Project No 226852

Securing the Conservation of biodiversity across Administrative Levels and spatial, temporal, and Ecological Scales

SCALES (2009–2014) is a European research project financed by the seventh EU framework programme for research and development (FP7). SCALES seeks ways to better integrate the issue of scale into policy and decision-making and biodiversity management in the EU. For more information please see: www.scales-project.net

SCALES briefs 9

Habitat utilisation across multiple spatial scales

1. Summary

A recent study shows that the importance of different habitats for the presence of animal species, such as butterflies, changes with increasing spatial scale. While an animal's local presence is largely determined by resource availability, species occurrence at larger scales depends largely on landscape properties and particularly the effects of urban areas. These findings are relevant for species centred conservation planning, since they highlight how different conservation approaches are required at different scales to ensure all-over protection of species across the legislative boundaries.

2. Key words

Species at risk, habitat utilisation, multiple scales, conservation

3. Relevance to legislation

Federal and national nature conservation acts, Habitats Directive 92/43/EEC

4. Relevance to actual environmental problems

Ecosystem degradation, habitat fragmentation, loss of biodiversity and ecosystem services, climate change

a

b

Figure 1: The Orange tip (*Anthocharis cardamines*) is a butterfly whose habitat utilisation remains quite constant across spatial scales (**a**). The Cranberry Blue (*Plebejus optilete*), in contrast, represents a butterfly with considerably different habitat requirements across spatial scales (**b**).

5. Description of the problem

Biodiversity loss, global change, Habitats Directive, Natura 2000 network

Conservation actions are scale-dependent

The concept of scale consists of four attributes of scale: sample unit, grain (or resolution), focus and extent. It has been shown that changing, for instance, the resolution of a study can affect the usefulness of the study outputs for management applications. Thus, ignoring scale runs the risk of drawing incorrect conclusions and could potentially suggest unfavourable management actions.

Ecological processes and effects caused by the environment on different facets of biodiversity are intrinsically scale dependent (Blackburn and Gaston 2002, Pearson et al. 2004, Schweiger et al. 2005). This has implications for the development of ecological theories but also for conservation and management practices. Conservation goals are scale-specific, ranging from the identification of priority areas at the continental level, to local site habitat management. Therefore, different conservation planning approaches are required at different scales (Cabeza et al. 2010), and cross-scale studies are necessary for identifying species-habitat relationships and guiding conservation planning (Altmoos and Henle 2010).

Habitat utilisation is scale-dependent

Hierarchical partitioning of the effects of different land-use and soil variables on 38 Finnish butterfly species showed that for most the importance of the environmental variables differed substantially across the scales (Fig. 1). When looking at the overall effects of coarse aggregated soil and land-cover variables, it became evident that soil conditions, arable land, pastures and artificial areas were the most important factors in determining butterfly presence across all spatial scales.

Soil was the most important factor at all spatial scales. While other variables that determine local habitat type and quality, such as arable land, pastures, transitional woodland-shrubs and mixed forests, was replaced to a large extent by an increasing importance of artificial areas at larger spatial scales (Fig. 2).

6. Recommendations

The main message of our study is that habitat associations can vary drastically among different scales of investigation. Even species that showed a high level of agreement by expert evaluation and modelling results shifted their dependencies on environmental variables considerably when the scale of investigation was increased. Our results suggest that resource availability largely determines the small-scale presence of a species. Occurrence at large scales is determined by different factors mostly describing landscape properties such as the amount of pastures, wetlands, or effects of urban areas.

Our results have potential applications in the fields of population dynamic studies, studies on the consequences of climate change, related dispersal studies, and species-centred multi-scale conservation planning.

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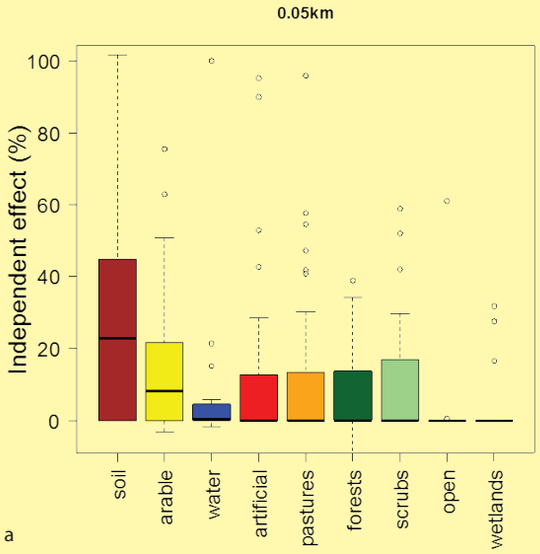

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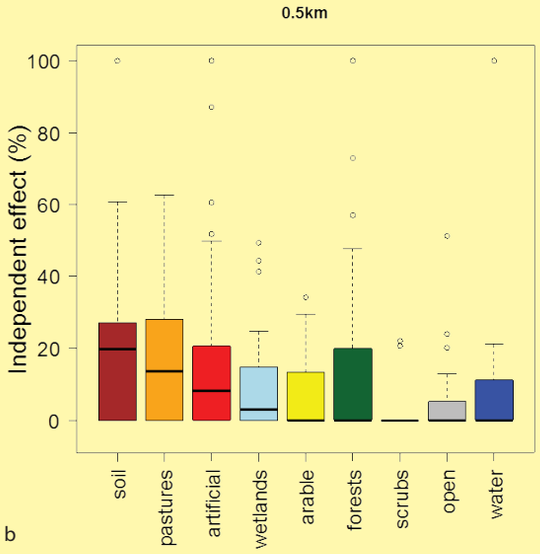

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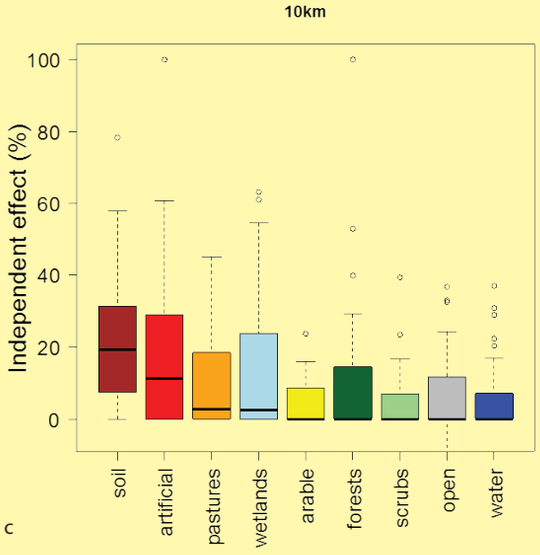

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Figure 2. Relative importance (independent effects) of different environmental variables on the occurrence of 38 Finnish butterfly species at three different spatial scales. Environmental variables are ordered according to their statistical median calculated across all species.


9. Sources

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