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Abstract:

The Sheep and Trees Initiative was introduced by the Scottish Government in 2017 as part of wider efforts to support farm diversification and the promotion of tree planting aligned with meeting sustainable development objectives. Designed to promote integrated forestry in upland farming across Scotland, the initiative has, to date, had a very low uptake. This study explores attitudes within the Scottish upland farming community towards integrated forestry in general and the Sheep and Trees Initiatives specifically in an attempt to understand why uptake has been low. We found that although upland farmers had positive attitudes towards certain types of integration, reinforcing the findings of previous studies, negative attitudes were also widespread which could act as a deterrent towards participation in the Sheep and Trees Initiative. The species of trees and styles of planting supported by the Sheep and Trees Initiative appear to be misaligned with the preferences of farmers wishing to adopt an integrated forestry system. The paper concludes with some recommendations for refining the Sheep and Trees Initiative which could enhance its attractiveness to large scale, commercial concerns and to other upland farmers interested in planting trees for amenity and environmental benefits.

Keywords

integrated forestry: upland farming; Sheep and Trees Initiative

Introduction

In the uplands of Scotland many challenges are faced when attempting to balance what are often conflicting land uses (SNH, no date). Upland livestock farming has been important for many years, providing employment, contributing to national food production efforts, and helping to create and sustain the landscape and cultural capital many people associate with rural Scotland. However, external pressures that include calls for rewilding, changes to agricultural subsidy regimes and wider economic challenges facing the farming industry pose a threat to this land use (NSA, 2013, Monbiot, 2013, Fisher and Marshall, 2010). Pressures on upland farming are set to increase in the context of Brexit (McCracken and Thomson, 2018). Diversification – introducing new/ multiple income streams[i] - could help to mitigate these pressures and provide a means of securing a long-term future for livestock rearing in the uplands. The Sheep and Trees initiative is an example of how a new policy relationship, one that explicitly links upland livestock farming and forestry policy, could be developed.

Tree planting provides an interesting diversification proposition for upland farmers in Scotland which could bring both economic and environmental benefits (Perks et al. 2018). Ambitious government tree planting targets, currently proposing that 15,000 hectares per year will be afforested by 2024/5 (Scottish Government, 2018) can only be achieved if large amounts of land are turned over to forestry. Bastin et al (2019) suggest that most of the potential for tree planting in Scotland is on grazing land and thus for national tree planting targets to be met a return to whole farm scale tree planting, which was common in the past (Dandy, 2012), is required. To avoid the risk of land abandonment it is important that trees are planted in a manner that supports existing agriculture (Morgan-Davis et al., 2012). Integrated woodland planting, or

agroforestry (see Figure 1 for definitions), has potential to help minimise conflict between grazing and woodland as on-farm land uses.

Background context

The profitability of sheep farming in less favourable areas (LFA) such as the Scottish uplands has decreased in recent decades and, concurrently, this sector has become increasingly reliant upon agricultural subsidies to remain financially viable (see Kerr, 2005 cited in Morgan-Davies et al., 2008). The future of these subsidies in post-Brexit Britain is uncertain and, if they are abolished, upland land abandonment could occur as has already been the case elsewhere in Europe (Morgan-Davies et al. 2017, Morgan-Davies et al. 2012). Albon et al (2007) reported that upland sheep farming is unsustainable because of its damaging effects on soil and vegetation. It is thought that reducing sheep densities in the uplands could have beneficial environmental impacts such as reducing moorland damage (Ross et al., 2016, Albon et al., 2007) and increasing soil organic carbon (Smith et al., 2014). Increasing the economic viability of sheep farming is a socio-economic priority (NSA, 2016). If required to move to lower livestock stocking densities farm businesses are likely to experience serious financial hardship (Matthews et al., 2006, Morgan-Davies et al., 2012).

The financial uncertainties associated with Brexit are a real threat to upland farming across the UK. The precarious financial position of contemporary farming has been reported in many quarters. Upland sheep farming has been shown to be unprofitable without subsidies (Eskedalemuir, 2014, Acs et al. 2010). At the time of writing, alternatives to subsidies administered under the Common Agricultural Policy remain unspecified. A third of Scottish lamb is exported to the EU (NSA, 2013) thus any changes to existing trading relationships with European Union member states could

see this important source of income threatened. In consequence, further attempts need to be made to align business models with the need to reduce grazing and increase economic sustainability. One option is to make more use of integrated woodland planting within farm business practices. The potential of upland agroforestry is now considered (see Figure 1 for definitions and Figure 2 for illustrations of different types of integrated woodland planting).

Attitudes towards, and barriers to the adoption of agroforestry

Previous research has shown that woodland integration is feasible and potentially desirable in Scotland as a means of supporting upland farm business diversification. Burton et al. (2018) included agroforestry as a key element in two woodland expansion visions designed by stakeholders. Perks et al. (2018) suggested the use of silvopastoral systems with woodland grazing and shelterbelts may be suitable in upland areas. Morgan-Davies et al., (2008; 2012) showed that an upland Scotland silvopastoral system, combining sheep and native woodland, was an achievable and beneficial system. Their research found that 23% of farmers were willing to diversify, with half already having made changes and 11.5% having diversified through afforestation. Here agroforestry was shown to have positive results, increasing overall productivity by 20% when tested in Perthshire.

These studies show that, although agroforestry is not always considered as an option for the uplands (Matthews et al., 2006), it could be part of efforts to support a sustainable future land use. Research undertaken by Bell (2014) and Bell and Greaves (2010) demonstrated positive economic impacts of forestry and integrated woodland schemes in upland environments. However, in these studies some government funding was required for the schemes to be economically viable and attractive to those it sought

to support. Subsidies, whether they be presented as agricultural and/or forestry support measures or carbon mitigation efforts will thus be crucial for encouraging further integration of woodland and upland livestock farming.

Farmers' attitudes towards large scale, commercial upland afforestation have traditionally been negative, which creates a barrier to achieving tree planting ambitions supported under agroforestry schemes (Hopkins et al. 2017). Numerous studies have reported the reluctance of farmers to afforest their land (*c.f.* Scambler, 1989, Mather and Thomson, 1995, Mather, 1996; Feliciano et al., 2014; Warren et al, 2016; Hopkins et al., 2017,), with particular reluctance identified in the uplands (Slee et al., 2012). Soil and climatic conditions may present location-specific challenges for introducing woodland on upland farms. For example, a need for soil improvements, such as fertiliser application before and after planting, could act as deterrent. Younger, better educated farmers appear to be the most willing to afforest land (Sutherland et al., 2016, Howley et al., 2015, Scambler, 1989). Farmers' values around food production, lifestyle, and reputation have also been found to be important determinants of attitudes to afforestation (Howley et al., 2015). As succinctly put by Warren et al. (2016, p176) "Farmers are … not the pure profit maximisers of economic models but are influenced by social norms, cultural beliefs, socio-psychological factors, aesthetic judgements and personal values concerning nature, family and community". Although these demographic and value predictors appear useful, farm characteristics are equally, if not more important determinants. Studies by Nijnik and Mather, (2008), Howley et al, (2015) and Crabtree et al (2001) all showed that larger farms that have existing woodland and are not involved in intensive activities such as dairying are the most likely to plant woodland. Traditional tenancy models may be a barrier to farmers introducing forestry activities. Burton (1998) noted that tenants need permission from

their landlord to plant trees and Towers et al. (2006), cited in Warren et al. (2016) observed that landlords often retain control of woodlands on tenanted land. Other research suggests that farms which are struggling financially are risk adverse, and thus unlikely to plant trees (Howley et al., 2015, Hopkins et al., 2017, Sutherland et al., 2016), although Morgan-Davies et al. (2012) found that an upland farmer had chosen to diversify with forestry when forced to reduce sheep numbers. Engagement with agroforestry is thus driven by a complex mix of internal and external drivers: farm characteristics, farm household attributes, management styles and aspirations for the business mediate responses to new initiatives which are also evaluated within the content of existing government subsidies and agricultural and forestry policy (Hopkins et al., 2017).

Rois-Díaz et al. (2018) found that farmers recognise the benefits of, and have positive attitudes towards agroforestry, as did Langenberg et al (2018). However, these studies both identified barriers to agroforestry adoption, including the voluntary nature of agroforestry and the lack of targeted (funded or subsidised) schemes. A need for financial support was also identified in Bullock et al.'s (1994) English study. Although some studies (e.g. Howley et al., 2015) have highlighted that farmers' behaviour is controlled by more than financial implications, others (e.g. García de Jalón et al., 2018, Rois-Díaz et al., 2018, Burgess and Rosati, 2018, Graves et al., 2017) have shown that farmers who are interested in agroforestry are discouraged from introducing it because of the associated costs. In contrast to commercial forestry, which has been planted and managed separately to agricultural activities and incentivised through subsidies for many years, agroforestry (explicitly integrating agricultural and forestry activities) has not received similar financial support. Large-scale European studies reported that 50% of farmers were interested in agroforestry, specifically silvoarbale practices (Graves et

al. 2009, Sereke et al., 2016), with the main barriers to adoption here being reputation (Sereke et al., 2016) and complexity of work. García de Jalón et al., (2018) found that, for livestock agroforestry, systems costs and additional management were the main barriers to adoption.

Incentivising agroforestry

Scottish Government agricultural and land use policy measures have, in recent decades, included various policies seeking to encourage the planting of native woodlands. Today, and specifically directed towards upland farmers, the Forestry Grant Scheme (hereafter FGS), provides funding for planting, establishment, and maintenance of trees (Scottish Government, no date). Within the FGS a number of targeted options are available but, to date, uptake of woodland integration policy support measures has been very low (Wright, 2019). The reasons for this are unclear but they most likely align with long-held, negative attitudes towards tree planting common amongst the farming community which previous research has attributed to: (i) issues with specific policies (Wynne-Jones, 2013); (ii) concerns over permanence, i.e. land is occupied by trees for many years before they can be harvested, (Heald and Farquhar, 2016); (iii) a prevailing productivist ethos (food production being prioritised over, for example, farming for environmental benefits); (iv) a lack of knowledge (Heald and Farquhar, 2016, Hopkins et al. 2017) and (v) the requirement for tenant farmers to obtain permission from landlords to plant trees (Burton, 1998).

Current Scottish agroforestry policy aims to remove the capital cost of planting, which has often been cited as a barrier to participation in previous schemes. However, the low uptake suggests that barriers to woodland integration in farming persist. Despite barriers to participation in agroforestry having been researched in many

national contexts, some of which has been reported above, the topic is under researched in Scotland which means that policymakers have little evidence upon which to base the design of Scottish schemes. Good scheme design is critical to generating good levels of uptake (Wynne-Jones, 2013) which is, in turn, critical to delivering government targets. It is within this context that a new scheme - the Sheep and Trees initiative - launched at the Royal Highland Show in June 2017 (Priestley, 2017) provides an opportunity to see if a new approach to incentivising on-farm woodland creation will increase uptake.

The Sheep and Trees initiative (hereafter S&T), a policy mechanism administered by Scottish Forestry, is a new effort to build relationships between upland livestock farming and forestry policy (see Figure 3). It combines two funding opportunities, woodland creation and forest infrastructure. The former encourages upland farmers to plant small stands, between 10 and 50 hectares, of productive conifer on farms where sheep farming will continue. The latter may be used to develop on-farm access routes which will, for example, facilitate timber harvesting. The S&T initiative is directly aimed at upland farmers planting productive conifer, offering funding to establish and manage productive conifers in small plantings on farms where sheep farming will continue. It aims to improve the productivity of sheep farming by increasing shelter and animal wellbeing and diversifying income streams by providing a timber crop. The system can be managed as wood pasture once trees are mature. Applications to the scheme may be submitted year round, making it an accessible funding opportunity. Reporting on the launch of the initiative in Farmer's Weekly, Priestley (2017) highlighted financial benefits that could accrue to farm businesses engaging in the scheme: reduced overwintering costs of £5 per ewe[ii] were noted alongside a suggestion that development of new access routes would make winter feeding easier. Despite these and other benefits of the scheme being highlighted the

S&T initiative has not seen high levels of uptake prompting the questions why, and what would a new scheme need to include to become more attractive to the upland farming community?

A first step towards agroforestry: exploring attitudes towards and barriers limiting adoption of the Sheep and Trees initiative

If woodland integration in upland farming is to be successful in the future, helping to meet Scottish Government tree planting aspirations that are aligned with wider policy objectives such as addressing climate change (e.g. Scottish Government, 2018) and meeting the sustainable development goals (Scottish Government, 2020) and to facilitate farm diversification at a time of profound uncertainty in the upland farming sector, in particular as EU funding is withdrawn, it is timely to investigate why previous woodland creation schemes have not proved more popular with farmers and to find out if the S&T initiative would be viewed more favourably. Establishing why current agroforestry schemes are not gaining their expected uptake is key to making future changes to meet government aspirations. Future government support for agriculture will most likely need be framed around schemes that support public goods (e.g. environmental benefits) rather than just direct financial support to farm business. To this end the paper reports findings from a research project which sought to (i) ascertain attitudes towards the Sheep and Trees Initiative; (ii) evaluate why limited interest in the Sheep and Trees Initiative had been expressed during the first two years it was available; and (iii) based on an understanding of the attitudes of upland farmers towards agroforestry in general, and the Sheep and Trees initiative in particular, offer suggestions as to how future agroforestry scheme design could be enhanced.

Methodological approach

A qualitative design was developed for the research, comprising a review of policy documents and other published materials to provide background context for the study and semi-structured interviews with Scottish upland sheep farmers and professional stakeholders, many of whom had an interest in the creation of integrated woodland.

Only a small number of farmers are currently involved in agroforestry in Scotland and with the focus of the research being upland farmers specifically there was a small target population available. Previous research reported difficulties recruiting conventional farmers in the UK to participate in research about agroforestry (Rois-Díaz et al., 2018). This project experienced similar issues. Opportunistic conversations at National Sheep Association (NSA) and Farm Woodland Forum (FWF) events held in June 2019 were used to gain access to professionals and sheep farmers. The FWF attracted mainly professionals with links to farmers involved in agroforestry. The NSA event provided an opportunity to recruit interviewees with less interest in agroforestry but to whom the S&T initiative is highly relevant.

Interviewees illustrating a variety of farm sizes, systems and locations were sought throughout the recruitment process and eventually thirteen interviews were secured. Attributes of interviewees are presented in Table 1 and Table 2 notes some system changes adopted by those interviewees directly involved in farming over the previous decade which could influence their attitudes towards agroforestry. Most interviewees had been involved with the Forestry Grant Scheme which has been running in various forms since 1981. Only one had used the S&T initiative (Interviewee 5), two had planted trees in a similar style to that advocated by the S&T initiative before it was introduced (Interviewees 1 and 2). All interviewees actively involved in farming/ crofting, except Interviewee 4 who was an agricultural contractor,

had some level of existing woodland integration on their property, ranging from agroforestry and wood pasture through to traditional forestry managed by the farmer.

Three interviews were conducted via the telephone, all others were conducted face-to-face. With permission, interviews were recorded and transcribed. They were framed around an interview guide that covered four topics, namely *Your Farm*, *Agroforestry*, *Integration*, and *Sheep and Trees.* No new topics or opinions emerged during interviews once eight had been conducted. With the number of interviews thus exceeding the saturation point findings presented below are considered robust. Interviews were transcribed verbatim and, following the procedure set out in Braun and Clarke (2006) and with additional guidance based on Maguire and Delahunt (2017), a thematic analysis was undertaken. The approach was similar to that used by Rios-Diaz et al (2018) in their study of farmers' perceptions of agroforestry which, influenced by the theory of planned behaviour, allowed new and novel themes and patterns around agroforestry to develop as the analysis progressed.

Findings

Thematic analysis of the interview transcripts identified three main themes describing interviewees options about the S&T initiative, namely positive attributes, negative attitudes and suggestions for improving the scheme. Prominent sub-themes related to agroforestry integration more generally, including policy design, drivers of and barriers to implementing integrated woodland on farms and interviewees own suggestions for the future direction of agroforestry policy. These themes are discussed below around three headings. First, attitudes towards the S&T initiative, and previous agroforestry schemes, are reviewed. Second, barriers to adoption of the S&T scheme are discussed. Third, interviewees ideas about what future agroforestry initiatives should prioritise to

improve take up and thus help meet government tree planting objectives are presented.

Attitudes towards integrated woodland systems, the Sheep and Trees initiative and other agroforestry schemes

This section examines attitudes towards agroforestry and, more specifically, the S&T initiative. As illustrated below, positive and negative attitudes towards agroforestry and associated integrated forestry systems were expressed by interviewees. Some views were based on direct experiences of participating in both the S&T initiative and other FGS opportunities.

Positive attitudes towards agroforestry

With most participants in the study having already planted some trees or expressed an interest in tree planting in the future it is perhaps not surprising that positive comments were made about the overall objectives of the S&T initiative and, more frequently, of agroforestry schemes supporting a range of different integrated systems in general. This supports Rios-Diaz et al's (2018) findings that farmer viewed agroforestry, where trees are integrated with agricultural activities, more positively than stand alone, commercial forestry. Support targeted towards upland farmers was particularly valued because initiatives recognised both the availability of large tracts of land that could be utilised for trees and the fact that many farmers lack access to the large capital sums required to support self-investment in tree planting, a considerable barrier to realising any ambitions to develop woodland.

Referring specifically to the S&T initiative, interviewees viewed favourably efforts to increase business viability and reducing the scale of woodland creation required to participate in an agroforestry scheme. For example, Interviewee 6 observed "*As long as it's thought out, and it is, the sheep get equal weighting with the trees, there*

has to be room for that, and the government, if it stops blanket afforestation it's a good thing". Further comments made by this interviewee, a tenant farming running c500 ewes as part of a mixed livestock enterprise who had undertaken some tree planting, emphasised their view that integrating woodland with existing farming activities, such as raising livestock, was much more desirable than the blanket afforestation route they thought whole farms and/or estates were following. Favouring integration over blanket afforestation underpins the S&T initiative, and in principle should make it more attractive to farmers.

Those interviewees who had developed integrated woodland themselves could clearly identify benefits accruing from their planting activities. The shelter created for livestock and enhanced biodiversity were viewed as distinct benefits, alongside enhanced amenity value of their land and economic benefits arising from reducing the amount of unused or abandoned land. Farmers voiced concerns about the future economic viability of the sheep industry and a need to change; they did not want to see sheep farming replaced by abandoned land and blanket forestry. Capital income from timber sales and reduced feed costs for sheep were cited by farmer and professional interviewees as benefits of the S&T initiative and underpinned their support for this scheme, views aligning with Morgan-Davies et al. (2008) who demonstrated that woodland integration does have the potential to increase the viability of sheep farming enterprises.

Participants thus articulated positive attitudes towards integrated planting and were aware of the financial benefits that could accrue. However, these positive views did not translate into widespread support for, or indeed awareness of, the S&T initiative. This, and the low take up of the scheme to date, suggests that the scheme is not meeting the criteria those interested in integrated planting wish to achieve. Understanding

negative attitudes towards agroforestry could help explain the lack of interest in, and sceptical opinions about, the S&T initiative.

Negative attitudes towards agroforestry

Despite some interviewees expressing negative attitudes towards blanket afforestation and traditional forestry, negative attitudes to integrated woodland were not widespread. Only one interviewee expressed a negative view of full integration of wood pasture in upland farming because of the complex management involved. Almost all of those interviewed in this study had adopted some form of integrated system, and no negative attitudes towards shelterbelts were expressed. However, evidence gathered from informal conversations with farmers attending a National Sheep Association event suggests that many farmers have negative attitudes to trees such as "*Why would I plant trees? The only point in planting trees is to make matches to burn them with".* If farmers conflate traditional and integrated forestry it is perhaps unsurprising that the negative attitudes often expressed towards the former (*c.f.* Hopkins et al, 2017) are also applied towards the latter.

Negative attitudes towards integrated forestry associated with the management complexity involved in adopting an integrated system were identified by farmers who had first-hand experience of integrated systems and by professionals. Additional labour could be required because of the time required to manage woodland effectively. Additional labour requirements could not necessarily be met by existing personnel and the costs of hiring labour could be prohibitive. These views concur with those reported in other woodland integration studies (e.g. Acs et al, 2010; Garcia de Jalon et al, 2018). If farmers are unable to manage their woodland and maximise the benefits they could achieve from integrated forestry, negative attitudes may prevail. No financial support

for labour is offered under the S&T initiative, nor is funding to support upskilling and training that would allow farmers to become better acquainted with integrated forestry management approaches and requirements. Some interviewees identified the costs associated with fencing extensive areas where trees are integrated into upland systems as being prohibitive, a further disincentive to engagement in agroforestry schemes.

Understanding barriers to the adoption of integrated forestry

If agroforestry initiatives supporting integrated forestry are to become more effective methods of promoting tree planting there is a need to understand why schemes have not been embraced by larger numbers of farmers. Analysis of interview data suggests that there is a misalignment between the S&T initiative's provisions and what farmers interested in integrated forestry want to plant or need to plant so that livestock interests are not compromised and that the administration associated with engaging with forestry grants schemes deterred applications. These factors, individually or in combination, could have influenced the low uptake of the S&T initiative (discussed in the next section), as could farmers attitudes to change.

Farmers expressed a desire for any new woodland to be well designed and well managed and noted that a market for the timber produced under a scheme such as the S&T initiative needed to exist. They did not want to create woodland that would be harvested in one go. Interviewee 7, an environmental professional, spoke about other benefits of including trees, saying:

> "*I am convinced that planting small blocks of conifers in that way, integrated into an upland farm, in a sensitive, well landscaped way, which they very often are not but they could be and mixed in with native woodland planting to soften*

the edges, with the landscape kind of dimension in mind … I think it is a very good thing to be doing".

Comments such as this point towards concerns about how planting is undertaken. There was a nervousness associated with tree planting, especially of conifer species, likely linked to the negative attitudes farmers and professionals had about blanket afforestation and an underlying concern that schemes promoting agroforestry could be blanket afforestation by the back door. Negativity towards planting specific types of trees such as conifers expressed in this research reflects attitudes reported in the literature. For example, Mather and Thomson (1995) and Mather (1996) suggested that poor planting practices in the past have coloured farmers' views of conifers. The interviewees favourable opinions about native broadleaf tree species, those thought best for enhancing amenity and biodiversity, and negative views of conifers - the planting of which is supported by the S&T initiative - is problematic, and is likely a reason underpinning low uptake of the scheme. This point is considered further below.

Explicitly expressed negative attitudes towards the S&T initiative voiced by interviewees focused on perceptions that the policy was inflexible, poorly designed and that too much paperwork was involved in making an application. The S&T initiative was viewed as inflexible by both professionals and farmers. There was also concern about the financial impacts for smaller farmers. Anecdotal observations suggesting that the scheme did not promote what farmers wanted to plant were made. Concerns were specifically related to planting density and the focus on productive conifer species. Interviewee 1, who had invested in agroforesty before the launch of the S&T initiative, highlighted a mis-match between tree numbers required for woodland to be commercially viable as a timber crop and the need to retain open land if livestock are to

be successfully integrated with trees. Density of planting required under the FGS, which like the S&T initiative has had a low uptake, was also identified as problematic. Interviewee 7, an environmental professional, observed that "*there are farmers out there who I've met practicing agroforestry in Scotland who aren't doing it through the current grant scheme*", hinting that if planting density requirements were reduced there would be more uptake of the S&T initiative and the wider FGS. Both interviewees 2 and 9 farmed large units and expressed support for large scale conifer planning. Interviewees who farmed on a smaller scale in the uplands, those less likely to benefit from or be able to develop commercial-scale planting, were more critical of the planting density expected under integrated forestry schemes. The ability of upland farmers to grow the quality of timber the market expected for uses such as biomass, fencing, paper and sawn timber was questioned, underpinning attitudes that the capital benefit of planting trees would be low.

Shelter could be created by planting tree species supported by the S&T initiative. Interviewees who already had experience of integration were aware that improving shelter could increase profit margins measures and were thus inclined to view the creation of shelter positively, as illustrated by Interviewee 1 who said: "*The shelterbelts, one of them has been absolutely fundamental and actually allowed us to move from a Blackface ewe to what you would term a more productive, um, meat breed, the Texel*". This ability to enhance production was an unforeseen consequence of introducing shelter and, if better promoted, could change attitudes towards integrated forestry and the S&T initiative specifically. Likewise promoting this benefit could encourage farmers whose existing shelter belts are coming to end of their natural life to introduce new planting. A 2018 publication prepared by the Woodland Trust and National Sheep Association highlighted a number of benefits of shelterbelts for sheep

farming, including improving animal health through, for example, providing shelter that reduces lambs' exposure to the cold, and extending the growing season of grass. The benefit of utilising shelter belts to improve animal welfare was noted by farmer interviewees, with concurrent monetary benefits from reduced use of supplementary feedstuffs. However, there were concerns expressed that creating more shelter by planting conifer species could compromise grazing, a point made by small-scale hill farmer interviewee 12 whose holding included areas planted with native tree species: "*No, they wouldn't, not at that density, they wouldn't to start with, ... There'd be no grass, by the time the trees are big enough to be protected from the sheep, ... they wouldn't be alright once they go high*". An environmental professional who was interviewed was concerned that the inflexibility regarding tree species that could be used made a nonsense of the scheme, observing that:

> "*... [the]* sheep *and trees grant is primarily aimed at establishment of commercial and diverse conifer, so you're looking at Sitka spruce or diverse conifer, Norway fir mixture. What immediately strikes you as wrong in that? The key thing in this is sheep. Now if you plant Sitka spruce, when that becomes a young plantation, there's nothing underneath it, it's, you try walking through a pile of Christmas trees ... It's a complete and utter nonsense that as a grant scheme*" (Interviewee 8)

The economic benefits of creating shelter can have a direct impact on the profitability of a farm business by enabling more productive breeds of livestock to be held and by reducing feeding cost, both clearly identifiable financial benefits. There was some evidence, however, that farmers did not necessarily appreciate the extent of economic benefits. Indeed, trials conducted at Glensaugh under the National Network Silvopastoral Experiment, which created examples of the benefits of shelter, did little to

increase agroforestry uptake (Sibbald et al., 2001). Coupled with the view that tree species supported by the S&T initiative would compromise grazing further reasons for low uptake of the S&T initiative are hinted at from these findings. As the quote above from Interviewee 8 clearly illustrates there is a misalignment between (a) the objectives of the S&T initiative, *viz.* to promote commercial timber production and the use of conifers for shelter belts, both means of enhancing the profitability of sheep farming enterprises and (b) what farmers want from integrated forestry, including non-coniferous shelter belts.

As was demonstrated in the preceding section, not all farmers hold negative attitudes towards woodland integration. However, although the S&T initiative promotes integration, it appears to be the 'wrong' type of integration and thus has not attracted interest from those already inclined to consider developing an integrated system. Farmers who participated in this study are more interested in planting diverse woodland on their land. A shift to the S&T initiative supporting mixed woodland was advocated by Interviewee 4, a stockman who worked as a contractor on a number of farms, who said "*we need hardwoods as well as soft woods*" and Interviewee 10, a tenant farmer, who observed that even limited use of hardwoods would represent "*added value*" and, by inference, make the S&T initiative more attractive to them

The professionals interviewed in this research offered interesting reflections on the mis-match between the provisions of the S&T initiative and the priorities of livestock farmers interested in integrated woodland. The policy was viewed by a forestry professional as one designed to "*target upland farmers planting on poorer ground and engage them with agroforestry*" (Interview 3) yet an environmental professional's reflection on an application to the S&T initiative they had been involved

with illustrates a point noted by Morgan-Davis et al. (2008), that poor ground would not necessarily support trees:

> *"The land wasn't suitable for growing commercial conifer, it might have grown some mountain willow, but it didn't fit in with the grant or it was on deep peat or it was saturated ground. You know, they were looking at the worst bits of ground they had that were hard to get at to plant trees on it, it just didn't work." (Interviewee 8)*

Other professionals described the initiative as trying to please everyone, with Interviewee 8 suggesting that the policy was misaligned with the practicalities of integrating commercial conifers with livestock rearing (exemplified in the observations about grazing underneath confers being poor, as noted above). This mismatch between the aims of policy and farmers interests is another possible contribution to the low uptake of the S&T initiative and, following Polman and Slagen's (2008) analysis, this poor scheme design could damage trust in it and other agroforestry policies.

Adopting woodland integration would represent a significant change in farm practice for many upland farmers. Is limited uptake of agroforestry, and the S&T initiative, a reflection of a general reluctance to embrace change? The nine interviewees directly involved in farming were asked about system changes they had introduced in the previous decade. As reported in Table 2, all but one had adopted at least one change with the most common being increased grazing management. All the system changes illustrate adaptations to changes in agricultural policy, such as the removal of headage payments, and were reactions to changes in the wider financial environment farming operates within. The findings are similar to those reported elsewhere as ways in which farmers may adapt to changing circumstances (Morgan-Davis et al. 2008, 2012, Acs et al. 2010). Interviewees reported that implementing

system changes had helped them to increase the success of their businesses, respond to policy changes and make space for trees. A reluctance to embrace change *per se* is thus not in itself a reason why uptake of the S&T initiative has been low.

Another topic provoking negative observations about both the S&T initiative and the FGS more generally was administration - or 'paperwork'. Smaller farmers and others who were not computer literate reported difficulties navigating the complexity of the scheme, difficulties which promoted use of a professional, adding an additional cost. Interviewee 9 recounted "*I thought about getting JK Rowling's books thinner than what the paperwork is and if you're not into paper and that's another cost, you've got to go and get a consultant to do the paperwork and there's a charge against you*". Despite this challenge, Interviewee 9, a business minded farmer, was not deterred from making an application, but their experience suggests a need for small farmers to be offered more assistance when completing complex applications. With many farmers knowing little about forestry, another cost not reimbursed under the S&T initiative could be necessary - using a professional to help design the type of woodland a farmer would apply to plant. This outlay would not be recouped until trees were mature enough for harvesting to commence. The financial administration of agroforestry schemes was also viewed negatively. A potential economic barrier to participation in the S&T initiative was identified, *viz* farmers are required to purchase supplies up front, before their grant is received, and for small enterprises this can make cash flow impossible to manage. Unhappiness with this aspect of scheme administration was narrated by a small-scale farmer, Interviewee 12, who said "*The grant scheme was so stressful and the way, the way the government expects small people like us to go ahead and borrow large amounts of money for a long period of time to plant trees is wrong*".

Why has uptake of the Sheep and Trees initiative been low?

When asked if they had heard of the S&T initiative, a majority of interviewees (eight out of thirteen, including a professional), responded that they were not aware of it, or knew little about it. Participants in this research are a very small sub-sample of the sheep farming community, but they are individuals who had already shown an interested in integrated forestry. If their low awareness of the S&T initiative is reflective of the wider picture that will have a direct impact on uptake rates.

There is no tradition of agroforestry in Scotland. Large estates commonly plant large-scale forestry and farming is seen as an entirely separate land use. Forestry schemes that farmers can engage with, including the S&T initiative, are administered through forestry channels, potentially further reinforcing the land-use divide. An observation offered by Interviewee 5, an estate manager whose responsibilities included the management of in-hand forestry and shelterbelts and who was involved with the S&T initiative, illustrates this: "*I remember when it* [the S&T initiative] *came out we went to a commission meeting about it and it was all, mostly bigger land owners you know guys who already knew it was coming*". This suggests that the scheme was mostly of interest to larger landowners and those who were already involved in forestry and receiving professional advice. The S&T initiative, in order to produce maximum capital value from integrated forestry, supports conifer planting. As discussed above, the farming community has negative attitudes towards conifer species. If the initiative included support for a wider range of tree species it might be more attractive to the farming community.

With most participants in this research voicing positive attitudes towards integrated woodland their views about this type of system do not explain low uptake and awareness of the S&T initiative. Despite the availability of resources such as

Scottish Forestry's *Woodland Grazing Toolbox* (see https://forestry.gov.scot/woodland-grazing-toolbox) there is, however, a lack of knowledge about specific integration opportunities and this, combined with underlying negative attitudes towards forestry, large scale forestry and conifer plantations in particular, could explain low uptake. Losing land to trees was of little concern to farmer participants, but with the growth of good quality conifer requiring planting to be on the best quality land in the uplands farmers could be deterred from entering the S&T initiative because they do not want to lose their best land to trees. The costs and the management of trees in combination with farming activities were concerns that could be deterring engagement. The S&T initiative provides funding for upfront costs associated with planting trees, but financial assistance for the management of the trees is only available for 5 years. As noted above, some farmers lack the capacity to provide tree management labour from existing resources and looking ahead may feel they cannot afford to pay for the labour required to manage their trees, deterring participation in the initiative.

While the *idea* of agroforestry is largely viewed positively, negative attitudes towards agroforestry in principle and the integrated forestry supported under the S&T initiative and other schemes specifically are widespread. To achieve their objectives, grant schemes need to be well designed, accessible and achievable by those who are targeted by the measures. Schemes must also be compatible with existing on-farm activities and be designed in such a way that the socio-cultural environment within which farmers make decisions about adopting new initiatives is acknowledged. With findings from this research indicating both a lack of awareness of the S&T initiative and evidence that, as currently framed, the S&T initiatives does not support the type of woodland farmers would like to plant and manage alongside their livestock enterprises, what type of scheme would attract uptake in the future?

What should future agroforestry initiatives prioritise? Farmers preferences for integrated woodland

From the positive views about integrated forestry voiced by interviewees it may be inferred that schemes such as the S&T initiative have the potential to be successful. However, as the findings presented in the previous sections indicate, there appears to be a misalignment between the design and provisions of the scheme and what farmers want from an integrated system which is preventing uptake. When asked explicitly about the S&T initiative, Interviewee 10 said "*I'm a wee bit disappointed that this is conifers. If we could get hardwoods in there singly, because of the added value, I think that's where it would be* [attractive]". If comments such as this were addressed the S&T initiative might become more attractive, especially to smaller-scale farmers.

Taking inspiration from Burton et al (2018), all those interviewed were invited to articulate how they would like to incorporate trees on farms - and if applicable to their own farm - and everyone described a scheme with a degree of integrated forestry system. The suggestions are captured in the drawings presented in Figure 4 which shown that farmers desire integration, with all but the largest landowners looking for some type of agroforestry. In their scheme designs the farmers who were interviewed showed that they wanted to plant what they thought would work best on *their* farm. The uplands of Scotland comprise a variety of environments and planting designs and tree species need to be tailored to specific circumstances. Integrated forestry offers a range of potential benefits to farmers and a desire was expressed to design a scheme that allowed tree species to be selected based on the type of planting a farmer wished to introduce. For example, a large stand of commercial conifers could be appropriate in one context while low density, mixed woodland would better suit the climatic, land capability and grazing requirements of another farm. More flexibility in design and

species supported was considered something required of all FGS, not just the S&T initiative.

Interviewees recommended a number of improvements to the S&T initiative and, as it is just one small part of a larger scheme, the recommendations could be transferable to other schemes. Advice, vision and flexibility were the main themes to frame the recommendations that were offered. As already discussed, adjusting existing provisions of the S&T initiative, to make it more flexible, was recommended. Specifically, more tree species should be included and expectations regarding planting density modified to accommodate the requirements of different species were suggested.

Farmers are not forestry experts. Smaller farmers/ landowners are particularly in need of specialist advice about integrated systems and guidance about how to apply for the sources of funding available to support the development of integrated forestry. It was suggested that the S&T initiative could be improved by providing more advice, possible through Scottish Forestry: "*it wouldn't happen if we leave it up to the big agents because there's no money in it and the farmer wouldn't do it*" (Interviewee 8). However, readily accessible advice *is* available (e.g. the woodland grazing toolbox, publications such as Wood Trust and National Sheet Association, 2018) which suggests that there may be a reluctance to search for information unless a decision to explore woodland opportunities has already been made by an individual farmer. Informal networks could be encouraged as a means of disseminating success stories and to challenge negative attitudes towards integrated forestry. For example, Interviewee 7 said: "*…. what we need all over, is brave farmers who are willing to try it out, be supported and helped to try it out, then others can see because peer to peer is so important*". This suggests that if integrated forestry became established as an attribute of being a good *upland* farmer (*c.f.* Burton 2004; Burton et al. 2020) engagement with

integrated forestry would become normalised and, in consequence, uptake of schemes such as S&T would increase. Professionals suggested that more trials/ demonstration plantings were needed which would allow farmers to see at first hand different types of integration which could be introduced in the uplands and use these to inform their own vision

This study has highlighted that farmers are concerned about planting the types of trees they think best suited for their circumstances, adhering to their evaluation of the principle 'right trees, right place'. This could help to explain why, despite the economic benefits associated with an initiative such as S&T, farmers are unwilling to undertake planting which they perceive to be 'wrong'. Further attempts to educate farmers about different agroforestry options could challenge misconceptions and inform more appropriate policy design. Agroforestry trials and attempts to promote integrated woodland education opportunities have been undertaken (e.g. work undertaken by the Farm Woodland Forum and various European projects such as that reported by Rios-Díaz et al. 2018) but, arguably, they could have done more to promote advantages of integration in upland contexts. Ambitions to promote good woodland management practices, again explicitly in upload contexts, could be built into future trial design, further developing an evidence base upland farmers keen to learn more about agroforestry could turn to.

Previous research has repeatedly identified negative attitudes towards forestry planting amongst the farming community (e.g. Scambler, 1989), reflecting "a long-standing antipathy amongst Scottish farmers towards tree planting and management, arising from a deep-seated sense of differentiation between farming and forestry within the respective professional communities" (Warren et al, 2016, p176). Negative attitudes are rooted in concerns about, for example, tree planting requiring, in the long term,

taking land out of cultivation or leading to grazing capacity being reduced, the dominance of a productivist ethos where food production is viewed as the principle objective of farming and a lack of knowledge about forestry(Heald and Farquhar, 2016) as well as issues with policy (Wynee-Jones, 2013). In addition, Burton's work (*c.f.* Burton, 1998) demonstrated that a wide range of economic, practical, and most importantly social reasons were found to influence farmers' willingness to plant woodland. More positively, however, there is some evidence in this study which builds on findings presented by, for example, Wynne-Jones (2013) and Heald and Farquhar (2016) to suggest that as sustainability, climate change and other environmental concerns have become more mainstream, upland farmers in Scotland are becoming more open minded about agroforestry as opposed to more traditional styles of forestry. This shift of opinion may also be influenced by integrated woodland being seen to align with more traditional farm activity (e.g. planting shelter belts to enhance animal welfare), which helps to alleviate social concerns and break down barriers between 'farming' and 'forestry'. Building on the achievements of bodies such as the Farm Woodland Forum and World Agroforestry, and to exploit the pivot in farmer attitudes towards integrated woodland planting and agroforestry, there is a real opportunity for schemes which support further woodland integration to have wide uptake amongst upland farmers in Scotland. However, as demonstrated by the S&T initiative further work is required to improve design and delivery to enhance farmer interest and uptake.

Conclusions

The findings from this study align with those reported in previous research that has reported attitudes towards agroforestry (Garcia de Jalon et al, 2018; Rois-Diaz et al, 2018), *viz-a-viz* general attitudes towards woodland integration are positive. Thus a well-designed scheme, based on farmers desires and which offers flexibility could be

very successful in the Scottish uplands if support was tailored to promote tree planting in various types of upland environment, on farms of different sizes and with different soil and climatic conditions, and accommodated densities and species best suited for integration with livestock rearing. A well designed scheme would also both provide a diversification route for economically fragile upland farming and address zero carbon commitments by supporting tree planting on land with potential to support this land use. However, the latest iteration of forestry policy endeavouring to promote upland tree planting, the Sheep and Trees Initiative, has yet to attract much interest.

Despite the relatively small number of interviews conducted in this study, a majority of whom were based in Eastern Scotland, and the slight bias towards those who had already expressed an interest in tree planting, the research reported here demonstrates the complexity of attitudes towards integrated farming held amongst the upland farming community in Scotland. Professionals and farmers interviewed for this research expressed concerns over the design of the scheme with many indicating a desire to plant non-conifer species and be able to vary planting density. Farmers willing to adopt an integrated system preferred wood pasture or scattered trees, for example, to the partial integration of small stands of commercial forestry such as that supported by the S&T initiative. Overall, the main reason for low uptake of the S&T initiative appears to be low levels of awareness of the scheme, coupled with farmers' preference to plant trees on their poorest land, ground which is largely unsuitable for the target species covered by the scheme

This research has highlighted a misalignment between attitudes towards integration generally and attitudes towards the Sheep and Trees initiative specifically. A range of improvements and different schemes were suggested by farmers and professionals which, interestingly, responded to both financial gains that developing

integrated forestry could offer and which could help to break down cultural barriers that have, to date, deterred farmers from developing forestry on their holdings.

Farmers' decisions are both emotional and economically rational, and to date agroforestry policy has focused primarily upon the economic opportunities farmers could exploit. As the UK exits the EU, agricultural and forestry policy and associated subsidy regimes are likely to change dramatically in the short and longer term. Put crudely, less money is likely to be available to support farmers. Now may be an opportune time to tackle the cultural barriers that, to date, have seen farmers be reluctant to plant trees. More opportunities for education and training, increased availability of forestry advice tailored to farmers and more flexibility within the various tree planting initiatives with regard to species choice and density could all be useful interventions. This does not mean that financial assistance is no longer necessary, rather addressing cultural barriers could allow subsidies and other forms of financial support to targeted more effectively, and successfully. The alternatives offered by farmers and presented in this contribution provide some ideas that could help shape future the design of future integrated forestry policy.

This research as shown that the implementation of the first phase of the Sheep and Trees initiative has been problematic. Low uptake is likely due to low awareness of the scheme and the inflexibility of this policy measures which has both created barriers for those with positive attitudes towards integrated forestry and failed to identify and address negative attitudes towards trees held by others. Future policies promoting integrated forestry in the uplands need to consider the unique situation of upland livestock farming and the challenges this farming environment poses to including trees on upland farms and do more to break down historic resistance and ensure financial incentives are effectively targeted. A larger scale, follow on study would be useful to

seek corroboration of the findings elicited from farmers and professionals reported in this contribution and would provide an opportunity to develop formal recommendations for taking forward the S&T initiative in a way that would garner increased levels of uptake.

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Agroforestry: a land use system in which trees and shrubs are deliberately grown around or among pastureland or crops. *World Agroforestry* (2019) describe agroforestry as agriculture which includes trees at a variety of scales, including, for example, systems where trees and agricultural crops occupy the same land and agricultural landscapes where trees are present.

Integrated woodland: largely synonymous with agroforestry, describes where woodland is integrated within an agricultural system such as livestock farming.

Agro-silvopastoral systems: a term describing agroforestry systems which combine trees or shrubs with cattle (and potentially sheep or pigs) on the same site. This system is based on silviculture (growing trees) in a way that is complimentary to pre-existing agricultural activities.

Silvopastoral system: an agroforestry land use system where perennial grasses or grass-legume mixes are managed within a stand of trees to provide livestock pasture.

Silvoarable system: an agroforestry land use system where a long term tree crop is grown alongside arable or other crops which provide an income until trees are mature and ready to harvest. Trees are grown in widely spaced rows, crops are grown between the rows.

Figure 1. Definitions of different types of integrated forestry

Top left: Silvopasture broadleaf planting in the mid-ground; Top right: A mature example of the type of block coniferous planting encouraged by the Sheep and Trees Initiative; Bottom left: Sheep enjoying the shelter of mature trees around their pasture; Bottom right: A mature example of the type of block coniferous planting encouraged by the Sheep and Trees Initiative set in a wider landscape context

Figure 2: illustrations of different types of integrated forestry in Scotland. Photographs © G Weston

Figure 3. Graphic used on the Scottish Forestry page providing information about the Sheep and Trees initiative.

Interviewee	Occupation	Location	Holding Size	Sheep Numbers	Other Enterprises?	Tree Type	Integration of livestock and woodland?	Additional relevant information
1	Farmer	Perthshire	Medium	~350	Yes	wood pasture, shelterbelts, native broadleaves, agroforestry	Yes	Investment and personal interest in agroforestry principals
2	Farm Manager	Aberdeenshire	Large		Yes	agroforestry, traditional forestry, shelterbelts	Yes	Had experience of deploying various styles of woodland integration.
3	Forestry Professional	-	-	-	-	-	-	
4	Contractor	Fife/Perthshire	various	-	-	-	None	
5	Estate Manager	Aberdeenshire	Large	~400	Yes	traditional forestry, wood pasture, shelterbelts	Some	Participated in the Sheep and Trees initiative.
6	Tenant Farmer	Moray	Small	~500	Yes	wood pasture, parkland	Some	
7	Environmental Professional	-	-	-	-	-	-	
8	Environmental Professional	-	-	-	-	-	-	
9	Farmer	Lanarkshire	Medium	~350	No	traditional forestry, shelterbelts	Some	Not from a farming background; very business minded.
10	Tenant Farmer	Perthshire	Small	variable	Yes	shelterbelts, native broadleaves	Some	Had environmental interests
11	Crofter	Invernesshire	Tiny	15	No	native broadleaves	Some	Had environmental interests
12	Farmer	Perthshire	Small	~50	Yes	native broadleaves	Some	
13	Estate Owner	Aberdeenshire	Large	~400	Yes	traditional forestry, wood pasture, shelterbelts	Some	

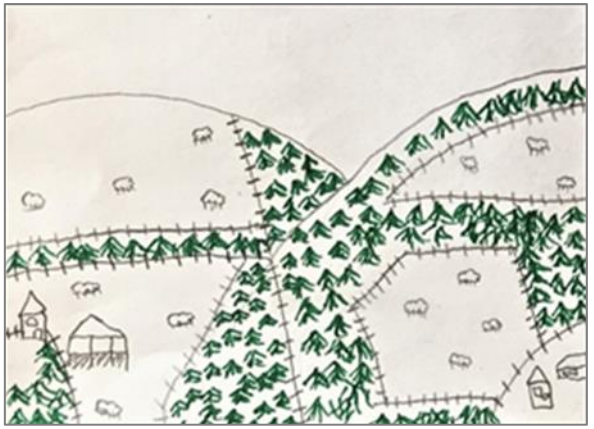
Table 1. Interviewee attributes

	Interviewee directly involved in farming								
System Changes	1	2	4	5	6	9	10	11	12
Increased Grazing Management	■	■	■	■		■			■
Reduced Sheep Numbers	■		■						
Breed Change	■					■			
Diversification							■		■
Tree Planting	■	■		■	■	■		■	■
Intensification						■			

Table 2. System changes adopted by those interviewees directly involved in farming over the previous decade.

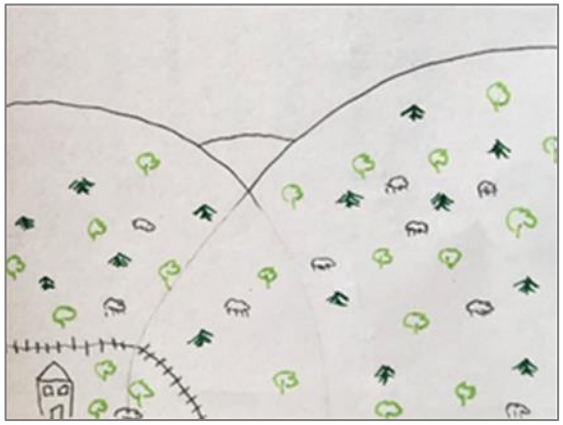
Small blocks of trees are mixed with agroforestry, hedgerows and wood pasture. Some areas are fenced for commercial growing, others are part of open grazing

Agroforestry using mixed tree densities. Clusters provide shelter and amenity is added by including widely spaced trees.



A scheme similar to that envisaged in the Sheep and Trees initiative, suggested by a larger landowner. Commercial plantations are integrated with both on-farm grazing and between farms.

Scheme with mixed shelterbelt and a mix of fenced and un-fenced planting



A scheme similar to the Spanish Dehesa. Low density, trees widely spaced out and integrated with grazing.

Figure 4. Interpretation of alternative integrated farming schemes suggested by interviewees. Drawings © G Weston

[i] Upland sheep farm diversification could include, for example, identifying new markets for wool products, rearing 'fancy' or unusual breeds which are attractive to 'hobby' famers and command higher prices than commercial breeds and becoming involved in carbon trading initiatives.

[ii] £5 per ewe is not in itself a large sum. The agricultural census reports most sheep enterprises in the north of Scotland run between 100-300 ewes thus savings of between £500 and £1,500 per annum could be gained. Such annual savings are thus quite small, but benefits could accrue over time.