A framework for understanding uptake of semi-natural habitat restoration schemes: general contributing factors, restoration issues, results-based approaches, and hay meadow restoration in Norway

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Abstract

With semi-natural habitats in Europe and Norway under pressure as a result of land use change and degradation there is currently an urgent need to understand what factors encourage stakeholders (both farmers and non-farmers) to participate in restoration schemes. This review contributes to this objective as part of the "Restoration of ecosystem functioning and biodiversity in semi-natural habitats under high pressure" project (RESTORE). It looks at four issues. Firstly, it explores the international literature on landowner engagement with agri-environmental schemes (within which restoration schemes fall) to identify factors that contribute to uptake of schemes. Four main areas emerged, namely: the characteristics of the farmer/farm family, the decision-making processes of the land manager, structural features of the farm, and the design of the scheme itself. Secondly, focusing on a much smaller body of literature, the review looks at issues relating specifically to restoration schemes to identify barriers to uptake and innovative ideas for promoting restoration emerging from the literature. Thirdly, the review looks briefly at results-based schemes, outlining in detail scheme design in the REAPs scheme and summarising the Burren scheme and its success. We examine semi-natural habitat restoration/management schemes in

Norway, focusing on the Action Plan for Hay Meadows, and finally further knowledge needs in the topic. The report does not conclude by suggesting an 'optimal' scheme design, but rather provides (a) a resource for those interested in understanding how to design restoration schemes that are likely to receive a positive response from landowners, and (b) the conceptual basis for fieldwork in RESTORE and c) a contribution of further knowledge needs.

Key words: Restoration, agri-environmental schemes, semi-natural habitats, hay meadow

Norsk sammendrag

Med semi-naturlige habitater i Europa og Norge under sterkt press som følge av endring i arealbruk og forringelse, er det nå et stort behov for å forstå hvilke faktorer som oppmuntrer forvaltere og interessenter (både bønder og ikke-bønder) til å delta i ordninger for restaurering og skjøtsel av slike habitat. Denne rapporten er et bidrag til dette gjennom prosjektet RESTORE: «Restaurering av økosystemfunksjoner og biodiversitet i semi-naturlige naturtyper under sterkt arealpress». Rapporten utforsker for det første internasjonal litteratur om grunneieres engasjement i landbruksmiljøordninger (som restaureringsordninger faller innenfor) for å identifisere faktorer som bidrar til å delta i slike ordninger. Fra litteraturen utpeker fire hovedtema seg: egenskaper og trekk ved bonden/gårdsfamilien, beslutningsprosessene til gårdbrukeren, strukturelle trekk ved gården og utformingen av selve ordningen. For det andre, basert på en mer begrenset litteraturbase, ser rapporten på spørsmål knyttet spesifikt til restaureringsordninger for å identifisere barrierer for deltakelse og innovative ideer for å fremme restaurering. Videre har vi en kort gjennomgang av resultatbaserte ordninger, og går i detalj gjennom utformingen i det irske REAP-prosjektet (Resultatbasert miljø-agri pilotprosjekt) og presenterer erfaringene med Burren-ordningen og dens suksess. Rapporten undersøker så ordninger for semi-naturlig habitatforvaltning i Norge, med fokus på slåttemark, og til sist videre kunnskapsbehov i temaet. Rapporten konkluderer ikke med å foreslå en «optimal» planutforming, men skal fungere som (a) en ressurs for de som er interessert i å forstå hvordan de kan utforme restaureringsopplegg, (b) legger det konseptuelle grunnlaget for feltarbeid i RESTORE og (c) gir et bidrag til å identifisere videre kunnskapsbehov.

Nøkkelord: Restaurering, landbruksmiljøordninger, semi-naturlige habitater, slåttemark

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1. Factors that contribute to or predict farmers' participation in agri-environmental schemes: A review of the international literature

1.1. Introduction

With semi-natural habitat in Europe and Norway under pressure as a result of land use change and degradation there is currently an urgent need to understand what factors are likely to encourage stakeholders (both farmers and non-farmers) to participate in restoration schemes. Factors threatening semi-natural grasslands include agricultural intensification, land use change, abandonment of farmland, and afforestation. In combination, these have led to over 90% of Europe's semi-natural grasslands being lost over the last century (Waldén & Lindborg, 2018). The main strategy for the continued management of semi-natural habitats has been the introduction of agri-environmental schemes whereby farmers are paid to perform actions that support the continuation of the habitat. However, despite these schemes being applied across Norway and Europe since the late 1980s the decline in habitat has been continuous – in some cases to the point where restoration of these habitats might provide the only solution.

One way to do this may be to simply increase payments. However, there is a major stumbling block. Even if governments were willing to offer financial incentives to manage meadows in an environmentally sensitive manner, WTO rules to prevent trade distortion limit the extent to which they are able to incentivise the behaviour. Two key criteria for agri-environmental payments are:

a) "Eligibility for such payments shall be determined as part of a clearly-defined government environmental or conservation programme and be dependent on the fulfilment of specific conditions under the government programme, including conditions related to production methods or inputs", and
b) "The amount of payment shall be limited to the extra costs or loss of income involved in complying with the government programme." (GATT, 1994, p. 63).

The key problem with a strict interpretation of these rules is that environmental provision it tied to the economic feasibility of agriculture – meaning that farmers, at best, are able to recover the capital of their management investment. As a result, the maintenance of semi-natural grasslands in Europe is largely dependent on the good-will of the farming community – with farmers pride and satisfaction in managing being a key reason for their continuation (e.g., Sandberg & Jakobsson, 2018). While some have argued that the WTO rules are more flexible than they are being interpreted (e.g., Schwarz et al., 2008) governments have been unwilling to create schemes that make conservation or restoration more economically viable than agriculture. As a result, to

improve outcomes we have the choice of either (a) improving the uptake of action-based schemes by exploring what motivates farmers to participate, or (b) designing new approaches that take advantage of the limited 'flexibility' WTO rules to better incentivise participation. With Restore's objective of improving the restoration of semi-natural habitats in Norway, it is important that we understand both of these aspects.

1.2. The objective of this section

While RESTORE's primary interest lies with encouraging farmers to engage with restoration schemes, there is very limited Norwegian and international literature focusing specifically on farmers' adoption of restoration schemes. However, the literature indicates that motivations for engaging with restoration schemes appear to be almost identical to those given for engagement in general agri-environmental provision. This review therefore focuses on factors that lead to participation in general while an assessment of what is more likely to affect engagement in restoration schemes and how is presented after the review (Section 2).

Given the importance of the uptake of voluntary agri-environmental schemes, a number of extensive reviews of factors leading to agri-environmental participation already exist (i.e., Defrancesco et al., 2008; Burton, 2014; Lastra-Bravo et al., 2015; van Dijk et al., 2016; Tyllianakis & Martin-Ortega, 2021; and Schaub et al., 2023). Rather than repeating the process by comprehensively reviewing primary literature, this review summarises conclusions drawn by the review papers and supplements this with information from recent original papers where the information to draw conclusions is limited or where relevant results are found.

Factors contributing to uptake of agri-environmental schemes can be broadly divided into four main groups, namely:

1. Farmer/farm family characteristics
2. Farmer decision-making processes
3. Farm Structural Features
4. Scheme design

These groups provide the structure for the following analysis of factors. While the factors can be (and often are) considered independently, it is important to note that in reality the influences on participation are multiple, layered and interact with other structural features on the farm. For example, Unay-Gailhard & Bojnec (2015) present a review on how farm size interacts with other factors to influence AES participation – e.g., the effects of farm succession status, decision-making processes, and scheme design on uptake of AESs may differ depending on the size of the farm.

1.3. Farmer/farm family characteristics

Demographic data is the most commonly gathered explanatory data for engagement with agri-environmental policy, however, as noted below it is also generally a poor predictor of engagement. Jones et al. (2021) suggest that the reason we rely on demographic data is its ease of collection and that interest and motivation to engage are in fact due to a range of individual social factors including peer group concerns, cultural interests and accumulated experiences. Nevertheless, some aspects of engagement can be explained through demographic data – particularly when the complexity of the situation surrounding the individual is considered.

1.3.1. The structure and nature of human capital on the farm

1.3.1.1. Age

The relationship between the age of the farmer and participation in AES schemes is complicated. Studies in different contexts have shown that younger farmers are more likely to participate than older farmers (e.g. Filson, 1993; Bager and Proost, 1997; Bonnieux et al., 1998; Ellis et al., 1999; Vanslembrouck et al., 2002; Mathijs, 2003; *Brodt et al., 2006; Siebert et al., 2006; van Rensburg et al., 2009; Boon et al., 2010;* Murphy et al., 2011), that age plays no role in participation (e.g. Wilson, 1997; Atari et al., 2009; Siebert et al., 2010; Yiridoe et al., 2010; Finger and Lehmann, 2012), and that older farmers are more likely to participate than younger farmers (Kristensen et al., 2004; Defrancesco et al., 2008; Barreiro-Hurlé et al., 2010; Waldén & Lindborg, 2018). Understanding the reasons behind this variability requires understanding how age influences the general behaviour of the farmer. In the literature there are three main explanations for the influence of age:

Cohort effects and societal values. Cohort effects occur when the attitudes and behaviours of the individual are formed during a particular time with specific social structures. These attitudes and behaviours then become locked in. For example, farmers raised in the post-war "productivist era" where they were encouraged to produce as much as possible often maintain these production-oriented beliefs – even when new policies encourage lower production (Wilson, 2001, Brodt et al., 2006). For them, farming is about food production and productivity. On the other hand, farmers raised in recent years when the emphasis is on mitigating climate change and preserving the environment are believed to be more environmentally oriented (e.g., Brodt et al., 2006; Galati et al., 2020).

Risk. Defrancesco et al. (2008) suggest that younger farmers may be more likely to engage in AES provision because they have a greater willingness to take risks. This may be somewhat tied with the life-cycle stage as farms at the early stages of the life-cycle have a longer time period to resolve any problems caused by risky behaviour (see below).

Physical and mental efficacy. As farmers age their physical and mental capacity declines and, as a result, their willingness to take on new work declines. This "slowing down" process has been suggested as one reason why older farmers are more likely to engage with agri-environmental schemes that involve low intensity land use (Potter & Lobley, 1992; Barreiro-Hurlé et al., 2010). In contrast, younger farmers with more energy may be more willing to engage with schemes that involve more activity than older farmers (e.g., Pavlis et al., 2016). Farmers entering retirement age, on the other hand, are "strongly motivated by the desire to reduce working hours" (Potter & Lobley, 1992).

Studies in Norway and Sweden have found that farmers engaging with hay meadow management (Wehn et al., 2018) and semi-natural grassland restoration (Waldén & Lindborg, 2018) have tended to be older – with many past retirement age. The issue of the effect of age on conservation of HNV grassland has been observed in the UK. McGinaly et al. (2017) note that staff responsible for the scheme were concerned that most of the farmers involved were over 60 years old and that there was no way of knowing what would happen to the meadows in 10 years time. The authors (p. 46) also observe that the number of candidate farmers in local landscapes are limited and appear to be declining, with the remaining farmers critical of conservation-oriented meadow prescriptions and restrictions. One problem here is that as older farmers drop out, the farmers remaining are more commercially oriented and may thus not be so easy to engage with schemes as farmers were in the past. This suggests that strategies for promoting conservation and restoration of semi-natural environments in the past may not be as effective in the future.

1.3.1.2. Life-cycle stage

Family farms tend to go through growth cycles based on a combination of the development of the farm as a business (investment, debt, expansion, consolidation, contraction, exit, and so on) and generational changes in farm families. As these factors change over time so the way the farm is managed to fit the needs the farm families of and resources available also changes. This results in developmental stages that may influence the uptake of agri-environmental schemes (and other environmental behaviours).

Stage 1 – confirmation of a successor leads to changes in which the farm is managed. In particular, bringing new (potentially pro-environmental) ideas to the farm and having a longer planning horizon leads to a phase of investment and innovation – including in environmental measures such as climate mitigation (Burton & Otte, 2022). This horizon varies from generations (in Stage 1) to a few years (in Stage 3) (Calus et al., 2008). Because farmers in Stage 1 tend to be more innovative and open to change there may be a greater chance of AES uptake as innovativeness has also been found to be related to willingness to adopt AESs (Barreiro-Hurle et al., 2010).

Stage 2 – as time progresses the farm enters a more stable phase as farmers raise families and have debts to service. Major changes have already been made. Once a successor is identified farmers may be less willing to accept long-term contracts for agri-environmental work so as not to discourage succession by locking land into non-agricultural production (Ruto & Garrod, 2009). Once succession occurs the farm returns to Stage 1. Calus et al. (2008) suggest this stage can be divided into an "expansion stage" (all farms early on following from Stage 1) and "consolidation stage" (when the farmer is uncertain about succession – leading into Stage 3).

Stage 3 – if a successor is not identified the time frame for decision-making becomes shorter and shorter as the farmer begins to consider retirement rather than the needs of future generations. As mental and physical efficacy decline (see above) less energy is put into the business. Debt, workload, and commitment to the farm also decline as the farmer approaches retirement. The farm may be managed as a 'hobby farm' post-retirement. When the farmer finally leaves the land, the farm may be abandoned, taken over by a new farmer, or taken over by a neighbour.

The important aspect of the life-cycle stage for semi-natural landscape restoration work is that farmers at different stages of the life-cycle are likely to respond differently to AESs. In Stage 1 the focus on investment and innovation provides an opportunity for significant changes in farm management practices – thus AESs that require significant effort or investment may be implemented. At the later stages farmers are effectively not making any significant change on the farm at all but, in an effort to reduce workload while maintaining income, may be willing to adopt extensification measures – requiring a different type of scheme. The problem is, as observed above (McGinaly et al., 2017; When et al., 2018; Waldén & Lindborg, 2018), whereas maintaining existing meadows can be done as a temporary measure to boost income, restoration has a longer time-horizon. As the time horizon shortens as the farm passes through the life-cycle stages with farmers towards the end of the life-cycle unlikely to invest in other than short-term activities. Restoration policies may therefore need to be targeted at farmers in the earlier stages of the life-cycle (e.g. Burton & Otte, 2022).

1.3.1.3. Experience

Studies consistently show that farmers with past experience of agri-environment schemes are more likely to engage in new schemes (e.g., Smithers and Furman, 2003; Lobley et al., 2004; Defrancesco et al., 2008: Siebert et al., 2006, 2010; Jongeneel et al., 2008; Moon et al., 2012). This is because:

(a) Skills and knowledge develop. Experience in an activity increases the efficacy of the behaviour as the farmer develops the knowledge and skills to do the job effectively (Jongeneel et al., 2008; Läpple, 2010). This also has the effect of decreasing perceived risk of negative outcomes.

(b) Positive attitudes develop. Some researchers have suggested that the action of engaging with environmental schemes promotes development of positive attitudes to new environmental measures (Vanslembrouck et al., 2002).
(c) Experience normalises action. Engagement with intensive production activities can lead farmers into thinking environmental damage is simply part of normal agriculture (Traoré et al.,1998), whereas engaging with environmental measures can have the opposite effect.
(d) Creates cultural norms. Groups of farmers with the same experiences in production create cultural norms around the behaviour (Burton et al., 2021). This leads to social expectations that the behaviour will be performed and thus increases the likelihood the behaviour will be performed in the future (peer pressure).

For environmental work the important aspect of experience is that once farmers have been encouraged to engage in a scheme, it may be easier to encourage them to engage in additional schemes. Farmers who initially begin by preserving existing meadows may thus be more likely to engage in restoration work if a scheme is introduced or the existing scheme extended.

1.3.1.4. Formal education

As with experience, the influence of education is to increase the likelihood of behaviours occurring in keeping with the education. However, the influence of education on engagement in agri-environmental schemes is complex. Some researchers have found a positive effect (e.g., Lambert et al., 2007; Barreiro-Hurlé et al., 2010), some no effect (Siebert et al., 2010; Yiridoe et al., 2010; Finger and Lehmann, 2012), and others a negative effect (e.g., Riley, 2006; Defrancesco et al., 2008). Education has two main ways of influencing behaviour

(a) Building knowledge and changing attitudes (also see below in information availability). Education can change attitudes by, for example, dispelling myths about the outcomes of environmental behaviours (Kreutzwiser et al., 2011) or creating new knowledge that enables farmers to recognise environmental problems (Jackson-Smith and McEvoy, 2011). Czajkowski et al. (2021) found in the case of protecting bird habitats that farmers with greater measured knowledge of birds (rather than subjective statements of knowledge level) were more likely to consider participating in an AES.
(b) Increases management efficacy. An agricultural education improves farm management by enhancing technical skills and understanding of complex farming systems. If education enhances understanding of ecological systems this can make farmers more likely to follow environmentally sustainable agricultural practices (Traoré et al., 1998). Education on the use of computers can assist farmers to cope with the administration required for many agri-environmental schemes – thus

increasing the likelihood of engagement (e.g., Pfeifer et al., 2009; Ruto and Garrod, 2009).

Burton (2014) suggests that the reason the influence of education on agri-environmental engagement is inconsistent is because of the way education is assessed. Studies looking at engagement with environmental schemes have measured education as the number of years in education or the highest education qualification achieved (e.g., Czajkowski et al., 2021). However, educating one farmer about ecology and another one about intensive agriculture will result in opposite outcomes. Studies that have measured specifically agricultural education have found, for example, that conventional agricultural education increases the intensity of hay meadow management (Riley, 2006) and can lead to different choices in a 'menu' scheme (Murphy et al., 2011). Promoting restoration is thus not so much about how much education, but the right type of education.

1.3.1.5. Gender

Many studies of gender have suggested that women are more environmentally oriented than men. For example, women have been found to be more likely than men to participate in agri-environmental programs or undertake private conservation activities (Curtis and DeLacy, 1996; Boon et al., 2010). Burns (2020) found in an Irish study that female participants were more positive about wildlife than male participants. However, other studies have found no relationship between gender and environmental behaviour (e.g., Borsotto et al., 2008; Best, 2009; Conradie et al., 2013). It has been suggested that shifting emphasis in agriculture over the last decades to roles such as environmental management and tourism has provided women with more of a say over farm management while the increase in paperwork has also increased the role of women in farm decision-making (Riley, 2009). Thus, the influence of women in terms of environmental engagement may be increasing.

While the topic has been relatively unexplored there is some evidence to support the notion that gender can play a role in environmental scheme participation. Unay-Gailhard & Bojnec (2021), for example, found that farms managed by young women were more likely to adopt agri-environmental climate measures than those managed by young men. As far as restoration is concerned, however, there is no evidence to suggest that women respond differently to men and, without further evidence, there is no reason for specific targeting of women farmers in restoration schemes.

1.4. Farmer decision-making processes

Non-structural factors that affect farmer's decision-making on whether to engage in agri-environmental schemes or not can be divided into two main groups. First, social and psychological elements that influence farmer's decision-making and, second, the way messaging around the scheme is created and received.

1.4.1. Social and psychological factors

1.4.1.1. Famer attitudes

Attitudes to the environment are well known motivators of farmers' behavioural choices. Unsurprisingly, farmers who hold more positive attitudes towards the adoption of agri-environmental practices are more likely to participate in AESs (e.g., Defrancesco et al., 2008; Ruto and Garrod, 2009; Barreiro-Hurle et al., 2010). Attitudes, however, are not fixed but can vary as a result of other factors such as additional education or the stage of the farm family life-cycle (see above). In addition, positive attitudes towards the environment do not guarantee engagement with AESs as many structural constraints reviewed here can also influence behaviour. In fact, studies show that general environmental attitudes not related to agriculture do not show significant relationships with scheme participation (Schaub et al., 2023). Some studies (e.g., Wilson – 1996; Battershill & Gilg, 1997) have suggested that attitudinal dispositions are more significant than structural constraints when it comes to decision-making to engage with AESs.

1.4.1.2. Dispositional factors

Schaub et al. (2023) suggest that the only two dispositional factors that have been looked at are risk aversiveness and trust. Of these, risk aversion is the most widely studied factor. Risk-averse farmers can be attracted by schemes where the year-to-year variability of income is evened out. Risk-averse farmers who face uncertainty in their production income have also been found to be more likely to comply with the requirements of AES policy (Fraser, 2002). Additional dispositional factors involve farmers' preferences for their work environment. Of these, farmers are known to value their independence which can make collaborative efforts problematic (Franks et al., 2016).

1.4.1.3. Social norms and social/cultural capital

Review papers suggest that the opinions and actions of neighbouring farmers are very important in determining uptake of AESs (Lastra-Bravo et al., 2015; Schaub et al., 2023). There are numerous reasons for this. Gatto et al. (2019) observe from the literature that factors such as horizontal networking with peers, incorporating learning from other farmers, sharing experiences and imitating neighbours all play a role in determining farmers' participation in AESs. Previous experience and opinions or recommendations of other farmers (Skerratt & Dent, 1996; Vanslembrouck et al., 2002) as well as cultural/social norms in favour of tidy productivity landscapes (Burton et al., 2008; Emery and Franks, 2012) have also been found to influence participation. Although not directly related to agri-environmental schemes, Sereke et al. (2016) found that the loss of reputation amongst neighbouring farmers was one reason

farmers in Switzerland were unwilling to revitalise the traditional agro-forestry-based farming system.

Dupraz et al. (2009) observe that cooperative approaches to agri-environmental provision might be possible in areas where a farmer is easily observable by neighbours and provides the example of mowing fields from the centre to the periphery. The authors note that a contract between the regulator and a consortium of farmers could be effective with the payment being an incentive over normal payments if the environmental objective is reached and nothing if it is not. Thus, if the consortium failed to deliver the environmental goods it would receive no money and have to pay back administration costs and the opportunity costs of using public funds. In this way, they note, the consortium agreement makes use of social pressure to ensure there are no free riders on the contract.

1.4.2. Information issues

1.4.2.1. Availability of information

Schaub et al.'s (2023) review paper concludes that despite an emphasis on information provision as a means of encouraging participation in AESs the weight of evidence suggests there is no connection between information provision and participation. One possible explanation for this is that it is not receiving information that drives participation, but the content of that information. For example, if information is obtained from private commercial advisory services this can have a negative effect on AES uptake (e.g., Polman & Slangen, 2008) whereas if it comes from publicly funded services the effect can be positive (Sepinosa-Goded et al., 2010; Schomers et al., 2021). Sutherland et al. (2013) observe that while private advisors might be incentivised to provide information on agri-environmental grants, there is a danger that they would advise on the grants with the easiest access rather than those with the greatest environmental benefits. It should also be noted that while increasing the availability of information might encourage some to participate, for others increasing their knowledge of the benefits of AESs may increase the level of payment expected for entering the scheme by increasing farmers' perceived value of the ecosystem services they are providing (Schaub et al., 2023).

1.4.2.2. Framing of information

Framing of messages is important for increasing participation. Schaub et al. (2023) suggest that messages should be framed positively (e.g., 'environmental enhancement' rather than either 'preventing destruction' or suggesting that farmers' have a responsibility as stewards to enter the scheme).

1.4.2.3. Source of information

Information coming from peers has been found to be more important for influencing participation decisions than coming from scientists (Villamayor-Tomas et al., 2019). In

addition, information coming from financial entities has been found to increase the likelihood of famers participating (Barreiro-Hurlé et al., 2010) which the authors suggest might be attributable to the channelling of other subsidies through these entities.

1.4.2.4. Trust in information

Trustworthiness concerns whether the source is perceived as being inclined to tell the truth, and concerns issues such as whether the source is open- or closed-minded, just or unjust, or selfish or unselfish. Trustworthiness depends on a number of characteristics of the source (i.e., speaker or company), such as, personality, institution they represent, qualifications, and interpersonal relationship (Zhou et al., 2018). For neighbouring farmers trust may be built up through years, decades or generation of reciprocal social interactions and thus be exceptionally strong (Sutherland & Burton, 2011). Where the communicator is not known to the farmer, trust revolves around whether the person/institution is qualified to know what is right and wrong with an expert communicator more persuasive than a communicator who is seen as lacking (Walster et al., 1966). Factors likely to convince the recipient include education, occupation, institution, and experience (O'Keefe, 2002). Sutherland et al. (2013) found that farmers engaging in agri-environmental schemes put their trust mostly in sources that were seen as either impartial or actively pro-agriculture. Trust in the implementation process has a major role in adoption meaning that clarity of contract requirements needs to be high to narrow the opportunity for interpretation (Ducos et al., 2009).

1.5. Farm Structural Features

Farms are diverse in terms of their structure such that some farms may be in a better position to engage in restoration work than others – regardless of the family characteristics or the preferences of the farm family members. As with farm family characteristics, there is no simple relationship between characteristics and participation.

1.5.1. Farm size

The relationship between farm size and participation in agri-environmental measures is highly context dependent but often seen as a key variable. Research on the influence of farm size on participation has found everything from a strong negative effect (larger farms less likely to participate) to a strong positive effect (larger farms more likely to participate) (Unay-Gailhard & Bojnec, 2015). However, the weight of evidence is in favour of the participation of larger farms. Schaub et al. (2023) observe that 58% of AES participation studies have found a positive relationship between scheme entry and farm size, while no significant relationship was found in 38% of cases. The reasons given for these differences are also varied but based around two key factors.

- Economies of scale (i.e., lower cost with higher production quantity) means that larger farms have higher opportunity costs associated with entering AESs. E.g., Lackner et al. (2020) found, farmers would only enter grassland in a scheme if they can spare the fodder production potential.
- Economies of scope (i.e., produce a variety of outputs, including those incentivised under schemes is more viable on larger farms) means larger farms have lower opportunity costs as they (a) have more machinery & labour available, and (b) have more low productivity land available.

Transaction costs – for example, gathering information on contracts and cost of filing contract forms as a proportion of the return – are also higher for smaller farms. Ducos et al. (2009) suggest these could have a significant negative effect on the participation of smaller farms.

Others have suggested that the relationship between farm size and AES participation may not be linear in that, beyond a certain farm size, further increase in size will not increase the likelihood of participation. For example, Cullen et al. (2020) found for 5 categories of farm size that the likelihood of participation increased with increasing farm size except in the largest category of farm, which had the lowest likelihood of participation.

1.5.2. Farm type

Factors such as the type of livestock production (e.g., cattle, sheep, dairy), the type of tillage system, intensity of production, soil type, and level in investment in machinery have been found to influence participation in AESs (Lastra-Bravo et al., 2015). Wossink and van Wenum (2003) also found that specialist (cropping) farms were less likely to participate in biodiversity conservation programs. Schaub et al. (2023) note that farms using environmentally friendly practices (such as organic farms) may have farming systems that make the implementation of AESs easier and cheaper.

1.5.3. Field position and type of scheme

Factors such as the distance of fields from the farm can play a role in whether they are entered into a scheme or not. For schemes that involve low levels of management distant fields are more likely to be entered because of the travel times required. However, when schemes require intensive work the opposite occurs – fields more distant from the farm are less likely to be entered (Schaub et al., 2023). Waldén & Lindborg (2018) found that some farmers who were restoring SNGs later shut down more distant (presumably more established) meadows that were more difficult to manage. Caution needs to be shown with restoration programs to ensure they are not simply used to consolidate the business.

1.5.4. Farm profitability

Schaub et al.'s (2023) review of the literature found that higher profitability led to higher opportunity costs and therefore lower participation in AESs.

1.5.5. Farm/field productivity

In contrast to profitability, the relationship between productivity and participation is less consistent. Schaub et al. (2023) found that eight studies showed a positive relationship, four a non-significant relationship, and five a negative relationship. Factors such as soil quality, plot steepness, potential for soil to be eroded, and growing degree days vary across farms meaning that the opportunity costs of using the land for environmental schemes changes from farm to farm. As farms are not generally compensated on the basis of varying opportunity costs this can mean some farmers are more willing to enter the scheme than others. A tendency for less productive agricultural areas to be entered into schemes was reflected in the regional level across the EU (Glebe & Salhofer, 2007).

1.5.6. Production intensity

Schaub et al. (2023) found that in 46% of studies farmers farming the land more intensively (e.g., fertiliser, stocking, pesticides, irrigation) were less likely to participate in AESs. Lanker et al. (2020), for example, found for grassland that farmers maintaining higher stocking densities were less likely to enter into AESs. This was attributed to higher opportunity costs. However, in 42% of the studies reviewed at by Schaub and colleagues there was no relationship and in 12% a negative relationship – those with higher levels of production were more likely to enter AESs. Again, the relationship between production intensity and entry into AESs is complex and depends on interactions with other factors. Mack et al. (2020) found that production intensity had a significantly negative effect regardless of whether the scheme was result or action-based. They argue this may be because the income foregone increases as intensity increases – and this varies from farm to farm – whereas payment rates are fixed.

1.5.7. Surrounding farms

Engagement in AESs may be enhanced through the availability of neighbouring farmers to manage the land. McGinlay et al. (2017) observe, for example, that landowners and conservation stakeholders who relied on others to manage the land often failed to recruit and retain partners to work the land. The outcome was increased turnover of scheme participants and, in some cases, sites being under-managed. Sullivan et al. (2020) suggest, with respect to restoring upland hay meadows, that studies have shown that when species-rich grasslands are surrounded by intensively managed farmland it can be difficult to maintain the target habitat or species – even where a low management regime is in place on the site itself. Khanna & Ando (2009) note of conservation schemes in the US that farm groups are suspicious of very long contracts

because they “might serve to pull so much land out of production that local economies of scale are compromised and the political power of the agriculture lobby is reduced.”

1.5.8. Ease of implementation – fits in with the farm business

Perceived ease of implementing the scheme can have a positive effect on participation. Defrancesco et al. (2008) found this was particularly the case with grassland conservation measures. Other studies have also suggested that the extent to which the scheme fits into the farm business is a key factor to uptake (Wilson, 1996; Wilson & Hart, 2000; Wynn et al., 2001; Riley, 2006) – for example, having the right farm machinery to do the required management, having a use for the grass/hay produced, or having suitable fields in a convenient position. Riley (2006) for example, points out that hay meadows in the UK are an integral part of most farming systems and changes in their management can have implications for the wider operation of the farm.

1.5.9. Off-farm income and part-time farming

It has been observed that farms that are more dependent on farm income are less likely to engage with AESs (Wossink and van Wenum, 2003). Defrancesco et al. (2008) found that the proportion of total household income from the farm plays a negative role in likely participation in AESs while, at the same time, significantly increases the probability of non-participation. Unay-Gailhard & Bojnec (2015) suggest that off-farm employment is often connected to more extensive systems of production which, as noted above, are more likely to lead to AES participation. Lackner et al. (2020) suggest the literature does not show any clear pattern as far as part-time farming is concerned – with some European studies showing a stronger disposition to adopt conservation measures while others indicate the opposite.

1.5.10. Proportion of rented land

A number of studies have found that the proportion of rented land decreases engagement in agri-environmental schemes because the landowner (not the farmer) has responsibility for making these decisions (Wilson & Hart, 2000; Defrancesco et al., 2008; Ruto & Garrod, 2009) or because rented land adds increased uncertainty to the business (Lastra-Bravo et al., 2015). In Norway where rented land makes up a growing proportion of farms (Forbord et al., 2014) this suggests there may be increasing difficulty in finding participants for restoration schemes.

1.5.11. Effect on land value

If agri-environmental schemes lower the market value of the land farmers have been found to be less willing to enter. Sponagel et al. (2021) suggest this extends to anticipated future increases in market value. For example, Burton (1998) found that farmers were unwilling to convert land to permanent forest – even when provided with strong incentives – because of the “hope value” of the land. As the forests could not

be removed for housebuilding farmers considered the opportunity cost of planting not in terms of agricultural land use, but in terms of the potential value of the land for houses – which was significantly higher.

1.5.12. Total farm labour supply

Defrancesco et al. (2008) found that farms may not participate because of a lack of additional labour to conduct the paperwork and administration necessary for administering the scheme but that a high level of family labour on a farm (which, they suggest, is an indicator of labour-intensive farming) increases the probability of non-participation. In their review paper Lastra-Bravo et al. (2015) observe that Polman and Slangen (2008) and Capitanio et al. (2011) found that having a large proportion of off-farm labour increases the likelihood of AES adoption – especially when the potential for intensive practices is limited and less labour is required. Schaub et al. (2023) concludes that a lack of disposable labour may discourage farmers from implementing AESs unless the AES work required less labour – in which case farmers might use a scheme to reduce labour requirements.

1.5.13. Use of business services and a business-oriented approach

There is evidence that the business orientation of the farm also affects AES adoption. Capitanio et al. (2011 – cited in Lastra-Bravo et al., 2015) found that the use of accountancy services and creation of farm business plan increased uptake of AESs. Lastra-Bravo et al. (2015) contend this may be because with external financial advice farmers are more likely to adopt schemes that do not appeal so much to those with strong farming values.

1.6. Scheme design

The design of the scheme is a critical factor in determining how well a scheme is able to attract participants and thereby achieve its ecological goals. Finn et al. (2009) observe that the design stage is critical, with inadequate design leading to poor environmental performance that can take a considerable period of time to correct. Poor initial design that needs to be adjusted may also initiate trust issues with the implementation process (Ducos et al., 2009) and affecting the overall success of the scheme. A number of key issues have been noted in the literature.

1.6.1. Length of scheme payments

A number of studies have suggested that farmers prefer shorter rather than larger AES contracts with older farmers and farmers renting land in particular preferring shorter contracts (Ruto & Garrod, 2009). This provides farmers with the flexibility to exit the scheme should their situation change – for example, a successor takeover the farm or to respond to changes in market conditions. However, short contracts have the disadvantage that they discourage farmers from investing in environmental provision

– both in terms of the machinery required and the ecological skills and knowledge necessary to manage the land effectively (Burton & Schwarz, 2013). Lengthy contracts may be particularly desirable when the objectives of the scheme are long-term (Ruto & Garrod, 2009) which suggests that, for restoration work, longer contracts are more suitable.

1.6.2. Payment levels

The importance of payment to motivation to engage with AES is well known. Studies have repeatedly shown that, while there are always some farmers willing to engage without payment, many farmers require adequate economic incentives to be encouraged to join schemes (Franks et al., 2016; McGinlay et al., 2017). Ruto & Garrod (2009) observe that farmers generally require higher financial incentives to join schemes with longer contract lengths, that offer less flexibility, or that have higher levels of paperwork. This raises the issue that many of the factors listed here associated with scheme design do not necessarily stop people engaging in the AES (or restoration scheme) but will add additional costs. This has implications for the issue raised by Kimball et al. (2015). Where can the scheme requirements be cut such that, for example, a 10% cut in ecological efficiency results in 80% better uptake of the scheme? Often the main trade off is between giving farmers control and the ability to manage land flexibly and the certainty of ecological outcomes. Bartolini et al. (2021) observe that in general a farmer will opt out of an AES if the expected costs are higher than the expected benefits – but it should be noted that the benefits may not be solely financial.

1.6.3. Periodic adjustment of payments

Periodic adjustment of payments in accordance with market prices for agricultural produce may increase the uptake of AESs (Niens and Marggraf, 2010 – cited in Lastra-Bravo et al., 2015).

1.6.4. Flexibility of scheme

While flexibility is rarely provided in agri-environmental schemes once the farmer has signed the contract, providing farmers with options is thought to have a positive effect on scheme uptake. In particular, farmers should be relatively certain that the practices will not become mandatory or more restrictive (Defrancesco et al., 2008). On the other hand, while eschewing flexibility from the government's perspective, farmers prefer schemes which allow them flexibility in terms of what land is entered and which environmental practices are adopted (Lastra-Bravo et al., 2015). Schaub et al. (2023) observe that 17 out of 19 studies in their review showed management flexibility to positively affect farmers' participation in AESs. In general, the more flexibility the scheme allows (e.g., termination possibilities), the lower the levels of compensation necessary to encourage participation (Epsinosa-Goded et al., 2010; Czajkowski et al., 2021). Flexibility can also influence outcome. For example, Kimball et al. (2015) suggest

that flexible business practices in ecological restoration “all dramatically influenced restoration success and effectiveness”.

1.6.5. Ease of administration

Ruto & Garrod (2009) found that farmers required greater financial incentives to join schemes that have high administrative costs in terms of the volume of paperwork. Ease of administration can vary depending on the size of the farm. Unay-Gailhard & Bojnec (2015) found in Slovenia that large farms with knowledge and experience filling out forms for other Rural Development purposes were the most likely to be able to comply with paperwork required for AES schemes. The implication here is that assistance may need to be provided for smaller farms.

1.6.6. Extent and impact of the required changes

The extent to which the scheme changes impact on farm production and management also has a significant impact on uptake as it effects the opportunity costs. Studies have found that farmers are less responsive to scheme incentives when the required changes had (a) a larger negative effect on food production, and (b) were more comprehensive (prescriptive) (Schaub et al., 2023). Citing references, Dupraz et al. (2009) suggest that the least demanding contracts are the most frequently selected. Lowering the impact of the scheme on farming practices and outputs is likely to increase likelihood of participation, however, to do so may result in a diminishment of the ecological outcomes.

1.6.7. Conflict with other subsidies

Schaub et al. (2023) observe that studies have shown that competing subsidies supporting productivity or direct payments decrease the likelihood of AES engagement because they increase opportunity costs of participation (also McGinlay et al., 2017). Farmers may need to consider what changes will occur in other subsidy payments when engaging with AES. However, one study showed that when payments involve maintaining environmental standards the likelihood of AES participation was higher (Unay-Gailhard & Bojnec, 2015).

1.6.8. Availability of support

Franks et al. (2016) suggest there are numerous studies showing that farmers’ external advisors are required to arrange farmer meetings, lead group development, and coordinate the submission of paperwork.

2. Adoption of restoration schemes

2.1. Introduction

The preceding literature review provides an over-view of factors that might encourage landowners (mainly farmers) to engage in agri-environmental schemes. While, in general, these will be similar whether that scheme involves management or restoration of semi-natural habitats, studies of restoration schemes have made some observations that may be unique to restoration efforts. This part of the review will examine some of these issues before briefly examining some more novel approaches that might be applied. Researchers have noted that studies of restoration success focus strongly on the ecological aspects while knowledge of social and economic issues is lacking (Guerrin, 2015; Rothero et al., 2020).

2.2. Issues with restoration schemes

2.2.1. The need to make restoration activities profitable

The need for the restoration activities to be as profitable as possible was a common theme in both the conservation and restoration literature. For farmers the level of payment, profitability, and whether the scheme fits in with the farm business all contribute to decisions concerning whether to engage with agri-environmental schemes. The more commercially viable biodiversity production can be made, the less compensation required for each individual landowner, thus freeing more funding to be used to increase the quality or quantity of the restoration. For example, Sommer et al. (2023) suggest that acceptance of low-intensity management practices necessary to restore floodplain meadows might increase if a way of profitably using the biomass could be found. A similar problem was noted in the case of APHM by Wehn et al. (2018) where in many cases meadow hay was dumped rather than being sold as a commercial product due to lack of market, small quantities, and sometimes also due to poor quality of the hay. This may be a key issue for restoration on farms in the earlier stages of the life-cycle where business objectives are stronger.

Note that the ultimate goal for authorities is that management will continue once the restoration process is complete, but Waldén & Lindborg's (2018) study noted that the economics of management played a key role in determining whether the grassland continued to be managed. This suggests that once a restoration scheme is completed it will be the economic viability of managing the land in this manner that will be critical to continuation. Thus, finding markets for products is essential if restoration schemes are to be self-sustaining – if not, a continuous payment scheme might be required to maintain the restoration. Farmers in Waldén & Lindborg's (2018) study contended that continued payments were critical to continued management with 27% noting they would not continue managing it if payments were not available. The authors suggest

that moving to a result-based payment system here may have been difficult because of the difficulty in developing and monitoring suitable indicators – however, there was no attempt to assess indicators in the study.

2.2.2. Difficulties restoring habitats where farming methods/communities have changed

The agricultural sector is under constant social, economic, and environmental change. This creates a number of potential problems for restoration schemes when aspects of agriculture necessary to restore land to its original state are no longer present. For example, McGinlay et al. (2016) note with respect to floodplain meadows in the UK that farmers were limited to nutrient inputs form "well rotted farmyard manure" but that changes in the numbers and distribution of livestock in the UK meant that this traditional input was no longer readily available (Rodwell et al., 2007). Waldén & Lindborg's (2018) farmers were limited in terms of the area of land they could enter into the scheme by the number of grazing animals they had. Perhaps even more importantly, the decline in the number of farm managers themselves (see Part 1) can also be problematic for restoration. This can even be the case when the landowners are non-farmers (e.g., NGOs) but are reliant on others to manage the land as it has been found problematic to find farmers to conduct the field work. McGinlay et al. (2017, p. 42) note:

> "… 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."

Walédn & Lindborg (2018) found that landowners who entered the scheme feared they might be unable to find a tenant in the future to manage the restored meadow. Ecological restoration schemes could possibly be managed by specialised land-management organisations. For example, McGinlay et al. (2017, p. 44) observe:

> "The Oxford Meads is a large area of meadows near Oxford (87 ha) with complex and fragmented land ownership, much of which 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."

However, this approach has problems of its own. In particular, the logistics and cost of managing small packages of land distributed widely throughout the countryside suggests this option would be applicable only in a limited number of situations. Further, it could prove particularly problematic due to the seasonal nature of management. A key advantage of engaging farmers to restore environments is that

they have appropriate equipment and labour 'on site' and can manage the land when necessary. Setting up a business model for restoration work based entirely on dedicated contractors is likely to be difficult – suggesting that targeting local farmers remains the best option.

Another issue is that the farming population is aging, and many farms are entering the later stages of the farm life-cycle. As noted in Part 1, as farmers age they reduce the intensity with which they manage the farm and, for livestock farmers, this commonly means reducing the number of animals (or getting rid of them entirely). The result is that farmers no longer have as great a need for fodder and thus the restoration projects are less likely to produce products of use to the farm system. Younger farmers, on the other hand, are trying to build up their herds and require feed. John et al. (2016) observe of the restoration of farmed grassland into lowland hay meadows that, as they represent a major source of fodder for livestock, farmers often stipulate that restoration sites are sufficiently productive to fulfil the needs of the farm. However, to do this may require fertilising, cutting twice a year and rolling the sites using large machinery – which raises issues for the quality of the restoration.

Changing life-style expectations can also create a problem for restoration. For example, Burton & Farstad (2020) observe in a Norwegian study that farmers install milking robots because gender and leisure expectations have changed – with the milking robots enabling farmers to spend time with the family and to take holidays away from the farm. However, to justify the milking robots requires increasing the herd size which, in many cases, means intensifying production or increasing the farm size through reclaiming moorland. In a study of flood-plain restoration in France, Guerrin (2015) reports that farmers believed that their farming techniques and life-styles had changed too much to enable agriculture to return to historic methods needed for restoring the flood plain meadows.

2.2.3. Monitor restoration project success more broadly? Social and economic factors

A number of authors observe that very few papers look at socioeconomic benefits of conservation/restoration[1] (Bullock et al., 2011; Wortley et al., 2013; Kimball et al., 2015) and according to Wortley et al. (2013), when they do, most effort is put into the resource input into the projects or the effects of local community involvement. Wortley et al. (2013) further suggest that in addition to ecological indicators, we need to monitor indicators of success not directly linked to the ecological outputs of the land such as realised social and economic outcomes and impacts. Similarly, McGinlay et al.

[1] Note that when looking at monitoring indicators of success we look at restoration and conservation studies because of the focus of RESTORE on indicators.

(2016) are of the opinion that social processes involved in landscape restoration need to be given equal attention to the biophysical processes. Their concern is that currently assessments follow a 'dominant hegemonic discourse' around the 'natural scientific view' which tends to determine all priorities. The result is that farmer concerns are relegated. As they note:

> "Attempts therefore to detach the two forms of value [biophysical and cultural/social] and relegate one are questionable and may be unrealistic as the two are inextricably linked, and neglect of the maintenance of one aspect of meadow character may have implications for others." (p. 239)

And further add:

> "Assessment activity focused heavily on botanical aspects of value ('natural' value conducted by conservation stakeholders) and to be patchy, inconsistent or absent for other aspects of value such as agricultural value ('social/cultural' value: quality and quantity of hay and pasture)." (p. 239)

The authors further suggest that monitoring and assessment of restoration schemes should also capture other measures of value associated with social and cultural processes co-produced in the landscape. This includes agricultural productivity. Jones et al. (2021) raise the issue of the delivery of cultural services from nature provision – including "cultural capital, social capital, and human capital as specific forms of human-centred capital". The authors suggest that cultural "services" can constitute a significant proportion of what people get from nature. This support's McGinlay's (2016) idea that monitoring should extend beyond natural features such as species numbers or diversity – although cultural services are difficult to measure (Chan et al., 2012).

Kimball et al. (2015, 806) suggest that evaluating costs within restoration schemes "allows for informed decisions regarding best practices" but that currently only 2.5% of restoration studies report both ecological and economic data. The greatest advantage of recording both is that it enables the correct balance between cost and outcome to be reached. This could be critical. Kimball et al. (2015, 806) note that "restoring lands to 40% native cover instead of 50% would free up funds to treat 80% more area". Monitoring may be relatively easy to do as for many farmers this is standard practice. Watzold et al. (2016, 505) suggest that "interviews with farmers indicate that they have excellent knowledge of the factors that influence their profit, including the different timings of mowing and grazing".

However, getting them to monitor farming activities on AES land may be difficult. Few farmers in McGinlay et al.'s (2016) study recorded hay yields despite the fact it was recommended they do so (particularly once they found that the information was not useful for management decisions) and even ceased recording management dates

despite the fact they were required to do so. In fact, very few metrics of agricultural performance were measured, and the information was not shared between farmers.

Scheme requirements themselves may contribute to the lack of monitoring. McGinlay et al. (2016) observe another issue with setting a date for cutting meadows – most commonly 15th of July whereas in the past hay cuts began typically in mid-June. Farmers mowing the meadows effectively stopped making any assessment of the condition of the meadow prior to cutting, believing the date of cutting was "late enough". In this case a design aspect of the scheme intended to improve the quality of the meadow resulted in a loss of engagement by farmers and, potentially, limited the development and recording of useful knowledge.

Restoration work measuring agricultural indicators may assist farmers by giving them a better reason to monitor the fields and, collectively, might provide data to establish whether the payment levels are fair. Although any indications of under-payment may prove a disincentive, this would probably only serve to confirm what farmers are aware of in any case but, importantly, it would provide a solid basis for discussions between farmers and scheme designers concerning changes to the scheme. If farmers were to compare economic outcomes with other farmers, it may also assist community-based learning and thus improve the economic outcomes of the hay meadows. Aspects such as the landscape value could also be monitored. As the maintenance of open landscape is a key reason for farmers to manage the meadows in Norway (Wehn et al., 2018) monitoring landscape impacts could provide a means of establishing a dialogue with farmers and enabling them to appreciate the value of their actions.

The final observation to make here is that restoration work is likely to have impacts beyond the specific land or farms entered into the schemes. For example, Bullock et al. (2011) note that restoration activities at the Sacramento River in California USA had to be reduced in response to farmers complaining about the loss of agricultural production and tax revenue. While a scheme on one field on one farm has local impacts, if a scheme is adopted by multiple farmers over a broader region, it can have undesirable impacts at the regional level. This is also observed in Waldén & Lindborg's (2018, p. 308) study of restoration on grasslands in Sweden where it is noted that

> "[n]eighbouring farmers reducing their production or ceasing farming caused both direct and indirect problems for the remaining farmers, like difficulties buying animals, sharing machines and hiring extra personnel when needed."

Where agricultural production is high and focused on a geographical region, support industries are attracted, and costs reduced through competition between companies – meaning extensive restoration programs can weaken the economic position even of those farmers who do not participate and may thus meet resistance.

2.3. Innovative ideas for restoration from the literature

As part of the objective of RESTORE is to look at innovative approaches to restoration we have identified a number of potential alternatives to conventional AES provision. While some emerge directly from the literature, some of the suggestions are constructed from broader knowledge about the uptake of AESs and how we might address issues that seem problematic.

2.3.1. Land purchase and management rather than AES

Collas & Balmford (2023) in a study of restoration in the UK ask whether it would be more effective for the government to simply purchase land and manage it themselves than to continue with AES schemes targeted at bird species and climate mitigation. The authors found that AESs are more cost-effective if the budget for environmental policies does not increase, but that the land purchase option would deliver more in the long-term if the budgets for conservation were to considerably increase to reflect the severity of the biodiversity and climate crises. Whether this would be an appropriate approach for semi-natural habitat restoration is questionable. Even if the government owned the land, management could still a problem due to the lack of farmers (as noted above). Studies outside the UK have also suggested land purchase may be better than AESs (Curran et al., 2016; Schöttker & Wätzold, 2018). Only in one study which contained different assumptions concerning the costs of contracting organisations, was government ownership found to be less effective (Schöttker et al., 2016). The question of whether government ownership would deliver good ecological outcomes remains open. However, Rothero et al. (2020) found that private landowners had greater success in restoring meadows than either public and charitable owners and private companies – suggesting again the current system of AESs may be more effective than a move to government ownership.

2.3.2. Consuming the biodiversity – "hay-milk" and other possibilities

Another option is to enhance the uptake of restoration measures by increasing the value of farm products. In work done in the UK in the early 2000s tests by chemists, tasting panels and focus groups showed relationships between biodiversity of grazing and food qualities (Buller, 2008). For example, the authors found

> "Lamb meat produced on biodiverse rich grassland (particularly heather pasture systems) displays higher levels of Vitamin E (a natural anti-oxidant affecting shelf life) … fat from lamb grazed on biodiverse rich grasslands recorded generally lower skatole levels (Skatole adversely affects meat odour, particularly during cooking) … and lamb meat from biodiverse rich grassland recorded higher levels of a number of nutritionally healthy fatty acids." (p. 2).

A study in Norway (Sickel et al., 2012) found similar advantages to grazing milk cows on alpine pastures with increased levels of α-Tocopherol (a type of vitamin E) present in milk from cows grazed in biodiverse alpine regions.

Despite these findings, there remains very little literature on the connection between biodiversity and food quality. If this link exists and can be made clearer to consumers the possibility of obtaining a market premium could lead to additional restoration of habitats as the loss of productivity caused by increasing species diversity (Donath et al., 2015) could be compensated by an increase in profitability. An area where this is already being done is with "hay milk" in the European Alps. "Hay Milk" is an EU TSG (Traditional Speciality Guaranteed) for cheese produced from cows fed with meadow hay rather than silage and is particularly important for cheese production in the alpine regions of Europe. Recent studies have suggested that consumers are positive towards hay milk (e.g., Busch et al., 2018; Palmieri et al., 2021) with perceived nutritional qualities a key reason for consuming the milk (or products made using the milk). In Norway, Wehn et al. (2017) observed that some farmers were able to gain a better price from their hay from hay meadows by selling it as "medicine hay" for livestock.

2.3.3. Selling biodiversity as a seed source for further biodiversity – e.g. green hay

Creating a market for hay harvested from biodiverse meadows may provide one option to increase the desirability of restoration. Applying green hay containing seeds from a diverse array of species was the most commonly used approach to restore floodplain hay meadows in the UK in Rothero et al's. (2020) study. There are some examples of farmers being paid for meadow hay as seed hay. For example, Starr-Keddle (2022) observe for hay meadow conservation in the North Pennines (UK) prescriptive payments to maintain traditional management practices have been in place since the late 1980s but, regardless of how well farmers have adhered to the schemes the botanical diversity of upland hay meadows has continued to decline. In their study farmers were paid £500 per hectare of green hay from a 0.6ha of donor area (on each 2 to 3 ha meadow). Donor areas were checked before harvesting to make sure all plants had fully set seed. To establish a market on a broader scale would require farmers to have a reason for improving hay meadows – which suggests that either a "hay-milk" approach (or something similar) or a results-based approach to AES provision would be required.

2.3.4. Incorporating a transition payment?

One idea for promoting the maintenance of restored meadows is to include a payment for cases where the farm transitions from one owner to another. Waldén & Lindborg's (2018) study of restoration of semi-natural grassland in Sweden found that 10% of the restored SNGs had been abandoned again 9-16 years after the restoration. A number of reasons were given for this. However, the authors report a general consensus was

that the failure of having a younger generation to take over the farm played a key role in restored grassland abandonment. This is similar to the problem identified by Wehn et al. (2018) in Norway for the APHM and identifies a possible need to incorporate a transition aspect (e.g., a bonus payment) into restoration schemes. We speculate that one way of addressing this might be a transfer payment to be paid when restored meadows are transferred to a new generation – making it less attractive for the next generation to cease management. This may also encourage farmers who are less sure of succession to engage with restoration schemes.

3. Result-based schemes in Ireland

This section contains information on the structure of results-based schemes in Ireland for use in RESTORE interviews with hay meadow managers.

3.1. REAP scheme and acres

In 2021 Ireland established a one year trial Results Based Environment Agri Pilot Programme (REAP). This scheme was established to test the scorecards for the ACRES scheme, work out any problems, and to train advisors (see https://www.gov.ie/en/service/64388-results-based-environment-agri-pilotprogramme-reap/).

Two options:

- Low Input Grasslands (LIG) – Designed to suit extensive farmers
- Multi-species Leys (MSL) – Designed to suit intensive farmers

In 2023 the "low input grassland" part of trial became part of the new ACRES program.

Objectives:

- To maintain and enhance the sustainability of agricultural grasslands, field boundaries and margins for a range of environmental benefits

Main scheme parameters:

- Total funding limited
- Applications accepted until the maximum budget is allocated
- In the case of over-subscription, the highest graded applications are awarded contracts
- Participation is voluntary
- One application per herd
- Land area entered between 2ha and 10ha
- Not a "whole farm" scheme
- Common land is ineligible
- Management work must be done over the whole period of the contract
- Complimentary actions (late mowing, tree planting, hedge planting, gapping-up) may lead to bonus payments

Farmer has control:

- *No minimum stocking density*
- *No fertiliser limits*
- *No mowing dates set (but no bonus payment if mowed early)*

Limits are replaced with recommendations of how to maximise environmental income

Qualifying for bonus payments:

To qualify for Late Meadow Bonus Payment

- Meadows must be closed to grazing and machinery for 6 weeks prior to cutting
- Earliest meadows cut for hay/silage July 1st
- Meadows may be cut until the end of August

To qualify for Managed Field Margins

- Margins must be managed by flailing/mowing or mulching once per year
- Margins must not be fertilised
- Pesticides may not be used on margins other than spot treatment of invasive plants
- Margins can only be managed between 1st September and 28th of February
- Removing cuttings from margins is voluntary (but recommended)

Training:

- Farmers must engage a (trained) advisor
- Farmers trained 'on farm' by their advisor
- Participants are expected to engage in training (online Webinar)

Evaluating environmental value:

- Land scored in the first year to set a baseline
- Farm features are scored using a scoring sheet
- Scorecards assess field condition, margins and boundaries (state of hedges, stone walls, etc.)
- Scoring is based on defined indicators
- Payments are linked to score and, therefore, environmental quality
- Farms with the highest scores get the greatest payments

Compliance checks:

- Field checks made by the advisor (farmer must be involved)
- Field checks made using scorecards
- Spot-checks may be carried out at the farm level by DAFM (Department of Agriculture, Food and the Marine)
- DAFM may request invoices to prove claim
- Geo-tagged photographs of meadow submitted within 5 days of mowing
- Self-assessed field scores may need to be adjusted – no penalties if within an acceptable range

Payments:

Costs

- Farmers must pay for the advisor
- There are no negative payments if field scores decline[2]

Income

- There is an upper limit to total payments (including bonuses)
- Three payments
    - Participation payment - to cover costs
    - Environmental payment - based on scorecard
    - Complementary payment - any complementary actions

- Late Meadow Bonus Payment for late cutting on low input grassland
- Bonus if a field margin is placed next to a watercourse or drainage ditch
- Time spent training is compensated

3.2. The Burren Programme

In this scheme land managers were (the scheme is now part of ACRES and payment levels have dropped) able to earn up to €7000 a year for managing species rich pastures. This has seen significant
improvements in the average 'score' for the fields between 2010-2021 (see below).

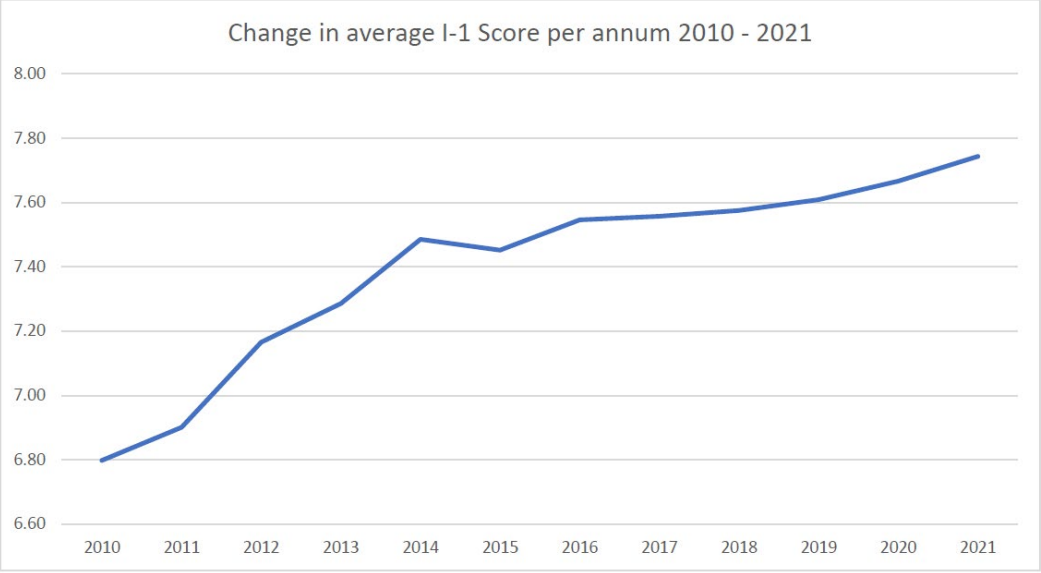
- Environmental health of eligible fields assessed using a scoring system
- Fields are evaluated based on evidence that farmers are carrying out management practices

[2] This is unlikely as farmers must perform management actions developed with the advisor.

- The scoring system also takes account of threats to the habitats present e.g. scrub and weed encroachment etc.
- Assessment measures factors including:

    - Grazing – Whether the field is being grazed appropriately, and whether there are signs of over or under grazing
    - Water – Whether there are signs of damage to springs and water sources
    - Silage – Whether there are signs of supplementary silage feeding. Fields in which silage is fed
    - receive no payments
    - Species – Whether key species associated with high ecological integrity can be found, or whether species which, or whether species which undermine ecological integrity are present undermine ecological integrity are present.

- Fields are scored by trained advisors using a one-page field sheet
- Fields are awarded an overall score of between zero and ten that determines the rate payment farmers receive.
- The results are shared with the farmers, along with recommendations as to as to how they could improve their score in following years.
- The scoring system allows them to make targeted environmental improvements to increase their payments in future years.



Change in the average I-1 (M1) score between 2010-2021 for all fields which were continuously in BFCP-BP since 2010, calculated on the basis of overall area per I-1 score (subset of 557 fields, 4,446ha).

4. Hay Meadow schemes in Norway

4.1. Semi-natural habitats in Norway: the case of hay meadows

Norway has committed to stopping the loss of biodiversity, and nationally set a goal of improving the development of threatened and near-threatened species and habitats (Meld. St. 14 (2015-2016)). The hay meadows (also called flower meadows) are considered one of Norway's most species-rich habitats (Svalheim, 2022). Retaining traditional hay meadows is therefore vitally important for biodiversity (Norderhaug, Ihse & Pedersen, 2000). Hay meadow as a habitat type is an open or highly dispersed semi-natural meadow, created by traditional and local land use (Svalheim, 2022; Bär, Øien & Johansen, 2020). That is, meadows that have not been fertilized, but mowed, grazed and/or harvested for feed once or twice a year (Norwegian Environment Agency, 2016). Over time a habitat type with a very high species diversity emerges.

In the past, hay meadows have been a normal part of active agriculture. However, over the past 50-60 years, farming practices have changed, and hay meadows and semi-natural habitats have been lost for various reasons, including over-fertilization, degradation or decommissioning and re-growth (Svalheim, 2012a; Eriksson, 2002). Hay meadows are now considered critically endangered, are on the Norwegian Red List of habitat types (Hovstad et al., 2018) and contain many vegetation types that are among the most threatened in Norway (Fremstad & Moen, 2001).

There are several processes that cause the loss of semi-natural grassland (of which hay meadows are a part) (Strijker, 2005). First, intensified management creates a transition from semi-natural grassland to arable land. Many farms that previously operated traditionally have been abandoned and many that remain engage in high-intensity agriculture (Losvik, 2003). Even if land is only abandoned for a short period of time there is a risk of losing species (Losvik, 1999). Second, interrupted agricultural management leads to successive changes from grassland to forest (Aune, Bryn & Hovstad, 2018; Olsson, Austrheim & Grenne, 2000). This can also be driven by the fact that overgrowth and planting of forest in new areas have been proposed as important climate measures to increase forestry's contribution to increased uptake of CO^2 (Dahlberg, Emanuelsson & Norderhaug, 2013). Svalheim (2022), on the other hand, points out that hay meadows play important roles in carbon sequestration, air purification, food production, livestock feed, gene bank biodiversity provision, and more.

While nature restoration and conservation are often based on the idea that wilderness and nature should be left to develop without human influence (Bele & Norderhaug, 2013), hay meadows and semi-natural habitats depend on human activity (Svalheim, Garnås & Hauge, 2018; Herzon et al., 2021). Hay meadows are now threatened by the

fact that traditional mowing has ceased as a form of farming, and by re-growth, reforestation, development/construction, cultivation, fertilization, earlier mowing times, a move to silage, grazing as management instead of mowing, climate change, alien species, as well as other factors (Hovstad et al., 2018; Svalheim, 2022). The challenge of recruiting and retaining farmers who operate traditionally poses a major risk to preserving grasslands of high natural value both in Norway and in the rest of Europe (Wehn et al., 2018; McGinlay, Gowing & Budds, 2017).

Research and knowledge gathering that increases available information about historical use of hay meadows, variation, restoration of biodiversity and ecosystem functions typical of hay meadows, can play a key role in the management of hay meadows (Svalheim, 2022). For example, knowledge of how various measures such as grazing and haying, type of grazing animal, grazing period, and grazing pressure etc. created variation of different species is important for restoration attempts (Svalheim, 2022; Losvik, 1988). The literature therefore points to a need to strengthen this knowledge, which, at the moment, is largely limited to how the meadows have been managed recently (Wehn et al., 2018).

A uniform management style, for example only mowing (rather than occasionally grazing) the hay meadows, can have negative consequences for biodiversity (Bele & Svalheim 2017; Wehn et al., 2018). Modern versus traditional cattle breeds also have different impacts on vegetation based on space use and diets (Bele, Johansen & Norderhaug, 2015). Research also shows that a fixed date of mowing is not beneficial for ensuring biodiversity, but, rather, plant species should be used as indicators of when to mow (Wehn et al., 2017; Bele & Svalheim, 2017).

The lack of such traditional knowledge is seen as a major threat as there are few left with knowledge of what management practices have produced the diversity one sees the remains of today, how to use different tools or what to do when (Svalheim, 2022, p. 30; Wehn et al., 2017). It has been suggested that more knowledge can be gained from other sources. In particular, there are still farmers who may be knowledgeable in this area, historical accounts available from internet sources (Burton & Riley, 2018), archives that contain important knowledge about how hay fields were previously managed (Svalheim, Garnås & Hauge, 2018), and reports outlining haying traditions and their significance in specific places are available (Svalheim & Bele, 2017).

It has therefore been suggested that the date of management should be site-specific and based on knowledge of previous traditional practice where available (Wehn & Johansen, 2016). For further follow-up of hay meadows, Svalheim (2022) points out that it is important to strengthen the sectoral cooperation in agriculture, continue to build regional professional communities, and focus on the landscape ecological contexts in which the hay meadows are placed.

4.2. Norwegian schemes for hay meadows

The 2009 national action plan for hay meadows (APHM), administered by the Norwegian Environment Agency (2009), was intended to safeguard hay meadows by giving owners and users grants to maintain and improve the hay meadow (Norderhaug & Svalheim, 2009). The plan was based on "Arvesølvmodellen" (the “Heritage silver model”), a project that facilitated broad cooperation and landowner participation (Svalheim, 2012a; Svalheim, 2022).

Figures from 2018 show that the majority (59%) of the hay meadows in Norway are used for active agriculture and receive production subsidies from the scheme. In addition, 2% are located within various agricultural properties where some parts are in operation and other parts are not. 21% are located on properties not in active agricultural operation, and18% of the mowed fields are located completely outside agricultural land which it is not possible to identify (Svalheim, 2022, p. 42).

While total area of the hay meadow sites has declined, the mid-term report for 2009-2011 (Svalheim, 2012b) pointed out that the action plan has generated enthusiasm. Recently, a new knowledge base has been created for revising the action plan for hay meadows, which provides a professional update and summarises the status of the follow-up work (Svalheim, 2022).

To be eligible for entry into the APHM hay meadows must meet the following selection criteria (Svalheim, 2022):

- The locality must be registered as A or B (‘very important’ or ‘important’ according to the Norwegian Environment Agency handbook) or equivalent status as “Selected habitat type”.
- The meadow must serve as a good example of local meadows
- The landowner/user must be positive to measures, follow-up and planning work
- The landowner/user must agree on a management plan

Local land management plans (skjøtselsplaner) are prepared in cooperation with the landowner and user and are revised after 5-10 years. This plan describes the biodiversity in the meadow, how it has been managed previously and provides a concrete plan for how the meadow should be managed in the future (Svalheim, Garnås & Hauge, 2018). The goal is that the management corresponds to the traditional use of the areas (Svalheim, 2022). See Elverland and Tanstad (2023) for an example of what a management plan might look like.

Apart from concern that the meadow could be depleted by not adding any fertiliser and that this would compromise intentions to maintain hay meadows, a qualitative analysis of the owners/drivers of hay meadows observes that the action plan and

guidelines in the management plan were seen as sensible by the interviewees and that they were easy to adhere to (Wehn et al., 2017). In addition, the report mentions that statements from some informants indicate that their specific experiences were not included in the management plans, even though the plan initially should have been made collaboratively. Instead, the report claims that the management plans can be viewed as expert-oriented and based on a top-down-approach (Wehn et al., 2017, p. 36).

Action plans are implemented and followed up by the County Governor of the Environment Department in each county (in line with the Norwegian Environment Agency's guidelines), with support from the regional management groups (Norwegian Environment Agency, 2013). The management groups consist of representatives from the County Governor's environmental protection department and agriculture department, of selected professionals who are familiar with the habitat type(s) regionally and who possess knowledge in topics such as biodiversity, management/restoration and local history and traditional use (Svalheim, 2022). The management group and the county governor also receive professional support from the Regional Adviser, who trains resource people in registration, valuation, and the production of management plans (Norwegian Environment Agency, 2013). The national coordinator acts as an overarching coordinator between counties, technical advisers, and the management groups, and assists these in the specific follow-up work.

Landowners on non-active farms often apply to the Norwegian Environment Agency's scheme for "threatened habitats", while landowners on active farms who are eligible for agricultural production subsidies often apply for both environmental management schemes and agricultural grant schemes in the Regional Environment Programme (RMP) and receive funding through a combination of these (Svalheim, 2022, p. 60).

The grant scheme for threatened species and habitat types was first established in 2010 for priority species (PA) and selected habitat types (UN) but was expanded from 2015 to include threatened species and habitats in general, both species and habitat types. This subsidy forms the basis for payments for a large proportion of hay meadow measures. As of 2012, those who could apply for measures in selected habitat types were private landowners, associations, municipalities, and institutions. Applications must be made via the Norwegian Environment Agency's electronic application centre, and the Application Centre reports whether the measures have been implemented (Norwegian Environment Agency, 2013). However, this solution may constitute a barrier, Svalheim (2022) suggests, and it may be useful to consider different types of incentives and ways of applying.

Magnusson et al. (2019, p. 3) point out that the scheme for grants to threatened species and threatened habitat types is resource intensive as funds are allocated to a

large number of measures. However, as in addition to the grant funded work applicants contribute private efforts this increases the economic efficacy of the scheme. This is somewhat lower for "threatened habitat types". This may be related to the fact that many of the grants to threatened habitat types go to support the management of hay meadows, for example, where the responses from the applicants indicate that there is a considerable element of idealism (Magnussen et al., 2019). A significant proportion of landowners who apply would probably implement the measures independently of grants, at least in individual years, but there is little doubt that the grants are important for sustaining activity. Wehn et al. (2017) also mention that some of interviewed owners/users would not have mowed if they had not received grants. At the same time, the majority would have mowed differently from the agreed management approach, which would change the character and biodiversity of the hay meadow. This indicates that the schemes work to some degree, but in general there is somewhat limited knowledge and overview of the effectiveness of the interventions that receive support.

Svalheim (2022) points out that landowners on active farms can also apply for SMIL funds (Grants for special environmental measures in agriculture) for restoration and other one-off measures. Furthermore, hay meadows in areas with the status of Selected Cultural Landscape in Agriculture, (UKL) can apply for funding under a separate grant scheme reserved for the 49 areas covered by the scheme. To support habitats around the hay meadows, payments can also be made from the environmental administration's grant scheme "Measures for pollinating insects" (Svalheim, 2022).

Hay meadows are still threatened by overgrowth and decay due to a lack of people to manage and change operations, but an increased focus on the habitat type and species diversity has initiated a promising "restoration trend" (Svalheim, 2022, p. 28; Svalheim, Garnås & Hauge, 2018).

Research shows that the Action Plan has limited the decline in biodiversity by promoting traditional practice (Wehn et al., 2018), and that many of the hay fields would not have been properly managed without the scheme (Wehn & Rønningen, 2017). Nevertheless, the management of hay meadows remains disconnected from active agriculture. In some cases, harvested hay is merely discarded as there is no reliable market or use for hay (Wehn et al., 2018). Reduced importance of hay also diminishes the need to invest in machinery for haymaking and limits the facilities for production and storage (When et al., 2018). Additionally, hay meadow owners and users are still an aging population, along with a lack of successors for these farms (Wehn & Rønningen, 2017). Hay meadows are often small and far away from each other which means that species have less opportunity to spread between sites than before (Svalheim, Garnås & Hauge, 2018). These challenges raise questions about the

future preservation of hay meadows, and the long-term viability of the rich biodiversity associated with this semi-natural habitat.

5. Knowledge needs for understanding uptake of restoration

The preservation and restoration of hay meadows and semi-natural habitats in Norway remains an understudied area, especially from a social science perspective. This section discusses the knowledge gaps and outlines areas for further exploration and understanding of the uptake of preservation, restoration, participation in relevant schemes, and the overall management of hay meadow habitats.

To understand how we can best facilitate the restoration of hay meadows it is necessary to look at what motivates the current hay meadow managers to manage these landscapes. As engagement in such schemes can be affected by a multitude of different factors (see Section 1), it is necessary to identify different "types" of hay meadow managers to ensure policy approaches are adequately targeted. The above review suggests, in particular, that we should look at both farmers and non-farmers, and managers of different ages and at different stages of the family farm life-cycle as we expect these groups to be motivated differently.

Key here is understanding the potential farm succession dynamics. The succession issue could turn out to be a major factor in ensuring the long-term viability of hay-meadow restoration because of the declining number of farmers in Norwegian agriculture and a lack of successors to take over the management of the meadows (Wehn et al., 2018). This is particularly problematic for restoration as it requires a long-term perspective – something which is much more likely at the early stages of the farm family life-cycle (see Section 1). As a result, it is the incentives the next generation of farmers have for engaging in restoration work that will ultimately determine the success of restoration schemes – not only in Norway, but across Europe. What are their motivation? How can we incentivize them to engage with restoration and management?

According to the Norwegian Environmental Agency (2023) there are only around 4000 environmentally valuable hay meadows remaining in Norway, but only 1000 of those receive management subsidies. This raises questions about the ability of current agricultural schemes to preserve these landscape types, and the role of current agricultural schemes related to hay meadow management. To what extent can current agri-environmental policy support the long-term preservation of hay meadows, and how do hay meadow managers imagine this might be improved?

Moreover, assessing how managers experience the management plans is relevant for understanding the uptake of hay meadow preservation. Do the management plans match the hay meadow managers wishes for how to manage the land? Do they give

the hay meadow managers enough flexibility? Does it motivate them to take the required actions?

Understanding the methods employed by managers in hay meadow management is crucial in evaluating their impact on conservation efforts. In that regard, it is also important to understand what role traditional ecological knowledge (TEK) plays in hay meadow management. TEK often encompasses valuable local knowledge and practices that have been passed down through generations and integrating such knowledge could contribute to preserving hay meadows. This includes the level of awareness managers have regarding the plant species within their hay meadows and whether they are used as indicators for understanding the condition of the hay meadow.

Identifying the contemporary challenges associated with hay meadow management is also essential. Has anything changed in modern agriculture making hay meadow management more difficult? Factors such as machinery availability, livestock, time constraints, labor availability, family expectations, community support, economic value and fragmented land holdings could significantly impact preservation, restoration and management efforts. It is crucial to gain further insight into the current infrastructure related to hay meadow management. This includes not only the actual mowing ("slått"), but also activities before and after mowing. For instance, the removal of hay, haymaking, or (absence of) hay demand, and if they have any influence on the motivation to manage hay meadows.

In the fieldwork that follows this report we will be addressing many of these questions – as well as others that might emerge in the course of the research. As with the general objective of RESTORE the work will try to develop new and more effective ways of promoting restoration including, for example, looking at the possibility of introducing results-based schemes. While hay meadows are studied in this example, the same knowledge and mechanisms should be able to be applied to other restoration schemes where the participation of landowners is required. The report itself provides the conceptual basis behind this work and can be used by others as a reference for understanding why conservation and restoration schemes may or may not succeed.

6. References

Atari, D. O., Yiridoe, E. K., Smale, S., & Duinker, P. N. (2009). What motivates farmers to participate in the Nova Scotia environmental farm plan program? Evidence and environmental policy implications. *Journal of Environmental Management*, *90*(2), 1269-1279.

Aune, S., Bryn, A., & Hovstad, K. A. (2018). Loss of semi-natural grassland in a boreal landscape: Impacts of agricultural intensification and abandonment. *Journal of Land Use Science*, *13*(4), 375-390.

Bager, T., & Proost, J. (1997). Voluntary regulation and farmers' environmental behaviour in Denmark and the Netherlands. *Sociologia Ruralis*, *37*(1), 79-96.

Bär, A., Øien, D. I., & Johansen, L. (2020). Forslag til nye definisjoner av slåttemark, slåttemyr og kystlynghei som utvalgte naturtyper basert på lokalitetskvalitet. *NIBIO rapport.*

Barreiro-Hurlé, J., Espinosa-Goded, M., & Dupraz, P. (2010). Does intensity of change matter? Factors affecting adoption of agri-environmental schemes in Spain. *Journal of environmental planning and management*, *53*(7), 891-905.

Bartolini, F., Vergamini, D., Longhitano, D. & Povellato, A. (2021). Do differential payments for agri-environment schemes affect the environmental benefits? A case study in the North-Eastern Italy. *Land Use Policy, 107*, 104862.

Battershill, M. R., & Gilg, A. W. (1997). Socio-economic constraints and environmentally friendly farming in the Southwest of England. *Journal of Rural Studies*, *13*(2), 213-228.

Bele, B., & Norderhaug, A. (2013). Traditional land use of the boreal forest landscape: Examples from Lierne, Nord-Trøndelag, Norway. *Norsk Geografisk Tidsskrift-Norwegian Journal of Geography*, *67*(1), 12-23.

Bele, B., Johansen, L., & Norderhaug, A. (2015). Resource use by old and modern dairy cattle breeds on semi-natural mountain pastures, Central Norway. *Acta Agriculturae Scandinavica, Section A—Animal Science*, *65*(2), 73-84.

Best, H. (2009). Organic farming as a rational choice: empirical investigations in environmental decision making. *Rationality and Society*, *21*(2), 197-224.

Bonnieux, F., Rainelli, P., & Vermersch, D. (1998). Estimating the supply of environmental benefits by agriculture: a French case study. *Environmental and resource economics*, *11*(2), 135-153.

Boon, T. E., Broch, S. W., & Meilby, H. (2010). How financial compensation changes forest owners' willingness to set aside productive forest areas for nature conservation in Denmark. *Scandinavian Journal of Forest Research*, *25*(6), 564-573.

Borsotto, P., Henke, R., Macrì, M. C., & Salvioni, C. (2008). Participation in rural landscape conservation schemes in Italy. *Landscape research*, *33*(3), 347-363.

Brodt, S., Klonsky, K., & Tourte, L. (2006). Farmer goals and management styles: Implications for advancing biologically based agriculture. *Agricultural systems*, *89*(1), 90-105.

Buller, H. (2008). Eating Biodiversity: An Investigation of the Links Between Quality Food Production and Biodiversity Protection. *Rural Economy and Land Use Programme,* 3.

Bullock, J. M., Aronson, J., Newton, A. C., Pywell, R. F., & Rey-Benayas, J. M. (2011). Restoration of ecosystem services and biodiversity: conflicts and opportunities. *Trends in ecology & evolution*, *26*(10), 541-549.

Burns, L. (2020). Challenges to Habitus: Scruffy Hedges and Weeds in the Irish Countryside. *Sociologia Ruralis,* 61 (1), 2-25.

Burton, R. J., Kuczera, C., & Schwarz, G. (2008). Exploring farmers' cultural resistance to voluntary agri-environmental schemes. *Sociologia ruralis*, *48*(1), 16-37.

Burton, R.J.F. & Schwarz, G. (2023). Result-oriented agri-environmental schemes in Europe and their potential for promoting behavioural change. *Land Use Policy 30*, 628– 641.

Burton, R.J.F. (1998). The role of farmer self-identity in agricultural decision making in the Marston Vale Community Forest. PhD, DeMontfort University.

Burton, R.J.F. (2014). The influence of farmer demographic characteristics on environmental behaviour: A review. *Journal of Environmental Management*, *135*, 19-26.

Burton, R.J.F., Farstad, M. (2020). Cultural “lock-in” and mitigating greenhouse gas emissions: the case of dairy/beef farmers in Norway. *Sociologia Ruralis 60* (1), 20-39.

Burton, R.J.F., Forney, J., Stock, P., Sutherland, L-A. (2021). *The Good Farmer: Culture and Identity in Food and Agriculture*. Routledge.

Burton, R.J.F., Otte, P. (2022). Promoting climate change mitigation in agriculture – establishing the need for a farm family life-cycle approach. *Journal of Rural Studies 96*, 270-281

Burton, R.J.F., Riley, M. (2018). Traditional Ecological Knowledge from the internet? The case of hay meadows in Europe. *Land Use Policy, 70*, 334-346

Busch, G., Kühl, S.; Gauly, M. (2018). Consumer expectations regarding hay and pasture-raised milk in South Tyrol. *Austrian Journal of Agricultural Economics and Rural Studies, 27*(11), 79-86.

Calus, M., Van Huylenbroeck, G. & Van Lierde, D. (2008). The relationship between farm assets and farm succession on Belgium farms. *Sociologia Ruralis, 48*(1), 38–56

Capitanio, F., Adinolfi, F., & Malorgio, G. (2011). What explains farmers' participation in rural development policy in Italian southern region? An empirical analysis. *New Medit*, *4*, 19-24.

Chan, K.; Satterfield, T., Goldstein, J. (2012). Rethinking ecosystem services to better address and navigate cultural values. *Ecological Economics 74*, 8–18.

Collas, L.; Balmford, A. (2023). Comparing the cost-effectiveness of delivering environmental benefits through subsidies to farmers vs land purchase. *Biological Conservation, 279*, 109913.

Conradie, B., Treurnicht, M., Esler, K., & Gaertner, M. (2013). Conservation begins after breakfast: The relative importance of opportunity cost and identity in shaping private landholder participation in conservation. *Biological conservation*, *158*, 334-341.

Cullen, P., Ryan, M., O'Donoghue, C., Hynes, S., Huallacháin, D. & Sheridan, H. (2020). Impact of farmer self-identity and attitudes on participation in agri-environment schemes. *Land Use Policy*, *95*, 104660.

Curran, M., Kiteme, B., Wünscher, T., Koellner, T., & Hellweg, S. (2016). Pay the farmer, or buy the land?—Cost-effectiveness of payments for ecosystem services versus land purchases or easements in Central Kenya. *Ecological Economics*, *127*, 59-67.

Curtis, A., & De Lacy, T. (1996). Landcare in Australia: does it make a difference?. *Journal of Environmental management*, *46*(2), 119-137.

Czajkowski, M., Zagórska, K., Letki, N., Tryjanowski, P., & Wąs, A. (2021). Drivers of farmers' willingness to adopt extensive farming practices in a globally important bird area. *Land use policy*, *107*, 104223.

Dahlberg, A., Emanuelsson, U. og Norderhaug, A. (2013). Kulturmark og klima – en kunnskapsoversikt. *DN-Utredning 7.*

Defrancesco, E., Gatto, P., Runge, F., & Trestini, S. (2008). Factors affecting farmers' participation in agri-environmental measures: A Northern Italian perspective. *Journal of agricultural economics*, *59*(1), 114-131.

Donath, T.W., Schmiede, R. & Otte, A. (2015). Alluvial grasslands along the northern upper Rhine – nature conservation value vs. agricultural value under non-intensive management. *Agriculture, Ecosystems and Environment 20*, 102–109.

Ducos, G., Dupraz, P. & Bonnieux, F. (2009). Agri-environment contract adoption under fixed and variable compliance costs. *Journal of Environmental Planning and Management, 52*, 669–687.

Dupraz,P.; Latouche, K., Turpin, N. (2009). Threshold effect and co-ordination of agri-environmental efforts. *Journal of Environmental Planning and Management, 52* (5), 613-630.

Ellis, N. E., Heal, O. W., Dent, J. B., & Firbank, L. G. (1999). Pluriactivity, farm household socio-economics and the botanical characteristics of grass fields in the Grampian region of Scotland. *Agriculture, ecosystems & environment*, *76*(2-3), 121-134.

Elverland & Tanstad (2023). Skjøtselsplan for Laukvika, Karlsøy kommune i Troms og Finnmark fylke. *NIBIO RAPPORT 9*, 14.

Emery, S. B., & Franks, J. R. (2012). The potential for collaborative agri-environment schemes in England: Can a well-designed collaborative approach address farmers' concerns with current schemes?. *Journal of Rural Studies*, *28*(3), 218-231.

Eriksson, O., Cousins, S. A., & Bruun, H. H. (2002). Land-use history and fragmentation of traditionally managed grasslands in Scandinavia. *Journal of vegetation science*, *13*(5), 743-748.

Espinosa-Goded, M., Barreiro-Hurlé, J., & Ruto, E. (2010). What do farmers want from agri-environmental scheme design? A choice experiment approach. *Journal of Agricultural economics*, *61*(2), 259-273.

Filson, G. C. (1993). Comparative differences in Ontario farmers' environmental attitudes. *Journal of Agricultural and Environmental Ethics*, *6*, 165-184.

Finger, R., Lehmann, B., (2012). Adoption of agri-environmental programmes in Swiss Crop production. *EuroChoices, 11* (1), 28-33.

Finn, J. A., Bartolini, F., Bourke, D., Kurz, I., & Viaggi, D. (2009). Ex post environmental evaluation of agri-environment schemes using experts' judgements and

multicriteria analysis. *Journal of Environmental Planning and Management*, *52*(5), 717-737.

Forbord, M., Bjorkhaug, H., Burton, R.J.F. (2014). Drivers of change in Norwegian agricultural land control and the emergence of rental farming. *Journal of Rural Studies, 33*(9)-19.

Franks, J. R., Emery, S. B., Whittingham, M. J., & McKenzie, A. J. (2016). Farmer attitudes to cross-holding agri-environment schemes and their implications for Countryside Stewardship. *International journal of agricultural management*, *5*, 78-95.

Fraser, R. (2002). Moral Hazard and Risk Management in Agri-environmental Policy. *Journal of Agricultural Economics, 53* (3), 475-487.

Fremstad, E. & Moen, A. (2001). Truete vegetasjonstyper i Norge. *Rapport botanisk serie 2001-4. NTNU*, Trondheim.

Galati, A., Sabatino, L., Prinzivalli, C. S., D'Anna, F., & Scalenghe, R. (2020). Strawberry fields forever: That is, how many grams of plastics are used to grow a strawberry?. *Journal of Environmental Management*, *276*, 111313.

Gatto, P., Mozzato, D., & Defrancesco, E. (2019). Analysing the role of factors affecting farmers' decisions to continue with agri-environmental schemes from a temporal perspective. *Environmental Science & Policy*, *92*, 237-244.

General Agreement on Tariffs and Trade Secretariat (GATT). (1994). The Results of the Uruguay Round of Multilateral Trade Negotiations. The Legal Texts.

Glebe, T. & Salhofer, K. (2007). EU agri-environmental programs and the "restaurant table effect". *Agricultural Economics, 37*, 211–218

Guerrin, J. (2015). A floodplain restoration project on the River Rhone (France): analysing challenges to its implementation. *Reg Environ Change 15*, 559–568.

Herzon, I., Raatikainen, K. J., Wehn, S., Rūsiņa, S., Helm, A., Cousins, S. A., & Rašomavičius, V. (2021). Semi-natural habitats in boreal Europe: a rise of a social-ecological research agenda. *Ecology and Society*, *26*(2).

Hovstad, K. A., Johansen L., Arnesen, A., Svalheim, E. og Velle, L. G. (2018). Slåttemark, Semi-naturlig. Norsk rødliste for naturtyper 2018. Artsdatabanken, Trondheim. Hentet 10.10.2023 fra: https://artsdatabanken.no/RLN2018/76

Jackson-Smith, D. B., & McEvoy, J. P. (2011). Assessing the long-term impacts of water quality outreach and education efforts on agricultural landowners. *The Journal of Agricultural Education and Extension*, *17*(4), 341-353.

John, H. Dullau, S., Baasch, A. & Tischew, S. (2016). Re-introduction of target species into degraded lowland hay meadows: How to manage the crucial first year? *Ecological Engineering 86*, 223–230.

Jones, L., Boeri, M., Christie, M., Durance, I., Evans, K. L., Fletcher, D., ... & Waters, R. (2021). Can we model cultural ecosystem services, and are we measuring the right things?. *People and Nature*, *4*(1), 166-179.

Jongeneel, R., Polman, N. & Slangen, L. (2008). Why are Dutch farmers going multifunctional? *Land Use Policy 25*, 81–94.

Khanna, M. & Ando, A. (2009). Science, economics and the design of agricultural conservation programmes in the US. *Journal of Environmental Planning and Management, 52*(5), 575-592

Kimball, S., Lulow, M., Sorenson, Q., Balazs, K., Fang, Y.-C., Davis, S. J., O'Connell, M. T., & Huxman, E. (2015). Cost-effective ecological restoration. *Restoration Ecology, 23* (6), 800–810.

Kreutzwiser, R., de Loe, R., Imgrund, K., Conboy, M. J., Simpson, H., & Plummer, R. (2011). Understanding stewardship behaviour: factors facilitating and constraining private water well stewardship. *Journal of environmental management*, *92*(4), 1104-1114.

Kristensen, L. S., Thenail, C., & Kristensen, S. P. (2004). Landscape changes in agrarian landscapes in the 1990s: the interaction between farmers and the farmed landscape. A case study from Jutland, Denmark. *Journal of Environmental management*, *71*(3), 231-244.

Lakner, S., Zinngrebe, Y. & Koemle, D. (2020). Combining management plans and payment schemes for targeted grassland conservation within the Habitats Directive in Saxony, Eastern Germany. *Land Use Policy, 97*, 104642.

Lakner, S., Zinngrebe, Y., & Koemle, D. (2020). Combining management plans and payment schemes for targeted grassland conservation within the Habitats Directive in Saxony, Eastern Germany. *Land Use Policy*, *97*, 104642.

Lambert, D.M., Sullivan, P. & Claassen, R. (2007). Working farm participation and acreage enrollment in the Conservation Reserve Program. *Journal of Agricultural and Applied Economics, 39*, 151–169.

Läpple, D. (2010). Adoption and abandonment of organic farming: an empirical investigation of the Irish drystock sector. *Journal of agricultural Economics*, *61*(3), 697-714.

Lastra-Bravo, X. B., Hubbard, C., Garrod, G., & Tolón-Becerra, A. (2015). What drives farmers' participation in EU agri-environmental schemes?: Results from a qualitative meta-analysis. *Environmental Science & Policy*, *54*, 1-9.

Lobley, M., Wakefield, D., Butler, A., & Turner, M. (2004). *The state of farming on Exmoor 2004: a report to Exmoor National Park Authority*. Centre for Rural Policy Research, University of Exeter.

Losvik, M.H. (1988). Phytosociology and Ecology of Old Hay Meadows in Hordaland, Western Norway in Relation to Management. *Vegetatio 78*, 3, 157-187

Losvik, M.H. (1999). Plant species diversity in an old, traditionally managed hay meadow compared to abandoned hay meadows in southwest Norway. *Nordic Journal of Botany 19*(4), 473-487

Losvik, M.H. (2003). Species-rich hay meadow sites in West Norway: conservation and management. *Transactions on Ecology and the Environment 64*, 1133-1141

Magnussen, K., Dombu, S. V., Rød, M. E., Nastad, A. T., Angell-Petersen, S., & Bergan, P. I. (2019). Evaluering av tilskudd til truede arter og truede naturtyper. MENON-PUBLIKASJON NR. 107/2019 M-1588

Mathijs, E. (2003). Social capital and farmers' willingness to adopt countryside stewardship schemes. *Outlook on agriculture*, *32*(1), 13-16.

McGinlay, J., Gowing, D. J. G., & Budds, J. (2016). Conserving socio-ecological landscapes: An analysis of traditional and responsive management practices for floodplain meadows in England. *Environmental Science & Policy, 66*, 234–241.

McGinlay, J., Parsons, D. J., Morris, J., Hubatova, M., Graves, A., Bradbury, R. B., & Bullock, J. M. (2017). Do charismatic species groups generate more cultural ecosystem service benefits? *Ecosystem Services 27*, 15–24.

Meld. St. 14 (2015-2016). *Nature for life – Norway's national biodiversity action plan*. Ministry of Climate and Environment.

Moon, K., Marshall, N., & Cocklin, C. (2012). Personal circumstances and social characteristics as determinants of landholder participation in biodiversity conservation programs. *Journal of environmental management*, *113*, 292-300.

Murphy, G., Hynes, S., Murphy, E., O'Donoghue, C., & Green, S. (2011). Assessing the compatibility of farmland biodiversity and habitats to the specifications of agri-environmental schemes using a multinomial logit approach. *Ecological Economics*, *71*, 111-121.

Myrvoll, E. R., & Skogheim, R. (2002). Kulturminnevern i kommunene. Kompetansekartlegging i kommunene Sør-Varanger, Skjervøy, Gjøvik, Skedsmo og Råde.

Niens, C., & Marggraf, R. (2010). Recommendations for increasing the acceptance of agri-environmental schemes-results of an empirical study in Lower Saxony. *Berichte über Landwirtschaft*, *88*(1), 5-36.

Norderhaug, A. & Svalheim, E. (2009). Faglig grunnlag for handlingsplan for trua naturtype: Slåttemark i Norge. Bioforsk Report 4 (57/2009).

Norderhaug, A., Ihse, M. & Pedersen, O. (2000). Biotope patterns and abundance of meadow plant species in a Norwegian rural landscape. *Landscape Ecology, 15*, 201–218

Norwegian Environment Agency (2009). Handlingsplan for slåttemark. DN rapport 2009-6. faktaark-hp-slattemark-utkast-2013_2.pdf (miljodirektoratet.no)

Norwegian Environment Agency (2013). Faktaark: Handlingsplan for slåttemark – organisering og status våren 2013.

Norwegian Environment Agency (2016). Slå et slag for slåttemarka! M-566/2016. Miljødirekoratet.

Norwegian Environmental Agency (2023). Miljøstatus: Slåttemark. Slåttemark (miljodirektoratet.no).

O'Keefe, D. J. (2002). *Persuasion: Theory and Research* (2nd ed.). Sage Publicaitons.

Olsson, E. G. A., Austrheim, G. & Grenne, S. N. (2000). Landscape change patterns in mountains, land use and environmental diversity, mid-Norway 1960-1993. *Landscape Ecology*, *15*, 155–170.

Palmieri, N., Pesce, A., Verrascina, M., & Perito, M. A. (2021). Market opportunities for hay milk: Factors influencing perceptions among italian consumers. *Animals*, *11*(2), 431.

Pavlis, E. S., Terkenli, T. S., Kristensen, S. B., Busck, A. G., & Cosor, G. L. (2016). Patterns of agri-environmental scheme participation in Europe: Indicative trends from selected case studies. *Land Use Policy*, *57*, 800-812.

Pfeifer, C., Jongeneel, R. A., Sonneveld, M. P., & Stoorvogel, J. J. (2009). Landscape properties as drivers for farm diversification: A Dutch case study. *Land Use Policy*, *26*(4), 1106-1115.

Polman, N. & Slangen, L. (2008). Institutional design of agri-environmental contracts in the European Union: the role of trust and social capital. *NJAS-Wageningen Journal of Life Sciences, 55*, 413–430.

Potter, C., & Lobley, M. (1992). The conservation status and potential of elderly farmers: results from a survey in England and Wales. *Journal of Rural Studies*, *8*(2), 133-143.

Riley, M. (2006). Reconsidering conceptualisations of farm conservation activity: The case of conservaing hay meadows. *Journal of Rural Studies, 22* (3), 337-353.

Riley, M. (2009). Bringing the 'invisible farmer'into sharper focus: gender relations and agricultural practices in the Peak District (UK). *Gender, place and culture*, *16*(6), 665-682.

Rodwell, J., Morgan, V., Jefferson, R., Moss, D. (2007). The European Context of British Lowland Grasslands. *Report-Joint Nature conservation committee, 394*.

Rothero, E., Tatarenko, I., & Gowing, D. (2020). Recovering lost hay meadows: An overview of floodplain-meadow restoration projects in England and Wales. *Journal for Nature Conservation*, *58*, 125925.

Ruto, E., & Garrod, G. (2009). Investigating farmers' preferences for the design of agri-environment schemes: a choice experiment approach. *Journal of Environmental Planning and Management*, *52*(5), 631-647.

Sandberg, M. & Jakobsson, S. (2018). Trees are all around us: Farmers' management of wood pastures in the light of a controversial policy. *Journal of Environmental Management, 212*, 228-235

Schaub, S., Ghazoul, J., Huber, R., Zhang, W., Sander, A., Rees, C., ... & Finger, R. (2023). The role of behavioural factors and opportunity costs in farmers' participation in voluntary agri-environmental schemes: A systematic review. *Journal of Agricultural Economics*, *74* (3), 617-660.

Schomers, S., Meyer, C., Matzdorf, B., & Sattler, C. (2021). Facilitation of public Payments for Ecosystem Services through local intermediaries: An institutional analysis of agri-environmental measure implementation in Germany. *Environmental Policy and Governance*, *31*(5), 520-532.

Schöttker, O., & Wätzold, F. (2018). Buy or lease land? Cost-effective conservation of an oligotrophic lake in a Natura 2000 area. *Biodiversity and Conservation*, *27*, 1327-1345.

Schwarz, G., Moxey, A., McCracken, D., Huband, S., & Cummins, R. (2008). An analysis of the potential effectiveness of a Payment-by-Results approach to the delivery

of environmental public goods and services supplied by Agri-Environment Schemes. *Report to the Land Use Policy Group, UK, 108pp. Macaulay Institute, Pareto Consulting and Scottish Agricultural College*.

Sereke, F., Dobricki, M., Wilkes, J., Kaeser, A., Graves, A. R., Szerencsits, E., & Herzog, F. (2016). Swiss farmers don't adopt agroforestry because they fear for their reputation. *Agroforestry systems*, *90*, 385-394.

Sickel, H., Bilger, W., & Ohlson, M. (2012). High Levels of α-Tocopherol in Norwegian Alpine Grazing *Plants Journal of Agricultural and Food Chemistry* 60 (31), 7573-7580.

Siebert, R., Berger, G., Lorenz, J., & Pfeffer, H. (2010). Assessing German farmers' attitudes regarding nature conservation set-aside in regions dominated by arable farming. *Journal for Nature Conservation*, *18*(4), 327-337.

Siebert, R., Toogood, M., & Knierim, A. (2006). Factors affecting European farmers' participation in biodiversity policies. *Sociologia ruralis*, *46*(4), 318-340.

Skerratt, S., & Dent, J. B. (1996). The challenge of agri-environmental subsidies: the case of Breadalbane Environmentally Sensitive Area, Scotland. *Scottish Geographical Magazine*, *112*(2), 92-100.

Smithers, J., & Furman, M. (2003). Environmental farm planning in Ontario: exploring participation and the endurance of change. *Land Use Policy*, *20*(4), 343-356.

Sommer, L., Klinger, Y. P., Donath, T. W., Kleinebecker, T., & Harvolk-Schöning, S. (2023). Long-term success of floodplain meadow restoration on species-poor grassland. *Frontiers in Ecology and Evolution*, *10*, 1061484.

Sponagel, C., Angenendt, E., Piepho, H.-P. & Bahrs, E. (2021). Farmers' preferences for nature conservation compensation measures with a focus on eco-accounts according to the German Nature Conservation Act. *Land Use Policy, 104*, 105378.

Starr-Keddle, R. E. (2022). Evaluating the success of upland hay meadow restoration in the North Pennines, United Kingdom, using green hay transfer. *Ecological Solutions and Evidence*, *3*(1), e12134.

Strijker, D. (2005). Marginal lands in Europe—causes of decline. *Basic and Applied Ecology*, *6*(2), 99-106.

Sullivan, E., Hall, N., & Ashton, P. (2020). Restoration of upland hay meadows over an 11-year chronosequence: an evaluation of the success of green hay transfer. *Restoration Ecology*, *28*(1), 127-137.

Sutherland, L. A., & Burton, R. J. (2011). Good farmers, good neighbours? The role of cultural capital in social capital development in a Scottish farming community. *Sociologia Ruralis*, *51*(3), 238-255.

Sutherland, L. A., Mills, J., Ingram, J., Burton, R. J., Dwyer, J., & Blackstock, K. (2013). Considering the source: Commercialisation and trust in agri-environmental information and advisory services in England. *Journal of environmental management*, *118*, 96-105.

Svalheim, E. & Bele, B. (2017). Slåttetradisjoner – med eksempler fra Telemark og Møre og Romsdal. *NIBIO–POP 3*(9).

Svalheim, E. (2012a). Arvesølvprosjektet. En pådriver for det kulturavhengige biomangfoldet. *Bioforsk Rapport*, *192*(7).

Svalheim, E. (2012b). Oppfølging av handlingsplan for slåttemark. Midtveisrapport for perioden 2009 t.o.m. 2011. *Bioforsk Rapport, 7*(167)

Svalheim, E. (2022). Kunnskapsgrunnlag for slåttemark og lauveng for nasjonal handlingsplanperiode 2023-2037. *NIBIO Rapport, 8(138).*

Svalheim, E., Garnås, I. M. B., & Hauge, L. (2018). Slåttemark, veileder for restaurering og skjøtsel. *Nibio rapport*, 4(151).

Traoré, N., Landry, R., & Amara, N. (1998). On-farm adoption of conservation practices: the role of farm and farmer characteristics, perceptions, and health hazards. *Land economics*, 114-127.

Tyllianakis, E., & Martin-Ortega, J. (2021). Agri-environmental schemes for biodiversity and environmental protection: How we are not yet “hitting the right keys”. *Land Use Policy*, *109*, 105620.

Unay-Gailhard, I. & Bojnec, Š. (2015). Farm size and participation in agri-environmental measures: Farm-level evidence from Slovenia. *Land Use Policy, 46*, 273–282.

Unay-Gailhard, I. & Bojnec, Š. (2021, August 17-31). Young Farmers' Attitudes Towards Agri-Environmental-Climate Measures: Do Young Women Farmers Make a Difference?. Virtual conference, *International Association of Agricultural Economists*.

van Dijk, W. F., Lokhorst, A. M., Berendse, F., & De Snoo, G. R. (2016). Factors underlying farmers’ intentions to perform unsubsidised agri-environmental measures. *Land use policy*, *59*, 207-216.

Van Rensburg, T. M., Murphy, E., & Rocks, P. (2009). Commonage land and farmer uptake of the rural environment protection scheme in Ireland. *Land Use Policy*, *26*(2), 345-355.

Vanslembrouck, I., Van Huylenbroeck, G., & Verbeke, W. (2002). Determinants of the willingness of Belgian farmers to participate in agri-environmental measures. *Journal of agricultural economics*, *53*(3), 489-511.

Villamayor-Tomas, S., Sagebiel, J., & Olschewski, R. (2019). Bringing the neighbors in: A choice experiment on the influence of coordination and social norms on farmers' willingness to accept agro-environmental schemes across Europe. *Land use policy*, *84*, 200-215.

Waldén, E. & Lindborg, R. (2018). Facing the future for grassland restoration – What about the farmers?. *Journal of Environmental Management, 227*, 305-312.

Walster, E., Aronson, E., Abrahams, D. (1966). On increasing the persuasiveness of a low prestige communicator. *Journal of Experimental Social Psychology, 2*(4), 325-342

Wätzold, F., Drechsler, M., Johst, K., Mewes, M., & Sturm, A. (2016). A Novel, Spatiotemporally Explicit Ecological-economic Modeling Procedure for the Design of Cost-effective Agri-environment Schemes to Conserve Biodiversity. *American Journal of Agricultural Economics*, *98*(2), 489-512.

Wehn, S. & Rønningen, K. (2017). Prosjekt ENGKALL: Tilpasset skjøtsel av verdifulle slåtteenger. *Blyttia*, 75 (4), 209-216.

Wehn, S., & Johansen, L. (2016). Implications for conservation management of hay meadows; cutting dates. In *The multiple roles of grassland in the European bioeconomy. Proceedings of the 26th General Meeting of the European Grassland Federation, Trondheim, Norway, 4-8 September 2016* (pp. 615-617). NIBIO.

Wehn, S., Burton, R., Riley, M., Johansen, L., Hovstad, K. A., & Rønningen, K. (2018). Adaptive biodiversity management of semi-natural hay meadows: The case of West-Norway. *Land Use Policy*, *72*, 259-269.

Wehn, S., Johansen, L., Hovstad, K., Rønningen, K., & Burton, R. J. (2017). Tilpasset skjøtsel av verdifulle slåttemarker basert på brukererfaringer og tradisjonell og forskningsbasert kunnskap–ENGKALL. *NIBIO rapport*, *3*(149).

Wilson, G. A. (1996). Farmer environmental attitudes and ESA participation. *Geoforum, 27*(2), 115-131.

Wilson, G. A. (1997). Factors influencing farmer participation in the environmentally sensitive areas scheme. *Journal of environmental management*, *50*(1), 67-93.

Wilson, G. A. (2001). From productivism to post-productivism. and back again? Exploring the, (un)changed natural and mental landscapes of European agriculture. *Trans. Inst. Br. Geograph., 26*(1), 77-102.

Wilson, G. A., & Hart, K. (2000). Financial imperative or conservation concern? EU farmers' motivations for participation in voluntary agri-environmental schemes. *Environment and planning A*, *32*(12), 2161-2185.

Wortley L., Hero, J. M. & Howes, M. (2013). Evaluating ecological restoration success: a review of the literature. *Restoration Ecology, 21*, 537–543

Wossink, G. A. A., & van Wenum, J. H. (2003). Biodiversity conservation by farmers: analysis of actual and contingent participation. *European review of agricultural economics*, *30*(4), 461-485.

Wynn, G., Crabtree, B., & Potts, J. (2001). Modelling farmer entry into the environmentally sensitive area schemes in Scotland. *Journal of agricultural economics*, *52*(1), 65-82.

Yiridoe, E. K., Atari, D. O. A., Gordon, R., & Smale, S. (2010). Factors influencing participation in the Nova Scotia environmental farm plan program. *Land Use Policy*, *27*(4), 1097-1106.

Zhou, M., Lu, B., Fan, W., & Wang, G. A. (2018). Project description and crowdfunding success: an exploratory study. *Information Systems Frontiers*, *20*, 259-274.

FORMÅL

RURALIS - Institutt for rural- og regionalforskning skal gjennom fremragende samfunnsvitenskapelig forskning og forskningsbasert utviklingsarbeid gi kunnskap og idéer for allmenheten, privat næringsliv, offentlig virksomhet og FoU-sektoren, og gjennom det bidra til å skape sosiokulturell, økonomisk og økologisk bærekraftig utvikling i og mellom bygd og by.

RURALIS skal være et nasjonalt senter for å utvikle og ta vare på en teoretisk og metodisk grunnleggende forskningskompetanse i flerfaglige bygdestudier, og fungere som et godt synlig knutepunkt for internasjonal ruralsosiologi.

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