Seeds of change

changes in vegetation at ECN sites

ECN is providing data about year-to-year changes in plant communities, information vital to understanding how climate change and other pressures are affecting vegetation

Vegetation composition is perceived to be relatively stable, but this assumption is rarely tested. There is evidence that some plant communities can change on a year-to-year basis, particularly in response to weather conditions. Plant species that tolerate stress and those that thrive in disturbed sites (ruderals) tend to increase in response to warm, dry weather during spring and summer whereas competitive species increase after wet conditions. However there has been no systematic study of the extent of year-to-year variability - or indeed resilience - in contrasting vegetation types and its dependence on weather.

Annual monitoring of a subset of ECN vegetation plots, undertaken from 1996, provides information about short-term variation in vegetation over time. These data were valuable, for example, in interpreting Countryside Survey 2000[1,2] vegetation data. Any year-to-year variation in vegetation is not likely to be driven by land use changes, since the management of ECN sites is quite stable compared to the wider countryside.

For the present study, annual vegetation data from 1996-2006 were summarised in a number of ways to represent ecological characteristics of the vegetation. The parameters range from indicator scores for habitat condition to measures of the similarity of species composition in successive years. These 'summary measures' might be expected to show differing levels of variability over time. They may also respond differently from the separate species that form the vegetation type. For example, the *number* of species within a given plot could remain constant over a period of years during which the *actual* species within the plot change completely. Table 1 summarises the patterns of change found.

Short-term changes

Surprisingly, for most vegetation types, all the summary measures of vegetation appear to be relatively resistant to short-term (i.e. from one year to the next) fluctuations in external influences and require sustained pressure to change. The only vegetation types where this is not the case are crops and weeds[3] and fertile grasslands[3]. These are the two vegetation types most likely to change as a result of agricultural management.

In contrast, the measure of short-term change in species composition (the percentage agreement in species between successive years) indicates greater variability. Taking all the ECN sites together, approximately 55% of species are common to successive pairs of years. This figure varies considerably with both site (table 2) and vegetation type. Upland sites and upland vegetation types are the most stable.

Longer-term changes

Over the whole 10 year study period, substantial differences were found between the different groups of summary measure. Ellenberg indicators were particularly stable, showing little long- or short-term variability. C-S-R scores showed moderate degrees of variability with time, whilst the number of species showed substantial long-term variation compared with short-term stability.

In many respects these results are not unexpected. Ellenberg scores are intended to reflect relatively stable underlying abiotic environmental properties, so they should change little. In contrast, the mix and number of species could vary markedly in a plot, even if the basic properties do not change, as a result of short-term and local influences.

The ECN data reveal a clear distinction between upland and lowland sites. Upland sites and vegetation types have higher diversity (as reflected by number of species per plot) and they contain fewer ruderal species and more stress-tolerant ones. As a result they appear to be somewhat more stable than lowland sites or vegetation types. Whether their increased stability is a consequence of the increased biodiversity or whether both reflect other influencing factors remains to be determined.

Climate change is expected to impact plant species in many habitats[4]. However, the differences in stability of vegetation at ECN sites suggest varying degrees of resilience among different vegetation types. In the short-term, upland vegetation may be less impacted by climatic changes than lowland vegetation.

▼ ***Table 1: Summary of the patterns of change found amongst the different vegetation parameters considered***

Parameter	Short-term	Longer-term
Ellenberg scores for light, wetness, fertility and pH. Ellenberg scores are assigned to plant species and are a measure of the species' tolerance to abiotic conditions such as soil pH or nitrogen content[5]	Stable	Stable
C-S-R scores, the 'Competitor', 'Stress tolerator' and 'Ruderal' scores developed by Grime, which relate to different plant survival strategies[6]	Stable	Moderately variable
Number of species	Stable	Variable
% of species that are the same from one year to the next, a measure of the persistence of species in a monitoring plot	Moderately variable	Very variable

Sourhope	79.6
Glensaugh	63.7
Moor House	60.0
Rothamsted	55.3
North Wyke	54.4
Drayton	49.5
Wytham	48.7
Alice Holt	47.6
Porton Down	46.5
Hillsborough	44.5
All	54.5

Increasing stability of plant community

▲ ***Table 2: Persistence of species between successive years.*** *(the number of species found in both years as a percentage of the total number of species in both years combined). A higher value indicates a more stable community.*