Weather extremes and populations persistence: possible adaptation strategies on landscape level

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:: background ::

Ecological networks are worldwide being implemented to conserve biodiversity in fragmented landscapes. The concept of ecological networks, including landscape cohesion (Opdam et al. 2003), key patch standard (Verboom et al. 2001) and ecologically scaled landscapes indices (Vos et al. 2001) is based on metapopulation theory (Levins 1970; Hanski & Gilpin 1997), it does not, however, account for the global climate change. One of the consequences of this change will be higher frequency of extreme weather events (IPCC 2001). Such increased weather variability will be mirrored in increased fluctuations of animal populations, thus, increasing their extinction risk (Shaffer 1987). Therefore the scientific foundations of ecological networks must be updated (Verboom et al. 2010).

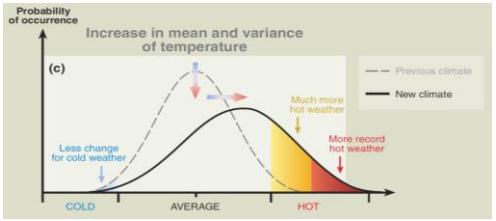

Figure 1 Schematic diagram showing the effects on extreme temperatures when both the mean and variance increase, leading to much more record hot weather; drawn after IPCC 2001

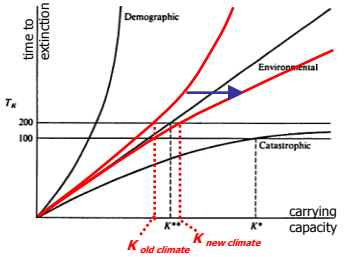

Figure 2 **Functional forms of the relationship of the expected time to extinction, or average persistence time (T_K), to population size (K) for three classes of uncertainty.** Modified after Shaffer 1987.

:: literature ::

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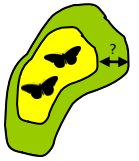
:: questions ::



1) How do minimum habitat area requirements for viable animal populations change under increased weather extremes?

2) How can nature management for patch / landscape heterogeneity be an applicable strategy in spreading the risks from increased weather variability and hence sustaining persistent populations?

3) How can the green-blue network of farmland (green infrastructure) be included to improve the capacity of the network to sustain viable populations under enhanced weather variability?

4) How can these findings be integrated in a real world planning problem to design resilient, climate-robust nature?

:: approach ::

Bayesian dynamic occupation models will be used to correlate monitoring data of birds and butterflies with weather. Results will be used to parametrise individual-based, spatially explicit population model METAPHOR (Verboom et al. 2001). Model simulations will test if area enlargement, green infrastructure and patch heterogeneity are valid adaptation strategies to future climate.

:: application ::

Novel design criteria for sustainable ecological networks based on these research findings will be developed and tested in real world planning case. This can be further applied to add new functionality to LARCH model, in terms of increasing weather variability and adaptation strategies.

LARCH - network assessment tools that combines population viability theory with spatially explicit decision-making; it is developed to facilitate the application of ecological networks in conservation in both design and evaluation phase (Verboom & Pouwels 2004)