INCREASING GRASSLAND BIODIVERSITY WITHIN THE ENVIRONMENTALLY SENSITIVE AREAS SCHEME IN THE U.K.

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ABSTRACT
The ESA scheme is the main vehicle in the UK for increasing biodiversity on agricultural land. It is voluntary, and payments are made to compensate for reduced profitability when prescribed practices are followed. These include conversion of cropping land to grassland, zero fertiliser use and late cutting for hay. The scheme is supported by an R & D programme aimed particularly at practical problems arising from the need to reconcile environmental targets with the need to maintain viable and profitable livestock systems. The paper cites examples of this R & D, including choice of seeds mixtures, the role of soil nutrients, introduction of new species to existing grassland, perennial weeds and grassland management for birds.

KEYWORDS
Grassland, Biodiversity, Restoration, Seed mixtures, Weeds, Birds.

INTRODUCTION

The UK is internationally important for a number of grassland habitats, for example chalk downland, and for bird species which breed and/or feed on grassland. The great increase in agricultural production in the UK, between 1940 and the 1980's, resulted in a large reduction in the extent and diversity of these habitats. There is also concern over the impact of the decline in extent of grassland on the landscape.

The achievement in the UK and Europe in the 1980's of near self-sufficiency in many foodstuffs offered the opportunity to halt, and ultimately reverse, this decline in biodiversity. In England and Wales, the main vehicle for this has been the Environmentally Sensitive Areas (ESA) Scheme, initiated in 1987. Some 25 areas, covering approximately 15% of the national land area, have been identified as of greatest importance for wildlife conservation and landscape, and under greatest threat from agriculture. In these ESAs farmers can choose to implement prescribed practices, such as zero fertiliser or late cutting for hay, designed to produce other environmental benefits. Payments are made to compensate for the associated reduction in profitability. The progress of the scheme is assessed by a monitoring programme. In addition, the scheme is supported by a research and development programme, targeted to address technical issues of current and future importance. In this paper, examples of this R & D will be given and future priorities will be outlined.

Conversion of cropping land to diverse grassland. Many ESAs in southern and eastern England have been dominated by production of cereals and oilseeds for at least twenty years. The soil seed-bank is impoverished, and remaining areas of diverse grassland are fragmented. Consequently there is interest in re-establishing grassland by sowing diverse seed mixtures.

Research has shown that it may be possible to re-establish swards containing characteristic grass and forb species on such land. For example in the South Downs ESA a plot experiment (Peel, Swash and McKenzie, 1994) and monitoring of commercial fields, has shown that typical chalk downland species such as *Briza media, Galium verum and Daucus carota* can establish, and persist under sheep grazing for at least three years; long enough to set seed.

In a further experiment on six contrasting sites extremely diverse mixtures were sown, as facsimiles of the semi-natural vegetation. Many key species established in the first year although many others were absent (Pywell, Peel and Hopkins, 1997). These may subsequently establish, although a few have relatively low seed viability. Careful selection of target species for sowing is likely to be required. Such mixtures, using native seeds, currently are some 20x the cost of conventional agricultural mixtures and future adoption will depend on reducing or subsidising this cost.

The role of soil nutrients. The above experiments have been carried out on soils relatively low in nitrogen but high in available phosphorus (>20 mg/l Olsen P) and potassium (>150 mg/l extractable K); typical following arable cropping. It is often suggested that this is incompatible with biodiversity, although there is relatively little evidence of the nutrient status of diverse grassland. Work is now underway to provide this.

Where land in ESAs has been sown to conventional agricultural seeds mixtures of ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*), and subsequently no fertiliser used, these species have often dominated the sward for 8 years and show no sign of decline under grazing management (ADAS, 1996). There are, however, examples which have a low proportion of clover. Here the ryegrass has thinned, there is an increasing proportion of bare ground, and productivity has fallen to a level well below that compensated by the payments. The nutrient status, and particularly the nitrogen supplying capability of these soils, is being investigated. This problem illustrates the need to establish a new lower equilibrium soil nutrient status, and a sward composition which is adapted to these conditions.

Introduction of new species to existing grassland. Much established grassland in ESAs had a history of fertiliser and herbicide inputs, and is showing little sign of botanical diversity after 8 years of zero inputs. The prospects for introducing seed following a range of levels of sward and soil disturbance is being examined on six contrasting sites under hay-cutting management.

Despite a promising start (Hopkins *et al.*, 1996), results after two years show that only with the most severe treatment, where the existing turf was completely removed, has a wide range of introduced species persisted (Pywell, Peel and Hopkins, 1997). With the less severe treatments, such as slot-seeding or rotovation to expose 50% bare ground, seedlings have been unable to compete with the existing sward. Even 'plug plants', introduced following removal of circles of turf of l5cm diameter, have shown a poor survival rate.

Perennial Weeds. Weeds are one of the commonest practical problems when managing grassland with low inputs. The species which are most intractable are common ragwort (S*enecio jacobea)*, spear thistle (*Cirsium vulgare)* and particularly creeping thistle (*Cirsium arvense*). These species are seen by farmers, and the public, as signs of neglect. In ESAs the use of conventional spraying is prohibited, but herbicide can be applied by 'weed-wiper' machines. These require the target plants to be taller that the surrounding vegetation; a boom or roller soaked in herbicide (eg. clopyralid on thistles) is then wiped over them. This technique can be very effective, but despite the use of systemic herbicides, roots often survive and regrow so that repeat treatment is necessary. Mechanical topping can also be effective (Peel and Jones, 1997) but must usually be repeated twice annually, or more, for several years.

Grassland management for birds. Lowland wet grassland is a very important breeding habitat for wading birds such as lapwing *Vanellus vanellus* (L), redshank, *Tringa totanus* (L) and snipe, *Gallinago gallinago* (L). Drier grassland is important for skylark (*Alauda arvensis*) and meadow pipit(*Anthus pratensis*). Several ESAs, notably the North Kent Marshes, are specifically targeted at birds such as these, which are under threat. This is thought to be because much grassland is now too dry, or because high stocking rates, and/ or frequent cutting for silage, discourages or disrupts nesting.

A study of 528 marshes in N. Kent is being carried out to further our understanding of the relationship between site factors, sward management and selection by birds (Peel and Milsom, 1997). The results so far confirm the preference of many bird species for grassland in which there are wet areas likely to be rich in an invertebrate food source. They also highlight the importance of micro topography, which is strongly related to bird settlement. The height and structure of the sward is also important, and bird species have different preferences depending on their behavioural characteristics. Type of grazing livestock has been shown to be important; mixed grazing by cattle and sheep produces a better sward structure than sheep alone.

CONCLUSIONS

1. The ESA scheme is popular with farmers and the public; it has very largely halted the decline in biodiversity on land under agreement and there are signs that it may, slowly, reverse this trend.

2. Attracting, and keeping, farmers in the scheme depends mainly on the level of payments offered. But it also depends, crucially, on reconciling environmental targets with the need to maintain viable livestock systems.

3. Although a great deal is known about management for biodiversity on reserves where this is the main priority, there are many problems, some illustrated in this paper, in incorporating this management into commercial farming systems. Research is being directed towards understanding systems and offering practical guidelines and, where necessary, compromises.

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REFERENCES

ADAS. 1996. Environmental monitoring in the South Downs ESA. ADAS report to the Ministry of Agriculture, Fisheries and Food.

Hopkins, A., R.H. Johnson, P.J. Bowling, R. Pywell and S. Peel. 1996. Techniques for restoring botanical diversity of grassland in ESAs. *Proceedings of 16th meeting of the European Grassland Federation*, Grado, Italy

Peel, S. and A.T. Jones. 1997. Control of creeping thistle (*Cirsium arvense*) on an ancient grazed common. *In*: Sheldrick, R D (Ed) *Grassland management in ESAs* Occ Symp. British Grassland Society (In press)

Peel, S., G. Swash and S. McKenzie. 1994. Seeds mixtures for chalk downland. *In*: Haggar, R. J. and Peel, S. (Eds) *Grassland management and nature conservation*. Occ. Symp 28, British Grassland Society, Reading

Peel, S. and T.P. Milsom. 1997. The selection of grazing marshes by breeding birds. *In*: Sheldrick, R. D. (Ed). *Grassland management in ESAs*. Occ. Symp. British Grassland Society (In press)

Pywell, R., S. Peel and A. Hopkins. 1997. Multisite experiments on the restoration of botanically diverse grassland in ESAs. *In*: Sheldrick, R. D. (Ed) *Grassland management in ESAs*. Occ. Symp. British Grassland Society. (In press)