Policy and Practice in the Assessment and Management of Floodplain Meadows in England

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Abstract

For centuries, most floodplains in lowland England were managed as hay meadows in Spring and Summer to provide feed for livestock and as grazing land over winter. The combination of climatic, hydrological, and soil nutrient conditions, together with the disturbance created by hay cutting and aftermath grazing, led to these meadows being populated by a particular combination of plant species that are now valued and conserved for reasons including their species richness, aesthetic appeal and cultural-historical origins.

This research has investigated the meadow assessment practices of stakeholders actively involved in the conservation management of floodplain meadow grasslands in England in order to ascertain what the nature, motivations and meaning of assessment activity are, and to what extent the assessment activity informs management of meadows within a model of responsive management. This was achieved by means of an interdisciplinary approach and a case-study and mixed methodology strategy focussing on floodplain meadow sites in England.

The work has highlighted the site-specific nature of the stakeholder networks that manage the meadows and the tensions between stakeholder groups' perspectives on the value of such meadows. It has been shown that stakeholder assessment practices draw on a partial view of meadow value and in consequence create partial understandings about the meadows which often do not appear to impact on management decisions. Meadow management decisions in turn were seen to be influenced by a range of factors other than assessment findings from ideas about what constitutes 'traditional management' to practical constraints on the managing farmers. Finally it has been found that tensions between conservation stakeholders and managing farmer stakeholders over meadow value pose a significant potential threat to meadow conservation by creating strains in the stakeholder networks and socio-economic processes that deliver meadow management.

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Glossary of acronyms used in the text

AES	Agri-environment scheme
AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
BBOWT	Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust
CBD	Convention on Biological Diversity
CSM	Common Standards Monitoring (Natural England)
CWS	County Wildlife Site
DEFRA	Department for Environment, Food and Rural Affairs
DOMD	Digestible organic matter in dry matter
EIA	Environmental Impact Assessment
EU	European Union
HAP	Habitat Action Plan
HLS	Higher Level Stewardship scheme
IoS	Indicators of Success (HLS)
ISA	Integrated Site Assessment
JNCC	Joint Nature Conservation Council
NAAONB	National Association of Areas of Outstanding Natural Beauty
NE	Natural England
NNR	National Nature Reserve
NVC	National Vegetation Classification scheme
RSPB	Royal Society for the Protection of Birds
SAC	Special Area for Conservation
SAP	Species Action Plan
SSSI	Site of Special Scientific Interest
TVERC	Thames Valley Environmental Records Centre
WkWT	Warwickshire Wildlife Trust

Chapter 1 – Introduction

1.1 Background to the study

For centuries, most floodplains in lowland England were managed as hay meadows in spring and summer to provide feed for livestock and as grazing land over winter (Rackham, 1987). The combination of climatic, hydrological, and soil nutrient conditions, together with the disturbance created by hay cutting and aftermath grazing, led to these meadows being populated by particular combinations of plant species that are now reported to be valued and conserved for reasons including their species richness, aesthetic appeal and cultural-historical origins (Ratcliffe, 1977; Rackham, 1987; Rodwell, 1998; Wharburton, 2006). In particular, one species-rich grassland plant community assemblage found on floodplain meadows (UK National Vegetation Classification (NVC) category MG4) has been classified as a habitat of European Importance for conservation, as a result of its scarcity and recent decline in extent (European Commission, 1992, 1997; Jefferson, 1997; Rodwell *et al*, 2007).

Modernisation and mechanisation of agriculture during the twentieth century, in particular the introduction of artificial chemical fertilisers, has meant that the agricultural economic value of traditionally-managed floodplain meadows has declined relative to more intensively-managed land uses, and most such meadows have been agriculturally 'improved' by ploughing and reseeding, or have been built upon (Milsom, 2006; Rodwell *et al*, 2007). It is estimated that fewer than 1500 ha of floodplain meadow now remain, most of which have been designated as Sites of Special Scientific Interest (SSSI), and the remaining total area of meadow is small and highly fragmented with most sites of less than 10 ha and geographically isolated (Blackstock, 1999; Jefferson and Pinches, 2010). Most such sites are now to be found in central southern England and the English Midlands, mostly south of a line from the Humber to the Severn. As a result, a narrative has developed within the nature conservation movement emphasising the value of the remaining traditionally-managed floodplain meadows and the need to conserve the few meadows that remain, the practices that created them, and what material form they should have.

The key biophysical drivers that influence the floristic composition and condition of floodplain meadow grasslands are the hydrology of the meadow site (moisture availability in the soil as well as frequency, timing and extent of flooding) and the soil nutrient status and nutrient cycling, which are in turn linked to flooding patterns (Gowing *et al*, 2002a, 2002b). In addition to this, agricultural management is also a key driver of the material composition of the meadow that, from the ecological perspective is a form of disturbance, but at the same time is a human practice governed by social, economic, cultural and historical factors.

Traditionally, the aim of hay meadow management was to produce a crop of herbage that would serve as feed for farm animals over the winter months outside the growing season. Ideal management from the farmers' perspective was that which delivered a sufficient quantity of biomass for feed, but also of suitable quality as to be palatable and nutritious to livestock yet not deteriorate over the winter months. To this end, the timing of the hay cut would influence the balance and trade off between hay quantity and quality. Furthermore, in traditional farming systems, land might not be managed as meadow every year but rotated with other uses such as pasture, according to the demands of the farm enterprise and the contemporary agricultural economy (Sheail, 1986).

Given that meadows were produced by traditional agricultural practices that create interplay between dynamic biophysical and social processes, the importance of such management practices is key to understanding constancy and change in the composition and condition of meadows, as well as recognising potential threats to their conservation and continued existence into the future. Considering management more broadly, this may be considered also to include manipulation of site hydrology and nutrient cycling, and therefore meadow management also influences the two other key biophysical drivers of meadow status, again underlying the importance of management to meadow conservation.

Furthermore, floodplain meadow grasslands are highly dynamic systems whose composition may change, fluctuate or cycle rapidly. The rapidity of change on floodplain meadows is a result of the

rapid variability of the hydrology on a floodplain, associated changes in soil nutrient status, as well as the fact that the meadow grassland is an early successional stage that would rapidly progress towards scrub without agricultural management (Humphries and Benyon, 2006; Gowing *et al*, 2002a).

1.2 Concept of responsive or adaptive management

Various researchers have investigated explicitly the role of hydrology and soil nutrient cycles on floodplain meadow characteristics and condition (Gowing *et al*, 2002a; Gowing *et al* 2002b; Gowing *et al*, 2005; Gowing, 2006; Humphries and Benyon, 2006; Mountford *et al*, 1993, 1996). However, less research has been undertaken on the role of management operations in creating and conserving floodplain meadows. Furthermore, much literature and guidance documentation published on meadow management presents the concept of responsive or adaptive management as a guiding model in the conservation management of floodplain meadows, whereby assessment activity designed to capture a view of meadow condition provides knowledge that may be used to inform meadow management decisions. Assessment activity on floodplain meadows by stakeholders actively involved in their management therefore provides a window onto how such stakeholders value the meadows and how decisions on meadow management are made to conserve such value.

This study therefore sets out to investigate the role of assessment and management in conserving floodplain meadows, specifically, the relationship between stakeholder assessment and the concept of responsive management. Assessment is a widely used tool in nature conservation site management. Pertinent questions are, therefore, what form does such assessment activity take, how useful is it, and does it help conservation stakeholders in their task of effectively managing meadow sites and in achieving their desired aims and objectives?

A range of stakeholders may be involved in managing floodplain meadows and arrangements for management delivery can be complex, with each stakeholder involved in the meadow management wishing to see conserved certain meadow characteristics that they consider to be of

priority. As a result, various methods may be used to assess the status of meadow characteristics in order to determine the effectiveness or otherwise of management interventions, and (in theory at least) to determine future management. Different assessment methods (e.g. yield estimation, population census, frequency of positive and negative indicator species, quadrat survey, NVC mapping, Natural England condition assessment or informal and experiential assessment) are based on different criteria and assumptions and as such are likely to produce different results. This information may (or may not) be mobilised in terms of decisions about future management actions, which in turn may have (intended or unintended) consequences for the future composition of the meadow. The processes involved may be summarised in the cyclical model in Figure 1.1 below.

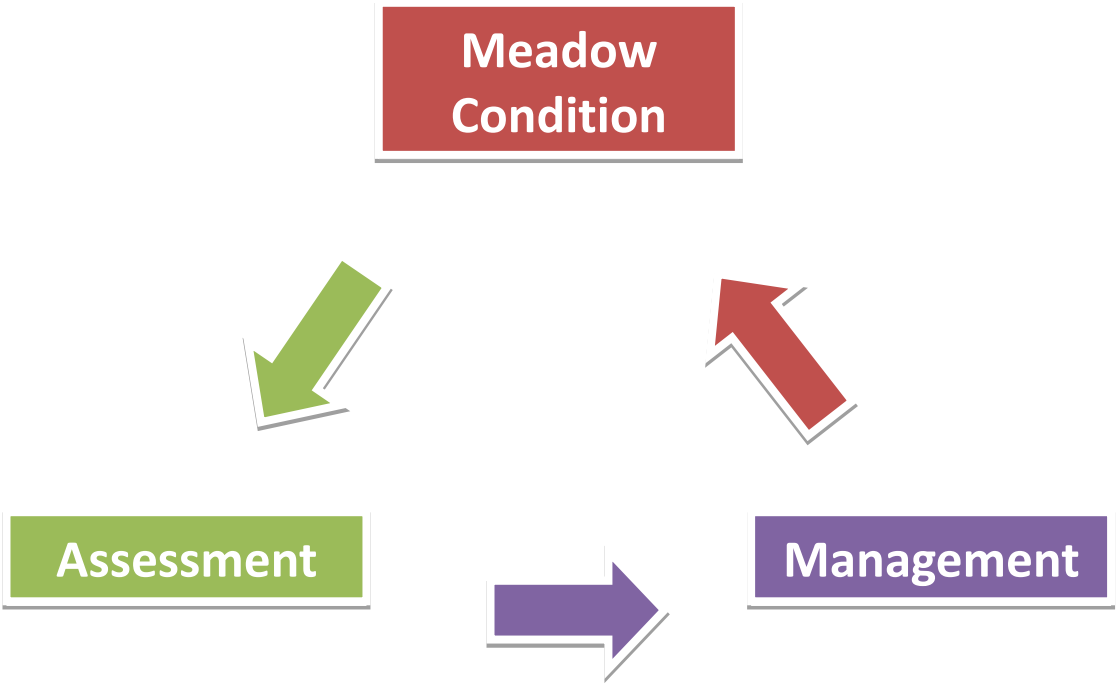


Figure 1.1 – conceptual model of responsive management, and the cyclical interaction between floodplain meadow condition, meadow assessment and management (source: designed by author 2013)

1.3 Justification for this study

Given that the remaining floodplain meadows were created by traditional management practices, it is often argued that all that is required to conserve meadows is to maintain the traditional management practices that created the meadows, and accept that meadows are dynamic systems that will fluctuate in composition as a result of both fluctuations in external system drivers such as flooding patterns, and as a result of internal ecosystem properties. A number of problems exist with this approach. In particular, records often do not exist regarding the details of long-term traditional management, which in any case would have varied from site to site and with time (Sheail, 1986) and may not have been highly prescriptive. In the face of such uncertainty, the philosophy underlying meadow assessments is based on an attempt to distinguish between cyclical ecosystem dynamism and uni-directional long-term change.

A starting point for this study is therefore the assertion by conservation organisations such as Natural England or Wildlife Trusts that management is a key driver of meadow condition and that it should be responsive (Robertson and Jefferson, 2000; Sutherland, 2004; Sutherland and Hill, 2006). Assessment of meadow condition is therefore necessary to ensure that it remains within certain parameters of acceptability beyond which management needs to be responsive to ensure that the meadow is kept in 'good condition'. Should meadow condition move outside certain pre-defined parameters then it may be considered to be potentially moving beyond the bounds of 'normal' dynamism and change may therefore represent a possible permanent shift in system function.

This therefore begs the question of whether management really is responsive to meadow assessment, or whether there are other significant factors that influence the modes of management applied to meadows. Rather than assessment influencing management decisions, such decisions may well be influenced by narratives about traditional management, formulaic management plans, socio-economic constraints or practical considerations that may prove equally or even more important. Where stakeholders' narratives about traditional management are important, it is necessary to understand what evidence has been used to construct these

narratives, and whether they would still be relevant in the face of changes in the surrounding landscape and environment. For example, changes in the climate could affect the validity of the traditional timings of meadow management operations. Similarly, nutrient flows in the meadow system could be affected by increased nutrient inputs from eutrophic flood waters or from enhanced atmospheric deposition.

If factors other than assessment are important in influencing meadow management, this poses a question regarding the utility of stakeholder assessment and knowledge generation about meadow condition and management in maintaining meadows in 'good' condition, however the latter is framed.

Should a significant body of numerical data exist on the management undertaken on meadow sites, as well as corresponding survey data on meadow botanical composition, then it may be possible to investigate for example the impact of agricultural management on meadow composition. This said, the agricultural operations undertaken on meadows are diverse and vary with time, and the impact of management on meadow composition is cumulative over several years, as has been shown to be the case for fluctuation in site hydrology (Gowing *et al* 2002a, Gowing *et al*, 2005). Such numerical analysis is therefore likely to be complex and require large and robust long-term datasets on meadow management and composition. Initial investigations undertaken for the purpose of this study showed that, whilst the desirability of collecting data is widely expressed, it is rarely consistently collected. Controlled field experiments have been undertaken to assess the impact of agricultural farming operations on meadow composition, but so far such work has been relatively limited in the case of lowland floodplain meadows, such as that by McDonald (2001) and Mountford *et al* (1993, 1996), although a large body of work exists in the broader context of European mesotrophic grasslands.

In the absence of a significant body of detailed and quantified information on past management operations on example lowland floodplain meadows, it is clear that more numerical and statistical correlation between quantitative parameters of meadow description or condition and past

management is currently likely to be very difficult and any results highly tentative. Furthermore, as management is a human practice influenced by economic, political, social and cultural factors, yet is also a key driver of the material composition of the meadows, an interdisciplinary approach is required that considers the influence of both biophysical and social processes on meadow composition, condition and management. Again, in the context of lowland floodplain meadows, the literature on the social, economic and cultural drivers of meadow management is relatively limited.

Therefore, this study is focussed as much on the set of human practices and social processes that lead to the delivery of particular kinds of management, which may allow us to consider the likely subsequent impact of the management on meadow condition, as it is on biophysical processes. The study of these processes has therefore made particular use of qualitative methodologies to understand social processes and practices and to contextualise work undertaken by others using natural science methods for examining biophysical processes.

1.4 Research Question

In order to investigate the role of assessment activity and its relationship with meadow management, it is necessary to investigate who the various stakeholders involved in the management of floodplain meadows are, and what their objectives are in managing the meadows. In turn it is necessary to ascertain whether and how stakeholders actually mobilise their criteria of a good meadow by using them in assessing the meadow and generating knowledge about the meadow. Where conclusions regarding condition are drawn by stakeholders, it will be necessary to investigate whether and how these understandings about the meadow, which have been generated in assessments, influence decisions about meadow management at various points during the year.

For the purposes of this study the key research question has been framed as:

> *What is the relationship between stakeholder assessment and the management of floodplain meadows?*

In order to answer this main question, it has been sub-divided into three further sub-questions:

1. *Who are the stakeholders involved in managing floodplain meadows and what value do they attach to such sites?*

2. *How are knowledge and understandings about floodplain meadow status, material condition, perceived value or management generated by the assessment activities of stakeholders involved in their management?*

3. *To what extent and how do the findings of meadow assessments influence the subsequent management actions of stakeholders?*

For the purposes of this study, the meadow has been considered to be the grassland sward itself, scoping out other aspects of the meadow such as boundary features (hedgerows and trees), or areas that could be classified as distinct habitats such as ponds, watercourses, scrub or woodland. This decision arose out of initial investigations, supported by subsequent research including inspection of the literature (Blackstock *et al*, 1999; Jefferson, 1997; JNCC, 2007; Natural England, 2010a, 2010b; Robertson and Jefferson, 2000; Ratcliffe, 1977; Rodwell, 1992), that clearly indicated that stakeholders identified the grassland sward as a distinct feature of interest and so this was therefore deemed to be a logical unit for analysis.

As will be discussed in detail in Chapter 4, the study has been undertaken using an interdisciplinary approach and a case-study and mixed methodology strategy focussing on floodplain meadow sites in England. The research methodologies employed have included: semi-structured interviews; archive documentation research of records kept by stakeholders; observational techniques; statistical analysis of meadow survey botanical data held by the Floodplain Meadow Partnership hosted by the Open University, as well as triangulation of findings from the different research methods.

1.5 Key Terminology

The following operating definitions have been used in this thesis. The working definition of a floodplain meadow is provided in Chapter 2.

1.5.1 Assessment

The term 'assessment' as well as a family of related terms such as 'evaluation', 'monitoring' and 'survey' are widely used within communities of practice with an interest in nature conservation. Such terms appear to be well understood within particular communities of practice but may vary between social groups. For example, assessment and evaluation for farmers may well hold broadly the same meaning for farmers and conservationists in terms of the general definitions of the words as given in a dictionary of English such as the New Oxford Dictionary of English (ref). However, within the particular communities they may assume particular characteristics, for example the specific meanings of these terms in Sutherland (2006) or the range of scientific literature considered in Chapter 2. However, often, a strict definition of these terms is not offered in literature and their meanings appear to be embedded in the common understanding of practitioner communities. In order to avoid strict definitions that might more accurately reflect the activities of one community of practice over another, a broad operational definition of assessment has been adopted for the purposes of this work.

For the purposes of this study, assessment activity may be considered to be any activity undertaken with the intention of generating knowledge or understanding about a meadow's status, materiality, condition or perceived value or about its management. It therefore may include more formal structured activity to identify or quantitatively measure physical characteristics of a meadow, or identify more qualitatively the presence or absence of material objects or their characteristics. However, it may also include more experiential and qualitative evaluation of meadow characteristics, which as well as encompassing the material, may extend to consideration and evaluation of the meaning that a meadow may hold for the assessor. This definition has been chosen in order to avoid prioritising one idea of meadow value, such as a

desired botanical composition, over other aspects such as aesthetic appreciation or the assessors feeling of an affective connection with a meadow.

1.5.2 Value

When discussing 'meadow value' in this work, the word 'value' is used to specify attitudes, perspectives, ideas or beliefs that stakeholders hold about floodplain meadows regarding their meaning, significance, importance, practical or economic utility. There are a range of perspectives and conceptual frameworks on the value of both meadows specifically and of 'nature' more generally, as discussed in Chapter 2. The use of the word here does not imply any assumption that meadow value is necessarily for example, intrinsic or anthropocentric. Again the aim of this work has been to establish the perspectives or perceptions of the stakeholders as regards the meaning of meadows for them. In this context the word 'values' constitutes the plural of value, and may be distinguished from 'values' in the sense of a set of principles, standards or ethical codes which might be held by an individual or social grouping.

1.5.3 Condition

Meadow condition may be any aspect of the materiality of the meadow of interest to stakeholders. It may therefore encompass species composition, vegetative productivity and the qualitative or compositional state of the flora and fauna, aesthetic appearance, soils conditions or hydrology or any other material aspect of interest.

1.5.4 Management

Management has been considered in this work to be any activity undertaken on a meadow to manipulate the physical or chemical aspect of either the biotic or abiotic material components of the meadow, or to manipulate biophysical or social process that take place on the meadow. This therefore refers not only to agricultural operations such as cutting or grazing the grassland sward, but may also encompass a broader range of activities such as addition of manure to alter soil nutrient status, alteration of flood defences to alter flooding patterns, or practices such as fencing off areas to exclude the public to reduce disturbance.

1.5.5 Narrative

The word 'narrative' has been used in this work to signify sets of ideas and representations related by stakeholders regarding a range of issues such as 'naturalness', why they value floodplain meadows, or what constitutes for them 'traditional management'. Taken as sets of ideas and representations, the use of 'narrative' here is similar to the idea of 'discourse' as used in the field of human geography and the social sciences. The term narrative has tended to be preferred as it highlights the way in which such ideas are related either in documentation such as a management plan justifying the need to conserve a particular meadow, or a farmer's oral account of why he or she is motivated to be involved in meadow management.

1.6 Key Considerations

The value that stakeholders attach to meadows may arise from a diversity of narratives and meanings that they attach to the meadows and that are socially constructed, for example, via a consensus amongst groups in society about what 'nature' is and its value, some of which may well be contradictory. For the purposes of this study it is necessary to understand the value attached to meadows by stakeholders in order to appreciate what for them is a good meadow and to understand the criteria that they apply when they assess meadows. This said, whilst it is certainly possible to deconstruct and critique such opinions on meadow value, for the purposes of this study it is not intended to undertake a fundamental critique of stakeholders' understanding of meadow value. Instead, it is intended to understand and appreciate the stakeholders' perspectives from their subjective point of view and any critique is generally limited to tensions that are relevant to the research question.

Conservation-oriented stakeholders have tried to establish formalised attributes and features reflecting desired characteristics that can be observed, monitored and measured and whose change through time can therefore be followed, at least in theory. Other stakeholders such as land managers and farmers also assess the condition of meadows in terms of their own criteria, which may be divergent from those of conservation managers. A significant aspect of this work is therefore to identify divergence and tensions between the value attached to floodplain meadows

by different stakeholders. The question arises as to how these values and criteria become expressed through the design, implementation and eventual impact of such assessments. Whose values are dominant or tend to be acted upon, and what are the implications of this?

Conservation of floodplain meadows requires a baseline, an underlying understanding of a good meadow on which such criteria can be based and against which meadows can be assessed. Also, if meadows were created by 'traditional' management then this baseline is likely to assume that at some point in history the condition and management were 'right' and understandings of such a state then become idealised. In reality the meadow composition and management practices are likely to have varied with time at any given site, and in space between different sites.

As noted, the value that stakeholders attach to meadows will be influenced by their view of what nature is and its value. Influential in this is the tendency to perceive a fundamental divide between nature and culture or between nature and society. This is exemplified in the extensive use by scientists of the phrase 'semi-natural' to describe such grasslands that are deemed 'good quality' conservation sites. On the one hand, this phrase suggests that there is an (at least) theoretical possibility of purely 'natural' sites, though most researchers do accept that no sites in a country such as the UK can be deemed such. Yet on the other hand, what is the other side of the 'semi-'? Such sites are never openly described as semi-cultural, yet this is perhaps implied; that the meadows are a nature-culture hybrid. Some researchers now therefore prefer to use the term 'socio-ecological' to describe sites such as meadows, which are the result of the interaction of both biophysical and social processes, and result from the agency of both human and non-human life (Castree, 2005).

The question arises as to how stakeholders manage to assess the status of desired meadow attributes, draw conclusions about the condition of meadow sites and about any change from previous years. If it is not possible to draw meaningful conclusions about change and continuity in the features of the meadows, then it is not possible to know if conservation management is effective in conserving the meadows, that is to say, in maintaining the desired features and

preventing them from being lost. It is therefore on the basis of these decisions about condition that decisions may, or may not, be taken to alter meadow management to intercept and prevent any long-term trajectory of change in meadow characteristics. As noted, this is made all the more difficult by the possibility of time-lag effects.

Good management decisions will rely on a good understanding of the likely effects of different management interventions. However, it will still be difficult to make effective management decisions if the picture of any change obtained by stakeholders is inaccurate. It is therefore pertinent to ask whether stakeholders then use the outcome of assessments to make decisions about meadow management that are then enacted, and of interest, where possible, to follow the impact of management decisions to see if the predicted and actual outcomes in terms of meadow condition were similar. Clearly therefore, an understanding of how stakeholders currently generate knowledge about meadow condition and change in condition are key to enabling effective meadow management for conservation. It is necessary to clarify how stakeholders are generating understanding about the meadows' condition and whether this reflects what they wish to create and conserve.

1.7 Summary

This work is ultimately intended to advance understandings of how stakeholders involved in floodplain meadow management generate knowledge about meadow characteristics, condition and value, and how this knowledge is used to inform meadow management. More broadly, these findings are of utility to inform how stakeholders involved in conservation management view the value of the sites that they manage, mobilise that value in assessment and the use of the knowledge that they generate through assessment in achieving their aims. The conclusions regarding stakeholder practice would therefore be of more general application to a wider range of habitats and sites of nature conservation interest. This is especially pertinent where climate change, site fragmentation and changing land use in the wider landscape may be debasing the baseline on which conservation and conservation management is based, and in which the socio-economic structures of land management are shifting, driven by factors such as rising global food

prices, the abolition of set-aside within the EU Common Agricultural Policy, and increasing pressure to maximise land use productivity for food, fuel and fibre. Such developments are likely to throw back into focus once again questions such as: do we need to keep sites such as species-rich floodplain meadows? If so, what kind of meadows do we need, how should we conserve them, and how much conserved meadow land is enough? Such knowledge and understandings are essential in order to allow us to frame in the most effective way possible the management of such nature sites, as well as the agri-environment schemes that support conservation of landscapes such as floodplain meadows.

1.8 Structure of the Thesis

Chapter 2 conducts a review of academic literature of relevance to the research topic. Grey literature and technical reports more specifically related to individual case studies or identified during archival research work are generally considered in the later empirical chapters 5-7, unless they illustrate a more general point regarding the research topic.

Chapter 3 then details essential relevant background information on floodplain meadows, both generally and specifically with regards to the case study meadows, and that is required to contextualise the findings presented in empirical chapters 5-7. Chapter 2 deals with more theoretical and conceptual material, whereas Chapter 3 is concerned with more factual background information.

Chapter 4 discusses the types of data required to answer the research questions posed in Chapter 1. It then goes on to describe the overall case-study and mixed-methods research strategy, as well as the methodologies adopted in order to collect and analyse these data.

The results of fieldwork undertaken are laid out in Chapters 5-7. Chapter 5 discusses evidence of the value that managing stakeholders attach to floodplain meadows involved in their management, and their motivations for involvement. It considers to what extent there are tendencies in the views, opinions and perspectives of different stakeholders, and whether there are tensions between stakeholders arising from differences of perspective on meadow value.

Chapter 6 details the assessment activity observed or documented to take place on the meadow site. It considers what type of assessment activity is seen to take place and how this related to the views on meadow value expressed by stakeholders and how this value is represented by the assessments' criteria and structure. Again differences between stakeholders in their assessment activity are noted and investigated.

Chapter 7 then considers what relationships exist between stakeholder assessment activity and knowledge generation, their use in making meadow management decisions, and what evidence there is for a process of responsive management. Factors other than assessment results that appear to influence management decisions are investigated and the relative importance of different factors in influencing meadow management evaluated.

Chapter 8 discusses and analyses the results found and presented in Chapters 5-7, drawing out the main findings of the work in the context of the overarching research question in order to establish what relationship can be seen to exist between stakeholder assessment activity and floodplain meadow management.

Finally Chapter 9 presents the overall conclusions of the study and proposes areas for further research in order to develop the findings of this study further.

Chapter 2 – Literature Review

2.1 Introduction

This chapter reviews relevant academic and grey literature of utility in framing the research questions posed in Chapter 1. As a guide to the work, the flow chart in Figure 1.1 is used as a model for the concept of responsive management. The chapter restricts itself to more theoretical and conceptual concerns, whilst Chapter 3 presents more descriptive background information on meadows or further background detail to points made in this chapter in order to provide the reader with the necessary background to follow the later chapters.

The chapter begins by considering literature on the drivers of floodplain meadow formation and on the concept of responsive management. It then considers in turn the three elements of the model in Figure 1.1: meadow condition and value, meadow assessment, and meadow management in order to inform each of the sub-questions in Chapter 1. Existing literature on research, policy, legislation and guidance regarding these three elements is reviewed to establish the extent of current knowledge and understandings about these elements of meadow conservation practice, as well as tensions and inconsistencies that may exist between the theory and reality of meadow conservation.

2.1.1 Approach to the literature review

The interdisciplinary approach required to answer the research questions posed has meant that the literature review has had to address a range of intersecting themes from across the natural and social sciences rather than primarily from within one specialist area. For many of the themes addressed very large bodies of literature exist. For this reason the literature review has followed a thematic approach, identifying key topics areas in which the literature needed to be interrogated. This said, the scope and coverage of the review has had to be very selective both in terms of the themes addressed and the extent to which the literature has been covered within each thematic area.

In terms of selectivity of thematic area, there are a number of topics and areas of research that potentially have a bearing on meadow conservation, but have not been covered in detail in this review as they were not seen to be directly relevant to stakeholder practices as described both in the literature and as observed in the field. For example, the ecosystem services perspective of the value of natural systems such as floodplain meadows was seen as relevant by policy specialists and high level reviews such as National Ecosystem Assessment (UNEP-WCMC, 2011). This approach to conceptualising meadow value is therefore potentially of great importance to thinking about meadows and why they might be worth conserving. However, as this perspective was not mentioned to a significant degree by managing stakeholders or site-specific documentation, and did not appear to have as a strong bearing on their perceptions of meadow value as other perspectives, it was decided not to review in detail the now extensive literature on this topic. Similarly, had stakeholders been noted to assess the landscape character of meadows, it would have been necessary to review in much greater detail the literature on landscape character and assessment.

The limited space available here to review the literature has therefore required space to be prioritised towards topics and themes that have proved most relevant to actual stakeholder practices rather than potential practices. This work has focussed particularly on the UK and English context of floodplain meadow conservation. For further information on the international context of floodplain meadows within Europe, the threats to their conservation, and of European lowland grasslands more generally, the reader may wish to consult Rodwell et al (2007) and its associated bibliography. A more recent update to the European context and threat of abandonment of European lowland grasslands is provided by Berg et al (2011). For a broader view of the global context of grasslands the reader may wish to consult Gibson (2009). Research on the agronomic performance of grazing grasslands as well as the relationship between performance and sward biodiversity are considered in various articles in Lemaire et al (2011), in particular Dumont and Tallowin (2011).

In terms of ideas about the value of floodplain meadows and why they should be conserved, a brief overview here has touched on the various broader perspectives that exist. However, more emphasis has been placed on the biodiversity perspective, and on ways of thinking about nature that have strongly influenced the conservation movement in the UK after the Second World War and that have been seen to influence subsequent stakeholder practices. Further consideration of alternative perspectives of the value of nature and natural resources may be found in Attfield (2003), Foster (1997) and Perman et al (2011). For further information on the ecosystem services approach and related approaches to ecosystem value, the reader may wish to consult Tietenberg (2004), Dumont and Tallowin (2011), Kareiva et al (2011), Lemaire et al (2011), Ninan (2011), Amiand and Carrere (2012), and Tietenberg and Lewis (2012), whilst the bibliographies of the UK National Ecosystem Assessment (UNEP-WCMC, 2011) and the international Millennium Ecosystem Assessment (2005) provide further background and context to this approach. Furthermore ideas on the nature/culture dichotomy are explored from a range of perspectives by Soper (1995), Soulé and Lease (1995), MacNaughton and Urry (1998), and Nelson and Callicott (2008), whilst for different perspectives on the idea of landscape see Wylie (2007) and Bell (2012) and their associated bibliographies.

In the case of meadow assessment and management practices, particular emphasis here has been laid on practices that are seen to be relevant to the context of floodplain meadows, and on associated literature from which such ideas were seen to be drawn such as standard guidance manuals and management plans. Tensions might arise between stakeholders resulting from different ideas about what constitutes traditional management, or the likely impact of particular management practices. The former depends on past practices and will have varied in time and space and is context specific whilst in the latter case varying degrees of research on the impact of different management practices on different types of grasslands including meadows have been undertaken.

Hubbard (1968) reviews older literature from agricultural reference works that provide an understanding of such traditional management practices. Regarding management operations,

this work has been focussed as much on the social, cultural and economic drivers of management, as on the impact of management as a driver of meadow composition. The review of literature on the impact of management operations as drivers of meadow composition has therefore been limited to issues of relevance to the context of floodplain meadows and the tensions that arise between stakeholders. For example, within the broader literature on European mesotrophic lowland grasslands a significant body of literature exists on the impact of operations such as cutting, grazing and manuring. However, for this work it has been important to determine the ideas that influence decisions on whether and how to execute these operations, which may or may not draw on ideas generated by such research or may well be determined by socially or culturally determined factors. For access to the broader literature on the material impact of agricultural management operations on mesotrophic grasslands, see Smith et al (1996a,b), Gowing et al (2002b), Bullock et al (2007) and Berg et al (2012). In terms of the broader approaches to conservation assessment and management, and their interrelationship, see Spellerberg (1992), Szaro and Johnston (1996), Sutherland (1998), Sutherland and Hill (1998), and Sutherland (2000). For a higher level review of the efficacy of protected area management, see Stoll-Kleeman (2010).

2.2 Definition of floodplain meadow grassland and phytosociology

For the purposes of this study a meadow is defined as agricultural land on which a crop of hay is grown during spring and summer. In the case of traditionally managed hay meadows, these are considered to be meadows that are cut for hay in early summer and grazed with livestock over the autumn and sometimes winter (Jefferson and Pinches, 2010; Rackham, 1987; Ratcliffe, 1977). Floodplain meadows are most commonly those located near the banks of a watercourse on land that floods periodically, though on a few sites flooding may also occur periodically in whole or in part as a result of groundwater flow, such as at Mottey Meadows in Staffordshire (Natural England, 2005). Whilst the above definitions may seem straightforward, complications do nevertheless arise in defining floodplain meadows for the purpose of identifying their value and assessing their conservation needs.

Floodplain grasslands managed for hay may contain a mosaic of various plant community assemblages that would be described by the UK National Vegetation Classification (NVC) system as MG4, MG5, MG7C, MG8 or MG13, amongst others (Rodwell, 1992). To confuse matters, the terms floodplain meadow, *Alopecurus pratensis-Sanguisorba officinalis* (meadow foxtail – greater burnet) grassland, MG4 grassland, flood-meadow, lowland hay meadow and even just hay meadow or meadow are commonly discussed in literature as though fully interchangeable when referring to the MG4 plant community and often more generally when referring to a landscape managed as a floodplain meadow, which may or may not include areas of MG4 community sward (Benstead *et al*, 1997; European Commission, 1992 & 2007; Gowing, 2006; Horton and Jefferson, 2006; Jefferson, 1997; Jefferson and Pinches, 2010; JNCC, 2007; Rodwell, 1992; Rodwell *et al*, 2007). This is probably because, unlike the other NVC communities, the MG4 community is almost exclusively confined to floodplain land managed as hay meadows.

As noted in Chapter 1, in the UK MG4 grassland is now recognised as being of high conservation value (Jefferson, 1997), and this has led to MG4 grassland becoming synonymous with floodplain meadows, and to the conservation value of floodplain meadows being tied to a large extent to their content of MG4 grassland. Understandings about meadow value and condition are therefore likely to be heavily influenced by such definitions and attempts to define baselines and boundaries against which a meadow can be assessed. Differences in interpretation or understanding of these definitions may lead to conflict between managing stakeholders.

2.3 Production of meadows: the key drivers of meadow plant communities

A number of researchers have examined the role of the key drivers of the floodplain meadow plant community assemblage (Critchley, 2007; Gowing et al, 2002a, 2002b; Gowing, 2005, 2006; Humphries and Benyon, 2006; Milsom, 2006; McDonald, 2001; Mountford et al, 1993, 1996; Toogood *et al*, 2008).

It is the unique co-incidence of climatic, hydrological and soil conditions, coupled with the disturbance and nutrient removal caused by hay cutting and grazing, that have led to the development of this particular series of plant communities. The species richness and distinctive composition results from the fact that sites where they occur do not have to endure lengthy extremes of soil drying or waterlogging (Gowing *et al*, 2002a; Gowing, 2006), and the mesotrophic soil conditions are neither so nutrient rich as to favour nutrient-responsive species nor so poor as to only be tolerated by stress-tolerant species. Site hydrology and soil nutrient availability are therefore key biophysical drivers of the floodplain meadow plant community, whilst management is another key driver influenced by socio-economic and cultural factors. The lack of environmental extremes permits a mix of stress-tolerant and stress-intolerant, nutrient responsive and unresponsive species, in an environment managed in such a way as to prevent a few aggressive competitors from taking over. This maximises the potential number of species that can co-exist as proposed by Grime (1973, 2001, 2007) in the so-called 'hump-back' model[1].

As noted previously, floodplain meadows are agricultural landscapes that owe their present characteristics and botanical composition to an extended period of continuous land use as meadows. Management, in addition to the two above key biophysical drivers, is also a key driver of meadow composition and condition, as component plant species must have life cycles that are able to fit in with the periodic disturbance that meadow agricultural management creates. As a mid successional plant community, meadow swards need regular intervention to arrest otherwise rapid successional processes towards scrub (Crofts and Jefferson, 1999).

In addition to the agricultural management of hay cutting and grazing, other site management operations such as drainage and flood control works or application of fertilisers in turn affect the other two biophysical drivers. Meadow management is therefore central to the maintenance and conservation of floodplain meadows in good condition.

[1] This model proposes that in such neutral grasslands the maximum number of plant species can co-exist in grasslands of intermediate levels of productivity.

Gowing *et al* (2002a, 2002b, 2005) and Gowing (2006) detail the dominant influence of hydrology in determining the plant communities of meadows, whilst Humphries and Benyon (2006) and Toogood *et al* (2008) note the rapid dynamism that exists in and between the wet meadow plant communities. Toogood *et al* (2008) in a reciprocal transplantation experiment of sward between flood-meadow grassland and wetter inundation grassland noted rapid changes in plant community composition and characteristics within one year of transplantation.

Further to this, Mountford *et al* (1993, 1996) found that addition of nitrogen fertiliser to hay meadows in Somerset led to significant changes in the meadow sward and a decline in meadow species richness within a period of three years, and that following cessation of these additions, the sward took several further years (3-9 years) to revert to a similar condition to that at the beginning of the field experiment, depending on the rate of application of fertiliser.

2.3.1 Resilience and fragility of floodplain meadows

Gowing (2006) suggests that species rich communities may need a stable environment to survive. This appears to agree with the idea that the finely-balanced hydrology, nutrient levels and consistent management provide a window of opportunity for a uniquely broad range of grassland plant species. However, it also suggests that traditional floodplain hay meadow plant communities may be fragile, in the sense that they are sensitive to fluctuation in the environment or variability in management. This accords with Holling's (1973) suggestion that resilient communities tend to be less fragile and more tolerant of fluctuating environments.

Therefore, paradoxically, floodplain meadows may be fragile communities that have evolved to function within relatively stable environmental conditions, despite the fact that floodplains are areas of periodic disturbance. Research indicates that the timing of flood events is highly significant in terms of the impact on meadow plant communities (Gowing et al, 2002b), summer flooding during the plant growing season having a much bigger negative impact on many plant species. Also, MG4 grassland tends to occur on those parts of the floodplain that are less prone to flooding during the growing season and so on the less disturbed parts of the floodplain. The fact

that these species-rich communities thrive in locations without extreme variation may therefore make them fragile and lacking in resilience in the face of environmental variation, change or extreme events.

2.4 Concept of responsive or adaptive management

Key literature relating to the assessment and management of floodplain meadow grasslands makes frequent reference to the principle of responsive or adaptive management, that is to say, management that is responsive to the findings of assessment and monitoring data (Robertson and Jefferson, 2000; Crofts and Jefferson, 1999; Benstead *et al*, 1997; Greenwood and Robinson, 2006). Greenwood and Robinson note that (2006, p68):

> changing the management regime in the light of experience and deeper understanding, adaptive management, is clearly a rational approach to both the exploitation and the conservation of wildlife.

Benstead *et al* (1997) note that surveying and monitoring form an essential part of conservation management without which the effectiveness of management cannot be assessed. In the *Lowland Grassland Management Handbook*, Crofts and Jefferson (1999, p15:1) note that:

> Grassland monitoring is part of the decision-making process required to manage semi-natural grasslands satisfactorily...The role of monitoring is to ensure that decisions made about management are correct and if they are found to be incorrect, to help to identify how management should be adjusted.

Importantly, Greenwood and Robinson (2006) further note that scientists are not the only important actors in meadow assessment:

> While scientists have an important role in wildlife monitoring, they are not the only players. The science is useful only if it is combined with the technical expertise of others, such as land managers and economists, and if it is used as part of the evidence on the basis of which decisions are made by the wider community. Decisions made without

> considering the scientific evidence is unsound: science that is conducted in isolation from the economic, social and political context is of limited value and is likely to be ignored.

The above clearly resonates with the findings of Forsyth (2003) about the dangers of scientific knowledge created and used in isolation from its social, economic and political context and that emphasises that sites such as meadows are managed and produced by networks of diverse agents or stakeholders. For example, scientists may have very particular interests in a system such as a meadow, and therefore only study a specific aspect of it, thereby generating a partial view of the issues and challenges facing conservation managers and other actors.

Roberston and Jefferson (2000) acknowledge that grassland systems are dynamic and note that condition monitoring for grassland sites is intended to act as an alert system intended to provide warnings when change in system variables has moved beyond the envelope of what is considered to be natural fluctuation or cyclical dynamism.

Key references produced by grassland conservation practitioners and researchers therefore highlight the importance of assessment and monitoring in influencing management. In terms of what to monitor, the focus is on the material botanical composition, though some authors recognise the need to record management too in order determine the relationship between meadow material composition and condition and management operations. As regards what should be monitored, Greenwood and Robinson (2006) note that both site materiality and condition as well as management practices should be monitored:

> changes in the management of individual sites or of the whole study area might not be known in advance to the ecologist monitoring the population, but an understanding of the impacts may be gained if the management is kept under surveillance together with the population (Greenwood and Robinson, 2006, p72).

Further to this the JNCC's *Lowland Grassland Management Handbook* (Crofts and Jefferson, 1999) includes a model for grassland site monitoring and feedback to responsive/adaptive management that includes periodic recording of botanical data on the grassland condition, but also on the

management operations in order to allow a critique of management if necessary. Furthermore, Crofts and Jefferson note that (p15:3):

> If the vegetation only is monitored and no records are made of management operations or other activities, it can be difficult to decide how to adjust management or control other activities if the condition of the nature conservation feature is found to be unacceptable..... Ideally the site manager should record where and when key activities occur that are likely to affect the conservation interest of the grassland.

Interestingly however, the guidance on setting up a monitoring scheme for wet grassland *The Wet Grassland Guide* (Benstead *et al*, 1997) notes that the baseline can only be determined by surveys, and in consideration of what should be monitored only mentions botanical surveys. For them the baseline would therefore appear to be based entirely on the material and botanical composition and not on any other consideration of meadow value.

Specific management operations for managing floodplain meadows are further discussed in more detail in Chapter 3.

2.5 Stakeholders involved in meadow conservation

Stakeholder networks that manage floodplain meadow sites can be complex and diverse. For example, at North Meadow, Cricklade, Wiltshire, Gilbert (1996) investigated the history of the meadow's ownership and management, tracing the complex changes in land ownership over the centuries, and discussed the traditional bodies such as the Manorial Court or Court Leet, which is responsible for administrating meadow grazing rights. However, in the literature, these stakeholders are generally reduced down to two main groupings that have been studied by researchers: conservationists and conservation bodies primarily interested in the 'nature' interest of the meadows (Adams, 2004; Sheail, 1986, 1995, 1998; Pullin, 2004, Sutherland, 2004, 2006a, 2006b, 2008, 2010), and farmer/managers who deliver the management on the site and have varying degrees of interest in the agricultural value of the meadow (Riley, 2006; Sheail, 1986; Whitehouse, 2009). In terms of meadow grasslands in the UK, researchers appear to have

focused more on the practices of the former than the latter, although some researchers have investigated the motivations and practices of farmers of conservation grasslands (Riley, 2006, Whitehouse, 2009). The impact of land-ownership on meadow management does not appear to have been investigated specifically.

In some instances the two groups are clearly distinguished and hold strongly different views on the value of conservation grasslands (Whitehouse, 2009) whilst in other cases the two stakeholders may be one and the same where a farmer landowner is also strongly interested in nature conservation (Christiansen, 2007). Whilst it may therefore be possible to conceptualise the stakeholders in terms of this simple dichotomy, in reality, the two groups can be heterogeneous and multi-party or overlapping and cannot be stereotyped. Nevertheless the two main groupings of stakeholders in terms of conservationists and farmers is useful in identifying tendencies in terms of the value that stakeholders attribute to floodplain meadow grasslands and to their motivations for being involved in their management. It will be necessary to identify any dichotomy in the understanding of meadow value and on management issues between stakeholder groups, how this affects knowledge generation and influences the implementation of management.

2.6 Cited value associated with floodplain meadow grasslands and justification for their conservation

A range of motives are cited in literature for preserving floodplain meadows. These can be split very broadly into: botanical interest and other biological value, agricultural value, and other value that encompasses a range of cultural heritage value including landscape and aesthetic value.

2.6.1 Botanical value

Recent formal conservation literature notes that floodplain meadows are notified as SSSIs and SACs for protection as a result of the presence of areas of MG4 grassland, and the remaining stands of MG4 grassland are considered to be of international importance for nature conservation (Jefferson and Pinches, 2010). According to Jefferson and Pinches (2010), over 90% of known

floodplain meadow MG4 grassland is now designated as SSSI (Special Sites of Scientific Interest) and whilst many sites remain the property of private landowners, the conservation of these sites is the responsibility of the statutory government agency Natural England. JNCC (NCC, 1989) notes that the NVC provides a "language" for dealing with vegetation in a systematic way (p24) and notes that botanical evaluation of grasslands "shall be according to detailed florisitics of NVC communities"(NCC, 1989, p4). This again highlights how the MG4 definition is used as a key baseline description for floodplain meadows.

2.6.1.1 Conservation criteria

The criteria that have been used in the past to select SSSI and NNR (National Nature Reserve) sites are the so-called Ratcliffe criteria (Ratcliffe, 1977) (see Table 2.1). Ratcliffe acknowledged that the values on which these criteria were based were subjective and liable to change into the future, a point echoed later by the *Guidelines for the selection of biological SSSIs* (NCC, 1989, p9):

> "Special interest" in the features of nature are not fixed in time. It is a combination of the intrinsic attributes of nature and the values that people place upon these; and both of these parameters are prone to change in time.

Ratcliffe noted that a number of different criteria had already become accepted as a means of judging the nature conservation value of a site on the basis of general agreement and established practice, and that were used to select the criteria in his review.

Table 2.1 the Ratcliffe Criteria (Ratcliffe, 1977,p6-10)

Criterion	Rationale
Size (extent)	Ratcliffe notes that the conservation value of a site increases with size as the unit is considered more viable in a fragmented landscape.
Diversity	Considered by Ratcliffe to be one of the most important attributes of a site in terms of number of both communities and species. Richness of flora and fauna in terms of number of species is noted as an important criterion, though he acknowledge that species richness has to be treated as a factor of relative and not absolute importance.
Naturalness	Here Ratcliffe notes that, whilst it has been customary to use the term 'naturalness' for vegetation or habitat unmodified by human practices, in reality, in Britain, this is rare. He notes that Tansley (1939) coined the phrase semi-natural to mean modified types of vegetation in which dominant and constant plant species were accepted natives and community structure conforms to a range of natural types.
Rarity	This is noted as being, for many people, one of the most important reasons for nature conservation; to protect rare or local species and communities.
Fragility	This criterion reflects the sensitivity of habitats, communities and species to environmental change, reflecting a range of intrinsic and extrinsic factors. Fragile systems are noted to be usually deemed of high value owing to the risk of loss.
Typicalness	Ratcliffe noted here that it is also important to identify sites that represent the typical and commonplace as well as the rare or unusual.
Recorded history	The existence of records of past condition and management is noted to be of practical value for scientific research.
Position in an ecological/geographical unit	Where two sites are deemed of equal intrinsic value, one will be rated more highly if it is contiguous with a highly rated example of another formation.
Potential value	This represents the scope to enhance a site that may be considered in some way to be degraded.

Criterion	Rationale
Intrinsic appeal	This criterion is to some extent a catch-all category for many aspects of site value that is non-biological or geological and therefore deemed to be non 'scientific'. It includes the aesthetic appeal or charisma of certain species that have popular appeal such as birds or attractive wildflowers when compared with insects or lower plants such as liverworts.

2.6.1.2 Application of the Ratcliffe criteria to floodplain meadows

In terms of the conservationists, a range of literature cites the main value of floodplain meadows as being located in the botanical species richness and diversity of the grassland swards (Jefferson, 1997; Jefferson and Pinches, 2010; Robertson and Jefferson, 2000) with faunal interest presented as at most secondary. The reasons cited for conserving floodplain meadows with MG4 grassland, both in official documentation and in interviews with grassland specialists, are primarily that they are species rich (up to nearly 40 species/m^2 Rodwell (1992)) and harbour a number of rare or threatened vascular plants such as *Fritillaria meleagris, Oenanthe silaifolia, Oenanthe fistulosa* and various rare microspecies of *Taraxacum* (Jefferson, 1997).

Rodwell *et al* (2007) note that the UK has so little 'high value' lowland meadow designated as SACs ((EU) Special Area for Conservation), as the UK has chosen to take the MG4 definition in Rodwell (1992) as being synonymous with the EU definition of 'high-value' lowland hay meadow, whereas other countries have selected other broader definitions within the *Arrhenatherion* category of European phytosociological systems (Ellenberg, 1988). The size of the remaining resource therefore inevitably depends on the human-defined boundaries of the definition selected, again highlighting the importance of definitions to understandings of meadows' status and condition.

2.6.1.3 Significance of diversity and species richness

The detailed reasoning for the value of species richness is not discussed by Ratcliffe and, considering the above comments regarding subjectivity, appears to have been taken as a cultural

given at least within the nature conservation community. Most commentators and researchers highlight species richness and alpha diversity of the grassland sward as a key value of meadow grassland and one that in theory at least can be readily measured as a conservation criterion. Indeed, in a review of the criteria used to assess conservation value in a range of studies, Margules and Usher (1981) found that five criteria dominated. In order of priority these were:

- diversity (including species richness and habitat diversity)
- rarity
- naturalness
- area/extent
- threat of human interference.

The first three criteria were the most commonly used and perhaps represent a classic view of what nature conservation is for. The last criterion is interesting as once again it raises the issue of humans' relationship with nature as 'other' and the conceptual distinction between society and nature as two separate entities.

As noted by Margules and Usher (1981), both literature on floodplain meadows and management plans for meadow sites written by conservationists focus strongly on the Ratcliffe criteria, a set of criteria by which management plans for some nature sites continue to assess their value (Natural England, 2008), especially that of diversity (or species richness). Kent and Coker (1992, p16) note:

> The whole subject of species richness and diversity is fraught with problems and misunderstandings. There is confusion over the meaning of diversity, over methods for measuring and assessing diversity and overly ecological interpretation of different levels of diversity. (Kent and Coker (1992, p16)

And so as a result:

> Despite arguments to the contrary, most interpretation of diversity indices is based primarily on species richness rather than both richness and evenness. (Kent and Coker, 1992, p95)

And again:

> Arguments over the ecological significance of high diversity still abound. Most of these arguments assume that diversity is equated solely with species richness and take no account of the relative species abundances and evenness. Most ecologists consider high species richness to be a desirable property of any community or ecosystem and this criterion has dominated most methods for ecologically conservation evaluation techniques. (Kent and Coker, 1992, p102).

Lindemann-Matties *et al* (2010) investigated to what extent the general public were able to perceive species richness in meadow grasslands and did conclude that the grassland swards that were more species rich were indeed perceived as such by members of the public, and that species rich swards were perceived to be more aesthetically attractive, suggesting that such species richness of grasslands does indeed enhance their aesthetic appeal and value for the general observer.

The focus on the conservation of species richness and diversity appears to resonate also with the broader emphasis within the conservation movement on conserving 'biodiversity' as exemplified by Wilson (1992), a relatively new way of reframing the conservation movement's focus on species and habitat conservation (Adams, 2004). The ultimate rationale for the importance of species richness on a site such as floodplain meadows is nevertheless unclear, other than that it is an intrinsic characteristic of such meadows, which are perhaps worthy of protection for other reasons.

2.6.1.4 Flora vs. fauna

Crofts and Jefferson (1999) generally consider grasslands that have a long history of management as meadows not to be of great importance for invertebrates, and that changes of management to

favour invertebrates that may prejudice the botanic interest are not recommended as the latter is the priority interest of concern on such meadows. Where ground nesting birds are a consideration on a meadow site then the hay cut should be as late as possible. Bird interest therefore has the potential on some sites to conflict with the botanical and indeed the agricultural interest of a meadow.

2.6.1.5 Rare species

Rarity is highlighted as being of great importance to conservation, though Ratcliffe (1977) acknowledges that different species may be rare for different reasons, making rare species interesting to study for scientific reasons. Rarity therefore is important as rare species may be at enhanced risk of loss, and may be interesting to researchers for practical purposes, but Ratcliffe does not suggest that rarity concedes intrinsic value, and in terms of choosing nature sites to conserve, emphasis was placed on rarity of habitats and communities rather than individual species. In this regard the rarity of floodplain meadows and MG4 grassland would be a priority under these criteria.

Rodwell *et al* (2007) point out that most of the characteristic plants of MG4 are widely distributed and occur in other plant communities. For example a 'typical' MG4 plant, *Sanguisorba officinalis*, is also to be found in drier MG5 meadows, a reminder that plants range across the human-defined boundaries of NVC classes.

Most floodplain meadows do not therefore contain rare or threatened plant species with the main exception of Snakeshead fritillary *Fritillaria meleagris* (Horton and Jefferson, 2006; Oswald, 1992; Rodwell, 1992), which is restricted to a minority of floodplain meadows. The value of most such meadows is not therefore seen as being as a refuge for rare or threatened individual species, but rather the rarity of the grassland habitat or more accurately the rare species assemblage itself (Jefferson, 1997, Crofts and Jefferson, 2010; Ratcliffe, 1977; Rodwell, 1992). Again, whether the rarity of such assemblages also concedes intrinsic value to the meadow, or merely makes them a

practical priority for conservation given that rarity may indicate an enhanced risk of permanent loss, is again a question not explicitly tackled by conservation or scientific literature.

2.6.1.7 Biodiversity perspectives and ecosystem services perspectives on nature's value

Whilst Adams (2004) notes that the conservation movement in the UK has developed from a focus on species and habitats and that is still reflected in the structure of much UK and EU conservation legislation (Cowley and Vivian, 2007), many researchers now consider that conservation should move away from a focus on conservation metrics such as species and communities and move towards conservation of ecosystem process (Harris, 2006). This view is in line with the current thinking on ecosystem function that emphasises the importance of focussing on restoring 'natural capital' and delivery of ecosystem goods and services (UNEP-WCMC, 2011). Indeed, from such a perspective, 'diversity' may now be seen to encompass diversity of ecosystem function, not only biodiversity of species and habitat composition. In particular, the European Commission note that for NATURA 2000 sites:

> Natura 2000 is not a system of strict nature reserves where all human activities are excluded. Whereas the network will certainly include nature reserves most of the land is likely to continue to be privately owned and the emphasis will be on ensuring that future management is sustainable, both ecologically and economically. (European Commission, 2013).

thereby noting the importance of maintaining the economic viability of protected area management.

2.6.2 Agricultural value

In contrast with the botanical value, on which a considerable literature has been produced, little recent literature looks at the agricultural value of semi-natural grasslands such as floodplain meadows.

Riley (2006) in his work with upland hay meadow farmers identified three key aspects of importance to these farmers: hay quantity, quality and the extent to which managing the hay meadows fitted in with other farm management activities.

Tallowin and Jefferson (1999) found that dry matter production from unfertilised species-rich semi-natural grasslands ranged from less than 20% up to 80% of that of agriculturally-improved and intensely managed grasslands whilst Gowing *et al* (2002b) found that floodplain meadow and MG4 grasslands tended to yield between one third and two thirds of the expected yield from improved grasslands.

Whilst the quantification of hay yields is relatively straightforward, at least in theory, hay quality is a more complex and potentially disputed aspect of agricultural value. Reference literature on grassland species (ADAS, 1990: Hubbard, 1968: Cope, 2009) rate the commercial and agricultural utility of grass and herb species according to growth pattern (quantity and when this is maximised in the growing season) whilst quality is framed in terms of palatability, determining the readiness with which the plant is eaten, for example, leafy rather than coarse and fibrous with no toxins, and nutritional value (dependant on chemical composition and chemical availability).

The agricultural value of species-rich swards is suggested to be in part the result of the different nutrient content of differing herbs (ADAS, 1990) complementing each other. Overall, no one forage herb species is ideal in terms of nutritional value, palatability, non-toxicity and yield (Crofts and Jefferson, 1997). To this end, where conservation swards are desired for non-agricultural reasons, a mixed sward where the advantages and disadvantages of different plants offset each other also improves the agricultural value.

Although they did not look specifically at MG4 or floodplain meadow sites, Tallowin and Jefferson (1999) found that hay from unimproved grasslands was inferior in terms of digestibility and metabolisable energy. They found that in terms of nitrogen and phosphorus, and sometimes magnesium content, it was sub-optimal for livestock rearing. Sodium content appeared to be adequate although potassium content of hay from semi-natural grasslands was sub-optimal if cut

after July. Such deficiencies are also exacerbated by losses during the hay-making process. They do however suggest that greater palatability of the unimproved hay may mitigate in part against lower digestibility and that the ecological amplitude of the sward composition may mean the feedstuff is not deficient in terms of trace elements.

ADAS (1990, p1) also notes that "chemical control for cosmetic reasons invariably reduces the valuable legume content", suggesting an alternative aesthetic within farming circles of what a good sward 'looks' like, which is different to that of conservationists.

2.6.3 Interplay and conflicts between conservation value and agricultural value

Tallowin and Jefferson (1999) conclude that, although semi-natural grasslands such as floodplain meadows are considered of high value for nature conservation, and although they are eligible for financial support for their maintenance:

> it is possible that the forages that they produce will be increasingly marginalised and abandoned by the agricultural industry if it cannot be demonstrated that their use can be successfully integrated into farming systems (Tallowin and Jefferson, 1999, p100).

thereby highlighting a significant socio-economic threat to the sustainability of meadow conservation. McDonald and Howard (2001) found that farmers on the Derwent Ings in Yorkshire were generally pessimistic about the future of Ings under the present management regime. A number of farmers said that they were close to giving up farming as the returns did not justify the investment. A key message from these farmers was that the balance between farming, conservation and water resource management in the Ings needed to be addressed with a solution that did not favour one interest group over all others.

If farmers state that the value of a hay crop depends on the quality and quantity of hay, work by Tallowin and Jefferson (1999) indicates that, whilst there may be a trade-off between these two aspects of value that affects the optimum cut date, at the same time the species richness and botanical diversity of traditional meadow swards may mitigate this trade-off to some degree. Tallowin and Jefferson (1999) found that diverse traditional grass swards mature more gradually

than modern monocultural or low-diversity grass swards, permitting greater flexibility in the cut date and making it easier for farmers to fit hay making in with other farm activities. In this way, the sward species richness may actually enhance the agricultural value of meadow hay under certain conditions. Hence the botanical diversity of value to conservationists is potentially implicated in the agricultural value of value to farmers such that the two forms of value cannot be totally separated. Tallowin and Jefferson (1999) suggest that the species diversity of semi-natural grasslands may lead to lower variability in yields from year to year in comparison with intensively managed grasslands.

Species rich conservation grasslands may be therefore on the one hand lower yielding and later maturing than intensively-managed grasslands, but on the other hand may be more reliable and resilient in terms of yield and more flexible to manage. Whether farmers deem them to be of value or not may depend on their personal circumstances and whether the flexibility, convenience and lower inputs compensate adequately for their lower output. Restrictions on their management that reduce this convenience and flexibility may therefore reduce their agricultural value to farmers and reduce farmers' motivations to be involved in their management.

2.6.4 Cultural heritage and landscape aspects of meadow value

According to Jefferson (1997), the key value of floodplain meadow grasslands lies in the unique assemblage of plants together in a landscape whose value is in part cultural and historical. It is this that is particular to the MG4 community, as well as the association with a distinctive agricultural system and landscapes that are increasingly rare. Jefferson and Pinches (2010) also cite their value as an ancient semi-natural grassland type, and acknowledge a cultural/historical value. This however suggests therefore that the 'natural' and 'social' value are inextricably linked and floodplain meadow landscapes are therefore also likely to be valued for landscape, aesthetic and recreational reasons.

However, such aspects of meadow value are not discussed in conventional scientific and technical literature, and are little discussed elsewhere. Such aspects of value are discussed in much more

generalised terms, and the philosophical foundation and ultimate locus of such value are not elaborated on, suggesting that such narratives are not well developed. As such, where such justifications for the conservation of floodplain meadows are mobilised in literature, they tend to appear very secondary and subordinate to the primary botanical value.

Wylie (2007, p3), citing cultural historian Raymond Williams, notes that for some in the European and Western tradition the idea of landscape has been shaped by artistic traditions and that:

> landscape is a particular way of seeing and representing the world from an elevated and even 'objective' vantage point.

This point appears to resonate with the fact that in the UK, Areas of Outstanding Natural Beauty (AONBs) are generally located in areas with either significant topographical relief, or at the coast, that is to say, the concept of a beautiful view is linked to the idea of a view from an elevated vantage point (NAAONB, 2012). Formal or statutory recognition of flat areas of countryside as scenically attractive appears to be rare and a clear narrative of the landscape value of such sites does not appear to have been as highly developed, at least not with regards to floodplain meadows. This said, Gray (2009) notes that over the past 20 years a wider landscape approach has begun to feature in conservation strategies, with two key themes being management and restoration of landscape and the characterisation of landscape, such as the Natural Areas classification (Natural England, 2012d) that cover all of England and has given rise to Landscape Character Assessments (Natural England, 2012c).

Morin (2009, p297) notes that:

> Landscapes carry symbolic and ideological meanings that reflect back and help produce social practices, lived relationships and social identities, and also become sites of claiming and contesting authority over an area. Social practices and landscapes mutually constitute one another in an on-going fashion

the meadow as a landscape being made by social practices and in turn influencing them.

For conservationists, these less tangible aspects of the meadow value appear to be linked back again to material botanical characteristics of the meadow. The four key 'pillars' of the Higher Level Stewardship scheme that underpins financially the management of so many floodplain meadows are: biodiversity, landscape quality, cultural heritage and environmental quality (Natural England 2009a, 2009b, 2010a, 2010b). So whilst the precise location or definition of such value is not clearly defined, it is a reason cited for the state to intervene financially to support meadow management.

Nevertheless, Brian (1993) and Gilbert (1996) note that whilst floodplain meadows are important to conservation as fossil agricultural landscapes, there is no statutory mechanism for protecting old meadows "for themselves, for what they are" (Gilbert (1996, p68)). This may be interpreted as meaning that there is no statutory ability to recognise their broader cultural heritage value without being obliged to link or defer this to their botanical or 'nature' value.

Just as Ratcliffe notes that the nature conservation criteria are subjective, so too Muñoz Viñas (2011) notes that cultural heritage value is also very much anthropogenic and liable to evolve over time.

2.7 Theoretical perspectives and influential narratives in assessing meadow value

Stakeholders' ideas about the value of nature sites such as floodplain meadows and what constitutes a 'good' meadow may well be influenced by the common perception of the natural and the social as inherently separate domains (Cronon, 1995; Castree, 2001; Castree, 2005; Demeritt, 2001; Ginn and Demeritt, 2009). For many, including parts of the conservation movement, the non-human and the human, the natural and the social, are two wholly separate spheres and nature/society is a fundamental dichotomy. Symbolic of this 'otherness' of nature is the concept of wilderness as a pristine nature utterly without human influence as well as the widespread use of the term semi-natural in conservation literature, hinting at the existence of a purely 'natural' state. The modification of such vegetation, being socially achieved, suggests that

conservationists may tacitly acknowledge semi-natural vegetation to be a socio-natural hybrid (Haines-Young, 2009). Yet the desirability of 'naturalness' is still implied and is one of the key Ratcliffe criteria. This said, Ratcliffe acknowledged that the distinction between natural, semi-natural and artificial cannot be rigidly defined and that the distinctions made in his review were somewhat arbitrary.

Many have taken these concepts of a nature/society dichotomy and of contemporary wilderness to task (Cronon, 1995; Castree, 2001; Demeritt, 2001; Castree, 2005; Ginn and Demeritt, 2009), asserting that the human and the non-human are intertwined with social and biophysical processes interacting such that nature is 'co-produced' in the sense that the 'natural' environment is not what it would be were humans not in existence. To this extent Castree and Braun (2001, p209) claim that "nature is social through and through" and they and others have coined the phrase socio-nature / social-nature to emphasise the interaction of human and non-human and the way in which nature is made and remade by society as a hybrid assemblage. Adams (2004) notes the difficulty that some scientists may have in accepting that nature is a socially-produced concept and that nature itself is co-produced, yet Usher (1989) notes that many conservation areas require a management system that prescribes some sort disturbance to retain their wildlife interest, the disturbance often being provided by humans, in the case of agricultural landscape under the guise of farming activity. Wylie (2007, p9) notes that:

> ....perhaps more than any other, the couplet culture/nature signals the tensions at work within the concept of landscape.

and that for many geographers nature plus culture equals landscape whereby what we see in a landscape is a (p9):

> process of continual interaction in which nature and culture both shape and are shaped by each other.

Interestingly however, the concept of wilderness and 'pure nature' still seems to hold sway with many conservationists and in a review of current conservation policy, Sutherland *et al* (2010) note

the increasing interest in creating and restoring landscape-scale wilderness areas, showing that this concept still has a strong attraction for many conservationists. Conservationists are still often very attached to the idea of nature as 'other'.

Whilst floodplain meadows are clearly historical agricultural landscapes, produced by human management practices, without which they would quickly change into a very different landscape through processes of natural succession, the desire by conservationists to frame meadows as 'nature' and therefore non-social may have a bearing on how they see the meadows, their value, and how they should be managed. Further to this, Woods (2010) notes that another dichotomy with a long history is that of the urban/rural divide, again socially produced. In a country such as the UK with a long history of human activity in the landscape, these two powerful narratives are likely to have a strong influence on how the countryside, the landscape and within it, and meadows themselves, are seen. Such a conceptualisation of nature conservation sites can lead to disputes between different social groupings who view them from differing perspectives.

For example, Whitehouse (2009) found a sharp clash of values when investigating grassland management around the Loch Gruinart RSPB reserve on Islay, Scotland. The RSPB had bought a grassland farm to manage for the local geese populations, but then proceeded to make the site wetter for wading birds. Local farmers criticised the RSPB for not managing the site 'properly', that is to say as a farm as they recognised it, judging the state of the land in terms of what they considered to be negative indicators of farm management. The farmers' criteria of good condition related to a landscape created through land drainage of the earlier landscape by their ancestors, and that was clearly managed, whereas the RSPB wished to create a landscape that more closely resembled that pre-drainage.

Whitehouse (2009) found that the RSPB conservationists and the local farmers of surrounding land were managing the land with sharply different visions of what 'good' land looked like. To the RSPB, 'good' land looked like a bygone pre-farming or even pre-human landscape, real or imagined, whereas to the farmers good land bore the mark of human intervention. It looked

managed. Disputes between farmers and conservationists therefore turned on disputes over what the land was for and both sets of land (reserve vs. farm land) representing opposing visions, one 'natural', the other 'social'.

In this sense, nature reserves such as floodplain meadows have a fundamentally dual character as farm/reserve. As traditional agricultural practices produced in the first place the landscape that it is desired to conserve, the farm and reserve should be one and the same. However, as Whitehouse (2009) found such farm/reserve duality can become decoupled with nature and society seen as separate non-overlapping realms. As Evely *et al* (2008) put it, even where monetary incentives are involved such as in agri-environment schemes, the uptake of such incentives cannot be based on objective arguments, but need to take account of what farmers think it means to be a good farmer.

Both Botkin (1990), an ecologist, and Thomas (1983), a historian, recount from different perspectives how throughout history human attitudes and behaviour towards non-human life have evolved according to how human relationships with other non-human life forms were perceived, and how this relationship affected how nature was valued. Attfield (2003) relates how such evolving ideas have also altered concepts of what behaviour towards nature and the environment may be deemed ethical. It therefore seems clear that ideas about nature, and therefore about floodplain meadows, rather than being objective, rational and derived from logic, have a history and indeed a cultural history leaving scope for mixed narratives about what the value of meadows is, and how and why they should be conserved. Indeed as seen, many scientists are in fact prepared to acknowledge that the criteria used to define what is of value in nature and is to be conserved are subjective (NCC, 1989; Ratcliffe, 1977; Usher, 1989).

The question therefore arises as to how stakeholders perceive and assess the value of meadows, and of how such ideas and associated narratives influence perceptions of how they should be managed, and the resulting management practices. In this work therefore, it will be necessary to identify stakeholders' narratives about meadow value, the different components of such value

and any tensions between them. It will then be necessary to evaluate whether such tensions and conflicts are underpinned by framings of floodplain meadows as natural, as opposed to socio-natural hybrids, and how this may influence decisions regarding meadow management.

2.7.1 Meadow conservation: Is change allowed?

If as Ratcliffe (1977) and NCC (1989) suggest, there are no purely objective 'scientific' criteria for what nature should look like given that it is inextricably linked to society, the human desire to conserve 'nature' has therefore had to make reference to historical benchmarks, drawing on a range of desires including nostalgia for a past, real or imagined, and a wish for continuity and familiarity in a world of change (Woods, 2010). The two main groups of benchmarks envisaged for nature conservation are pre-human (wilderness) and traditional or pre-industrial. In the absence of an ultimately 'natural' landscape against which floodplain meadows can be compared as a benchmark, this begs the question of what the conservation benchmark for meadows should be.

Sheail *et al* (1997) have noted a progressive move in the nature-conservation movement from 'preservation' (keeping exactly the same) towards 'conservation' a more flexible concept whereby a nature site may be 'improved' by enhancing certain aspects. However, again, the choice of characteristics to be enhanced is subjective. Muñoz Viñas (2011) notes that with regards to cultural heritage conservation, perfect preservation is impossible and all conservation acts involve choices to enhance some aspects whilst incurring loss elsewhere. Interestingly, Adger (2000), in considering whether social and scientific concepts of resilience are the same, concludes that a difference between the two is that scientific definitions of resilience require system variables always to return to the same value, thereby precluding uni-directional change (preservation by Sheail's definition), whereas social resilience allows for the concept of change through learning and adaptation. Pimm (1991) also considered a range of scientific definitions of resilience that also conclude that resilience precludes permanent uni-directional change in a system. This therefore begs the question of whether floodplain meadow conservation is compatible with change or evolution.

Crofts and Jefferson (1999, p8:21) note that:

> increasingly with biodiversity initiatives there is interest in increasing the nature conservation value of such swards which often involves increasing their plant species-richness guided by the original composition of the previous unimproved semi-natural grassland type where this is known. Restoration or recovery...normally involves reducing the residual effects of the previous fertilisation and drainage.

This would suggest that change is sometimes justified in terms of returning to a lost former baseline, assuming this former state to be known.

If only certain meadow characteristics are valued the question arises whether the meadow should be allowed to change to enhance and maximise those characteristics whilst other characteristics may be allowed to decline or disappear, in which case the meadow is in fact not being preserved but is evolving. This also raises the question as to what sort of change if any is permissible in conservation and indeed whether old traditional practices should be preserved too. As noted in the dispute over Loch Gruinart RSPB reserve (Whitehouse, 2009), both sides were making reference to a different historical baseline.

Harris (2006) has even questioned the validity and viability of projecting historical benchmarks into the future for conservation purposes, given that predicted climate change is likely to lead to significant alterations in biophysical processes. As a result some ecosystems may become increasingly fragile and less resilient by becoming increasingly marginal within their range and genetically isolated from other similar systems. Such systems may need different and possibly ever greater intervention to conserve them in their current state.

This might suggest that trying to keep floodplain meadows exactly as they are (or were) is futile as the materiality of the floodplain meadows and the traditional practices that produced them become decoupled, and that the management regime may actually need to move away from traditional management, thereby abandoning some of the cultural and historical links with the past, in order to maintain the biological characteristics the same, a choice to prioritise some

characteristics over others. Indeed, the climate is not the only way in which the environment of meadows may change. Changes in flooding patterns, affected both by climate and human activity through river catchment management, as well as floodwater nutrient and pollutant loadings, and changes in the surrounding land uses to meadows are just some of the other ways in which the landscape context of meadows will continue to evolve.

In this regard Harris (2006) again suggests moving away from conservation metrics such as species and community conservation towards conservation of ecosystem and processes; from biota towards restoration of natural capital and delivery of ecosystem goods and services. Harris considers that historical sources can be a guide but should not be a prescription of what does and does not belong in a landscape, and that it is more realistic to protect ecosystems rather than species. This would therefore suggest 'letting go' of rarities in some instances and prioritising function over tradition. Indeed as Proctor (2001) puts it, it is difficult to argue the value of biodiversity and why particular species merit our concern, with charismatic species and habitats attracting more concern, for reasons that may appear to be aesthetic and sentimental.

Yet with the emphasis of meadow value being placed on the floral assemblage and rare plant species, it is still in terms of biota content and distribution that many of the conservation criteria are currently framed for sites such as floodplain meadow grasslands, and it is not clear how such criteria could be framed in terms of process rather than material composition. Also, using floodplains for ecosystem services such as flood storage capacity in ways that alter the flooding patterns significantly, may pit one source of ecosystem services value (flood defence) against others related to the meadow grassland sward.

There is also the risk that abandoning historical benchmarking may leave no clear alternative and undermine support for conservation (Harris, 2006). This said, the past may not be an accurate guide to the future, and whilst a historic benchmark may fulfil needs for nostalgia it may nevertheless prove to be unrealistic and counterproductive.

2.7.2 The role of vegetation assemblage classification systems in defining the conservation baseline

As noted, in the case of floodplain meadow grasslands, greater emphasis is put on the value of the grassland community species assemblages rather than on individual species. Again, in order to conserve such assemblages a baseline definition of a good meadow assemblage is required and in the UK a number of classification schemes have been influential, particularly those of Ratcliffe (1977), Ellenberg (1988) and most recently and influentially the UK National Vegetation Classification (NVC) system (Rodwell, 2006). In almost all recent literature and documentation regarding floodplain meadows, plant community assemblages are conceptualised in terms of the categories of the NVC system. However, a number of issues arise in using the NVC to describe and evaluate habitats or plant assemblages. It should be noted that the editor of the NVC, Professor John Rodwell, makes clear that the NVC descriptions were meant to be merely that: descriptions, and not 'targets' or 'gold standards' to which conservation should aspire (Professor John Rodwell, University of Lancaster, pers. comm., Milton Keynes, 21/04/10).

Nevertheless, given that conservation is about identifying that which is of value and preventing it from changing, it seems unavoidable that any such descriptions of 'good' habitats chosen subjectively by experiential knowledge will then form the baseline for conservation and embody and symbolise the desirable characteristics against which other sites such as floodplain meadows will be evaluated.

As a result, whilst floodplain meadows may be heterogenous and dynamic, varying in time and space, with various plant assemblages present on any one site and different from site to site, it is the MG4 description based on 22 samples of grassland mainly in Central and Central Southern England that has been enshrined in legislation up to European level (European Commission, 1992, 2007) as the defining and symbolic plant assemblage of floodplain meadows. It therefore appears to have become necessary for a floodplain meadow to at least have a substantial area of grassland sward that is recognisably similar to the MG4 description in order to be considered a 'good' floodplain meadow.

Yet this reification of a certain standard habitat description is problematic. As Kent and Coker (1992) note, what constitutes a plant community and an ecotone (transition zone) is subjective and indeed to cite the original pole-opposites, following Gleason (1939), some researchers reject the concept of the plant community as a concept with intrinsic or emergent properties as originally proposed by Clements (1928), making it at most a useful human construct used to help make sense of complexity. Furthermore Kent and Coker note that the sharp distinctions between different plant communities in a landscape is often a function of the sharp boundaries in human land use in the landscape, that prioritise certain plant assemblages (as it does individual plant species) that fit in with the human land use whilst eliminating others. The patchwork of fairly distinct plant assemblages in the landscape is therefore very much socially produced, and therefore arguably so are the NVC community classes, seen as a snapshot of British landscapes in time and that will evolve and change.

2.8 Stakeholder Assessment of Meadows

In considering the utility of assessment activity on floodplain meadows, it is necessary to consider the motivations, structure and deployment of such assessments. Usher (1989) notes that monitoring programmes can gain a momentum of their own, consuming resources year after year, outliving their usefulness. On the other hand, long term ecological datasets are rarely found in the literature that can provide the basis for subsequent theoretical work. Monitoring and assessment activity can serve a range of purposes, intended to inform whether natural resources are being maintained in a desired condition, to inform on future management where this is not the case, to measure the success of management interventions as well as to assess the effects of perturbations and disturbances such as extreme or summer flood events on floodplain meadows. However, several researchers have questioned the utility of much activity in biodiversity monitoring in generating meaningful information to inform conservation management (Yoccoz *et al* 2001, Legg and Nagy 2006, Greenwood and Robinson 2006).

Researchers investigating the broader role of assessment and monitoring in conservation have critiqued the motivations and execution of much conservation assessment and monitoring. These

criticisms tend to revolve around either the lack of clear objectives in assessment, and the relative value of 'expert' scientific knowledge versus experiential knowledge, that is, what is the best type of evidence and what kind of data it is feasible and practical to collect. The latter is often stereotyped as being generated by 'non-experts' such as farmers despite their specialist knowledge of the very agricultural operations that produced landscapes such as floodplain meadows.

Yoccoz *et al* (2001) distinguish two main types of monitoring objective: more theoretical scientific objectives intended to inform understanding of underlying mechanisms and processes, and more practical management objectives intended to inform responsive/adaptive management that is able to respond to undesirable changes in system state variables. Danielsen *et al* (2005a) assert that methods for monitoring biodiversity are assessed on their ability to detect trends not for their ability to impact management, thereby decoupling the assessment/monitoring-management chain, or at least lack of consideration of the ultimate utility of assessment and monitoring. This suggests that monitoring philosophy is still dominated by the perspectives of 'pure' ecological research priorities, rather than catering to more applied aims.

According to Legg and Nagy (2006), most conservation monitoring work is initiated without clearly defined aims and is not driven by a clear hypothesis to be tested. It thereby generates data that are of little use for subsequent scientific research or to assist in decisions on site management. Yoccoz *et al* (2001) also criticise many monitoring programmes for lacking predetermined well-defined objectives and note that mere collection of information is assumed to be bound to be inherently useful. Among the reasons Legg and Nagy (2006) cite for the inadequacy of such monitoring data are the use of semi-quantitative or qualitative methods to collect data that cannot then be interrogated via well-established statistical methods. This would appear to include rapid assessment methods such as those used by Natural England (Robertson and Jefferson, 2000) to assess meadows.

Legg and Nagy (2006) suggest that a good monitoring programme requires a simple and accommodating design in which essential measurements and experimental treatments are straightforward and unambiguously repeatable even by staff lacking sophisticated training. This suggests that good monitoring methods should be highly formalised and standardised and taking measurements that leave no room or need for more experiential knowledge. Yet it is precisely this type of knowledge such as good botanical identification skills that is needed to undertake the more detailed surveys that they advocate, and the lack of which has driven the search for simpler semi-quantitative methods.

2.8.1 Choice of indicators

Assessment methods intended to codify the above value and criteria indicate that assessment of species richness or diversity is not always 'species blind' in that species identity is not irrelevant. Whilst quadrat population census data record all species in the grassland sward (Rodwell, 2006), commonly used rapid assessment methods identify lists of indicator species that assign positive and negative values to different plant species. For example, Natural England's rapid condition assessment method for MG4 (Robertson and Jefferson, 2000) is based on identifying the presence or absence of plants from closed lists of positive and negative indicator species. The only quantification is the recorded frequency with which an indicator species is found in a series of samples (see Appendix 1) and suggests that evenness of grassland species across a meadow is desirable (high alpha but low beta diversity).

The stated reason for this is to make the assessment rapid and feasible for assessors with limited botanical identification skills by eliminating the need to identify all species, in particular those that are difficult to identify. The lack of availability of such skills and the time-consuming nature of thorough quadrat surveys also mean that they are expensive to undertake, especially on a regular basis.

According to Natural England's Senior Grassland Specialist (Senior Grassland Specialist, Natural England, pers.comm., Peterborough, 01/12/10) the indicator species in the English

Nature/Natural England rapid assessment method for MG4 were chosen by a panel of experts. The panel of experts selected the indicator species by examining the range of species on 'good quality' floodplain meadow sites, the constancy tables in the NVC description for MG4 that indicate typical meadow species and their frequency of occurrence, the traits and autecology of the various species present including information in the York database on autecology of plants (Fitter and Peat, 1994), and the Grime strategy descriptions (relative characterisation of a plant as a competitor, ruderal or stress-tolerant) for the various species (Grime, 1973, 2001). Final decisions were based on consideration of these sources, and consideration of the opinion of practitioners in conservation including conservation site managers. For floodplain meadows the positive plant indicator indicators are divided into a List A and List B. The latter is a broad basket of typical meadow plant species, whereas the former is a more specific list of species restricted to the wetter meadows found on floodplains. In addition to this, practical issues such as ease and rapidity of identification were also factors in the choice. The choice of indicators therefore appears to have been a mix of scientific evidence, expert judgement and established practice.

In terms of selecting monitoring criteria, Büchs (2003) notes the difficulty of choosing indicators of 'biodiversity' value when compared with abiotic value such as water quality, particularly of choosing indicators that function at the local context-specific level (especially important for floodplain meadows that have considerable individual character) and also at the aggregated landscape level. Koelher (1999) also notes that the basic indicator unit is the species, a comment that is line with the fact that the Natural England condition assessment is based on the identification of species from closed lists of plant species when the ultimate value of meadows is supposed to be the assemblage.

Meanwhile, Dunger (1982) and Phillipson (1983) (cited in Büchs (2003)) contest that using single species and their populations as biotic indicators only gives very limited and incomplete representative value, and that it is necessary to include community-based parameters (such as species richness and evenness) to give a complete picture, or are even to be preferred. Given the above description of the valued characteristics of floodplain meadows, this would appear to be

particularly appropriate for this type of site. Indeed some species are much more strongly associated with particular plant assemblages and biophysical conditions than others (Kent and Coker (1992), so that community indicators may prove stronger integrative indicators, provided that the positive indicators are well chosen. This suggests that semi-quantitative assessments may have their place in following meadow evolution in time.

Crofts and Jefferson (1999) note how positive indicator species are more specific to particular grassland types than is the case for negative indicators, and that ideally indicator species should have some predictive value. The function of positive and negative indicators could therefore be different to some extent. The question arises over the meaning of the positive indicators. Their choice is presented as practical based on 'typicalness' of a particular valued landscape or habitat, but may also be symbolic or indeed aesthetic, although such matters are not seen to be discussed in the literature on floodplain meadows.

2.8.2 Dispute over the role of expert versus experiential knowledge

Disputes often arise over what type of data it is best to collect, a debate that is constrained by the limited resources available for conservation management. A number of scientific researchers have called for a more 'evidence-based' conservation (Sutherland *et al*, 2004; Pullin and Knight, 2003). Sutherland *et al* (2004) claim that much current conservation work is based on myth and anecdote (p305) rather than systematic evaluation of evidence with little information being collected on the efficacy of management interventions other than in the personal recollection of practitioners, which represents a single isolated 'data-point'. Sutherland *et al* (2004) draw parallels with the practices in medicine in the past, and the growth of 'evidence-based' medicine. They also assert that practitioner knowledges circulate within the conservationist community of practice in a way that makes verification of sources, such as an experiment or an academic paper, impossible and critical appraisal impracticable. In this way "dogma" (p306) can become common practice.

Crofts and Jefferson (1999, p5:38) note:

> Site managers often have to make decisions on the basis of quite superficial knowledge of the composition, structure and functioning of the grassland ecosystems being managed. The information used is often anecdotal in origin, and although factually it may be correct, conceptually it may sometimes be misguided.

Pullin and Knight (2003) add that environmental conservation has lacked such a shared formal evidence base, but that the inadequacy of project reporting makes such an endeavour difficult. Prior to the promotion of more 'evidence-based' medicine practices, medical experts issued guidance that could be based on individual experience and opinion as much as on research evidence. Pullin (2004) has similarly found that conservation managers, when updating management plans, make similar use of handbooks and previous management plans. The practices of management plan compilers appeared to be repeating much information without periodically testing its validity.

As Forsyth (2003) points out, some discourses may become dominant or 'hegemonic', as already noted with documentation on meadow value that is dominated by conservationists' focus on the botanical value. Similarly, experiential knowledge of non-scientific parties may have to be expressed in terms of Western scientific terms of reference in order to be taken seriously (Fazey *et al* 2006). Non-scientific knowledge therefore has to be reframed in terms acceptable to orthodox science. Which knowledges dominate has real material effect where it comes to be acted out in management (Castree, 2001).

Crofts and Jefferson (1999) consider that only experimentation can clearly establish the factors that drive vegetation change. Meanwhile, Bakker *et al* (1996a, 1996b) make the case for long-term permanent plot experiments in order to follow both system state and function over time. Such studies are considered of value in separating fluctuations and trends, allowing consideration of possible future trends and trajectories, allowing generalisability to other sites, and permitting testing of ecological models.

However, Fazey *et al* (2006) note that experiential knowledge is often intuitive and goes beyond the scope of scientific knowledge but the two can be complementary, forming a component of knowledge that is qualitatively different from quantitative scientific knowledge. Both forms of knowledge have their limitations. Whilst mechanisms that produce tendencies can be researched, complex systems such as floodplain meadows encompass a range of heterogeneous systems whose behaviour cannot be readily predicted (Evely et al, 2008).

Whilst some researchers therefore clearly are in favour of a knowledge generated by experiment and feel that experiential knowledge is limited and unreliable, other researchers see the experiential knowledge of 'non-experts' (in this case in fact non-scientists) as an untapped resource. Danielsen *et al* (2005b) make a case for the utility of community-based participatory monitoring rather than professionalised scientific expert-led assessment and monitoring. Given that the latter is often expensive, hard to maintain long-term and often has little or no impact on management, they assert that a range of participatory techniques including local community members, local rangers or managers can be as reliable, if properly designed and implemented and especially when linked to delivering ecosystem goods and services to local communities. In the case of floodplain meadows in England this could include for example the utilisation of assessment work by volunteers.

As Danielsen *et al* (2005b) point out, in some areas local people have undertaken natural resource monitoring themselves for centuries as an integral part of land management. In addition, the alternative to participatory monitoring is often no monitoring. In contrast, the protocols on assessment of meadows devised by conservationists for floodplain meadows do not appear to require any information, knowledge or opinions from site farmers or other stakeholders, other than at most a factual description of the management undertaken.

A note of caution is also raised by Sheil (2001), in considering the role of scientific research in conservation in tropical developing countries. Sheil considers that in certain contexts monitoring and research can be a hindrance and a distraction to conservation work as many threats to

conservation sites are readily identified in the field and so elaborate monitoring may not always be necessary. He notes that where resources are limited technical data collection will rarely be as cost effective as local experience and that the problem may lie in the assertion that (Sheil, 2001, p1181):

> Measuring is not protecting. 'Good science' is often seen as detached and value-free. In contrast good conservation management is driven by clear aims and priorities derived from conservation values.

Case-by-case assessment is needed, emphasising the need to consider context-specific issues.

2.9 Traditional and contemporary meadow management

Given the desire to preserve traditionally-managed floodplain meadows, there is a need to define what traditional management is and whether it still is practiced. The question also arises as to how conservation of traditional management practices fits in with the model of responsive management.

As regards the appropriate management for floodplain hay meadow grasslands, key literature is in agreement over the broad approach to meadow management. The meadows should be grazed over the autumn/winter period, then shut up for hay[2] by late winter, and the hay cut in June/July (Crofts and Jefferson, 1999, Benstead et al, 1997). This broad strategy is also in agreement with the historical understanding of meadow management (Rackham, 1987; Brian, 1983, Gilbert, 1996; Sheail, 1986; Wharburton, 2006). Furthermore, philosophically, the starting point for defining default management is that the traditional management created the meadows in the first place and therefore, in theory at least, continuity of long-term historical ('traditional') management should continue to deliver a meadow materially the same into the future. To this extent, the management of floodplain meadow sites would appear to be relatively straightforward. However, a number of issues arise from this approach of historical continuity allowing considerable scope for disagreement over meadow management.

[2] Cessation of grazing

In reality, knowledge of long-term past management is not a simple matter. As already noted, each meadow site is different, having different soils, climate, and hydrology, but also existing in its own landscape and socio-economic context. The management that local farmers in each area understood to be most productive or most suitable to their needs will have varied for site to site, and as Sheail (1986) notes from era to era. So 'traditional management' can only be defined as a broad envelope of management activities that were applied whilst the land was managed as a hay meadow and would have varied in detail in time and space. Furthermore, it appears to have been uncommon for farmers or land managers to record the specific details of their management practices. So again, only the broad approach to management is known and even this would have changed, as many meadows were managed as part of rotational agriculture or where converted back and forth to and from other land uses such as pasture or arable as the local economy dictated (Sheail, 1986).

Sheail (1986) describes the wax and wane of the area under grass in Britain over time and notes that between 1874 and 1884 alone the grassland area in Great Britain rose from 2.1 million acres to 15.3 million acres following a fall in cereal prices in 1874, the reverse of the trend since the Second World War (Crofts and Jefferson, 1999). Brian (1993) notes that some hay meadows now designated as SSSIs are known to have been arable land in the 19th century. 'Traditional management' for floodplain meadows can only be defined as a broad approach to meadow management that held for a long period of time historically prior to the advent of modern mechanised and industrialised agriculture in the twentieth century. McDonald and Howard (2001) note that in the Yorkshire Derwent Ings not all meadows were cut every year and some were used to rotate stock as part of a mixed farming cycle that has become less common more recently. McDonald and Howard (2001) also found that in the 1970s several farmers attempted to convert Ing meadows to arable cereal production but abandoned this within 2-3 years.

This leaves considerable scope for disagreement over specifics such as: the best time to cut the meadow, how intensively to graze and with what animals, and whether practices such as manuring, rolling or harrowing should be allowed. Historical evidence from the above sources and

from more site specific sources suggests that there was significant variation in time and space in all these activities within the broad envelope of agreed traditional management. The specifics will therefore have depended on both past farmer attitudes of what the meadows were for and what they wanted from them, and understandings of what were the best practices to achieve what they wanted. The variability in time and space of such resulting practices will therefore be reflected in the unique character of different meadows, as an integrated result of the varying past practices. Reflecting this complexity, Crofts and Jefferson (1999, p5:38) note:

> The way in which parameters such as grazing animal species, stocking density, duration of grazing, seasonal grazing or grazing system interact with each other to affect the sward is often complex, making accurate predictions of outcome more difficult. However this also means that a desired result can often be achieved using a variety of regimes. The process of establishing an appropriate grazing regime is therefore usually an empirical one based on best-guess and guess test, and it is often difficult to decide what is appropriate until something has been tried. The key to success is having tried something, being able to decide if it is working and when it is not, being able to identify and correct the problem.

This clearly highlights that while the reliance on traditional management is the default in the face of uncertainty, it highlights a 'trial and error' approach to management in the face of high levels of uncertainty and complexity, which should certainly require a responsive/adaptive approach to management. As regards research to uncover deterministic models of the impact of management they note that:

> the current biological features of the site will broadly reflect the ecological consequences of human intervention, and non-intervention during the preceding years. However the relationship is usually a complex one with layers of events and consequences superimposed on each other and merging into each other so that the precise cause and effect connections are not always easy to determine.

This perhaps suggests that disputes over narrowly-defined practices such as cutting hay only after the 15th July, or prohibitions on manuring may be too rigid, as past management may well have varied in time and managing the meadows with a highly constant and prescriptive regime may actually fail to deliver the same meadow into the future as it is an inaccurate reflection of past management. In a review of the effectiveness of agri-environment schemes, Natural England (2009a) concluded that early Environmentally Sensitive Area (ESA), Countryside Stewardship (CSS) and HLS (Higher Level stewardship) schemes for grassland maintenance had had the unintended consequence of comparatively uniform management and that the ESA and CSS schemes had limited scope for site-specific intervention. The schemes did not see sites as unique assemblages.

Ultimately, given the lack of records of past management for most meadows, scientists have tried to fill the knowledge gap by asking 'what management is required to deliver a good meadow?' Again, what constitutes a good meadow is subjective (Ratcliffe, 1977), and therefore the scientific knowledge needs to be interpreted in this light.

2.10 Summary

In summary, consideration of the literature leads to the following conclusions of relevance to the research question.

Firstly, narratives on the value of floodplain meadows are dominated by a focus on botanical characteristics of the meadows and within this, on a selected series of criteria, particularly species richness and the rarity of the MG4 assemblage. Meanwhile, narratives regarding other aspects of meadow value are poorly developed and very little contemporary literature appears to consider the traditional agricultural value of meadows for which they were originally created. Assessment criteria are then selected to capture this partial view of value and therefore this would be expected to manifest itself in assessment activity observed on meadows during this study.

Secondly, some narratives also seek to frame sites such as meadows as 'natural' in opposition to the 'social' despite being agricultural landscapes, and again this study will seek to identify where

such a perspective influences stakeholders' views on the meadows and how they interact with them.

Thirdly, a model of responsive or adaptive management does appear to underpin much assessment practice on nature conservation sites and may be seen in literature relating to the assessment of species-rich floodplain meadows such as in Natural England's condition assessment.

Literature on assessment highlights a frequent lack of clarity on the role of assessment and monitoring in conservation management, as well as questions over the design of many monitoring programmes. There is also disagreement as to what extent assessment of meadow characteristics may be objectivised, the relative utility of expert (scientific) knowledge compared with experiential knowledge in generating understandings about the meadows and informing decisions regarding their management, and whether formal scientific approaches to research and assessment can ever realistically fill all the gaps in knowledge given the limited funds for conservation work. Again, this work will evaluate how meadow management stakeholders view the role of assessment activity in meadow management and its utility.

Finally, uncertainty regarding historic meadow management leaves significant scope for dispute regarding what constitutes appropriate management and leaves questions of whether contemporary management is traditional or innovative, or a hybrid of both. Once again, this study will look at how such uncertainty on specific case-study meadows influence stakeholders' attitudes towards meadow management and whether they believe there to be such a thing as 'traditional' or even 'correct' management.

Chapter 3 – Background to Floodplain Meadows

This chapter is intended to provide more in-depth contextual information on floodplain meadows in England in order to allow the reader to follow the subsequent chapters. It begins by providing further information on floodplain meadows in England in general, specifically the origins and history of meadows in the English landscape, their more recent decline, and their remaining extent and current status. It examines continuing perceived threats to the conservation of floodplain meadows, the policy and legislative context that underpins their conservation, and provides a general review of contemporary meadow management.

Following the above general background, the chapter then goes on to provide details of the three major and nine minor case studies that have been examined during this research. For each of the three major case studies this section provides at least information on the meadow's conservation status, land ownership and other stakeholders involved in the meadow's management, any knowledge of the site's longer term history and management (if known), and funding support for meadow conservation as well as an overview of any management objectives for the site. The research methodology and rationale for the case study approach is discussed in Chapter 4.

3.1 History of Floodplain Meadows and their Decline

Floodplain meadows have been a part of the lowland British landscape for over a thousand years, if not much longer (Rackham, 1987), and at one time were highly valued as land that was fertilised by sediment from seasonal flooding before the invention of artificial chemical fertilisers (Gowing, 2006). With the advent of modern industrialised farming methods and the development of modern chemical fertilisers in the twentieth century, the extent of semi-natural grasslands in the UK has declined greatly. As McDonald (2001) recounts, agricultural policy following the Second World War was to strive for maximum yield of production through a productivist approach (Woods, 2011). Only around the mid-1980s was there a change of philosophy, with the

establishment of the first agri-environment schemes, intended to improve environmental management of agricultural landscapes (Sheail, 1998).

Blackstock *et al* (1999) estimated that in Great Britain up to 1984 97% of all types of semi-natural grassland was lost over 50 years leaving a total of 0.2m ha nationally with a further 2-10% annual loss, and that only 1-2% of permanent lowland grassland cover was of floristic interest. More recently, of these semi-natural grasslands, Rodwell *et al* (2007) estimate that between 5,000-10,000 ha of lowland meadow now remain in highly fragmented small stands, over 70% of which is in England, and of which now only an estimated 1500ha are floodplain meadow.

Most designated sites containing MG4 grassland occur south and east of a line from the Tees to the Severn (Figure 3.1) with around 80% of the remaining sites in the catchments of the Severn, Trent, Thames and the Yorkshire Ouse, whilst 75% of sites are smaller than 10 ha in size (Jefferson and Pinches, 2010).

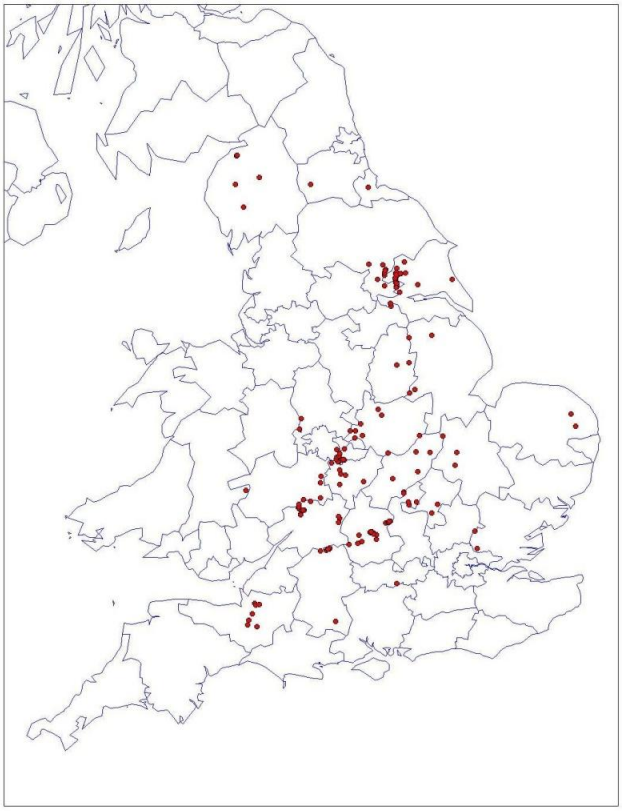


Figure 3.1 – Extent of known floodplain meadow sites in Great Britain (image created by Mike Dodd, Open University, 03/11/2009). Ordnance Survey © Crown Copyright and Database Right 2013.

3.2 Contemporary threats to meadow conservation

According to the Joint Nature Conservation Committee (2007), continuing threats to floodplain meadow grasslands include changes to site hydrology such as alterations to river catchment management including flood defences or deterioration of water management infrastructure, changes in or cessation of management such as agricultural improvement , abandonment of traditional management or total abandonment of management (i.e. neglect), or partial or total destruction such as by fragmentation, development or for gravel extraction (JNCC, 2007; Environment Agency, 2010).

As regards changes to catchment hydrology, Gowing *et al* (2002b), Wharburton (2006) and Milsom (2006) all relate the impact that flood defence works have had on the meadows of the Derwent Ings in Yorkshire resulting from changes to flooding patterns as a result of flood defence works. Flood defence measures at East Cottingwith in the Derwent Ings (Yorkshire) in the 1970s have put an end to historical flood patterns and with this an end to sediment nutrient deposition (Wharburton, 2006). Similarly McDonald (2001) notes how river banks on the River Thames near Oxford have reduced flooding in the Oxford Meads.

Regarding land management, according to Critchley (2007), based on experimental work in northern upland hay meadows (MG3), fragmentation has led to species loss even when management that is considered ideal is maintained, whilst Rodwell *et al* (2007) consider that abandonment may now be the main threat facing these floodplain meadows, although overly prescriptive management (rather than responsive management), that is, the expectation that guidance and management plan conditions such as hay cutting dates be rigidly adhered to, may also be detrimental to the botanical diversity of these grasslands. Conversely, in a study of ownership and management of semi-natural grasslands in Worcestershire, ADAS (1990) found that these were being lost at a rate of 10% per year in the 1990s, the main threat being from inappropriate management. This included grazing with horses, “incorrect” grazing dates, fertiliser application and supplementary feeding of livestock.

Another potential threat to meadows is the risk of the collapse of the social networks through which management is delivered and therefore the ability to deliver 'ideal' or indeed any management, to fend off abandonment or inappropriate management. The ADAS (1990) study in Worcestershire also found that most farmers, owning nearly half of all fields, were over 60 and therefore likely to transfer ownership within 10 years of the report. Riley (2006) identified a relationship between farmer/land manager age and likelihood of participating in an agri-environment scheme, with older farmers less likely to participate.

Crofts and Jefferson (1999) do note that mesotrophic grasslands tend to be more easily improved from the agricultural point of view and therefore potentially vulnerable to agricultural improvement. This said, floodplain meadows can still be marginal agricultural land owing to their wetter hydrology, as noted by McDonald and Howard (2001) in the Yorkshire Derwent Valley, where farmers had abandoned attempts to convert such meadows to arable land after 2-3 year trials, suggesting that some meadow sites may be susceptible to abandonment.

3.3 Policy and legislative framework underpinning meadow conservation

Conservation policy has produced a range of legislation and structures to support meadow management and protect them from the diverse threats (JNCC, 2007, 2012). The UK Government produced the UK Biodiversity Action Plan (UK BAP) in 1994 and which has provided much of the structure that has subsequently guided nature conservation in the UK (Ovenden *et al*, 1998). The focus on species and habitats (or species assemblages) in conservation thinking is reflected in the structuring of UK and European conservation legislation with legislation and policy oriented towards protected priority species and habitats (Cowley and Vivian, 2007). This included the identification of priority species and habitats, such as lowland meadows, and the production of Species Action Plans (SAPs) and Habitat Action Plans (HAPs) (JNCC, 2007).

A Habitat Action Plan (HAP) for lowland meadows (JNCC, 2007) has been produced focussing particularly on the three plant communities identified in the NVC as communities MG4, MG5 and

MG8, all of which may occur on floodplain meadows, but with MG4 being particularly closely associated with this land use. As noted earlier, the MG4 definition has been cited in the EU Habitats Directive (European Commission 1992, 1997) and associated UK Regulations (The Conservation (Natural Habitats, &c.) Regulations 1994).

The UK Government's main policy tool for delivering good environmental quality on SSSI sites including floodplain meadows, as well as other grassland sites deemed to be of good quality, are agri-environment schemes (Natural England, 2009a, 2009b, 2010a, 2010b). Agreements under these schemes compensate farmers for income forgone where, in the case of floodplain meadows, they agree to manage meadows in a low intensity manner similar to traditional pre-industrial agricultural practices. Büchs (2003) noted that consideration was being given at EU level at that time to not just compensation but also rewarding land managers for ecological accomplishments and treating ecological products as goods with a market value in society. Whilst this is not yet the case, such an initiative would be likely to significantly alter the economics of floodplain meadow conservation.

3.4 Contemporary Management

Considerable knowledge and understanding of the likely effects of different management interventions is demonstrated in the literature. The *Lowland Grassland Management Handbook* (Crofts and Jefferson, 1999) and *Wet Grassland Handbook* (Benstead, 1997) bring together the findings of a range of knowledge and research on the effects of different agricultural practices on grassland sites, as well as other guidance such as the *Ecological Guidelines for Lowland Wetland Plant Communities* (Wheeler *et al*, 2004). Nevertheless, literature on management operations leaves open a number of questions that could give rise to dispute among stakeholders. A number of management operations are considered in some detail in the literature.

In terms of the general philosophy for meadow management, and as noted in Chapter 2, Crofts and Jefferson note that (1999, 6:11):

> Maintenance of the botanical richness of semi-natural grasslands is best achieved by mimicking the historical management which was responsible for creating and maintaining them in the first place.

This suggests that traditional management should be a baseline or a starting point for contemporary management, although the same guidance also provides models for responsive management.

3.4.1 Cut date and its effect on the relationship between hay quantity and quality

The issue of the optimum cut date for a meadow relates to the impact this has on two aspects of agricultural value: hay crop quantity and hay quality (i.e. nutritional value and palatability to livestock), and is complicated by the fact that each growing season is different according to the weather each year, a stochastic event that varies unpredictably. For example, cold or dry springs can lead to the hay crop developing slowly and to light yields and to late ripening and flowering.

Roberston and Jefferson (2000) note that in order to maintain the botanical interest of MG4 meadows they should be cut between late June and the end of July. Gowing *et al* (2002b) in a survey of a range of floodplain meadow grasslands found these to be mostly cut in July, and Rodwell (1992) states that floodplain meadows are generally mown in July. Baker (1937) noted at the time that the Oxford hay meads were cut in mid-July, whilst Gilbert (1996) notes that North Meadow, Cricklade is also mown in July. McDonald and Howard (2001) cite the present hay cut on the Derwent Ings as after 1st July but note that prior to the SSSI agreement with English Nature the majority of farmers claimed to start the cut between the end of May and beginning of July, with common dates cited being 20th-21st June with the crop cleared off the Ings by 15th July. Farmers cited the long day length and preponderance of warm dry weather as reasons for these cut dates.

This said, Benstead *et al* (1997) note that whilst meadows, particularly floodplain meadows that have been cut annually at about the same time for many years, often have a valuable species-rich sward, many diverse grasslands are the result of very irregular regimes with mowing at different

times each year or in some years not at all, non-cut years being potentially useful for seed fall. Sheail (1986) furthermore found that some meadows would have been rotated with other land uses historically.

Crofts and Jefferson (1999, p6:11) suggest that an occasional late cut in August or September occur on meadows to ensure that all plants can set seed as would occur anyway after a wet summer. For lowland flood meadows they consider cutting after 1st July to be normally acceptable in the lowlands:

> Where grasslands are being managed for a hay crop, it is important to retain an element of flexibility in prescribing dates for cutting where possible, as haymaking is very weather dependent..... [they] maintain a flexible approach to hay cutting dates on semi-natural meadows (cut when the crop is at the right growth stage and when the weather is suitable) but to ensure that cutting does not take place before breeding birds have hatched (*sic*) or populations of desirable plant species which depend on seed production for regeneration have set seed (eg. yellow rattle *Rhinathus minor*). The dates will vary according to the locality but will range from late June to late July.....Ensure an occasional late hay cut (late August/September) (eg. 1 year in 5), where practical, especially on sites which support late flowering species.

Here, they do therefore appear to take account of the importance of agricultural value in influencing management decisions, and this also highlights the individual character of meadows, which varies in both space and time. Cutting time affects botanical sward structure with earlier cuts favouring lower-growing plants and according to Bakker (1989) cited in Benstead (1997), optimum cut time depends on soil fertility with earlier cuts in July being more effective for more productive sites (such as floodplain meadows).

As seen above, Crofts and Jefferson (1999) cite the desirability of delaying the hay cut to allow all or most component plant species to set seed and for ground nesting birds to be sufficiently mobile to avoid the hay cut machinery. However, Gowing (2005) notes that cutting later than

midsummer in order to allow species to set seed may not be necessary (most are perennial and many can propagate vegetatively) and could be detrimental because nutrients are not as efficiently removed by a late cut and coarser species of grass are favoured.

In summary, the optimum hay cut date cannot be fixed but varies from year to year according to weather patterns, requiring a certain responsiveness in the management to achieve a particular management goal. The decision between early and late cuts is then a subjective matter of the desired end product.

3.4.2 Grazing

Crofts and Jefferson (1999) note that management of meadows for nature conservation normally involves aftermath grazing with sheep or cattle.

Gowing *et al* (2002b) note that late-summer, autumn or winter grazing of meadows before ground conditions get too wet is important in order to maintain species diversity as the unevenness of grazing and the poaching of the ground provide seedling establishment opportunities. Sheep, cattle and horses may all be used to graze meadows, but cattle tend to be preferred for wetter sites such as floodplain meadows.

McDonald (2001) has demonstrated the striking difference in botanical composition between meadows that are grazed or not grazed, the latter being less species diverse, and the effect of grazing being stronger for cattle than for sheep. Crofts and Jefferson (1999) note that hay meadow management by cutting alone can quickly result in a less species rich community.

Benstead et al (1997) note that ideal stocking densities are more a rule of thumb than scientifically determined but that inappropriate stocking densities are a common factor in reducing the conservation value of wet grassland.

Crofts and Jefferson (1999) also note that, despite the desirability of cattle grazing, it is more difficult to obtain commercially-farmed cattle than sheep for conservation grazing. This is partly or largely attributed to the reduction in the availability of cattle caused by the increasing

geographical specialisation of cattle farming and arable in the UK, and in the past two decades has been exacerbated by animal welfare and hygiene legislation introduced after the outbreaks of BSE, Foot and Mouth and cattle TB, which has reduced the utility of lower productivity semi-natural swards to farmers competing in a market with high expectations of productivity. Despite the extensive guidance that they provide on ideal grazing regimes for semi-natural grasslands, they acknowledge that stock availability often determines when grazing is undertaken, and where animals are supplied by commercial livestock businesses, these may only be available when the animals are less sensitive to swards of low productivity and nutritive value. Such grazing in particular coincides poorly with parts of the dairy farming cycle. As regards grazing duration , they note that for winter grazing, short intense periods of grazing are potentially more damaging and the annual requirement is ideally spread out over 12-16 weeks.

Crofts and Jefferson (1999) note that the rationale underpinning conservation grazing contrasts strongly with that which informs commercial livestock farming, not least as the former is seldom measured in terms of financial output. Conservation livestock enterprises need to steer a path between two extremes: that of over-emphasising the economic and commercial (agricultural) value, and under-exploiting this very commercial value without which the costs of management may be unsustainable. They noted that very little information was available regarding the physical and financial performance of specific conservation grazing projects, again probably because they were not undertaken for financial reasons. Transportation costs and logistics may constitute a significant barrier to obtaining grazing animals and stock managers are also required by law to maintain accurate records of animal movements.

Finally Crofts and Jefferson (1999) note that grazing of most conservation grasslands is achieved via grazing licences and agreements, which in theory gives greatest flexibility with least resources to the conservation manager. Yet the key is finding a good grazier with enough stock and flexibility in their operations, something that tends to occur by chance, and that the farmer's objectives will be different from those of the conservation managers. To this end, should conservation land owners find a good grazier, a longer-term agreement to provide both sides with

longer term certainty, especially if organic certification is an option (a minimum commitment of 5 years is required here), is desirable. Other risks noted in grazing agreements are that land that is of marginal interest to local farmers may only attract a peppercorn rent, and that farmers only buy the optional right to graze land and cannot be forced to do so if they choose not to exercise their contractual right. So even if a contract is let to graze a meadow, the grazier may well still not graze it.

3.4.3 Manuring

Crofts and Jefferson (1999) in the *Lowland Grassland Management Handbook* note that existing semi-natural unimproved grasslands can be made more productive and of better agricultural quality by the use of inorganic fertilisers and that management of meadows for nature conservation normally involves occasional applications of farmyard manure (but not artificial fertilisers). In contrast, they cite a range of research that demonstrates that the application of artificial fertilisers to semi-natural grasslands rapidly reduces the sward diversity and species richness, in accordance with the findings of Mountford *et al* (1993, 1996).

Historical sources do indicate that some hay meadows were traditionally fertilised to varying degrees with farmyard manure, such as North Meadow, Cricklade (Gilbert, 1996; Natural England, 2008; Snakeshead Revisited Project, 2010). However, in the case of floodplain meadows, disagreement arises over the validity of such practice, as the fertility of these meadows are supposed to be maintained by the inputs from floodwaters. Baker (1937) found no historical evidence of addition of organic fertilisers such as manure on the Oxford Meads site, though Rodwell (1992) indicates that light dressing of manure is typical for floodplain meadows.

At most meadow sites, manure application is restricted despite evidence that this was practiced in the past (McDonald and Howard, 2001, Natural England, 2008) and farmers' agency to make decisions regarding this operation is heavily constrained. Crofts and Jefferson (1999) note that in the case of MG4 grassland manure should not be routinely added unless there is evidence of falling crop yields, an assessment that would require the recording of historical yields.

3.4.4 Rolling and harrowing

Crofts and Jefferson (1999) note that rolling and harrowing may conflict with ground-nesting bird interest on meadow sites, but are generally acceptable practices provided they take place in the spring before mid-March or at least 6-8 weeks before flowering of snakeshead fritillary or green-winged orchid, if present. The management plan for North Meadow, Wiltshire (Natural England, 2008) notes that rolling and harrowing did take place on the meadow but that since the mid-1980s, only chain harrowing has been permitted until early March and when ground conditions allow.

3.4.5 Drainage and water level management

Crofts and Jefferson (1999), Gowing *et al* (2002) and Wheeler *et al* (2004) all note the importance of maintaining appropriate water table regimes for semi-natural grassland communities such as MG4. Guidance on maintenance of drainage focuses on maintaining existing conditions and not allowing changes in site hydrology through alteration to ditches or failure to maintain long-standing land drainage systems. In this regard, continuity of past conditions is considered to be key.

3.5 Introduction to the case studies

The detailed methodology of this research is discussed in Chapter 4. Three meadows were studied in detail (the major case studies), whilst in addition to these a further nine meadows were examined in lesser detail (the minor case studies) in order to provide a broader context for the three detailed cases, and to test the generalisability of the findings from these major case studies.

Sections 3.6.1 to 3.6.3 provide a description and background information on each of the three main case study meadows examined in this research (the major case studies). Essential details for all the meadows studied are summarised in Table 3.2 below. Figure 3.3 shows the locations of the major case study sites, and Figure 3.4, the other minor cases study sites.

Table 3.2 – Meadows examined during the research

Meadow name	Location	GB OS Grid Reference	Area (ha)	Conservation designations	Key Stakeholders actively involved in meadow management	Level of study detail
North Meadow	Cricklade, Wiltshire	SU094946	44.4	SAC, NNR, SSSI	Natural England (owner, Statutory reponsibility, site manager, HLS administrator/advisor) Three farmers who cut the hay (NMC1, NMC2, NMC3) buy a license from Natural England Grazier paid by Court Leet Hayward (Court Leet).	Major case
Brook Meadow	Darley Green, Warwickshire	SP180743	1.73	SSSI, CWS	Warwickshire Wildlife Trust (owner), Natural England (Statutory reponsibility and HLS administrator/advisor), Subcontractor Farmer BM1 buys a license from the Trust	Major Case
Long Mead	Eynsham, Oxfordshire	SP440086	10.5	CWS	Private Landowner Purchaser of hay license Hay Farmer LM1 Grazier LM1 Natural England (HLS advisor only)	Major Case
Mottey Meadows	Wheaton Aston, Staffordshire	SJ 840134	44.6	SAC, NNR, SSSI	Natural England (owner, site manager) Three hay farmer/graziers MM1, MM2, MM3 buy licences from Natural England	Minor case
Portholme	Huntingdon, Cambridgeshire	TL 238708	104	SAC, SSSI	London Anglers Association (owners) Natural England (Statutory reponsibility, HLS administrator/advisor) Meadow is managed each year by farmers who buy the rights to the hay and grazing each year at an auction. Managing farmers may therefore vary from year to year	Minor Case

Oxford Meads (Pixey and Yarnton)	Wytham/ Cassington, Oxfordshire	SP480105	86.9	SAC, SSSI	Land ownership is complex with many small plots with different owners. Natural England (Statutory reponsibility, HLS administrator/advisor). FAI Farms Ltd cut the hay and graze the site with sheep under agreement with Natural England	Minor Case
Sherbourne Meadows	Norton Lindsey, Warwickshire	SP 242618	21.5	SSSI	Land owner leases to tenant farmer Natural England (Statutory reponsibility, HLS administrator/advisor) Farmer SH1 cuts hay and grazes site	Minor Case
Birches Barn	Polesworth, Warwickshire	SK 282021	10.7	SSSI	Land owner is also farmer Natural England (Statutory reponsibility, HLS administrator/advisor)	Minor Case
Welford Fields	Welford on Avon, Warwickshire	SP 140529	2.1	SSSI	Land owned by three local nearby residents Natural England (Statutory reponsibility, HLS administrator/advisor) Hay cut by friend of one of the land owners Not currently grazed	Minor Case
Seaton Meadows	Harringworth/ Seaton, Rutland, Leicestershire	SP 915979	11.4	SSSI	Land owner is the conservation charity Plantlife Natural England (Statutory reponsibility, HLS administrator/advisor) Current farmer-managers not identified	Minor case
Racecourse Meadow	Stratford upon Avon, Warwickshire	SP 185536	1.7	SSSI	Natural England (Statutory reponsibility, HLS administrator/advisor) Current owners and managers not identified	Minor Case
Deans Green	Ullenhall, Warwickshire	SP132633	4.9	CWS	Owned by Warwickshire Wildlife Trust Natural England (HLS administrator/advisor) Farmer DG1 cuts hay and grazes under contract to Trust	Minor case

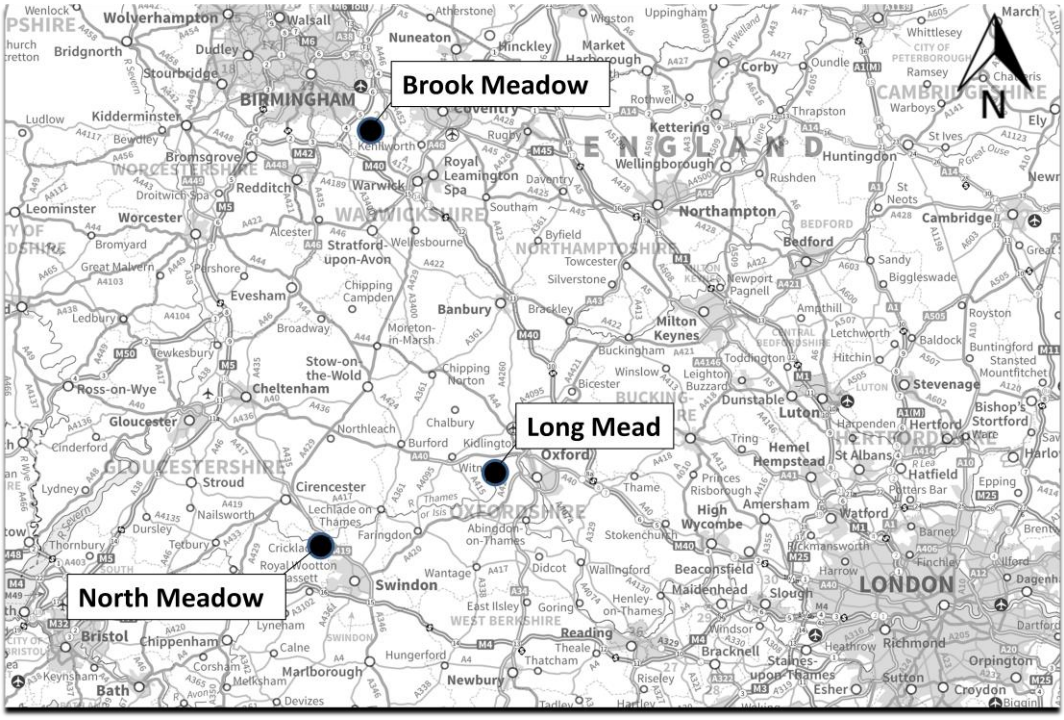


Figure 3.3 – Location of the three major case study floodplain meadows examined in this research (created by the author, 2013). Ordnance Survey © Crown Copyright and Database Right 2013. An Ordnance Survey/EDINA supplied service.

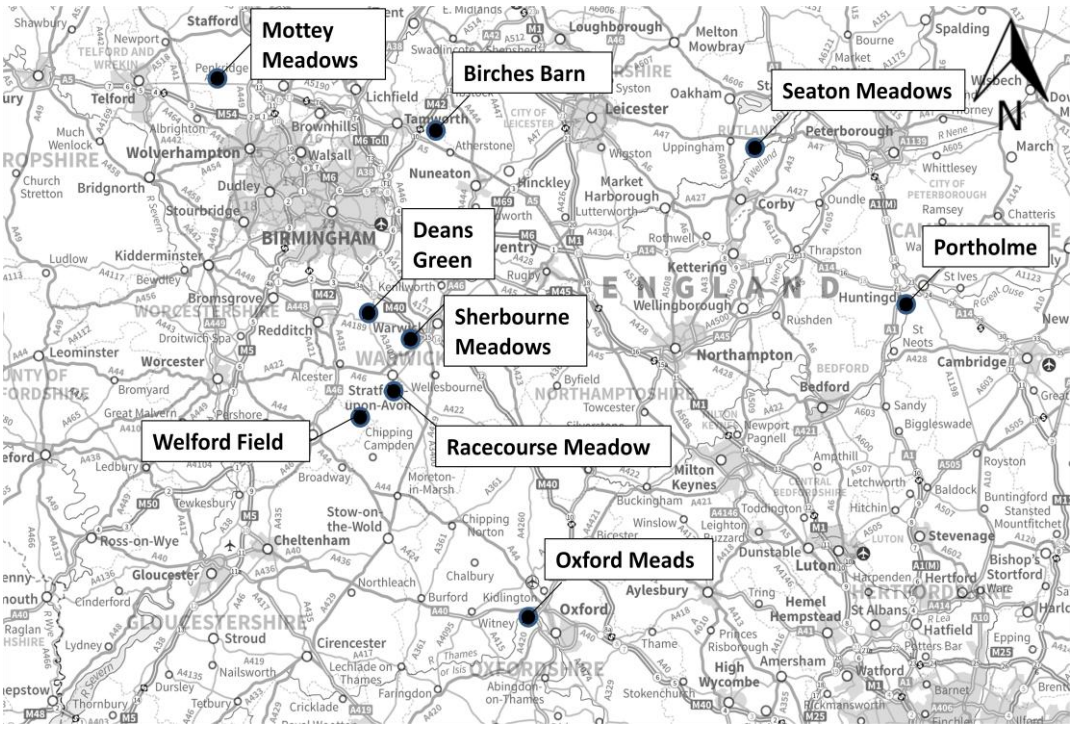


Figure 3.4 – Location of the nine minor case study floodplain meadows examined in this research (created by the author, 2013). Ordnance Survey © Crown Copyright and Database Right 2013. An Ordnance Survey/EDINA supplied service.

3.5.1 North Meadow, Cricklade, Wiltshire

North Meadow is a large floodplain meadow (44.4 ha) in North Wiltshire located on the north west outskirts of the town of Cricklade (Figs 3.5-3.8). The site is bounded by the River Churn along the northern boundary and the River Thames along much of the southern boundary, and is surrounded by agricultural fields on all sides. The site is currently owned by Natural England apart from one small section in the south-east of the site, which is owned by a private landowner (Compartment 11, Figure 3.8), and is designated of national (SSSI, NNR) and international importance (SAC) for nature conservation. The site floods periodically, mainly in winter, but can flood at other times of year including in summer.

Other than the biological interest of the site, the dole stones that mark the boundaries of the meadow hay plots are also listed as scheduled monuments under separate cultural heritage legislation.

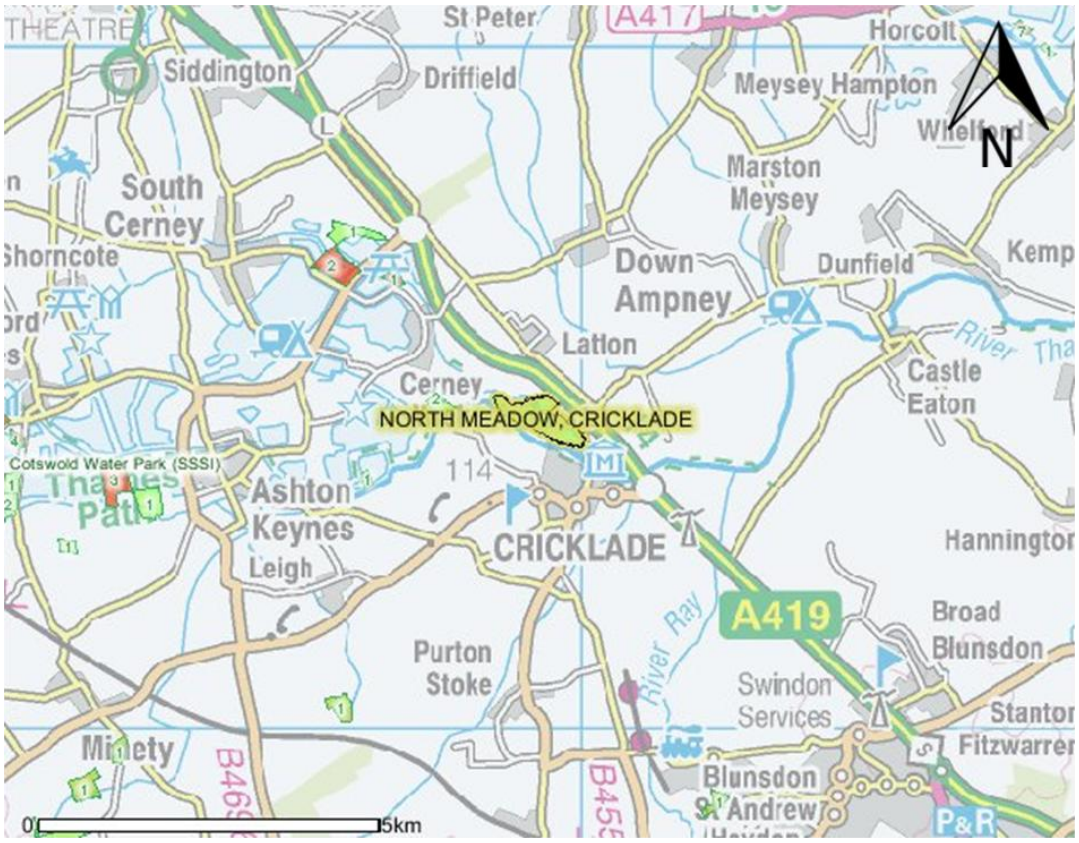


Figure 3.5 – Location of North Meadow, Wiltshire (GB OS Grid Reference: SU094946) (source: Natural England www.natureonthemap.co.uk, 25/06/2013). Ordnance Survey © Crown Copyright and Database Right 2013.

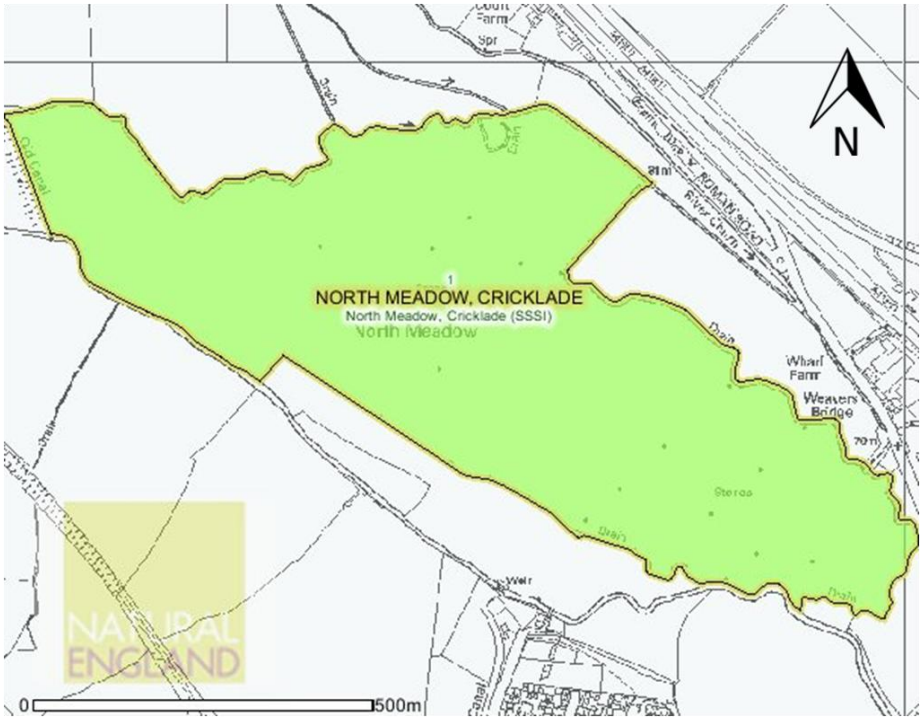


Figure 3.6 – Detailed location of North Meadow, Cricklade (source: Natural England www.natureonthemap.co.uk, 25/06/2013). Ordnance Survey © Crown Copyright and Database Right 2013.

Figure 3.7 – View of North Meadow looking north-west from the main public entrance (16/04/2011) (author's photograph).

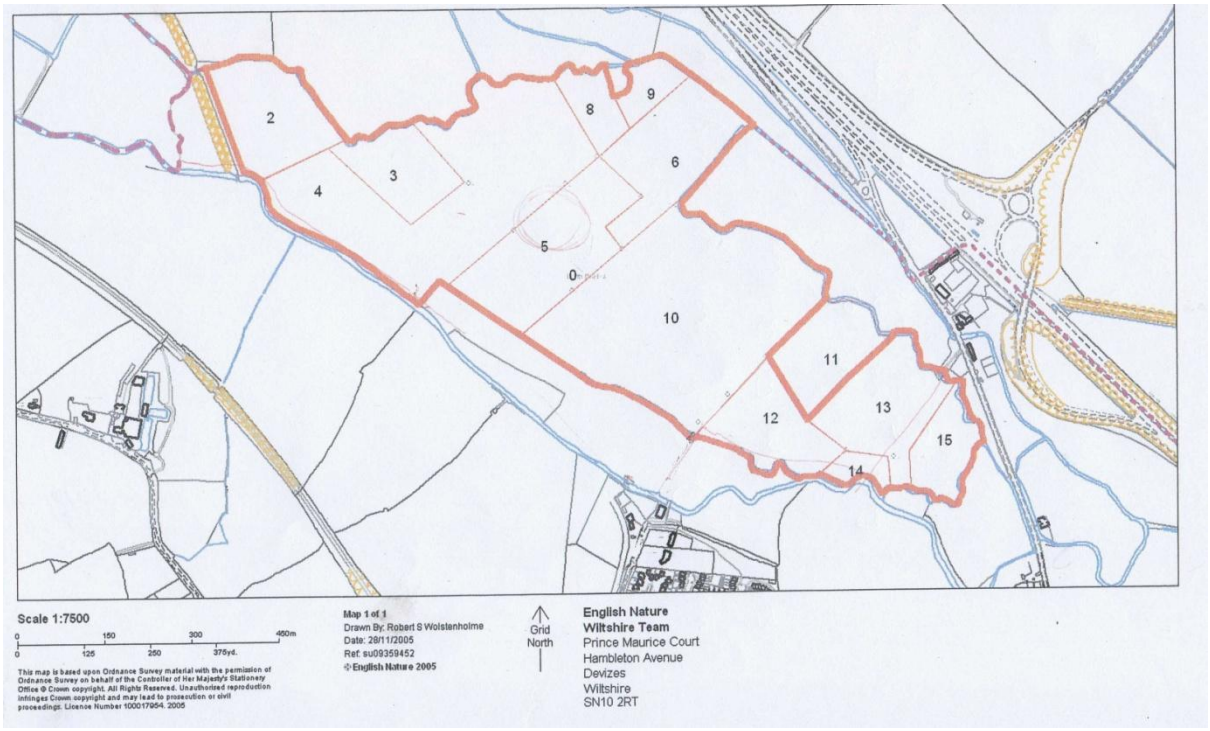


Figure 3.8 – Map of the management compartments on North Meadow (Wolstenholme, 2005). Ordnance Survey © Crown Copyright and Database Right 2013.

3.5.1.1. Past History and baseline for traditional management

Gilbert (1996) notes that 'The Inclosure Act' (*sic*) of 1814 is the source of most of what is known about the meadow's early history. The main change instigated at that time was that of consolidating the land strips belonging to the same land owner into coherent blocks, whilst the grazing remained communal, was administered, and continues to be administered, by a form of Manorial Court known as the Court Leet, which appoints a Hayward to supervise the grazing. In 1970, just prior to the notification of the meadow as a SSSI, the Nature Conservancy Council began to purchase these privately owned blocks with only one now remaining in private hands (Compartment 11 in Figure 3.8).

An oral history of the meadow compiled by the Court Leet and featuring local residents of Cricklade (Snakeshead Revisited Project, 2010) provides evidence that part of the meadow was managed as a water meadow in the past. According to Bettey (2007), water meadows were a feature of many parts of Wiltshire in past centuries. The extent to which parts of the meadow were managed as fully-fledged water meadows as understood by Cook and Williamson (2007), or

to which flooding of all or part of the meadow was manipulated in a more informal manner is not clear.

3.5.1.2 Funding support for conservation and management

As Natural England owns most of the site and is also an agency of the Government Department for Environment, Food and Rural Affairs (DEFRA), it is ineligible to enter the meadow into an agri-environment scheme relating to management of a hay meadow (North Meadow site manager, Natural England, 09/06/2011, pers. comm.). The management plan (Natural England, 2008) notes that traditionally a fee is due to the Court Leet to graze the meadow. However, as a result of the difficulty of finding graziers in recent years, the Court Leet has been able to enter the meadow into Higher Level Stewardship for the grazing only, in order to provide funds to pay a grazier as a contractor. The meadow is therefore entered into HLS to support the grazing regime (Natural England, 2012b). This has allowed the management to move from a situation where a license was offered for a fee to graze the site, but no graziers were interested, to one where Natural England/the Court Leet are able to pay to engage a grazier as a paid contractor, permitting meadow cattle grazing to resume after a gap of nearly 10 years.

3.5.1.3 Conservation baseline condition and management plan objectives

The meadow is described in the management plan as containing two plant communities that fit "rather shakily into the NVC MG4 community" (Natural England, 2008, p1.5/6), which according to the NVC map cover the large majority of the site area (Figure 3.9).

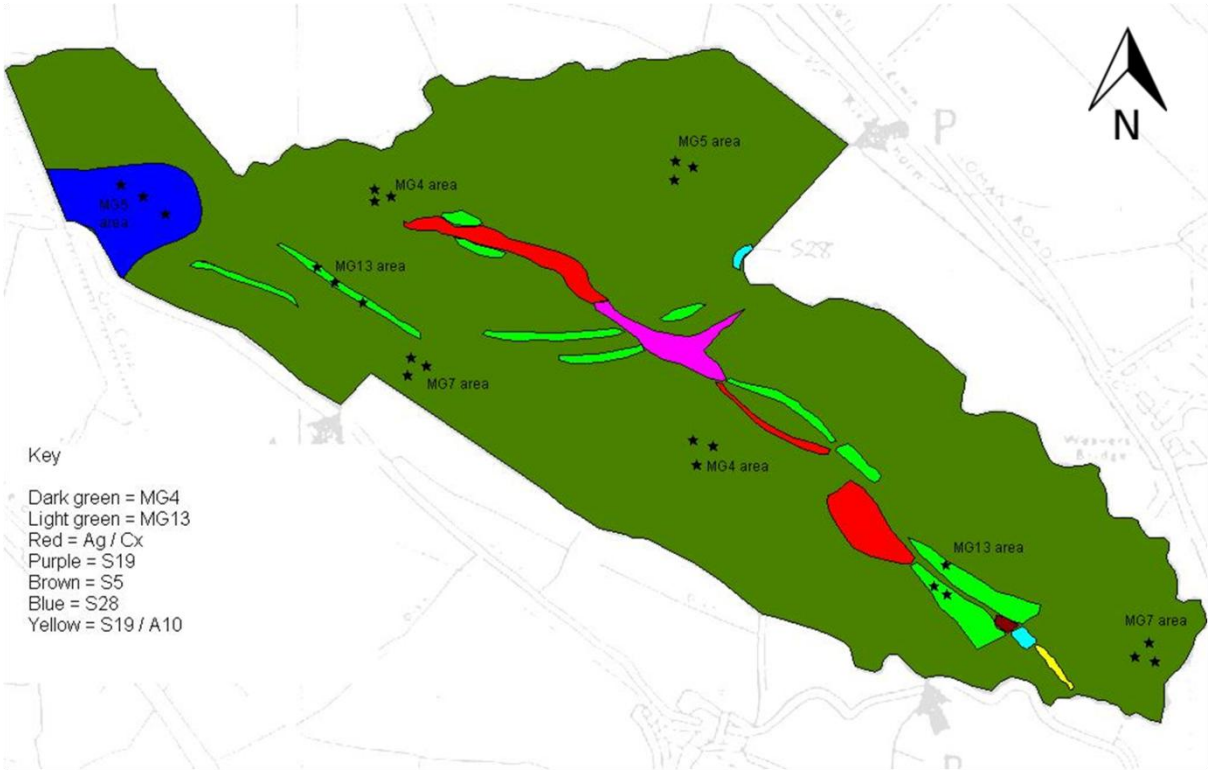


Figure 3.9 – NVC map of North Meadow (Natural England, undated). The key relates colour coded areas to vegetation descriptions from the National Vegetation Classification scheme (Rodwell, 1992). Ordnance Survey © Crown Copyright and Database Right 2013.

The management plan lists a range of objectives for North Meadow indicating the attributes of the site that are of priority for conservation. It notes:

> Subject to natural change, to maintain the diverse hay meadow community with all its associated locally and nationally rare species in favourable condition, with particular reference to the internationally important lowland hay meadow community (MG4: *Alopecurus pratensis* - *Sanguisorba officinalis* grassland) and its associated species. (Natural England, 2008, p2.4/1).

This clearly relates the concept of good condition for the meadow to a description of what constitutes the MG4 plant community and establishes this as the baseline composition. For both MG4 and MG5 there are two attributes and targets. Firstly the extent, which is to remain unchanged and secondly, the species composition and frequency, the target for which is to "pass the Natural England condition assessment" (p2.4/1). The value of the MG4 and MG5 grassland is

therefore linked clearly to the condition assessment criteria, which are in turn linked to the MG4 definition. Further evidence of the use of NVC definitions as baseline standards is provided later (p2.4/3) that sets out the objective to:

> Monitor meadow vegetation communities for change.... The MG5 areas are generally MG4/MG5 transitional communities rather than classic examples of MG5.

Again, the idea of 'classic' examples of NVC categories suggests the existence of clearly definable categories of grassland with distinct features and reification of certain assemblages as 'classic' whilst others are 'transitional' and considered of lesser value. In particular the MG4/MG5 classification marks a distinction between an assemblage deemed in policy to be of international importance and another merely of national importance, hence the 'fit' with the NVC system has policy implications.

No discussion of what constitutes natural change or how this might be defined is presented in the management plan, nor are the rare species specified, other than *Fritiallaria meleagris*, for which a separate objective is set:

> Subject to natural change, to maintain the populations of rare plant species snake's head fritillary in favourable condition (p2.4/4).

The 'Objective Methods' cited include to "continue with the grazing/mowing regime, based as far as practicable on the traditional system" (p2.4/1). However, the caveat "as far as practicable" suggests that adhering strictly to 'traditional' management practices may not always be feasible and suggests that management in reality will be a hybrid of traditional management and other contemporary or innovative practices aimed at meeting non-traditional concerns.

Objective 3 Landscape and Cultural Objectives is to "conserve the pattern and structure of the willow pollard and hedgerow habitat and to maintain healthy ditch and reedbed habitats" (p3.1/2). Only boundary features appear to be of relevance to landscape character and the meadow grassland itself does not feature in objectives for landscape or cultural heritage.

3.5.1.4 Stakeholders involved in managing the site

Natural England has assigned a specific site manager to the meadow, who is responsible for co-ordinating and overseeing the site management and associated contracts, including making decisions regarding hay cut and grazing start dates, and also for undertaking assessment work under the Natural England Common Standards Monitoring (CSM) regime.

North Meadow is mostly now owned by Natural England, with one small area in the south east of the site owned by a private landowner. This private landowner is now very elderly and Natural England considered that she no longer played an active role in site management. As well as being statutorily responsible for the meadow's SSSI and SAC interest, Natural England therefore manages the hay cut of the site by selling licenses to the same three local farmers each year, who between them cut all of the meadow including the privately-owned section. The three farmers buy the licenses and in exchange keep the hay crop either for their own personal use or to sell.

Farmer NMC 1 has been involved in cutting the hay on the meadow since the late 1970s and said that the family had been involved in managing the meadow for over 100 years. His father-in-law cut the meadow before him and his wife's parents and grandparents used to own part of the meadow. They sold their compartments to the Nature Conservancy Council in the late 1950s.

Farmer NMC 2 has also known the meadow for many years, having lived in Cricklade since 1955. He said he had been cutting the hay for the past 7-8 years and before that worked for a company that did the work. He described farming as his main livelihood and used to keep cattle. He still keeps a few horses that he grazes on the meadow.

Farmer NMC3 in contrast is younger than the other two farmers and has no family history of involvement. He became aware that English Nature were looking for a local farmer to help manage the meadow 10 years ago (approximately 2001) and applied for the job. He was offered a small area at first and then was offered a larger area to cut. He describes himself as a hobby farmer who is not reliant on the income from cutting the meadow. He also said that he had no knowledge of the meadow's past history.

Communal grazing on the other hand continues to be administered by the Court Leet in Cricklade and is formally supervised by the Hayward whom the Court appoints. The Hayward has long lived in the Cricklade area and his family used to cut hay on the meadow, part of which they owned and part of which they rented from the Court Leet. The Hayward himself was involved in the hay cut in the 1950s and 1960s.

Before 2009 for at least 10 years, the meadow was only grazed with a small number of horses as the Court Leet was unable to find a suitable grazier with cattle to undertake the grazing. Finally, in 2009 a grazier was found who was able to graze the meadow with cattle. Following the death of this grazier in early 2011 the Court then found another grazier to graze the meadow with cattle in the autumn of 2011, who also agreed to graze the meadow with cattle again in autumn 2012. The current cattle grazier lives nearby and used to buy a license to cut the hay but has not done so for about 20 years. Officially the grazing is supervised by the Hayward and grazing contracts are set up by the Court Leet, not the landowner Natural England. Natural England had contacted him when he began to graze adjacent land for another landowner. This accords with Crofts and Jefferson (1999) that graziers are commonly found through local connections and word-of-month contacts. The grazier has a mixed income from livestock farming and working for a building firm.

Most of the farmer stakeholders therefore live locally and have a long history of connection with the meadow or of involvement with its management. The grazier and Farmer NMC3 also have more diversified incomes than Farmers NMC1 and NMC2.

3.5.2 Brook Meadow, Darley Green, Warwickshire

Brook Meadow is a small floodplain meadow (1.73 ha) in South Warwickshire along the southern bank of a brook (Cuttle Brook) approximately 1km south-east of Dorridge. The site is bounded to the south by the main road, to the west by a domestic garden and caravan/camp site, to the north-east by fields in the grounds of a large house, and to the south east by a domestic garden. The site is owned by Warwickshire Wildlife Trust and is a notified Site of Special Scientific Interest (SSSI). The site management plan indicates that the site is subject to annual flooding (Segawa

and Wright, 2011). The site is also designated a Grade A County Wildlife Site (CWS) for planning purposes.

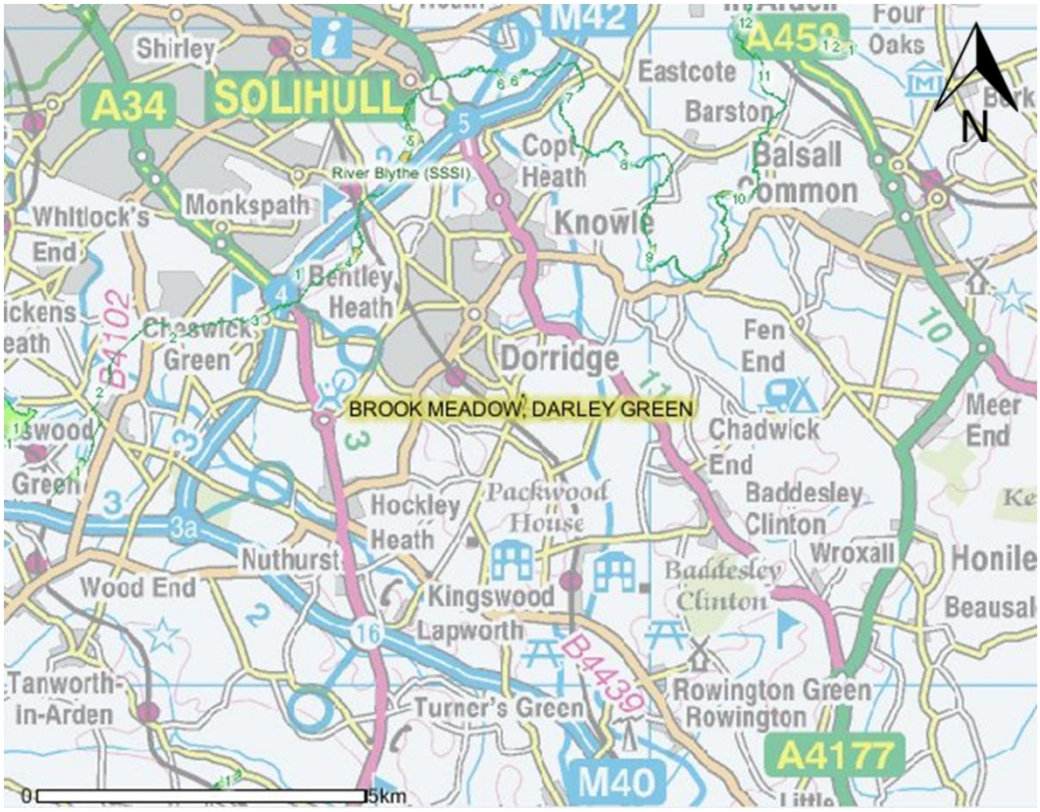


Figure 3.10 – Location of Brook Meadow, Warwickshire (GB OS Grid reference: SP180743) (source: Natural England www.natureonthemap.co.uk, 25/06/2013). Ordnance Survey © Crown Copyright and Database Right 2013.

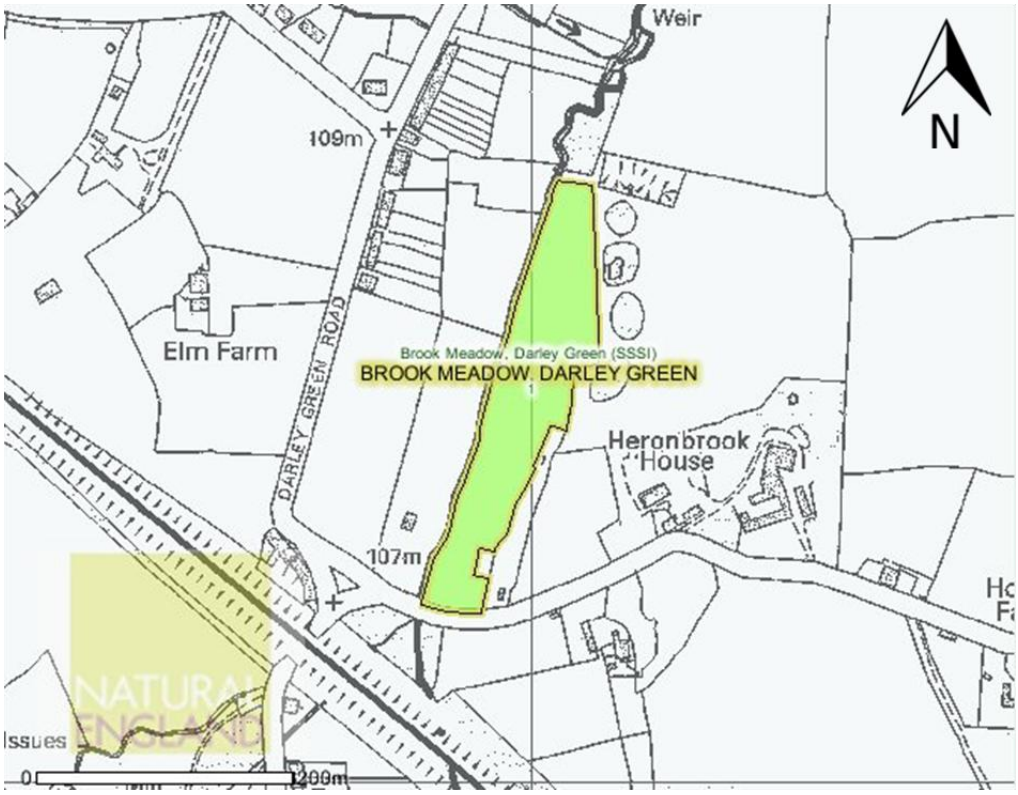


Figure 3.11 – Detailed location of Brook Meadow, Warwickshire (source: Natural England www.natureonthemap.co.uk, 25/06/2013). Ordnance Survey © Crown Copyright and Database Right 2013.

Figure 3.12 – View of Brook Meadow looking north along site centreline (22nd July 2011) (author's photograph)

3.5.2.1 Past History and baseline for traditional management

The site became a Warwickshire Wildlife Trust reserve in 1992 and ownership transferred from the former private owners to the Trust in 1995. Currently little appears to be known about the site's history beyond the last 20 years and the site management plan states that "little historical research seems to have been undertaken on this reserve" (Segawa and Wright, 2011, n/p). Archive research undertaken at the offices of Warwickshire Wildlife Trust for the purposes of this research did not identify any research on the history of the meadow. The plan also states that the site has been "traditionally managed" (n/p) for hay, with an annual cut and aftermath grazing by cattle, though it does not indicate the earliest date on which this management is known to have taken place, or the extent of detail that is known about this traditional management. Nevertheless, the plan attributes the "rich diverse flora present today" to the site "probably [having] had a long history of traditional management" (n/p). Given the apparent absence of historical research on the historical management of the meadow, it appears to have been presumed that the meadow has had a long-standing history of fairly consistent traditional management based on its present botanical composition and its conformity with what is recognised as a good hay meadow and good MG4 grassland.

3.5.2.2 Conservation baseline condition

The site documentation such as the management plan (Segawa and Wright, 2011) and the SSSI citation (English Nature, 1995) relate a broad narrative about the site's value as a traditionally-managed hay meadow, as discussed in Chapter 5. Apart from this, no highly specific baseline for good meadow condition appears to be provided. No NVC map of habitat areas has been found, although documents found in the archives of Natural England in Worcester for Brook Meadow highlight the criteria for selecting the site as a SSSI as being the presence of NVC class MG4 and MG5 vegetation in accordance with the *Guidelines for selection of biological SSSIs* (NCC, 1989). This clearly demonstrates that NVC category descriptions have been highly significant in establishing the baseline for the site's conservation.

3.5.2.3 Funding Support for conservation and management

In order to support the management of the meadow it has been entered into three Higher Level Stewardship options: HR2 supplement for native breeds at risk; HK6 maintenance of species-rich, semi-natural grassland and; HK18 supplement for hay making. The three options therefore cover both the hay-making and grazing aspects of management specifically. The Indicators of success are all related to site botanical interest, and although the HLS documentation notes that the options HK18 can be beneficial for landscape character, historical landscape integrity and in reducing diffuse pollution, no features specifically related to these three aspects of the site are noted.

3.5.2.4 Management Objectives

An archive search at the offices of Natural England in Worcester and of Warwickshire Wildlife Trust in Coventry revealed that a range of management plans have been produced for the meadow over the past 20 years of increasing length and complexity. The earliest plan seen from 1994 cited the management aims to be:

> To increase the present diversity of the meadow plants. To monitor the effects of management on the plant community. (Warwickshire Wildlife Trust, 1994, p1).

This indicates that preservation of the meadow exactly as it was at that time was not the aim, but rather to 'improve' the meadow by increasing plant diversity towards a superior ideal, either as a theoretical ideal, or on the assumption that this was the true past baseline, since lost. It is also noted that the management itself was not to be monitored, but rather its impact on the plant community as an aspect of meadow condition, implementation of 'correct traditional' management being secondary to producing a plant community with a particular composition.

A subsequent plan in 1996 (Christophers and Christophers, 1996, p1), which appears to have been written at least in part by the former land owners from whom the site was purchased, altered these to (among others):

- maintain the flood meadow grassland with its component species of flora and fauna.

- continue the traditional hay cutting with aftermath grazing.

The emphasis has shifted from 'improvement' of the meadow to conservation as it is now, both in terms of botanical composition and traditional management practices. There appears therefore to be uncertainty regarding the role of change and continuity in meadow conservation.

Since then a series of management plans have been produced by Warwickshire Wildlife Trust, as well as other parallel documentation on meadow management produced by English Nature and Natural England. The latter's documents have included:

- Site Management Statement (English Nature, 2000)
- Whole site objectives (English Nature, 2001)
- A View on Management (English Nature, 2003)
- Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest (English Nature, 2005)

The 'Whole Site Objectives' (English Nature, 2001) also noted the conservation objective to "monitor for the reoccurrence of meadow thistle (*Cirsium dissectum*) and consider reintroduction". This suggests that a narrative exists that meadow thistle 'belongs' on the meadow and if it disappears, it should be reintroduced by humans and that such human agency would not compromise the value of the site as it would be returning the site to how it should be, to a former perceived baseline. The so-called 'favourable conditions table' (*Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest* (English Nature, 2005)) specifies the designated features of the SSSI, the desirable attributes associated with these features, and criteria for assessing when they can be deemed to be in good condition. It defines the specific designated features of the site as being the MG4 and MG5 grassland.

The latest version of Warwickshire Wildlife Trust's own management plan was published in 2011 and follows a very similar structure to those produced by Natural England for NNR sites, which are themselves based on the guidelines in 'NNR Management Plans – a guide' (Natural England, 2009c). Of the five Conservation Objectives laid out in the current plan (Segawa and Wright,

2011), the first is to maintain the grassland in favourable condition, which is expressed in the same terms as the Natural England Favourable Condition Table (FCT) and Natural England rapid condition assessment through the frequency of positive and negative indicator species, which are almost identical to the Natural England lists, suggesting a closely related narrative shared between Natural England and the Trust on meadow value.

3.5.2.5 Stakeholders involved in managing the site

The stakeholders who could be identified as playing an active role in management of Brook Meadow included:

- Warwickshire Wildlife Trust
- Natural England, and
- the subcontractor Farmer BM1.

The site is currently owned by the Warwickshire Wildlife Trust. The Trust normally maintain boundaries and access to the public, whilst a local farmer cuts and grazes the site as the Trust does not own any livestock. Natural England is statutorily responsible for the SSSI interest and the site is also enrolled in an HLS scheme, administered by Natural England, as noted above. The current Natural England Conservation Officer responsible for the site has known Brook Meadow for more than 20 years, and since it was notified as a SSSI.

The present farmer BM1 managed the site for the first time in 2011, both cutting the hay and grazing the site with cattle. He said that he lived very near the meadow, had long known of its existence and got involved in managing it when the Warwickshire Wildlife Trust advertised for a manager on a sign by the meadow entrance gate. He earns a living from a mixed income from farming and gardening work and manages his own 14 hectares of grassland with cattle and sheep as well as makes hay and silage. According to the Trusts' officers, before 2011, the site was grazed by a local hobby farmer and a friend who cut the hay. These farmers could not be contacted and were not interviewed for this research.

3.5.3 Long Mead, Eynsham, Oxfordshire

Long Mead, Eynsham is a floodplain meadow located on the banks of the River Thames in Oxfordshire approximately 1km south east of the town of Eynsham. The meadow is 10.5 ha in area and is registered as a County Wildlife Site (CWS), making it a significant site in terms of planning policy, but the site possesses no statutory designations providing legal protection against development, damage or destruction. There are therefore no legal restrictions on the change of use of the meadow, other than the EIA Regulations (Natural England, 2012a), but it has been entered into an agri-environment scheme (HLS) in order to support the meadow's management. The site was also registered as an organic farm for organic hay production in 2005. The meadow was originally divided into two fields (the eastern two-thirds and the western third) but the boundary hedge is mostly missing now.

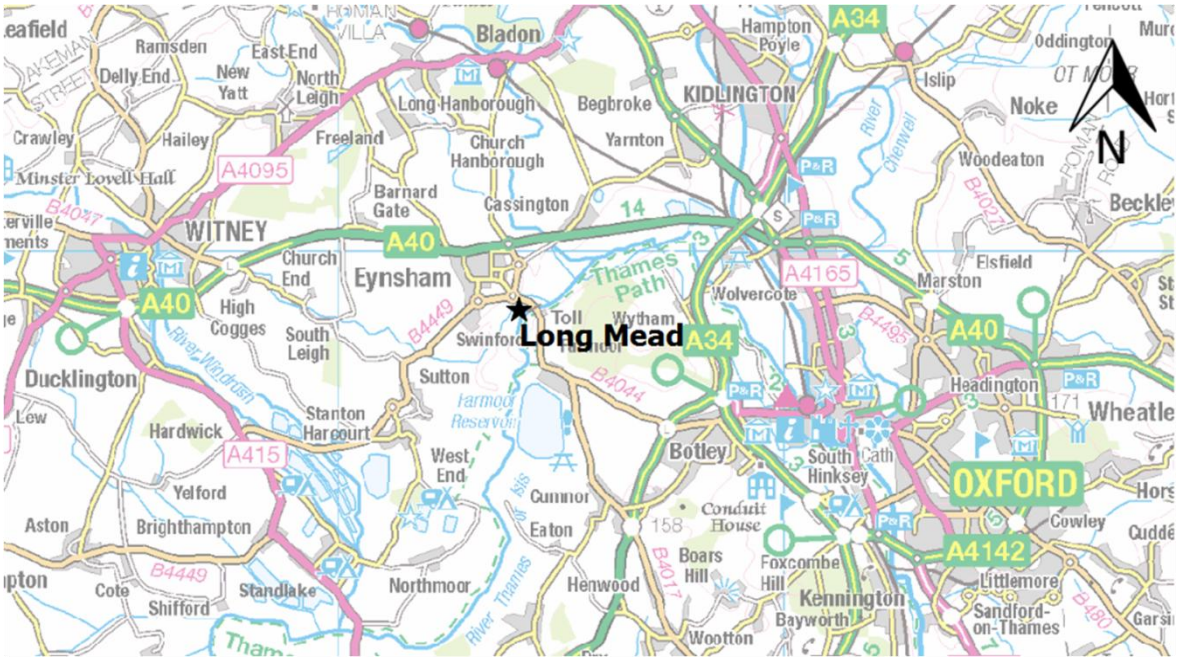


Figure 3.13 – Location of Long Mead, Oxfordshire (GB OS Grid Reference: SP440086) (source: Natural England www.natureonthemap.co.uk, 25/06/2013). Ordnance Survey © Crown Copyright and Database Right 2013. An Ordnance Survey/EDINA supplied service.

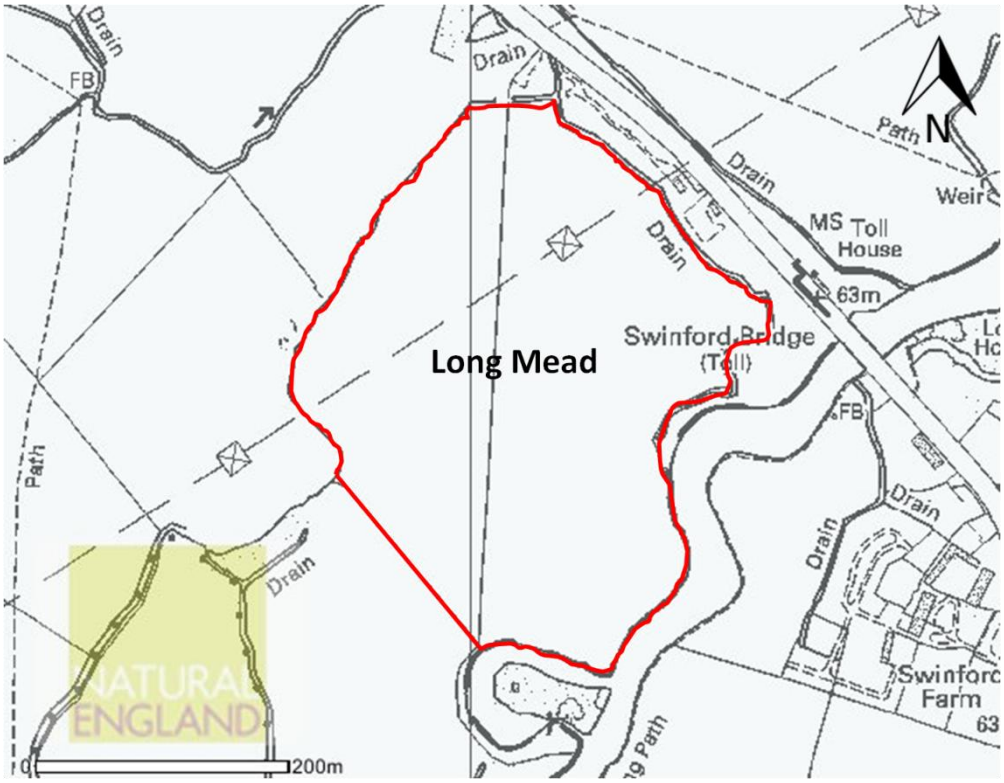


Figure 3.14 – Detailed location of Long Mead, Oxfordshire (meadow boundary in red. Source: Natural England www.natureonthemap.co.uk, 25/06/2013). Ordnance Survey © Crown Copyright and Database Right 2013.

Figure 3.15 – View of Long Mead, Oxfordshire looking south east towards the River Thames (30th June 2011) (author's photograph)

3.5.3.1 Past history and baseline for traditional management

The current owner bought the meadow in 2000. When she saw the meadow in flower for the first spring in May 2001, she contacted the local wildlife trust BBOWT and the TVERC who then did a survey of the site:

> Everyone came to look at it and they wanted to make it a SSSI, but there was a backlog of sites to notify so it was made a County Wildlife Site instead.

This suggests that the site was deemed to be of SSSI standard, but for administrative reasons was not notified as such.

3.5.3.2 Conservation baseline conditions

On the basis of botanical surveys in 2001 and 2004, the site was declared a County Wildlife site, the eastern two-thirds next to the River Thames first in 2001 and then the western one third in 2004 (BBOWT, 2001, 2004). From the results of the two surveys, the meadow has clearly been associated with the MG4 NVC definition of grassland, on the basis of which it was deemed to be worthy of conservation and protection.

3.5.3.3 Funding support for conservation and management

The meadow has now been entered into a new Environmental Stewardship Scheme agreement at both Entry and Higher level (two options HK6 and HK18) from 2011 to 2021. The HLS prescription specifies, as for other sites, a series of Indicators of Success focussed on the maintenance of the extent of meadow grassland, and the floral composition and sward structure of the meadow.

3.5.3.4 Management Plan Objectives

A detailed management plan such as that prepared for North Meadow and Brook Meadow has not been prepared for Long Mead. However, a brief conservation plan has been prepared by the meadow owner (Long Mead site owner, undated), and management is addressed to some degree in the Environmental Stewardship agreement and associated Farm Environment Plan.

The meadow conservation plan details the perceived value of Long Mead, focussing primarily on flora and fauna, and which it notes should be maintained and enhanced, as well as briefly mentioning threats to the site. Beyond this the plan does not detail specific objectives or measures, nor a timetable for achieving any improvements. To this extent the plan is more of a statement of value to serve as a baseline for the future.

The objectives of the Environmental Stewardship Agreement (Natural England, 2011a) for the meadow are essentially to maintain the species-rich, semi-natural grassland, as noted, defined in terms of the floristic composition of the sward, to be achieved by means of a range of specified and restricted management operations. The associated Farm Environment Plan (Natural England, 2011b, p4) contains the current owner's own objectives for the site that for the meadow are:

- To maintain and enhance the conservation potential of this small but unusual site
- To continue to work as I have done for the last 11 years for the environment and education
- To manage the farm for the benefit of wildlife and to maintain the traditional hay meadow

These various documents therefore identify the perceived value of the meadow grassland and set the objective to maintain it in terms of the flora and fauna for which it is valued. Otherwise the aspirations of the documents are quite general to maintain and conserve the meadow.

3.5.3.5 Stakeholders involved in managing the site

The present owner does not conduct any of the management operations on the meadow herself. She sells a license for the hay for a sum of £100 to a nearby resident organic farmer, who in turn pays a local farmer to cut the hay. Since buying the site the hay has been cut by a number of contractors. For the past two years the hay has been cut by a friend who lives locally and she noted that:

> He doesn't have a lot of other fields to do so you're not last in the queue like with big contractors

Other parties involved in managing the meadow include another local farmer who works for a local commercial livestock company and grazes the meadow in the autumn.

The only other stakeholder with an active interest in the meadow is Natural England, who support the meadow management through an agri-environment scheme. Natural England has no other statutory involvement with the site as it is not a designated SSSI site. Since the notification of the site as a County Wildlife Site, the local wildlife trust BBOWT, who led the County Wildlife Site initiative, do not appear to have any further active involvement with the site.

Farmer LM1 cuts the hay on the meadow on behalf of the hay license owner, and has done for approximately the last 4 years. Before that the hay was cut by a contracting company who did it for between 2 and 4 years. He cuts and bales all the standing crop including sedges. This arrangement began when the previous hay cut contractor lost the crop following summer flooding. Farmer LM1 spoke to the land owner, said that the contractor's machinery was too big and the owner suggested that he take over.

Grazier LM1 works for a farming livestock firm, whose cattle he uses to graze Long Mead and who also rents land across the road. He said that the firm rented parcels of grazing land at various locations locally. He started grazing the meadow field when the present landowner bought it (2001). He said that he has known the meadow for about 50 years ago since he was a child (in the 1960s) and said that it had always been laid to grass, but had no knowledge of the longer history.

3.6 Summary

Over the past century floodplain meadows have undergone a marked decline in their extent, driven by the decline in their economic value, real or perceived, relative to more intensively managed grasslands. The remaining meadows face a range of threats both from external off-site factors caused by changes in the surrounding landscape context, and also from on-site changes in land-use, in meadow management, or in abandonment (total cessation of management).

Literature indicates a consensus on the broad outline of how floodplain meadow management should be, though with scope for disagreement over some operations, particularly the earliest time to cut the hay, and the appropriateness of manuring, harrowing or rolling. Such literature is also restricted to a relatively narrow body of guidance documentation produced by conservation organisations.

Consideration of the three main case studies examined in this research highlights the strong individuality of each meadow site in terms of size and surrounding landscape context, and in terms of the uniqueness of each meadows managing stakeholder network, each facing its own challenges as well as those common to all meadows. The management of each site is also influenced by a set of objectives that reflect the uniqueness of the individual participating stakeholders and their inter-relationships.

Chapter 4 – Methodology

4.1 Introduction

This chapter describes and discusses the methodology used to address the research questions posed in Chapter 1. The overall research question explores the interaction between the assessment practices of meadow stakeholders and the management that they apply to the meadows. As noted in Chapter 2, management is a key driver of meadow materiality, that is, meadow composition and condition, and in its broader definition also affects the other key biophysical drivers of hydrology and soil nutrient status and cycling. Clearly in such meadow systems biophysical and socially-driven processes interact intimately to co-produce the meadows (Castree, 2005, Demeritt, 2001).

Immediately therefore, such a question is interdisciplinary in its remit, requiring a range of research methodologies that are able to interrogate both biophysical and social processes (Öberg, 2011; Clifford *et al*, 2010). As noted in Chapter 2, most work on semi-natural grasslands and floodplain meadows in particular has focused on the biophysical processes that produce them, with much less work having been done on the social processes that influence their production through site management. Such processes are influenced by social, economic and cultural factors that have been much less explored and that require a more qualitative approach to their investigation.

In contrast to most previous research on floodplain meadows, which as seen in Chapter 2 has focussed predominantly on the biophysical drivers of meadows, this thesis aims to build on the findings of such work, refocusing on the social processes that play their part in making meadows, in order to understand the relationship between meadow condition and assessment and management practices.

The work is intended to shed light on the meaning and value that floodplain meadows represent for people, and understandings of their place in the landscape, as well as to shed light on the

purpose that conservation of such sites serves for different actors in society. It also provides understandings of the motivations of actors playing different roles in meadow conservation and insights into their practices. As noted in Chapter 1, the findings will also be relevant to conservationists to both revisit and interrogate the underlying philosophy of meadow conservation, but also more practically, to highlight tensions, threats and issues that affect the day-to-day delivery of meadow management.

4.2 Overall research strategy

Given that each meadow is likely to constitute a complex and unique assemblage of material objects (such as plants, soil, water, cattle) and processes (such as water and nutrient flows, hay cutting, grazing, stakeholder communication), it was decided to follow a case-study strategy, carrying out a detailed investigation and cross-comparison between some different examples of floodplain meadows to attempt to identify how each meadow's condition is linked to assessment and management, and what this implies in practice (Denscombe, 2010), a strategy used by other researchers such as Whitehouse (2009) to provide in-depth knowledge of particular cases. It was also anticipated that a large amount of data would be generated for each case study site and therefore a broad and shallow survey would yield a large volume of superficial data that would not be sufficiently detailed to address the research question and its component sub-questions. It was therefore considered that the above approach would provide a balance between the depth needed to explore complex interactions between assessment and management, and the breadth required to allow any conclusions to be representative of the broader picture.

The need to examine both biophysical and social processes, as well as to engage with a range of different stakeholders from differing backgrounds and perspectives, suggested also the need for a mixed methodology approach, with several methods employed in order to obtain and produce different kinds of data about the case study sites. This would then provide both information on interacting processes that are different in kind. Given the desire to examine both the social and biophysical processes that produce meadows, the primary data have relied more heavily on qualitative methodologies to investigate the social processes implicated in meadow assessment

and management, while the secondary data have drawn more substantially from the more extensive base of previous natural science work, and have been augmented to a limited extent for the purposes of this study.

4.3 Empirical data required

In terms of the research questions laid out in Chapter 1, a number of the research methods are used to inform each of the three sub-questions. Five main methods are used:

- a review of institutional literature produced by stakeholders such as meadow management plans, guidance handbooks or management statements, as well as the literature on assessment methodologies and management practices (Healey and Healey, 2010)
- semi-structured interviews designed to explore stakeholders' perspectives on meadow value as well as their assessment and management practices (Longhurst, 2010)
- archival research related to the case study sites to collect background information and any previous records and data relating to assessment and management of the specific meadows studied, and to be able to assess what types of data were deemed noteworthy (Black, 2010)
- observational techniques, including participant observation, to document actual in-the-field practices (Laurier, 2010)
- quantitative analysis of numerical biophysical data from field surveys in order to test a number of assumptions about the interrelationships between different criteria of value and how stakeholders draw conclusions from assessments (White, 2010).

The stakeholders involved in managing the case study floodplain meadows were identified through a review of literature, as well as through inspection of archival documents. The semi-structured interviews and field observations were then used to confirm and clarify the role of each stakeholder identified, as well as to identify any further significant actors involved in meadow management who had not been initially identified through literature and documentation.

The value that meadow management stakeholders place on the floodplain meadows is key to understanding their motivations for conserving the meadows (Adams, 2004; Attfield, 2003; Rackham, 1987; Sheail, 1986; Wilson, 2001; Woods, 2010), and are embedded in the criteria that they mobilise in meadow assessment practice (Kent and Coker, 1992; Ratcliffe, 1977). Therefore, once identified, the views of stakeholders on meadow value were identified and described both from literature and archive documentation and from stakeholder interviews. The former method was particularly useful for establishing the view of organisations and their formal narratives on meadow value, whilst the latter was used to establish the views of individuals whose personal viewpoints may contrast with the formal view of their institutions such as Natural England, or indeed the views of other stakeholders such as farmers. Finally, observation of assessment practices in the field also yielded data on the extent to which the stated views of stakeholders in interview or documentation are reflected in the reality of their practices.

In terms of identifying and characterising meadow assessment and management activity, all the methods contribute to this aspect of analysis. Literature such as management plans and guidance set out the formal view of assessment and management, archival documentation indicates what assessment and management activities have been undertaken in the past and what data has been deemed worthy of recording, whilst interviews and observational techniques allow evaluation of what stakeholders say they assess, what they are actually observed to assess, and what management operations they claim to undertaken and what actually occurs in reality. It is necessary to ascertain what stakeholders' actual assessment practices are, and so to determine how they mobilise their ideas about meadow value, if at all, in any kind of assessment or evaluation practice and which stakeholders are most active or even dominant in this regard.

Similarly, stakeholders' management practices were investigated through formal protocols and guidance, semi-structured interviews and observation. Once again the intention here was to follow the thread from theoretical ideals about assessment and management and their rationales and justifications, through to individual practitioners' perspectives and views, and in turn to observation of the actual assessment and management activity in the field. Literature also allows

an analysis of the philosophical position, structure and motivations of assessment and management activity, whilst field observations and in particular participatory methods allow a deeper understanding of the reality of undertaking such work. In the case of assessment work, I possessed the necessary skills and knowledge to be able to participate in assessment activity where this was considered more useful than passive observation.

Similarly, botanical survey data were interrogated to test assumptions by conservationists about the inter-relationship between different criteria of botanical value and between criteria of botanical and agricultural value (Adler *et al*, 2011). In this way quantitative data produced by ecologists and conservation practitioners were examined to help investigate tensions between stakeholders. The analysis of biophysical data as well as other data collected in assessments also allowed a critique of the effectiveness of the assessment methods and their ability to capture either a measure or even an impression of the stated value or condition of meadows.

When considering the interaction between assessment and management practices, and the associated decision-making processes, it is necessary to determine what conclusions stakeholders draw from their assessment activity. To investigate the relationship between assessment and management activity, again, the more theoretical position was explored by means of literature, guidance and plans, whilst the reality, problems and tensions were examined through archives and interviews both formal and in the field. Here, the secondary quantitative data that exists regarding meadows is useful in testing the validity of conclusions being drawn by stakeholders. For example, disputes between conservation stakeholders and farmers over whether meadow productivity is declining can be examined using the albeit limited data collected by stakeholders on hay yields.

Whether the conclusions drawn from assessment activity are then used to make decisions regarding meadow management, or whether other factors influenced management, is investigated via consideration of literature on meadow management and by analysis of the information given and views expressed in interviews. Here the management undertaken could be

compared to the differing views of stakeholders to determine whether there were dominant stakeholders (Forsyth, 2003), views or factors that override all other considerations in decision-making. Indeed, are decisions on management made year-on-year at all, or are standard prescriptions in guidance simply followed? This requires the investigation of the nature of the assessment methods and their translation into management measures across the case study sites.

The methods are mostly qualitative as they are intended to capture narratives, storylines, perspectives and personal preferences of the stakeholders. In addition, the use of a range of methods to address each sub-question permits cross-comparison to evaluate whether stakeholders' statements are actually reflected in their practices, allowing conclusions to be drawn about whether stakeholders mobilise their ideas in practice or whether other factors influence what they do relative to what they say. Similarly it allows a critique of whether the ideas and narratives detailed in formal institutional documentation present a different view to that expressed by individual stakeholders. To some degree this comparison between stated opinion and practice may help mitigate the observer effect where for example, the stakeholders may feel the need or desire to express opinions or values that they feel are appropriate to their role even if these diverge from their beliefs or the reality of what they can achieve in their role given any constraints on them.

4.4 Selection of case studies

The main criteria used for selecting a floodplain meadow site as a suitable case study included:

- The site must be managed as a meadow i.e. cut for hay
- The sites must be be located on a floodplain
- The meadow must include at least some grassland sward recognised as MG4 community assemblage, though not necessarily on the whole site.
- There must be a contactable and willing gatekeeper and access to information.

These criteria were chosen as the first two are essential in order to define a floodplain meadow, whilst the third recognised the conservation role of floodplain meadow grasslands and for which they were commonly cited as being of 'high conservation status'.

The first stage of the work involved identifying suitable case studies. Five high profile internationally designated SAC (Special Area for Conservation) sites exist in England, as well as a network of nationally protected SSSI (Special Site of Scientific Interest) sites, and also many non-statutory sites that may be County Wildlife Sites or have no conservation status at all. Case study sites were sought that spanned this range of designation status in order to try to assess whether this was a significant factor in the assessment and management of meadows.

Even for statutorily notified meadows, many sites are privately owned and the Data Protection Act provisions meant that owners' contact details could not be released to third parties without their prior permission. This required them to be approached indirectly through gatekeepers at Natural England or Wildlife Trusts at county level. In each case a county-level gatekeeper had to be identified and a meeting arranged to discuss potential case-study sites, make a selection and then approach the land owner or manager via the gatekeeper. This was attempted as a pilot study for two counties: Oxfordshire and Warwickshire, where knowledge of meadow sites, including undesignated sites, was expected to be good. In fact relatively few suitable sites were identified and response rates from formal letters to landowners and land managers were very low. Furthermore, the higher the conservation status of a meadow, the greater the existing data and knowledge about the site and whether it met the criteria of a species-rich floodplain meadow grassland with possible conservation interest. For sites with no designations, there was no clear way of identifying all sites still managed for hay, or the current status of sites identified several years ago and rejected for notification as a SSSI.

As little information was often readily publicly available about many smaller, low-profile and non-statutory meadow sites, the assistance of locally-based Natural England staff was therefore needed to identify suitable case study sites. It was impractical to undertake such close liaison

with a large number of Natural England officers across all counties of England and so it was decided to approach officers based in counties containing a significant proportion of designated meadows, establish good working relations with them and then use a snowball technique to identify potential case study sites. That is to say, early discussions and contact with stakeholders such as Natural England or Wildlife Trust officers informed decisions on which meadow sites to target as potential case studies and which other officers or stakeholders to contact or interview subsequently. In this way, a small number of case studies spanning the range of conservation profile (internationally important SAC to non-stautory site) were identified based on local knowledge and expert judgement. This approach proved effective in four English counties: Staffordshire, Warwickshire, Oxfordshire and Wiltshire. These four counties were considered to span the central area from the West to the South Midlands of the region in which the majority of floodplain meadow sites and hectarage are found. The study area excludes the northern-most significant area of meadow in the Yorkshire Derwent Valley. Consideration was given to including the Yorkshire Derwent within the study; however, it represents a large site with complex land ownership with particularly contentious issues surrounding river catchment management that were not particularly representative of other sites studied.

In order to maximise the generalisability of the work a two-tier case study approach was developed.

- Initial identification of a larger number of potential case studies for which selected interviews with the main stakeholders and basic documentation analysis were undertaken, coupled with:

- More detailed work on a smaller number of major case studies including more extensive analysis of documentation and field observations to allow comparison with the stakeholders' comments in interviews.

In order to gain sufficient depth in relation to certain cases, a limit of three major case studies was set. Case study meadows were chosen in an attempt to represent diversity of:

- Conservation designation status (e.g. international, national and local, statutory and non-statutory)
- Land ownership
- Diversity of management actor network
- Geographical distribution across Central/Southern England

Most effort focussed on the major case study meadows, but additional work at a lower level of detail on a number of supplementary minor case-study meadows was used to provide further evidence and to test conclusions drawn from the three main case studies. These minor case studies were chosen based on a number of factors: the recommendations of gatekeepers, practical matters such as location within the study area, conservation status, an interesting feature such as the yearly auction at Portholme Meadow at which the managing farmers buy licenses to manage the site, or because they represented a windfall opportunity such as to attend a meadow condition assessment or meet additional stakeholders.

4.4.1 Case study locations

As noted in Chapter 3, almost all known floodplain meadow sites in the UK are found in England, and the majority of these are found in the English Midlands and Southern England south of the Humber, with the exception of the Yorkshire Derwent. As the relevant statutory bodies for conservation are different in England, Scotland, Wales and Northern Ireland, and the majority of the known meadows are found in England, it was decided to select only case studies in England. In this way, the number of potential stakeholder organisations and the associated diversity of influence on policy, legislation and implementation was reduced without excluding geographical regions that harboured a significant hectarage of floodplain meadows.

Three main case study sites were selected:

- North Meadow, Cricklade, Wiltshire: a large high profile 45 ha SAC, SSSI, NNR

- Brook Meadow near Dorridge, Warwickshire: a very small 2 ha Wildlife-Trust-owned SSSI
- Long Mead, Eynsham, Oxfordshire: a small County Wildlife Site with no public access

These three case studies represent a range of conservation designation status and high to low profile as well as some degree of geographical spread across the core region in which most meadows are located. The three sites also varied in their ownership and management stakeholder networks, with North Meadow being mostly owned by Natural England and managed by a relatively complex network of agents, Brook Meadow being owned by a private Wildlife Trust charity with Natural England interest and managed by farming contractors, and Long Mead being owned by a private individual again using farming contractors to deliver management. These three cases inevitably could not cover all possible permutations of land ownership and management actors. For this reason, some fieldwork was done on other meadows to provide further breadth to the study, which were studied in lesser detail:

- Mottey Meadows, Staffordshire: SAC, SSSI, NNR, entirely owned by Natural England and farmed by contractors
- Oxford Meads, Oxfordshire: SAC, SSSI, complex ownership but managed by one commercial farming enterprise
- Portholme, Cambridgeshire: SAC, SSSI but not NNR and privately owned by London Anglers Association, farmed by contractors following yearly auction
- Sherbourne meadows, Warwickshire: SSSI, privately owned, farmed by tenant
- Birches Barn, Warwickshire: SSSI, privately owned, farmed by owner
- Welford Fields, Warwickshire: SSSI, privately owned, managed by contractor
- Racecourse Meadow, Warwickshire: SSSI, site management arrangements not known
- Deans Green, Warwickshire: County Wildlife Site, owned by Wildlife Trust, farmed by contractors
- Seaton Meadows, Rutland, owned by Plantlife, site management arrangements not known

Of the 156 meadows documented by the Floodplain Meadow Partnership based at the Open University and registered with Natural England, the three major case studies represent approximately a 2% sample of known sites (3% of known hectarage), whilst all twelve sites studied represent approximately a 7% sample of known sites (18% of known hectarage).

4.4.2 Identification of Stakeholders

As a result of each meadow's history of landownership and management, the stakeholders actively involved in managing floodplain meadows varied from site to site. As all case study meadows bearing a statutory designation (SAC or SSSI) had been identified via Natural England, acting as advisor and administrator for any meadow in an HLS scheme, as well as having statutory responsibility for the nature conservation interest of such sites, this stakeholder was also the gatekeeper through whom all other stakeholders were identified, and through whom contact details of other stakeholders (mainly farmers and landowners) could only be accessed under the Data Protection Act.

For non-statutory sites such as Long Mead, the site was identified as a candidate case study through other organisations such as Thames Valley Environmental Records Office (TVERC), Warwickshire Wildlife Trust or Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT), who in turn acted as gatekeepers for reaching further stakeholders. In many cases stakeholders identified through the first gatekeeper led to the identification through snow-balling to further potential stakeholders such as volunteer groups.

For the purposes of this study it was decided to scope out stakeholders who did not appear to have a clear active role in management or assessment of meadows. For example, a Friends Group that saw its role as awareness-raising, outreach and fund-raising work but that saw itself as not having a direct role in, or opinion of, management or assessment, would not be considered to be directly involved in management and was scoped out. This is not to say that such latter groups have no influence or that their opinions or activities have no influence on management at all. However, it has been assumed for the purposes of this study that such groups, if they have any

influence over meadow assessment and management, they do so indirectly via the other relevant stakeholders and that their influence may be seen through the actions and opinions of these actors.

4.5 Data collection methods

4.5.1 Semi-structured interviews

Once relevant stakeholders with an active role in management had been identified, a semi-structured interview was undertaken with each stakeholder. Some questions were not relevant to all stakeholders. A range of questions were asked concerning several main areas:

- Interviewee's history of involvement with the case-study meadow and knowledge of the site's past history
- Motivation and interest for involvement in the management of the meadows
- Opinions on the valued characteristics of the site and whether it is worth retaining in its present form rather than changing to a new use
- Opinion on what constitutes a 'good' or 'bad' meadow or meadow condition
- Assessment or evaluation, formal or informal, that the stakeholder undertakes of meadow condition, status or management
- Management operations that the stakeholder is involved in with the meadow
- Factors influencing decisions about management operations, and whether the outcome of assessments influences the operations
- Interactions with other stakeholders (extent and whether these were positive or not)
- Any records that the stakeholder kept of assessment or management activities
- Personal opinions and perspectives on the current state and management of the meadow at present an in the future

Some flexibility had to be exercised in conducting the interviews in order to accommodate the different priorities and perspectives of the interviewees, but always with the intention of covering the above areas. In some cases certain stakeholders appeared unused to being asked to discuss

certain aspects of their work and so found it difficult to express an opinion or were unsure what was being asked of them, and it was therefore necessary to either rephrase the question, return to the question later on in another guise, or to leave it to one side in order not to disrupt the flow of the interview. Where only one formal interview was possible with a stakeholder, some questions therefore remained unanswered or the answers remained unclear. However, where follow-up interviews were possible, or where subsequent site observations or informal conservations took place, opportunities were taken to seek clarification.

Where participants consented to it, the interviews were recorded using a portable digital voice recorder to permit careful analysis of the transcript. Where so, voice recognition software (Nuance DragonSoft v11) was used to create transcripts of the interviews. In all cases hand-written notes were also taken.

Following interviews, notes were made of the interviewees' responses as soon as possible, organising the information into a template based on the research components and sub-questions. This provided a standard structure that permitted cross-comparison of answers and opinions between different stakeholders for the same site and between sites, as well as cross-comparison with other data such as site observations.

A summary of the interviews undertaken with stakeholders and other specialists is provided in Table 4.1 below. Where more than one interview is indicated, this constitutes in all cases one full formal semi-structured interview as above, plus any additional follow-up, however brief. This proved necessary in certain cases at the end of the hay growing season to follow-up activity seen during field observations in cases where ambiguity remained following the main interview. In all but two cases, the anonymity of interviewees has been maintained throughout this thesis by allocating to each one a unique code that reflects their role in meadow management (e.g. Farmer, Conservation Officer), the meadow site they manage (e.g. NMC for North Meadow Cricklade) and a unique number where more than one interviewee performed the same role at the same site

(e.g. Farmer NMC1, Farmer NMC2). The two exceptions are specialists whose identity is clearly implicated in the information that they provided.

Table 4.1 – Summary of semi-structured interviews

Meadow	Stakeholder	Role	Dates of Interviews with Stakeholder
National Specialists			
All meadows	Natural England	Senior Grassland Specialist	16/3/10 28/1/11
	Natural England	Head of Historic Landscape (West Midlands Region)	13/2/12
	Centre for Ecology and Hydrology (CEH)	Grassland specialist	25/3/10
	Professor John Rodwell	Editor of National Vegetation Classification (NVC)	24/4/10 11/6/10
	Dr Alison McDonald	Researcher on meadow management, Oxford University Field Station	21/6/10
Regional Specialists			
Oxfordshire Meadows	Thames Valley Environmental Records Centre (TVERC)	Archive specialist with personal knowledge of SSSI notification process in Oxfordshire	31/1/10
	BBOWT	3 conservation officers with responsibility for Oxfordshire Meadows	25/3/10
Major Cases			
North Meadow	Natural England	Site Manager	18/10/10 16/12/11
	Farmer NMC1	Cuts hay crop	9/12/10 1/7/11
	Farmer NMC2	Cuts hay crop	8/3/11
	Farmer NMC3	Cuts hay crop	7/3/11 1/7/11
	Hayward	Oversees grazing regime	12/3/11
	Grazier NMC	Grazes meadow	7/12/12
Brook Meadow	Warwickshire Wildlife Trust	Reserves Manager (overall responsibility of meadow)	30/3/11
		Reserves Biodiversity Manager (responsible for monitoring programme)	30/3/11 20/12/11
	Natural England	Conservation Officer (SSSI) and HLS advisor	20/1/11 8/4/11 19/7/11
	Farmer BM1	Cuts hay and grazes meadow	2/2/12
Long Mead	Site owner	Organises management but does not undertake activities	28/3/11
	Farmer LM1	Cuts hay	8/2/12

Meadow	Stakeholder	Role	Dates of Interviews with Stakeholder
Long Mead	Grazier LM1	Grazes meadow for livestock company	4/2/12
	Natural England	HLS advisor	27/3/12
	Surveyor LM1	Undertook survey on behalf of TVERC/BBOWT from which Long Mead was notified as a County Wildlife Site (CWS)	26/3/12
	Surveyor LM2	Undertook survey on behalf of English Nature from which Long Mead was notified as a County Wildlife Site (CWS)	26/3/12
Minor Cases			
Mottey Meadows	Natural England	Former site manager now Conservation Officer for region	9/9/10 2/12/10
	Natural England	Current site manager	9/9/10
	Farmer MM1	Cuts hay at north end of site	23/11/10 03/12/10 10/12/10
	Farmer MM2	Cuts hay and grazes most of Mottey Meadows	23/11/10 20/7/11
	Farmer MM3	Cuts hay at south eastern end of site and grazes northern fields of MM1	1/11/10
Portholme Meadow	Site owners (London Anglers Association)	Chairman of LAA	25/3/11
	Farmer PH1	Has cut hay on meadow in past	2/7/11
	Natural England	Site manager/HLS advisor	15/11/10
Oxford Meads	Natural England	Site manager	18/11/10
	FAI Farms Ltd	Manager who cuts hay and graze meadow with sheep on behalf of land owners and Natural England	13/9/10 27/5/11
Yorkshire Derwent Ings	Natural England	Site manager/conservation officer	1/3/11
Birches Barn	Natural England	Conservation officer and HLS advisor	As per Brook Meadow
	Farmer BB	Land owner and farmer, cuts hay and grazes	4/4/11
Sherbourne Meadows	Farmer SH	Tenant farmer, cuts hay and grazes	29/3/11
Deans Green	Natural England	HLS advisor	11/4/11
	Warwickshire Wildlife Trust	Reserves manager and Reserves Biodiversity Manager	As per Brook Meadow

Meadow	Stakeholder	Role	Dates of Interviews with Stakeholder
	Farmer DG	Tenant farmer, cuts hay and grazes	19/5/11
Other interviews			
Wall Farm	Owner/farmer	The land owner farmer has recreated species-rich grassland under an HLS funded project	12/6/10
	Surveyor	Conducts annual botanical surveys on the recreation meadows on behalf of the landowner	24/1/11

4.5.2 Site observations of assessment and management

A range of observational fieldwork was undertaken primarily for the major and to a more limited extent for some of the minor case studies focussing on on-site assessment activity and on management activities. However, where this was not possible or where there was little activity to observe (for example on a site that was not assessed by any stakeholder in the fieldwork period: summer of 2011), further evidence was sought by carrying out field observation work at the minor case study sites.

Three main forms of observation were undertaken. Firstly, sites were visited in the absence of any stakeholders to observe what site management activities were taking place such as cattle grazing, or could be observed to have recently taken place such as the hay cut. Secondly, passive observation of site activities by stakeholders was undertaken in order to observe what activities stakeholders undertook and how they executed these activities, for example observation of the hay cut or a stakeholder assessment to see how the activity is undertaken whilst attempting not to interfere with the execution of the activity. Thirdly, participatory observations were undertaken where I engaged as fully as possible in the on-site activity in order to gain a fuller understanding of the activities. Examples of this include undertaking a condition assessment

jointly with the Natural England site manager at North Meadow, each taking two different sections of the meadow, then pooling the results at the end, and undertaking a condition assessment of Brook Meadow as a volunteer for Warwickshire Wildlife Trust. Table 4.2 below summarises the observational work undertaken during this research.

Table 4.2 – Summary of participant and non-participant observation

Meadow	Activity	Type	Date
Major Cases			
North Meadow	Natural England rapid condition assessment (CSM)	Participant with Natural England site manager	9/6/11
	Open University/ Floodplain meadow Partnership Fritillary Population Census	Participant with group of volunteer surveyors from the Open University	14/4/10 19/4/11 24/4/12
	Open University botanical survey	Participant: using GPS equipment to relocate permanent quadrat locations for botanical surveyors. Secondary data from the database was used in the analyses discussed in Chapter 6	Yearly in May/June 2010-2012
	Attended meadow Open Day organised by Natural England	Participant as member of public, attending to evaluate how the meadow is presented by Natural England to the general public	16/4/11
	Visit meadow to observe management	Non-participatory	Weekly – monthly as required 2011
	Fritillary count volunteers meeting	Participant as volunteer	21/1/13
Brook Meadow	Natural England rapid condition assessment (CSM)	Participant with Natural England Conservation Officer for Warwickshire	13/6/11
	Warwickshire Wildlife Trust's in-house rapid condition assessment	Participant as volunteer with Trust volunteers and Trust' Volunteers Officer	21/6/11
	Visit meadow to observe management	Non-participatory	Weekly – monthly as required 2011
Long Mead	Natural England rapid condition assessment (CSM)	Participant with no other party.	30/6/11

Meadow	Activity	Type	Date
	Visit meadow to observe management	Non-participatory	Weekly – monthly as required
Minor Cases			
Mottey Meadows	Observation of hay making by Farmer MM1	Non-participatory	25/7/11
	Fritillary walk	Participant as member of the public	23/4/11
	Hay Festival	Participant as member of the public	18/6/11
Sherbourne meadows, Deans Green	Visit meadow to observe management	Non-participatory	Weekly – monthly as required 2011
Deans Green	Warwickshire Wildlife Trust's in-house rapid condition assessment	Participant with Trust volunteers and Trust' Volunteers Officer	23/6/11
Racecourse Meadow	Natural England rapid condition assessment (CSM)	Participant with two other Natural England assessors	7/6/11
Welford Field	Natural England rapid condition assessment (CSM)	Participant with two other Natural England assessors	7/6/11
Other			
North Meadow, Oxford Meads, Portholme, Mottey Meadows, Derwent Ings	Open University botanical survey	Participant: using GPS equipment to relocate permanent quadrat locations for botanical surveyors. Data from these surveys are fed into the Floodplain Meadow Partnership database. Secondary data from the database was used in the analyses discussed in Chapter 6	Yearly in May/June 2010-2012
Oxford Meads	Botanical identification training	Participant: Training course in plant identification to be able to undertake botanical surveys on floodplain meadow grasslands	5-6/5/11 25/4/12
Preston Montford Field Studies Centre	NVC for Grasslands course	Participant: Training course in plant identification and in the National Vegetation Classification system in order to be able to classify meadows to NVC categories using data from botanical surveys.	28-31/5/10
Open University, Milton Keynes	Soils and Hydrology of floodplain meadows workshop	Range of workshop topics on meadow soil science and hydrology	31/2/12
Wall Farm, Shropshire	Survey of recreated meadows	Non-participatory shadowing of surveyor	29/6/11
Seaton Meadows	Natural England rapid condition assessment (CSM)	Participant with two other Natural England assessors	14/6/10

Meadow	Activity	Type	Date
Bernwood Meadows, Bucks	Rapid botanical assessment by local wildlife Trust	Participant as volunteer	31/5/11
Leaches Farm, Bucks	Rapid botanical assessment by local wildlife Trust	Participation as volunteer	7/6/11
Upper Ray Meadows, Bucks	Rapid botanical assessment by local wildlife Trust	Participation as volunteer	28/6/11

4.5.3 Archival research

In order to shed further light on stakeholders' assessment and management practices, a search was made of written documents held by stakeholders regarding the meadows. The documentary evidence collected and examined was almost exclusively held by formal government or charitable organisations, in this case Natural England, Warwickshire Wildlife Trust and the Thames Valley Environmental Records Centre (TVERC). Other stakeholders were not generally found to keep written records, although other sources such as records kept by farmers are discussed in subsequent chapters where relevant. Searches were also restricted to documentation available at the offices of relevant stakeholder organisations, complemented by a very limited amount of information available via the internet. Information available varied greatly from site to site as policy on document retention and availability varied from county to county and was also reliant on the practices of individual staff members. Sources of information varied greatly from site to site but those that had been retained included correspondence between stakeholders regarding management operations and past reports on historical ownership and management.

For minor case meadows basic documentation that was readily available, either from the internet, or from an interviewee, was obtained for the meadow site. This normally included at least the citation for any statutory designation, and a copy of a management plan and agri-environment agreement. Interviewees were also asked if they kept any records of assessment or management operations and whether copies of these could be readily obtained.

In terms of the content of documentation examined, particular attention was paid to records kept of meadow assessment activity, documentary evidence of conclusions drawn from assessments, factors affecting management decisions and the management activities undertaken. However,

files inspected were also considered more generally in terms of the types of information of any kind that stakeholders considered worthy of recording and often contained evidence of the closeness or otherwise of interaction between different stakeholders.

Table 4.3 – Summary of archival research

Meadow	Archive Consulted	Date
Major Cases		
North Meadow	Natural England archives at: Devizes Ebsworth	 29/10/10 18/10/10
Brook Meadow	Natural England archive (Worcester) Warwickshire Wildlife Trust (Coventry)	20/5/11 30/3/12
Long Mead	Natural England archive (Long Hanborough) Thames Valley Environmental Records Centre (Eynsham)	2/4/12 31/1/10
Minor Cases		
Mottey Meadow	Natural England archive (Telford)	23/11/10 02/12/10
Portholme Meadow	Natural England archive (Peterborough)	15/11/10
Oxford Meads	Natural England archive (Long Hanborough)	18/11/10
Deans Green	Natural England archive (Worcester) Warwickshire Wildlife Trust (Coventry)	As per Brook Meadow
Sherbourne Meadow, Birches Barn	Natural England archive (Worcester)	As per Brook Meadow

4.5.4 Secondary data

A significant issue in studying the effects of particular forms of management on meadows and their botanical composition was the very limited availability of robust and systematically collected sets of numerical biophysical data. Such information might include data on agricultural metrics such as hay yields or chemical analysis of hay for nutrient content, botanical surveys of meadow plant composition and its evolution over time, or management activities applied to the meadow such as the date of the hay cut or its duration and intensity, and animals used in grazing regimes. Any such data generated through assessment of meadows or regarding meadow management was sought from stakeholders through the interviews and document searches described above. Both Natural England and the Open University indicated the difficulty in obtaining such data.

However, one integrated source of numerical data on such aspects of floodplain meadows is the database hosted by the Floodplain Meadow Partnership at the Open University. This database contains a range of data for many of the known floodplain meadows in England, including some of the minor case study sites (Mottey Meadows, Portholme, Oxford Meads and Sherbourne) and one of the major case study sites (North Meadow). The database includes a range of data from several years over the past 20 years including:

- Botanical population census quadrat data
- Hydrological data including water table depth measurements
- Soil chemical analysis, particularly for key plant nutrient cations
- Hay yield data
- Hay chemical nutrient content analysis

The data set is particularly detailed for the major case study site North Meadow, Cricklade with annual botanical survey data for sample areas of the meadow dating back to 1998, and intermittently to 1992.

Where numerical data for a site was limited or non-existent, it was necessary to formulate conclusions based on the more qualitative data collected in this project. However, where

quantitative data existed for a case study site and this could be used to support conclusions drawn from other data sources, the database was examined for further quantitative evidence.

The datasets in the Floodplain Meadow Partnership Database allowed further investigation of possible correlations between parameters representing certain meadow characteristics for meadows in order to provide further supporting evidence for conclusions drawn from fieldwork. For example, it was possible to investigate the correlation between hay yield and species richness as criteria of botanical and agricultural value respectively, or the presence/absence of positive indicators and desired characteristics such as species richness and similarity to the MG4 description in the NVC (Rodwell, 1992) and hence their utility as indicators of such criteria and value.

In total data from 293 botanical survey quadrats for which plant survey and hay yield data both existed was downloaded from the database. From this, quadrat values for a range of parameters were calculated for use in subsequent analyses.

- Species richness
- Percentage herb coverage
- Similarity coefficient to MG4 assemblage
- Ellenberg N value as an estimate of soil nutrient status
- Plant species counts of List A and B indicator species from the Natural England rapid condition assessment for MG4 grassland
- Hay yield per hectare

The analyses on the above data are explained in Chapter 6 below.

Chapter 5 – Value attributed to Floodplain Meadows by Stakeholders

5.1 Introduction

Having considered the literature and background to floodplain meadows and their conservation in England, this first empirical chapter considers the value attributed to such meadows by the stakeholders actively involved in their management, as identified in Chapter 3.

The aim of this chapter is to explore what floodplain meadows mean to the stakeholders, what value they attach to them and why, or whether, they feel that they should be conserved as they are, as well as to explore the tensions arising from differences between stakeholders. The chapter begins by noting the site-specific individuality of meadow stakeholder networks. It then goes on to consider the embedded narratives in documents produced by conservation organisations regarding meadow value. This is compared and contrasted with the opinions expressed by the stakeholders. The analyses of values presented in documentation are also considered, including how such value is compartmentalised, and the various components prioritised in order to assess which aspects of meadow value are dominant and which are subordinated or dismissed.

Empirical evidence considered is taken primarily from documentation identified during archival research and semi-structured interviews with stakeholders for the three main case studies. Where conclusions drawn from this evidence are reinforced significantly or are contradicted by evidence from the minor case study sites, this evidence is also presented in the analysis. In addition, evidence from interviews with selected policy specialists at relevant government organisations has been considered in the analysis.

5.2 Stakeholder Networks that manage floodplain meadows

The main stakeholders involved in managing each case study meadow were specified in Chapter 3. This section briefly draws conclusions about the stakeholder networks in order to then permit consideration of issues this may raise about stakeholders' perceptions of meadow value.

This research indicated that the stakeholder networks actively involved in managing floodplain meadow sites are very much site-specific with considerable variation in each case. Three essential groupings of stakeholders were identified at all sites:

- Land owner
- Conservation organisation or conservation-interest party
- Farmer/land-manager

Typically the conservation-interest party was Natural England or a Wildlife Trust, but could be any stakeholder, including landowners, whose primary interest in a meadow may be considered to be oriented towards nature conservation rather than agriculture. In most cases one entity or person might fall into two groupings. In no case did just one entity or person cover all three categories, so at least two entities interacted in order to deliver management on a meadow. This could therefore have implications for the management delivered on a site depending on the views of each of the two or more stakeholders, and the relative power relations between them.

The land owner in half of the cases examined was a private individual whose main interest in the land, or at least livelihood, was not conservation, examples being Birches Barn SSSI, Sherbourne SSSI in Warwickshire and Long Mead CWS in Oxfordshire, all owned by private individuals, as well as Portholme meadow in Cambridgeshire owned by London Anglers Association. In such cases the land was managed by tenant farmers or one or several contractors, with the exception of Birches Barn, which was managed by the owner, who is a farmer. Where contractors are used, the hay-making and grazing may be undertaken by different contractors.

Natural England was always a stakeholder, as a statutory consultee if the meadow was a SSSI site, and in all cases as administrator of an HLS scheme financially supporting the management. All sites identified carried some nature conservation designation, even if only the non-statutory County Wildlife Site and were enrolled in an agri-environment scheme administered by Natural England. In all cases therefore a nature conservation group had an interest.

In as many cases however the landowner was also a conservation organisation. In the case of the high-profile NNR sites (North Meadow, Cricklade in Wiltshire and Mottey Meadows in Staffordshire) this was Natural England. In the case of smaller SSSI sites and non-statutory sites this was a Wildlife Trust (Brook Meadow or Deans Green in Warwickshire) or another conservation charity such as Plantlife (Seaton Meadows in Rutland). Conservation interest could also be multiple in that the smaller Trust- or charity-owned meadows might be a SSSI and were in all cases in HLS, making Natural England also a conservation-interest party. In all such cases, the owner/conservationist did not maintain the necessary resources to manage the meadow directly and contracted the management out to one or several contractor-farmers, with hay cutting and grazing sometimes managed by different contractors.

A few cases were more complex and a range of actors were involved in actively managing a site. For example at North Meadow, the site is jointly owned by Natural England and a private landowner, the rights to take hay reside with the landowners, the rights to communal grazing are administered by the Court Leet in Cricklade, and the hay cut and grazing respectively are each undertaken by a separate set of local farmers who buy a license to undertake the management.

Inter-year continuity of farmer-contractor relations was also variable with some sites, particularly the large sites (North Meadow, Mottey Meadow) being managed consistently by the same organisation or individuals, whilst the smaller sites (Brook Meadow, Deans Green, Long Mead, Sherbourne) were generally more likely to see changes in contractors every few years.

Overall then, even on a small meadow site, at least two stakeholder entities will be involved in delivering management on a meadow site, with land-owners rarely managing the meadow

directly themselves. The network of individuals and organisations involved in the management, and their interrelation is therefore unique to each site. Stakeholder power relating to the ownership of the land may be held by private individuals with interests in agriculture, conservation or both, or by conservation-interested organisations. Conservation organisations may appear to hold greater power in terms of negotiating meadow management through legislative powers and control of agri-environment funding but, as seen, they do not deliver management directly themselves and therefore need to establish relationships with willing contractors who see incentives for being involved in meadow management.

5.3 Overview of stakeholders' views on meadow values

In terms of the views expressed by stakeholders regarding the value of meadows and the reasons for keeping them as meadows rather than converting them to another use, these seemed to fall along a spectrum of views. At one extreme this focussed entirely on the conservation value, expressed very dominantly through a narrative of biodiversity value, seen as the value of the botanical composition of the grassland sward, and at the other, total disinterest in this conservation value, seeing the meadow entirely as an agricultural resource. Overlapping this spectrum onto the main stakeholder groups however, is not straightforward and stakeholders, particularly farmers, could not be readily categorised.

Of the broad narratives that appeared to underpin ideas about the value of floodplain meadows, two were especially prominent. Conservationists all related a strong storyline about the importance of meadows in terms of biodiversity conservation, and also sometimes made strenuous attempts to frame meadows as 'natural' as opposed to social despite their agricultural origin. For example, the management plan for Brook Meadow (Segawa and Wright, 2011) notes:

> The site was designated as a Site of Special Scientific interest (SSSI).....for its herb-rich flora. The meadow is of special interest for a type of herb-rich flood meadow grassland classified as MG4... (p2)

and then attempts to square the 'naturalness' of the meadow with its agricultural origins:

> Like all meadows, the site is artificial having arisen and been maintained as a result of human activity. However the [plant] communities have arisen naturally and there is no sign of artificial introductions (p5).

despite evidence that wood anemone may have been introduced as well as a desire to reintroduce meadow thistle.

Farmer-land-managers shared these biodiversity and naturalness narratives to widely varying degrees, but mostly still saw the meadows as an agricultural resource. For example, at Long Mead, the grazier appeared to be somewhat ambivalent about the meadow's value (Grazier LM1, pers. comm., Eynsham, 04/02/2012):

> They tell me there's some rare flowers out there, now I wouldn't know and I'm not overly interested in that sort of thing but if they're rare and that sort of thing we should keep them, shouldn't we? But I wouldn't worry about them too much.

Meanwhile, the hay farmer at Long Mead was much more enthusiastic:

> I don't think it should be lost. We should do everything possible to keep these few meadows that remain. From a modern farming point of view, yes that meadow wouldn't yield a fantastic crop but from the conservation point of view it's wonderful to be out there haymaking in the summer. It's heaven.

In the case of North Meadow, Cricklade, a very strong narrative was also developed in the management plan (Natural England, 2008) that the meadow is an "extremely fragile reserve" (p2.2/1) which contrasted with the views both of the site's own manager, and the general view regarding other meadows, which were viewed as robust and resilient provided current management regimes could be maintained. In the North Meadow management plan, considerable emphasis was also put on the threats posed by human-induced change with the genetic material of natural ancient strains being "polluted" (p2.2/2) by modern agricultural strains, as well as those posed by human-induced changes in hydrological processes and nutrient cycling.

At Brook Meadow and Long Mead, the meadows were framed as fragile more in terms of the socio-economic forces shaping the ability to engage farmers to assist with meadow management. Narratives regarding non-biodiversity related aspects of cultural heritage and landscape value were not well developed by any stakeholder group and were tacit and implied, and agricultural value was at best deemed secondary.

For this research, the grassland specialists from CEH and Natural England were also interviewed to obtain their view on the value of floodplain meadow grasslands. The most distinctive contrast with the views of most other stakeholders was the framing of the biodiversity value in terms of the eco-system services perspective, noting for example the value of meadows for carbon sequestration, flood alleviation and pollination services. The Senior Grassland Specialist at Natural England shared the view expressed by other conservation stakeholders regarding biodiversity value and naturalness, particularly highlighting naturalness as an important factor. The grassland specialist at CEH also expressed the same views and framed the biodiversity value in terms of the widely-expressed biodiversity narrative, as well as invoking the ecosystem services view. However, he qualified this view by saying that:

> Biodiversity is the poor relation of the environmental movement..... Conservationists need to be conscious of fighting a losing battle and of what we are losing.....We need to learn to talk the talk of ecosystem services.

The ecosystem services perspective is in some aspects wider and more encompassing than the biodiversity narrative, but the above quote strongly suggests that the ecosystem services view did not capture all the value of meadows perceived by this interviewee, but merely represented a common currency or language that could be shared with other stakeholders who did not entirely share the view of the value of biodiversity held by many nature conservationists. This stakeholder also highlighted the aesthetic value of the meadows and said that the value of MG4 grassland was especially related to their cultural, social and aesthetic merit. This CEH expert saw an intrinsic

value in such meadows, perceived as their cultural, spiritual and aesthetic appeal as well as a moral imperative on society to conserve them.

5.4 Key documentation on meadow value

Two key documents were identified in some form for every meadow site studied. Firstly the SSSI citation document, or a similar statement that was prepared at the time that the meadow was notified as a SSSI or awarded another conservation-related designation. Such statements are intended to describe the meadow in question and explain why it is deemed to be worthy of protection and conservation. They are therefore a good point of departure for considering views on meadow value, particularly at the time when they were written, which may have been as early as the 1970s.

Since the creation of such citation statements, a management plan, however brief, is usually prepared and may be updated periodically, typically every 5 years in the case of the Natural England-managed NNR sites. Such plans, particularly for more high profile sites such as NNRs and SACs, may be very long and detailed documents, but they invariably begin with an analysis of the meadow's perceived value and importance, analysed and broken down into geographical compartments[3] or components, or differing aspects of value. For management plans a very dominant analytical structure used is that of the Ratcliffe Criteria cited in Table 2.1. The two forms of documentation are considered in further detail below for the three main case studies.

5.4.1 Citation statements

5.4.1.1 North Meadow

North Meadow was first designated as a SSSI in 1971 and the latest citation document (English Nature, 1986, p1) describes it under the heading 'Description and Reasons for Notification' as:

[3] Land parcels

> A traditionally-managed hay meadow with a rich flora which includes the largest British population of snake's head fritillary *Fritillaria meleagris*.....The meadow is 'lammas land'[4] grazed in common between 12 August and 12 February each year and cut for hay no earlier than 1 July. This pattern of land use has existed for centuries, helping to maintain a rich grassland flora.

Immediately, this identifies two main aspects of the perceived value of the meadow: on one hand the botanical value in terms species richness and botanical diversity, as well as the presence of a uniquely large population of the nationally scarce species the snake's head fritillary, and on the other hand to the cultural heritage value of the traditional agricultural landscape and associated practices.

The botanical value of the meadow then is perceived to be primarily in the species richness and diversity of the grassland sward with large numbers of plant species present. In terms of plant species identity, the presence of higher plants, herbs and grasses are highlighted. On the one hand the 'typicalness' of characteristic and perhaps specifically-named charismatic hay meadow species is highlighted, that is to say those that would be expected to be found in such meadows and therefore may be considered to be symbols of a meadow. On the other hand the rarity of the snake's head fritillary is also highlighted along with the uniqueness of the site, which holds an estimated 80% of the UK population of these flowers.

In terms of non-biological value of the site, aspects highlighted are 'traditionally-managed hay meadow', discussion of the site's management as 'Lammas Land' and "this pattern of land use which has existed for centuries" (p1). The emphasis here is placed on long-term continuity of land use and recorded history, and could therefore be interpreted as valued historical and cultural aspects of the meadow.

[4] Lammas land was managed according to traditional regulation that stipulated that it be grazed communally, typically between 12th August and 12th February, after which it was 'shut up' for hay. That is to say, grazing ceased in late winter to allow a crop of hay to be grown. The hay crop would then often be cut by local farmers in strips allocated to them by drawing of lots.

Despite locating value in the grassland sward, the citation makes no mention of specific plant assemblages or communities other than the general definition of "species-rich hay meadow". No attempt is made to analyse or define the grassland sward in terms of NVC categories (the NVC definitions were published after the citation's publication), or earlier precursors such those in Ratcliffe (1977).

Similarly, the HLS prescription applied to North Meadow by Natural England (Natural England, 2012b) in respect of the grazing rights recognises the following features of value:

- Lowland meadow and pasture (UK BAP habitat)
- Above ground historic feature, historic route way and historic water meadow
- Protected fauna: Daubenton's bat, otter, Pipistrelle bat, water vole

This prescription therefore again appears to recognise both flora and faunal 'natural' interest as well as the 'cultural' heritage aspects of the site, albeit in a compartmentalised fashion, as the historic interest relates to specific artifacts on the site such as old routes across the site and an area of historic water meadow, but not the meadow as a whole. Similarly faunal interest relates to habitat peripheral to the main meadow in the marginal tree lines and watercourses.

5.4.1.2 Brook Meadow

The site was first notified as a SSSI in 1995 and the citation document (English Nature, 1995) describes the site as one of the two last remaining traditionally-managed herb-rich flood meadow sites in Central Warwickshire, highlighting the county-level geographical scale of importance, and the rarity of a landscape or habitat once typical of the region.

Again it notes that the meadow is of special interest because of its:

> herb-rich flood meadow grassland characterised by meadow foxtail *Alopecurus pratensis* and great burnet *Sanguisorba officinalis*, which is now very scarce nationally and within the County (p1),

again noting the importance at national and county-level scale. The citation then goes on to say that:

> the sward associated with the meadow foxtail-great burnet community is species-rich with a great diversity of grasses and herbs (p1),

and that

> the meadow is also one of two localities in Warwickshire for meadow thistle *Cirsium dissectum*, but that this has not been recorded in recent surveys (p1).

Again value is attached to the meadow as a 'traditional typical' landscape:

> Brook Meadow is a traditionally-managed herb-rich meadow...There is evidence that in the nineteenth century this grassland type was widespread and common in some parts of Britain, particularly the Midlands and also southern England in the case of flood meadows (p1).

In terms of botanical interest, the Brook Meadow citation therefore makes indirect reference to the MG4 grassland type, noting the valued diversity of the various plant assemblages on site, although no NVC community class types are cited. Importance is attached to the species richness and diversity of the herb-rich grassland sward and the citation also attaches value to characteristic species such meadow foxtail, great burnet and meadow thistle, the first two being typical of such sites. Whilst Meadow Thistle is characterised in the citation as a rarity at county scale, it is not nationally rare, being classified as of 'Least Concern' in the *Vascular Plant Red Data List for Great Britain* (Cheffings and Farrell, 2005).

5.4.1.3 Long Mead

The CWS citation (BBOWT, 2004, p1) notes that:

> [Long Mead] is a species-rich floodplain hay meadow adjacent to the River Thames. The field has abundant meadow buttercup and common sorrel, together with a wealth of

> interesting species which are usually found only in meadows which have been traditionally managed for many years without the use of artificial fertilisers.

And:

> The sward has 75% herbs and also has many species characteristic of unimproved hay meadows. Species-rich floodplain hay meadows such as this are now rare in Britain and a high priority for conservation.

Immediately the citation focuses on the floristic species richness and diversity, as well as the herb-rich botanical composition consisting of characteristic and "interesting" species typically only found on meadows, though a definition of interesting species is not offered. The rarity of the species confined to meadows and of the meadow assemblage itself in Britain are also offered as a reason to make such meadows a priority for conservation, though which plants are deemed rare is not specified, nor does any other documentation suggest the presence of plants deemed to be rare in Great Britain.

The site is noted as being lowland meadow and therefore a UK Priority BAP Habitat (JNCC, 2007) and as being noted for two UK Priority BAP species and 'Birds of Conservation Concern' Red List Species (skylark and reed bunting). The citation does not discuss the meadow plant assemblages in terms of NVC plant community descriptions.

Apart from the botanical value the acknowledgement of the meadow as traditionally managed also appears to concede some value to it as a cultural and historical landscape but this aspect of the site's potential value is not explored further.

5.4.2 Management plans

The management plans for the two case-study meadows notified as SSSIs provide an analysis of floodplain meadow value that is highly structured and compartmentalised, using the Ratcliffe Criteria (Table 2.2) to break down perceived value into its sub-components. Whilst some Ratcliffe criteria are intended to capture the values themselves, others such as fragility or rarity focus on

threats to such value and the potential for their loss, both of which together can constitute reasons for prioritising a meadow for conservation.

Some statements in the North Meadow management plan regarding management are contradictory, variously claiming the management has remained very similar over time, whilst also claiming that changes in management will have impacted the meadow. To what extent change in any of the meadows matters is not clarified, with indications that contemporary management is really a hybrid between traditional practices and alterations to meet non-traditional aims. Documentary opinion appears to vary in terms of its view of whether conservation of the meadow is essentially a question of keeping the meadow the same, returning it to a state that represents a now-lost historic baseline, or indeed changed to a new, improved or enhanced and novel ahistorical state that highlights particular features deemed to be 'of value' at all times in all places.

5.4.2.1 North Meadow Management Plan

The North Meadow management plan (Natural England, 2008) considers the site to be of importance overall for the botanical composition and the MG4 grassland, describing the meadow as 'botanically very important' (p1.5/1). Whilst the butterfly interest of the site is noted, most faunal interest is considered to be peripheral to the meadow as management generally disrupts invertebrate life-cycles (p1.5/3):

> North meadow has a rich flora which supports a rich fauna. However, the traditional management pattern of a summer hay cut followed by grazing, which keeps the sward short, is not conducive to a rich fauna. In fact much of the meadow's fauna is supported by the peripheral habitats of the river, ditch and hedge with pollards. In winter the meadow does provide a refuge for birds, particularly when partially flooded, though disturbance by visitors is an increasing problem

again thereby partitioning the flora and fauna interest into separate areas of the site.

The management plan includes a description of the meadow's value analysed in terms of the structure provided by the Ratcliffe Criteria (Ratcliffe, 1977). Four key aspects of the meadow's value highlighted by the plan are the 'naturalness' of the semi-natural grassland, the rarity both of the MG4 grassland assemblage and of the snake's head fritillary *Fritillaria meleagris ,* the species diversity and herb richness of the grassland sward as well as the meadow being "a large representative of the traditional hay meadow habitat of the Upper Thames Valley of which very few remain" (p1.5/1).

5.4.2.2. Brook Meadow Management Plan

Overall the meadow management plan compiled by Warwickshire Wildlife Trust (Segawa and Wright, 2011) provides a summary of the site that highlights features of the site very similar to the SSSI citation. Again the site is described as a traditionally managed hay meadow that is:

> ...of special interest for a type of herb-rich flood meadow grassland classified as MG4 in the National Vegetation Classification and characterised by meadow foxtail *Alopecurus pratensis* and great burnet *Sanguisorba officinalis*, which is now very scarce nationally and in the County. At the south end of the meadow, the more freely draining raised areas, are small fragments of the neutral grassland community MG5 characterised by crested dog's-tail *Cynosurus cristatus* and common knapweed *Centaurea nigra*. At the north end, drainage is more impeded leading to patches of a wetter community approaching MG8 classification. The site contains Meadow Thistle *Cirsium dissectum* and is one of two such localities in the county (p2).

Again the description focuses on the botanical interest of the site, the patchwork of locally and nationally rare plant species assemblages (MG4, MG5 and MG8) with their herb-rich sward and typical component species, as well as one locally rare species, meadow thistle.

As regards potential value it notes that the "the value of the site at present simply needs to be maintained and there is no reason to attempt to change this" (p5), suggesting that the Trust

believes the site management should seek to maintain and conserve the site rather than change or improve it in any way.

Under the Ratcliffe Criteria of 'potential value', despite acknowledging that little historical research seems to have been undertaken on the reserve, it nevertheless asserts that:

> The site has probably had a long history of traditional management as a hay meadow, which has led to the rich, diverse flora present today (p4).

On the one hand this appears to acknowledge that the meadow has cultural heritage value, but again appears to ascribe the importance of the long-standing management practices to having delivered the rich, diverse flora that again seems to be the ultimate source of meadow value.

As for North Meadow and in a very similar analytical framework, the management plan then provides a very similar breakdown of what it considers to be the value of the site in terms of the Ratcliffe criteria (Ratcliffe, 1977).

5.4.2.3 Long Mead Conservation Plan

As the Long Mead meadow is not a notified SSSI, a formal management plan has not been prepared in the standardised Natural England format. However, a conservation plan for the site has been prepared (Long Mead site owner, undated). The plan again surveys and details the perceived value of the site, which is framed very much in terms of the species richness and diversity of the site's flora and fauna. Again the "rich diversity of meadow flora" is cited along with named plant species of note (p1). The site is also highlighted as important for invertebrates including meadow butterflies, grass snakes and wintering wader birds, also echoed in the Farm Environment Plan (FEP)(Natural England, 2011b).

The Conservation Plan also acknowledges two-fold value for the meadow:

> Both in historical and biodiversity terms, it is important to maintain this rare environment (p4).

The conservation plan does also recognise the landscape character of the meadow, noting it as "hay meadow in valley bottom, open floodplain landscape" (p5), though no further detail or analysis of this landscape value is offered. The FEP also notes that no historic features had been identified on the site. The meadow itself does not therefore appear to have been considered a historical feature itself of relevance for the purpose of the FEP. The associated environmental stewardship agreement does not provide an analysis of the meadow's value other than to describe it as "species-rich" (Natural England, 2011a, n/p).

Again, throughout this documentation the emphasis is very much on the bio-diversity and characteristic nature of the meadow plants and associated fauna. To this are added the rarity of a range of typical meadow species, although without specifying individual species, and the rarity of the plant assemblages. Some recognition is given to the meadow as having landscape value and possibly cultural heritage value as a traditionally managed landscape, although paradoxically the FEP notes that the meadow has no historical features. None of these non-biological aspects of value are described in any detail beyond the briefest of acknowledgements or allusions.

5.5 Dominance of botanical value and the conservationists' perspective

In documentation and interviews, conservation stakeholders generally expressed a very specific view of meadow value. Some described what they saw as meadow value in a more personal fashion, whilst others cited more standard reasons for conserving meadows. Nevertheless, these tended strongly to revolve around a biodiversity narrative focussed on the species richness and diversity of the meadow grassland sward and its rareness as a habitat, that is, as an assemblage rather than because of the presence of particular rare species, and often linked to the MG4 grassland description of the NVC, as noted above. In the management plans locally or nationally scarce individual species that were noted to be of interest were the snakes head fritillary at North Meadow, and the meadow thistle at Brook Meadow.

For example, the site manager for North Meadow cited the reason for conserving the meadow as to "protect the flora and fauna and the species richness of the assemblage rather than the

individual species" (North Meadow site manager, Natural England, pers. comm., Ebsworth, 18/10/10), although she did also cite public access and the long history of continuous management of the meadow as reasons for conserving it as it is now. According to the site manager:

> the biodiversity there, the attraction to wildlife is huge now and we really need to hang on to that. It's important that we keep that range of plants. And remember they are all wild in there, nothing has been introduced.

highlighting the botanical composition as the priority and framing the meadows as natural ("wild"). To the site manager, the meadow was in good condition when there were "ticks in the positive indicator species box" and absence of negative indicator species such as large sedges. Again this shows that the ultimate focus of value is on the botanical diversity and associated aesthetic appeal, and a narrative of naturalness. The pinning of the definition of good condition to the positive and negative species lists in the Natural England rapid condition assessment ties the concept of a good meadow to the very particular criteria embodied in that assessment, which are again botanical and selective.

The Natural England HLS adviser for Long Mead thought that the value of these meadows lay in the floristic diversity and richness of the grassland and the absence of a weed-like plant species such as thistles, thereby pinning the value firmly to the botanical interest of the site. If it is being managed correctly she would expect to see a good coverage and diversity of wildflowers with not too much grass, although she would distinguish between good grasses and bad grasses and also good herbs and bad herbs in the sense of negative indicator species. Long Mead was notified as a County Wildlife Site on the basis of two surveys undertaken by Surveyor LM1 and Surveyor LM2 in 2001 and then again in 2004. Surveyor LM1 recalled Long Mead as having:

> ...nothing particularly notable but just a good mix of nice things. I was encouraged to say rather broadly that the field was dominated by something, had additional interesting species and a few notable ones, and that there was a damp area in the Southwest corner

> which also had a shortlist of those species (Surveyor LM1, TVERC, pers. comm., Oxford, 26/03/12).

again focussing on the botanical composition.

Interestingly, whilst the value expressed in the Brook Meadow management plan was very specific and dominated by the biodiversity narrative, the Trust officers with responsibility for the site seemed to have a broader value of its value. When asked what the overall valued characteristics of such sites were the Reserves Manager described meadows like Brook Meadow as fantastic examples of what the wider landscape used to look like to previous generations and that told us about pre-intensive [agricultural] landscapes. He said that the Trust took a broad approach to habitat management, had more of a "habitat approach at landscape scale" (Brook Meadow Reserves Manager, Warwickshire Wildlife Trust, pers. comm., Coventry, 30/03/2011); they rarely took a species-specific focus within particular reserve sites and particular species were not seen to be the whole picture. He said that the intention was to conserve a holistic landscape and the meadow was seen to have value in its own right and as a component of the broader landscape. The Trust tried to have management that benefited as many species as possible, rarely just specific species, and did not micro-manage smaller sections of sites.

As regards the use of the NVC as a reference point or baseline, the Reserves Manager thought this had some influence as it provided some structure and framework in order to work with Natural England, and represented "the theory of what they [Natural England] were trying to achieve". The Trust Managers did not feel constrained by the 'scientific value' but thought that such concepts were useful to fall back on and to give a national context, as a broad-based comparison, but only generally as every site is different. The Trust did not see conflict between the formal designation of MG4 and their own site conservation priorities.

The uniqueness of individual meadow sites and the fact that their current state has resulted from past management and local factors is acknowledged in the management plan for Brook Meadow, which states that:

> The Trust has three reserves with this type of grassland, representing some of the best such sites in the county. All are slightly different, probably representing different soil types and histories (p8).

This therefore appears to represent an acknowledgement of the individual character of meadows and the fact that they need not conform to a universal and precise prescription.

The above indicates that the Trust's Reserves Manager had a broad view of Brook Meadow's value as a landscape of cultural and historical as well as biological importance. It also highlights how he felt that the Trust's and Natural England's views on value were somewhat different and that managing the site therefore involved some compromise between the two views of the site's value. This view of the site in terms of landscape and cultural value is not evident from the management plan, which follows the standard structure of a Natural England management plan template and focuses heavily on the botanical value and the Ratcliffe Criteria of value.

In further contrast to the other views on value noted above in the site documentation, the Reserves Manager seemed to see conceptual ideas such as NVC categories more as a framework and a vehicle for dialogue with Natural England, more in keeping with Rodwell's original idea of the NVC as a baseline description of British habitats than a 'standard'. He also appeared to play down the importance of conserving individual species, which is in keeping with the absence of species on the meadow that may be considered rare or threatened at least at UK national and international level.

5.6 Farmers' views on Meadow Value

The views of farmers appear to vary more than those of conservationists and cannot be stereotyped. Generally the farmers see the hay and grazing as primarily an agricultural product and so the criteria of good meadow condition relate to their desire to see a balance between hay (agricultural) quality and quantity, and convenience of management regarding how meadow management fits in with the rest of their agricultural operation both practically and economically (Riley, 2006). Only Farmer NMC1 at North Meadow expressed no interest at all in any aspect of

meadow value other than as an agricultural resource. All other farmers expressed interest and enthusiasm for the non-agricultural or conservation value such as flora, fauna, landscape and heritage value to a greater or lesser degree, either in a utilitarian sense (they are happy to provide a conservation product rather than an agricultural product if someone pays them to do it), or indeed out of their own personal interest and enthusiasm for nature conservation.

At one end of the spectrum are those farmers who are actively enthusiastic about the conservation value of the meadows. Examples are Farmers MM1 and MM2 of Mottey Meadow in Staffordshire, whose families used to own the meadow and who seem to express considerable pride at being still associated with the meadows, as well as the hay farmer at Long Mead as seen earlier. Farmer MM1 at Mottey Meadows even commented that:

> you can't farm an area for 500 years and not be a conservationist.

indicating at least his own strong sense of (family) attachment to the meadows.

The owner of Long Mead, though not a commercial farmer and by her own acknowledgement not commercially minded, was very positive about the 'nature' conservation value of her meadow and appeared to feel that this was now its primary value. However, she was "not oblivious to agricultural value" and this may have been motivated by concern for the managing farmers' interests, given the difficulty in finding contractors to manage the site. She said that she was interested in conservation and so it was not currently a problem that the site was not a SSSI. She had not bought the meadow field to manage it commercially, and could not imagine ploughing it up. For her, the meadow was in good condition when it was "diverse-looking" and it was not important for the grassland sward to be "lush-looking". Conversely it could be said to be in bad condition when there were fewer species, as after the summer flooding in 2007 and 2008.

Meanwhile Farmer LM1, the farmer that cuts the hay crop on Long Mead appeared also to be very enthusiastic about conserving the meadow:

> I don't think it should be lost. We should do everything possible to keep these few meadows that remain. From a modern farming point of view, yes that meadow wouldn't yield a fantastic crop but from the conservation point of view it's wonderful to be out there haymaking in the summer. It's heaven.

Farmer LM1 enjoys the hay-making process and thinks the traditional process is disappearing to silage-making. Regarding the agricultural value of the meadow, he did think that the traditionally-managed meadow had some advantages and that there was some merit in preserving traditional farming practices:

> Those old grasses have much more variety than in modern farm grasslands. The emphasis now is on maximum yield and profit and no one seems much interested in the old species of grasses and the old ways. Floodplain meadows are always late as it's wet in Spring and not fertilised. Old grasses are late summer maturing and the range of plants mean the sward takes longer to mature.

He felt it was worth keeping the old practices and that meadow conservation appeared to be a cultural heritage issue too. He admitted that he did not know much about the plants and was not able to name them, but lacking this kind of botanical knowledge did not seem to diminish his enthusiasm for preserving the meadows, indicating that for him a scientific perspective is not required to see value in the meadows over and above strict economic value.

The only commercial farmer who owns a meadow that he managed himself is the owner of Birches Barn SSSI meadow in Warwickshire. Whilst running the rest of his operation commercially to make money, he too is extremely positive about managing the meadow for conservation, and expressed no resentment at its statutory designation and the restrictions this placed on its management. From interviews with him and the corresponding Conservation Officer at Natural England, their working relationship appeared to be very positive and cordial. As regards the botanical value he described the meadow as "pretty as a flower garden in June time when they're all in flower". He said he enjoyed the meadows and got a lot of pleasure out of them. He felt that

they fitted in “wonderfully well” with his farm and would happily manage more low input land as he found the meadow easy to manage. He felt the meadow was marginal land and suspected it might not be worth the money to reseed or fertilise the meadow land, and that indeed the public would not want the land to be managed intensively. As regards the interaction between botanical value and agricultural value he thought the herb-rich diverse sward to be very balanced and very palatable to animals, and he was able to sell it at a premium through his own farm shop. Clearly he enjoyed the botanical value of the meadow, perhaps all the more so as he perceived that it was the best use for his land, was not worth agriculturally improving , and that the botanical conservation interest possibly even enhanced the agricultural value as a traditional product. Further to this he described the meadows as having meaning through childhood memories, so adding a personal social and historical value to the meadow’s conservation.

Nevertheless, the farmer-manager group as a whole saw a balance to be struck between the agricultural and non-agricultural value, and almost all were critical to some degree of meadow management, as is discussed in detail in Chapter 7. On this point, Farmer MM1 at Mottey Meadows noted:

> As a farmer, it’s totally useless, as a conservationist, it’s a real treat. I’m really torn.

Other farmers said that their interest in the meadows was essentially agricultural but that they acknowledged that other groups in society saw other non-agricultural value in the meadows and they appeared to appreciate and respect that view, even though they may only share it to a limited degree. Indeed, as the farmers of Deans Green and Sherbourne Meadow in Warwickshire put it, if they could not make any money, they would not wish to actually make a loss on managing a meadow.

Farmer BM1 at Brook Meadow recognised that biodiversity value is important to other people and sees the validity of this point of view, though he personally is interested in the meadow as an agricultural resource, albeit one with little scope for improvement. He said that he was interested in the site as he wanted some more grazing land to put heifers on. For him it was “quite handy as

there are no other cattle around there", but he was really only interested in it personally for practical reasons as a grazing and hence agricultural resource (Farmer BM1, pers. comm. Darley Green, 02/02/2012).

As regards the prospect of converting Brook Meadow to another use, Farmer BM1 was of the opinion that Brook Meadow had limited agricultural utility because of its size and so it would not be worth ploughing up for more commercial agricultural. So despite his interest being essentially agricultural he said that he thought it was worth keeping as a traditional hay meadow. This said he thought the quality of the hay was not good as mid-July is late in the season to cut the hay. He felt that by then much of the 'leaf' (vegetative leaf matter) had become coarser. He said that it could be cut earlier:

> ...but you wouldn't get the flowers....It's worth keeping the traditional management for the flowers. People round here like seeing it.

Clearly the late hay cut diminishes the quality of the hay crop and therefore its agricultural value, though not sufficiently for him to have no interest in managing the site. He thought that the meadow had been a useful resource to him in 2011 as yields of grass on his other fields had been low and so the extra hay from Brook Meadow was useful. He said that the site yielded in 2011 13 large round bales of 600-700 kg/bale, suggesting that the site yielded between 4.5 t/ha – 5.2t/ha in that year. According to Gowing *et al* (2002b) this represents a mid-range yield for such a floodplain meadow site.

Farmer NMC3 who farms the northern end of North Meadow thought the meadow was a good source of hay and, although he said the quantity was not high, he accepted that:

> You don't get quality and quantity; there's a trade-off. If you take measures to increase yield you are bound to see a decline in quality. If you leave it too long you get heaps of grass but you don't get much goodness. That's the sort of thing I look at. If I make a really good bale of hay on North Meadow I can still smell it next winter in the barn with all the herbs you can smell it different from ordinary grass.

He sells some of his hay but keeps the rest. He considered the meadow hay to be very good quality and very good for feeding cattle. He professed to enjoy traditional hay-making as an activity and did not mind if it was for agriculture or for conservation purposes, as he does not rely on the money and so generating income is a bonus. He therefore saw agricultural value in the hay but also saw further merit in the meadows in terms of traditional practices. Like Farmer BM1 at Brook Meadow, Farmer NMC3 also seemed to draw a distinction between seeing merit in the value that broader society placed in the meadow, and his own more specific interest in agriculture for being involved in its management.

The North Meadow grazier was also broadly enthusiastic about the flora and fauna conservation aspects of the meadow. However, he again made a distinction between what he thought was the broader social value of the meadow, which he shared to some extent, and his own more specific interest in being involved in site management. He noted that

> The value of the meadow isn't in the agriculture, it's in the flowers and the insects and the birds.

He thought that the meadow was a well-known feature in the local area and should be kept for the wild flowers. He said he was interested in natural history himself, especially birds, and would go for a walk in the meadow in summer. He also thought that the meadow had value for recreation and was a feature of cultural history too, broadly in keeping with the values cited by the management plan and the site manager. In contrast however, he cited his own personal main motivations for being involved in the management of the meadow as including extra income and an extra grazing resource so that he could let his own land lie fallow for a period in autumn, with other interests being much less important to him. His primary interest was therefore economic and agricultural. As far as good condition was concerned, he said that Natural England wanted the sward grazed down so there was not a lot of rough grass over the winter, offering a definition of good condition that deferred to Natural England's wishes.

As noted earlier, the grazier of Long Mead meanwhile saw the meadow as essentially an economic resource and said that he was not personally interested in the flora and fauna, although again he thought there was some merit in preserving the conservation interest of the Mead. His own interest in the Mead is essentially as a grazing resource; a useful resource for the business. The graziers neither charge for grazing the site nor do they pay to graze it. It is essentially a mutually convenient agreement with the meadow owner, with no financial arrangement in place. Using the Mead is convenient because of where it is relation to the other fields they use, including the field across the road.

The Hayward who supervises the grazing at North Meadow for the Court Leet thought that the meadow was in good condition when there was "new fresh green grass coming up". He thought the meadow was worth keeping "for the area it was set in" but thought that "if it were not for the fritillaries there would be nothing here, only the grazing", suggesting that apart from the fritillaries the meadow's value was agricultural. (Hayward, Court Leet, pers. comm., Cricklade, 12/03/2011).

Finally, and in contrast the older farmer NMC1 said he had no strong opinions on the meadow being a nature reserve but said he had no interest in the site with regards to nature conservation and would not be concerned if it were converted to another use such as a wheat field. For him the main value of the meadow is as a source of hay and hence an agricultural product for animal feed. His criteria for assessing the meadow condition would therefore be the quantity and quality of the hay. He judges the latter in terms of its palatability to the animals and associated saleability.

In summary, any one farmer can express a mix of feelings and attitudes towards the meadows. Some appeared more able to relate to conservation farming as either a possible part of their identity as farmers such as the farmers at Mottey Meadows, or at least as an alternative 'product', such as the farmers of Sherbourne and Deans Green Meadows in Warwickshire, whereas Farmer NMC1 from North Meadow totally rejected any such view, being only interested in the

agricultural productivity of the meadow. Farmers with more diversified incomes such as Farmer MM2 at Mottey Meadow or hobby farmers such as Farmer NMC3 at North Meadow agreed that had they been more reliant on the income, they might have a less relaxed and positive view on the non-agricultural value of the meadows.

5.7 Conflict between farmers' and conservationists' views on meadow value

At North Meadow a significant difference between the farmers and Natural England emerged in their understandings of threats to the meadow. The management plan expressed grave concerns about contamination of the 'naturalness' of the meadow, and the agricultural value of the meadow was clearly stated to be strongly secondary. It is clear that the botanical value is dominant:

> Natural England takes the view that floristic diversity is more important than hay yields or profit (Natural England, 2008, p2.2/5).

According to the site manager (North Meadow site manager, Natural England, pers. comm., Ebsworth, 18/10/10), the priority is:

> not to get a fantastic hay crop, not to get 18 inch high fritillaries; [but to] keep that range of species that come in for us all to enjoy

In contrast the hay farmers expressed concern regarding changes in the meadow that included declining yields and changes in hay composition prejudicial to the hay quality. Farmer NMC2 felt that the southern end (much of which he manages) was now "very poor" with large patches of meadowsweet, which he said was spreading rapidly and taking over, and that he said his animals would not eat. He said the situation was getting worse and that nothing was being done about it. He said that moss was spreading and the meadow needed to be harrowed but Natural England would not allow it.

> This isn't good pasture (sic). It needs a good cover of grass

There were not enough grasses, but lots of rosette herbs, moss, and buttercups. In the past there was a greater variety of herbs and grasses and the hay was "nicer". Both Farmers NMC2 and NMC3 therefore were not optimistic about the meadow's future, Farmer NMC2 noting that:

> If the meadow management carries on like this then the future isn't too wonderful with more weeds and reeds[5].

He said he had no idea of Natural England's opinion of the meadow but thought that they were "just worried about money and flowers, nothing else" (Farmer NMC2, pers. comm., Cricklade, 08/03/2011). He felt that the two previous site managers had not listened to advice, indicating that he thought Natural England had a narrow perspective on the meadow's value and was not interested in the farmers' perspective. This would appear to relate to the view expressed in the management plan that agricultural value is secondary to botanical value. As seen, at Mottey Meadow, Farmer MM1 also expressed the view that the meadow's agricultural value was now minimal whilst praising its botanical merit.

In this regard, the Natural England HLS adviser for Long Mead also thought that most farmers were mainly interested in the economic situation and wanted to manage the meadows as economically efficiently as possible with the most modern equipment (HLS Advisor Long Mead, Natural England, pers. comm., Oxford, 27/03/2012)). However, as seen above, whether this is true or not does not mean that such farmer-managers do not share in the conservationists' alternative view of the meadow having other non-agricultural value at least to some degree.

Neither agricultural nor socio-economic value are included in the Ratcliffe criteria and receive much less attention in documentation than the botanical criteria above. Agricultural value does receive a very brief mention in the North Meadow management plan as a component of economic value, which is recognised as assisting the economics of meadow management. Economic value is ascribed to the meadow's and in particularly the fritillaries' draw in bringing visitors to Cricklade, as well as the economic value of hay for meadow seed production.

[5] sedges

Nevertheless such acknowledgement is cursory and as noted for North Meadow, is clearly in secondary place behind botanical value by the plan and by the site manager.

5.8 Role of the Ratcliffe Criteria

5.8.1 The significance of botanical composition

As regards the symbolism of certain species for stakeholders, some interesting points of view emerged in terms of what species were perceived to belong or not belong on the meadows. The value of component species appears to be interpreted according to a very particular value system that relates to a baseline that, as seen in these case studies, in reality might be very poorly defined both in terms of meadow botanical composition and traditional management practices.

For example, in the case of Brook Meadow on the basis of past evidence of the presence of meadow thistle, it is felt that this plant 'belongs' on the meadow. A desire has therefore been expressed to reintroduce the plant if it does not return unaided. In this case human intervention to facilitate the return of meadow thistle to Brook Meadow would not appear to be a troubling compromise to its 'naturalness'. The Natural England Conservation Officer for Warwickshire notes that meadow thistle had at the time not been noted in recent years and he stated that the site is "supposed to have meadow thistle" (Conservation Officer for Warwickshire, Natural England, pers. comm. Darley Green, 23/06/2011), suggesting that a narrative exists about what belongs (and perhaps does not belong) on the site, and that the presence of particular positive indicator species represent a permanent baseline against which the conservation of the site should be evaluated. Overall, and as discussed in Chapter 2, whilst the practical utility of negative indicators is as a warning sign of biophysical conditions that are leading or may lead to undesired change in a meadow, the choice of positive indicator plant species appears to be much more subjective.

Conservation stakeholders often described meadow plant species as 'notable', 'significant', 'important' or 'interesting'. What is meant by these terms was never articulated either in interviews or in documentation and they do not constitute formal definitions. When pressed to

define these terms, Surveyor LM1 for Long Mead agreed that such concepts are subjective and therefore constitute personal perspectives among nature conservation enthusiasts, rather than objective reality.

What constituted a notable species was left to her discretion during her survey. She acknowledged that what constitutes a good meadow is very subjective and she agreed that the drawing up of species lists for the county was intended more to make the process more explicit than as a definitive statement of value. She agreed that conservation value is often subjective and cultural and is not just objective and scientific, noting that:

> I am not particularly worried about the continued existence of the smallpox virus.

And:

> There is no obvious ecosystem service in creeping marshwort!

This accords with the view of the *'Guidelines for selection of biological SSSIs'* (NCC, 1989) and Ratcliffe (1977), that present such interest as essentially anthropocentric in origin, prone therefore to change and therefore a matter of subjective opinion. Whilst there may be a great desire amongst scientifically-educated conservation practitioners to objectivise such matters as much as possible, even the guidelines acknowledge that such objectivisation has its limitations and that as regards site survey and assessment this often only really amounts to standardisation of methodology.

Most farmers expressed an appreciation of the aesthetic appeal of the characteristic meadow species that conservation stakeholders would identify as positive indicator species. Indeed in an interview at Seaton Meadows in Rutland (Conservation Officer, Natural England, pers. comm. Harringworth, 14/6/2010), the Natural England conservation officer expressed the opinion that for the general public she thought the appeal of meadows was essentially aesthetic. To the farmers too positive indicator species represented a good meadow and were seen positively. This said, with the exception of the farmers at Birches Barn SSSI and Long Mead, who were very

enthusiastic about conservation, the others claimed that they could not actually name many or most of the species, as noted below in Chapter 6. The farmers were more focussed on the so-called negative indicators as practical indicators of undesirable biophysical conditions that might threaten agricultural meadow value, such as *Juncus* rushes as indicators of excessively wet ground conditions.

Interviews conducted with elderly residents of Cricklade (Snakeshead Revisited Project, 2010) indicate that some local residents agreed with the North Meadow Hayward that conserving the snake's head fritillaries is the most important aspect of preserving the meadow and indeed the site manager indicated that the fritillaries are "the show-piece that the tourists come to see". Positive indicator species then do appear to be aesthetically pleasing, characteristic, charismatic or typical plant species that serve as a symbol of a good meadow for stakeholders.

5.8.2 Naturalness and cultural value

A historic landscape specialist at Natural England noted that for many conservation specialists, animate and inanimate objects are seen as fundamentally different in kind and so their conservation is governed by different conceptual worlds, although she also thought that this world view is increasing being seen as "old-fashioned" among cultural heritage specialists (Head of Historic Landscape (West Midlands Region), Natural England, pers. comm., Oxford, 13/02/2012). Increasingly it is being appreciated that the 'natural' can be part of our cultural heritage and the cultural is implicated in our 'natural' heritage. She thought that the culture/nature divide had been breaking down in the conservation profession for about the last 5-10 years, but was of the opinion that the cultural heritage specialists were more aware of this than the nature conservationists.

As already seen, the management plan for North Meadow frames the meadow strongly as natural as opposed to social, with the plan at times expressing ambivalence regarding the role of people in the landscape. A similar narrative was also seen in documentation for Brook Meadow and Long Mead but to a less extreme extent. Despite some acknowledgement that meadows are produced

by agricultural and therefore human/social processes, considerable emphasis was put on the 'naturalness' of the species and their genetic variety, as well as assemblages composed of indigenous species that had established themselves on the meadow unassisted by people, which may or may not be true. The management plan for North Meadow notes that the meadow grassland communities are "semi-natural created by a very long established regime of hay making followed by late summer and winter grazing" (p2.1/3). The management plan makes the very strong assertion of naturalness under threat from contamination:

> the ancient and natural strains and grasses and clovers within the meadow are gradually being polluted. Alien genes are entering the genetic pool of the meadow population through incoming seeds and pollen from neighbouring leys sown with modern strains of species. New genes have also been introduced to the meadow in seed sown on dredgings by the Water Authority (p2.2/2)

and:

> The meadow communities are likely to be very ancient in origin and contain distinctly 'unimproved' strains of species like *Lolium perenne*, as well as an unusual strain of *Agrostis stolonifera* with fully awned lemmas. (p1.5/6)

and again, under the heading 'Rarity':

> Ancient neutral grasslands..... were previously found throughout the Thames Valley.....they have greatly decreased in extent in southern and eastern England as a result of man's activities (p2.1/2)

All these statements make a very strong claim to the 'naturalness' of the meadow and its otherness to 'man' (i.e. human society) and takes the rarity narrative down to the level of the sub-species, species variety or even gene in raising concerns about the contamination of that which is ancient, pure and original versus that which is "polluted" or contaminated by human activity or perhaps modernity (as opposed to tradition). As regards the last quote, no acknowledgement is

made that the meadows would not have existed before human agriculture and are co-produced by human activity as well as the agency of non-human life (Castree, 2005).

Farmers also often share the narrative about the 'naturalness' of the meadows to some degree. Farmer NMC3 was the most positive about meadow conservation at North Meadow. He said:

> It's natural as it is. If you plough it up you've lost all the variety of things that are out there. If you planted corn you'd kill all the wildlife, all the natural insects. It's bound to matter to somewhere along the line but not to me particularly. Oh, yeah, got to keep it. Once it's gone it's gone forever. It does make good hay. Where would you get seeds to recreate [meadows]? It's worth keeping for that.

As seen at Brook Meadow too, despite the acknowledgement of the meadow as produced by agriculture, there still appears to be a strong desire to frame the meadow as 'natural' asserting that the meadow has arisen 'naturally', which appears to contradict the assertion that it is 'artificial'. Also, this contradicts the assertion elsewhere that wood anenomes in the meadow at the drier southern end may have been introduced. In contrast, narratives about what belongs or does not belong in the meadow appear to also allow humans to reintroduce meadow thistle where this has disappeared. Human agency then appears to be permissible to return the meadow to how it 'should be'.

The desire to set up the 'natural' meadow in opposition to the human 'other' can lead to confused narratives when the historical and cultural value of meadows is considered. Under the heading 'intrinsic' appeal, the North Meadow plan notes:

> Perhaps of all the habitats associated with the English countryside, the hay meadow has the greatest intrinsic appeal. It has had a very long association with the English artistic and cultural scene. Even today, when it is rarely seen in the countryside, it is widely used in advertising to conjure up a feeling of 'naturalness' and pastoral tranquility. (2.1/6)

Therefore despite the rarity of such meadows nowadays, the plan points to the strong role that they play in rural imaginings and nostalgia for past landscapes (Woods, 2010), and despite the claims for naturalness noted above and threats from humans, the meadow is described as:

> ....a living monument reflecting hundreds of years of continuous management by the people of Cricklade (p1.6/4),

now acknowledging the role of local people in producing and maintaining the meadows and their valued characteristics as well as its role as a 'monument' or artefact of cultural heritage.

Yet when explicitly addressing historical artifacts and cultural heritage it notes:

> The historical artefacts around the reserve should be maintained. The boundary stones are now a 'listed building' and so have statutory protection. However, the field bridges are of historical interest and should be maintained where possible. The concrete blocks put across the meadow during the 1939-45 war are also part of its history and the remaining few, now in cpt. 1, should be left intact. (2.2/7)

Again an attempt is made to define a clear distinction between 'natural' artifacts and 'cultural' artifacts, despite a number of contradictions. The meadow is a 'monument', yet on discussing cultural heritage features, only the boundary features and dole stones are identified as such. Discussion of archaeological and historical features only mentions the allotment boundary stones, which are scheduled monuments under separate cultural heritage legislation, and does not appear to consider the meadow as a whole or the grassland sward as a landscape or cultural heritage feature. Paradoxically, the plan also acknowledges specifically elsewhere the landscape value of the meadow but discusses the Landscape Character again in terms of habitat, the MG4 grassland community and snake's head fritillaries. This does not appear to be different from the consideration of the biological interest.

In the North Meadow management plan, extensive discussion of meadow historic value in fact is a relation of site history of which the meadow could presumably be seen as a material artefact.

Furthermore, during an open day for the public at North Meadow the site manager did talk about the history of the meadow and its past management as part of a guided tour. Stakeholders at various meadows (both conservation and farmer-managers) did sometimes mention the historical importance of a site as a result of its traditional management and long-standing presence in the landscape. However they seem unclear as to how to articulate what exactly constitutes cultural heritage and landscape value and as noted, narratives about these aspects of value can be somewhat unclear, confused or contradictory.

Again the Regional Head of Historic Landscape at Natural England noted that in the past, interest in historic land uses and landscapes such as meadows did exist amongst cultural heritage experts, but was fragmented between different interest groups who did not interact and were not interested in each other's fields. There would have been cultural heritage actors interested in meadows in the past but the focus was more on scheduled monuments and historic buildings. The current compartmentalised nature of the natural and cultural heritage conservation legislation therefore reflects this specialised view of conservation as has been seen above in the way in which the North Meadow management plan segregates natural and cultural heritage interest between the meadow grassland on one hand, and boundary features and scheduled monuments on the other. Conceptualisation of the meadow itself as a valuable landscape or an artefact of cultural heritage, whilst vaguely acknowledged, remains ill-defined.

In the case of meadows, the only opportunity to assess the cultural heritage or (historic) landscape value of a site would be when it enters HLS and an HER is prepared (Historic Environment Report). This would be a desk study by the local county archaeologist prepared by looking at aerial photographs and historic maps, and who probably would not visit the site. Consultation with a cultural heritage body such as English Heritage or the National Trust would only take place if a possible scheduled monument that fell clearly within the guidelines was identified. A meadow alone would not be sufficient and falls clearly outside the cultural heritage guidelines. The compartmentalised view of conservationists and of the legislation would have

meant the meadows had to fall in someone's remit and therefore be subject to their conservation philosophy and world view.

Interestingly however, the farmer of Sherbourne Meadows, Warwickshire described such meadows as "the land equivalent of listed buildings" (Farmer SH, pers. comm., Oxford, 29/03/2011). Meanwhile, in documentation on Brook Meadow and Long Mead, no clear narrative of cultural or landscape value is developed, and such value, such as it is acknowledged, appears to be contingent on and emergent from the ultimate material botanical composition of the meadow. The Natural England Conservation Officer for Warwickshire noted that he felt that such meadows were generally too small for landscape value to be of relevance.

5.8.3 Typicalness and Rarity

The Ratcliffe Criteria of typicalness and rarity seem to form a couplet, with meadows described as of value for being examples of landscapes, once common (or typical) and now rare. The North Meadow Management Plan notes that:

> North Meadow is typical of the type of neutral hay meadow community once common in the floodplain of the Thames Valley. (p2.1/3).

Further to this, English Nature's Nature Area Profile for the Thames and Avon Vales (English Nature, 1997) notes that North Wiltshire is a stronghold of semi-natural grasslands. The Brook Meadow site is indicated to be "very typical of MG4 grassland with many characteristic species of flowering plant" (Segawa and Wright, 2011, n/p). That the site may be described as very typical of MG4 grassland with characteristic species of MG4 suggests a circularity of argument, as the MG4 definition in Rodwell (1992) was itself intended as a description of a typical floodplain meadow.

Meanwhile, rarity is one of the Ratcliffe criteria, the precise significance of which is not necessarily explicit. Whether rarity of a species or habitat in itself concedes intrinsic value is not an issue addressed clearly in the conservation literature. Nevertheless it is certainly a criterion that may be used to identify sites as priorities for conservation as it may indicate a possible threat and therefore the potential for loss of value.

For Brook Meadow the rarity of the MG4 plant assemblage and the rarity of meadow thistle at county scale are highlighted as key in the management plan. Again for North Meadow, an essential part of the meadow's perceived value is located in the rarity of the grassland sward plant species assemblage, which has been closely associated with the MG4 NVC definition. Also, as regards snake's head fritillaries, the site is noted to harbour an estimated 80% of the British population and therefore is important for conserving a national rarity. The plan also notes that between 1987 and 1994 two projects were undertaken to transplant fritillaries from one area of the site to another in order to encourage their spread. This again suggests that conservation strategy does allow for change to the meadow, though this may be motivated by evidence that the fritillaries were more abundant in the past as claimed by farmer NMC1, and by elderly local residents of Cricklade interviewed by the Court Leet (Snakeshead Revisited Project, 2010). Change in the meadow therefore appears to be acceptable in order to move the meadow characteristics and composition towards a baseline, perceived or imagined, of how it was believed to be in the past.

5.8.4 Fragility

Fragility is also one of the Ratcliffe criteria used to identify sites as priorities for conservation that, rather than denoting value, is intended to indicate threats to a site and therefore the potential for loss of value. It may be considered the opposite of resilience or robustness.

As noted already, the management plan for North Meadow frames the site as "extremely fragile" (Natural England, 2008, p2.2/1), in a finely balanced state of equilibrium, and again forms a strong narrative regarding the various threats to the meadow.

> This site criterion [fragility] reflects the degree of sensitivity of the habitats, communities and species to environmental change, and is closely linked with diversity and rarity. The nationally rare ancient meadow habitat of the reserve has resulted from the very long history of very similar management, and has developed a fine degree of balance with the environment..... [a range of changes] such as a change in the hydrological balance, would

> be likely to result eventually in an irrevocable loss of value, and thus North Meadow is an extremely fragile reserve which needs careful safeguarding if its conservation interest is to be maintained. (p2.2/1)

In contrast to this framing of the reserve as extremely fragile, the site manager felt that the site was "robust and dynamic" (North Meadow site manager, Natural England, pers. comm., Ebsworth, 18/10/2010). In building this narrative of extreme fragility, the management plan dedicates significant space to a range of threats to the meadow. In keeping with the desire to frame the meadow as 'natural', this plan deals separately with threats deemed to be 'natural' and those considered to be 'social'. Again, a distinction is made between "Natural Trends" and "Man-induced Trends" to which two separate sections of the management plan are dedicated. The section on natural trends notes weed infestation as a problem in parts of the meadow and focuses on problems with species whose presence on the meadow is deemed to be negative, but does not appear to focus on change or indeed trends. The much longer section on "Man induced trends" talks at length about various threats to the meadow's perceived value:

> .....The meadow has in the past been degraded as a result of changes to the hydrological, hydrochemical and management regimes, by the application of farmyard manure and inappropriate grazing. (p2.4/2)

These threats therefore fall in to two broad categories, threats related to the hydrology of the meadow sites, and other threats essentially related to the agricultural management of the site.

5.9 Summary

In conclusion conservationists' views on meadow value appear to be strongly dominated by a narrative on the botanical value of the grassland sward, which highlights the species richness, botanical diversity of the sward, as well the presence of positive indicator species, noted either for their rarity, or their typicalness as species emblematic of a good meadow. The choice of such positive indicators appears to be at least in part subjective and based on their aesthetic appeal.

In particular the documentation produced by conservationists often presents a formal and structured breakdown of meadow value based around the Ratcliffe Criteria. These criteria note characteristics of the meadow that are deemed themselves to be of value such as species richness, as well as others that appear to focus more on the risk of loss of value such as rarity or fragility. Again, in such analyses botanical value dominates. Cultural heritage and landscape value are also noted as of value, although the narratives around these aspects of meadow value are not well developed and can be confused or contradictory. Ultimately botanical, faunal and cultural heritage value of the meadows appear often to be spatial segregated into separate areas of the meadows and not to overlap perhaps where there is potential for conflict. Finally conservationists make little or no mention of the agricultural value of the meadows. Any such mention invariably describes such value as at best secondary to botanical value.

Although they all note their interest in meadows as being primarily as an agricultural resource, farmers' views of meadow value are diverse and follow a spectrum from being very interested in non-agricultural conservation value to total disinterest in the latter. This said total disinterest in conservation value was rare and most at least acknowledged that the traditional floodplain meadows should be conserved if other groups in society desired it, with many farmers actively enthusiastic about the non-agricultural value of meadows.

Chapter 6 – Stakeholder Meadow Assessment

6.1 Introduction and overview

This chapter considers whether and how stakeholders involved in managing meadows go about generating knowledge and understanding about the meadows' condition, status and management through assessment activity, formally or informally. The chapter begins by considering the motivations cited by stakeholders for undertaking meadow assessment activity. It goes on to consider how different stakeholder groups' broad methodologies have evolved over time, and the similarities and differences between their approaches. It then goes onto discuss in more detail stakeholders' assessment activity, how assessment work is undertaken and conclusions drawn from assessment activity, as well as how these vary from site to site and between stakeholder groups before considering the tensions between the stakeholders' priorities and perspectives.

Links with the value attributed to the meadows by stakeholders as discussed in Chapter 5 are investigated. In addition, consideration is given to the utility and efficacy of the assessment criteria used and their usefulness in capturing concepts of meadow value, as well as evidence that the case-study meadows are changing over time. Quantitative survey data from botanical surveys undertaken by the Floodplain Meadow Partnership, as well as any numerical data collected by stakeholders are interrogated in order to consider the utility and efficacy of the assessment criteria and methods employed in linking meadow value to assessment conclusions. Evidence is also presented from the interviews conducted with stakeholders, from participatory and non-participatory observation of stakeholder assessments on site, and from documentation held by stakeholders, where available. Again, the presentation of evidence is based primarily on the three main case studies, with additional evidence, where relevant, from the other minor case-study meadows.

6.2 Motivations for Stakeholder Assessment Activity

As noted already in academic and grey literature, assessment activity is motivated at least in part by a model of responsive management (Robertson and Jefferson, 2000). Assessment activity is intended to follow indicators of value to ensure that meadow value is being maintained and not lost, or where it appears to be being lost, to provide a warning that intervention may be required. The management plan for North Meadow (Natural England, 2008) does not mention explicitly responsive management as a motivation for assessment activity, but does cite its motivations as being to assess change and natural variation (cyclical dynamism), whilst Objective 1 in the plan is to maintain the grassland sward and fritillary population in favourable condition (p2.4/2).

Particular insight into conservation-oriented stakeholders' motivations for undertaking assessment activity on floodplain meadows, beyond the standard justifications given in the literature, were provided by the Trust officers at Warwickshire Wildlife Trust responsible for Brook Meadow and Deans Green. Brook Meadow was assessed in 2009 by the Trust and in 2010 by Natural England and by both in 2011. In terms of the Trust's motivations for undertaking the botanical assessment, the stated reason is in order to build a body of data that may be interrogated and used to inform management and research. Comments made by the Reserves Biodiversity Officer however suggest that such surveys, when undertaken by volunteers, may perform a different role at least in part. This may be that the surveying is seen as a form of outreach work, or as an activity that allows Trust staff and volunteers to interact in a practice that is also presented as a purposeful activity generating useful data. Given that in 2011 this work duplicated that of Natural England, the data collection activity may therefore have been secondary to that of allowing the volunteers to participate in an activity they enjoy and in effect interact with the meadow.

At another local Trust-owned meadow site, Deans Green, there are two volunteer wardens who live locally, are very keen botanists and who do simple walk-over assessments of the meadow every month throughout the year. The Trust also assesses it once a year and the Reserves Biodiversity Officer noted:

> We go out because the warden is there and it's something that they enjoy and we go out as much for their benefit really.

This again suggests that the volunteer surveys have a primarily social role as outreach work, rather than as key monitoring activity to generate useful research data.

For the purposes of this research I participated in a survey of Deans Green meadow, with the Trust volunteers and the site volunteer warden in June 2011. During this survey it was indeed noted that volunteers openly admitted that they surveyed "the nice bits" (Volunteer A, Warwickshire Wildlife Trust, pers. comm., Ullenhall, 23/06/2011) and that they did the surveys for enjoyment. This again appears to confirm that the volunteer surveys are as much if not more about outreach work and public engagement than the generation of research data. The Reserves Biodiversity Officer in charge of monitoring programmes also noted:

> ..... we have the warden saying about [the meadow] getting better but I'm sure they're surveying the best parts and even when we go out without volunteers it's meant to be random sampling but I have seen them throw the stick over there which reduces the randomness of it.

This suggests a subjective approach to sampling the meadow.

According to the Trust's Reserves Biodiversity Officer, up until 2005 the Trust did not do any monitoring of sites and they have greatly increased the amount of monitoring activity on their nature reserves in recent years. In the past Natural England would assess Brook Meadow and give feedback, but the Trust would confine itself to management activities as it had no resources for monitoring. Again, any assessment was highly subjective and visual, based for example on whether or not the meadow appeared to look the same as the previous year or years. The Trust had only one member of staff for the monitoring of 65 sites before then and there was no co-ordinated approach. The Reserves Manager also noted that the Trust had originated through volunteer work. When the volunteers were leading, any kind of survey work was very much *ad hoc* without a coordinated approach.

By 2010 the Trust had a team of six people dedicated to monitoring and to co-ordinating monitoring activities though volunteers. Before this the Reserves Biodiversity Officer said that monitoring had been "informal, anecdotal and patchy". Owing to resource limitations the Trust does not necessarily plan to assess Brook Meadow every year as they do not consider that it changes much from year to year. In fact, inspection of the Trust's archives in Coventry showed that the site has been assessed by them every year since 2006 except in 2010.

The Reserves Manager also noted that there was a "hidden community" of ecologists, botanists, both amateur and professional, who were undertaking surveys on the site but not communicating with the Trust. He said that the Trust had become much better at communicating with other experts, but there was still a lot of work going on at Brook Meadow that they did not know about. Such people may have very good historical records for the meadow but do not provide them to the Trust, based perhaps on the assumption that the Trust already knows everything about the site and does not need the records. In reality the Trust Officers said that Trust resources are too limited for them to "be everywhere and know everything".

The Reserves Biodiversity Officer said that the Trust wanted to gather data it could use, although at the time of interview (30th March 2011) they said that they did not yet have a long term dataset and that currently data analysis is deciding on condition but is not yet influencing management, suggesting perhaps a lack of clarity on how decisions about meadow condition could potentially influence management. They felt that recording currently was still determining the baselines for their sites against which future conservation decisions could be judged. The plan was to use the monitoring data more in the future and that they thought that it could have some utility as an early warning of changes in management, that is to say to inform responsive management.

In contrast, at Long Mead no formal assessment activity was identified and the concept of responsive management was not mentioned or hinted at in any guise. Unlike at the two SSSI meadows, the involvement of Natural England is more distant in terms of involvement. For this

site Natural England have a stake in the meadow as funder and administrator of the HLS scheme that supports the management, but has no statutory responsibility for the site under conservation legislation.

6.3 Evolution of the monitoring methodologies

Following on from the findings of Chapter 5 that different stakeholders hold differing views on meadow value, the two main stakeholder groups actively involved in management of the case study meadows (conservation-orientated stakeholders and farmer/managers) are perhaps inevitably interested in different aspects of the meadows and so focus on different characteristics to a greater or a lesser extent when assessing them.

This said, a common theme emerging from examination of stakeholders' assessment of meadows has been the evolution of their approach to assessment in recent years, influenced by their respective motivations for undertaking meadow assessment and their role and status in the stakeholder networks. On the one hand conservation-oriented stakeholders have moved consciously away from a more experiential approach to meadow assessment that acknowledges subjective aspects of assessment and is not unlike the way in which farmers form a view of meadow condition. This appears to be motivated by a desire to objectivise assessment, to make it more 'scientific' and 'evidence-based', but also to assist with the assessors' lack of the type of personal knowledge of meadows that is often required to make such experiential assessments.

On the other hand, farmers appear to increasingly no longer make routine or regular assessments of the meadows motivated by the need to inform management, though they invariably do have opinions on the condition and management of the meadows informed by more a general assessment of them.

The Conservation Officer for Warwickshire, Brook Meadow and Deans Green noted that previously (until around 2000) English Nature/Natural England meadow condition assessments were still very much based on the subjective and qualitative judgement of the assessor, walking across the site and evaluating what it looked like compared with a 'good' site that the assessor

was familiar with as a baseline. This assessment was therefore still very qualitative, visual and experiential, and similar to the way in which farmers still assess sites (by the 'look': visual). Earlier assessments therefore had been more based on expert judgement and experience and were more subjective. The assessor would walk across the site looking for things they liked or did not like and so the baseline for a good meadow was experiential:

> If it was in reasonable nick we'd say it was favourable. Obviously the population of MG4 [grassland] was rather restricted, but we knew a good one when we saw one based on how herb-rich it was. We were looking for the same indicator species but not in a formal way.

This also appears to be the approach in the newly proposed Natural England Integrated Site assessment (ISA) rapid assessment (Conservation officer for Warwickshire, Natural England, personal communication, Dorridge, 13/06/2011).

As discussed in Chapter 2, since 2001/2002, most sites have been assessed and monitored using the English Nature/Natural England Common Standards Monitoring (CSM) protocol, also known as the 'condition assessment', which appears to have spawned a range of very similar frameworks used independently by Wildlife Trusts such as BBOWT and WKWT condition assessments, and another similar assessment used until recently by Natural England agri-environment HLS scheme advisory teams. These assessments again essentially select a range of positive and negative indicator species that may indicate the 'right' botanical composition (positive indicators) or 'wrong' botanical composition, sward structure or biophysical conditions (negative indicators of 'wrong' conditions). Use of the condition assessment and its combination with earlier more subjective approaches to assessment varies from site to site but the Natural England condition assessment has clearly provided a framework that conservation stakeholders use to a greater of lesser extent, in part because it codifies what was previously done informally. Stakeholder opinion on the condition assessment varies, with the manager of North Meadow noting that she thought it "quite good at picking up problems", whereas the Natural England staff involved in

managing Mottey Meadow, Staffordshire felt that the standard condition assessment was too insensitive and not very useful.

The condition assessment therefore constitutes a structure, a framework, devised to formalise assessment for a number of reasons articulated by one Natural England HLS advisor (Natural England HLS Adviser, personal communication, Stratford upon Avon, 07/06/2011):

> ....because Natural England aspire to be an evidence-based organisation and therefore wish to collect data on meadow condition in an objective and scientific manner.

Another reason cited by the above HLS advisor for structuring assessments was to make results more comparable between operators, standardise and routinise procedures and remove the need for expert judgement or specialist botanical skills. In part this is a result of increasing staff turnover at Natural England meaning that the assessment might never be repeated by the same person twice. This would appear to be particularly significant for criteria with a strong subjective or experiential/expert-eye element such as selection of sampling locations or estimating the herb:grass ratio, for which the assessment protocol does not give very specific instructions.

The desire to make the assessments more objective and scientific on one level may represent a claim that data derived in such a way about meadow condition will be epistemologically superior to that derived from previous more informal approaches, but if nothing else, its supposed objectivity is clearly intended to address more practical problems too. As already noted this includes lack of continuity of assessor staff and lack of experienced staff with strong botanical skills. It therefore allows data to be collected in a standardised and repeatable way that will also improve inter-site and inter-year comparability, to yield data results that could be stored and used in the future for scientific research purposes. Thus far evidence suggests that in reality most assessments are used to give a one-off indication that the meadow is in good condition at that moment in time, is therefore by implication being managed appropriately and that no action is needed, to then be filed and forgotten.

This said, conservation-oriented stakeholders were aware that such an approach may not be ideal. At Brook Meadow the Reserves Biodiversity Manager's opinion of the Trust's meadow condition assessment was that:

> I think it's a good starting point but we can't just use that blindly. You have to use your own common sense and interpretation of that and that's something that I want to look at in the future especially for Deans Green because we have several years of data from the wardens as well to look at and the warden's data to analyse and perhaps use it to make an assessment based on that data rather than the Natural England guidance.

This suggests that the Reserves Biodiversity Officer thought it necessary to think more broadly beyond the highly structured form of the condition assessment and to consider the potential role of more experiential knowledge. Coupled with their statement that monitoring is still not informing management, this suggests that the Trust officers did not necessarily find the results of the current assessment very useful or informative, and are looking for other sources of knowledge and information to help them form understandings of the meadow.

At the moment they do not adapt the assessment or make their own interpretations of it or adapt the conclusions:

> .....not at the moment but that's something I need to look into, that again goes back to the management plan because we were assessing things against what it says the ideal targets are for the management plan.

The Reserves Biodiversity Manager said that another Trust meadow (Deans Green) is considered to be in unfavourable condition at every assessment:

> According to the assessments we make it comes out as unfavourable because of the amount of rushes, but that might be a fault of the assessment method rather than the actual site because of the nature of the site it's always going to be like that and therefore we may have to change the assessment to acknowledge the character of sites. That's

how it is so we might have to change the way that we assess it. The Deans Green assessment has been negative every single year however the warden insists from her own surveys that it has been getting better.

This again acknowledges the circular relationship between the baseline description of a meadow against which it is to be judged, and the criteria of the assessment intended to monitor changes in that baseline. At North Meadow the site manager also supplements the condition assessment with her own criteria, also noting the coarse grass *Arrhenatherum elatius* false oat grass during her surveys as a negative indicator. Meanwhile at Long Mead, the condition assessment is not relevant as no party undertakes this at this meadow and the owner merely notes whatever she finds interesting on the meadow, as discussed below.

6.4 Similarities and Differences between stakeholders' assessments

Overall, assessment activity identified at the case-study meadows was dominated by conservation-oriented stakeholders, with farmer-managers rarely carrying out assessment activity. As found in Chapter 5 for conservation-oriented stakeholders' views on meadow management, assessments clearly prioritise the botanical composition of the meadows above any agricultural value, and assessment of any other aspect of meadow value such as landscape or cultural heritage value was not observed at any meadow. Again therefore, assessment activity is heavily influenced by the conservationists' dominant narratives about meadow value.

Botanical composition and species and herb richness of the grassland sward is the dominant interest of the conservation-oriented stakeholders and they were then seen to deploy highly structured assessments, all based on the same underlying philosophy and general structure that looked very specifically at certain aspects of botanical value, namely, the presence/absence of a closed list of key meadow herb species as symbols of a good meadow and the species richness and evenness thereof. As noted in Chapter 5 the MG4 description features as an important baseline description for floodplain meadows. As seen, the manager of North Meadow did express interest in agricultural value whilst making clear that such value was secondary to botanical

composition. Despite being clearly stated as desirable, monitoring of management on all case-study meadows was at most patchy and inconsistent or did not take place at all. Potential indicators of the farmers' key concern of agricultural value were therefore rarely recorded in a consistent way. Farmers themselves did sometimes make notes of management activities or hay yields for their own interest, but except at North Meadow, rarely shared these data with the conservationists.

The greatest correspondence between the assessment criteria of farmers and conservationists is the use of negative indicators as a sign of either undesirable sward composition or poor performance, and of biophysical conditions that may lead to poor condition. Negative indicators of sward performance and biophysical conditions are similar between farmers and conservationists, though they may signify different issues to the two stakeholder groups:

- Competitive plants as indicative of nutrient enrichment (e.g. nettles), which indicate the possibility of sward becoming dominated with aggressive or invasive plants. This concerns conservationists as they may reduce plant diversity and farmers as they may contaminate the sward with unpalatable or toxic species.
- Reeds, sedges and rushes as indicators of excessively wet ground conditions or standing water that concern both conservationists, due to their exclusion of more diminutive species, and farmers due to their low feed value.
- Sward structure and ground conditions relating to inappropriate management (over/under-grazed, not cut)

Natural England Conservation Officers and other conservation-orientated stakeholders who undertake regular assessments on the meadows only focus therefore on the botanical interest of the meadows using their protocols. Natural England advisors for agri-environment schemes are also potentially interested in landscape value, cultural heritage and good environmental quality (e.g. river water quality etc.). However, no evidence has been found that these characteristics are commonly associated with floodplain meadow sites, where biological value seems to dominate,

nor that they are assessed, other than possibly being tacitly acknowledged at the initial identification of a site and/or enrolment into HLS, for example by means of the general statements in HLS documentation. This acknowledgement might take the form of general statements in prescriptions on how the site management can also contribute to conservation of landscapes, cultural heritage and environmental quality. The recent integration of the HLS assessment with the SSSI condition assessment into the ISA (Integrated Site Assessment), which very much resembles the SSSI condition assessment protocol, may well accentuate further this emphasis on the biological 'scientific' interest. As a result, at the two SSSI meadows Brook Meadow and North Meadow the great majority of data seen to be generated about the meadows focused on the botanical composition. Meanwhile at Long Mead, assessment data were not generated on a regular basis.

Such dominance of the mobilisation of the botanical value in assessment links clearly to the hegemonic nature of the conservation stakeholders' narratives on meadow value, placing other considerations firmly in second place. This narrative on value appeared to drive the assessment activity at the two SSSI meadows though not at Long Mead where formal conservation organisations are more distantly involved.

The Reserves Manager for Brook Meadow thought that, following the hay cut after the 15 July, grazing should be as soon as there is enough grass to eat until the end of the growing season or until the ground becomes too poached by animals' hooves. The start date was determined by when the sward was sufficient to support the animals after the hay cut, but they considered it to be in the farmer's interest to leave it until that time. The Trust did not therefore feel any need to make an assessment of the sward as there was a default management protocol and the Trust left it up to the farmer to make the right decision. They felt that they could trust them to do that because they considered that it was not in the farmer's interest to do otherwise. In fact the Trust might well have no communication with the farmer all year once the management contract had been put in place, suggesting that the stakeholder network is very 'loose'.

6.5 Methodologies: Conservation-oriented stakeholders

As significant differences were identified between the assessment practices of conservation-oriented stakeholders and farmer-managers, the approaches of the two groups are described below separately.

6.5.1 North Meadow

Two conservation-oriented stakeholder organisations were observed to undertake assessments of the meadows during the grass-growing season in 2011. Natural England, owner of most of the site was observed to undertake a census of the snake's head fritillary *Fritillaria meleagris* population on the meadow in April, and to undertake in June the Natural England Common Standards Monitoring (CSM) rapid condition assessment, which provides an assessment of the grassland sward's condition (composition and structure) using a range of positive and negative indicator species and a few key sward structural indicators, as discussed in Chapter 2. The Floodplain Meadow Partnership, hosted by the Open University, also undertook a census of the snakehead fritillary population entailing a different methodology, again in April, and in June undertook a survey of all vascular plants in selected areas of the meadow, both surveys being based on permanent quadrat sample locations.

6.5.1.1 Natural England grassland assessment

The site manager for North Meadow was seen to undertake regular yearly assessments of the meadow condition using the standard Natural England rapid condition assessment method based on criteria relating to the botanical composition and vegetation structure of the meadow grassland sward. However, she also noted that she did combine this standardised assessment approach with other more experiential visual assessment to build her own impression of the meadow's condition.

Regarding assessment of the agricultural value of the meadow, although she did not mention this in connection with assessments and said that it was secondary to botanical value, the fact that she had recommenced recording of hay yields and grazing records after a break of several years

indicates that either she did not think this aspect of meadow value to be totally irrelevant, or thought that recording management data would help to assess the management activities' impact on meadow condition, although evidence that this information is currently processed or used in some way was not identified.

Natural England's periodic standard rapid condition assessment of the meadow is intended to be undertaken on a cycle of 3-6 years. However, the site manager herself also undertakes the same assessment informally on a yearly basis for her own information. This is because, as already noted, she considers the Natural England rapid condition assessment to be good for identifying problems, though she also said she had her "own feel for it", again demonstrating that she supplements the results with experiential knowledge and interprets the results through the filter of her own experience.

The criteria used for this assessment were the standard criteria for a rapid condition assessment of MG4 grassland as laid out in Robertson and Jefferson (2000) and as discussed in Chapter 2 (see Appendix 1), with no additional tailoring to local circumstances or to take into account any peculiarities of North Meadow. Each year the assessment is undertaken by walking two zig-zag walks, one along the north-eastern side of the site, the other on the south-western side of the site, each with 20 stops to undertake the sampling as per the standard rapid condition assessment for MG4 grassland. The exact locations of the sampling points are not surveyed accurately, will be different each year and so the survey could not be repeated exactly.

The 2011 informal condition assessment survey of the 9th June 2011 was observed and participated in as an exercise in participatory observation for the purposes of this research. The site manager marked out on a map of the site two zig-zag paths each of twenty sampling points that covered most of the meadow compartments (Figure 3.8 Chapter 3), although neither transect reached the south-eastern-most compartments 12-15, cut by farmer NMC2. The site manager said that this was because the designated site interest is the MG4 grassland and so she did not assess areas that were not classified as MG4 in the original baseline NVC survey (see

Figure 3.9, Chapter 3). She therefore did not locate any sample points in the southern margin that had been deemed to be MG5 or the south-eastern extreme. In fact the NVC map provided only shows a very small area here as MG5 and the south-east corner is noted by the farmer as being dominated by meadowsweet *Filipendula ulmaria* and in poor condition in his opinion.

The site manager provided copies of the survey form with the indicator species list pre-populated with the names of the positive indicators found on site from 2009. In fact more indicators both positive and negative were found during this assessment and needed to be added to the list, including small amounts at a few sample points of *Arrhenatherum elatius* (false oat grass), a coarse grass that is not a CSM assessment negative indicator, suggesting some adaption of the standard protocol to the site manager's own knowledge.

The site manager surveyed along the southern transect whilst I surveyed the northern transect. We surveyed the first and last two sample points together in order to ensure consistency of methodology. No specified search time was employed at each sample point, at which the presence or absence of the specified positive and negative indicators was noted along with details of the sward structure in accordance with the standard methodology.

The results will be held on a computer at the local office but not on Natural England's central ENSIS system as this was not a formal assessment (CSM) required by Natural England's corporate Common Standards Monitoring programme. The current site manager stated that no separate assessments of the meadow were undertaken for the purposes of HLS, other than the condition assessments undertaken of the SSSI interest.

6.5.1.2 Results – the process of translation

On the basis of the assessment, the meadow was deemed by the site manager to have been maintained in favourable condition and indeed that meadow condition had improved over the previous two years. The reasons for this were, firstly that no negative indicators were noted and therefore no indications either of invasive or problematic species of concern were noted, or of problematic biophysical condition. In addition the sward height, litter content and extent of bare

ground were deemed acceptable as structural indicators of a good meadow and of appropriate management. As regards the positive indicators, a sufficient number of these were found, which was interpreted as meaning that the meadow was sufficiently species and herb-rich, with a sufficient number of symbolic meadow species present to agree with the narrative on meadow botanical value.

She considered the meadow to be herb- and species-rich, as a number of the listed positive indicator species were found (12 out of 19 species found, of which 6 out of 8 from List A) and many were found 'frequently' (in at least 40% of sample points suggesting evenness of presence at the large scale of the whole meadow). The sward was also observed to have a herb:grass ratio much greater than 40% at almost all sample points. The coverage of 'rare species', in this case snakeshead fritillary was deemed to be satisfactory (change in extent relative to reference survey less than 25%) but was not assessed on this occasion as this had already been undertaken on an earlier occasion in April. Figure 6.1 below illustrates the type of data collected in the April fritillaries survey.

She also said that the number of positive indicators recorded from 2009 to 2011 had increased (Table 6.9 below), perhaps as the meadow recovered from the summer flooding of 2007 and 2008, but that in the past three years no significant levels of negative indicators had been noted. The impact of this flooding therefore appears to have manifested itself in the sward structure and the reduced presence of characteristic positive indicators. Indeed in 2009 the number of positive indicator species noted was only 7 out of 19 positive indicator species, though the use of a closed list of positive indicators only allows comparisons of the presence of a limited number of symbolic character species and does not allow conclusions about broader species richness to be drawn. These results she attributed to two consecutive years of a prompt hay cut starting before or around the 1st July followed by cattle grazing, which recommenced in 2009 after many years without it.

6.5.1.3 Floodplain Meadow Partnership surveys

Prior to the summer hay cut, the Floodplain Meadow Partnership hosted by the Open University, Milton Keynes, also undertakes an annual botanical survey of the meadow. This is based on a quadrat survey of 320 1 m x 1 m quadrats distributed across the meadow in 4 blocks of 50-130 quadrats in each block. These surveys follow a standard protocol in which all vascular plant species and bryophytes are identified within the permanent 1 m x 1 m quadrats and their percentage ground cover estimated. This work has been done yearly since 1998, with different surveys intermittently before this since 1992. The permanent quadrats were located using accurate GPS equipment and I participated in this survey work during the summers 2010-2012.

From this data, the Partnership then reports annually to Natural England on the evolution in a range of parameters relating to the meadow plant populations and assemblages, including the species richness and composition, the latter being related to the NVC descriptions for mesotrophic grasslands using statistical similarity analyses. In addition the Partnership monitors water-table depths and periodically samples soil and hay nutrient composition thereby permitting the relationship between plant assemblage composition and biophysical parameters of hydrology and soil nutrient status to be investigated. All data are then stored on a database held at the Open University.

6.5.1.4 North Meadow Fritillary population census surveys

Natural England also sample the snake's head fritillaries in order to estimate the total population on the meadow annually, and sample the colour and size of individuals in the population. This survey was observed on 19th April 2011. The fritillary population is sampled in 5 large sample plots (2m x 10m) distributed across the meadow and divided into 20 quadrats (1 m x 1 m). The number of fritillaries in each 1 m^2 quadrat are counted and the height of each plant recorded. The number of flowering plants of each colour (red or white) is recorded and the number of leaves on non-flowering individuals is recorded. From these results an estimate is made of total population of fritillaries on the meadow, and statistics calculated relating to flower colour and age cohort based on number of leaves per plant. The results indicate that the population on fritillaries

in each plot surveyed vary considerably on a periodic cycle of several years with no particular long-term trend discernible (Figure 6.1).

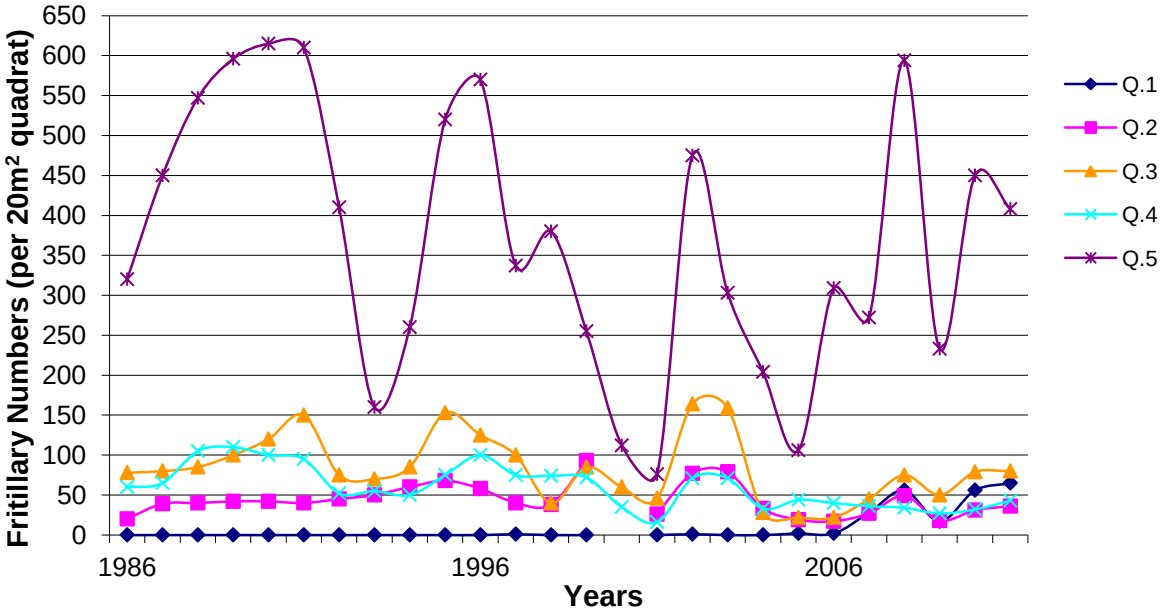


Figure 6.1 - Total Number of Fritillaries (flowering & non-flowering) in Permanent Quadrats Q.1-Q.5, 1986-2011 (Figure created by Natural England)

Each year the Open University Floodplain Meadow Partnership also undertakes a count of fritillaries using a different sampling strategy, with a series of permanent sample plots (1 m^2) distributed across the meadow. I participated in this survey for the purposes of this research on 19th April 2011 and 24th April 2012. Again the number of individuals in a 1 m x 1 m quadrat (divided into 10 cm x 10 cm squares to assist counting) was counted and for each individual the plant's height, flower colour (if flowering), and the number of leaves were noted. From these results, an estimate is made of total population of fritillaries on the meadow, and statistics calculated relating to flower colour and growth stage cohort based on number of leaves per plant. Natural England's criterion of good condition in their condition assessment is that the total fritillary population has not declined significantly, in this case defined as 25% less than the long-term average. As seen in Figure 6.1 above, in fact the inter-year variability in the population

appears to be much more than 25% around the long-term mean at some locations. Nevertheless, no party expressed concern about the fritillary population and the meadow was deemed acceptable against this parameter.

6.5.1.5 Other assessments of the grass sward

Records of grass sward height have also been taken by the Natural England site manager three times per year using a drop-disk[6] along three transects across the meadow since 1988. Although such data might prove a useful surrogate for sward productivity and yield, no evidence has been found that this information is used to assess the meadow or to influence management. The manager said that to make management decisions she tended to use visual assessment of the sward rather than use the drop-disk data. Again, experiential knowledge appears in reality to be weighed against quantitative data from formal 'expert' assessment.

It is understood that a number of surveys of the fauna on the site are also undertaken periodically, notably for birds, butterflies and odonata (dragonflies and damselflies). However, stakeholders did not make any reference to these surveys and no data relating to them was found on file, suggesting that such assessment work was considered to be marginal to the main value of the meadow and to its management.

Finally, at North Meadow, both Natural England and the Floodplain Meadow Partnership also attempt to record annual management of the meadow in terms of hay cut date and grazing patterns. However, the Partnership notes that such management data are often difficult to collect as it is not regularly recorded or supplied by farmer/managers, a point echoed by comments in the Natural England site management plan and by the site manager. The current site manager is responsible for three sites spread across a wide area and is based in an office 30 km away. Natural England staff are not therefore based at the meadow to make regular observations of management.

[6] A simple sampling device consisting of a vertical pole with a horizontal disc attached. The end of the pole is placed on the soil surface and the disc allowed to drop until it comes to rest on the vegetation. The height of the disc above the soil surface is taken as a measure of the vegetation depth.

Intermittent records have been kept of the management of North Meadow, both in terms of hay yields and in terms of number and type of grazing animals. From 1974-1984 records were kept of the number of cattle and horses grazing the meadow and the number of weeks of grazing. This recording continued in a slightly different format from 1984 to 1994, the records from which period also indicate occasional grazing with sheep and donkeys. No records were kept from 1994 to 2001 when records recommenced, though from 2001-2009 the meadow was almost exclusively grazed by a small number of horses. Grazing records from 1987-1993 suggest that the grazing was monitored every month with a diary compiled of changes throughout the season. The changes in recording may reflect changes in staffing and resources available to do this but could also be the result of a lack of clear aims for the monitoring. More recently, recording of hay yields has resumed and is considered in more detail below.

6.5.2 Brook Meadow

During 2011, meadow assessment activities were observed to be undertaken on Brook Meadow by the two conservation stakeholders: the owners Warwickshire Wildlife Trust and by Natural England.

6.5.2.1 Natural England condition assessment

The new Natural England Integrated Site Assessment (ISA) was observed to be undertaken by a single assessor on 13th June 2011 using both the new ISA proforma, which combines the criteria of the SSSI Common Standards Monitoring rapid condition assessment (Robertson and Jefferson, 2000) and the previous very similar agri-environment HLS assessment (Natural England, 2010a). The new ISA form can be electronically formatted to be site specific, although in fact the standard form was used for this assessment. This assessment was undertaken only against criteria for MG4 grassland using both the previous methodology for SSSI interest and the new methodology being introduced under Integrated Site Assessment (ISA).

As the previous assessment method had not been tailored to be site specific, in reality the criteria under the two assessment methods were identical apart from the sample plot size, based on 20

sample points in two zig-zig rows of 10 samples each either side (east and west) of the site north-south centreline, excluding the wetter northern end, as this was deemed not to be MG4 grassland. As seen also at North Meadow, it was therefore deemed inappropriate to apply the MG4 criteria to this area. The approximate locations of the sample plots were plotted on the map at the start to ensure an even spread of samples at both meadow edges and middle, and then the locations were identified approximately on the ground, although no method was employed to ensure randomness of distribution or avoid bias of sample location at the small scale. Samples were not recorded accurately with a GPS and therefore could not be relocated accurately.

Whereas sample plot size was 1 m^2 under the previous CSM methodology in 2010, for the 2011 assessment this was 2 m x 2 m (4 m^2) as prescribed by the new ISA methodology, representing a significant change in the size and scale of the sample. This might therefore be expected to influence, potentially increasing, the number of indicator species found in each sample. There was no specific predetermined search time at each sample point (typically 5-10 minutes maximum).

A number of meadow thistle plants, *Cirsium dissectum*, was noted. The Natural England assessor did not know whether this species had been intentionally reintroduced by the Trust, as it had not been seen on the meadow for a number of years. This was considered to be very positive as meadow thistle is considered a rarity at County level.

Results were recorded on the old form and transferred to the new form to ensure that all criteria in both were identical. As regards the HLS site assessment (previously undertaken by a separate unit of Natural England representing the former Rural Development Service or RDS staff from DEFRA), the assessing HLS Officer in a previous interview had stated that for a SSSI site, the HLS Indicators of Success for biodiversity (flora and fauna) were the same as the criteria in the condition assessment, as Conservation Objectives for SSSI interest took precedence over HLS objectives, although the latter may be broader (HLS Advisor, Natural England, pers. comm., Worcester, 20/01/2011). In fact the HLS prescription for the site notes no features of interest on

the site other than the 'biodiversity' interest, making no note of features of landscape or cultural heritage interest. This part of the assessment in effect therefore was also an assessment of whether site management was adequate to deliver favourable condition for the SSSI (biodiversity) interest.

As regards the question on the form: "Is the required HLS management being carried out?", it was evident from visual inspection of the sward (length and absence of lying litter) that the hay had been cut in the previous growing season, but it was not possible from visual inspection to tell whether it had been grazed. Indeed the Natural England officer did not know whether it had been grazed, suggesting that this had not been discussed with the Trust or recorded in the site notes and records. The stakeholder network therefore appeared to be loose in this regard, with limited communication between stakeholders.

The site was deemed to be in Favourable Condition, and likely to meet the Indicators of Success for the HLS options, with no activities adversely affecting the SSSI feature condition [of the grassland sward]. Again this was based on the number of positive plant species found and the absence of any negative indicators above the thresholds set for percentage ground cover.

6.5.2.2 Warwickshire Wildlife Trust Assessments

The Trust that owns the site also undertook assessments of the meadow's condition on 21st June 2011 using volunteer Trust members guided by a Trust member of staff. The meadow condition was assessed using three slightly different methodologies recorded on three different forms:

1. Habitat monitoring form
2. Lowland wet grassland monitoring form- species rich grassland
3. Lowland wet grassland monitoring form- grassland for breeding waders

The first form (Form1) represents the Trust's own in-house meadow condition assessment for MG4 grassland sites. The methodology is virtually identical to the Natural England CSM rapid condition assessment method. The assessment is structured in the same way and the closed lists of indicator species are almost identical. The underlying philosophy of the assessment therefore

appears to be the same as the Natural England assessment. Also, meadow thistle is included as a positive indicator: the total number of meadow thistle plants counted on the reserve is to be noted, although no specific sampling protocol is given for counting these.

The Trust's Reserves Biodiversity Manager said in an interview that she did not know the full rationale behind the assessment methodology as it was devised before her arrival at the Trust, but she said that it would have been devised in consultation with the Natural England Conservation Officer for Warwickshire, who in the case of Brook Meadow was the assessor for Natural England in the same month. This perhaps begs the question as to why the Trust felt the need to undertake an identical assessment to Natural England that would generate, in theory at least, the same results. This said, the fact that the Trust uses volunteers to undertake the survey suggests that the assessment activity may only in part be intended to generate monitoring data and indeed may be as much 'outreach' work intended to engage the public.

Form1 includes an annual management report in which are included the questions:

- Hay crop taken?
- Both meadows grazed appropriately?
- Comments on hay and grazing

Inspection of the Trust's files and discussion with the Trust's Reserves Biodiversity Officer confirmed that in fact this information is never recorded. Monitoring of the site management is therefore not undertaken despite being recognised as desirable. Comments by Trust Officers indicated that this is because the Trust does not have enough staff to follow the management or to liaise with the farmer to obtain this information. In interview, the Trust Officers for Brook Meadow agreed that most aspects of monitoring assessment are botanical and that the Trust did not monitor or assess agricultural value or record yield. The Reserves Officer also noted that they had never recorded aspects of agricultural value or liaised more closely with the farmer to record aspects of this, and had wondered whether this would actually show anything of interest, suggesting that they considered such data to be of uncertain value. The Reserve Manager at

Brook Meadow thought that the species composition of the current contemporary 'conservation meadow' would be slightly different from the original 'agricultural meadow', acknowledging that meadow conservation is a hybrid between past and present priorities.

The condition of the meadow was found to be favourable according to the Trust's own assessment (Form 1). The results were 4 frequent, 1 occasional positive indicators, of which 1 frequent and 1 occasional from List A. This result is broadly similar to the Natural England assessment result (5 frequent and 1 occasional of which 2 frequent from List A). In total 9 positive indicator species were found compared with 8 in 2009, and 9 on the NE CA this year, suggesting reasonable consistency of findings across the assessments in time.

It is not known how Forms 2 and 3 are analysed, and the Trust officer responsible for monitoring was not involved in their analysis. The Trust's Reserves Biodiversity Officer in charge of monitoring stated that:

> The 'Lowland Wet Grassland Monitoring' forms for 'species rich grassland' [Form 2] and for 'Grassland for Breeding Waders' [Form 3] were things that we were asked to trial as part of something that the local regional group of Trusts were looking into in an attempt to standardise methodology across the region. It was decided that that methodology would be trialled again at another site (more suitable for breeding waders) next year and that we would carry on with our original forms until further guidance and recommendations were issued.

Overall there seemed to be significant assessment activity of which the primary aims or the utility of the resulting data was not clear.

6.5.2.3 Participatory Observation of 2011 Warwickshire Wildlife Trust condition assessment

Five surveyors participated in the assessment, divided into two groups starting in the middle of the site: one volunteer plus myself heading South, and the Trust Volunteer co-ordinator plus two volunteers heading North. The Trust Volunteer co-ordinator demonstrated the methodology for

the first sample, then we each surveyed 10 sample stops, the last 5 of the Trust co-ordinator's being done with all surveyors together, stopping short of the wetter northern area with *Caltha palustris* and tall grasses, which was excluded. We walked a zig zag across the site throwing a cane to locate a random sample at least at small scale. Form 1 was completed with a 1m radius sample area defined around the surveyor, whereas for Forms 2 and 3 the sample area was a 2m x 2m quadrat. Sample points were not mapped or recorded by GPS and could not be relocated precisely. None of the volunteers appeared to have significant botanical identification skills. No assessment is made, or appears to have been made in the past in terms of any other aspect of site value such as landscape or cultural heritage. As already noted, the Trust do not record the annual management operations despite acknowledging that this is desirable.

6.5.3 Long Mead

What little active assessment has been undertaken at Long Mead has been done by conservation actors, either in the original botanical surveys by Surveyor LM1 in 2001 and 2004, or subsequent fairly unstructured and informal assessment by the HLS advisor and by the meadow owner. In comparison with the SSSI sites, very little assessment activity was carried out. Such assessment has been infrequent but has focussed like all such surveys on the botanical composition and sward structure of the meadow grassland. Whilst HLS is also considered to encompass landscape, agricultural potential and cultural heritage value of a site, no evidence has been found either in documentation, or in interviews with stakeholders, that these aspects of the meadow have been considered in any detail.

A number of brief walk-over surveys of the flora on the site have been conducted since the late 1970s (1978, 1980, 2001 and 2004). In each case, a species list was compiled using standard Nature Conservancy Council recording cards[7]. These surveys noted little else other than presence/absence of species from a standard list for neutral grassland, some of which were noted as 'interesting' or 'characteristic', and did not make any significant notes on contemporary

[7] These cards contain a standard list of several hundred plant species that may be found on UK lowland neutral grasslands.

management. The owner of the meadow said that as yet (2011) no one had done, or asked to do a more extensive formal botanical quadrat survey of the site. She herself tried to record the flora and fauna to have a record for future reference. Her own surveys involved making a note of the herbs, which she did not do in a systematic way as she was "always walking around the site". In addition she took photographs of the site, especially after the 2007 summer floods, but she did not make maps of the site or do a full botanic survey noting all the species. She said that she could identify many herb species and most grasses and that new species were being found even after four or five surveys. Assessment therefore again focussed on botanical composition and herb species appeared again to serve as symbols of a good meadow.

She noted that 2010 was the first year the meadow began to look "interesting" again after the summer floods in 2007 and 2008, denoting again the idea that certain botanical compositions as assessed visually were of particular value. She noted that quaking grass and early marsh orchid did not come up again [after the 2007 floods] and that cowslips still had not been found on the meadow, the latter in particular suggesting certain expectations about meadow composition and which plants 'belong' on the meadow. Examples of observations she had made included:

> ....[there was] a huge preponderance of meadowsweet and yellow rattle after the floods [2007], after which the meadowsweet began to decline..... there was quite a lot of variability in patches of species such as pepper saxifrage.

This indicated that she was conscious of the dynamic variation of the botanical composition of the meadow and how it changes in space and time. She also noted that "as the weather varies it's not possible to predict [how the sward will be] in advance".

The only other surveys that the present owner said that she had also done were bird surveys on the site with the Oxfordshire Ornithological Society. She said that she did not evaluate the grassland sward structure, for example by looking at the sward height when thinking about the grazing regime, but did however think about practical issues such as poaching and soil structural

damage. She also keeps a diary of grazing dates, and intermittent records of the hay yields for her own interest, but that were not shared with Natural England.

For the purposes of this research I assessed the meadow condition by following the Natural England rapid condition assessment protocols for MG4 and MG5 grassland on the 30th June 2011 (10 sample points) and again on the 13th July (a further 10 sample points). On the basis of positive indicators or 'symbols of a good meadow', the meadow could be deemed both a good MG4 meadow, or a good MG5 meadow, though the conservation status of the two assemblages and the value attached to them are significantly different.

The Natural England HLS advisor for Long Mead said that she visited the site once every one to two years. She said that as part of the HLS application, an assessment of the meadow would have been made by the site owner as part of the preparation of the Farm Environment Plan (FEP)(Natural England, 2011b), the objective of which was to establish what type of grassland it was, and to assess its condition so that the Integrated Site Assessment objectives could be determined. This assessment therefore in effect determined the baseline for the meadow's future conservation. No detailed notes on this assessment were found on file and no further assessments have been done of the meadow to date. Such an assessment was not based on a detailed quadrat survey and therefore appears to have been based on a broad assessment of the meadow as a floodplain meadow landscape with the presence of positive indicators as listed in the Farm Environment Plan handbook (broadly the same as the condition assessment indicators). Indeed, under the previous ESA scheme that ended in 2011, the Advisor visited the meadow to assess it:

> It was fairly general really, we just went for a wander round and made sure that there were no obvious problems and the site looked like it was being well managed and a good diversity of wildflowers in the sward. It wouldn't be anything more detailed than that.

Such assessment is therefore very qualitative, visual and experiential. The assessments were not as specific and detailed as currently laid out in the Farm Environmental Plan handbook and did

not have specific lists of positive or negative indicators. These assessments, again like the previous type of English Nature condition assessment were therefore very experience based. Assessors had an idea of the 'look' of a good meadow that they compared to the meadow to be assessed in a less structured and more intuitive way. Nevertheless they looked for indicators of problems, that is to say negative indicators, as well as indicators of good condition that might be positive indicator species or appropriate sward structure such as the current Natural England rapid condition assessment attempts to structure and codify more formally.

The HLS Advisor said that she tried to visit the site every year ideally in June before the hay was cut to ensure that the Meadow was being used to grow hay and not being grazed before the hay cut. If she saw anything that suggested it was not being correctly managed she may make a note of this or discuss it with the owner. However if everything appeared to be fine she would probably not make a note of anything. Therefore, there is not normally any note of routine management or when operations take place. The Advisor said that there is no formal record kept of routine management of the hay meadow.

6.6 Methodologies: Farmer-managers

As noted already, farmer-managers rarely actively make any kind of assessment of their meadows, but nevertheless do hold opinions on meadow condition and management, and that constitute a more general assessment of the meadows. In contrast with the conservation-oriented stakeholders, the positive indicators for farmer-managers are primarily hay quantity, with hay quality somewhat more secondary. Where quality is assessed, this tended to be assessed from the presence of broad plant groups rather than individual species, and farmers were not found to use individual characteristic species as positive indicators of value.

Another related positive indicator cited by farmers is the grass:herb ratio, which farmers would like to be higher on some sites, whereas conservation managers are usually happy for the grass proportion, and therefore productivity, to be low. The latter is a point of contention on some

sites and affects the economics and administration of management, and was particularly noted at North Meadow and at Mottey Meadow.

All the farmer-managers expressed that they used very simple visual qualitative criteria to assess the condition of the meadows as good or bad. Indicators were therefore used to make judgements about:

- Sward quality
- Sward quantity
- Appropriateness of site conditions and possible need for operations to manipulate these

Hay quantity, productivity or yield is judged from simple visual indicators such as sward height or density. A range of indicators may be used to judge hay quality:

- Sward colour
- Sward botanical composition (looks herb-rich or grass-rich but rarely attached to specific species identification beyond distinguishing broad-leaved herbs from grasses, rushes, sedges, reeds)
- Presence of negative indicator species groups as indicators of poor biophysical conditions such as rushes (soil conditions getting too wet), weeds/nettles (soil nutrient conditions becoming nutrient-rich), or toxic or unpalatable plant species that reduce the sward's utility as animal feed such as common ragwort)
- Presence of standing water (as indicator of excessively wet conditions)

Farmer-managers therefore have a range of visual structural positive indicators, for example, tall sward, green, lush vegetation, grassy, and of negative indicators of either undesirable biophysical conditions, poor sward performance or inappropriate management. They can rarely identify specific plant species other than broad common distinctive groups (grasses, rushes, reeds, sedges, flowering herbs) and do not make specific use of positive indicator plant species to signify positive value, unless expressly interested in non-agricultural botanical value.

This is most straightforward for sward quantity based on assessment of sward height and density; and to some extent for site conditions, based on the presence/absence and abundance of simple negative indicators, which may initiate consideration of works such as clearing of ditches or addition of fertilisers. The latter point relating to decisions made regarding management and the timing of agricultural operations is discussed further in Chapter 7.

Assessment of sward quality is not always a significant consideration for the farmers and depends on the balance between their interest in agriculture and conservation. Most farmers were of the opinion that the hay was not of the best quality from an agricultural perspective, because it was cut too late in the season. Their attitude towards this varied according to their interest in the non-agricultural nature conservation aspects of the meadows. Farmers who were enthusiastic about the botanical, landscape, cultural heritage or other non-agricultural conservation interest of the meadows tended to accept that the management was a compromise between conservation and agricultural interest. Farmers with little or no interest in conservation tended to see this compromise as bad management leading to an inferior product and decline in the condition of the meadow.

The idea that management is a compromise between agricultural and conservation value is perhaps at least in theory a contradiction as agricultural operations designed to maximise agricultural value created the conservation value. Therefore conserving the agricultural value, at least, at pre-intensification levels, should conserve the other aspects of meadow value. The two forms of value should not be in conflict and so the idea that management might now be a compromise demonstrates how there has been at least a shift in the balance between the two types of value.

Ultimately however, farmers were found only to form general impressions of the meadows rather than to assess them systematically for the purposes of management. Reasons given for this are considered further in Chapter 7, but focussed particularly on the need to follow the prescription

set by the conservation stakeholders and the lateness of the cut pushing farmers to cut the hay or commence grazing as soon as permitted by others.

6.6.1 North Meadow

The hay makers, the grazier and the Hayward all claimed that they did not make any assessment of the meadow, either its condition or management. This was considered by them to be irrelevant or unnecessary as the management prescription imposed by Natural England's management plan was considered to override all other considerations. This said, they all had their own opinions on the general condition of the meadow and therefore had made their own overarching assessment of meadow condition and management, even if they did not actively undertake regular assessment activity to help inform their management.

Farmer NMC1 said that any assessment of the meadow would be to walk across the site and make a visual assessment of the sward to see if it is ready to cut. However, he said that he felt that June hay was:

> the best hay you can get. It's still got the nutrients in it. By July it's drying out.

The look of the grass indicated when it was ready, with greener hay in June and brown hay in July. He also felt it was not possible to cut too early as the weather wasn't right and there wasn't enough sun. He felt that the first week of June onwards was ideal. As regards hay quality he noted:

> Ten years ago this was the best hay you could get. Now it's rubbish 'cos it's all reeds (sic)[8].

He said he still took the crop but had to dispose of much of it or burn it as it was too 'reedy'. He claimed that he couldn't sell the crop or use the hay and it was getting worse each year. For him good condition means a good crop with a substantial content of grass. He also claimed that 50 years ago the flowers were larger than presently and that the grass used to grow taller. These

[8] In fact, very few reeds are present on the meadow. Some farmers use the generic terms 'reeds' or 'rushes' to apply to other species found in wetter areas of grassland. In the case of North Meadow this refers to species of sedge.

statements are in agreement with comments by elderly residents of Cricklade as recorded in an oral history (Snakeshead Revisited Project, 2010), that fritillaries, marsh marigolds and grass were bigger and taller even though the hay was cut at the end of May or the beginning of June, a hay cut date that agrees with the Hayward's comments below. He also claimed that there was widespread perception amongst older local people that the meadow had declined.

For him bad condition was indicated by the presence of plant species such as rushes and reeds and he thought that meadowsweet was taking over badly in some areas, a comment in agreement with those of Farmer NMC2 who cuts the southern-most compartments. Also dredged silt on the bank was now covered in nettles and the hedges and trees were overhanging badly. The meadow was not in good condition because of the lack of grass in the sward and too many sedges, which were unpalatable to animals.

Each summer his daughter telephoned Natural England after the hay cut to tell them the number of bales of hay made off his part of the meadow, as they requested this information from the farmers. However he said that he did not keep any written records regarding the meadow for his own purposes. The onus is therefore on Natural England to record this information as the farmer did not appear to be interested in it for his own purposes. As noted above, the records of hay yields from North Meadow have been kept intermittently and a continuous record of yields over an extended period has not been kept.

He did not therefore appear to make any assessments of the meadow for the purposes of influencing management, although he certainly had his own opinions on the meadows condition that constitute a broader assessment of it. He thought that the meadow started deteriorating approximately 10 years earlier (around 2000/2001) when fertiliser was no longer added to the adjacent fields owned by the Co-op, thereby shifting the baseline conditions of the meadow's surroundings and external environment. This said, such a change would represent a shift back towards more traditional conditions in a less eutrophic environment. He said that the wet summers hadn't helped but that there were always wet summers from time to time.

Farmer NMC1 said that Natural England were not focussed on hay quality as they were not concerned with hay yield. This did seem to agree with the management plan's comments that hay yields were secondary to floristic diversity and the site manager's comments that site management was not about getting a big crop. He said that he had to buy a licence and make the money back by selling the crop, but that he hadn't been able to sell it for 4-5 years. It was not therefore clear why he continued to buy the licences and had not dropped out of managing the meadow.

Farmer NMC2 commented that he saw no point in making any assessment of meadow condition as he felt Natural England dictated the management and so he merely followed the prescription laid down by Natural England in the management plan. Despite this and as seen in Chapter 5, he clearly had his own view of the meadow based on a broader assessment of its condition.

Farmer NMC2 noted that the "herbs shouldn't be taking over and competing out the grasses", a key point of contention with Natural England, whose criteria seek to maximise herb coverage to high levels of up to 90%. It was in the southern compartments of the meadow that both he and farmer NMC1 as well as the site manager all noted that this area had come to be predominated by meadowsweet *Filipendula ulmaria*. He thought the hay was better in the Northern compartments that he cut compared to those from the southern end of the meadow. He said that in the northern compartments it had some coarse grasses but was good. He used all the hay himself and did not sell it.

Farmer NMC3 also said he did not do any assessment of the meadow's condition before he started to cut it. He felt that a 15th July start date for the hay cut was already too late. He said that he "might walk round once to see the weight of the crop" and he did go down to the meadow two or three times in spring to assess the growth rate and look at the herb/grass mix out of interest, but he did not make any decisions about management based on this; he merely followed the prescription as laid down by Natural England.

Farmer NMC3 did not think the meadow was in bad condition but it could be better and was definitely deteriorating in his opinion. For him good condition is represented by a good variety of herbs and grasses and an absence of 'weeds'. The major concern was the spread of 'weeds' as the hay would not be worth having, though he did not specify what type of weeds or the species of concern. He thought the current herb /grass mix was acceptable but was pessimistic about the meadow's future concluding that "it needs a good shake up and managing properly".

The meadow grazier said that he did not assess the condition of the meadow in summer, but waited for permission from Natural England to start grazing after a rest period for the grass to recover from the hay cut. Permission to start based on Natural England's assessment therefore dictated the grazing start date. As regards the end of grazing, the contract stipulated a minimum of 6 weeks of meadow grazing and he said that Natural England didn't want the cattle on the meadow in wet weather.

Similarly, the Hayward felt he had no need to assess the condition of the meadow as he felt the farmers knew what they were doing and he felt he didn't need to get involved. He felt it was more his job to check that the animals didn't come on too early (before the Lammas start date of 12th August) or if the animals needed to come off the meadow because of flooding and to ensure that the graziers were abiding by the rules. To this end he came down to the meadow weekly during the grazing period to have a look at the grazing animals but he didn't assess the grass sward condition; he left that to the graziers, and therefore saw his role as one of enforcing regulations.

6.6.2 Brook Meadow

The farmer that manages Brook Meadow (Farmer BM1) said that he looked the site over before he cut it:

> Well we looked it over but,..... the grass varies from one side to the other to be honest. Some places it was good, other places it.....could have done with a bit more grass really.

In terms of good condition for the meadow the farmer thought that this was:

> Plenty of grass in it. I mean there were some weed grasses in it. I don't know the name of the one to be honest..... What is bad condition? Well there just wasn't enough grass. Where the flowers had been. It isn't very tall.

Hence the meadow's value was limited by low productivity as a result of a high herb content and low grass coverage.

He noted that the timing of hay cutting was constrained by the hay cut date and the weather, and so he cut the hay as soon as permitted and as soon as practical. To this end, there was no need to assess the condition of the meadow or make any decision in this regard. For the grazing:

> As soon as there's a bit of green on it we put the cattle on it. And they kept on top of it. [In terms of finishing the grazing this was when] it was getting short of keep [growth/vegetative matter]. Otherwise we would have started to have to feed them something else I think.

The Farmer said that he kept records of cattle movement as it was a legal requirement and also noted the number of bales made for his own personal interest, but this information wasn't shared with the Trust.

The farmer therefore appeared again to have his own opinion of the meadow's general condition, but had little need to make any specific assessments. The simple visual assessment of the sward after the hay cut was all that was required to ensure that the cattle had feed to eat before commencing grazing. The end of grazing would then come 60 days later as after this time the cattle would have to be re-tested for TB. He did not feel that the meadow resource was of sufficient value to him to merit this added expense and so at this point the cattle would be removed permanently, irrespective of meadow condition.

Management of the meadow appears therefore to be driven by the management prescription, and other practical considerations that constrain the farmer's scope for decision making. In this regard, whilst the farmer has his own opinions of the general value and condition of the meadow,

the only assessment he has to make to influence management is to ensure that there is visual evidence of green grass re-growth after the hay cut before he commences the grazing.

6.6.3 Long Mead

Farmer LM1 who cuts the hay has known Long Mead all his life since at least the 1960s. He did not think the meadow had changed in that time except for "maybe a bit more sedge [now]". He thought that it had always been managed in more or less the same way. In terms of assessing the meadow before cutting it:

> I'd have a look in there before cutting but we're controlled by that date. The biggest factor is the weather forecast

As regards what constitute good condition to him:

> You're looking for bulk really. There's enough growth there to make the job worthwhile.

In this regard therefore, Farmer LM1 has assessed the meadow's general long-term condition, but does not appear to make regular assessments of condition at a specific moment in time in order to inform management decisions. In terms of indicators of good and bad condition, he notes a few species as negative (thistles and sedges) but none as positive indicators. The positive indicator he noted was hay quantity.

The Long Mead Grazier clearly also had his opinion on what good condition looked like for the meadow. For him good meadow condition was represented by a "nice and green" grass sward, but he also did not make any specific assessment of meadow condition in relation to grazing management. He said that he would be waiting to get the cattle onto the meadow as soon as it was cut and so did not assess condition beforehand. He did say that he did not want to overload the meadow but did not specify how he established when it was overloaded. Typically about 20 cattle were put onto the meadow from various of the company's fields. There did not appear to have been any calculation used to determine this number, which seems to be a number that is practically convenient for the contractor and not excessive from the owner's perspective. As he

said that the cattle would be on the meadow from mid-July until October (mid-November at the very latest), this represents 2LU/ha[9] over a maximum of 3 months, which would not exceed the recommendations in Crofts and Jefferson (1999). In terms of assessment, he said that he thought it would be the site owner who would be assessing meadow condition, whereas they were interested in animal condition and the weather. As already seen, however, the owner does not in fact look specifically at the grassland sward condition during grazing activity but rather looks at ground conditions such as poaching or waterlogging.

No regular active assessment of Long Mead appears to be undertaken therefore by the stakeholders involved in managing the meadow. Whilst the farmer-contractors are interested in the agricultural value of the meadow in terms of forage quantity and quality, they do not appear to assess this actively. The hay farmer and owner make notes of hay yields but this appears to be done intermittently and they do not use this information in making management decisions or share it with other stakeholders. The grazier said he did not make any note of any aspect of meadow management or condition, and decisions regarding the grazing regime appeared to be dictated by other practical limiting factors.

6.7 Tensions between stakeholders' priorities and perspectives

A range of issues surround the assessment activity of stakeholders. As already seen, as well as differences in opinion over the value of the meadows, there are differences of opinion regarding the meaning and significance of particular criteria such as for example percentage herb versus grass coverage. At the heart of such disagreements are issues surrounding narratives regarding meadow value, the extent to which criteria of value can be objectivised, and uncertainty over how to use expert and experiential knowledge to reach conclusions about the meadows' status and condition. Particular questions revolve around issues of the choice of conservation baseline, choice of positive indicators, and how to sample meadow characteristics.

[9] Livestock Units (LU). One adult cow constitutes 1LU.

6.7.1 Conservation baseline and subjectivity

The conservation documentation and assessment methodologies for Brook Meadow and North Meadow indicate the importance of the NVC plant community descriptions in determining the meadows' value. The MG4 class proved to be an important benchmark against which the meadow grassland was assessed with areas that were deemed unable to meet this benchmark such as the wetter northern end of Brook Meadow, or the south-eastern corner of North Meadow being 'bounded out' of the assessment.

In 2001 an experimental assessment was undertaken on North Meadow in which the meadow was divided into six sections that were assessed separately. The northern half of the meadow all passed either the MG4 or the MG5 assessments. The southern half of North Meadow all failed the MG4 assessment as it was considered too grassy and the southern-most tip also had too few positive indicator herbs. It is now in this area that the farmers are complaining of the spread of meadowsweet, and a lack of productivity resulting from low grass coverage. The small area assessed as MG5 was deemed favourable as MG5 grassland though it may be noted that from the information available, it might have failed the corresponding assessment for MG4 had this been undertaken, on the basis of the low number of List A positive indicator species present. This area would therefore been considered in a 'good' piece of MG5 grassland but a 'poor' piece of MG4 grassland. This approach to assessment suggested a different approach to valuing areas that were not deemed good MG4. Different areas with different characteristics were assessed against different criteria, rather than having a one-size-fits-all assessment, and a reluctance to dismiss some areas of low/no value. This however raises the question of how to define boundaries between areas of differing value, which appears in reality to done by surveyors on the basis of subjective experiential knowledge by visual inspection. Since 2001 assessments have only assessed the meadow against MG4 criteria.

The rapid assessment undertaken at Long Mead indicated that the meadow would pass the Natural England assessment for both MG4 and MG5 suggesting that this assessment cannot always readily distinguish distinctive characteristics of these two assemblages, despite the

significant difference in status that is afforded to the two different plant communities. The decision whether to assess against the two different sets of criteria must therefore be determined beforehand based on other information from, for example, a detailed botanical quadrat survey, or indeed a subjective qualitative experiential or visual assessment by an experienced surveyor.

The 1999 assessment of North Meadow noted that:

> For both halves (and especially the eastern half [of the meadow]) the positive indicator species are not represented to the degree expected/necessary for favourable condition. However it was deemed that sampling missed out one of the [species] richest areas in the eastern half (the area that juts out closest to the road on the north eastern boundary), while a few samples were taken from the less species rich area bounding the Thames. The eastern-most part of the site is relatively species-poor (a part of which was extensively manured in the past). There was no doubt that the richer areas were in excellent condition, and that a more detailed knowledge of the site would have helped determine a more representative sampling route of the areas of interest for which the site was notified. The species-poor area was species-poor at the time of notification.

This reveals that the surveyor already had a well-formed opinion of the meadow's condition and composition before sampling began, based on experiential knowledge. The surveyor felt sure that the meadow would match the chosen baseline well provided that more data was recorded. However, clearly, a more representative sampling route represents a circularity of argument whereby the additional survey data would be collected in such a way as to confirm the pre-determined experiential conclusions. This highlights that for a survey such as this, much experiential knowledge and subjective judgement is still required on the part of the surveyor in deciding which areas are 'representative' and therefore where to survey. The surveyor has to have an idea in mind of how a meadow should be beforehand. This is not least the case as 40 survey points of approximately 1 m^2 is a very small sampling rate in 45 ha of meadow (0.009% of

the area). In this regard, subjective knowledge and experiential knowledge is marshalled to mitigate uncertainty against which enough data cannot be collected readily.

6.7.2 Positive indicator species

No clear or overt narrative on the choice of positive indicators was identified either in documentation or in interviews. Those used by Natural England were identified by a working party in the late 1990s, although no documentary evidence can be found to describe in detail exactly how the choice was made. The Senior Grassland Specialist at Natural England has given an outline of the relevant factors in the choice of indicators (Senior Grassland Specialist, Natural England, personal communication, Peterborough, 18/01/2011). This included constancy and fidelity of particular plant species to particular NVC classes of vegetation, this being the MG4 class in the case of floodplain meadows, yet again clearly associating floodplain meadows with the MG4 description. Landscapes and habitats were clearly required to be assigned to an NVC class and then meet the requirements of this standard description as a specification. Whilst other organisation such as Wildlife Trusts may occasionally pick different indicators, the broad approach used by them is the same as that of Natural England, with positive value attached to the presence of key emblematic herb species seen to be aesthetically pleasing and symbolic of a good meadow. Clearly therefore the NVC class descriptions of MG4 have been very heavily influential in assessment structure.

6.7.3 Interpretation of Results

As the assessments of farmers and conservationists are so different, the question arises as to whether any aspects of their assessments are mutually beneficial or contradictory. It is already noted that there is a dispute at many sites over the value of a low grass:herb ratio, with farmers desiring a higher ratio of productive grasses, the conservationist being happy for the grass percentage to be very low to allow a larger variety of less competitive characteristic or even charismatic herb species. Do the conclusions reached about assessment results contain inherent contradictions?

Farmers' assessments are simple and visual, and focus especially on hay yield. Yet even here high yield might relate to a good crop of good quality hay or to a crop of unpalatable coarse grass or to a sward that has "grown on too long". As Farmer PH1 of the Portholme NNR at Huntingdon and Farmer NMC3 at North Meadow put it, there is a trade-off between quality and quantity, with swards allowed to grow on longer yielding more hay of lower quality. It is therefore possible to interpret a higher yield of hay in different ways. Similarly, species richness may indicate a community characterised as typically species-rich such as MG4 or might represent a transitional community between 'standard' community descriptions, which ecological surveyors have been noted to value negatively. The idea of a transitional community may in fact be ambiguous or even meaningless in terms of ecology given that such plant community descriptions are social constructs, but which have political implications in terms of the difference in conservation status implied. Such distinctions emerge from the structure of the NVC.

Finally, as regards the use of positive indicator species, how does knowing that we have two 'Frequent' and three 'Occasional' positive indicator species tell us that the grassland sward is actually species rich or has a composition similar to MG4?

These are all examples of situations where the output of structured assessments such as the Natural England assessment might not necessarily be useful to distinguish between conclusions with differing implications. In such situations, more subtle and unstructured experiential knowledge may be required to help distinguish between quite different situations that appear identical according to the rapid assessment criteria. However, this may require experiential knowledge of each meadow, which resource-constrained and time-pressed conservation-oriented stakeholders may not possess unless use is made of the farmer-managers' knowledge.

As already noted, Natural England has also gone from making very simple experiential assessments of the meadow to more structured and formal assessment. Given comments by the Brook Meadow staff regarding the absence of staff with close personal knowledge of the meadow, the move towards more structured assessment may not necessarily be motivated solely by the

opinion that such more structured assessments are superior. It may in fact be an acknowledgement that the more subjective experiential assessments require assessors with good personal knowledge of the meadow in question, and who are becoming increasingly uncommon.

Not all sites have volunteer wardens, and at Brook Meadow the stakeholder playing the closest role to a warden in terms of experiential knowledge would be that of the farmer or the midweek volunteers. The Brook Meadow Reserves Manager at Warwickshire Wildlife Trust noted:

> The Trust can't therefore work on experiential knowledge because the Trust doesn't have enough staff to have an intimate knowledge of each site. We don't have staff who can focus on just one site, which is why the Reserves Biodiversity Officer can only dedicate one third of her time to monitoring the 56 sites and which is why we are treading water rather than trail-blazing. We don't do fixed-point photography or anything like that or visual records year-on-year. It is at the moment just subjective, people's interpretation.

6.8 Critique of assessment criteria

As noted already, the selection of assessment criteria is subjective and based on associations made between the criteria and concepts of meadow value, as alluded to in stakeholders' narratives about meadow value. Even then, comparison between such criteria and the results of assessments may not always be straightforward for reasons discussed above. The narratives may also contain assumptions about relationships between different criteria, such as the assumption of an inverse relationship between meadow grassland species richness and biological productivity as seen in hay yields.

The database held by the Floodplain Meadow Partnership at the Open University was interrogated to evaluate what data in the database could be analysed in order to investigate some of the relationships between different assessment criteria. This database holds botanical survey data for nearly 20,000 sample quadrats that have been surveyed on a large number of floodplain meadows across England. In most cases survey data have been recorded in the past few years and cannot yet be used to produce extended time series of the evolution of botanical composition

on the meadows. However, for a few meadows, notably North Meadow, more than 15 years' of survey data now exists. All quadrat locations in the database for meadows that include hay-yield data were downloaded along with their associated botanical survey data from the same growing season. There were approximately 300 such locations available for analysis. From these data, it was possible to plot scatter plots to investigate the relationship between various botanical criteria used by conservationists to assess conservation value and hay yields. Scatter plots are presented here where they are discussed in detail, whilst the remainder are shown in Appendix 2.

6.8.1 Intercorrelation between botanical criteria of meadow value

Correlation between the following criteria of botanical value were investigated:

- Species richness
- Percentage of herb cover
- MG4 correspondence coefficient (Czekanowski, 1913)
- Count of List A and B positive indicators for the Natural England rapid condition assessment
- Percentage cover of List A and B positive indicators for the Natural England rapid condition assessment

Table 6.2 below summarises the strength of the correlation (R^2 values) between each pair of criteria, based on a simple linear model. The data plots are included in Appendix 2 (Graphs A2.1 – A2.23).

Table 6.2 – Correlation between various criteria of botanical value used to assess floodplain meadows (R^2 value of simple linear correlation). In all cases the P value of significance of gradient: P < 0.001)

R^2 values	**Species richness (n)**	**Herb coverage (%)**	**MG4 correspondence coefficient (0 – 1)**
Species richness (n)		0.41	0.70
Herb Coverage (%)	0.41		0.41
MG4 correspondence coefficient (0 – 1)	0.70	0.41	
Count List A species	0.38	0.32	0.40
Count List B species	0.65	0.46	0.54
Count List A & B species	0.70	0.53	0.63
Percentage cover List A species	0.09	0.54	0.16
Percentage cover List B species	0.43	0.35	0.31
Percentage cover List A and B species	0.27	0.76	0.33

In terms of the criterion of species richness, there appears to be a significant degree of correlation with other common criteria of botanical interest, particularly with MG4 correspondence coefficient, and with the count of condition assessment positive species, particularly the List B species, and the total List A and B, but interestingly, not so strongly with the count of List A species which are intended to be particularly emblematic species of MG4 floodplain meadow grassland. The count of indicator species seems to be much more closely correlated with species richness and MG4 character than is the abundance of the same indicators, represented here by percentage coverage, which are correlated more strongly with percentage herb cover. The strongest correlations between botanical criteria therefore appear to be either between those

which represent species identity and presence/absence, or between those related to abundance in a sample.

6.8.2 Correlation between botanical criteria and hay yields/productivity

Figures 6.3 – 6.7 further illustrate the relationship between species richness and hay yield, whilst Figures A2. 24-A2.31 in Appendix 2 illustrate the relationship between hay yield and other botanical criteria: percentage herb cover, MG4 correspondence coefficient, count of List A and B species (from the Natural England rapid condition assessment) and, percentage cover of List A and B species.

Visual inspection of Figures 6.3 – 6.7 suggests no simple relationship (linear, logarithmic, exponential etc.) between yield and species richness. One possible model for the relationship is suggested by the Grime Hump-back model (Grime, 1973, 2001, 2007), which if valid would suggest that the relationship is such that species richness reaches a maximum at intermediate levels of productivity/hay yield, as discussed in Chapter 2. Proving such a 'hump-back' relationship statistically is difficult, as the points would fit under the curve, not along it, and due to the range of meadow surveyed, there is a lack of data points in the 'tails' of the bell curve, at high and low productivity. Nevertheless, a polynomial curve relationship and a simple linear model have been fitted to Figure 6.3 of all the quadrat survey data points. A quadrat polynomial hump-back curve does indeed prove a better fit than a linear model ($R^2 = 0.12$ and $R^2 = 0.09$ respectively), though the polynomial curve has been fitted through the points rather than over them.

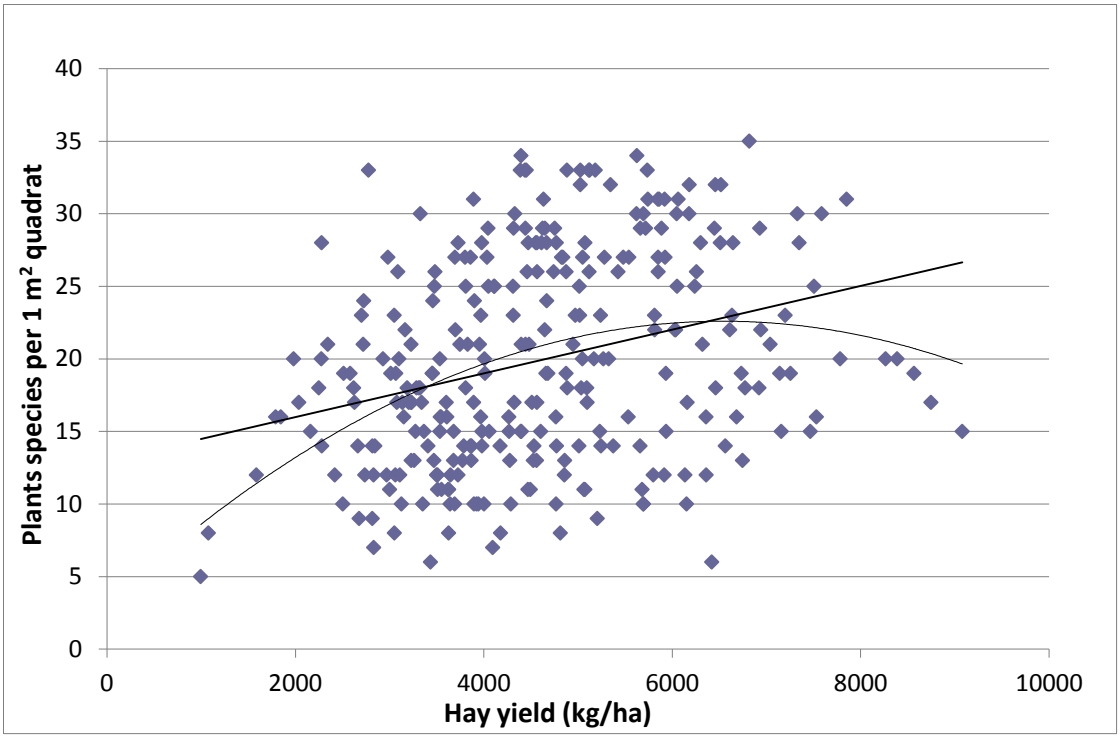


Figure 6.3 - Plant species per 1 m^2 quadrat vs. hay yield for all meadow sites (linear model: R^2 = 0.0924, P < 0.001; polynomial model: R^2 = 0.1244)

Figure 6.4 shows the scatter of data points distinguished for individual meadows and indicates that the relationship between species richness and hay yield is different at different meadows, with each occupying a different area of the plot, though still possibly sitting under a bell-shaped-curve. Figure 6.5 shows only the points for North Meadow, and here the polynomial curve relationship is now seen to be stronger than the linear relationship (R^2 = 0.16, R^2 = 0.04 respectively). Figures 6.6 and 6.7 show this comparison repeated for Oxford Meads and for Yorkshire Derwent sites. Here the correlation coefficients are much lower for both linear and polynomial models and the two models represent a poor fit to the data. In such a case either the models are not valid, or as noted above the number and spread of points is insufficient to detect a relationship. Similarly graphs A2.24-A2.31, Appendix 2, do not indicate a clear relationship between the other botanical criteria and hay yield. Again, a hump-back model is possible.

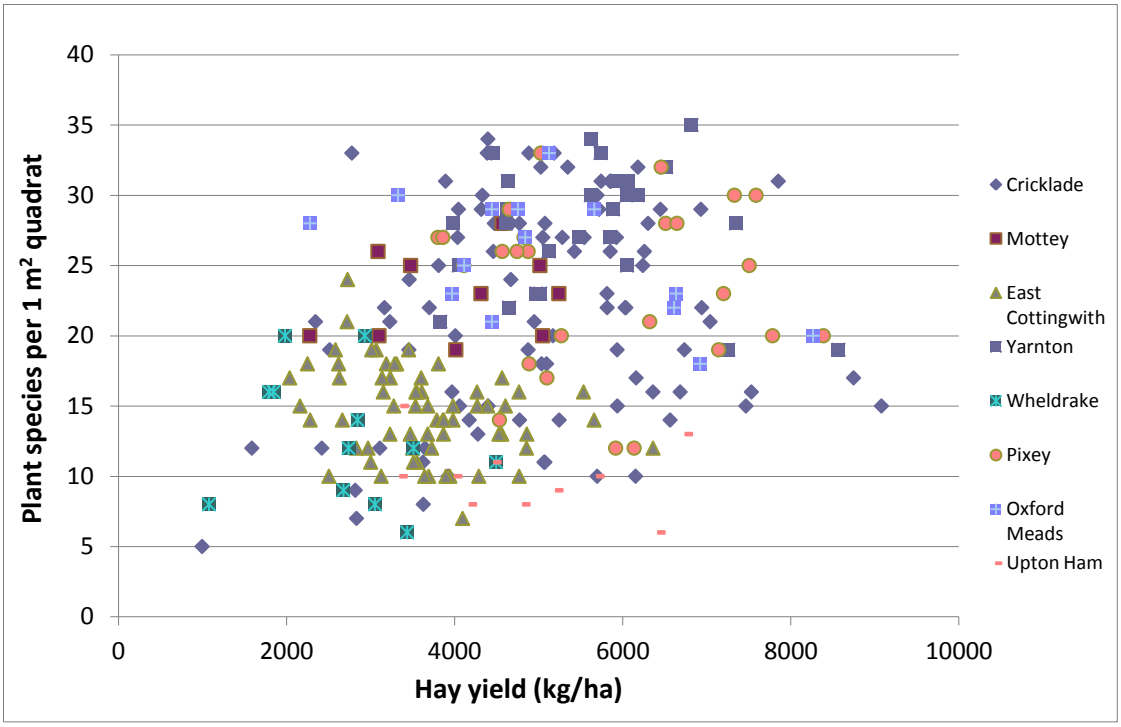


Figure 6.4 - Plant species per 1 m^2 quadrat vs. hay yield for selected meadow sites

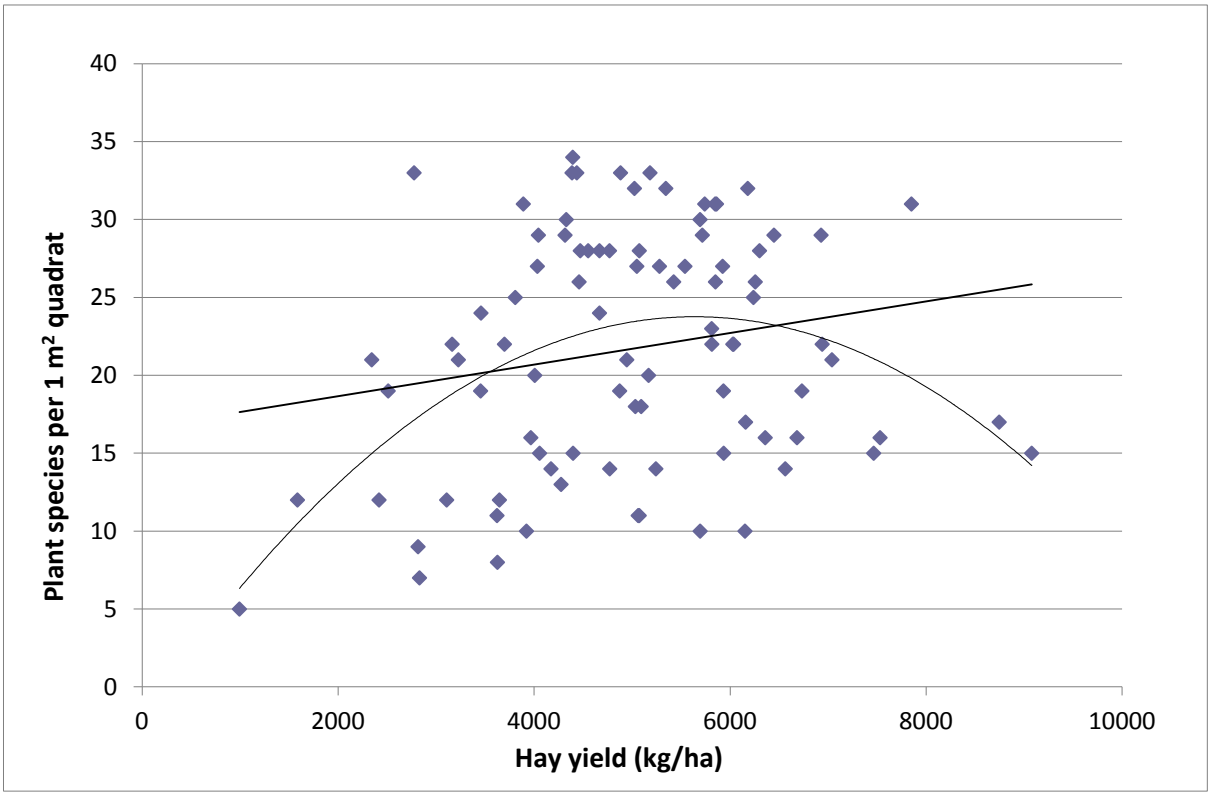


Figure 6.5 - Plant species per 1 m^2 quadrat vs. hay yield for North Meadow (linear model: R^2 = 0.0381, P = 0.065; polynomial model: R^2 = 0.1599)

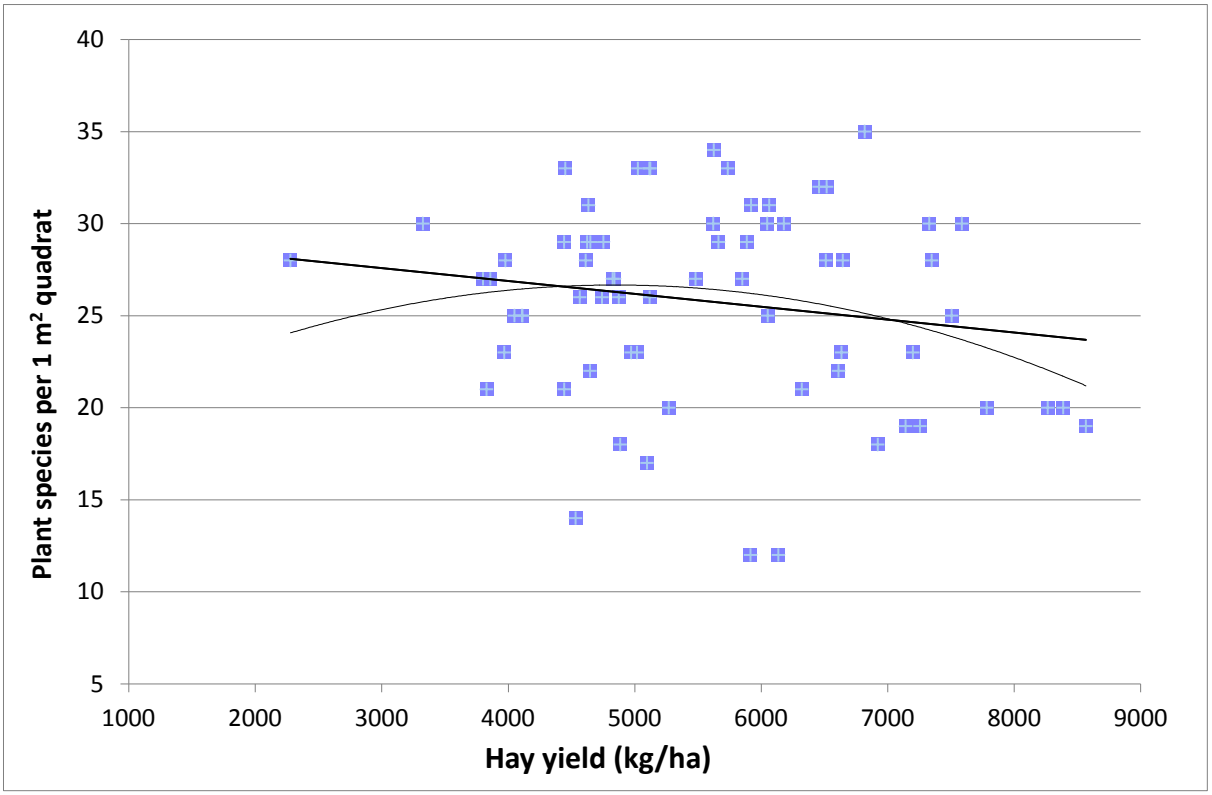


Figure 6.6 - Plant species per 1 m^2 quadrat vs. hay yield for Oxford Mead (linear model: R^2 = 0.008, P = 0.458; polynomial model: R^2 = 0.0547)

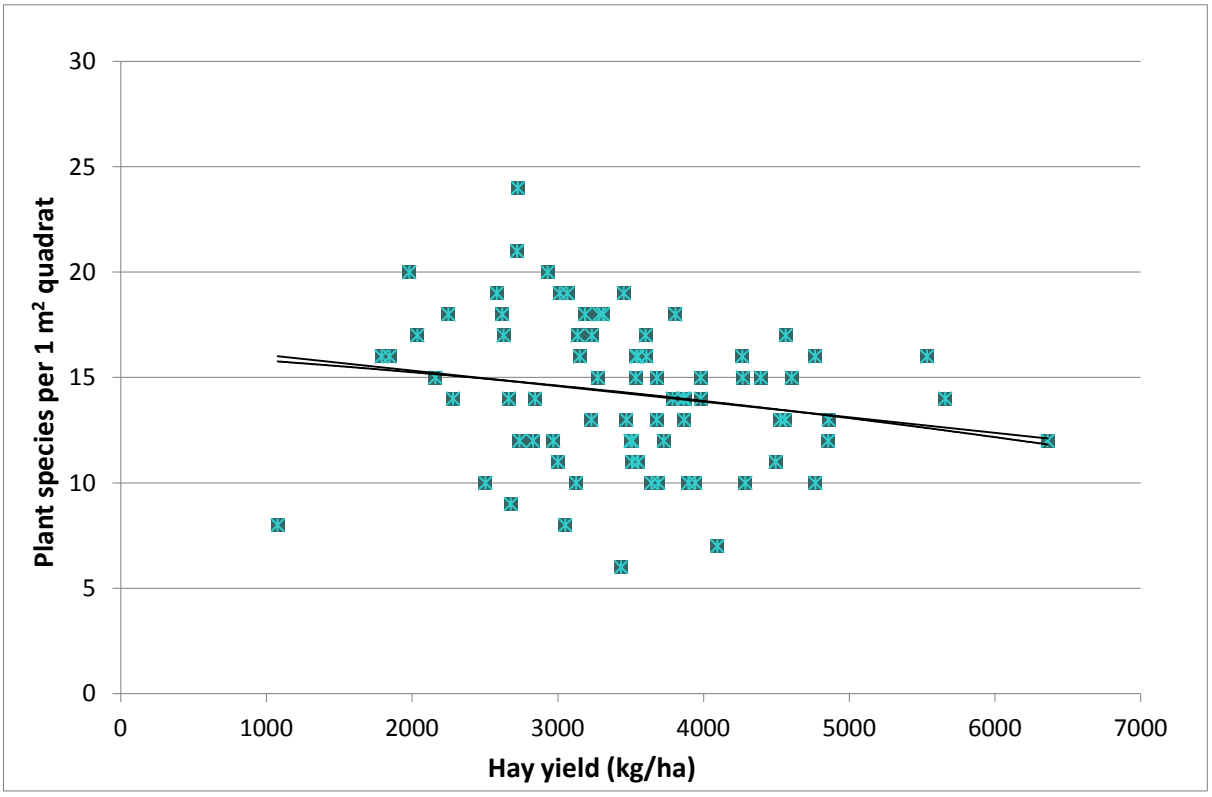


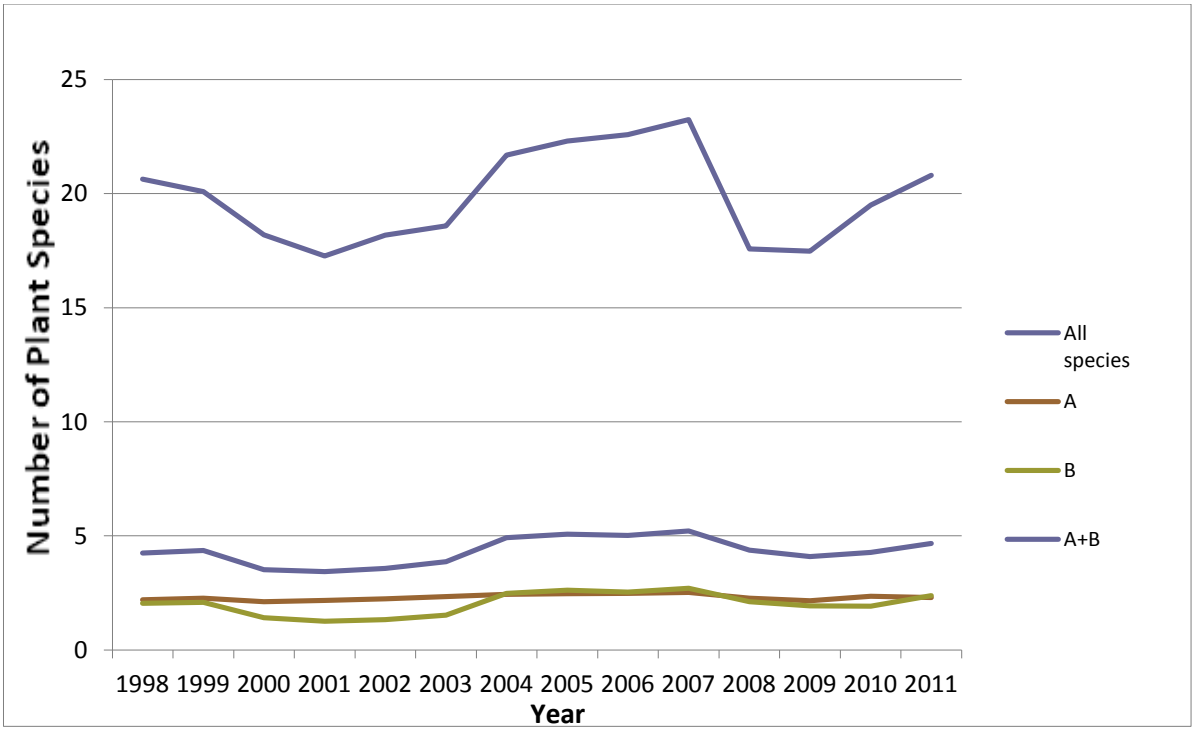
Figure 6.7 - Plant species per 1 m^2 quadrat vs. hay yield for all Yorkshire meadows (linear model: R^2 = 0.015, P = 0.278; polynomial model: R^2 = 0.038)

Also, if species richness, assemblage composition and the presence of positive indicator species are significantly inter-correlated in terms of a simple linear model, then the relationship between these criteria and hay yield/productivity may be similar. That is to say, if the relationship between species richness and hay yield follows a hump-back model, so too may the relationship between yield and MG4 character or presence of positive indicators.

6.8.3 Evolution through time of species richness

To examine further the utility of List A and B positive indicators as criteria of overall sward species richness, the Floodplain Meadow Partnership data for North Meadow were examined. For each quadrat surveyed in a given year, the total species count was calculated, as well as the count of List A and B species. The results for each quadrat were then averaged across all quadrats surveyed in the same year. Figure 6.8 shows how each parameter varied from year to year.

Figure 6.8 – Average count per 1 m^2 quadrat of all species and List A and B species per year at North Meadow, Cricklade 1999-2011



It may be seen that, as found in the previous analysis, the time variation in overall species richness is reflected in the variation in the count of List B species and List A+B species, whilst the List A species found on the meadow do not vary to as large an extent. This may be expected as the List A species are long-lived perennials whose presence on the meadow would be expected to be slow to respond to variations in meadow biophysical conditions and management (Grime, 2007). These results were then compared with a summary of the findings of the condition assessments on North Meadow 1999-2011 (Table 6.9 below).

Table 6.9 – Results of Natural England rapid condition assessments at North Meadow, Cricklade 1999-2011

Year	Positive indicators	List A species	Average species richness estimated from quadrat survey data	Other parameters noted	Conclusion for MG4
1999*	2F, 2O	1F, 2O	20.0	Trial of earlier version of rapid condition assessment	Favourable
2000	5F, 5O	2F, 2O	18.2	Fritillary count noted to be much lower than long-term mean across previous population census surveys, which is attributed to previous heavy flooding.	Favourable
2001*			17.3	Trial assessment in which six different areas of the meadow were assessed against either MG4, MG5 or MG8 criteria.	Northern half Favourable, southern half unfavourable
2002			18.2	No assessment found on file	
2003	5 F, 3 O	3 F, 1O	18.6		Favourable
2004	7 F, 2 O	4 F	21.7		Favourable
2005	8 F, 2 O	5 F	22.3		Favourable
2006**	5 F	4 F	22.6		Favourable
2007**	4 F, 1O	4 F	23.3		Favourable
2008**	5 F	4 F	17.6	Significant litter layer across more than 25% of the sample area.	Unfavourable
2009**	4 F	3 F	17.5	Significant litter layer across more than 25% of the sample area. Positive indicator count low.	Unfavourable
2010	6 F	3 F	19.5		Favourable
2011	6 F	4 F	20.8		Favourable

F = frequent O=occasional

* Results not directly comparable with other assessments

** Pre-populated species short-list used

The criteria for favourable condition are given in the Natural England pro-forma for the condition assessment reproduced in Appendix 1. The meadow was noted to fail the condition assessment following summer flooding events in 1999/2000 and 2007/2008 on the basis of there being too few positive indicator species identified in the assessment (2009) or because of the extent of leaf litter across the meadow site (2008 and 2009). Comparing these results with the species richness estimates calculated using the quadrat survey data, a reduction in species richness was indeed seen in these years, again suggesting that the selected basket of positive indicators do provide some indication of the fluctuation in overall species richness.

6.8.4 Hay yield as an indicator of biological productivity and thus system function

As regards positive indicators, farmers are most often interested in productivity. Farmers mostly did not keep any records of their assessment and management (qualitative or quantitative). In a very few cases they have records of hay yield but these are usually highly intermittent with several years missing. They often only keep these for their own personal interest and do not generally share them with the conservation stakeholders, who often do not appear to request them, even if documentation such as management plans state that this is desirable information to be recorded. Data were however found for the northern-most fields of Mottey Meadows NNR in Staffordshire, which has a 15 year hay yield record (Figure 6.10). There is also a 25 year time series for an area of the Yorkshire Derwent Ings, East Cottingwith (Figure 6.11).

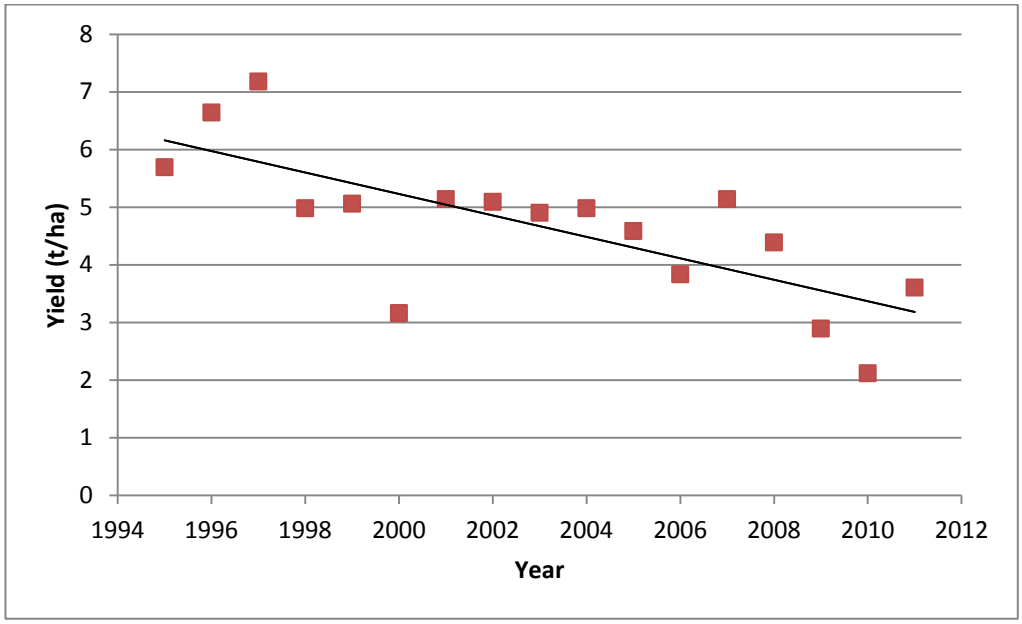


Figure 6.10– Hay yields recorded for the two northern-most fields (compartments 2 and 4) of Mottey Meadow NNR, Staffordshire ($R^2 = 0.5413$, $P < 0.001$)

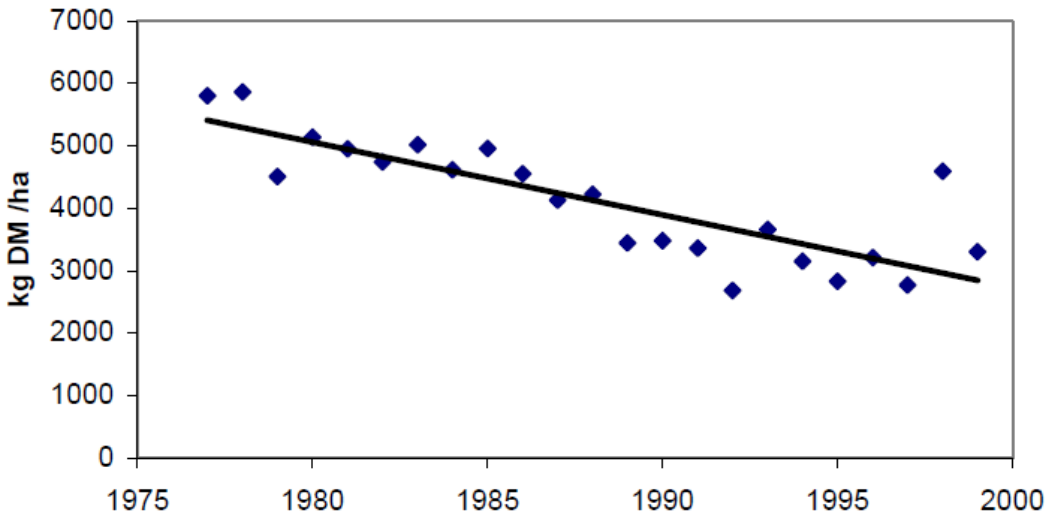


Figure 6.11 – Mean hay yield from East Cottingwith flood meadows (Derwent Ings, Yorkshire) ($R^2 = 0.69$) (Gowing *et al*, 2002)

Figures 6.10 and 6.11 both show clear downward trends in productivity and the long term trend line indicates an approximate halving of typical yields over the recording period, from yields towards the upper end of the range of yields expected for such meadows, towards yields towards the bottom end of the range cited by Gowing *et al* (2002b). In the case of the Derwent Ings,

controversy surrounds the impact of flood defences implemented on the River Derwent in the 1970s that altered flood patterns on the floodplain grasslands and reduced the amount of flood silt deposited on the meadows (McDonald and Howard, 2001). In the case of Mottey Meadow, the farmer of the fields in question relates the decline to the restrictions placed by Natural England and its predecessors on manuring practices since the 1980s (Natural England, 2005). Although no other such continuous time-series records have been found so far from farmer-managers, similar downward trends in productivity are hinted at elsewhere such as in the data provided by Natural England for North Meadow, and anecdotally by farmers here and at other meadows.

For North Meadow, English Nature/Natural England have records of the hay cut yields from 1999-2005, and then again from 2010, although complete records for all areas of the meadow were collected only for 1999-2001 and from 2010 onwards. Figure 6.12 below shows an estimate of the average hay yield per hectare for North Meadow in these years.

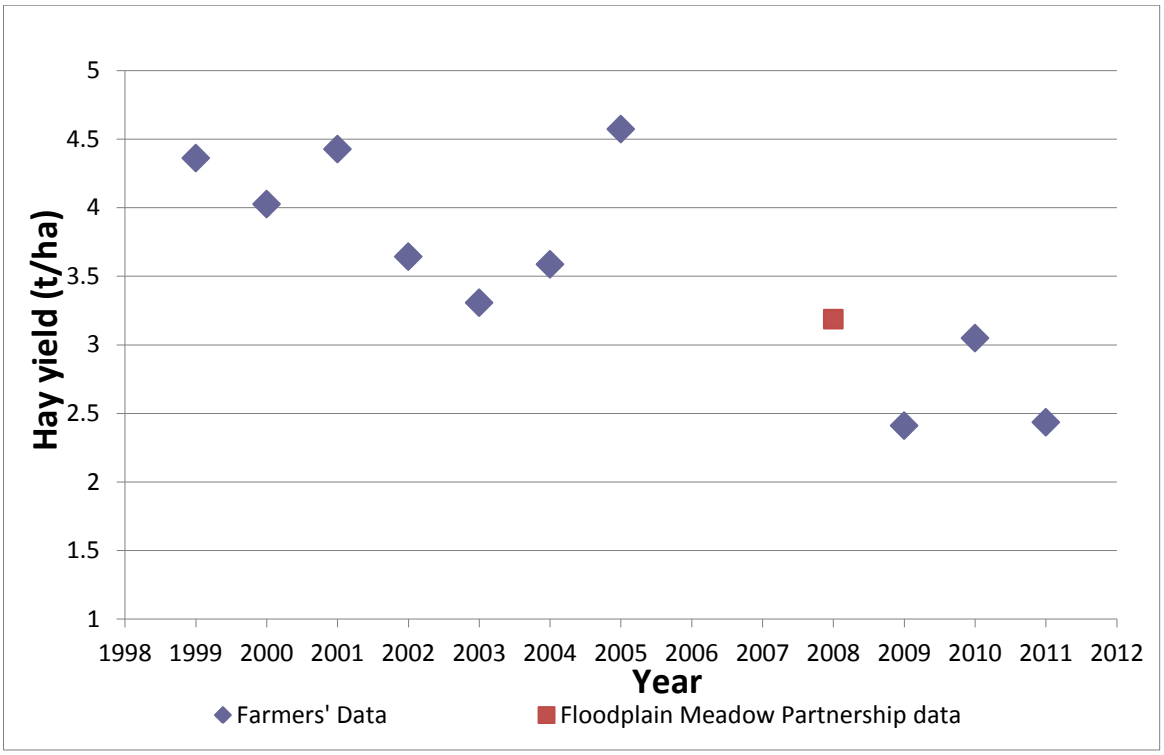


Figure 6.12 – Mean hay yields from North Meadow (estimated all compartments) 1999-2011. Farmers' data: $R^2 = 0.639$, $P = 0.006$, All data: $R^2 = 0.645$, $P = 0.003$

Figure 6.12 indicates that average yields from the meadow may now be lower than a decade ago. Whereas yields between 1999-2005 were estimated to be in the range 3.3-4.5 t/ha, in the mid to lower range for such meadows as cited by Gowing *et al* (2002b), the data from 2009-2011 suggest yields in the range 2.4-3.0 t/ha at the bottom end of the cited yield range for floodplain meadows and MG4 grasslands.

Farmer NMC2 felt hay yields had declined and he said that he kept records of his annual hay yields though it was not possible to obtain these for the purposes of this research. In a good year he thought he got about 1t/acre (approximately 2.5 t/ha) but it varied from year to year. Such data as he had supplied to Natural England was obtained from the Natural England site manager (see Figure 6.13 below for the southern compartments only). Whilst the data time-series is very limited it suggests a decline in typical hay yields from moderate yields in the range 4-7 t/ha in the late 1990s, early 2000s, declining to perhaps typically below 4t/ha. It is this southern area of North Meadow where the farmers have complained of the spread of meadowsweet and low grass sward content. Continued monitoring would be required in order to clarify any trend in yields.

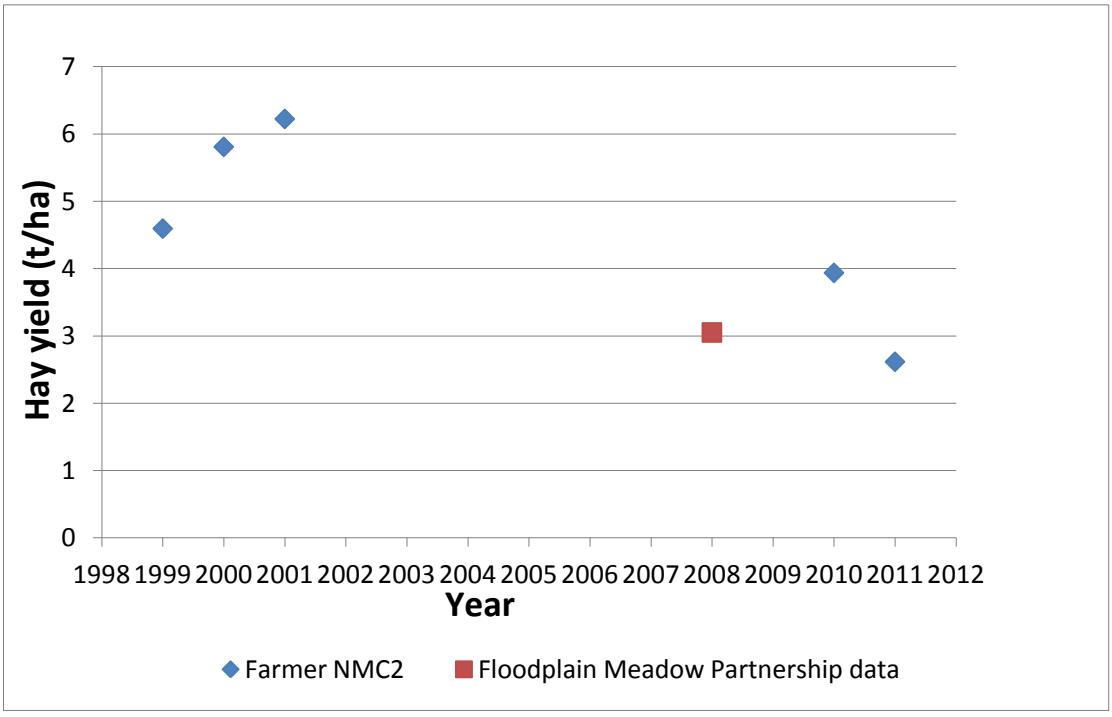


Fig 6.13 – Mean hay yields at the southern end of North Meadow (compartments 12-15 only)

Farmers' data: $R^2 = 0.667$, P = 0.092, All data: $R^2 = 0.685$, P = 0.042

Meanwhile, Farmer NMC3 said that he was always happy with his own yields, which are from compartments at the northern end of the meadow and he said they varied from 70-100 bales/acre (estimated to be approximately 4.3 – 6.2 t/ha). These figures indicate moderate to high yields for this area of the meadow. Data supplied by Natural England (Figure 6.14 below) confirmed yields to be in this range, and indicated that no decline in yields has taken place over the past decade. He informs Natural England of the number of bales made but no longer keeps records of the yield for his own purposes.

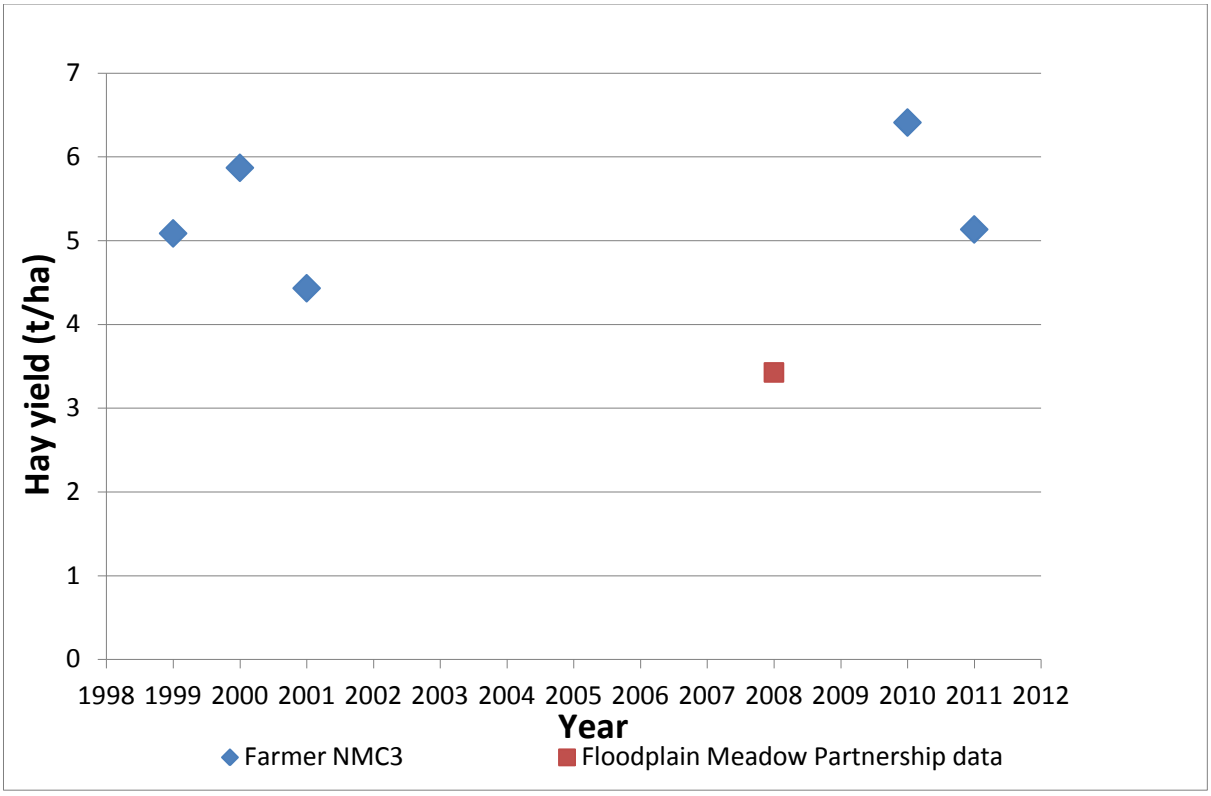


Fig 6.14 – Hay yields in tonnes/hectare at the northern end of North Meadow cut by Farmer NMC3

Farmers' data: $R^2 = 0.146$, P = 0.525, All data: $R^2 = 0.0004$, P = 0.968

Many comments made by farmers regarding change in floodplain meadows related to changes in the biological productivity of the meadow grassland and changes that related to the quality and quantity of hay produced. In 2001 the Natural England condition assessment for North Meadow

found the southern end of the site to be much grassier than the northern end, yet by 2011, the farmers were of the opinion that the northern end of the meadow was more productive than the southern end. As seen, yield data collected in 2010 and 2011 indeed confirmed that hay yields appeared to have dropped significantly at the southern end of the site to levels considered to be relatively low for this type of meadow. This therefore may explain the fact that Farmers NMC1 and NMC2 who manage the southern compartments are more dissatisfied with the hay yields and quality than Farmer NMC3.

The southern end of the meadow, which the farmers consider to be in poor condition as a result of low productivity and a predominance of meadowsweet, is excluded from the Natural England condition assessment because it is not considered to be good MG4 grassland, despite being managed as meadow, and being within the boundary of the SAC and SSSI notified areas. It appears therefore to be excluded from the area of relevance to conservation (despite being shown as MG4 grassland on the NVC map with some MG7) because its condition appears to have deteriorated in such a way that it is effectively 'lost' from the meadow. Yet the rapid condition assessment is presumably intended to detect such changes and prevent just such losses. It is in this area particularly where Farmer NMC3 has detected the greatest fall in hay yields to quite low levels, suggesting that management intervention may be needed.

Table 6.15 below summarises yield estimates for other meadows studied for this research, where data were available.

Table 6.15 – Yield estimates for various floodplain meadow grasslands

Meadow Site	Year	Yield estimates (t/ha)	Area of estimate (ha)	Source of data
Oxford Meads SAC Pixey	2010	3.6-4.2	3.0	FAI Farms Ltd
Oxford Meads SAC Pixey	2010	5.5-6.1	41.6	FAI Farms Ltd
Oxford Meads SAC Yarnton	2010	4.6-5.2	31.1	FAI Farms Ltd
Oxford Meads SAC Wolvercote	2010	3.2-3.8	2.32	FAI Farms Ltd
Oxford Meads SAC Wolvercote	2010	3.5-4.1	2.41	FAI Farms Ltd
Oxford Meads SAC Wolvercote	2010	2.1-2.5	1.26	FAI Farms Ltd
Oxford Meads SAC Pixey	2011	1.5-1.7	3.56	FAI Farms Ltd
Oxford Meads SAC Pixey	2011	4.2-4.7	41.55	FAI Farms Ltd
Oxford Meads SAC Yarnton	2011	2.3-2.5	31.06	FAI Farms Ltd
Oxford Meads SAC Wolvercote	2011	2.3-2.6	2.32	FAI Farms Ltd
Oxford Meads SAC Wolvercote	2011	2.8-3.1	2.41	FAI Farms Ltd
Oxford Meads SAC Wolvercote	2011	1.4-1.6	1.26	FAI Farms Ltd
North Meadow Cpts 2-4	2010	6.4	9.0	Natural England
North Meadow Cpts 12-15	2010	3.9	8.4	Natural England
				Natural England
North Meadow Cpts 2-4	2011	5.1	9.0	Natural England
North Meadow Cpts 12-15	2011	2.6	8.4	Natural England
Brook Meadow	2011	4.6-5.4	1.7	Farmer
Brook Meadow	2012	2.4	1.7	Farmer
Long Mead	2002	1.8-2.0	6.32	Owner
	2003	2.2-2.5	6.32	Owner
	2009	4.1	10.46	Owner
	2010	2.8	10.46	Owner
	2011	2.7-3.4	8.46-10.46	Owner
Birches Barn	2011	3.0-3.2	10.7	Farmer
Deans Green[10]	2010	0.9	4.5	Farmer

Note: Estimate ranges based on range of bale sizes provided by data source

The above indicates that hay yields vary significantly between meadows, between different areas of the same meadow, and indeed in the same meadow from year to year. Meadows do therefore appear to vary considerably in their productivity in time and space and show considerable individual character in this regard.

[10] Deans Green meadow is not on a floodplain. However, as it is considered to be MG4 grassland by the owners, it is managed as a floodplain meadow.

It has already been noted above that conservation stakeholders consider that the productivity of the meadows is secondary to its botanical composition. However, such productivity, whilst a key component of agricultural value, is also an aspect of biological system function. Changes in yield may therefore be an indication of a change in system function. Apart from signifying a decline in agricultural value, this may also indicate system change that could well impact on aspects of the value of the meadows as perceived by conservation stakeholders, such as floristic composition. Whilst a clear relationship between botanical criteria such as species richness and productivity such as hay yield is hard to confirm, consideration of the average Ellenberg N values for the 'constant' characteristic species of MG4 and MG5 grassland (Rodwell, 1992) indicate that MG4 grassland typically exists in systems with a higher nutrient status than MG5 grassland (Table 6.16 below).

Table 6.16 – Average Ellenberg N value for species cited in the frequency tables for MG4 and MG5 plant species assemblages in Rodwell (1992)

Plant community Assemblage	Species	MG4	MG5
Ellenberg N value Mean (range)	All cited in description	4.2 (2-8)	4.0 (2-8)
	Frequency classes IV and V	5.2 (3-7)	4 (3-6)
	Frequency class V	4.6 (3-7)	3.5 (3-4)

It may also suggest that as nutrient levels fall below those typical of MG4 systems, the floristic composition may begin to alter, for example moving towards a composition more typical of MG5 or other assemblages typical of lower nutrient status. This contrasts with narratives in the North Meadow Management Plan, which suggest that manuring is a potentially damaging operation under all or most circumstances and the experience of the hay farmers there that manuring is not permitted in practice if not in theory. Whilst evidence from field experiments (Mountford *et al*, 1993, 1996) do indeed indicate that rising nutrient status on floodplain meadows alter their

floristic composition, this may well be true for decline in nutrient levels to low levels also. Indeed Figures 6.3-6.7 and A2.24-A2.35 all indicate that there is no clear negative correlation between hay yields and species richness or presence of positive indicators herb species.

6.8.5 Overview

Overall, there appears to be significant correlation between the various criteria of botanical value used by conservation-oriented stakeholders, particularly where these are based on species identity (presence/absence) rather than abundance. The positive indicator species in the Natural England (and other related) condition assessment do therefore appear to be correlated with overall species richness, similarity to the MG4 description and thus with other botanical criteria, and so are capable of indicating desirable aspects of botanical value. However, as noted, without additional contextual information such as experiential knowledge of the meadow assessors, the condition assessment may miss important changes in meadow composition and function.

Furthermore, little attention is paid by stakeholder assessments to hay yield as an indicator of biological productivity. Yield data obtained suggests productivity is site-specific and varies significantly from site to site. Assumptions regarding the significance of productivity cannot therefore be generalised across all meadows. Furthermore, whilst the relationship between yield and botanical criteria such as species richness is not clear, declining productivity may be as associated with declining botanical value as is high productivity.

More broadly, stakeholder assessment practice is dominated by the activities of conservation stakeholders whilst farmers now see little point in undertaking assessment to inform management. Conservation stakeholders' aims and motivations for undertaking assessment activity are not always clear. Their assessment practice is dominated by a focus on botanical aspects of meadow value and a desire to objectivise measures of meadow value. Despite a frequently stated desire to record meadow management as part of a model of responsive management, this rarely occurs.

Chapter 7 – The role of assessment in meadow management decision-making

7.1 Introduction

The aim of this chapter is to establish what relationships exist between stakeholders' assessment practice, established in Chapter 6 and underpinned by the understandings on meadow value established in Chapter 5, and decisions made by stakeholders about the management to be delivered on the meadows during the year. Is an interrelationship, such as that illustrated by the model of responsive management in Figure 1.1 or indeed an alternative model, discernible in stakeholders' activities and decision-making?

For each of the main management activities required on a traditionally-managed floodplain meadow, the views and opinions that stakeholders hold about meadow management are first considered. What do they consider to be good or bad practice, and what problems and conflicts do they perceive in meadow management both between their own priorities and with those of other stakeholders? This includes what opinions, if any, stakeholders hold about the concept of 'traditional' management and what meaning they attach to this concept. The aim here is to establish the extent to which the management delivered is in fact pre-determined to some extent by narratives embedded in stakeholders' beliefs about meadow value and management, or whether there is scope to make decisions regarding management, based on other factors. Such factors that were considered to influence decisions on management during the year, whether to vary this or to keep it the same as in past years are considered, and whether assessment activities during the year, either of meadow condition, status or management, proved to be a significant factor in shaping views on management and its actual implementation.

This chapter begins by considering the views of stakeholders on meadow management and what views if any they hold regarding traditional management, as well as evidence of tensions between

stakeholders regarding how the meadows should be managed. It then goes on to consider how these perspectives and tensions influence specific management operations that are undertaken during meadow management and how decisions are made regarding these operations, including how the stakeholder network operates to perhaps favour the views of one or more stakeholders over the others. Evidence of the factors that influence management decision-making is reviewed and the relative importance of assessment activity evaluated. Finally, the implications for the future of meadow conservation of these decision-making processes and the use to which assessment results are put are considered, including threats to the future sustainability of the current meadow conservation practices.

7.2 Tensions between Stakeholders regarding Meadow Management Practices

Tensions were evident between conservation-oriented stakeholders and farmer-managers to varying degrees at all three main case study sites. These were perhaps sharpest regarding the appropriateness of the application of farmyard manure as fertiliser and the permissibility of rolling and harrowing. These operations were considered desirable by farmer-managers, but tightly restricted by Natural England at all sites either as a potentially damaging operation on a SSSI or under the HLS agreement or both. At all three meadow sites, Natural England was able to impose specific practices via the above legal and contractual instruments, with little scope for flexibility for the farmer-managers. At most meadows no evidence was found that these practices have taken place in recent years. As regards the hay cut, most farmer-managers tended to want to cut the hay earlier than Natural England would like. Again Natural England were able to determine the practices to be adopted through SSSI and HLS provisions, but did sometimes show greater flexibility on this issue.

Tensions arose as conservationists sought to impose management regimes that they perceived to maximise botanical aspects of meadow value from their perspective, but that farmer managers

saw as prejudicial to their view on meadow value, which revolved around hay quantity, hay quality and convenience of the management in fitting in with their other work commitments.

In relation to grazing regimes, the extreme difficulty that meadow owners experienced in finding stakeholder partners to engage meant that conservation stakeholders' control over the grazing regime was markedly weaker and conservationists were forced to accept whatever grazing regime was convenient for the grazier stakeholder.

As noted in Chapter 5, farmer stakeholders' views on the broader value of meadows were such that they could often share the enthusiasm of conservation stakeholders for non-agricultural aspects of meadow value. This said, when it came to their opinions on the meadows' agricultural value, the validity of the contemporary management regime and their motivations for being involved in meadow management, the farmers were generally critical and less positive. The hay farmers were the most critical of contemporary management as they are directly affected by conservation-oriented restrictions on management operations. The utility and value of the meadows to graziers was less affected by such restrictions and they were less critical of meadow management and condition, but they nevertheless often showed limited enthusiasm for involvement in meadow management, suggesting that they often saw the meadows' agricultural value as somewhat marginal. Stakeholder networks that deliver management on meadows therefore appear to be fragile to some degree, constituting a significant risk to the sustainability of meadow management into the future.

7.3 Views on Meadow Management and 'Traditional' Management

7.3.1 North Meadow

The management plan for North Meadow (Natural England, 2008) lays out the philosophy and principles behind the site's management. It states that the management of the meadow has remained largely unchanged over the past 150 years at least. It notes that:

> The basic management regime of the meadow (hay making followed by grazing) has long been defined by statute and should remain unchanged. Associated agricultural practices such as rolling, harrowing and mucking have all been shown to be potentially damaging to the meadow communities and so should be strictly controlled to keep damage to a minimum. This can be achieved by limiting the timing and rate of operations.

The statement in the management plan for North Meadow that basic management should remain unchanged clearly indicates that long-established or 'traditional' management practices should form the basis of future management, not unreasonably perhaps, as these would have been the very practices that produced the meadow in the first place. Detailed evidence regarding the precise practices that constitute traditional management is not presented, but it is suggested that these are well known and understood and makes no suggestion of disputes over how the meadow was managed in the past. The comments regarding rolling, harrowing and mucking do not specify under what circumstances these operations are deemed to be damaging, nor the source of evidence that they are as such. Indeed interviews with the managing farmers suggested some confusion over whether or when these operations might be allowed. As noted in Chapter 2, the broad outline of traditional management for such meadows is well known (Crofts and Jefferson, 1999) and indeed is known for North Meadow (Gilbert,1996), but as seen from Gilbert (1996) and Sheail (1986), the detail of management will have varied in time and space, depending on the desired agricultural end product.

At North Meadow there appeared to be a strong element of agreement among the three hay farmers that the management of North Meadow differs significantly from traditional management. Indeed they and various other older inhabitants of Cricklade appear to consider that present management differs significantly from the management of the meadow in the early and mid-20th Century. The hay farmers all question whether continuation of the current management regime will continue to deliver a meadow with the same material characteristics or value as in the past, at least as seen from their perspective.

These views and concerns do not appear to be shared by the grazier or Hayward, although the grazier did note similar issues regarding the difficulty of engaging local farmers to deliver a suitable grazing regime at the site, at least as a result of the decline in small-scale cattle operations in the local area. This said, his interest in the meadow as a resource differed from that of the hay farmers.

The opinions expressed particularly by the hay farmers about appropriate and traditional management of the meadow appear to be in sharp contrast with some of those expressed in the site management plan, which problematises many of the operations that the farmers deem to be essential to the continued good condition of the meadow. There is evidence that present management is in fact a hybrid between traditional and other practices, which as already seen try to reconcile botanical value and bird interest value, but that ignore agricultural value and reject economic value as a significant consideration. This is despite the latter having been central concerns of traditional management practices that produced the meadow in the first place. As seen in Chapter 6, botanical value is partly inter-related with agricultural value (both depending on botanical composition), and the bird-interest is a non-traditional concern. The Natural England site manager meanwhile appears to occupy an intermediate position between the management plan and the farmers in agreeing with their view that the management is not entirely traditional.

Changes in farming techniques in terms of equipment types, as well as possible changes in flooding patterns also suggest that the long-standing traditional management practices, even where these are known, may no longer deliver a meadow with the same characteristics as in the past, thereby decoupling the link between traditional meadow composition and traditional management practices, forcing a dilemma between conserving the material meadow artefact, or management practices. In this regard the conservationists may be justified in deciding to prioritise one over the other, in this case meadow condition and material composition.

However, conservationists' anxieties over the negative impact of management practices that may well be traditional such as manuring, could be influenced by stakeholders narratives about

meadows and their management. For example, a desire to frame the meadow as natural not cultural as noted in the management plan may lead to anxiety about robust human intervention in meadow management and a presumption towards minimum intervention. They may therefore end up protecting the meadow against human practices that created the meadow in the first place.

The tensions created by such issues appears to be impacting on farmers' motivations for involvement in meadow management, and already the grazing has moved from being based on licensees to being based on contractors. As two of the three hay farmers are in their 70s and may be expected to retire in the next decade, the economic structure of the hay farming may too have to change in this way in order to incentivise local farmers' continued participation.

The three farmers who cut the meadow hay at North Meadow expressed views on the site's management that suggested significant tensions between them and the conservationists. Farmer NMC1 did not agree with how the meadow was being managed and did not consider it to be traditional. He held strong views on the current management as differing from the long term historical management and indeed that which his father-in-law undertook before the 1970s. He clearly felt that the present management was insufficiently interventionist and would be likely to lead to the decline of the meadow. He said that if allowed to he would cut the meadow earlier, fertilise it with manure and chain harrow it in the Spring, but thought that all these activities were forbidden by Natural England. Given this farmer's views on the value of the site as discussed in Chapter 5, this meant decline in the agricultural value in terms of hay quality and quantity. He also said that the management was much the same from year to year as there was no flexibility and changes were only imposed by floods. He said he did try to negotiate early cuts with Natural England but that they were inflexible and that there was no real negotiation.

He also claimed that the Court Leet did not really manage the grazing and that the farmers had no say in the management. Theoretically the Court Leet should manage the grazing of the meadow in winter but he claimed in fact that Natural England manage all aspects all year and the Court

Leet merely rubber stamp their decisions. Indeed the Hayward said that Natural England do most of the organising and consult the Court Leet, which to some degree agrees with the farmers' and grazier's assertion that Natural England lead on management including the management of grazing.

Farmer NMC2 said that there was not enough two-way communication about management and he characterised the Natural England managers responsible for the site as lacking understanding of agriculture:

> You sign the agreement and take it or leave it.....That's the heart of the problem over management and they won't listen to suggestions. Natural England want to listen to people who understand the job.

Again, this farmer felt that the current meadow management would not maintain the meadow's value, which for him was primarily agricultural (hay quality and quantity) and as seen in Chapter 6, this farmer appeared to be experiencing significant declines in hay yields on the Southern-most compartments that he cuts. He clearly felt that the conservationists were not interested in the farmers' opinions on the meadow's condition or management and that an effective two-way communication did not exist between the two sides. Again this is likely to be the result of disagreement over what the meadow is for and the lack of acknowledgement of the importance of the agricultural value of the meadow.

Farmer NMC3 thought the management was acceptable but could be better and he did not regard the current management as traditional management. He said that Natural England dictated what to do and there was no negotiation. He said he made recommendations to Natural England but that there was no formal process for doing this and he did not know if it had any effect. As a result the management stayed the same from year to year.

In contrast with the hay farmers, the Hayward did think the management was "pretty much traditional management", although he did note changes in the horse grazing regime, the lack of cattle grazing and cessation of chain harrowing as non-traditional practices.

The Natural England site manager said that the management was fairly flexible and that the provisions of the management plan were a default, but that management had indeed tended to be similar over the past 40 years since the Nature Conservancy Council bought the site.

7.3.2 Brook Meadow

The first documents produced by English Nature regarding Brook Meadow were the SSSI citation, which says little about management, and the associated list of Potentially Damaging Operations (PDOs) dated May 1995 (EN, 1995b). This listed a range of operations likely to damage the grassland conservation interest including new agricultural operations and changes to the hay cutting and grazing regime, addition of agri-chemicals, change of land use, species introductions or removals, and changes to the hydrological drainage regime, all of which represented a move away from past management and land use practices.

The Site Management Statement (English Nature, 2000) cites the required management actions, including (amongst others) the requirement to [my emphasis here]:

- Chain harrow the meadow in April *if necessary*
- Mow the meadow for hay in mid or late July *according to the season*
- Graze the aftermath with 4-8 cattle from late August until the end of November
- Monitor the recurrence of meadow thistle *and consider re-introduction from nearby Monkspath Meadow if there are no records by 2002*
- *Monitor the diversity of plant species in the meadow* once every three years
- *Review the management of the SSSI interest in 2003 when the management plan is revised*

These provisions do therefore seem to allow some leeway for interpretation and flexibility. All other discussion of management operations and what may constitute appropriate management was found in the management plans produced by the site-owning Trust (Segawa and Wright, 2011, n/p). The site management plan notes that:

> The site has probably had a long history of traditional management as a hay meadow, which has led to the rich, diverse flora present today.....the management of these sites by cutting hay and grazing the aftermath is well-established and no variation from this should be considered. Substantive decisions on management are only required for the periphery of the site, the hedgerows, stream and marginal trees.

An earlier management plan (Warwickshire Wildlife Trust, 1997) indicated that "traditional management is likely to date back to at least the late 19th Century" (n/p). This suggests that, notwithstanding the uncertainty expressed above about knowledge of past management, this management has led to the site's desired characteristics and should remain unaltered from the standard default. The Reserves Biodiversity Officer said that the Trust had used a consultant to draw up management plans though the last update has since been produced in-house by the Trust's staff:

> The plans are pragmatic and realistic and it's about the resources to hand and the Trust's ability to deliver. He is a professional ecologist using national guidance and textbooks: it's not an exact science and every site is different.

This appeared to acknowledge that whilst standard references were used as an external set of references against which Brook Meadow was judged, the site was nevertheless in itself a unique assemblage. It was not known whether the consultant had discussed past management with the previous owners and farmers. The Reserves Manager said that the Trust now did this looking at the previous 10-20 years but thought it unlikely that they investigated past management over longer timescales such as the past 100 years, suggesting that their conservation baseline is only based on relatively recent knowledge not the longer-term historical condition of the meadow. The Reserves Manager thought that the site hadn't changed much in recent years and so management was probably fairly continuous with the past, and thought that encroachment [from boundary trees and shrubs] was more of an issue.

According to the Reserves Manager, the Trust prescribed what it wanted in terms of cut date and number of grazing cattle, and Trust staff visited the site once a year to check upon the operations. To this extent there was monitoring of management in the sense of checking that the required operations of hay cut and grazing had been undertaken, but not in any greater detail. This said, no records had been kept on file of such visits and no evidence was found that such visits had actually occurred in recent years.

The farmer who cuts and grazes the meadow did not express any strong views on current meadow management and expressed no opinion as to whether the meadow management could be considered traditional. He said that he would prefer to cut the hay earlier than the Trust's prescription, but also thought that it was better to manage a site like Brook Meadow traditionally for conservation as otherwise its agricultural value was limited.

7.3.3 Long Mead

The owner of Long Mead considered that the site management was largely in keeping with long standing pre-industrial farming practices and was therefore broadly traditional. As part of the agri-environment agreements, fertiliser application is not permitted (apart from farmyard manure). Overall the current owner thought that the management worked "mostly more or less". She felt it was "fine and roughly what had always happened on the site". She also felt that whether she could be optimistic about the meadow's future depended on what happened regarding climate change and that optimism would be difficult if more summers floods occurred unexpectedly before the hay cut. In this last regard the owner perceived that the weather was increasingly unpredictable for making hay, suggesting that the site was fragile with regards to a shifting baseline where the traditional management practices might no longer deliver the same meadow. The 2007 hay crop was lost due to flooding and again she said that a June date would provide more time to deliver a timely hay cut. Indeed, in 2011 the site was seen to be cut between early August and mid September, much later than the 15th July, with cattle grazing seen to have commenced by 9th October with 32 cattle, and to have ended before 20th November.

The Hay Farmer was also of the opinion that the management was "fine" apart from a problem with moles. As noted in Chapter 3, little detail appears to exist about long-term meadow management, but that all the stakeholders involved in managing the site feel confident that the meadow management is traditional in the sense of being largely unchanged over the recent decades, which they also take to suggest that it has changed little since before living memory. The grazier also did not express any opinions on the management other than to say that he thought that it was essentially the same as 50 years ago when he was a child. The Natural England HLS advisor for Long Mead said that she was happy with the current management but acknowledged that the meadow's owner sometimes struggled to get contractors to undertake the management operations.

Apart from a possible desire by the owner to cut the hay in June, there did not appear to be any other significant tensions between the various stakeholders regarding how the meadow should be managed, and the HLS prescription mostly therefore appeared to represent a consensus of how the meadow should be managed.

7.4 Specific Management Operations

7.4.1 Fertiliser application and the influence on aspects of meadow value

Commentators interviewed by the Court Leet (Snakeshead Revisited Project, 2010) regarding North Meadow noted that in the early to mid 20th Century the meadow was chain harrowed by some farmers after 12th February and was fertilised with farmyard manure. Following purchase by the Nature Conservancy Council and the declaration of the site as a SSSI and National Nature Reserve, the NCC put an end to manure spreading from 1970s. Two interviewees claimed that the meadow used to have a higher proportion of grass with respect to "weeds"[11] and one said that the hay cut could start as early as 10th June. The Natural England site manager agreed that in the past more manure may have been added than presently. As noted already, comments in the

[11] Herbs

2001 condition assessment also indicated that the southern end of the site was grassier than currently. The grass was also alleged to be taller.

As already noted, the North Meadow management plan notes that:

> Although there has been considerable pressure from local farmers for mucking to continue on the meadow, Natural England takes the view that floristic diversity is more important than hay yields or profits. Mucking will not be allowed at all within the NNR sections of the meadow... (Natural England, 2008, p2.2/5)

As noted in Chapter 2, work by Mountford *et al* (1993, 1996) indicates that nutrient enrichment of semi-natural grassland swards can indeed lead to reduced species richness. However, as also noted and discussed in Chapter 6, the response of sward species richness may be complex, and may potentially also decline or change at low levels of soil nutrient status with the optimum intermediate nutrient status for species rich swards poorly defined and likely to be site-specific. Furthermore, a range of sources also suggest that historically manure was in fact permitted on the meadow (Gilbert, 1996; Snakeshead Revisited Project, 2010; Hayward, pers. comm., 12/03/11) and so a prohibition on this activity would represent a non-traditional innovation or a presumption towards minimum intervention. According to the Hayward farmyard manure was added in the past in an informal way in that farmers added whatever they had left over from their other land.

In this regard farmers appeared to be critical of the prohibition on rolling, harrowing and manuring and maintained that manuring would have been part of traditional management. Natural England have stated as policy (see quotes below) however that it is their opinion that floodplain meadows are fertilised by flood silt and therefore (presumably by definition) do not require further fertilisation either by traditional methods with farmyard manure nor with modern technological methods using chemical fertilisers.

This latter philosophical position that fertilisation of meadows is a question of 'all or nothing' does not appear to allow for the fact that each site is unique and will have different flood patterns.

These may or may not provide sufficient fertilisation and the extent and duration of flooding will vary across a site up to the edge of the floodplain where dry conditions pertain and meadows tend to have a more Old Hay Meadow or MG5-like composition. Indeed at Mottey Meadow SAC/NNR, Staffordshire, the site's floodplain meadow-like grassland sward results from hydrological conditions that are partly furnished by groundwater flow and only partly by flooding from a nearby small stream (Natural England, 2005).

Nor does the prohibition of manuring allow for changes in river catchment management that may have altered flood patterns and nutrient import to an extent where traditional fertilisation practices will no longer deliver the same meadow, forcing the dilemma of either conserving the meadow materially by abandoning conservation of traditional practices, or abandoning the material traditional meadow and its botanical composition in order to conserve traditional farming practices (Harris, 2006). As noted, the current view on cultural heritage conservation, at least within Natural England, appears to be that preservation of material artifacts of cultural heritage would appear to generally take precedence over preservation of traditional practices.

According to farmer NMC1, in the past the meadow was chain harrowed and rolled in the spring with an addition of farmyard manure, but not lime. He thought that the meadow would decline without rolling and harrowing, which aerates the soil and clears the "mess"[12] left by winter flooding. Farmer NMC1 felt that just cutting and grazing was not sustainable as "you're taking out but never putting back" alluding to the lack of nutrient inputs. Farmer NMC 2 agreed that it was not always good to use chemical fertiliser as it reduced the herb variety and encouraged "rubbish" (weeds), but he also said that gravel ground was "very hungry and needs feeding", referring to the relatively free draining nature of the soils and sub-strata that allow nutrients to leach away in water flows percolating down to the water table. He didn't feel that management was as it should be and was not traditional management:

> It needs farming correctly; you can't keep robbing the ground.

[12] Remaining leaf litter

Farmer NMC2 also said that years ago it would have been rolled, manured and harrowed. Farmer NMC3 too saw the lack of manure addition as "taking but not putting back" and thought there was a need to "feed the ground" as the flooding did not fertilise adequately. He thought the quantity of hay could be increased without affecting quality. According to the yield data presented in Chapter 5, the compartments cut by Farmer NMC3 were the most productive and didn't appear at least on the basis of limited evidence to be suffering from any significant decline. This said, of the three hay farmers he was the happiest with his hay crop, perhaps precisely because he was the farmer whose hay yields did not appear from the limited data to have declined.

At Brook Meadow, disputes over fertilisation of the meadow were less acute. The management plan notes that (Segawa and Wright, 2011, n/p):

> The application of pesticides including herbicides or fertilisers would be damaging but periodic dressings of well-rotted farmyard manure may be acceptable if the sward does not receive regular input of nutrients from flooding.

This appears to acknowledge, in spite of Natural England policy, that flooding may not be sufficient to maintain the system's nutrient status. According to the Trust officers, Brook Meadow floods regularly and the Trust haven't added nutrients or harrowed the site. Meanwhile the farmer had not carried out these operations either nor expressed a desire to do so.

At Long Mead, the HLS agreement permits an application of well-rotted farmyard manure every other year. However, neither the owner, nor the farmers stated that they had done this in recent years.

7.4.1.1 Decline in hay yields

As already noted, associated with the discussion of the validity of fertiliser addition to floodplain meadows is the issue of whether hay yields are declining on meadows. The North Meadow management plan does acknowledge that local inhabitants of Cricklade believe that the hay yields

have been declining on the meadows. Whilst the management plan does not refute or support this contention, it goes on to say that:

> Local inhabitants believe that hay yields have been declining on the meadow in recent years. They attribute this to a fall-off in the practice of manuring the hay plots annually. It is probable that this belief is only partially correct; some of the drop in yield can be attributed to a cessation of flooding over parts of the site. Drop disc measurements of the vegetation height suggest that lack of flooding causes about a 20% drop in yield whilst lack of manure causes about a 15% drop. English Nature's view is that in a regularly flooded meadow the application of farmyard manure is not necessary. Hay yields will be monitored, however annual hay yield returns requested from licencees are not always provided. (Natural England, 2008, p2.2/2)

This suggests that hay yields have fallen by around a third despite the assertion that such floodplain meadows require no fertilisation to maintain their productivity. A contradiction is therefore also implied here in that on the one hand a regularly flooded floodplain needs no fertiliser addition, yet yields are suspected to have fallen as a result of declining flooding. This indicates that local perceptions of falls in meadow productivity (as noted in the Oral Local History (Snakeshead Revisited Project, 2010)) as a result of falling levels of nutrient replenishment may indeed be correct irrespective of the cause, either reduction of flood frequency or cessation of manuring. Both factors appear to constitute step changes in the historical site nutrient imports, the former an off-site external factor potentially beyond site managers' control at least in part, the latter an on-site internal factor largely within the control of site managers. To this end a bund was removed along the banks of the River Churn in the summer of 2011 to attempt to reinstate earlier flooding patterns. A third factor affecting meadow nutrient levels noted by all three farmers who cut the hay is the cessation of off-site fertilisation of the adjacent land owned by the Co-op in recent years such that nutrient run-off onto the meadow no longer occurs.

As noted in Chapter 6, hay yields have in fact been recorded very intermittently at North Meadow and it is not currently clear whether yields are declining or not. However, limited data suggests that this is the case at least at the southern end of the meadow. Despite this, the management plan goes on to state that Compartments 11 and 15 at the South-East end of the meadow are less rich in flora and attributes this to being exacerbated by continued application of manure, though this conclusion was not be attributed to research from a specific study. However, it is understood from discussions with the farmers that cut these compartments and the Natural England site manager that this practice has ceased. Also, as noted in Chapter 6, the farmers of Compartments 11- 15 have noted what may be significant declines in yields from this area to relatively low levels.

7.4.2 Hay cut date

7.4.2.1 North Meadow

Some insight into the hay cut in the mid 20th Century was provided by the Hayward, appointed by the Court Leet to administer the grazing rights on the meadow. His family used to cut a part of the meadow and he was personally involved in the cut in the 1950s and 1960s. At that time he claimed that the cut began around the 1st June but that it is now cut later, which he thought was to let the hay drop its seeds. One commentators interviewed by the Court Leet (Snakeshead Revisited Project, 2010) said that the hay cut could start as early as 10th June.

At North Meadow the start date for hay cutting appears now to be dictated by Natural England to the farmers each year but can vary from year to year, suggesting some flexibility as noted by the site manager. The Management Plan only states that July is the appropriate time to cut the meadow and should be cut "when ready" but does not state a specific default start date such as the 15th July as commonly cited for other meadows, although the farmers' comments demonstrate that the cut start date can be this late. Past records of management for a period from the late 1980s/early 1990s indicate that with the exception of two compartments in the south east of the site that could be cut in late June, the rest of the meadow was cut from early July onwards.

In more recent years, interviews with the site manager and the farmers indicated that the default cut start date (though not noted in documentation) appears to be 1st July, has been later than this in the past, but between 2007-2011 has varied between 20th June and 9th July with the earliest being 15th June in 2012. The decision by Natural England to allow earlier cuts was to ensure that the meadow did get cut despite the weather, as the entire process can take several weeks, and in 2007/2008 and 2012 had been interrupted by summer flooding. After the summer flooding that affected the site in 2007 and 2008 and delayed or prevented the hay cut, the site was covered in litter. Further to this the Floodplain Meadow Partnership noted in its report of the previous year's botanical surveying (Floodplain Meadow Partnership, 2011) that following these summer floods, the species richness in the meadow sward was generally observed to decline (as seen also in Table 6.3). The Partnership therefore made the recommendation to Natural England that the hay cut be brought forward to late June to maximise the removal of nutrients in the hay cut and to subdue larger more aggressive species. Following this Natural England authorised relatively early hay cuts of the 1st July in 2009, 2010 and 2011, and the 15th June in 2012 to ensure that the cut took place and that the meadow got cut and cleared in a timely manner before the start of grazing and was not interrupted by the weather.

Observations of the management at North Meadow in the summer of 2011 showed that the meadow took over 5 weeks to cut and clear, and was seen as still not complete on 8th August, 4 days before the official start of Lammas grazing on the 12th.

Farmer NMC1 said that his father in law, who cut the meadow before him had always mowed the meadow at the end of June. He said that June weather was better for the hay cut as the weather was drier and a start date in July meant there were only weeks to clear the meadow before the 12th August. For him July was too late as by then the hay had begun to dry out, which diminished it in terms of quality.

Farmer NMC2 said that in a good year the meadow can be cut in two weeks even with fairly old machinery (30-40 years old). In this regard, if the hay cut starts at or before the 1st July then there

is time to do the cut the hay and allow for bad weather. Where the cut start date is the 15th July then this allowed little flexibility to cut it all before the 12th August if there was too much wet weather. He said he had many years association with the meadow and had lived in Cricklade since 1955, but that in those days he didn't remember it being cut as late as the 15th July. NMC2 said that he started cutting as soon as permitted and so the start of the hay cut was essentially determined by the cut start date in turn determined by Natural England.

Farmer NMC3 thought that being able to cut the hay from the 1st July was appropriate and that there was no need to cut in June, although 15th July was too late as the 'seed was starting to fall. He said that "you need to keep an eye on it", suggesting a need to assess the condition of the sward. He was allowed to cut his part of the meadow from 1st July in 2011 and was seen to have started by the 3rd July and to have finished by 29th July. He said that the decision when to cut was based on a range of factors, primarily the weather and other work priorities, though the formal cut start date of 1st July appears to have been a key limitation.

In some years then, assessment of meadow condition have had some influence on decisions on when to cut the hay. Summer flooding had impacted on meadow condition in ways that were noted by the condition assessment in terms of positive indicator species richness and litter layer presence. The Floodplain Meadow Partnership surveys that noted a decline in species richness (Wallace and Gowing, 2008) and their subsequent advice to cut the hay earlier may have combined with the condition assessment results to over-ride default prescriptions towards a later hay cut.

7.4.2.2 Brook Meadow

The HLS agreement from Brook Meadow, under section HK6 (maintenance of species-rich, semi-natural grassland) limits hay cutting to after 1st July. The Site Management Statement (English Nature, 2000) noted that:

> In neutral hay meadow, the above objective [of meadow management] is traditionally achieved by closing the fields to stock in the autumn and cutting the resultant growth as

> hay, usually in early July. The precise timing of the cut depends on local factors, including past management and current weather conditions, but should be after ground-nesting birds have fledged their young and any short-lived characteristic plants have set seed.

This indicates a flexible approach, suggesting that hay is normally cut in early July but in keeping with past practices and practical issues, but then states that the cut date should be a compromise with bird interest, a non-traditional concern. Again this suggests a tendency towards hybrid traditional-innovative management that tends to lead to cut dates limited to after the 15th July. Documentation found on file at the Trust's offices noted that the meadow should be cut in 'mid or late July' (1996) or 'after 15th July' (2002), though the sources of such information are not cited.

Past management contracts between the hay farmer and the Trust indicate that in the past the meadow cut date fluctuated between 1st and 15th July, with the site management plan up until 2011 stipulating that the hay crop should be taken in July. The new management plan of December 2011 is unclear containing limit dates of 1st July and 15th July, but the most recent management agreement with the managing farmer in 2011 stipulated that the hay be cut after 15th July. No policy of alternating early and late cut dates has been identified. Nevertheless there appears to be a trend towards a more clearly defined later default cut start date of 15th July.

According to the Reserves Manager the Trust can only set broad parameters for the timing of management operations within which the subcontractor farmer is free to make their own decision about timing depending on the weather and other demands on their time:

> The answer to the timing [of the hay cut] question really results from the weather and the farmer's availability. It isn't really in our control. We set the parameters i.e. no earlier than the 15th July and no later than the middle of August, but beyond that it is down to the other variables mentioned above. We cannot be more restrictive than that really.

The farmer said that he cut the hay after July 15th "after the flowers have finished" in accordance with the site management agreement. He said that he would prefer to cut the hay at the end of

June, as the hay quality has declined by mid July. He considered the main factor affecting when the meadow was cut to be the weather conditions:

> You don't want it to rain, you want a good window with plenty of sunshine.

So the prescribed cut date, followed by weather and other constraints on the farmer's time dictated the cut date and assessment of conditions wasn't significant as he considered the grass sward to be already past its best by the end of June.

The Trust's Reserves Manager said that he suspected that the farmers would want an earlier cut and the Trust is aware of this but is reluctant to agree to this.

7.4.2.3 Long Mead

For Long Mead, some limited comments regarding past and present management of the site were found in the notes of old surveys held at the Thames Valley Environmental Records Centre (TVERC) and in the County Wildlife Site citations from 2001 and 2004. In addition, some provisions regarding management that have been agreed between Natural England and the site owner are included in the HLS agreement. The County Wildlife Site (CWS) citation for the meadow noted at the time of writing (2004):

> The present management of taking a hay cut after the beginning of July followed by light grazing of the aftermath by cattle, is ideal for this ancient hay meadow.

Further to this the 2001 survey report notes that:

> The hay was formerly cut in June, but now not till July to allow the flowers to seed and birds to nest. The aftermath is lightly grazed by cattle.

It is not known whether any research was in fact done to back the assertion that the hay used to be cut in June, or indeed that the meadow was ancient, that is to say of very long historical standing. However, the site owner expressed her own doubt as to whether the meadow was indeed cut in June in the past, although no other evidence has been found to back or refute this assertion. If true, this again suggests a management hybrid between traditional and

contemporary practices intended to reconcile traditional and more recent views on the value of the meadow.

Overall, no stakeholder expressed the opinion that the 15th July limit cited in the HLS agreement on the hay cut was inappropriate. This said, the owner thought that hay cut in June was of better quality, and that a June cut would allow more time to cut the meadow in a timely manner although neither she nor the farmer expressed a desire to negotiate an earlier cut with Natural England under the HLS agreement.

> Getting it cut is very precarious and stressful especially in wet summer years. You're dependent on others. You need to look for five days sunshine and that the farmer should be cutting *your* meadow. Again it's easiest in June.

This suggested that a June hay cut would provide greater flexibility to deliver the hay cut in a timely manner. She said that the cut date varied a lot and is dictated by practical matters not meadow condition:

> [The farmer] has cut the hay as late as early September but after that the days are too short and cool and the hay doesn't dry. The grazing has tended to be more stable although if the cut is late then the cattle come on late.

The hay farmer commented that sometimes the weather is unsettled and in consequence the hay remains uncut until August. In total the whole process typically takes five days in ideal weather. He felt that by 15th July the hay is ready for cutting and so it is ideal to cut as soon as possible when there is a clear window of weather, though he felt that if left longer the hay crop would not decline in quality as rapidly as a commercial grass crop:

> Traditional meadow grass swards don't go off that quick. Commercial grass goes off quicker.....Even at the end of August there's still quite a lot of green..... I probably wouldn't cut earlier even if could. On my own land [a drier meadow] it's browning off and has set seed by then.

Thus, his own hay meadows needed to be cut at the end of June or in early July. This he attributed to the greater variety of grasses in old meadow swards, suggesting that the botanical diversity of meadow grass conferred on it the characteristic of maturing more gradually, in accordance with the findings of Tallowin and Jefferson (1999).

The hay cut in 2011 was seen to take place from early August to mid-September, after which it was grazed for a brief period of less than 6 weeks.

Overall, assessment of meadow condition, status or management did not appear to be a factor in making decisions regarding management as regards the hay cut. The Hay Farmer appeared to decide on the cut date based on the constraint of the HLS agreement to cut after 15th July, the weather and his other work commitments elsewhere.

7.4.3 Rolling and Harrowing

Commentators interviewed by the Court Leet (Snakeshead Revisited Project, 2010) regarding North Meadow noted that in the early to mid 20th Century the meadow was chain harrowed by some farmers after 12th February. As noted already, the management plan describes rolling and harrowing as potentially damaging operations, and farmers NMC1 and NMC2 appeared to believe that these operations are forbidden. According to records found on file at Natural England's offices, requests to roll or harrow North Meadow in the 1980s and 1990s were rejected by English Nature, leading to disputes where the farmers carried these operations out anyway, perhaps in line with what they had always done prior to NCC involvement. The Hayward noted that the meadow didn't get chain harrowed like in the past. He said that:

> Everyone used to chain harrow the plots years ago to get the rough stuff up. Perhaps now the farmers haven't got time?

In this regard Farmer NMC1 is very critical of what he sees as a prohibition on rolling and harrowing. NMC2 said that years ago it would have been rolled, manured and harrowed, whilst Farmer NMC3 said he was a 'great believer' in chain harrowing to remove dead grass whilst rolling gets rid of winter hoof marks. In contrast with the opinions of the other two hay farmers who

thought harrowing was not allowed, and in agreement with the provisions of the management plan, Farmer NMC3 requested permission and was allowed to chain harrow in 2011, despite the assertion by the other farmers that this was forbidden, suggesting that communication between stakeholders was poor. This also suggests that whilst he perceives the management to be dictated by the management plan prescriptions, there is some scope for flexibility as seen by his successful application to harrow his part of the meadow.

At Brook Meadow, the HLS agreement under section HK6 (maintenance of species-rich, semi-natural grassland) limits rolling and harrowing to between 15th March and 15th July (likely to be an error of wording with the dates transposed). However, according to the Managers at the Trust the site has not been harrowed in recent years.

At Long Mead the hay farmer said that he had mentioned this issue to the land owner as he thinks the site should be harrowed in spring. The land owner hasn't asked him to do this and he didn't know if harrowing was allowed under the HLS agreement, suggesting that he doesn't possess a copy of the conditions attached to management. In fact the agreement does allow this except between 15th March and 15th July. He didn't think that in reality this was a big problem and suspected the ground might be too soft in any case to tolerate harrowing. He said that he would prefer to harrow in April, which would not be permitted.

Overall then, the operations of rolling and harrowing are restricted but not prohibited by management prescriptions for the meadows, yet they rarely take place despite farmers' opinions that this would be beneficial for meadow condition and performance. The reason for this is not clear, but the disputes at North Meadow suggest that farmers are expected to ask permission to do this and that there is a presumption against such operations as potentially damaging such that permission is sometimes not forthcoming. In addition, in line with the North Meadow Hayward's comments, it is possible that the farmers do not see enough benefit from the meadows to merit spending any more time than absolutely necessary on managing them.

7.4.4 Grazing

7.4.4.1 North Meadow

At the time of the first interview in Autumn 2010, the North Meadow site manager was concerned that the site's condition was declining as a result of aftermath grazing having been conducted for the past almost 10 years by only 20 horses as it was proving impossible to engage local farmers to graze the site with cattle. The Hayward claimed that there used to be as many as 400 head of cattle out in the meadow, but now, as a result of restrictions imposed after the BSE, Foot and Mouth, and most recently cattle TB outbreaks, farmers could not mix herds so the cattle had to be from one operator. Interviews conducted with elderly residents of Cricklade (Snakeshead Revisited Project, 2010) indicate that in the early 20th Century the meadow had never been of interest to such large-scale farmers, but that the grazing opportunity afforded by the meadow was of interest to smallholders in the local area, who negotiated with the Hayward to ensure optimum grazing levels. Commentators also noted the reduction of smaller farms around Cricklade and so the reduction in the number of farmers interested in grazing the meadow. Coupled with stock movement and herd mixing restrictions, the lack of cattle handling facilities on the meadow, and the winter flooding leaving an uncertain grazing period has reduced the value of the meadow as a grazing resource in the view of local farmers.

Data provided by Natural England and from field observations showed that for a number of years there were therefore only up to 20 horses to graze the meadow up to 2009. Since the reintroduction of cattle grazing, current numbers were around 90 head of cattle in 2009 and 2010, and 45 in 2011. Animal hygiene and welfare issues were therefore a significant practical consideration in constraining scope for action in terms of grazing management.

In contrast to the opinions of the hay farmers, the North Meadow grazier felt that the site was managed "really well" and having known the site for 25 years felt that it was managed in the same way and looked much the same as it did then. The grazier said he did not interact with the

other farmers, only Natural England's site manager, whom he felt was happy with the way the meadow had been grazed down short, a view that the site manager corroborated.

He felt that a significant issue with the grazing regime on the meadow was indeed the restrictions on cattle movements since the Foot and Mouth outbreak in 2001, and he also felt that the TB outbreak in the local area was approaching the same level of importance. To this end he kept an animal movement book so that he could prove where all his animals had been at all times, which he said was a legal requirement, and which contrasts with the statements of livestock farmers at some other sites who claimed not to do so.

As noted in Chapter 5, the North Meadow grazier said he did not assess the meadow condition in summer but waited for the site manager to give permission to commence grazing, at which point he immediately introduced his animals. He said that any assessment of when to start grazing would be done by the site manager and so:

> It wasn't for me to say when to put them on.

In 2011 he put his cattle on for seven weeks at the end of which they needed to be retested for TB. This was more conveniently done elsewhere after which he saw no point in returning them to the meadow, especially as it cost £200 in transport costs each time the cattle herd was moved. The contract with the Court Leet was for a minimum of 6 weeks grazing. He put 45 cattle on the meadow, a number which he said was not determined by any calculation but was a convenient number for practical reasons given the distribution of his other land and herds, avoiding herd mixing, and that Natural England were apparently happy with. As noted the grazier did not pay for access to the grazing as a resource but was paid by the Court Leet as a contractor for the grazing service.

The Hayward thought that decisions on when to start and stop grazing would be determined by sward feeding prospects, animal health and the flooding pattern. Given the above comments by the grazier any assessment of sward feeding prospects would be taken by the site manager, of animal health by the grazier and flood patterns possibly by either party.

7.4.4.2 Brook Meadow

At Brook Meadow the grazing density was theoretically based on a default value one Livestock Unit/hectare (1 LU/ha) from a course that the Reserves Manager had attended, although he found it did not work for all sites. In fact 5 animals were seen to graze the 1.73 ha site in autumn 2011 in keeping with a limit in the management agreement for that year.

The Trust's Reserves Manager stated that grazing starts when there's enough sward to eat, as no supplementary feeding is permitted, and ends when the site is too wet or when there is no grass left. The Trust particularly wanted the site grazed with cattle, not sheep and also wanted it grazed until Christmas. However, the farmer could only graze for 60 days, after which the cattle had to be TB tested again, adding to the cost and which he thought was not justified. He put cattle on as soon as new green growth was seen in the last week in August, taking them off again after 60 days (18th October) to avoid having to give them a new TB test (costing £112) and as there was not much new growth left, so he would have needed to start supplementary feeding, which is not permitted in the management plan.

Communication with farmers was very variable, some have little or no regular contact with the Trust. At Brook Meadow therefore the start and finish dates of the grazing were dictated by off-site practical considerations that included restrictions imposed by animal health legislation and the costs that this imposes on the farmer. The maximum grazing density was imposed by the management contract agreed with the Trust.

7.4.4.3 Long Mead

At Long Mead the grazing starts in August after the hay cut, the timing being dictated by the contractor's off-site practical requirements, and the decision to stop is dictated by whether the site is getting too wet or is starting to get poached, although the meadow's owner said that there are in reality never enough animals to graze the sward right down. She said that it had been agreed that 12 adult cattle was the right number to graze the site but she felt that the ESA agreement was vague about stocking level and grazing duration.

If you put more animals on and get a wet week it causes lots of damage.

A new HLS agreement was introduced in 2012 that prescribes no more than 1 cow per hectare. The Grazier said that there were no contractual conditions to follow and the grazing period was flexible according to cut date and weather permitting, suggesting that he was unaware of the stocking limits prescribed in the HLS agreement. The hay is cut, depending on the weather, after 15th July in accordance with the HLS agreement and the grazing starts as soon as possible afterwards to then finish in early to mid-October or before, if the site gets too wet. Rather than looking at meadow condition the grazier said he was more interested in looking at animal condition and the weather. He said that it would be the land owner who would be looking at the meadow condition to check that it wasn't becoming poached. In any case he said that the cattle would be gone by mid-October at the very latest. He said that in 2011 there were about 20 animals on the Mead (cows and a few calves). In fact 32 cattle were seen on site on the 11th October 2011. The Grazier said that he didn't keep any records of grazing dates and cattle numbers.

Overall, the Grazier reported that he communicated with the Hay Farmer, as management was affected by the weather and therefore they needed to co-ordinate their activities. The Grazier was constrained by the need to clear the hay crop first before grazing could begin, and decisions on when to remove the cattle appeared to be unrelated to an assessment that the sward having been grazed down sufficiently, but rather their own practical and commercial considerations. To this end the sward may in fact be overgrazed or undergrazed at the end of the autumn.

7.5 Decision-making and the role of assessment

This section examines the factors affecting decisions made by stakeholders regarding meadow management and the key factors influencing their decisions. In particular, what role if any was played by assessment activity in influencing decisions is considered.

7.5.1 North Meadow

By Summer 2011, the Natural England site manager thought that North Meadow was in good condition and the rapid condition assessments also indicated favourable condition. As a result she felt that no decisions were necessary regarding management and she felt no need to discuss management issues with the farmers or grazier. The grazing management was also considered a success with the sward "grazed down beautifully". It may therefore be presumed that the default management could continue with no need to discuss anything with the farmers, whose views might therefore remain unheard. She also thought the meadow's condition was relatively stable, with the exception of years of summer flooding such as 2007 and 2008. In contrast with the management plan, which frames the meadow as a very fragile system, the Natural England site manager felt that the meadow was "robust and dynamic" and it was not necessary to react quickly to assessments every year, although she thought that the farmers would like to respond more quickly and would like to cut the hay earlier and clear drains more frequently. She said that the original NVC mapping survey of plant communities on the meadow was not used to decide management, only the Natural England condition assessment was used to decide if management was adequate, based on the conclusion that meadow condition was acceptable. This said, areas of the meadow not deemed to be MG4 grassland were seen to be excluded from the condition assessment.

Interestingly, the manager noted that the grass sward length measurements from drop-disk data were not used in assessing meadow condition, though to some extent this data could be used as an indicator of relative yield, and appeared to have been used by the previous site manager to explain past declines in hay yield, as noted in the management plan. The condition assessment only notes whether the sward was on average more than 10cm tall during the summer visit, which is short for a mature hay sward, but no numerical estimate of actual sward height is recorded.

The opinions expressed above by the hay farmers at North Meadow suggested that Natural England's policy position on the site's management is dominant and that the management

generally follows the prescriptions in the site management plan, at least as a default. The plan's position on operations such as rolling and harrowing is that these should be strictly controlled, which farmers NMC1 and NMC2 interpret as a prohibition, following disputes over requests to carry them out in the past, although NMC3 successfully negotiated the right to carry out harrowing in 2011. Meanwhile the prohibition on manuring introduced by the Nature Conservancy Council and maintained since the 1970s is criticised by all three farmers, despite the fact that hay yield data suggests that hay yields may be falling significantly towards the southern end of the site. However, as yields are not consistently monitored, any trend is not yet clear. Deviations from the prescription may be possible on occasion but must be approved by Natural England and approval appears to be unlikely, especially regarding Natural England's prohibition on manuring. The only exception to this appears to have been the alteration of hay cut date limits, though again this is strictly controlled by Natural England. Overall, this rigidity of management regime appears to have removed farmers' incentives towards taking the initiative with management and as noted in Chapter 6 they made little or no attempt to assess meadow condition as this was not necessary to undertake the prescribed management work.

In conclusion therefore, the three hay farmers assert that Natural England hold a central and dominant position in controlling and deciding management at North Meadow. Default management is determined by pre-established ideas as discussed above, although this appears to be more a hybrid of traditional and innovative practices. The farmers say that they therefore see no purpose in challenging or negotiating variations to this management and merely comply with the default, although in fact, as farmer NMC3 found, negotiating variations may not always be impossible. Furthermore, comments that the hay cut on or after 15th July is too late do appear to have had some influence as in the past 4 years the cut date has been brought forward closer to the preferred dates of the farmers, suggesting that the site manager is willing to alter the plan prescription to ensure timely cutting of the meadow. This appears to accord with the hay farmers' view that factors influencing the cut, apart from the cut date limit, are the weather and their other work commitments. Such earlier hay cut dates appear to recognise the need to give the

farmers the time to undertake the work allowing for interruptions caused by rain, and to allow them to attend to their other work, given that they cannot survive solely on the income from North Meadow. This decision does appear to have been influenced both by the hay farmers' opinions or by the recommendations of the Floodplain Meadow Partnership. The results of assessment work on meadow condition may have played a role in influencing decisions regarding the hay cut start date but do not appear to have been the sole factor.

7.5.2 Brook Meadow

As regards the outcome of the Natural England and Trust condition assessments in 2011 for Brook Meadow, the Trust's Reserve Biodiversity Officer stated:

> I've looked at ours and Natural England assessments and as the assessment was favourable for both we won't be changing the management apart from taking Natural England's suggestion to reduce the shading by trees into consideration. As the Natural England monitoring also highlighted the population and location of Meadow Thistle we will be adding this onto future monitoring efforts and incorporation into the management plan.

It therefore appears that where the condition assessment concludes that meadow condition is favourable, there is assumed to be no need to change the management is this is considered to be successful.

Under his contract with the Trust, Farmer BM1 pays £50 rent for the land for which he receives the right to the hay crop and to graze the land. He commented that he had wondered whether, if he were to say to the Trust that he no longer wanted to use the site, he might even get it for nothing, though he thought £50 a fair price for the resource. Brook Meadow was useful to him but if an alternative source of pasture came up he would use that instead. At the time of interview in 2011 he said he didn't know if he would manage the meadow again in 2012. This suggested that he was essentially interested in the agricultural resource and otherwise his motivation to participate in meadow management was weak. In his opinion there were therefore

significant barriers to grazing the site. He said he was tempted to manage the meadow again in 2012 but that he would "wait and see":

> If it was 8-10 acres it would be a lot easier to manage. It's awkward to manage small sites. I would be happy if it was a bit bigger.

Despite buying a licence to manage the meadow in 2012, subsequently, he decided not to exercise his right to graze the meadow as he considered it was not worth the expense of vaccinating his cattle against TB in order to be able to do this, as well as because ground conditions were unusually wet in summer 2012. This key aspect of annual meadow management was not therefore undertaken despite his contract with the Trust as a result of an economic and practical factor, highlighting the weakness of the Trust's bargaining power in this situation. The Trust might only have secured grazing with total certainty, had they been prepared to incentivise the farmer further, perhaps by being prepared to cover all such costs, or even by paying him to do the work as a contractor rather than a licensee.

In conclusion, at Brook Meadow the farmer's motivation for involvement in meadow management appears to be weak, and the Trusts feels it cannot dictate management to the farmers as they find it difficult to recruit and retain farmers. This said, the farmer's motivation is weakened by the small size of the meadow and the late hay cut date of 15th July, which he feels undermine the agricultural value of the resource. Other than the cut start date, the other considerations regarding management are the weather and the farmer's other time commitments. The outcome of any assessment work does not appear to have been a factor in decisions regarding management and the Trust does not appear to have discussed the assessments with the farmer.

7.5.3 Long Mead

Clearly the owner of Long Mead considers the site to be vulnerable in terms of future delivery of management and sees inability to secure meadow management contractors as a significant risk. Contractors have limited interest and motivation in managing the site, particularly the grazier,

and the meadow's management competes directly with the contractors' other work commitments. When asked about factors influencing the management of the meadow, the site owner emphasised her concern regarding engaging farmers to deliver the management:

> It's precarious because farmers can't be bothered with hay anymore. The traditional management has to fit in with people's other agricultural practices. At the moment it's still working but the person who buys my hay is thinking of getting rid of her livestock and so won't need hay anymore and I don't know if she wants it this year [2010]. Nothing is guaranteed long-term and in that sense it's all quite precarious. The price of hay is quite high now but one year I wasn't sure there was a market for 1300 [small] bales of hay after Foot and Mouth. One year I gave it away to the farmer who cut it. The economics is quite precarious and the situation shifts every year. The most important thing is fostering long-term relationships to take the precariousness out.

The owner liked the grass to recover after the cut, but said that:

> .....if the cattle don't come straight on then there isn't a long enough window of grazing and it's not worth the grazier's while.....The farmer [grazier] isn't interested; it's not his problem. He's interested in getting use of the space. It's a real issue.

The site aftermath is grazed by another local farmer as part of a livestock business of which he is an employee. The owner said that this commercial cattle dealer was not interested in conservation and that:

> ..... it is much harder to get animals to graze the site after the Foot and Mouth outbreak in 2001. In 2011 hay prices were at a premium but I'm sticking with the current arrangement. It's more important to have a good working relationship than to drive a hard bargain.

The owner felt that she was most 'hands-on' with regards to meadow management when the cattle grazing was taking place. In the past the contractor had grazed the site quite hard and she

had to tell them when to take the cattle off. She had to assess the ground conditions as the site can get very damp and so can become poached. She said that:

> As there are fewer herds and an excess of grazing land, you need to be careful of relationships. If they say it's not worth their while then it's a problem. It's the most stressful time of year and you need to remind them to graze the site. The balance is fine. Owners are competing for grazing animals and last year the grazier didn't pay.

The current owner thinks that the site is too small to be of interest to bigger contractor-farmers, but too large for the one-man hay makers, suggesting that the intermediate size (approximately 10 ha) of the meadow is a factor in the difficulty in finding suitable farmers to manage the meadow, but contrasts with the comments of the farmer at Brook Meadow who found that site too small (1.73ha).

She said that she had noticed significant antagonism between conservationists and farmers in her own experience of managing her meadow. One county adviser she remembered in particular "had a manner of telling her how to do things". She thought this style was unconducive to building good working relations, which suggests that she thought that the conservationist may at times have fixed narratives and agendas and see no need to negotiate with other stakeholders.

The Natural England HLS advisor for Long Mead said that she was happy with the management of the meadow but that she was aware that the site owner struggled sometimes to get contractors to do the work. She said that this was an increasing problem with many similar sites and was not unique to Long Mead. Again, she said that increasingly with hay meadows the owners could not find farmers who wanted to make hay traditionally. Because the meadows are meant to be herb rich farmers say that the meadows will not produce a crop of sufficient quantity and quality for their purposes. Also, farmers are not happy with the late cut date that Natural England require because the farmers say that the crop will not be of the quality that they would want to feed to their animals. Furthermore she said that Natural England wants farmers to make hay in small bales whereas farmers may no longer make small bales on their own fields so that they no longer

possess the appropriate machinery to do this. Finally, the timing of haymaking is also bad for farmers as in the summer they are busy with other priorities and don't want to be making hay at that particular time.

The HLS advisor thought that most farmers were mainly interested in the economic situation and wanted to manage the meadows as economically efficiently as possible with the most modern equipment. She said that she often received comments from farmers saying that it was just as well that they received a subsidy to make a hay meadow because they were not getting much of a product to sell. This said, a desire not to waste money is not necessarily the same as only being interested in the economic aspect of meadow management. As seen from Chapter 5, it is not the case that farmer-managers have absolutely no interest in any aspect of the meadows other than economics. Indeed they generally take a broad and balanced view of meadow value.

In terms of her optimism or pessimism about hay meadows in the future the HLS advisor thought that the most important driver of whether the meadows survived into the future will be government policy on agri-environment schemes. She pointed out that the reason for their loss was government policy in the past that encouraged agricultural improvement. So whether the hay meadows continue to exist in the future will depend on whether the grant schemes continue to exist to maintain the meadows as they are. The HLS Advisor thought that if the agri-environment schemes continued then most of the farmers she worked with would want to keep their meadows in the schemes, that they were quite fond of them and would want to keep them as they were and enjoyed having them. The only risk would be if the schemes were not there and therefore the farmers would have to only look at the economics. She found that in the Thames basin and meadows along the Thames the farmer and landowner were usually the same person and thought that the farmers were generally positive about the meadows provided they got the money from the grant schemes.

In conclusion, the owner of Long Mead did not appear to see meadow condition as a relevant factor in making decisions regarding meadow management. She perceived the relationships

between her and the farmers as very much one of a mutually beneficial non-economic arrangement that was precarious and in which the incentives for the famers' involvement were weak. Indeed the low level of economic value that the livestock company appear to attach to the meadow is emphasised by the fact that they do not pay for access to the resource. Her top priorities in terms of managing the meadow were to maintain a good working relationship with the farmers and not weaken their motivation for involvement in any way, by imposing any restrictions on management, as alternative contractors would be likely to be difficult to find. This said, she was required to comply with the management prescription in the HLS agreement in order to secure funding to manage the meadow, which includes a late hay cut.

Decisions on when and how to manage the meadow therefore were related to a broad range of practical issues none of which were influenced by perceptions of meadow condition. The agricultural value of the meadow was therefore important to incentivise farmers to stay involved and the most likely threat to the meadow's future was likely to be cessation of management resulting from a lack of local contractors to undertake the necessary work or loss of interest from present contractors.

7.5.4 Overview

At all three meadows, conservation-oriented stakeholders were aware of tensions created between them and farmer-managers over either group's priorities, the farmers' priorities being dominated by the practical need to fit meadow management in with other work, and the economic need to at the very least not make a loss on meadow management. In general, the motivation of most farmer-managers to be involved in meadow management was limited.

The conservation status of the meadow site appeared to impact on the management regime and priorities. At the high-status internationally designed North Meadow, Natural England felt most able to assert their vision of meadow management, but whilst the management plan presents an assertive and inflexible view of meadow value and management, the current site manager is aware of the farmers' views and is more flexible. Here, the meadow assessment in past years had

played a role in altering the default management for the hay cut based on pre-established narratives if meadow condition was found to be inadequate.

At other sites, decisions on changing the hay cut start date were influenced by practical considerations to ensure a timely hay cut. At Mottey Meadow Natural England decided to make the cut earlier, starting from 1st July rather than 15th July, to ensure enough time for farmers to cut the hay and attend to their other work. According to the site manager, this followed advice by the Floodplain Meadow Partnership that the most important factor in ensuring the meadow's good condition was consistent management.

At the other sites, the conservation stakeholders and site owners felt they had no leeway for negotiation over the management regime as farmers' motivations for involvement were low and they therefore had limited bargaining power as the main threat to management was inability to engage farmers to manage the site. The conservation stakeholders' limited power was seen at Brook Meadow in 2012 where the farmer decided not to graze Brook Meadow for a range of practical reasons despite having signed a contract with the Wildlife Trust.

Nevertheless, where management did take place, the conservation stakeholders did manage to impose the cut date limit, even though the late cut date reduced farmers' perception of meadow value, and made meadow management more practically inconvenient for them. At Brook Meadow and Long Mead therefore, assessment activity had no interaction with or impact on meadow management, and farmers' decisions on management were based on practical matters relating to their workload, and the economics of meadow management and restrictions imposed by the weather.

7.6 Implications of Conservation-oriented Stakeholders' Narratives for Management Practices

7.6.1 Possibility of declining hay yields

As seen in Chapter 6, assessment tends to focus on meadow condition, not management or productivity, and hay yields are not consistently recorded by either farmers or conservationists, so that it is difficult to confirm conclusively whether a fall in hay yields is occurring on a meadow and whether supplementary fertilisation may be required to maintain productivity. This said, the statement in the North Meadow management plan that floristic diversity is more important than hay yields or profits, as well as being a point of tension with farmers, appears to ignore two issues.

Firstly, irrespective of financial and economic considerations, hay yield is a function of biological productivity and therefore is a manifestation of ecological system function. A change in yields may therefore be indicative of a change in system function and therefore may be evidence of change in meadow condition. If yields are not measured, then this aspect of system function and meadow condition may go unnoticed until it begins to impact of meadow condition parameters that are measured in the assessments undertaken such as botanical composition and diversity.

Secondly, the dismissal of profits as of lesser relevance may ignore indications that the financial arrangements between stakeholders are of relevance to farmers in terms of their motivations for involvement in meadow management. Furthermore, the North Meadow management plan notes that:

> Seed harvesting, a recent innovation, might prove to be beneficial to the meadow, incorporating more seed into the sward than modern hay making does. However, this has not yet been substantiated and the process, though far more profitable to Natural England than hay making, should not be allowed to usurp the traditional usage.

This suggests that profitable by-products of the meadow are still desirable as a source of funding for management, although it is not stated here that of course the traditional usage of the

meadows that should not be usurped is in fact an agricultural usage to produce a crop of hay as a livestock foodstuff, a product that is generally not directly considered in the meadow assessment process. This quote also acknowledges that meadow management includes innovation as well as traditional practices.

The presumption by Natural England against certain agricultural practices that are considered by farmers to be 'traditional' meadow management may perhaps suggest a presumption towards a 'minimum intervention' approach to site management. This on the one hand may simply be to prevent heavy-handed or 'modern' management by farmers to increase yields and profits at the expense of other more diverse aspects of meadow interest and value as discussed previously, particularly the botanical diversity value prized by conservationists. Alternatively there may also be an element of philosophical 'leakage' from conservationists' belief in the opposition of nature and culture. That is to say, whilst no stakeholder consulted denied that meadows are produced by human practices (ie. agriculture), the consistent framing of desired characteristics of meadows as 'natural' and therefore different in kind from the social may have made conservationists uncomfortable with the idea that meadows are cultural and produced by human practices, and that the latter should be as limited as possible to allow nature to flourish unmolested. A further possible motivation for minimum intervention approaches to management is suggested by Muñoz Viñas (2011) as being to mitigate risk in the fact of uncertainty about traditional management practices. This may have given rise to the tension between conservationists and farmers, one of whom (NMC2), as already noted felt that conservationists did not listen to farmers' opinions on meadow management.

Interpretation of such comments by Natural England as resentment of their control of management in a way that limits profitability for farmers may have given rise to comments about profitability being of lesser importance than floristic diversity at North Meadow, and by the Long Mead HLS advisor that farmers are only interested in the economics of meadow management. However, this presumes automatically that farmers' criticism of management only results from a

desire to increase profitability and not from any anxiety on conservationists' part about human intervention in a landscape framed as 'natural' rather than social.

7.6.2 Contemporary Meadow Management as an ahistorical hybrid

As regards adherence to 'traditional practices' as the best guide to those that produced the meadows in the first place (Pullin, 2004), and notwithstanding the conflicts and uncertainties over what these practices might have been in the past, as noted already some evidence suggests that the present management prescriptions are in fact 'hybrids' between traditional practices intended to produce an agricultural meadow for a crop of hay, and innovative practices intended to safeguard other interest that would not have been considered relevant historically to hay farmers, and therefore constitute an ahistorical baseline for meadow conservation. For example, possible modification of traditional practices to later hay cuts and prohibition of rolling and harrowing after March appear to be based on consideration of ground-nesting birds during the breeding season. This acknowledgement of bird interest competing with botanical interest contrasts with the position of entomologists who appear to accept that the summer hay cut disturbs invertebrates and their acknowledgement that the entomological interest of meadows must by necessity be secondary to their botanical interest (Crofts and Jefferson, 1999).

As noted in Chapter 5, the North Meadow management plan considers changes or trends in the meadow under two headings: 'Natural Trends' and 'Man-Induced Trends' thereby maintaining the social/nature dichotomy. The section on 'Man-induced trends' notes that:

> The changes in hay harvesting techniques might well have affected the meadow communities. A change from reciprocating to rotary mowers allows the cut to be made closer to the ground, removing more plant material and speeding up the harvest operation, thus reducing the time for seed ripening and fall

Though no evidence is presented here of actual changes to the meadow caused be the technological changes to harvesting, this in essence is an acknowledgement and perhaps expression of anxiety that such changes have occurred and that the management practices do in

reality differ from those in the past, though no concern is expressed regarding the changes in rolling, harrowing or manuring are noted here. Alteration of the timing of operations for bird interest, mower technology changes and seed harvesting, as well as perhaps cessation of practices such as manuring, rolling and harrowing all therefore appear to represent innovation in meadow management.

At North Meadow Farmer NMC1 also claimed that the Environment Agency management of the river had altered flood patterns. He claimed that the Agency held floodwater back at Lechlade (downstream of Cricklade) so that instead of the meadow flooding for 3-4 days at a time, water could sit on the meadow for weeks at a time. Farmer NMC2 similarly felt that the Agency had held back flood waters that flooded the meadow in 2007. This would suggest that the baseline conditions of flood timings and duration had shifted and therefore would challenge the assertion that unaltered traditional practices can continue to deliver the same material meadow as in the past. The Co-op also stopped adding fertiliser around the year 2000 to the adjacent fields that they owned immediately north-east of the meadow, again creating a shift in the background baseline nutrient conditions.

Coupled with off-site changes such as river catchment management and water quality altering hydrology and nutrient flows, potentially debasing the relevance of traditional practices as suggested by Harris (2006), it appears that rigid adherence to 'traditional management', even where this is well documented, is not likely to be occurring and may be futile, impossible or inappropriate, depending on the ultimate goals of conservation.

The North Meadow site manager is aware that the farmers would like to cut the meadow earlier, and whilst she thinks the meadow management has not changed significantly in the past 30 years or so (since the site was declared a National Nature Reserve), she also thinks that it is probably different from the 'traditional' management longer ago in the past. She thought that the meadow would probably have been manured and harrowed, with probably more ditching works, and took longer to cut from early June to late July, comments which are indeed supported by the

interviews of elderly Cricklade inhabitants undertaken by the Court Leet (Snakeshead Revisited Project, 2010) and the Hayward as noted above. She said that the hay cut might even have started as early as May, but is now fixed to no earlier than the 1st July. She agreed that the farmers would not consider the current management to be 'traditional' in that they no longer manure or harrow the meadow. Again, hybrid management practices between tradition and innovation to provide a meadow conserved to an ahistorical baseline appears to be creating tensions between stakeholders.

Similarly, at Long Mead, the ESA and subsequent HLS agreements stipulate that the hay cut may not commence before the 16th July in order to avoid disturbing ground nesting birds and to allow hay seed to drop. Surveyor LM1, who conducted the botanical surveys in 2001 and 2004 that lead to the site being declared a County Wildlife Site, agreed that the late cut date is a compromise between different valued aspects of the meadow, particularly the botanical and entomological interest. She commented that she understood that meadows in the East of England were traditionally considered ready to cut earlier than those in the West and North of England. This would appear to accord with the fact that Portholme Meadow SAC/NNR in Huntingdon may be cut from 15th June, and according to Farmer PH1 of Portholme meadow, used to be cut even earlier in previous decades, as early as from 31st May in 1949. Furthermore Long Mead Surveyor LM1 thought that that the Oxford Meads along the Thames North of Oxford were formerly cut earlier than 15th July in the past.

The Natural England HLS advisor for Long Mead stated that in her opinion the ultimate driving force for the late hay cut is to allow time for seed to fall from the plants although it also benefits ground nesting birds. She said that in the past Natural England would have been much more rigid in insisting on the late cut but nowadays they are to some degree more flexible and are moving towards allowing earlier cuts perhaps one year in three but insisting on the late cut two years in three. When asked whether it was a matter of concern if evidence showed that a late cut was not strictly traditional, she responded:

HLS Advisor: I don't think that would be a problem. Natural England tries to be an evidence-based organisation. As I said we have already become more flexible about the cutting date after that research that came out recently from the Floodplain Meadow Partnership and so if there was more evidence that came out showing that the late cut was not the best thing for the meadows then we would certainly take that into consideration.

Interviewer: I suppose the question is, if the prescription for a site wasn't strictly traditional management, as in how it was managed decades ago, does it really matter if it is not exactly the same?

HLS Advisor: The most important thing is the end result so if it [the meadow] was meeting its indicators of success and had a good diversity of wildflowers and met all the other indicators of success we wouldn't be as concerned about how they got to that end result.

Interviewer: So you think the management is just a means to an end. Do you think it is realistic to stick to traditional management?

HLS Advisor: I don't know, that's a bit of a general question. I would have to look at the management they were proposing. If a landowner came to me and said 'we have found evidence that this is how the meadow was managed in the past and we are proposing to do that now what do you think?' I would consider that and would talk to my colleagues and ask what they thought and if we also thought that it sounded like it would work we'd say yes let's give it a try for a couple of years, make sure the Meadow is still in good condition and then yes we will give you permission to do that.

This therefore suggests again that meadow material condition and composition is ultimately the primary concern with meadow practices secondary. Should, for reasons suggested by Harris (2006) the traditional material meadow and the associated practices become decoupled then the former would take precendence. Hybridity of management practices would not necessarily therefore be of concern.

This suggests that evidence of long-standing or 'traditional' management is not necessarily sufficient to convince Natural England to permit changes to the HLS management prescription. As previously noted, the material artefact of the meadow takes precedent over the traditional practices, hence perhaps the prioritising of condition over management practices. Given that the Indicators of Success are based on botanical parameters only, it may also suggest again that the site is being managed to an external ideal that does not take into account a site-specific and unique history, and which is also an ahistorical baseline that does not necessarily take into account all aspects of how the meadow was in the past.

Once again, the management, constrained by the HLS prescription for Long Mead appears to be a hybrid between traditional and non-traditional priorities, where the site is managed to conform to a set of external ideas, which ignore the agricultural value. This does not appear to be an issue as the present owner is not a farmer and has no personal long-term memory of the site. Also, both managing farmers are paid as contractors rather than paying for a licence to access the meadow as a resource,and therefore may have less of a stake in the successful outcomes of management.

At Brook Meadow, as at North Meadow there appears to be a prescription of management that is a compromise between traditional and non-traditional priorities, for example with a trend towards a later hay cut date, and which ignores agricultural value and site individuality. The management prescription therefore appears again to reduce the value of the site to farmers and reduces their motivation for involvement.

7.6.3 Threat to Management Delivery

With regards to optimism about the meadows' futures, the Warwickshire Wildlife Trust were most optimistic about Brook Meadow. The Reserves Biodiversity Manager said she was optimistic about the site's future and saw no reason why it could not sustain its condition or 'improve' floristically, again highlighting the prioritisation of floristic diversity and that conservation is not necessarily about preserving a meadow exactly as it is.

The Reserves Manager said that it was necessary to be realistic:

> We have had consistent management for ten years but there are question marks over management in some years. Sites can miss [management] the odd year, though it's not ideal. The main threat is definitely in keeping farmers on board.

The Trust staff are therefore conscious that it is difficult to find farmers willing to manage the site and see the meadow as vulnerable in terms of provision of future management. The main threats were all interlinked to farmers staying on board and being able to do the management in the face of the weather and the economics. In the case of mixed farmers, the required late hay cut clashed with their other harvests. A late cut can constrain their resources, but seemed to be acceptable in the case of Brook Meadow, but it depended on how it fitted in with the rest of their business(es). Meadow management had to be convenient for them.

According to the Reserves Manager and Trust documentation examined, the Trust used to sell licenses but had agreed to pay the farmer in summer 2010 to manage the site and the situation from year to year had been variable. The farmer managing Brook Meadow until 2010 was no longer interested as his circumstances had changed. The Reserves Manager cited the aging farmer network is an issue (most reserve farmers are over 60).

> If they have no family to take on where will we be in 10 years time? Relationships are individual and don't know who's over the hedge in terms of broader landscape.

The Reserves Manager said that he had been talking to farmers about Single Farm Payment (SFP). The Trust normally keep the SFP and HLS payments but might now be prepared to pay for some work. As seen already, the evaluation of the value of Brook Meadow by the farmer was already weak and his motivation for involvement low. Involving stakeholders requires adequate financial compensation and incentives, as well as being practically convenient. Indeed in terms of the economics, there was already a shift towards greater compensation and incentivisation.

In contrast, at North Meadow, the negative views on the current management regime may be the result of the fact that the hay farmers pay for their license (typically approximately £15/acre or £37/ha) to cut the hay and then need to make enough financial return or get enough personal use

out of the hay crop to make involvement worthwhile, hence concern over any decline in the agricultural value of the crop and a feeling of personal involvement in the management. This contrasts with the position of the grazier who is now paid to provide a grazing service and therefore gains both from a fixed and pre-determined financial benefit, as well as the additional enjoyment of the grazing resource itself for his cattle. The nature of the contractual relation between landowner and farmer therefore appears to influence opinions, positive or negative regarding the centralising of executive power over management on the side of Natural England and of the utility and value to them of the management operations imposed by the site plan regime. Indeed the grazier, given the difficulty of finding suitable graziers locally, is in a strong position within the stakeholder network and has no need to participate if he feels that there is no benefit for him in the arrangement.

The motivations of the hay farmers, especially NMC1 and NMC2 therefore appear to be weaker as a result of the less favourable financial arrangement that devolves greater economic risk to them. This said, were they to cease to participate in the meadow management, Natural England would possibly have great difficulty in engaging new farmers to cut the hay without changing significantly the financial contractual arrangements to incentivise participation.

At Long Mead, the site owner thought that the socio-economic threats to the meadow's survival were the biggest ones.

> If I don't follow the ESA prescription I don't get the money. It'd be easier to sell June hay as it's considered to be more nutritious.

Of all the management provisions in the HLS agreement for Long Mead therefore, the above quote suggests that the cut date possibly represents the one condition that the owner would like to change as it would allow more time to deliver the hay cut in a timely manner and would provide a crop with greater commercial agricultural value. However, this appears to be constrained by the HLS agreement management prescription on the basis of a trade-off between agricultural value and perceived nature conservation value.

In summary therefore, at all meadows, a significant threat to meadow survival is that of the discontinuation of management resulting from an inability on the part of land owners and conservation stakeholders to engage farmers to undertake the management. This inability arises from the changing structure and demographics of farming, meaning that there a often few local farmers in the local area have the equipment and livestock resources to undertake traditional low-intensity meadow management. In addition to this, farmers' motivations are commonly weak as the economics of meadow farming are such that farmers no longer have a strong interest in hay meadows. Only a subset of farmers therefore is in a position to be involved, being financially independent enough to be involved in meadow management for non-economic reasons or at least for small returns on their efforts.

Chapter 8 – Discussion

8.1 Introduction

The purpose of this chapter is to draw together the theoretical discussions laid out in Chapter 2 and background to meadows in Chapter 3 with the findings of the empirical chapters 5-7 in order to address the main research question given in Chapter 1, namely:

> *What relationship is there, if any, between stakeholder assessment and the management of floodplain meadows?*

Chapters 5-7 have each addressed one of the three sub-questions into which the main question has been divided:

1. *Who are the stakeholders involved in managing floodplain meadows and what value do they attach to such sites?*
2. *How are knowledge and understandings about floodplain meadow status, material condition, perceived value or management generated by the assessment activities of stakeholders involved in their management?*
3. *Do the findings of meadow assessments influence in any way the subsequent management actions of stakeholders, and if so how?*

The intention here is to consider the findings for each of the sub-questions in the light of the over-arching main question in order to draw overall conclusions, both those strictly related to the main question, as well as any other interesting or significant findings relating to the implications of the main conclusions.

8.2 Stakeholder networks and stakeholder perceptions of meadow value

This section considers further the findings in terms of Sub-question 1:

> *Who are the stakeholders involved in managing floodplain meadows and what value do they attach to such sites?*

This section considers firstly the views held by stakeholders on meadow value and the role and purpose of meadow conservation. Secondly, it considers the underlying narratives and perspectives that may inform such views, and in particular examines the possible role of narratives regarding the duality of the 'natural' and the 'social'. Finally, the implications of the above are considered in relation to the research questions.

Sub-question 1 was revealing in terms of the networks of actors actively involved in managing floodplain meadows and their motivations for being involved in meadow management. It also helped to reveal stakeholders' priorities as well as the positions of power that enabled them to impose a particular view of meadows in terms of what they are for, how they should be maintained materially (condition), and how they should be managed, as revealed in consideration of the later sub-questions.

Background literature on floodplain meadows considered in Chapter 3, as well as the empirical research undertaken and described in Chapter 5 showed that each floodplain meadow is a unique assemblage, each with considerable individual character in terms not only of its material composition and biophysical processes, but also in terms of its history and contemporary management delivered by a unique stakeholder network that tended to be larger or more complex for sites with higher levels of conservation status, such as North Meadow or Mottey Meadows. Such larger, higher-status sites also had more formal structured management plans with greater control of management operations as discussed below. This was seen to be influential on dominant views of how a meadow was seen to be of value and the assessment and management activity that took place on each meadow. In different stakeholder networks, different actors had different levels of interest in the site as well different levels of power to influence or impose their perspectives of meadow value and management.

As regards the views of stakeholders on meadow value, as seen in Chapters 5 and 6, significant differences were found between the views of conservationists and farmer-managers, some of which were leading to tensions between these two main stakeholder groups, and that also

highlighted issues and contradictions at the heart of meadow conservation, particularly the question of what the meadows are for and whether change and evolution in the meadows over time is acceptable.

As detailed in Chapter 5, stakeholders' views on meadow value divide into two broad streams: conservationists' views and farmer-managers' views. Within each stream, the diversity of views tended to be greater for the latter than for the former. Stakeholders whose interest in meadows is nature-conservation orientated rather than agricultural generally deployed highly developed, structured and detailed views of meadow value that focussed heavily and almost exclusively on the botanical value of the floodplain meadows, that is to say the botanical composition. Within this, a sub-set of characteristics were highlighted as key, namely the species richness of a grassland sward characterised by a range of symbolic positive-indicator herb species considered typical of such landscapes significant in terms of, and probably having been chosen for, their aesthetic appeal. Emphasis was also put on similarity to the MG4 assemblage description and on the rarity of MG4 as found on such meadows. In some cases the rarity of a particular plant species such as snakes head fritillary at North Meadow or meadow thistle at Brook Meadow was also noted although generally the emphasis was on the whole plant assemblage rather than individual species.

As seen in Chapter 2, the origin of many of the criteria of value appear to have developed historically over time and become embedded in the Ratcliffe Criteria, which objectivise them as a baseline against which to assess meadow botanical value. These then in time have influenced the subsequent choice of criteria in assessments such as those in the Natural England rapid Condition Assessment (Robertson and Jefferson, 2000). However, as discussed in Chapter 5, the criteria may be more subjective than often acknowledged and therefore they may be unstable concepts where conservationists try to deploy them as an objective baseline, an issue in nature conservation noted by Demerritt (2001).

That the particular aesthetic appeal of the positive indicator plant species might be an important reason for their having been chosen as indicators of meadow value is not clearly acknowledged by conservationists. Yet if this is so, then the positive species constitute a manifestation of the landscape and cultural heritage value attached to meadows (UNEP-WCMC, 2011a,b), which is at least acknowledged by most conservationists to some extent. However, as noted, the narratives on cultural and landscape value of floodplain meadows are very ill-defined. The fact that they typically only receive cursory mention by conservationists after botanical value may indicate that within existing strong narratives of botanical value, conservation stakeholders are uncertain how to fit such ideas of value into the existing structures of assessment and decision-making, rather than because they think cultural and landscape value to be unimportant. It may therefore be that more work needs to be done to develop more holistic narratives of meadow value that encompass broader perspectives of what meadows are for.

As an example of the lack of clarity around landscape and cultural value of meadows, it is interesting to note that the aesthetic value of meadows was rarely mentioned in documentation but was often mentioned or at least hinted at by stakeholders in interview. For example the North Meadow site manager spoke of the flowers being there "for us all to enjoy" clearly indicating that the presence of flowers on North Meadow had an aesthetic importance. In a similar sense, the volunteer surveyors at Deans Green meadow surveying preferentially "the nice bits", presumably the areas of the meadow that they found attractive. In a slightly different sense, farmers such as Farmer NMC3 at North Meadow talking about actually enjoying the practice of traditional hay making, mentioning the sights and smells associated with the practice of traditional hay making. All allude to an aesthetic aspect to interaction with meadows through people's practices. Yet aesthetic value is rarely overtly cited up-front as a clear aspect of meadow value by stakeholders despite clearly being a significant aspect of their value for some. Again this may be because the aesthetic value of meadows is clearly cultural and subjective. Such value therefore sits with difficulty alongside the desire to objectivise meadow characteristics such as in

the Ratcliffe Criteria. The botanical composition is therefore perhaps simply easier to objectivise as a baseline description.

Also, crucially, conservationists' narratives of meadow value firmly relegate agricultural value to a minor consideration as seen for North Meadow, or ignore it altogether. As this form of meadow value was the original driver for meadow assembly, this begs the question as to whether it is possible to shift perspectives of meadow value in this way without it having impact on the meadows' material characteristics and condition, either intended or unintended. This again has raised the question of whether conservation of floodplain meadows should seek to keep meadows as they are or whether it is legitimate to change some of their characteristics, which is likely to incur losses elsewhere (Muñoz Viñas, 2011). In terms of the view on long-term change in meadow condition and composition, no consistent line was clear from literature, guidance or interviews with conservationists. These sources often suggest that meadows may be 'improved' botanically by increasing the herb content and overall species-richness. Sometimes it is suggested that such change is returning them to an earlier baseline before they had become degraded, such as at North Meadow or at Mottey Meadow where degradation through past manuring or agri-chemical use is put forward as a reason for poor condition in some areas of the sites, or indeed the desire to reintroduce meadow thistle to Brook Meadow as a plant, until recently absent, that was deemed to belong on the meadow.

In such cases, specific evidence of past condition does sometimes appear to be assumed rather than backed by specific data. In other cases, this assumption of past degradation is not explicitly stated and so it is possible that conservationists do indeed consider meadow condition to be subjective and therefore they deem it legitimate to improve the desired botanical aspects of meadow condition at the expense of other values such as grass content as a feature of agricultural value, (which as seen at Mottey and North Meadows has led to complaints by farmers that the meadows are becoming degraded). In this sense the meadows are being changed towards an ahistorical state that is creating something new, namely an aesthetic herb-rich grassland, rather than conserving a hay meadow. In this regard the UK National Ecosystem

Assessment (UNEP-WCMC, 2011b) does note that the contemporary value of semi-natural grasslands is indeed a balance of considerations.

So again, whilst conservationists often appear to present meadow conservation baselines as objective, permanent and fixed, and to be monitored within an evidence-based scientific framework, in reality there is much evidence that meadow conservation baselines are acknowledged overtly or by implication to be subjective. Indeed as seen this is openly acknowledged in Ratcliffe's review (Ratcliffe, 1977) and the JNCC/NCC's subsequent guidelines on the selection of SSSIs (NCC, 1989). Yet whilst the overarching theoretical framework of conservation is prepared to acknowledge this subjectivity, day-to-day local practices by conservationists appear to still desire objectivisation of meadow baselines and conservation, which may lead to tensions between stakeholders over what the meadows are for.

The sidelining or even dismissal of the agricultural value of meadows is discussed in Chapter 5, in the fact that, in contrast to conservationists, farmer-managers rarely presented strong narratives regarding what the meadows are for and where their key value lies. This is likely to be because the primary interest of all farmers ultimately is the agricultural value, which they are not in a position to increase and the limits of which are determined by the conservationists' priorities that limit scope for varying the management. This said, farmer-managers certainly do have their own perspectives on meadow condition and management, and yet despite their primary interest in the agricultural value, farmers' perspectives appear to vary more than those of the conservationists in that they were willing to share the latter group's view of the non-agricultural value of meadows to varying degrees, with only Farmer NMC1 at North Meadow claiming total disinterest in, though not hostility to, the conservation or biodiversity value of the meadow.

This is perhaps unsurprising as had they had no interest in the conservation value it would probably not have been possible to recruit them to manage the meadows, as only the farmer of Birches Barn actually owned the meadow in question and therefore had a significant personal stake in the land. Nevertheless, as noted by the farmer of Deans Green, they would not be willing

to manage the meadows at a loss, and so the meadows must therefore retain some agricultural value in terms of income for them. This agrees with statements made by farmers with diversified income such as Farmer NMC3 at North Meadow or Farmers MM1 and MM2 at Mottey Meadow that they were more enthusiastic about the non-agricultural value of the meadows they managed, given that their reliance of meadow income was limited so that they could participate in meadow management for more personal non-financial reasons.

However, most farmers were critical to some degree of the condition and management of the meadows. Few acknowledged that meadow management was particularly traditional and many thought that the restrictions on management operations imposed by the conservationists reduced the agricultural value of the hay crop by reducing both hay yields and the perceived quality of the hay crop. Some farmers were of the view that management was unsuitable and was leading to a decline in meadow condition as seen from their perspective, linked to the value of resulting agricultural products, which contrasted with the conservationists' satisfaction with meadow value and who generally did not view botanical or biodiversity value as declining. This was especially notable at the higher profile sites such as North Meadow and Mottey Meadow, where conservationists more tightly controlled management. Conservation stakeholders were often aware of farmers' views but were reluctant to make concessions to them as noted by the Reserves Manager at Brook Meadow, perhaps as such concessions might conflict with conservationists' own narratives about meadow value and management. For example, part of this narrative appeared to assert that increasing nutrient inputs to meadows would lead to declining species richness in the sward. This said, at North Meadow and Mottey Meadow in recent years the site managers have begun to allow hay cuts to begin earlier to allow farmers to get them cut and cleared in a timely manner. This also allows them more time to fit meadow management in with farmers' other work, something which Riley (2006) found to be of key importance in farmers' views of the utility of meadows and thus their value as an agricultural resource for producing livestock feed.

8.2.1 Production of dominant narratives and perspectives

As already noted, a number of narratives or storylines emerged around the value of floodplain meadows and what they are for. Such narratives are in essence explanations or justifications told in documentation or by interviewees of the perspectives and viewpoints of stakeholders that underpin their views on meadow value, appropriate meadow condition and management. Such narratives circulate within communities of practice such as conservation policy specialists, conservationist practitioners, or farmers who work together and communicate to a significant degree. Conversely, where barriers exist between such communities of practice, such as between meadow farmers and conservationists, a disjuncture may arise in their perspectives and attitudes. As discussed in Chapter 2, such views on value have developed over time, have histories, and as a result may also contain inconsistencies, contradictions or tensions.

For example, during this research it was noted that, on-the-ground conservation practitioners such as site managers and the documentation they produce such as management plans tended to revolve around the biodiversity concept, analysing 'nature' in terms of its floral and faunal structure and composition, and focussing on species and by extension their assemblages in communities and habitats. The objective of 'nature' conservation is to preserve as many species as possible, as well as within-species genetic diversity, and community and habitat assemblage diversity (Wilson, 1992). Meanwhile, higher level policy-orientated conservation stakeholders also deployed the ecosystem-services perspective to justify meadow conservation (UNEP-WCMC, 2011b). The ecosystem services perspective is very much anthropocentric (Attfield, 2003) and therefore attaches value, ideally expressed in economic terms, to 'services' delivered by an ecosystem to human society. Such services as mentioned by policy specialists on grassland conservation included for example 'regulating' services such as 'pollination services' by providing a habitat for insects that then pollinate commercial crops, flood storage services, as floodplains may hold floodwater and prevent flooding in urban areas, as well as 'cultural' services such as recreation, where people visit meadows for pleasure.

Wild species diversity is noted in the National Ecosystem Assessment to be both a 'provisioning' service and a 'cultural' service, whilst agricultural value is seen to constitute a 'provisioning' ecosystem service by providing a foodstuff commodity for livestock, thus forming a link with farmers' views of meadow value, and is indeed mentioned as such by higher level policy-oriented conservation stakeholders. Yet this view on the agricultural value is not then reflected in site-specific management plans or the views of conservation stakeholders who manage specific sites. Questions therefore arise over the origin of the narratives that dominate views on floodplain meadow value, appropriate condition and management.

As noted already, botanical criteria for nature reserves, such as those of Ratcliffe, grew out of a consensus among conservationists in the UK after the Second World War. Whilst Ratcliffe openly acknowledged the subjectivity of the criteria, once they began to be used as a set of criteria to judge the value of a site, such as a floodplain meadow, they became a benchmark of value, becoming reified and often perceived, or at least treated in day-to-day practices as objective. As noted already in Chapter 2, this has also happened with the NVC description of habitats, which too has come to be used as a benchmark for conservation value despite being originally intended as a description of British habitats and therefore again a subjective snap-shot in time, with no implication that such a snapshot represented a permanent enduring state.

Yet again, as noted already, a central problem of conservation (the word preservation was rarely seen to be used in the context of floodplain meadows) is that the desire to keep an object the same ('preservation' in the view of Sheail *et al*, 1997), or at least to keep a selection of its characteristics the same whilst allowing others to change ('conservation' in the view of Sheail *et al*, 1997), requires a baseline definition of that which is to be conserved or preserved. By implication it also means an end to change and development over time in whole (preservation) or in part (conservation), which historically may be what always occurred, hence the apparent uncertainty over whether meadows should be 'preserved' exactly as they are or whether they should be allowed to evolve in some way ('conserved'), enhancing some characteristics whilst allowing others to decline or disappear (Muñoz-Viñas, 2011).

A range of motivations may lead to the desire by conservationists to objectivise criteria of such botanical and natural value in order to stabilise the conservation baseline and protect it from being undermined, despite evidence of the subjectivity of aspects of meadow value as well as of possible permanent change in meadow condition and composition. A lack of clarity exists over the significance of permanent change in meadow characteristics, and to what extent meadow conservation is preservation, re-creation, or new creation.

The objectivisation of criteria that are often subjective may therefore be hard to avoid in conservation and since the decline in the economic value of traditionally-managed meadows, nature conservationists have had a major role in ensuring their survival with attendant power and influence over their management. Conservation stakeholders may hold such power either as landowners such as at Mottey Meadows and North Meadow, through the powers provided by legislation to protect designated SAC or SSSI sites, or through provision of funding for meadow management through agri-environment schemes. In this way, conservationists' criteria have become reified through their objectivised baselines and benchmarks of how meadow condition should be. Furthermore, the desire to objectivise meadow characteristics as parameters of value may also be stimulated by a reluctance to acknowledge the subjectivity of aspects of meadow value and downplay those aspects of value such as cultural or aesthetic value because as Harris (2006) suggested, the acknowledgement of subjectivity of conservation value may undermine support for conservation, given that such value is merely built on "shifting sands" (Demeritt, 2001).

If meadows can be considered to be cultural heritage, it should be noted that researchers on the theory of cultural heritage conservation (Muñoz Viñas, 2011) have noted that the philosophical trend in cultural heritage conservation is away from objectivity and 'truth' as the driving force of conservation towards inter-subjectivity and a focus on value, function and expression. In this regard, cultural heritage objects have no intrinsic value, but their value is cultural or 'anthropogenic' as Attfield (2003) puts it, deriving from the meanings that people attribute to them. This view accords with the ecosystem-services view of nature which is also anthropocentric.

Neither in documentation on floodplain meadow conservation nor in interview did stakeholders involved in managing specific meadows often give an indication of their own deeper ethical or philosophical views on the value of floodplain meadows or why they should be conserved. However, one Trust officer at BBOWT Wildlife Trust did explicitly cite moral arguments for conserving meadows, that is, that people did not have the right to destroy other species and that non-human life had the right to exist, whilst the CEH Grassland Specialist also noted a moral imperative to conserve sites such as meadows. Other ethical frameworks about the value of nature, such as the 'Deep Green' view, that place intrinsic value within nature such as bio-centric or eco-centric views (Attfield, 2003), may well therefore be shared by some stakeholders who see meadows from a perspective other than the ecosystem services perspective. Some conservationists may not therefore be comfortable with the idea that the conservation criteria are not objective.

The historical development of the biodiversity perspective of conserving species and habitats has developed in parallel with corresponding policy and legislation on nature conservation, which as seen in Chapter 2 is also therefore structured around species and habitats with its focus on conserving rare plant species and assemblages. Similarly a set of understandings has also formed about the management operations that maintain suitable meadow condition. All in all, a series of dominant narratives have been developed by nature conservationists backed by power to assert their perspectives.

Conversely, narratives on the agricultural resource value of floodplain meadows, the value of the hay crop and utility of the grazing aftergrowth, whilst relatively clear at least in the minds of the farmer-managers, are downgraded or dismissed altogether, especially where they conflict, or are perceived to conflict with, ideas about botanical value. Finally, narratives on other aspects of meadow value such as cultural heritage value or landscape value, rather than being dismissed, are alluded to or hinted at, but these ideas of value are not developed further or made explicit. They therefore give the impression of being supplementary or 'add-on' justifications to bolster primary narratives of value.

In effect, such dominant biodiversity perspectives and narratives could be considered to constitute "hegemonic" narratives as proposed by Forsyth (2003), narratives that circulate within social groups, in this case conservationists, that hold particular power to promote or enforce their view of value in the case of meadows. Farmers for their part have largely disengaged from floodplain meadow management as a result of the relative decline in their utility as an agricultural commercial resource, such that only a specific sub-group of farmers remain interested in involvement in meadow management for a range of reasons discussed in Chapters 5 and 7. Farmers' narratives about meadow value have therefore in a sense collapsed along with the economic value, given that as seen, few farmers appear to have any interest in the agricultural utility of meadows.

Therefore, stakeholders' respective positions regarding the value of meadows, the storylines that stakeholders tell to explain their views, opinions and perspectives, have developed differentially. Those of conservation stakeholders have developed and become more elaborate, structured and focussed on botanical characteristics of meadows, whilst farmers' narratives have become more heterogeneous and perhaps also ill-defined. Nevertheless, the perspectives of the conservationists have developed historically. The underpinning philosophical justifications are not deployed explicitly, are often unclear or underdeveloped, and at times appear to be unstable concepts. Once developed and embedded into formal structures such as legislation, guidance, management plans and other documentation, as well as of course the structure of meadow assessments, such perspectives of value appear to be taken as a 'given' and deployed without further question by conservation practitioners.

In this sense, a more holistic view of meadow value has been 'chopped up' by conceptual dichotomies and compartmentalised ideas of meadow value. The conservation of floodplain meadows is highly structured by the compartmentalised form of legislation, policy and guidance on nature conservation, and that focuses on habitats and species, informed by the structure of the National Vegetation Classification scheme and of the Ratcliffe Criteria. The various ways in which 'nature' is defined and subdivided then finds its way into conservationists' mobilisation of

ideas of meadow value in the highly structured assessments. Meadow conservation is therefore informed by conceptual dichotomies and structures that prioritise some characteristics of value, whilst downgrading others.

8.2.2 Floodplain Meadows: nature or culture?

As has been seen in Chapter 5 considerable effort is made to portray meadows such as North Meadow or Brook Meadow as 'natural' and to frame some aspects of human activity in the meadow such as manuring or harrowing that may increase their agricultural resource value, as problematic and out-of-place; the social that does not belong. Potential consequences of this may include a possible inclination of conservationists' views on management towards or a minimum-intervention approach, with a presumption against all management operations beyond the absolutely essential such as the hay cut and autumn grazing, as well as a reluctance to acknowledge, or a difficulty in knowing how to engage and measure the significance of aspects of value that are more overtly cultural or social, such as aesthetic appeal or agricultural productivity.

In the most extreme case at North Meadow, the management plan seeks to frame the site strongly as 'natural' and 'non-social' and so narratives on the value of meadow flora (and to a much lesser extent fauna) are highly developed, and strongly linked to broader ideas about the value of biodiversity and the threat from human activity. At other meadow sites, this tendency is less extreme with some acknowledgement of human agency and cultural value, but still with a desire, as seen at Brook Meadow to highlight the 'naturalness' of the meadow flora.

One way in which some nature conservation stakeholders might generally assert that there is a fundamental qualitative difference between conservation of 'natural' and 'cultural' objects, is that the former are, or at least include, living organisms, whereas cultural objects do not. Nature and culture are therefore qualitatively different in kind. Indeed, embedded in narratives deployed by conservation stakeholders regarding meadow conservation is not only the fundamental qualitative difference between living and non-living, a fundamental tenet of the biological

sciences, but also the elision with this narrative of another dichotomy of two highly complex and contested concepts: nature and culture.

Neither documentation nor interviews clarified most conservationists' view of what 'nature' is precisely and as seen in Chapter 2, work by a number of academic researchers indicates that nature is a complex socially-produced concept. However, as regards the use of the word 'nature' in documentation and everyday use by conservation stakeholders, it often appeared in the context of meadow conservation to be essentially a shorthand term for flora and fauna, i.e. non-human life forms, as references to nature value tended to make reference ultimately to lists of species and species assemblages, such as in SSSI citations, or reference to MG4 grassland. The idea of natural objects can of course encompass the non-living such as rocks and mountains, but such objects are not noted as of relevance in the context of floodplain meadows, though the concept could of course be extended to non-living objects such as water and soil. Nevertheless, given that most floodplain meadows are designated as 'Special Sites of Scientific Interest', and the objects of this interest in terms of meadows are focussed on the plant species, in the context of meadows, the idea of nature appears to focus strongly on non-human living objects, particularly plants. So as living objects appear to come under the category of 'natural' and the idea of a nature/society divide sets society up in opposition to nature, this appears to implicate meadows in the natural and divorce it from the social in the minds of some or even many conservationists.

Most conservationists at the case study meadows, and also as seen in the literature, assert that the main value of the meadows lies generally not so much in the individual component species, but in the plant assemblage. So given that the assemblage has been produced by agricultural activity and would not be found without it, it may be argued that the valued assemblage is really cultural heritage at least as much as it is natural heritage.

Yet as noted in the interview with the Natural England Head of Historic Landscape, ideas about what constitutes a 'natural' object or a 'cultural' object have developed such that for meadows the focus has been very much on their material composition of living plants, rather than the

human practices that create them so that meadows have been deemed by conservation specialists to fall within the remit of 'natural heritage' and outside the scope of 'cultural heritage'. As she also noted, cultural heritage legislation focussed on scheduled monuments, non-living artefacts such as the dole stones at North Meadow, but that the materiality of a meadow could not qualify it for consideration for protection under cultural heritage legislation. This suggests that in conservation practice there is a sharp divide between nature and culture and meadows must be deemed to fall on one side or the other of this divide. This divide has considerable implications for the way in which legislation and policy are framed on the assumption that nature and culture are two non-overlapping realms. It also has implications for the deployment by conservationists of the biodiversity narrative about the value at all levels of biodiversity including at community/ecosystem level, as thought needs to be given to the 'biodiversity' value of communities and ecosystems (i.e. assemblages) that are clearly strongly cultural, such as floodplain meadows.

Finally, in the case of meadows, a further elision of nature/culture and rural/urban may also mean that the rurality of meadows is also equated with naturalness. As noted by Woods (2010), imaginings of rurality in the UK frame rural lifestyles as 'closer to nature' and are also likely to interact with the positive framing of traditional management versus any agricultural practice that might be deemed 'modern' agriculture. Yet management appears to be a hybrid with non-traditional concerns as discussed below.

8.2.3 Implications of the findings for the main research question

Ideas of the nature/culture-society divide may fuel the desire to see only 'natural' value in floodplain meadows, framed as the botanical composition, with social and cultural aspects of value bounded out or relegated in importance with a reluctance to recognise that meadows are in fact a nature-culture hybrid, co-produced by the interaction of biophysical and social processes. Such a dominant perspective of meadow value held by conservationists would be expected to make botanical value dominant if conservationists have the power to enforce their perspectives. This partial view of meadow value would then be expected to be mobilised in meadow

assessment with implications for stakeholders' views on meadow condition and potentially on required management interventions.

The lack of clarity over the form and definition of other possible forms of meadow value mean that they are unlikely to be mobilised in meadow assessment, may not be recognised and may not therefore be conserved. This is likely to be true particularly for agricultural value, any decline in which may impact on farmers' motivations for involvement in meadow management.

8.3 Stakeholders' meadow assessment practices

Sub-question 2 below tackled the question of how stakeholder perceptions of meadow value are mobilised into assessment activity and what stakeholders perceived the role and function of such assessment activity to be:

> *How are knowledge and understandings about floodplain meadow status, material condition, perceived value or management generated by the assessment activities of stakeholders involved in their management?*

As seen in empirical evidence presented in Chapter 6, of the range of valued characteristics of meadows overtly acknowledged or hinted at both verbally and in print, only a small subset are actually mobilised in assessment and evaluated in regular assessment or monitoring activity.

On floodplain meadows with a degree of statutory protection such as an SAC or SSSI designation, a significant amount of formal structured assessment activity was undertaken by conservationists. This mostly took the form of the Natural England rapid condition assessment or a very similarly structured assessment based on the same underlying criteria and philosophy. The focus was on aspects of meadow condition relating essentially to the botanical composition, with very little consideration of other aspects of meadow value, such as the recording of criteria of agricultural value such as hay yield, or of meadow management operations. Most farmers for their part, whilst they certainly had opinions on the condition of the meadows they managed, undertook no regular assessment activity to form specific understandings about meadow condition. This they

typically said was because they had little or no say in decisions regarding management activities, management being dictated by a standard prescription, other stakeholders' priorities, or other practical factors unrelated to the meadows' condition as discussed below. Farmer-managers therefore no longer assess meadow condition as they see no mechanism to translate this into management decisions.

Whilst the identity and nature of these other factors are considered in more detail in following sections, this section considers the reasons for the partiality of assessment activity on floodplain meadow sites. Reasons for this revolved around three main concerns: firstly, as noted the mobilisation of a partial view of meadow value, secondly stakeholders views on the purpose of meadow assessment, and thirdly issues of what is the best kind of data to capture understanding of meadow condition.

The reasons for a partial view of meadow value have already been discussed above whilst Chapter 6 has detailed how this partial view of value is embedded in the assessments' criteria. However, the relationship between assessment criteria and meadow value is also influenced by the stakeholders' objectives in undertaking assessment activity. What is it that they want to learn from these assessments and what is the best kind of data to collect for their purposes? Furthermore, why do stakeholders mostly not collect management data, despite this being expressed as desirable across a range of documentation by conservation stakeholders?

8.3.1 The aims of assessment

Theoretically, according to much of the literature and documentation produced by conservationists, management is supposed to be 'responsive', that is to say, successful management should deliver a meadow with the desired material characteristics, and if it does not it should be altered to achieve the desired meadow characteristics. Yet virtually all assessment activity is focussed on condition, not management. A positive condition assessment by conservationists is interpreted as a success in maintaining the valued characteristics of the

meadow. Yet, as previously seen, the criteria are limited and the assessments partial with potential sources of information being ignored.

In this case, the question arises as to how is it possible to make management responsive if there is no record of past management? This issue may become more critical as farmer turnover appears to be increasing at some meadow sites meaning that past managers' personal recollections are being lost. It must also be said that not all monitoring and assessment work in reality appears to be done in order to collect data to address questions of condition and management. It may actually meet other needs such as cultivating public enthusiasm for meadow conservation through volunteer activities that allow enthusiastic members of the public to interact with the meadows in a way that is presented as practical, 'scientific' and useful, and which appeals to a broader conservation-minded community whose worldview has been shaped by the dominant narratives and discourses presented by conservation stakeholders.

Nevertheless, consideration of both general guidance documentation and meadow-specific documents clearly indicate that the recording of site management is considered desirable within the philosophical context of 'responsive management'. However, as has been noted in chapter 6, assessment activity on meadows was seen to be overwhelmingly focussed on meadow condition, and the monitoring of management activities rarely occurs. The question therefore arises as to why this is so. Evidence found suggests that whilst considered desirable, the recording of management data often does not occur for practical reasons, particularly staff shortages by conservation organisations, the limited enthusiasm of farmers for recording meadow management, and limited inter-stakeholder communication.

Firstly, regarding staff shortages, the Natural England archives show that in the past (1980s and early 1990s) extensive notes were made on management of North Meadow over the summer. At this stage the site had a warden, a person who was dedicated to monitoring the meadow. Currently the site has a manager who is based in an office remote from the meadow and also manages two other nature reserve sites elsewhere. Recent rationalisation of Natural England's

activities also proposed to have no NNR managers by 2014. The trend therefore appears to be towards a decline in personal detailed knowledge of individual meadows, loss of experiential knowledge and increased reliance on data that can be captured in very brief interactions with the meadows. At smaller sites the conservation stakeholders may only see the site once per year or even less frequently. Reliance on 'objectivity' and 'science' may be used to cover for anxieties about uncertainty and risk (Muñoz Viñas, 2011).

Secondly, interviews with farmers involved in managing a number of meadows indicate that many farmers question the appropriateness of contemporary meadow management and their interest in the meadows is often marginal for reasons already discussed. As a result, the level of interest of the very people who could most easily record management activities that they themselves carry out and communicate this information to other stakeholders is so low that they no longer undertake to do so.

Thirdly, perhaps also partly as a result of the staff shortages experienced by meadow owners and conservation stakeholder organisations, stakeholders acknowledge that often they have very little interaction with one another during the hay growing season. Stakeholder networks are often therefore very 'loose'. Conservation stakeholders may not therefore interact with farmers at the crucial time of management operations and so may not discuss management undertaken that they themselves have not had time to observe. If farmers do not then record management, the opportunity to record these data is lost.

As recording of management is considered desirable, yet does not occur for mainly practical rather than philosophical reasons, it appears that consideration should be given to how these practical barriers could be overcome.

8.3.2 What is the best kind of data to collect?

It has already been noted that conservationists have tended to objectivise criteria of meadow value that may be considered in fact to be subjective. Further to this and as noted in Chapter 6, a further possible "hegemonic" narrative regarding the epistemology of assessment and

knowledge-generation practices is that which frames the data generated by the standardised formal condition assessments and quadrat surveys as 'objective' and 'scientific', and asserts that such knowledge is intrinsically superior to the experiential knowledge generated not only by non-conservation-orientated stakeholders such as farmer-managers, but indeed also by experienced conservation assessors. As has been seen already in Chapter 6 and above, the standardisation and 'objectivisation' of the criteria in the Natural England condition assessment was not only because Natural England aspired to be an 'evidence-based' organisation, but also because staff turnover and lack of botanical skills or field experience would be likely to prevent field assessors from generating and/or incorporating such experiential knowledge. Furthermore, as already seen, many of the criteria selected to represent value actually represent a subjective choice with no clear explanation for their selection, or philosophical justification of their objectivity.

Whilst resource restrictions and practical issues have constrained conservationists in terms of the data that may be collected on meadow condition and management, the dominance of scientific and objective types of knowledge has led to a range of assessment activity, at least on high profile meadow conservation sites such as North Meadow and other SAC and SSSI sites, based on the same philosophical framework of criteria, with other types of more experiential knowledge either explicitly dismissed as anecdotal or even propagandistic (for example, assuming that all farmers want to intensify management) or at least not acknowledged or investigated further. This may be either because conservation stakeholders are unaware of such experiential knowledge, or simply do not know how to incorporate such knowledge into their preferred formal objective knowledge frameworks, which do not recognise such informal knowledge as valid data. Objectivisation of criteria may also be perceived as mitigating risk of undesirable change.

As seen in Chapter 2, different researchers have debated the relative merit of different kinds of knowledge about nature conservation sites. Whilst Sutherland (2004) criticised some non-quantitative data collected by non-formal scientific field methods as unverifiable single data points, it needs to be recognised that highly detailed scientific studies can only be done on a small number of field-study sites and do not form the basis for local monitoring studies across a large

number of meadow sites if resources are very limited. Standardised field studies such as detailed quadrat surveys with an adequate sampling rate are labour and resource intensive and resources for conservation are not currently sufficient to allow large amounts of such detailed work. Monitoring of condition at meadow sites therefore requires an approach that is realistic in terms of resources yet delivers an adequate level of certainty and accuracy to make the results of utility to inform management as noted by Danielsen *et al* (2005). Furthermore, as Sheil (2001) noted, many such field studies are useful for formulating ecological theory, but not useful for informing management.

As noted by Natural England's conservation officer for Warwickshire, prior to 2000, most conservationists' assessments of meadows were simple walk-over visits to gain an impression of the meadow's condition, much indeed as farmers still do. Such an impression is formed by experienced staff by making their own experiential comparison with other good meadows as well as looking for recognised indicators of good meadow condition. Such an impression is indeed just one data point, is hard to verify independently and is not transferable to another researcher in the way that numerical data are. However, if the assessor is experienced, it is a data point that may well be accurate. Indeed any disparity between such experiential knowledge and formal data may in itself constitute a useful data point. A botanical surveyor, in order to gain the same overall impression of the same meadow as an experiential assessment by a knowledgeable assessor, may have to spend much longer gathering numerical data in order to draw the same conclusions, although of course such monitoring data is easier to store and is transferable to another researcher who does not know the study site in question. Ultimately, which form of data is better for informing management will depend on available resources and aims.

Interestingly, the two dominant perspectives regarding the 'naturalness' of meadows and the superiority of scientific knowledge are to some degree in conflict. The former appears to share common origins with the 1960s 'crisis of modernity' narrative in which the natural and the traditional are prized over the social, the modern or the innovative. This contrasts with the privileging of scientific knowledge about meadows and as already noted, modern management is

to some degree a compromise between botanical interest and non-traditional concerns, specifically seed fall and ground-nesting birds, but not with agricultural value. All this serves to highlight the hybrid nature of meadows and of the management that maintains them.

Clearly therefore the question again arises as to what purpose assessment of meadow condition serves. Farmer-managers no longer appear to assess meadow condition whilst conservation stakeholders believe that their assessments capture the essential value of meadows and therefore can prevent loss of value through monitoring to maintain vigilance. However, as they do not monitor non-botanical parameters or management operations, and as management networks are often very loose with limited communication, conservationists have perhaps not noticed that non-assessment factors are determining management and that focus on botanical aspects does not capture all aspects of value. Clearly there is widespread belief in the model of responsive management and that adequate meadow condition is clear evidence of adequate management. For example, Warwickshire Wildlife Trust have significantly increased their staffing and resourcing of site monitoring in recent years and whilst they admit that this assessment activity is still not informing meadow management, this was the stated intention of setting up the new monitoring schemes.

However, the assumption that meadow condition reflects the adequacy of management is only valid if a wide enough range of parameters are followed to capture a holistic view of meadow value. As seen in Chapter 6, whilst the positive indicators used in the widespread rapid condition assessments do act as fairly good indicators of aspects of botanical value such as MG4 character or true species richness at the quadrat scale, the fact that such species are nearly all long-lived perennials means that these indicators may be slow to respond to deteriorating biophysical conditions or inappropriate management. The signs of such changes will only manifest themselves after poor or unsuitable conditions have pertained for some time. Furthermore, coupled with the low level of frequency of such assessments on the lower-profile meadows, decline in meadow condition may be quite advanced before it is noticed, as was seen at Welford Field meadow, Warwickshire, where the meadow was overtaken by coarse grasses and failed the

condition assessment as it had not been grazed for approximately five years despite this management activity being subsidised by an agri-environment scheme. Monitoring of management, even remotely through discussions with the landowners or farmer, coupled with occasional very simple spot checks would therefore have proved of greater utility than the rapid condition assessment after the meadow's condition had already declined.

The broad rationale for meadow condition assessment with regards to responsive management does appear to make sense given the uncertainty over past traditional management practices and their relevance to today's context. However, such structured assessments appear to take place because they follow changes in meadow condition with regards to the conservationists' interest in botanical value and thus do conform to the view of assessment as objective. As already noted in Chapter 6, it is possible that in some contexts assessment activity may also play other roles such as public outreach. This was hinted at by Warwickshire Wildlife Trust staff but is not an aim overtly stated in documentation or by most conservation staff in interviews.

Nevertheless, assessment is based on too narrow a range of criteria to inform responsive management as the remit of this assessment is, as seen, too narrow. A broader concept of successful management needs to acknowledge a wider range of value as understood by a more extensive range of actors, and consider that management that undermines the socio-economics of meadow management can be prejudicial to the survival of meadows as management that causes inappropriate changes in biophysical conditions. Indeed the National Ecosystem Assessment (UNEP-WCMC, 2011b) acknowledges the agricultural value of semi-natural grasslands and notes that a balance needs to be struck between different forms of value delivered by grasslands such as floodplain meadows.

The imposition of a partial view of meadow value and of the 'best' kind of knowledge to inform their conservation, as well as an unacknowledged hybrid management may be leading to change in meadows. Change may be an inevitable part of conservation (Muñoz Viñas, 2011) but conservationists need to be conscious of the perspectives and narratives they deploy and the

rationale behind them, how these influence their attitudes and decisions, as well as any implications of their decisions. Also, assessment activity may not be able to capture many types of change owing to its partial focus and criteria. Conservationists need to be conscious that they may not necessarily be 'preserving' the meadows in the sense of preventing any change in them. The product of meadow management has always been what people subjectively wanted to produce and has fluctuated over history, albeit driven by changing agricultural desires in the past. Consideration is therefore needed as to whether current views on value provide the ideal balance between different types of meadow value, and how assessments might capture a holistic view of value. Meadows are also individual assemblages that differ from site to site as does the pattern of cyclical dynamism on each meadow. The standardised assessments as currently utilised do not therefore appear to be adequate to capture the diversity of value and individualism of different meadows and also to capture a view of meadow change.

8.4 Interaction between stakeholder assessment practice and meadow management

Sub-question 3 investigated what decisions, if any, stakeholders took regarding meadow management and what factors were seen to influence such decisions. This in turn informed what role or influence, if any, assessment activity had in prompting responsive or at least reflective management:

> *Do the findings of meadow assessments influence in any way the subsequent management actions of stakeholders, and if so how?*

Consideration of how perspectives of meadow value translate into assessment and conclusions about meadow condition allows an evaluation of the stability of understandings generated by stakeholder assessment practice and its ultimate utility in influencing management practices. Where assessment practices are seen not to influence management, it also allows an appreciation of whether this is because assessment activity is not fit for purpose, that is to say, it fails to meet stakeholders' aims, or whether other factors are influential for other reasons and so dominate

management decisions. This section therefore considers to what extent meadow assessment achieves its aims of generating understanding about meadow condition and management, and whether a model of responsive management can be discerned in stakeholders' decision making.

Firstly this section considers whether meadow assessment activity observed on floodplain meadows was efficient at detecting change in the meadows' condition over time in a way that related to stakeholders' views on meadow value. As seen, the partiality and infrequency of meadow assessment casts doubt on its ability to detect a range of changes in meadow condition. It then considers what factors were seen to affect decisions regarding meadow management operations and whether, and to what extent, assessment conclusions were among these significant factors. Finally, the implications of the findings for the future of floodplain meadows is considered.

8.4.1 Detecting change in meadow condition

As seen, the criteria selected and highlighted by conservationists and deployed in the rapid condition assessments will allow them to detect fluctuation of certain restricted parameters of biological composition, such as the fluctuation in the individual populations of selected charismatic species, the positive indicator species, and the species richness of a limited 'basket' of such symbolic species. However, they do not permit evaluation of the full botanical species richness of the grassland sward that conservationists claim to be the key characteristic of such meadows rather than the performance of individual species. This said, Chapter 6 indicates that the number of positive indicators does correlate to a significant degree with other aspects of botanical value: species richness or MG4 composition, and so do have value as indicators of such parameters of meadow condition. However, the two main groups of stakeholders (conservationists and farmers), if they make assessments at all, use different positive criteria and neither party knows much about, or is concerned with the interrelationship of performance between the criteria of different kinds of value.

Again, the limitations in the assessments are that they do not capture a broader view of meadow condition and management. As noted in Chapter 6, agricultural aspects of meadow condition are related to botanical composition and therefore botanical aspects of value in non-straightforward ways that have not been extensively investigated. Economic value may not be of immediate interest to conservationists but hay yield is a parameter of biological productivity, and whilst the effect of eutrophication on mesotrophic grasslands is well researched, the relationship between botanical composition and low levels of fertility and productivity on such floodplain meadows is less so.

Some farmers are aware of trade-offs between different aspects of agricultural value, between quality and quantity, but conservation narratives appear to have determined that either there is an inverse relationship between botanical value and agricultural value, or that the inter-relationship is irrelevant in the face of their own priorities. The findings in Chapter 6 suggest that this may not be the case and the assertion that good botanical and good agricultural quality are necessarily diametrically opposed needs to be questioned to ascertain for each meadow to what extent this is the case. In Chapter 6 the relationship of these botanical parameters and the agricultural parameter of hay yield was seen to be more complex. This relationship appeared to be site-specific and potentially follows the Grime hump-back model (Grime, 1973, 2001) in that both increasing and decreasing productivity either side of an optimum may lead to a decline in the positive botanical criteria. It would therefore be necessary to examine the performance of each meadow as a unique system in order to evaluate this likely optimum level of productivity relative to biodiversity value not just because it affects farmers' interest, but because biological productivity is clearly a manifestation of system function which in turn affects the criteria of botanical value.

Finally, as seen, the modes of management and associated activities that are taking place on meadows are not often recorded and so it is not known if management is adequate until it has already had a negative impact on condition that may not be noted for some years. The lack of records on past meadow management also makes research into the general efficacy of

management operations difficult. Again, with regards to the model of responsive management, failure to record management makes it impossible to be sure of how to alter management where the meadow is considered to be changing in undesirable ways. This is particularly an issue for meadows in the face of increasing turnover of farmer-manager contractors.

As few stakeholders record management practices and agricultural output such as hay yield, most data on changes in hay yield are anecdotal and from farmers, and so are difficult to verify independently. This said, many farmers believe that current conservation management practices are leading to a decline in meadow productivity and hay quality, that in some cases clearly impacts on their enthusiasm to participate. The numerical data obtained during this research has been able to verify that declines in hay yields have been occurring on some meadows in recent years, suggesting that at the very least, there is now greater urgency to monitor meadow productivity more widely to assess the situation at each conservation meadow. This is because neglect of the importance of agricultural value in terms of the motivations of farmer-managers, appears to be having an adverse impact on conservationists' ability to enrol local support for meadow management in a socio-economic environment where few candidates are available to help, and enthusiasm for non-agricultural conservation management is often limited to a few local farmers with a personal enthusiasm for meadow management and traditional practices.

Overall it appears that the assessment activity currently undertaken on floodplain meadows is not capable of capturing all but a narrow impression of change in meadows and which is limited to a specific view of meadow condition based on botanical composition. The rapid assessments undertaken do seem to have some utility as an early warning system through the use of negative indicators, which are shared with farmers. Otherwise the assessments only follow the fluctuation of the grassland sward population of distinctive and charismatic or 'symbolic' meadow species that people associate with such meadows. Declines in parameters based on positive indicators therefore tell us that the meadow is changing in so much that there are fewer subjectively chosen meadow symbols as well as an indication of decline in species richness or MG4 character, but yields no other information about the meadow's value, condition, or management. Theoretically

and by definition, if conservationists are conserving a traditional system, then the agricultural meadow and the conservation meadow should be the same, yet as seen, some evidence suggests that meadows are not the same as in the past and that conservation management may well be altering the meadows materially, but that a partial view of meadow value and assessment is not capturing this.

8.4.2 Factors affecting management decisions

Having considered the nature, structure and embedded values of assessment, as well as the utility of its deployment, a further question of relevance is whether assessment is a significant factor affecting meadow management decisions, or whether other factors dominate? A range of factors were seen in this work to influence the management that is applied to a meadow and the relative importance of each factor varies from site to site, depending on the network of actors involved and their interrelationship.

Factors include (in no particular order):

1. Assessment by stakeholders/management actors
2. Management prescriptions and guidance (formal and institutional narratives and perspectives)
3. Stakeholders' perspectives regarding 'appropriate' management
4. Inter-actor relations
5. Farmers' interest and enthusiasm versus other commitments, obligations and priorities (influenced by perception of value and economics)
6. Site conservation status
7. Land ownership
8. Weather (strongly influences timing)
9. Animal health and welfare considerations restricting animal movements

Other than assessment, the other factors fall into three main categories. Factors 2 and 3 (and by extension 6) relate to management prescriptions and defaults relating to stakeholders' narratives

and perspectives that, as already noted, include an element of presumption towards 'minimal intervention' by conservation stakeholders in management for reasons already discussed. Muñoz Viñas (2011) considers that in the context of cultural heritage conservation, the presumption towards 'minimum intervention' in restoration and conservation is motivated by a desire to avoid the risk of damaging a conservation object, and constitutes a refusal to take responsibility for conservation actions that may subsequently prove to be unpopular with some stakeholders, given that all courses of conservation action favour a particular outcome with enhancement of some features and the loss or reduction of others. As seen earlier, in the context of floodplain meadows this may be motivated by uncertainty regarding knowledge about past historical management, as well as conservation stakeholders' mixed feelings about people in these landscapes, given their desire to frame floodplain meadows as 'natural'.

Factors 8 and 9 related to practical issues imposed from outside the stakeholder networks with which all stakeholders had to contend, and which have been discussed in Chapters 5 and 7. The remaining factors relate to a complex of issues relating to status, power relations and inter-personal relations between stakeholders.

As seen in Chapter 7, assessment findings were seen to influence the decision to cut hay on North Meadow earlier than usual following summer floods in 2007/2008, and the predominance of a negative indicator species (dock) at Portholme alerted Natural England to problems with site drainage leading to eutrophication and waterlogging via standing floodwater. Here widely acknowledged negative indicators shared by conservationists and farmers alike (excess leaf litter and presence of dock, respectively) alerted stakeholders to the need for intervention. Similarly, botanical and hydrological assessment by the Floodplain Meadow Partnership was seen to inform Natural England of the need to maintain regular management of Mottey Meadow. All three meadows are high-status sites where conservation stakeholders exercise a high degree of control on assessment and management. Otherwise, the results of assessment largely do not seem to lead to any decisions regarding meadow management, the latter being influenced by the range of other factors above. Decisions about management take place via processes of negotiation

between stakeholders but differential power and status between stakeholders, which vary from site to site in relation to factors such as legal conservation status, influence whose opinions and wishes are dominant and decisive.

In terms of factors 4-7, these all interact, and have significant influence on farmers' motivations to be involved in meadow management. In this study, land ownership issues did not seem to influence stakeholder interactions as apart from Birches Barn, no landowners were also the farmer managers and land tenure issues did not appear to surface as a significant issue in stakeholder relationships. This may not necessarily be the case to the same extent in some areas of the country such as North Yorkshire or Worcestershire where private ownership of meadows appears to be more common, or in other countries in Europe or elsewhere in the world.

Larger sites such as North Meadow tended to have more stakeholders involved in that their management is shared between several farmers, although the reverse is true in the case of the Oxford Meads, where a single organisation now manages the whole Meads complex on behalf of multiple landowners. The number of stakeholders in the network did not however appear to affect decision-making as management was compartmentalised into different functions such as cutting hay on separate land parcels or grazing. This tended to lead to a series of one-to-one relationships between the conservation stakeholder and each farmer-manager with limited interaction between the farmer-managers. Even stakeholder relationships between conservationists and farmers were fairly loose with little evidence of regular interaction or communication, suggesting that the dominance of default prescriptive management not only made assessment activity by farmers redundant, but also reduced the need for communication once farmers knew what prescription was required of them, they no longer needed to liaise with the other stakeholders.

As already discussed above, legislative and institutional structures put conservationists in a strong position to impose their perspectives on floodplain meadow management, granting them power to dictate limits and restrictions on management operations. This situation is potentially

bolstered in situations where the conservationists were also the landowners and on sites where the meadow carried a higher level conservation designation such as SAC compared with a SSSI or an undesignated site such as Long Mead. Overall, the greatest difference was seen between North Meadow and Brook Meadow on the one hand, as both carried statutory designations, and Long Mead on the other, which did not possess any statutory designation.

This is because at Long Mead, the lack of statutory duties meant that Natural England's relationship with the meadow was looser. However, the one factor that constrained conservationists' ability to impose their view of meadow management was their inability to deliver management themselves and the need to find farmers as partners to undertake the management. As seen in Chapter 5 and 7, there is a very limited number of potential candidate farmers in the local landscape around all the major case study meadows and at all three the landowners and or conservation stakeholders had difficulty finding and retaining farmers to manage the meadows. Farmers' motivations for participation in meadow management are already limited, and the constraints on management imposed by conservationists, such as the late hay cut, further depress the perceived value and economic return of meadows to farmers. This may prove a significant issue in terms of the long-term survival of such floodplain meadows into the future as discussed below.

8.4.3 Possibility of neglect or abandonment as a major threat to floodplain meadow conservation

In terms of the specifics of management (exactly when the meadow is cut, how often the drains are cleared, exact grazing duration and intensity), the meadows may be resilient to a greater or lesser degree, which may well be site specific. Without detailed data of past management, the degree of resilience is difficult to judge. However, evidence suggests that the meadows are potentially fragile in terms of the socio-economic structures through which management is delivered and therefore the greatest threat to the meadows in the future could well be total lack of management as conservation agents fail to find farmer-managers to undertake management.

Factors identified in this research and noted earlier in this thesis affecting farmer recruitment include:

- Limited number of small-holders in the local area near meadow sites able to deliver management (possessing appropriate small light-weight hay cutting machinery that increasingly farmers no longer possess, possessing grazing animals that they can readily move to meadow sites)
- Level of interest among local farmers in managing meadows (even if enthusiastic about conservation farming, they are unlikely to want to manage a meadow at a net financial loss)
- Candidate farmers' level of income diversification and reliance on farming
- Age demographics of farmers knowledgeable and enthusiastic about traditional low intensity farming methods
- Even with recent rises in hay prices, many participating farmers' enthusiasm for managing meadows remains low even though they often pay nothing for access to the meadow as an agricultural resource (license fee is often a peppercorn rent e.g. £1).
- Increasing rate of turnover of farmers managing meadows, where the farmer is a tenant or contractor rather than land-owner.

As seen in Chapters 5, 6 and 7, some farmers as stakeholders are losing interest, or their interest in meadows is marginal. Recognition of the agricultural value of meadows and farmers' stake in management would be likely to enhance buy-in, without which management may become unaffordable or unsustainable for conservation organisations. Alternatively, farmers would need to be further incentivised to participate in meadow management, thereby increasing management costs. Current meadow management is perhaps depressing farmers' motivations as seen in interviews and increasing staff turnover, stimulating a move to paid contractors. Dismissal of agricultural value is therefore depressing the already marginal economic value of the hay crop and grazing resource.

As Muñoz Viñas (2011) notes regarding cultural heritage, decisions on what action to take to conserve or restore a conservation object are subjective. The highlighting and enhancement of one characteristic of a conservation object always involves some associated loss, a view that accords with the National Ecosystem Assessment view that there is a balance to be struck between different grassland ecosystem services. The balance between value enhancement versus value loss is determined by 'trading' between stakeholders. In the case of meadow conservation, management is not an end in itself for most stakeholders, but the end product is a choice rather than an objective given. This may explain why conservation stakeholders do not always focus on maintaining meadows exactly as they are presently but can also 'improve' them (botanically, not agriculturally). Furthermore, in meadow conservation, the stakeholders are found to be mostly professionals, certainly those taking an active role in meadow management. If such 'trading' takes place through negotiation, building relationships, and networks and through translational processes, the question remains, where is the public in the process, in whose name the conservation allegedly takes place in the guise of 'society'?

In terms of a wider constituency of stakeholders, evidence of the limited involvement of members of the public in meadow assessment and management activities suggest that meadows appear to be low in the consciousness of members of the public. Public interest in the meadows clearly exists as evidenced by the participation of conservation volunteers in the surveys at Brook Meadow, as well as public visits to North Meadow, particular in April when the snakes head fritillaries are flowering. However, there does appear in some contexts to be a clash between encouraging their participation and anxiety about people and their roles in such a 'natural' landscapes, as evidenced in the North Meadow management plan. Volunteer surveys are one way in which the public can be involved in interacting with meadows in an environment controlled by conservationists. Other than the volunteer surveys and public visits to the meadows, the wider public were not seen to have a role in the stakeholder networks that manage meadows. If value loss versus enhancement is determined by 'trading' between stakeholders, in most meadows these are all professionals. The public is largely absent in this process and appears to

have little or no say. There does not appear to be any 'trading' with them. The objective view of science appears to mean that any such 'trading' is irrelevant. Knowledge about meadows is objective and flows uni-directionally from conservation experts with no reverse flow of knowledge on value appearing to occur.

8.5 Summary

Overall then, the findings of this research in terms of the main research question are that in most cases, assessment of floodplain meadow condition appears to play a very limited role in making management decisions regarding floodplain meadow management. Assessment practice is often driven by a desire to influence management decisions through a stated desire to enact a model of responsive management. However, the aims of such assessment activity often seem unclear or assessment is focussed on a very partial view of what the meadows are for and their value, leading to a range of tensions between stakeholders. This in particular appears to be depressing the motivations of farmers to participate in meadow management making the delivery of meadow management more precarious. Furthermore, a range of factors, from power relations, to socio-economic issues, to external practical constraints often determine the management that is delivered on the meadows.

In this regard, following a prescription of perceived ideas of traditional management may be acceptable and on some meadows may be successful in maintaining meadows into the future. However the findings of this work suggest that assessment work in fact may well not capture a holistic picture of meadow condition and therefore cannot provide certainty that some aspects of meadow condition are changing in a permanent manner. On the one hand conservationists need to be clear whether they are preserving meadows' condition to a baseline, or whether they are creating something new and ahistorical, and if the latter is true, whether this is considered acceptable. More generally, if conservationists wish to conserve floodplain meadows, they need to be sure that their policies, perspectives and practices do not undermine the socio-economic structures that underpin meadow management, as the system's most fundamental requirement is continued management.

Chapter 9 – Conclusions

9.1 Introduction

This research has investigated the assessment practices of stakeholders actively involved in the management and conservation of floodplain meadows in England in order to ascertain, firstly, what the nature, motivations and meanings of assessment activity are, and, secondly, to what extent the assessment activities inform management practices within a model of responsive management. The work has shed new light on the structure of the stakeholder networks that manage the meadows, stakeholders' varying perspectives on the value of meadows, and their views on the meanings of and motivations for meadow conservation. The links between broader perspectives of meadow value and meaning on the one hand, and the stakeholders' assessment practices on the other, have been thoroughly investigated in order to clarify precisely what assessment activity takes place, what its motivations are, and what knowledge and understandings about the meadows are created. This in turn has allowed an evaluation of the extent to which assessment practices influence management practices, and what factors other than assessment are also influential for meadow management. This work has highlighted the significant potential threat to meadow conservation from the fragility of the stakeholder networks and socio-economic processes that deliver meadow management.

The specific conclusions drawn are elaborated below in relation to the overall research question posed. Section 9.3 then considers the implications of the findings of this work for the future of floodplain meadow conservation in England.

9.2 Overview of Conclusions

The results of assessment activity investigated by this research mostly did not lead to any specific decisions regarding meadow management. This was because in fact, the management delivered on meadows was influenced by a range of other factors; either default prescriptions imposed by conservation stakeholders (with their own rationale as discussed in Chapter 5), or a range of practical issues, such as the weather, legal restrictions on animal movements, or other demands

on farmers' working time. As assessment activity looked at a narrow range of botanical parameters and rarely focussed on meadow management, the latter would not be noted, although conservation stakeholders were often aware of the factors affecting management. So the limited scope of assessment activity means that the data generated are not necessarily of utility in making decisions regarding management, as the picture they generate of the meadows is very partial.

Furthermore the limited communication between stakeholders limits scope to pool and compare different types of data including experiential data (for example on hay yields), to allow a fuller picture of meadow condition to emerge. As noted, change in biological system function is evidenced by declining hay yields at some sites where regular measurements are made; at others where yields are not regularly recorded, such change is simply flagged by anecdotal evidence from farmers that cannot be confirmed. Both types of evidence of biological system change tend to be ignored by conservation stakeholders as they do not see it as relevant to their view of meadow condition. Furthermore, appropriate assessment activity is framed as being 'objective' and 'scientific'. Any data that cannot be readily captured by such assessment methods is not assessed significantly or at all. As a result, the potential utility of data from more experiential assessment of meadows is being under-utilised.

Any decisions made about management take place via processes of negotiating or 'trading' between stakeholders, but differential power and status between them (which vary from site to site in relation to factors such as legal conservation status), influence whose opinions and demands are dominant and decisive. Influential in these power relations is that each floodplain meadow site is a unique assemblage in terms of its material composition and its constituting biophysical and social processes, and in this regard, the stakeholder networks managing floodplain meadows are also unique networks. Although stakeholders mostly fall within the categories of conservationists or farmer-managers, more complex networks tend to exist for larger or higher-status meadow sites. Conservationists' views on meadow value are more highly structured and elaborated, but their narratives about floodplain meadow value are dominated by

a focus on the botanical composition of the meadows. The value of meadows as an agricultural resource, the purpose for which they were originally created and maintained, is relegated in importance or not noted as relevant. For this reason, the importance of meadows for farmers has significantly declined, with most farmers having lost interest in managing hay meadows except under quite specific circumstances. Other forms of meadow value such as landscape, aesthetic or cultural heritage value are briefly acknowledged, but are not significant drivers for conservation and tentative attempts to discuss landscape and cultural value in the documentation on meadows tended to revert to discussion of the biological composition of the grassland sward.

Reasons for this marginalisation of agricultural value appear to be the result of the greater power of conservationists to assert their view of meadow value, either as landowners, as statutory bodies with legal responsibility for the meadows' 'scientific' interest on sites carrying a statutory designation such as SSSI or SAC, or as funders supporting meadow management through schemes such as HLS. Their views on meadow value are elaborately structured and highly compartmentalised by perspectives such as the biodiversity perspective, the Ratcliffe Criteria, and also by a number of conceptual dichotomies, notably the view of a fundamental dichotomy between nature and society, as well as the living/non-living, and the urban/rural. The partial and compartmentalised view held by conservationists of meadow value therefore results from their perspectives that see this value as 'chopped up' by this range of intersecting and overlapping dichotomies and systems of categories such as the NVC.

In particular, the meadows are often strongly framed by conservation oriented stakeholders as 'natural', yet are inconsistently recognised as being co-produced by social processes. This is therefore why forms of value that are deemed more 'social' than 'natural' (such as agricultural resource value) are relegated to minor importance or dismissed as irrelevant. Analyses of meadow value in documentation clearly showed meadow value to be divided: cultural from natural, natural into flora and fauna, and into species and habitat/assemblage, with different categories being assigned higher or lower priority. In consequence of this highly compartmentalised and partial view of meadow value identified during this study, assessment

practices of conservation stakeholders are also seen to be dominated by activity that focuses narrowly on botanical composition and vegetation structure. Other forms of assessment were not found to be mobilised by conservation stakeholders to any significant extent, and by farmer-managers to a very limited extent. Understandings generated then in turn impact on views of whether management is delivering a meadow as desired by the dominant stakeholders, in this case conservationists.

The effect of differential power and the imposition of conservationists' dominant perspectives on default management prescriptions have been seen for example in the imposition of later hay cut dates than the farmers would like. According to many agri-environment schemes, hay is not to be cut before July, sometimes not before mid-July to allow nesting birds to breed, a non-traditional concern in meadow management, and to allow seed to fall from plants, the latter being considered unnecessary by some ecologists. This imposition of a late cut has a negative impact on farmers' views of meadow value as an agricultural resource, as they perceive it to reduce the quality of the hay as well as the window of opportunity they have to fit the hay cut in with their other work.

However, whilst conservation stakeholders hold significant power to assert their view of meadow management, this is constrained by the difficulty they experience in finding farmers to undertake meadow management. As the constraints on farmers' agency to decide on meadow management have a direct negative impact on their view of the value of the agricultural resources provided by the meadows, for example on hay quality or convenience of management, this causes most farmers to lose interest in participating in their management.

Meadow assessment activities are also strongly focussed on the assessment of meadow condition, that is, the material state of the meadow at the time of assessment. Whilst monitoring and assessment of management activities are considered desirable by conservation stakeholders, they are rarely observed to occur, with adequate condition being presumed to indicate appropriate management. The reasons for this appear to be practical rather than as a matter of policy, as

despite the stated desire of many stakeholders to record management, this does not occur for practical reasons, suggesting omission rather than intention. Furthermore, the stakeholders best placed to record the management activities, the farmer-managers, are not required in practice to report their practices by any conservation stakeholders identified in this study, and in most cases appeared to have lost interest in recording management. Even where they do so out of personal interest, limited communication with other stakeholders means that this information is rarely shared, thus limiting its utility.

Nevertheless, the assessment of botanical composition and vegetation structure that is regularly undertaken at most sites can only be used to follow change in certain aspects of meadow condition related to the botanical composition of the grassland sward. In the case of the rapid condition assessments, even these are restricted to change in a limited number of symbolic species. With few exceptions, such as the field survey work of the Floodplain Meadow Partnership, year-on-year changes and fluctuations in the parameters of these assessments were not found to be regularly reviewed by conservation assessors who undertake them, and so there was little evidence that the opportunity to follow change over time in meadow composition and to consider the implications of such change was taken by stakeholders. This again may result from the partial nature of the data collected, which limits its utility.

The research undertaken also identified a degree of uncertainty about the role of change over time in meadows, especially in terms of whether some change in meadow characteristics is acceptable and how this should relate to the conservation baseline. For each meadow a clear conservation baseline is usually defined, even if only in terms of descriptions such as the NVC MG4 description. This has the effect of objectivising the conservation baseline and precluding change in the meadows, suggesting that the meadows are in fact being 'preserved'. This said, some documentation does acknowledge that conservation baselines are subjective, whilst documentation for some meadows refers to 'improving' meadows botanically by making them more herb-rich, thereby creating a new ahistorical state (that is, a new state that differs from that of the meadow in the past). This would suggest that meadows are being 'conserved'. Meadow

conservation could in fact therefore be 'partial' or 'selective preservation' in that some characteristics are deemed essential, such as maintenance of the presence of a key emblematic species such as snakes head fritillary, and must be retained, whilst others may change, such as a rise in herb cover with attendant fall in grass content leading to falling hay yields. Reluctance by conservationists to recognise that many botanical criteria are essentially subjective may also arise from the threat this poses to the hegemonic position of conservationists' narratives and views on meadow value.

Acknowledging the value of meadows as an agricultural resource would represent acceptance of the social activities that made the highly-valued plant assemblages. This in turn would help conservationists to engage farmers who manage the sites as well as help set new boundary parameters for the discussion of the extent to which meadows should be kept the same or allowed to change. Very species-rich meadows with little grass content are of little value to farmers but are also unlikely to represent a historical state that existed in the past. This in turn represents recognition of the cultural, aesthetic and historical aspects of meadow value and the place of the meadows in the landscape, all of which appear to be of value to society. The UK National Ecosystem Assessment (UNEP-WCMC, 2011a) summary classifies conservation of wild species diversity as partly 'provisioning' and partly 'cultural', and may therefore represent a move in the right direction.

9.3 Implications for policy, practice and research in the future conservation of floodplain meadows

Below are discussed some key recommendations regarding the future of floodplain meadow conservation in terms of policy, practice and further academic research.

9.3.1 Consideration of a broader, more holistic view of floodplain meadow value

The implications of the above findings are that a more holistic appraisal of floodplain meadow value, both qualitative and quantitative, would be useful, with consideration given to the broader societal stakeholders to whom diverse aspects of value matter. This would need to take into

account the different ethical perspectives (anthropocentric, bio-centric, eco-centric) and the biodiversity and ecosystem services perspectives, each of which view aspects of value differently. Nature conservationists need to recognise that floodplain meadows are also cultural heritage as well as natural heritage. This may require them to 'let go' to some degree and recognise other stakeholders' views of meadows as valid.

In this way, a view may be formed of what the options are for floodplain meadow conservation for the future, and about which aspects could or should be prioritised and which are currently undervalued. There is a need to openly acknowledge the subjective basis of many aspects of meadow value and the legitimacy they have for some stakeholders. This would entail the risk noted by Harris (2006) of a shift from objective views of meadow conservation towards an acknowledgement of inter-subjectivity (Muñoz Viñas, 2011) and a renegotiation of control and agency between different stakeholders. Furthermore, this would likely lead to a shift in the botanical composition of the meadows. However, as the meadow plant assemblages were created by agriculture, then in theory at least, such a shift might be towards meadows that resemble more how they were historically.

Further to the broadening of ideas about the value of meadows to society, current public engagement activities such as the volunteer surveys seen at Brook Meadow and public open days such as those at North Meadow and Mottey Meadow could be harnessed to engage a broader constituency of public stakeholders by emphasising more the cultural, historical, landscape and aesthetic aspects of the meadows. Given that conservation stakeholders are already time and resource constrained, this could be achieved through partnership with interested cultural heritage organisations, be these at national level such as the National Trust or English Heritage, or at more local level such as local history societies. In this way, conservationists, both natural and cultural could seek to publicise and broaden the appeal of meadow conservation to a wider audience and involve the public to a greater degree. This in itself could generate useful debate about perceptions of meadow value and their future role in the landscape.

In terms of further academic research, consideration should be given to how the hybrid nature of meadows might be valued, in terms of how the gap between the perspectives of 'nature' and 'culture' conservation may be bridged for floodplain meadows. An evaluation should also be undertaken of the trade-offs and conflicts between the different forms of value to confirm or dispel assumptions about their compatibility or conflict with one another. Specifically, the relationships between the criteria of botanical value assessed in Chapter 6 could be investigated further to confirm the relationships identified and the utility of the specific indicator species chosen as part of current assessments. Further to this, given the presumption by some conservation stakeholders that there is an inverse relationship between botanical and agricultural value with regards to hay yield, research is need to help to clarify the relationship between desirable botanical characteristics such as species richness or MG4 character and biological productivity through indicators such as hay yield, to confirm this for individual case study sites and assess how this may vary from site to site. Such work could draw on existing research on broader grassland types, including that from Continental Europe, combined with more UK-based field-based research. The relationship between criteria of biological and agricultural value could thereby be investigated further and compared to models such as the Grime Hump-back Model (1973, 2001). This would provide data to assist greater understanding of a key trade-off between different aspects of floodplain meadow ecosystem function.

9.3.2 The need to broaden the scope of meadow assessment

This study has found that current condition assessments based on indicator species do appear to capture data that correlate reasonably well with aspects of botanical value of interest to conservationists such as species richness and similarity to MG4 assemblage. However, following on from the above, assessment practices could be reappraised to ascertain whether the broader range of aspects of meadow value could be captured, within financial and resource constraints. Assessment activity that informs management decisions effectively should be considered a priority, and may not be the same as that which is useful for ecological research. Consideration needs to be given to what data on management activities can be realistically collected, would

prove useful in the context of responsive management, and could be implemented by stakeholders. Clearly there is a tension between data that it is useful and data that is realistic to collect. As seen, management data are considered useful, but are not collected. If the merit of non-botanical aspects of meadow value were more clearly acknowledged, then serious consideration could be given to precisely which metrics could be collected to reflect those dimensions and how this may be achieved.

Relegation of ideas about agricultural value in particular as a significant form of value not worthy of assessment carries two risks. Firstly it risks ignoring a source of information about change in the meadow's biological system function. Secondly it threatens to undermine farmer-managers' motivations for involvement in meadow management in a way that may make finding suitable contractors impossible and thus undermine conservation stakeholders' ability to manage the meadows. The residual agricultural value of meadows, rather than being irrelevant, underpins the conservation management of the meadows economically at least to some extent, by providing supplementary income and by providing farmers with an incentive to manage them. Consideration of how this value may be maintained or enhanced is needed to safeguard future management of meadows. If current farmer-managers and contractors lose interest in meadow management, or can no longer afford to undertake it, conservation stakeholders may be forced to manage meadows themselves, which would be unaffordable and impractical for some conservation organisations.

The minimum requirement for meadow condition assessment required by Natural England up until the introduction of the new ISA framework was for relatively infrequent assessment, as little as every 6 years. In reality, some meadows were assessed more frequently, if not yearly. In some cases, the assessment effort may in fact be more usefully deployed by alternating botanical assessment in some years with non-botanical assessment in alternate years. For example in some assessment years, instead of undertaking botanical assessments, the conservation stakeholders could meet in person on site with the farmers and discuss the management operations and collect data on agricultural productivity. Time spent collecting hay yield data and records of management

operations may subsequently prove highly useful if the botanical assessments indicate change in the meadow sward. Spending time communicating with farmers, or even discussing the management with them by telephone, attempting to understand the farmers' perspectives regarding the problems they face in managing the meadows may also help strengthen the stakeholder networks and reduce the risk of farmers withdrawing from meadow management. Acknowledging that ideas about meadow value are subjective and socially produced may allow greater consideration to be given to the subjective and experiential nature of assessment activity, permitting conservation stakeholders to both develop and project a more holistic view of meadow value. In all, a looser less highly structured and more varied approach to assessment may allow stakeholders to develop a broader more rounded view of the meadows.

9.3.3 Implications for meadow management practices

In effect, management is influenced by two models: the tradition management model, and the responsive management model. As seen, these two models are partly in tension, but could potentially be complementary. Conservation practitioners could acknowledge the advantages and problems of the two models and seek to develop a hybrid model that incorporates their advantages and acknowledges their tensions. For example, instead of envisaging traditional management as a prescription, it should be seen as a broad envelope of management practices within which flexibility of management is allowed under the model of responsive management. Such a model would also need to emphasise much more the responsive feedback aspect of the responsive model, which currently appears to be limited by the partiality of existing assessment and the lack of recording of management data, requiring conservation stakeholders to fall back onto management prescriptions with their own inherent uncertainties.

In the context of pre-industrial agriculture, past farmers sought to maximise yields on meadows at the contemporary level of technology, that is without use of artificial fertilizers, pesticides and large farm machinery, and it is this level of technology that created the meadows with their botanical characteristics rather than the approach of 'minimum intervention' sometimes advocated by contemporary conservationists. In this context a more open dialogue is required

between conservation stakeholders and farmers regarding their respective views on traditional management. Conflicts regarding the perceived validity of certain practices considered to be farmers such as manuring, rolling and harrowing need to be resolved. Where conservationists wish farmers to forgo practices which appear to have been traditional, it will be necessary to recognise this as a deviation from long-standing tradition and acknowledge where this may have an impact on the farmers' perspectives of the utility and value of the meadows.

Reconsideration should be given to the view that the agricultural value of meadows is subordinated to 'conservation' value. Whilst there is no doubt that the value of hay meadow productivity has declined relative to intensively-managed grasslands, the fact that contractor-farmers who cannot afford to make a loss managing traditional meadows can still be engaged to manage such sites suggests that such meadows still retain some value for some farmers, despite the fact that agri-environment payments to land-owners are still not generally passed on to farmer contractors. The assertion commonly heard that meadows disappeared because they 'lost their value' is therefore clearly inaccurate. Where conservationists wish farmers to refrain from traditional management practices because of non-traditional priorities, they may need to compensate the farmers for loss of income or practical convenience. It should be noted that agri-environmental schemes are intended to compensate farmers for income foregone. However, this income was seen to be paid to the land-owner, and in this work it was found that agri-environment funds were rarely shared with the managing farmer where this was not the land-owner. Conservation organisations and land-owners who contract meadow management out to contractor-farmers should consider whether there is a need to share these funds with the meadow contractor-farmers in order to provide an adequate level of incentivisation.

9.3.4 Further research

As regards further academic research, it would be worth testing the findings of this work further on privately-owned meadows that are managed directly by the land-owner, and also on 'low profile' meadows, that is to say, with no nature conservation designation at all. This would help to improve generalisability of the findings given that most of the case study sites examined in this

work were not owned by the farmer who undertook the management, whereas in some parts of England meadow ownership by farmers is more common.

Furthermore, during this research such 'low profile' meadows proved very difficult to identify and therefore it has not been possible to consider the impact on management at many such sites. This may have been because of a reluctance by the land-owner to be identified and, in their view, run the risk of having their meadow notified as a SSSI, which they might perceive would mean loss of control of meadow management on their part. Also difficult to identify were privately-owned meadows managed by the land-owner where a SSSI notification had proved a source of serious tension between land-owner and conservation stakeholder. Again, further work on such sites may prove illuminating in terms of understanding farmers' motivations and their relationships with conservation stakeholders.

Useful further research would also be to investigate further and more quantitatively the relationship between the economics of meadow management and farmers' motivations, looking more closely at how they fluctuate in order to gauge more accurately the resilience or fragility of meadow management delivery in terms of the economic drivers. Such work would again be of utility in informing the role and importance of management support mechanisms delivered through agri-environment schemes.

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Appendices

Appendix 1 – Pro-forma used in the Natural England rapid condition assessment (Chapter 5)

Appendix 2 – Graphs of correlations between parameters of meadow botanical value and hay yield (Chapter 6)

Appendix 1 – Pro-forma for Natural England rapid condition assessment for MG4 grassland

ENGLISH NATURE

Lowland grassland SSSI condition assessment (version date 10/10/00)

Site Name: .....

NVC type: **MG4**

Unit/subdivision reference ..... Date.....

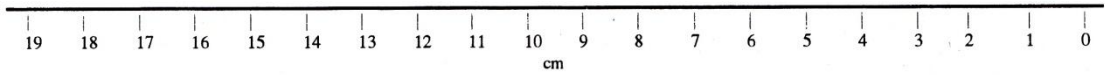
Condition: Favourable maintained/Favourable recovered /Unfavourable improving/
Unfavourable no change/Unfavourable declining/Partially destroyed/Destroyed

Recommended visiting period: Late May - early July (before hay cut time) except for *Fritillaria* attribute, with periodic visit in autumn-winter visit to check condition at end of aftermath grazing period.
Recommended frequency of visits: Site-specific decision

Key management activities affecting condition to discuss with manager:

Hay+aftermath grazing
FYM input
Other inputs
Drainage
Raising water levels
Grazing intensity/stocking rate
Grazing period
Supplementary feeding
Stock type
Rolling and chain harrowing
Weed control

Attribute (*= mandatory attribute. One failure among mandatory attributes = unfavourable condition)	***Target***	***Estimate for attribute***
*Extent of community (recoverable reduction = unfavourable; non-recoverable reduction = partially destroyed).	No loss without prior consent	(Describe and refer to map)
*Sward composition: grass/herb (ie non-Graminae) ratio	**40-90%** herbs	
*Sward composition: rare species. Extent (not density) of flowering *Fritillaria meleagris* population (specific to certain sites) mid-late April to early May depending on early/late spring. Sample eg by transect if necessary.	Extent not less than **25%** of appropriate reference level	
*Sward composition: frequency of positive indicator species from lists A and B. Species on list A can substitute for species on list B to give an overall total of at least 2 frequent and 3 occasional or locally abundant. **List A** *Filipendula ulmaria ( ), Leontodon autumnalis ( ), Oenanthe silaifolia ( ), Persicaria bistorta ( ), Sanguisorba officinalis ( ), Silaum silaus ( ), Succisa pratensis ( ), Thalictrum flavum ( ).* **List B** *Centaurea nigra ( ), Filipendula vulgaris ( ), Galium verum ( ), Lathyrus pratensis ( ), Leucanthemum vulgare ( ), Lotus corniculatus ( ), Primula veris ( ), Rhinanthus minor ( ), Serratula tinctoria ( ), Stachys officinalis ( ), Tragopogon pratensis ( ).*	Overall total of at least two species **frequent** plus at least three species **occasional** throughout the sward or **locally abundant** in more than 10% of the sward, **including** at least **one** species **frequent** and **one occasional** or **locally abundant** from **list A**	



Attribute (= mandatory attribute. One failure among mandatory attributes = unfavourable condition)*	*Target*	*Estimate for attribute*
*Sward composition: frequency and % cover of negative indicator species *Anthriscus sylvestris ( ), Cirsium arvense ( ), Cirsium vulgare ( ), Rumex crispus ( ), Rumex obtusifolius ( ), Senecio jacobaea ( ),Urtica dioica ( ).*	No species/taxa more than **occasional** throughout the sward or singly or together more than **5%** cover	
*Sward composition: negative indicator species. Frequency and % cover of all tree and scrub species, considered together.	No more than **occasional** throughout the sward or more than **1%** cover	
*Sward composition: % cover of *Juncus* spp, *Deschampsia cespitosa*, large *Carex* spp. (leaves more than 5mm wide) eg *Carex acutiformis*, large grasses (leaves more than 10mm wide, stout stems) ie *Glyceria maxima, Phalaris arundinacea, Phragmites australis.*	No species/taxa together or singly covering more than **10%** of the sward	
Sward composition: frequency of negative indicator species. *Senecio aquaticus ( )*	No more than **occasional** throughout the sward	
Sward structure: average height in summer visit period only. NB If site is permanent pasture in summer period discuss with site manager.	Sward **10** cm or above	
Sward structure: litter in a more or less continuous layer, distributed either in patches or in one larger area.	Total extent no more than **25%** of the sward	
Sward structure: extent of bare ground (not rock) distributed through the sward, visible without disturbing the vegetation.	No more than **5%** of the sward	

Structured walk recording form
Frequencies: totals out of 20 stops. 1-4 = rare, 5-8 = occasional, 9+ = frequent or more

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total

Appendix 2 – Graphical representation of relationships between selected assessment criteria

Appendix 2.1 Relationships between criteria of botanical value

The graphs below illustrate the relationships between various criteria of botanical value (species richness, percentage herb coverage, similarity to the MG4 description). Where graphs indicate that samples were taken from all meadows, the meadows included in the analysis and the number of samples taken in each is indicated in Table A2.1 below.

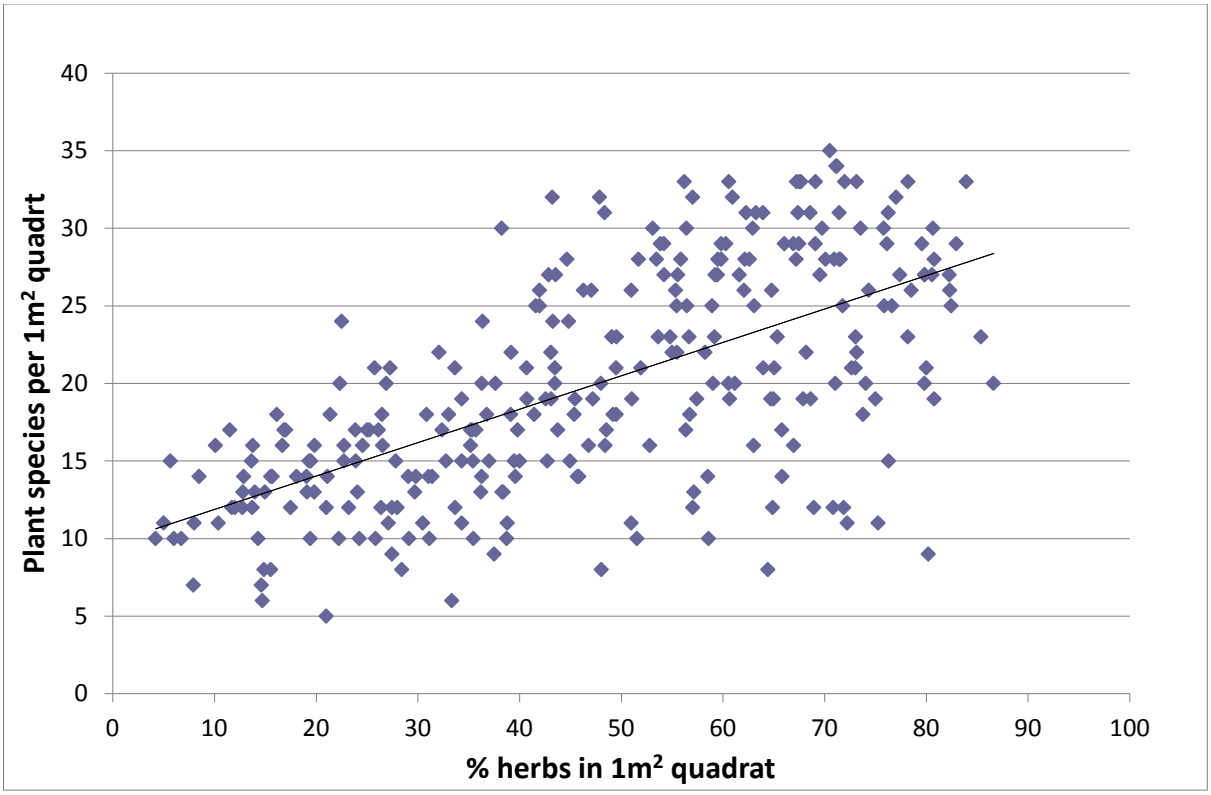


Figure A2.1 Plot of species richness vs. % herb cover per 1m² quadrat at all meadow sites (see table A2.1 below) n = 293. R^2 = 0.406, P < 0.001.

Table A2.1 Meadow sites from which samples were taken in the analyses presented in Appendix 2

Meadow name	Number of samples included in analysis
Bubwith Ings, Yorkshire	5
Ellerton Ings, Yorkshire	5
Ducklington Meadow, Oxfordshire	11
East Cottingwith (E Cott), Yorkshire	65
Mottey Meadows, Staffordshire	10
North Duffield Carrs	5
North Duffield Ings, Yorkshire	5
North Meadow, Crickalde	90
Oxey Meads, Oxfordshire	2
Oxford Meads, Oxfordshire	14
Pixey Meads, Oxfordshire	26
Upton Ham, Worcestershire	10
West Carr Ings, Yorkshire	5
Wheldrake, Yorkshire	12
Yarnton Meads, Oxfordshire	28

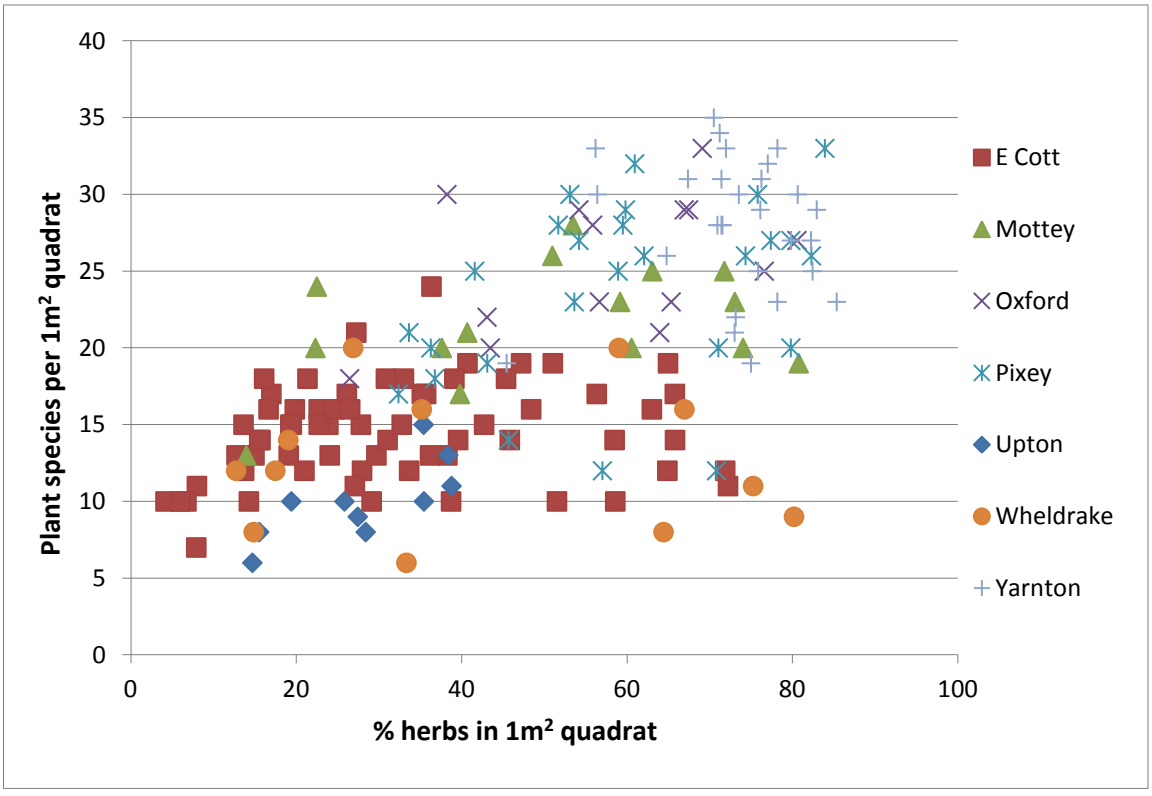


Fig A2.2 Plot of species richness vs. % herb cover per 1 m² quadrat at various named meadow sites

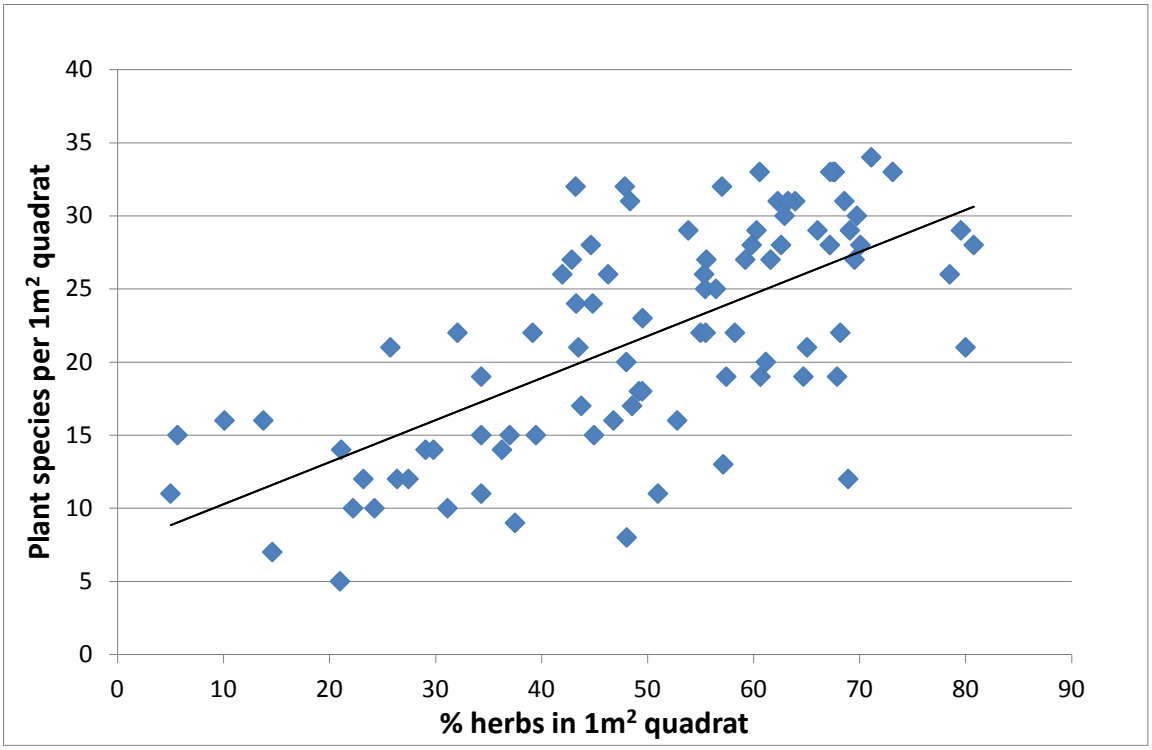


Figure A2.3 Plot of species richness vs. % herb cover per 1m^2 quadrat at North Meadow. n = 90. R^2 = 0.453, P < 0.001

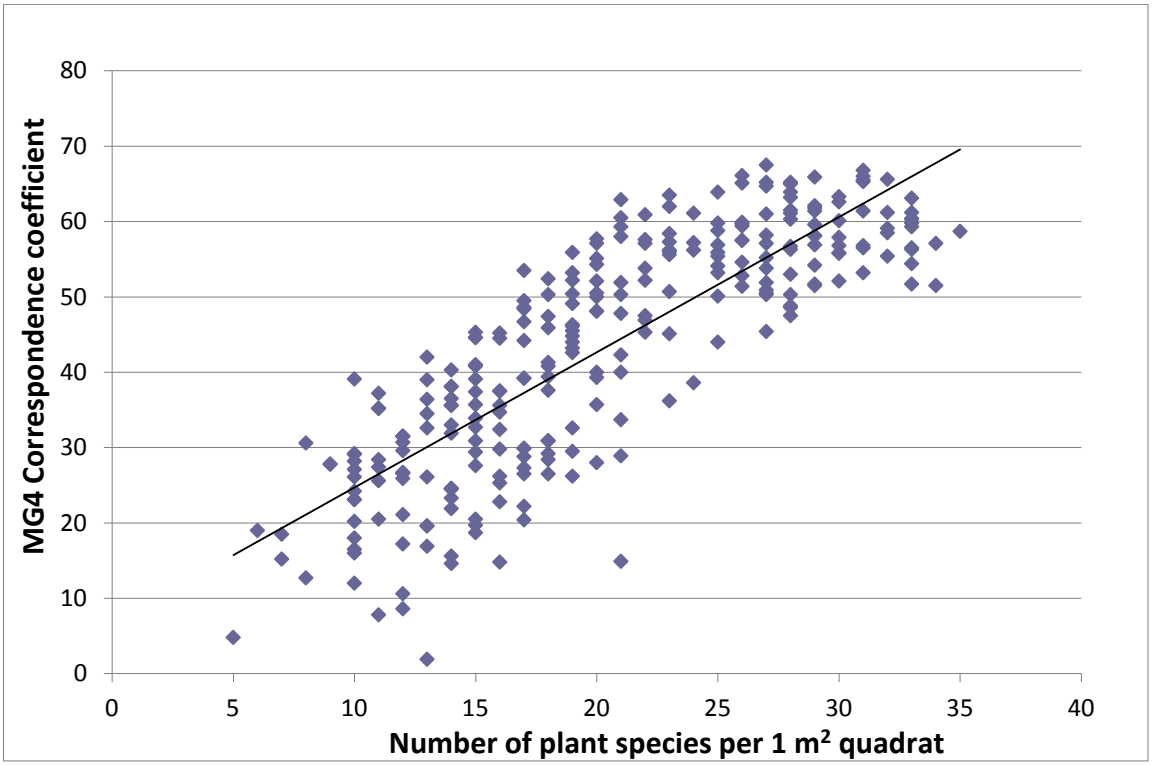


Figure A2.4 Plot of MG4 correspondence coefficient (x100) vs. plant species richness per 1 m^2 quadrat at all meadows. N = 293, R^2 = 0.698, P < 0.001

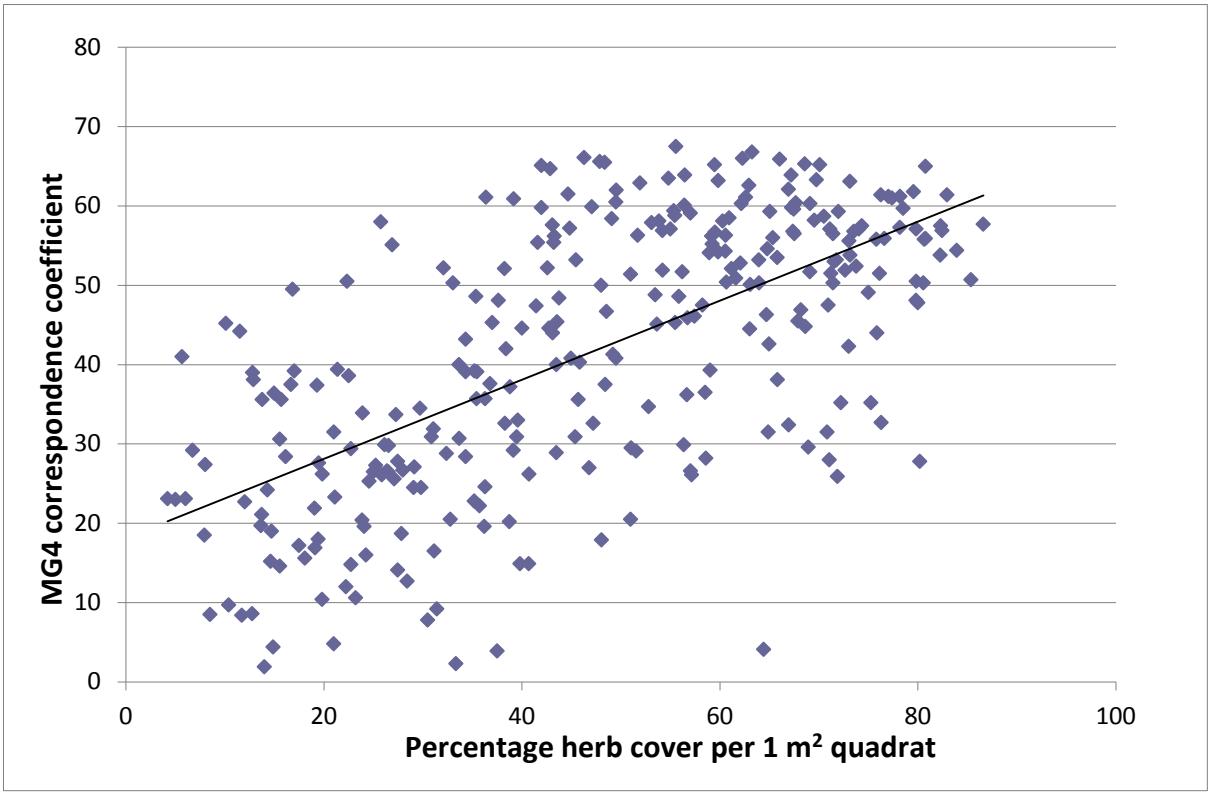


Figure A2.5 Plot of MG4 correspondence coefficient (x100) vs. percentage herb cover per 1 m^2 quadrat at all meadows. N = 293, R^2 = 0.410, P < 0.001

Appendix 2.2 Relationship between criteria of botanical value and indicator species parameters

The graphs presented here illustrate the relationship between selected criteria of botanical value as discussed in Chapter 5 and indicator species parameters used in the Natural England rapid condition assessment for MG4 grassland as discussed in Chapter 6.

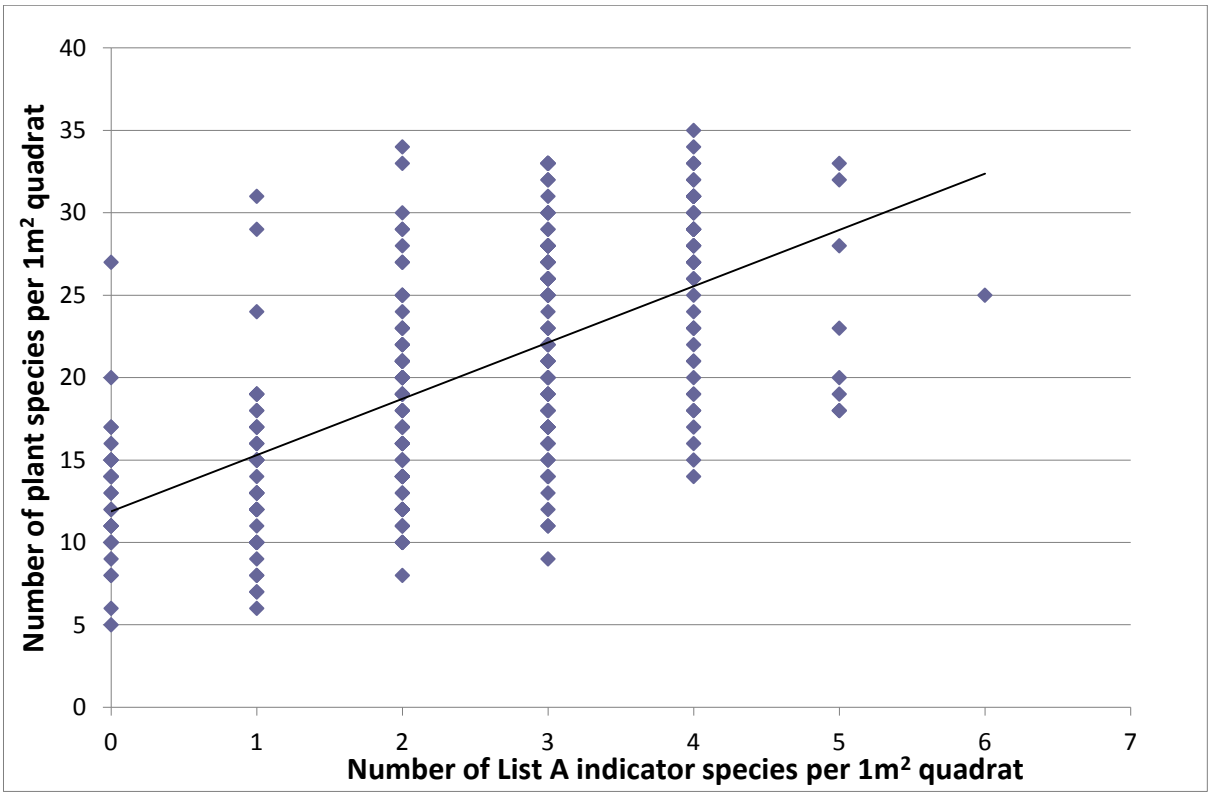


Figure A2.6 Total number of plant species vs. the number of List A species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.380, P < 0.001

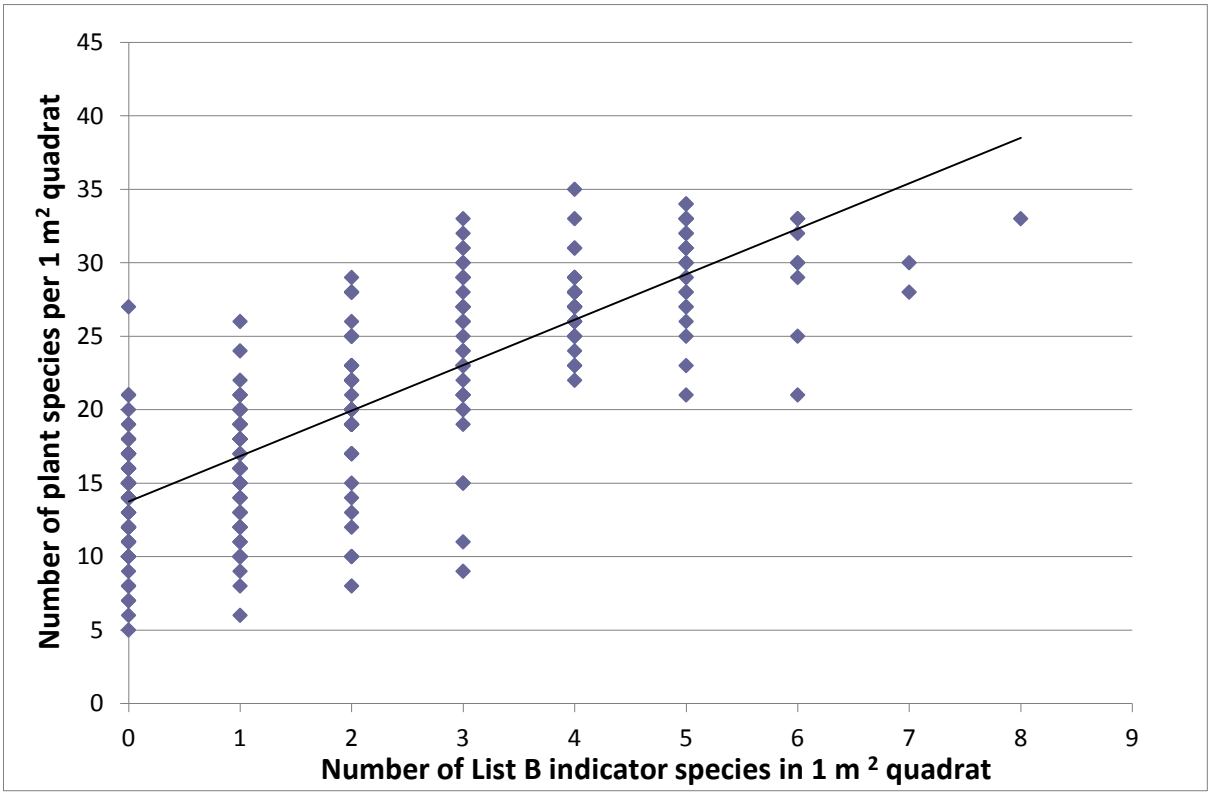


Figure A2.7 Total number of plant species vs. the number of List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.646, P < 0.001

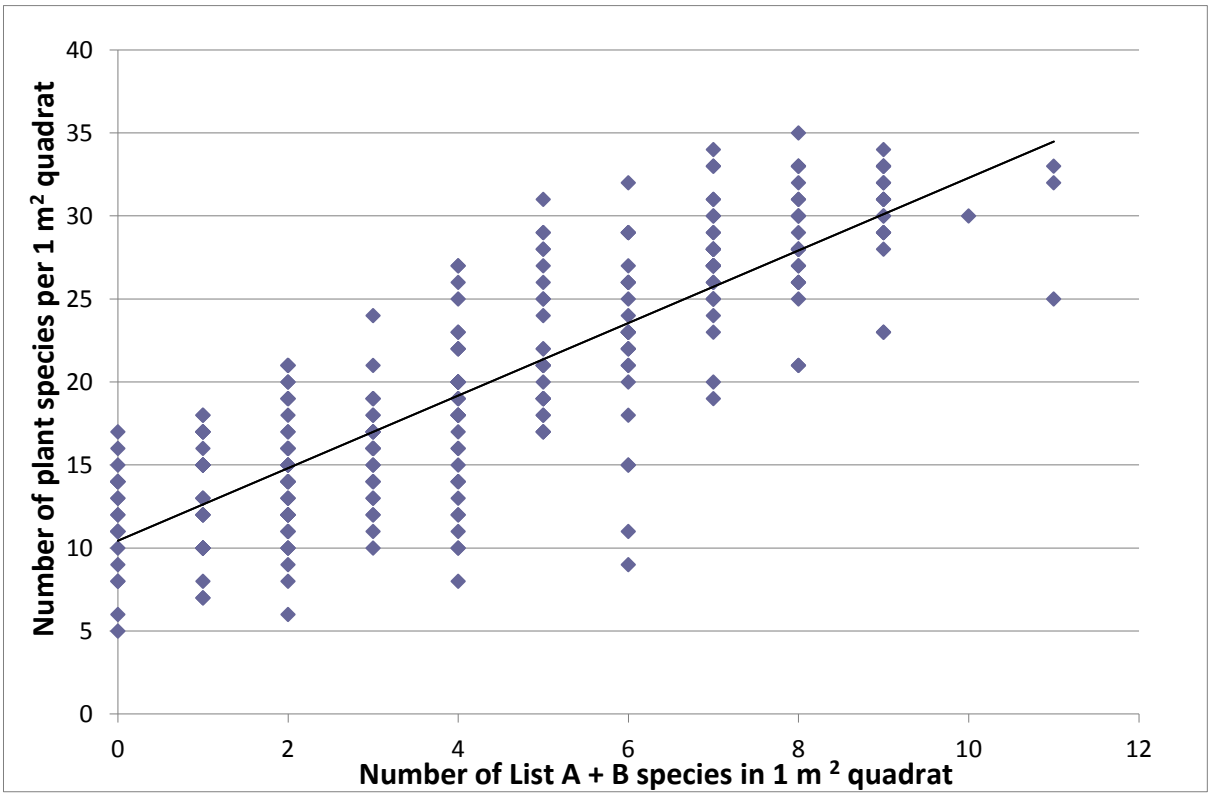


Figure A2.8 Total number of plant species vs. the number of List A and List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.700, P < 0.001

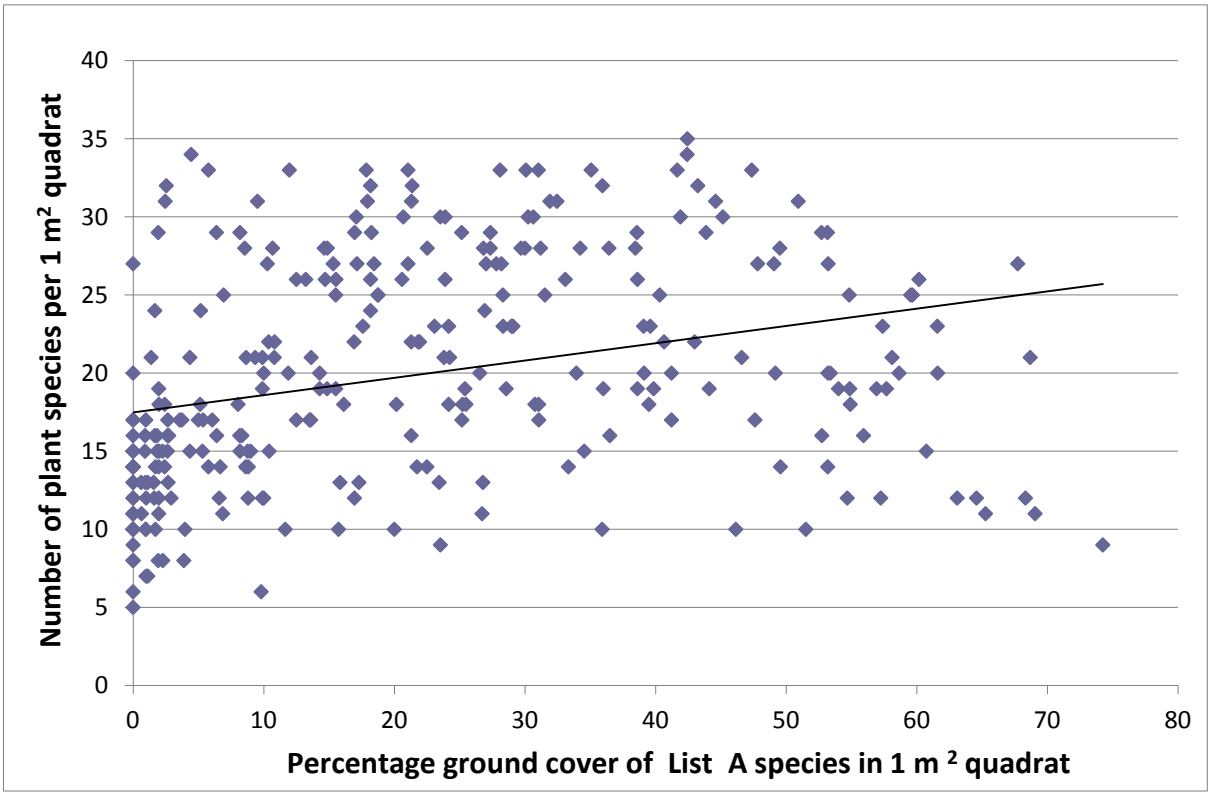


Figure A2.9 Total number of plant species vs. the percentage ground cover of List A species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.088, P < 0.001

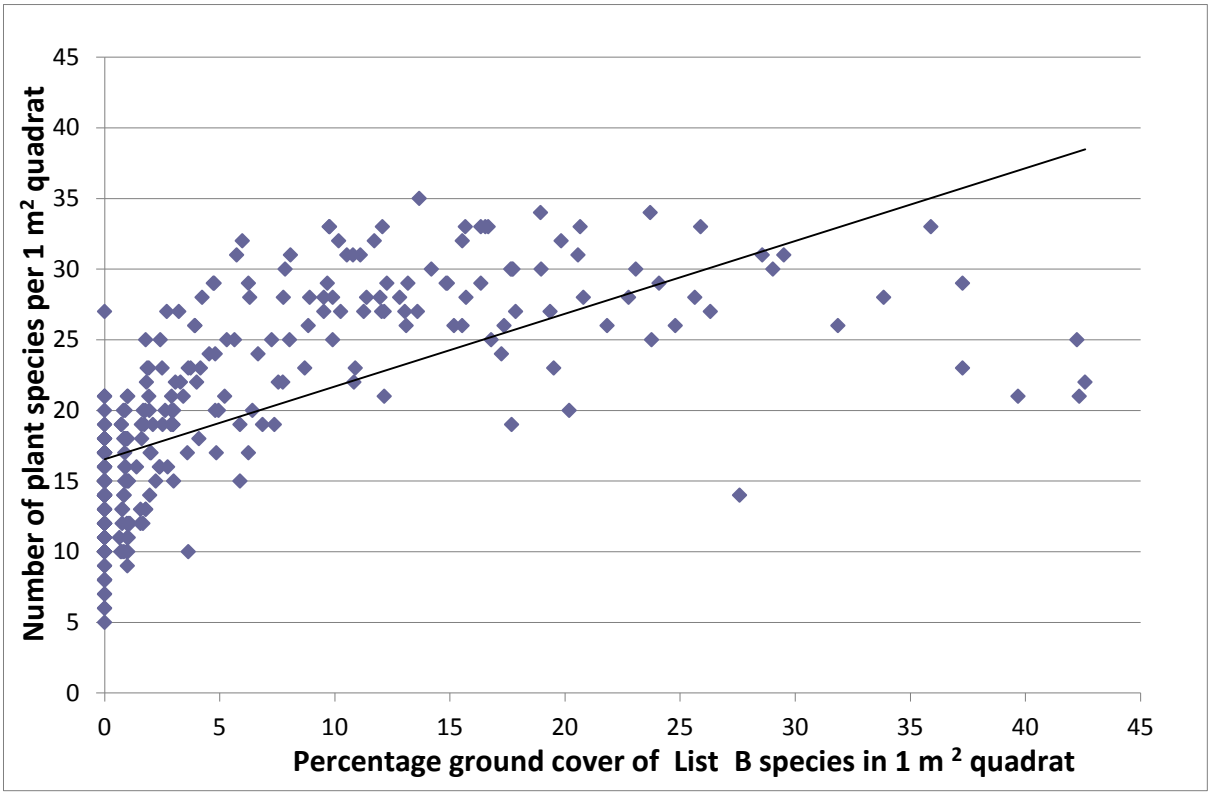


Figure A2.10 Total number of plant species vs. the percentage ground cover of List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.426, P < 0.001

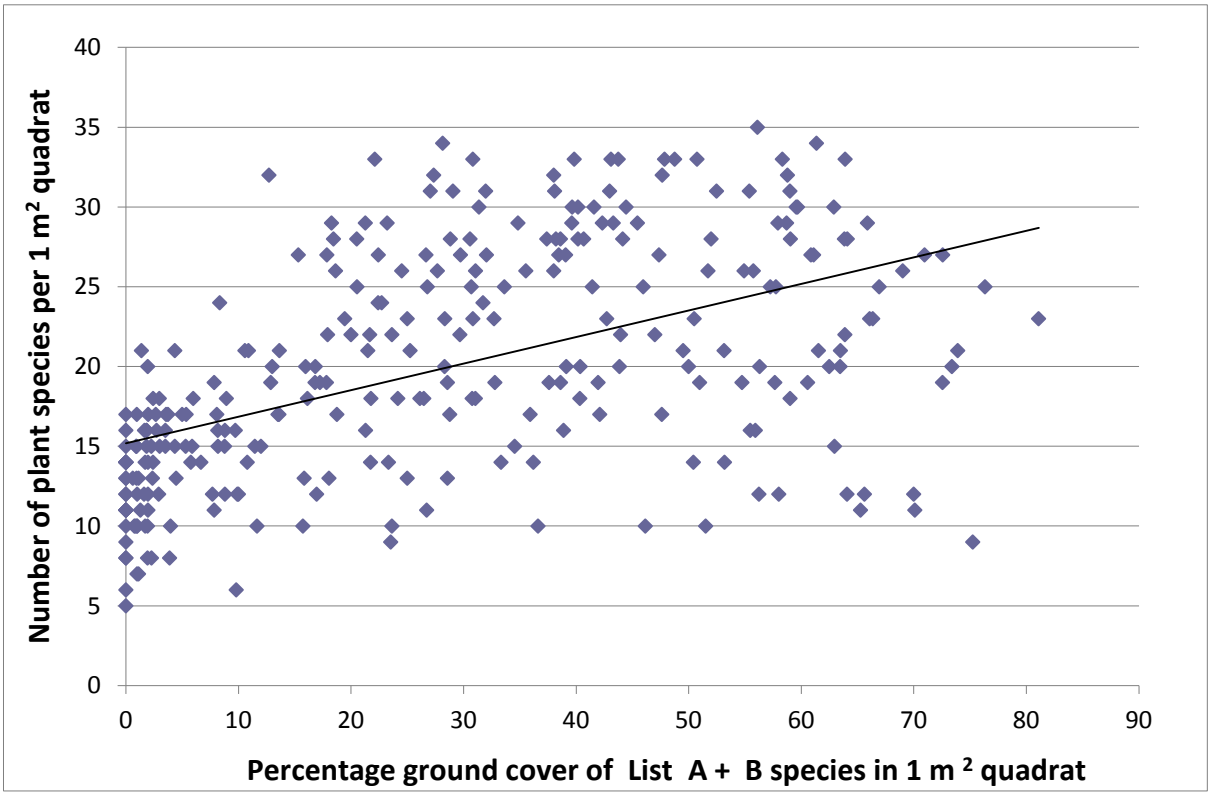


Figure A2.11 Total number of plant species vs. the percentage ground cover of List A and List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.270, P < 0.001

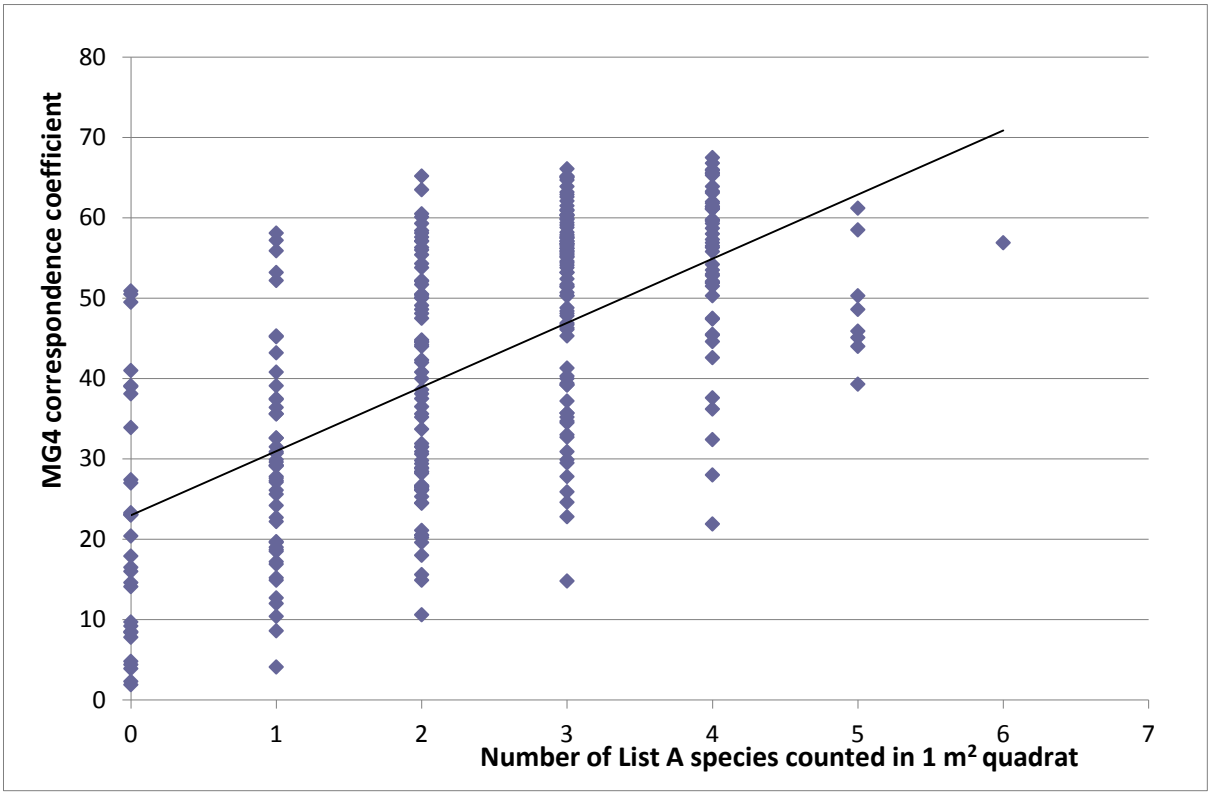


Figure A2.12 MG4 correspondence coefficient (x100) vs. the number of List A species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.395, P < 0.001

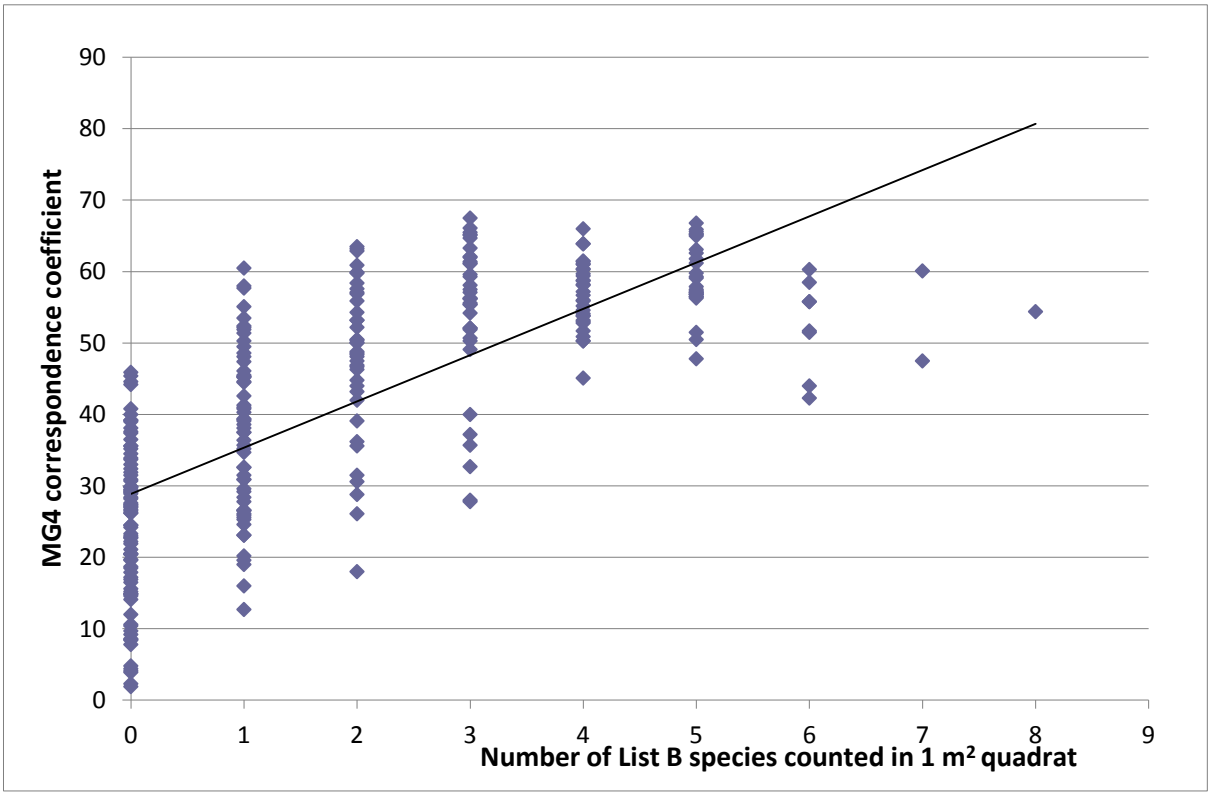


Figure A2.13 MG4 correspondence coefficient (x100) vs. the number of List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.538, P < 0.001

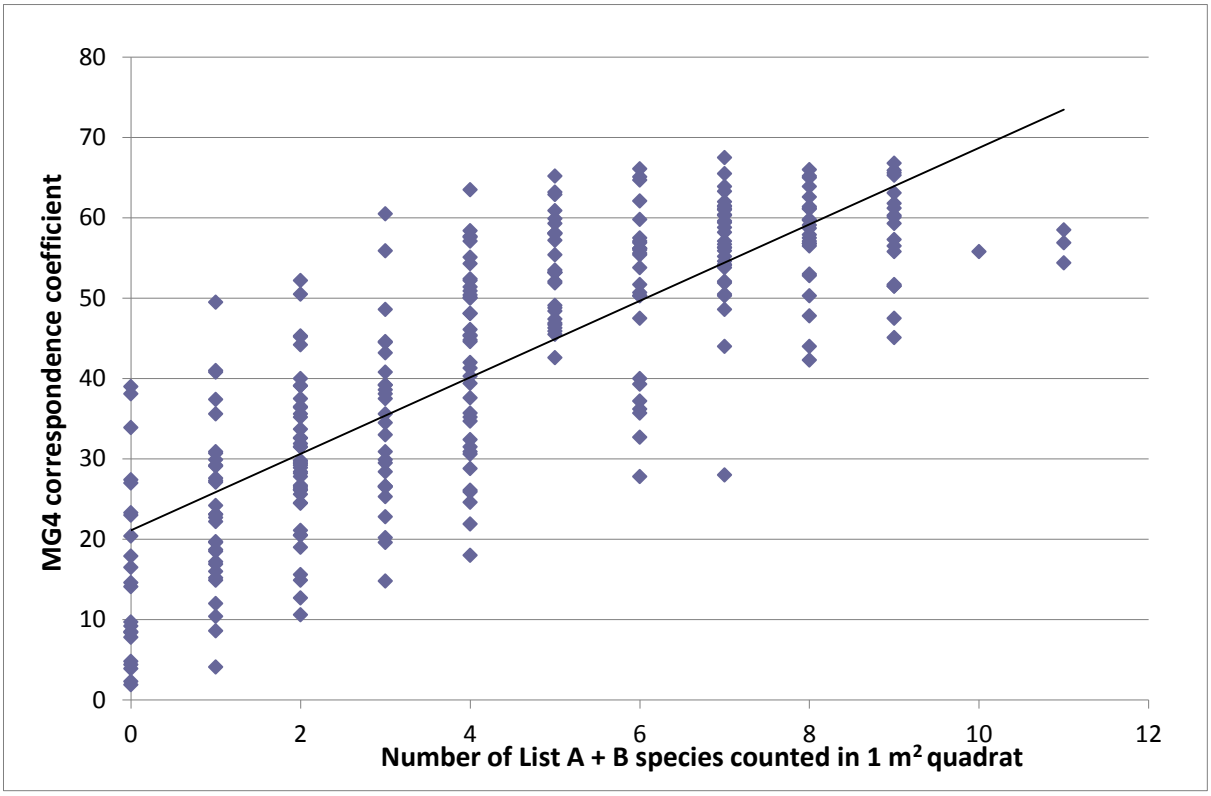


Figure A2.14 MG4 correspondence coefficient (x100) vs. the number of List A + B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.631, P < 0.001

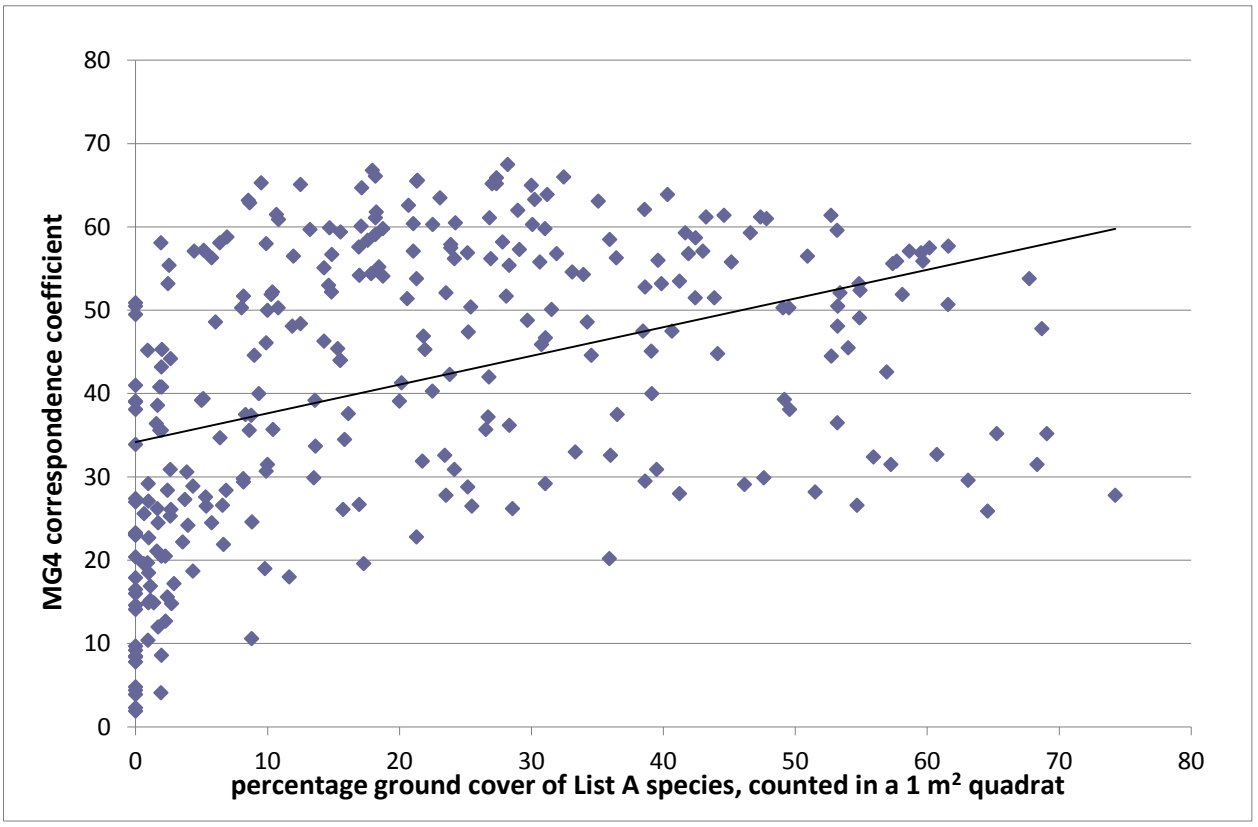


Figure A2.15 MG4 correspondence coefficient (x100) vs. the percentage ground cover of List A species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.162, P < 0.001

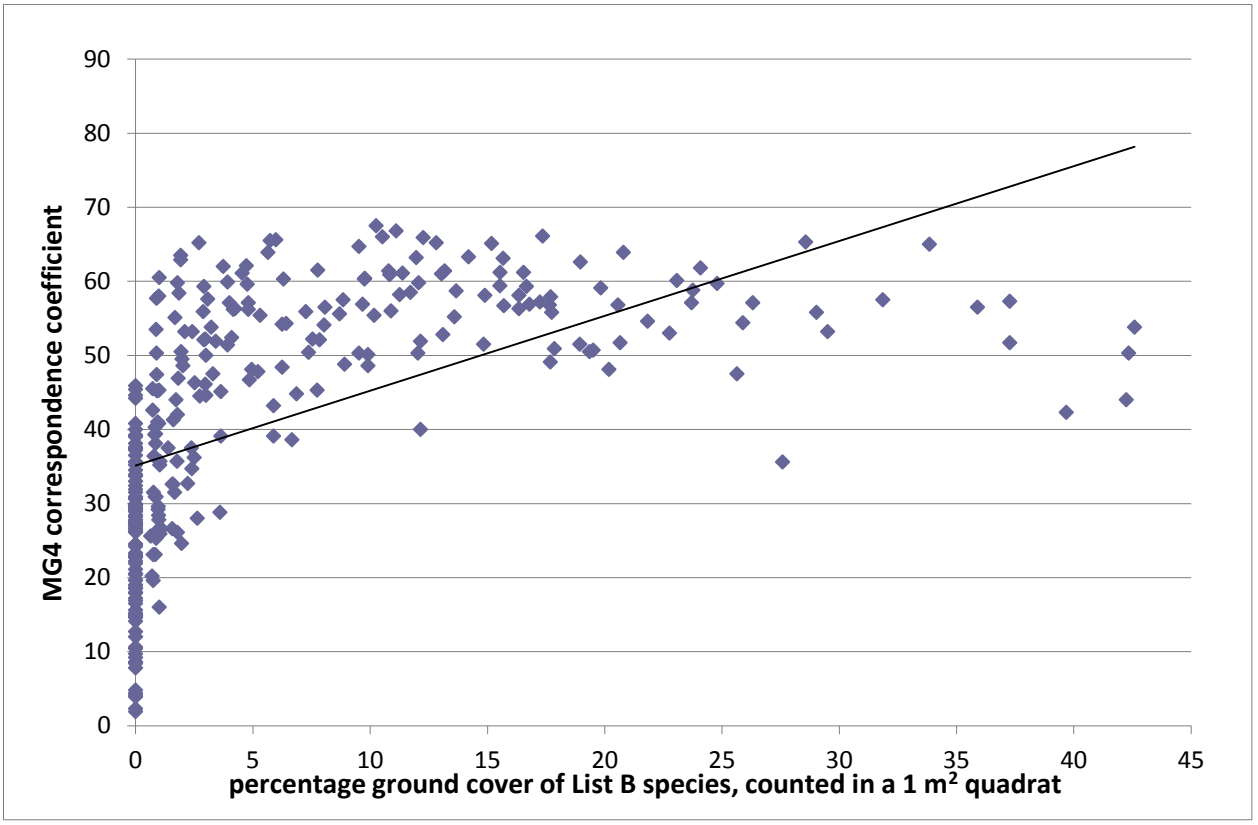


Figure A2.16 MG4 correspondence coefficient vs. the percentage ground cover of List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.312, P < 0.001

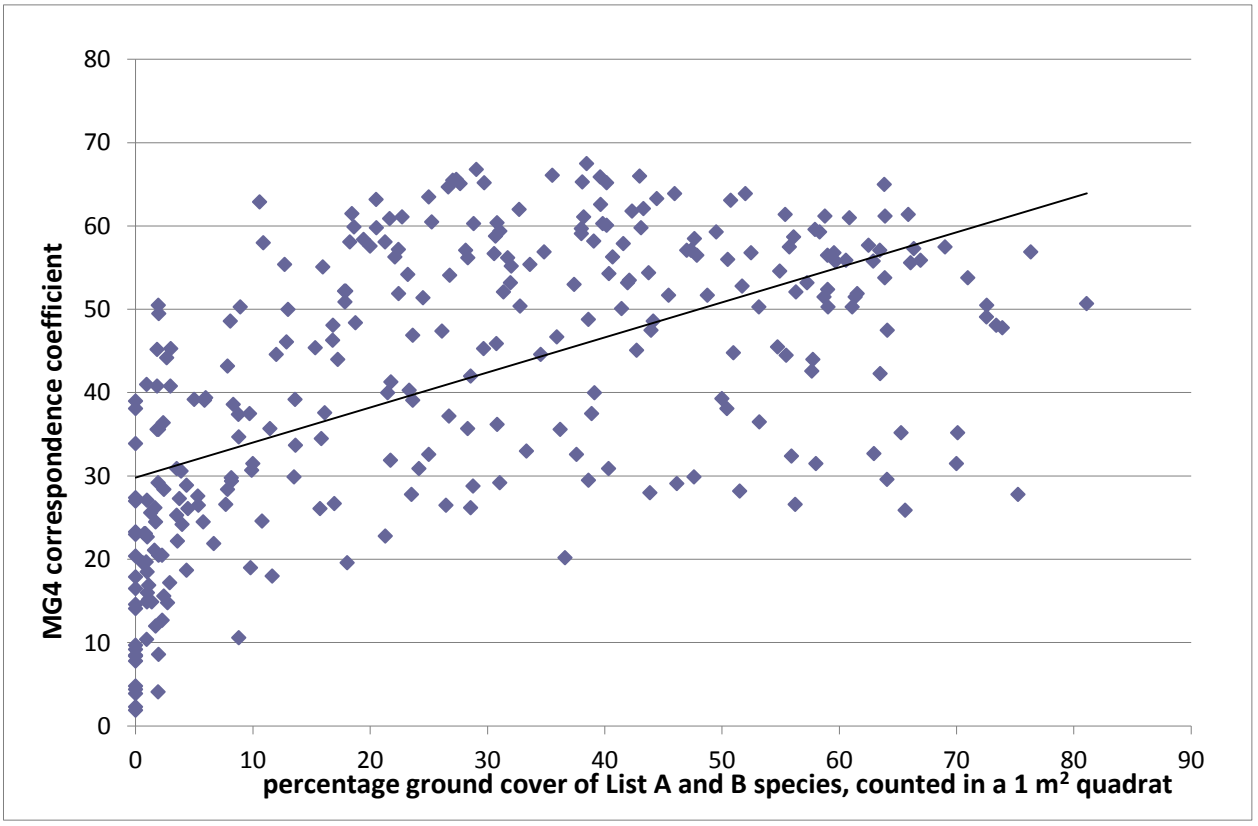


Figure A2.17 MG4 correspondence coefficient (x100) vs. the percentage ground cover of List A and List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.327, P < 0.001

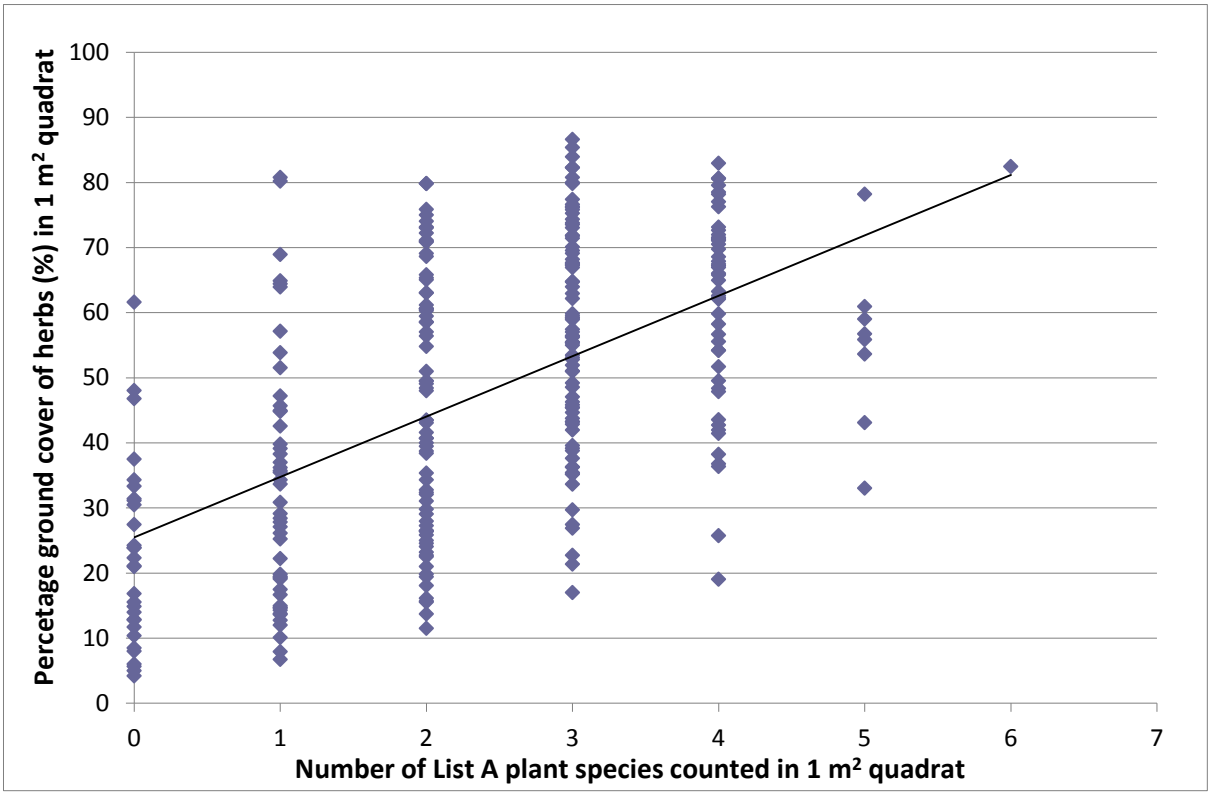


Figure A2.18 Percentage ground cover of herbs vs. the number of List A species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.321, P < 0.001

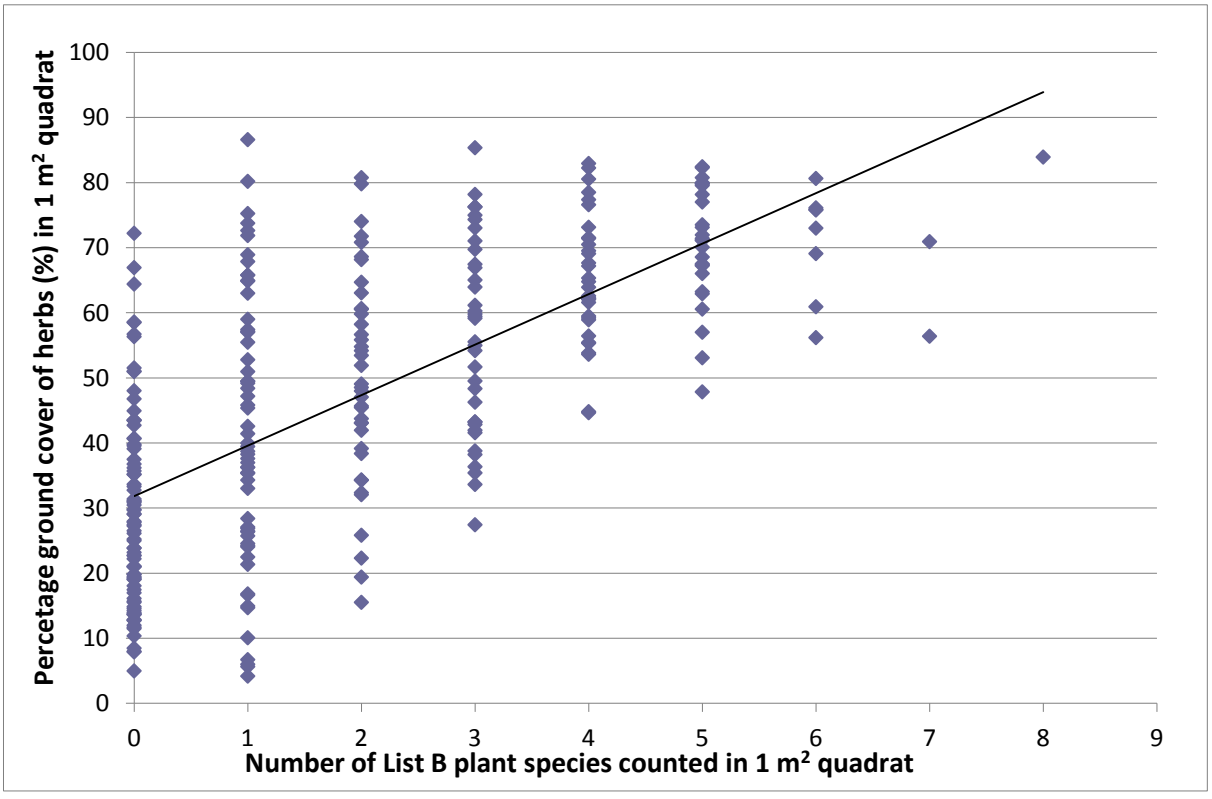


Figure A2.19 Percentage ground cover of herbs vs. the number of List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 =0.464, P < 0.001

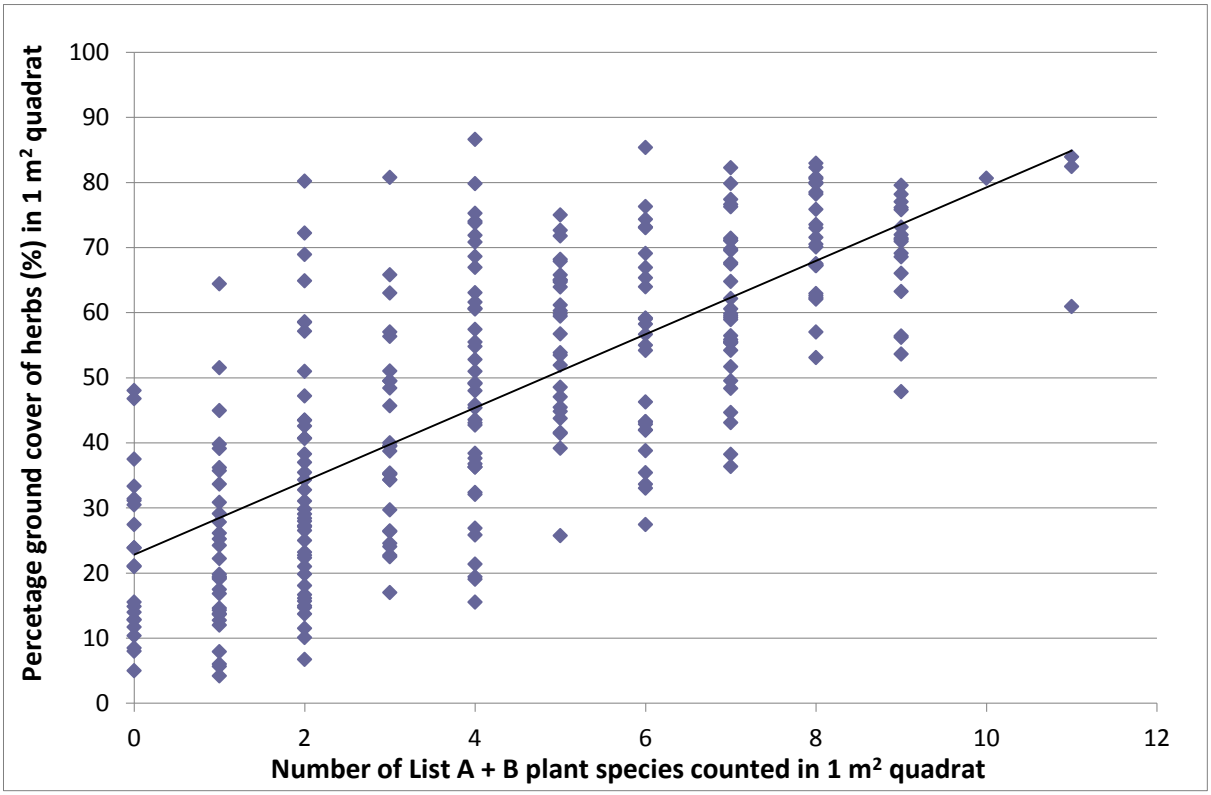


Figure A2.20 Percentage ground cover of herbs vs. the number of List A + B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.532, P < 0.001

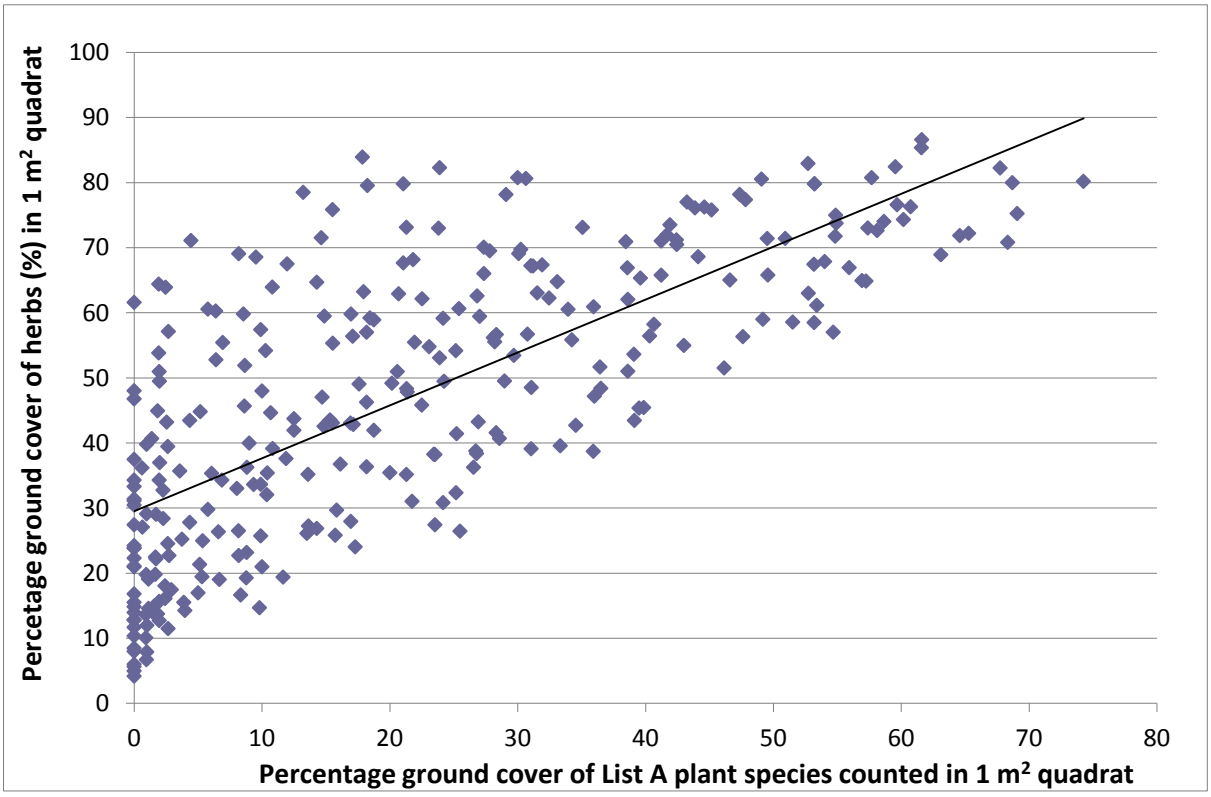


Figure A2.21 Percentage ground cover of herbs vs. the percentage ground cover of List A species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.541, P < 0.001

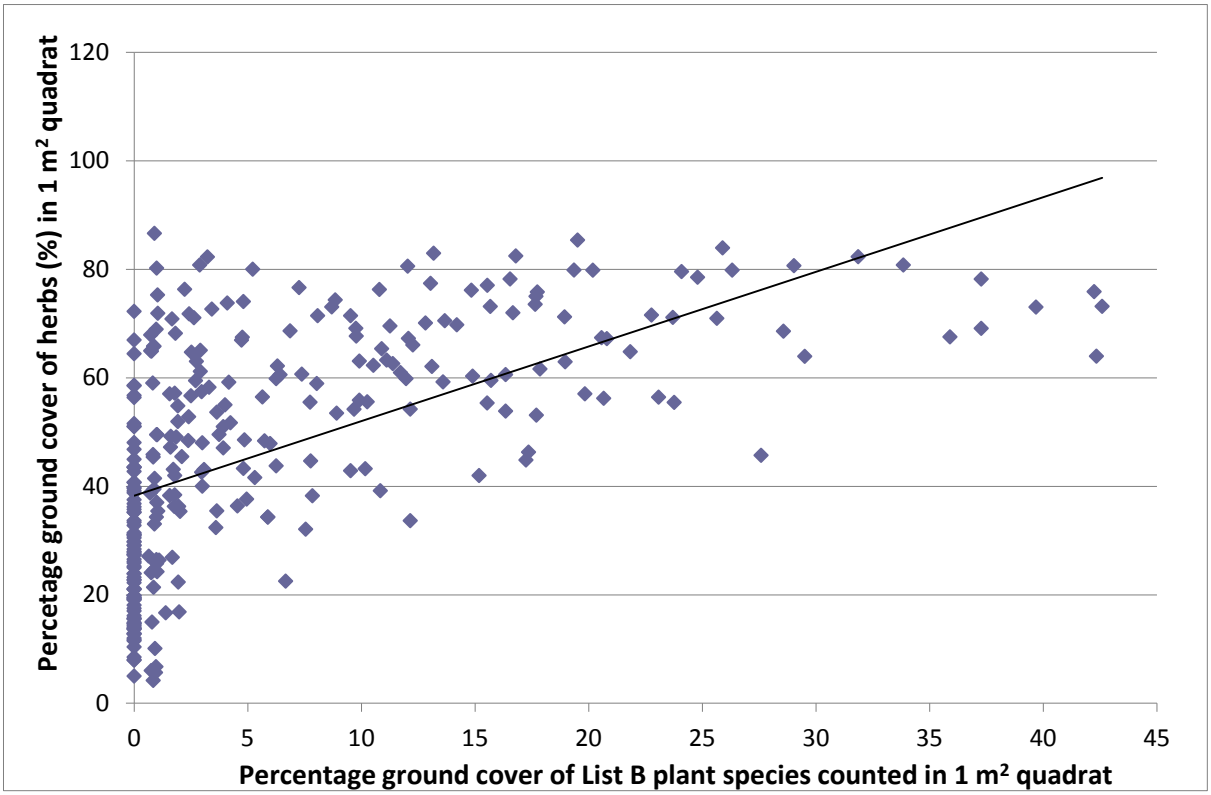


Figure A2.22 Percentage ground cover of herbs vs. the percentage ground cover of List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.347, P < 0.001

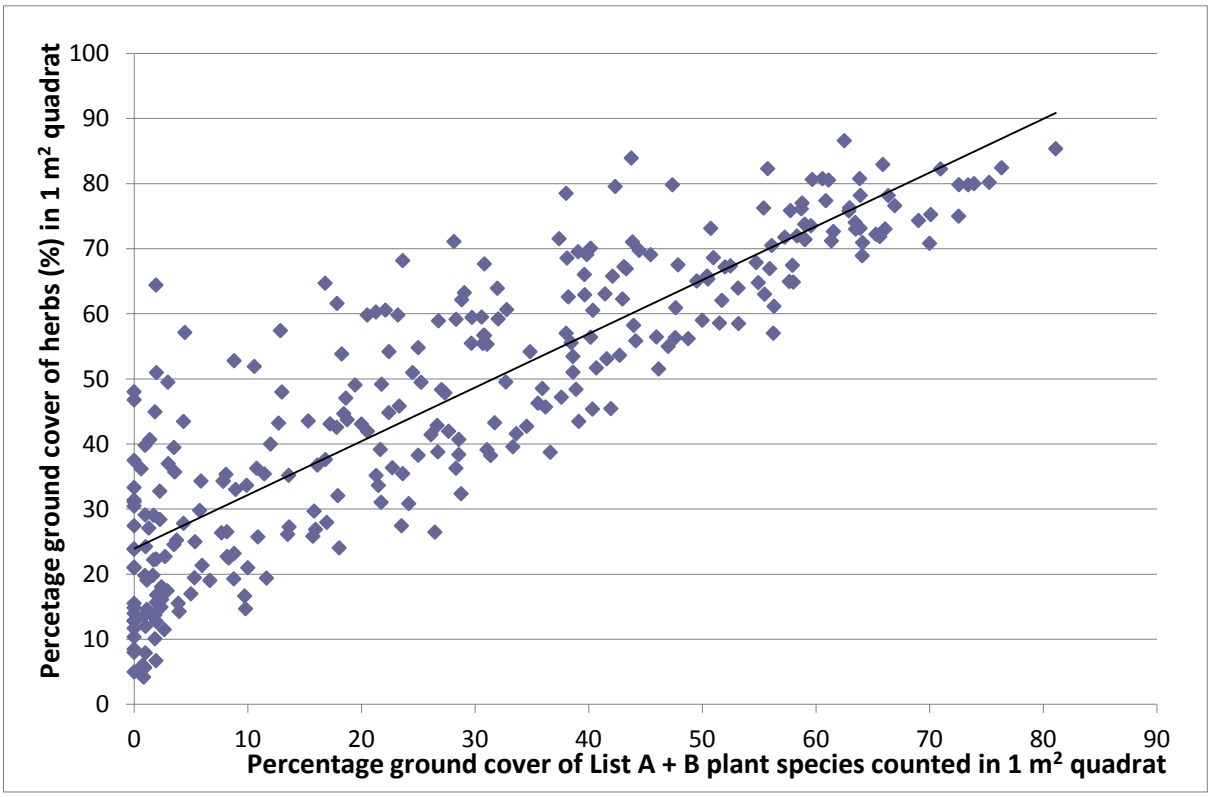


Figure A2.23 Percentage ground cover of herbs vs. the percentage ground cover of List A and List B species, counted in a 1 m^2 quadrat at all meadows. n = 293, R^2 = 0.757, P < 0.001

Appendix 2.3 Relationships between selected criteria of botanical value and agricultural value

The plots below examine the relationships between selected criteria of botanical value discussed in Chapter 5 and hay yield as a measure of biological productivity.

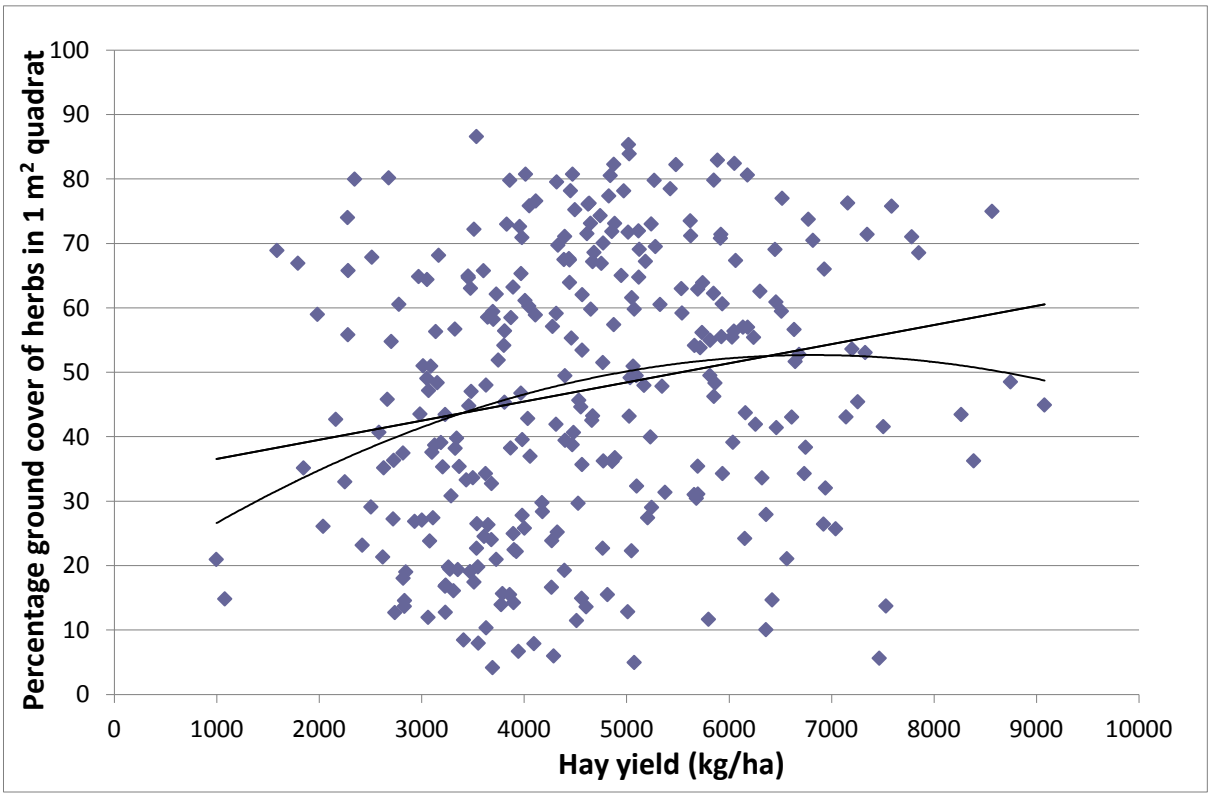


Figure A2.24 – Percentage ground cover of herbs versus hay yield for all meadows (linear model: $R^2 = 0.041$, $P < 0.001$; polynomial model: $R^2 = 0.052$)

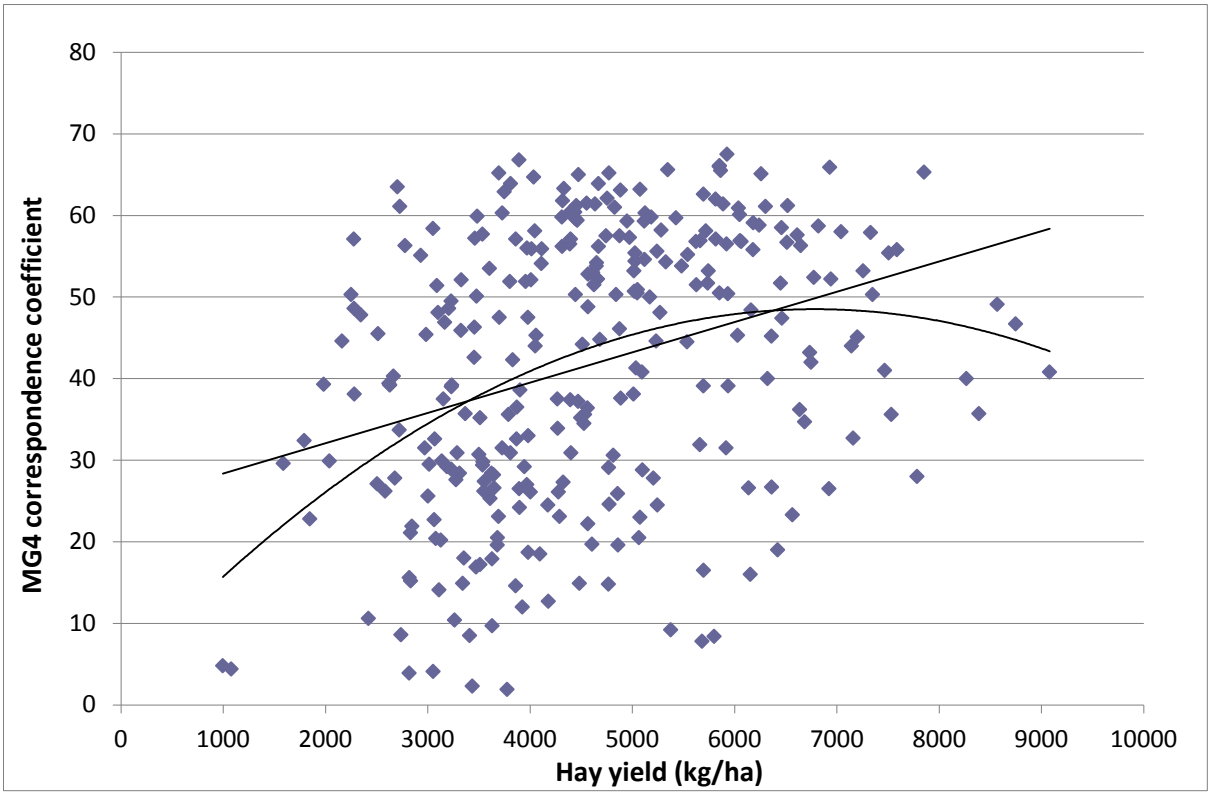


Figure A2.25 – MG4 correspondence coefficient (x100) versus hay yield for all meadows (linear model: $R^2 = 0.107$, $P < 0.001$; polynomial model: $R^2 = 0.135$)

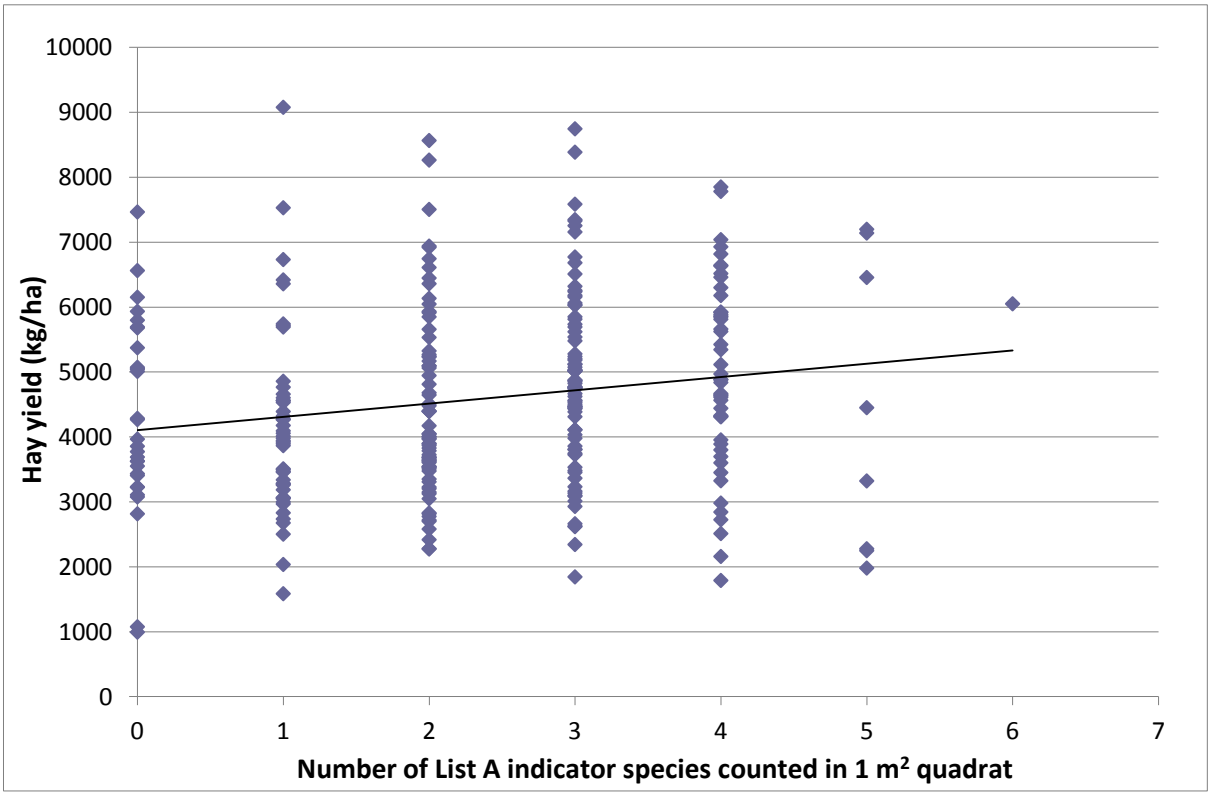


Figure A2.26 – Number of List A indicator species per 1 m^2 quadrat versus hay yield (linear model: $R^2 = 0.033$, $P = 0.002$)

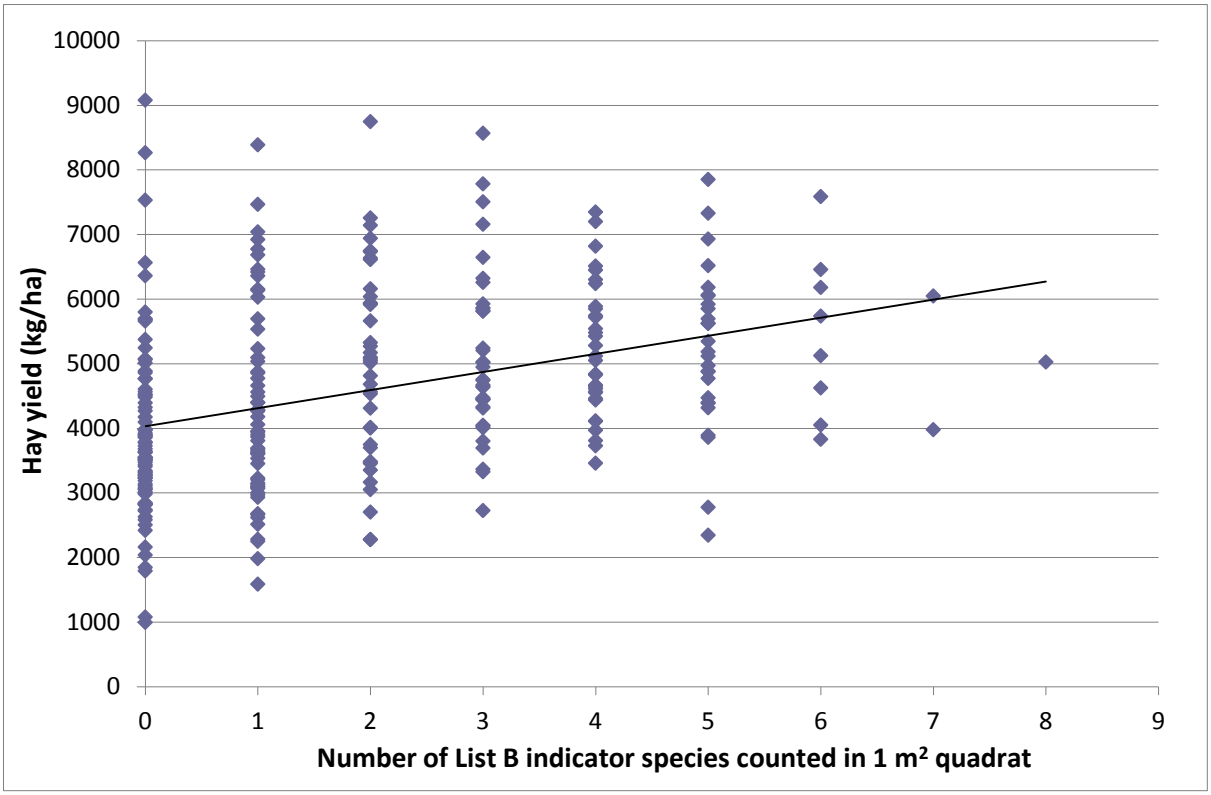


Figure A2.27 – Number of List B indicator species per 1 m^2 quadrat versus hay yield (linear model: $R^2 = 0.130$, $P < 0.001$)

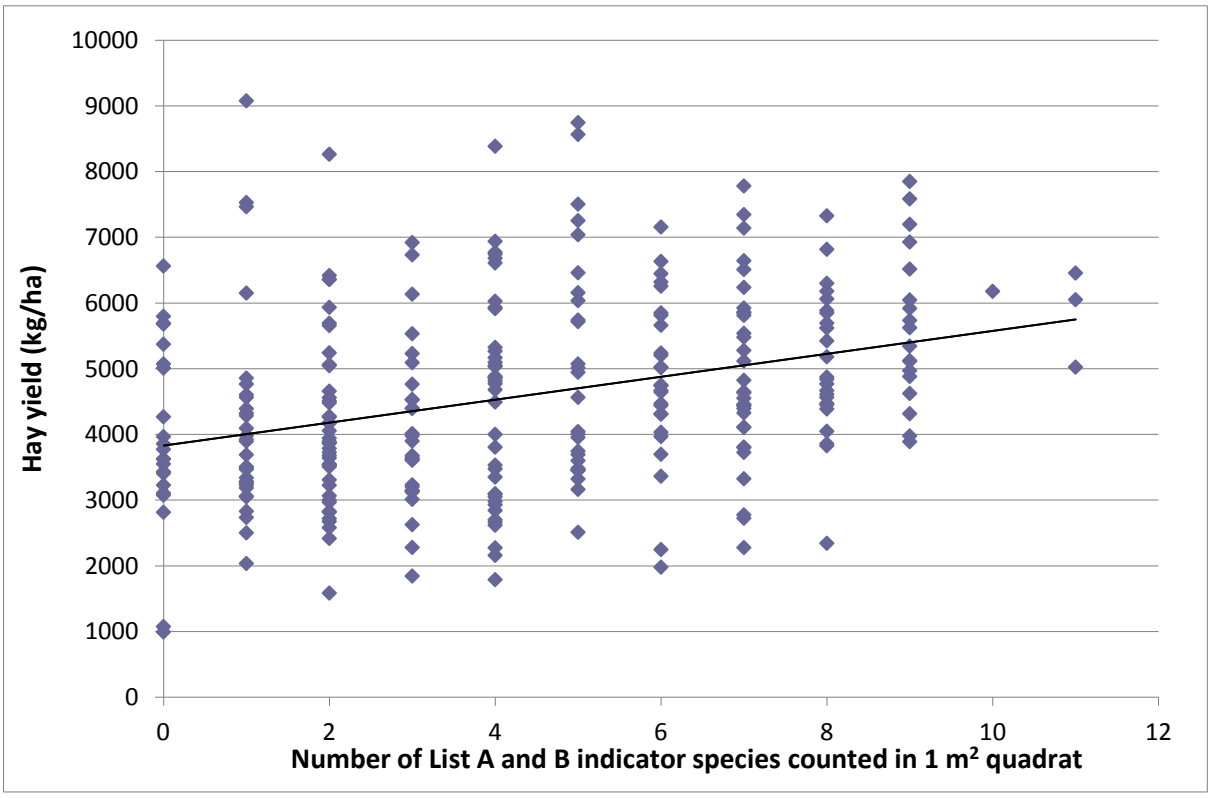


Figure A2.28 – Number of List A and B indicator species per 1 m^2 quadrat versus hay yield (linear model: $R^2 = 0.109$, $P < 0.001$)

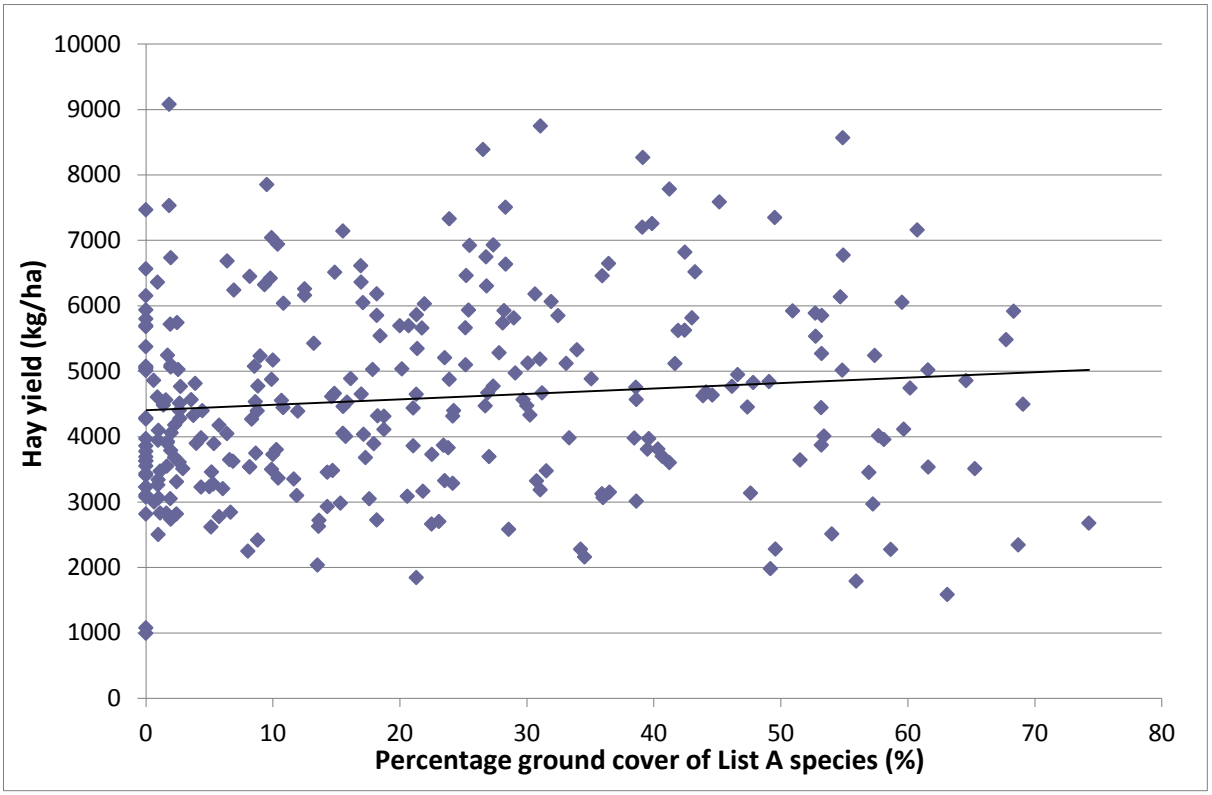


Figure A2.29 – Percentage ground cover of List A indicator species per 1 m^2 quadrat versus hay yield (linear model: $R^2 = 0.012$, $P = 0.061$)

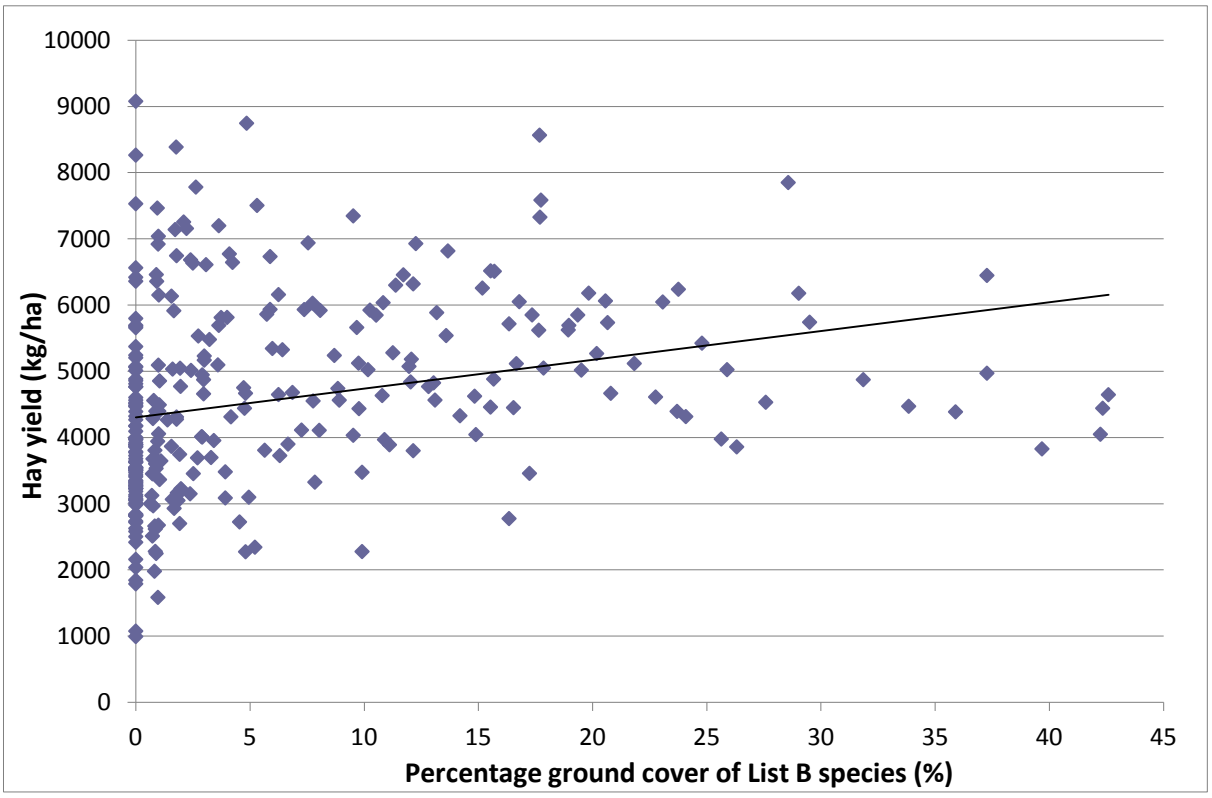


Figure A2.30 – Percentage ground cover of List B indicator species per 1 m^2 quadrat versus hay yield (linear model: $R^2 = 0.074$, $P < 0.001$)

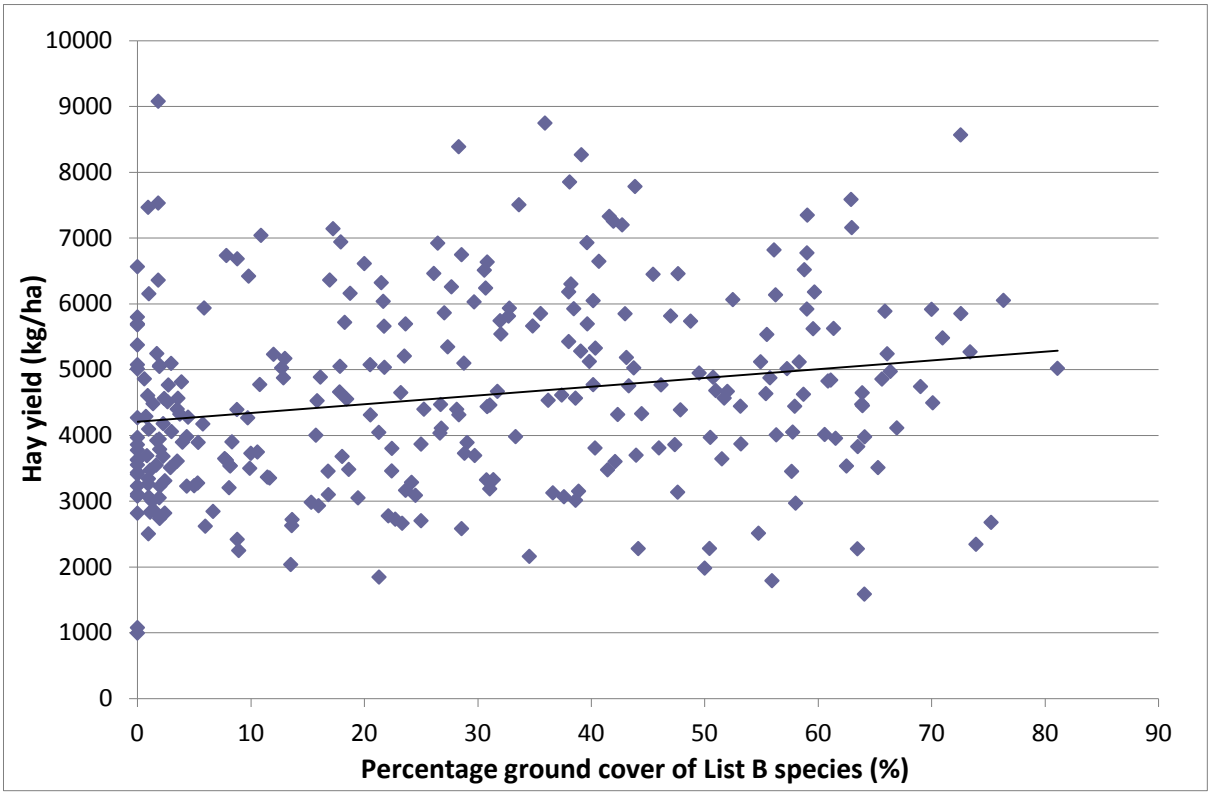


Figure A2.31 – Percentage ground cover of List A and B indicator species per 1 m^2 quadrat versus hay yield (linear model: $R^2 = 0.042$, $P < 0.001$)