Spring Farm Riverside Meadows: upstream from Sheffield Bridge, East Sussex

River Ouse Project Report No. 2

Centre for Community Engagement
University of Sussex

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The Leverhulme Trust

Front cover Bird's-foot-trefoil growing in Spring Farm Meadow 2.

Contents

1 Introduction

This is one of series of reports produced by University of Sussex River Ouse Project about MORPH (Middle Ouse Restoration of Physical Habitat) sites. The reports provide information to the Environment Agency, the National Trust and other interested stakeholders to enable appropriate decisions to be made about biodiversity enhancement of riverside land in the Middle Ouse linked to flood alleviation. In this report, Middle Ouse refers to the Ouse and its tributaries in the area defined as Middle Ouse by MORPH.

Our work has focussed particularly on streamside grassland. The two main objectives were to discover more about species-rich sites and to assess the suitability of species-poor sites for either grassland enhancement or wet woodland restoration.

The report sets our work in context and describes the methods we used (Section 2 and 3). A site description (Section 4) includes details of the frequency of flooding and potential for the site to act as a flash washland. Relevant changes in land use over the last 200 years are detailed in Section 5. Sections 6 and 7 describe present-day vegetation with notable species and an indication of biodiversity value, while proposals for biodiversity enhancement that could be linked to flood alleviation are given in Section 8.

2 Context

2.1 A washland flood alleviation strategy

The river Ouse in Sussex is a flashy river, which rises quickly after prolonged heavy rain and then soon subsides. It has a wide catchment area with a large number of small streams, many of which become dry in their upper reaches during summer (Figure 1). This capillary system is mostly well-wooded with imperfect or poor-draining soils; mini-floodplains alternate with steep-sided sections of ghyll. Rain falling at the end of a dry period is absorbed initially but, once the ground becomes saturated, any extra rainfall causes rapid flows in these streams. The result is a sudden and dramatic rise in water level in the main Ouse. In the past, this water spilled on to land bordering the Middle Ouse resulting in flooding, which lasted 2-3 days. Land subject to such flooding is known as ‘flash washland’. Navigation works between 1790 and 1799 on the main Ouse and the deepening of Ouse streams in the 1970s to drain agricultural land have reduced the amount of land subject to this ‘flash’ flooding – leading to destructive flooding of homes and businesses further down the river.

A flood alleviation strategy for the Ouse depends on holding back the peak flow temporarily in the upper regions until water from lower down the system has passed through. Flash washlands, which flood briefly and then drain quickly, are ideal because they soon become available to store water again. Such a naturally functioning system is better for biodiversity and inexpensive compared with hard structures and sluice gates.

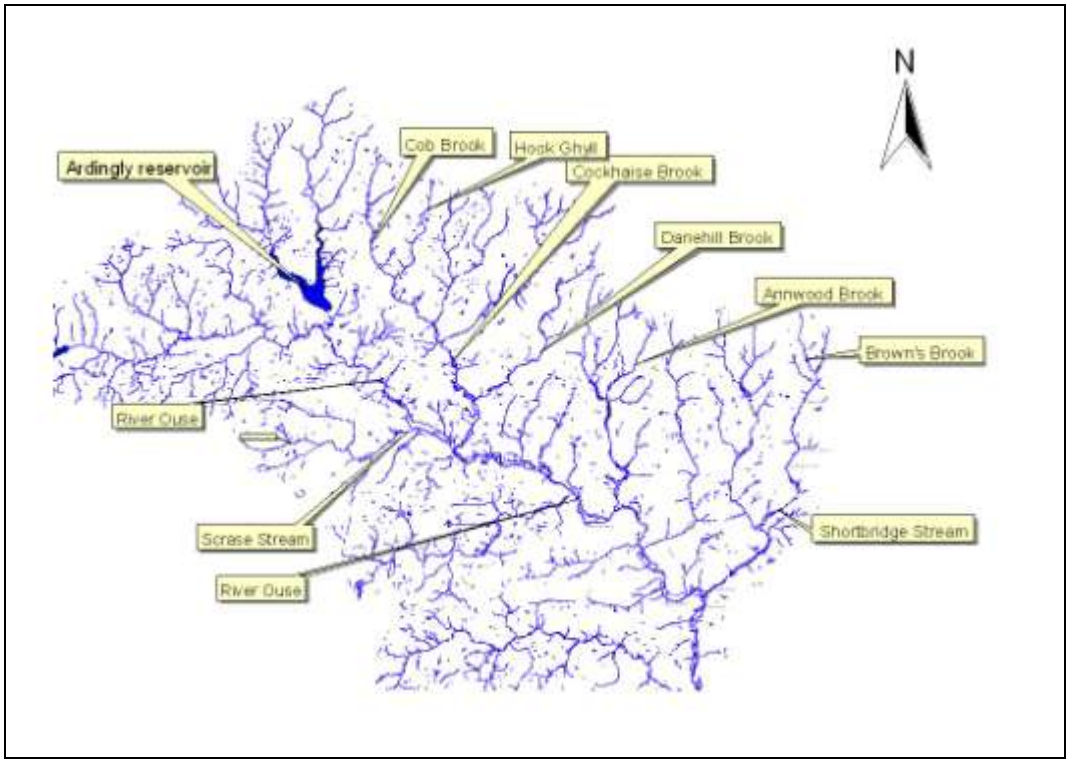

Figure 1. The stream system that feeds into the upper reaches of the river Ouse.

2.2 Flash washlands in the Middle Ouse

Flash washlands in the Middle Ouse share the following properties.

- They flood for 2–3 days during periods of peak flow after heavy and prolonged rain, usually during winter.
- They have free-draining soil as a result of the sandy silt brought down in floodwaters from the High Weald.
- They were managed as hay-meadows with flower-rich 'Crested Dog's-tail–Common Knapweed Grassland' (MG5 grassland in the National Vegetation Classification – see section 3.1). Such grassland tolerates short duration flooding.
- They are too dry for most of the year to support wetland plants unless they contain permanently wet areas fed by springs.
- Washlands with a matrix of spring-fed wetland areas within MG5 grassland are the most biodiverse habitats.

2.3 Wildflower meadows full of butterflies and bumblebees – a Biodiversity Action Plan target plant community

Wildflower meadows are rare. Despite the 1995 Biodiversity Action Plan target of no further depletion of this habitat, they have continued to vanish from our landscape. The decline in native bumblebees, which are essential crop pollinators, particularly early in the year when hive bees are inactive, is linked to the decline in flower-rich meadows.

In the days of horse transport, the best land was used as hay meadow and all along the Middle Ouse there were extensive hay meadows and pastures. Wild flowers such as cowslips and oxeye daisies grew in profusion. Now only small pockets of flower-rich grassland remain and the connected meadow-scape essential for bumblebees

has gone. The linear landscape along the Middle Ouse provides a wonderful opportunity for re-connecting the flower-rich fragments through grassland enhancement of suitable sites.

Our research shows that this can be done on sites where the soil fertility is low by planting wildflower plugs and sowing Weald Meadow Initiative wildflower seed. Such enhancement would retain agricultural land in good condition, enabling a return to low-input farming when oil-driven agriculture is no longer possible.

3 Methods

3.1 National Vegetation Classification (NVC) survey of principal grassland habitats bordering the Middle Ouse

The NVC is the most widely used system for describing vegetation and is particularly useful in the context of the present report because it relates to soil properties and site management. We followed the methods described in Rodwell (1992). The starting point is a botanical survey, which records the abundance (determined by a visual estimate of percentage cover using the Domin scale – see Box 1, p. 13 – for a description) of all the species present in a series of sample squares (quadrats) of either 2 x 2 or 4 x 4 metres. From this dataset we assign an NVC community to the present-day grassland based on the frequency (percentage of quadrats in which each species is present) and abundance of each species. Points of difference between our data and the average for this type of grassland are noted. We can then draw conclusions about how this grassland has evolved in the context of past land use and about how it can be transformed in future.

3.2 Determination of historical land-use and flooding

The historical land use of the site was investigated through document analysis and oral history interviews with local farmers.

3.3 Selection of appropriate future management

Survey data were analysed in an historical and cultural context to enable decisions to be made on the most appropriate management with respect to biodiversity and flood alleviation for the site.

4 Site Description

4.1 Location

Spring Farm Meadow 2 lies along the main Ouse from TQ399241 to 403239 about 350 m upstream from Sheffield Bridge. It is a broad meadow, which is bounded to the north-east by an embankment along which runs the Bluebell railway and to the south-west by the main Ouse.

Great Pole Mead lies immediately upstream from Meadow 2 on a canalised section of the main Ouse from TQ396242 to 398241 with the remains of Bacon Wish Lock at the junction. The meadow is surrounded on all sides by water with a canalised section of the Ouse along the south boundary and the original course of the meandering river winding around the other three sides. At the north-west corner of

the meadow a stream from Heaven Farm joins the river at the tip of the largest meander (see Figure 2).

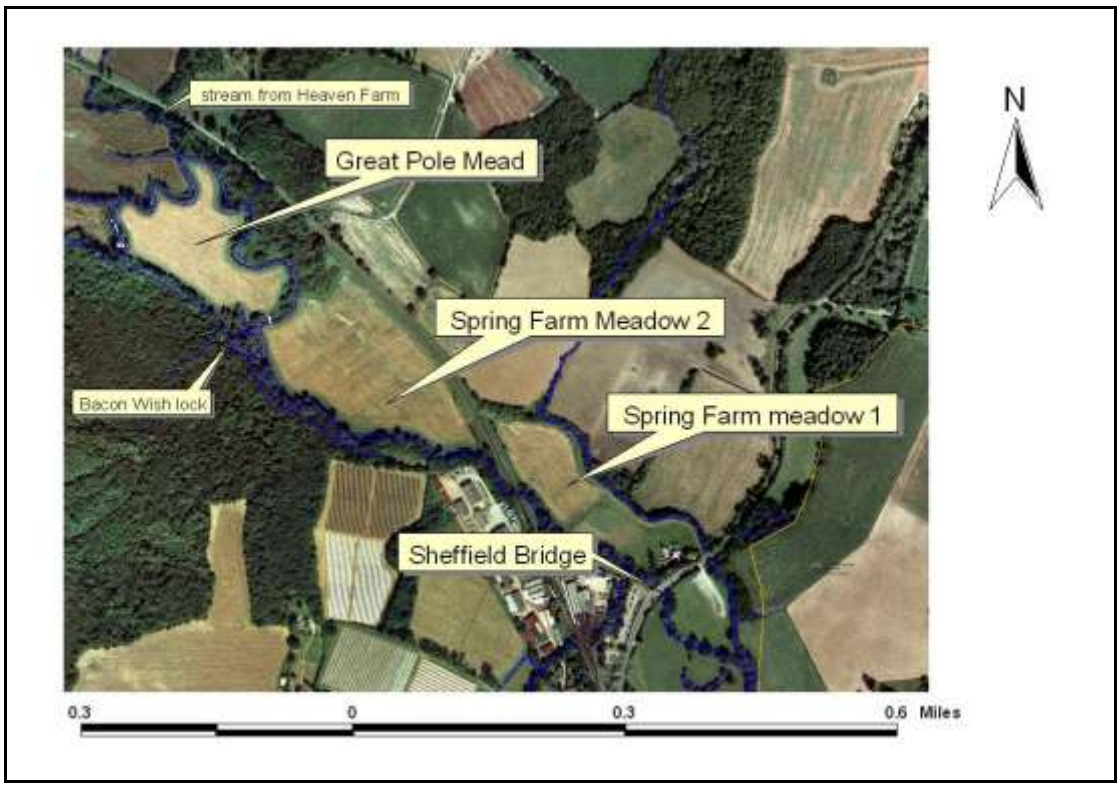

Figure 2 Location of Spring Farm meadows in relation to Sheffield Bridge.

4.2 Soil type

Most of the meadow soil is Alluvium, but the junction between Alluvium and Upper Tunbridge Wells Sand formation cuts across the meadow and is visible on the ground as a band of rush vegetation kept wet by spring water (Figure 3). This is in marked contrast to the bulk of the meadow, which has a very free-draining silty soil. Above this junction, the remaining part of the meadow rises as a low bank to the north-west. Soil pH is 6.4 in Great Pole Mead and 6.6 in Meadow 2.

4.3 Meanders and spring-fed wet areas

There are two former meanders, which are clearly visible in the aerial photo from 1947 (Figure 4), but are difficult to discern on the ground and have the same vegetation as the surrounding meadow. A band of spring-fed wetland crosses the meadow parallel to the railway embankment.

4.4 Flooding

Flooding occurs typically 2–3 times a year usually in winter (Figure 5) and normally lasts for 2–3 days. Like Iron Gates Mead the soil is free-draining as the owner explained.

> *'… it's remarkably free draining,… it's nothing like what we have here at the Home Farm where it's heavy clay, that sits wet, it seems very free draining'.*

Figure 3 Geology and soil of the site.

Figure 4 Aerial photograph of 1947, showing the old meanders.
(source: < http://www.geog.sussex.ac.uk/grc/info/sussexairphotos/1940/6-3047.jpg

Figure 5 Flooded entrance to Spring Farm Meadows photographed 23 January 2009.

5 Land use

The meadows at Spring Farm were part of an extensive band of flower-rich grassland lying alongside the river Ouse until well into the last century. Figure 6 shows the fields at the time of the Tithe map survey of 1840-41. Great Pole Mead and a large part of what is now meadow 2 was hay meadow. At the time of the Tithe survey the northern part of meadow 2 was hop garden. In 1931 all of the fields were being managed as hay meadow (Figure 7).

The fields were bought by the present owners in June 1998; prior to this they had been arable and in set-aside. The fields were left as arable reversion without re-seeding apart from spreading about 25 bales of wildflower hay in about 2002. Great Pole Mead was cut for hay in 2004, 2005 and 2006. It was grazed in 2007 and 2008. The taking of a crop of hay or haylage is important to the present owners both as a means of reducing soil fertility and as essential winter feed for their animals.

Christine's interview with the current land-owner in 2011 tells us that at the time of purchase, the fields were in a very bad state with large cracks in the ground and masses of ragwort, dock and creeping thistle. These problem weeds have been almost completely eliminated by pulling and spot treatment over several years, and Weald Meadows Initiative wildflower seed has been sown. The fields are now cut for haylage with some sheep grazing. They are currently in higher level stewardship. This year Meadow 2 was full of wildflowers as the owner told us:

> *'… the middle field, has been absolutely full of oxeye daisies this year, it was absolutely spectacular'.*

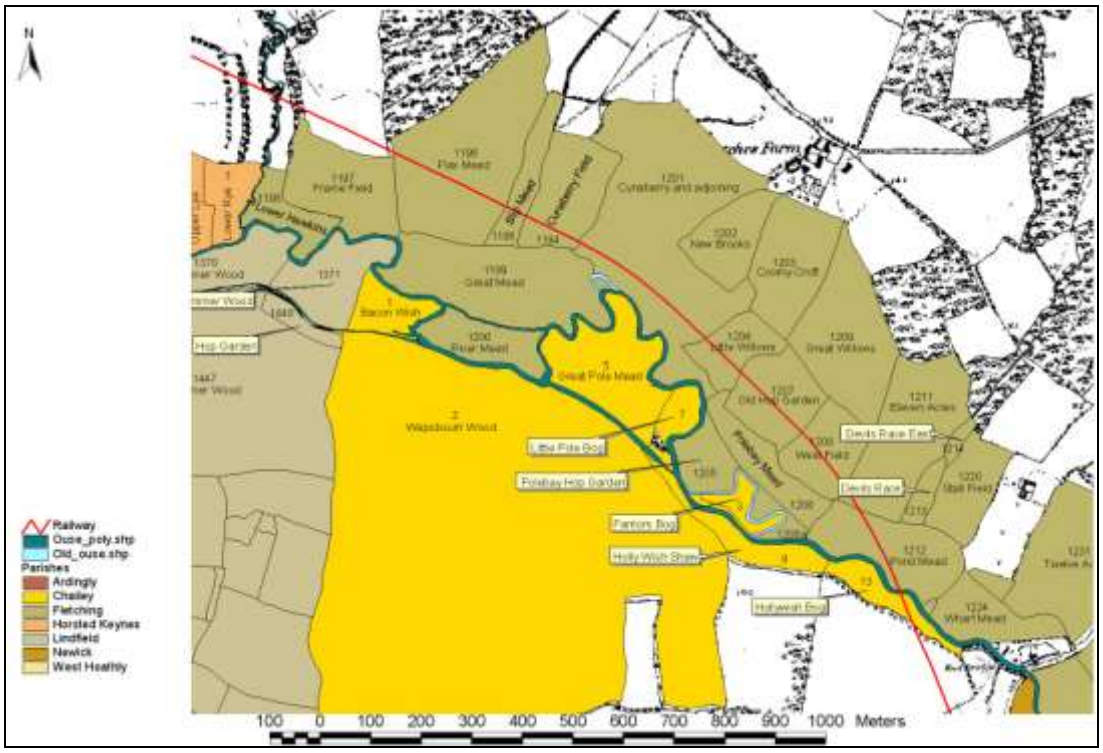

Figure 6 Map showing land use and field names compiled from the 1840-41 Tithe Map and apportionment data by Nick Steer. Tithe maps for Fletching and Newick: East Sussex Record Office: ESRO TD/E 145 and TD/E 42

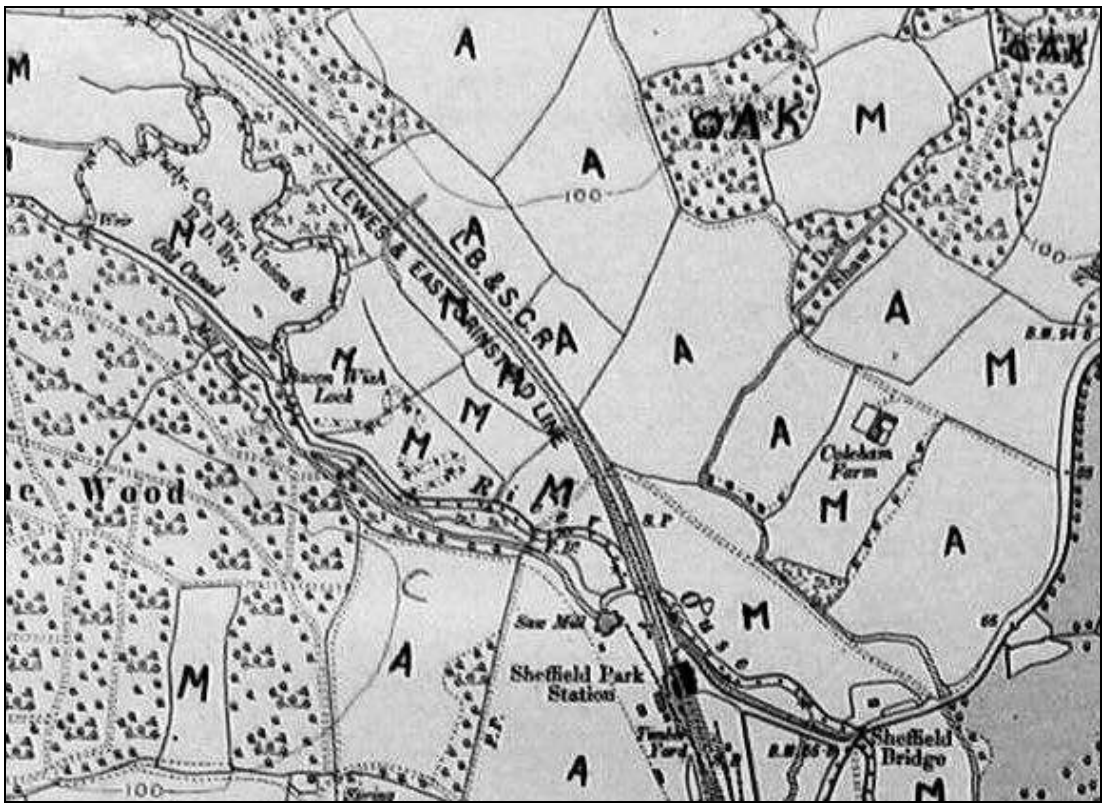

Figure 7 Part of the Land Utilisation Survey map 1931 of the Sheffield Park area. London School of Economics: LSE PA7248 Field Map/Fletching. M indicates meadow Land.

6 Botanical survey of grassland

6.1 Survey of Great Pole Mead

6.1.1 Grassland community

The results of this survey are presented in Table 1. The grassland best fitted the typical sub-community of Ryegrass–Crested Dog's-tail grassland, MG6a, in the NVC, which is characteristic of grassland managed as permanent pasture without the addition of artificial fertiliser. One constant species was lacking: red fescue.

6.1.2 Notable species

Three additional species were constant: soft brome, rough meadow grass and cut-leaved crane's-bill. Soft brome is likely to have come in the green hay that was spread; and the meadow grass and crane's-bill probably arrived naturally during the process of arable reversion.

6.1.3 Number of species per quadrat

There was an average of 16 species per quadrat, with a range of 10 to 17. This is more species-rich than the standard table for MG6a – 13 (9-20).

6.1.4 Relationship with other grassland communities

This type of grassland develops from agriculturally-improved grassland when the soil fertility is gradually reduced by treatment as permanent pasture without the addition of artificial fertiliser. In this case a similar process has taken place by arable reversion with soil fertility being reduced through removal of nutrients in the hay crop combined with sheep grazing (Figure 8).

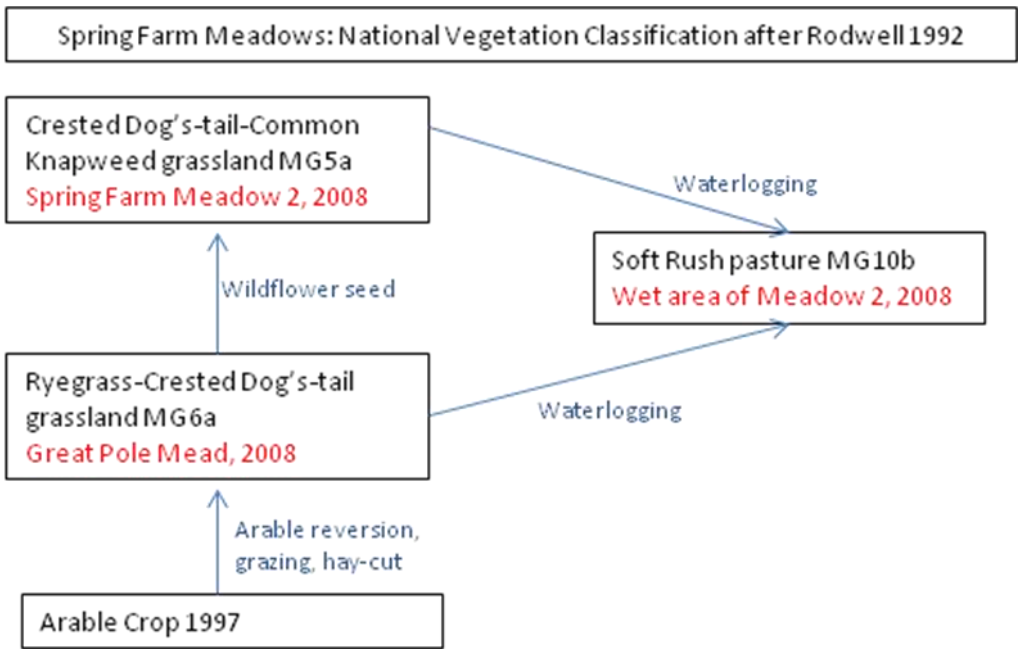

Figure 8 Summary NVC diagram showing relationship between three types of grassland community in Spring Farm Meadows.

Table 1 Results of botanical survey in Great Pole Mead (TQ397242), 19 June 2008. Fourteen samples (quadrats), each 4 m x 4 m, were surveyed and the summarised results show Frequency and range of Domin Values for each species. See Box 1 (p. 13) for explanations.

English name	Scientific name	Frequency and Domin range
Bent grasses	*Agrostis* spp.	V (5–10)
Soft Brome	*Bromus hordeaceus*	V (3–9)
Creeping Thistle	*Cirsium arvense*	V (2–7)
Cut-leaved Crane's-bill	*Geranium dissectum*	V (2–4)
Yorkshire Fog	*Holcus lanatus*	V (6–8)
Perennial Rye Grass	*Lolium perenne*	V (2–7)
Rough Meadow Grass	*Poa trivialis*	V (1–5)
White Clover	*Trifolium repens*	V (4–9)
Lesser Trefoil	*Trifolium dubium*	IV (1–4)
False Oat-grass	*Arrhenatherum elatius*	III (1–4)
Common Mouse-ear	*Cerastium fontanum*	III (1–3)
Creeping buttercup	*Ranunculus repens*	III (3–7)
Curled Dock	*Rumex crispus*	III (1)
Broad-leaved Dock	*Rumex obtusifolius*	III (1–3)
Cock's-foot	*Dactylis glomerata*	II (1–3)
Meadow buttercup	*Ranunculus acris*	II (1–2)
Dandelion	*Taraxacum officinale*	II (1–2)
Red Clover	*Trifolium pratense*	II (3)
Common Nettle	*Urtica dioica*	II (1–3)
Common Bent	*Agrostis capillaris*	I (4)
Creeping Bent	*Agrostis stolonifera*	I (4)
Agrimony	*Agrimonia eupatoria*	I (1)
Marsh Foxtail	*Alopecurus geniculatus*	I (3)
Crested Dog's-tail	*Cynosurus cristatus*	I (1)
Soft Rush	*Juncus effusus*	I (1)
Greater Bird's-foot-trefoil	*Lotus pedunculatus*	I (4)
Timothy	*Phleum pratense*	I (3–4)
Selfheal	*Prunella vulgaris*	I (2)
Prickly Sow-thistle	*Sonchus asper*	I (1)
Lesser Stitchwort	*Stellaria graminea*	I (1)
Upright Hedge-parsley	*Torilis japonica*	I (1)
Germander Speedwell	*Veronica chamaedrys*	I (3)
Thyme-leaved Speedwell	*Veronica serpyllifolia*	I (3)
Smooth Tare	*Vicia tetrasperma*	I (1)
Meadow foxtail	*Alopecurus pratensis*	In field
Hogweed	*Heracleum sphondylium*	In field
Square-stalked St John's-wort	*Hypericum tetrapterum*	In field
Common Sorrel	*Rumex acetosa*	In field
Common Vetch	*Vicia sativa*	In field
pH 6.4–6.6		

Box 1
Frequency
I – occurs in 1-20% of samples; II – occurs in 21-40% of samples; III – occurs in 41-60% of samples; IV – occurs in 61-80% of samples; V – occurs in 81-100% of samples.
Domin values: percentage cover being assessed by eye in each sample
10, 91-100%; 9, 76-90%; 8, 51-75%; 7, 34-50%, 6, 26-33%, 5, 11-25%; 4, 4-10%; 3, <4% with many individuals; 2, <4% with several individuals; 1, <4% with few individuals.

6.2 Survey of Spring Farm Meadow 2

6.2.1 Grassland community

The results are presented in Table 2. The grassland best fitted the typical sub-community of Crested Dog's-tail – Common Knapweed grassland, MG5a, in the NVC. Some MG5 constant species were absent: red fescue, cat's-ear and meadow vetchling. Although creeping thistle occurred in every sample and two species of dock appeared in about half the samples at the time of our survey, the owners continued with weed control and, as a result, these species were markedly less frequent and abundant 3 years later (in 2011) when Dawn Brickwood of the High Weald Meadow Initiative visited the site and was impressed with the lack of dock and thistles. This is now a species-rich hay meadow grassland and demonstrates the success of the owner's thistle and dock control and their sowing of wildflower seed

6.2.2 Notable species

As in Great Pole Mead, rough meadow grass and soft brome were constant.

6.2.3 Number of species per quadrat

There were between 7 and 25 species per quadrat, with an average of 19. This is not quite as species-rich as that given in the standard table for MG5a: an average of 22 with a range of 13 to 32.

6.2.4 Relationship with other grassland communities

This community has developed by arable reversion in which the soil fertility has been gradually reduced through hay cutting and grazing without the application of artificial fertilizer. Sweet vernal-grass and the characteristic wildflowers of the MG5a community were added by sowing wildflower seed (Figure 8).

7 Botanical survey of wet area in Meadow 2

7.1.1 Grassland community

The grassland in the wet spring-fed area of meadow 2 fits best NVC MG10b, the Hard Rush subcommunity of Rush Pasture community with hard rush and hairy sedge (Figure 9). The results are presented in Table 3.

7.1.2 Notable species

Floating sweet grass was constant and there was a high frequency of soft brome and lesser trefoil. Gipsywort and burnet-saxifrage were present.

Table 2 Results of botanical survey in Meadow 2 (TQ400240), 18 June 2008. Twelve samples (quadrats), each 4 m x 4 m, were surveyed and the summarised results show Frequency and range of Domin Values for each species. See Box 1 (p. 13) for explanations of Domin Range and Frequency.

English name	Scientific name	Frequency and Domin value range
Bent grasses	*Agrostis* spp.	V (7–10)
Soft Brome	*Bromus hordeaceus*	V (1–7)
Creeeping Thistle	*Cirsium arvense*	V (3–6)
Crested Dog's-tail	*Cynosurus cristatus*	V (1–5)
Yorkshire Fog	*Holcus lanatus*	V (2–7)
Perennial Rye Grass	*Lolium perenne*	V (1–5)
Common Bird's-foot-trefoil	*Lotus corniculatus*	V (1–4)
Rough Meadow Grass	*Poa trivialis*	V (2–5)
White Clover	*Trifolium repens*	V (1–8)
Cut-leaved Crane's-bill	*Geranium dissectum*	IV (1–3)
Oxeye Daisy	*Leucanthemum vulgare*	IV (1–4)
Ribwort Plantain	*Plantago lanceolata*	IV (1–4)
Lesser trefoil	*Trifolium dubium*	IV (1–5)
Sweet Vernal-grass	*Anthoxanthum odoratum*	III (2–4)
Common Knapweed	*Centaurea nigra*	III (1–4)
Common Mouse-ear	*Cerastium fontanum*	III (1–3)
Greater Bird's-foot-trefoil	*Lotus pedunculatus*	III (1–4)
Meadow buttercup	*Ranunculus acris*	III (1–3)
Creeping buttercup	*Ranunculus repens*	III (1-7)
Curled Dock	*Rumex crispus*	III (1–2)
Broad-leaved Dock	*Rumex obtusifolius*	III (1–3)
Dandelion	*Taraxacum officinale*	III (1–2)
Red Clover	*Trifolium pratense*	III (1–3)
Squirrel-tail Fescue	*Vulpia bromoides*	III (3–5)
Timothy	*Phleum pratense*	II (1–3)
Common Vetch	*Vicia sativa*	II (1–2)
Meadow foxtail	*Alopecurus pratensis*	I (3–4)
Rough-stalked Feather-moss	*Brachythecium rutabulum*	I (3)
Cock's-foot	*Dactylis glomerata*	I (1)
Holcus mollis	*Creeping Soft-grass*	I (4)
Soft Rush	*Juncus effusus*	I (2)
Hard Rush	*Juncus inflexus*	I (2)
Changing Forget-me-not	*Myosotis discolor*	I (3)
Burnet-saxifrage	*Pimpinella saxifraga*	I (1)
Selfheal	*Prunella vulgaris*	I (1)
Common fleabane	*Pulicaria dysenterica*	I (1)
Common Sorrel	*Rumex acetosa*	I (1)
Prickly Sow-thistle	*Sonchus asper*	I (1)
Lesser Stitchwort	*Stellaria graminea*	I (1)
Thyme-leaved Speedwell	*Veronica serpyllifolia*	I (1–3)
Tufted Vetch	*Vicia cracca*	I (3)
Smooth Tare	*Vicia tetrasperma*	I (3)
Heath Speedwell	*Veronica officinalis*	I (1)
Hairy Sedge	*Carex hirta*	In field
Spear Thistle	*Cirsium vulgare*	In field
Common Nettle	*Urtica dioica*	In field
pH 6.6–6.7		

Table 3 Results of botanical survey in Wet Area of Spring Farm Meadows (TQ401241), 19 June 2008. Three samples (quadrats), each 4 m x 4 m, were surveyed and the summarised results show Frequency and range of Domin Values for each species. See Box 1 (p. 13) for explanation of Domin Range and Frequency		
English name	**Scientific name**	**Frequency and Domin value range**
Creeping Bent	*Agrostis stolonifera*	V (5–9)
Floating Sweet Grass	*Glyceria fluitans*	V (2–7)
Hard Rush	*Juncus inflexus*	V (4–8)
Creeping Buttercup	*Ranunculus repens*	V (3–5)
Broad-leaved Dock	*Rumex obtusifolius*	V (1–3)
White Clover	*Trifolium repens*	V (2–5)
Soft Brome	*Bromus hordeaceus*	IV (4)
Hairy Sedge	*Carex hirta*	IV (5–7)
Soft Rush	*Juncus effusus*	IV (4–5)
Rough Meadow Grass	*Poa trivialis*	IV (3)
Lesser Trefoil	*Trifolium dubium*	IV (3)
Marsh Foxtail	*Alopecurus geniculatus*	II (5)
Sweet Vernal-grass	*Anthoxanthum odoratum*	II (3)
Common Mouse-ear	*Cerastium fontanum*	II (1)
Creeping Thistle	*Cirsium arvense*	II (2)
Common Marsh-bedstraw	*Galium palustre*	II (5)
Yorkshire Fog	*Holcus lanatus*	II (1)
Jointed Rush	*Juncus articulatus*	II (4)
Common Bird's-foot-trefoil	*Lotus corniculatus*	II (1)
Greater Bird's-foot-trefoil	*Lotus pedunculatus*	II (5)
Gipsywort	*Lycopus europaeus*	II (1)
Ribwort Plantain	*Plantago lanceolata*	II (1)
Meadow Buttercup	*Ranunculus acris*	II (1)
Common Sorrel	*Rumex acetosa*	II (1)
Dandelion	*Taraxacum officinale*	II (1)
Common Nettle	*Urtica dioica*	II (1)
Thyme-leaved Speedwell	*Veronica serpyllifolia*	II (1)
Common Knapweed	*Centaurea nigra*	In area
Perennial Rye Grass	*Lolium perenne*	In area
Burnet-saxifrage	*Pimpinella saxifraga*	In area

7.1.3 Number of species per quadrat

There was an average of 16 species per quadrat, with a range of 11 to 18. This is consistent with that given in the standard table for MG10b: an average of 15 and a range of 8-24.

7.1.4 Relationship with other grassland communities

This type of rush pasture develops in waterlogged areas of MG5a or MG6 grassland (See Figure 8) on relatively base-rich soils.

Figure 9 Hairy sedge in wet area of Meadow 2.

8 Conclusions from our research

8.1 General comments

These meadows have a similar free-draining soil to Iron Gates Mead (Pilkington *et al*., 2011), but do not retain an unploughed soil structure. No fertiliser has been applied for 13 years and careful management has led to wildlife habitat recovery following a period of arable cultivation. This is most marked in Meadow 2 where some wildflower seed sowing has resulted in MG5a hay-meadow vegetation.

8.2 Potential for grassland enhancement

The potential for grassland enhancement in Great Pole Mead is good following 13 years without fertiliser application and with hay cuts taken in most years since 2004.

In 2011, volunteers planted 3000 wildflower plugs into a small area of Great Pole Mead and Weald Meadow Initiative wildflower seed was sown over the same area (Figure 10). Green hay from this area will be spread on strips of meadow in subsequent years, so that the species-rich vegetation is 'rolled out' across the whole meadow.

8.3 Potential for flood alleviation

As flash washlands these meadows already provides flood alleviation.

The Environment Agency is looking at the possibility of re-instating the cut-off meanders in meadow 2. We think that this is a good idea provided the following precautions are taken:

1. The soil of the meadow is not compacted by heavy machinery. We understand that the plan is to take machinery in along the route of the meanders, which should prevent this happening.

2. The meadow vegetation is not disturbed by digging and that no spoil from the meanders is spread on top because this would allow the ragwort, dock and creeping thistle so painstakingly removed from the meadow to return.
3. Hydrological modelling shows that slowing down the flow of water at this point in the catchment will not increase the risk of flooding in Lewes.

Figure 10 Volunteers planting plugs into Great Pole Mead (photo: John Prodger).

8.4 Discussion of Royal Haskoning suggestions

The Royal Haskoning Report (2009) makes the following suggestions for Spring Farm Meadow 2:

1. 'Re-instate the meander upstream of the railway' See comment under 8.3.
2. 'the potential to re-profile the banks and create buffer strips should also be investigated'. This would disturb the existing meadow vegetation, so it is critical that soil compaction is avoided and subsequent Weald Meadow Initiative wildflower seed sowing is carried out to prevent the return of creeping thistle and dock.

In addition, the report (p. 46) suggests under 'potential for biodiversity improvement' that there will be significant benefits from the 'creation of wetland habitat'. This is unlikely as the soil over most of the area is very free-draining.

8.5 Other considerations: the Hammerdip

The stream that runs along the north-east side of Spring Farm meadow 1 continues below Sheffield Park bridge and runs along the north side of Iron Gates Mead (see Pilkington *et al.,* 2011) before entering the main Ouse at the north-east corner of Iron Gates. This stream rises in Circle Wood to the north of Ketches Lane and originally flowed into the Ouse at the north-west end of Spring Farm Meadow 1 before it was diverted through 90 degrees to its present course. A report prepared by the River Restoration Trust (2000) suggested that this stream could be used to create wetland but we understand that this is no longer being considered. This is fortunate because the stream makes a substantial contribution to the flooding of Iron Gates: a point that seems to have been overlooked.

9 References

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