The threat of abandonment in socio-ecological landscapes: farmers' motivations and perspectives on high nature value grassland conservation

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Abstract

Future sustainability of the conservation management of socio-ecological landscapes is typically reliant on on-going agricultural management. Such management may be threatened by changes in the drivers of management and the fragility of the stakeholder networks that deliver management. This study examined evidence for the risk of abandonment in a series of case study high nature value (HNV) grassland sites. The work found that the motivation of farmers to participate in the conservation management was typically limited and often marginal. Landowners and conservation stakeholders who relied on partner farmers to manage such sites often struggled to recruit and retain their participation, leading to increased turnover among managing farmers and to some sites being under-managed. Primary reasons for difficulty of recruitment and farmer turnover included a lack of candidate farmers in the local landscape, and the marginal and fluctuating economics of grassland management. A trend towards greater financial incentivisation of farmers was evident, which policy-makers responsible for agri-environment schemes should note, and elsewhere some conservation organisations were seen to be bringing grassland management in-house. Farmers' motivations to participate in conservation management of such systems may continue to weaken and abandonment may therefore become a significant risk to the successful conservation of such systems. Conservation stakeholders need to foster good relations with their farmer-manager partners and not further depress their limited motivations to participate, as well as consider carefully whether farmer stakeholders are being adequately compensated for their efforts.

Highlights

- Abandonment is a key risk to the management of some high nature value grasslands
- Risks result from the difficulty in recruiting and retaining managing farmers
- Farmers' motivations to participate are limited by marginal economic benefits
- Trend towards increased financial incentivisation of farmers to improve retention

Keywords: species-rich meadow, agri-environment scheme, high nature value grassland conservation, traditional meadow management, recruitment of farmers, economic incentivisation.

Introduction

Socio-ecological landscapes[1] consisting of high nature value (HNV) grasslands valued for biodiversity require the continuation of the traditional land-management practices that created them in order to be conserved into the future (Losvik, 2003; Fischer et al, 2012). Yet worldwide, changes in agricultural practices are leading to the abandonment of grasslands as a result of social, economic, cultural and historical factors (Scanga and Leopold, 2012; Babai and Molnar, 2014; Beilin et al, 2014; Joyce, 2014; Sharma et al, 2014; Lieskovsky et al, 2015). For European landscapes, a large proportion of which comprise grasslands that are highly valued for biodiversity (Habel et al, 2013), researchers have emphasised the importance of the continuation of traditional management (Bignal and McCracken, 1996; Isselstein et al, 2005; Schmitt and Rakosy, 2007; Bezak and Halada, 2010; Krause and Culmsee, 2013; Birge and Herzon, 2014; Molnar, 2014). Across Europe, changes in agriculture are leading to varying degrees of farmland abandonment (Young et al, 2005; Keenleyside and Tucker, 2010; Rewilding Europe, 2012; Habel et al, 2013; Wild10, 2013), which may result in the loss of associated traditional ecological knowledge (Hopkins and Holz, 2006; Prince et al, 2012; Babai and Molnar, 2014). Whilst Keenleyside and Tucker (2010) note that the trend is strongest in parts of Southern and Eastern Europe, and generally less prevalent in Northern and Western European countries such as the UK, they also note that semi-natural and extensive grassland landscapes are particularly at risk of abandonment. This would lead to a rapid loss of the biodiversity for which they are valued, grasslands commonly being an early successional stage in the native vegetation of Northern and Western Europe (Joyce, 2014). Following this loss of value, intensification could potentially follow, where restoration work cannot be funded or sustained over time, as such restoration work can be a lengthy process (MacDonald, 2001). Drivers of the loss of HNV grasslands have varied spatially and temporally, but Rodwell et al (2007) note that for some, abandonment may prove to be the most significant threat.

Literature regarding the impact of abandonment of traditionally managed agricultural land on biodiversity is extensive. However, less common are studies of the drivers of such abandonment, with much of the existing work focussing on Eastern Europe and upland areas of Central and Alpine Europe, and less covering the risk of the abandonment of HNV grasslands in lowland Northern and Western Europe, where much loss has often been the result of agricultural intensification (Woods, 2011).

Abandonment of traditionally managed agricultural lands in Europe is driven by a broad range of biophysical and socio-economic factors. These include changes in rural demography, society and culture (ADAS, 1993; Crofts and Jefferson, 1999; Lieskovsky et al, 2015), competition from intensification, as well as a lack of financial incentives that may compensate for low productivity in order to sustain traditional farming (Jitea and Arion, 2015; Graf et al, 2014). Other practical and biophysical factors include topography, soil quality and remoteness of land from human settlements (Lieskovsky, 2014; 2015; Jitea and Arion, 2015), as well as factors that serve to make management more difficult, inconvenient, unattractive or uneconomic to farmers, thereby affecting the sustainability of grassland management and threatening the ability to maintain sites in good condition.

[1] co-produced by the interaction of biophysical and social processes

In some countries, traditional and low-intensity conservation-orientated farming is subsidised by agri-environment schemes, for example in Europe funded under the European Union (EU) Common Agricultural Policy and by some EU Member States (European Commission, 2012; 2015). Such schemes are intended to incentivise the management of sites such as HNV grasslands, by providing compensation where a financial disadvantage is incurred by the low-intensity management and corresponding low productivity. Given the lack of emphasis in current literature on the drivers of grassland abandonment, especially in Northern and Western Europe, the threat of abandonment of HNV grassland represents a gap in knowledge.

A significant proportion of European high nature value socio-ecological sites are grasslands, and of these, lowland species-rich floodplain meadows are considered to be of European importance. They now constitute a rare landscape in Europe, highly valued for their species-rich sward, for the rarity of their grassland assemblages[2] (Ellenberg, 1988; Rodwell, 1992), and in some cases for the presence of uncommon or threatened plant species such as the snakeshead fritillary *Fritillaria meleagris* (Jefferson, 1997; Horton and Jefferson, 2006; Rodwell et al, 2007; JNCC, 2007). Good examples are now deemed of international importance for nature conservation at the European level, and five of the largest sites in the UK have been designated as Special Areas for Conservation (SACs) (European Commission, 1992, 2007), with most of the remaining known sites notified as Special Sites of Scientific Interest (SSSIs) (Nature Conservancy Council, 1989; JNCC, 2007).

The key drivers that influence the floristic composition of floodplain meadows are well known, and include the hydrological regime, the mesotrophic soil nutrient conditions and nutrient flows associated with river silt delivered by flooding patterns, and the meadow management regime (Mountford et al 1993, 1996; McDonald, 2001; Gowing et al, 2002, 2005; Crichley et al, 2007). The broad styles of traditional meadow management regimes and the impact of particular management operations on the grassland sward and species composition are also well-researched (Benstead, 1997; Crofts and Jefferson, 1999; McDonald, 2001; Gowing et al, 2002). Management regimes typically consist of a hay cut in early summer, followed by aftermath grazing in the autumn, usually with cattle.

The aim of this paper is therefore to assess the risks posed to the conservation of HNV grasslands by abandonment and its associated drivers. A case study approach is taken to examine a series of high nature value (HNV) grassland sites in England, in order to answer the following three questions: (1) What are the views of farmers involved in traditional grassland management regarding meadow value and management, and how do their perspectives influence their motivations to undertake grassland management? (2) What factors enhance or undermine such motivation? (3) What are the resultant risks of abandonment of meadow management? In answering these questions, this paper aims to evaluate the risk of abandonment of HNV grasslands and contribute to debates on how to mitigate them.

[2] *Alopecurus pratesis-Sanguisorba officinalis* grassland, community MG4, as defined in the UK National Vegetation Classification (NVC; Rodwell, 1992) and Habitat type 6510 in Annex II of the EU Habitats Directive (European Commission, 1992).

Methodology

In order to address the above questions, the perspectives of farmers actively involved in the management of high nature value floodplain meadows in Lowland Central and Southern England were explored in detail (Table 1 and Map 1), using a case-study strategy (Yin, 2014) and semi-structured interviews (Longhurst, 2010). Most work on semi-natural grasslands, and floodplain meadows in particular, has focused on the biophysical processes that produce them, with much less work on the social processes that influence their production through site management. Such processes are influenced by social, economic and cultural factors that have been little explored and that often require, at least initially, a more qualitative approach to identify and explore key issues affecting meadow management.

This work was focused on the association between the perspectives, attitudes and motivations of farmers and other stakeholders towards traditional meadow management, and the risk of grassland management abandonment. It sought to shed light on the meaning and value that floodplain meadows represent for farmers and other stakeholders in the meadow management network, on their understandings of the place of meadows in the landscape, as well as on the purpose that conservation of such sites serves for society. The work was also therefore exploratory in its desire to examine and identify a wide range of factors and influences, and needed to be open-minded in its approach.

The research strategy was designed to provide in-depth knowledge of specific case studies as a broad survey would yield a large volume of superficial data that would not be sufficiently detailed to address the research questions. Three meadows were studied in detail (Case Studies 1-3, Table 1: North Meadow, Brook Meadow and Long Mead) to obtain rich data on specific sites, with which to generate detailed understandings about the issues involved. A further six meadows were studied in less depth to provide data against which to test the results from the main case studies in order to improve the generalisability of findings. This approach was therefore designed to provide a balance between the depth and breadth required to allow any conclusions to reflect the broader context.

Table 1 – Case study meadows examined during the research (see also Map 1)

Case study number (Map 1)	Meadow name	Location	Latitude, Longitude	Area (ha)	Conservation designations
1	North Meadow	Cricklade, Wiltshire	51.651, -1.865	44.4	SAC, NNR, SSSI
2	Brook Meadow	Darley Green, Warwickshire	52.367, -1.736	1.73	SSSI, CWS
3	Long Mead	Eynsham, Oxfordshire	51.775, -1.363	10.5	CWS
4	Mottey Meadows	Wheaton Aston, Staffordshire	52.718, -2.238	44.6	SAC, NNR, SSSI
5	Portholme	Huntingdon, Cambridgeshire	52.322, -0.184	104	SAC, SSSI
6	Oxford Meads (Pixey and Yarnton)	Wytham/ Cassington, Oxfordshire	51.792, -1.305	86.9	SAC, SSSI
7	Sherbourne Meadows	Norton Lindsey, Warwickshire	52.254, -1.646	21.5	SSSI
8	Birches Barn	Polesworth, Warwickshire	52.616, -1.584	10.7	SSSI
9	Deans Green	Ullenhall, Warwickshire	52.312, -1.808	4.9	CWS

SAC = Special Area for Conservation; SSSI = Special Site of Scientific Interest; NNR= National Nature Reserve; CWS= County Wildlife Site[3]

The case studies were selected to represent a geographical spread across the region in which most meadows are located, as well as a range of conservation designation status, from high-profile internationally-protected SAC sites to lower-profile non-statutory CWS sites (see Table 1 for definitions). However, it was not possible in this study to include meadow sites with no conservation stakeholder involvement, as the owners of such sites that were approached declined to participate[4]. The situation regarding such meadow sites remains in question and should form the focus for future work.

[3] SAC is an international statutory nature conservation designation of the European Union, SSSI and NNR are statutory designations of the UK Government, and CWS is a non-statutory designation used in English local government for spatial planning purposes.

[4] Landowners may have been concerned that research could lead to statutory designation of their land and possible ensuing loss of control over management as new prescriptions would be enforced (personal communication, Natural England Conservation Officer, Warwickshire, UK, 20/01/2011).

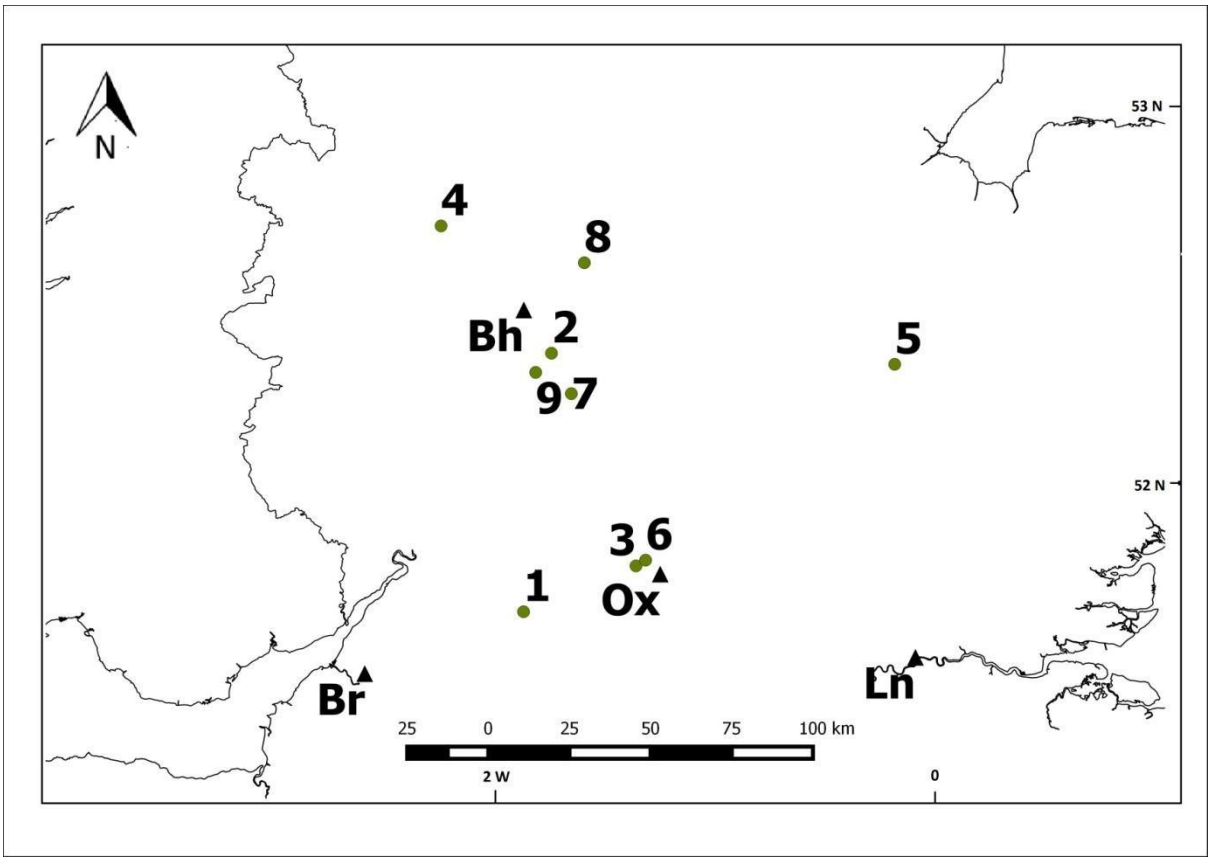

Figure 1 – Location of the case study floodplain meadows examined in this research (circles - site names given in Table 1). Triangles: nearest major cities (Ln=London, Br=Bristol, Bh=Birmingham, Ox=Oxford). McGinlay, James, GB National Outlines [SHAPE geospatial data], Scale 1:250000, Tiles: GB, Updated: 8 June 2005, Ordnance Survey (GB), Using: EDINA Digimap Ordnance Survey Service, <http://digimap.edina.ac.uk>, Downloaded: November 2014.

Stakeholders involved in meadow management were identified through a review of literature and websites, and through discussion with key gatekeepers, such as Natural England[5], Wildlife Trusts[6] and the Floodplain Meadow Partnership, a research consortium hosted by The Open University, UK. The role of each managing stakeholder and farmer identified was first confirmed and clarified, and these contacts were asked to identify any additional significant actors involved in meadow management for each case study site.

Stakeholders' views, perspectives and motivations were documented using semi-structured interviews. A semi-structured format was used to obtain data on specified topics, yet allow the interviewee to express themselves and reveal the issues that they felt were important, and to clarify and contextualise their responses. A range of questions were asked concerning several areas (although some were not relevant for all stakeholders):

- History of involvement with the meadow and knowledge of the site
- Motivation and interest for involvement in meadow management

[5] Government agency responsible for statutorily designated nature sites in England, and administering agri-environment schemes.

[6] Nature conservation charities.

- Opinions on the valued characteristics of the site and whether it is worth retaining in its present form
- Perspective on what constitutes a desirable or undesirable meadow or meadow condition
- Any assessment or evaluation, formal or informal, undertaken of meadow condition, status or management
- Management operations that the stakeholder is involved in and factors influencing decisions about these, including whether the outcome of any assessments influences operations
- Interactions with other stakeholders (nature and extent)
- Any records kept of assessment or management activities
- Views on the state and management of the meadow at present and in the future

Some flexibility had to be exercised in conducting the interviews to accommodate the different priorities and perspectives of the interviewees, but always with the intention of covering the above areas.

The semi-structured interviews characterised the role of each stakeholder in the meadow management network, the activities they undertook, the decisions they made (if any) regarding management activities, and the factors influencing or constraining their scope for action and decision-making. The interviews were also used to document interactions between stakeholders - including any tensions between farmers, landowners and conservation stakeholders, which might influence their view of meadow value and motivation to participate in meadow management - as well as formal structures and processes such as the requirement to request permissions to undertake hay cuts, or regard shown to formal documentation such as management plans or agri-environment agreements. The role, if any, of funding mechanisms was noted in order to assess the extent to which these may or may not incentivise farmers to continue participating in meadow management.

As well as practical motivational factors, more personal and affective factors were also explored, such as farmers' perspectives about meadow value, their sense of the meaningfulness of meadow conservation, and their broader motivations for participation. This approach allowed a fuller exploration of the influence and balance of motivational and demotivational factors on their views of meadow value and their interest and enthusiasm for participating in meadow management.

Where participants consented, the interviews were recorded using a portable digital voice recorder to permit careful analysis of the transcript. 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.

In total, 53 semi-structured interviews were conducted with 44 stakeholders between March 2010 and December 2012, including 22 interviews with 16 farmers, 21 interviews with 19 other stakeholders with an interest in meadow management, and a further 9 interviews with regional and national grassland conservation specialists (e.g. Natural England, Centre for Ecology and Hydrology, Thames Valley Environmental Records Centre, and Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust). All quotations in the text have been anonymised to protect the identity of the interviewee.

Results

The stakeholder networks managing the case study sites were unique to each meadow but generally comprised three groupings: landowner, conservation organisation or conservation-interest party, and farmer/land manager or other agricultural-interest party. One such entity might fall in to more than one grouping, but at least two such entities were identified at each site. For the purposes of this analysis, the stakeholders involved in managing the case study meadows have been divided into two groups: conservation-orientated stakeholders whose primary interest is nature conservation, and farmer-managers whose interest is primarily agricultural. This said, these two groups in reality represent a spectrum of views, perspectives and interests, which overlap to some degree. The landowner could fall into either group. Generally, large sites tended to have more stakeholders involved, with for example several hay farmers and a separate grazier. Most inter-stakeholder relationships consist of a one-to-one relationship between the conservation stakeholder or responsible landowner and each managing farmer. A summary of the key findings by case study is provided in Table 2.

Candidate availability

At most meadows, conservation-oriented stakeholders experienced some degree of difficulty in recruiting and retaining farmers to undertake agricultural management operations. Challenges noted were two-fold: firstly the difficulty of replacing farmers where the incumbent retired or ceased involvement for other reasons, and secondly the associated issue of an ageing farmer population approaching retirement.

North Meadow was not adequately grazed for nearly 10 years between 2001 and 2009 as a suitable cattle grazier could not be found. As noted by the Hayward[7] and by elderly residents of Cricklade interviewed for an oral history of the meadow (Snakeshead Revisited Project, conducted by the Cricklade Manorial Court and supplied by Natural England) this contrasts with the larger herds of cattle that would have grazed the meadow historically. Participants in the oral history noted that, in their recollection, for at least the second half of the twentieth century, farmers with larger cattle herds had not been interested in the meadow as a resource. The meadow had in the past been of interest to small-scale farmers and it is precisely these smaller farming concerns that have been disappearing from the landscape.

Similarly, at North Meadow the hay cut is delivered through a long standing licensing arrangement. At the time of the fieldwork (2010-2012) the meadow hay was cut by three farmers, two of whom were past retirement age and one of whom has since died, the hay cut being then shared between the two remaining farmers. The meadow hay cut appears therefore to be susceptible to the demographic factor of an ageing farming population, as noted above.

The Natural England site manager for another large SAC meadow noted that the greatest concern regarding meadow management was that the managing farmers would no longer wish to be involved in meadow management, as they would be difficult to replace. Other meadows were noted to have experienced increased farmer turnover, including Sherbourne Meadows, Brook Meadow, Deans Green and the Oxford Meads. The Oxford Meads is a large area of meadows near Oxford (87

[7] Traditional post appointed to oversee the meadow grazing.

ha) with complex and fragmented land ownership, much of which had had inconsistent management until the government agency, Natural England, brokered an arrangement for the entire site to be managed under contract by one land-management company. Sherbourne Meadows in Warwickshire were reported to have been managed by the same family for around 100 years, followed by another farmer for approximately 10 years. At the time of fieldwork (2011) it was being managed by a new farmer for the first year.

At Brook Meadow, the land-owning Wildlife Trust staff noted the difficulty in finding farmers to manage the meadow and saw it as vulnerable in terms of the provision of future management.

Trust staff also cited ageing farmers as an issue, noting that most reserve farmers were over 60 and:

> If they have no family to take over where will we be in ten years time? Relationships are individual and we don't know who is over the hedge in terms of the broader landscape[8].

Farmers' perspectives on meadow value

The views of farmers interviewed on meadow value varied and could not be neatly categorised. They generally held holistic views of the value of traditionally managed floodplain meadows. These typically encompassed an appreciation of the non-agricultural aspects of meadow value, which they either shared with conservation stakeholders or at least acknowledged as valid, even if they did not strongly share the conservationists' view of meadow value. They therefore commonly acknowledged the validity of biological, cultural and landscape aspects of meadow value. One farmer noted that he was happy to manage a meadow for either agricultural or non-agricultural goods and services. Two hay farmers professed to enjoy the traditional hay-making process from an aesthetic perspective, whilst another described the meadows as being equivalent to listed buildings[9].

The farmers generally placed most importance on the agricultural value of the meadows, in line with the findings of Kleftoyanni et al (2011) and Riley (2006). It was hay quality, hay quantity and convenience of management that were of key importance to them. Those that did not rely strongly on the income from managing the meadows acknowledged that they felt more able to enjoy the non-economic aspects of meadow value. Had they been more dependent on meadow income, they thought that they would have to be more focussed on the meadow as an agricultural resource. This resonated with the views of one Natural England conservation officer who administers the agri-environment scheme for one Oxfordshire meadow, and who noted that many of the private landowning clients liked their conservation meadows and wanted to keep them, but that this hinged on the continuation of government support, without which they would need to focus more on the economic output. As regards the divergence of the rationale behind conservation and commercial farming (Crofts and Jefferson, 1999), one farmer noted:

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

[8] Personal communication, Warwickshire Wildlife Trust officer, Coventry, Warwickshire, UK, 30/3/2011

[9] In the UK, this refers to buildings conceded statutory protection for cultural heritage reasons.

Barriers to farmers' agency in meadow management

As convenience of management in fitting in with other work is a key issue for farmers, their agency to make decisions about management operations, such as the timing of the hay cut or intensity of grazing, are therefore likely to influence their view of meadow value and of any management restrictions imposed by conservation stakeholders.

For example, the hay cut is constrained by a prescribed earliest start date, typically in mid-July, imposed on sites with a statutory nature conservation designation through their management plan, or on sites where management is funded through an agri-environment agreement and the hay-cut start date is cited in the agreement. These restrictions are reported in management plans and by conservation stakeholders to relate to the need to allow ground nesting birds to fledge and plants to set seed (although ecologists consider that there is no significant evidence for this latter reason).

The impact of the restriction, which varies from site to site, is that farmers perceive a reduction in hay quality, thereby reducing its utility and value to them. The restriction also narrows the window of opportunity for farmers to fit the hay cut in with their other work at a busy time of year. The effect has been a generally negative impact on farmers' views on meadow management, with hay farmers at most of the case study sites expressing the desire to follow the traditional custom of cutting hay in June.

Similarly, disputes exist about the validity of fertilisation of meadows by manuring, which conservationists wish to restrict, though not necessarily prohibit. Some farmers, particularly those at North Meadow and Mottey Meadows, viewed manuring as a traditional farming practice without which the meadows would change materially, particularly in terms of falling yields. Rolling or harrowing were also considered by many farmers to be traditional practices that improve sward performance in terms of hay yield, but which conservation stakeholders restrict as potentially damaging. Again, some farmers were sharply critical of such restrictions. Evidence from the case studies suggests that these operations (manuring, rolling and harrowing) are now very rarely undertaken on floodplain meadows. In many cases, this appears to result from the conservation stakeholders' presumption against them. This said, the Hayward overseeing the grazing at North Meadow did question whether rolling and harrowing no longer took place because farmers no longer had time for this work, or whether, as Rodwell *et al* (2007) note, lower cattle stocks may locally reduce the availability of manure, suggesting that manuring may be increasingly difficult to undertake, even if desired.

Farmers were also affected by animal welfare and hygiene legislation in relation to bovine spongiform encephalopathy (BSE), foot-and-mouth disease and bovine tuberculosis (TB), which restrict the movement and mixing of cattle herds. This legislation has introduced financial and administrative barriers to local cattle farmers' ability and willingness to provide their cattle for meadow grazing. For example, at two case-study meadows (North Meadow and Brook Meadow) in 2011, autumn cattle grazing was stopped because the cattle had to be removed from the site to be tested for TB. The graziers judged it inconvenient to return them to the meadow, which would incur transport costs. Meanwhile in 2013, the farmer at one meadow chose not to exercise his right to graze the site at all (for which he had paid a fee) as he claimed that the cost of TB testing made it financially unviable.

Management delivery models and compensation schemes

In terms of the economic relationship between conservation stakeholders, landowners and the managing farmers, four main models were identified:

1. Licensee: the farmer pays the landowner for the right to cut the hay or graze the meadow;
2. Non-economic mutual arrangement: the farmer cuts and retains the hay or grazes the meadow for free as a mutually beneficial arrangement;
3. Bought-in contractor service: the farmer is paid as a contractor to cut the hay or graze the meadow;
4. Owner-manager: meadow farmed by the landowner.

In Model 1 the arrangement is most beneficial for the landowner and the farmer must ensure that they can recoup at least the cost of the licence. Model 1 was the most common option for meadow management among the case studies. For Models 1 and 2, the agri-environment funding that most landowners receive was not passed on to the farmer. A tendency to move from Model 1 to 2 to 3 was noted as landowners and conservation managers experienced difficulty finding farmers to deliver management (Brook Meadow moved from Model 1 to 2, North Meadow grazing moving to Model 3), and the Wildlife Trust staff responsible for Brook Meadow noted that they were considering whether they should share the Trust's agri-environment scheme payments with the farmer, thereby moving to Model 3. Indeed, the farmer of another Warwickshire meadow, a small-scale part-time farmer, stated that he did not own most of the land he farmed and that he paid nothing for access to most of it. Furthermore, some conservation stakeholders and landowners have taken the initiative of bringing some aspects of meadow management 'in-house' whereby they use their own staff and machinery for hay cutting, and/or their own cattle for grazing (Model 4).

Marginal economics and the impact of disputes over meadow value and management

Farmers noted that the economics of meadow management were marginal and the economic situation shifted every year, making management precarious. Farmers' economic motivations for involvement in traditional meadow management were therefore weak and management had to fit with their other work. The owner of one privately-owned meadow noted:

> 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 are quite precarious and the situation shifts every year. The most important thing is fostering long-term relationships to take the precariousness out.

This was true particularly for the grazing at this site, where the grazier noted that whilst access to the meadow for grazing was of utility, this utility was clearly judged to be limited and somewhat marginal. Again, the owner noted:

> 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 [was not required to pay].

At Long Mead, the owner considered the socio-economics of meadow management to be the most significant threat to their future survival. The relationship with the managing farmers was perceived to be very much one of a mutually beneficial non-economic arrangement that was precarious and in which the incentives for the farmers' involvement were weak. Furthermore, a Natural England agri-environment scheme advisor for one Oxfordshire meadow said that farmers often commented that the subsidy to make hay was essential because the yields were often low. Whether the hay meadows continue to exist in the future would therefore depend on whether the agri-environment schemes are continued.

Regarding the marginal economics of meadow management, farmers and conservation stakeholders often clashed to some degree over meadow value and management practices. As noted above, at North Meadow, all three hay farmers felt that the hay-cut start date was too late and were critical of restrictions on manuring, rolling and harrowing. These restrictions affected the hay yields and quality that were most important to them. Hay yields are indeed afforded lower priority in the site's meadow-management plan (Natural England, 2008):

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

In the case of North Meadow, this had not yet deterred the hay farmers sufficiently to withdraw their participation, even though they paid a fee each year for the hay crop. This suggests that, whether the agricultural aspects of value were declining or not, sufficient perceived value remained to motivate them to continue. The large size of the resource may mitigate against the lower hay yields, as evidenced by the comments of the farmer of a small Warwickshire meadow:

> If it was 8-10 acres [3-4 ha] 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.

This farmer paid for access to the site (hay and grazing) in 2011. Although he thought the sum he paid was fair, he noted that whilst the meadow was useful, if an alternative source of grassland became available locally, he would use that instead and would review his involvement from year to year. His motivation for involvement in the meadow's management thus appeared to be marginal under the current regime of incentivisation.

It is in the light of such views that Warwickshire Wildlife Trust staff commented (above) that they might consider sharing the agri-environment payments with managing farmers. This interviewee also noted that retaining the farmers in the face of economic reality was key, as the late hay cut clashed with mixed farmers' other work. Ultimately meadow management had to be convenient for the farmer. This also illustrates the Trust's view that, apart from enforcing the hay-cut start date, it was otherwise not in a position to impose management restrictions upon farmers.

At North Meadow the grazier was more positive about the meadow management. The grazier, in contrast to the hay farmers (paid under Model 1), is paid as a contractor (Model 3) and so is both incentivised to participate but also gains access to a useful grazing resource. He therefore felt that his enjoyment of the grazing resource was not significantly constrained, and in any case was adequately incentivised financially. He noted his intention to continue grazing the meadow, suggesting that the cattle grazing at North Meadow is secure under this financial arrangement.

Overall, the low levels of motivation of many participating farmers were noted by the owner of an Oxfordshire meadow, who underlined the difficulty in maintaining the managing farmers' level of interest to remain involved:

> 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.

Discussion

Farmers' motivations for involvement in the management of HNV grasslands such as floodplain meadows are influenced by a diverse range of drivers. Farmers' initial interest and enthusiasm may include aesthetic and affective reasons and interest in cultural landscapes and nature conservation, but ultimately, they still focus primarily on economic factors, as found elsewhere (Riley, 2006; Babai and Molnar, 2014; Lieskovsky, 2015). However, as noted by one farmer who was happy to manage meadows regardless of the objective, farmers can still take a holistic view of meadow value and meadows can provide a range of benefits, as envisaged by the ecosystem services perspective (UK National Ecosystem Assessment, 2011). This suggests that, provided that the financial incentives are sufficient, meadows can be managed to produce traditional agricultural products (hay and grazing) and/or biodiversity and cultural goods and services (landscape and heritage).

However, whilst existing farmers are mostly motivated to continue, potential candidates to replace them when they leave or retire are limited. Several conservation stakeholders noted the difficulty of recruiting and retaining hay makers and graziers due to ageing, as well as lower interest in traditional farming, as noted elsewhere (ADAS 1993; Lieskovsky, 2015). Other structural changes in farming included regional specialisation, which in the UK is the specialisation of arable in the eastern counties and livestock grazing in the west (Crofts and Jefferson, 1999; Rodwell et al, 2007), which means that some landscapes lacked candidate hay farmers whilst others lacked candidate graziers.

The importance of the demographics of participating farmers may depend on whether older farmers are more involved in meadow management because this is of greater interest to their generational cohort, or because they become more interested in conservation farming as they get older. In the former case, generational turnover will further deplete the pool of candidate farmers, likely requiring additional incentivisation of younger farmers. Younger farmers may or may not be less interested in the non-economic aspects of meadow value or may value them differently from older farmers. Whatever the case may be, the present situation appears to be similar to that found by ADAS (1993), suggesting that in part at least the latter is true: as farmers age and their perspectives change or broaden, and if they have more diversified incomes, they may become more interested in conservation. Further research on farmers' motivations to participate in conservation farming and the relationship with farmer age would help address this question.

Other disincentives were noted among existing hay farmers and graziers, which would also likely limit interest among potential candidate farmers. As also established here, for upland hay meadows in Northern England, Riley (2006) found that key motivators for hay farmers included hay quality, hay quantity and fit with other work. Therefore any restrictions or barriers to these aspects would be expected to discourage farmers. Lieskovsky (2014, 2015) also found for Slovakia that

inconvenience of management such as remoteness, difficult terrain and poor soil, deterred farmers from continuing grassland management, and in turn would impact economic factors.

Above all, though, a major disincentive identified by other studies is marginal and constantly shifting economics (Lieskovsky, 2015, Jitea and Arion, 2015). Scotton et al (2014) found that late hay cuts limited hay quality in the Italian Alps, which was a concern raised in this study leading to tension with conservation stakeholders. Similarly, the cessation of fertilisation by manuring appears to have impacted negatively on farmers' impressions of hay yields, and the cessation of what some farmers considered 'traditional' meadow management practices (rolling and harrowing) has also impacted negatively on their view of meadow management more broadly. In this study, traditional grazing was also impacted by legal restrictions on animal movements, cattle-herd mixing and disease testing (Defra 2013, 2014), which meant that the benefits of meadow grazing were not fully enjoyed. In a possible positive feedback loop, this sense of the very limited utility of the meadows may discourage the latter three operations even when allowed, in an attempt to spend as little time on management as possible, farmers themselves thereby potentially contributing to the meadows' perceived depressed value.

Counter-balancing these disincentives are financial incentives such as the agri-environment schemes part-funded by the European Union's Common Agricultural Policy (European Commission, 2015) to render traditional management financially viable. In this research, interviewees noted the key role of agri-environment funding in keeping farmers involved in meadow management, which is echoed by other studies from across Europe (Lieskovsky, 2015, Jitea and Arion, 2015; Babai and Molnar, 2014). Indeed agri-environment funding can also drive extensification (Graf et al, 2014), the reverse of intensification, and in England funding schemes are used to fund restoration schemes (Natural England, 2009). However, the implementation of, and eligibility criteria for, such schemes vary considerably from country to country (Kleijn & Sutherland, 2003; Dahlstrom et al, 2013). Whereas, for example, schemes to support hay meadow management have been widely adopted in Switzerland (Knop et al, 2006), in the UK, most of the options relevant to the management of species-rich grasslands are discretionary and targeted, such as the Higher Level Stewardship schemes discussed in this work, and its replacement, Countryside Stewardship.

Nevertheless, these findings indicate that candidate farmers in local landscapes are limited and may be continuing to decline, and existing farmers are critical of conservation-oriented meadow prescriptions and restrictions. Farmers' motivation and enthusiasm for involvement in meadow management was limited in many cases, and this is a cause for concern. Evidence of the negative impact of farmer availability and motivation on the future sustainability of meadow management was found in that landowners and conservation stakeholders often experience difficulty recruiting farmers and management operations did not always take place. Our study also detected a trend towards increasing compensation and incentives for farmers to counter this. The shift to management models involving increasing levels of financial incentivisation appears to be driven by the need to compensate for a continuing decline in perceived meadow value and a picture of falling farmers' motivations to be involved in meadow management in landscapes where the number of potential candidates is itself declining. Financial support mechanisms therefore appear to influence farmers' motivations for involvement in meadow conservation and are crucial for keeping some involved, and so are likely to form part of the solution to retaining farmer involvement. However, we would contend that this direction is only likely to address some aspects of low candidate farmer

availability, and do little to affect others, especially farmer demographics. Our findings also suggest that a response among some conservation agencies and landowners is to bring meadow management under their own responsibility, by using their own staff and equipment to deliver management, but there are risks to this direction also, as the additional costs may mean that conservation agencies struggle with limited funding, and landowners may not be able to sustain self-management, raising again the prospect of abandonment.

More broadly, contemporary meadow management represents a trade-off between the provision of different goods and ecosystem services (UK National Ecosystem Assessment, 2011) and a compromise between the rationale of agricultural and nature conservation management (Crofts and Jefferson, 1999). Farmers' motivations to participate in meadow management are impacted negatively by disputes over the overall value of meadows, the importance and impact of management operations they consider to be 'traditional', and the relevance and utility of the restrictions that conservation stakeholders impose on managing farmers and that impact on farmers' perception of meadow value.

Such disputes inevitably revolve around a wider clash between nature conservationists and farmers about the meaning and value of meadows, and which aspects of value should take precedence. Nature conservation stakeholders clearly prioritise floristic/botanical diversity and biodiversity over hay yields and economics, as reflected by formal meadow policies and plans (Ratcliffe, 1977; Nature Conservancy Council, 1989; Robertson and Jefferson, 2000; European Commission, 2007, JNCC, 2007). As conservation stakeholders hold formal authority in conservation of meadows through responsibility for statutory designations and control of agri-environment scheme budgets, they are in a position to impose this approach on other stakeholders such as farmers, who are also actors in making meadows. The difference between farmers' and conservationists' views of meadow value and also the farmers' lack of a sense of control regarding the trade-off that exists between these differing perspectives, appear to lead to farmers' often negative views of meadow management.

The above disputes do impact on the aspects of value of interest to farmers, affecting in turn their motivation to be involved in meadow management. Yet, whilst meadow management has sometimes been represented as a trade-off between biodiversity and agricultural value, it is not possible to place these dimensions in opposition, (Cronon, 1995; Demeritt, 2001; Proctor, 2001; Castree, 2001, 2005; Adams, 2004; Ginn and Demeritt, 2009), as if these were a clear-cut either/or choice between 'natural' value and 'social' value, as both forms are co-produced by meadow management agents and cannot be separated.

However, little evidence was found in this study of a dialogue between conservation and farming stakeholders regarding these issues, or attempts to build a consensus across the stakeholder network regarding the meaning of meadow conservation and the value of traditionally managed floodplain meadows. The assumption by some conservation stakeholders that farmers' desire to question the restrictions they impose on meadow management is motivated by a wish to intensify management appears to be belied by the generally holistic view of meadow value expressed by most meadow farmers interviewed for this study. Greater dialogue between conservationists and farmers regarding meadow value and management, in line with the co-management approach to nature protected area management (Vokou et al, 2014), could play a significant role in enhancing farmer recruitment and retention, and thus securing meadow management into the future.

Conclusions

This work has examined the perspectives and motivations of farmers, who manage meadows and grasslands based on traditional agricultural practices, in order to evaluate the risk of abandonment.

Farmers' motivations to participate in conservation management were influenced by their own sense of the value and meaning of traditional grassland management and a balance between incentives and disincentives. This balance was also found to be influenced by tensions and disputes over HNV grassland value and management that often do not appear to be being resolved to the mutual satisfaction of farmers and other conservation stakeholders. Evidence suggests that such disputes are leading to a negative view of grassland-management practices among many farmers, which where inadequately compensated, led to depression of their sense of the grasslands' value and motivations to be involved in their management. Coupled with demographic changes in the surrounding farming community, the potential pool of candidate farmers to participate in management is often very limited, farmer turnover can be high, and a number of nature-conservation organisations are beginning to bring management operations in-house.

A general trend of weakening motivation among farmers managing floodplain meadows is apparent in this study, and it appears that further incentivisation will be required to support farmer retention and mitigate the risk of abandonment. There is therefore a significant potential threat to meadow conservation from the fragility of the managing stakeholder networks and such meadows appear in general to be vulnerable in terms of the socio-economic factors that influence delivery of meadow management, and any accentuation of this situation may lead to neglect or abandonment of some meadow sites.

To maintain existing HNV grassland management networks, more dialogue between conservation and farmer stakeholders is required to form greater understanding and mutual appreciation of each other's views of a site's value, reduce misunderstanding and consolidate relationships to mitigate the risk of farmers losing interest and ceasing participation in management. Landowners and landowning conservation stakeholders may need to consider carefully the rationale for the restrictions that they put on farmers' agency to determine grassland management and to consider the need to share agri-environmental compensation with the managing farmers in order to incentivise and compensate them for their efforts. Alternatively they may need to plan to manage the sites themselves, for which funding streams may need to be identified and secured over the longer term. In this study, a trend over time from management by licensees towards contractor-managers was noted, suggesting that in general HNV grassland management is likely to become more costly. In particular, where small lower-profile sites, or sites without legal protection, are owned by individuals or organisations that lack the funds to undertake management or provide further incentives, management may therefore become increasingly irregular or may cease altogether. Policy-makers responsible for agri-environment schemes will also need to respond to this increase in the cost of management in order to defend such grassland sites from under-management and abandonment.

In countries where agri-environment schemes support traditional extensive HNV grassland management, the inter-relationship between incentives and disincentives on the one hand, and farmers' sense of the value of the socio-ecological landscape are likely to impact on recruitment and retention of farmers, either to assist conservation stakeholders and landowners with system

management, or in the case of landowning farmers, to recruit them into the incentivisation schemes that prevent either system abandonment, or change of land use.

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Table 2- Summary table of the intersection of key issues identified as influencing the potential risk of meadow abandonment with major case study meadows. For details of meadow location, size and conservation status, see Table 1 and associated footnotes.

Issue	North Meadow	Brook Meadow	Long Mead	Other case studies*
Candidate availability	Little or no grazing 2001-2009. Evidence of loss of small-scale graziers from the landscape and lack of interest from larger-scale graziers. Ageing farmer profile noted.	Difficulty of recruiting and retaining farmers. Future management provision seen as vulnerable. Ageing farmer network viewed as an issue (most reserve farmers over 60 years old).	Land-owners are competing for graziers.	Conservation stakeholder for one major SAC site noted that loss of managing farmers was a major concern as would be hard to replace. Periodic farmer turnover in recent past noted at: Sherbourne Meadows, Deans Green, Oxford Meads.
Farmers' ideas and perspectives on meadow value	Hay farmer enjoyed the traditional hay-making process, but economic value is important. Hay farmers critical of management regime that they consider depresses hay yields.	Farmer considers access to the meadow a useful agricultural resource, but would consider other land as an alternative.	Hay farmer enjoyed the traditional hay-making process. Grazier focussed on utility of meadow as a grazing resource.	One farmer described such meadows as equivalent to a listed building and was happy to provide agricultural and non-agricultural goods. **Most farmers no longer interested in traditional hay making.**

Issue	North Meadow	Brook Meadow	Long Mead	Other case studies*
Barriers to farmers' agency in meadow management	Manuring, rolling and harrowing considered by farmers as traditional practices, but are restricted by management agreements and such activities were not seen to take place. Grazing curtailed by animal health regulations (Bovine Tuberculosis testing requirements). Farmers expressed desire to cut hay earlier. Late hay cut seen to reduce hay quality and time available to undertake hay cut.	Manuring, rolling and harrowing not seen to take place. Meadow farmers wish to cut meadows earlier but land-owner wished to maintain restrictions on cut start date. Grazing curtailed by animal health regulations (Bovine Tuberculosis testing requirements).	Manuring, rolling and harrowing not seen to take place. Hay cut start date restricted by agri-environment agreement, reduces window of opportunity to cut hay at busy time of year making hay cut difficult to achieve.	Manuring, rolling and harrowing not seen to take place at any site. Most farmers expressed a desire to cut hay earlier. Late hay cut perceived to reduce hay quality and reduces window of opportunity to cut hay at busy time of year making hay cut difficult to achieve. Traditional management has to fit in with other work. **Grazing not exercised one year as animal health regulations (Bovine Tuberculosis testing requirements) made inconvenient.**
Management delivery models and compensation schemes	Hay farmers bought license to cut hay (Model 1) Shift from sale of grazing license to paying grazier as a contractor (From Model 1 to Model 3)	Farmer (hay and grazing) buys license but in some years can be peppercorn rent of £1. Trust considering sharing agri-environment scheme payments with the farmer to enhance incentivisation. (Model 1, sometimes Model 2, with possible future shift to Model 3).	Hay farmer has bought license in past but in some years has not been required to pay. Grazier does not pay for access to grazing as a resource. (Hay farmer: Model 1, sometimes Model 2). (Grazier: Model 2).	One small-scale farmer noted he paid nothing for the use of most of the land he farmed that was owned by others. Most farmers do not receive any of the agri-environment scheme payments received by the landowner. Some conservation agencies are bringing aspects of meadow management in-house.

Issue	North Meadow	Brook Meadow	Long Mead	Other case studies*
Marginal economics and the impact of disputes over meadow value and management	Hay farmers critical of yields on meadow and of restrictions on manuring, rolling, harrowing and hay cut date restrictions. Tendency towards minimal management regime (restricting management interventions to the minimum) may be in part motivated by limited financial returns. Grazier satisfied with arrangement for grazing.	Farmer finds the small size of the meadow inconvenient to manage. Even having bought a license, sometimes not worth while undertaking the management. Would consider using other land instead. Not possible to dictate most management conditions to farmers as management has to be convenient for them.	Socio-economics of meadow management considered the most significant threat to survival of management regime.	Some farmers consider meadow land to be too marginal to be worth improving (agriculturally). One farmer notes that his meadow is 'a real treat' as a conservation space but 'totally useless' as agricultural land. Some farmers' enjoyment of meadow-making relies on not being economically dependent on meadow income. Farmers enjoy meadow making but rely on subsidies or would need to focus more on income generation. Would not want to make a loss. **Farmers are no longer interested in (traditional) hay-making. Economics of hay-making change every year and in some years unable to sell crop. Need to foster long-term relationships to reduce precariousness of situation.**

* Data in bold here relates to one of the three main cases studies named in the table, but has been moved to this column in order to anonymise the data.

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