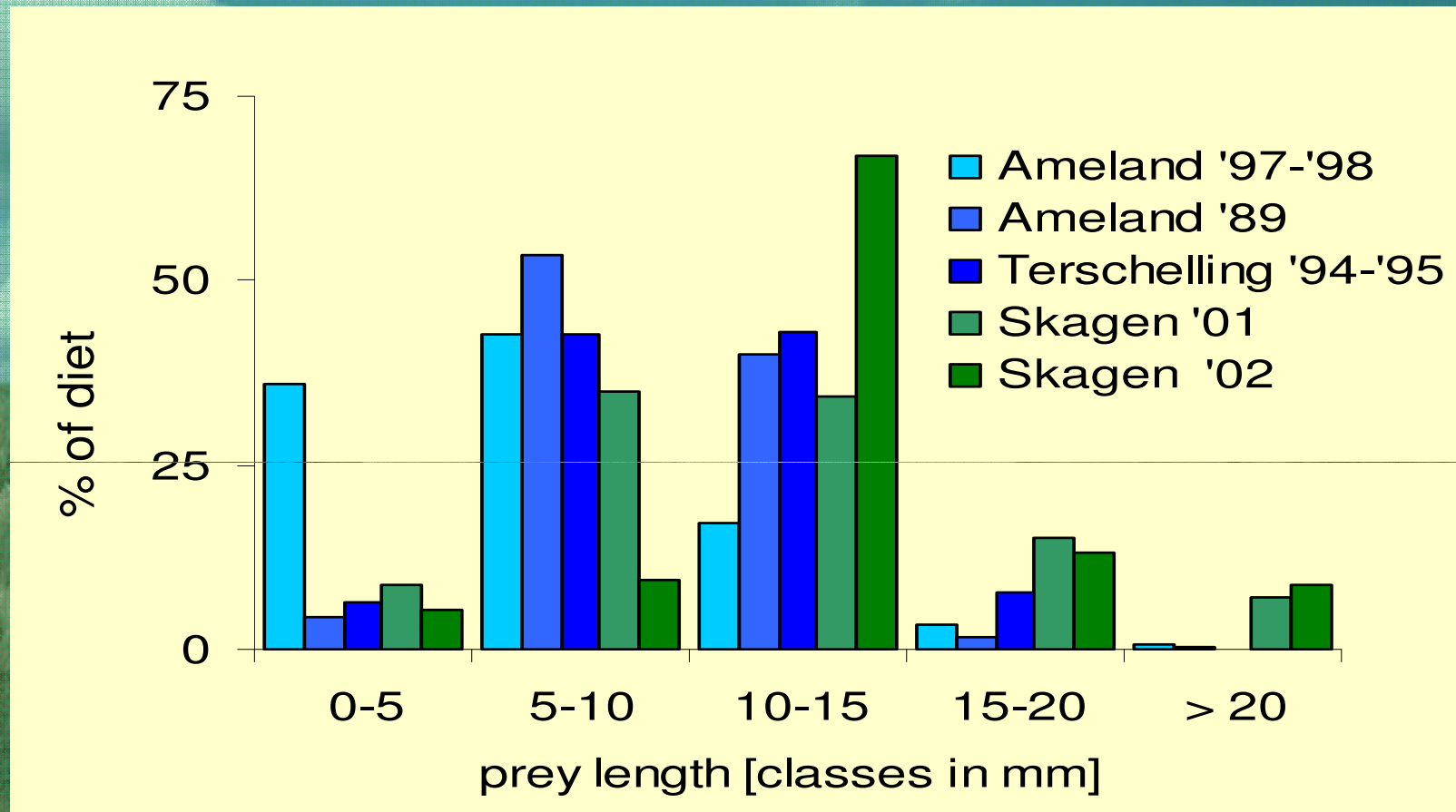
Intact

Skagen, Denmark



Bottlenecks

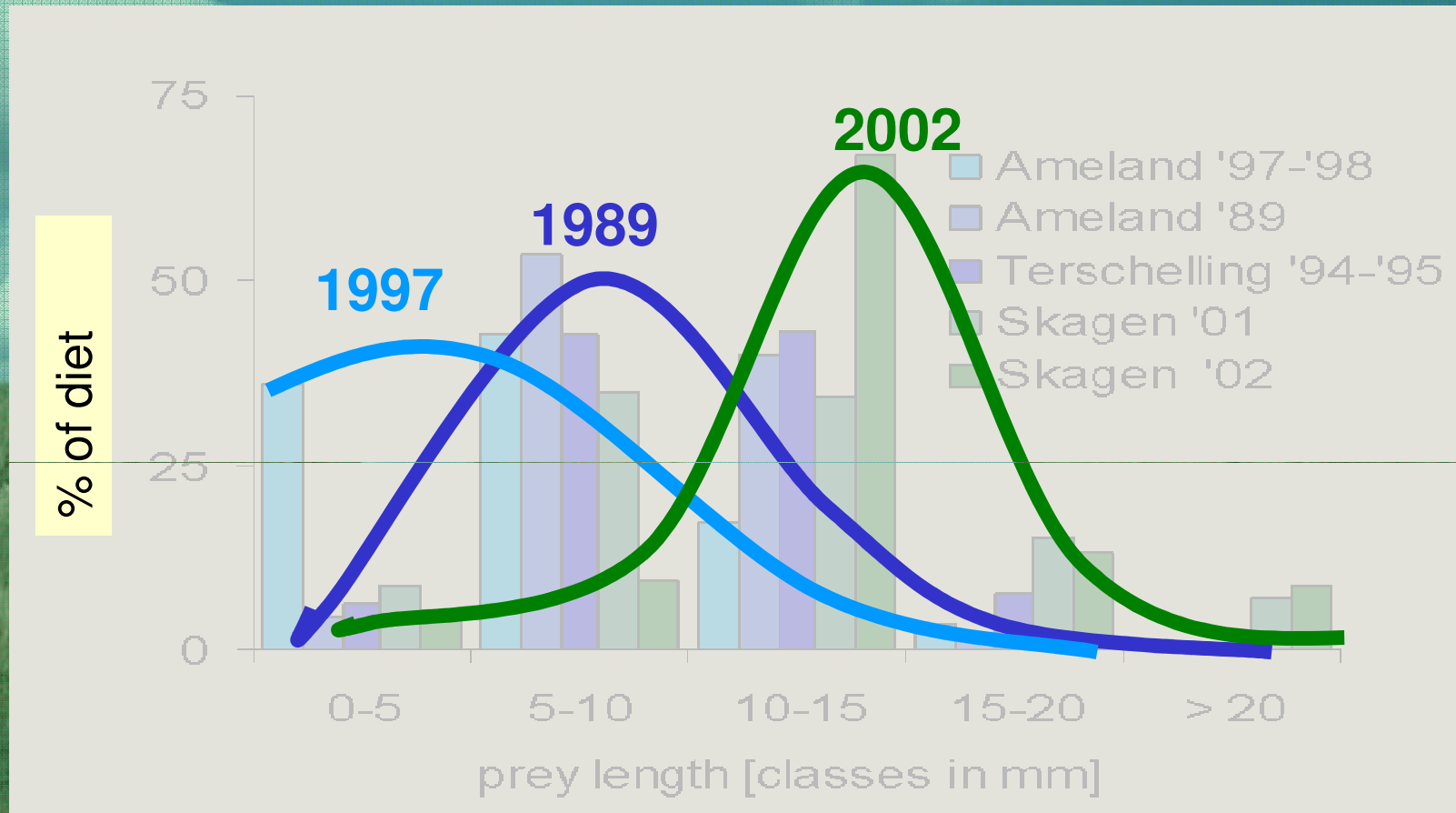
Red-backed Shrike as indicator for biodiversity



PREY LENGTH IN ADULT DIET

Bottlenecks

Red-backed Shrike as indicator for biodiversity



PREY LENGTH IN ADULT DIET

Bottlenecks

Red-backed Shrike as indicator for biodiversity

Diet composition

	Ameland '89	Ameland '97-'98	Terschelling '94-'95	Skagen '02
Beetles	79,0	34,5	25,7	56,1
<i>Scarabids</i>	49,5	3,9	7,0	46,5
<i>Carabids</i>	5,5	7,9	2,6	3,3
<i>Weevils</i>	6,9	8,3	9,2	1,7
<i>Other</i>	17,1	12,5	6,9	4,6
Hymenoptera	17,1	55,9	62,6	30,8
<i>Bumblebees</i>	11,9	4,0	33,4	14,4
<i>Ants</i>	2,0	44,9	19,3	7,0
<i>Other</i>	3,2	7,1	10,0	9,4
Other	3,9	9,5	11,7	13,1
n. pellets	115	35	63	52
n. ind. prey	1381	864	629	458



Bottlenecks

Red-backed Shrike as indicator for biodiversity



Highest density at vital
growth of Marram grass

Bottlenecks

Degradation causes 'mismatch' at different scales

- increased vegetation succession
- sand, organic layer (detritivores)
- changes in microclimate (soil fauna)
- changes in plants (herbivores & nectivores)
- less heterogeneity (carnivores)

Restoration

Degradation

Fauna

Bottlenecks

Restoration

Recommendations



Restoration

Site conditions
(microscale $\sim m^2$)

Acidification
Eutrophication
Desiccation



Degradation of
site conditions

Restoration

Mowing
Sod-cutting
Rewetting
...

Bottlenecks:
Decline of
fauna diversity

Restoration

Site conditions
(microscale $\sim m^2$)

Acidification
Eutrophication
Desiccation



Restoration of
site conditions

Restoration

Mowing
Sod-cutting
Rewetting
...



Restoration



Largescaled
≡ *Fast*
Intensive

Restoration

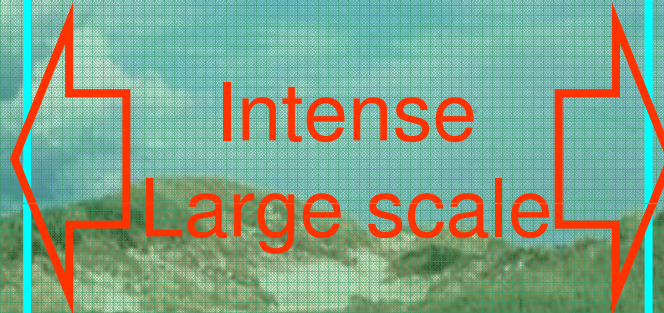
Site conditions
(microscale $\sim m^2$)

Acidification
Eutrophication
Desiccation



Restoration of
site conditions

Restoration



Intense
Large scale

Landscape conditions
(mesoscale: $\sim ha$
macroscale: $\sim km^2$)

Fragmentation
Homogenisation

Restoration

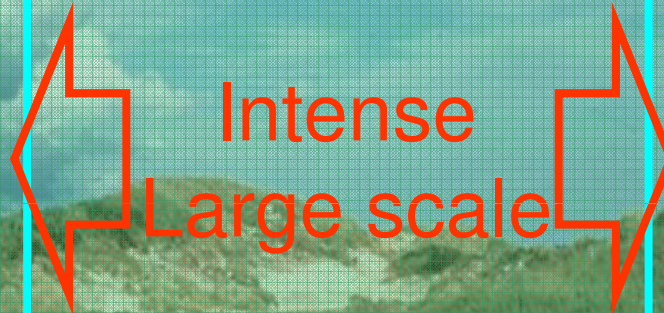
Site conditions
(microscale $\sim m^2$)

Acidification
Eutrophication
Desiccation



Restoration of
site conditions

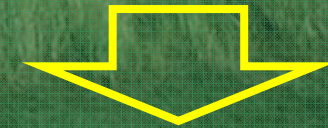
Restoration



Intense
Large scale

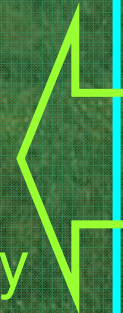
Landscape conditions
(mesoscale: $\sim ha$
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Fragmentation
Homogenisation



further
degradation of
Landscape?

Bottlenecks:
Decline of
fauna diversity

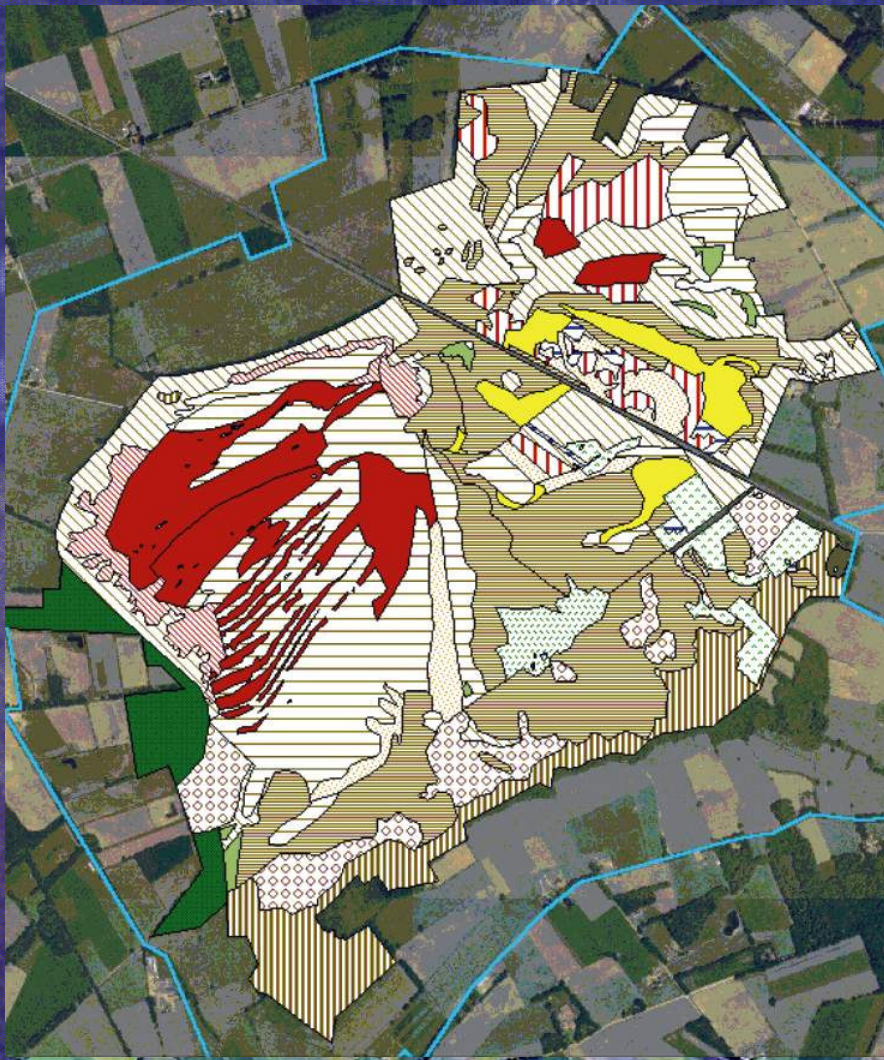


Restoration



Fauna

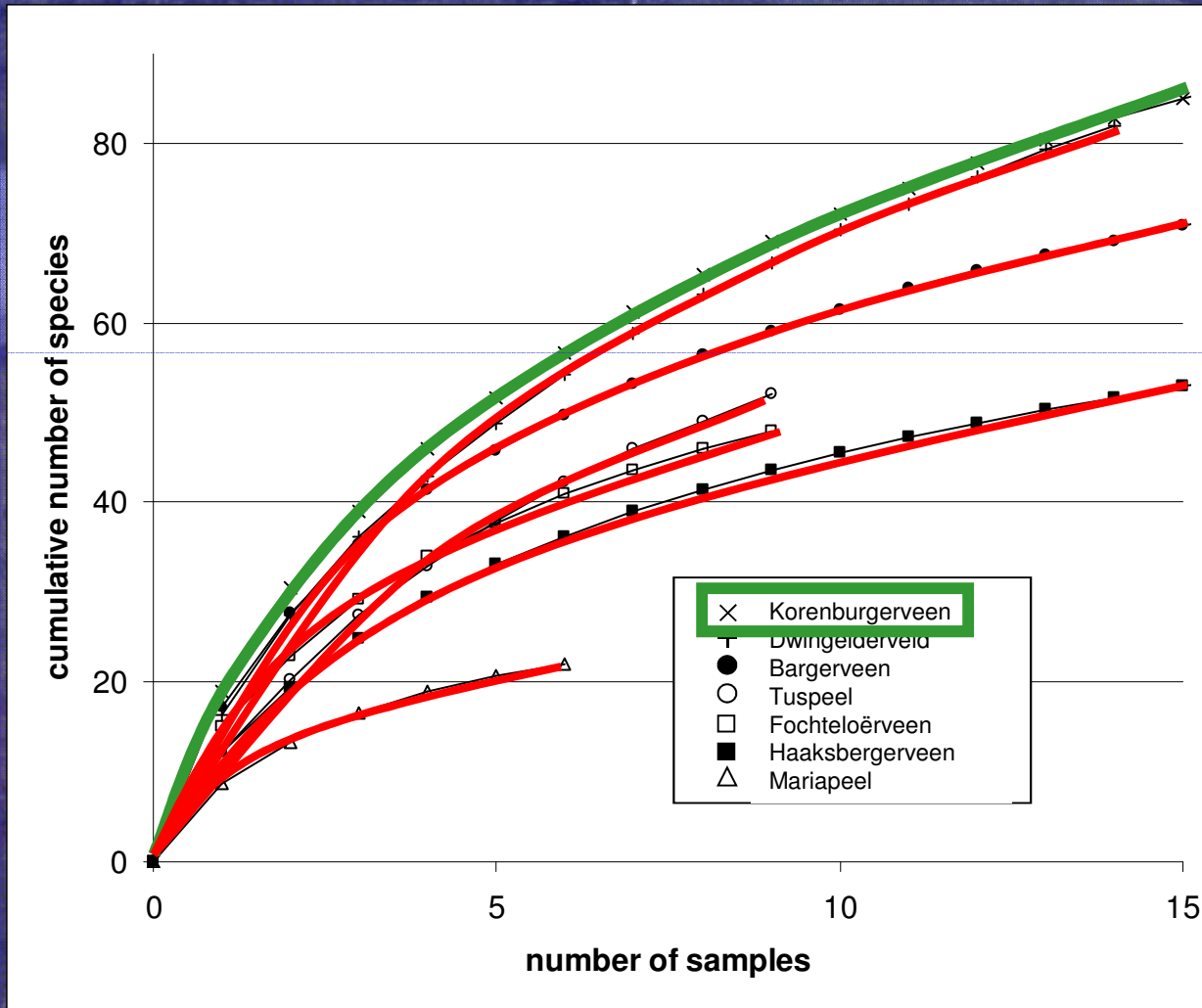
Relation between landscape heterogeneity and fauna diversity



Large variation
Fine scale mozaic
Gradual transitions

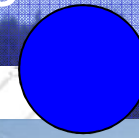
Fauna

Relation between landscape heterogeneity and fauna diversity



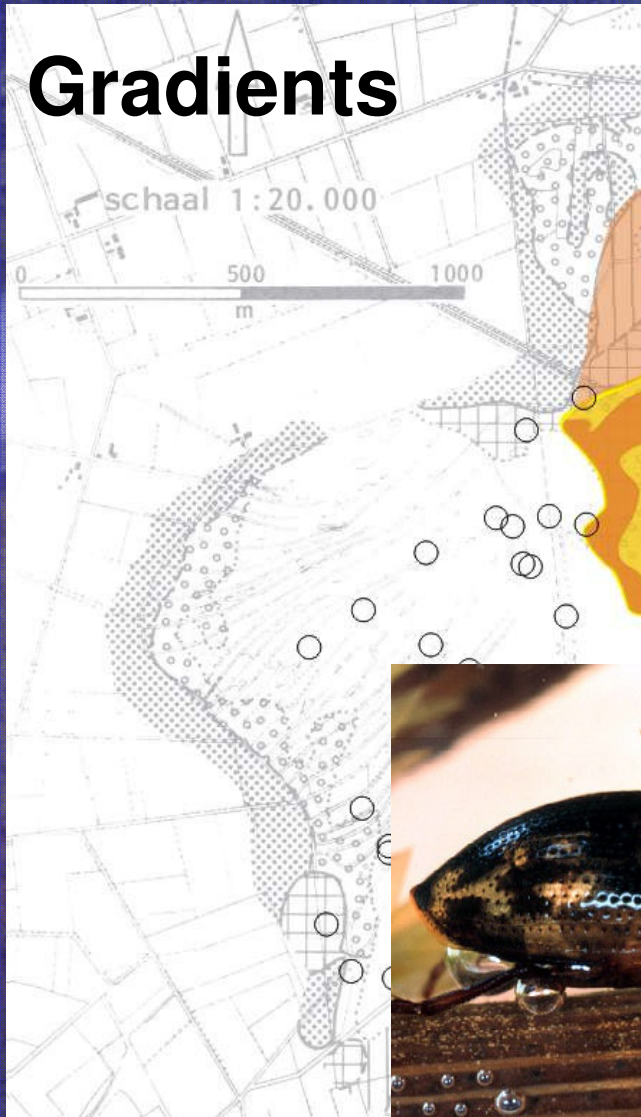
Fauna

Relation between landscape heterogeneity and fauna diversity



Coenagrion hastulatum

Gradients

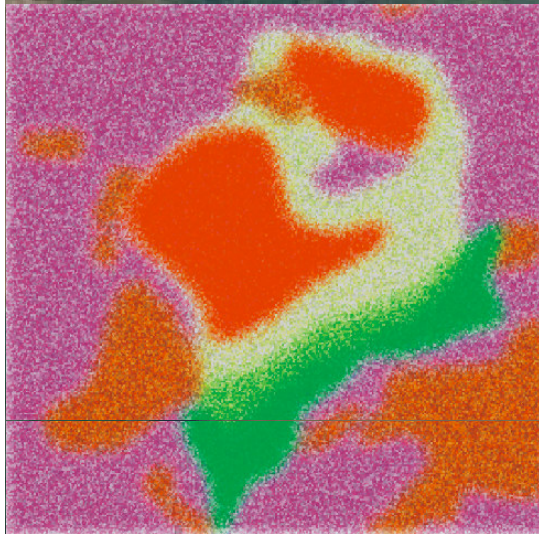


Restoration

Effect of (large scale) rewetting measures in raised bogs

Intact

Deteriorated



deterioration

Restoration?



Temporary?

Restoration?

Restoration measures

Restoration

Effect of (large scale) rewetting measures in raised bogs

Macro invertebrate samples from:

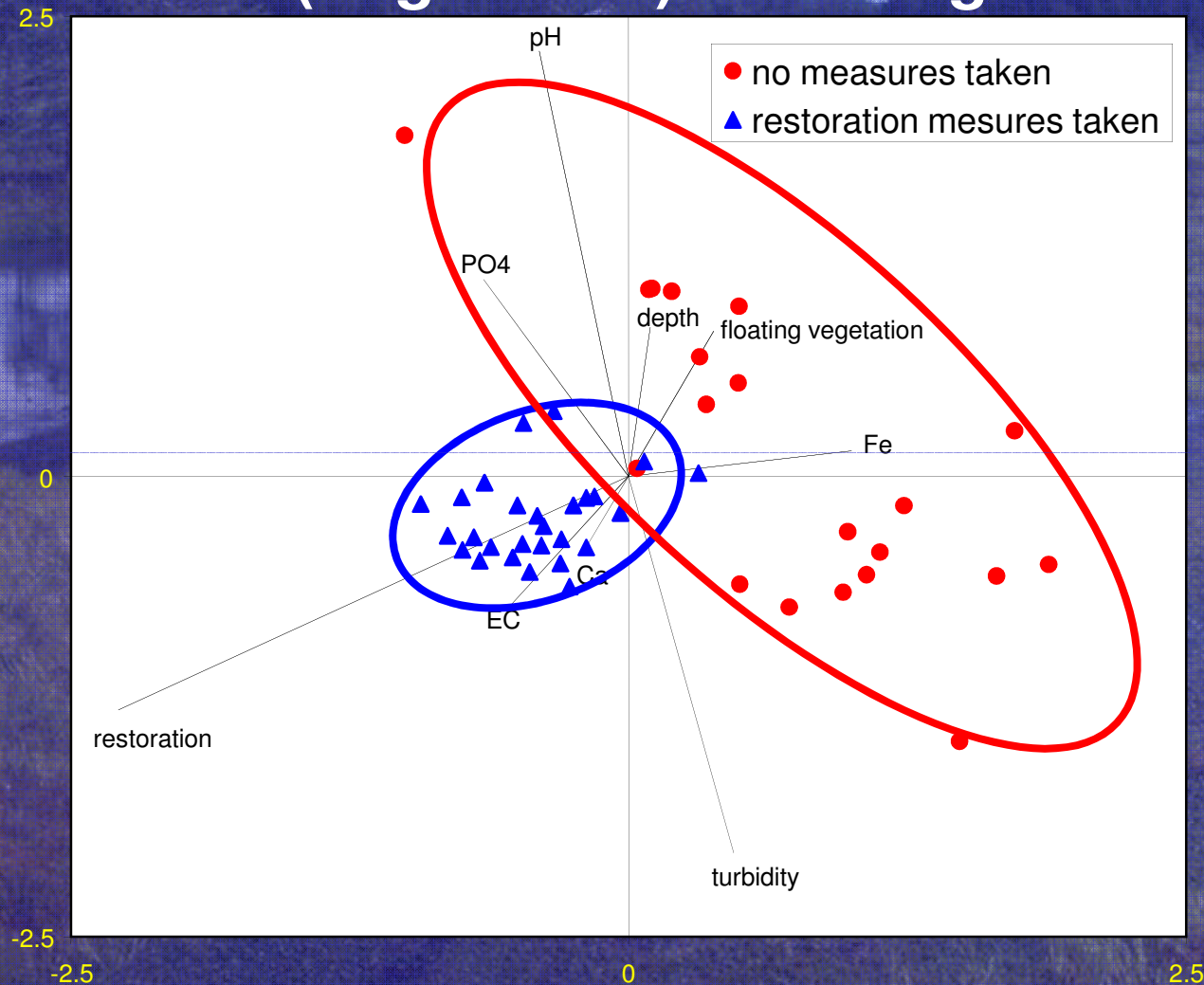
1. Restoration sites in the Netherlands

2. Not-restored (remnant) sites in the Netherlands



Restoration

Effect of (large scale) rewetting measures in raised bogs

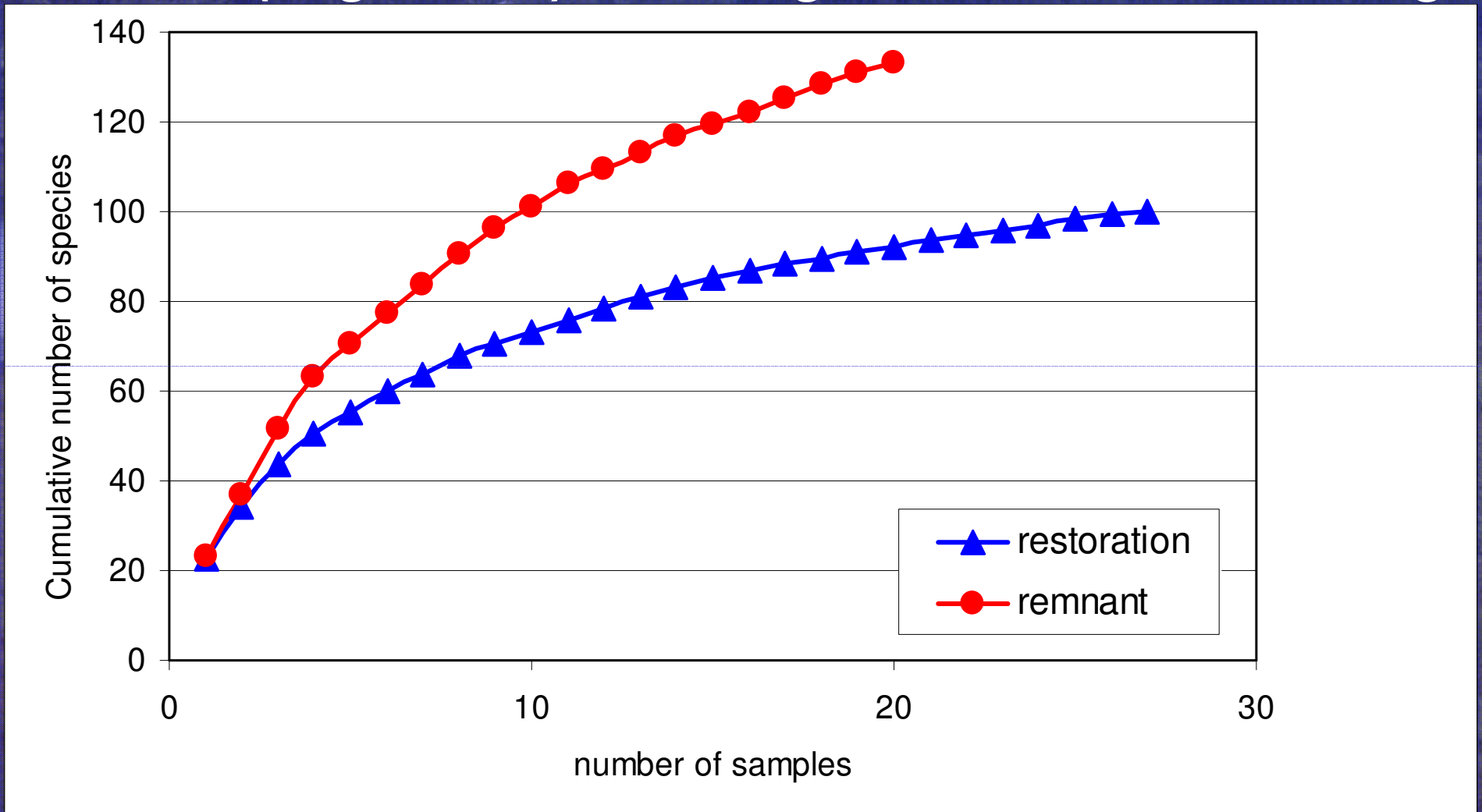


Correspondence analysis



Restoration

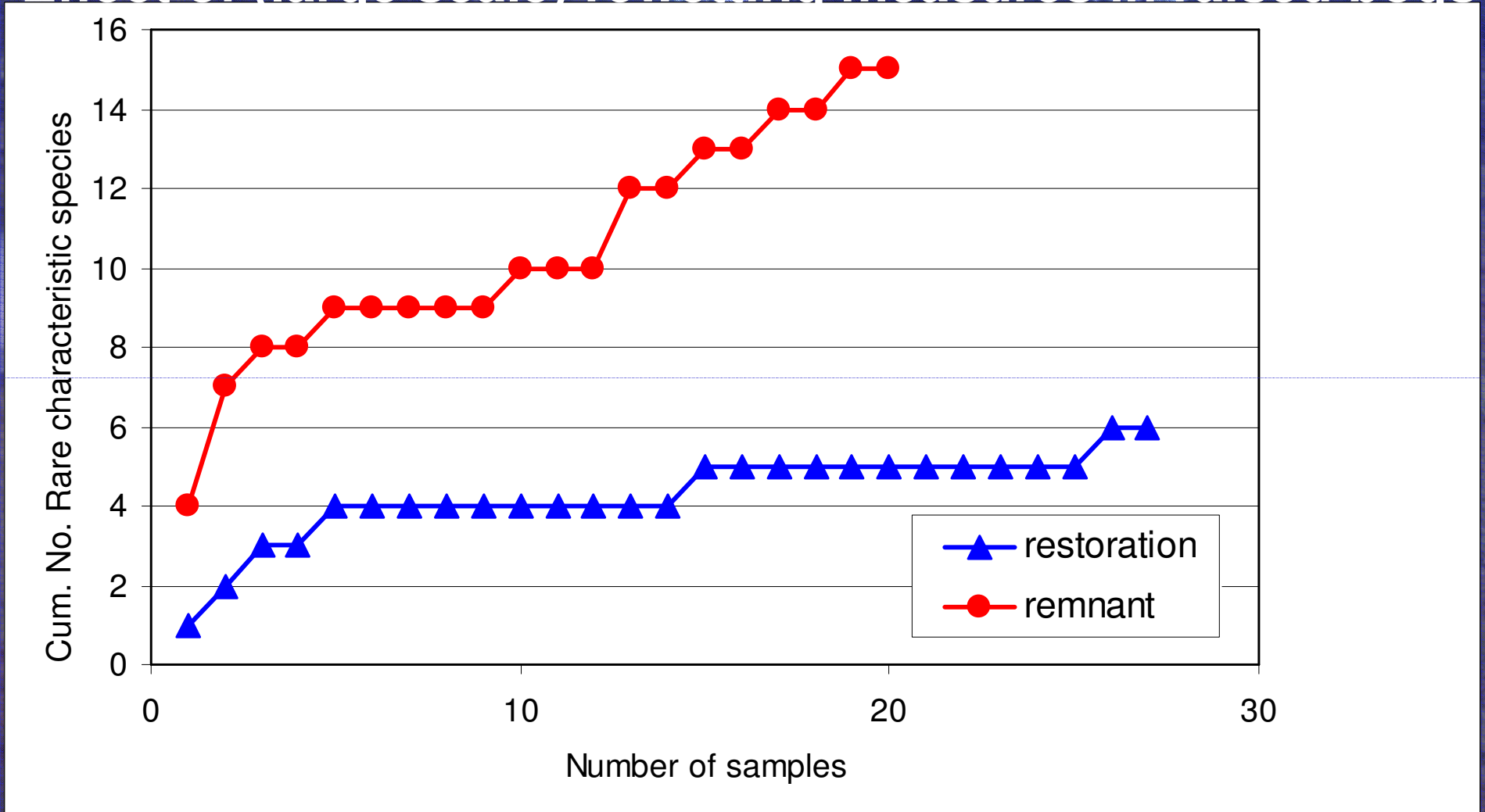
Effect of (large scale) rewetting measures in raised bogs



Total species richness

Restoration

Effect of (large scale) rewetting measures in raised bogs



Species richness: rare & characteristic species



Problem analysis insufficient:
what are the causes for decline of fauna and
failure of recovery?

Most evident factor need not be the key factor
behind loss of species...

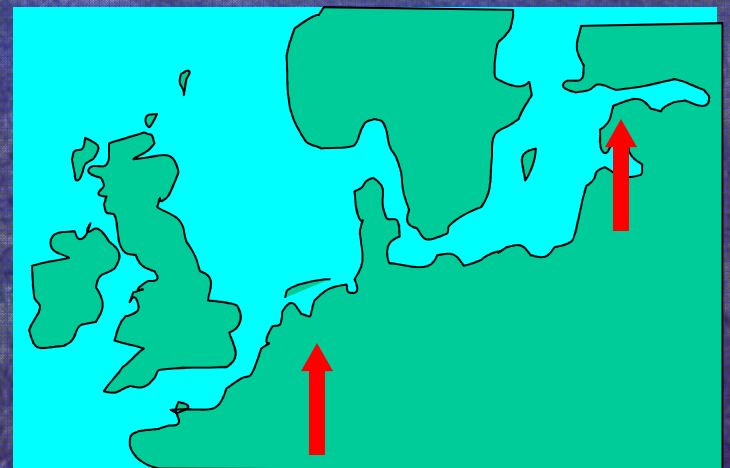
or colonisation (source populations)

Restoration

Effect of (large scale) rewetting measures in raised bogs

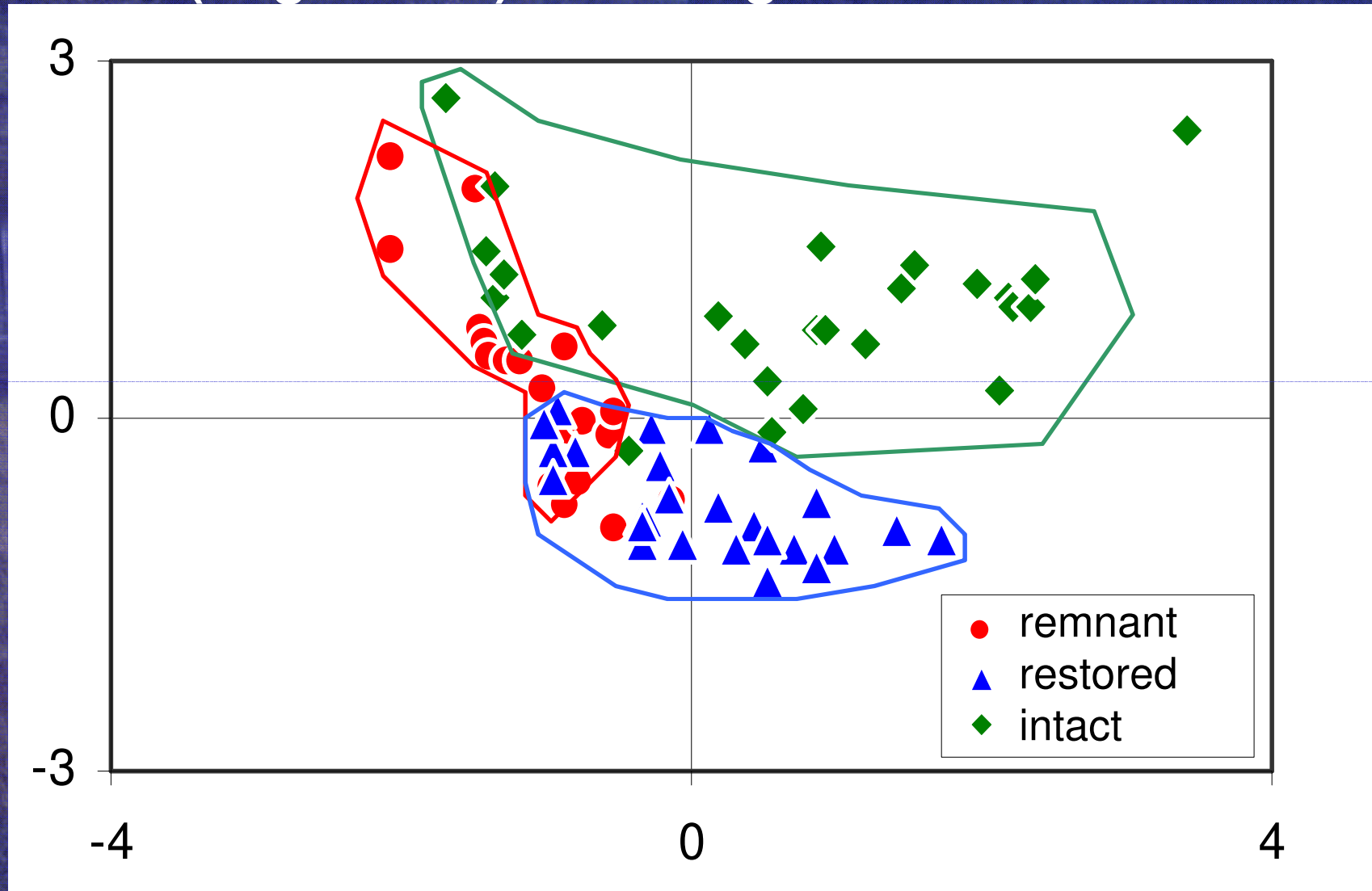
Macro invertebrate samples from:

1. Restoration sites in the Netherlands
2. Not-restored (remnant) sites in the Netherlands
3. Intact raised bogs in Estonia



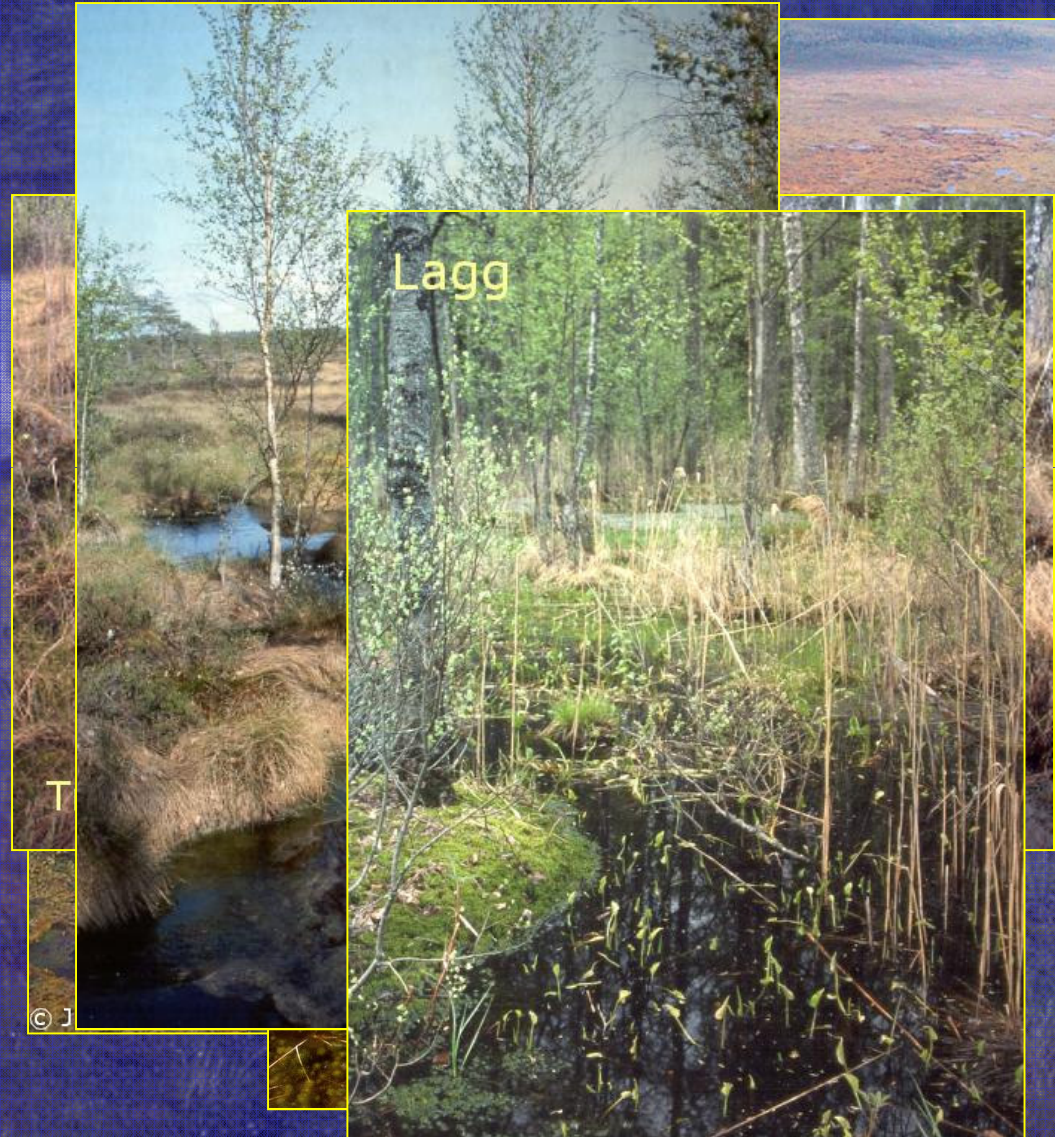
Restoration

Effect of (large scale) rewetting measures in raised bogs

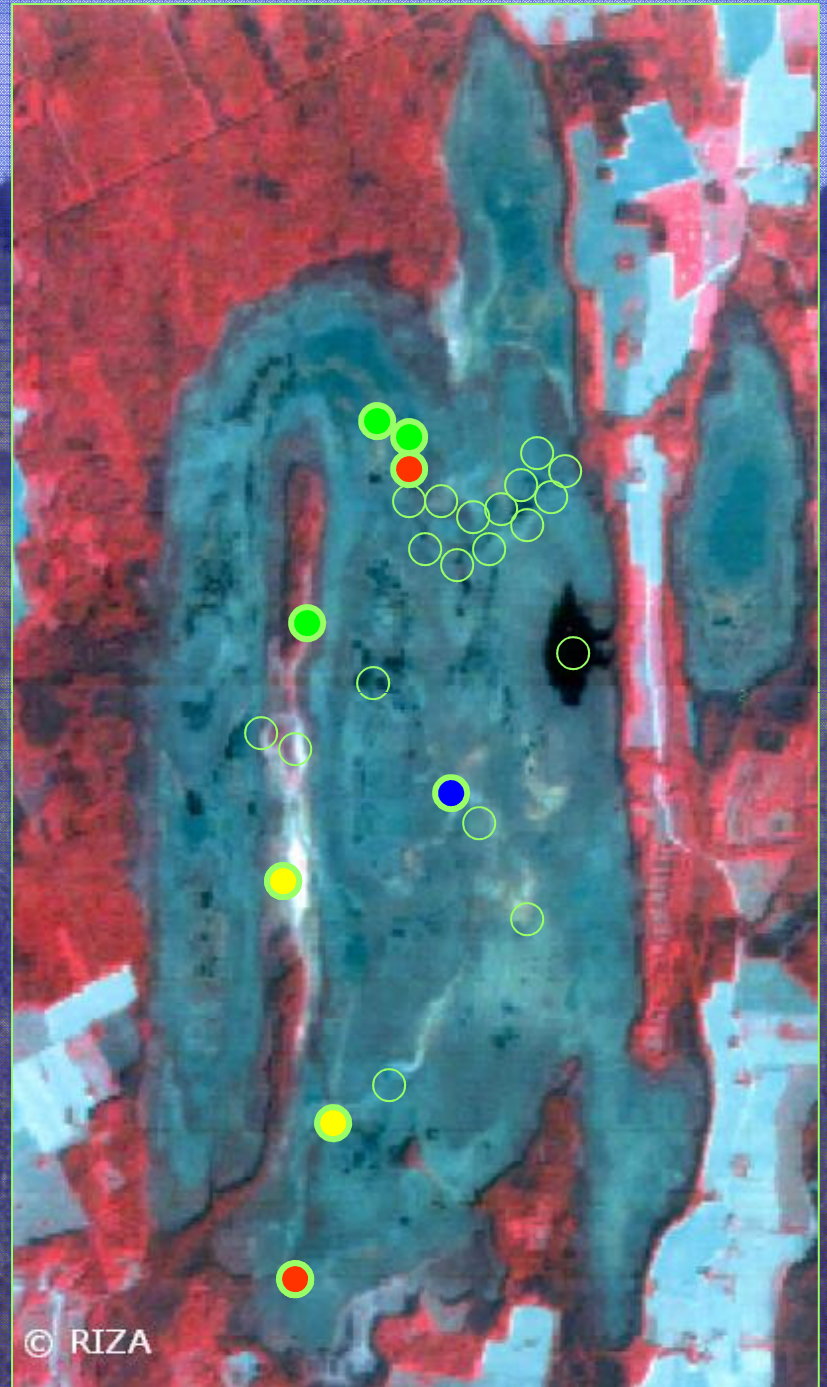
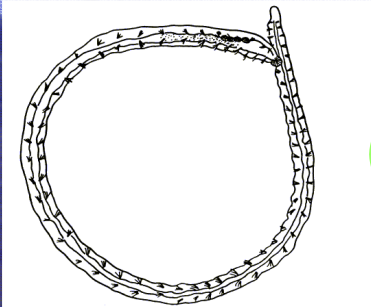


Remnant sites still contain communities from intact bogs

Nigula Raba



Nigula Raba



© RIZA

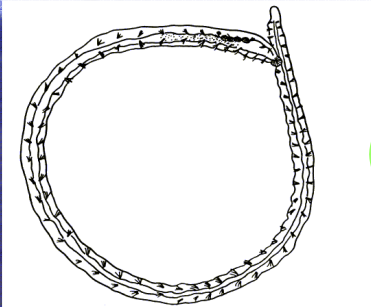
Nigula Raba

in Estland limited by nutrients

Soortnaam	Estland	Nederland
<i>Nais variabilis</i>	6.8	42.5
<i>Coenagrion lunulatum</i>	0.2	15.2
<i>Pyrrhosoma nymphula</i>	0.4 (+)	0.6 (+++)
<i>Leucorrhinia rubicunda</i>	5.1	48.1
<i>Libellula quadrimaculata</i>	0.8	4.0
<i>Enallagma cyathigerum</i>	5.4	18.4
<i>Ablabesmyia phatta</i>	1.7	23.5

NL↑

Nigula Raba



NL↑



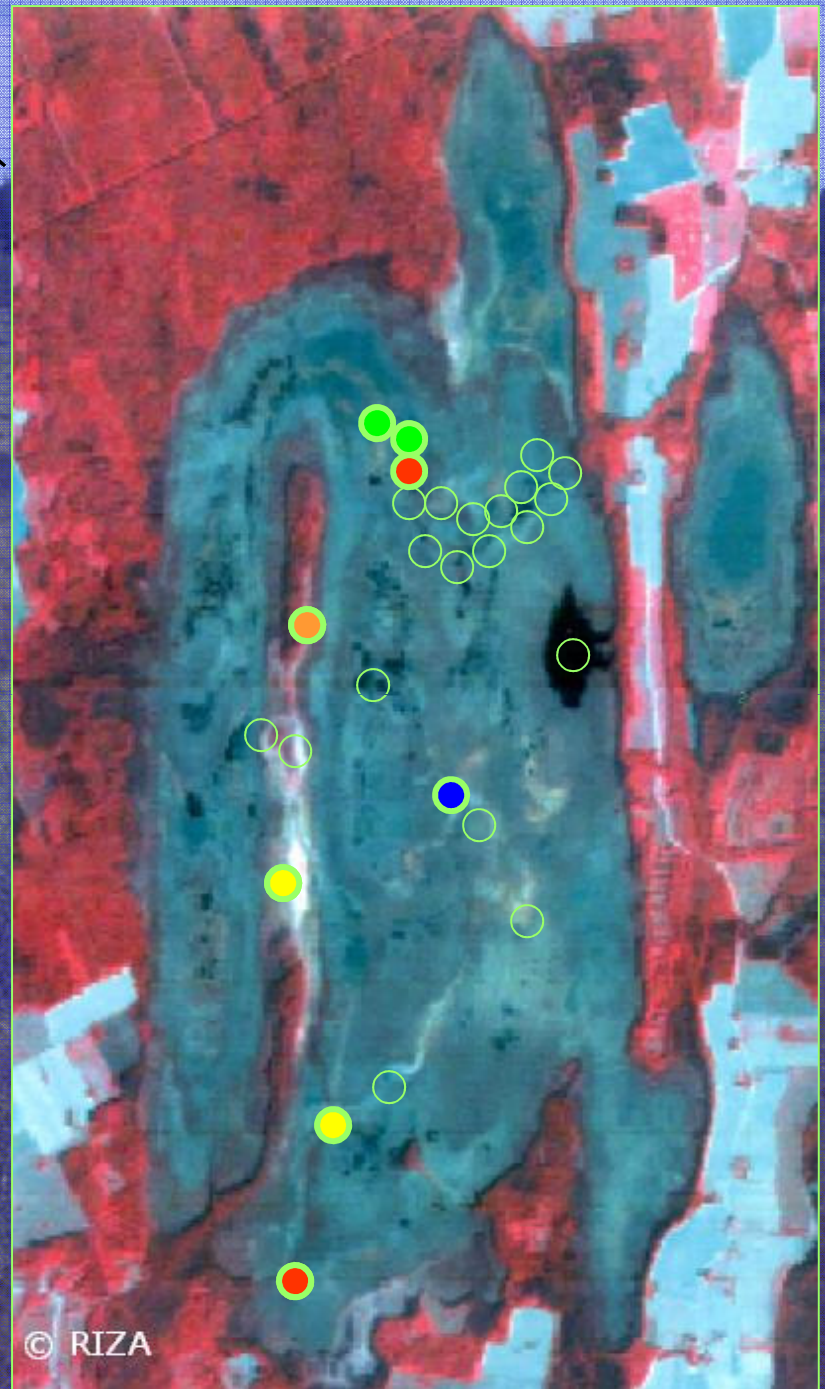
NL↑



NL↑

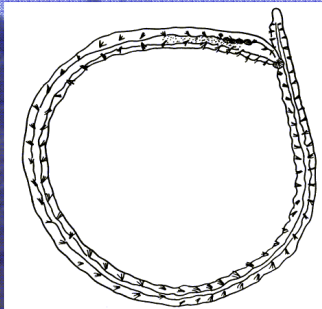


NL↑



© RIZA

Nigula Raba



NL↑



NL↑



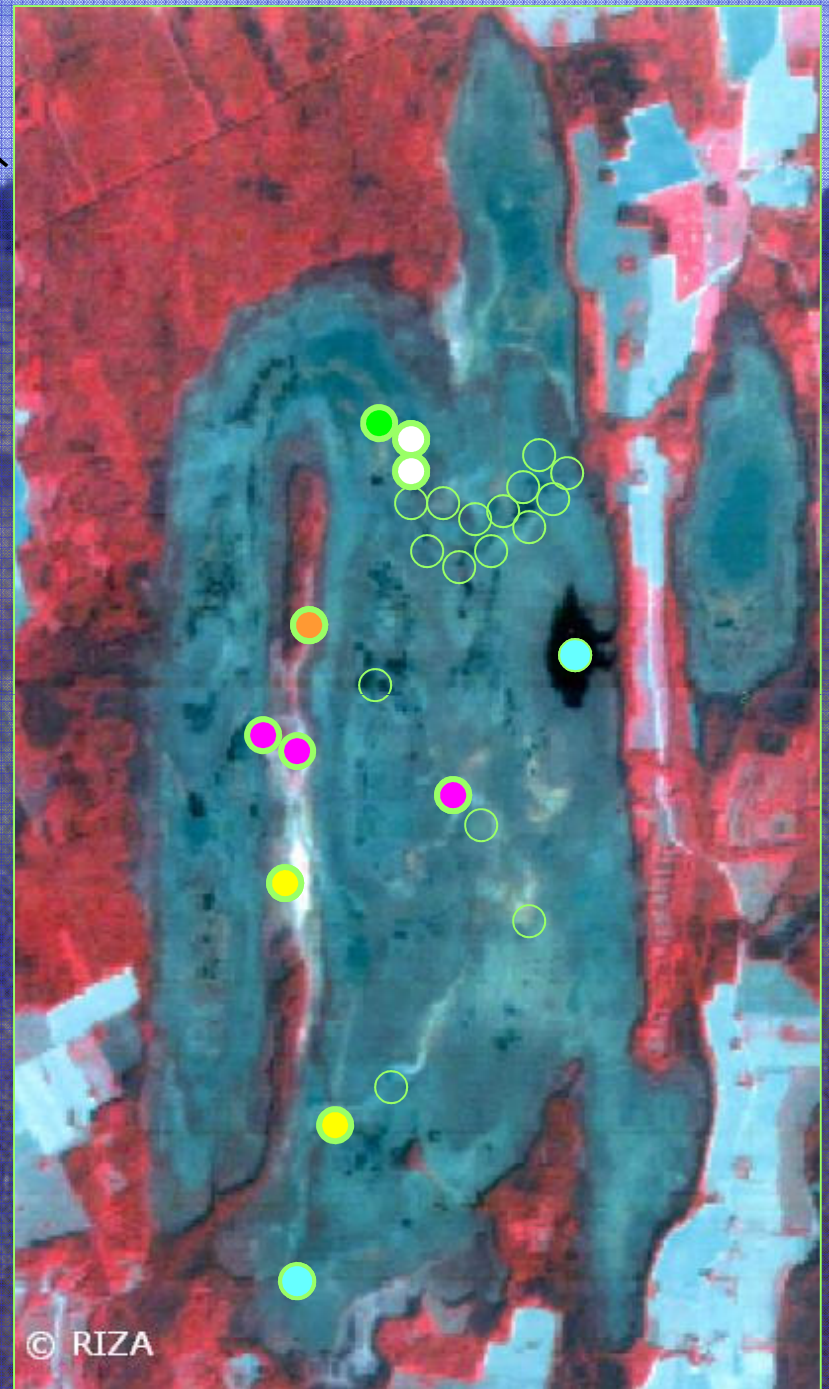
NL↑



NL↑



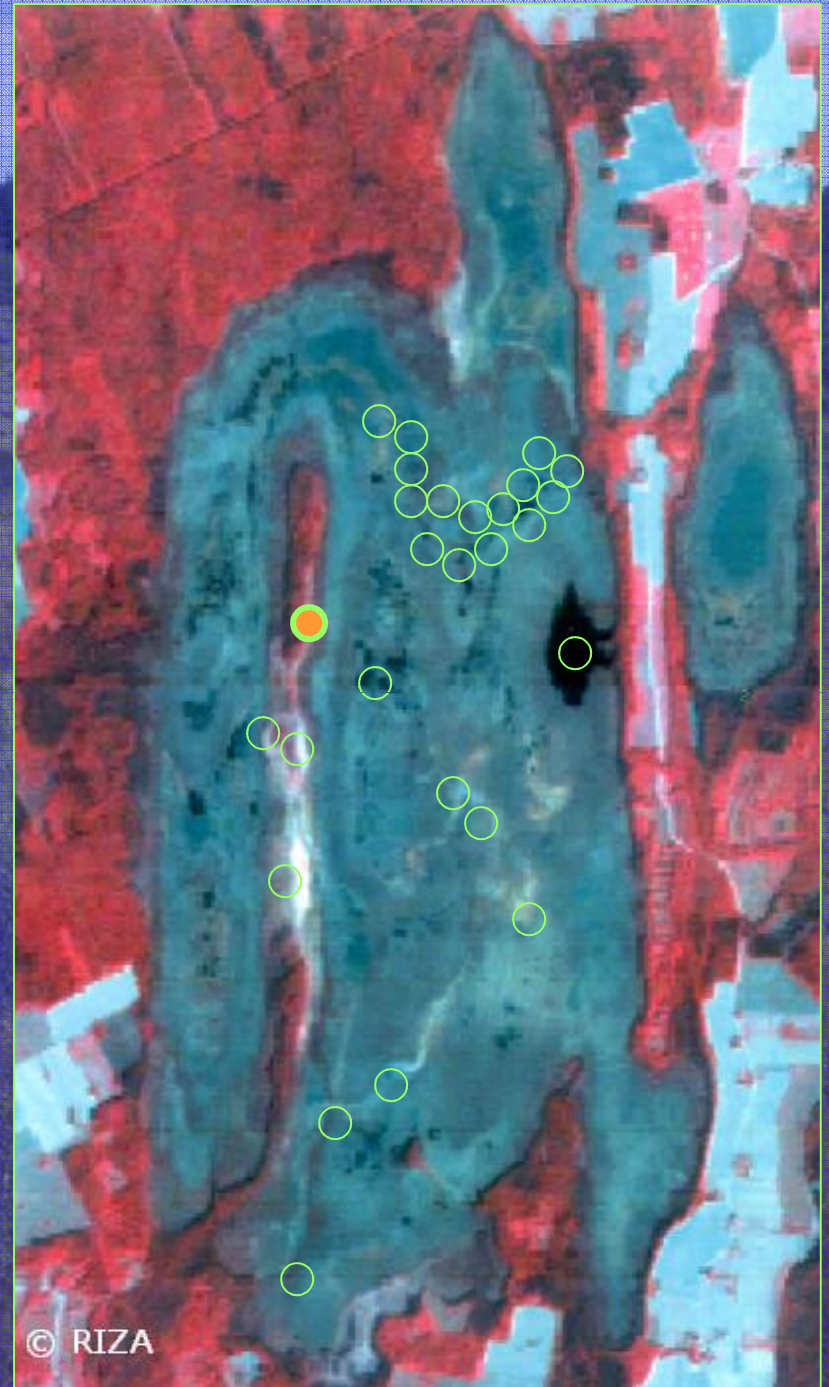
NL↓



© RIZA

Nigula Raba

Haliphus fulvicollis



Nigula Raba

In Estland limited to gradual transitions

Soortnaam	Estland	Nederland
<i>Somatochlora arctica</i>	1.5	0
<i>Somatochlora metallica</i>	1.3	0
<i>Coenagrion hastulatum</i>	0.7	+ (0)
<i>Lasiodiamesa spec.</i>	6.6	0.7 (0)

NL↓

Recommendations

Degradation

Fauna

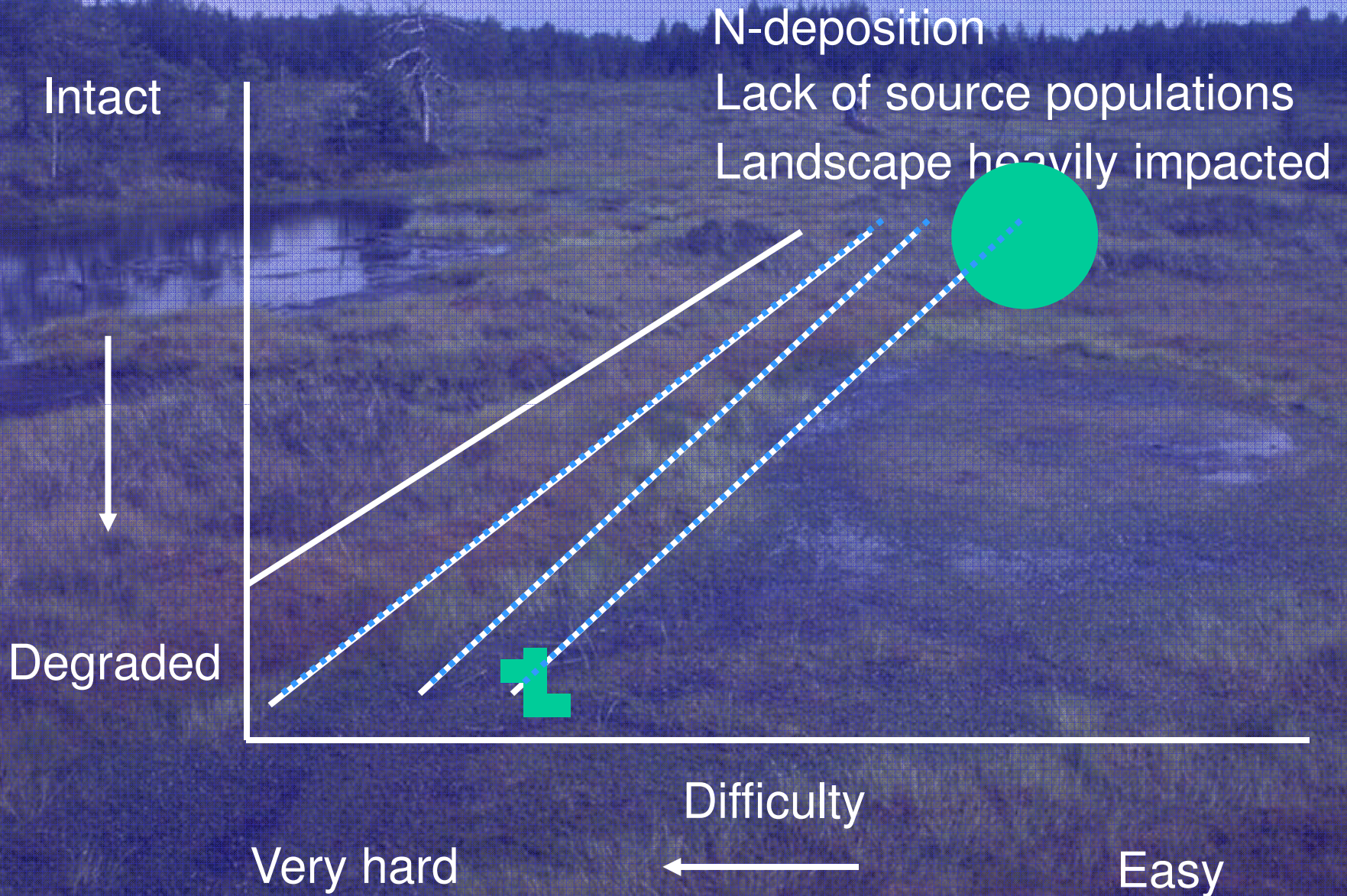
Bottlenecks

Restoration

Recommendations

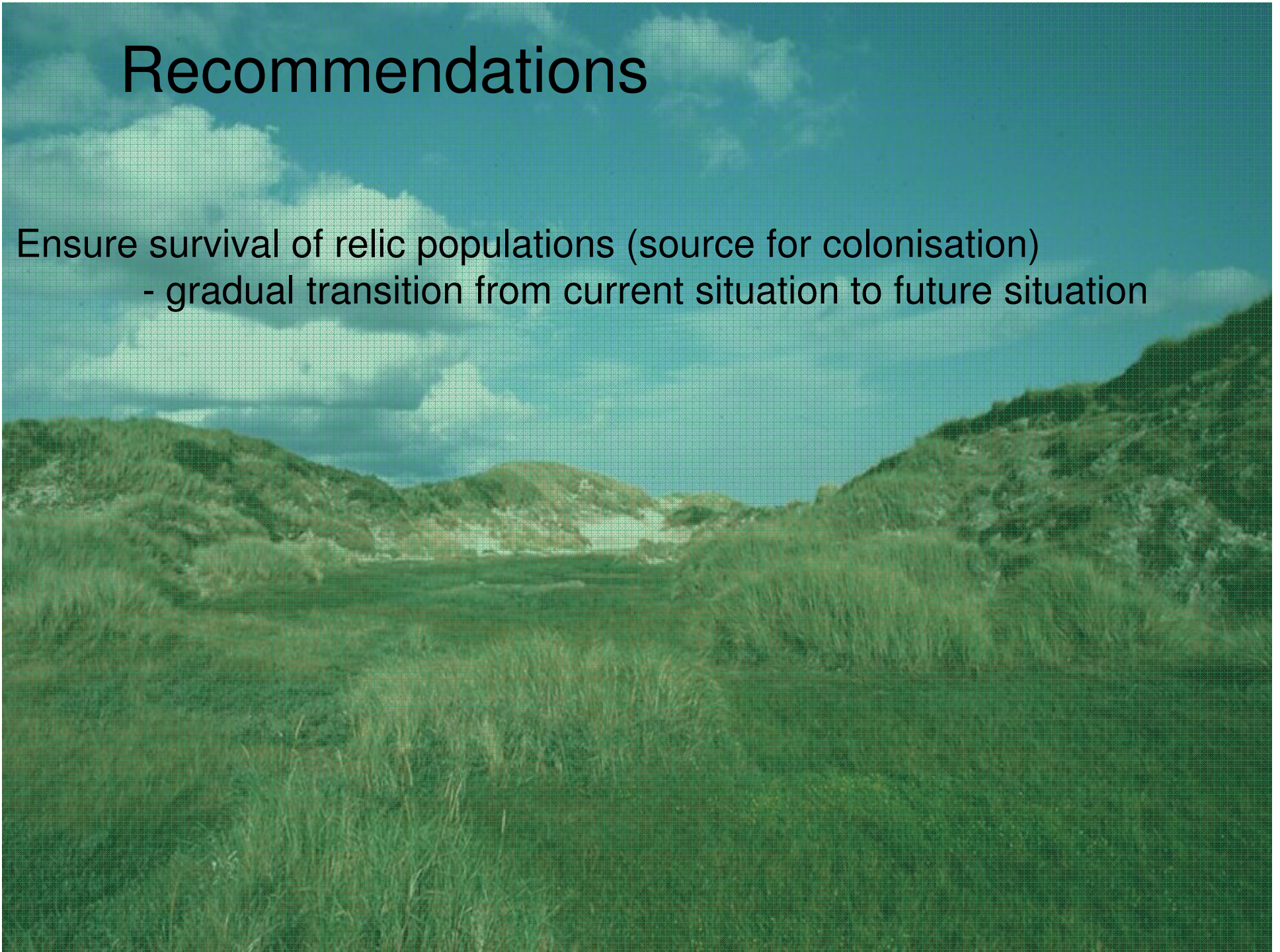


Recommendations



Recommendations

Ensure survival of relic populations (source for colonisation)
- gradual transition from current situation to future situation



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- gradual transition from current situation to future situation

Conserve heterogeneity

- internally and externally, relations at landscape level
(including all habitat types and their transitions)
- small scaled intensive (phased)
- large scaled slow (reversible)

Recommendations

Ensure survival of relic populations (source for colonisation)

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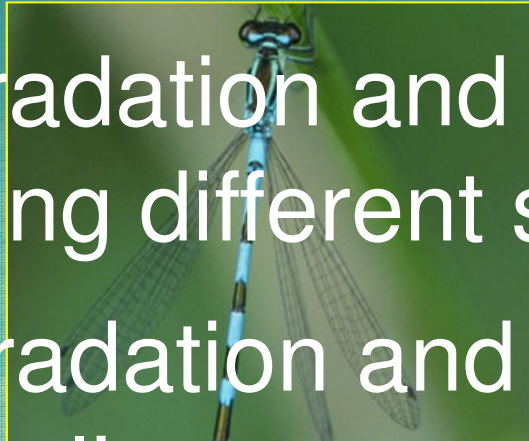
Create heterogeneity

- differential management
- strengthen key processes

Landscape degradation and restoration cooperation different disciplines

Landscape degradation and restoration
Incorporating different scales

Landscape degradation and restoration
an animal's perspective



Thank you for your attention!

Questions?

van Duinen GA, Brock AMT, Kuper JT, Leuven RSEW, Peeters TMJ, Roelofs JGM, van der Velde G, Verberk WCEP & Esselink H (2003) Do restoration measures rehabilitate fauna diversity in raised bogs? A comparative study on aquatic macroinvertebrates. *Wetlands Ecology and Management* 11: 447-459.

van Duinen GA, Brock AMT, Kuper JT, Peeters TMJ, Smits MJA, Verberk WCEP & Esselink H (2002) Important keys to successful restoration of characteristic aquatic macroinvertebrate fauna of raised bogs. In: Schmilewski G & Rochefort L (Eds) *Proceedings of the International Peat Symposium: Peat in horticulture – Quality and environmental challenges*. International Peat Society, Jyväskylä, Finland. Pp. 292-302.