Broad Mead: a riverside meadow in Sheffield Park, East Sussex

River Ouse Project Report No. 3

Centre for Community Engagement
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The Leverhulme Trust

Front cover Broad Mead with spring-fed wet area of rushes and lady's-smock; meadow foxtail is in the foreground.

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. Section 6 describes 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 7.

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.

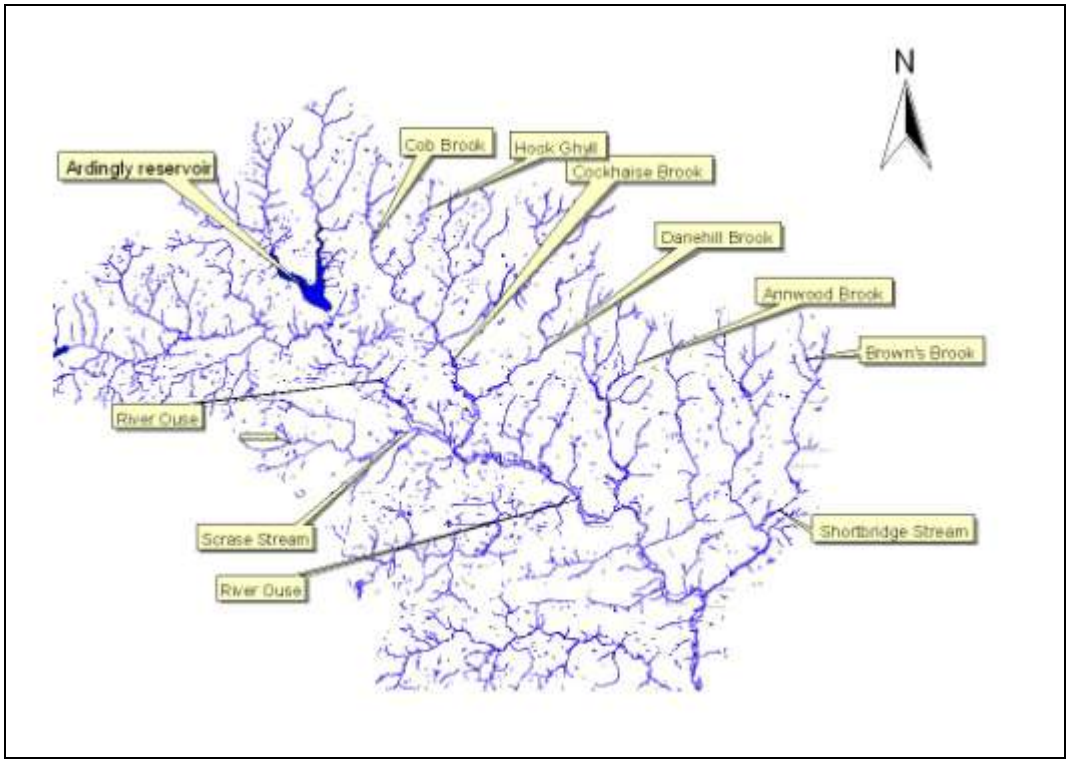

Figure 1. The stream system that feeds into the upper reaches of the river Ouse.

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

Broad Mead is a heart-shaped meadow (21 acres) that lies along the north side of a deep, v-shaped curve in the river Ouse from TQ407233 to 413229. Broad Mead is immediately downstream from Iron Gates Mead (Pilkington *et al*., 2011) with a short boundary on the west side with Lower Welsh Mead. A ditch runs along the north side and a stream from the lower lakes in Sheffield Park Garden runs for a short distance along the east side before joining the main Ouse (Figure 2).

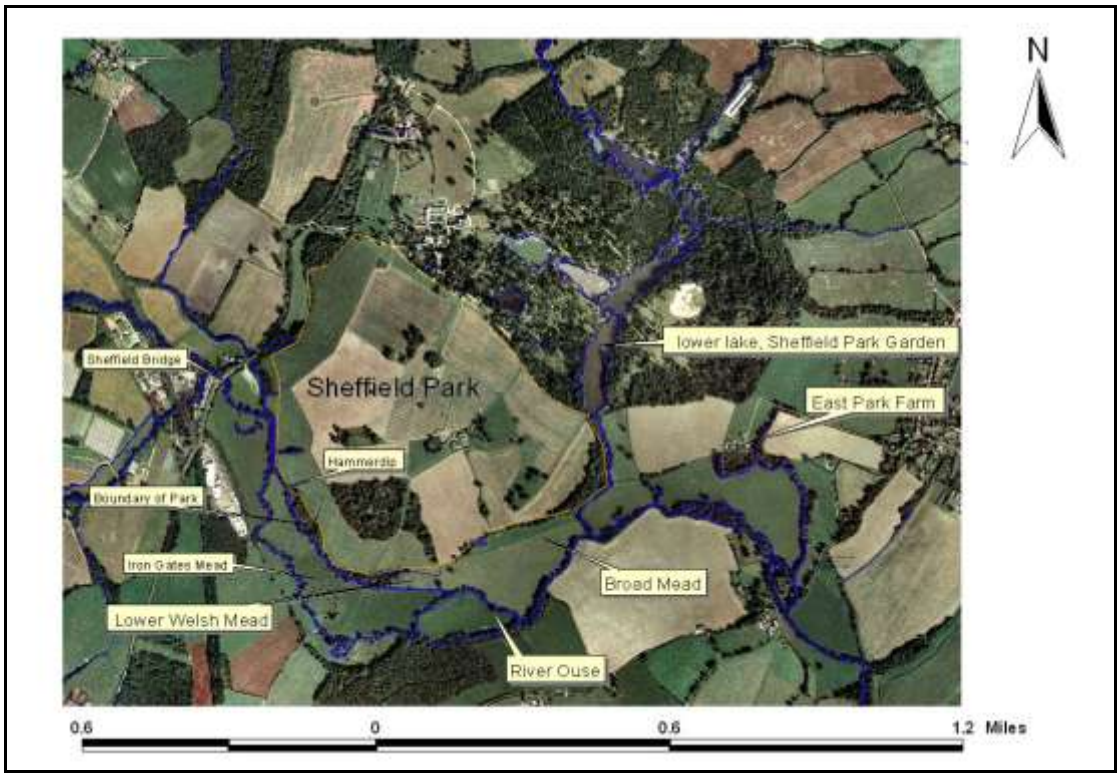

Figure 2 Location of Broad Mead.

4.2 Soil type

The soil is Alluvium lying within the Upper Tunbridge Wells Sand formation (Figure 3). The soil pH is 6.5. Unlike Iron Gates, the soil is heavy and not so free-draining, as the farmer explained:

> *'Broad Mead was some of the heaviest soil on the farm.'*

4.3 Meanders and spring-fed wet areas

A spring-fed wetland area, showing up as darker green in Figure 2, forms a broad band along much of the northern end of the meadow, There are no meanders.

4.4 Flooding

Flooding occurs typically 2–3 times a year usually in winter (Figure 4) and normally lasts for 2–3 days. The meadow floods from the stream along the eastern side long before water over-tops the banks along the main Ouse. The meadow rises slightly towards the main Ouse, so that it is possible for animals to be trapped here by floodwaters from the stream forming a barrier across the meadow:

> *'I've ... got sheep back ... and cattle.... it's actually downhill away from the river so their escape route gets cut off, they keep going to higher ground but you've actually then got to get through the water to get out.'*

Interestingly, the spring-fed wetland area in the north part of the meadow usually remains above the floodwaters.

Figure 3 Geology and soil of the site.

Figure 4 Broad Mead under floodwater.

5 Land use

Broad Mead was part of an extensive band of flower-rich grassland lying alongside the river Ouse until well into the last century. It was managed as hay meadow, retaining its species-richness until World War II when the tenant farmer was required to plough up and grow arable crops.

> *'the war agricultural committee made them plough up, but they made such a mess of it that it didn't produce anything.'*

In 2005, the tenancy agreement was terminated by the owner, Sackville-West of Knowle and in October 2006 the land was sold to the National Trust. Following this, Broad Mead was managed with a silage cut followed by cattle grazing until 2010, when the National Trust negotiated a new agreement. No silage cut or grazing took place in the summer/autumn of 2010 but grazing was reinstated in 2011, mostly with sheep. A hay cut took place in August 2011.

Figure 5 shows Broad Mead marked on the Sheffield Park Estate Map of 1816. Figure 6 shows it as it appeared as meadow on the Tithe Map of 1840-41, where it is labelled Round Mead. Figure 7 shows Broad Mead as a meadow on the Land Utilisation Survey map of 1931 and Figure 8 shows Broad Mead in the aerial photograph of 1947.

Figure 5. Part of Sheffield Park Estate Map 1816 by William Ebden showing Broad Mead.

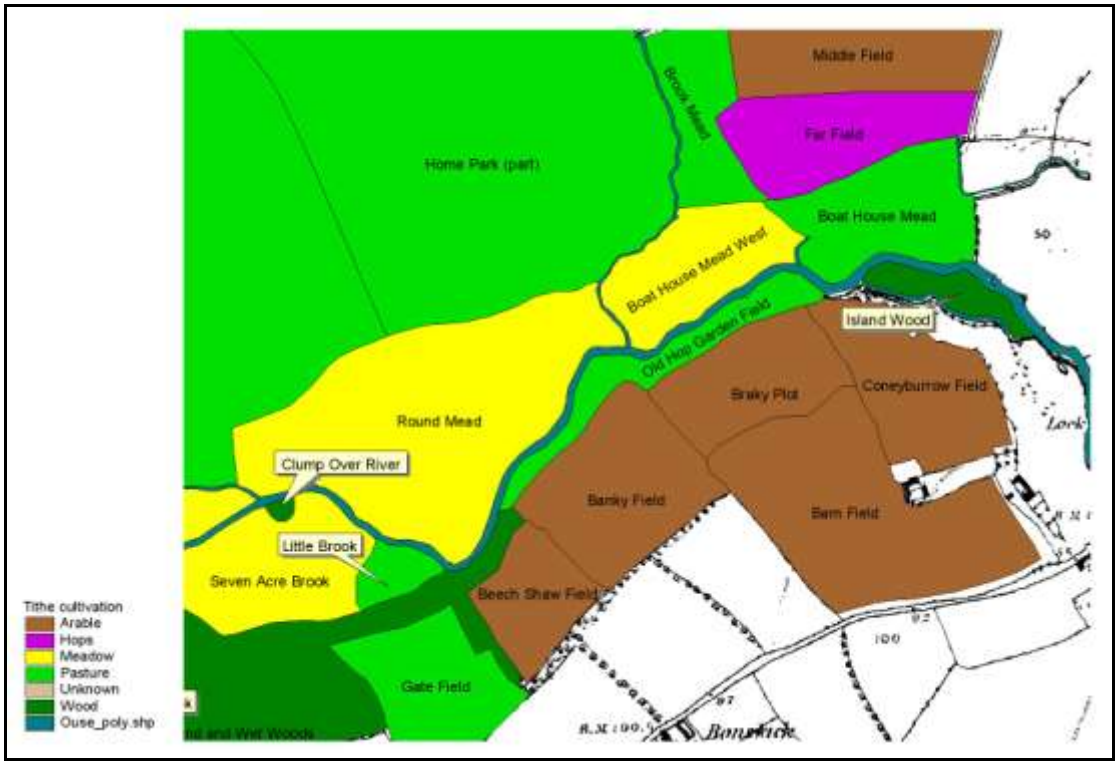

Figure 6 Map showing land use and field names compiled from the 1840-41 Tithe Map and apportionment data by Nick Steer. Tithe maps for Fletching and Newick: East Sussex Record Office: ESRO TD/E 145 and TD/E 42. Broad Mead is labelled as Round Mead.

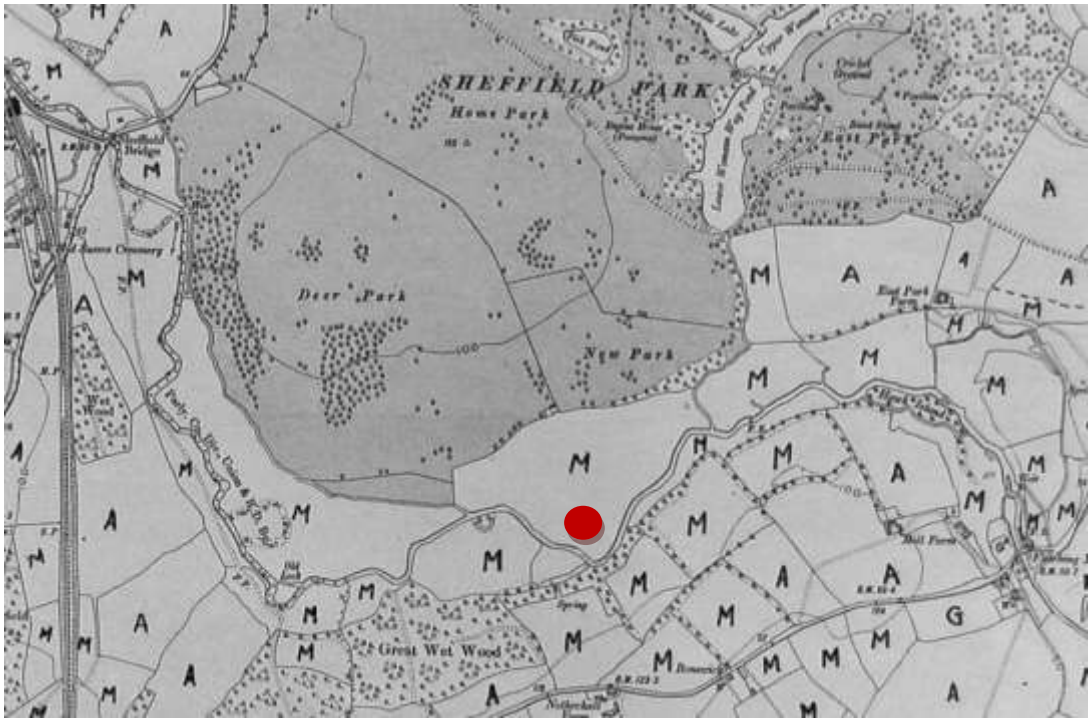

Figure 7 Part of the Land Utilisation Survey map 1931 of the Sheffield Park area. London School of Economics: LSE PA7248 Field Map/Fletching. M indicates meadow Land. Broad Mead

Figure 8. Aerial photograph of Sheffield Park in 1947. Broad Mead

6 Botanical survey of grassland

6.1 Survey of Broad Mead

6.1.1 Grassland community

A botanical survey in 2008 revealed that the grassland best fitted the NVC MG6a Ryegrass–Crested Dog's-tail grassland (Table 1). This community is characteristic of grassland managed as permanent pasture without the addition of artificial fertiliser. One constant species, crested dog's-tail, was lacking. Creeping thistle, dock and dandelion were constant.

6.1.2 Notable species

In addition to the characteristic species of the MG6a community, several hay-meadow species (found in MG5 Crested Dog's-tail–Common Knapweed grassland along the Ouse) were present in at least one quadrat: bugle, oxeye daisy and fleabane.

These may have survived in the seed bank during the years when the field was arable. The particular species of ryegrass, *Lolium multiflora*, which is characteristic of Ryegrass–White Clover sown grassland was present in more than half the quadrats – no doubt surviving from the sowing in the late 1970s or early 1980s as the farmer explained:

> *'I kept it as arable for several years and then my son put it down to grass again – in late seventies or early eighties.'*

Table 1 Results of botanical survey in Broad Mead, 25 & 26 June 2008. Twenty-eight 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**
Creeping Bent	*Agrostis stolonifera*	V (see note below)
Yorkshire Fog	*Holcus lanatus*	V (3–8)
Smooth Meadow Grass	*Poa pratensis*	V (3–9)
Creeping Buttercup	*Ranunculus repens*	V (3–9)
Broad-leaved Dock	*Rumex obtusifolius*	V (1–7)
Dandelion	*Taraxacum officinale*	V (2–4)
White Clover	*Trifolium repens*	V (3–6)
Creeping Thistle	*Cirsium arvense*	IV (1–6)
Cut-leaved Crane's-bill	*Geranium dissectum*	IV (1–4)
Perennial Rye Grass	*Lolium perenne*	IV (3–6)
Rough Meadow Grass	*Poa trivialis*	IV (3–8)
Common Bent	*Agrostis capillaris*	III (see note below)
Soft Brome	*Bromus hordeaceus*	III (1–7)
Italian Rye Grass	*Lolium multiflorum*	III (2–5)
Red Clover	*Trifolium pratense*	II (1–3)
Common Nettle	*Urtica dioica*	II (1–5)
Bugle	*Ajuga reptans*	I (2-4)
Marsh Foxtail	*Alopecurus geniculatus*	I (2–3)
Meadow Foxtail	*Alopecurus pratensis*	I (3–5)
False Oat-grass	*Arrhenatherum elatius*	I (2)
Common Knapweed	*Centaurea nigra*	I (2)
Common Mouse-ear	*Cerastium fontanum*	I (1–3)
Beaked Hawk's-beard	*Crepis vesicaria*	I (2)
Cock's-foot	*Dactylis glomerata*	1 (2)
Tufted Hair-grass	*Deschampsia caespitosa*	I (2–3)
Great Willowherb	*Epilobium hirsutum*	I (1)
Red Fescue	*Festuca rubra*	I (3–5)
Common Marsh-bedstraw	*Galium palustre*	I (2)
Cat's-ear	*Hypochaeris radicata*	I (1)
Soft Rush	*Juncus effusus*	I (3)
Oxeye Daisy	*Leucanthemum vulgare*	I (1–3)
Water Mint	*Mentha aquatica*	I (1)
Timothy	*Phleum pratense*	I (2)
Greater Plantain	*Plantago major*	I (2)
Common Fleabane	*Pulicaria dysenterica*	I (3–4)
Meadow Buttercup	*Ranunculus acris*	I (1)
Bramble	*Rubus fruticosus*	I (2–4)
Common Sorrel	*Rumex acetosa*	I (1)
Rumex crispus	*Curled Dock*	I (1)
Common Ragwort	*Senecio jacobaea*	I (1)
Sow-thistle	*Sonchus* sp.	I (1–4)
Germander Speedwell	*Veronica chamaedrys*	I (3)

Note: The Domin values for these species were not recorded because of difficulty in separating them.

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.

There was an average of 13 species per quadrat, with a range of 9 to 18. This is consistent with 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.

6.2 Survey of spring-fed wet area

This area was walked and the species present were listed but no estimates of abundance were recorded. The species list is given in Table 2. Lady's-smock is particularly abundant in this area and supports a thriving population of orange-tip butterflies, which use the flowers as a nectar source (Figure 9). Mating and egg-laying have been observed and subsequently the caterpillars feed on the flowers and developing fruits.

Table 2 Species list for spring-fed wet area

English name	***Scientific name***
Creeping bent	*Agrostis stolonifera*
Lady's-smock	*Cardamine pratense*
Hairy sedge	*Carex hirta*
Floating Sweet Grass	*Glyceria fluitans*
Yorkshire Fog	*Holcus lanatus*
Sharp-flowered Rush	*Juncus acutiflorus*
Soft Rush	*Juncus effusus*
Greater Bird's-foot-trefoil	*Lotus pedunculatus*
Meadow Buttercup	*Ranunculus acris*
Lesser Spearwort	*Ranunculus flammula*
Creeping buttercup	*Ranunculus repens*
Common Sorrel	*Rumex acetosa*

Figure 9 Orange-tip butterfly feeding on lady's-smock.

7 Conclusions from our research

7.1 General comments

This is not such a special meadow as Iron Gates (Pilkington *et al*., 2011) because it was ploughed up during the war and was used for arable crops for about 40 years before being returned to permanent grassland in the late 1970s. However, it still retains some of its former hay-meadow species because, unlike Iron Gates, it has not been treated with herbicide. Soil fertility is low, making it ideal for grassland enhancement.

7.2 Potential for grassland enhancement

Like Great Pole Mead, which was also arable in the past and has reverted to Ryegrass–Crested Dog's-tail grassland (Pilkington *et al*., 2012), this meadow has good potential for grassland enhancement. In 2011, following thistle and dock treatment, volunteers planted wildflower plugs into Broad Mead and a small area was sown with Weald Meadow Initiative Seed (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.

7.3 Potential for flood alleviation

As a flash washland this meadow already provides flood alleviation. It floods mainly from the stream along its eastern boundary, which is in fact an extensive tributary, one branch of which rises in Chelwood Gate, another branch in Chelwood Common, three branches in Sheffield Forest area of woodland, including Annwood Brook (Figure 1), and a final branch at Holmesdale Farm. It then flows down through the

two lower lakes in Sheffield Park Gardens. As well as flooding Broad Mead, this stream also floods streamside meadows in East Park Farm on its east side, thus holding back a considerable body of water from entering the main Ouse at times of peak flow. The main Ouse upstream from this point may also flood into Broad Mead.

Figure 10 Volunteers planting plugs into Broad Mead.

7.4 Discussion of Royal Haskoning suggestions

The Royal Haskoning Report (2009) made the following suggestion for Broad Mead:

1. 'The potential to create floodplain scrapes should be investigated.' The soil of Broad Mead is more suitable for scrapes than Iron Gates, but it is still predominately dry grassland over most of the area. Scrapes need to be located carefully where there are already patches of rushes and other wetland plants, such as water mint and marsh bedstraw. They should also be created in such a way that cutting of the restored hay meadow is not impeded. The existing spring-fed wetland with its population of orange-tip butterflies should not be disturbed.

8 References

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