Agroforestry ELM Test

Incentives and disincentives to the adoption of agroforestry by UK farmers: a semi-quantitative evidence review

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Executive summary

With growing public concern about global warming and biodiversity loss there has been an increased emphasis on tree planting by the UK Government. Much of this is currently incentivised through woodland creation but there has been a recent surge in interest around agroforestry, which is typically smaller-scale planting in and around farmers' fields. Agroforestry may be particularly attractive to farmers because, as well as capturing carbon and increasing biodiversity, it can ultimately bring financial benefits to the farmer through functions like reducing soil erosion, improving soil fertility, and improving livestock performance through shelter and fodder provision.

Following Brexit, direct farm subsidy payments will be replaced by a "public money for public goods" approach mediated by an Environmental Land Management (ELM) mechanism in which farmers will, in parts of the system at least, be required to develop a Land Management Plan. To develop and refine elements of the ELM mechanism, Defra has commissioned a range of Test and Trial programs in which land-themed organisations and research groups will interact with farmers across the public goods areas that ELM will encompass.

Defra has awarded the Agroforestry ELM Test to a consortium consisting of the Organic Research Center, The Woodland Trust, The Soil Association, and Abacus Agriculture. Based on previous research, the consortium has proposed to focus on "Payment" and the "Role of Advice and Guidance" aspects of the ELM, by conducting a series of nationwide farmer workshops and questionnaires. The purpose of the current evidence review is to confirm, or otherwise, that "Payment" and the "Advice and Guidance" do represent the principal incentives or disincentives to the adoption of Agroforestry by famers in the UK and to suggest additional foci that will help to refine workshop and questionnaire design.

Ten source documents, representing the principal evidence sources available on UK farmer opinion of the main incentives/disincentives to the adoption of agroforestry, were examined. They comprised four quantitative surveys of UK farmer opinion, one quantitative survey of European farmers with UK-specific data, one interview study of European farmers with UK-specific data and highlighted findings, and four non-quantitative expert reviews of published work on UK farmer opinion and attitudes to agroforestry. One hundred and five factors mentioned in these documents as potential incentives/disincentives to the adoption of agroforestry by UK farmers were identified and reduced to 36 using a coding framework. These 36 factors were organised under the headings: Economic/financial, Policy, Advice, Knowledge, Synergies and clashes with agricultural processes and other farm activities, Environmental, and Other. To improve objectivity of factor importance ranking procedures, a quantitative approach was adopted. Both "the number of studies addressing a particular factor" and "the number of studies finding that factor to be "significant"" as an incentive/disincentive to farmers adopting agroforestry were quantified and a simple algorithm integrating both these numerical values applied to provide an overall rank of factor importance.

Using this procedure, it was found that economic/financial and farmer knowledge-based factors comprised nine of the top ten ranked factors. Grants, subsidy, and funding opportunities for agroforestry or lack thereof is a key incentive/disincentive to agroforestry. Farmers also find: agroforestry establishment costs, capital investments requirements, longer term management and maintenance costs, and loss and profit and yield due to agroforestry, significant disincentives to its adoption. It is suggested that any effective farmer payment mechanism for agroforestry within ELM should consider these factors. Farmers feel that they have, or there is more generally, a lack of conceptual understanding and knowledge of agroforestry. They also find a lack of practical and economic knowledge of agroforestry significant disincentives. Improved access to case studies and

agroforestry demo farms is also considered important. "Advice" themed factors are poorly surveyed and reviewed in the context of UK agroforestry and only two studies have considered them. Both studies, however, have found access to conceptual or practical advice or lack thereof to be an important incentive/disincentive to adoption of agroforestry by UK farmers.

It is concluded that the focus of the Agroforestry ELM Test on "Payment" and the "Role of Advice and Guidance" aspects of the ELM is justified. Financial factors are a key determinant of whether UK farmers will adopt agroforestry and the current review provides foci for further survey work on payment mechanisms. Farmers will need substantial advice and guidance to develop Land Management Plans within ELM so the focus on "Advice and Guidance" is justified. This conclusion is further emphasised by the fact that role of advice and advisory services are so poorly surveyed and reviewed in the context of agroforestry. This evidence review does, however, reveal a weakness in the foci of the Agroforestry ELM Test: its exclusion of farmer knowledge-based factors. It is suggested that survey work within Agroforestry ELM Text be extended to address the issues of poor farmer knowledge of concepts in agroforestry, practical aspects of agroforestry, and economic aspects of agroforestry.

Farmer quotes representing main findings:

Financial: 'The family believes agroforestry will be less profitable than cereals alone'[1]

Financial: 'I don't have enough time to manage an agroforestry system'[1]

Financial: Q - Why were trees planted on your land?, A – 'For subsidy pay, but also to look nice in the correct areas – hedgerows'[2]

Financial: 'Wanting to set up a system but not having the finances'[1]

Knowledge: 'There is a lack of on-farm research available, I would like to see evidence of real working systems'[1]

Knowledge: 'I simply don't know enough about agroforestry'[1]

Knowledge: 'I'd like to learn more about agroforestry please!'[1]

Knowledge: 'I don't have enough knowledge about agroforestry systems'[1]

Introduction

The UK has less tree cover than the rest of Europe with 13% woodland cover compared to around 37% for the countries of the EU[3]. With increased public attention on global warming and biodiversity loss, the UK govt has increased efforts to incentivise tree planting by landowners and farmers. Most of these incentives, however, are in the form of woodland creation grants: funding for relatively large plantations[4]. The last few years has seen a significant increase in interest among farmers in agroforestry[2]. Agroforestry is typically tree planting in and around farmers' fields and it is distinguished from forestry by the assumption that it contributes to the productivity of existing agricultural systems. For example, agroforestry can reduce soil erosion and increase soil fertility in arable systems, and can increase growth rates and animal survival in livestock farming[5].

Perhaps in response to the perceived rise in interest in agroforestry among farmers, Defra has explicitly included agroforestry as one of the practices delivering public goods inputting into the design of its new post-Brexit incentive payment system for farmers: the Environmental Land Management system or ELM. At least in parts of this system, farmers and landowners will be asked to prepare a Land Management Plan explaining how they will deliver public goods and it is expected that this document will be prepared with formal input from advisors, but the nature of the advisory system is still under development[6]. The nature of "Advice and Guidance" within the ELM mechanics in only one of six ELM areas that are current under investigation by an assortment of research teams and organisations interacting with farmers and land owners within the Defra Test and Trials process[6]. The others are: the Land Management Plan, Spatial prioritisation, Collaboration, Payments, and Innovative delivery mechanisms.

The Agroforestry ELM Test project was awarded by Defra to a consortium consisting of the Organic Research Centre, The Woodland Trust, The Soil association, and Abacus Agriculture. The current evidence review document is the first formal output from this consortium within the Agroforestry ELM Test project, which will run until 2023. Within the project, the consortium plans to run a series of workshops and surveys with farmers and landowners focusing on "Payments" and "Advice and Guidance" aspects of the ELM. Essentially, the project aims to determine how famers and landowners would like advice and guidance delivered to them for agroforestry projects funded by the ELM and how they think the payments systems should be designed. The choice of "Payments" and "Advice and Guidance" aspects of the ELM in relation to agroforestry was chosen by a reading of the available evidence by the consortium during the application process. In essence, the consortium considered that, based on their knowledge and a reading of the available evidence on incentives and disincentives to the adoption of agroforestry by UK farmers, "Payments" and "Advice and Guidance" were key determinants of agroforestry uptake and so an appropriate focus for refinement of the ELM mechanism in the context of agroforestry.

The purpose of the current evidence review is to determine whether "Payments" and "Advice and Guidance" are indeed the principal determinants of uptake of agroforestry by UK farmers and, if so, to suggest points of focus within each area to assist in the design of workshops and surveys within the Agroforestry ELM Test project. This review also aims to determine additional key determinants of agroforestry uptake by UK farmers to allow potential expansion of workshop and survey themes within the project. Ten key evidence sources on incentives and disincentives to the uptake of agroforestry by UK farmers comprising quantitative surveys and expert reviews are analysed and 105 key factors extracted. These are reduced to 36 using a coding procedures and factor importance ranking is undertaken using a quantitative algorithm. Based on findings, foci and expanded themes for Agroforestry ELM Test workshops and surveys are suggested in the "Conclusions" section of this document.

Methods

Selection of source material

A suggested list of evidence sources was provided by Sally Westaway, an agroforestry expert previously employed by the ORC. To ensure all evidence sources relevant to factors incentivising/disincentivising UK farmers to adopt agroforestry were covered, additional Google and Google Scholar searches were undertaken with the following search term: farmer AND (agro-forestry OR agroforestry) AND UK AND (survey OR interview OR review). No more sources specific to UK farmer opinion on agroforestry were revealed. Some sources suggested by the above researcher were rejected. This did not reflect their quality, but because, generally speaking, it was not clear that they referred specifically to UK agroforestry and UK farmer opinion. A list of the sources used in this review with details of the nature of each study and how they specifically word their intention to survey/review "incentives/disincentives to the adoption of agroforestry by UK farmers" is show in Table 1.

Sources used comprised four quantitative surveys of UK farmer opinion on agroforestry, one quantitative survey of European farmers with UK-specific data, one interview study of European farmers with UK-specific data and highlighted findings, and 4 non-quantitative expert reviews of published work on UK farmer opinion and attitudes to agroforestry (Table 1). One quantitative survey pooled opinion of farmer and other land professional opinion and this pooled data was used as farmer-specific data could not be obtained. Where studies contained data on both farmer and other land professional opinion, only the farmer data was used. In European studies, only the data on UK farmers was used (See Table 1 for examples). This review considers only UK farmer opinion and does not consider the opinion of farmers from mainland Europe or other countries on agroforestry. Some studies distinguished between conventional and agroforestry farmers, however, in the current review all opinion was pooled. "Farmer" in the current study, therefore, means farmer in the broadest sense, regardless of the systems or methods by which they farm.

Quantification of ranked factors

In quantitative surveys used as source material, all factors presented to farmers as potential incentives/disincentives to the adoption of agroforestry were listed. This included factors that were eventually found to be "insignificant". In reviews or interview studies with highlighted findings, all factors discussed or mentioned as possible incentives/disincentives were similarly added to this list. However, due to the nature of reviews, where only significant findings tend to be presented and not the factors that were eliminated, listing all factors "discussed or mentioned" tends to be the same as listing only those factors which were found to be significant. This is a relatively minor technical point but readers should be aware that the two major metrics used to quantify ranked factors described below are not completely independent.

In essence, then, all source materials were read and a list of 105 factors mentioned or assessed in source material as potential incentives/disincentives to adoption of agroforestry, regardless of whether they were found to be 'significant' factors, were listed (Table 2). This list was then studied for factors that were somewhat similar and could be placed in a single grouping. Following this procedure, a final list of 36 factors were obtained, which were organised into 7 major categories: Economic/financial (9 factors within this grouping), Policy (5 factors), Advice (1 factor), Knowledge (6 factors), Synergies and clashes with agricultural processes and other farm activities (2 factors), Environmental (1 factor), and Other (12 factors). The final categories and their individuals factors potentially incentivising/disincentivising adoption of agroforestry by UK farmers is show in Table 2,

along with the factors, as worded in source material, that were organised together to reduce the original list of 105 factors to 36.

Generally, the source material used in this review assumed agroforestry in the UK is at an undesirably low level and, therefore, assumed farmers were disincentivised to adopt it. The wording of factors in source material and the current review generally reflects this. However, there are some instances where incentives to agroforestry were specifically examined in surveys/ reviews and in some cases in the present study factors will be worded as incentives (Table 2). Wherever possible in this review incentives and disincentives of the same general type have been merged, assuming an incentive becomes a disincentive in the absence of the incentive. For example, some surveys assumed that the presence of better and more visible grants and subsidies would act as an incentive to agroforestry, while others assumed that there is a lack of available grants and grants and subsidies are worded in surveys/reviews as disincentives. It is reasonable to assume grants and subsidies can act both as an incentive and a disincentive depending on their availability, so studies examining them in these different contexts can be considered under the same factor heading. Merging studies considering the same factors in a different context increases the statistical power (sample size) of the current study and so is desirable. If readers are in doubt as to whether a factor used in the current study is or has been studied previously as an incentive or disincentive to agroforestry, this should be clear from an examination of the 105 source factors show in Table 2 that have been grouped together to generate the 36 factors used in this review.

Finally, to generate a ranking of importance of each of the 36 incentivising/disincentivising factors used in this study, two fundamental metrics were generated. The first was "Number of source surveys/reviews that have addressed this factor" which we will call Metric 1 (M1) here for convenience. For each of the 36 factors considered, all studies were examined and the number of studies addressing or discussing the factor, regardless of whether it was considered "significant", was noted. This produced a metric with a minimum possible value of one (where only one of the 10 source studies addressed it) and a maximum possible value of ten (where all studies considered the factor). In reality this metric had a maximum value of 7 in the current study: the factor "Lack of conceptual understanding and knowledge of agroforestry" was considered by 7 of 10 source studies and no factor was considered by more source studies. The second metric generated was "What proportion of surveys/reviews that have addressed this factor have found it to be a significant incentive/disincentive to agroforestry". We will call this metric M2. Again, all source material was examined and now it was noted whether each factor was both considered/discussed by a particular source *and* whether it was considered to be a significant incentive/disincentive to the adoption of agroforestry by UK farmers. In reviews or interview studies with highlighted findings, a "significant" factor is defined as one that is highlighted by the reviewer as important and/or discussed at length as an important incentive/disincentive. Significant factors in quantitative surveys were defined as those that ranked in the top 50% of factors considered. To produce a final value for factor ranking, both metrics were placed on the same scale by dividing Metric 1 by 7 and a mean taken: $((M1/7) + M2)/2$. Factors that rank highly using this score are both widely considered by studies and widely found to be significant incentives/disincentives to the adoption of agroforestry by UK farmers. Factors that rank low using this system tend to be reviewed only in a very few studies and not well supported in those studies they are reviewed in. This rank score was used to place factors in their relative order in Tables 3 and 4 of the "Findings" section below.

Findings

Here the importance of 36 factors incentivising and disincentivizing the adoption of agroforestry by UK farmers is considered in the order they appear in Table 3 (Economic/Financial, Policy, Advice,

Knowledge, Synergies and clashes with agricultural processes and other farm activities, Environmental, Other), both in terms of their absolute importance within the list of all 36 factors assessed and their relative importance within their own major factor category.

Economic/financial factors

Factors in this category are extremely important incentives/disincentives to the adoption of agroforestry by UK farmers. Eight of the 9 economic/financial factors considered in this review appear in the top 50% of all 36 factors considered (Table 4), and the economic/financial factor "Grants, subsidy, funding opportunities for agroforestry or lack thereof " ranks equal second highest of all 36 factors considered, along with the knowledge-based factor "Lack of practical understanding and knowledge of agroforestry" (Table 4). Four economic/financial factors: "Establishments costs" (purchasing materials etc.), "Capital investment requirements" (such as the purchase of new machinery of storage facilities), "Management and maintenance costs" (long-term costs associated with managing and maintaining the agroforestry system after establishment), and "Reduced profitability and loss of yield" (consequent of new agroforestry projects), each rank tied 3th of the 36 individuals factors considered (Table 4) and are all among the top 10 factors considered here. Along with knowledge-based factors, economic/financial factors make up 9 of the top 10 ranked factors incentivising/disincentivizing farmers to adopt agroforestry (Table 4): economic/financial and farmer knowledge-based factors are the principal incentives/disincentives to the adoption of agroforestry by UK farmers indicated by this review.

Policy-related factors

Policy-related factors are important incentives/disincentives to the adoption of agroforestry by UK farmers but are not as critically important as economic/financial and farmer knowledge-based factors. Of the 5 policy-related factors categorised, "Uncertainty about policy / legislation" and "Policy / subsidy clashes and perceived loss of existing payments" appear most important (Table 3). However, more generally, only 2 of the 5 policy-related factors categorized in this review appear in the top 50% of the whole set of 36 factors incentivising/disincentivising farmers to adopt agroforestry in the UK. No policy-related factors appear in the top 10 factors incentivising/disincentivising farmers (Table 4).

Advice

To distinguish "Advice" from knowledge-related factors, only factors from original studies actively mentioning "Advice" i.e. active receipt of information from other individuals, were summarised under this heading. Perhaps surprisingly, the importance of advice and the role of advisory services do not appear widely surveyed in UK farmers in the context of agroforestry. Only 2 surveys/reviews have considered this factor (Table 3) but both have found it to be a significant factor in determining whether agroforestry will be taken up by farmers. "Advice" lies outwith the top 10 overall incentives/disincentives to the adoption of agroforestry by UK farmers but lies 5th by rank: this is explained by the large number of factors tying second and third in rank (Table 4).

Knowledge

Factors relating to farmer knowledge of agroforestry, along with economic/financial factors, are the most important incentives/disincentives to the adoption of agroforestry by UK farmers. The highest ranked of all 36 factors considered in this review is the farmer knowledge factor "Lack of conceptual understanding and knowledge of agroforestry" (Table 4). As this is such a key factor, it is worth considering its precise meaning. This is a cover-all term from a host of factors from the 10 surveys

and reviews considered that includes a general understanding of how trees benefit different farm types, best tree combinations, and optimal system design (see Table 2). I distinguish conceptual knowledge from "practical knowledge", which is knowledge of how to go about setting up and maintaining an agroforestry system: maintenance and technical knowledge and practical guidelines for the implementation of an agroforestry system (Table 2). Practical knowledge (or, more specifically, a *lack* of practical knowledge) is also a key factor in this survey: tied second by rank along with the economic/financial factor "Grants, subsidy, funding opportunities for agroforestry or lack thereof" (Table 4). Two other knowledge-based factors lie within the top 10 factors considered here: "Lack of economic understanding of agroforestry" and "Access to case studies and demo farms". Both factors tie third by rank overall, along with a number of predominantly economic/financial factors (Table 4). Clearly, UK farmers do not think there is enough detailed economic information about how agroforestry will benefit them financially and would find easy access to demonstration agroforestry systems to learn new agroforestry techniques and knowledge incentivising. The knowledge-based factor "Lack of awareness of agroforestry among farmers" ranks fifth most important of all 36 factors considered, but is outwith the top 10 factors due to ties (Table 4). Both studies that indicate a lack of awareness of agroforestry among farmers are relatively old[7,8] and more recent surveys[2] indicate that this is now a lesser problem.

The above discussion of knowledge-based factors considers how they rank among all 36 factors considered in this review. The relative ranking of the 6 knowledge-based factors can be inferred from the above, but to summarise: "Lack of conceptual understanding and knowledge of agroforestry" is the highest ranked knowledge-based factor, "Lack of practical understanding and knowledge of agroforestry" is ranked second, "Lack of economic understanding of agroforestry" and "Access to case studies and demo farms" rank equal third, "Lack of awareness of agroforestry among farmers" ranks fourth, and the potential for agroforestry to enable research ("Agrofestry enabling research") is last by rank (Table 3).

Synergies and clashes with agricultural processes and other farm activities

The potential for agroforestry to enhance or clash with existing agricultural (animal welfare, soil fertility, pest control etc.) and additional farm-based activities (game shooting, recreation etc.) (see Table 2) has been considered by three surveys/reviews. There is some evidence to suggest that farmers consider agroforestry to be an activity that will clash with farm processes rather than enhance them. All three surveys/reviews found clashes to be a significant disincentive to agroforestry whereas only 2 of the 3 studies found enhancements to be an incentive (Table 3). Considered another way, however, a majority of surveys/reviews find that agroforestry can enhance existing agricultural and farm-based activities. Farmers clearly believe that agroforestry can clash or enhance agriculture and farm-based activities depending on which process or activity is under consideration. "Clashes with existing agricultural processes and activities" is among the top ten factors incentivising/disincentivizing UK farmers to adopt agroforestry, ranked third along with a number of economic/financial and knowledge-based factors. Due to one of three studies finding "Enhancement of agricultural processes and other farm economic activities" to be an insignificant incentive to the adoptions of agroforestry, this factor falls outwith the top 10 factors of the total 36.

Environmental

Two Surveys/reviews have considered "Benefits to the natural environment" as an incentive to agroforestry and both have found it to be a significant incentive (Table 3). This factor falls outwith the top ten of all 36 factors considered here but principally because it has not been addressed by

many studies. In all studies in which it has been considered, it has been found to incentivise the uptake of agroforestry by UK farmers (Table 4).

Other

 "Other" factors in this review are predominantly made up of factors that have only been addressed by one previous survey/review and their significance in a single study should not be considered an indication of their general importance. There are three notable exceptions that are informative. "Acreage and field size limitations" have been considered in two surveys/reviews and in both they have been found to be a significant disincentive to the adoption of agroforestry (Table 3). "Tenancy clashes" have been relatively widely surveyed/reviewed, appearing in three studies. Tenancy clashes include landlords not giving permission to plant trees and other such potentially issues as the short-term nature of many tenancies and the long-term nature of agroforestry. Most surveys/reviews, however (2/3) have not found tenancy clashes to be a significant disincentive to the adoption of agroforestry by UK farmers (Table 3). Lastly, two surveys/reviews have considered a "Lack of interest in agroforestry on the part of farmers" but neither of them found it to be a significant factor: farmers are not disinterested in agroforestry (Table 3).

Top three

The highest ranked factor in this review of 36 considered is the knowledge-related factor "Lack of conceptual understanding and knowledge of agroforestry". Two economic/ financial and knowledge-based factors tie for second rank: "Grants, subsidy, funding opportunities for agroforestry or lack thereof" and "Lack of practical understanding and knowledge of agroforestry" (Table 4).

Agroforestry in the UK is being held back by a lack conceptual and practical knowledge of agroforestry on the part of farmers. Increasing the availability of funding for agroforestry will significantly increase its adoption by UK farmers.

Conclusion

Based on the evidence presented in this review, the focus of the Agroforestry ELM Test project on "Payment" and the "Role of Advice and Guidance" appears justified. Access to grants and subsidies is a key factor incentivising adoption of agroforestry by UK farmers, so an investigation of payment mechanisms is necessary. This evidence review also highlights some perceived cost areas associated with agroforestry that concern farmers: establishments costs, capital investment requirements, management and maintenance costs, and potentially reduced profitability and loss of yield. It is likely that any effective agroforestry payment mechanism will have to consider these factors and they provide a focus for workshop and survey work on payments within the Agroforestry ELM Test project.

The focus of the current ELM Test on the "Role of Advice and Guidance" is justified for numerous reasons. Farmers are likely to require substantial support and advice during the creation of Land Management Plans and clarification of the nature of advisory services inputting into this process is required[6]. This is further emphasised by the finding of the current review that the role of "Advice" and advisory services is poorly surveyed and reviewed in the context of agroforestry. Agroforestry advice and guidance to farmers may be important for other reasons identified in this review, namely, the lack of knowledge farmers feel they have in numerous areas of agroforestry: basic conceptual knowledge, practical knowledge, and knowledge of its economics. As advisors are likely to be interacting with farmers during the construction of Land Management Plans, this may be an important conduit for the transfer of knowledge on agroforestry to farmers. However, knowledge

acquisition and its transformation into changed practice in farming comes from a wide variety of sources[9]. It is recommended that workshops and surveys conducted during the Agroforestry ELM Test expand their scope to determine the means by which farmers feel they could best acquire increased knowledge of agroforestry.

One subtle knowledge-related problem identified by the reviewers is the precise nature of the knowledge deficit of agroforestry identified by farmers. Even through detailed examination of the wording of source surveys it is not clear whether farmers feel there is only a knowledge deficit on their part or if there is a wider lack of specialist technical knowledge, even among those professing to be agroforestry professions. Is it simply farmers who know little of agroforestry or is the academic field of agroforestry at such a fledgling stage that the knowledge of agroforestry required by farmers simply does not exist? It may be beneficial for the Agroforestry ELM Test to clarify these different possibilities as the implications for closing the knowledge gap consequent of each are quite different.

One last issue that the Agroforestry ELM Test project may wish to address is the suggestion (but no more than a suggestion) that farmers consider agroforestry more detrimental than beneficial to their farming operation. Workshops and surveys could resurvey and probe further this issue and if it is found to be a genuine viewpoint of farmers, agroforestry experts may wish to consider how this point of view can be overturned.

Evidence Sources

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Within-Text References

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Table 1: A description of the source material used in the current semi-quantitative review of factors incentivising/disincentivising the adoption of agroforestry by farmers in the UK.

Source	Type of study	Specific wording of study objective to determine "incentives/disincentives to the adoption of agroforestry by UK farmers".
Farmers Weekly Woodland Trust Agroforestry Survey 2020. https://tinyurl.com/y5tgqwry Detailed survey results taken from a Woodland Trust presentation provided by Sally Westaway. Presentation available on request from report author: colin.t@organicresearchcentre.com	Quantitative survey of UK farmers	"Which of the following would encourage you to plant more trees on your farmland?"
Agroforestry Handbook Reader Survey 2020 Document available on request from report author: colin.t@organicresearchcentre.com	Quantitative survey of UK land-related professionals (only farmer data used)	"The extent to which the following represent barriers to adoption of agroforestry"
Smith, J., Westaway, S., and Knight, I., 2018. Report on the 2nd RAIN workshop in the United Kingdom (UK) Output of the **AFINET** project Document available on request from report author: colin.t@organicresearchcentre.com	Quantitative survey of agroforestry farmers and other land-related professionals (data pooled between profession types by report authors)	"What are the key challenges facing farmers, land managers and advisors when considering how to design and implement a new agroforestry system"
Mosquera-Losada, M.R., 2018. We have a dream: fostering agricultural transition towards agroforestry. In European Agroforestry Conference-Agroforestry as Sustainable Land Use, 4th. EURAF. Output of the **AFINET** project	Quantitative survey of European farmers (only UK findings use here)	"…priority European bottlenecks/challenges" [to adoption of agroforestry]"
Mayer, C., 2012. Agroforestry: A study of farmer attitudes and perceptions in England. MSc Thesis, University of Reading. Document available on request from report author: colin.t@organicresearchcentre.com	Quantitative survey of conventional and agroforestry farmers	""Perceived incentives" of conventional farmers to agroforestry" / "Perceived incentives in agroforestry farmers" / "Perceived disincentives in conventional farmers" / "Perceived

		disincentives in agroforestry farmers"
Rois-Díaz, M., Lovric, N., Lovric, M., Ferreiro-Domínguez, N., Mosquera-Losada, M.R., Den Herder, M., Graves, A., Palma, J.H.N., Paulo, J.A., Pisanelli, A. and Smith, J., 2018. Farmers' reasoning behind the uptake of agroforestry practices: evidence from multiple case-studies across Europe. Agroforestry Systems, 92(4), pp.811-828. Output of the **AGFORWARD** project	Interviews of European conventional and agroforestry farmers with key factors highlighted (only UK findings use here)	"Drivers for practicing conventional farming [and not agroforestry]" / "Drivers for practicing agroforestry [and not conventional farming]"
Defra Agroforestry Review, 2017. https://tinyurl.com/yy3xtn39	Non-quantitative review of published literature	"Barriers to uptake"
Smith, J., Westaway, S., Pearce, B., Lampkin, N., Briggs, S., 2013. ORC Report: Can agroforestry deliver production and environmental benefits in the next rural development programme? Document available on request from report author: colin.t@organicresearchcentre.com	Non-quantitative review of published literature	"Current barriers against wider adoption of agroforestry in the UK and England"
The Woodland Trust, 2018. Policy paper: Agroforestry in England: benefits, barriers and opportunities https://tinyurl.com/y2ft8lfa	Non-quantitative review of published literature	"Barriers to uptake"
Doyle, C.J., Thomas, T. and Hislop, M.J., 2000. The social implications of agroforestry. In *Agroforestry in the UK, Forestry Commission, Bulletin 122* (pp. 99-106). Forestry Commission.	Non-quantitative review of published literature	"Farmer attitudes to forestry and agroforestry"

Table 2: The 36 factors incentivising/disincentivising UK farmers to adopt agroforestry used in this study, with all 105 incentivising/disincentivising factors worded as they appear in source material and grouped to construct each of the 36 factors used in this study.

Reduced groupings of source material factors incentivising/disincentivising the adoption of agroforestry by UK farmers with their major categories	Factors contained within each reduced grouping, as worded in source material
Economic/financial	
Grants, subsidy, funding opportunities for agroforestry or lack thereof	Grants / Funding opportunities / Subsidised tree planting / subsidies / weak and inflexible existing public financial support for agroforestry (grants lack of) / existing system of grants was seen as militating against the adoption of agroforestry compared to conventional forestry / Lack of grant aid available
Establishments costs	Help with purchasing materials / Establishment costs / Cost of establishment
Capital investment requirements	Capital investment requirements / Investment in new machinery or new storage facilities / Significant capital investment with long term return (short term tenancies)
Management and maintenance costs	Maintenance costs / Management effort / High cost of protecting trees / Increase aftercare and maintenance
Reduce profitability and loss of yield	Potential loss of profits from the pre-existing cropping system / Profitability / Loss of profits / Loss of arable/Livestock yield
Business diversification and risk reduction	Product diversification / Spread of financial risk
Aesthetic value	Aesthetics value for tourism
Labour costs / help with labour costs	Help with labour costs / More labour-intensive system
Uncertainty about market for outputs from trees	Uncertainty about market for outputs from trees
Policy	
Uncertainty about policy / legislation	Uncertainty about rules in relation to agroforestry and support payments / Reducing legislative uncertainty with regard to tree planting on agricultural land / Complications and uncertainty around support payments / Policy ambiguity within UK govt / Legislative uncertainty
Policy / subsidy clashes and perceived loss of existing payments	Perceived loss of losing support payments/ restrictions on the use of agroforestry as a greening measure / Complications and uncertainty around support payments / Loss of single farm payments
Falls into a funding gap: agroforestry typically not large enough for woodland creation grants	Falls into a funding gap: agroforestry typically not large enough for woodland creation grants
Unfavourable policy environment	"Unfavourable policy environment" / Policy framework
Improved policy support	Improving policy support tools to promote agroforestry / Improving Policy Support
Advice	
Conceptual / practical advice or lack thereof	Advice on where to plant trees / Tailored on-site visits / Tailored off-site advice / Sourcing trees / lack of practical guidance and advice
Knowledge	
Lack of conceptual understanding and knowledge of agroforestry	Better understanding of how trees benefit your farm type / Understanding of how trees benefit wildlife / Knowledge of best time within year to plant / Understanding of how trees deliver

	environmental goods / Lack of knowledge on system design / More information on optimal tree/crop/livestock combinations, in order to maximize productivity, soil improvement etc. / Lack of knowledge of AF / Lack of knowledge / Optimal Combinations / Lack of information available / Lack of knowledge about trees
Lack of practical understanding and knowledge of agroforestry	Lack of knowledge on maintenance / Lack of technical knowledge / Development of practical guidelines/best management practices for tree and tree understorey management / Practical guidelines
Lack of economic understanding of agroforestry	More information on the costs and benefits of specific agroforestry systems / Better understanding of the value chain (supply, demand and marketing opportunities) of demand and marketing opportunities) of products,…) / Informing consumers and society in general about agroforestry and its benefits (both environmental and economic) / A lack of evidence on the economics of agroforestry / cost/benefit insights / Value chain / Informing consumers
Access to case studies and demo farms	Access to case studies: showcasing farms which demonstrate good agroforestry practices / Learning from others / Demonstration farms
Lack of awareness of agroforestry among farmers	Lack of awareness of agroforestry among farmers and landowners / Most farmers unaware of agroforestry (lack of knowledge)
Agroforestry enabling research	Enable research
Synergies and clashes with agricultural processes and other farm activities	
Clashes with existing agricultural processes and activities	Increased weed burden / Increased pest burden / Difficulties with machinery access / Farmers perceive it as an irreversible land change / Difficulties with mechanisation / Bad use of productive land / Damage to drains from tree roots / Difficulties mowing beneath trees / Difficulties with weed control / Livestock will damage trees / Lack of reseeding flexibility
Enhancement of agricultural processes and other farm economic activities	Animal welfare / Sustainable eco-intensification / game and shelter benefits / recreational benefits / animal welfare benefits / Combines production with the environment / Potential to produce biomass/woodfuel / Increases the organic matter in soil / Increased nutrient recycling / Animal welfare benefits / Reduced need for fertilisers / Natural pest control / Shelter for livestock / Decreases the loss of soil / Microclimate modification / Flood control / Provision of forage for livestock / Provision of natural fencing / Recreational opportunities
Environmental	
Benefits to the natural environment	Considered environmentally friendly / Landscape benefits / Wildlife conservation benefits / It is a sustainable system / Enhanced biodiversity / Carbon sequestration / Air and water quality regulation / More aesthetically pleasing
Other	
Acreage and field size limitations	More land/space / Plot size
Farmers perceive farming and agroforestry as two separate things	Farmers perceive farming and agroforestry as two separate things
Tradition	Tradition
Lack of processing capacity in England for crops like nuts that go well with agroforestry	Lack of processing capacity in England for crops like nuts that go well with agroforestry

Perceived by farmers as a stable use of land against a background of instability in agriculture	Farmers with a knowledge of AF perceive it as a stable use of land against a background of instability in agriculture
Provision of rural jobs	Provision of rural jobs
Tenancy clashes	Problems with agroforestry on tenanted land / Land classification and tenure prejudicing against agroforestry / Landlord will not grant permission
Lack of interest in agroforestry on the part of farmers	Cannot be encouraged to plant more trees / Lack of desire from landowners and/or farmers to plant trees on farms
Land is not suitable for growing trees	Land is not suitable for growing trees
No known successor for the business	No known successor for the business
No interest in diversification	No interest in diversification
Other	Other

Table 3: A semi-quantitative review of ten surveys and reviews examining UK farmer perceptions of barriers and incentives to taking up agroforestry. Factors representing incentives/disincentives to farmers adopting agroforestry are **organised into sections**, with **best supported factor at the top of each section** and the **least supported at the bottom**. Factors with the same scores in coloured boxes are tied for importance.

key			
7	1	A factor that is extensively surveyed/reviewed and extremely well supported in surveys/reviews	
1	0	A factor that is not extensively surveyed/reviewed and poorly supported in surveys/reviews	
2	0.5	A factor that is moderatley well surveyed/reviewed and moderately supported in surveys/reviews	
7	0	A factor that is extensively surveyed/reviewed but not supported in surveys/reviews	
1	1	A factor that is not extensively surveyed/reviewed but supported in the surveys/reviews undertaken	

Barriers / incentives to farmers taking up agroforestry

Economic/financial	How many surveys/reviews have adressed this factor?	What proportion of surveys/reviews that have adressed this factor have found it to be a significant incentive/disincentive to agroforestry
Grants, subsidy, funding opportunities for agroforestry or lack thereof	4	1
Establishments costs	3	1
Capital investment requirements	3	1
Management and maintenance costs	3	1
Reduce profitability and loss of yield	3	1
Business diversification and risk reduction	2	1
Aesthetic value	1	1
Labour costs / help with labour costs	2	0.5
Uncertainty about market for outputs from trees	1	0

Best supported ↓ **Least supported**

Policy

Uncertaintly about policy / legislation	5	0.6
Policy / subsidy clashes and percieved loss of existing payments	2	1
Falls into a funding gap: agroforestry typically not large enough for woodland creation grants	1	1
Unfavourable policy environment	2	0.5
Improved policy support	2	0

Advice

Conceptual / practical advice or lack thereof	2	1

Knowledge

Lack of conceptual understanding and knowledge of agroforestry	7	1
Lack of practical understanding and knowledge of agroforestry	4	1
Lack of economic understanding of agroforestry	3	1
Access to case studies and demo farms	3	1
Lack of awareness of agroforestry among farmers	2	1
Agrofestry enabling research	1	1

Synergies and clashes with agricultural processes and other farm activities

Clashes with existing agricultural processes and activities	3	1
Enhancement of agricultural processes and other farm economic activities	3	0.666666667

Environmental

Benefits to the natural environment	2	1

Other

Acreage and field size limitations	2	1
Farmers perceive farming and agroforestry as two separate things	1	1
Tradition	1	1
Lack of processing capacity in England for crops like nuts that go well with agroforestry	1	1
Perceived by farmers as a stable use of land against a background of unstability in agriculture	1	1
Provision of rural jobs	1	1
Tenancy clashes	3	0.333333333
Lack of interest in agroforestry on the part of farmers	2	0
Land is not suitable for growing trees	1	0
No known successor for the business	1	0
No interest in diversification	1	0
Other	1	0

Table 4: A semi-quantitative review of ten surveys and reviews examining UK farmer perceptions of barriers and incentives to taking up agroforestry. Factors representing incentives/disincentives to farmers adopting agroforestry are **not organised into sections**, with **best supported factor at the top of the list** and the **least supported at the bottom**. Factors with the same scores in coloured boxes are tied for importance.

key					
7			1	A factor that is extensively surveyed/reviewed and extremely well supported in surveys/reviews
1			0	A factor that is not extensively surveyed/reviewed and poorly supported in surveys/reviews
2			0.5	A factor that is moderatley well surveyed/reviewed and moderately supported in surveys/reviews
7			0	A factor that is extensively surveyed/reviewed but not supported in surveys/reviews
1			1	A factor that is not extensively surveyed/reviewed but supported in the surveys/reviews undertaken

Barriers / incentives to farmers taking up agroforestry

			How many surveys/reviews have adressed this factor?	What proportion of surveys/reviews that have adressed this factor have found it to be a significant incentive/disincentive to agroforestry
Lack of conceptual understanding and knowledge of agroforestry			7	1
Grants, subsidy, funding opportunities for agroforestry or lack thereof			4	1
Lack of practical understanding and knowledge of agroforestry			4	1
Establishments costs			3	1
Capital investment requirements			3	1
Management and maintenance costs			3	1
Reduce profitability and loss of yield			3	1
Lack of economic understanding of agroforestry			3	1
Access to case studies and demo farms			3	1
Clashes with existing agricultural processes and activities			3	1
Uncertaintly about policy / legislation			5	0.6
Business diversification and risk reduction			2	1
Policy / subsidy clashes and percieved loss of existing payments			2	1
Conceptual / practical advice or lack thereof			2	1
Lack of awareness of agroforestry among farmers			2	1
Benefits to the natural environment			2	1
Acreage and field size limitations			2	1
Aesthetic value			1	1
Falls into a funding gap: agroforestry typically not large enough for woodland creation grants			1	1
Agrofestry enabling research			1	1
Farmers perceive farming and agroforestry as two separate things			1	1
Tradition			1	1
Lack of processing capacity in England for crops like nuts that go well with agroforestry			1	1
Perceived by farmers as a stable use of land against a background of unstability in agriculture			1	1
Provision of rural jobs			1	1
Enhancement of agricultural processes and other farm economic activities			3	0.666666667
Labour costs / help with labour costs			2	0.5
Unfavourable policy environment			2	0.5
Tenancy clashes			3	0.333333333
Improved policy support			2	0
Lack of interest in agroforestry on the part of farmers			2	0
Uncertainty about market for outputs from trees			1	0
Land is not suitable for growing trees			1	0
No known successor for the business			1	0
No interest in diversification			1	0
Other			1	0

Best supported

Least supported

Figure 1: Word cloud generated from all factors, as worded in the original surveys and reviews, that go to make up the top 50% supported factors in Table 4. Word cloud produced on the https://www.wordclouds.com/ website.