Sustainable Finance Design and Valuation of Ecosystem Services: An Expert Stakeholder Analysis

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Abstract

Optimising the balance between the ecosystem services provided by agriculture and those provided by forestry has been a challenge for stakeholders and policymakers across Europe. While afforestation supports several ecosystem services, existing market structures and government policies have failed to effectively support afforestation. To overcome this challenge, novel financial instruments are needed to compensate for the opportunity cost of transitioning land from agriculture to forestry. This study leverages expert knowledge via a Delphi survey to identify effective financial mechanisms for the promotion of native afforestation which go beyond the existing government forestry subsidy programs. The results of this study suggest that land-use stakeholders recognise the local and national environmental benefits of native afforestation, while also understanding the economic and financial challenges which currently hamper native forestry growth. These results identify a need for novel financial supports to make the land-use transition to native forestry financially feasible and economically attractive to landowners over the long term.

1. Introduction

The importance of forestry ecosystem services has been researched extensively (Acharya et al., 2019; Krieger, 2001; Mori et al., 2017; Brockerhoff et al., 2017). Forests provide value through regulating services which provide benefits such as carbon sequestration and climate regulation, provisioning services (i.e. timber production), supporting services which benefit biodiversity and habitats, and cultural services such as recreation and aesthetics (Acharya et al., 2019; Mori et al., 2017; Ryan et al., 2022; Thorsen, 1999; Strange et al., 2019). Given the importance of forestry ecosystems, the European Union has set out ambitious forestry policies to meet its climate, biodiversity, and environmental goals (EC, 2021). The current EU Forestry Strategy aims to further the European Green Deal and the EU 2030 Biodiversity Strategy and envisions a central role for forestry help to achieve sustainability and carbon-neutrality throughout the economy by 2050 (EC, 2021). Specifically, the EU Forestry Strategy requires "larger, healthier, and more diverse forests" to support carbon sequestration, end habitat loss, and mitigate air pollution (EC, 2021). Among the mechanisms to achieve these goals, the EU Forestry Strategy highlights the need for financial incentivisation to make forestry ecosystem services provision economically viable for landowners (EC, 2021). The range of opportunities and benefits provided by

forestry have also been recognised in Ireland by stakeholders including Government (Climate Action Plan, 2023) and environmental organisations (Environmental Pillar, 2021).

While the importance of forestry ecosystem services are widely recognised in the scientific, governmental, and environmental communities, achieving afforestation has been a challenge. Ireland in particular has struggled to achieve afforestation goals and continues to have a very low level of woodland area (only 11.6-14.1 percent of total land area) making Ireland one of least forested countries in the European Union (DAFM, 2022; Eurostat, 2018). While the Irish case is extreme, Ireland is not alone among European nations in failing to meet afforestation policy goals (Ryan et al., 2022). Research has identified several barriers to afforestation, including sociocultural opposition at the community level and competition with traditional agricultural land uses (which in themselves support a range of ecosystem services) at the landowner level, as well as uncertainty, irreversibility, (Carroll et al., 2011; Ryan et al., 2022; Song et al., 2020) and information asymmetry between farmers and foresters (Gelo and Koch, 2009). Policy subsidies may partially defray these impacts (Thorsen, 1999), but as many of the barriers are non-monetary in nature, afforestation may not be an appealing option even when the net present value returns from forestry exceed that of agriculture (Weimers and Behan, 2004).

Given the increasing need for ecosystem service delivery and related environmental benefits which forestry provides, there exists a knowledge gap in the development of successful financial mechanisms and policies to support afforestation (Forster et al., 2021). To achieve significant changes in land use from agriculture to forestry, strategies must acknowledge the substantial economic value of forestry ecosystem services, while also accounting for the nonmonetary and sociocultural costs faced by landowners transitioning away from traditional land uses. A one-size-fits-all approach to afforestation is likely to face opposition and fail (Carroll et al., 2011; Ryan et al., 2022). This research applies a case study approach to consider native afforestation on land currently used in dairy agriculture set within Irish dairy sector. The dairy sector is the focus of this study as dairy farms are generally more profitable and market-oriented than other Irish farm systems (Hennessy and Moran, 2015; Knapp and Loughrey, 2017). Furthermore, pasture-land (of which Irish dairy farming is an intensive user) is the target of the government's efforts to transition land into forestry as tillage land area is planned to increase significantly under the current Government agricultural policy, Food Vision 2030 (DAFM, 2021). Despite this, the national dairy herd size (with accompanying environmental impacts) has grown substantially since the lifting of the milk quota in 2015. While Irish dairy farmers have previously been more reluctant to plant forestry than cattle, sheep, or tillage farmers in Ireland (Ryan et al., 2022), the economic success of the dairy industry may offer a source of funding to effectively finance afforestation on dairy pasture-land. This land use change has the potential to counteract the environmental impacts of dairy production, such as methane and nitrate emissions (Duffy et al., 2020).

This study is applied to native afforestation which has the potential to overcome the sociocultural barriers faced by non-native forestry models, while also benefiting from increased biodiversity and recreational benefits (Carroll et al., 2011). Native afforestation using slow growing broadleaves, such as oak, has increased life-cycle carbon storage benefits in the long-term when compared to non-native afforestation with conifers especially given that Irish native forestry is typically planted for non-timber purposes (Catovsky and Bazzaz, 2000; Bullock et al., 2014; Bullock et al., 2016).

The current study identifies and examines the most promising design features for a financial instrument that can incentivise the creation of native forestry (and the critical ecosystem services which it provides) through land use change on Irish dairy farms. To this end, a heterogeneous knowledge pool of 36 experts were engaged using the Delphi method (Linstone and Turoff, 1975) to elicit expert opinions and preferences on the general strategy to achieve native forestry goals as well as the particular aspects of financial instrument architecture necessary for successful implementation. Sustainable finance solutions (particularly private sector applications) do not have an extensive history in Ireland. In addition, the dairy sector has been the subject of a decade-long intensification period. Expert elicitation is needed to identify facilitators of, and barriers to, land use change in relation to increased afforestation and transitions to net zero carbon emissions. Specifically, it considers financing innovations as mechanisms to increase native afforestation in this sector. To date, no quantitative research has been conducted into the mechanisms which could support native afforestation on dairy farms in Ireland. Given the lack of existing empirical data, the Delphi approach is suitable as "the investigation at hand does not lend itself to precise analytical techniques but can benefit greatly from subjective judgements on a collective basis" (Grisham, 2008, p114).

Following the deliberative research approach of Shipley et al. (2020) and the scenario analysis method of Ehlers et al. (2022), an in-depth, in-person discussion group was applied to further define the results which emerged from two-round Delphi method survey. This approach is appropriate to analyse this complex and understudied issue, especially in relation to future decisions and actions (Grisham 2009; Ehlers et al., 2022). In particular, the requirements and stakeholder acceptability of potential financing strategies and mechanisms to support native afforestation has not yet been studied. The economic valuation of rural ecosystem services emanating from both agriculture and forestry is complex, but must be addressed if land use change is to support the transition towards a net zero carbon emissions economy (Shipley et al., 2020).

Financial literacy and land use

The decision faced by Irish farmers to permanently change the land-use of their property from agriculture to native forestry is a financially complex one (Źróbek-Różańska et al., 2014; Ryan and O'Donoghue, 2016). While government and potential private sector afforestation support mechanisms benefit farmers, these are often paid over a long time horizon and must be balanced against the opportunity cost of lost agricultural earnings and European Union Common Agricultural Policy direct subsidy payments, as well as potentially complicating inter-generational land transfer. These costs are in addition to the non-pecuniary social and cultural costs of afforestation. In this context, the financial literacy of land managers becomes a critical component of their decision-making process.

Research has found that financial literacy significantly impacts land management decisions such as those relating to farmland transfer (Tan et al., 2022); borrowing, the use of farm assets as collateral for credit, and credit management (Guo et al., 2023); and resource allocation (Lusardi et al., 2017). In the specific context of forestry, Guo et al. (2023) found that financially literate farmers could effectively use forestland as collateral to improve access to credit. This result encourages the potential use of forestry as collateral as part of a private sector afforestation scheme in Ireland. Financial literacy is also associated with improved savings outcomes (Lusardi et al., 2017). These results are supportive of policies which encourage financial literacy among farmers, especially low-income farmers, in the areas

of "…the lending process, interest rates, loan terms, and awareness of the risks and benefits of household financial strategies." (Guo et al., 2023; Tan et al., 2022).

Irish forestry context

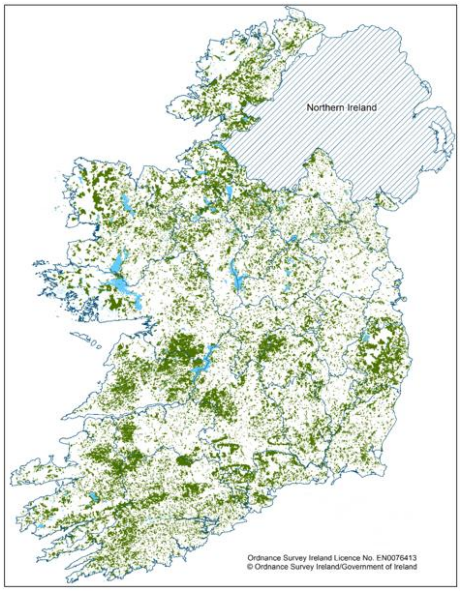
Forests in Ireland began to be diminished during the Iron Age in the 3rd century BCE and continued to be cleared through the Industrial Age of the 19th century CE (O'Carroll, 2004, p.5). Population expansion in Ireland to more than eight million people by 1841 led to deforestation to both increase food production and supply the forest product needs of the industrial economy (O'Carroll, 2004, p.5). Land reform policies, which from 1870 began to redistribute land to small-holding farmers, further contributed to deforestation as private woodlands within large estates were deforested and converted to agricultural use (O'Carroll, 2004, p.10). During the land reform process in the late 19th and early 20th centuries forestry developed a negative connotation as "Trees were associated with landlords." (O'Carroll, 2004, p.12).

Since the foundation of the Irish State in 1922, Ireland has struggled to recover from centuries of deforestation and has attempted to increase forested land area from a very low base (DAFM, 2022). The first Irish limited afforestation policies and forest grant payments began as early as 1922 (Neeson, 1991). However, by 1928, the Irish government estimated that only 1.2 percent of Ireland's land area was forested, the lowest percentage on record (Minister for Lands and Agriculture, 1928). In 1946, the Forestry Act enshrined in law the obligation to replant, within twelve months of felling, all cleared forest land (O'Carroll, 2004, p.35). Thus, afforestation became, legally in Ireland, a permanent and irreversible land-use change. Despite these policies, Ireland's stock of forested land remained low through most of the twentieth century, with the forested area not exceeding 5 percent until 1985 and not exceeding 10 percent until 2006 (DAFM, 2022). The modest increases in forested area from the 1980s onwards were stimulated by European Economic Community Forest incentives which were launched in 1981, and by national policies including the Forestry Operational Programme and the Operational Programme for Rural Development which began in 1989 as well as the Forest Premium Scheme in 1990 (Ryan et al., 2022).

At present, Irish forestry policies seek to preserve and expand Ireland's stock of private and public forested land. In fact, the Irish Government has planned a transformational increase in forestry land use order to support biodiversity, mitigate climate change, and improve water quality among other reasons. According to Ireland's Forest Strategy 2023-2030, the Government has ambition to afforest 8,000ha of land per year during the 2023 to 2030 period. Also planned is an increase in forested area from 11.6% to 18% of land area by 2050 (DAFM, 2023a). To achieve this goal, Ireland along with several other European nations such as the United Kingdom, Switzerland, Denmark, Croatia, Finland, Portugal, Germany, and France use policies and grant subsidies to incentivise and stimulate afforestation (Ryan et al., 2022; Raum, 2017; Thees et al., 2020; Madsen, 2003, Neidzweidz et al., 2011; EC, 2021). In this context, Irish forestry policy aims are twofold: to develop a viable forestry industry (which is currently centred on non-native tree species) while also providing an alternate income stream to farmers in the context of increasing competition and farm consolidation (Carroll et al., 2011). To date, these policies have had limited success in stimulating substantial changes in land use to forestry (Ryan et al., 2022). The current situation of Irish forestry is one of low forested area with approximately half (49.1 percent) of Ireland's forested land being publicly held, mainly by the State-owned forestry company, Coillte (DAFM, 2022; Eurostat, 2018). The majority (69.4%) of Ireland's forest area is populated with conifers with the primary conifer species being non-native Sitka Spruce covering 44.6

percent of forest area (DAFM, 2022; Carroll et al., 2011; Ryan et al., 2016). Ireland's forests are also relatively young with seventy percent of forest area being less than seventy years old (DAFM, 2022). Figure 1 below illustrates Ireland's forested area (in green) as of 2017.

Figure 1. Map of Forest Cover in Ireland



Source: DAFM (2023b)
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Tailte Éireann
Clárúchán, Luacháil, Suirbhéireacht
Registration, Valuation, Surveying

Theoretical context

This research is grounded in the theory of real option value. Rather than valuing decision-making solely on the basis of net-present-value of returns, which only considers the impact of time-value of money on returns, real option value also considers the concepts of uncertainty of returns and irreversibility of decisions (Yemshanov et al., 2015). This approach is specified in the context of native afforestation where returns (both monetary and nonmonetary) are accrued over multiple decades and sources of uncertainty range from policy risk to climatic instability to land value volatility (Yemshanov et al., 2015). The use of real option value models in resource economics to value preservation in an environment of uncertainty began with Arrow and Fisher (1974) and Henry (1974) which considered the land-use decision to develop land or preserve land as an environmental amenity. Given that development of natural land is irreversible (particularly in the present case of Irish afforestation), and the benefits accruing to development are uncertain, preservation was reported to be economically viable across a wider range of scenarios compared to when simple net present value of returns had been used as the valuation tool.

In the case of forestry, real option analysis has been applied by Thorsen (1999) and Yemshanov et al. (2015) to the afforestation decision. More recently Strange et al. (2019) applied this analysis to

afforestation of agricultural land. The results suggest that consideration of uncertainty is important in afforestation decision-making, which is incentivised by more than simply the net present value of forestry returns plus subsidy payments (Thorsen, 1999; Strange et al., 2019). Landowners face uncertainty not only in terms of uncertain returns from agriculture and forestry, but uncertainty about future government forestry policies and land values (Thorsen, 1999; Yemshanov et al., 2015). Irreversibility also impacts decision making about the value of forestry versus the preservation of agricultural land given that afforestation is legally irreversible in Ireland (Strange et al., 2019). Given the non-market nature of many of the benefits which accrue from afforestation, their expected future value is uncertain (Strange et al., 2019). As an example, recreational benefits and other cultural ecosystem services may become more valuable where natural areas become scarce due to increasing urban sprawl (O'Driscoll, 2023; Ahrens and Lyons, 2019). However, benefits from ecosystem services may lose value if the land uses surrounding the afforested area inhibit the provision of ecosystem services in the locality (Strange et al., 2019).

2. Methods

This study applies a deliberative approach to the problem of forestry financing mechanism development and applies the approach of Shipley at al. (2020) and Ehlers et al. (2022). This approach involves a multi-stage Delphi survey followed by an in-person discussion which allows for live dialogue between the expert panellists. Given that various monetary and non-monetary values hang in the balance, deliberation among a heterogeneous group of experts and stakeholders is required to consider the diversity of viewpoints in the decision-making process (Shipley et al., 2020; Kenter et al., 2019). The in-person workshop also allows for scenario analysis which facilitates dialogue, deliberation, and consensus amongst stakeholders in an area of uncertainty and complexity (Ehlers et al., 2022).

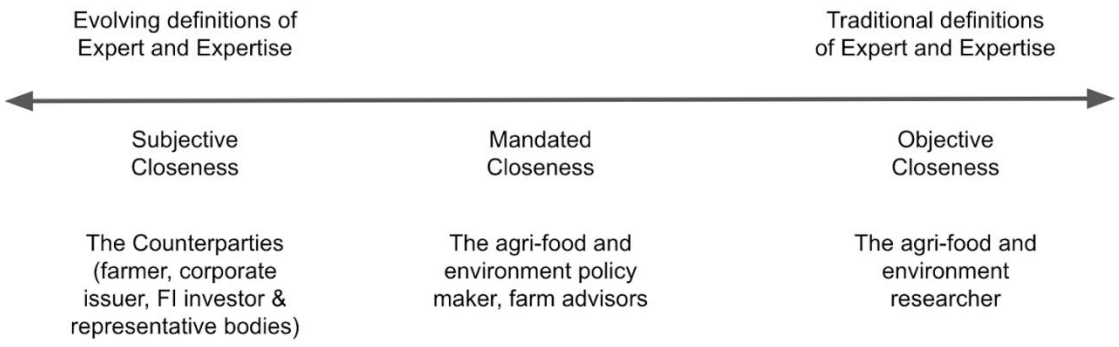
According to Linstone and Turoff (1975), the Delphi method is a structured, iterative inquiry process of gathering the anonymous viewpoints from a group of experts in the research area. This method can be utilised in various ways, such as developing expert consensus or identifying points of dissensus (Kendall et al., 2018). Delphi surveys typically involve multiple rounds of submitting survey questionnaires to the expert respondent group (Kendall et al., 2018). These surveys may include both open-ended and structured questions (Ehlers et al., 2021). After each survey round respondents have the option to refine their answers based on feedback about group responses (Walters et al., 2021) or individual narrative comments justifying scores (Frewer et al., 2011). While increasing the number of survey rounds offers additional opportunities for consensus building, increasing the number of survey rounds also increases the likelihood of panellist dropout (Belton et al., 2019). A key role in a Delphi survey is that of the coordinator or administrator who makes judgment-based decisions on the method structure and facilitates the collation selection, and presentation of the results from one survey round to the next (Belton et al., 2019). Participants in the expert respondent group do not know who the other participants are (Grisham, 2009). The anonymous nature of the Delphi process allows for more varied views and interpretations of an issue than a traditional group meeting by eliminating the possibility of certain individuals dominating the discussion and crowding out other opinions i.e. "groupthink" (Belton et al., 2019; Shipley et al., 2019). This anonymity further serves to minimise individual-level bias associated with personal experiences and interpersonal interactions (Grisham, 2009). Other features of the Delphi method include its usability in resource-constrained, high complexity research environments where stakeholder views are often difficult to rigorously quantify

and to incorporate into effective policies (Walter et al., 2021; Shipley et al., 2020). The Delphi method has been applied in various research fields including in areas relevant to this study such as the agri-food sector (Ehlers et al., 2022; Kendall et al,2018), the ecology of land-use changes (Wolf et al., 2023; Mack et al, 2023), agro-environmental management (Triana et al., 2022), rural landscape ecosystem services (Shipley et al., 2020), and ecosystem services assessment (Walters et al., 2021).

Sampling experts

Based on the conceptual continuum developed by of Donahoe and Needham (2009) and Devaney and Henchion (2018) and the expertise and knowledgeability requirements of Wolf et al. (2023) and Grisham (2009), a heterogenous set of 36 experts from across the agri-food industry, government policy, and academia were sampled. The experts are categorised based on three levels of closeness (subjective, mandated, and objective closeness to the research question) (Devaney and Henchion, 2018). The subjective closeness category includes stakeholders with direct, experiential knowledge in the industry of study (Devaney and Henchion, 2018). Experts with subjective closeness to the aims of the research include executives from the dairy industry, intensive and extensive dairy farmers, representatives of farmer and industry advocacy groups, and executives from financial institutions. Mandated closeness can be described as a professional, legal, regulatory, or policy relationship with the area of analysis (Devaney and Henchion, 2018). Study participants with expertise in the mandated closeness range of the expertise continuum include policy makers in the agri-food space as well as farm advisors with experience in the dairy sector. Stakeholders exhibiting objective closeness derive their expertise in the topic of interest via unbiased academic study and research (Devaney and Henchion, 2018). Academics with forestry and/or agri-food research experience represent objective expertise in the present study. Figure 2 below illustrates the conceptual continuum of Donahoe and Needham (2009) Devaney and Henchion (2018) as applied in this research.

Figure 2. The conceptual continuum of expertise. Adapted from Devaney and Henchion (2018)



The experts were located across the island of Ireland, that is the Republic of Ireland and Northern Ireland. This allows the unique historical and sociocultural aspects of land use in Ireland to be captured in the expertise base. Panellists maintained anonymity from each other during the two survey phases, which allowed for consensus building and the honest sharing of opinions without the influence of dominant individuals. The results were further explored by participants at the in-person discussion group following the Delphi survey.

Delphi Survey

The Delphi survey instrument was drafted and piloted with six expert pilot respondents in March of 2023. In August of 2023, a revised survey instrument was submitted electronically to the complete panel of 36 experts. The expert participants were invited to participate in a two-round Delphi method survey on the topic of native afforestation on dairy pasture in Ireland. Participants were also informed of and invited to the optional in-person scenario workshop to be held following the completion of all Delphi survey rounds. Sampled experts were asked to complete the electronic survey instrument independently and return the completed round-one survey questionnaire electronically within a two-week deadline. In the first round of the Delphi survey, 19 respondents completed the survey. In the second round, 12 respondents completed the survey. Overall, the responding experts represent a rich and heterogeneous pool of expertise. See tables 1 and 2 below for a demographic breakdown of the sample.

The Delphi survey questionnaire (available from the corresponding author upon request) was developed to minimise respondent burden while simultaneously eliciting expert opinion through structured and open-ended questions on the benefits, costs, and feasibility of developing a new financial instrument to support native afforestation in Ireland. The structured questions required answers ("I don't know" was an option) for survey completion while unstructured or open-ended questions were optional and could be left blank. The round-one survey included ten structured questions on the topic of the benefits of afforestation benefits and financing. After each structured question, respondents were prompted to answer an unstructured, follow-up question to explain their answer. Following the afforestation questions, respondents were asked eight contact information and basic demographic questions which included items of respondent age, education, occupation, and years of experience.

After the conclusion of the three-week round-one response period, respondent data was collated and the group responses of the structured questions were summarised for presentation to round-two participants following the method of Walters et al. (2021). The survey coordinators also analysed the responses to the unstructured questions provided quotes representing the different viewpoints of the sample.

The same sample of experts was asked to respond to the round 2 survey beginning on October 1st, 2023. Survey questions from round 1 were repeated except for those questions where consensus had been reached. In the Delphi method literature, the definition of consensus varies widely (Diamond et al., 2014). While Kher et al. (2010) use 50% as the threshold and Kendall et al. (2018) use greater than 60%, Diamond et al. (2014) systematically reviewed Delphi studies in the literature and found that the median consensus threshold was 75%. Based on the need to highlight areas of strong agreement, the present study uses 75% as the consensus threshold. Therefore, questions with greater than 75% agreement were not repeated in round 2 as consensus had already been achieved among the expert panellists. This resulted in two questions referring to these issues being dropped from the round 2 questionnaire. Two additional questions were included based on the qualitative responses of the experts. One new question was asked about possible economic features of a hypothetical successful native forestry scheme. The other new question asked about possible financial features of a hypothetical successful native forestry scheme. Before being asked to answer repeated questions from round 1, respondents were prompted with feedback showing the simplified results of the round 1 survey for each question where disagreement occurred. Respondents were also shown two quotes

from the long-answer qualitative questions which were representative of the alternative viewpoints of the sample. Tables 1 and 2 below illustrate the diversity of respondents to the Delphi survey rounds 1 and 2 respectively including academics, farmers, and farm advisors of varying ages, genders, and experience levels.

Table 1. Attributes of Delphi survey participants Round 1 (n=19)

Career background	Gender = Female	Gender = Male	Gender = Other	Highest educational attainment = secondary or technical training	Highest educational attainment = tertiary or postgraduate training	Age = 40 or less	Age = 41 or older	Experience in current role = 20 or less years	Experience in current role = greater than 20 years
Academia	2	1			4	1	2	4	
Agricultural/ forestry advisor*	1	4	1		6	1	4	2	4
Dairy farmer		3		2	1	1	1	1	2
Financial institution		1			1		1		1
Other	1	3		1	3	2	2	2	2
Public policy		1			1			1	

*In Ireland many agricultural advisors are simultaneously forestry advisors

Note: some respondents preferred not to respond to gender and age demographic questions

Table 2. Attributes of Delphi survey participants Round 2 (n=12)

Career background	Gender = Female	Gender = Male	Gender = Other	Highest educational attainment = secondary or technical training	Highest educational attainment = tertiary or postgraduate training	Age = 40 or less	Age = 41 or older	Experience in current role = 20 or less years	Experience in current role = greater than 20 years
Academia	2	1			3	1	1	3	
Agricultural/ forestry advisor*	1	4			5	1	4	2	3
Dairy farmer		1		1			1		1
Other		2		1	1	1	1	1	1

Note: One respondent did not provide career background information.

Discussion group

The scenario workshop structure was adapted from that of Ehlers et al. (2022) and Shipley et al. (2020). Expert participants who completed rounds one and two of the Delphi survey were invited to attend an in-person scenario workshop which was conducted in Limerick, Ireland in December 2023 and attended by 6 of the sampled experts representing farmers, a forestry industry group, a dairy industry group, an environmental group, a forestry advisor, and academia. This workshop was conducted in three phases. Firstly, the summarised results of the round-two Delphi method survey were presented by the survey coordinators to the assembled participant experts. Experts were given opportunity to ask questions about the survey, its results, and possible implications of this research. Under the supervision of two discussion facilitators, experts in the discussion group discussed the barriers to native afforestation as well as potential opportunities for land-use change toward native reafforestation. The discussion was transcribed verbatim.

The respondents to the two-round Delphi Survey highlighted the benefits of afforestation including national environmental benefits. Also identified were the potential pitfalls of a novel forestry financing mechanism such as the low likelihood of support from the dairy and finance industries. The discussion group which followed the Delphi survey allowed for increased stakeholder engagement and offered invaluable local expert insights to the research coordinators. Participants in the follow-on discussion group provided further qualitative detail and validation to the data collected in the Delphi survey. This research approach established the feasibility of native afforestation financing schemes and generated consensus around the features of financing mechanisms which could be incorporated into future agro-environmental policy.

After the in-person discussion, the core project team including the discussion coordinators reviewed the discussion results and categorised the discussion findings into two broad themes. These themes were barriers to afforestation in Ireland and opportunities for land use change in Ireland towards afforestation. Following the review by the core project team, a brief summary of the discussion findings, along with highlighted results of the Delphi survey rounds one and two, were shared with agricultural and environmental economics experts at a seminar in Dublin, Ireland in January 2024. These experts broadly concurred with the discussion and survey findings.

3. Results

Delphi survey results

Despite the diverse viewpoints and heterogeneous experiential backgrounds of the expert panel convened for this study, the results of this Delphi survey demonstrated multiple areas of strong agreement. Table 3 below shows the survey questions in both survey rounds which yielded consensus, i.e. 75 percent or more of respondents reported the same answer. In round 1 of the survey, respondents were in agreement on the environmental benefits of native afforestation and 90 percent of respondents agreed that native afforestation in Ireland offers benefits at the national scale. After being prompted with the results of the round 1 survey, two additional questions garnered agreement levels above the consensus threshold. A strong majority of round 2 respondents (92 percent) thought that the dairy industry was unlikely to compensate farmers to encourage land use change to native forestry and furthermore 83 percent of respondents did not see native afforestation compensation as the role of the dairy industry.

Table 3. Points of consensus

Survey round	Survey question	Result	Respondent quote example
1	Native afforestation offers environmental benefits.	100% agreed	"…I'm seeing a big change in positive attitude towards the environment…"
1	Native afforestation benefits Ireland as a whole.	90% agreed	"I would say native afforestation can benefit everyone…when implemented correctly."
2	Would the dairy industry provide fair compensation to support change in land use by dairy farmers?	92% thought it was unlikely	"Unlikely, unless support for afforestation is translated as a "licence to farm" i.e. building social capital amongst the dairy industry's mainly urban customer base."
2	The dairy industry should compensate farmers who plant native forestry (83% disagreed	83% disagreed	"I don't think it is the role of the dairy industry to be responsible for the paying of the compensation."

Even after respondents were shown the round 1 survey results, less than three quarters of respondents were in agreement on the questions shown below in Table 4. Two thirds of respondents thought that short-term (within two years) land use change on dairy farms was unlikely despite the existing government afforestation support programmes. This result underscores the need for novel afforestation financing mechanisms. An interesting result was that two thirds of respondents thought that native afforestation would negatively impact production on dairy farms. This response suggests that some reforestation could occur without hampering the primary agricultural enterprise of dairy farms. In parallel with the responses on the role of the dairy industry, most respondents (66 percent) thought that the financial industry did not have a role in encouraging farmers to plant native forestry.

Table 4. Points of dissensus

Survey round	Survey question	Result	Respondent quote example
2	What is the likelihood that dairy farmers in Ireland will change some part of their land area away from grassland and towards native forestry during the next two years?	33% thought it likely, 66% thought it unlikely	"There would need to be a big change towards incentivising farmers to do so, and/or a change in regulation."
2	Would native afforestation on dairy farms help to reach national targets for carbon sequestration and/or biodiversity?	50% thought little or no impact, 50% thought moderate or significant impact	"The levels of sequestration would possibly be modest due to the slower growth rates, the biggest results would be for biodiversity as it is the most sustainable environment for Irish wildlife."
2	Would native afforestation on dairy farms negatively impact milk production?	66% thought little or no impact, 33% thought moderate or significant impact	"A less intensive, more balanced farm will still produce milk if the herd is less stressed."
2	Should the financial industry compensate dairy farmers who plant native forestry?	33% agreed, 66% disagreed	"Involving more corporate entities in financing such projects would only give them an opportunity for green washing their activities."

In round 2 of the survey, respondents were also asked about their preferred financial and economic features in a native afforestation support programme. The features which survey participants were prompted with were derived from the programme features mentioned in free-response comments by round 1 participants. The most preferred economic features highlighted by respondents were "additional payments to support biodiversity", "funding for farmer education and market support to generate a business income from forestry", and additional payments for carbon sequestration. In terms of preferred financial features in a native afforestation programme, respondents chose "incorporating forestry payments in succession plans to benefit multiple generations", "extend payments over a longer time-period, and "participation in afforestation programmes provides farmers with access to lower cost loans". In both the structured and free response queries of ideal programme features, respondents were most concerned with ensuring that native afforestation would yield a long-term, sustainable funding stream which could help to maintain farm viability on a multi-generational timescale.

Discussion group results

The in-person discussion group elicited a wide-ranging conversation amongst the assembled participants. In broad terms, the discussion can be summarised into two themes: barriers to afforestation and opportunities for afforestation. Barriers to afforestation are described in Figure 3 below. This figure illustrates the policy barriers raised by discussants which include lack of trust in government to follow through on long-term forestry policies as well as cumbersome bureaucracy which makes afforestation a slow process with the added pitfall of limited eligibility. An equally important set of afforestation barriers derives from the significant social pressures faced by farmers.

Farmer discussants highlighted the pressure they face from their social network to use land productively and maintain their farmer identity or face social exclusion.

Despite the several barriers to afforestation faced by landowners, the expert stakeholders in the discussion did identify multiple opportunity pathways towards land use change. Figure 4 below illustrates the ideal underpinnings of a successful programme of native afforestation. Such a program would leverage local farmer forestry networks to address local afforestation needs. Discussants contrasted this ideal with current government afforestation programmes which are national in scale. Another opportunity pathway which was mentioned by both farmers and forestry advisors in the discussion group is the need for native forestry planning at the multi-generational timescale. Given the long growth cycle of native broadleaf forestry and the desire of farmers to pass on their land as a productive and financially sustaining asset to the next generation, discussants felt that the current native afforestation programme timescale of ten years was too short. The final area of afforestation opportunities was identified by discussants as a shift in the forestry paradigm in Ireland which traditionally focused on large-scale, non-native conifer forestry. Several discussants felt that small-scale native afforestation could be implemented in harmony with agricultural production.

Figure 3: Barriers to afforestation

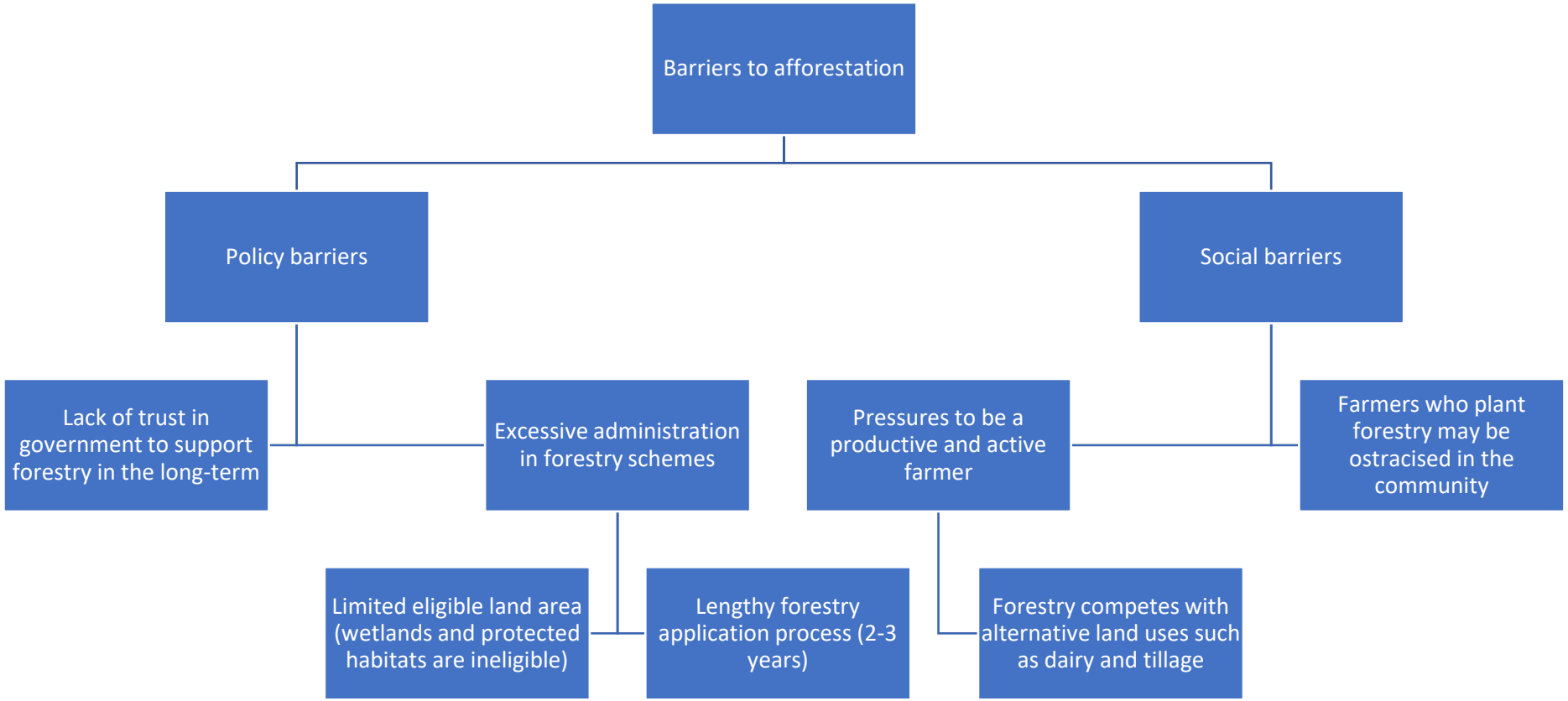
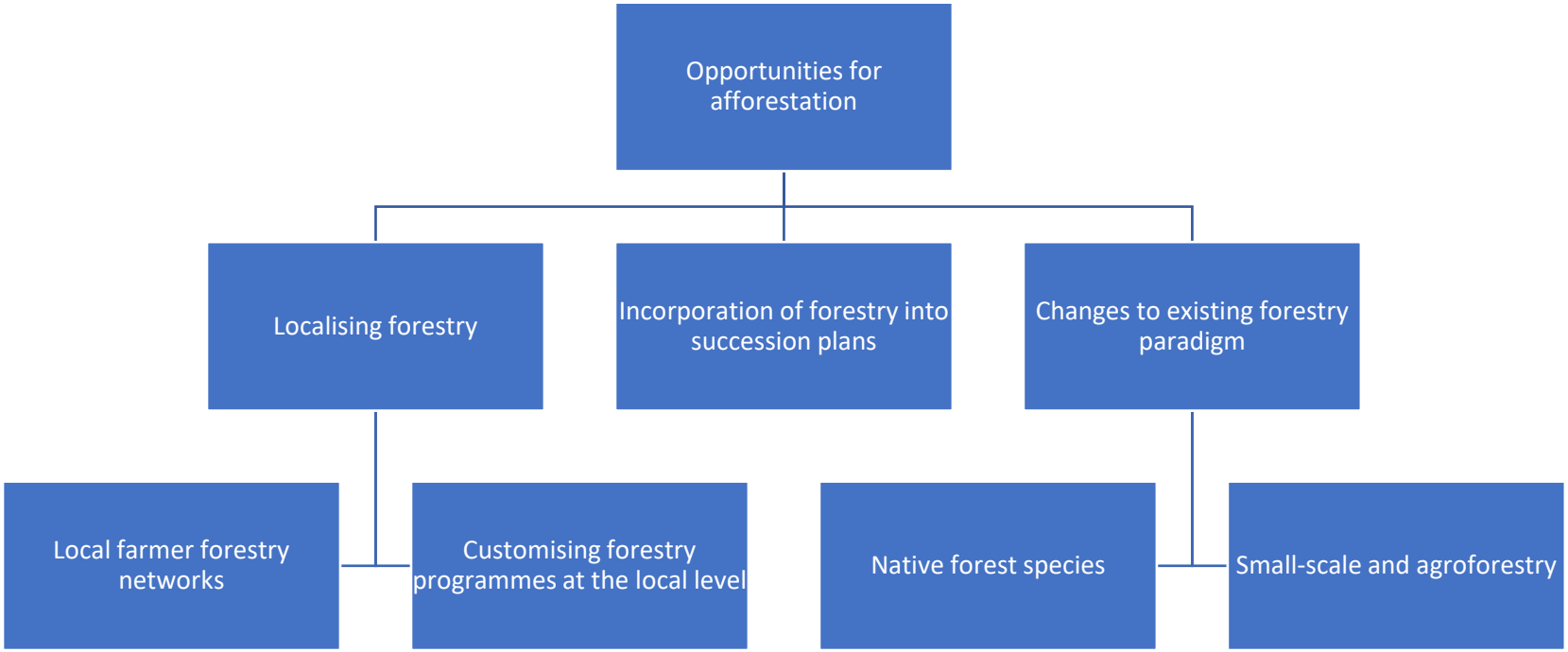


Figure 4: Opportunities for afforestation



4. Conclusions

The results of this study establish the need for, and feasibility of, novel native afforestation financing mechanisms. While existing government forestry support programmes have failed to overcome the socioeconomic barriers to native forestry land use change, this research leverages the expertise of stakeholders in this field to identify opportunity pathways to substantially grow native forested area in Ireland. These pathways are local, long-term, and work with farmers, not against them. This qualitative research develops the groundwork for empirical research at the local farmer network scale which can contribute to more detailed policy development and costing.

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