## Effects of landscape structure on plants species richness in small grassland remnants in two different landscapes

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**Introduction** There is an increasing interest in using the landscape as the operational scale in many ecological studies. Current species richness in the landscape may be explained by past land use, and habitats may harbour species favoured by an environment that no longer exists. In this study we have included both a landscape scale and a temporal scale. The objective was to explain species pattern and the effect of isolation, habitat size and surrounding land use, and past land use change, on small grassland remnants in rural landscapes.

**Materials and methods** Two different landscapes were analysed in south-eastern Sweden, a modern open agricultural landscape (Selaön), with little (5%) semi-natural grassland left and a forested traditional rural landscape (Nynäs), with more (11%) semi-natural grassland left. Both landscapes have a long rural management history. Maps, 100-years-old, and aerial photos from 1950 and 1990 were used in a GIS. Plant species presence and abundance were recorded in 4 $m^2$-plots, 40 plots along road-verges and in all midfield islets in each landscape. Size of midfield islet and connectivity to other habitats, and roadside vegetation were also analysed.

**Results** A hundred years ago both landscapes had 60% managed grassland; 50 years ago Selaön had less than 11% grassland left whilst Nynäs had 19%. Table 1 shows the number of species found. Species richness was 54% higher in road verges (R.V.) and 20% higher in midfield islets (M.I.) at Nynäs compared to Selaön. More species were found at Selaön, although with a lower abundance. Landscape structures were more important for species richness and numbers at Selaön, as 60% of the species in midfield islets and 48% in road verges was influenced by area, connectivity, or surrounding vegetation compared to 20 and 22% at Nynäs respectively. Nynäs not having reached a fragmentation threshold or a shorter time-range since the threshold was passed could explain the differences, thus local populations are still remnant. A conceptual model based on the results (Figure 1) illustrates that small grassland remnants are sensitive to extinction and fragmentation effects can be detected in landscapes that have been fragmented for >50 years. Past land use history was not particularly important for present species richness or incidence in small grassland remnants, contrary to other studies in the region (Cousins & Eriksson 2002, Lindborg & Eriksson 2004). If the focal habitat has an internal heterogeneity, which may be the case in these studies, there are local processes that uphold species richness within the habitat compared to small relatively homogenous areas. However, it is important to stress that difference in species incidence and landscape structures between the two landscapes is still a result of land use history.

**Table 1** Total number of species and mean species richness (sd)/plot

| | Selaön | Nynäs |
|---|---|---|
| Total number | | |
| road verges | 146 | 135 |
| midfield islets | 237 | 160 |
| | (173 islets) | (53 islets) |
| Mean species | | |
| richness | 18.8 | 29.0 |
| road verges | (±5.8) | (±6.4) |
| midfield islets | 13.5 | 16.2 |
| | (±5.5) | (±6.4) |

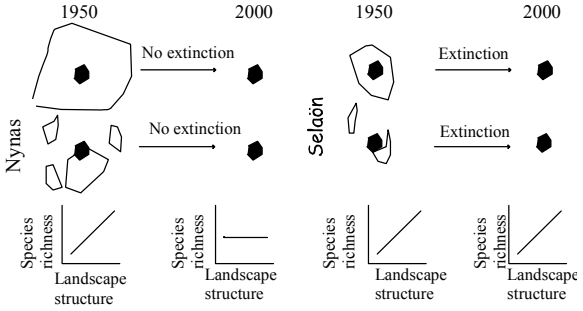


**Figure 1** Conceptual model

**Conclusions** The study demonstrates the importance of conducting studies in different landscapes and not only using grassland "hotspots". The legacy of surrounding landscape remains in local species pools for at least 50 years. Small grassland remnants are more sensitive to fragmentation effects compared to larger grasslands and can thus be useful in finding fragmentation thresholds for plants. They also encompass a substantial part of the grassland species pool and can be valuable to include in reconstructions of grassland management.

**References**

Cousins S.A.O. & O. Eriksson. (2002). The influence of management history and habitat on plant species richness in a rural hemiboreal landscape, Sweden. *Landscape Ecology,* 17, 517-529.

Lindborg, R. & O. Eriksson (2004). Historical landscape connectivity affects present plant species diversity. *Ecology,* 85, 1840-1845.