Department for Environment Food & Rural Affairs

The enablers and barriers to the delivery of natural flood management projects

Appendix A: Literature Review

April 2020

Llywodraeth Cymru
Welsh Government

Cyfoeth Naturiol Cymru
Natural Resources Wales

Environment Agency

Joint Flood and Coastal Erosion Risk Management Research and Development Programme

Funded by the joint Flood and Coastal Erosion Risk Management Research and Development Programme (FCERM R&D). The joint FCERM R&D programme comprises Defra, Environment Agency, Natural Resources Wales and Welsh Government. The programme conducts, manages and promotes flood and coastal erosion risk management research and development.

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Introduction

Milestones including the publication of the Working with Natural Processes (WwNP) Evidence Base by the Environment Agency (EA) (Environment Agency, 2017) and the incorporation of Natural Flood Management (NFM) into large, catchment-scale flood alleviation schemes (FAS), such as that in Leeds, demonstrates how NFM is increasingly accepted as a legitimate form of Flood and Coastal Erosion Risk Management (FCERM). The science and practice behind NFM are still evolving, and although there are many examples of successful NFM projects to date, it is not yet routinely adopted with confidence and with ease within the catchment flood risk management process. The implementation of NFM schemes, from inception through to design, installation, monitoring and maintenance, is complex on account of the many broad ranging issues that are encountered. The NFM literature (academic and practice-based) is increasingly looking beyond the technical aspects of NFM (e.g. hydraulics and modelling) and is beginning to address the wider enablers and barriers of NFM schemes, including organisational and funding factors.

NFM schemes have been delivered in numbers in recent years, however it is recognised that this is only a small fraction of the potential deployment. As such it is necessary to explore the complexity and levels of uncertainty surrounding this 'new' approach compared to that of more mature deployment of hard, engineered flood defence schemes. At present, the majority of the literature that explicitly address barriers to NFM schemes has been based in Scotland and there is little that considers barriers and enablers in an English or Welsh context. Overall, there is a broad evidence gap relating to NFM with limited research and literature addressing the wider demands and governance of implementing NFM schemes, beyond technical elements.

This research project seeks to answer the following research questions:

1. Who are the main **stakeholders** delivering NFM projects and what is their **engagement** in the projects?
2. What social, regulatory and/or institutional **barriers** are experienced in the delivery of NFM projects?
3. What social, regulatory and/or institutional **enablers** are experienced in the delivery of NFM projects?
4. What are the main enablers and barriers associated with different **funding mechanisms** used to deliver NFM projects?

This literature review will help to begin the process of answering these questions and identify any emerging evidence gaps. The findings of this report will help to shape the next stage of the research project (interviewing and farmers focus groups) by:

- Identifying key stakeholders to be interviewed;
- Informing the interview question guide (combined with our own practical experience of delivering NFM schemes).

This report is also accompanied by a detailed spreadsheet which was used to carry out an initial high-level review of literature and highlights the key findings of each publication or article. Also included in this report is a short summary of the key learning points from the 'JBA Knowledge Exchange Event' which took place in December 2018. This event was organised a year on from the release of the new national WwNP Evidence Base (Environment Agency, 2017) to share recent experiences of NFM (see below).

Methodology

Articles and publications have been identified by searching for key terms including 'natural flood management' and 'working with natural processes'. We have included peer-reviewed academic articles, practical guidance documents and outputs from case studies across the UK. Following an initial review of the key findings from each article or publication, six broad categories have been identified, within which there are both enablers and barriers. This first review also highlighted some areas that could be explored through further analysis, particularly the role of farmers and landowners who are relied upon for their land and cooperation in the vast majority of schemes. Owing to this, more detail on the opinions and experiences of the farming community were researched by reviewing farming publications and forums such as 'Farmers Weekly' and the 'Farmers Guardian'.

Overall, the review has revealed a lack of literature which explicitly relates to or explores enablers of NFM schemes. Instead, much of what we have found is focused around the barriers with occasional reference to potential solutions to overcome them. As a result, some of the enablers that are identified below have been inferred from the literature, drawing on our own professional knowledge and experiences of NFM, for example, when communities have successfully engaged with an NFM scheme. Similarly, parallels have been drawn between the barriers and enablers of wider, more traditional FRM methods as this literature is more widely available, therefore we have investigated how this might apply to NFM.

For the purpose of this study, we have defined enablers and barriers as the following (adapted from Feliciano et al., 2014):

- **Barriers**: Circumstances or obstacles that prevent communication or progress
- **Enablers**: Circumstances that cause particular outcome to happen or develop

This report is structured to follow the six broad categories that were initially identified through a high-level review of available literature:

1. Land use and land management;
2. Local communities;
3. Partnership working;
4. Funding;
5. Policy;
6. Evidence and best practice.

Land use and land management

Barriers

The implementation of NFM schemes are often heavily reliant upon the goodwill and buy-in of landowners and farmers who own and manage potentially valuable areas of land within a catchment (Howgate and Kenyon, 2009a; Holstead *et al*., 2014). As such, land management can often be seen as a barrier as a result of uncooperative or reluctant landowners or farmers.

Often landowners and farmers are crucial stakeholders who will only consider NFM if it fits within their current business strategy and if the scheme is financially viable to them (McLean *et al*., 2015). Farmers may have concerns regarding the potential commercial impacts of an NFM scheme and the possibility of losing control over future land use (Spray *et al*., 2015). The process of engaging farmers is complicated by the lack of clarity regarding responsibility for the long-term management and maintenance of NFM structures once they have been implemented, alongside any associated costs (Environment Agency, 2018a). A survey of stakeholders involved in schemes funded by Defra's £15m funding for NFM highlighted this problem, as well as concerns over liability if NFM features fail or exacerbate flood risk (Environment Agency, 2018b).

In 2014, Holstead *et al*. conducted a study which focussed on the barriers to NFM from the farmers' perspective. Whilst the study was based in Scotland and therefore the geographical context of the results should be appreciated, there are several key learning points that can be taken from this study when seeking to implement an NFM scheme elsewhere that will require the buy-in of farmers. Figure 1 summarises the criteria that is known to affect NFM implementation at the farm level.

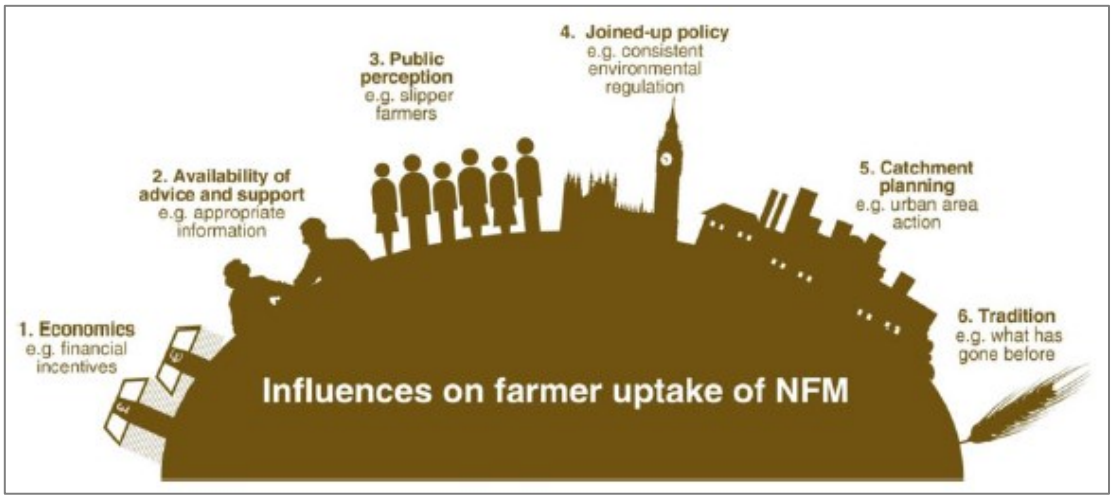

Figure 1. Influences on farmer uptake of NFM (Holstead *et al.*, 2014)

Enablers

This review revealed a lack of documented enablers regarding land use and land management. However, Holstead *et al*. (2016) does suggest that incentives are required for successful land management change.

Despite there being a lack of 'enablers', examples of practical guidance documents and tools that have been produced to support land use and land management activities which encourage NFM. For example, a practical guide for farmers was published by the Yorkshire Dales National Park Authority (YDNPA) at the request of the farmers and land managers (Yorkshire Dales National Park Authority *et al*., 2017). The value of best practice guidance documents, tools and evidence are discussed further on page 15.

Local communities

Enablers

If organised and executed appropriately and effectively, community participation and contribution to NFM schemes can add significant value. Geaves and Penning-Rowsell (2015) state that a collaborative relationship between the public and local authorities is more likely to be successful than a contractual relationship that has arisen from obligation. A study by Howgate and Kenyon (2009b) looks at community cooperation and provides an insight into participatory approaches to NFM with the results placing a heavy emphasis on the use of local organisations and local means of communication and engagement. The study emphasises the necessity of

voluntary cooperation from local communities, particularly landowners, to make a success of NFM schemes, and the lack of action that has taken place from governing organisations to inform “interested and affected parties of the shift in policy towards NFM” (2009b, p.331).

An example of successful collaboration and partnerships between ‘flood experts’ (such as academics, consultants, non-governmental organisations (NGOs) and government authorities) is the Pickering NFM scheme in North Yorkshire. With the help of Oxford University who facilitated a social-learning process, local residents were given the opportunity to learn how to understand and interpret catchment flood plans, which resulted in the formation of the Ryedale Flood Research Group (RFRG). The group published a report entitled ‘Making Space for People in Flood Risk Management’ (RFRG, 2008) and then went on to contribute to the design and build of the flood risk scheme in their community, which drew heavily on the premise of NFM. This project took place prior to the Defra multi-objective Flood Management Demonstration Project. However, thanks to the empowerment of the local community through the preceding collaboration and social learning process, the residents were in a unique position to engage with the organisations managing the NFM scheme, owing to their improved understanding of flooding and the institutions involved. The scheme has been deemed as successful after evidence showed that the NFM measures, combined with the large engineered flood storage area, helped to reduce the flood peak by 15 to 20% during the Boxing Day storm in 2015 (Haggett, 2017).

Similarly, the NFM scheme above the town of Haltwhistle (Northumberland) used citizen science as a means of engaging the local residents who were trained by Newcastle University to monitor the performance of individual features using various low-cost techniques (Starkey and Parkin, 2015; Starkey *et al*., 2017). Starkey *et al*. (2016) demonstrated that citizen science proved to be a useful engagement and involvement tool which encouraged the downstream community to connect with the upper catchment and communicate with landowners involved. Citizen science also helped to bridge the gap between the public and professional stakeholders.

Likewise, a study of participatory catchment organisations in the Scottish-English borders from Cook *et al*. (2013) highlights the importance of participation that is built on trust and the value it brings throughout a project, including the ability to overcome challenges and solve problems more easily. Furthermore, high levels of trust in a partnership may enable greater buy-in from local stakeholders, for example, wider uptake of land use changes or acceptance of new ideas and methods (Rouillard *et al*., 2014; Buchecker *et al*., 2016).

Research completed by Broomby (2017) also highlights the importance of project champions within an NFM scheme. Gattiker and Carter (2010) highlight the value of project champions in gaining intra-organisation buy-in during environmental projects, stating, “when key stakeholders commit to a project, they are more likely to strive to overcome barriers to make that project succeed” (2010, p.78). Broomby (2017)

found that a number of schemes were partially driven by an individual who championed the scheme and what it sought to achieve. Many, if not all of the champions were local to the scheme, again highlighting the value local communities can bring to a project, which in the case of a project champion included helping overcome barriers, gaining buy-in from other local residents and organisations, and striving to keep the project on track once in progress. Broomby (2017) concludes that whilst it is difficult to prove, it is possible that some schemes would not have been as successful without these key project participants.

It is important to note that stakeholders should to be involved throughout the whole NFM project process to allow everyone to share their local knowledge and ensure the project is accepted by everyone (Starkey *et al*., 2017; Creed *et al*., 2018), particularly at the inception stage (Esteves and Thomas, 2014).

Barriers

Residents and local community groups such as Flood Action Groups (FAGs) are often heavily involved in NFM projects, whether through stakeholder engagement or on an informal basis due to a vested interest in the outcomes of a flood scheme. Some local residents can initially pose barriers to NFM schemes on account of their scepticism of NFM as a means of protecting their community from flooding, and many often prefer more traditional and engineered flood defences, such as dredging and 'hard' flood walls (Broomby, 2017). This was the case in the Pickering scheme, whereby there was split in opinion within the local community regarding FRM options. Whilst this initial reluctance is often resolved, it takes time and resources to bring local communities into agreement which can delay a project. Whilst the involvement and participation of local communities in the NFM scheme itself is not crucial to success, as mentioned previously, having the buy-in from as many local residents and stakeholders as possible will support a project throughout its lifecycle, aiding problem solving, and in best case scenarios, broaden the benefits which a scheme delivers.

Stakeholders' capacity including the time they have free to give up, their financial situation, and their interest in the scheme may also influence levels of participation (Thaler and Levin-Keitel, 2016).

Partnership working

It is generally accepted that NFM and catchment management schemes necessitate a partnership approach (SEPA, 2015) due to the requirement to work cooperatively across whole river catchments and stretches of coast, and the need for different skills and experiences (Waylen *et al*., 2017a). Working across such large areas requires "balancing and bargaining between a wider range of land uses and spatial

demands", requiring the consideration and incorporation of the "needs and priorities of more stakeholders, economic sectors and more policy fields in the planning process" (Challies *et al*., 2016, p.278). Partnerships should generally be seen as a facilitator of an NFM scheme due to the increased range of skills and cooperation. However, the complexities of partnership working, including the coordination of multiple organisations, stakeholder liaison and other governance issues, can also act as barriers to the implementation of NFM schemes.

There is limited literature that addresses the specific barriers and enablers related to NFM partnerships. Instead, publications, such as the SEPA NFM Handbook (SEPA, 2015), provide guidance on how to improve partnership working. The wider, academic literature has focused largely on the technical evidence and performance of specific NFM measures and does not touch on the associated logistics and governance that are required to implement a scheme. For this reason, in this theme we have not separated the findings into barriers and enablers and have instead provided a discussion of different factors that impact the success of NFM partnerships.

A study of a selection of the 65 WwNP Evidence Base case studies by Broomby (2017) drew on the concept of proximity in FCERM (Thaler *et al*., 2016), which is argued as being instrumental in determining the success of FCERM partnerships. Proximity is defined by Torre and Rallet (2005) as "not only […] being near him/her, but also […] having a strong complicity within a person who is geographically distant, whether that person belongs to the same circle of friends, family, or even to the same network". Thaler deconstructs this concept, expanding it into six different types. Table 1 sets out how these different types apply in the context of FCERM. Broomby (2017) suggests that proximity is further applicable in the specific context of NFM, highlighting where different types have either hindered or enabled a successful partnership between different organisations or local communities (Table 2).

Table 1. Proximity in FCERM (Thaler et al. 2016 cited in Broomby, 2017)

Proximity	Definition	Concept of proximity in FCERM
Physical	Physical differences in terms of geographical units (km)	Fundamentally influences frequency and attendance of informal face-to-face meetings and ability to monitor efficient use of resources. Incurs transactions costs (transport).
Spatial	Political boundaries between different actors and stakeholders, e.g. jurisdictional boundaries (local authorities)	Local boundaries for spatial and land use management and regional boundaries for FCERM policy.
Institutional	Regulative, normative and cognitive aspects, such as the rules and procedures that govern individual behaviour, structure social interactions and support the decision-making process	Formal and informal rules can influence behaviour, e.g. traditions, juridical decision and administration practices, all of which can significantly impact a partnership.
Social	Social relationship between different members, e.g. interpersonal linkages such as friendship and trust	Strongly refers to aspect of trust, which is a key factor in the inter-local co-operation process.
Technological	Shared understanding of technological experiences, knowledge and expertise	Adoptions of new technologies are strongly linked to willingness of public administrations and stakeholders to implement and use new technologies.
Relational	Aspects of similarities between the different stakeholders, e.g. common communication, understanding and language	Key aspect of inter-local cooperation concept is the personal relationship between different members.

Table 2. Proximity in NFM adapted from (Broomby, 2017)

Proximity	Increased proximity	Decreased proximity
Physical	**Use of local offices** – local communities are able to more regularly engage with those managing the scheme (facilitates social proximity)	
Spatial	**Defra Family** – fewer political boundaries Existing relationships/partnerships – familiar working environment	**Upstream/downstream conflicts** – local authority boundaries prevent wider collaboration
Institutional	**Defra Family** – similar rules and procedures	**Lack of governance structure –** lack of understanding regarding roles, responsibilities and the primary aims of the schemes (multiple benefits conflict)
Social	**Defra Family** – familiar with one another, previous working experience **Existing relationships/partnerships** – high levels of trust built over a longer period	
Technological	**Social learning** – sharing of knowledge and upskilling of participants to increase understanding of NFM and beyond.	**Knowledge level mismatch** – impacts the extent to which a partner organisations or community was a barrier or a driver **Evidence gap** – causes difficult in persuading organisations and funding streams to support and engage in NFM
Relational	**Defra Family** – common goal Collaboration between organisations that share similar goals and objectives	**Upstream/downstream conflicts** – different priorities/aims/visions, e.g. wishes of farming communities upstream vs those of flooded communities downstream **Inter-organisational mismatch** – conflicting priorities between partner organisations, particularly complicated by multiple benefits of NFM **Intra-organisational mismatch** – conflict between departments within organisations; national vs local differences

Funding

Barriers

The introduction of Defra's partnership funding approach allows Lead Local Flood Authorities (LLFAs) to raise contributions (financial and in-kind) from local organisations and partners, which in some cases is essential to more local projects being able to proceed (Halcrow Group Ltd and CIRIA, 2012).The 'Partnership Funding Calculator', however, poses issues for NFM schemes on account of the requirement to state the number of properties that will be protected as a result. For a large number of projects, this is not always possible either because modelling has not been completed or modelling results cannot assuredly confirm if or how many properties will be protected as a result of NFM. Wider environmental benefits from NFM schemes can help to back the case for a scheme, however protecting homes and businesses takes precedence (Environment Agency, 2018a). It would therefore be reasonable to assume that funding sources and the processes by which to secure them could be viewed as a barrier to NFM schemes.

A further barrier regarding funding stems from the lack of guidance on an appropriate, standardised compensation schemes to compensate landowners who might be changing the use of their land for NFM (Holstead *et al*., 2014; Collentine and Futter, 2018).

Enablers

Funding streams such as the partnership funding calculator (outcome measure 4) do consider some wider environmental benefits as a criterion to secure financial contributions for an NFM scheme. Increasingly, natural capital assessments are seen as a means of identifying and demonstrating wider environmental and social benefits (Chorlton, 2018) and therefore further facilitating the ability to secure funding (Nicholson *et al*., 2012).

Despite the apparent lack of guidance on an appropriate compensation scheme, financial incentives, either as annual payments or full cost grants, are likely to be the preferred way to encourage landowners to agree to a change in land use (Spray *et al*., 2015). Wheeler *et al.* (2016) recommend that it would be appropriate to set up a fund to specifically reward land managers and provide the necessary financial incentive to encourage them to get involved with NFM schemes as a part of wider environmental stewardship. Wheeler *et al*. (2016) also recommend that it may be appropriate to set up a fund to specifically reward land managers and provide the necessary financial incentive to encourage involvement in the wider environmental stewardship (Wheeler *et al*., 2016).

One particular facilitator with regards to funding is the Countryside Stewardship Facilitation Fund, which provides funding to local communities and organisations on the understanding that they are bringing together different stakeholders to improve the local

environment (Natural England, 2017). Whilst this funding source can support a variety of environmental schemes, a project was specifically set up to help communities in Northern England tackle flood risk issues after the record-breaking 2015/16 storms, and has provided funding to 12 successful groups to implement NFM techniques (McDonald, 2017).

Some communities and FAGs are also sourcing their own funding from smaller and independent initiatives (e.g. those which have environmental and community engagement related goals), which in turn can be applied or used to facilitate NFM schemes, often with the help of, and guidance from, the National Flood Forum (National Flood Forum, 2018).

Policy and regulation

Barriers

Regulation can cause barriers to NFM as it can discourage the use of NFM features, through favouring more traditional flood management measures (Huq and Stubbings, 2015). Whilst some of the key pieces of UK flood risk management policy and catchment flood management plans acknowledge both NFM and working with natural processes (Wentworth, 2011), there is still a lack of specific policy on NFM. This absence, combined with a general scepticism towards statutory bodies (Myatt *et al*., 2003a; Myatt *et al*., 2003b), makes it less likely that NFM will be included in flood management from a regulatory side, and people are more likely to have a negative outlook if their opinion towards statutory bodies is negative.

A further element of regulation that causes a barrier for NFM is site designations, permits and licencing. It has been identified that it can be difficult to implement schemes in a designated area (e.g. Site of Special Scientific Interest (SSSI's)) due to the assessments required to understand the impact on these, and the fees and lengthy processes associated with permits (Environment Agency, 2018a).

It is also possible that health and safety legislation can act as a barrier to NFM schemes being implemented (Harrison, 2017). A review by Harrison (2017) suggests that where schemes have many distributed small NFM features, there is a risk it can become complex to demonstrate and implement proportionate health and safety requirements. Harrison recommends increased guidance on health and safety legislation for NFM schemes as a result.

Enablers

Recently many environmental policies and legislations have included NFM for the first time. For example, the most recent National Planning Policy Framework (NPPF) sets out a

“requirement to consider using NFM techniques” (Ministry of Housing, Communities and Local Government and Ministry of Justice, 2018). Similarly, Government’s 25 Year Environment Plan, released in early 2018, makes reference to “greater use of natural flood management solutions” in reducing the risk of flooding and coastal erosion. The plan also enables many other components that can contribute to the success of NFM including community engagement and wider environmental benefits (H.M. Government, 2018). Furthermore, the Flood and Water Management Act (2010) lists “maintaining or restoring natural processes” as a method to manage flood risk and in Scotland SEPA is required to identify the most sustainable actions, such as NFM, under the Flood Risk Management (Scotland) Act 2009 (SEPA, 2015).

The availability of evidence and best practice guidance

Barriers

There is limited evidence associated with NFM such as what features will look like, how they will work and their effectiveness, particularly at a catchment scale (McIntyre *et al*., 2012; Starkey *et al.,* 2016; Waylen *et al*., 2017b). This generates a barrier to implementing NFM as often farmers and landowners prefer reliable and convincing evidence to demonstrate that their change in land use and contributions to an NFM scheme will be effective before they participate *(Spray et al*., 2015). There are also problems with discrepancies between expectation and reality of flood risk management which can subsequently cause conflict and distrust between stakeholders (Tseng and Penning-Rowsell, 2012).

When delivering an NFM project, providing unreliable evidence has been identified as a barrier (Harrison, 2017), which links back to the issue of using this evidence for funding (number of homes protected) and developing a strong business case for NFM schemes (Environment Agency, 2018a).

Enablers

There is growing evidence which demonstrates that NFM is a viable form of FRM (amongst other benefits), in particular how different types of features perform at a reach scale (Nicholson *et al*., 2012; Environment Agency, 2018c). Simple techniques that produce meaningful and visual evidence for all stakeholders, such as time-lapse cameras and photographs, can also help to increase the accessibility of monitoring and modelling outputs. This further enables and encourages public engagement and involvement (Kenyon, 2007; Howgate and Kenyon, 2009b; Starkey *et al*., 2016).

There is an increasing number of NFM resources, guidance documents and tools available which disseminate and encourage the use of best practice right across the NFM project lifecycle. Whilst these are not directly referred to as enablers in their own right, it can be assumed that the content helps to enable the implementation and delivery of NFM schemes. The list below provides some examples of such resources which have been published at a national or regional level:

- WwNP Evidence Base (Environment Agency, 2017);
- SEPA Natural Flood management Handbook (SEPA, 2015);
- Natural Flood Management Toolbox (CBEC and Environment Agency, 2017);
- Natural Flood Management Measures - a practical guide for farmers (Yorkshire Dales National Park Authority *et al*., 2017);
- How to model and map catchment processes when flood risk management planning (Hankin *et al*., 2016).

Additional research – Farmers

A comprehensive review of farming publications, in particular Farmers Weekly and the Farmers Guardian, has been undertaken to identify the sentiment towards NFM in the farming community. The articles included a mixture of opinion and news pieces relating to NFM in practice and further developments in the availability of funding. It was found that the articles fell into four broad categories: positive, negative, informative, cautious/sceptical, with some falling into multiple categories. 138 articles were reviewed in total, with publication dates ranging from 2009 to 2018.

Many articles appeared to serve as a means of highlighting developments in NFM including funding and scientific evidence, without asserting any positive or negative bias on the news. For example, announcing the availability of funding streams for farmers for woodland planting schemes. There are also a number of articles which focus on the findings of new studies, quoting scientists, consultants and government agencies. Here, despite many of the quotes being positive from those who are behind the research, we have counted this as being 'informative' in a neutral sense as there is no comment from anyone representing the farming community, such as the Country Land and Business Association (CLA) or the National Farmers Union (NFU). Where such organisations or individual farmers have commented on the findings in a positive or negative light, we have categorised them accordingly. A separate spreadsheet of the key findings and categorisation of the articles is available to view alongside this document.

The high-level findings from the review of farming media are:

- Where NFM is portrayed as 'rewilding' (removal of land from agricultural production and management leading to its natural reversion to an unmanaged state), there is more likely to be negative sentiment. This is on account of the sentiments of

farmers towards the implications and demands of other aspects of rewilding including the release of beavers and major changes in land use.
- Out of the 17 articles that showed a negative attitude towards NFM, 8 related to the release or introduction of beavers (apparent buzzword) into the rural landscape.
- There are many articles that highlight opinions towards environmental stewardship schemes, and often relate to, for example, soil management and water quality. Whilst many of the techniques used in such schemes are known to be beneficial to flood risk management and are often adopted as NFM measures, there was generally no reference to any flood risk benefits. The latter appears to be a general theme whereby environmental stewardship schemes for specific areas are considered in isolation to other multiple benefits.
- Until 2015 there was a greater number of 'pro-dredging' articles, the majority of which were focused on the Somerset Levels, which suffered severe flooding in 2013/14. Since 2015, there have been no overtly 'pro-dredging' articles.

It is also acknowledged that the wider media can play a significant role in shaping positive and negative perceptions of NFM. This is a cross-cutting issue across the six themes and will be explored in the next phase of this study when interviewing stakeholders.

Next steps

Looking ahead to the next stages of this project, this literature review will shape the question guide for the interview process and farmer focus groups to find out more about enablers and barriers from practical experience, following the six overarching themes. As a result of this literature review and drawing upon our own experience of developing, implementing and delivering NFM schemes, it is recommended that the following key points are explored further:

- Target stakeholders who are less readily involved in catchment or flood risk management schemes, alongside less established organisations – exploring their awareness and asking what do they know about NFM;
- Exploration of whether different stakeholders or organisations have the capacity, skills and resources required to successfully implement an NFM scheme (e.g. secure funding, work with partners, engage with communities and convince land owners to be involve);
- Exploring the concept of an 'NFM toolbox' to find out whether stakeholders have the tools that they need to complete NFM projects successfully. Do they currently use specific resources to guide and support their NFM projects?
- Exploration of what encourages stakeholders to get involved and what were the incentives (land use / management change);
- Explore administrative burdens and legislative 'red tape';
- Investigate further the role of the media in shaping perceptions of people (particularly local communities) involved in or engaged with the scheme;

- Explore stakeholders and project targeting of funding and whether funding is believed to be an issue;
- Establish current practice on the evidence necessary, captured, and reported during the NFM planning process;
- Research the use of any other supportive tools (e.g. natural capital) to help justify NFM schemes.

Due to the lack of clear 'enablers' documented in the literature, it is also recommended that NFM stakeholders are questioned about best practice when schemes have been successful, particularly if they were/are the landowners or farmers involved.

Conclusions

This review of the NFM literature has identified six key themes under which there are a several barriers, as well as a growing number of enablers, associated with the implementation of NFM schemes on the ground. The continued and growing interest in NFM as a legitimate form of FCERM means it is important to fully understand how issues such as funding, regulation, and the interests of different stakeholders, act as a potential barrier to expanding the use of NFM further, and how these factors might be changed or already be a facilitator to increasing the uptake of these more natural features.

Some of the key issues identified through this review include the conflicting interests of different stakeholders, the lack of guidance on maintenance and liability of the features, the difficulties in obtaining funding, and the limited regulation in place to encourage the use of NFM.

Alongside the barriers, it has been identified that building a good relationship between community stakeholders and organisations, enabling different groups of stakeholders to get involved early in a project, and schemes such as the governments facilitation fund, can all act as ways to enable the uptake of NFM.

It is evident from this literature review that the occurrence of disrupting flood events in catchments appears to initiate action both on the ground in the implementation of NFM schemes (in particular, driven by local communities and flood actions groups), as well as the publication of guidance, evidence and other tools. The frequency and severity of flood events could therefore be considered to have significant influence over the enablers within the six themes that have been identified within this report.

References

Broomby, J. 2017. *Partnerships in Working with Natural Processes schemes in the UK: Identifying factors that impact & shape success* [Online]. Saltaire: JBA Trust. [Accessed 13 December 2018]. Available from: https://www.jbatrust.org/wp-content/uploads/2017/12/JBA-Trust-WWNP-Partnerships-Research-Project-JBroomby-concise.pdf.

Buchecker, M., Ogasa, D.M. and Maidl, E. 2016. How well do the wider public accept integrated flood risk management? An empirical study in two Swiss Alpine valleys. *Environmental Science & Policy*. **55**, pp.309–317.

CBEC and Environment Agency 2017. *Natural Flood Management Toolbox: Guidance for working with natural processes in flood management schemes.* [Online]. Available from: https://catchmentbasedapproach.org/wp-content/uploads/2018/08/EA-NFM-Toolbox-Final-Draft.compressed.pdf.

Challies, E., Newig, J., Thaler, T., Kochskämper, E. and Levin-Keitel, M. 2016. Participatory and collaborative governance for sustainable flood risk management: An emerging research agenda. *Environmental Science & Policy*. **55**, pp.275–280.

Chorlton, K. 2018. *Valuing natural capital: A study of natural capital tools and their application to natural flood management.*

Collentine, D. and Futter, M.N. 2018. Realising the potential of natural water retention measures in catchment flood management: trade-offs and matching interests: Realising the potential of natural water retention measures. *Journal of Flood Risk Management*. **11**(1), pp.76–84.

Creed, R., Baily, B., Potts, J., Bray, M. and Austin, R. 2018. Moving towards sustainable coasts: A critical evaluation of a stakeholder engagement group in successfully delivering the mechanism of adaptive management. *Marine Policy*. **90**, pp.184–193.

Environment Agency 2018a. *Barriers & solutions to mainstreaming Natural Flood Management within the Capital Programme*. Bristol: Environment Agency.

Environment Agency 2018b. *NFM programme's Interim Lessons Learnt Review*.

Environment Agency 2017. *Working with Natural Processes – Evidence Directory* [Online]. Bristol: Environment Agency. [Accessed 19 December 2018]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/681411/Working_with_natural_processes_evidence_directory.pdf.

Environment Agency 2018c. *Working with Natural Processes: Evidence Directory* [Online]. Bristol: Environment Agency. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/681411/Working_with_natural_processes_evidence_directory.pdf.

Esteves, L.S. and Thomas, K. 2014. Managed realignment in practice in the UK: results from two independent surveys. *Journal of Coastal Research*. **70**, pp.407–413.

Feliciano, D., Hunter, C., Slee, B. and Smith, P. 2014. Climate change mitigation options in the rural land use sector: Stakeholders' perspectives on barriers, enablers and the role of policy in North East Scotland. Environmental Science & Policy. 44, pp.26–38

Gattiker, T.F. and Carter, C.R. 2010. Understanding project champions' ability to gain intra-organizational commitment for environmental projects. *Journal of Operations Management*. **28**(1), pp.72–85.

Geaves, L.H. and Penning-Rowsell, E.C. 2015. 'Contractual' and 'cooperative' civic engagement: The emergence and roles of 'flood action groups' in England and Wales. *Ambio*. **44**(5), pp.440–451.

Haggett, D. 2017. Working with nature to reduce flood risk - Creating a better place. [Accessed 13 December 2018]. Available from: https://environmentagency.blog.gov.uk/2017/03/30/the-natural-flood-management-debate/.

Halcrow Group Ltd and CIRIA 2012. *Partnership funding and collaborative delivery of local flood risk management: a practical resources for LLFAs* [Online]. Defra. [Accessed 20 December 2018]. Available from: http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17085.

Hankin, B., Burgess-Gamble, L., Bentley, S. and Rose, S. 2016. *How to model and map catchment processes when flood risk management planning* [Online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/523456/How_to_model_and_map_catchment_processes_-_report.pdf.

Harrison, D. 2017. *The engineering challenges and opportunities of delivering Natural Flood Management*.

H.M. Government 2018. *A Green Future: Our 25 Year Plan to Improve the Environment*.

H.M. Government 2010. *The Flood and Water Management Act 2010* [Online]. Available from: https://www.legislation.gov.uk/ukpga/2010/29/contents.

Holstead, K., Colley, K. and Waylen, K. 2016. *Tackling the barriers to implementing natural flood management* [Online]. Scotland: James Hutton Institute. [Accessed 29 November 2018]. Available from: https://www.hutton.ac.uk/sites/default/files/files/22_03_29_NFM_workshop_report(1).pdf.

Holstead, K.L., Kenyon, W., Rouillard, J.J., Hopkins, J. and Galán-Díaz, C. 2014. Natural flood management from the farmer's perspective: criteria that affect uptake: Natural flood management from the farmer's perspective. *Journal of Flood Risk Management*. **10**(2), pp.205–218.

Howgate, O.R. and Kenyon, W. 2009a. Community cooperation with natural flood management: a case study in the Scottish Borders. *Area*. **41**(3), pp.329–340.

Howgate, O.R. and Kenyon, W. 2009b. Community cooperation with natural flood management: a case study in the Scottish Borders. *Area*. **41**(3), pp.329–340.

Huq, N. and Stubbings, A. 2015. How is the Role of Ecosystem Services Considered in Local Level Flood Management Policies: Case Study in Cumbria, England. *Journal of Environmental Assessment Policy and Management*. **17**(04), p.1550032.

Kenyon, W. 2007. Evaluating flood risk management options in Scotland: A participant-led multi-criteria approach. *Ecological Economics*. **64**(1), pp.70–81.

McDonald, B. 2017. *Facilitation funded groups: Case studies* [Online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/656911/csff-case-studies.pdf.

McIntyre, N., Ballard, C., Bulygina, N., Frogbrook, Z., Cluckie, I., Dangerfield, S., Ewen, J., Geris, J., Henshaw, A., Jackson, B., Marshall, M., Tim Pagella, Park, J.-S., Reynolds, B., O'Connell, E., O'Donnell, G., Sinclair, F., Solloway, I., Thorne, C. and Wheater, H. 2012. The potential for reducing flood risk through changes to rural land management: outcomes from the Flood Risk Management Research Consortium. Available from: https://abdn.pure.elsevier.com/en/publications/the-potential-for-reducing-flood-risk-through-changes-to-rural-la.

McLean, L., Beevers, L., Waylen, K., Wright, G. and Wilkinson, M. 2015. *Learning from community led flood risk management* [Online]. CREW. [Accessed 20 November 2018]. Available from: https://www.crew.ac.uk/sites/www.crew.ac.uk/files/sites/default/files/publication/CREW_COS_fullreport.pdf.

Ministry of Housing, Communities and Local Government and Ministry of Justice 2018. *National planning policy framework*.

Myatt, L.B., Scrimshaw, M.D. and Lester, J.N. 2003a. Public perceptions and attitudes towards a forthcoming managed realignment scheme: Freiston Shore, Lincolnshire, UK. *Ocean & Coastal Management*. **46**(6–7), pp.565–582.

Myatt, L.B., Scrimshaw, M.D. and Lester, J.N. 2003b. Public perceptions and attitudes towards an established managed realignment scheme: Orplands, Essex, UK. *Journal of Environmental Management*. **68**(2), pp.173–181.

National Flood Forum 2018. National Flood Forum. Available from: https://nationalfloodforum.org.uk/.

Natural England 2017. *Guide to Countryside Stewardship: Facilitation fund 2017* [Online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/641188/cs-guide-to-facilitation-fund.pdf.

Nicholson, A.R., Wilkinson, M.E., O'Donnell, G.M. and Quinn, P.F. 2012. Runoff attenuation features: a sustainable flood mitigation strategy in the Belford catchment, UK: Runoff attenuation features. *Area*. **44**(4), pp.463–469.

RFRG 2008. *MAKING SPACE FOR PEOPLE: INVOLVING LOCAL KNOWLEDGE IN FLOOD RISK RESEARCH AND MANAGEMENT IN RYEDALE, YORKSHIRE* [Online]. Pickering: Ryedale Flood Research Group. Available from: http://knowledge-controversies.ouce.ox.ac.uk/news/Making_Space_for_People.pdf.

Rouillard, J.J., Reeves, A.D., Heal, K.V. and Ball, T. 2014. The role of public participation in encouraging changes in rural land use to reduce flood risk. *Land Use Policy*. **38**, pp.637–645.

SEPA 2015. *Natural Flood Management Handbook* [Online]. Stirling: Scottish Environment Protection Agency. [Accessed 15 May 2017]. Available from: https://www.sepa.org.uk/media/163560/sepa-natural-flood-management-handbook1.pdf.

Spray, C.J., Arthur, S., Bergmann, A., Bell, J., Beevers, L. and Blanc, J. 2015. Land management for increased flood resilience. *CREW*. **CRW2012/6**.

Starkey, E., Barnes, M., Quinn, P. and Large, A. 2016. Insightful monitoring of natural flood risk management features using a low-cost and participatory approach. *Geophysical Research Abstracts*. **EGU2016-6497**, p.1.

Starkey, E. and Parkin, G. 2015. *A Review of Current Knowledge: Community Involvement in UK Catchment Management* [Online]. Marlow, Buckinghamshire: Foundation for Water Research. Available from: http://www.fwr.org/Catchment/frr0021.pdf.

Starkey, E., Parkin, G., Birkinshaw, S., Large, A., Quinn, P. and Gibson, C. 2017. Demonstrating the value of community-based ('citizen science') observations for catchment modelling and characterisation. *Journal of Hydrology*. **548**, pp.801–817.

Thaler, T. and Levin-Keitel, M. 2016. Multi-level stakeholder engagement in flood risk management—A question of roles and power: Lessons from England. *Environmental Science & Policy*. **55**, pp.292–301.

Thaler, T., Priest, S. and Fuchs, S. 2016. Evolving inter-regional co-operation in flood risk management: distances and types of partnership approaches in Austria. *Regional Environmental Change*. **16**(3), pp.841–853.

Torre, A. and Rallet, A. 2005. Proximity and Localization. *Regional Studies*. **39**(1), pp.47–59.

Tseng, C.-P. and Penning-Rowsell, E.C. 2012. Micro-political and related barriers to stakeholder engagement in flood risk management: Barriers to stakeholder engagement in flood risk management. *The Geographical Journal*. **178**(3), pp.253–269.

Waylen, K.A., Holstead, K.L., Colley, K. and Hopkins, J. 2017a. Challenges to enabling and implementing Natural Flood Management in Scotland. *Journal of Flood Risk Management*.

Waylen, K.A., Holstead, K.L., Colley, K. and Hopkins, J. 2017b. Challenges to enabling and implementing Natural Flood Management in Scotland: Challenges to enabling and implementing NFM. *Journal of Flood Risk Management*. **11**, pp.S1078–S1089.

Wentworth, J. 2011. *Natural Flood Management* [Online]. Available from: https://researchbriefings.parliament.uk/ResearchBriefing/Summary/POST-PN-396.

Wheeler, N., Francis, A. and George, A. 2016. *Smarter flood risk management in England: Investing in resilient catchments.* [Online]. London: Green Alliance. [Accessed 9 May 2017]. Available from: https://nls.ldls.org.uk/welcome.html?ark:/81055/vdc_100042616734.0x000001.

Yorkshire Dales National Park Authority, Yorkshire Dales Rivers Trust, North Yorkshire County Council, Environment Agency and Natural England n.d. *Natural Food Management Measures- a Practical guide for farmers* [Online]. Available from: http://www.yorkshiredales.org.uk/__data/assets/pdf_file/0003/1010991/11301_flood_management_guide_WEBx.pdf.

Appendix

JBA Knowledge Exchange Event

Some insights into barriers and enablers of NFM were captured during a knowledge exchange event held by JBA Consulting in December 2018. At this event a variety of organisations and people within the NFM community were in attendance to discuss progress a year on since the release of the Environment Agency's WwNP Evidence Base (Environment Agency, 2017). From this event, it was possible to get an appreciation of what stakeholders' thought were some of the key barriers and enablers based on their personal experiences to date.

One experience shared during a presentation highlighted how important it is for all stakeholders to work together to enable the implementation of NFM. However, there is a barrier to this as it can take a time to build strong relationships. An example was given here of the length of time required to gain the trust of the land owner and subsequently for them to assent to allow for the scheme to be implemented. It was also suggested that stakeholder engagement should begin at the onset of the project process when presenting an adequate business case.

Another barrier identified throughout the event was that both monitoring and modelling (both before and after implementation of NFM) are time consuming and potentially costly processes. However, monitoring and modelling can also be identified as a facilitator. Modelling of NFM in the early stages of a project has the potential to target suitable locations for interventions and help identify where multiple benefits can be gained from different combinations of features. However, in order to capture robust evidence, data from the field is required to quantify feature performance, but this is still limited to date.