IRJEMS International Research Journal of Economics and Management Studies
Published by Eternal Scientific Publications
ISSN: 2583 – 5238 / Volume 3 Issue 11 November 2024 / Pg. No: 54-73
Paper Id: IRJEMS-V3I11P107, Doi: 10.56472/25835238/IRJEMS-V3I11P107

Research Article

Investing in Carbon Sequestration Woodland Project: An Analysis in the Context of the Lowland Region of England

[1]Md Shirajul Islam
[1]Global Business Management Program, Global Banking School, London, United Kingdom.

Received Date: 09 October 2024 Revised Date: 20 October 2024 Accepted Date: 25 October 2024 Published Date: 06 November 2024

Abstract: *With the aim of participating in governments' net-zero goal, many organizations are showing interest in direct or indirect investment in woodland creation as a means of carbon sequestration. Some SMEs (Small and medium-sized enterprises) and charities also consider woodland creation a source of sustainable income. As this is a relatively critical and strategic decision for small-scale organizations that requires both management skills and a source of finance to manage such a project, they may seek the answer to whether it would be a viable option for them to invest in woodland and whether it will be more beneficial to acquire or lease a land etc. A mixed research method was conducted to analyze answers to these questions, using cost-benefit analyses and interviewing different stakeholders. The findings from the research reveal that the project is viable in both cases of woodland leasing and acquisition and beneficial to society if appropriately planned with professional advice and secured income from grants and environmental services. For the decision of land acquisition, primarily leasing with an option to buy in the future is recommended as this will provide interested organizations with the opportunity to practically realize the viability of the project in terms of both financial and manageability.*

Keywords: *Carbon Sequestration, Environmental Services, Forestry in the UK, Impact Investment, Woodland Creation.*

I. INTRODUCTION

In line with the global trend of sustainable development, many government and private sector companies are trying to change their operation to eliminate harmful environmental impacts. Green investing and offsetting carbon footprints are gaining popularity and legislative support as part of this measure. Therefore, investing in forestry or creating woodlands to preserve biodiversity, offset carbon, and harvest wood as sustainable construction materials has become a part of Environmental, Social, and Corporate Governance (ESG) or Corporate Social Responsibility (CSR).

The UK is one of the least densely forested countries (13.3% of UK land area comprises 10% in England, 15% in Wales, 19% in Scotland and 8% in Northern Ireland, as presented in Figure-1) in Europe compared with 46% for Europe as a whole and 31% worldwide (Forest Research, 2021a; 2021b), the UK government initiated long term environmental plans to increase forest cover in the country. This has accelerated the market development for woodland creation and selling carbon offsetting facilities and other environmental services.

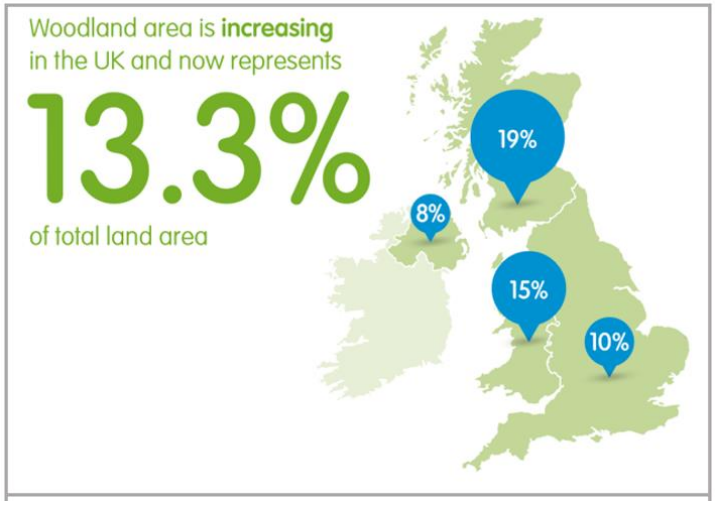

Fig. 1 Forest density in the UK, Source: Forest Research

A) Sustainability and Forestry:

Any business and its operations are said to be sustainable when it has a balanced focus on economic, environmental, and societal interests, in other words, on the triple bottom lines of People, Profit and Planet (Nigel et al., 2016). The modern conception of sustainability has its origins in forestry, which is based on the silvicultural principle that the amount of wood harvested should not exceed the volume that grows again; later, the thought was transferred to the ecological context as reserving the ability of nature to regenerate itself; most recently it then has developed the modern definition of sustainability including concerns for people and profit as the balanced and systemic integration of intra and intergenerational economic, social, and environmental performance (Geissdoerfer et al., 2017).

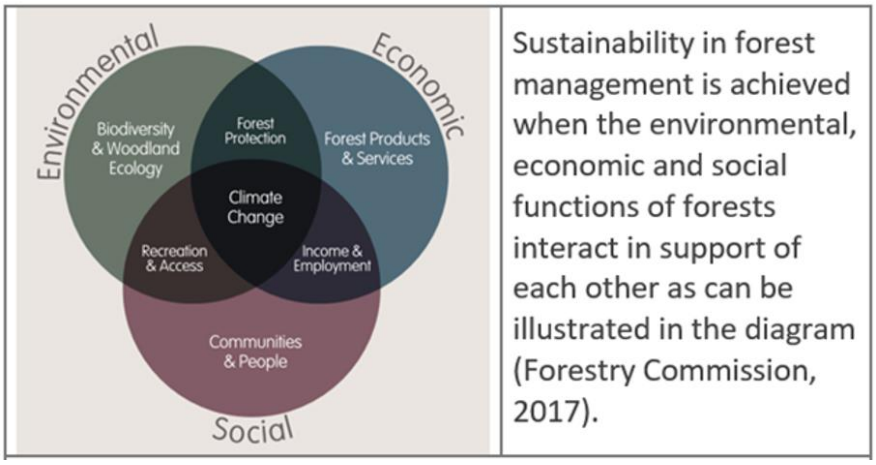

Fig. 2 Sustainability in Forest Management, Source: Forestry Commission

Following political and social movements for sustainability and sustainable development, corporations have recently become more conscious about ESG or CSR. Government measures and supports, such as tax reduction and social awareness about sustainability, have influenced corporations to become more responsible in their operations. These ultimately firmed their focus on green or sustainable operations through caring for the triple bottom line of sustainability- people, planet, and profit. In line with the measures, corporations are now more interested in investing in sustainable ways where possible or aiming to allocate their investment funds in external projects with notable social and environmental impacts, such as investing in woodland to offset their carbon footprints. These interests are especially centered on 'sustainable forestry' or sustainably managed forestry (Figure-2) that balances the needs of the environment, wildlife, and forest communities- supporting decent incomes while conserving forests for future generations (Rainforest Alliance, 2016).

B) Climate Change and Forestry:

Greenhouse Gas (GHG) emissions are considered extremely critical for global warming and subsequent environmental disasters. The UK government's measures on environmental protection, the Climate Change Act 2008 and the accompanying impact assessments provided the rationale for taking effective actions to reduce GHG emissions by at least 34% by 2020 and at least 80% by 2050 (CJC Consulting, 2014).

As a component of GHG emissions, CO2 (carbon dioxide) is considered to have critical impacts on the disastrous climate change of our planet. Forests and rescuers remove this CO2 gas and other harmful GHG from the atmosphere by photosynthesizing and other bio-mechanisms. The Read Report of UK Forestry and Climate Change Steering Group-2009, with the analysis of woodland planting scenarios for the UK, concluded that forestry could make a significant contribution to meeting the UK's challenging GHG emissions reduction targets as it is estimated that about 25% of current CO2 emissions from fossil fuels can be offset by 2030 through a combination of reduced deforestation, forest management and afforestation (The Read report, 2009). Following these, the UK Government adopted a countrywide target in February 2020 to create 30,000 hectares of new woodland annually by 2024-25 (Gov. uk, 2020), which will contribute to the 25-Year Environment Plan's aspiration to increase tree cover in England from 10% to 12% by 2060 (DEFRA, 2018).

C) Impact Investment and Forestry:

Woodlands are often seen as a long-term impact investment that provides investors and landowners with many benefits, including income from marketable timbers and the sale of sequestered carbon under Woodland Carbon Code and several grants and tax exemptions.

Woodlands also provides other non-market benefits, such as rents from recreational and environmental training use and many other environmental services. A report by the Office for National Statistics (ONS, 2020) estimates that the non-market benefits of woodland significantly exceed the market benefits of timber, representing only £275.4 million out of £3.3 billion total annual value of woodland in the UK in 2017. The latest MSCI UK Annual Forestry Index (Figure-3) that is calculated from a sample of private-sector commercial forestry in mainland Britain, also shows a strong overall total return of 11.6% per annum for the three years 2015 to 2017, comprising an annual return of 13.9% for the year 2017 from woodland investments (MSCI, n.d.).

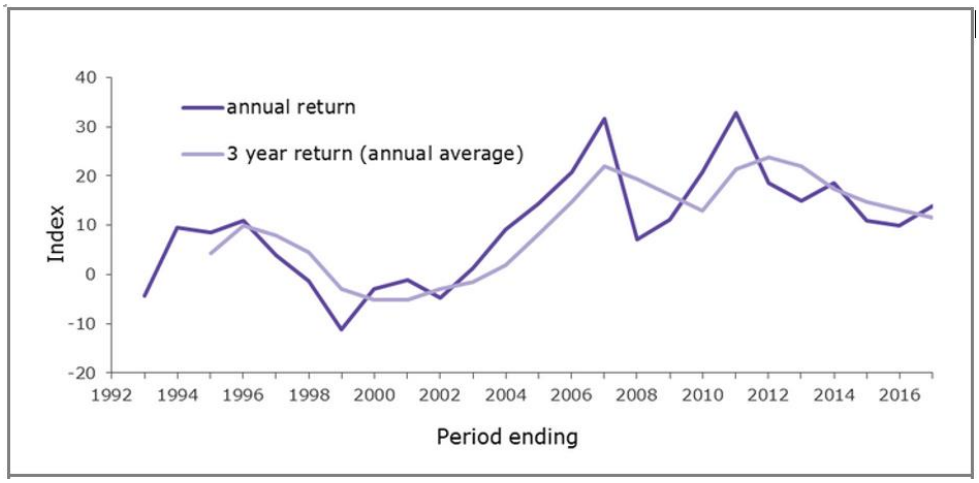

Fig. 3 Estimates of the overall return from commercial forestry

Source: MSCI UK Annual Forestry Index, retrieved from *https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2018/finance-prices-2/financial-return-from-forestry-investment/*

An analysis for the Woodland Carbon Task Force (www.forestry.gov.uk/england-wctf) run by Forestry Commission England indicated that a wide variety of organizations and individuals are interested in investing in woodlands to sequester carbon. These groups include high-net-worth individuals, landowners, institutional investors, retail investors, and other organizations looking to reduce their carbon footprint for financial reasons and/or corporate social responsibility (Haw, 2017).

Financially focused Investors usually consider returns while considering different investment options. Therefore, if other associated returns are not considered, sustainable or green investment opportunities appeal to the investors when they only evidently perform equivalently in line with other no-sustainable investment options. Many empirical studies find that sustainable investment opportunities perform no less than those of other non-sustainable investments.

A study by Friede, Busch, and Bassen (2015) that combines 2200 academic studies finds that ESG investing is empirically very well founded, where roughly 90% of studies find a non-negative ESG–CFP (corporate financial performance) relation with the large majority of studies reporting positive findings. They also observed promising results when differentiating portfolio and nonportfolio studies, regions, and young asset classes for ESG investing, such as emerging markets, corporate bonds, and green real estate.

An exhaustive study by Mudaliar and Bass (2017, p. 26) on the financial performance of impact investments, cited by Cornelia Caseau & Gilles Grolleau (2020), concluded that “impact investors seeking market-rate returns can achieve them. Across various strategies and asset classes, top-quartile funds seeking market-rate returns perform similarly to peers in conventional markets. In many cases, median performance is also quite similar. Generally, the range of fund returns in impact investing mirrors conventional investing.”

Another research conducted by Morgan Stanley (2019) on the performance of nearly 11,000 mutual funds from 2004 to 2018 found that sustainable funds provided returns in line with comparable traditional other funds while reducing downside risks. Moreover, they found strong statistical evidence that, during a period of extreme volatility, sustainable funds remain more stable. Thus, the study concludes that incorporating environmental, social, and governance (ESG) criteria into investment portfolios may help to limit market risks.

From the above-mentioned empirical studies and their suggestions, it is evident that sustainable investment, for example, investments in woodlands or similar projects, has the potential to generate financial returns along with other non-financial social and environmental returns. The recent trends of growing social concern over sustainability have found more

firm ground following the recent COVID-19 pandemic, pushing established corporations to invest responsibly, considering the triple bottom line of sustainability. This ultimately brings changes towards sustainable operations while different other provisions are growing rapidly in the market where corporations can invest their allocated funds for ESG investments.

II. PROJECT OBJECTIVES AND RESEARCH QUESTIONS

The main aim of this study is to look at the feasibility of woodland creation and management for financial and non-financial returns. The analysis will focus on the ESG or CSR and impact investment benefits to corporations that aim to contribute to achieving the UK Government's 25-year Environment Plan (DEFRA, 2018), Net Zero goal by 2050 (HM Government, 2021) and/ or United Nations' Sustainable Development Goals (United Nations, n.d.). The returns of forestry investments will be analyzed by comparing the costs for the land and the other relevant cost elements with the financial and non-financial benefits of the investment to the investor organization/ corporations.

Decisive answers to the following key questions will be critically analyzed through the study:

A) Could investing in woodland projects be attractive as a proposition to corporations or potential financial investors?

This question will particularly look at how likely the financial and non-financial benefits from a woodland project will surplus its financial and other costs in kind that may make the project attractive to both the management of direct investor organizations or corporations and indirect financial investors or external stakeholders.

B) Purchasing or leasing land for a certain period, which is a better option for the woodland project?

This analytical question will look for the most beneficial option in terms of long-term financing if the project poses to be viable overall. It will be answered by looking at the scope, capacity, and subsequent benefits and risks for an investor organization that finances this type of long-term project by itself or in association with other investor/s.

C) What are the key benefits and risks an organization would need to consider for investment in a woodland project?

This question will be answered by looking at the possible direct and indirect risks and benefits associated with the woodland creation project that might be of critical interest to the key stakeholders.

III. METHODOLOGY

Research is a process that is undertaken systematically with a clear purpose: to find things out (Saunders et al., 2019). Two distinct methods applied in research are qualitative method and quantitative method. Quantitative research method is mainly conducted by anlysing numeric data and statistics, while qualitative research deals with non-quantitative data, information, concepts, and meanings aiming towards exploring social relations and describing reality as experienced by the respondents (John et al., 2007).

Although qualitative and quantitative research methods are distinct in terms of the use and analysis of information and data, sometimes particular research may require the adaptation of both methods. The use of both types of methods in single research is termed a 'mixed method of research' where quantitative and qualitative techniques are combined in various ways, such as single-phased, multi-phased or sequentially (Hesse-Biber & Johnson, 2016).

Concurrent mixed research methods, which is the focus of this study, involve the separate use of quantitative and qualitative methods within a single phase of data collection and analysis. This allows both sets of results from the research to be interpreted and combined to provide a richer and more comprehensive response to the research question/s where required, in comparison to the use of a mono-method design only (Saunders et al., 2019).

The basis of economic appraisal of an investment is normally cost-benefit analysis, but making decisions about investments in the forestry sector can be complex and uncertain since it is often not possible to adequately monetize all the costs and benefits, particularly where these are non-market, social or environmental in nature. Valuing these non-market costs and benefits in monetary terms is an important issue for forestry investment appraisals. Therefore, these costs and benefits are sometimes assessed through qualitative inputs in research; for example, the views of stakeholders captured through interviews or surveys can be an important input in weighing up costs and benefits to reach an assessment of the overall value for money of a forestry project proposal (Snowdon and Harou, 2014).

Within the scope of this study, to analyze answers to the key research questions explained in the project objectivess section, a mixed method of research is applied. Particularly, quantitative analysis is performed for questions **A** and **B**, and qualitative analysis is performed for all three questions to combine evidence and emphasize the findings for them.

A) Qualitative Method:

For the qualitative part of the research, non-standardized interviews were conducted with different stakeholders and professional consultants. Non-standardized interviews include semi-structured and unstructured interviews, often called

'qualitative research interviews' (Saunders et al., 2019). Here, the focus is on semi-structured interviews with a predetermined set of open-ended questions related to the themes of the project objectives. The outcomes are then used to compare participants' responses to each theme to identify the underpinning reality related to the viability of the woodland creation project for positive returns.

B) Quantitative Method:

In the case of quantitative analysis, all the possible sources of revenue or income from the woodland and the associated costs are identified by referring to similar projects, available secondary market data and authentic research reports to realistically forecast the financial outcomes of the project. A conservative approach is followed for benefits estimation, carefully considering relevant uncertainty and risks.

Projects like woodland investments generate cash in different time intervals in the longer term. While investing in projects that generate cash in longer time intervals, the money's time value is considered as the current opportunity cost by discounting future cash flows with an appropriate discount rate. While different financing options are considered to analyze and justify the cost-benefit or financial viability of the project, the financial project appraisal tool, Net Present Value (NPV) estimation of future cash flows, is applied to appraise this real asset investment.

Net Present Value (NPV) estimation of future cash flows is a widely used tool in the financial sector to appraise investment decisions. Discounted cash flows calculate the present comparable values of future cash flows by discounting them with an appropriate discount rate, and NPV calculates the present net of costs and benefits or cash outflows and inflows at different points in time. A positive NPV project or, in the case of multiple mutually inclusive projects, the project with the largest NPV is considered for investment, assuming the project to be promising to generate higher return on capital investment based on the cash flow forecast (Berk, 2013).

The choice of discount rate has a critical impact on the evaluation of the profitability of an investment option. Therefore, choosing the right discount rate that closely replicates actual market returns for the foregone other investment options is very important. Usually, nominal and real discount rates are used in financial evaluations. While nominal discount rates are based on interest rates on borrowing or the rate of returns on alternative investment options, real discount rates represent the opportunity cost of time that are applied when future revenues or costs are projected uninflated in present-day (real) terms (Hardaker & Healey, 2021d).

The present value (PV) of a future cash flow is calculated by applying the following formula:

$$\text{Present value of a future cash flow} = \frac{\text{Value of future cost or revenue}}{(1 + \text{discount rate})^{\text{year into the future}}}$$

Which is mathematically presented as:

$$PV = \sum_{n=0}^{N} PV(C_n) = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n}$$

Where PV = Present value, C_n = Cash flow at n^{th} year and r = discount rate.
Then the Net Present Value (NPV) is calculated as $NPV = PV(benefits) - PV(costs)$

C) Sensitivity and Risk in Woodland Project Investments:

Forestry or woodland projects are also subject to different risks and uncertainties like any other investments. Effectively identifying and managing these risks helps improve project performance by paving for suitable responses such as mitigation actions or contingency arrangements to handle risks if they occur. Hardaker & Healey (2021e) suggest some considerable risks and uncertainties that may affect outcomes from a woodland project; these are characterized as Environmental- natural calamities, for example, woodfire, drought, extreme wind, animal attacks and diseases; Economic- price fluctuation of timber and carbon over time; Technological- technological advances may affect woodland management thus the use and value of the woodland products; Policy environment- changing policy over time where woodland is situated may affect management and use of the woodland product and services.

Following the qualitative and the quantitative data and information analyses, a sensitivity analysis will be performed to develop an in-depth understanding of the viability of the project by accommodating scenarios for different uncertainties and risks, different discount rates and fluctuation of different estimated costs and revenue streams. As a formal economic analysis approach, this will indicate the sensitivity of the evaluation outcomes of the woodland project to the best- and worst-case scenarios (Hardaker & Healey, 2021a; Snowdon and Harou, 2014).

D) Research Design:

A three-step procedure (Figure-4) will be followed to conduct the analysis. In step one, relevant qualitative and quantitative data and information will be collected simultaneously. Step two will be followed by performing an analysis of the collected data. Then, step three will be followed by identifying results from the analyses and formulating appropriate recommendations for interested organizations that wish to invest in the woodland projects.

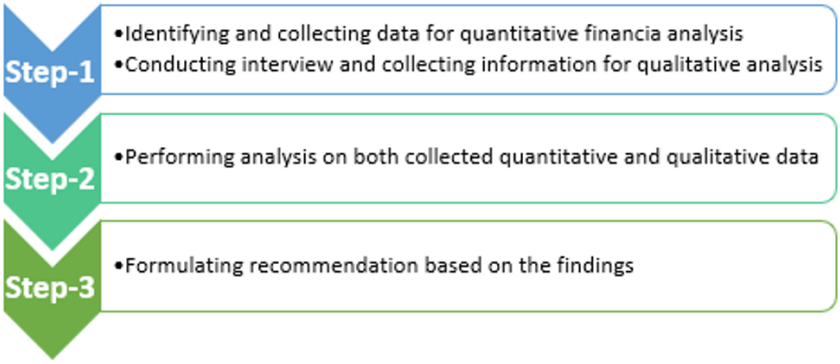

Fig. 4 Project structure, Source: Author's own work

To proceed with quantitative analyses, the following revenue and cost identification model (Table-1) will be applied to record cash flows (characteristically in different time intervals) and calculate the Net Present Values (NPVs).

Table 1: Revenue and Cost Elements

Revenues	**Characteristics**
Grants	UK Government and other grants for woodland creation and management
Timber income	Income from sales of harvested timber
Carbon income	Income from carbon sequestration
Site rental income	Income from rental for leisure and recreational activities
Training/ Course income	Income from providing woodland-related courses
Costs	**Characteristics**
Woodland Management Plan & Grant Application	Prerequisite for woodland creation, cost of forestry professional
Land	Leasing or acquisition cost of land
Planting, Fencing and Maintenance	Planting costs for the different tree species, fencing and other development costs and continuing woodland management cost
Net Present Value = Present value of Revenue − Present value ocostt	

Since the NPV is dependent on the cashflows from the different revenue and cost elements, the following sensitivity analyses in Table 2 will be performed to calculate different NPV outcomes from the fluctuation of the core revenue and cost elements- timber price (for different market prices and combination of plant species) and timber production over different rotation period, carbon sequestration price, grant incomes and costs of land.

Table 2: Sensitivity Factors

Sensitivity Factor	**Characteristics**	**NPV Outcomes**
Timber Income	Fluctuations in timber price and different planting combinations	NPV Outcomes-1
Carbon Income	Fluctuation in carbon price	NPV Outcomes-2
Land Cost	Land leasing or acquisition cost	NPV Outcomes-3
Grant Income	Total income with or without grant income	NPV Outcomes-4
Discount Rate	Variable discount rate in practice	NPV Outcomes-5
Rotation Period	Different harvesting periods for timber	NPV Outcomes-6

IV. DATA AND ANALYSIS

A) Ethical Considerations:

The interviews were conducted for the study by requesting the participants to contribute voluntarily. Detailed Participant Information and Consent forms were distributed beforehand, and the participants were made aware of their

contribution, participation purpose, and any relevant risks. All data collected are kept secured in personal computers and cloud storage, and anonymized the participants' information was referred to them in this study.

B) Qualitative Analysis:

Several open-ended questions (as presented in Table 3) were asked in the interviews, centering the focus on whether the woodland project is viable and whether whether small-scale investors/organizations can manage it. The questions mainly targeted the participants from four groups of potential stakeholders of a woodland investment project: 1. Corporate consultant, 2. Financial advisor, 3. Board member of any organization interested in woodland project, and 4. Member of senior management (MD/Director/CEO) of any organization interested in woodland projects. As Mitchell et al. (1997) suggest, stakeholders who count possess the attributes- power, urgency, and legitimacy over an organization; it is presumed that the above-mentioned groups of stakeholders possess all or some of these attributes and may have the key insights and opinions on the overall viability of a woodland investment project.

Table 3: Interview Questionnaire

Questions	Underlying Question Themes	Aimed Participants
How attractive is investing in woodland projects for corporations or institutional investors **for financial** and **non-financial** returns?	The attractiveness of woodland investment project to a corporation **for financial** and **non-financial** returns	Corporate consultants, Financial Advisor
What are the possible sources of revenue streams from a woodland project?	Awareness and indication of potential sources of revenue streams from a woodland project	Corporate consultants, Financial advisor, Board Member of any organization interested in woodland project
Is there any particular time frame or payback period for the woodland project that needs to be critically considered?	Awareness and criticality of the time frame for return on investment in woodland project	Corporate consultants, Finance advisor
How likely is it that an SME or charity can manage a woodland?	Woodland management capacity of direct investor SME or charity organization	All stakeholder groups
Is there any significant risk (Financial/ Legal/ Operational/ HR) associated with woodland project management that an organization should be aware of before investing in a woodland project?	Awareness or criticality of possible risks (Financial/ Legal/ Operational/ HR) associated with woodland project management	All stakeholder groups
What positive or negative impact may an organization experience in its core operation (in the case that woodland management is not its core business) if it proceeds with a woodland project?	Awareness of risk and complexity of expanding operational management in a non-core or different area of business	All stakeholder groups
Leasing for a certain period or acquisition of land, which could be the best option for a woodland project?	Opinion on or underlying rationale for long-term asset acquisition, such as leasing or acquiring land	Corporate consultants, Financial advisor, Board Member of any organization interested in woodland project
What are the usual exit strategies for investors from these kinds of investments?	Awareness of investment return timeframe and process for both financial investors and any organization interested in woodland project	Corporate consultants, Finance provider
Any further suggestions or comments in this regard?	Personal suggestion or opinion of the participant	All participants

The participants for the interviews were recruited by randomly contacting consultancy firms and professionals through personal contacts. As the participation was voluntary, four interested respondents were interviewed. To comply with the ethical consideration, the participants were anonymized, and their actual names were replaced with the English alphabets- A, B, C and D.

The summary of the participants' professional background and their belongings to the stakeholders' group are as follows in Table 4:

Table 4: Participants' Professional Background

Participant	Stakeholder Group	Professional Background

Participant- A	Member of senior management (MD/Director/CEO) of any organization interested in woodland project	A senior member of the management team of Abberton Rural Training (ART), a charitable vocational training centre that operates in the rural Essex region. ART is actively seeking indirect investors and land to create the woodland project. The interviewee deals with the day-to-day operation of the organization.
Participant- B	Board member of any organization interested in woodland project	A member of the board of trustees of ART, an ex-local government's environment officer who also serves as an environmental and sustainability consultant
Participant- C	Corporate consultant	A Forestry and Sustainable Plantations consultant who is also a Technical Director of the organization- Confederation of Forest Industries (Confor) that promotes sustainable management of forests and successful wood-using businesses
Participant- D	Financial advisor	A corporate tax adviser with having background of working as Director/ Group Head of tax in multiple private and public limited companies

C) Quantitative Analysis:

Depending on the aimed benefits, such as income from timber, recreational site rental, carbon abatement and other environmental services, etc., different types of woodlands are created based on the combination of plant species. For example, Farm woodland is managed for mixed objectives, Broadleaved woodland is managed for game and biodiversity, Broadleaved woodland is managed for timber, Upland conifer is managed for timber, Lowland conifer is managed for timber, etc. (CJC Consulting, 2014; Haw, 2017). Woodland creation (on average of planting 90% of total land, leaving 10% open space) with the combination of lowland conifer and broadleaved is considered for this analysis focusing on the lowland region of England, specifically the county of Essex and the surrounding areas.

The values of the revenue and cost elements identified in Table-1 in Research Design Section- 3.4 vary depending on different factors, production yield from a combination of different plant species (e.g., conifer or broadleaved) and market price sensitivity of woodland products and other environmental services.

Due to the nature of the woodland project, the cash outflows and inflows of different costs and revenues occur in different time intervals. As per the NPV method discussed in the Quantitative method section-3.1, the future cash flows are discounted for present values (PV), and then the net of present values (NPV) is calculated for different scenarios of sensitivities discussed in the Research design section. All the calculations of revenues and costs are based on an indicative area of one-hectare of woodland.

a. Timber Production and Price:

One of the key revenue sources from woodland is timber, typically sold by volume and measured in cubic metres (m3). Potential timber productivity of a given tree species on a given site is expressed in Yeild Class (YC), which is measured in terms of cubic metres of timber production per hectare per year (m3 ha-1 year-1). The actual production of timber will certainly differ from forecasted estimates because woodland will not grow exactly as predicted, and the actual management of a woodland is very unlikely to be exactly as planned. The expected volume of harvestable timber from a woodland usually depends on six main factors: 1. Plant species, 2. Productivity or yield class, 3. Area, 4. Initial tree spacing, 5. Proposed management, and 6. Harvesting period or rotation length.

The price of timber mainly depends on the end use and the likely relevant processing costs. Usually, bigger logs have more potential end uses. Larger logs typically have lower conversion losses. Therefore, larger logs produce more final products than the same total volume of many small logs. Typically, the market price per cubic metre of standing timber declines when the mean volume of individual trees falls below 0.4 cubic metres (Hardaker & Healey, 2021c).

For the timber revenue calculation, the data from the Forestry Commission's (2022) Timber Price Indices have been used for softwood (conifer). According to the Coniferous Standing Sales Price Index, the average price for coniferous standing sales was £42.55 per cubic metre in the year 2022 till March. Broadleaved timber prices are not documented like coniferous timber prices. However, industry professionals and recent research recommend, depending on species and quality, broadleaf prices will either be similar to coniferous standing sales prices if it is going into the firewood or biomass market or, significantly higher if it is a quality hardwood processed for construction or furniture making (Hardaker & Healey, 2021c; Haw, 2017). In the cases of small or medium-sized direct investors (including charities), broadleaved portions of the woodlands are most likely to be used for environmental or entertainment services like gaming and biodiversity. Therefore, from a conservative point of view, it is assumed that only 25% of the value of similar conifer

timber will be realized, which means the base price for the revenue calculation from broadleaved wood is estimated to be 25% of the conifer price.

The yield class for lowland conifer species such as Douglas fir, Corsican pine or Western red cedar is estimated to be 18 and for broadleaved species such as Sycamore, Birch or Oak, the yield class is estimated to be 5 for the region in Essex and the surrounding areas as per the Forest Research database (http://www.forestdss.org.uk/geoforestdss/).

The scenarios of three planting combinations (Figure-5) comprising Combination-1 (55% Conifer, 35% broadleaved), Combination-2 (65% Conifer, 25% broadleaved) and Combination-3 (75% Conifer, 15% broadleaved) and three harvesting rotations (25, 40 and 50 years) applied in the sensitivity analyses.

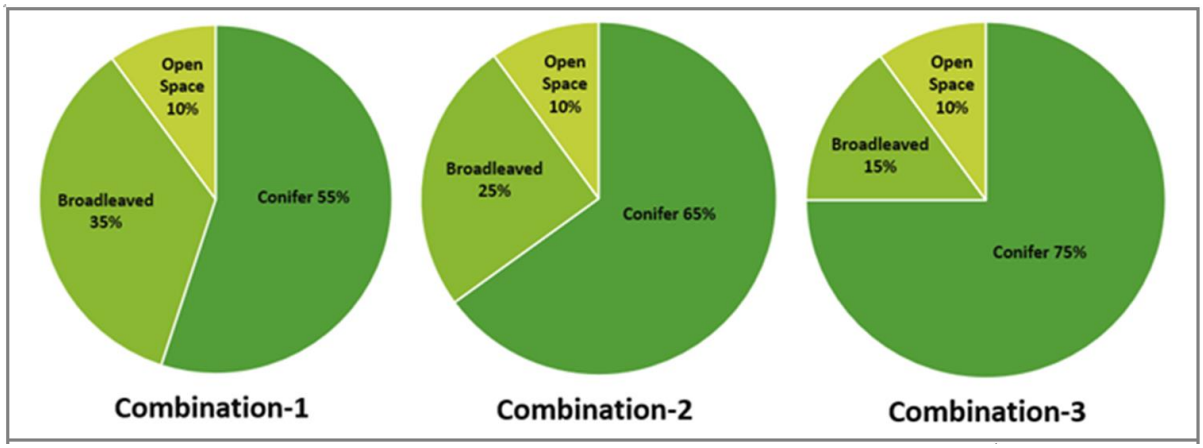

Fig. 5 Scenarios of three planting combinations, Source: Author's own work

b. Carbon Sequestration and Price:

Carbon sequestration is one of the environmental benefits of woodland, which is currently tradeable in open national and international markets. Backed by the government, the forest industry and carbon market experts, the Woodland Carbon Code (WCC) is the quality assurance standard for woodland creation projects in the UK (https://woodlandcarboncode.org.uk/) that generates independently verified carbon units to be traded in the market. The WCC issues carbon units, which represent measurable amounts of carbon dioxide (CO2) removed from the atmosphere by trees as they grow – one unit is 1 ton of carbon dioxide equivalent removed from the atmosphere. There are two types of units to measure tradable carbon credits: a Woodland Carbon Unit (WCU) is a ton of CO2 that has been sequestered in a WCC-verified woodland and is guaranteed to be there, which can be used by companies to report against UK-based emissions. The other measure is the Pending Issuance Unit (PIU), which promises to deliver a WCU in future based on predicted sequestration. It is not 'guaranteed' and cannot be used to report against UK-based emissions until verified. The amount of independently verified PIUs available usually can be sold straight after the trees are planted (Woodlandcarboncode, n.d.; Hardaker & Healey, 2021c).

Since felling releases carbon that eventually goes back into the atmosphere, not all the carbon sequestered can be claimed. Broadmeadow and Matthews (2003) suggest that the realistic carbon sequestration amount that can be claimed for commercial woodland over a full rotation may be no more than three tons per hectare per year (3 tC ha-1yr-1). This suggested amount is applied in the analysis as an average estimation for the calculation of carbon revenue.

Depending on woodland location, woodland type, and the buyer's preferences, the carbon price varies even for the similar woodland in different contexts (David, 2021). According to the UK National Statistics Report (ONS, 2020), each ton of sequestered carbon in 2017 was valued at approximately £66. The Department for Business, Energy & Industrial Strategy publishes updates on short-term traded carbon values for valuation (DBEIS, 2019), and the prices vary widely depending on different economic scenarios. In line with that, for the carbon income analysis, the prices of £8, £18, £60 and £80/tCO2 (PIU) are applied, assuming the income will be generated after two years of plantation until the harvesting period.

c. Grants:

As part of the UK government's environmental plan to accelerate woodland creation, to maintain and manage woodland and to manage tree health, several grants are offered by woodland creation projects. The government website (Gov. uk, 2022) presents a list of available UK Government grants and the subsequent eligibility for those grants in an overview table. Most of the grants listed in the table require the woodland minimum size to be 0.5 hectares which can be in

reach of many SMEs or charities who are considering small-scale plantations with an approximate land size between 3 to 10 acres or 1.2 to 4.0 hectares or more. A summarized list of considerable Government and Non-Government grants for such projects is presented in Table 5. The grants vary for initial capital expenditure cover ranging from £1000 to £8,500 up to 75% of total costs, and for the maintenance cost, it ranges from £100 to £200 per hectare per year covering 5 to 10 years from plantation. In line with the forestry commission's recommendations (Haw, 2017) and considering multiple grant options available that can be applied simultaneously, an average of £8,500 per hectare for initial capital establishment costs and maintenance payments of £200 per hectare for 10 years is applied as an estimated grant income in the revenue calculation.

Table 5: Woodland Creation and Management Grants

Grant	Financial Incentives	Minimum Project Area
England Woodland Creation Offer (EWCO) is a flagship new grant scheme for farmers and landowners to encourage investment in woodland creation.	standard capital costs of tree planting (up to a cap of £8,500 per hectare) and annual maintenance payments of £200 per hectare for 10 years,	The minimum total size of woodland included in an EWCO application is 1 hectare.
Woodland Management Planning Grant (WMP) is a one-off payment to create a 10-year Woodland Management Plan, which is UK Forestry Standard (UKFS) compliant.	Flat rate of £1,000	3 - 50 hectares
Woodland Improvement: This grant is to improve the biodiversity of woodland and/or make it more resilient to climate change.	It pays £100 per hectare for five years and also offers 40% of actual costs for capital item woodland infrastructure.	3 hectares of woodland-only. 1 hectare of woodland is a site of Special Scientific Interest. 0.5 ha of woodland within an application that also includes agri-environment land (a 'mixed' application)
Woodland Tree Health: There are two elements within this grant: • restoration provides support for restocking woodland after felling due to a tree health issue • improvement provides support for the removal of diseased trees and infected rhododendron	To restock native tree species on an ancient woodland site, the payment is capped at an average of £3,500 per hectare (£1,750 per hectare for non-native species), whilst on any other sites, it's £2,750 per hectare for native species (£2,250 per hectare for non-native species) To fell diseased trees, amount can received between £260 and £1,680 per hectare and between £2,800 and £4,400 per hectare for rhododendron control.	0.25 hectares
MOREwoods funding is designed to create new habitats for wildlife across the UK. Further details are available at: https://www.woodlandtrust.org.uk/plant-trees/trees-for-landowners-and-farmers/morewoods/	Helps in designing woodland, creating a bespoke species mix, supplies the agreed trees and tree protection, and covers up to 75% of costs.	At least 0.5 hectares of new woodland that includes 1000-1600 trees per hectare
Woodland Carbon Guarantee (WCaG): is an incentive scheme to help accelerate woodland planting rates across England to mitigate the effects of climate change	Provides the option to sell captured CO2 to the government for a guaranteed price every five or ten years up to 2055/56	No minimum requirement

d. Training and Site Rental:

Apart from timber and carbon sequestration income, there are other potential sources of income, such as income from woodland-related training courses, site rental for recreation and game shooting or business models like the National Garden Scheme (https://ngs.org.uk/who-we-are) where a donation can be collected from garden visitors. Evidence from the UK

Office for National Statistics suggest that there were an estimated 475 million visits to woodlands in 2017, which generated a public transaction of £515.5 million collectively (ONS, 2020).

Incomes from none of the above-mentioned sources are precisely quantifiable due to lack of available data while it depends on the context regarding the infrastructure of the site including its location for visibility and public accessibility, the time it may take to get the site ready to provide such services etc. and available potential clients for such services.

Although these can be key sources of income from a woodland project, to eliminate any 'Optimism bias' (Snowdon and Harou, 2014), which is the tendency for project appraisers to be over-optimistic about benefits while under-estimating costs and time, income from training and site rental services excluded in the calculation.

e. Woodland Creation Costs:

There are different types of costs associated with woodland creation. These costs can be broadly categorized as initial fixed investment costs and ongoing variable operational and maintenance costs (Hardaker & Healey, 2021b). The costs of land, Woodland Management Plan & Grant Application are considered as fixed initial investment costs and the planting, fencing and, maintenance and other infrastructure development costs are considered ongoing variable costs for the analysis.

The acquisition cost for the land (£33,520 per hectare) estimated from a random preference of ART for a woodland site (https://www.forests.co.uk/woodlands/east-anglia/hockleyhall-wood-part/) and the leasing cost (7%) estimated from available market data on lease financing costs (here Ecology Building Society woodland mortgage rate is used as a proxy). The estimation of Woodland Management Plan & Grant Application costs (£4000) was generated from relevant recent research data (Hardaker & Healey, 2021b). Also, the planting, fencing and maintenance and other infrastructure development costs (£8,000 initially and £550 each for years one and two and then £150 for year three) are estimated from relevant research data on forestry project costing (Hardaker & Healey, 2021a).

D) Limitations of the Study:

As the study comprises both qualitative and quantitative research and data, the quality of data is critical to the precision of the outcomes. The significant limitation of this study is the unavailability of updated market data for revenue and cost analyses; for instance, the data for broadleaved hardwood timber is not recorded like the conifer softwood price index and the sequestered carbon price and income from other environmental services are also very dispersed and ambiguous. The land price is also very dispersed depending on the region. Therefore, some back-dated estimations from different consultancy and government reports are applied in the calculation of NPVs. However, no estimation is absolute, up-to-date data is most likely to indicate outcomes that may lie within the smaller spread of error limit.

The limitation of the qualitative data is the lack of representative volunteer participants for interviews from all the potential stakeholder groups of the woodland investment project. Although four crucial participants contributed to the study, reaching a broader participant group could help identify further insights and validate the findings from many different perspectives.

Another notable limitation within the scope of this study is that data in the costing elements have not been calculated at a detailed micro level; for instance, an estimated planting cost is applied in the calculation instead of calculating the quantity of plants required per hectare and their unit costs. The sensitivity analysis was also kept limited to the sensitivity of a few revenue and cost elements while other elements were considered to remain constant; for instance, the average amount of timber harvesting applied instead of calculating for scenarios of staged timber harvesting with thinning. These would not precisely match with real outcomes, as other cost and revenue elements would also fluctuate. Also, reduced fixed costs for a larger scale project have not been considered while costing is measured on a per hectare basis. Capturing all these in the sensitivity analyses would generate massive data that would be difficult to summarise for an indicative insight.

V. RESULTS AND RECOMMENDATIONS

A) Findings from Interviews:

As mentioned in the Qualitative Analysis section, the summary of the key findings and opinions of the interviewees on the subject themes are presented in **Table 6:**

Table 6: Key Findings from the Interviews

Underlying Question Themes	Key Responses
The attractiveness of woodland investing to corporations **for financial** and **non-financial** returns	Participants believe woodland creation projects are becoming attractive as green or impact investments with a greater focus on non-financial social and environmental returns.
Awareness and indication of potential sources of revenue streams from a	Participants, including both ART management and the advisors, indicated about the possible sources of income from woodland projects, for example, specific

woodland project	government or private funding for environmental projects, timber sale, carbon sequestration and, site rental for gaming and recreation, etc.
Awareness and criticality of the time frame for return on investment in woodland project	The participants indicated the need for longer-term investment horizon for the woodland project to gain the highest potential benefits.
Woodland management capacity of direct investor SMEs or charity organizations	Participants indicated having relevant experience as an asset of required skill sets but also mentioned access to professional consultancy or advice as a key factor for woodland management capacity.
Awareness or criticality of possible risks (Financial/ Legal/ Operational/ HR) associated with woodland project management	The participants indicated financial risks, the risk of not getting enough funds to run a woodland project and indirect investors' exit. There are other possibilities of risks indicated, for instance, lack of efficient manpower for management, neighbours' complaints, etc., but not considered to be significant for such projects. Participant D specifically mentioned accidental risks while the woodland is used for training or recreation and advised to have appropriate precautions and insurance cover.
Awareness of risk and complexity of expanding operational management in a non-core or different area of business	Participants indicated that professional advice would help efficiently develop and manage a woodland.
Opinion on or underlying rationale for long-term asset acquisition, such as leasing or acquiring land	Participants indicated that the acquisition of land would be an option for autonomy and good long-term investment in the assets as usually, land prices usually go up over time. But considering immediate cash tying up while there might be other financial obligations, Participants-C suggested that leasing or joint venturing with existing woodland can be a feasible option that gives immediate access to many time-consuming regulatory obligations for woodland development in England. Participant D also recommended short-term leasing to practically check for the financial viability and manageability of the woodland project for SMEs or charities.
Awareness of investment return timeframe and process for both financial investors and any organization interested in woodland project	The participants indicated awareness of the investor exit requirements. Although the longer time horizon is indicated in the discussion, it is suggested that payment in kind, for instance, carbon abatement or recreational opportunity for indirect investors, could be options for paying off the investment principle and return on their investments.
Personal suggestions or opinions of the participants	Participants were encouraged to proceed with the project but recommended to consider professional advice for forestry project planning and take adequate precautions for financial and non-financial risks.

"I come from a finance background, right; So, it's going to be driven by what are the numbers… If you're looking at corporates or looking at some sort of funds or people or things like that (for funding), that is already a (financing) vehicle they're going to want all their money back within the short term" -Participant-D; "Acquisition of land – again depends on what the investor is looking to gain whether it is more financial or non-financial" -Participant-A; "In the UK there's a lot of money interested in buying woodland and investing in woodland… I can think of 2 or 3 funds, which have got well over 300 million funds looking to invest in forestry… the main driver is timber..." -Participant-C.

B) Findings from NPV Analyses:

From the revenue and cost data, NPVs were calculated with the discount rates of 3.5% and 5% from a conservative perspective, while a discount rate of 3% is broadly used by private investors in commercial forestry investment appraisals (Haw, 2017). A weight of 5% probability of 50% of income loss from extreme wind or major storm is applied in all scenarios of calculations.

In the case of land acquisition for the woodland, the incomes from both the timber sale and carbon sequestration price (ranging from £0 to £80) do not cover the investment costs for any of the timber rotation periods 25, 40 and 50 years resulting all the NPVs negative (as presented in Table-7). If it is assumed that the land will be sold at the end of the timber harvesting period at the acquisition price, the NPVs become positive, indicating that the project is financially viable.

Table 7: Sensitivity to Carbon Price-Land Acquired

Sensitivity Factors				25 Year Rotation NPV	40 Year Rotation NPV	50 Year Rotation NPV
Land cost	33,520	Combination-1	Land unsold	-27025	-24070	-22457
Conifer Price	42.6		Land sold	**6495**	**9450**	**11063**
Broadleaved Price	10.5	Combination-2	Land unsold	-26289	-23367	-21834
Carbon Price	***80***		Land sold	**7231**	**10153**	**11686**
Discount rate	3.5%	Combination-3	Land unsold	-25553	-22664	-21211
			Land sold	**7967**	**10856**	**12309**
Sensitivity Factors				**25 Year Rotation** NPV	**40 Year Rotation** NPV	**50 Year Rotation** NPV
Land cost	33,520	Combination-1	Land unsold	-28341	-26176	-25089
Conifer Price	42.6		Land sold	**5179**	**7344**	**8431**
Broadleaved Price	10.5	Combination-2	Land unsold	-27605	-25473	-24467
Carbon Price	***60***		Land sold	**5915**	**8047**	**9053**
Discount rate	3.5%	Combination-3	Land unsold	-26870	-24770	-23844
			Land sold	**6650**	**8750**	**9676**
Sensitivity Factors				**25 Year Rotation** NPV	**40 Year Rotation** NPV	**50 Year Rotation** NPV
Land cost	33,520	Combination-1	Land unsold	-31105	-31859	-30618
Conifer Price	42.6		Land sold	**2415**	**1661**	**2902**
Broadleaved Price	10.5	Combination-2	Land unsold	-30369	-31361	-29995
Carbon Price	***18***		Land sold	**3151**	**2159**	**3525**
Discount rate	3.5%	Combination-3	Land unsold	-29634	-30863	-29372
			Land sold	**3886**	**2657**	**4148**
Sensitivity Factors				**25 Year Rotation** NPV	**40 Year Rotation** NPV	**50 Year Rotation** NPV
Land cost	33,520	Combination-1	Land unsold	-31763	-31651	-31934
Conifer Price	42.6		Land sold	**1757**	**1869**	**1586**
Broadleaved Price	10.5	Combination-2	Land unsold	-31028	-30949	-31311
Carbon Price	***8***		Land sold	**2492**	**2571**	**2209**
Discount rate	3.5%	Combination-3	Land unsold	-30292	-30246	-30688
			Land sold	**3228**	**3274**	**2832**
Sensitivity Factors				**25 Year Rotation** NPV	**40 Year Rotation** NPV	**50 Year Rotation** NPV
Land cost	33,520	Combination-1	Land unsold	-32290	-32494	-32987
Conifer Price	42.6		Land sold	**1230**	**1026**	**533**
Broadleaved Price	10.5	Combination-2	Land unsold	-31554	-31791	-32364
Carbon Price	***0***		Land sold	**1966**	**1729**	**1156**
Discount rate	3.5%	Combination-3	Land unsold	-30818	-31088	-31741
			Land sold	**2702**	**2432**	**1779**

When the income from timber is considered to decline by 20%, the project still shows positive NPVs even without any income from carbon sequestration for the same 3.5% discount rate and recovered land cost (as presented in **Table 8**). If the discount rate is raised to 5%, the project shows negative NPVs for the scenario of no carbon sequestration incomes. It shows positive NPVs for higher timber production from a larger portion of conifer plantation while considering for the stable current market rate of timber (Conifer- £42.6/m3 and Broadleaved- £10.5/m3) and £8 per ton of sequestered carbon.

Table 8: Sensitivity to Timber Price- Land Acquired

Timber prices decline 20% with no carbon income				25 Year Rotation	40 Year Rotation	50 Year Rotation
Sensitivity Factors				NPV	NPV	NPV
Land cost	33,520	**Combination-1**	Land unsold	-32976	-33149	-33568
Conifer Price	***36.2***		Land sold	**544**	**370**	**-48**
Broadleaved Price	***8.4***	**Combination-2**	Land unsold	-32347	-32548	-33036
Carbon Price	***0***		Land sold	**1173**	**971**	**484**
Discount rate	3.5%	**Combination-3**	Land unsold	-31719	-31948	-32503
			Land sold	**1801**	**1571**	**1017**
Timber prices decline 20% with no carbon income				25 Year Rotation	40 Year Rotation	50 Year Rotation
Sensitivity Factors	Discounted @ 5%			NPV	NPV	NPV
Land cost	33,520	**Combination-1**	Land unsold	-34347	-34966	-35446
Conifer Price	***36.2***		Land sold	**-827**	**-1446**	**-1926**
Broadleaved Price	***8.4***	**Combination-2**	Land unsold	-33908	-34628	-35187
Carbon Price	***0***		Land sold	**-388**	**-1108**	**-1667**
Discount rate	*5.0%*	**Combination-3**	Land unsold	-33469	-34290	-34928
			Land sold	**50**	**-770**	**-1408**
Timber prices decline 20%				25 Year Rotation	40 Year Rotation	50 Year Rotation
Sensitivity Factors	Discounted @ 5%			NPV	NPV	NPV
Land cost	33,520	**Combination-1**	Land unsold	-33821	-34123	-34394
Conifer Price	***36.2***		Land sold	**-301**	**-603**	**-874**
Broadleaved Price	***8.4***	**Combination-2**	Land unsold	-33382	-33786	-34134
Carbon Price	***8***		Land sold	**138**	**-266**	**-614**
Discount rate	*5.0%*	**Combination-3**	Land unsold	-32943	-33448	-33875
			Land sold	**577**	**72**	**-355**

The investment is analyzed from a land leasing perspective instead of acquisition with an estimated lease financing cost of 7% on the proposed similar land value (as presented in Table 9). In this case, the results from the calculations show that the project becomes very sensitive to income from carbon and the discount rate. Income from the current market rate of timber and carbon at a rate of £18 per ton does not suffice for the positive return when the discount rate of 5% is applied. If the carbon price is raised to £60 per ton, the project shows a positive return even for a 5% discount rate. When an average land value of £14,700 per hectare, as reported in the UK Forest Market Report (William, 2021), which is also equivalent to the average land cost estimation proposed by Hardaker (2021b), is applied, £18 per ton of carbon income provide positive NPVs for all rotation except the planting combination- 1.

Table 9: Sensitivity to Carbon Price- Land Leased

Sensitivity Factors			25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***2,346***	Discounted @ 5%	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	-2691	-3421	-3988
Broadleaved Price	*10.5*	**Combination-2**	-2177	-3025	-3684
Carbon Price	***0***	**Combination-3**	-1663	-2630	-3381
Discount rate	*5.0%*				

Sensitivity Factors			25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***2,346***	Discounted @ 5%	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	-2165	-2579	-2935
Broadleaved Price	*10.5*	**Combination-2**	-1650	-2183	-2631
Carbon Price	***8***	**Combination-3**	-1136	-1787	-2328
Discount rate	*5.0%*				

Sensitivity Factors			25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***2,346***	Discounted @ 5%	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	-1506	-1526	-1619
Broadleaved Price	*10.5*	**Combination-2**	-992	-1130	-1315
Carbon Price	***18***	**Combination-3**	-478	-734	-1011
Discount rate	*5.0%*				

Sensitivity Factors		*Discounted @ 5%*	25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***1,029***	Land cost@14700/h	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	-189	-208	-301
Broadleaved Price	*10.5*	**Combination-2**	**325**	**188**	**2**
Carbon Price	***18***	**Combination-3**	**839**	**583**	**306**
Discount rate	*5.0%*				

Sensitivity Factors			25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***2,346***	Discounted @ 5%	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	**1258**	**2897**	**3909**
Broadleaved Price	*10.5*	**Combination-2**	**1772**	**3293**	**4213**
Carbon Price	***60***	**Combination-3**	**2286**	**3688**	**4517**
Discount rate	*5.0%*				

Sensitivity Factors			25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***2,346***	Discounted @ 3.5%	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	**-1111**	**-1315**	**-1809**
Broadleaved Price	*10.5*	**Combination-2**	**-374**	**-612**	**-1185**
Carbon Price	***0***	**Combination-3**	**362**	**92**	**-562**
Discount rate	*3.5%*				

Sensitivity Factors			25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***2,346***	Discounted @ 3.5%	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	**-585**	**-473**	**-756**
Broadleaved Price	*10.5*	**Combination-2**	**152**	**231**	**-132**
Carbon Price	***8***	**Combination-3**	**889**	**934**	**491**
Discount rate	*3.5%*				

Further analyses were performed to check the significance of grant income on the project (as presented in Table 10). It shows that without grants, even with the lower average land value of £14,700/h (lower than the proposed land value of £33,520/h) and the discount rate of 3.5% with a higher carbon price of £60/ton do not produce positive NPVs in both land acquisition and leasing case. NPVs remain negative even if the land is sold at a cost price in the case of land acquisition for the project.

Table 10: Sensitivity Without Grant Income

Without any ***Grant*** *Income*				25 Year Rotation	40 Year Rotation	50 Year Rotation
Sensitivity Factors				NPV	NPV	NPV
Land cost	14,700	Combination-1	Land unsold	-19392	-17227	-16141
Conifer Price	42.6		Land sold	**-4692**	**-2527**	**-1441**
Broadleaved Price	10.5	Combination-2	Land unsold	-18655	-16523	-15517
Carbon Price	***60***		Land sold	**-3955**	**-1823**	**-817**
Discount rate	3.5%	Combination-3	Land unsold	-17918	-15820	-14894
			Land sold	**-3218**	**-1120**	**-194**

Sensitivity Factors		*Without* ***Grants***	25 Year Rotation	40 Year Rotation	50 Year Rotation
Land leasing cost	***1,029***	*Land cost@14700/h*	NPV	NPV	NPV
Conifer Price	*42.6*	**Combination-1**	**-5721**	**-3556**	**-2470**
Broadleaved Price	*10.5*	**Combination-2**	**-4984**	**-2852**	**-1846**
Carbon Price	***60***	**Combination-3**	**-4247**	**-2149**	**-1223**
Discount rate	*3.5%*				

Although a higher proportion of conifer planting generates greater timber income, overall, the results indicate that income from timber alone does not suffice to cover the outlay costs for positive return on investment in both cases of land acquisition and leasing. There must be secured income flows from woodland creation subsidies and other environmental services to make the project financially viable.

C) Recommendations:

Analyzing the findings from the study, the following recommendations are made (**Table-11**) that answer the key research questions discussed in the Project Objectives and Research Questions section- 2:

Table 11: Research Questions and Recommendations

Research Questions	Recommendations
A. Could investing in woodland projects be attractive as a proposition to corporations or potential financial investors? Yes, but it is subject to the recommendations made to showcase the project viability and the direct investor company's management commitment to the woodland project.	**1)** Direct woodland project investors should seek advice from local professional foresters to plan for woodland site selection and planting, funding applications, licensing, and management. **2)** The investors should develop and follow a stakeholder engagement plan from the very beginning, for which Confor's Guidance (Confor, 2015) can be followed.
B. Purchasing or leasing land for a certain period, which is a better option for the woodland project? Leasing is recommended with an open option of buying. This will enable the direct investor organization to practically justify their woodland management capacity and the capacity to source potential incomes that will make such a project viable.	**3)** Preference should be given to cheaper land to minimize the investment outlay. **4)** Environmental services clients should be secured beforehand with terms and contracts to secure income from the project. Governments' Woodland Carbon Guarantee scheme can be considered as an option for this (as presented in Table-5). **5)** The project investors should keep backup funding for their day-to-day operations as the woodland project will likely not generate income in the short term.
C. What are the key benefits and risks an organization would need to consider for investment in a woodland project? The key risks are associated with the financing	**6)** The investors should have an appropriate risk assessment and mitigation plan with insurance

and management of the woodland project. The recommendations made would help to mitigate the risks and make the project viable and attractive to investor/s or funder/s.	cover for the project. **7)** Investors may look for joint venture opportunities from local authorities or corporations that may ease initial funding and minimize many financial and non-financial risks while still serving their needs.

VI. EXPECTED IMPACT OF THIS REPORT:

This study may have a significant impact on interested direct woodland investors' long-term strategy and operation and many of their stakeholders. This research identified potential financial cost benefits along with the recognition of other non-financial benefits of woodland creation. It recommended proceeding with such projects by considering some actions recommended in the Recommendations section 5.3. The recommendations will develop the investor organizations' confidence to decide and act on the likely outcomes regarding both risks and returns of woodland projects before they go ahead. If an interested organization proceeds, the project most likely will contribute to its own sustainability as a source of income for operation, while subsequent other key benefits will contribute to society by caring for people and our planet. Precisely, woodland projects will contribute to achieving national and global sustainable goals with a significant impact as forestry projects are one of the main elements of the United Nation's sustainable development goal, while it is also a key requirement for the UK Government's 25-year Environment Plan and Net Zero goal by 2050 that aim to increase tree planting rates to 30,000 hectares per year (HM Government, 2021; DEFRA, 2018).

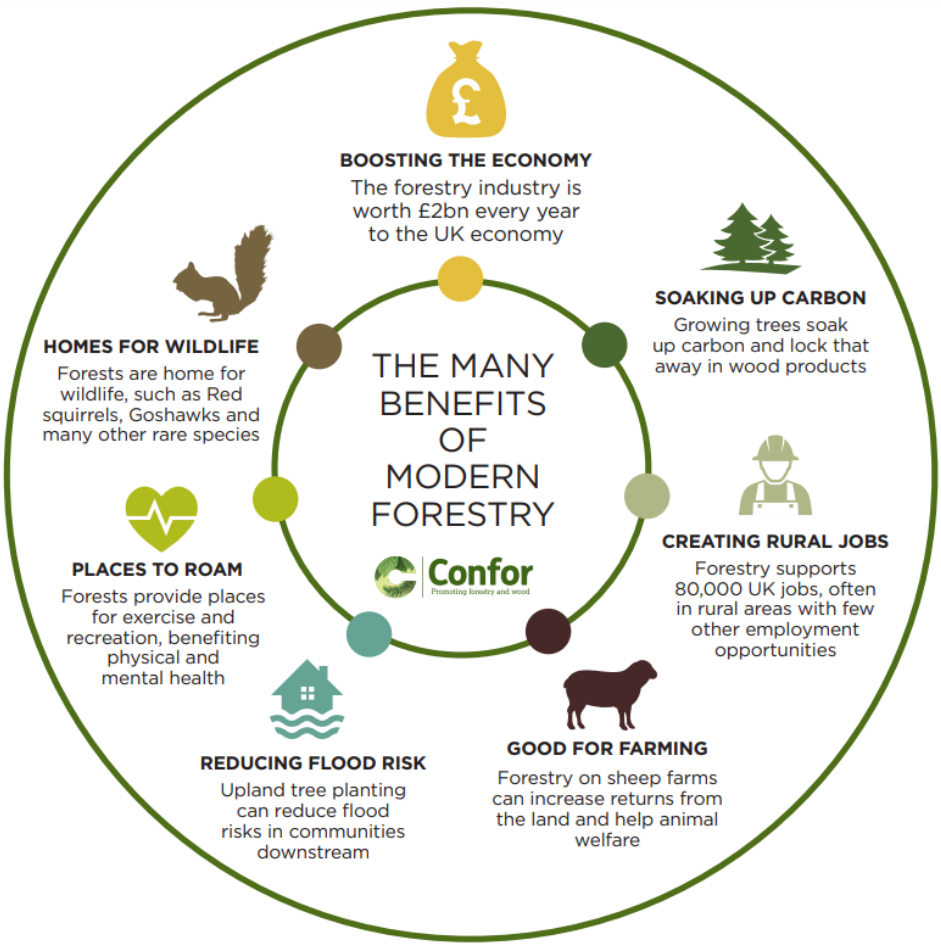

Fig. 6 The many benefits of modern forestry,
Source: https://www.confor.org.uk/media/246562/benefits-forestry-farming-focus.pdf

The impact of forestry is evidenced in authentic research and statistics reports that the woodland projects are most likely to create jobs in their surrounding regions (Forest Research, 2021c; PACEC, 2020).

Many important benefits and ecosystem services from forestry projects are not financially measurable, which are then estimated in different terms- as impacts on the society and/ or the environment. An estimation reported by the Office for National Statistics (ONS) presents that the non-market benefits of woodland exceed the market benefits of timber by approximately 12 times in 2017 (ONS, 2020). Therefore, the impacts of woodland creation on the environment and society by protecting climate, creating space for recreation, benefiting mental well-being* and social inclusion may not be precisely measured financially, but the estimation of resulting subsequent benefits will be huge, as illustrated in Figure-6 by Confor. For instance, the statistics report reveals that the removal of air pollution by woodland in the UK saved an equivalent of £938.0 million in health costs in 2017 (ONS, 2020). In line with the other benefits referred to, woodland projects will also have a direct impact on biodiversity by creating habitats for animals. By analyzing the viability of the woodland creation project as a means of investment and referring to the economic and social benefits of it, this report may serve as a catalyst for the woodland creation project to the interested organizations.

**UK Public Opinion of Forestry Survey 2021 finds around one half (51%) of respondents who had visited forests or woodlands in the last few years reported an increase in their level of happiness (Forest Research, 2021d).*

VII. CONCLUSION

Traditionally investments only focused on financial returns irrespective of any social or environmental impact the investments may have. This led to Industrial Revolution but with the cost of a negative impact on the environment caused by the extreme levels of GHG emissions and deforestation. Which then ultimately distressed the climate and ecosystem, thus affecting the biodiversity of our planet. This disturbance on the environment ultimately created great negative impacts on human lives by causing droughts, floods, raised temperatures, air pollution and causing many diseases resulting from this pollution and ecosystem disturbance. When scientists started to realize that inconsiderate abuse of natural resources caused self-destruction instead of easing of life, the concept of sustainability came into serious focus that includes caring for the triple bottom lines- people, planet, and profit instead of just profit. As part of sustainable development, investing in forestry became a very attractive and productive approach. Investments in forestry do not only serve the environment or ecosystem; being a growing industry, it is now also providing profit through environmental services and serving people by creating jobs, green space for recreation and mental wellbeing.

Many organizations are focusing on participating in this new trend of sustainability by creating woodland that will serve corporations in meeting their ESG commitments and also will serve for their own sustainability through generating income. As this can be a long-term strategic decision for many SMEs, it is material for them to analyze or appraise whether they can manage woodland projects by meeting financial and non-financial (skills and commitment) needs and mitigating subsequent risks. Snowdon and Harou (2014) suggest a good quality economic appraisal provides a structured and consistent approach to taking account of the issues that helps to carefully plan a proposal by considering all relevant issues and options and promotes worthwhile projects to gain funding while examining new financing options such as payments for ecosystem services (PES) and other financing mechanisms. Focusing on this suggestion, a mixed method of research has been conducted through analyzing quantitative data for cost-benefit analysis along with seeking deeper insight through interviewing industry experts and stakeholders to evaluate the viability of undertaking and managing woodland creation projects for interested organizations.

In the context of the research, there were some limitations with data, as there were insufficient up-to-date market data for cost-benefit analyses, and not many participants from all relevant stakeholder groups have been reached and/or showed interest in interview participation. However a core insight has been analyzed in line with relevant available research and industry reports, which can be critically informative for interested organizations' long-term strategic decision-making for woodland creation projects.

The analyses revealed that undertaking a woodland project is worthwhile considering the factors that, the interested organizations seek professional advice for selecting woodland areas and the development of woodland management plans to secure different grants. Since acquiring land is a huge capital expenditure for the woodland projects, primarily leasing land is recommended with the option to buy later. Securing income from selling environmental services before proceeding with the project is highly recommended, as this income is found to be material for the financial viability of such projects. Therefore, it is recommended that interested organizations manage effective expert-advised plans for maximum utilization of the woodland for both financial and non-financial returns.

VIII. REFERENCES

[1] Berk, J., & DeMarzo, P. (2013) Corporate Finance, global ed. *Essex: Person Education Limited*.

[2] Broadmeadow, M. and Matthews, R. (2003) Forests, carbon and climate change: the UK contribution. *Forestry Commission. Information Note, 48*, 1-12. Available at: https://cdn.forestresearch.gov.uk/2003/01/fcin048.pdf

[3] Cornelia Caseau & Gilles Grolleau (2020) Impact Investing: Killing Two Birds with One Stone?, Financial Analysts Journal, 76:4, 40-52, DOI: 10.1080/0015198X.2020.1779561

[4] Confor (2015) Stakeholder Engagement: Guidance Note 2015. Available at: https://www.confor.org.uk/media/246576/stakeholder-engagement-

guidance-note-dec-2015.pdf
[5] CJC Consulting (2014) Assessing the cost-effectiveness of woodlands in the abatement of carbon dioxide emissions. Final report to the Forestry Commission. CJC Consulting, Oxford. Available at https://forestry.gov.scot/publications/590-assessing-the-cost-effectiveness-of-woodlands-in-the-abatement-of-carbon-dioxide-emissions/download
[6] David McCulloch (2021) Exploring the factors influencing prices for woodland carbon. *The UK Forest Market Report 2021. Tilhill.* Available at: https://www.tilhill.com/resource-hub/publications/the-uk-forest-market-report/
[7] William Johnson (2021) Planting land insights. *The UK Forest Market Report 2021. Tilhill.* Available at: https://www.tilhill.com/resource-hub/publications/the-uk-forest-market-report/
[8] DBEIS (2019) Updated short-term traded carbon values: used for modelling purposes. *The National Archives, London.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794188/2018-short-term-traded-carbon-values-for-modelling-purposes.pdf
[9] DEFRA, J. (2018) A green future: our 25-year plan to improve the environment. *London: Department for Environment, Fisheries and Rural Affairs. Available online: https://www.gov.uk/government/publications/25-year-environment-plan*
[10] Forestry Commission (2017) The UK Forestry Standard: The Governments' approach to sustainable forestry; *4th Edition.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/687147/The_UK_Forestry_Standard.pdf
[11] Forestry Commission (2022) Timber Price Indices. *Forest Research.* Available at: https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/timber-statistics/timber-price-indices/
[12] Forest Research (2021a) Forestry Statistics 2021: Woodland Area and Planting. Available at: https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2021/1-woodland-area-planting/
[13] Forest Research (2021b) Forestry Facts & Figures 2021: A summary of statistics about woodland and forestry in the UK. Available at: https://cdn.forestresearch.gov.uk/2021/09/frfs021_zgb9htp.pdf
[14] Forest Research (2021c) Forestry Statistics 2021: Chapter 7: Employment & Businesses. *Forestry Commission.* Available at: https://cdn.forestresearch.gov.uk/2022/02/ch7_employment_fs2021-1.pdf
[15] Forest Research (2021d) Forestry Statistics 2021: Chapter 6: Social. *Forestry Commission.* Available at: https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2021/6-social-2/
[16] Friede, G., T. Busch, and A. Bassen (2015) "ESG and Financial Performance: Aggregated Evidence from More than 2000 Empirical Studies." *Journal of Sustainable Finance & Investment* 5 (4): 210–33.
[17] Geissdoerfer, M. et al. (2017) The Circular Economy – A new sustainability paradigm? *Journal of cleaner production.* [Online] 143757–768.
[18] Gov.uk (2020) Reassurance to land managers to plant trees now. Available at: https://www.gov.uk/government/news/reassurance-to-land-managers-to-plant-trees-now
[19] Gov.uk (2022) Woodland grants and incentives overview table. Available at: https://www.gov.uk/government/publications/woodland-grants-and-incentives-overview-table/woodland-grants-and-incentives-overview-table
[20] Hardaker, A., & Healey, J. (2021a) Financial evaluation of afforestation projects - basic steps: Economic aspects of woodland creation for timber production 1. Woodknowledge Wales in association with Bangor University. Available at: https://research.bangor.ac.uk/portal/files/38418360/forestry_economics_1_final.pdf
[21] Hardaker, A., & Healey, J. (2021b) Evaluating the financial costs of forestry: Economic aspects of woodland creation for timber production 2. Woodknowledge Wales in association with Bangor University. Available at: https://research.bangor.ac.uk/portal/files/38418402/forestry_economics_2_final.pdf
[22] Hardaker, A., & Healey, J. (2021crrevenuefrom forestry enterprises: Economic aspects of woodland creation for timber production 3. Woodknowledge Wales in association with Bangor University. Available at: https://research.bangor.ac.uk/portal/files/38418442/forestry_economics_3_final.pdf
[23] Hardaker, A., & Healey, J. (2021d) Accounting for time: Economic aspects of woodland creation for timber production 4. Woodknowledge Wales in association with Bangor University. Available at: https://research.bangor.ac.uk/portal/files/38418490/forestry_economics_4_final.pdf
[24] Hardaker, A., & Healey, J. (2021e) Incorporating uncertainty and risk into forestry financial evaluations: Economic aspects of woodland creation for timber production 6. Woodknowledge Wales in association with Bangor University. Available at: https://research.bangor.ac.uk/portal/files/38418575/forestry_economics_6_final.pdf
[25] Haw, R. (2017). Assessing the investment returns from timber and carbon in woodland creation projects. *Research Note-Forestry Commission*, (031). Available at https://www.woodlandcarboncode.org.uk/images/PDFs/FCRN031a.pdf
[26] Hesse-Biber, & Johnson, B. (2016) *The Oxford handbook of multimethod and mixed methods research inquiry* (Hesse-Biber & B. Johnson, Eds.). Oxford University Press.
[27] HM Government (2021) Net Zero Strategy: Build Back Greener. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf
[28] John Adams *et al*. (2007) *Research Methods for Graduate Business and Social Science Students*. New Delhi: Sage Publications Pvt. Ltd. Available at: https://search-ebscohost-com.uniessexlib.idm.oclc.org/login.aspx?direct=true&db=nlebk&AN=278216&site=ehost-live
[29] Morgan Stanley (2019) "Sustainable Reality: Analying Risk and Returns of Sustainable Funds." Available at: https://www.morganstanley.com/content/dam/msdotcom/ideas/sustainable-investing-offers-financial-performance-lowered-risk/Sustainable_Reality_Analyzing_Risk_and_Returns_of_Sustainable_Funds.pdf
[30] Mitchell, Agle, B. R., & Wood, D. J. (1997) Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. *The Academy of Management Review*, *22*(4), 853–886. https://doi.org/10.2307/259247
[31] Nigel Slack, Alistair Brandon-Jones and Robert Johnston (2016) *Operations Management.* Harlow, England: Pearson. Available at: https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1419813&site=eds-live
[32] ONS (2020) Woodland natural capital accounts, UK: 2020. *Office for National Statistics.* Available at: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/woodlandnaturalcapitalaccountsuk/2020
[33] PACEC (2020) English Forestry Contribution to Rural Economics: Final Report. *Forestry Commission.* Available at: https://forestry.gov.scot/publications/609-english-forestry-contribution-to-rural-economics-final-report/download
[34] Rainforest Alliance (2016) What is Sustainable Forestry? Available at: https://www.rainforest-alliance.org/insights/what-is-sustainable-forestry/
[35] Read, D.J., Freer-Smith, P.H., Morison, J.I.L., Hanley, N., West, C.C. and Snowdon, P. (eds). 2009. *Combating climate change – a role for UK forests. An assessment of the potential of the UK's trees and woodlands to mitigate and adapt to climate change. The synthesis report*. The Stationery Office, Edinburgh.
[36] Saunders, Lewis, P., & Thornhill, A. (2019) *Research methods for business students: 8. ed*. Pearson.
[37] Snowdon, P. and Harou, P. (2014) Guide to Economic Appraisal of Forestry Investments and Programmes in Europe. *European Forest Institute.*

Available at https://efi.int/sites/default/files/files/publication-bank/2018/tr_94.pdf
[38] United Nations (n.d.) Sustainable Developments: The 17 Goals. United Nations. Available at: https://sdgs.un.org/goals
[39] Woodlandcarboncode (n.d) What are PIUs & WCUs and what can you say about them? Available at: https://www.woodlandcarboncode.org.uk/buy-carbon/what-are-woodland-carbon-units
[40] MSCI (n.d.) MSCI UK Annual Forestry Index. Available at: https://www.msci.com/www/ipd-factsheets/ipd-uk-annual-forestry-index/0163322597
[41] Ecology Building Society (n.d.) Woodland mortgages. Available at: https://www.ecology.co.uk/mortgages/residential-mortgages/woodlands/?utm_source=google&utm_medium=cpc&utm_campaign=1506835576&utm_adgroup=58354619032&utm_keyword=woodland%20mortgages&gclid=CjwKCAjwsMGYBhAEEiwAGUXJaajwqV7wV5HcWzpGQa5nIOSeR5v_tRO5TQfBC1oqDeJGn2Zyno-l4hoCf8cQAvD_BwE