

Administrative burdens as barriers to afforestation: A sludge audit of Ireland's afforestation scheme

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ABSTRACT

Many governments offer financial incentives to encourage landowners to plant trees. However, administrative burdens associated with these afforestation schemes can hinder grant uptake. This paper builds on existing research on administrative burdens and “sludge,” which addresses these administrative challenges, by conducting a sludge audit of Ireland's Afforestation Scheme. We create a journey map that outlines the typical steps involved in securing afforestation grants, assess the level and type of sludge at each step in this process, and conduct a thematic qualitative analysis of stakeholder interviews. The audit reveals that unpredictable timelines in the application process serve as a significant barrier to afforestation efforts. Additionally, the high level of uncertainty surrounding grant application outcomes complicates the decision-making process for landowners, making it challenging to determine whether pursuing the scheme is worthwhile. To address these challenges, we recommend streamlining information requirements, establishing clear timelines, and enhancing communication to reduce friction and facilitate afforestation.

1. Introduction

Climate change is leading to many social and environmental problems, such as rising sea levels, food and water insecurities, and loss of biodiversity (Calvin et al., 2023). The sequestration of carbon dioxide in forests has substantial potential for climate change mitigation (Doelman et al., 2020). Encouraging carbon removal and afforestation are key pillars of the European Union's (EU) climate change mitigation strategies (European Environment Agency, 2022) as part of the EU's aim for carbon neutrality by 2050 (EU, 2021). Governments worldwide are funding forestry planting initiatives to tackle environmental and social problems (Kaine et al., 2023; Kobayashi et al., 2023; Westaway et al., 2023). However, there are many financial and non-financial barriers to afforestation which impede the implementation and delivery of these planting schemes (e.g. Duesberg et al., 2014; Kaine et al., 2023).¹

Administrative burdens are an overlooked barrier to the uptake of

afforestation grants when landowners experience the formal requirements of the grants as onerous. Interest in administrative burdens is increasing worldwide as governments and international organisations aim to better understand how burden reduction initiatives can improve processes (NSW Behavioural Insights Unit, 2024b; OECD, 2024; OIRA, 2024). Public administration research has identified administrative burdens as important barriers in many areas, especially in the context of social and health benefits (Halling and Bækgaard, 2023). However, environmental grant schemes have received minimal attention from the administrative burden perspective, and understanding about the hassles that landowners face when applying for financial support from afforestation and agroforestry schemes is limited (but see Del Rossi et al., 2021; Falconer, 2000; Kaine et al., 2023; Lawrence and Dandy, 2014).

This paper builds on research on administrative burdens (e.g. Herd and Moynihan, 2019; Moynihan et al., 2015) and “sludge” (e.g. Sunstein, 2021; Thaler, 2018) to analyse Ireland's efforts to increase the

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¹ Planting trees is sometimes seen as a less productive, less profitable use of land compared to farming (Irwin et al., 2023), and farmers are concerned about potential long-term revenue loss (Kaine et al., 2023; Ryan et al., 2018). Non-financial barriers to afforestation include values that farmers hold related to a perceived priority for food production, land-use flexibility, and family tradition (Duesberg et al., 2014) as well as farmers' worry about losing their cultural capital and connection with the land and loss of farming lifestyle when transitioning to forestry (Howley et al., 2015). The irreversibility of the land designation from farmland to forest and binding government contracts can also discourage afforestation (Ryan et al., 2022; Vidyaratne et al., 2020). Concerns over property ownership, tax implications from inheritance/succession, and access to the land are additional barriers to afforestation (Lawrence and Dandy, 2014).

number of trees in the country. Administrative burden research highlights the importance of the experience of citizens (such as landowners) when interacting with the government (e.g., when applying for afforestation grants). Sludge describes frictions that make it harder for people to navigate their lives and achieve their goals, and [Sunstein \(2022\)](#) calls for “Sludge Audits to catalogue the costs of sludge and to decide when and how to reduce it” (p. 654). We present a sludge audit that measures how landowners and foresters experience their interactions with Ireland’s Afforestation Scheme 2023–2027 as part of a new national Forestry Programme which aims to increase forest cover in Ireland by providing annual premiums to landowners who decide to plant trees ([Department of Agriculture, Food and the Marine, 2023](#)). To the best of our knowledge, this is the first sludge audit that aims to identify administrative frictions in an afforestation scheme.

The remainder of the paper is structured as follows. Section 2 provides the background to the sludge audit, presenting recent advances in the academic literature on administrative burden and sludge and more information about the state of afforestation in Ireland and Ireland’s Afforestation Scheme. Section 3 describes the sludge audit method which is composed of three phases: the development of a journey map, a step-by-step assessment of the administrative burdens in each step of this journey, and a more holistic qualitative assessment of the administrative burden in the process. The main data source of the sludge audit are qualitative interviews, as detailed in Section 3. Section 4 presents the results of the sludge audit in three subsections corresponding to the three phases of the audit. Section 5 summarises and discusses the findings and presents some recommendations for policy and future sludge audits. The final section concludes with wider research insights.

2. Background

2.1. Administrative burdens and sludge

Administrative burdens can manifest in numerous forms, such as complex application forms, long idle waiting periods, or requests to provide the same information multiple times. In the public administration literature, administrative burdens are defined as individuals’ experiences of policy implementation as onerous ([Burden et al., 2012](#)). These onerous experiences can have damaging impacts on interactions between citizens and the government. As a result of administrative burdens, policy adoption rates are lower and participation in programmes can be more difficult ([Bearson and Sunstein, 2023](#)). Moreover, administrative burdens can impact different groups differently ([Christensen et al., 2020](#)), which can have problematic distributional consequences ([Halling and Bækgaard, 2023](#); [Herd et al., 2023](#)). Administrative burdens lead to different types of costs, including search costs (when administrative processes make it hard to find information), compliance costs (when administrative processes make it hard to comply with government regulations), and psychological costs (when administrative processes create frustration, shame, and other emotional costs) ([Herd and Moynihan, 2019](#); [Moynihan et al., 2015](#)). Demarcating administrative burdens into different types of costs makes it easier to identify and assess different types of administrative burdens ([Madsen et al., 2022](#)).

The concept of sludge is related to administrative burdens ([Madsen et al., 2022](#)) but they are not the same. Sludge is defined as frictions that make it harder for people to achieve what they want ([Mills, 2023](#); [Newall, 2023](#); [Sunstein, 2021](#)). Sludge is a broader concept than administrative burdens, as it also includes the use of frictions by private companies to increase revenues ([Mills et al., 2023](#); [Thaler, 2018](#)). [Shahab and Lades \(2024\)](#) define sludge as aspects of the choice architecture that lead to the experience of costs (see also [OECD, 2024](#)). The benefit of this definition is that sludge can be linked to different types of costs which facilitates the identification of sludge. Following this literature, we distinguish between the following cost categories.

- **Search costs:** when sludge makes it hard to find information about, for example, funding opportunities or other programmes that might be beneficial.
- **Evaluation costs:** when sludge makes it difficult to evaluate the pros and cons of a decision so that it becomes more difficult to determine what to do.
- **Implementation costs:** when sludge makes it difficult to implement a decision one has made.
- **Psychological costs:** when sludge creates frustration, stress, worry, embarrassment, shame, or other negative emotions.
- **Time costs:** when sludge creates unnecessary waiting periods, lengthy application processes, or other time delays.²

Insights from the transaction costs literature suggest three important factors that influence whether sludge is prevalent in a process: specificity, frequency, and uncertainty ([Shahab and Lades, 2024](#); [Williamson, 2008](#)).³ *Specificity* describes the extent to which resources such as knowledge and skills are specific to one particular process. The more specific a process is, the more sludge is prevalent. *Frequency* describes how often the same task is performed. If a task is performed very rarely, sludge is more likely to be present because people do not have the opportunity to get to know the procedures. Finally, *uncertainty* increases the sludge within a process. When future costs and payoffs, timelines, and required actions are uncertain, more sludge is present. We organise our sludge audit based on the above list of costs, and refer to specificity, frequency, and uncertainty in the analysis.

Administrative burdens and sludge are increasingly recognized as important barriers that prevent people, organisations, and governments from achieving their goals. For example, the [OECD \(2024\)](#) and the [UN \(2023\)](#) published work on reducing frictions and the US Government started a “Burden Reduction Initiative” ([OIRA, 2024](#)). The New South Wales Government’s Behavioural Insights Unit (2024) is world leading in sludge reduction initiatives and has conducted an increasing number of sludge audits. The focus of most previous research and applied work on administrative burden and sludge identification and reduction is on social and health policy ([Halling and Bækgaard, 2023](#)). Work on administrative burdens and sludge to better understand the barriers to achieving environmental targets is only slowly emerging ([Carter et al., 2018](#); [El Benni et al., 2022](#); [Mack et al., 2021, 2024](#); [Reissig et al., 2022](#); [Shreedhar et al., 2024](#)).

2.2. Ireland’s afforestation scheme

Over the past 35 years, the Government of Ireland has administered an ambitious program of grant-based afforestation on private lands ([Crowley, 2006](#); [Ní Dhubhain and Wall, 1999](#)). However, total (public and private) annual afforestation peaked in 1995 at almost 25,000 ha nationally (75% of which was private). By 2000, the Republic of Ireland’s total forest cover reached 9% and maintained the highest rate of afforestation in the EU, largely due to financial support from an EU Community Support Framework ([O’Leary et al., 2000](#)). In 2007, the national government removed the forestry program from the EU Common Agricultural Policy remit, making the Exchequer (the main accounting fund used by the government of Ireland) the sole funder of the

² Compared to the cost typology used in administrative burden research where compliance costs do not describe a specific element of a decision, this cost typology focuses more on specific elements in the decision-making process.

³ Sludge and transaction costs are also related but distinct concepts, as discussed in [Shahab and Lades \(2024\)](#). One of the key distinctions is that sludge focuses on aspects of how choices are presented, or the “choice architecture”, and transaction cost economics largely ignores these design features. Another distinction is that sludge can lead to subjectively experienced costs, and these costs include psychological costs which are largely ignored in transaction costs economics.

forestry and afforestation programs (Magner, 2023) and a new Forestry Programme was launched, including an Afforestation Scheme that ran until 2013 (Duesberg et al., 2014). Annual afforestation rates dropped to a maximum of 8314 ha in 2010 under this scheme (Department of Agriculture, Food & the Marine, 2024). Another Forestry Programme and Afforestation Scheme was established from 2014 to 2020 and the Forest Service established its current policy for all licence applications to be screened by the Department of Agriculture, Food and the Marine (DAFM) (hereinafter referred to as the 'Department') in an appropriate assessment process (Department of Agriculture, Food and the Marine, 2024a).

In Ireland, landowners are required to obtain an afforestation licence from DAFM for new woodland creation on land greater than 0.10 ha (Government of Ireland, 2014). This regulatory policy ensures that planting proposals meet sustainable forest management standards and comply with essential environmental protections, such as the Habitats Directive. Separate licences are also mandated for operations including tree felling and forest road works. Financial support through the Afforestation Scheme is only available if the afforestation licence is in place, which requires technical approval. When landowners create forests, they retain the property rights to their land. However, these rights are exercised subject to regulatory conditions and obligations set out in the Forestry Act 2014 (Government of Ireland (2014) and additional conditions apply if financial support is received (Department of Agriculture, Food and the Marine, 2024a). For example, landowners are obliged to maintain the forest and replant trees after felling.

As a result of EU environmental regulation and the licence application screening process, the Department saw a noticeable increase in backlogged licence applications in 2020, with the number more than doubling in 18 months from 2300 applications to 5000 (Lades et al., 2022). As of 2024, Ireland remained behind its ambitious afforestation targets, with an annual afforestation rate of roughly 2000 ha per year since 2021 (Department of Agriculture, Food and the Marine, 2024a). Forests now cover 11.6% of land in the Republic of Ireland, compared to the EU average of 38%. Although this figure marks an improvement from the 1% forest cover recorded in 1922 (Department of Agriculture, Food and the Marine, 2024b), Ireland has set a goal to increase forest cover to 18% by 2050, with a target afforestation rate of 8,000ha per year (Department of Agriculture, Food and the Marine, 2024b). However, to meet the national climate goal of net zero emissions by 2050, Ireland needs to exceed this target, planting an estimated 25,000 to 35,000 ha annually (Thorne et al., 2023). In 2023, the Land Use, Land Use Change, and Forestry sector contributed 9.3% of Ireland's overall greenhouse gas emissions (EPA, 2024). The recent decrease in the total area planted may be due to delays in implementing the new forestry programme (CCAC, 2024).

To increase afforestation and address licencing issues, the Government of Ireland published the Forestry Programme 2023-2027 in August 2023 (Department of Agriculture, Food and the Marine, 2024b). A key component of this programme is the Afforestation Scheme 2023-2027, designed to encourage farm-to-forest transitions. This scheme provides

incentives for farmers to plant trees and offers premiums for a duration of up to 20 years (Department of Agriculture, Food and the Marine, 2024b). Like the previous Afforestation Scheme 2014-2020, the new scheme offers a maximum of 15-years premiums to landowners and covers forest planting costs through grants and premiums, with provisions for fencing and forest maintenance. In 2023, grant-aided private forests represented 35.7% of forest ownership in Ireland (Department of Agriculture, Food and the Marine, 2024b). The scheme further supports Irish agricultural forestry by incentivizing the development of twelve different forest types (Department of Agriculture, Food and the Marine, 2024b). Table SII in the Supplementary Information details the fixed grant rates and premium durations for each of these forest types.⁴

3. Sludge audit methodology

This section presents the four components of the sludge audit (in subsections 3.1 to 3.4, respectively). First, we develop a behavioural journey map which illustrates the typical steps that lead to afforestation through Ireland's Afforestation Scheme as described in subsection 3.1. This journey map informs, and is informed, by semi-structured interviews that are described in subsection 3.4. These interviews also inform a fine-grained sludge assessment of sludge present at each step in this journey as explained in subsection 3.2. The interviews and the fine-grained assessment then inform a more holistic assessment of the process obtained through a qualitative analysis as presented in subsection 3.4. The structure of this analysis is summarised in Fig. 1.

Since our paper presents a sludge audit, we will use the term "sludge" rather than "administrative burden" in the remainder of the paper. However, since we are investigating sludge related to a government process, in most instances sludge and administrative burden could be used interchangeably in the context of this paper.

3.1. Behavioural journey mapping

As recommended by existing literature on sludge audits (Martin, 2023; NSW Behavioural Insights Unit, 2024b; OECD, 2024; Shahab and Lades, 2024; Sunstein, 2022), the first step of a sludge audit is an initial scoping exercise to establish the first draft of a user journey map. In our case, this journey map outlines the full behavioural journey of a landowner to plant a forest on their property through Ireland's Afforestation Scheme. We identify stages in this journey and further segment the stages into individual steps that a typical user must take. To obtain information about the typical user journey, we review the application process and complete relevant forms in "cognitive walk-throughs" or "mystery shopping" exercises and go through the steps as described in the journey map ourselves. We also use the Afforestation Scheme 2023-2027 documentation to inform the behavioural journey mapping process, including the detailed Application Procedure portion of the document (Department of Agriculture, Food and the Marine, 2024b). In our qualitative interviews with relevant stakeholders (see section 3.4), we present this journey map to stakeholders and ask for their guidance

⁴ Since our analysis took place, the Forestry Division within Ireland's Department of Agriculture, Food and the Marine has continued in their efforts to improve uptake of the Afforestation Scheme. Ireland's new Forestry Programme 2023-2027 includes a Farmers' Charter commitment to issue forestry licences within six months in respect of applications that do not require further Appropriate Assessment, and nine months for those that do (DAFM, 2024). In addition, the Department is about to promote new planting under a new Strategic Communications Plan to further encourage uptake and planting. However, the new Forestry Programme also provides additional environmental requirements, including for new surveys (e.g. Habitat Maps, High Nature Value surveys, peat surveys, and threatened species considerations, depending on the site), all of which could create additional administrative barriers. Further investigation into barriers at the point of submission of the applications might thus be warranted.

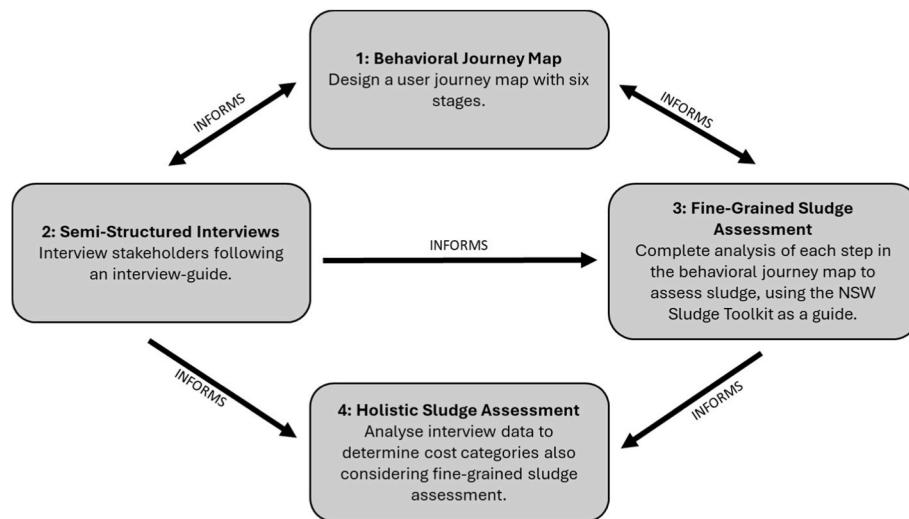


Fig. 1. Overview of the methodology used in the sludge audit.

on the accuracy of the map. We then update the map based on their feedback.

3.2. Fine-grained sludge assessment

After completing the behavioural journey map, we assess the type and level of sludge at each step of the process. Following guidelines from the New South Wales (NSW) Behavioural Insights Unit (2024), this analysis involves data collection, estimation of time and cost, and scoring of the customer experiences, among other steps. Data collection includes mystery shopping exercises and the completion of forms accessible on the Government of Ireland website or obtainable through the Department. The primary data source, however, is a series of semi-structured interviews (see Section 3.4).

To facilitate sludge audits, the NSW Behavioural Insights Unit provides a “sludge finder” tool, which guides audit teams through the assessment process (NSW Behavioural Insights Unit, 2024a). We rely on this tool to support our customer experience review for each step of the journey map. We give each step a rating from 1 (very easy) to 5 (very difficult) using the sludge scales that are implemented in the sludge finder tool. These scales evaluate elements of the customer experience (e.g. language, content, design, navigation) and recommend ratings based on descriptive criteria (e.g. if language is unclear or complex, a rating of 4 is suggested). While these scales improve accuracy and replicability, it is acknowledged that the ratings are inherently subjective, representing the audit team’s assessments (i.e. the authors of this paper), and that absolute accuracy is unattainable in any sludge audit (NSW Behavioural Insights Unit, 2024b).⁵ To increase transparency of the sludge audit, we do not use the sludge finder tool’s online functionality. Instead, we share the sludge assessments of each step in a long table in the Supplementary Information of this paper. We also assess the type of sludge present at each step, drawing on the typology by Shahab and Lades (2024) which distinguishes sludge that leads to search costs, evaluation costs, implementation costs, psychological costs, and time costs at each step of the journey map.

⁵ These sludge ratings may be influenced by our subjective interpretations of these processes. As environmental policy researchers, we are familiar with many environmental policies and regulations in Ireland. While we have a general interest in improving the efficiency of environmental policies, we do not hold specific interests in afforestation outcomes.

3.3. Qualitative assessment of sludge

The final step of our sludge audit involves a qualitative analysis of the data gathered from the semi-structured interviews with stakeholders. We apply thematic content analysis to examine this qualitative data (Vaismoradi et al., 2013). This approach enables us to identify collective patterns and experiences with sludge that may not be apparent through a solely fine-grained sludge assessment (Braun and Clarke, 2006). Through thematic analysis, we can extract overarching themes that are consistently emphasized in the interviews. To structure the analysis, we use predefined cost categories (search costs, evaluation costs, implementation costs, psychological costs, and time costs) as initial themes, while allowing additional themes to emerge from the data. The interviews are coded in NVivo 12 (Wong, 2008).

To illustrate the themes, we incorporate selected quotes from the interviews. Quotes are chosen based on criteria of being (i) representative of the insights from the interviews, (ii) reasonably concise, and (iii) reflective of the data’s patterns. In line with the literature, which suggests using quotations to either “illustrate the data analysis process” or to “illustrate findings,” we adopt the latter approach. To enhance readability and protect stakeholders’ anonymity, selected quotations are condensed from the raw transcript data (Eldh et al., 2020).

3.4. Semi-structured interviews

We conduct semi-structured interviews to support the three phases of the sludge audit: the behavioural journey map, the sludge rating for each step, and the more holistic qualitative evaluation of sludge in the process. To design the interviews, we follow an interview guide that provides a structure to conduct interviews to identify sludge (Lades and Martin, 2024). Each interview begins with an introduction to the project, including a brief presentation, followed by a discussion of the stakeholder’s role in the process. We then review the behavioural journey map with the stakeholders and invite them to provide input on its accuracy. This is followed by a step-by-step discussion of the whole process and interviewees are asked to comment on the scope and the extent of sludge at each step.

To recruit participants, we target key users of the scheme, including registered foresters, farmers, landowners, and government staff. Interviews are conducted until no new information emerged, achieving theoretical saturation (Glaser and Strauss, 2017). Conducted virtually on Zoom, the interviews are recorded for transcription, with Otter transcription software used for transcription and anonymization. All interviewees signed consent forms before the interviews and provided

verbally recorded consent at the beginning of the interviews. Ethical approval was granted by University College Dublin Human Research Ethics Committee (reference number: LS-LR-23-208-Lades).

A total of 12 interviews were conducted with relevant stakeholders from April to May 2024. Registered foresters from all 26 counties in the Republic of Ireland were contacted through the Department website, with interviewees representing all four targeted stakeholder types. Of the 12 interviews, 9 were with registered foresters responsible for submitting afforestation applications on behalf of property owners in the Afforestation Scheme process.

4. Results of the sludge audit

4.1. Summary of the afforestation scheme journey

The first step of the sludge audit involves dividing the application process of Ireland's Afforestation Scheme into six stages, from learning about the scheme to receiving payments, as illustrated in Fig. 2. Each stage is further divided into specific steps. We summarize the process here, with additional details provided in Supplementary Information S2.

In Stage 1, once landowners become aware of the scheme, they can begin preparing their application. This preparation involves obtaining preliminary advice, confirming eligibility, and getting in touch with a registered forester. This forester then examines the property virtually and in-person and accepts the applicant as a client if the property is deemed suitable. In Stage 2, the forester submits the initial technical

approval application to the Department. This application includes photos of site notices on the property, property maps, property assessments, site details, property ownership information, and an Environmental Impact Statement for sites of 50 ha or more. After submission, public consultation is open for 30 days, and the Department reviews the application, which can include an Environmental Impact Assessment to be completed by the Department (SI.2 Detailed Description of the Journey Map).

A common outcome of this review is a "Further Information Required" letter, requesting additional assessments, such as environmental impact statements or ecological and/or archaeological assessments, which can cost landowners several thousand euros. Responding to this request constitutes Stage 3. Once all necessary information is submitted, the Department publishes a licensing decision, notifying both the forester and the landowner by post.

If the license is granted, the process moves to Stage 4, financial approval. At this stage, the forester submits a financial approval application, and within a few days, the Department informs both the forester and landowner of its decision, confirming financial eligibility and funding availability. Upon receiving financial approval, Stage 5 begins. The registered forester submits a notice of substantial commencement, initiates and completes the planting, submits a notice of completion, and conducts a detailed field and forest plot assessment for the Department.

Stage 6, the payment stage, follows. The forester applies for the first fixed grant payment and the initial premium, including the detailed field and forest plot assessment. Prior to disbursement, a district inspector

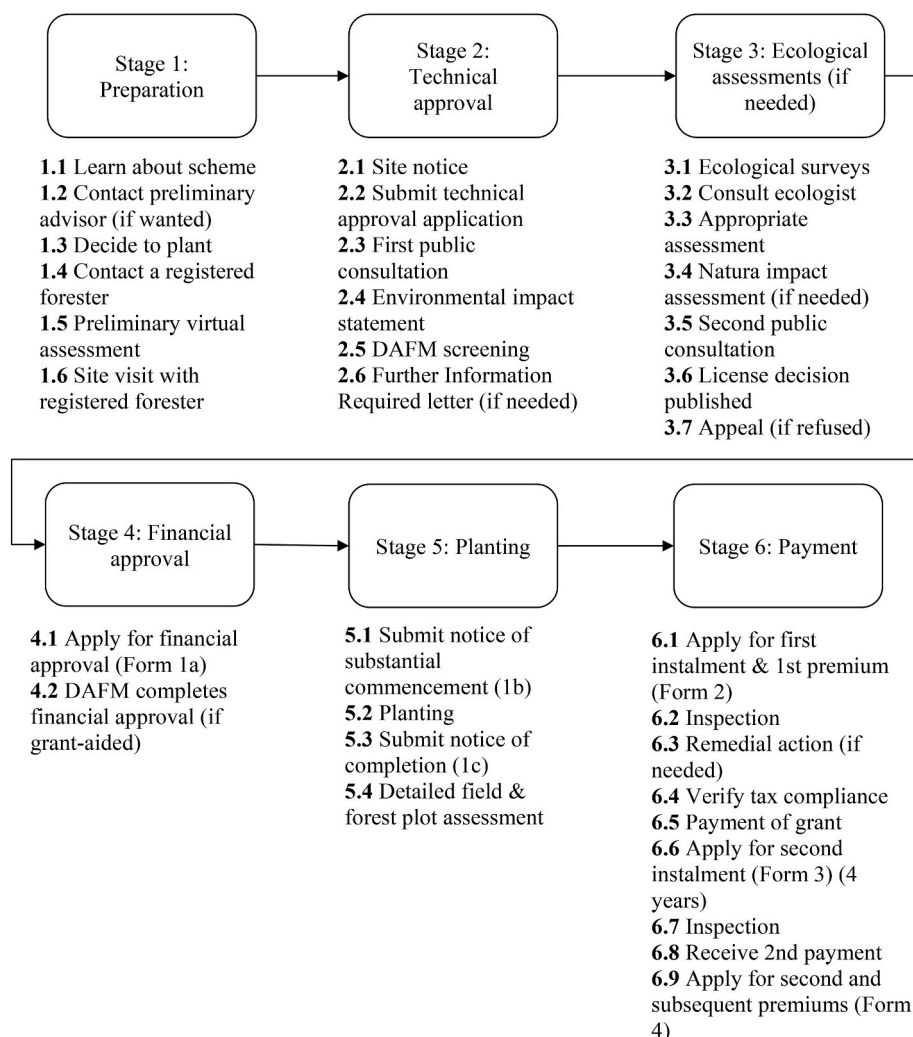


Fig. 2. Journey map of applicants participating in Ireland's Afforestation Scheme, as of April 2024.

assesses the property, and, upon approval, the first grant instalment (75% of the total, excluding VAT) is paid. This first instalment also includes allowances for fencing and an environmental report grant to help offset regulatory costs. After the initial premium payment to the applicant and the forester, the forester manages the forest for the next four years. At the end of this period, the forester applies for the second grant instalment (the remaining 25%), and the inspector reassesses the property before payment. Following these four years, if the landowner wishes to receive additional premiums, they must apply independently, as the authority for forest management transfers from the forester to the landowner.

The final stage involves the long-term management of the trees. Although interviewees did not mention this step, and it is therefore excluded from Fig. 2, it is essential to consider the responsibilities a landowner must undertake to manage the forest over the 30 years until the trees reach maturity. These long-term responsibilities include applying for felling licenses, conducting thinning operations, addressing any remedial actions from inspections, and managing the site through tasks such as constructing forest roads and developing forest management plans. For example, once a felling license is granted, property owners must wait 28 days before beginning felling operations to allow time for any appeals.

4.2. Fine-grained sludge assessment

For this assessment, we used the NSW sludge scales to measure the level of sludge at each step. We also specified the types of sludge present at each step using the cost typology from the literature. This section provides a summary of the results, which are also illustrated in Fig. 3. More details are available in Table SI2 in the Supplementary Information. Sludge levels, ranked as 1 to 5 in Fig. 3 and Table SI2, are categorized as “very low,” “low,” “medium,” “high,” and “very high,”

respectively. As shown in Fig. 3, various levels of sludge are present across different stages for landowners and foresters applying for grants through Ireland's afforestation scheme. Below, we outline the type and level of sludge at each stage.

4.2.1. Sludge at stage 1: preparation

In the preparation Stage 1, *low search costs* are present as information about the Afforestation Scheme is generally shared through word of mouth, though reliability may vary. Finding a registered forester is relatively easy through peer networks. However, *medium evaluation costs* arise because landowners often find it challenging to evaluate the long-term costs and benefits of applying for a grant, particularly regarding the financial impact of transitioning from farming to forestry. Interviews also suggested that interactions with agricultural advisory services and the Department can feel impersonal, creating *low psychological costs* for some landowners. *Psychological costs* can become *high* for farmers who experience worry and stress over the prospect of transitioning to forestry, particularly regarding the implications for family legacy. *Implementation costs* are *low* at this stage since the initial virtual and in-person property assessments are not considered burdensome.

4.2.2. Sludge at stage 2: technical approval

In the technical approval stage, significant sludge is encountered. Registered foresters experience *high implementation costs* when submitting technical approval applications due to requirements for detailed attachments, including site photos, maps, property assessments, and Environmental Impact Statements (for properties over 50 ha). This step can take approximately a week of office work for foresters. Interviewees also highlighted significant uncertainty around application outcomes, leading foresters to include as much information as possible to avoid requests for additional information. This uncertainty, coupled with delays and limited communication from the Department, results in *medium*

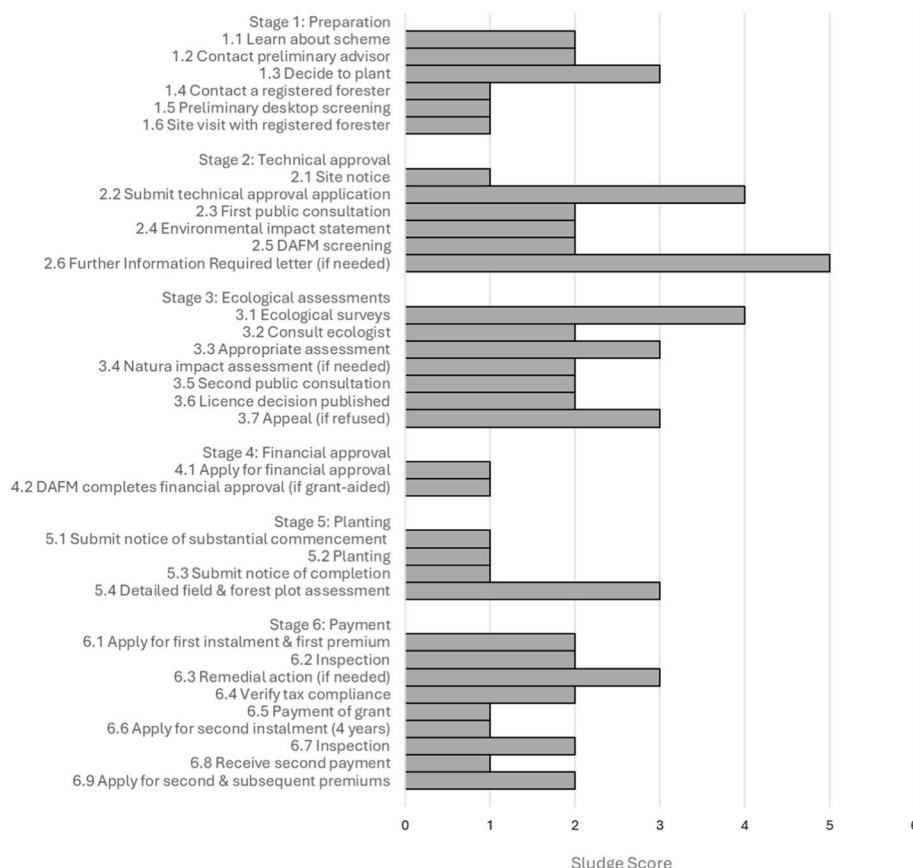


Fig. 3. Fine-grained sludge assessment from 1 (= very easy) to 5 (= very difficult) of Ireland's Afforestation Scheme as of April 2024.

psychological costs for both foresters and landowners. *High time costs* are also prevalent, as applications often move through several Department divisions, such as the Ecology and Archaeology Section, which can prolong the process. Additionally, time costs are incurred from posting site notices, waiting through the public consultation period, and the completion of environmental impact assessments.

The most challenging aspect of Stage 2 is the “Further Information Required” letter in Step 2.6. This letter often demands additional environmental assessments that may require hiring an ecologist, imposing *high implementation costs* on foresters. Interviews revealed that the uncertainty and potential delays of this step can cause *very high psychological costs* for landowners, manifesting as stress and frustration. Foresters may also become frustrated with repeated information requests, especially when they impact their credibility with clients. Further information requests can create *high time costs*, as meeting additional requirements can necessitate costly and time-consuming assessments. The financial burden on landowners can also be high, with additional assessments potentially costing between €500 and €2,500, occasionally leading applicants to withdraw. Consequently, the “Further Information Required” letter introduces *very high evaluation costs* due to its uncertainties and financial implications.

4.2.3. Sludge at stage 3: ecological assessments

The ecological assessments foresters must conduct incur *medium implementation costs* due to the detailed paperwork required, which must be completed within eight weeks. Organising these assessments often entails *high time costs*, as surveys can be expensive (up to €2500) and may prompt some applicants to withdraw. The uncertainty surrounding these assessments results in *high psychological costs*, with no assurance that further assessments or financial reimbursement will follow. *Search costs*, however, remain *low* for foresters who typically have access to a known ecologist. Once submitted, applications may require an appropriate assessment report and further impact statements by the Department, depending on site specifications, adding weeks to the timeline and incurring *medium time costs*. An additional 30-day public consultation period adds further time costs. Landowners and foresters can appeal the Department's decisions for a €200 fee, though *medium evaluation costs* arise as applicants may hesitate to invest further resources given the possibility of additional survey requirements. Overall, the high uncertainty and unpredictable timelines result in *high psychological costs*.

4.2.4. Sludge at stage 4: financial approval

Stage 4, the financial approval stage, incurs *very low sludge*. *Implementation costs* are *minimal*, as registered foresters are familiar with the form and online submission system. The Department responds quickly, resulting in *very low time costs*.

4.2.5. Sludge at stage 5: planting

During the planting stage, the forester must submit notices of substantial commencement and completion, both of which are straightforward and well-understood processes, resulting in *very low implementation costs*. However, foresters are required to perform a detailed site assessment that includes complex map submissions following Department guidelines, which incurs *medium implementation costs*.

4.2.6. Sludge at stage 6: payment

For the first instalment and premium payment, foresters must submit a forest management plan along with a nine-page form containing property details, ownership proof, and plot maps. These are standard procedures, resulting in *low implementation costs*. A property inspection by the Department's forestry inspectors also follows, which is routine and associated with *very low implementation costs* and *low time costs*. However, potential requests for remedial actions by the inspector create *low psychological costs* for landowners. If remedial actions are necessary, the forester and landowner must adjust the property accordingly, which may cause *high psychological costs* for landowners if the adjustments are

extensive. The forester is also responsible for confirming the landowner's tax compliance, which incurs *low implementation costs* as tax status can fluctuate annually. The grant payment itself is straightforward and processed directly to the forester and landowner, incurring *very low implementation costs*.

Four years after planting, foresters submit a form and additional site documentation for the second grant instalment, a straightforward process associated with *very low implementation costs*. Following this submission, the Department inspects the property again, with *low time and implementation costs*. Nevertheless, landowners may face *low psychological costs* regarding the possibility of not receiving the second instalment or needing further adjustments, given that forest management responsibility now fully shifts to them. This final transfer of responsibility entails *low implementation costs*, as landowners simply register online with the Department and submit any required forms.

4.3. Qualitative assessment of sludge in Ireland's afforestation scheme

This section presents findings from the thematic analysis of semi-structured interviews, organized by the different cost types associated with sludge. Additional themes identified through exploratory thematic content analysis are also included. A summary of this section is provided in [Table 1](#).

4.3.1. Time costs

Interviews revealed significant time costs associated with sludge in Ireland's Afforestation Scheme, with both farmers and foresters expressing concern over the lack of predictable timelines in the application process. The average application timeline often extends beyond one year, with numerous cases spanning two to three years. Interviewees noted the unpredictable nature of each application stage, preventing a clear time estimate for specific steps and excluding them from this audit. Time costs peak during the ecological assessment stage (Stage 3), where applicants face substantial uncertainty regarding licensing decisions due to unenforced timelines at the Department level. This unpredictability adds to applicants' frustration and psychological distress, as illustrated by the following interview excerpts:

“The local authorities have eight weeks to deal with a planning application for a hotel. The Forest Service has one year, two years, or three years to get a decision. Are you joking me?” (Former Registered Forester)

“There have been applications in there now for over three years ... [...]. There are no updates [on] where they are. You are just kind of left in the cold with them.” (Registered Forester)

“There are no timelines. We need timelines. So, if you are a landowner, and you come to me as a forester and you say, “Look, I'd like to plant this now with forestry.” I should be able to say “Look, I think it's suitable. We'll make an application for approval. We will have a decision by ...” you know, six months. We have licences that we have been waiting for almost four years now. We still don't have a decision.” (Registered Forester)

“The amount of people that I have made applications for who [have] actually passed away and then ... They literally died on me, because we were waiting. Because most of our people are elderly people ... And they literally die before we get to plant the land for them.” (Registered Forester)

“No, I had previously, two years before, I had dealt with the Department of Agriculture trying to get a herd number and recognition that I was not the owner of the land. And that took me over 12 months. And I basically talked to Department officials in nearly every county in Ireland. So I don't rate the efficiency of the Department of Agriculture.” (Landowner)

4.3.2. Search costs

Administrative procedures in the Afforestation Scheme can also

Table 1

Summary of the qualitative assessment of sludge in Ireland's afforestation scheme.

Cost category	Level	Key Sources of Sludge and Examples
Search Costs	Low	Information is primarily shared via word-of-mouth and peer networks. The Department's website and Registered Foresters are accessible. While information is easy to find, the lack of a centralised contact point in the Department can lead to fragmented communication.
Evaluation Costs	Medium to Very High	High uncertainty regarding the "Further Information Required" (FIR) letter, which makes it difficult to predict if the transition from farming to forestry is financially viable. Landowners struggle to decide whether to proceed when faced with potential additional survey costs and no guarantee of approval.
Implementation Costs	Low to High	Requirements for detailed maps (fencing, drainage, biodiversity) and site notices during technical approval, plus complex field assessments post-planting. Foresters often spend a full week on a single technical application. Landowners must hire ecologists for mandatory environmental reports.
Psychological Costs	Medium to Very High	Frustration due to unpredictable delays and perceived inconsistencies in inspector decisions. Distress occurs when repeated Department requests for more information erode the landowner's trust in their forester's competence.
Time Costs	High to Very High	Applications frequently take 1 to 3 years to process, with no enforced timelines at the Departmental level. Unpredictable timelines are a major barrier. Elderly applicants might pass away before planting licences is granted.
Unpredictability & Inconsistency	Significant	Inconsistent decisions among regional inspectors. Some request more remedial actions or refer files to ecology more frequently than others. This creates uneven standards and varying workloads for applicants depending on their location, adding to the overall uncertainty of the outcome.
Sub-optimal Government Management	Significant	A perceived lack of senior management and leadership within the Forest Service. Civil servants may not be guided by efficient centralised systems. Stakeholders feel the Department looks inwards rather than outwards, resulting in a system where nobody is in charge.
Trust & Reputation	Significant	Long-term licence backlogs have led to disillusionment. Foresters and farmers feel the Department has a double standard regarding timelines. Many farmers now refuse to deal with the Forest Service regardless of financial incentives, and some foresters have stopped accepting new afforestation work entirely.

result in search costs, particularly when potential applicants struggle to find information about the program. While these costs are most pronounced during the initial preparation stage (Stage 1), they are still not very high. Search costs are low because applicants who want to learn more about afforestation can easily access information through registered foresters, residents who have already participated in the scheme, and the Department website. It is common for interested farmers or

landowners to contact registered foresters or forestry advisors to discuss the scheme and their property. Stakeholders indicated that landowners primarily learn about the scheme through "word of mouth" from farmers, previous participants, or local registered foresters, as seen in the following remarks:

"A lot of our clients would never have gone near a computer. Not that that's got to do with age necessarily, but like there would be ... a lot of word of mouth." (Registered Forester)

"So the majority of our work would be actually going out to farmers and meeting them and actually sitting down and having a cup of coffee ... And actually, going through the scheme with them and walking the land with them and saying this would be suitable here." (Registered Forester)

While access to information may be relatively easy for some due to foresters' assistance, interviewees noted that the lack of a centralized Department contact point introduces some search costs. Multiple email addresses exist for different queries, leading to fragmentation in communication (Forestry Division, [Department of Agriculture, Food and the Marine, 2024b](#)).

4.3.3. Evaluation costs

The Afforestation Scheme's design generates substantial evaluation costs due to complex uncertainties that complicate decision-making. With applications sometimes taking years to complete, landowners and foresters cannot confidently predict if current schemes will still apply when their applications are eventually processed. Additional information requests from the Department can further delay applications and create unexpected financial burdens. It is also hard to predict the type and extent of further information requests which may involve a substantial amount of work and costs. Unexpected requirements for site surveys can cause an additional financial burden that the landowner must consider in the decision-making process. One interview participant said that, in their experience, a second habitat map was requested by the Department, costing an additional €600 to the initial €1000 survey. The level of uncertainty in the process makes it difficult for an applicant to make an efficient decision, as illustrated by the following quotes:

"So, you could be talking [about] thousands of euros. [It] could be three or four thousand. And you still might not have your approval for a couple years. So that is what turns people off at the talking stage when they come in to us. Just the price of everything and how long they will actually take, we can't give them a timeline." (Registered Forester)

"The forester is out of time, resource, money, and the landowner has to incur the costs that were incurred on any ecological or ornithological reports ... What landowner in their right mind would take on very significant risks in applying for an area that there is uncertainty about? And that is a big issue." (Registered Forester)

"But if an inspector wants to stop forestry happening, all he does is ask you for a survey, and it could be for anything. It could be breeding waders, hen harriers, anything. Knowing the fact that you are not going to pay for it and the landowner is not going to be able to. And the file will go away." (Registered Forester)

"Purely for funding ... I would say, over the last number of years, I've never heard of anybody doing it ... Actually, only recently, I've heard of somebody doing this, you know, for environmental reasons." (Farmer)

"And then it looks like the registered forester is incompetent because he did not do it right in the first place. Whereas it will be due to a new requirement that was added after the application came in. ... And again, that is very frustrating, because it does not look good for registered foresters when they go back to their clients." (Registered Forester)

4.3.4. Implementation costs

One key feature of the current Afforestation Scheme is that

landowners *must* engage with a registered forester to apply. These foresters are more familiar with the procedural complexities of the process, and this reduces implementation costs which often emerges when a process is unfamiliar to users. However, some implementation costs still exist in the application process for the foresters applying on behalf of the landowners. Interviewees suggested that the application process is quite lengthy and complicated and highlighted that it is not always clear what information (for example, a particular survey map or details about the property) needs to be included in the application as illustrated in the following quote:

"And it is very considerable work that is involved. [...] There is a myriad of maps now required for a proposed afforestation project. There is the drainage map, there is the biodiversity map, there is the species map. And there is the whole list of constraints around it, so it is a significant amount of work for a forester. Very significant." (Registered Forester)

Another factor contributing to implementation costs in the Afforestation Scheme is the significant inconsistency in decisions among inspectors. Some inspectors request more remedial actions than others, creating uneven standards and varying workloads for applicants. Additionally, inspectors' response times differ greatly, which adds unpredictability to the process. Interviews also revealed inconsistencies in communication within the Department, often varying by individual personnel, which complicates the process further. This lack of standardised procedures and clear communication channels makes it challenging for foresters to complete applications accurately and on time.

"It is the death of a thousand cuts. Inconsistencies of inspectors, which I think just makes our job very difficult in managing applications." (Registered Forester)

"There is a guy ... If I email him, generally, I get a response straightaway. [He is] more than helpful, outstanding ... Other guys, I know, I'll send a message to and I won't get any response ... One guy, 'I'll ring you tomorrow,' 'I'll meet you next week.' And I just know that it is not going to happen." (Registered Forester)

"No, no. There was very little [Communication with Department] at the time. There was very little actually there. The registered forester did everything." (Farmer)

4.3.5. Psychological costs

High uncertainty in the Afforestation Scheme creates considerable psychological costs, manifesting as stress, frustration, and anxiety for both landowners and foresters. Landowners worry about the financial impact of moving from farming to forestry, while foresters feel responsible for application delays outside their control. Persistent additional requests and lack of progress erode landowner trust in foresters, as expressed in the following comments. For example, landowners expected the foresters to know what is needed for application submissions, but when extensive requests keep emerging from the Department, the landowner may lose trust in the foresters' knowledge and abilities.

"I had a site in Kerry with a landowner which was made under the old programme. And he paid for his ecology reports, his application. And then under the new programme, he was told his site was refused. And it wasn't plant-able, which under the old programme, it was. And he paid for all of his reports. So now he has no approval. And he's down a couple of thousand. That's happened a few cases I've had as well." (Registered Forester)

4.3.6. Additional themes

The thematic analysis of the interviews revealed further recurring themes. First, many interviewees expressed concerns over the *unpredictability* in afforestation applications which leads to evaluation costs, implementation costs, and psychological costs. Some of this uncertainty is due to inconsistent inspector decisions where some regional forestry

inspectors move through the process at a slower rate than others, and some inspectors are more likely than others to refer applications to ecology where the applications can face further delays. Moreover, landowners face uncertainty in the long-term management of their properties when they apply for tree felling licences for forest thinning. Again, the outcomes of these applications are uncertain and unpredictable with unknown timelines. Another type of uncertainty that was mentioned in the interviews arises due to unpredictable changes of the forestry licencing system as illustrated in the following quote:

"So basically, this is a new form we had to opt in or opt out of in the new scheme rules. So, here is an example of where they are now imposing new rules on an application that is already two years in the system." (Registered Forester)

A second theme that emerged was a perceived *sub-optimal of management* of the scheme at government level. Several interviewees suggested that, while there are many capable people working in the system, civil servants may not be sufficiently guided by centralised systems and support from leadership team could be improved.

"Number one, there is absolutely no management. There is no senior management within the Forest Service. There is nobody managing anybody. I think there are many, many good people in the Department of Agriculture. And I say there are many, many really good people who are really frustrated with the processes, the admin and how files are handled in the Department. But there is no management. And there is nobody with the ability to manage. I think that is the starting point of the root of the problem." (Registered Forester)

"I don't have the highest respect for the structure of the Department. I think there's ... Yeah, it doesn't look outwards. It looks inwards. And that's never a good thing." (Landowner)

"In fairness, the Forest Service don't know where the file is themselves. And there's nobody. There's nobody actually in charge of it. If you know what I mean? There's nobody in charge of this file. It's not somebody's job to get this place passed, if you know what I mean." (Registered Forester)

Finally, the interviews suggested that there are implications of administrative burdens on *trust and reputation*. For example, licence backlogs over years have led to foresters to view the system (including the Department and the government as a whole) in a negative way. Foresters seem to have lost faith in the Department implementing the scheme efficiently. Moreover, a few stakeholders highlighted a double standard in that, while the Department does not have clear timelines internally, registered foresters are given only eight weeks to complete all the information requests in the further information required letters.

"They [Farmers] are totally disillusioned with the forest service and do not want to deal with them again. Regardless of how good a deal it looks like they are getting, they say 'No, they will only trick me again.'" (Registered Forester)

"Well, basically, I have stopped doing that type of work for farmers. I mean, if anybody phones up and says, 'I want to plant trees,' I will refer them to another forester who might do the job." (Registered Forester)

"With the further information required letter, there is an eight-week timeline. So, if this problem is not fixed within eight weeks, they say they will bin the application. But applications will be in for two years. And we know that they have a timeline for us, but there is no timeline for them." (Registered Forester)

5. Discussion

5.1. Key insights

Sludge audits are thorough, systematic investigations that seek to identify frictions that reduce the efficiency of a process (Sunstein, 2022).

Given that almost no process is frictionless, nearly every sludge audit will uncover some sludge. This audit is no exception. While we focus in this paper on the sludge that we identified, it is important to highlight that many steps in the application process are designed efficiently and without much friction. For instance, learning about the scheme and receiving financial approval – once technical and ecological assessments are complete – are relatively straightforward.

The main administrative obstacle we identified occurs when the Department of Agriculture, Food and the Marine issues a “further information required” letter during technical approval checks. This letter requests applicants to provide detailed information about their property within an eight-week period, and additional surveys, remedial actions, and environmental assessments may be required. The timing and specific requests of this letter are difficult to predict, introducing uncertainty that can cause stress and anxiety for landowners. Many applicants withdraw their applications after receiving this letter, partly due to the possibility of further requests down the line.

Our sludge audit also identified the unpredictability of timelines in the application process as a significant barrier to successful afforestation efforts. This insight aligns with findings from a review of Ireland's licensing process, which found that nearly 70% of felling license applications in 2019 took over six months for approval (Mackinnon, 2019). Unpredictability and inconsistent decision-making across the regional forestry inspectorate were emphasized as primary reasons for abandoned applications and foresters opting not to take on afforestation applications.

Notably, search costs did not emerge as a major barrier in our sludge audit, contrasting with findings from previous studies on afforestation schemes in Ireland and elsewhere. For example, Duesberg et al. (2014) found that lack of information was a barrier to afforestation in Ireland from 2007 to 2013. Similarly, in Germany, technical advice to farmers was found to increase interest in afforestation (Lienhoop and Brouwer, 2015). However, our findings suggest that Ireland's current Afforestation Scheme has been sufficiently advertised and communicated, minimizing search costs as a barrier.

5.2. Recommendations for Ireland's afforestation scheme

Based on the findings of this sludge audit, we recommend several targeted improvements to streamline the Irish Afforestation Scheme. By addressing identified sources of sludge, these recommendations aim to reduce administrative burden, increase clarity, and ultimately enhance the scheme's accessibility and effectiveness.

5.2.1. Re-evaluate the process around “further information required” letters

While requesting additional information is necessary to ensure compliance and assess environmental impacts, the “further information required” letters and the associated information requirements are significant barriers to scheme participation. They introduce time costs, evaluation costs, and psychological costs for landowners and foresters. Thus, a re-evaluation of the process around the “further information required” letters is recommended, such as providing earlier, more proactive communication regarding the kind of information that may be required and loosening the eight week deadline in which landowners have to provide this information, particularly in cases where the additional information is particularly onerous and may require external assistance to compile.

5.2.2. Establish clear timelines

Without established timelines for approval decisions, payments, and overall program completion, landowners and foresters struggle to make informed decisions about participation. To reduce this ambiguity, the Department could consider defining maximum durations for each stage in the process, such as the review period in the inspectorate's ecology or archaeology sections. A centralised tracking system, similar to the

passport application system used by Ireland's Department of Foreign Affairs, could further enhance transparency. By notifying applicants when their application moves between departments, such a system could reassure applicants that progress is being made and help them manage their expectations.

5.2.3. Improve communication between the department and registered foresters

Foresters, who play a crucial role in keeping landowners updated on their application status, require timely access to accurate information. However, foresters report challenges in staying informed about application progress, especially when applications are within Department review. Improved communication through the Integrated Forestry Information System (iFORIS iNET) is one solution. The system could provide status updates, details on delays (such as those occurring in ecology review), and automated email notifications when applications move to different sections. Additionally, assigning each application to a specific case officer could further streamline communication and ensure accountability, allowing foresters a direct point of contact for updates. This would avoid the existing fragmented communication through multiple Department email addresses which complicates the process, reinforcing the need for a single, streamlined contact channel.

5.2.4. Address administrative burdens in other licencing programmes

In addition to issues specific to the Irish afforestation scheme, we identified sludge within other forestry-related licensing requirements in Ireland, such as those for planting, felling, and harvesting. Each licensing process introduces its own set of financial, time, and psychological burdens for applicants. Conducting further sludge audits to examine these licensing processes could reveal opportunities for improvement, ultimately making forest management in Ireland more accessible and encouraging greater landowner participation in afforestation efforts.

5.3. Methodological considerations for future sludge audits

The method of conducting sludge audits is still evolving, and standardised guidelines for these audits are not yet well established. However, the OECD is currently working on such guidelines, which are anticipated to be published in 2026. Our approach integrated three primary components: a journey map, a step-by-step sludge assessment, and a broader qualitative assessment, informed by semi-structured interviews that informed each component. This combination yielded several observations and insights valuable for refining future sludge audits.

We began the semi-structured interviews by presenting an initial version of the journey map to interviewees. This proved to be very helpful as many interview partners appreciated seeing a detailed description of the process sometimes for the first time which helped create a positive atmosphere in the interviews. The fact that the journey maps received appreciation also highlights that the knowledge about the process that leads to an afforestation grant is incomplete and that visual aids such as these maps can provide new insights and understanding of the process.

For the step-by-step sludge assessment, we drew from the NSW Behavioural Insights Unit's Sludge Finder Tool methodology (NSW Behavioural Insights Unit, 2024a), but adapted it to fit our needs. To share our sludge assessments of each step in the Supplementary Information of this paper, we opted not to use the NSW tool's online functionalities, nor their Excel version of the tool. This decision led us to slightly simplify the sludge audit process, potentially making it easier to replicate in future studies.

Our audit also deviated from NSW recommendations, which emphasise tracking both time and customer experience for each step. Given the lack of specific or reliable time estimates, we focused solely on customer experience, as measuring time costs would not have added

useful insights. Future audits could benefit from gathering reliable time estimates for each process step to support more comprehensive time-based evaluations. However, our finding that inconsistent timelines create significant applicant uncertainty highlights the inherent challenge in accurately measuring time costs and offers a valuable direction for future research.

Unlike prior sludge audits in other fields, we included a qualitative thematic analysis of the interviews, which proved invaluable for capturing complex and subjective experiences. For example, the step-by-step analysis identified that sludge was most significant during the “further information” stage of technical approval checks, while the qualitative assessment revealed that unpredictable timelines and overall uncertainty are major obstacles in the grant process. Together, these complementary approaches provided richer insights into the nuances of applicant experiences.

We acknowledge that there are overlaps between the cost categories. For example, we classified the uncertainty about additional information requests from the Department as evaluation costs (see section 4.3.3.). However, since it often requires time and money to obtain such additional information, these costs could also be classified as under time and financial costs. We also classified the uncertainty about whether current schemes will still apply when the applications are eventually processed as evaluation costs. However, as one of the interview partners explained, this uncertainty is rather frustrating and hence these costs could also be classified as psychological costs (also in section 4.3.3.). More detailed sludge audits might include a matrix to identify overlap between the cost categories. However, for this paper, with its applied focus, we did not consider this necessary.

6. Conclusions

The sludge audit of Ireland's Afforestation Scheme illustrates how administrative burdens hinder the progress of afforestation in Ireland, even as afforestation is increasingly crucial for meeting national climate change mitigation targets. Research has shown that financial incentives alone are not enough to persuade landowners to transition from farming to forestry, as numerous non-monetary and psychological barriers exist (Duesberg et al., 2014). Given the challenge in making the decision to plant trees, excessive administrative hurdles can often tip the balance, leading landowners to maintain the status quo. Based on our sludge audit, we recommend simplifying the scheme's application process, reducing uncertainties, establishing predictable timelines, and improving communication on both the information required and the application status.

What can we learn from this analysis of the Irish Afforestation Scheme for other countries? First, this paper presents one of the first sludge audits aimed at identifying sludge as a barrier to achieving climate action targets. The approach taken in this study can, and should, be applied to similar environmental schemes worldwide to identify process improvements that ease participation and enhance the likelihood of meeting climate goals. Our sludge audit approach was systematic. It involved a three-phase methodology: a behavioural journey map, a step-by-step sludge assessment, and a comprehensive qualitative evaluation. Within these phases, we identified different types of administrative burdens that lead to search costs, evaluation costs, implementation costs, psychological costs, and time costs. Each phase offered unique insights into potential administrative burdens. For future sludge audits, we recommend applying a similarly structured approach to yield actionable findings and help streamline procedures for environmental programs.

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CRediT authorship contribution statement

Patricia Lentz: Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft. **Cara Augustenborg:** Data curation, Funding acquisition, Project administration, Supervision, Writing – review & editing. **Leonhard K. Lades:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jrurstud.2026.104078>.

Data availability

The data that has been used is confidential.

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