

# Effects of rotation and cropping system on dynamics of seedbank species diversity

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## Introduction

The number of plant species in managed farmland has declined since the 1930's, but populations of buried, viable seed (seedbanks) remain potential sources of plant diversity. Seedbank analysis in several recent long-term experiments has provided clear indications of the rate at which seedbank diversity reacts to change in the intensity of modern farming practices.

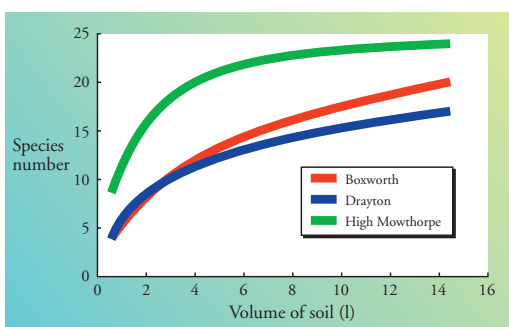
Variables include

- Winter or spring rotation (Talisman experiment) at ADAS Boxworth, Drayton and High Mowthorpe, 1990-1996 (funding by MAFF).
- Sown covers and natural regeneration at ADAS Boxworth, Bridgets, Drayton, Gleadthorpe and High Mowthorpe, 1989-1997 (funding by ADAS/MAFF).
- Herbicide dose at ADAS Bakefarm, Boxworth, Bridgets, Drayton, Gleadthorpe and Rosemaund, 1987-1992 (funding by Home Grown Cereals Authority).

A range of techniques is being used to explore this rich source of information on diversity.

## Species volume curve

The number of species detected varies with volume of soil as a diminishing returns curve. Since the parameters of the curve differ between sites and treatments, estimates of species richness should at least be referenced to a sample volume.

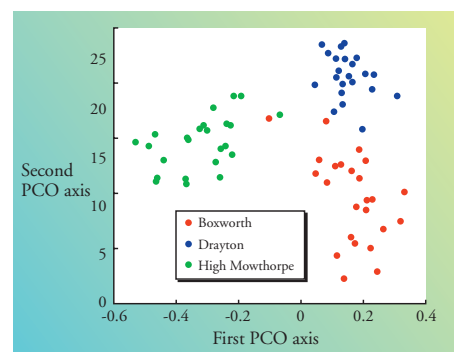


Species volume curves in the Talisman experiment, 1993, for all treatments combined at ADAS, Boxworth, Drayton and High Mowthorpe.

## Multivariate analysis

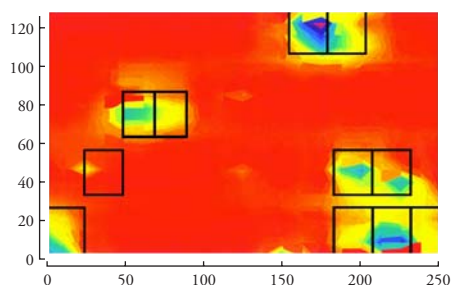
Relaxing management usually causes the species complement to diverge as the local environment and husbandry act to amplify populations of rarer species in the locality. Principal co-ordinate and principal component analysis identify sites and treatments where species diversity changes rapidly.

Principal co-ordinate analysis of plots in the Talisman experiment, based on the presence or absence of 36 species, showing clumping by site.



## Spatial variation

Mapping of spatial variation within fields demonstrates that a spatially randomised set of treatments can affect the local seedbank in a similar way, giving 'hot spots' of species richness.



Field dimensions, ADAS Gleadthorpe, shown in metres. Red indicates low concentrations of seed; blue/purple, concentrations up to 9600 m<sup>-2</sup>. The overlaid rectangles indicate plots where natural regeneration was allowed.

## Conclusion

- Treatments that included a greater proportion of spring sown crops and less herbicide or else a period of fallowing encouraged species number to increase by 1.5 to 2.5 a year over five to six years.
- The seedbank could be increased up to around 45 species (detected in about 30 litres of soil) where a range of management treatments were imposed within one field.
- Some arable weed species that are now considered uncommon were induced to return to detectable populations by appropriate treatment, e.g. round-leaved fluellen *Kickxia spurea*, red bartsia *Odonites verna* and wild mignonette *Reseda lutea*.
- Forms of land management that encourage a large diverse seedbank tended also to amplify the dominant weeds.

The data are presently being examined to determine optimum forms of management that maximise the rise in species number while keeping the dominants in check.

