ECO-HYDROLOGICAL SURVEY OF HUNSDON MEAD SSSI – UNIT 2, ROYDON MEAD 2015 - 2017

FLOODPLAIN MEADOWS PARTNERSHIP AMBASSADOR PROGRAMME

SPRING VIEW OF ROYDON MEAD (2015)

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1. EXECUTIVE SUMMARY

Roydon Mead is part of Hunsdon Mead SSSI, designated for its floodplain meadow plant communities. It is one of the remaining sites in the area still managed on the ancient Lammas system of hay making followed by winter grazing.

Roydon Mead is the smaller of the two units of the SSSI and is a complex of meadows, privately owned, that seasonally flood from the Canons Brook. High nutrients levels and waterlogging have been known issues on the site and may be a threat to the existing plant communities.

This 2 year study was lead as part of the Floodplain Meadow Partnership Ambassador programme. Its aim was to study the different aspects influencing the ecology of floodplain meadows, understand a site and make informed management recommendations.

The conclusions of this study reinforced the known issues and hopefully underpinned it with useful data. The main grassland community still shows an interesting list of positive MG4 indicator species and indeed some part of the site display a species rich sward. Other parts of the site though suffer from the water logging and the high nutrient levels and this reflects in the plant community with a seasonal shift between an MG4c and MG15b community, both being at the higher end of both the water and fertility spectrum.

Management recommendations have been made to address both issues and hopefully help the site to recover towards a species rich floodplain meadow. These were of two types:

- Restore surface drainage, to avoid water pooling, especially after summer flood events. This can be achieved by maintaining existing ditches, which hadn't been done for decades. Once restored, this will not need to be carried out again for a while.
- Reduce nutrient input by continuing working on the Diffuse Water Pollution Plan but also improve the nutrient removal by considering an earlier hay cut.

Figure 1. One of the many positive experiences from the FMP Ambassador programme was to work with many skilled and experienced people. Left: Irina Tatarenko and Emma Rothero from the Floodplain Meadow Partnership. Right: Neil Fuller (Natural England) and Emma Rothero

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2. INTRODUCTION

2.1. Floodplain Meadow Partnership Ambassador programme

The Floodplain Meadow Partnership (http://www.floodplainmeadows.org.uk) developed the Ambassador programme in 2015 thanks to a grant from the Esmée Fairbairn Foundation. The programme was offered as a training opportunity to people across the country and across a wide range of organisations involved in conservation, to understand more about floodplain meadows, their ecology and their management.

Ambassadors have undergone a two year vocational training programme to better understand the eco-hydrology of floodplain meadows. By the end of the course, Ambassadors gained a better understanding of floodplain meadow site and were better able to give advice on management and restoration of floodplain meadows. Once the training completed, the participants will act as ambassadors for the Floodplain Meadow Partnership (FMP).

Each Ambassador worked on a chose site for the period of the programme. This report is the summary of the tasks and results from the study I undertook on Roydon Mead (Unit 2 of Hunsdon Mead SSSI) as part of the Floodplain Meadow Partnership Ambassador Programme in 2015-17.

The study on my chosen site started in May 2015 and finished in July 2017.

2.2. Hunsdon Mead SSSI - Context

The complex of meadows of Hunsdon Mead are designated as a SSSI.

The SSSI is divided into two units:

- Unit 1, Hunsdon Mead

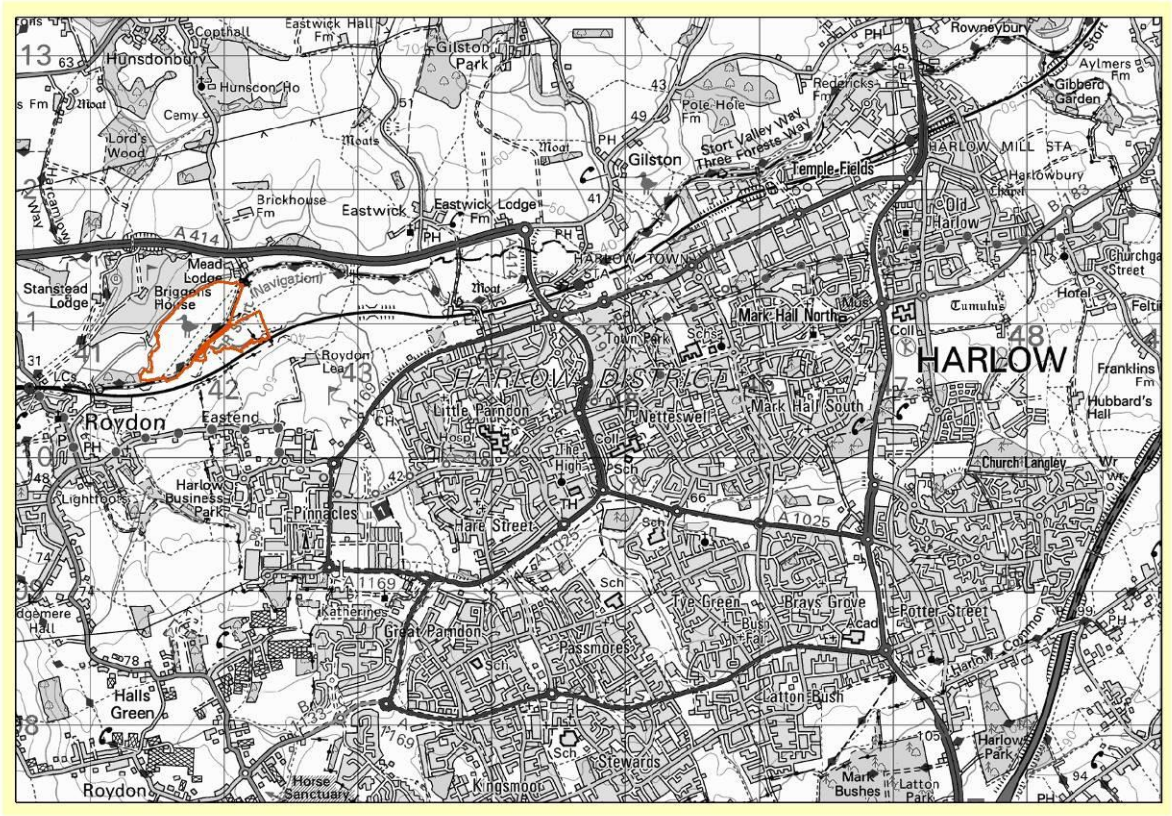
Hunsdon Mead lies just inside the Hertfordshire border between the Stort Navigation and the old River Stort, just to the west of Harlow. It is a registered Common and covers about 26.5 ha. It is managed by the Wildlife Trust.

- Unit 2, Roydon Mead

Roydon Mead, which is in Essex, lies to the east of Hunsdon Mead and is separated from it by the Stort Navigation. It is under private ownership and is composed of three meadows, divided by ditches and hedges. These meadows cover about 7.5 ha.

Together they form a large area of unimproved grassland on alluvial soils subject to occasional winter flooding. The SSSI is notified for its MG4 *Alopecurus pratensis – sanguisorba officinalis* and MG5 *Cynosurus cristatus – Centaurea nigra* grassland. The Citation summarises well their importance in the area:

"Hunsdon Mead […] is one of the last remaining sites in Essex or Hertfordshire to still be managed on the ancient Lammas system of hay making followed by winter grazing. Roydon Mead, which is in Essex, lies to the east of Hunsdon Mead and is separated from it by the Stort Navigation. Together they form a large area of unimproved grassland on alluvial soils subject to occasional winter flooding."



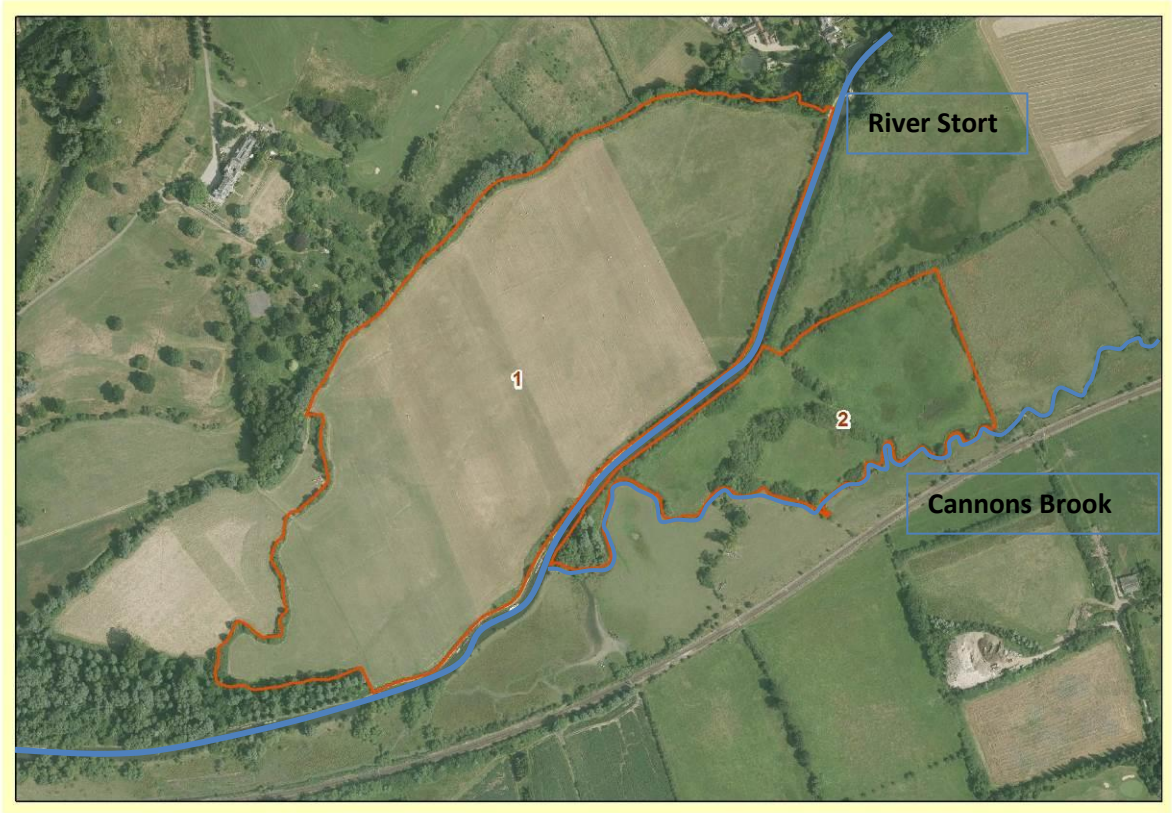
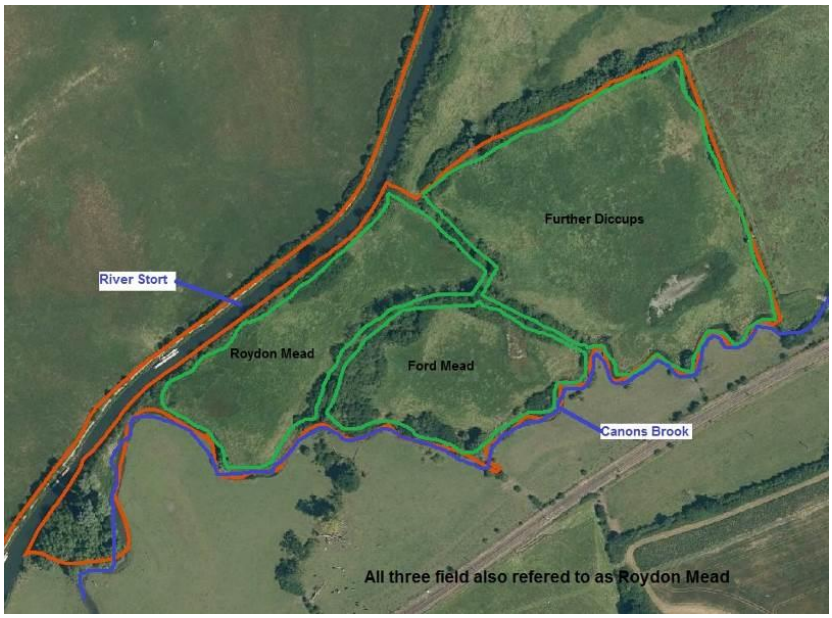


Figure 2. Location maps of Hunsdon Mead SSSI: top – wider location, bottom – focused view with numbered units

2.3. Roydon Mead (unit 2) - Context

Roydon Mead is bordered to the North-West by the Stort Navigation and to the South by the Cannons Brook. The meadows of Roydon Mead flood from the Cannons Brook.



In this report, Roydon Mead refers to the complex of three fields.

Occasionally if needed to refer to the separate fields, their separate names will be used as shown on this map.

Figure 3. Roydon Mead with names of each meadow

2.3.1. Management

The meadows of Roydon Mead are traditionally managed by the owner. He is supported in this by an agri-environment scheme (Higher Level Stewardship (HLS) scheme).

The meadows are cut for hay after the 15 July (as per the HLS prescription) and aftermath grazed until about October/November depending on the years.

Figure 4. Left- Hay cut in July 2015. Right – Aftermath grazing in 2016

2.3.2. Known issues before the start of the study

There have been known issues on the site before the start of the study:

Water quality

Though Lammas Meadows traditionally required some form of river flooding to replenish nutrients, introduce marsh flora to the seedbank & seasonally wet the soil, on Roydon Mead, the flooding from the Canons Brook is poor quality, nutrient-enriched water that is regarded as detrimental to a more diverse MG4 community.

The SSSI sites has been identified by Natural England and the Environment Agency as having issues with diffuse water pollution and requiring remedial works to achieve and sustain favourable condition status. As a consequence the site has a Diffuse Water Pollution Plan (DWPP) written in collaboration between the Environment Agency and Natural England. The DWP plan is intended to:

- identify the causes, evidence of impacts and knowledge gaps;
- identify remedies and plan when and how action will be taken;
- identify the monitoring required to validate remedies.

A key identified action is as further information regarding nutrient loading on to the SSSI.

Occasional summer floods

As shown on Figure 2, before reaching the meadows, the Cannons Brook flows through Harlow town, just a few miles upstream. This has several consequences:

- impact on water quality (chemical), contributing to the issue described above,
- impact on other pollution forms (floating objects, etc),
- impact on water levels in the cannons brook, especially in the summer. The large areas of hard surfaces in the town mean that after heavy rainfall the water flows into the brook. This results in summer floods and flash floods.

Figure 5. Left: Summer flood in July 2015. Right: Floating rubbish washed onto the meadow after a flood

Expanding sedge beds

The meadows have various sedge beds of varying size and importance. The more substantial one can easily be spotted on the aerial photograph and can hold standing water into the summer depending on the years.

Though not a problem in itself (it provides a mosaic of habitats that can be beneficial to wildlife), the owner of the site reckons that the sedge dominated areas have expanded their ranges into the rest of the grassland.

This can be an issue as it might reflect an underlying problem and because it can affect the extent of notified grassland habitat.

Figure 6. Sedge bed in July (left) and May 2016 (right)

2.3.3. Choice of site

This site was chosen as it was conveniently located and also because it had known issues that needed addressing. Though this study doesn't claim to solve all these issues, I hope it will help in understanding the site better.

I decided to study unit 2 after talking to the responsible officer for the site, as Roydon Mead had less available data than Hunsdon Mead managed by the Wildlife Trust.

More specifically I worked on the largest of the three meadows (Further Diccups).

3. METHODOLOGY

The tasks undertaken during the length of the study are summarised in the table below. They will be detailed in the rest of this chapter.

Task	Description	Date it was carried out on site
Soil monitoring	Take one or more soil cores, describing the profile	October 2015, April 2016, November 2016
	Take soil samples and send to FMP for analysis	November 2015
Sediments	Install a Sedimat and send to FMP after flood event for analysis	Installed in January 2016 Collected in April 2016
Botanical monitoring	Draw a vegetation map (identify boundaries between communities)	May 2015 then April 2017
	Set up and monitor a botanical transect (at least 5 quadrats)	June 2016 and June 2017
Hydrology	Install at least 1 dipwell and take a monthly reading	Dipwell 1: October 2015 onwards Dipwell 2: November 2016 onwards
Management	Record date and yield of hay cut	In 2015 and 2016
	Record grazing details (date animals are turned on site, number and bread of animals, etc.)	In 2015 and 2016

Table 1. Tasks undertaken during the FMP Ambassador programme in 2015-2017

This chapter describes the methodology only, the results will be given in the following chapter.

3.1. Soil monitoring

3.1.1. Soil profile, soil texture and structure

In total three soil profiles were taken with a 1.2 m, 5 cm diameter auger

- Profile 1: taken on 7 October 2015 when installing dipwell 1
- Profile 2: taken on 27 April 2016 with Emma Rothero and Irina Tatarenko (FMP) when they came to visit the site
- Profile 3: taken on 28 November 2016 when installing dipwell 2

For their location please see Figure 7.

Figure 7. Location of soil cores

In each profile the depth of the darker surface horizon was measured, as was the depth to sand and/or gravel, and any mottling of grey/brown when it was visible.

3.1.2. Soil chemical analysis

A soil sample was taken from an area near the botanical quadrat number 4 (TL 42287 10924) on 22/11/15.

Methodology:

- Soil sampled from a representative area of vegetation from the area of meadow where botanical quadrats were located.
- 12 small soil cores taken, to a depth of 10cm, within a few metres and put as a bulk sample into a plastic bag. Samples taken at a consistent depth for all samples.
- Collection of the full soil cores (being careful that some pieces of soil don't fall out). The amount of soil collected should weigh about 250-300 grams as smaller soil samples are difficult to analyse. The number of the cores could be increased (or decreased) in order to get an appropriate amount of soil.
- Dried out the sample completely by spreading it out on a piece of paper in a warm dry airy place. No direct heat on the sample. Soil in bags not sealed with ties or placed in an air-tight box (except briefly if absolutely necessary for transport). Allowing anaerobic conditions to develop will strongly distort the P-availability reading. Keeping the samples chilled is not a priority, encouraging them to dry out is.
- Taken to the lab

3.2. Sediments and Sedimat

The sedimat was installed on the 15/01/2016 (for location see Figure 7) and was removed on 27 April 2016. Though the site had flooded a few times between these two dates, I left the sedimat on longer as I thought it hadn't trapped enough sediments. Irina Tatarenko (FMP), who visited the site on 27 April 16, thought it did have enough sediments and it was removed then.

Full methodology in Appendix 4.

3.3. Botanical records

3.3.1. Vegetation mapping

The vegetation was mapped on two occasions in May 2015 and May 2017.

This was done by walking across the site and mapping significant changes in the plant communities.

3.3.2. Botanical quadrats

7 botanical quadrat were taken along a transect that stretched across the main field (Further Diccups), ie. from the Cannons Brook toward the Stort. This transect was chosen as it should reflect an interesting hydrological gradient going from the Cannons Brook, through the main sedge bed in continuing towards the Stort.

The quadrats were surveyed twice: in June 2015 then again in June 2016.

The sampling unit was a 1 x 1 m quadrat. This sampling size was advised by the FMP[1]:

"The standard sampling unit for botanical monitoring in floodplain meadows is a 1m x 1m quadrat. This is smaller than the typical 2m x 2m recommended for grassland in some other methodologies, because in floodplain meadows the vegetation is often species rich and the spatial heterogeneity is high due to changes in microtopography."

Within each quadrat a list of all species of vascular plant (grasses, sedges and forbs) was put together. Once all species in the quadrat had been listed, they were given a cover values, using visual estimates of % cover. This involves looking down on the quadrat and determining what proportion of the ground area within the quadrat each species covers. It is often the case that the total cover exceeds 100%, but in grasslands is unlikely to exceed 130%.

The location of each quadrat was recorded using a handheld GPS (Garmin eTrex 10). This GPS has a 3 m accuracy, which means that it is likely that not the exact same location was re-surveyed in 2015 and 2016. For this reason there will be no direct comparisons between two "identical" quadrats. They should though give us an indication if there has been a broad change in the community as a whole.

See Figure 8 for the location of the botanical quadrats.

[1] See reference number 1, FMP.

Figure 8. Location of botanical quadrats (along a transect going from the Cannons Brook towards the Stort) and relative position of the two dipwells.

In 2016, two additional quadrats were taken in the smaller meadow (quadrat A and B), but they will not be analysed in detail in the report.

3.4. Hydrological monitoring

I installed two dipwells (see Figure 8 for location):

- Dipwell 1 was installed on 07/10/15. It is 65 cm deep (depth of the gravel). It is a 55mm external diameter PVC pipe with 6mm holes drilled at 10cm intervals, covered by geotextile socking. The top is covered by a screw-cap and aluminium sheet tread-plate.
- Dipwell 2 was installed on 28/11/16. It is 100 cm deep. It is 40mm external diameter PVC pipe with 6mm holes drilled at 10cm intervals, covered by a ladies stocking. The top is covered by only an aluminium sheet tread-plate.

Dipwell readings were taken once per month in average since the installation, with a buzzing stick, at soil level. Unfortunately a few months were missed.

Figure 9. Dipwell reading equipment (metal detector, buzzing stick, trowel, screw cap and tread-plate)

3.5. Management

The management information was provided by Mr Chris Camp. Owner of the site.
The data collected involved dates and yield of hay cuts as well as information on aftermath grazing.

4. RESULTS

4.1. Soils and sediments

4.1.1. Soil profile, structure and texture

See on the table below the results of the three soil profiles.

ID	Location	Distance from surface (cm)	Description
1	See map	0 - 15	Good structure (dark material present in first 4 cm). Silt (no sand little clay)
		15 - 35	Clay content gradually increases with depth. On the other hand silt decreases
		35 - 65	Clay content high, almost forming a ring (cracking on the sides). Silt, no sand.
		65	Bottom of the profile: gravel, clay and silt.
			Mottling indistinct in the lower horizons
2	See map	0 - ??	Very light mottling
		?? - 86	High clay content (ring forming). Grey clay towards the bottom, mottling increases. Lots of iron.
		86 - 110	Sand and gravel. Water at 110.
3	See map	0 - 10	Dark material. Lots of roots. Good texture.
		10 - 70	High clay content (ring forming). Mottling indistinct.
		70 - 100	Dark material (peat?) and gravel

Table 2. Soil description

The basic profile across the site is a top layer of dark soil and a good structure, followed by a band of clay at about 10 cm below the surface. The clay content gradually increases and becomes high enough to be able to form a ring. There is generally little sand throughout the profile, and if present only at the bottom. The gravel bed varies in depth with the first profile at 65 cm and 100 cm or more for the two others.

Mottling is present in the clay but is not always very clear/easy to see. A lot or iron (red markings) was observed in the second core. The third profile had very dark material at the bottom of the profile, and we wondered if it could be a layer of peat (it doesn't show very well on the photo).

The soils profiles are illustrated in Appendix 2.

Figure 10. Left: signs of mottling. Right: well-formed clay ring

4.1.2. Soil sample

Results of the soil sample analysis:

Site name	Soil-pH	Olsen-P mg/kg PO_4-P	Typical range for restoration (FMP Handbook)
Roydon Mead	6.391	15.0	Fertility (P): 5 – 25 mg/L pH: 5.5 – 8.0

Table 3. Soil sample analysis results

When the results of the site are compared with the values given for restoration (FMP Handbook[2]), the soil samples are within range.

4.1.3. Sedimat

Results of the sediments analysis:

Site name	pH	Olsen-P mg/kg PO_4-P
Roydon Mead	7.7	193.4

Table 4. Sedimat analysis results

4.2. Hydrology

The detailed readings can be consulted in Appendix 3. These have been used to create the following hydrograph.

[2] See reference number 6, FMP Handbook.

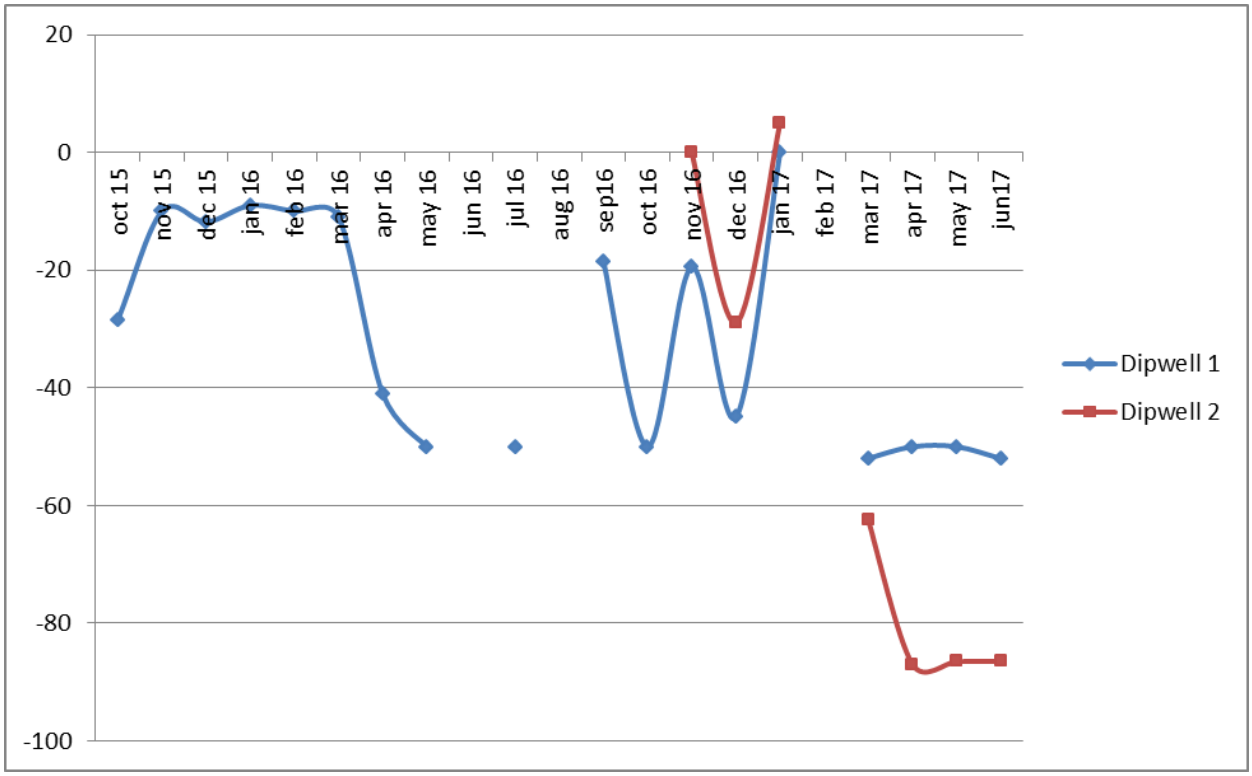


Figure 11. Hydrograph for both dipwells

After only 18 months of data, it is difficult to read a trend in the water levels. The winter 2015/16 showed a fairly stable table around 10 cm below ground level, whereas winter 2016/17 shows much bigger variations. Both winters have shown variable climate patterns (15/16 was a wet winter, 16/17 was a very dry winter-spring), so this probably had an influence on the water levels. The variations in 16/17 probably illustrate occasional floods, drying up quickly after the flood receded.

The FMP provided a tool that helps link water levels and plant communities (Hydrotool): by inputting monthly dipwell readings and soil type, it calculates how many weeks of wet and dry soil the communities in the vicinity of the dipwell experienced and links it to a potential NVC community.

As there is not have enough data for the dipwell 2, the hydrotool couldn't be used on that set of data.

Several sets of data have been put through the hydrotool for dipwell 1. This was done because the two years of monitoring showed very different weather conditions that reflected in the ground water levels. I thought it would be interesting to see how this would reflect on the output:

Code	Period of time	Weeks of dry soil	Weeks of wet soil
1	1 year: October 2015 to September 2016	13	34.8
2	1 year: July 2016 to June 2017	30.4	17.4
3	1.75 year: October 2015 to June 2017 (ie. the whole dataset)	12.8	14.2

Table 5. Hydrotool output for Dipwell 1 on various datasets

The results are quite varied as shown on the output graph, though they will have to be looked at critically as they come from a restricted dataset:

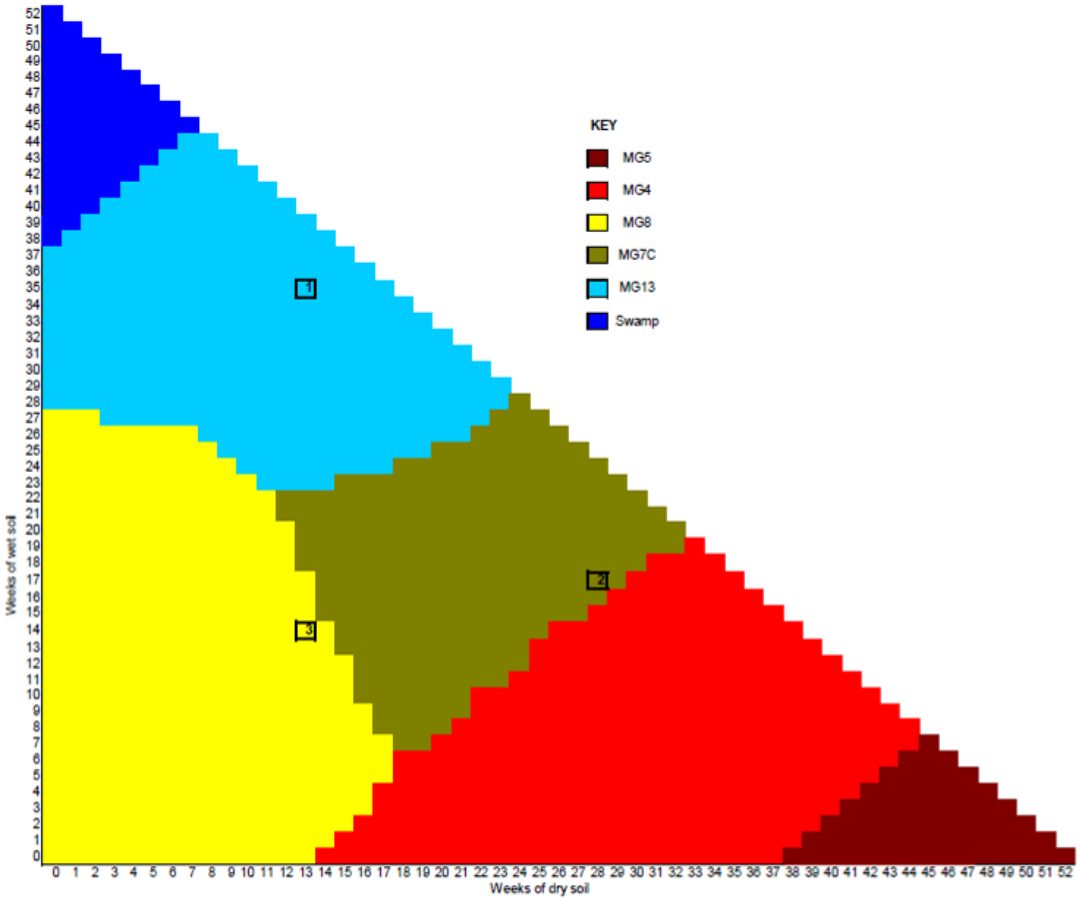


Figure 12. Hydrotool plant matrix output

Though it might not be possible to solely rely on this tool to predict the community accurately, it gives an indication that the site's water levels broadly tend to be toward the wetter end of the plant community spectrum (for all three datasets). The dataset 2 (July 16/June17) reflects a slightly wetter community (MG7c , now MG15) but is still within reach of a wet MG4. The dataset 3 comprises two winters but only one full summer, which may bias the results.

4.3. Botanical data

The botanical survey has concentrated on the larger of the three meadows (Further Diccups), though all three meadows were walked when mapping the vegetation communities.

When mapping the vegetation communities (from a walk through), these were roughly mapped as follows. Though there might be more subtle community variations within these blocks, for ease of analysis this mapping was kept as simple as possible to avoid too much sectioning.

Figure 13. Rough vegetation mapping. Orange: main grassland community (MG4?) of various quality and species richness. Blue: sedge and swamp communities. Green: wetter grassland communities (possibly MG8, but not studied in detail here)

Quadrats were not taken specifically in each community but the transect crosses two main communities from the larger field:

- Quadrats 1, 4, 5, 6, 7 are in the main grassland community
- Quadrats 2, 3 are in the swamp community or transition zone.

4.3.1. Main grassland community

The focus will be on this community as it covers the main area, is the notified feature and is the main floodplain community.

Quadrat data

The full data collected during the transect survey is summarised in Appendix 5. The following constancy table provides both a species list and a constancy class.

		Constancy class		Flood duration
		2015	2016	FSC leaflet[3]
Alopecurus pratensis	Meadow foxtail	IV	II	Short flood duration
Hordeum secalinum	Meadow barley	IV	-	
Lathyrus pratensis	Meadow vetchling	IV	II	Short flood duration

[3] See reference number 3. Guide to floodplain Meadows (Field Study Council)

Poa trivialis	Rough-stalked meadow-grass	IV	II	Short flood duration
Ranunculus acris	Meadow buttercup	IV	III	Rarely flooded
Ranunculus repens	Creeping buttercup	IV	IV	Short flood duration
Agrostis stolonifera	Creeping bent	III	IV	Longer flood duration
Filipendula ulmaria	Meadowsweet	III	III	Short flood duration
Lolium perenne	Perennial rye-grass	III	III	Rarely flooded
Vicia hirsuta	Hairy Tare	III	-	
Bromus racemosus	Smooth brome	II	I	
Carex hirta	Hairy sedge	II	III	
Holcus lanatus	Yorkshire fog	II	-	
Persicaria maculosa	Redshank	II	III	
Plantago lanceolata	Ribwort plantain	II	I	
Rhinanthus minor	Yellow rattle	II	II	
Rumex acetosa	Common Sorrel	II	I	
Rumex crispus	Curled dock	II	II	Longer flood duration
Arrhenatherum elatius	False oat-grass	I	-	
Festuca pratensis	Meadow fescue	I	I	
Geranium dissectum	Cut-leaved Crane's-bill	I	I	
Leontodon autumnalis	Autumn hawkbit	I	-	
Potentilla reptans	Creeping cinquefoil	I	I	
Silaum silaus	Pepper-saxifrage	I	I	
Taraxacum sect. vulgaria	Dandelion	I	-	
Trifolium dubium	Lesser Trefoil	I	-	
Trifolium pratense	Red Clover	I	-	
Vicia tetrasperma	Smooth Tare	I	I	
Cardamine pratensis	Cuckoo flower	-	I	
Rorippa palustris	Marsh yellow-cress	-	I	
Trifolium repens	White Clover	-	I	

Table 6. Constancy table for the main grassland community

This table shows variations in species occurrence between 2015 and 2016:

- Green highlight: those species occur frequently (IV or III) on both years. With a decrease in Meadow Buttercup (*Ranunculus acris*) and a slight increase of Creeping bent (*Agrostis stolonifera*), this suggests a trend toward a slightly longer flooding conditions, though the number of quadrats is too low to predict this accurately.
- Orange highlight: those species show a slightly bigger shift. Broadly, based on the species for which the FSC leaflet provides flood duration information, we notice a similar shift towards species more tolerant to longer flood durations.
- Yellow highlight: these two species strangely don't show big variations between both years in this set of data. A walk through the site in 2016 though showed a dramatic increase in these two species, especially in the lower lying areas. Quadrat 5 illustrates the change best (see figure 14). This could be due to the fact that the transect might not have had many quadrats in the lower areas and might not have captured that shift.

According to the FSC leaflet, Curled Dock (*Rumex crispus*) indicates waterlogging and eutrophication, which could possibly be addressed by restoring surface drainage and and early hay cut (mid-June).

Figure 14. Changes between in vegetation 2015 and 2016: left-quadrat 5 in 2015, right-quadrat 5 in 2016.

Unfortunately the results had to be based on a reduced number of quadrats (5 in each year). This will not be enough to confidently assert these vegetation changes, though a shift in vegetation was visible on site.

Observed changes in the community could be due to various factors:

- Influence of the climate. Winter and spring 2016 were wet with water staying on the meadow later in the season. This could have influenced the presence of Curled Dock (*Rumex crispus*) and Redshank (*Persicaria maculosa*)
- GPS accuracy means that quadrats can't be compared like for like, though they should be within 3m and they were all taken in large homogenous patches. Comparing years should still be possible.
- Some changes in species occurrence can be due to human error and mistakes in identification.

MAVIS analysis

These quadrats were also put through MAVIS 2016. The following output was obtained:

2015	
NVC	**output**
MG4c	64.32
MG15b	62.62
MG15	61.88
MG15a	59.76
MG4d	58.01
MG4b	56.57
MG4v2	55.06
MG7c	49.79

2016	
NVC	**output**
MG15	60.25
MG15a	59.33
MG4c	58.42
MG15b	56.76
MG4d	54.62
MG10b	52.14
MG10a	49.86
MG4v2	49.17

2015 - 2016	
NVC	**output**
MG4c	64.36
MG15b	63.89
MG15	63.27
MG15a	61.27
MG4d	59.08
MG4b	58.79
MG4v2	58.09
MG6d	51.72

MG9	49.30	MG4b	49.11	MG9	51.46
MG9a	48.75	MG10	48.95	MG9a	51.15

Table 7. MAVIS 2016 output for the main grassland community in 2015, 2016 and 2015/16 combined

I decided to analyse the combined 2015-2016 outcome, as this is based on the highest number of quadrats (10 quadrats) and might cover yearly variations. Nevertheless, it will be interesting to look at each yearly output as this might confirm conclusions from the vegetation survey.

The top matches suggest to look at two community types: MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland and MG15 *Alopecurus pratensis-Poa trivialis-Cardamine pratensis* grassland.

Let's compare their constancy tables, and a few of their sub-communities to our own quadrat data[4]:

MG4	**15**	**16**
Constants		
Festuca rubra		
Ranunculus acris	IV	III
Holcus lanatus	II	-
Anthoxantum odoratum		
Sanguisorba officinalis		
Rumex acetosa	II	I
Lathyrus pratensis	IV	II
Sub-community c & d "Holcus lanatus" & "Agrostis stolonifera"		
Alopecurus pratensis	IV	II
Poa trivialis	IV	II
Deschampsia cespitosa	x	x
Oenanthe silaifolia		
Phalaris arundinacea		
Rumex crispus	II	II
Elymus repens		
Sub-community d "Agrostis stolonifera"		
Agrostis stolonifera	III	IV
Filipendula ulmaria	III	III
Cardamine pratensis	-	I
Carex acuta		
Polygonum amphibium		
Carex disticha		
Achillea ptarmica		
Myosotis laxa caespitose		

MG15	**15**	**16**
Constants		
Poa trivialis	IV	II
Agrostis stolonifera	III	IV
Alopecurus pratensis	IV	II
Lolium perenne	III	III
Cardamine pratensis	-	I
Ranunuculus repens	IV	IV
Ranunculus acris	IV	III
Sub-community a "Agrostis stolonifera"		
Polygonum amphibium		
Alopecurus geniculatus		
Rumex crispus	II	II
Elymus repens		
Carex disticha		
Sub-community b "Lolium perenne – Ranunculus acris"		
Anthoxantum odoratum		
Rumex acetosa	x	x
Trifolium repens		
Taraxacum officinale agg.		
Holcus lanatus	II	-
Cynosurus cristatus		
Phleum pratense		
Filipendula ulmaria	III	III
Festuca pratensis	I	I
Plantago lanceolata	II	I

[4] See reference number 2 & 4. FMP & Rodwell 1992.

Alopecurus geniculatus		
Lysimachia nummularia		
Stellaria palustris		
Galium palustre		
Other associated species (here only a selection relevant to our study site)		
Leontodon autumnalis	I	-
Silaum silaus	I	I
Ranunculus repens	IV	IV
Hordeum secalinum	IV	-
Festuca pratensis	I	I
Carex hirta	II	III
Potentilla reptans	I	I
Trifolium dubium	I	-

Festuca rubra		
Deschampsia cespitosa	x	x
Trifolium pratense	I	-
Bromus racemosus	II	I
Agrostis capillaris		
Other associated species (here only a selection relevant to our study site)		
Leontodon autumnalis	I	-
Lathyrus pratensis	IV	II
Hordeum secalinum	IV	-
Silaum silaus	I	I
Carex hirta	II	III
Trifolium dubium	I	-
Rhinanthus minor	II	II

Table 8. Constancy tables for MG4 and MG15 grasslands and species recorded in transect for 2015 and 2016. Species noted "x" are present in the grassland though not recorded in quadrats.

Table 8 confirms that the community bears resemblance to both MG4c and MG15b communities.

A note on the MG15 community[5]:

MG15, previously MG7c, was recently described by Wallace and Prosser as a separate community.

The following description is particularly interesting with our site in mind:

"The community comprises swards of moderate species richness which are dominated by robust grasses of which *Alopecurus pratensis* is the most prominent with *Phleum pratense, Festuca pratensis, Deschampsia cespitosa* and *Bromus racemosus* making varied, but often substantial, contributions. The sward is usually dense with a lower storey of *Agrostis stolonifera* and *Ranunculus repens*. Tall forbs, of which the most prevalent are *Ranunculus acris* and *Filipendula ulmaria*, also feature together with high frequencies of *Cardamine pratensis, Leontodon autumnalis* and *Silaum silaus* whilst the normally rare *Oenanthe silaifolia* is occasionally frequent."

"The proposed MG15 is however closely associated with the less species rich forms of MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland and the two form a pair of 'accordian' communities tending to replace one another on suitable sites during alternating series of wetter and drier seasons."

It sits between MG4 and MG8 on the hydrological gradient, generally on more fertile soils. A species-poor community of damp sites with good restoration potential (to MG4).

A reminder of the MG4c community[6]:

MG4c is the Yorkshire fog sub-community. It tends to be associated with sites which experience a high water table for longer periods during the growing season. It lacks the species that are common in the Cock's-foot (MG4a) and Typical (MG4b) sub-communities, and does not have any strongly

[5] See reference number 7, Wallace and Prosser 2017.

[6] See reference number 6, FMP Handbook.

preferential species, although the frequency of common couch and tufted hair-grass is often higher, indicating less intensive management. It is less species-rich than the Cock's-foot (MG4a) and Typical (MG4b) sub-communities.

Further discussions on NVC communities will be lead in the next chapter (conclusion and discussion), though a preliminary conclusion can be made:

The plant community present still shows an interesting plant combination expected on such a meadow (Meadow sweet, Pepper Saxifrage, Meadow vetchling, etc.), which would still lead us to think of an MG4 type community. Nevertheless, dominance of grasses and presence of species such as dock, suggests the more fertile end of the MG4 spectrum: MG4c - more species poor, slightly wetter (less than MG4d though). It is though very close to shifting towards an MG15b community (higher in the fertility scale), and might indeed do so in some years, especially after wet years like 2015/16. As a matter of fact, the MAVIS output confirms this when looking at the separate 2015 and 2016 data: the 2016 community seems to have shifted to the wetter MG15 after the wet 2016 winter/spring.

Ellenberg values

The table below shows the average Ellenberg values for the main grassland community, per recording year.

	Light (L)	Fertility (F)	Reaction (R.)	Nitrogen (N)	Salt (S)
2015	6.9	6	6.3	5.6	0.3
2016	6.9	5.9	6.3	5.6	0.3

Table 9. Ellenberg values for the main grassland community

Focusing on the Fertility and Nitrogen values:

- Fertility is associated with wetness. Values over 6/6.5 are considered high for an MG4 community. Our values show that we are reaching the top limit of a MG4 type sward. This could be associated to drainage or water logging issues.
- Nitrogen is associated with nutrient levels. The top range for an MG4 community is around 6/5.5. Here again we are reaching the top limit.

4.3.2. Sedge/swamp community

Two quadrats were taken near and in the main sedge bed. The table below shows little variation between the two years.

Quadrat no		**2**	**2**	**3**	**3**
		2015	**2016**	**2015**	**2016**
Agrostis stolonifera	Creeping bent	5			
Alopecurus geniculatus	Marsh foxtail	80	50	2	1
Carex acutiformis	Lesser pond-sedge		10	100	100
Carex hirta	Hairy sedge	10	30		
Poa trivialis	Rough-stalked meadow-grass	5		5	
Persicaria maculosa		2	3		

Rumex acetosa	Common Sorrel	2			
Rumex crispus	Curled dock		1		

Table 10. Vegetation data for the sedge community.

Quadrat 2 clearly sits in a transition position between the swamp community and the grassland, so there is no point to look at it in too much detail.

The MAVIS output for the main sedge community (quadrat 3 for 2015 and 2016 combined), is as follows:

NVC	output
S22c	48.78
MG13	38.15
S7	32.35
OV29	27.27
MG13v2	26.98
S22	22.64
MG10c	16.04
MG15a	16.04
OV24a	16.04
OV28a	15.56

Table 11. MAVIS output for the sedge area

Figure 15. Quadrat 3 in 2015

Rodwells description for the S7 Carex acutiformis swamp[7] fits the community on site: "The *Caricetum acutiformis* is always dominated by *Carex acutiformis* forming an open or closed canopy of shoots and arcuate leaves about 1 m tall. No other species is constant but there are usually some scattered tall fen herbs such as *Angelica sylvestris* and *Valeriana officinalis* and shorter species like *Galium palustre* and *Mentha aquatic*. […] However, many of the occasionals reflect the particular floristic context of the often small stand."

"It has been recorded […] in wet hollows within flood-meadows […]."

The Ellenberg values for this community are predictably very high:

	Light (L)	Fertility (F)	Reaction (R.)	Nitrogen (N)	Salt (S)
Quadrat 3	7.3	8	7	6.3	1

Table 12. Ellenberg values for the sedge community.

4.3.3. Other field (Ford Mead)

The smallest of the three meadows (Ford Mead) appears to be more species rich than the others. For this reason I took two botanical quadrats in this meadow in 2016. Due to the restricted amount

[7] See reference number 5, Rodwell 1995.

of data I will not go too far in the interpretation, but I thought it would be interesting to see if the “feeling” on site would be reflected by in the plant community.

The two quadrats were put through MAVIS:

NVC	output
MG4b	70.45
MG6d	69.00
MG15b	67.44
MG4c	66.86
MG4v2	65.91
MG8d	63.42
MG15	62.72
MG4a	61.82
MG8b	58.71
MG8	58.55

Table 13. MAVIS 2016 output for Ford Mead

Figure 16. Quadrat B on Ford Mead in 2016

It shows a strong correlation to MG4b typical sub-community that is confirmed by the MG4b constancy table (see below).

The vegetation data is as follows:

Quadrat no		A	B	MG4b community species
Agrostis stolonifera	Creeping bent	15	5	
Alopecurus pratensis	Meadow foxtail	5		
Anthoxanthum odoratum	Sweet vernal-grass		5	constant
Carex hirta	Hairy sedge	10	10	
Centaurea nigra	Common knapweed	5		Sub-comm. b
Cerastium fontanum	Common mouse-ear	1	2	Sub-comm. b
Cynosurus cristatus	Crested dog's-tail	7	10	Sub-comm. b
Festuca rubra	Red fescue	10	10	constant
Filipendula ulmaria	Meadowsweet		20	
Holcus lanatus	Yorkshire fog	10	5	constant
Lathyrus pratensis	Meadow vetchling	3	3	constant
Lolium perenne	Perennial rye-grass	5	10	Sub-comm. b
Phleum pratense	Timothy	3		
Plantago lanceolata	Ribwort plantain	5		Sub-comm. b
Poa trivialis	Rough-stalked meadow-grass	10	7	
Ranunculus acris	Meadow buttercup	3	2	constant
Ranunculus repens	Creeping buttercup	20	5	
Rhinanthus minor	Yellow rattle	2	5	
Rumex acetosa	Common Sorrel	1	2	constant
Silaum silaus	Pepper-saxifrage	3		
Trifolium pratense	Red Clover	10		Sub-comm. b
Trifolium repens	White Clover	3		Sub-comm. b
Total species count		**20**	**15**	

Total % grasses		65	52	
Total % sedges		10	10	
Total % surface all species		131	101	

Table 14. Quadrat data (2016) on Ford Mead

With 20 and 15 species per square meter, these are some of the most species rich quadrats, especially in 2016 (see Appendix 5 for the full table).

Interestingly the Ellenberg values for F and N still remain quite high.

	Light (L)	Fertility (F)	Reaction (R.)	Nitrogen (N)	Salt (S)
Quadrat A	7.1	5.8	6	5.6	0.3
Quadrat B	7.1	6.2	6.3	5.6	0.4

Table 15. Ellenberg values for Ford Mead in 2016

4.4. Management

Management data:

4.4.1. Hay cut

Hay yield details for 2015 and 2016:

Year	Date of hay cut	Dry yield (no. bales)	Type of bales	Size of bales	Observations on impact of vehicles on site
2015	17 July 2015	102	round	4 feet x 4 feet	no impact observed
2016	July 2016	121	round	4 feet x 4 feet	no impact observed

Table 16. Hay yield details (2015 – 2016)

Figure 17. Left: Hay making machinery. Right: Hay cut in July 2015 (the hay got wet after cutting, it was thus wrapped)

4.4.2. Grazing

Grazing details for 2015 and 2016:

Year	Date animals on site	Date animals removed	Number of animals	Type of animals	Sward height when animals removed
2015	middle of September	Back and forth but removed around 8/12/15	29 & 18 calves	Aberdeen Angus x South Devon cross, Belted Galloways, Salers (young and calves)	12 cm
2016	around 18/09/16	29-Oct	24 young stock (1 & 2 years old)		About 5 cm. Good graze
	29-Oct	06-Nov	70 cows, calves & young stock (this large number was for just one week, prior to moving them onto Hunsdon and Eastwick Meads, to the north).		

5. CONCLUSION

In this document the focus was on the main grassland community as it is the notified feature and the floodplain community of the site. Information about the other communities can still provide useful information to understand the site's ecology and will be used as such.

The main results described in the previous chapter were as follow:

Soil and Nutrients	Fairly high levels though still in the range of floodplain meadows.
Hydrology	Though the data set is not very extensive, it generally shows water levels pointing towards wetter communities. Different data sets showed different results, but interestingly the July 2016/June 2017 data set, matches the botanical findings.
Botany	The main community shows aspects of both MG4c (wetter and higher fertility end of the MG4 community) and MG15b (community close to MG4c but further along the fertility and wetness gradient.
Management	Traditional management with late hay cuts (July).

These results all point towards high moisture and high fertility for a traditional MG4 community.

Using the average Ellenberg values for the main grassland community, it could be placed on the graph created by the Floodplain Meadow Partnership (figure 18). This confirms those findings: the community is drifting away from the core MG4 communities towards a higher fertility community.

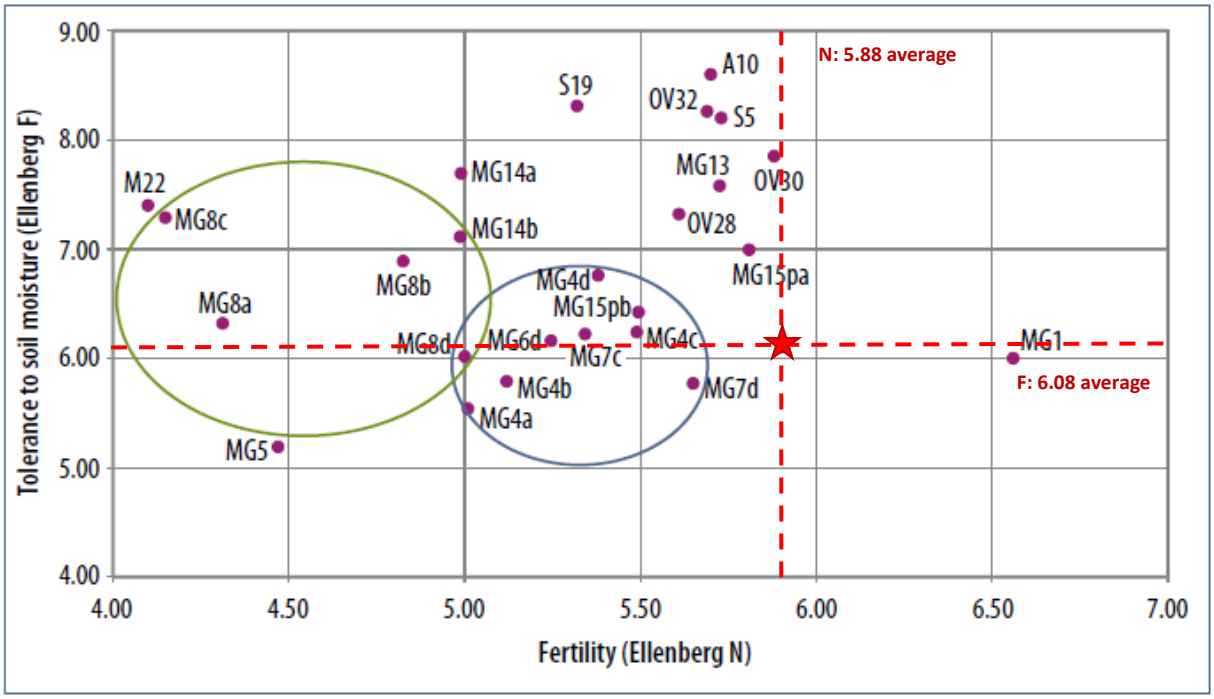


Figure 18. Distribution of communities on floodplain meados in relation to Ellenberg's values for fertility and water logging[8]. The main grassland community has been marked on the graph.

[8] See reference number 6, FMP Handbook.

All these findings confirm that the community shifts between a fertile MG4 (MG4c *Holcus lanatus*) and an MG15b depending on years and conditions. Nevertheless, the site holds nice plant species across all three meadows, and the smaller meadow even displayed a typical MG4 species rich community after a wet winter/spring.

Finally the swamp community is probably a result from both micro-topography, soil, as well as more general drainage issues. Addressing the waterlogging issue should hopefully help reduce it extending into the grassland.

6. MANAGEMENT RECOMMENDATIONS

This survey has confirmed two suspected issues:

- waterlogging,
- high nutrient levels.

These both influence the grassland community, shifting it towards a wetter, richer sward. The site is notified for its MG4 grassland community, so it is worth considering management options to help address these issues and maintain the right community.

6.1. Waterlogging

Though floods are an essential component of a floodplain meadow's ecology, it needs to:

- reach the meadow at the right time of year: ie. in the winter when the vegetation is dormant,
- leave the meadow quickly enough to avoid waterlogging and "drowning" less moisture tolerant species.

The issue on Roydon Mead seems to be that the water can't escape from the meadow quickly enough, that is particularly true for summer floods.

A suggestion was to restore the surface drainage. The existing network of ditches hadn't been managed for several decades and didn't fulfil their drainage role anymore. Ideally this would be done in August and in sections, when they are dry and the works are less likely to harm wildlife.

This suggestion was taken on board in winter 2016/17, with a first section of ditch de-silted then. This work is planned to continue this year (see figure 19).

Figure 19. Work planned on ditches around Roydon Mead. In red the ditches planned for 2016/17, in blue the ditches planned for 2017/18.

It will be interesting to see how this reflects in the water levels and ultimately in the vegetation community.

6.2. High nutrient levels

Reducing fertility is a difficult task with many components that the managers might not have direct control over (ie. water quality, silt nutrient levels).

Ways to reduce the nutrient load brought on site from floods are already in place and should be pursued.

Nevertheless, one way to help reducing the nutrient load could be to take an earlier hay cut (mid June). By mid-July, when the meadow is currently cut, the plants have started dying back and restoring their stored nutrients into their roots and into the soil. Taking the hay off when it is at its most productive helps export more nutrients.

Most floodplain meadow species are perennials and do not need to set seed every year. Taking a hay cut before the seed-set shouldn't be a problem for maintaining a rich sward. Delaying the hay cut to allow a seed set could be done occasionally (1 in 3 years for example) without harming the community.

After a mid-June hay cut, the cattle could potentially be turned on site earlier (July/August). Though cattle don't play an important role in reducing nutrient levels (ca.10% of nutrients), they play an important structural role, breaking up a tight sward and reducing thatch.

7. REFERENCES AND AKNOWLEDGEMENTS

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7.1.2. Acknowledgements

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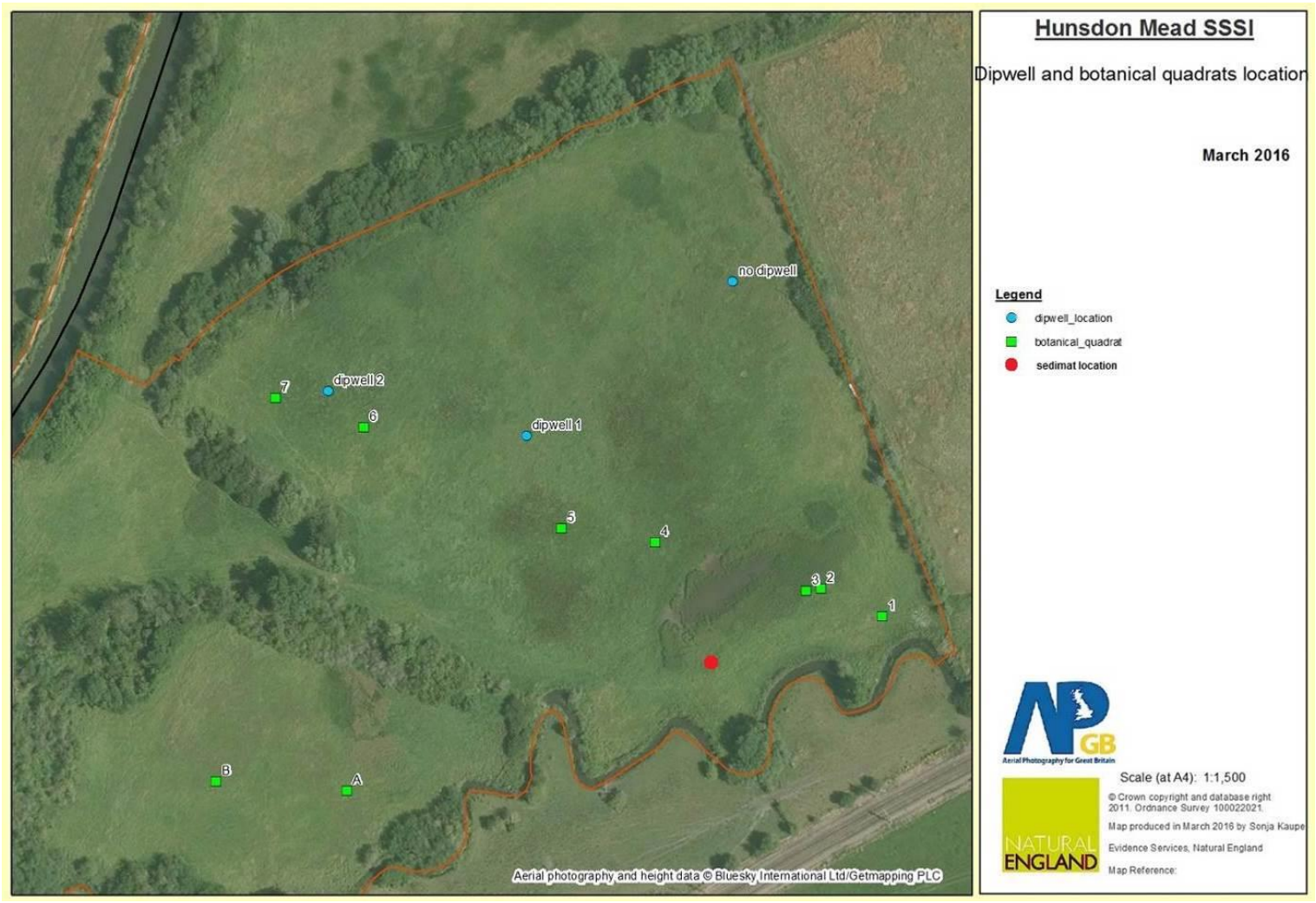
Thank you to Dominic for proof reading this document and accepting to co-organise a training day based on this programme in June 2017.

Thank you to my partner Andy who patiently accepted me working on this project or visiting the site during weekends for almost 2 years.

APPENDIX 1: LOCATION OF ALL SAMPLING STATIONS.



APPENDIX 2: SOIL CORES

1	
2	

3	  top section

APPENDIX 3: DIPWELL READINGS

Below are the readings taken on the two dipwells.
Readings were taken at soil level in cm. Negative readings mean “below ground level”.

Results for Dipwell 1:

Date	Reading (cm)	Comment
07/10/2015	- 28.5	Installation day
22/11/2015	- 10	
15/12/2015	- 11.8	
15/01/2016	- 9	Site flooded for several days (4/5 days) but water withdrew 1/2 days ago
12/02/2016	- 10	Site flooded 4 days ago
14/03/2016	- 11	Site flooded 6 days ago
28/04/2016	- 41	
12/05/2016	- 50	Bottom of dipwell filled with silt at 50 cm: I won't be able to record any lower levels in the future
June 2016		NO READING
06/07/2016	- 50	Dry all the way to the silt
August 2016		No READING
23/09/2016	- 18.5	Site flooded a few day ago
17/10/2016	- 50	Dry all the way to silt
28/11/2016	- 19.5	Tube was replaced and silt emptied: deeper readings should possible in the future
16/12/2016	- 45	
13/01/2017	0	Flooded at soil level
February 2017		NO READING
20/03/2017	-52	Dry all the way to silt
20/04/2017	-50	As above
16/05/2017	-50	As above
22/06/2017	-52	As above

Results for Dipwell 2:

Date	Reading (cm)	Comment
28/11/2016	0	Installation day, water to top of tube
16/12/2016	- 29	
13/01/2017	+ 5	Site flooded: water over the tube
February 2017		NO READING
20/03/2017	- 62.5	
20/04/2017	- 87	
16/05/2017	- 86.5	Dry
22/06/2017	- 86.5	

APPENDIX 4: SEDIMAT METHODOLOGY

What is a sedimat?

Small pieces of astroturf (weighed in advance and pinned down with pegs), called 'sedimats' are used to capture sediment deposited during a flood. They must be placed on site before a flood and then collected and removed to a lab afterwards.

Sedimat on Hunsdon Mead SSSI

How to choose the material for your sedimat and prepare it

There are no particular standards on the sedimats.

The general idea is to cut pieces of astroturf of the same size: make sure you note the size of your piece of astroturf. Knowing the size is important for calculating the sediment deposition per hectare later, if required.

You will also have to weigh each mat before it goes into the field and mark (number) it with a very good permanent marker.

Recommendations from experience, which type of astroturf to choose:

- do NOT use curved (curly) astroturf as it is much more difficult to get sediments off it later;
- the base of the turf should not be sparsely-woven, the denser the better because you will want the sediments to stay on the mat and only water to go through and out – it acts as a filter to some extent;
- the height of the green bits of the astroturf should be about 1.5 cm, not longer than 2 cm – again, for the sake of cleaning the sediments off the mat.

Installing a sedimat

You will need:

- the sedimat: a piece of astroturf with a number and a weight (g) written on the back
- 4 metal pegs (at least 1 of the 4 should be triangular and wobbly edged)
- a piece of plastic the same size as the sedimat (for example a cut out piece from a compost bag or similar)
- a mallet/hammer
- a ziplock bag (needed when collecting the sedimat, after flooding event)

This is your sedimat kit. You need to put this out on your site before a flood is likely. If possible wait until any livestock have been removed as they are likely to soil the mat.

Where to locate the sedimat

Find a low point in the field, somewhere where you think sediment is likely to drop out. This is more likely where water flow slows down. The ground surface should be relatively flat, no hummocks or slopes – to get an even deposit of sediment.

How to install the sedimat

Put the piece of plastic on the ground where the sedimat is to go. Place the sedimat on top. The plastic prevents silt loss through the mat during the flood and keeps the underside of the sediment clean.

Peg down the 4 corners of the plastic and the mat. It is important that one of the pegs is a triangular one as this will lend strength in the event of a big flood.

Record the location on your GPS, and consider marking it with a cane as well if necessary and if your site is private not public access (or if there is risk of interference you could place the marker cane 3 m due north (or east, S, W) of the mat so that it serves as a guide for you without drawing the attention of others directly to the mat.). Note the distance from nearby landmarks in case GPS is unreliable, as for botanical quadrats.

Wait for a flood.

How to remove the sedimat

Return to the sedimat as soon after a flood as you can, if possible noting the date, duration and depth of the flood. Take your ziplock plastic bag with you.

Remove the sedimat and underlying plastic as one unit. Remove the pegs (usually they stick in the mat) and carefully slide the mat into the plastic bag, being careful not to let any sediment fall through or off the astroturf. The underlying plastic should be removed. It is there mainly to keep the underside of the sedimat clean and will probably have worm casts and leaf litter sticking to it so should be removed. It prevents water seeping through the mat and thereby limits sediment loss through the gaps.

Close the bag.

Analysing your material

After bringing the dirty mat back from the field, you will have to dry it first. To avoid unwanted chemical processes taking place in the sealed bag, let the mat air-dry as soon as possible (within 24/48 hours) after picking it up. Be careful during drying that sediment is not lost.

When dry, weigh it. This will give you an overall amount of sediments on the mat (as a difference with the clean mat weight).

Calculation of sediment deposition in kg per hectare

Knowing the size and weight of the clean mat will allow you to calculate the sediment deposition in kg per hectare. This information is usually used in discussions about the sediments on a site.

Chemical analysis

To do that you will need to get the sediments off the mat. You can use different techniques (brushing, washing), depending on the amount of sediment as well as where it is trapped on your mat.

Sometimes, the sediments sit relatively on the top of the mat or close to the top. In that situation they can be tapped or brushed out fairly easily. Sometimes, they will sit on the base of the astroturf,

between the bristles, and it could be very difficult to brush them out. In that case you might need to wash it off, collect it and dry again.

There is no need to get all sediments off the mat if there is plenty; you only have to scrape/brush/wash out a sufficient amount for the chemical analysis.

Send your sediment sample to a lab for analysis.

APPENDIX 5: FULL BOTANICAL TRANSECT DATA

Survey dates: 21 June 2015 / 06 July 2016

	Quadrat no		1		2		3		4		5		6		7		A	B
	GPS		93		94		95		96		97		98		99		175	176
	GridRef		TL 42312 10916		TL 42292 10925		TL 42287 10924		TL 42237 10940		TL 42207 10945		TL 42142 10978		TL 42113 10988		TL 42136 10859	TL 42094 10862
	Year		2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2016	2016
122	*Agrostis stolonifera*	Creeping bent	5	40	5					30	5	15	5	30	10	50	15	5
156	*Alopecurus geniculatus*	Marsh foxtail			80	50	2	1										
158	*Alopecurus pratensis*	Meadow foxtail	5						10		10		15	10	10	5	5	
171	*Anthoxanthum odoratum*	Sweet vernal-grass																5
197	*Arrhenatherum elatius*	False oat-grass											2					
259	*Bromus racemosus*	Smooth brome	10	5					5				5					
295	*Cardamine pratensis*	Cuckoo flower												1				
302	*Carex acutiformis*	Lesser pond-sedge				10	100	100										
324	*Carex hirta*	Hairy sedge	1	2	10	30			5	10	10	20		10			10	10
371	*Centaurea nigra*	Common knapweed															5	
384	*Cerastium fontanum*	Common mouse-ear															1	2
460	*Cynosurus cristatus*	Crested dog's-tail															7	10
575	*Festuca pratensis*	Meadow fescue									5					15		
576	*Festuca rubra*	Red fescue															10	10
583	*Filipendula ulmaria*	Meadowsweet							20	20	10	5	20	20				20
	Geranium dissectum		5							1								
680	*Holcus lanatus*	Yorkshire fog	15	5					5				15	15			10	5
685	*Hordeum secalinum*	Meadow barley	20	10					10		5		15		15	5		
758	*Lathyrus pratensis*	Meadow vetchling	5						10	2	5		5		5	2	3	3
768	*Leontodon autumnalis*	Autumn hawkbit									2							
796	*Lolium perenne*	Perennial rye-grass	10	30					10	5			10	15	10	10	5	10
844	*Medicago lupulina*	Black medick		1										2				
960	*Phleum pratense*	Timothy		5						5							3	
973	*Plantago lanceolata*	Ribwort plantain							2	2	5						5	

990	*Poa trivialis*	Rough-stalked meadow-grass	15	5	5		5		10	20	10	15	5		15		10	7
	Persicaria maculosa				2	3			5	7	5	10				3		
1050	*Potentilla reptans*	Creeping cinquefoil									5	5						
1081	*Ranunculus acris*	Meadow buttercup	20	5					5	3	5		10	5	10	2	3	2
1095	*Ranunculus repens*	Creeping buttercup		5					20	5	15	7	10	10	25	15	20	5
1196	*Rhinanthus minor*	Yellow rattle	2	2									5	2	2	5	2	5
1139	*Rumex acetosa*	Common Sorrel			2				2	1	5						1	2
1143	*Rumex crispus*	Curled dock	1	3		1				10	10	25			5			
1250	*Silaum silaus*	Pepper-saxifrage									15	7					3	
2982	*Taraxacum sect. vulgaria*	Dandelion							2									
1343	*Trifolium dubium*	Lesser Trefoil											10					
1349	*Trifolium pratense*	Red Clover	20														10	
1550	*Trifolium repens*	White Clover		5													3	
	Vicia hirsuta								2		2				5			
	Rorippa palustris											3						
	Vicia tetrasperma		2	1														
	Total species count		**15**	**15**	**6**	**5**	**3**	**2**	**16**	**14**	**18**	**10**	**14**	**11**	**11**	**10**	**20**	**15**
	Total % grasses		80	100	90	50	7	1	50	60	35	30	72	70	60	85	50	47
	Total % sedges		1	2	10	40	100	100	5	10	10	20	0	10	0	0	10	10
	Total % surface all species		136	124	104	94	107	101	123	121	129	112	132	120	112	112	116	96