

# Population dynamics under weather extremes: implications for ecological network design

Jana Verboom, Anouk Cormont, Marjolein Sterk,  
Peter Schippers, Claire Vos, Paul Opdam

Alterra, Wageningen UR



# National nature policy based upon 20<sup>th</sup> century knowledge

e.g. 1980's: MVP/MAR theory for sustainable areas

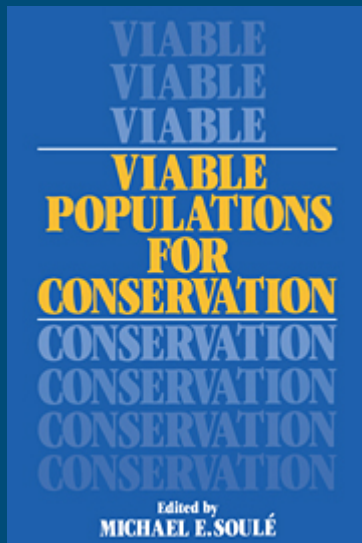
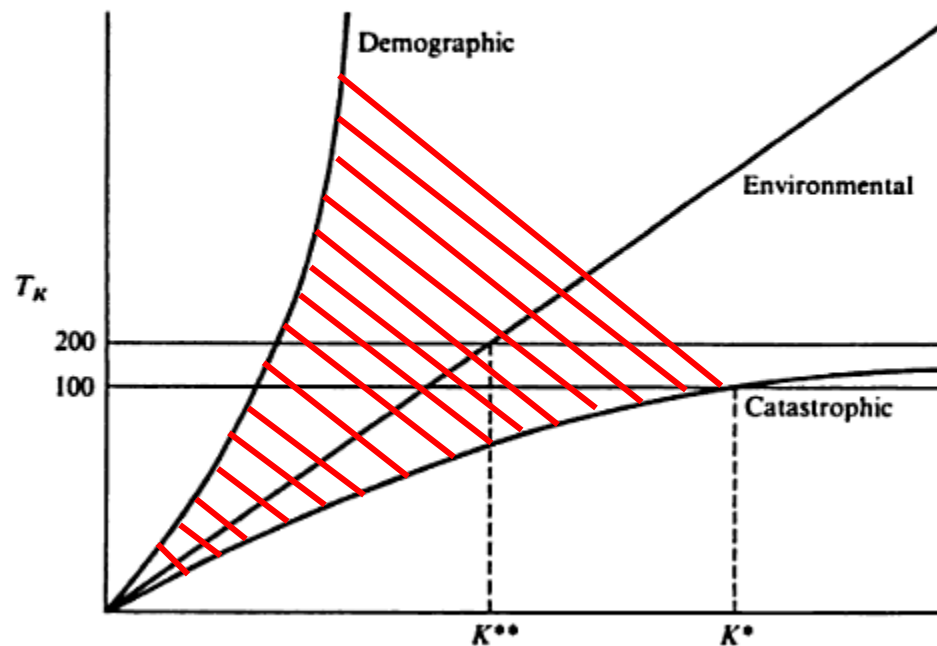


Figure 5.1. Functional forms of the relationship of the expected time to extinction, or average persistence time ( $T_K$ ), to population size ( $K$ ) for three classes of uncertainty.



---

# BIG IS BEAUTIFUL

# The National Ecological Network (NEN)

Design based upon 20<sup>th</sup> centuries concepts and data

## Dutch Ecological Network in 2018

*This map shows the Dutch Ecological Network, which is to be realised by 2018. As described in the National Policy Plan 'Nature for people, people for nature', the network will consist of core areas and robust ecological corridors. The ecological network is to be set up in co-operation with provincial authorities, local communities and a wide range of non-governmental organisations. The Natura 2000 areas in the Netherlands (Habitats and Birds Directive areas) will, to a large extent, be part of the Dutch Ecological Network.*

**Draft**

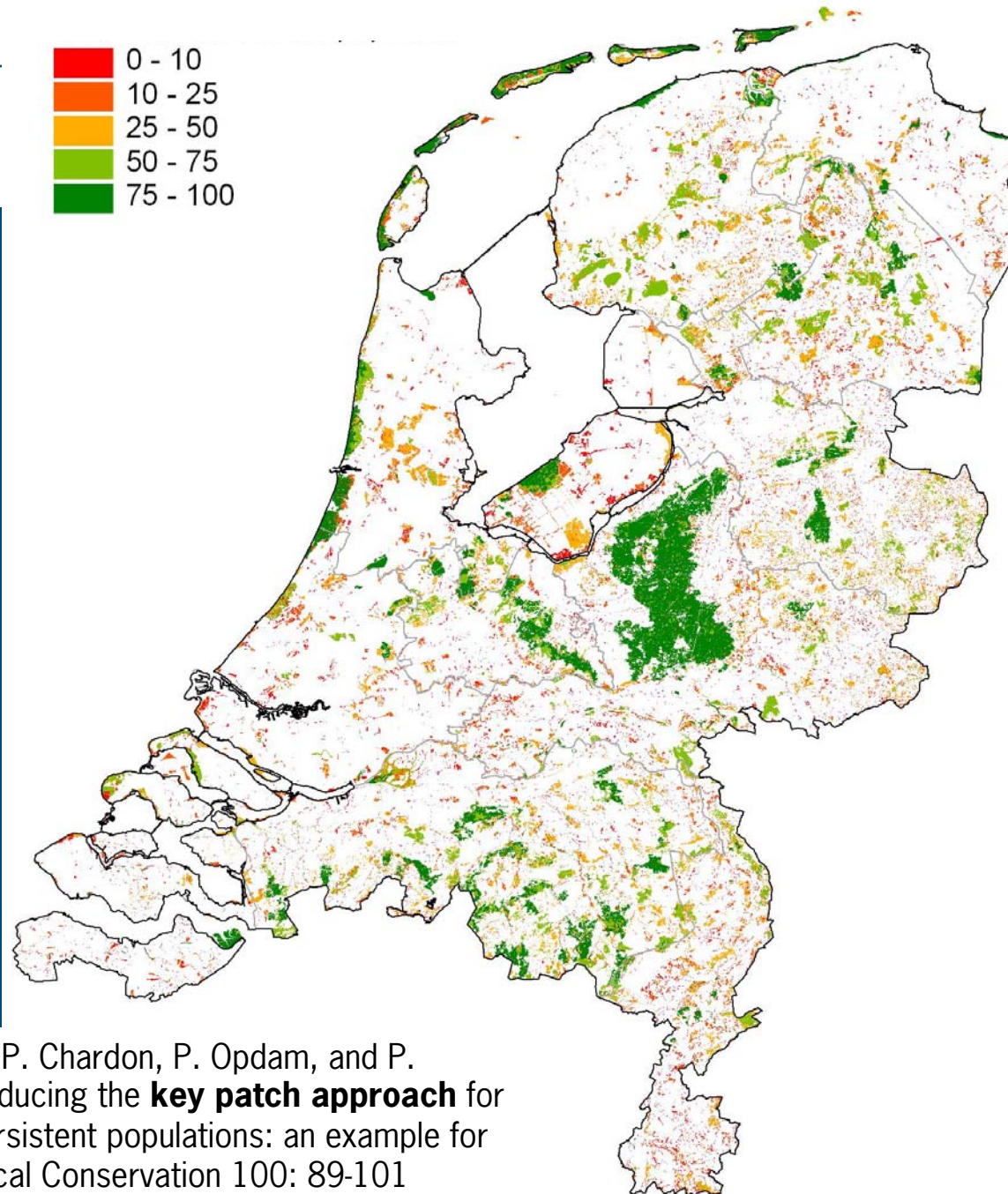
**Disclaimer:**  
This map is a draft. We accept no responsibility or liability for the use of this map





*% target species with key patches*

## Evaluation of ecological network

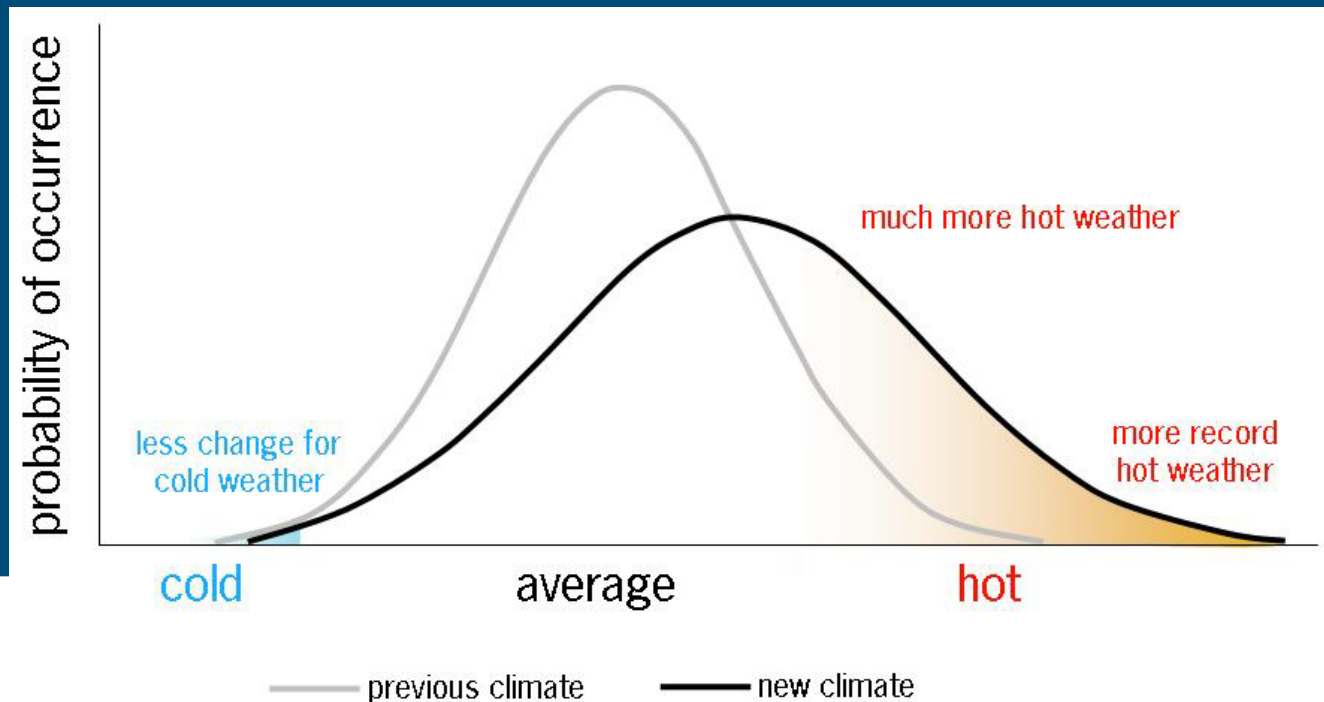


Verboom, J., R. Foppen, P. Chardon, P. Opdam, and P. Luttikhuisen. 2001. Introducing the **key patch approach** for habitat networks with persistent populations: an example for marshland birds. *Biological Conservation* 100: 89-101

# Extreme weather events (IPCC 2001, 2007)

## Climate change:

- Global warming
- Changes in precipitation patterns
- **More variation ( both T and P)**



*July 2006*

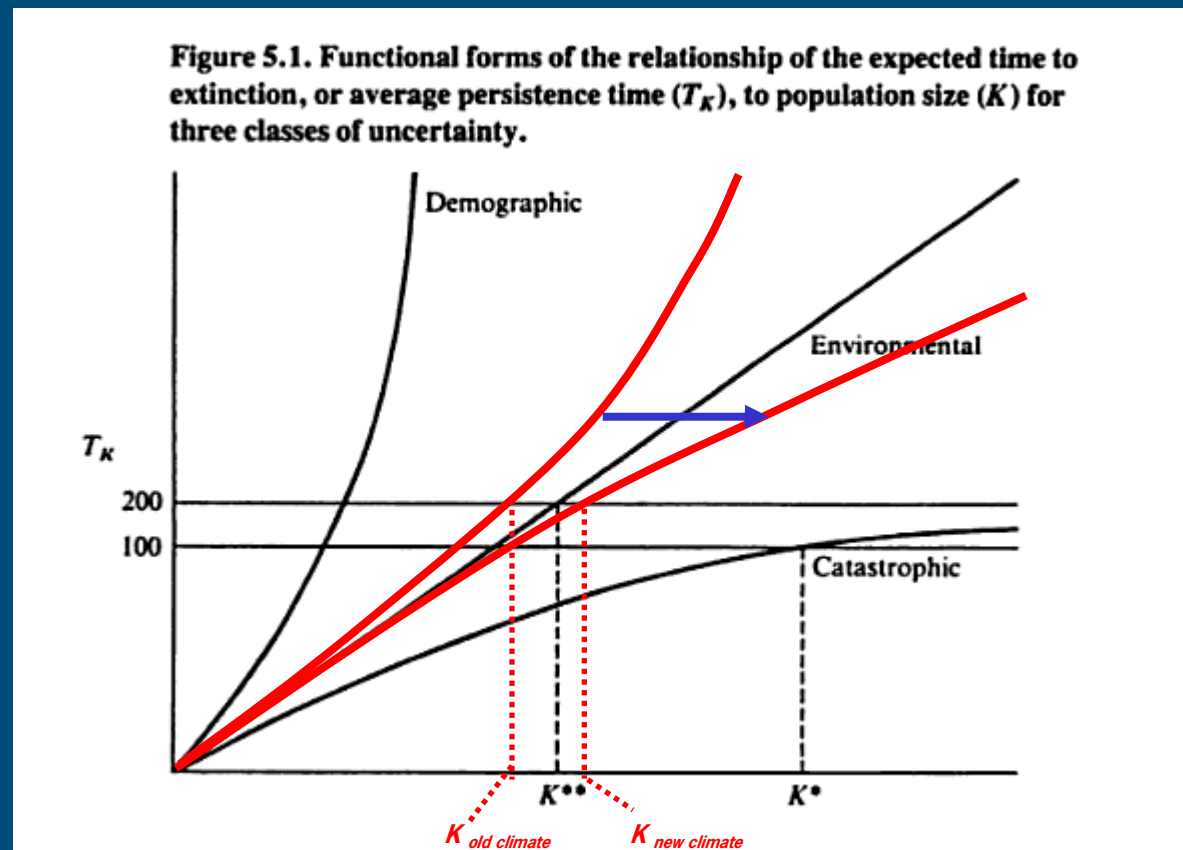


*July 2007*





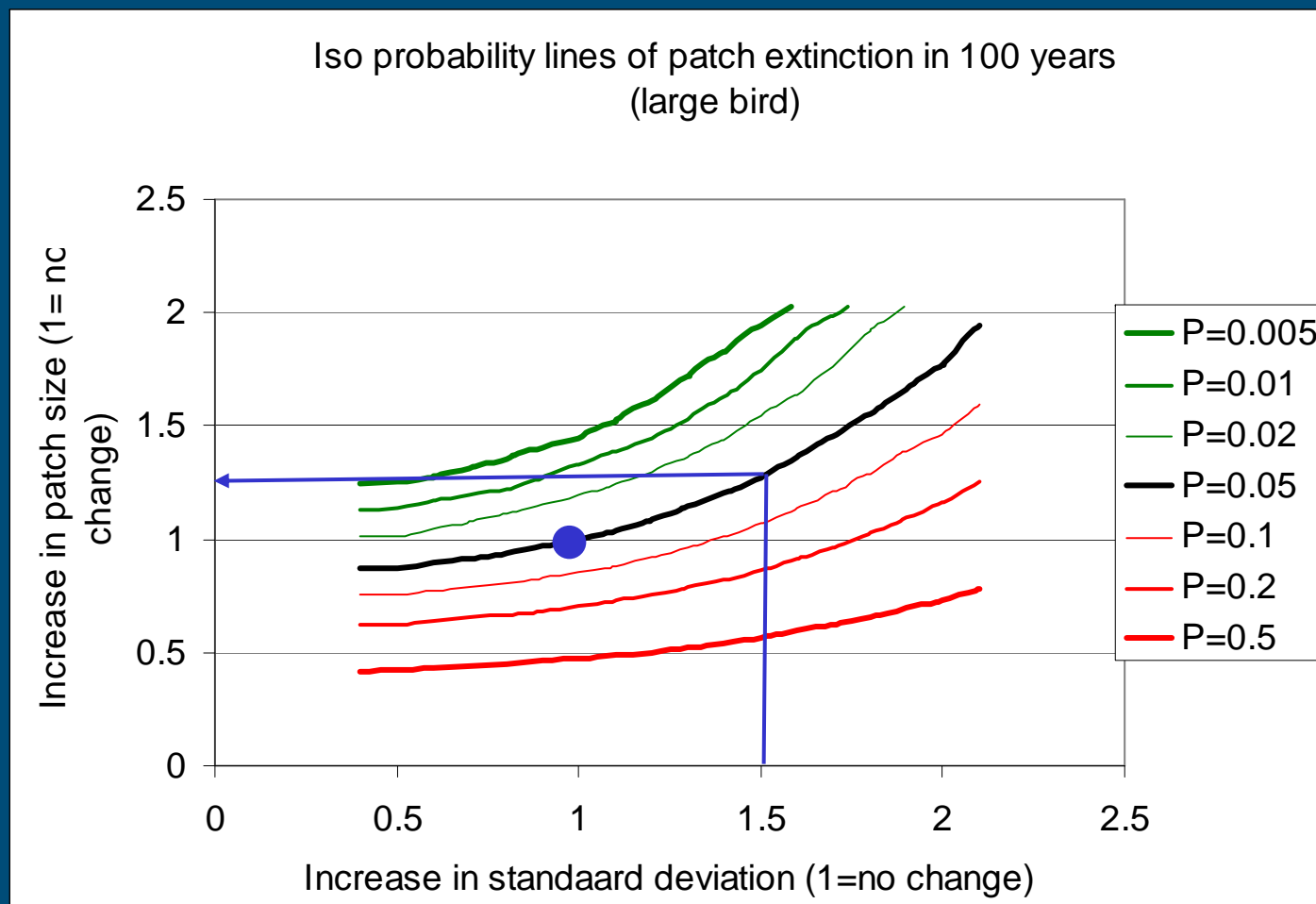
## Climate change changes the relations between extinction risk and population size (or habitat area) as uncertainty increases



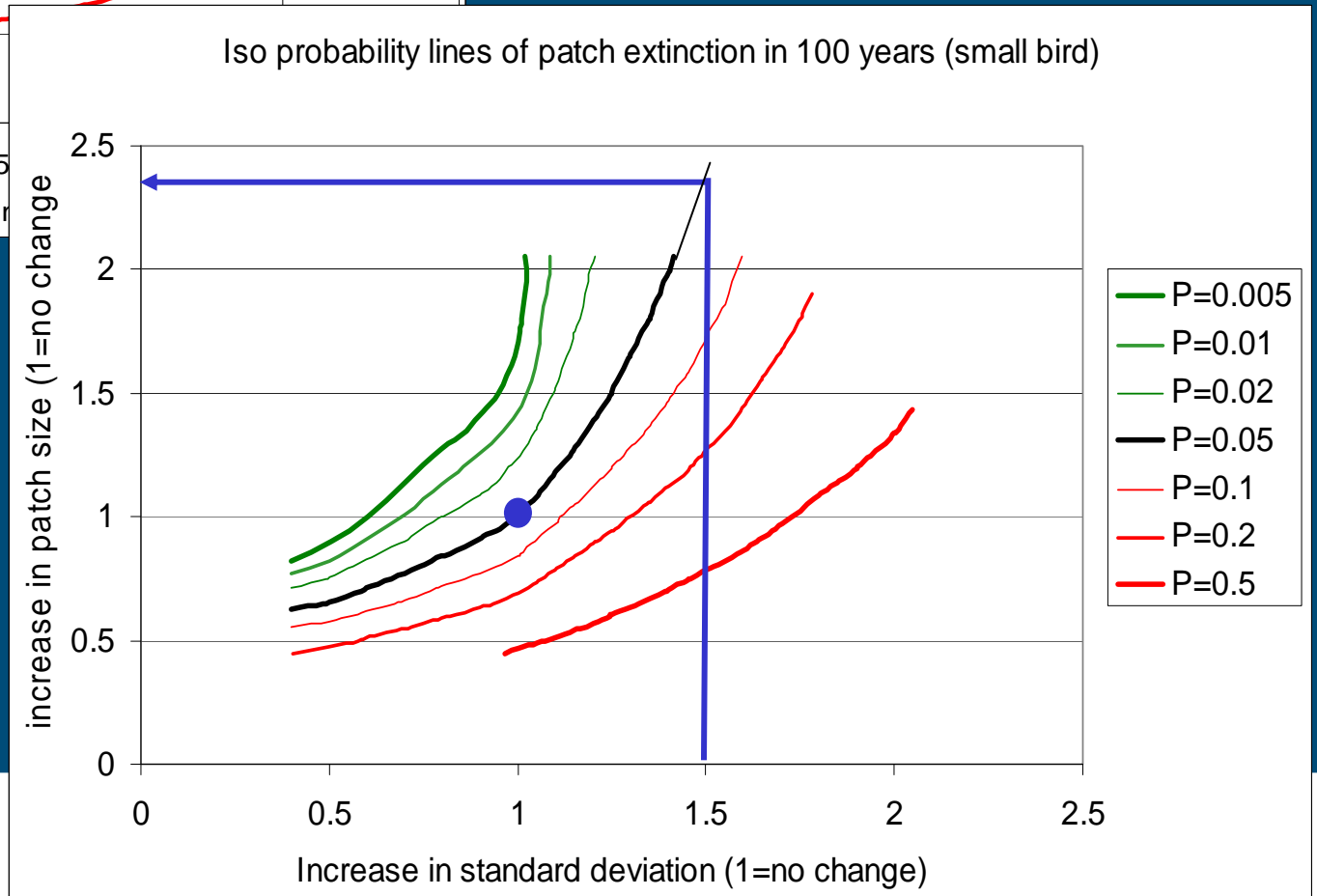
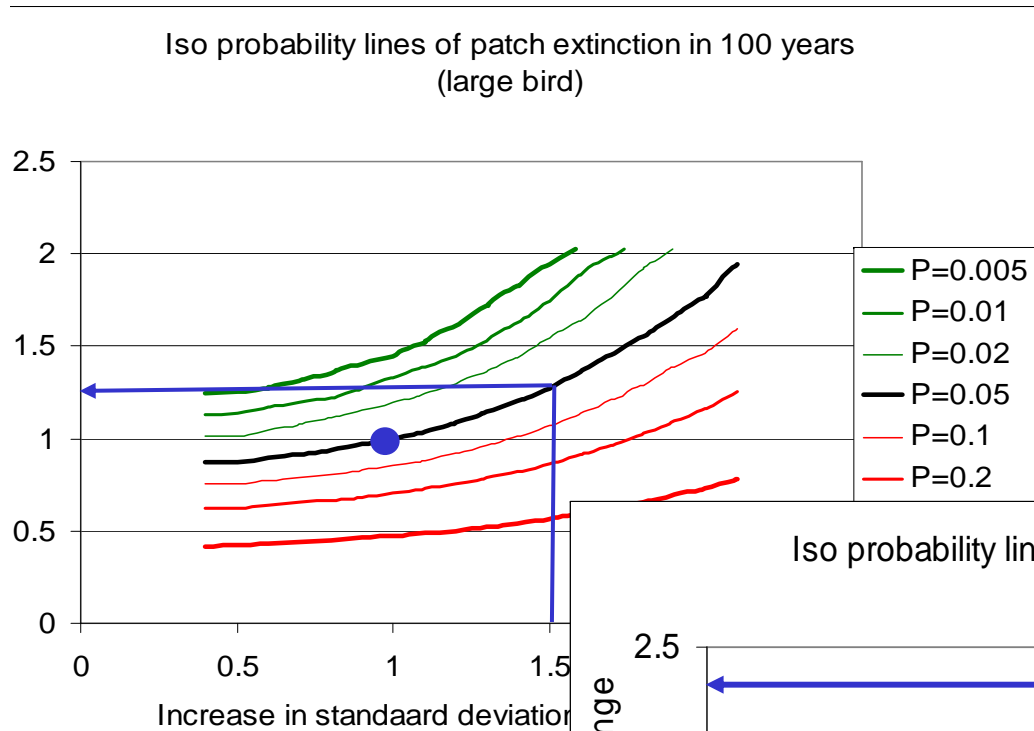
Modified after Shaffer 1987.



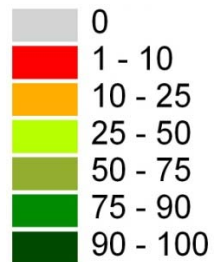
## Simulation results: large long-lived bird (low sensitivity)



## Simulation results: small short-lived bird (high sensitivity)



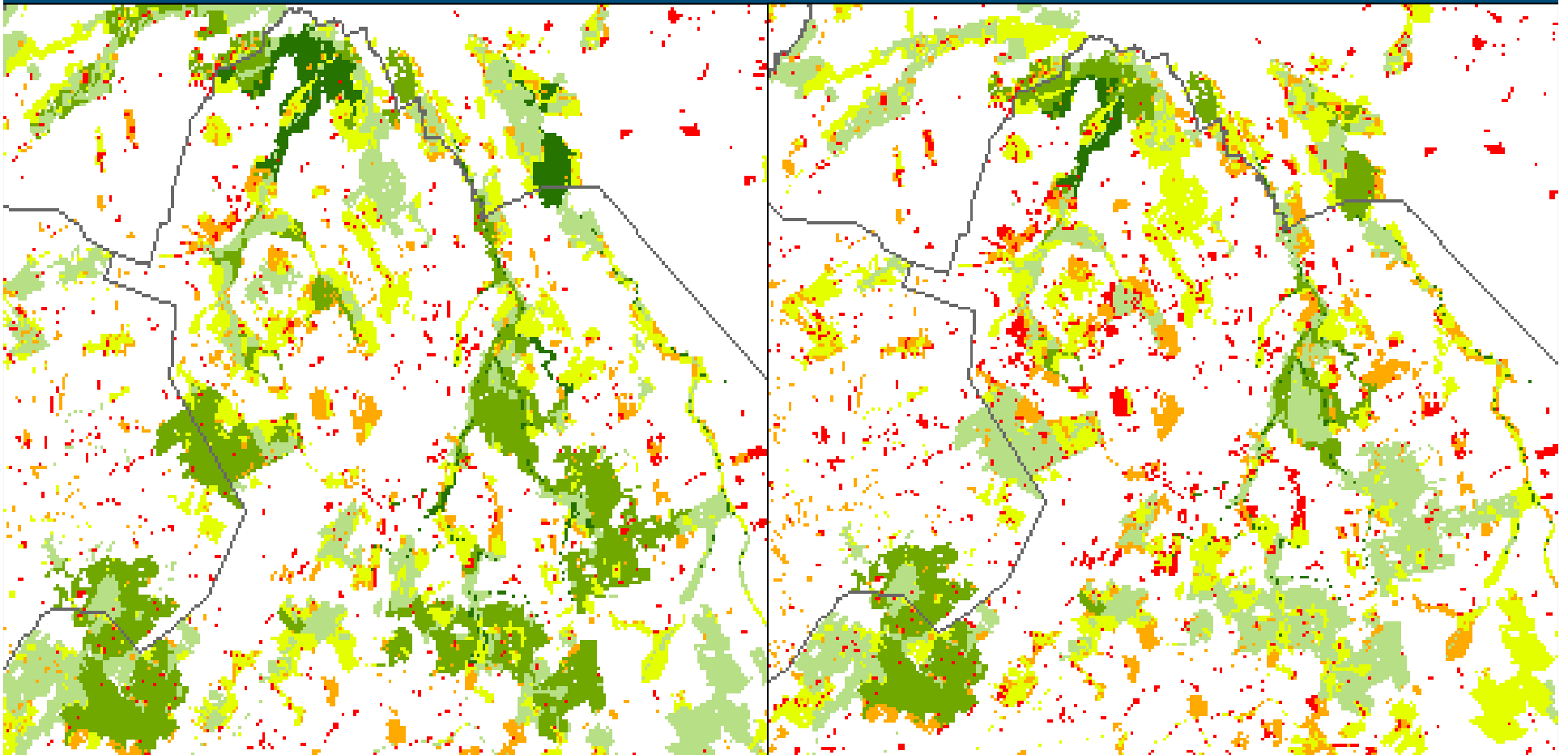
# Status of species and areas sensitive to assumptions about environmental stochasticity



% of policy target species  
for wetlands occurring in  
key patches

Assessment with old key patch standards

Assessment with doubled standards

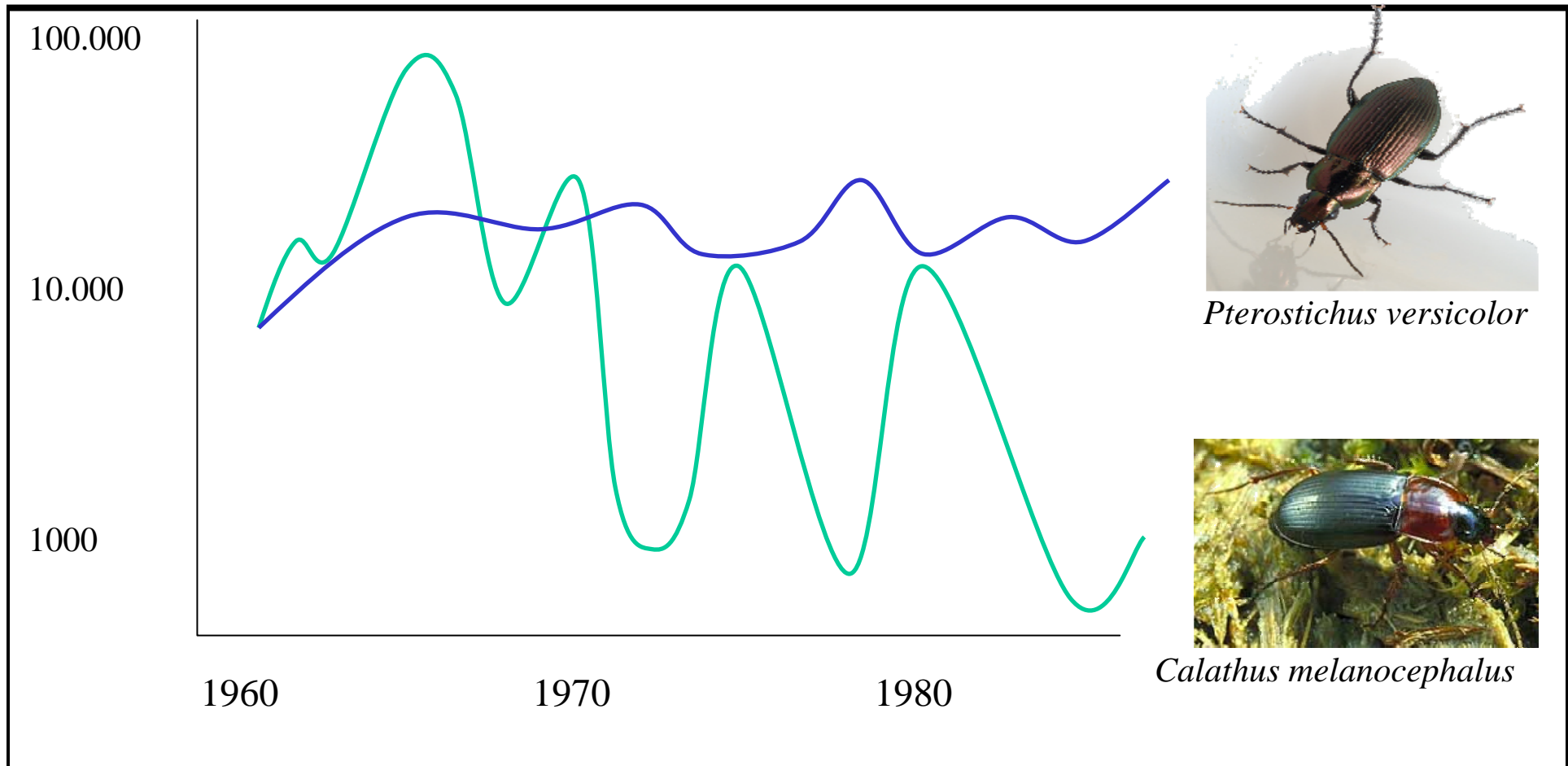


---

# BIG IS STILL BEAUTIFUL?



## Populations tend to fluctuate more in homogeneous habitat



source: Den Boer 1986

# Conclusion

---

We have to rethink ecological network design

- Area ~ extinction risk
- Connectivity ~ colonization, range shifts
- Heterogeneity ~ resilience

# Thank you for your attention!

