Grassland Enhancement Field Trial in Iron Gates Mead: a riverside meadow at Sheffield Park, East Sussex

River Ouse Project Report No. 8

University of Sussex

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Front cover: Cowslips growing in Field Trial in Iron Gates Mead, Sheffield Park

Acknowledgments
We wish to thank the National Trust, Kew and the Weald Meadows Initiative for their help as well as the team of volunteer botanists who took part in the annual monitoring.

Contents

1 Introduction

This is one of a series of reports produced by the University of Sussex River Ouse Project about streamside habitats in the upper Ouse. In the 1800s, much of this land was managed as hay meadow, providing a connected landscape of flower-rich grassland. Some of the hay meadows flooded briefly after periods of prolonged rain and thus alleviated the flood risk downstream by holding back peak flows high up in the catchment and allowing water from lower down to pass through first. Hay meadow vegetation, which tolerates the brief periods of flooding such 'flash' washlands are subjected to, is now present only in small isolated areas. A key aim of the project is to link biodiversity enhancement of riverside land to flood alleviation by putting back the wildflowers into suitable sites where soil fertility is low. Such meadow grassland is a Biodiversity Action Plan plant community. There are two grassland enhancement techniques that we could use: we could sow wildflower seed or insert plant plugs into the sward. Sowing wildflower seed is a cheaper, less labour-intensive option, but may be less successful for some species especially on these 'flash' washland sites. A field trial was set up in October 2009 on a low-fertility, species-poor washland known as Iron Gates Mead in order to compare these two techniques.

2 Methods

2.1 The site and its management

Iron Gates Mead lies alongside the river Ouse at Sheffield Park (TQ 410228) and has been extensively studied by the Ouse Project team. We know from historical research, including interviews with the tenant farmers, that it was used as a hay meadow until the latter half of the last century and that it was full of Cowslips (*Primula veris*) until fertilizer was applied in 1949 (Pilkington *et al.,* 2011). Then in 1998, the sward was killed with herbicide and seed from agriculturally-improved grass was direct-drilled into the ground. Subsequent flooding killed this grass, but the indigenous grasses in untreated areas survived.

In 2005, the tenancy agreement was terminated by the owner, Sackville-West of Knole, and in October 2006 the land was sold to the National Trust. Following this, Iron Gates was managed with a silage cut followed by cattle grazing until 2010 when the National Trust negotiated a new agreement. Unfortunately, although the Field Trial was grazed by cattle over the first winter, no grazing took place in the summer and autumn of 2010. Grazing was re-instated in March 2011, mostly with sheep. A hay cut took place in August 2011 to try to reverse the damage done by lack of grazing over the previous autumn and winter.

Prior to setting up the field trial in 2009, *Alopecurus pratensis* Meadow Foxtail, *Agrostis capillaris* Common Bent, *Holcus lanatus* Yorkshire-fog and *Poa trivialis* Rough Meadow Grass were constant in the meadow, but there were very few forbs (Pilkington *et al.*, 2011).

2.2 Experimental design

A randomized complete block design was used with four blocks of 30 m x 70 m set out contiguously down the field. Within each block, three plots of 10 m x 10 m were marked out and a Feno ground anchor put in to mark one corner of a central 2 m x 2 m monitoring quadrat. Measurements from cup hooks on posts at the edge of the

experimental area enabled the Feno markers to be easily located in future years (Figure 1).

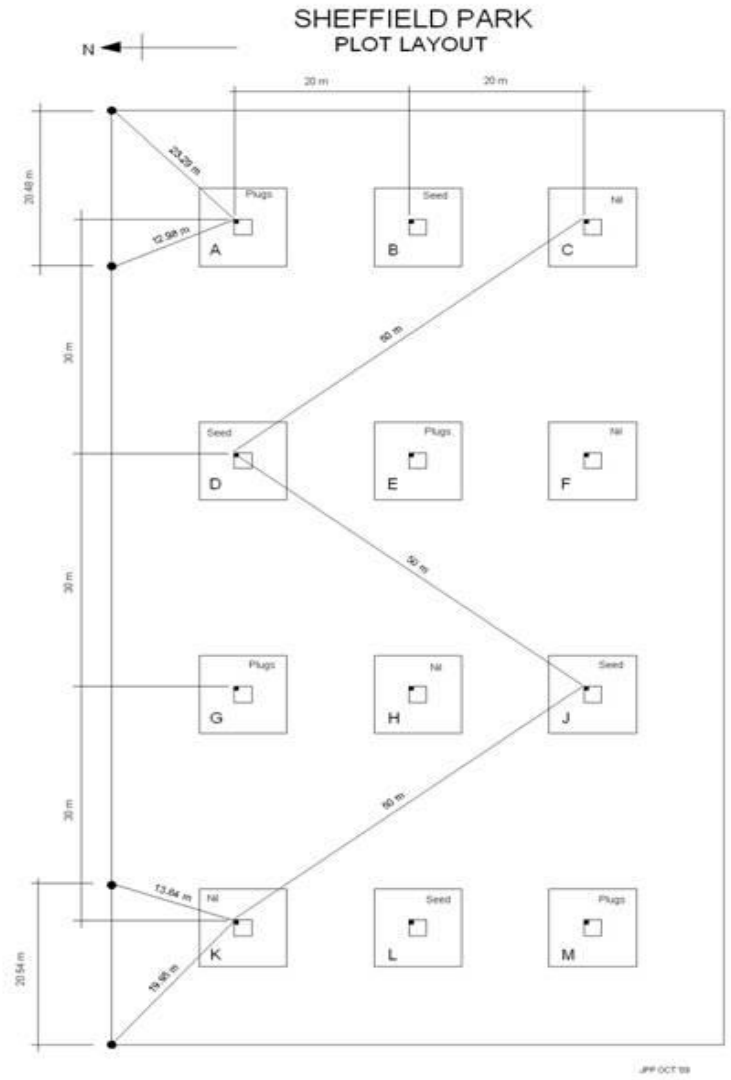

Figure 1. Diagram showing experimental layout

Three treatments were randomly assigned to plots within each block:

1. 10 species of wildflower seed sown within the 10 m x 10 m plot;
2. plant-plugs of the same 10 species planted in four patches within 10 m x 10 m plot, but not within the monitoring quadrat (Figure 2);
3. control – no seed or plant-plugs added.

We followed recommended practice for the seed sowing and plug-planting, so the seed was sown throughout the 10 m x 10 m plot but the plugs were planted into discrete patches. We expected the plug plants to spread quickly into the adjacent monitoring quadrat.

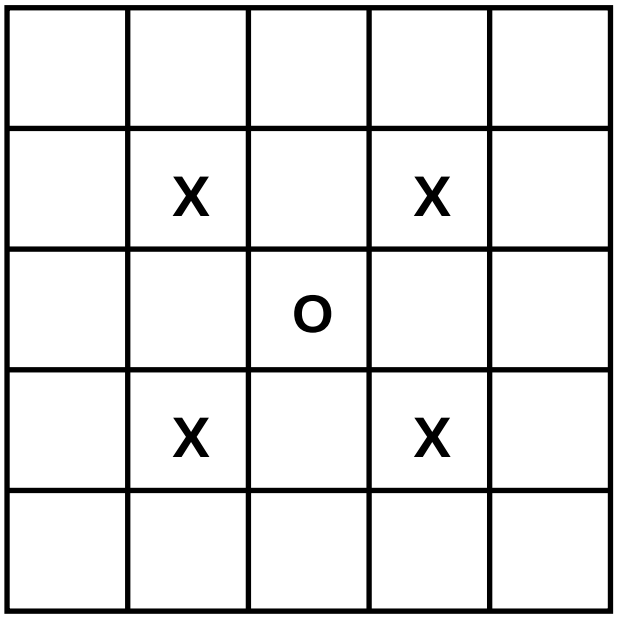

Figure 2. Position of 2 m x 2 m plug planting areas (X) within the 10 m x 10 m plot and 2 m x 2 m monitoring quadrat (O).

2.3 Source of seed and site preparation

The seed used in the field trial was harvested from Wealden hay meadows by the Weald Meadow Initiative in summer 2008 and a small amount of this seed was used by Iain Parkinson (Kew's Conservation and Woodlands Manager at Wakehurst Place) and his team to grow 64 plant plugs of each of ten wildflower species. The remaining seed was stored in the Kew Seedbank at Wakehurst Place, so that the same seed could be used for sowing in the field trial in October 2009. The existing sward was cut short and a grass harrow used to create patches of bare ground before sowing and planting in October 2009.

2.4 Wildflower species used

Achillea millefolium Yarrow
Centaurea nigra Common Knapweed (note: this was the un-rayed form, which is the one that occurs in Sussex)
Genista tinctoria Dyer's Greenweed
Lathyrus pratensis Meadow Vetchling and *Vicia cracca* Tufted Vetch (very similar seed)
Leucanthemum vulgare Oxeye Daisy
Lotus corniculatus Bird's-foot-trefoil
Lychnis flos-cuculi Ragged Robin
Primula veris Cowslip
Prunella vulgaris Selfheal
Trifolium pratensis Red Clover (Note: there was no red clover seed available from WMI, so plug plants were grown from seedbank seed.)

Botanical names follow Rodwell (1992) because our meadow research is based on the National Vegetation Classification. Common names are those recommended by the Botanical Society of the British Isles (Dony, Rob & Perring, 1974).

2.5 Monitoring

The 2 m x 2 m monitoring quadrats used were sub-divided into 25 40 cm x 40 cm squares with removable metals rods, which were slid into place through the vegetation after positioning the frame on the ground. The presence of each plant species in each of the 25 40 cm x 40 cm squares was recorded annually in May. At the same time, plug plants in the 2 m x 2 m planted areas were counted. Tram-lines were put out to make the plug counting easier.

3 Results

3.1 Seed-sown plots

The most successful species was Yarrow *(Achillea millefolium)* closely-followed by Oxeye Daisy *(Leucanthemum vulgare)* (Figure 3). The third most successful was Cowslip (*Primula veris)*, but this was severely affected by the lack of grazing in the second year. Fortunately it showed signs of recovering in the third year.

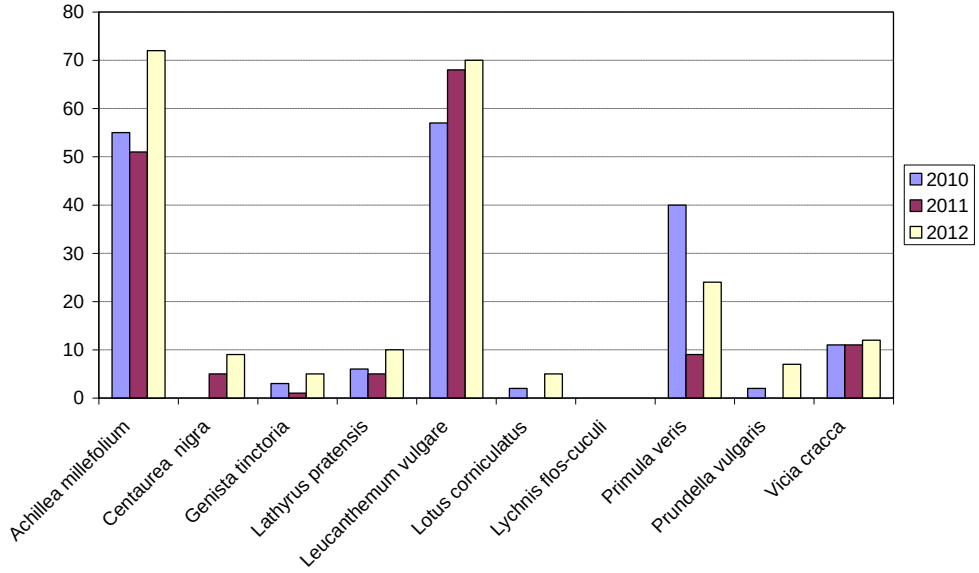

Figure 3. Sown plots – percent of monitoring quadrat squares in which species found, 2010–2012.

Tufted Vetch *(Vicia cracca)* had reasonably successful germination in the first year, maintained its presence over the second year and then continued to spread in the third year.

Bird's-foot-trefoil *(Lotus corniculatus)* and Selfheal *(Prunella vulgaris)* showed poor germination in the first year and disappeared in the second year, but increased in the third year. Similarly, Dyer's Greenweed *(Genista tinctoria)* and Meadow Vetchling (*Lathyrus pratensis)* had a small amount of germination in the first year and were severely reduced in the second year, but increased in the third year.

Common Knapweed *(Centaurea nigra)* failed to germinate until the second year, but continued to increase in the third year. Other workers have told me that they have noticed similar slow germination of Common Knapweed and that it subsequently becomes dominant in the sward. It is also possible that different weather conditions from one year to the next favour the establishment of different species.

No Ragged Robin *(Lychnis flos-cuculi)* seed germinated in the first 3 years of the trial.

3.2 Plant-plug plots

It was expected that the plug plants would quickly spread into the area of the monitoring quadrat, but this did not happen over the first 3 years of the trial. However, all the plug plants of Yarrow *(Achillea millefoilium)*, Oxeye Daisy (*Leucanthemum vulgare)*, Ragged Robin *(Lychnis flos-cuculi)*, Cowslip *(Primula veris)*, Selfheal *(Prunella vulgaris)* and the vetches survived through the first winter and had increased dramatically within the planted areas by the third year (Figure 4).

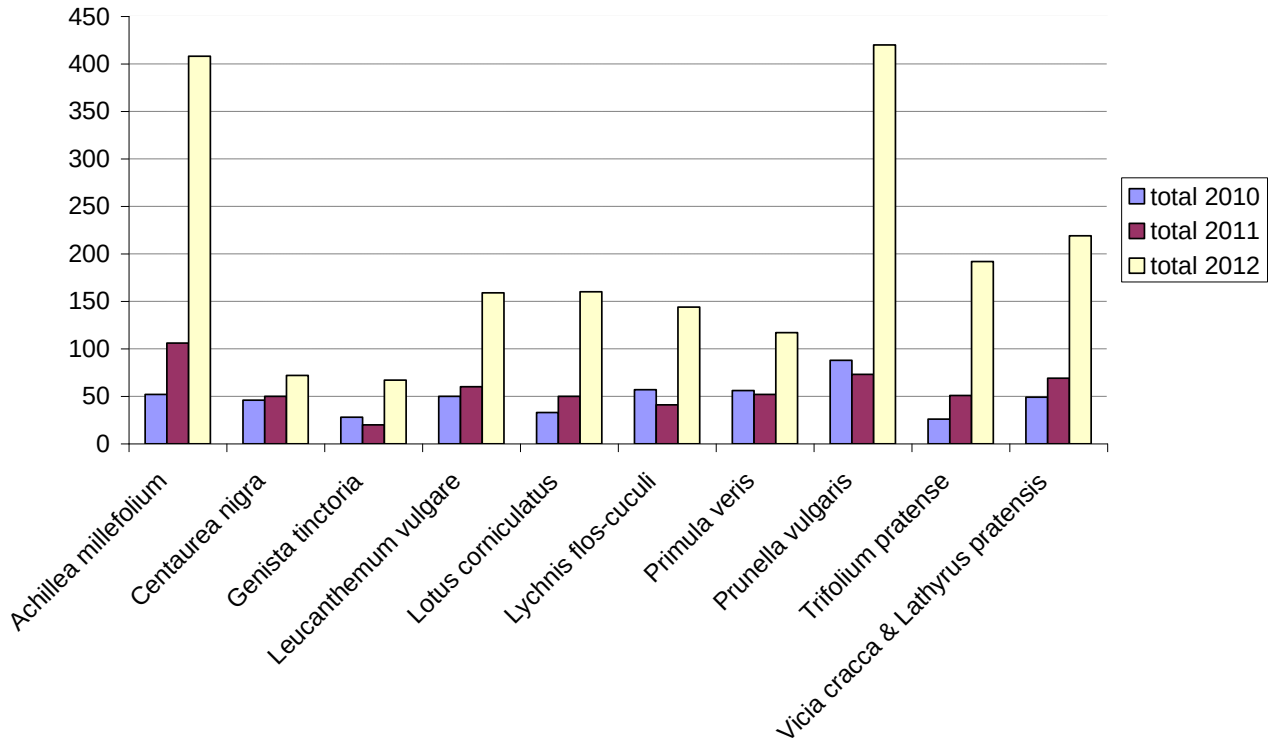

Figure 4. Plug plots – number of plants of each species in plug-planted areas, 2010–2012. Note: 64 plugs of each species were planted

There were slightly fewer plants of Common Knapweed *(Centaurea nigra)*, Dyer's Greenweed *(Genista tinctoria)*, Bird's-foot-trefoil *(Lotus corniculatus)* and Red Clover *(Trifolium pratense)* at the end of the first winter, but again they had maintained their presence (Common Knapweed *Centaurea nigra* and Dyer's Greenweed *Genista*

tinctoria) or increased in numbers (Bird's-foot-trefoil *Lotus corniculatus)* and red clover *Trifolium pratense*) by the third year.

The lack of grazing in the second year adversely affected Cowslip (*Primula veris)*, Dyer's Greenweed *(Genista tinctoria)* and Ragged Robin *Lychnis flos-cuculi)*, but they recovered in the third year.

3.3 Recording from monitoring quadrats for 2 further years

We discontinued plug plant counting after 3 years because the plants had increased so much, but we continued to record from the monitoring quadrats for a further 2 years.

Some species in the seed plots, such as Tufted Vetch *(Vicia cracca)* and Oxeye Daisy *(Leucanthemum vulgare)*, which had done very well over the first 3 years, declined. This may reflect the change from cattle grazing to sheep grazing in 2010. Dyer's Greenweed *(Genista tinctoria)*, Common Knapweed *(Centaurea nigra)* and Selfheal *(Prunella vulgaris)* decreased in 2014 following continuous grazing by sheep over winter.

A few Ragged Robin *(Lychnis flos-cuculi)* plants appeared for the first time in 2013 in the seed plots and were present in the same number of squares in 2014. Like Common Knapweed *(Centaurea nigra)*, Ragged Robin may be slow to germinate or it may be that certain weather conditions favour germination.

In the plug plots in 2014, Selfheal *(Prunella vulgaris)* plants occurred in 5% of squares, Common Knapweed *(Centaurea nigra)* in 1% and Bird's-foot-trefoil *(Lotus corniculatus)* in 1%. None of the sown or planted species occurred in the control plots.

4 Discussion of grassland enhancement on washland sites

The upper catchment of the river Ouse system is particularly suitable for re-instatement of species-rich washlands because the small streams mostly rise on heathland soils such as Ashdown Forest. This means that the silt deposited in these washlands is sandy, producing infertile, free-draining soils. This was particularly noticeable in Iron Gates Mead (Figure 4) and the tenant farmers were not allowed to plough because of the special free-draining soil structure (Pilkington *et al.*, 2011). This is not usually the case on sites that flood and indeed further downstream streams such as the Bevern rise in areas where large amounts of maize are grown and the extensive washlands downstream have high soil fertility. Until there is a change in agricultural practices it is difficult to see how such washlands can be returned to species-rich grassland. South-East Water is currently piloting a project (Upper Ouse Thinking, OUT) in which farmers are being financially encouraged to prevent phosphate, sediment and metaldehyde getting into the Bevern stream. If we paid the full price for meat and milk produced from feeding maize to cows this practice would stop (Lymbery, 2014).

Figure 5. Sandy silt brought down from Ashdown Forest in floodwater and deposited on surface of sward in field trial, December 2009.

5 Conclusions

Sown plants require more careful management than plug plants, so seed sowing should be chosen for grassland enhancement only if appropriate management can be maintained. This can be difficult to achieve for a sufficiently long period of time because the person responsible for managing the site may change. This was the case with both our field trials. It also highlights the importance of conservation of surviving meadows, which are much more resistant to short term lack of management.
Yarrow *(Achillea millefolium)* and Oxeye Daisy *(Leucanthemum vulgare)* establish well from seed and are not too sensitive to management, so there is no need to go to the extra cost and labour involved in using plant plugs. Cowslip *(Primula veris)* establishes well from seed, but appropriate grazing is essential for survival. On some sites it may be fine to use Cowslip seed rather than plugs.

Bird's-foot-trefoil *(Lotus corniculatus)*, Ragged Robin *(Lychnis flos-cuculi)* and Selfheal *(Prunella vulgaris)* establish well from plant plugs but not from seed. For these species it is wise to use plant plugs.

Some species are slow to establish from seed. Common Knapweed *(Centaurea nigra)* germinated in the second year and Ragged Robin *(Lychnis flos-cuculi)* in the fourth year.

6 References

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