

# Climate change in fragmented landscapes; can we develop spatial adaptation strategies?

Introduction to the symposium theme: Climate change in fragmented landscapes; can we develop spatial adaptation strategies?

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# Symposium: Climate change in fragmented landscapes; can we develop spatial adaptation strategies?

Claire Vos & Jana Verboom

1. **Introduction** to the symposium theme. **Jana Verboom** et al.
2. Projecting the **shifting climate envelope** of species and how the landscape can enhance or hamper the response of populations. Pam Berry & **Hans Baveco**
3. The interplay of landscape structure and **evolution during range shifting dynamics**. **Justin Travis** et al.
4. Large scale modelling of **potential future distribution** of tree species under a climate change scenario in central and southern Italy. **Fabio Attorre** et al.
5. Can we **mitigate climate change** effects on biodiversity at treeline ecotones? Thomas Dirnböck & **Johannes Peterseil**
6. Climate change, habitat fragmentation and the **resilience** of ecological networks. **Kevin Watts** et al.
7. **Adaptation strategies** for climate change: what have we got now and how can they be improved? **Jake Piper**
8. **Adapting the landscape** to climate change: linking ecosystem networks. **Claire Vos** et al.
9. **General discussion**

*Our climate is changing...*

*July 2007*



*July 2006*



New species reach us from the south...



*But only good dispersers are able to shift their range...*



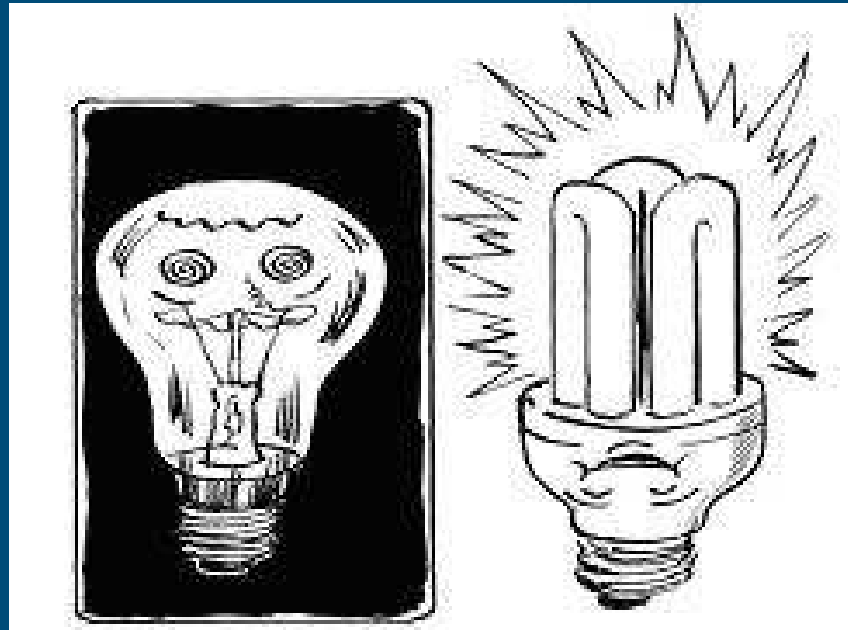
# Climate change and habitat fragmentation: a deadly anthropogenic cocktail

(Travis 2003)



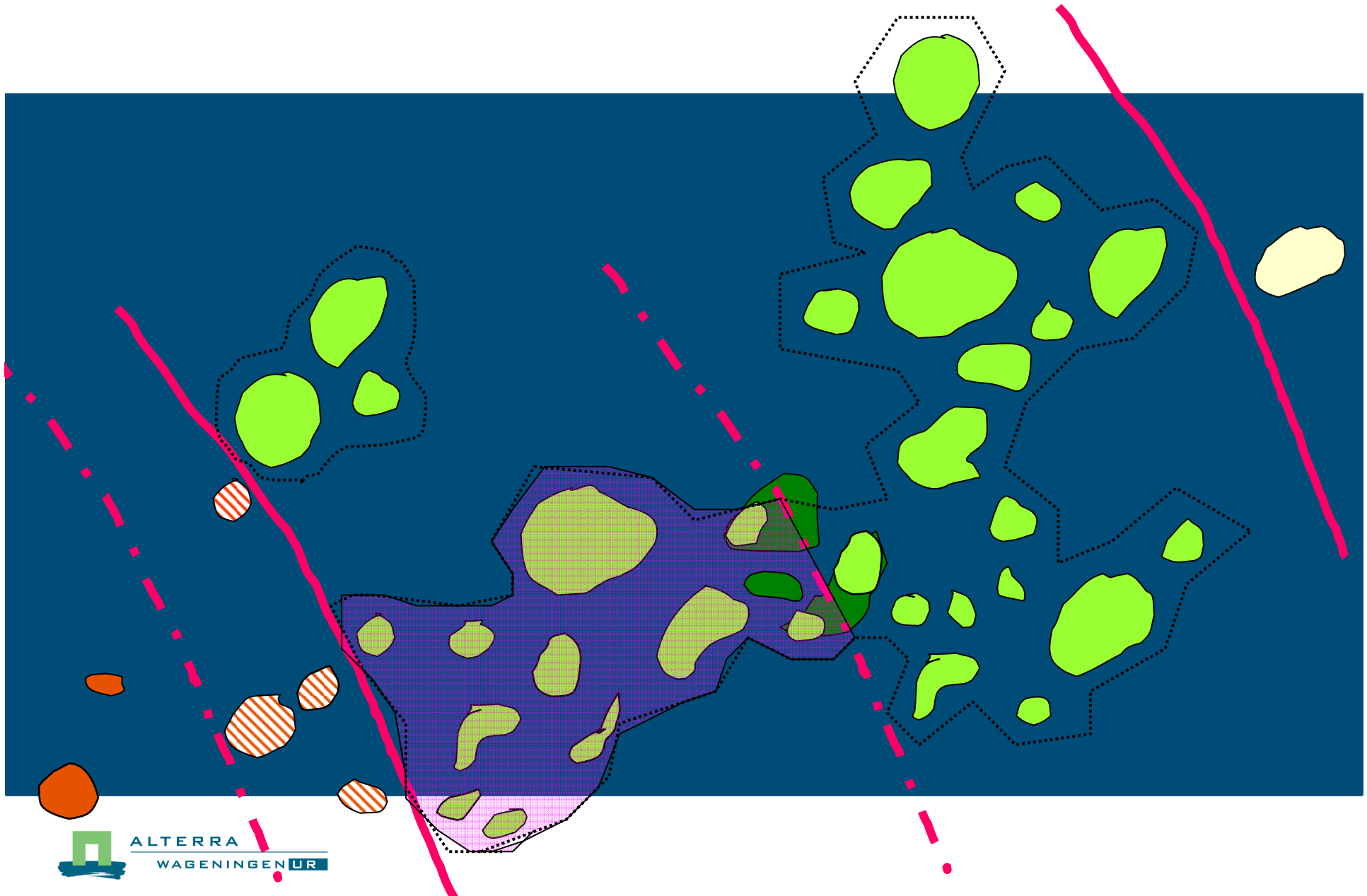
*We cannot stop climate change...*

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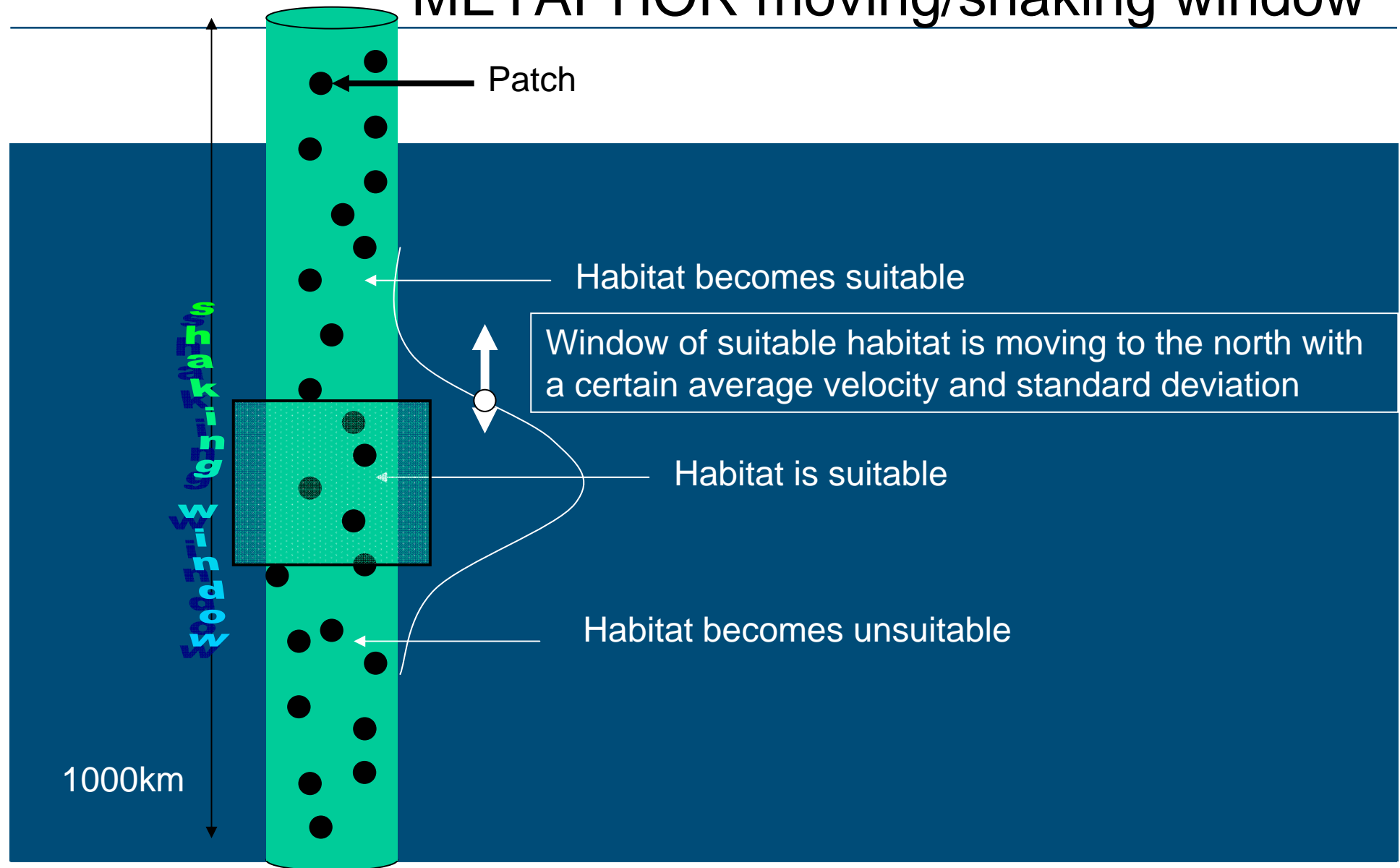
*No matter how many light bulbs we replace by energy saving bulbs...*

*But we can adapt the landscape!*



North

# METAPHOR moving/shaking window





# METAPHOR flowchart

————→ Flow of individuals

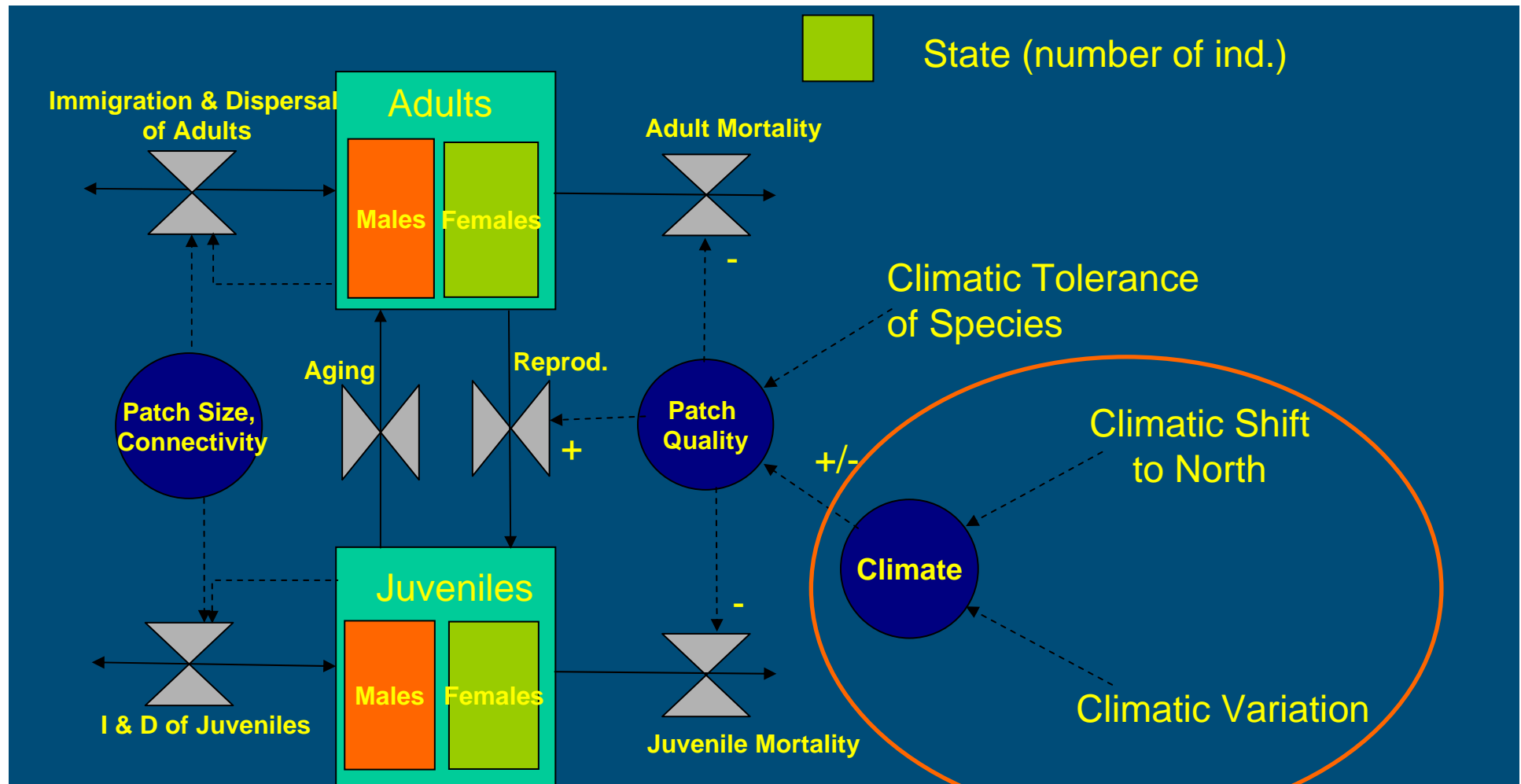
-----→ Flow of information (effect on)



Rate ( flow of ind.)



State (number of ind.)

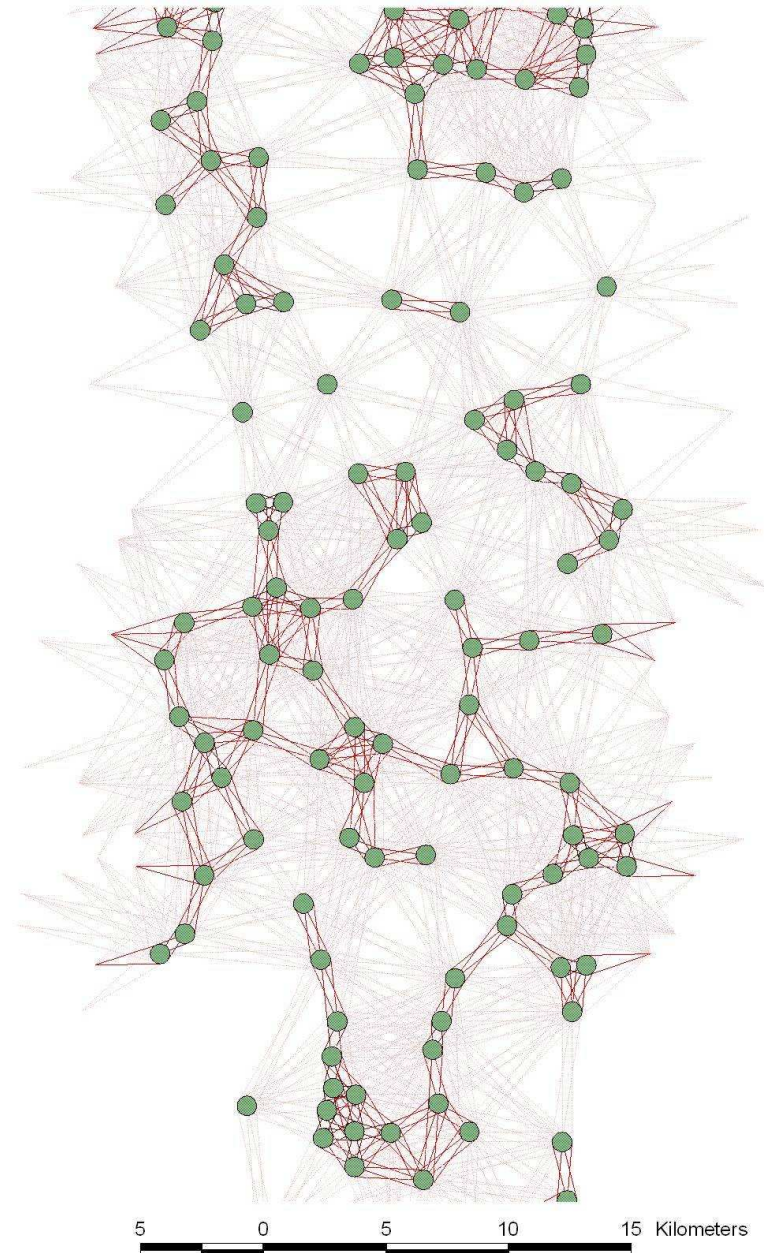
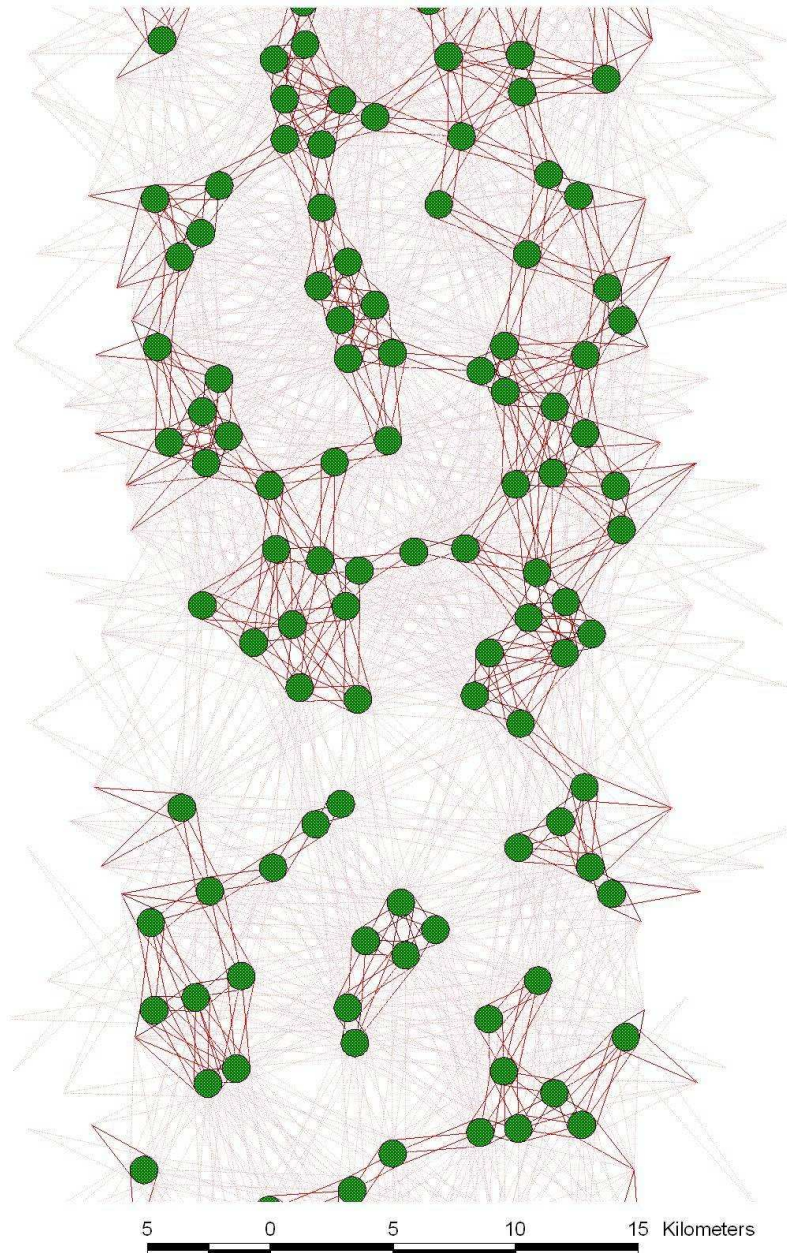


# Parameters of moving/shaking window

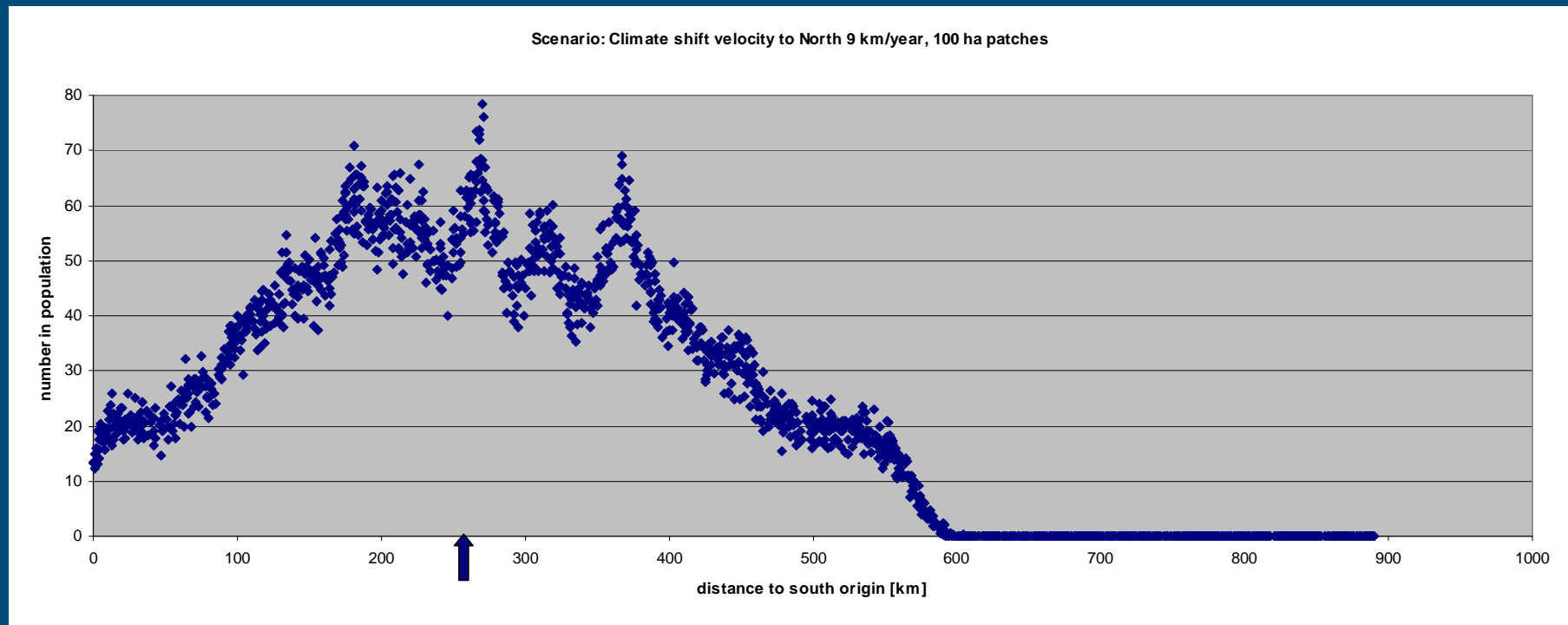
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- Empirical data (1980-2006) in the Netherlands
  - Change:  $+1.4^{\circ}\text{C}$  in 25 years =  $0.056^{\circ}\text{C}/\text{year}$
  - Gradient  $0.42^{\circ}\text{C}/100\text{ km}$
  - **isocline moving  $13.3\text{ km}/\text{year} = 36.4\text{ m}/\text{day}$**
- KNMI scenarios
  - $+1^{\circ}\text{C}$  or  $+2^{\circ}\text{C}$  in 2050 vs. 1990
  - $0.0166$  or  $0.0333^{\circ}\text{C}/\text{year}$
  - **isocline moving  $4.0$  or  $8.0\text{ km}/\text{year} = 11$  or  $22\text{ m}/\text{day}$**
- $\text{STD} = 0.58^{\circ}\text{C}$ 
  - **Shaking  $\text{STD} = 0.58/0.42 = 138\text{ km}$**

## Landscape: random 100 ha patches vs. 50 ha patches (1 p.p.km<sup>2</sup>)

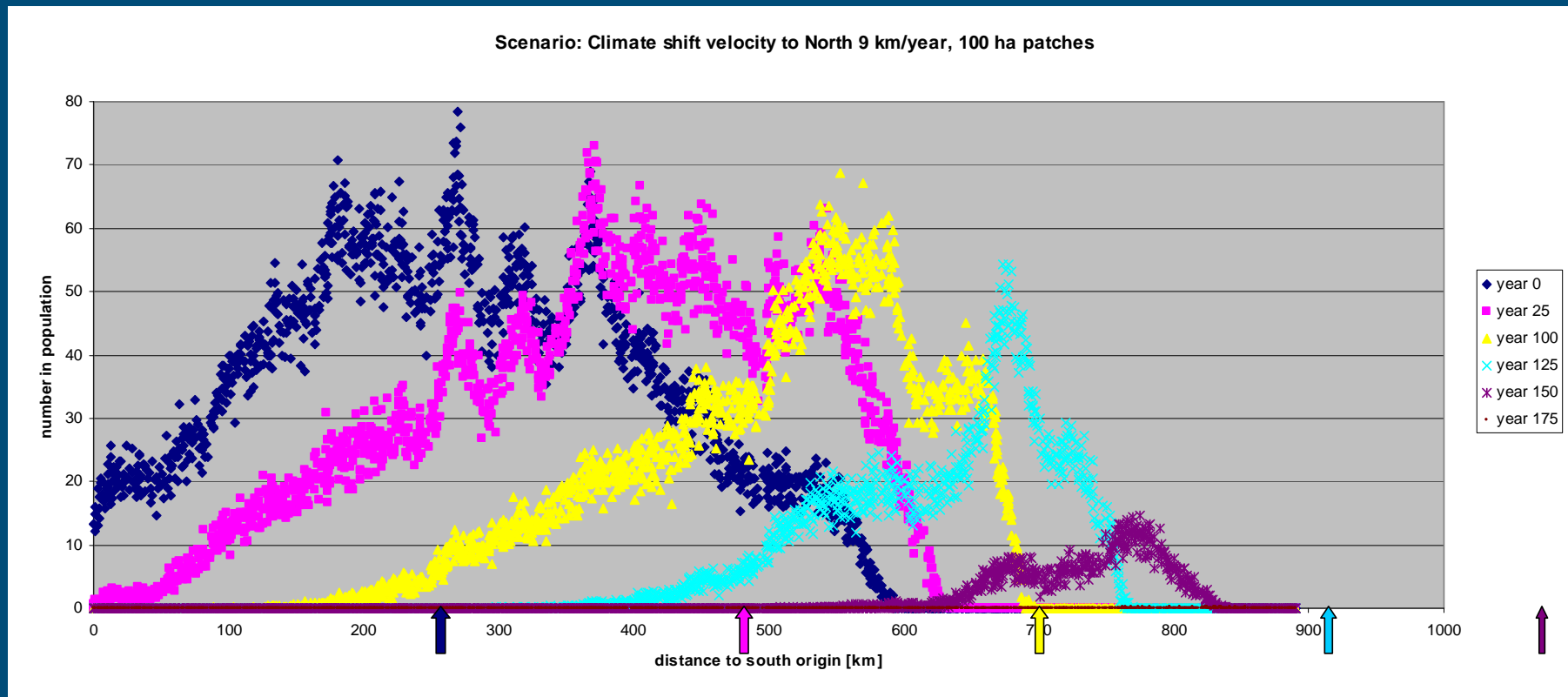


## Location of the population (no climate change: window shaking, not moving)

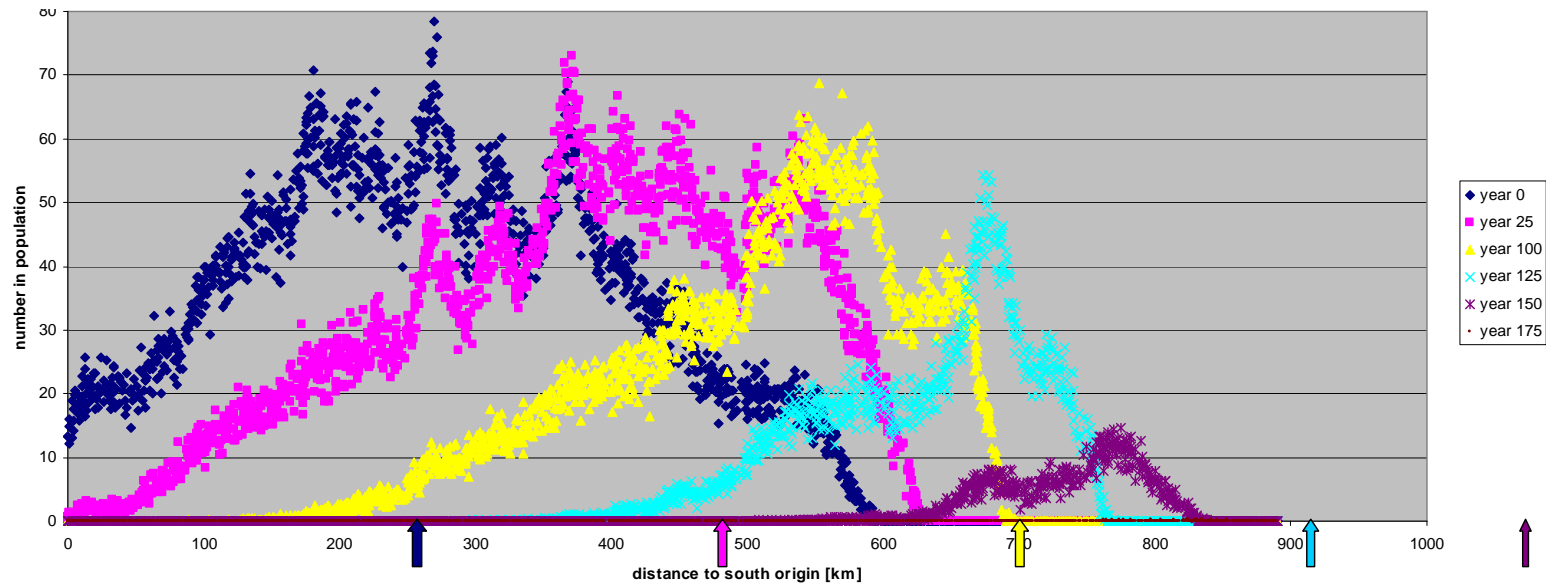




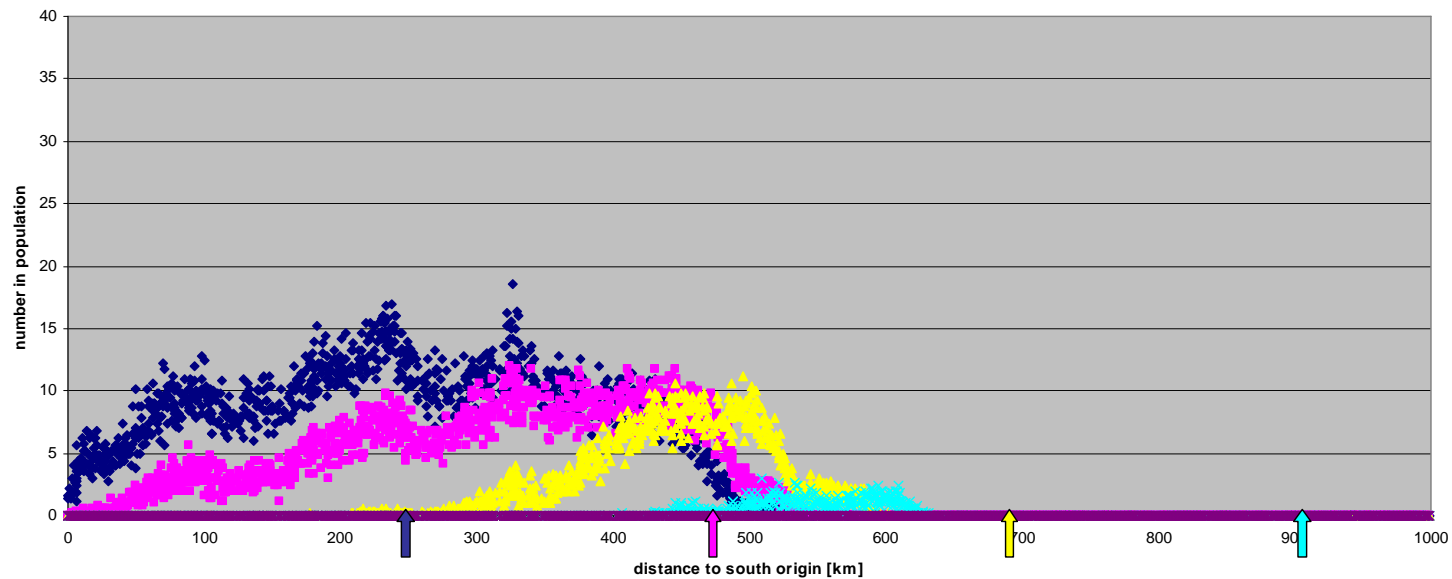
## Location of the population (25 year intervals: moving and shaking window)



# *Fast climate change (9 km/y): 10% habitat vs. 5% habitat*

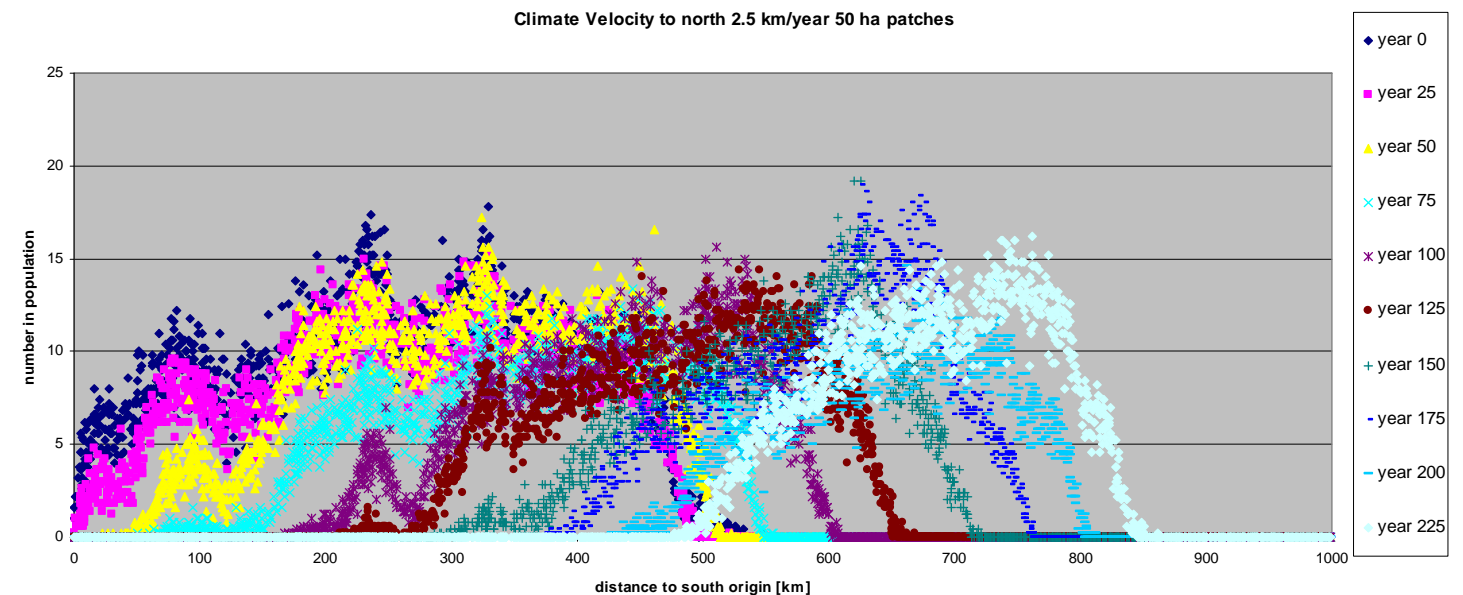
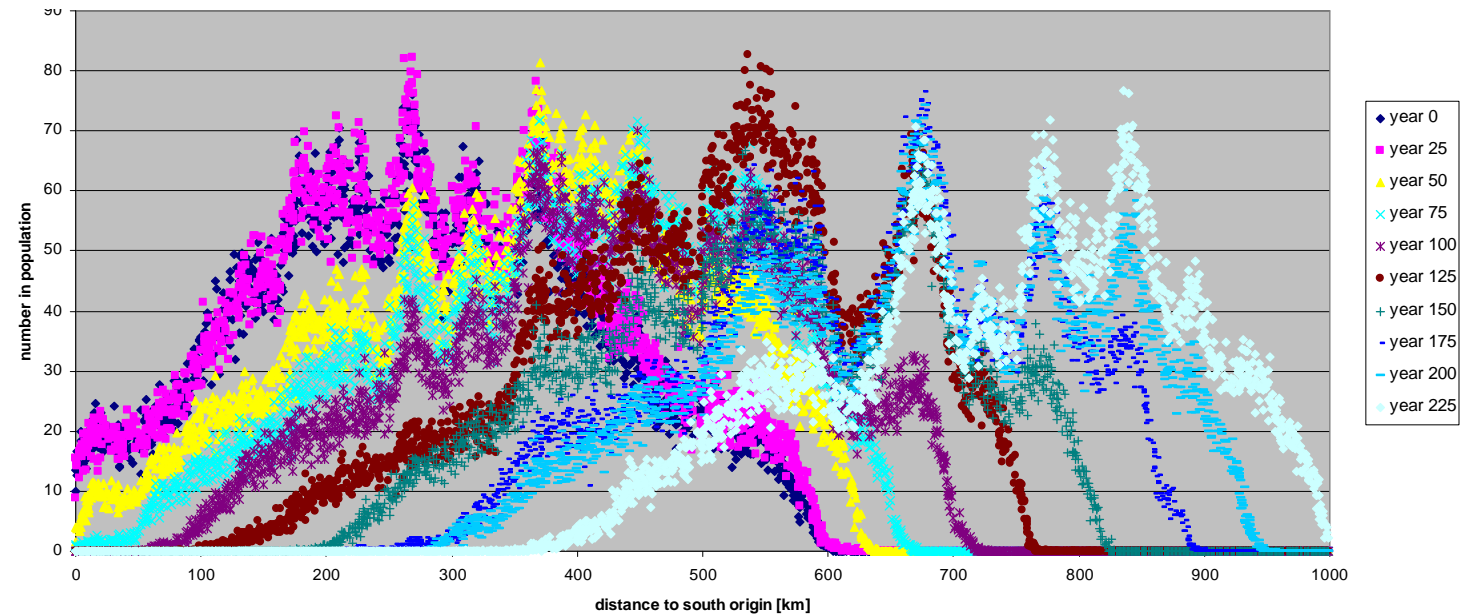


Climate velocity to North 9 km/year, 50 ha patches





# Slow climate change (2.5 km/y): 10% habitat vs. 5% habitat



# Summary of METAPHOR simulation results:

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- actual population movement rate << potential dispersal distance
- stochastic climate change decreases population movement rate
- habitat fragmentation decreases population movement rate
- climate change and fragmentation decrease population viability

# Back to the theme of the symposium...

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## some points for discussion:

### Adaptation necessary at different levels:

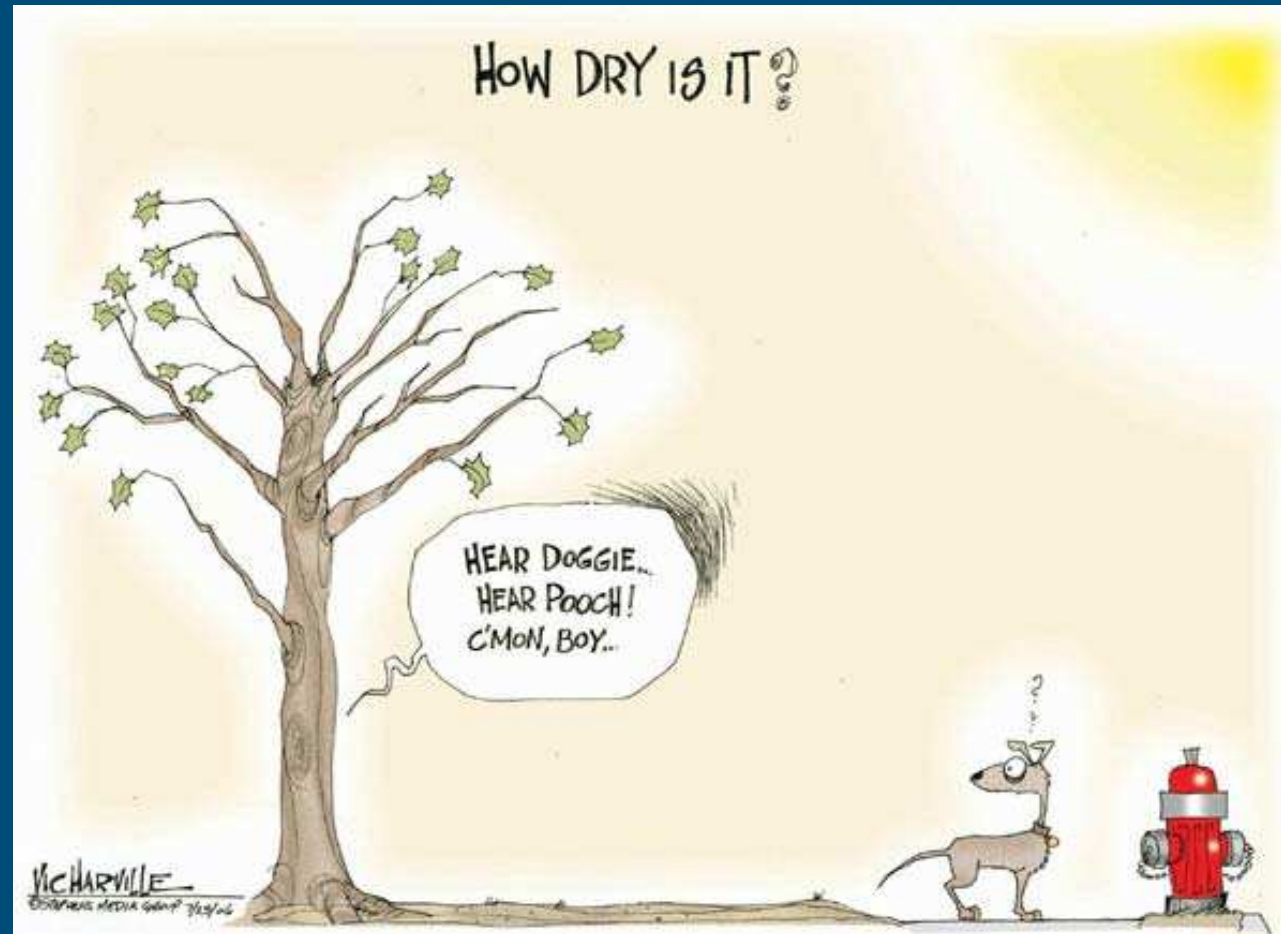
- New nature conservation paradigms and goals?
- New concepts and tools?
- Adaptation of the landscape for biodiversity conservation?

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Symposium theme in a nutshell: Climate change + habitat  
— fragmentation = a deadly anthropogenic cocktail. We cannot stop  
climate change, but we can adapt the landscape (all we need to do  
is find out how and where and how much)



# *Thank you for your attention*

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## Summary of simulation results: population shift rate

	5 ha patches = 5% habitat	10 ha patches = 10% habitat
Quality = 1	2.6 km/year	3.3 km/year
Shaking window 9 km/year average movement	2.2 km/year	2.6 km/year
Shaking window 2.5 km/year average movement	1.3 km/year	1.7 km/year

