



Factors that affect uptake of natural flood management features by farmers in Scotland: A review



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Executive Summary

Factors that affect uptake of natural flood management features by farmers in Scotland: A review

Kirsty Holstead, Wendy Kenyon and Josselin Rouillard

Background to research

A new sustainable approach to flood risk management which considers a range of actions to manage flood risk, and aims to utilise land management where appropriate has been brought to the forefront of policy making in Scotland through a policy chain including the EU Water Framework Directive 2000, the Water Environment and Water Services (Scotland) Act 2003, the EU Floods Directive 2007 and the Flood Risk Management (Scotland) Act 2009. This new approach manages risk in an integrated and holistic way, to proactively tackle the cause of flooding. Land use is central. Natural flood management (NFM) utilises land management measures to store water and attenuate flow in upland areas to reduce flood risk downstream. NFM measures typically include wetland and bog creation or restoration, improvement and maintenance of buffers strips, contour ploughing and afforestation, and the installation of leaky barriers in water courses. To date, uptake of NFM by farmers has been poor suggesting substantial barriers to implementation exist. This paper reviews recent research and the literature to examine those factors that are likely to influence farmers' decisions related to water management, and NFM in particular.

Objectives of research

To review recent research and the literature to determine those factors which are likely to influence farmers' implementation of natural flood management features on their land.

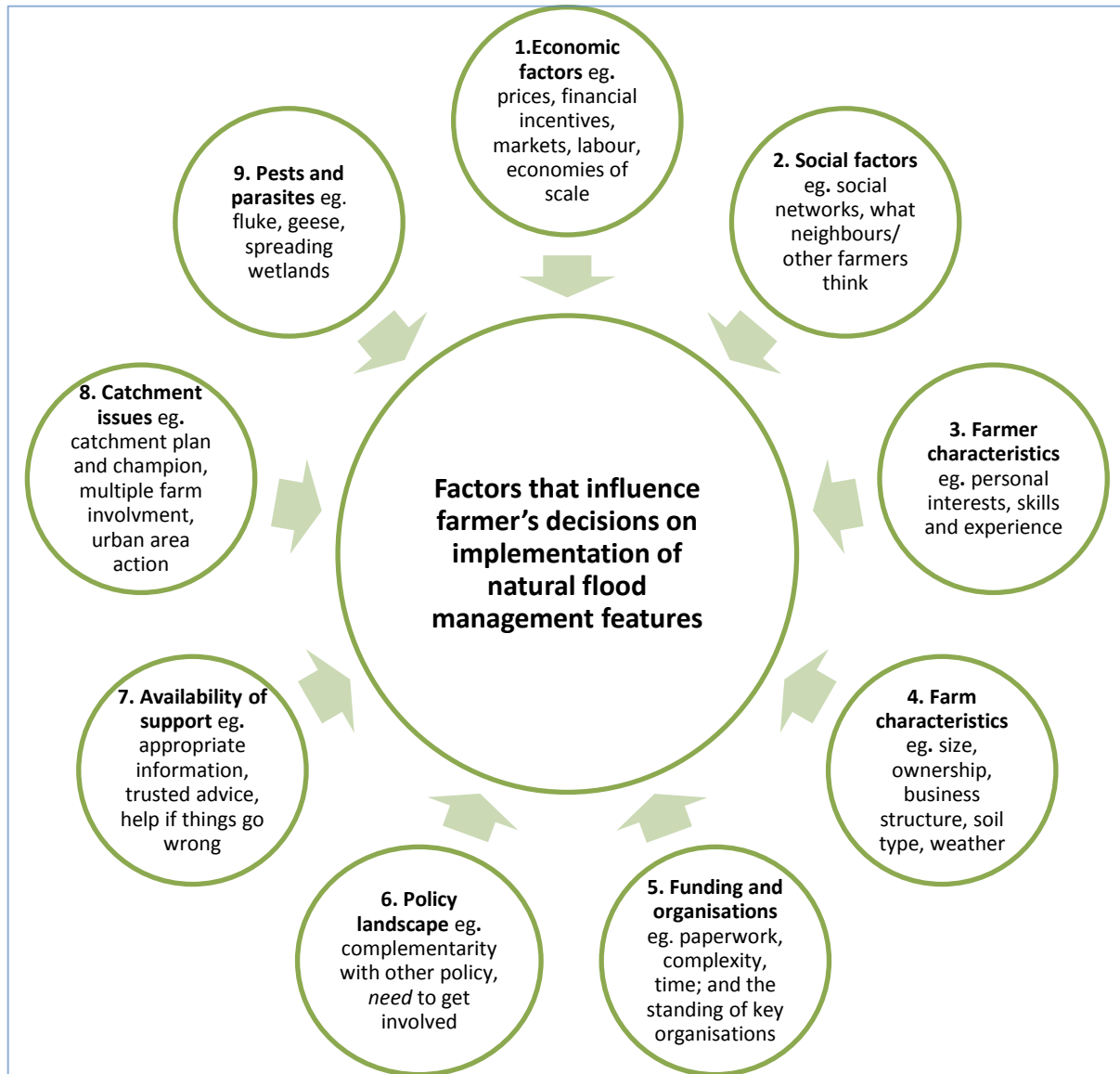
Key findings

A review of recent research and literature shows that nine factors are likely to be influential in farmers' view of natural flood management and whether they might consider implementing it on their land.

1. Economic factors eg. prices, financial incentives, markets, labour, economies of scale
2. Social factors eg. social networks, what neighbours/other farmers think
3. Farmer characteristics eg. personal interests, skills and experience
4. Farm characteristics eg. size, ownership, business structure, soil type, weather
5. Funding and organisations eg. paperwork, complexity, time; and the standing of key organisations
6. Policy landscape eg. complementarity with other policy, *need* to get involved
7. Availability of support eg. appropriate information, trusted advice, help if things go wrong
8. Catchment issues eg. catchment plan and champion, multiple farm involvement, urban area action
9. Pests and parasites eg. fluke, geese, spreading wetlands

These are summarised in Figure 1.

Figure 1: Factors that influence farmer's decisions on implementation of NFM features



Key words

Natural flood management, flood risk, farmers

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Figure 1 Factors that influence farmer’s decisions on implementation of NFM features

1. INTRODUCTION

A new sustainable approach to flood risk management has been brought to the forefront of policy making in Scotland through a policy chain including the EU Water Framework Directive 2000, the Water Environment and Water Services (Scotland) Act 2003, the EU Floods Directive 2007 and the Flood Risk Management (Scotland) Act 2009. This new approach manages risk in an integrated and holistic way, to proactively tackle the cause of flooding. Furthermore, it requires the consideration of a range of actions, structural (such as building floodwalls, natural flood management, clearance and repair works) and non-structural (such as flood warning, land use planning and raising public awareness). Central to considering structural actions is the role of land use. This approach often referred to as 'Natural flood management' (NFM) utilises land management measures to store water and attenuate flow in upland areas to reduce flood risk downstream. NFM measures typically include wetland and bog creation or restoration, improvement and maintenance of buffers strips, contour ploughing and afforestation, and the installation of leaky barriers in water courses. To date, uptake of NFM by farmers has been poor suggesting substantial barriers to implementation exist. This paper reviews recent research and the literature to examine those factors that are likely to influence farmers' decisions related to water management, and NFM in particular.

2. APPROACHES TO FARMER DECISION MAKING

Research on farmer decision making has evolved from initial models which assumed that farmers are solely profit maximisers (Willock et al 1999), to extensions which include environmental considerations within profit maximisation models (Morris 1995; Wilson 1997), and now to models that acknowledge that behaviour is also influenced by a diverse range of social factors such as family situation, farm type, farmers' goals and objectives and the policy landscape (Dwyer et al 2007; Burton 2004; Blackstock et al 2010).

Whilst it is important to acknowledge that farmers are first and foremost business men and women, consideration of additional influential factors allows a richer understanding of why farmers may or may not implement NFM.

There are a number of 'typologies' that try to explain and categorise factors that influence farmer behaviour in up-take of environmental initiatives (Shucksmith and Herrmann 2002; Slee et al 2003; Dwyer et al 2007). Drawing on these and the results of recent research in this area, particularly in Scotland we would argue that the factors that influence farmer uptake of NFM might be categorised as follows:

1. Economic factors such as prices, financial incentives, markets, labour, economies of scale;
2. Social factors such as social networks, what neighbours/other farmers think;
3. Farmer characteristics such as personal interests, skills and experience;
4. Farm characteristics such as size, ownership and business structure, soil type, weather, availability of unproductive ground;

5. Funding and organisations such as paperwork and complexity, time required; and the standing of key organisations
6. Policy landscape such as does the scheme complement or conflict with other policy requirements;
7. Availability of information about NFM including farm specific information and funding mechanisms.
8. Pests and parasites such as fluke, geese, spreading wetlands;
9. Catchment issues such as whether other farms are involved, whether urban areas are also taking responsibility for flooding, a catchment champion.

We examine these factors in more detail below.

3. ECONOMIC FACTORS

A significant body of literature exists which highlights financial incentives as a primary motivator behind farmer agri-environmental scheme engagement (Wilson 1997; Morris and Potter 1995; Burgess et al 2000). In the context of NFM, the perceived lack of financial incentives has been found to be a key barrier to NFM uptake (Rouillard, 2010; Rouillard et al, 2010; Werritty et al 2010; Holstead 2011). Studies have shown that farm viability is a primary concern for many farmers and that entry into flood management schemes is ultimately a business decision (Parrott and Burningham 2007; Holstead 2011, Waylen et al 2011). As one farmer stated “The fine line is that you have to remember that farmers are businessmen, our key concern is that our businesses are viable” (Holstead 2011 p.68).

A number of aspects relate to this key consideration of farm viability.

First, for many farmers current payments offered for installation of NFM features are not high enough to warrant consideration as they do not compete with alternative land uses such as food production. Compensation for NFM implementation is offered as part of the rural priority options of the Scottish Rural Development Programme (SRDP) through a subsidy for the ‘management of flood plains’ at £39/ha/annum for a period of 5 years. A further option to ‘create, restore and manage wetlands’ is also provided at a rate of £226.17/ha/annum for 5 years (RSPB, 2009). At the time of writing gross margins for average output of arable crops were as follows; spring barley £431/ha, winter oats £808/ha, spring oats £461/ha, spring oilseed rape £436/ha) (SAC, 2010/2011) showing that dynamic market prices can provide a higher profit margin than static NFM compensation structures offered through the SRDP. As Parrott et al (2009) note, the uptake of land management measures is often constrained because available financial incentives do not cover the loss of agricultural income.

Further financial losses are associated with NFM in Posthumus and Morris (2010) and Werritty et al (2010) who point out that the opportunity cost of NFM schemes fall on farmers, but the associated benefits such as reduced flood risk and increased biodiversity are accrued to society as a whole. The lack of financial provision for the income forgone (during and after periods of inundation), opportunity loss and fall in capital value of the land provided to be a substantial policy barrier to NFM in the Eddleston catchment (Werritty et al 2010). Rouillard (2010) notes

how farmers were also concerned by the impact of NFM agreements on their tenancy arrangements, in particular the degree to which payments covered rent costs (in addition to capital, maintenance and opportunity costs).

These issues were observed in two further Scottish case-studies (Rouillard, 2010; Rouillard et al, 2010); farmers would participate in an NFM agreement if payments represented an additional income and did not reduce opportunities for future business development. Nisbet and Thomas (2008) relay the value which farmers place on economic factors and the importance of suitable funding in flood management schemes when it is shown that a Forestry Commission's proposal to plant a 40ha floodplain woodland on the River Lave/Skell in North Yorkshire failed because land owners did not want to submit a grant application because "the lack of sufficient payments/incentives to compensate for the perceived reduction in capital value of the land and loss of agricultural income" meant that the project was discarded (p 7).

Second, implementation of NFM features may affect the economies of scale of the farm as a whole. In interviews with farmers Holstead (2011, p 69) found this to be important. One farmer stated "Economies of scale play a large part in the viability of a farm business [...] if you have less land, it will be more expensive to run and the rest will have to be run more intensively. It has to be economically sustainable to keep things in production".

4. SOCIAL FACTORS

Much of the literature notes that whilst economic considerations are important, other factors also influence farmers' uptake of environmental features such as NFM (Anosike & Coughenour, 1990; Turvey, 1991; Wise & Brannen, 1983). Blackstock et al (2010) and Dwyer et al (2007) suggest that a deep fabric of social influence governs the farmer decision making process; they are influenced by ideas and the practices common to their social environment. There are several components relevant here.

Tradition can be a key to farmer decision making (Abd-Ella et al 1981; Anosike and Coughenour 1990; Sontag and Bulboz 1985). Investigation suggests that when farmers are attached to the values of previous generations, their own way of doing things is an established, traditional method, possibly limiting potential for innovation such as NFM (Neumann et al 2007). In her interviews with farmers Holstead (2011) found that some farmers perceive NFM to contradict work previously done on the land by past generations, in particular referring to land drainage which has characterised postwar agricultural policy. As one farmers stated "My great grandfather was paid by the Duke of Gordon to cut the [...] burn straight through the farm and beyond [...] they would turn in their grave if they thought I was ignoring the work they did".

Burton (2004) argues that the symbolic meaning farmers attach to land management choices is an important aspect of decision making. He found that farmers judge other farmers and develop self-identity based on their farming abilities. Farmers judge each other through criteria that include the physical appearance of crop or livestock and the total yield per acre/hectare (or weight/quality per beast). For example, a "good farmer" should have fields which are consistent in colour, the crop should be a specific height and livestock should look 'healthy'. Other research

reference the importance of neat and ordered landscapes in the creation of farmer identity (Young et al 1995; Brush et al 2000). Untidy landscapes demonstrate to other farmers that the land owner is a poor land manager, whereas healthy and ordered fields represent a symbol of the farmers' knowledge and commitment to the land (Burton, 2004). Sutherland (2010) shows that this is reinforced by 'roadside farming' where farmers assess each other's crops whilst driving by and subsequently judge the quality of their husbandry skills. By contrast, in her online survey of Scottish farmers, Holstead (2011) did not find tidy landscapes to be important to farmers. Indeed no farmer stated that the specific positioning of NFM, away from the roadside, would encourage implementation of such features. Rouillard (2010) found that farmers preferred rivers with reinforced, stable river banks to more naturally eroding river corridors because rivers should look maintained and should look as they always had in the past.

5. FARMER CHARACTERISTICS

Dwyer et al (2007) found that farmer characteristics can influence whether a farmer is likely to be involved in water management schemes; age education and experience are all relevant. Rouillard (2010), Rouillard et al (2010) and Werritty et al (2010) show that personal attitudes to NFM can vary widely between farmers within one catchment. Some farmers value the contribution that NFM features can make to reduce runoff from hills and store water on floodplains, others may appreciate their amenity or biodiversity benefits. Many farmers were skeptical about the contribution that land management changes can make to alleviate flood risk, or were not interested in their associated benefits. Farmers tended to rely on personal experience and observations, and question the effectiveness and benefits of NFM features in the context of their catchment (Holstead, 2011). In her interviews with farmers, Holstead (2011) interviewed a "proud conservationist" who was more likely to be interested in NFM schemes and bear any direct and indirect costs associated with them.

6. FARM CHARACTERISTICS

In their typology of what influences farmers decision making Dwyer et al (2007) suggests that farm characteristics may be important. Holstead (2011) found that farmers were more open to natural flood management feature installation when they were placed on unproductive land or land which had less valuable alternative uses as this would contribute farm viability into the future. In her online survey, Holstead (2011) also found that farmers were more likely to be favorable towards NFM if valuable areas of their own farm were vulnerable to flooding.

Research conducted by Rouillard (2010) and Werritty et al (2010) revealed that issues of land ownership could influence uptake of NFM features. Under current legal arrangements, agreements might be necessary when changes on one property may affect the hydrology of a neighbouring property. Boundaries between farms may also have to be clarified. This can become contentious when boundaries traditionally lie along a river (e.g. who owns river banks). Previous studies have highlighted the difficulties in environmental goods and service provision without the co-ordination of land management activities (Ayer, 1997; Hodge and McNally, 2000; Lubell et al 2002). The Pontbren programme in mid Wales can be used as a case study which shows the possible importance of farmer cooperation in NFM installation. The Pontbren programme is

considered a successful example of NFM where farmers cooperated to reduce upland sheep stocking densities, increase plantations of shelterbelts, ponds and wetlands leading to a significant reduction in flood peaks (Richards, 2010).

Land ownership is a further potential threat to NFM installation. Tenured properties are less likely to participate in activities unless they are financially lucrative in the short term. Owners and large estates take a more long term view of activities on their land and are, as a consequence more likely to recognise the value to water management schemes such as NFM as part of a long term plan (Werritty et al 2010).

Rouillard (2010) found that farmers were more likely to agree to targeted changes on their farm by taking into account the productivity of land but also impacts on farm management and the development of new business opportunities. For example, tree planting on hill should not make livestock gathering more complex. Targeted riparian and tree planting could however benefit livestock shelter and shooting opportunities.

7. FUNDING AND ORGANISATIONS

Recent research has highlighted the significance of both features of NFM funding mechanisms and the role of other factors such as the farmer perception of funding/organising bodies in determining NFM implementation at the farm level.

Firstly, Donaghy (2011) conducted interviews with farmers on the potential role of the SRDP as a funding mechanism for NFM. He found that the SRDP was not seen as an appropriate method of funding because of the poor level of incentives it offers, the complexity of paperwork, time and costs involved in the application process, and the difficulty in getting involved in the scheme. There is also evidence that the competitive nature of the highest tier of SRDP (i.e. rural priorities) deterred many from applying because there was a high risk of failing while spending time and resources in the application process, in particular when hiring a consultant to prepare it (Rouillard, 2010; Rouillard et al 2010; Werritty et al 2010). A joined up, easy approach to funding mechanisms is demanded by the farming community (Waylen et al 2011). Similarly, Rouillard (2010) observes that farmers may fear the risk of failing the terms of funding agreements. For example farmers were reluctant to enter riparian SRDP schemes because 1) under current arrangements they are responsible for replacing fences although fences in riparian areas are at a higher risk of getting washed away through flooding, 2) agreements did not allow adapting management practices with changes in river behaviour (e.g. shifting river channel).

Research in Scotland has shown that farmers deem the timescale over which land management interventions are planned by funding and institutional bodies as inappropriate. Farmers see NFM as another demand on multiple land use and one which must be implemented, managed and operated. As such, a new long term contract is view to be suitable by farmers who incur the costs of delivering the public benefits associated with NFM (Ecosystem services) (Werritty et al 2010; Holstead, 2011). Holstead (2011), Langan and Kenyon (2011) and Robertson (2011) show that farmers preferred NFM payments extended over a long time period (greater than 5 years)

because they consider NFM as a longer term land use which incurs expenses in disarmament and soil degradation. These findings are contradicted by Sutherland (2010) who contends that farmers are resistant to schemes that bind them to lengthy contracts that render them incapable of responding to external factors such as crop performance or commodity prices.

Scottish research demonstrates that as well as certain features of the contract, the relationship farmers have with relevant organisations involved in NFM is likely to be important. Langan and Kenyon (2011) and Holstead (2011) both found that many farmers have an antagonistic relationship with SEPA (Scottish Environment Protection Agency). In her interviews with farmers, Holstead (2011, p80) found that farmers did not trust SEPA:

“SEPA would rather see you lose your business [than drain ditches]. You try to keep everything maintained to the best of your ability but then SEPA comes in and says “sorry you can’t do that”. We have been custodians of this land for generations and then they suddenly appear and say you can’t do it”.

Many farmers regarded dredging water courses as one of the most important aspects of local flood management and as such criticised SEPA for preventing this action in accordance to regulations on river engineering through the Controlled Activities Regulations (established in accordance with the WFD which regulates sediment management/water course dredging), in particular the manipulation of wet gravel (e.g. dredging, removing gravel bars). Opposition was related to the cost and administration of applying for authorization. Regulations ran against historical practices that protected their most valuable floodplain fields against flooding, and farmers therefore blamed SEPA for increasing flooding on their land (Rouillard, 2010; Holstead, 2011, Waylen et al 2011, SNIFFER, 2011).

Positive relationships between farmers and organisations can have a positive impact on likely uptake of NFM as seen in the Scottish Borders where a series of NFM features have been employed in a variety of projects where Tweed Forum acts as a broker (Rouillard et al 2010, Werritty et al 2010).

8. POLICY LANDSCAPE

Many businesses face a congested policy landscape and have to adhere to copious amounts of legislation, regulation and guidelines. Farmers are no different and face considerable legislation and regulation related to the water environment. The literature indicates farmers are concerned not only about the volume of legislation and regulation, but also how these policies are, or are not, joined up. For example, farmers have expressed concern as to how implementation of NFM features will affect other policy areas such as their eligibility for Single Farm Payment (Rouillard, 2010; Donaghy, 2010; Holstead, 2011, Robertson, 2011; SNIFFER, 2011).

However, the existence of different policies and regulations provides opportunities for win-win situations. Research from the European Aquarius Project shows that farmers may be willing to negotiate, trading-off rigid meeting of regulations in one area against less stringent implementation elsewhere. For example they found that in Sweden, farmers could be incentivised

to install NFM features by granting permission for them to use water from their constructed wetlands for irrigation purposes on their land. This negotiation or 'win-win' situation acts to write off the negative financial position farmers face from using the land for NFM. As many as 75% of the farmers agreed to this type of environmental contract (Aquarius, 2010a).

Aquarius also identified opportunities for win-win situations in Scotland through negotiations between farmers and regulators related to the costs of production, fertiliser and water management (Aquarius, 2010b). Research conducted in the North East Scotland catchments of Moray (Holstead, 2011) and Tarland (SNIFFER, 2011) and the Bowmont-Glen catchment (Rouillard, 2010) found that farmers were interested in negotiation around areas of water management such as the Controlled Activity Regulations. Farmers perceived this legislation to be confusing and contentious because they see removal of sediment as an essential element to ensuring the farm remains productive with dry fields (Rouillard, 2010b; Waylen et al 2011; SNIFFER 2011; Holstead, 2011). Any move towards a more pragmatic approach would be welcomed by farmers. A note of caution however: it is unclear how these negotiations would tie in with international commitments which Scotland must adhere to.

9. AVAILABILITY OF INFORMATION

The literature suggests that an important barrier to NFM uptake is the lack of appropriate information available to farmers (Holstead, 2011; SNIFFER, 2011). Although it has been shown that farmers need more information on NFM before they are willing to consider implementation, the significant time constraints which they face mean that lengthy generic brochures are likely to be inappropriate (Holstead, 2011, Waylen et al 2011). Farmers consider simple, concise and personalised information that considers local contexts and farm characteristics to be an effective means of government-farmer communication (Waylen et al 2007; Aquarius 2010b; Schaafsma and van Os 2010; SNIFFER, 2011). This is consistent with the views of Sutherland et al. (1996) who suggest that the farming community prefer personalised information and perceive written communication to be inaccurate because of the lack of local context. Langan and Kenyon (2011) suggest that some of the information required includes communication about: the multiple benefits NFM provides; how NFM on particular farms fit within the catchment-wide context; and how in practice NFM features have worked on other farms.

Whilst the written word is one means of communicating information about NFM to land managers, research has highlighted the value of 'key people', a 'trusted intermediary' or a 'catchment champion' in the communication process who would translate key national messages into a local context for the farm level (Kenyon et al 2008; Aquarius 2010b; Schaafsma & van Os 2010; SNIFFER, 2011).

The standing of the body/person involved in communication is also important. O'Keefe (2002) suggests that behaviour change is more probable (especially if messages are complex or involve a high degree of risk) when information is offered by body of high credibility. The two elements of credibility have been identified as 'expertise' and 'trustworthiness'. Credible 'intermediaries' for NFM communication should therefore possess expertise, be highly trained in the agriculture industry and belong to a trusted catchments-wide network (Blackstock et al., 2010; SNIFFER

2011). Key people who fit these specifications can be sourced from agricultural advisory organisations, private consulting firms, farmers' unions and retired policy makers (Schaafsma & van Os, 2010).

Personalised Information can also be effectively conveyed to farmers regarding NFM through 'kitchen table talks,' where authorities, scientists and farmers meet at the local level, at the kitchen table for example, or on a larger scale, in local town halls (Schaafsma and van Os; 2010). Findings of other projects in Scotland have also reported this small scale interaction important (Waylen et al 2011; SNIFFER, 2011). Kenyon et al (2008) suggest that farm advisors, for example from the Scottish Agricultural College, need to be provided with information and training on NFM, so that they in turn can advise farmers. In contrast, Rouillard et al (2010) found that farmers may question the capacity of science in understanding flood processes and providing effective solutions, and may ignore consultants and farm advisors in their decision-making.

10. PESTS, PARASITES AND SUPPORT

Recent investigation highlights the unintended consequences that may arise as a result of the installation of NFM features and the extent to which farmers consider these in considering NFM installation. In her qualitative interviews and online survey Holstead (2011) found that farmers were worried about pests. One farmer was apprehensive about NFM due to the location of his land on a geese flight path. He saw significant danger for the farm business in installing ponds or wetlands as "they could naturally sit on wetlands and then hover onto the crops next door to it [...] they would eat the crops, you'd have to watch what crops you put in the ground and at what times, you'd maybe have to change your cropping regime to compensate for it" (Holestead, p 73). With reference to a neighbour's pond, another farmers was concerned that "all it does is smell, entices vermin and is full of weeds which blow on to our ground and that involves more pest irradiation [...] we have more spraying costs" (Holestead 2011, p 72). In terms of parasites, Holestead (2011, p 73) found that farmers were concerned about "...the potential introduction of diseases such as BVD (Bovine Virus Diarrhoea), TB (Bovine Tuberculosis) and liver fluke infection (Fasciolosis)..."

More broadly, Holestead (2011) noted that if such pests and parasites did materialise due to the implementation of NFM features, farmers did not know who they could go to for help or advice. Farmers suggest that problems of pests and parasites could be overcome with increased support in managing NFM features; as one farmer suggested, the establishment of a body to liaise with farmers and oversee NFM schemes, discuss management issues and offer advice on how to develop the feature further would act as an incentive to NFM provisions. This study found that lack of support and advice was a key barrier to NFM in Scotland. "I would like somebody to come round once a year and to give a bit of advice as to how to manage it, if the thing is overrun with mink, where do you go for help?" (Holestead p.74)

11. CATCHMENT WIDE ISSUES

Wider catchment issues can influence whether farmers will consider implementation of NFM. Wider community stakeholder engagement could also play a role in influencing farmer uptake of

NFM (Howgate and Kenyon, 2008). Posthumus and Morris (2010) and Holstead (2011) suggest that farmer resistance to involvement in water management schemes may partly be the result of the negative public perception of the farming sector. Literature on farmer participation in agri-environmental schemes can portray farmers as being “anti-environment” (Wilson 1997; Morris and Potter 1995; Sutherland 2010). Aquarius (2010b) found that farmers are often seen as ‘polluters,’ and as a result, feel unfairly targeted as being responsible for environmental degradation. This can be overcome through increased communication with the wider community, emphasising the positive externalities associated with the farming industry (Posthumus and Morris 2010; Dwyer et al 2007).

Holstead (2011) found that Scottish farmers see a link between urban policy and practice as being related to flooding and rural policy and practice. In her qualitative interviews she found that interviewees were highly critical of construction on flood plains occurring in nearby urban centres. One farmer stated that “Too much has been built on flood plains. When there is a big flood it wouldn’t have happened if they weren’t building houses on flood plains. If everybody kind of went together and did something, it would help.” (Holstead 2011 p. 82). Similarly, Werritty et al (2010) found in interviews with Scottish land managers involved in a river restoration program to alleviate flooding that farmers were critical of houses being built on floodplains.

This confirms the results found by Langan and Kenyon (2011) that placing NFM in a catchment-wide context for the farmers is vital. A local trusted catchment ‘champion’ could facilitate the uptake of NFM features by: negotiating between farmers and agencies on meeting regulations; accessing a variety of funding streams; and promoting an integrated catchment approach to water, environmental and farm management. This ‘champion’ might also provide support required in the ongoing management of NFM features and help farmers manage pests and other unforeseen consequences.

12. CONCLUSION

A review of the literature and recent research provides an insight into those factors that have been found to influence farmers’ decision making process on implementation of NFM features. The focus of all literature and recent research is that a farm has to be a viable business and that NFM has to be promoted within that context. However, an understanding of the factors likely to influence farmers can help to focus research, policy action and stakeholder interaction in this developing area.

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