Technical Advice on WEAG Recommendation 10: Integrating woodland management and farming

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Contents

1. Introduction 3
2. Our brief 5

Methodological approach 6

3. The debate about woodland expansion 7
4. Contextual issues 10
5. A review of background literature on European farm woodlands 15

5.1 Introduction 15

5.2 Types of farm and propensity to plant trees 15

5.3 An overview of European farm forestry 17

5.4 UK farm woodland 19

6. A theoretical perspective: Kahneman and Bourdieu combined 22
7. Types of farm woodland in the UK 22
8. Likely economic impacts at farm level 26
9. Interim Findings 31

9.1 Factual findings 31

9.2 Policy findings 33

9.3 Practical considerations 33

9.4 Theoretical reflections 34

10 Recommendations for further research 36

References 37

Appendices 39

1. Introduction

The expansion of woodland area in Scotland has become a contentious issue in recent years. The Scottish Government initially set a target for 25% forest cover by 2050, but, as a result of review by the Woodland Expansion Advisory Group, the target was then altered to an aspiration to create 100,000 hectares of new woodland by 2022. There remains a strong government desire to get rural land managers to plant more trees, largely to deliver to climate change targets through woodland's capacity to sequester carbon, but also to contribute to other desired Scottish Government outcomes such as enhanced landscape and biodiversity and through the contribution to development of the rural and wider economy.

Any significant increase in the planted area will almost certainly require afforestation of farmland and this is often viewed rather negatively by many in the farming community. Woodland cover in Scotland is about 17% of the land area. Urban cover amounts to around 3 % of the land area (though estimates vary up to 8%, depending on definition). Agriculture and sporting land make up the residue, with sporting land with modest numbers of farmed livestock potentially taking up as much as 20% of the land area, suggesting that agricultural use predominates on about 60% of Scotland's land area. Farm management practices and intensities vary greatly, with the better quality land managed rather more intensively and much of the poorer quality land managed less intensively, albeit with pockets of relatively intensively pastoral farmed land in some upland areas. There is no obvious correlation between low stocking density and a high desire to plant more woodland, but Matthews et al.'s (2011) work for WEAG suggests that the planting of new woodland on farmland could be accomplished with very little loss of food production, if lightly stocked land with moderate to high technical planting potential were to be afforested.

In recent years the Scottish Government has been actively developing a more integrative vision for its rural land uses, recognising that there is scope for both synergy and conflict between different land uses and seeking to use policy and partnership to enhance synergies and reduce negative conflicts. One of the outcomes of this integrative approach was Scotland's Land Use Strategy. It articulates a number of principles for sustainable land use. Two of the ten principles are especially pertinent to the forest expansion debate:

- "Where land is highly suitable for a primary use (for example, food production, flood management, water catchment management and carbon storage) this value should be recognised in decision-making; and
- Land-use decisions should be informed by an understanding of the opportunities and threats brought about by the changing climate. Greenhouse gas emissions associated with land use should be reduced and land should continue to contribute to delivering climate change adaptation and mitigation objectives."

Arguably, forests and woodland are land uses that often but not always have capacity to deliver high levels of multiple benefits through enhanced carbon storage and enhanced water quality. They can also reduce flood peaks. With many types of woodland/forest, the capacity to stack multiple ecosystem service benefits on a single area of land is often high. Given the high carbon stage capacity of woodland and its capacity to deliver low carbon construction material and renewable heating materials, its contribution to mitigating climate change is also likely to be positive. Equally,

where forestry replaces livestock farming there is a strong likelihood that water quality in adjacent streams will be improved and salmonid spawning opportunity enhanced.

In its attempts to overcome conflicts between farming and forestry interests, at the same time as delivering to woodland expansion objectives, the Scottish Government appointed the Woodland Expansion Advisory Group which, in its report in 2012, made a number of recommendations as to how the apparent gulf between farming and forestry interests could be bridged. The group contained representatives of a wide range of interests.

Amongst its recommendations was one advocating better integration of forestry and other land uses (WEAG 10- see box below).

Woodland Expansion Advisory Group Recommendation 10: Integration.

The next SRDP should encourage better integration between woodland creation and farming or deer management, including:

- Making use of 'agroforestry' measures in the Rural Development Regulation;
- Supporting woodland creation models which combine grazing and shelter; and
- Ensuring that eligibility criteria permit and encourage the creation of small woodlands, riparian woodlands and hedgerow trees.
- Single Farm Payment eligibility criteria for grazed woodland should also be changed to help achieve this; and Forestry Commission Scotland should ensure that suitable technical guidance and support is available.

Scottish Government response:
The working groups responsible for developing the next SRDP have been asked to consider how best to implement this recommendation. Careful consideration will be given to formulating detailed rules on land eligibility for Single Farm Payments in ways that facilitate integration as far as is possible within the EU rules that will be agreed during the current CAP reform process.

FCS will commission research and gather evidence on the costs, benefits and operation of systems which integrate woodland creation with farming and deer management by the end of December 2012. Once it is clear what measures can be included in the next SRDP, this evidence will be used to produce suitable technical guidance.

2. Our brief

Our brief was to explore the impact on farm profitability of undertaking a number of different types of farm woodland creation through a case study approach. Our emphasis was on farms rather than sporting estates and on the types of farm that would be most likely to have scope for tree planting. We accept the WEAG group's argument that it is on the medium quality farmland in both the uplands and lowlands that most planting can be expected to take place, although we recognise that on one hand, the personal predilection of some farmers and on the other, the need to protect watercourses from phosphate emissions, may create space for trees in areas of higher land quality as well.

Our challenge was to identify examples of farms where effective synergies had been developed between farming and woodland management. These exemplars would show the range of possibilities of woodland creation; and by talking to farmers, we might arrive at a better understanding of aspirations, motivations and drivers of behaviour, and how woodland creation has worked out in terms of impacts on their businesses.

Integration is already evident in some situations where positive spillovers exist between forestry and farming. Land-based businesses in receipt of CAP support account for nearly 400,000 hectares of Scotland's forest area, although the extent to which this is actively integrated into farm business activity is unknown. However, casual observation of the rural landscape of Scotland reveals countless examples of shelter belts in both upland and lowland situations, out-wintered livestock in woodlands and wood pasture grazings. In different parts of the world a range of authors report that stock derives benefit from shelter (Black-Rubio et al. 2008) and evidence from Wales suggests that newly planted forests do not impact on sheep production until 6 years after planting (Teklehaimanot et al., 2002). Further, there is a consensus that 'during winter, cattle behaviour is a trade-off between maximizing energy gain (thermal and food) and minimizing energy loss (thermal and metabolic (Olsen and Wallander.2002). In a wide ranging review of shelter benefits of trees (in both situations of woodland grazing and conventional shelter belts Gregory (2005) reports a range of benefits to the animals, especially in times of storm, including reduced perinatal mortality in lambs and lower feed requirements of stock. He also reports that high wind speeds reduce pasture growth. In a survey of grazed woodland in the UK, Armstrong et al (2003) report that respondents indicate both conservation benefits and production benefits to cattle enterprises, with the latter more frequently cited in Scotland than England. Common ownership of individual proprietal units at least provides a suitable platform for the realisation of opportunities for integration, which is a considerable advance on the relatively recent situation where a predominantly tenanted farm sector had no rights to trees or woodland on the holding.

In Scottish conditions, there are three principal situations where integration can be seen to be beneficial. First, given Scotland's cold and windy climate, trees are likely to provide beneficial shelter to stock, thereby reducing maintenance requirements and potentially enhancing plant growth. This explains the widespread evidence of shelter belts in rural Scotland, although other motives such as landscape enhancement and game management may have also been influential in shelter belt planting. Second, some Scottish soils, particularly in coastal Moray and Nairn, but to a lesser extent in parts of Fife and Aberdeenshire, can be affected by wind erosion, to the extent that, in a bad spring 'blow', roads can be rendered impassable by windblown topsoil and growing crops severely damaged. Shelter belts reduce wind speed and limit wind erosion. Third, wood pasture

systems afford shelter and food, as well as a range of other ecosystem services. Additionally, farmland is valued for its amenity as well as its productive potential by many farmers, and although this rarely is income-generating, it might in some cases add to capital values of rural landholdings.

Methodological approach

Our approach in this study was to undertake a desk-based study of socioeconomic research on farm woodlands, drawing on research from throughout Europe but paying specific attention to that from the UK and Ireland.

The core of this project comprised the production of case studies of different types of integration of woodlands and forestry within farm businesses. In liaison with conservators and other key informants, a range of farm busimnesses was identified which gave good geographical coverage and which showed the variety of ways in which woodland could be integrated into farming activity.

A proforma was devised to gather information from respondents. A copy of the questions can be found in the appendix. Possible candidate case study farm owners were telephoned and if they agreed to participate (there were no refusals), a set of question prompts was sent to them by mail or email. Wherever possible, a follow up visit took place.

This report summarises the key findings from these case studies which are intended to comprise free standing glossy brochures to convey to a farm audience the ways in which woodland can be integrated into farming enterprises. Insofar as possible, we sought to give the participants an opportunity to express their views and to reflect their valuations on farm woodland within their land management unit.

3. The debate about woodland expansion

Two main sets of arguments are cited as to why farmers will not plant more trees. Some authors attribute the decision of farmers not to grow trees to simple economics: forestry does not pay as well as the alternative of farming (especially if we include subsidies). Another group of authors argues that even if the economics were right, some farmers would not plant woodlands because of their predispositions, values and attitudes. There is almost certainly some truth in both these assertions. But, in practice, any decisions about tree planting will all depend on the attributes and values of the landowners/land managers/farmers who are a heterogeneous group: some may be closer to economically rational man than others, avoiding woodland creation because of its low profitability; while others may retain a visceral dislike of forestry and see it as having no place on their land, whatever the economics of the case. But, as we consider below, the economic analysis is not that simple and the range of values about woodland planting held by those who think of themselves as farmers is very broad.

Woodland planting is contentious in part because there is no simple measure that can enable the effective economic comparison of trees and farmland or the development of intermediate forms of land use such as pasture woodland or agro-forestry. The financial comparison is difficult in part because of the need to factor in the length of time it takes to grow trees. This requires selection of an appropriate discount rate (to represent the time value of money) and this itself can be a matter of debate. The overall economic comparison is also clouded by the presence of so many negative and positive externalities associated with land use. These include biodiversity, landscape, carbon sequestration and water pollution and they are rarely factored into individual decisions about how land is to be used. Land managers are neither rewarded accurately for the provision of environmental goods, nor taxed accordingly for environmental bads. Measurement of non-market costs and benefits can be difficult because we are dealing with complex land use systems. There is a need for good technical information on impacts and then the ability to put a value on the non-market goods. Put simply, the financial and economic appraisal of farm woodland planting is not at all straightforward. Quite what a level playing field would produce in terms of the net values of farming and forestry on a particular area of land is highly contestable.

In addition to the challenges of valuing the relative benefits of woodland vs farmland, the core of the farming community has often been resolutely opposed to planting trees on what is usually termed by them and many commentators 'productive farmland'. Many farms contain woodland, often on relatively agriculturally unproductive areas and these are rarely managed and rarely deliver any income to the farm. Because until recently trees and woodlands on tenanted farms were landlord's property and were often associated with game management, there was little scope for tenant farmers to manage woodland and no benefit to be derived from its presence. Indeed, there were often obvious disbenefits, such as shading of crops, marauding by deer, vermin habitat refuges, their use for landlord's game shooting etc.). These problems do not seem to arise in other parts of Europe where farm forest holdings are very much the norm (with the exception of Ireland with its links to UK landownership and property rights). Neither do they in general arise on mixed land use estates which are also part of the Scottish rural land use sector, although forestry is not normally a preferred land use immediately adjacent to intensively managed grouse moors because of predators and the risk of fire spreading when engaging in muirburn.

A third factor that leads to disagreement is the conflicting policies and political stances. After fifty or so years of improving food security, there is now probably more food insecurity than at any time in

recent decades in developed Western countries, caused both by climate change and reduced food reserves because of WTO induced policy changes. In the late 1980s, Scottish farmers were taking land out of farm production to plant trees because of cereal surpluses and wider concerns about overproduction, using newly developed grants to expedite the process. More recently, commentators such as Sir John Beddington have talked about a 'perfect storm' of food shortages, growing population and climate induced food insecurity. Farmers have warmly embraced the food security discourse and it has made them sensitive both about farmland acquisition for forestry by others and sensitised them against planting trees on their own land. It is a moot point as to whether food security or fuel security is the bigger challenge. In a cold country, we need both to satisfy basic human needs for food and warmth and woodland creation potentially contributes to the latter.

Until relatively recently, rural policies were focussed around food and forestry. But rural areas have become a far more crowded policy field. Industry support to rural land uses has to a large degree been displaced at least rhetorically, by the public good argument as a rationale for public support. Rural land use policies first broadened out from the 1980s to include biodiversity and, more recently, climate change and energy policy have come to prominence. On the one hand, the Climate Change (Scotland) Act 2009 with its bold aspirations to cut emissions has required a sector by sector appraisal of emissions reduction in which the rural land use sector must play a part. Second, the rush for renewables in the bid to decarbonise energy systems has made renewable energy one of the most important forms of farm diversification because of favourable feed-in-tariffs for farm based renewables. The final part of the policy jigsaw for renewables is the Renewable Heat Incentive which pays businesses for using woody or other biomass to produce heat and opens up significant new possibilities for developing wood energy supply chains using low grade wood products. The land use sector is seen as having a potentially important role. This last factor could be a 'game changer' with respect to creating a reliable demand for low grade wood for energy, and some landowners have already developed integrated wood energy supply chains based on short rotation coppice.

Figure 1. This crop of short rotation willow is destined for a woodchip heating scheme associated with a nearby housing development

Woodland expansion on farmland is thus a plausible policy goal but its achievement to the degree sought in policy aspirations is almost certainly compromised by negative attitudes and a failure to deliver policy which creates appropriate incentives. Before proceeding to consider the findings from a number of case studies of farming integration with woodland, there are further contextual issues that merit attention.

4. Contextual issues

4.1 The evidence base

The UK has some of the poorest quality data on forest ownership in Europe. The type of woodland is accurately delineated through the National Forest Inventory, but this indicates very little about forest ownership. In a recent study in Scotland, Wightman (2012) has argued that 'there can be little doubt that the pattern of forest ownership is a very important issue for public policy. However, officially, we know nothing about forest ownership patterns in Scotland. Unlike most other European countries (which not only consider the ownership of forests to matter a great deal but collect and publish data on the subject), the Scottish Government and Forestry Commission collect minimal information on forest holdings and publish nothing.' This lack of knowledge of who owns woodland is also replicated in England (John Clegg Ltd, 2012).

Forest and woodland in all European countries can be split into a state sector, a private sector and a NGO-owned sector. In many countries, a distinction is made between industrial private forestry where wood processors own large areas of forest and small-scale private forestry where ownership is in individual hands rather than corporate ownership. In the UK, there is almost no industrial private forestry where processors buy or lease large areas of forest to ensure integrated supply chains, but a new type of private forest ownership was created by the post Second World War policy to allow a switch between Schedules B and D which encouraged very rich private individuals (as well as the anticipated policy targets of traditional landowners) to invest in forestry. A number of companies were formed to provide an acquisition, planting and management function for such woodlands and they grew rapidly in the 1970s before, after a heated public debate, the relevant tax loophole was withdrawn in 1979.

Farm woodland area is not especially easy to estimate. It ought to be possible when farms are mapped for the Integrated Administration and Control System which informs the Single Farm Payment and through analysis of individual farm 'June Census' returns to establish the extent of farm owned woodland, or at least the area of woodland under land management units in receipt of the Single Farm Payment. Evidence from agricultural statistics reveals a substantial increase in woodland area of over250,000 hectares over the last decade. However, these data must be considered unreliable as WEAG (2012:19) report an annual average planting of just over 5,000 hectares per annum over this period for ***all*** woodland not just farm woodland. It is beyond the scope of this study to evaluate the competing data sources on forest area but improving data quality on farm woodland area remains a significant need.

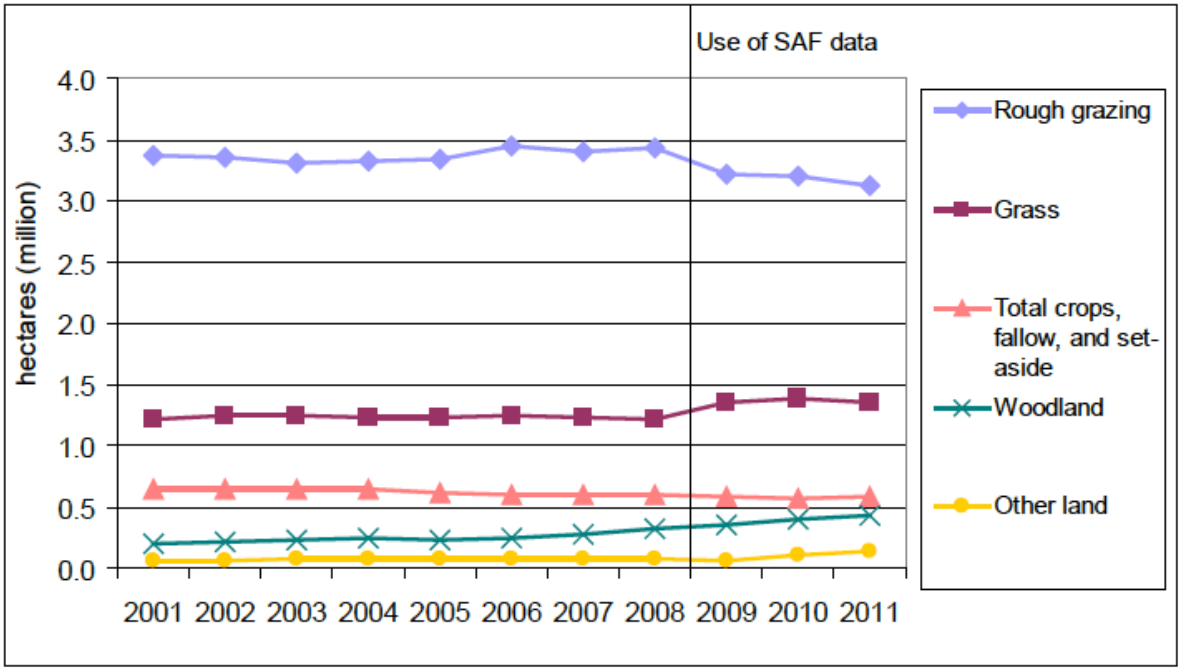
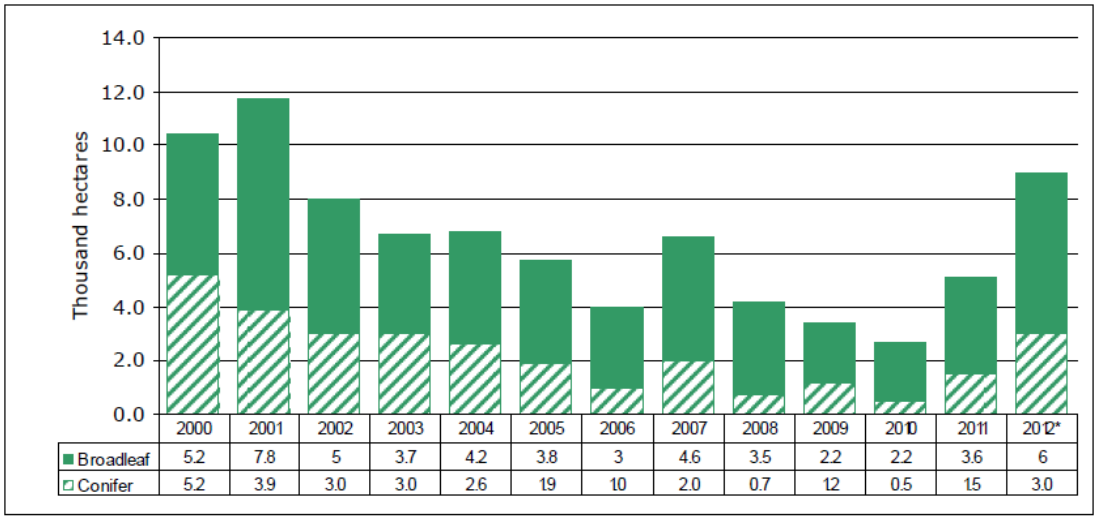


Figure 1 Agricultural trends Scotland 2001-11, showing woodland cover and other land use changes

Source: http://www.scotland.gov.uk/Publications/2011/09/27083355/3



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012*
Broadleaf	5.2	7.8	5	3.7	4.2	3.8	3	4.6	3.5	2.2	2.2	3.6	6
Conifer	5.2	3.9	3.0	3.0	2.6	1.9	1.0	2.0	0.7	1.2	0.5	1.5	3.0

*Provisional figures

Figure 2 WEAG data on woodland planting 2000-2012

Source: WEAG (2012)

There has been extensive research on styles of farming (e.g. van der Ploeg and Long, 1994), but much less on where new woodland planting or forest and woodland management connect to wider land management practices. As indicated earlier, estate owners have long tended to view woodland as part of a portfolio of land uses, often subject to multiple use, whereas to farmers, especially productivist farmers, existing woodland is more often than not a residual and largely neglected land use on marginal areas of land, such as wetlands or steep banks, within the farm business.

4.2 Ownership and property rights

Ownership and property rights can be considered as important contextual variables, because types of owner and types of tenure frame both the owner predispositions and the scope for woodland planting. Mather (1987) attributes the changing ownership structure of UK forests to policies. In particular, he argues that the exploitation of a tax loophole designed to support private forestry by a major forestry consultancy led super-rich people to acquire and plant low quality ground to reduce their overall tax liability. This fuelled the activity of forestry management companies and produced a considerable expansion of a class of absentee private forest owners. This contrasts to changing patterns of continental European forest ownership which are seen to be more a product of the decline of small-scale farming and, in post socialist countries, the application of restitution practices.

Many authors associate the low levels of engagement of farmers with forestry to the disposition of property rights under a landlord tenant system. Under normal farming tenure, trees and woodland were (and still normally are) landlord's capital. Given the dominance of the landlord tenant system in the UK until the mid-20th century and its continued influence on land use, it is unsurprising that tenant farmers should be largely disengaged from tree planting. The continued significance of the landlord tenant system, especially in marginal farming and upland areas, where lower grade farmland might be deemed relatively suitable for timber production, further militates against woodland. However, a full tenancy does allow the tenant to diversify, including into forestry, subject to landlord's approval and with recourse to the Land Court if there is disagreement.

4.3 The Policy Context

A range of rural policies shape woodland engagement. The post-war European policy settlement with agriculture created strong state support for the farming industry, albeit in different forms in different countries. Farm and wider rural policies (outside Norway and Switzerland and some eastern European countries) are now driven by the Common Agricultural Policy. It is widely recognised that the high levels of support to farming have resulted in increased land values, which necessarily militate against new planting of woodland. Since the late 1980s, when overproduction of certain farm products became a major policy issue, new policies for farm woodland planting were introduced to try to reduce the production of costly European surpluses of cereals. Such grants normally supplemented the existing forestry grants by paying farmers for the loss of farming revenue arising early in the forestry production cycle. There was a significant uptake of farm forestry in some parts of Scotland, although the extent to which this has been undertaken by mainstream farmers is sometimes questioned.

The current policy context for farm woodland is set within the Scottish Rural Development Programme. However, it is also important to consider other areas of policy which could influence the demand for wood and the recent introduction of the industrial Renewable Heat Incentive creates a really significant market for low grade wood products.

Forest policy for private sector forestry since the Second World War was built initially on so-called 'Dedication Schemes' under which woodland owners received grants and tax benefits from planting and/or actively managing woodlands. The Dedication Scheme was replaced by a Woodland Grant Scheme from the early 1980s, when much greater financial encouragement was given to broadleaved planting. In 1987 as part of the UK's response to Common Agricultural Policy challenges, in particular the presence of food surpluses, the UK introduced a Farm Woodland Premium Scheme in 1987. This scheme paid farmers for the losses arising from planting trees

instead of farming for a period of up to 15 years as well as the normal forestry grants, thereby reducing the opportunity costs of planting trees. Such farm-specific support has continued since that date.

From 1987, agri-environmental support was mainstreamed in UK agricultural policy with private sector forestry and woodland management supported under some of the stewardship and Environmentally Sensitive Areas schemes. At the same time, the normal private forestry support schemes remained for non-farm afforestation, with the farm woodland schemes providing top-up payments for loss of farm income over the planted land for 10 or 15 years.

In the 1990s, regionally specific discretionary grant schemes operated in some parts of Scotland which used a tendering model to increase woodland cover in central Scotland and North East Scotland. This challenge model meant that the funded projects were those that had either high levels of public benefit or low cost.

With the introduction of area-based Less Favoured Areas payments in 1999 and Single Farm Payments in 2003, there was a danger that woodland planting would result in loss of payments even if stock numbers were unchanged. This meant that woodland grants always needed to 'trump' the combined effects of LFASS and SFP to be viable. Some farmers got around the loss of SFP by planting trees on land for permanent set aside, but where trees have been planted since 1999, LFASS payments have been foregone. Under current farm support schemes tree planting results in loss of the Single Farm Payment, even if the woodland planting is integral to the farming enterprise and results in no loss of farmland production.

One of the problems highlighted by some contemporary observers is that pasture woodland, which is regarded as highly beneficial in delivering environmental public goods (such as landscape and biodiversity) is not able to draw down much public support (except where designated for conservation purposes), because the tree spacing is too wide to benefit from forestry grants and too high to benefit from Single Farm Payments. Consequently, policy support undermines the scope for achieving the synergistic effects of agro-forestry.

Perhaps the most significant recent legislation and policy that can impact on woodland is that relating to climate change. First, the Climate Change Scotland Act 2009 with its explicit emissions reductions targets necessarily raises the profile of forestry as the most beneficial of rural land uses with respect to carbon sequestration. Second, the high level of space heating through non-renewable carbon and hydrocarbon in Scotland has led to interest in woody biomass as a source of space heating, as space heating is a major area of consumption of energy in Scotland (See table 1). A long-promised commercial Renewable Heat Incentive scheme was introduced in 2011, but the private household scheme is still awaited.

Table 1 Feed in Tariff rates under the Renewable Heat Incentive.

Technology	Capacity	Feed-in tariff
Small biomass	Less than 200 kWth	8.3 (tier 1) or 2.1 (tier 2)
Medium biomass	200 kW to 999 kWth	5.1 (tier 1) or 2.1 (tier 2)
Large biomass	1,000 kWth and above	1.0

https://www.gov.uk/renewableheatincentive/what-youll-get accessed May13th 2013

In summary, a long history of modest supply-side support in the form of grant aid, but with more advantageous grants in specific regional projects such as the Grampian Challenge project has been to a degree replaced by demand-side initiatives which increase the demand for low grade wood products. Not only does RHI offer scope for within farm initiatives such as the installation of grain driers, but it substantially raises the value of low grade woodland on farmland and elsewhere by creating a marketable product. Forestry grants remain but in modified form and their drawdown means that there will be a loss of LFASS support and SFP even where the woodland is an integral part of the farm business.

4.4 The lack of leverage of the public good argument for forestry

There is a powerful strand in policy logic and appraisal that justifies policy intervention where there is market failure. Policy means provide a remediation strategy for market failure. This has been a prominent part of the EC's CAP reform agenda with a call for "public money for public goods" but not for long term subsidy of industry activity. Forestry can be seen to deliver a number of public goods: it normally enhances landscape values, though enhancement may well diminish at higher levels of forest cover. Forestry supports biodiversity, although levels of biodiversity are contingent on both species selection and management regime. Of increasing importance are carbon sequestration and the protection of water quality.

Stern has argued that climate change is the greatest externality ever to confront mankind; and, as such, climate change mitigating land uses such as forestry can be seen to reduce that negative externality. Some types of forestry also offer adaptive potential, for example by reducing downstream flooding by floodplain planting, or reducing phosphate emissions into water bodies by buffer strip planting.

The public good argument is highly plausible at a theoretical level but not generally effectively operationalized. Levels of policy support to new woodland planting cannot be seen to reflect any estimate of public good values. Intuitive appraisal of societal benefit was used when there were proposed forestry challenge schemes.

Estimates of the social value of a tonne of carbon sequestered vary but Treasury figures suggest that a tonne of sequestered carbon could be valued at around £200 per tonne. If farmers were to be paid half of the value of carbon sequestered in upland forestry on their land, it is inconceivable that higher rates of tree planting would not take place.

Thus the integration of farming and forestry is likely to be significantly impacted by policies. Many policies have impacted negatively on woodland expansion on farms but since 1987, a number of measures have been available, which have somewhat altered the balance. On balance, however, agricultural production would seem to be favoured over woodland.

5. A review of background literature on European farm woodlands

5.1 Introduction

This literature review explores the nature of farm woodlands in Europe with particular reference to the UK and seeks to better understand from published sources, first, why farm woodland planting is not strongly favoured by most Scottish (and UK farmers more generally), and second, why management of farm woodlands is so often neglected.

There is a substantial literature that points out the very different attitudes of UK and Irish farmers to woodland creation compared to those of their continental European counterparts (e.g. Stubbs 2011; O'Leary 2000). In much of Europe, farm forestry is a common form of land use with a long history. Farmers own and manage both farmland and forest resources in tandem. Such land use systems are the norm in Nordic countries (except Denmark) and Austria, common in many parts of Germany, Italy, France and Spain and new EU member states, but relatively uncommon in the British Isles and Ireland.

This section focusses on better understanding the factors that drive farm woodland planting and explores a number of farm forestry systems under the different farming systems containing the land most suited for woodland expansion. It explores the costs and benefits of farm woodland planting. It necessarily contextualises this in a study of the use which Scottish farmers make of farm woodlands and the factors that might predispose them to make greater use of their woodland resource.

One challenge is to identify which styles of farming are associated with antagonism or enthusiasm with respect to farm forestry. The dominant private forest owners numerically in Scotland are almost certainly farmers and estate owners. The traditional landed estate typically comprises a mixed array of farming, forest and sporting activities, sometimes associated with a wider range of processing activities (e.g. sawmills) or newer style diversified enterprises often related to recreation and tourism. The typical farm in Scotland is now owner-occupied and may contain small areas of trees which, if predating the farm woodland grant scheme, are likely to be in poor condition and may at best be used as pasture woodland or out-wintering areas. It might also be argued that the amenity farm is more likely to be associated with woodland planting than the *bona fide* farmer. Where identity is more associated with rural property ownership rather than farming *sensu stricto*, tree planting also seems more likely to be more favoured. However, where woodland is instrumental in contributing to farming enterprise, through the provision of shelter (Coed Cymru n.d.), or the provision of woodfuel for grain drying or domestic use, forest and woodland may also acquire a new salience within mainstream agriculture.

5.2 Types of farm and propensity to plant trees

The study necessarily begs the question of what is a 'farm' and what is a 'farmer'? Arguably, the nature of those that own and manage farms has become more heterogeneous, with hobby farms and part-time farms becoming more common, not only in the UK but also elsewhere. The ingress of urban wealth into rural areas and amenity purchase of farms has become a common social phenomenon in the UK and beyond. It is known that part-time, hobby and amenity farmers use land in different ways to mono-active farmers (Gasson and Errington 1993). Alongside the increasing diversity of land management practices on holdings that are typically thought of as farms, there are (or in some areas, have been) other types of land-holding, that have a different identity. The rural

estate typically comprises a more broadly based land management entity where farming, forestry and sporting use (and sometimes other activities such as recreational horse rearing and riding) are practised within a single proprietal unit. In some ways, the contemporary hobby farm mimics some of the land management practices found on some but by no means all estates.

On hobby farms, land use practices vary enormously. Hobby farmers may engage in normal farming practices with rather less attention to profit than mono-active farmers. More often they focus on one or more of horses and horse riding, rare breeds, sporting shooting and amenity, although the mix varies widely from landholding to landholding. Another common form of land use is rearing of rare breeds which may replace the more technically optimal mainstream animal production systems. Farming enterprises on such farms may be driven more by personal predilection than profit. Busck (2002) and Kristensen (1999) have both identified certain styles of farming (often part time or hobby farming) which are conducive to tree planting. Woodland planting to enhance amenity of living space may thus be seen in a much more positive light than by mainstream productivist farmers. Sometimes potentially value-adding lifestyle businesses such as food processing and tourism are also involved. This mix of amenity-influenced farming has created a mosaic of farmland ownership with very different patterns of use and styles of farming, the importance of which varies greatly from one region to another.

In the UK and Ireland tenurial arrangements and a history of feudal tenure and clearly separated property rights between tenant farmer and the landowner, which left all rights to trees and woodland to the landlord, has created a significant sense of alienation of farmers from woodland. Such holdings (grand proprieté in French, or latifundia (which translates from Latin as broad-based estate) were common in many countries under under feudal tenure; and where they have survived the exigencies of time and new types of taxation and land reform, they remain a feature of some rural areas. Traditional landowners have rarely showed the negative attitudes towards trees found most strongly among tenant farmers. Such holdings often let their farmed areas to tenants, whilst sometimes retaining a home farm in-hand. Rights to woodland or trees were strictly codified under feudal law and were landlord's property.

However, as with farmers as a category of land managers, the landowning class is now highly fractionated, with their landholdings ranging from very large inherited estates owned by traditional aristocratic families, to predominantly sporting estates owned by industrialists, to small working estates which differ little in character from owner occupied farms. Nevertheless, as an increasingly heterogeneous group, estate owners have generally been much more predisposed to having working woodlands on their holdings or planting more trees for productive and amenity purposes.

Mixed land use holdings also characterise very small land holdings of independent peasants in other parts of Europe, particularly where owners have acquired the forests and woodland formerly linked to large landholdings. In France, individual plots within larger woodland blocks were given to peasants after the Napoleonic break up of large estates and many are retained by farmers, often in non-contiguous locations to their holdings. A similar approach has been followed in many but not all Central and Eastern European countries in the last two decades, with farm and forest restitution combining in an explicit desire to recreate farm forest holdings (as found in much of Germanic and Nordic parts of Europe), with a consequence of often very fragmented land holdings and tiny forest plots, again often not consolidated into a single land management unit.

In summary, the variety of contemporary rural land management units in terms of farming and land use practices challenges historic notions of farm or estate. Small hobby farms often imitate the land management practices of large landed estates. To better understand the diversity of management practices, rural sociologists have endeavoured to identify 'styles' of farming (Burton 2004) and this can potentially be transferred to other types of landholding.

5.3 An overview of European farm forestry

The scale of farm forest holdings in continental Europe is highly variable, ranging from relatively large forest holdings in Nordic countries (Finland has an average forest size of 25 hectares and Sweden 45 hectares (http://www.nordicforestry.org/facts) to tiny forest holdings with an average size of less than three hectares in some new member states of the EU and the Balkans (Medved, 2003), with the modal holding size of less than one hectare, and around the same figure is found in regions such as Galicia (Torrijos et al 2003). For example, more than half of all Slovenian private forest holdings are less than one hectare in extent. In Spain, holdings are often highly fragmented, often as a result of inheritance practices which can make commercial exploitation of timber much more difficult.

Some Mediterranean countries and parts of Central and Eastern Europe, particularly mountain and semi-arid areas, have experienced significant amounts of land abandonment, with a reversion to scrub woodland and eventually forest, in the absence of intervention by fire (McDonald et al.2000; Keenleyside and Tucker, 2010). Keenleyside and Tucker (2010) argue that by 2030 3-4 % of the current European area of farmland may be abandoned, with high rates of abandonment in particular areas. The loss of young people from rural areas, poor returns to farming and the impacts of climate change are all implicated in land abandonment. Keenleyside and Tucker (2010) note the possibility that a proportion of abandoned land may also be transferred into commercial forest plantations.

Over the last 20-30 years the archetypal farm forest holding has been threatened by a rise of absentee ownership as inheritance has passed farm forests into the hands of the urban-based successors of their former owners. Ownership of forests is changing relatively rapidly. Hogl et al. (2005) report a 50% reduction in the number of farmers in Austria between 1960 and 1999 and that when farms are given up 'forest land is often removed from its close connection with agricultural production.' Looking forward, they anticipate a striking shift in the shares (of forest ownership) from peasant owners or part-time farmers to more "urban" forest owner types.

In Finland in the 1970s, 75% of private forest ownership was in the hands of farmers; now the proportion is only 22% (Tasanen, 2003). There is now a great deal of absentee ownership of private forests in Europe and much of the management of forests is undertaken by agents or co-operative bodies. Many European countries have well developed farm forestry co-operative organisations (Forest Owners Associations, (FOAs)) which seek to overcome some of the obstacles associated with small-sized holdings. These are often supported by the state. The Nordic, German and Austrian models of FOAs are particularly well developed (see e.g. Berlin et al. 2003) and they have also been introduced in post-socialist eastern European countries and post-dictatorship countries in Iberia.

For many private forest owners, amenity is becoming more important than meeting domestic subsistence needs (Wiersum and Elands, 2005) or selling timber. These changes are mirrored by changes in farming. In the case of residential amenity farm holdings, these tend to be concentrated in attractive area in the hinterland of large urban areas. Amenity forests are often in more remote

rural areas often comprise forest holdings owned by those that have moved away from their home areas and whose values have shifted away from productivism towards environmental conservation.

The evidence reveals a rapidly changing structure of private forest ownership in Europe with farm forestry declining and the gap caused by the absence of a resident owner filled in part by FOAs, whose efficacy varies very considerably even in different parts of the same country (Feliciano and Mendes). The small scale of forest holdings in some countries means that there is little commercial use of woodland and forest, but woodlands can still meet some subsistence needs, especially in relation to woodfuel and game.

The European country that most closely matches (in an even more extreme form) the UK's woodland history is Ireland. Since the late 1980s Ireland has encouraged farm forestry and policy support has strengthened over time. Ní Dhubháin and Gardiner, (1994), Ní Dhubháin and Greene, (2009) and O' Leary et al. 2000) have all investigated the reticence of Irish farmers to plant trees and found them particularly unwilling to plant on anything that is considered reasonable quality farmland, in spite of significant incentives so to do. Duesberg et al. (2013: 156) report that 'interest in planting dropped significantly after the (reformulated) strategy was launched. In the period from 1996 to 2009, only 48% of the targeted area of farmland was planted with trees, even though the value of the premium was increased in 1995, 1999, and 2007.' Even the explicit inclusion of the Single Farm Payment with the woodland grants in Ireland did little to increase afforestation rates on farmland. Their conclusions are highly relevant for Scottish conditions: 'This study demonstrated that Irish farmers' value systems with regard to farming and afforestation can be a barrier to engage in this alternative land use. This finding is highly significant for future policy design in the area of farm afforestation support in Ireland. As the majority of the farmers interviewed were not guided by profit-maximisation values when it comes to afforestation, it is questionable if the farm afforestation scheme in its current form alone will be sufficient to increase the planting rates as envisaged in the Irish policy strategy.'

In summary, there are some countries where farm forestry is vibrant and an important part of the rural economy. In such places, forests are generally managed with timber production in mind, FOAs are present and supportive, and there is a significant wood processing sector that handles different grades of wood for timber, fibre and wood energy. There are other parts of Europe where woodland makes a significant contribution to household subsistence needs, especially in relation to woodfuel, but also wider household needs. In these areas, farm woodland is also a significant source of wood energy.

Commercial extraction of timber from private farm forests does not deliver a continuous income stream, but can make a significant contribution towards major events in a family life cycle such as building a new home on a farm for the next generation. However, there are many forces militating against the productive management of small privately owned woodlands in continental Europe. The proportion of Mean Annual Increment (MAI) cut is generally rather low (Austria is an exception) and the level of forest activity by forest owners is generally in decline. The Irish study points to the extreme difficulty of engendering farmer engagement in tree planting because of major cultural barriers within farming, revolving primarily around the idea of not wanting to afforest 'good farming land' even where it was clearly more profitable to plant trees rather than farm that land.

5.4 UK farm woodland

5.4.1 Why farm woodland has often been neglected

Over most of the 20th century In the UK, most mainstream farmers have often not actively managed farm woodlands. Inaccessibility, under- and non-management and a lack of a significant rationale beyond game management meant that, outwith wartime, there was a tendency for farm woodland to remain a largely neglected resource on the average farm.

Numerous studies have reported on the neglected and unmanaged state of farm woodlands with the majority of non-state owned woodland not actively managed for timber (e.g. South West Forest and Woodland Framework, 2004). Over the last 40-50 years, a number of studies have sought to better understand the reasons for this. Two broad sets of reasons dominate explanations though there may be further factors: first, there are reasons associated with farmer attitudes; second, there are economic reasons.

In his paper to the WEAG study, Wilson (2011) argues that three main factors have militated against the development of farm woodlands: the inadequate support infrastructure in terms of advice, the overly complex grant schemes and lack of on-farm capacity, skills and inclination. The resistance of many farmers to tree planting is seen to be rooted in their sense of identity (Burton 2004) rather than economic logic, although the lack of profitable opportunities is also likely to deter active management. Further, the lack of a significant subsistence farming/subsistence forestry sector in the UK and the omnipresence of coal and then oil have militated against domestic heating through wood. Finally, the association of game management with wooded areas may have compounded farmer resistance, as game was normally the landowner's not the tenant farmer's right.

One of the most important reasons for farmer disinterest in woodland management has also been the relative economics of farming and forestry. Farmer resistance to the management of farm woodlands is likely to be influenced by a combination their lack of knowledge of good practice, the relatively large farm size in the UK (and its ability to make full use of household and hired workers) and the low returns to woodland management (John Clegg Ltd 2012). While both agriculture and forestry were supported by the post-World War 2 policy settlement, agricultural policy has been much strengthened by the entry of the UK into Europe and the farm subsidies have trumped those for forestry. Public support for increased food production from our own resources created a policy climate in which forestry was effectively pushed into the hills and uplands or practiced separately from food production within the existing forests and woodlands of estates.

Forestry generates low returns to forestry activity but has recently delivered good returns to forest ownership. Smiths Gore (2013) report that 'forestry is likely to be the top performing type of property in the UK again……. Like rural land, its performance is mainly driven by increases in the capital value of the land and trees (19.4%) as it does not generate much income each year (-0.9%). Over a 10 year period, the IPD UK Forestry Index has produced an average return of 16.3% each year at lower volatility than other property investments which, with its significant capital tax benefits, has made it an attractive asset class for large and small investors (investing £10-15k or more)'.

Stubbs (2011) reporting another survey identified six main factors which militated against farmers in Grampian planting trees. These included:

- Cultural factors: there was a strong desire of mainstream farmers not to plant trees.

- Capabilities and confidence: trees and woodland were not on the mental map of most farmers and they would not act in ignorance.
- Transaction costs: negotiating a way through the grant system and understanding replanting obligations were seen as a barrier.
- Option values: the obligation to replant after the forest cycle was complete was seen as unduly limiting of farmer's choice.
- Policy instability: policy was not seen as stable and future support might offer more incentives.
- Farmer vs forestry driven: farmers were seen to want to plant trees on their terms and through the lens of the farm, rather than respond to forestry's dictums.

Stubbs (2011) does not rank these factors in terms of their relative importance, but the list of factors confirms that there are a number of barriers to the management and/or planting of farm woodland in Scotland.

The combination of factors militating against tree planting is likely to continue to lead to low planting rates among mainstream productivist farmers. It may make more sense to consider segmenting the market, or considering different styles of land manger and to actively target support to those segments which show the greatest interest. This approach to policy delivery is being adopted in other parts of the UK by Defra.

5.4.2 Why some farmers have planted trees

The most comprehensive and useful analysis of landowners' attitudes to woodland planting was undertaken by Lawrence et al. (2010). It notes:

> *'There is a clear pattern amongst the studies that provide evidence on owners' reasons for having and planting woodland. Landscape and conservation (wildlife and shelterbelt) are ranked highest, with shooting also often high; production and profit come low in the list of priorities, and provision of public recreation even lower.'*

Lawrence et al. (2010) go on to point out a very distinct divergence of opinion on why some landowners do not plant trees. One body of evidence which reinforces that provided by Stubbs et al. (2010) suggests cultural factors are dominant whilst the other suggests that financial returns are very low. However, drawing on a wide range of mostly English studies, it is clear that for some farmers cultural factors appear to outweigh any financial drivers.

One policy factor has the capacity to change the economics of small woodland management is the Renewable Heat Initiative (RHI). It could dramatically increase the case for managing small areas of woodland for chipping or pelleting, but does not apply to technologies based on logs. In our view, this is a potential game changer, because for the first time in the last 50 years, low grade timber in farm woods has reasonable potential value, even for on-farm use. Some of the negativity surrounding a sense of productivist farmers being pushed to plant trees is likely to be overcome as the demand for low grade wood for biomass heating increases, especially where this is connected to business activity such as grain drying. The payback periods for woody biomass-fuelled grain driers may be as little as one year and press reporting of such success stories (Press and Journal 26th April 2013) may well increase farmer interest in sourcing wood and re-instigating management.

Attempts to revitalise the rural economy through the more effective integration farming and forestry have been a recurrent theme among those seeking rural regeneration. It is evident in

Scotland's Land Use Strategy (Scottish Government 2012). But it is a recurrent refrain which was implemented very effectively in the work of Dartington Hall in Devon from the 1930s by Dorothy Elmhirst, an American heiress, and her agricultural economist husband, who bought a derelict estate and created a number of estate enterprises in an effort to revitalise the rural economy of the region. Better integration of land use was integral to their vision. W E Hiley, a well-known forester and forestry author, took on the running of the Dartington woodlands and reinstated management of their woods, as well as initiating training programmes for private woodland management. Dartington Amenity Research Trust (a part of the Dartington enterprise mix) conducted a number of studies of farm woodlands in the 1980s and found many of them moribund and unmanaged. More recently, the Dartington ethos has been associated with the transition movement and permaculture, the latter an imported land management philosophy but which also explicitly integrates farming and forestry. However, both transition movement and permaculture are both probably likely to be regarded by mainstream farmers as eccentric and alternative social practices.

6. A theoretical perspective: Kahneman and Bourdieu combined.

Our approach to deriving enhanced understanding of farmer's desire to and capacity for integrating farming and forestry is rooted in case studies and the case study approach but is informed by two other theoretical perspectives. Daniel Kahneman is a Nobel laureate psychologist, although his prize was for the subject of economics. He has explored how people make decisions and come up with conclusions that suggest that the model of economically rational man is less often encountered in reality than in economics text books and teaching. In his book, Thinking Fast and Slow, he talks about System 1 thinking which is intuitive and emotional and not based on any rational calculus (but is still he argues often right) and System 2 thinking which is slower and more rational and more scientific in its approach. These two ways of thinking can lead the same individual to arrive at different conclusions using the same data. It is not at all improbable that farmers contemplating woodland development would choose not to plant trees for reasons that are connected to System 1 intuitive thinking rather than rationalist scientific System 2 thinking.

Pierre Bourdieu was a French sociologist, anthropologist and philosopher. One of his core ideas was that of habitus. A habitus is essentially a disposition to act but Bourdieu argues that the disposition to act is a result of social conditioning of behaviour. Habitus frames an individual's response to the objective world and is influenced by social background and culture. Again, the implication of Bourdieu's habitus is that individual behaviour is socially conditioned and may not necessarily represent an individual's best interests.

Through their different disciplinary lenses both Kahneman and Bourdieu focus on how people react to the external world and in particular to changes in it. They both, in different ways and from different theoretical bases inform us that actions attitudes and behaviours may often not be narrowly profit or utility maximising, but are socially constructed and influenced by culture as well as economics.

Arguably, when the conditions in the external world change fast, there is likely to be an adjustment lag, as old ideas and values continue to drive preferences and choices. Equally, in a situation where there is endemic market failure and important public goods fall outside the operation of markets, prices fail to convey signals appropriately and land use choices will be driven without heed to non-market values. The emergence of climate change as a major policy concern coupled with recognition of the capacity of woodland to deliver enhanced values over farmland with respect to a number of public goods, most especially carbon sequestration, leaves policy enhancement as the most likely means to deliver effective integration.

7. Types of farm woodland in the UK

A number of studies have considered the types of farm woodland in the UK. Wilson (2012) in supporting work for WEAG suggests the following types of woodland:

- Small farm woodland blocks, shelterbelts and hedgerows
- Riparian and floodplain woodlands

- Productive farm woodlots (grazing excluded semi-permanently)
- Productive farm woodlots (grazing re-admitted within the first 30 years)
- Silvo-arable and silvo-pastoral agroforestry (initial spacing up to 500 stems/ ha)
- Farm forestry small-holdings and forest gardens (including orchard systems)

These categories may only indirectly reflect the motives of woodland owners. Further, some of the categories such as hedges and orchards may not even be conceived of as woodland by farmers, although there are a number of good examples of new hedgerow creation. QMS and others are showing increased interest in new hedgerows, which are recognised as having benefits including shelter and biosecurity, some types of which may also sequester significant amounts of carbon.

Forest Research use four farm woodland type models for their work in relation to their research work on climate change:

- Native;
- Multi-purpose;
- Production; and
- Short Rotation Forestry

Each has different characteristics, different management needs and different capacities for carbon sequestration.

We propose a fourfold classification based on the evidence of the types of woodland management commonly practiced by Scottish farmers. Of course, some farms will practice very different styles of woodland management on different parcels of land.

Shelter woodland

Shelter woodland typically consists of areas of woodland where the primary purpose is stock (or occasionally crop/soil) protection. Woodland areas are typically likely to be elongate with largish boundaries per unit area, often with consequent loss of timber production and/or quality at the woodland edge and enhanced risk of wind damage. However some farmers plant field corners or even roundels to provide stock shelter.

The principal function is to protect stock from chilling winds which increase energy requirements and nutrition costs, or to protect crops where (as in say Morayshire) wind blow of light dry soils can have serious soil loss consequences. Shelter woodland will also produce timber but quality will most likely be compromised by edge effects. Such woodland will also offer landscape and biodiversity benefits but can also provide a suitable habitat for vermin such as rabbits which can attack nearby cereals crops and for foxes which can take lambs.

Production woodland

Production woodland comprises that woodland where the primary function is production of timber or biomass for profit. Woodland will often be in larger blocks, often but by no means always be dominated by single species in even-aged stands, as this is assumed to be the profit-maximising model of commercial and state forestry. The most widely grown species will be commercial conifers, especially Sitka spruce, Norway spruce and Scots pine or, on better soils, Douglas fir. In short rotation forestry, willow is likely to be grown as the most productive species. This category thus includes both Forest Research's 'Commercial' and 'Short Rotation Forestry' categories (if short rotation forestry takes off in the wake of the RHI, there may be a case for a separate category. Its development will be framed by a mix of establishment grants and product end prices.

Amenity and conservation woodland

Amenity and conservation woodland is an extremely broad category. What is distinctive about it is that the reasons for its planting/management revolve around the desire of the owner to enhance amenities. In some cases, where the amenity interest is principally related to landscape quality, a variety of visual amenity-enhancing species will be selected. Siting of planting will usually be driven more by aesthetic or conservation considerations than production issues. Game management has been cited as a major driver of tree planting, but may be under-reported as sporting shooting can be seen to have negative connotations to some people and is not a legitimate reason for receiving grants for afforestation. Whether for game conservation or more conventional biodiversity conservation, these woodlands will also sequester carbon and deliver landscape benefits. Woodland can also be planted as a buffer to phosphate emissions. In wet riparian areas woodland can provide a barrier

against particulate emissions, and deliver beneficial shading, and an enhanced insect population for fish.

Agroforestry

In general, agroforestry and silvopastoralism has been more hypothesised than practiced in the UK. Various authors have described a range of possible agroforestry practices. Most agroforestry comprises grazing open woodland or orchards. This type of woodland is sometimes termed pasture woodland. As with shelterbelts, trees provide shelter for livestock and reduce chilling of livestock and energy requirements necessary to maintain body heat, but also produce shade which reduces forage growth. It is also possible that shade confers benefits on stock in hot summer weather. Casual observation suggests that ruminants gather under trees on hot days and avoid direct sunshine. At very least, woodland would seem to create scope for more contented animals. Research experiments have shown how different species and different planting regimes can affect the relative outputs of farm and forest systems, but these more formal approaches to agroforestry have not been widely taken up in the UK, although agroforestry was widely practiced in New Zealand in the 1970s and 1980s. However, rapid tree growth in New Zealand compromised wood quality and the practice is now rather less common.

8. Likely economic impacts at farm level

The term 'economic impact' can be subject to multiple interpretations. First, it can mean the impact of a change of enterprise or production system on the financial performance of a business. Second, it can relate to the result of an analysis of the real resource costs and benefits (as in Cost- Benefit Analysis) where the market prices are adjusted (to take account of subsidies and market failure) and externalities are assessed and factored into the analysis. This second form of analysis is usually undertaken at a scale above the individual business and would normally be undertaken for a major project or in policy appraisal. A third type of economic impacts is those arising in a specific area from the upstream (supplier) and downstream (buyer) connections between a business and other firms and the aggregate impact of the firm on a local regional or national economy. This latter type of economic impact analysis is often termed a multiplier study.

In this study, our primary interest is with the on-farm economic impacts. However, the economic costs and benefits of woodland creation are difficult to compare with normal farming enterprises. First, the two industries deal with very different time horizons, though the forestry time horizon is reduced somewhat where short rotation forestry is practiced for biomass production. Second, farmers and foresters have historically used rather different metrics for assessing financial performance. Whereas farmers have often looked at Gross Margins (the gross output of an enterprise less its variable (allocatable) costs, forestry appraisal tends to hinge around estimating net present values, that is the discounted stream of costs and revenues reduced to a single lump sum value, which provides an appropriate mechanism for taking into account the long production cycle. This approach, which is occasionally used by farmers with respect to large-scale, relatively long-lived investments (in say new milking parlours), is not part of the normal repertoire of farm business management techniques used in everyday farm decision making.

The primary reason for using Gross Margins analysis with farm enterprises is that there are usually some costs which are directly attributable to an enterprise and some that are fixed and unallocatable to specific enterprises. Assuming fixed costs cannot be readily changed, at least in the short term, the gross margin gives a reasonable estimate of enterprise performance to allow one enterprise to be compared with another; or one farms performance to be compared with another. There is still a need to consider how fixed costs can impact on net farm income, but the gross margin for an enterprise or the farm as a whole on an enterprise by enterprise basis allows some consideration of performance.

When farmers consider enterprise changes they often think in terms of a partial budget. What costs would be saved and what benefits forgone from an existing enterprise? What additional benefits would arise from the new enterprise and with what costs? Such an approach does not consider the time value of money, which is integral to normal forestry accounting procedures.

In contrast, the discounting approach reduces the stream of costs and benefits over time to a net present value (or an internal rate of return for the project). Benefits and further costs in the future are discounted at an appropriate discount rate. The choice of the discount rate is critical. High discount rates militate against the profitability of longer term projects such as forestry, because the bulk of value is the final crop felled over forty years after planting. What discount rates should be used is hotly debated. Theory would suggest that the discount rate should be the Social Rate of Time Preference- that is how society adjudges the value of a £ today compared to a year or ten years

hence. In practice, those using discounting will tend to discount at the cost of capital which will almost certainly be greatly in excess of the Social Rate of Time Preference.

As indicated above, such appraisal techniques do not capture either spillover benefits from one enterprise to another (as in the provision of shelter and reduced feed costs) or non-market benefits such as the social (non-market) value of carbon sequestered. However, forestry is widely acknowledged as a sector delivering rather high values of non-market goods such as carbon sequestration and water quality enhancement and relatively few non-market bads such as chemical pollution from pesticides or fertiliser application.

Where policies exist to explicitly capture non-market values (such as paying farmers for biodiversity through grant schemes), the non-market goods converted to a grant are effectively taken into account by the land manager when making a decision about the use to which land should be put.

Unfortunately, there is a raft of grant schemes of which different elements pull in different directions. The main farm subsidy system under the CAP is the Single Farm Payment (SFP). This sum has been determined by the level of subsidy received by an individual holding between 2000 and 2002, but is due to change to a so-called 'flattened' regime to become compliant with WTO rules and CAP changes. The Single Farm Payment is paid only on eligible land, so if land is taken out of agricultural production, there will be a proportional decrement in the SFP. Over and above the SFP 'hurdle', any farm forestry proposal will take land away from livestock production and the LFASS scheme receipts will also be decrementally affected.

Farms and estates are multi-enterprise firms. They are now less free standing as business entities than they were in the past. They often include on-farm diversified enterprises (such as renewable energy or tourism). They are often supported by off-farm income sources. Their relatively advantageous tax position makes them valued assets. But they are not businesses pure and simple. They are more complex entities which combine family aspirations for income creation capital asset building and leisure consumption in different proportions in different places. An interest in game management is acknowledged by many who plant woodland. This may or may not raise revenue, but is most likely to be associated with leisure rather than income generation.

There is within many farm households a trading off of profit against amenity generating activities. This is a particular feature of land based businesses but may also be found in lifestyle tourism businesses such as ecotourism, or indeed in second home ownership where owners often trade off income against their own leisure use of the facility. The trade off is often not calculated explicitly, making the assessment of any opportunity costs associated with forest and woodland development extremely challenging for most farm woodland owners.

In consequence the economics of farm woodland and how it is integrated into family businesses must be seen in the context of both business development and household consumption. The economics of woodland creation and how it is integrated with the farm will be contingent on the type of farm and the role of woodland. Our case studies have revealed a range of motives from enhancing the environment in an abstract sense, to enhancing personal living space, to acquiring capital assets, to generating cost-effective heating or grain drying systems. There are no doubt cases where profit generation is a primary motive; but in many cases that we explored this is not the over-riding driver; at least not in an entrepreneurial sense. However, the opportunistic uptake of grants has made a financial case for woodland planting compelling at some times and in some places.

In Table 2 below we summarise the likely economic impacts of different types of farm woodland on farm businesses. These are generalised statements and there is likely to be considerable variation from one farm to another. Amenity woodland creation is likely to have more positive impacts on capital values where the demand for amenity farmland is greatest (i.e. there are large numbers of lifestyle farmers in attractive countryside near wealthy built up areas) or where the woodland can connect to diversified enterprises. Shelter woodland will have greater value on windy and exposed livestock rearing farms or in areas prone to wind-blown erosion. Production woodland is likely to be most valuable where the opportunity costs of releasing land from farming are low. Typically this will occur where stocking rates are low and on patches of land that are not effectively incorporated into farm rotations or mainstream farming activity.

Table 1 Economic impacts of different types of farm woodland

Woodland type	Impact on income	Impact on capital values	Notes
Shelter woodland	Modestly beneficial but very difficult to estimate accurately	Modestly beneficial	High fencing costs as boundary: area ratio is high
Production woodland	Lumpy returns except with SRC Linked to RHI, major income stream possible with SRC	Modestly beneficial	Depends on site selection and good management Major savings in grain drying or domestic heating.
Amenity woodland	Negligible and maybe negative opportunity cost	Potentially quite high in some situations	Highly location-dependent
Agroforestry	No grant aid currently available therefore low, however incentives have been included in the SRDP consultation document	Modest because of impact on subsidy	Public policy out of kilter with public good argument for agroforestry

In this study, no attempt has been made to value the non-market costs and benefits of woodland creation. In general, the balance of non-market benefits is likely to be positive, although it is widely recognised that woodland creation on deep peat (> 50cm) will release large amounts of carbon and would not be allowed (or grant-aidable). It is now recognised that rather than looking for single benefit outcomes, it ought to be possible to 'stack' ecosystem service benefits, for example delivering carbon, wood production, biodiversity, shelter, water quality and landscape enhancement.

The 12 case study farmers investigated as part of this study had very different attitudes to appraising the costs and benefits of new woodland creation. One relatively small group of farmers was very keen to make their woodlands an economic proposition and their decisions to plant trees were strongly influenced by the financial impact on the farm business. Almost all such cases involved a mixture of making careful use of grants made available by earlier farm woodland support schemes or forestry grants within the SRDP. Some had made use of forestry grants and locational supplements which made forestry planting much more favourable from a financial perspective, but

because Challenge-funded forestry was based on discretionary funding, it would be possible for a farmer to prepare a scheme and not be funded. In addition, most of the financially motivated farmer foresters had also introduced biomass heat systems which themselves had been supported by grant aid and are now supported under the Renewable Heat Incentive (RHI) scheme. However, even profit-oriented farmers tended not to think in gross margin terms though, in principle, gross margins could be used to compare the returns to new planting where the farm woodland payments were made over the 10-15 year period after planting. In most cases where farmers had recorded costs, the impact on farm income was broadly neutral, even before the valuation of woody biomass as a fuel source. However, where RHI was being used, the profitability of woodland is dramatically enhanced although of course under such conditions there is no requirement that the wood be sourced from the farm. Indeed, it can be sourced elsewhere although ownership of the whole supply chain could be deemed advantageous if demand for woody biomass increased and prices rose accordingly, although the use of the wood through RHI is needed in order to glean the value.

Some of the farms (Knock, Ifferdale and Glensaugh) are self-consciously trying to build resilience into their land use systems through turning farms into diversified rural businesses with woodland, energy and tourism enterprises.

A further reason why gross margins are an inappropriate measure through which to assess the financial performance of the case study farms is that several of the farmers were planting trees in the wake of major business restructuring. Gross margins analysis is much more appropriate when considering the day-to-day or year –to-year functioning of a business not going through significant structural changes. Some farmers were restructuring for financial reasons (for example Glensaugh was seeking to reduce stock numbers) and similar restructuring occurred among Kintyre farmers and other hill and upland farms (e.g. Corrimony) where poorer quality grazings could be foregone at no cost except the loss of the LFASS payments which, on the larger hill holdings, created a negligible loss. Other farms, such as Knock, had restructured for a mixture of environmental and family reasons.

A third group of farmers could be considered as taking a very holistic view of costs and benefits but undertaking such appraisal in an intuitive rather than formal manner. Even the most financially motivated farmer would find it hard to put a value on shelter, although shelter to stock was universally valued by all farmers and is recognised as a major benefit of trees in the scientific literature. As well as considering the value of shelter, woodland was also recognised to have value in reducing water pollution and sequestering carbon. Forestry was seen as having value for shelter both within the forest in agro-forestry schemes and using stock-protected shelter belts. The sample was too small to compare the relative merits of shelter belts vs agroforestry.

A final group of farmers saw the principal benefits as arising from enhancing the environmental quality of the farm either for their interests, the public interest or both. In some cases, sport shooting was enhanced by woodland planting. Many of the amenity-driven woodland creators recognised that there was a modest cost to their farm but were trading off personal non-pecuniary benefits against pecuniary benefits from the farming enterprise.

There was no consistent view from the respondents of the impact of woodland on capital values. Most woodlands were planted on relatively poor quality farmland with an eye to improving amenity or improving shelter. On balance, it seems probable that the impact of woodland planting on capital

values of whole holdings is rather low and this general finding might be expected to prevail where a relatively small proportion of the farm is taken up by woodland.

Almost all woodland creation was supported by grant aid. It is difficult to establish a counterfactual: what would have happened in the absence of grant aid? Our suspicion is that while some woodland planting might have taken place, it would have been substantially less. Where Challenge-funded forestry opportunities existed, the economics of woodland planting were sometimes considerably enhanced. Where there are obvious multiple benefits from forestry, Challenge funding would appear to offer a sensible approach to delivering non-market values, as long as land managers have a clear view of the public benefits sought.

The economics of planting trees is substantially impacted by changes in the levels of grant aid. However, changes in grant aid can turn a non-viable proposition into something highly viable or can work in reverse. Consistency in grant aid is clearly important if a clearer impact of the economics of woodland planting is to be considered.

The decision to plant trees is usually driven by individuals/groups taking a long view, and is not based on short term profitability criteria. Decisions to plant trees are necessarily driven by values and assumptions, but rarely are the assumptions of the opportunity costs of planting and the future values of crops formally and actively factored into the decision making process. Instead, woodland creators take a long view, often invoking benefits that will be received primarily by future generations and values associated more with custodianship of land than profit.

Figure 2 Wood energy systems have been supported by SRDP grants (as in this case), the Energy Efficiency Financing Scheme (EFF), but in future most likely through the Renewable Heat Incentive (RHI)

9. Findings

We divide our findings into four main groups. First, we establish the factual findings based on background reading and case studies. Second, we make some policy observations. Third, we make practical suggestions as to how at aggregate level it ought to be possible to identify farmland suitable for tree planting. Finally, we offer some theoretical reflections.

9.1 Factual findings

- A substantial amount of woodland is found on farms. Scottish Government data (2010) suggest that those claiming EU farm or rural support of some kind also have about 400,000 hectares of forestry. We surmise that the majority of this will be actively managed forests on estates and larger farms, but a substantial but unknown area of small farm woodlands is still not actively managed. We also suggest that the apparent increase in farm woodland in the last decade is a quirk of land registration in relation to European policy, rather than a real increase.
- Patches of rough woodland often play a role for out-wintering stock, and often contain sacrificial feeding areas to avoid damage to more productive pasture. They may also play a role in provision of domestic fuel production. The woodfuel demand will increase with the substantial savings in heating costs arising from adoption of the Renewable Heat Incentive (RHI), although currently only the commercial scheme is operational.
- This residual woodland on farmland which is often of poor quality is not a good indicator of woodland potential on other areas of farmland but its neglected condition but current use may help frame farmer's negative expectations of woodland potential.
- There is probably less homogeneity in the farming community in terms of attitudes to woodland planting today than there was 20, 50 or 100 years ago when most farmers were farming for a living and had a stronger production orientation (albeit with a stronger subsistence or own production component than at present). The primary reason for this has been the acquisition of farms by people who are not seeking to farm the land as a productive asset, but for whom the pursuit of private amenity is a strong or sometimes the over-riding interest. In the public mission to extend woodland area, the motive to enhance amenity should be recognised.
- The evidence accumulated from both the literature and interviews does suggest that there are both behavioural and attitudinal barriers and economic barriers to tree planting, particularly on mainstream Scottish farms. There are signs from both the UK and other parts of Europe that hobby or part-time farms are much more willing to plant trees for conservation and amenity reasons than are mainstream farmers. There is no evidence of their numbers, although they are increasingly being investigated by social scientists. Game management is also a significant reason for tree planting and a strong interest in game management may allow the normal farmer reticence to plant trees to be at least partially overcome. Finally, emergent markets for low-grade timber for woody biomass, which have arisen in the wake of the introduction of the RHI, could result in a step-change of interest in woodland management, although the lack of any long-term guarantees in policy may militate against new planting.
- Neither traditional farmers nor new amenity owners have well developed skill sets with respect to woodland development and/or management. Engaging with grant aid has also become more

difficult with the merging of woodland grants into the SRDP, rather than easier as might have been hoped. This has made farmers much more consultant-dependent and in the absence of a known and respected land management consultant, new woodland developments are unlikely to materialise. While estate owners have frequent experience of in-house foresters or use of forest consultants, most farmers do not, although some farm consultants have acquired woodland management skills in their practices.

- Tenanted farms are likely to be more resistant to woodland creation than owner occupiers.
- It is almost impossible to make a simple and meaningful financial comparison of farming and forestry. This arises partly because of long time horizons in forestry, compared to farming and the sensitivity of results to choice of discount rate or expected prices in up to 50 years' time, about which we, inevitably, have very limited insight. This leads to default to the 'constant relative prices' rule which tends to maintain the status quo. However, recent information shows increasing capital values of woodland are sometimes decisive in delivering higher land values; and, more generally, firm prices for woodland products and a growing market for woody biomass augur well for forestry. Case studies of farmers indicate that their land use choices between farming and forestry are rarely driven by financial considerations alone, although some farmers have clearly responded to high levels of grant aid, for example under Challenge-funded forestry.
- It is extremely difficult to see farmers' decisions about woodland planting as driven exclusively by money, although the public support in the SRDP for woodland planting has been taken advantage of by many, often once they have found an agent to master the complexities of the application process for the SRDP support. Financial returns are likely to have been one factor in the decision to plant trees but, in most cases, are not likely to have been decisive. However, the development of the RHI has made the use of low-grade timber for fuel potentially so profitable that the development of wood energy supply chains is likely to be a game changer for existing undermanaged farm woodlands and is likely to stimulate additional woodland planting of fast-growing biomass crops. There are already emergent examples of good practice, some private sector and some driven by machinery rings.
- Two examples indicate the economic value of planting trees. In one case a farmer had a £100,000 surplus over costs when he received the grants under a Forestry Challenge Scheme in the early 2000s. More recently another farmer had paid off all the investment in a wood heated grain drier system in one year using RHI. Such an investment might normally take 10 years to pay off. These examples are not typical and reflect exceptional business acumen by the farmers involved.
- There is a minority of farmers who have managed their woodlands actively. This may arise because of particular interests in woodland, a willingness to think outside the box of conventional farming practice, or because of beliefs that there are beneficial synergies between farming and forestry. They have been motivated by various factors. Some want to enhance the landscape for their own amenity; others are keen on game management and have used woodland planting to enhance the quality of their shoot. Others see woodland as providing stock shelter, either within the woodland or using the woodland boundary as a means of protection from the elements. Other factors such as a desire to build more sustainable and resilient land management systems have also influenced some farmers.

9.2 Policy findings

- The current policy arrangements although in some ways supportive of farm woodland planting are currently insufficient to overcome the multiple behavioural, attitudinal and financial barriers that characterise mainstream productivist farmers, but are sufficient to encourage planting by hobby/lifestyle farmers and amenity-motivated land-owners. It is uncertain whether this will lead to the right trees in the right place from a public policy perspective.
- Some types of farm woodland, particularly pasture woodlands and other related woodland grazing systems, operate with stocking densities that lead to neither woodland nor farm subsidy and support being available. Paradoxically, the wood pasture system probably has very high levels of public good and would thereby merit significant public support.
- The emergence of the Renewable Heat Initiative as a policy to support the increased production of renewable energy is a major factor in stimulating farmer interest in woody biomass or other forms of biomass. Farmers who have installed biomass-based grain drying have found it extremely profitable, with reported payback periods of a few years at most, and sometimes less than one. As sector knowledge expands on the financial profitability of biomass boilers, so interest may be stimulated in own production
- There is a strong strand in reformist agricultural policy discourse arguing that public payments should be for public goods. To reward farmers for the non-market value of carbon sequestration through tree planting such as is being developed for peatbog restoration could, if the price was set at anywhere near the Treasury's social value of carbon, create an enormous boost for farm woodland planting.
- Equally, any tax or other policy measure to mitigate emissions from land use would stimulate farmers to think about where they could at lowest cost reduce their GHG emissions. Any move in this direction (and larger-emitting businesses and organisations already are obligated to comply with the carbon reduction commitment energy efficiency scheme by buying allowances for every tonne of carbon that they emit.
- The biggest economic barrier to tree planting is a product of policy: that is the potential loss of SFP and actual loss of LFASS (or its successor) on planted land, even where the farm business activity is wholly or virtually unaffected by the planting. Currently, if a farmer plants 20% of his LFASS eligible land he will lose that proportion of subsidy, even if that land were very lightly stocked and of no significance to the farming enterprise.
- We concur with the WEAG 10 recommendation that woodland grazing by farm livestock needs to be accommodated within the SFP system and that the current failure to effectively reward farmers with subsidies for silvopastoral systems is anomalous and unreasonable. We would see scope for remediation of this situation through changed eligibility for SFP.

9.3 Practical considerations

- Using GIS of livestock densities, it is possible to identify significant areas of farmland where there would be minimal displacement of stock if woodland planting were to be undertaken. This should enable very low cost afforestation to take place but the possible loss of the Single Farm Payment on afforested land might well still deter farmers from woodland creation.

For example, the partially afforested hill in Figure 3 below could be further afforested with zero loss of production as the non-forested part of the knoll outlined in yellow is currently un-grazed and uncultivated for agricultural purposes. It is typical of many areas of upland in the north east of Scotland, which if not ungrazed, is very lightly stocked. It is not known whether any of the land currently attracts Single Farm Payment.

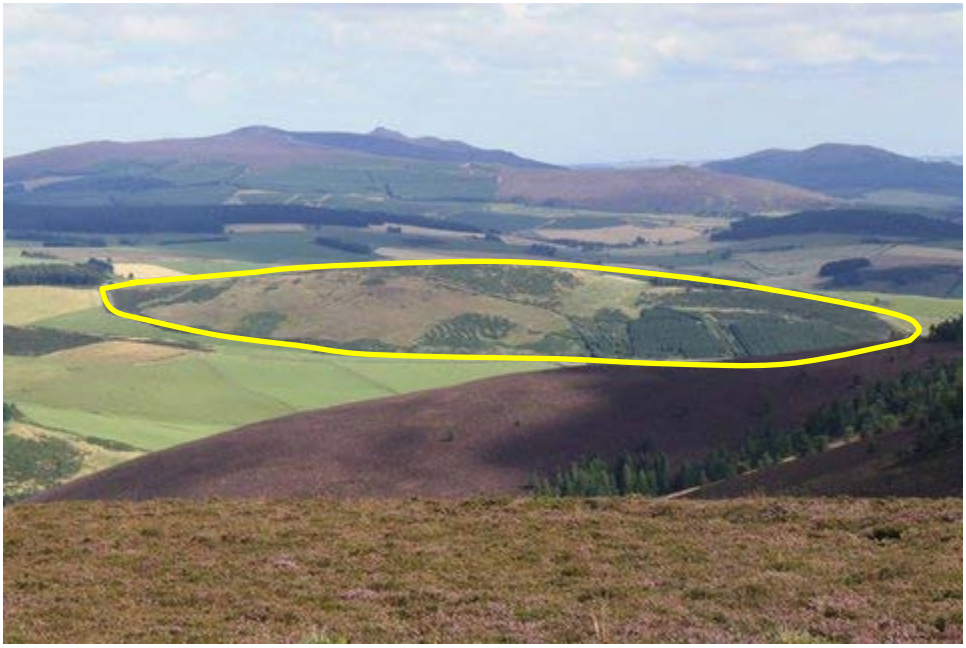


Figure 3 The woodland creation challenge: reducing the costs of afforestation on land in receipt of subsidy

9.4 Theoretical reflections

- Social theorists, including Kahneman and Bourdieu suggest that people do not always behave rationally. Their key ideas of system 1 and System 2 thinking in Kahneman's case, and habitus in Bourdieu's case, can help us at least understand why the anticipated rational outcomes do not occur.
- The category 'farm' is stereotypically considered as a wholly productive economic entity run by an economically rational farmer. This is not true, as many farms combine production with consumption and are family businesses rather than normal businesses in which capital and labour are separate entities.
- The exploration of farmers predisposition to plant trees might benefit from a segmentation of the farm population, to help explore more deeply, by factor or cluster analysis or similar, which groups of farmers exhibit a greater propensity to plant trees and to plan communication of policy messages to connect to the different aspirations and values of different segments. Whereas commercial farmers may show an interest in the very considerable economic advantages of RHI, hobby farmers may be more interested in grants that support woodland creation for amenity, but which may inadvertently impact positively on capital values. Such work is currently being undertaken for Defra and should soon be in the public domain (January 2014).

- A final point of reflection relates to the possible impacts of RHI on land use systems. If, as seems highly probably, the roll out of the RHI at commercial and domestic scale generates increased demand for low grade woody biomass, the exploitation of low grade existing farm woodlands is more likely, as is the planting of short rotation coppice. It is very difficult to build scenarios of the future, but any market-induced or policy-induced price rise for hydrocarbons is likely to increase the demand for woodfuel, which would favour more active management of existing woodlands or new woodland planting.

10 Recommendations for further research

- There is a strong demand for evidence based or evidence informed policy in the UK. The literature review surrounding this study threw up a wide literature but very little related to UK conditions. Accordingly, we see a case for an up to date literature review or meta-analysis of farm forestry in the UK including the biophysical aspects and the economic aspects. This should be used to highlight evidence gaps and research needs.

- There is a need for better information on the benefits to animals from shelter and the impact of this both on growth and maintenance demands of the animal and of main nutritional plants. These benefits are widely acknowledged but not enumerated with any precision, certainly not in economic or financial terms. Understandably, these benefits will vary from place to place because of wind speed etc, but it ought to be possible to specify the range of benefits in terms of improved animal condition, reduced mortality e.g. of lambs and reduced feed requirements.

- There is a need for careful comparison of woodland grazing vs woodland shelter as land management practices, including all dimensions including access to animals for difficult calvings/lambings, impacts on body temperature, mortality etc.

- There is a need for continuous updating of examples to reflect changing policy conditions, particularly in the wake of the roll-out of the Renewable Heat Incentive. This is expected to make poor quality woodland more valuable as bio-energy values increase to reflect the RHI. This might be expected to incentivise management of existing woodlands and to nudge farmers to consider short rotation woodland.

References

Armstrong, H.M., Poulsom, L., Connolly, T. and Peace, A. (2003) A survey of cattle-grazed woodlands in Britain, Forest Research, Roslin.

Berlin, C., (2003) Swedish non-industrial private forest owners in co-operation, in Robek, R. and Arzberger, U, eds. Workshop Proceedings on forest operation improvements on farm forests.

Black-Rubio, C.M., Cibils, A.F.2 Endecott, R.L., Petersen, M.K. and Boykin, K.G., (2008).Pinon–Juniper Woodland Use by Cattle in Relation to Weather and Animal Reproductive State, *Rangeland Ecological Management* 61, 394–404.

Burton, R.J.F. (2004) Seeing Through the 'Good Farmer's Eyes: Towards Developing an Understanding of the Social Symbolic Value of 'Productivist' Behaviour, *Sociologia Ruralis,* 44(2), 195-215

Coed Cymru, (n.d.), The Pontbren project: a farmer led approach to sustainable land management in the uplands, COED CADW, Woodland Trust, COED Cymru.

Duesberg,S., O'Connor, D. and Ní Dhubháin, Á., (2013) To plant or not to plant—Irish farmers' goals and values with regard to afforestation, *Land Use Policy* 32 155– 164

Feliciano, D. and Mendes, A.C.**,** (2011) Forest owners' organizations in North and Central Portugal – an assessment, *SEEFOR, 2, 1-11*

Gregory, N. G. (1995). The role of shelterbelts in protecting livestock: A review, New Zealand Journal of Agricultural Research, 38:4, 423-450, DOI: 10.1080/00288233.1995.9513146

Hogl, K., et al. (2005) Who are Austria's forest owners? Attitudes and behaviour of traditional and new forest owners, IUFRO Symposium Small Scale forestry in a changing Environment: proceedings of the International Symposium IUFRO Research group 3.08.00.

John Clegg Consulting Limited (2012) Opportunities to add value to south west home grown timber : *Analysing the business case,* a report for Forestry Commission England & South West Woodland Renaissance Partnership.

Keenleyside, C. and Tucker, G. M. (2010) *Farmland Abandonment in the EU: an Assessment of Trends and Prospects*. Report prepared for WWF. Institute for European Environmental Policy, London.

Lawrence A., Dandy, N. and Urquhart, J., (2010) Landowner attitudes to woodland creation and management in the UK. Forest Research, Alice Holt, Farnham. Available at www.forestry.gov.uk/fr/ownerattitudes

Mather, A.S. (1987). The structure of forest ownership in Scotland: a first approximation, *Journal of Rural Studies*, 3 (2) 175-182.

MacDonald, D., Crabtree, J.R., Wiesinger, G., Dax, T., Stamou, N., Fleury, P., Gutierrez Lazpita, J. and Gibon, A. (2000) Agricultural abandonment in mountain areas of Europe: Environmental consequences and policy response, *Journal of Environmental Management* 59, 47–69

Medved, M., (2003) Influence of the private forestry ownership structure in Slovenia on the production and utilisation of wood, in Robek, R. and Arzberger, U, eds. Workshop Proceedings on forest operation improvements on farm forests.

Ní Dhubháin, A., Gardiner, J.J., (1994). Farmers' attitudes to forestry. *Irish Forestry 51*,

Ní Dhubháin, A., Greene, R., (2009). How much do Irish forest owners know about forestry? *Small-Scale Forestry 8.*

O'Leary, T.N., McCormack, A.G., Clinch, J.P., (2000). Afforestation in Ireland: regional differences in attitude. *Land Use Policy 17*.

Olson, B. E. and Wallander, R.T., (2002). Influence of winter weather and shelter on activity patterns of beef cows. *Canadian Journal of Animal Science* 82:491–500.

Rackham O. (1980). Ancient Woodland: Its History, Vegetation and Uses in England. Edward Arnold, London.

Scottish Government (2011) *Getting the best form our land: a land use strategy for Scotland*. Scottish Government : Edinburgh.

Sibbald A.R. and Sinclair F.L., (1990). A review of agroforestry research in progress in the UK. Agrofor Abst 3: 149–164

Smiths Gore, (2013). Landscope, Forestry: UK forestry produces 18.3% return on investment in 2012 Week ending 17/05/2013

Smout, T.C. (1997). Scottish woodland history, Scottish Cultural Press: Dalkeith.

Stubbs, R., Yuill, B., and Moxey, A., (2010). Responding To The Woodland Creation Targets In The Grampian Conservancy Area, A report to Grampian Conservancy.

Tasanen, T., (2003). The recent development and future challenges of family forestry in Finland, in Robek, R. and Arzberger, U, eds. Workshop Proceedings on forest operation improvements on farm forests.

Teklehaimanot, Z., Jones, M. and Sinclair, F.L. (2002) Tree and livestock productivity in relation to tree planting configuration in a silvopastoral system in North Wales, UK *Agroforestry Systems* 56: 47–55.

Torrejos, Y.A. et al. (2003). Small non industrial forest owners cooperation examples in Galicia in North west Spain, in Robek, R. and Arzberger, U, eds. Workshop Proceedings on forest operation improvements on farm forests.

Van der Ploeg, J.D. and Long, A., (1994) Born from Within: Practice and Perspectives of Endogenous Rural Development, van Gorcum : Assen.

Wiersum, F., Elands, B. and Hoogstra, M.A., (2004). Small scale forest ownership across Europe: characteristics and future potential, *Small Scale Forest Economics, Policy and Planning* 4(1) 1-19.

Wilson, S. McG., (2011) Approaches to the future expansion of tree cover on farmland and deer-range in Scotland, WEAG Discussion Paper.

Appendices

Appendix 1

Farm woodland study

Forestry Commission Scotland, Woodlands Expansion Advisory Group, James Hutton Institute

Introduction:

Thank you for agreeing to take part in this study, we appreciate your time and enthusiasm.

We are undertaking the study for FCS on farm woodlands. Our principal aim is to identify a number of good practice examples and look at the costs and benefits of farm woodlands and your name has been suggested as someone who might make an appropriate case study. We have a number of questions about your approach to land management and farming in general and some more specific questions on forestry which we anticipate should take 30-45 minutes to complete.

Subject to your consent and with you having a chance to review any content we will build up a short case study of your farm. We would also like to obtain a farm map and have the chance to take some photographs of your farm and its woodland (unless you have any of your own). We plan to design some 2 page glossy brochures to take to the Royal Highland show highlighting the various ways farm woodland can be utilised

The general context

1a) How long you have been on this farm?

1b) Do you own the land or are you a tenant (or have mixed tenure)?

1c) Can you tell me a little about what drives the way you approach the management of your land?

1d) Can you tell me a little about the enterprise mix and main farming systems and how things have evolved over the last 10 years to their current 'shape'?

Cattle

Sheep

Other livestock

Arable

1e) Have there been any changes in numbers and/or intensity?

1f) Do you have LFASS or not?

1g) Do you currently receive any environmental payments from the current SRDP

1h) Would you utilise the SRDP again if it were to continue in its current form?

1i) If not why not?

1j) Have you received payments for environmental activity on your farm under previous schemes?

2. The woodland forest enterprise

2a) Where does forestry/woodland fit into the scheme of things on your farm?

2b) How many separate areas of woodland do you have on the farm in total?

2c) Was there any woodland on the farm when you took it on?

2d) Can you tell me a bit about the current condition of that woodland and what, if any, value you derive from it? By value I mean both monetary and non-monetary values.

2e) Do you see your wood in terms of commercial forest only or have you got other uses for it (eg firewood, fencing)

Can we look in a bit more detail now at any more recently (less than 15 years) planted woodland plot by plot?

Plot (a) (name:……)…….. hectares; grant aid Y/N; land use displaced (rotation/yield loss, stocking changes etc.); value of any product (monetary and non-monetary, incl. grants); SFP (single farm payment) still on the land?

Plot (b) (name:……)…….. hectares; grant aid Y/N; land use displaced (rotation/yield loss, stocking changes etc.); value of any product (monetary and non-monetary, incl. grants); SFP still on the land?

Plot c (name:……)……. hectares; grant aid Y/N; land use displaced (rotation/yield loss, stocking changes etc.); value of any product (monetary and non-monetary, incl. grants); SFP still on the land?

Plot d (name:……)……. hectares; grant aid Y/N; land use displaced (rotation/yield loss, stocking changes etc.; value of any product (monetary and non-monetary, incl. grants); SFP still on the land?

And more if need be here:

2f) What were the principal barriers to you creating new woodland on the farm (e.g. lack of advice; trust in contractors; peer pressure; prejudice (some farmers just don't like trees!), vermin habitat; lack of knowledge of woodland and their management) and how did you overcome them?

2g) What would have been the agricultural use of this land had it not been planted in trees and what is the effect planting a specific area of land has had on the overall output of the unit.

2h) what effect has planting this area of land had on the physical output of the farm?

2i) Have you reduced livestock nos. /crop area as a consequence of the establishment of these woods and if so by how much?

2j) How valuable is your woodland to you in terms of landscape enhancement?

2k) Do you find the public using your woodland? Is this a good thing or has it been abused?

2l) How does the combined old and new woodland fit into the running of the farm?

2m) Can you identify the positives and negatives of woodlands on their farm

2n) Do you undertake the principal strategic thinking about what you will do in your woodland yourself or take advice from others?

2o) Do you undertake any work in the woodland yourself: e.g. beating up; thinning; extraction?

2p) Do you have any interest in: please highlight in bold.

Game/sport shooting	strong	medium	a little
Habitat or species conservation	strong	medium	a little

Looking forward

Looking forward, how do you see your land management on this unit evolving, particularly with respect to your farm woodland? Please highlight in bold-

No change	very likely	maybe	not likely
More agroforestry	very likely	maybe	not likely
More production forestry	very likely	maybe	not likely
More environmental forestry (e.g. conservation or wooded buffer strips)	very likely	maybe	not likely
More shelter belts	very likely	maybe	not likely