



01 Economic aspects of woodland creation for timber production

Financial evaluation of afforestation projects - basic steps

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Guidance

This document is part of a series of *guidance notes* aiming to provide practical information for farmers and other landowners interested in investing in forestry. It is designed to help develop a first understanding of economic evaluation of afforestation projects. As such it introduces the basic steps involved in the assessment of such projects to allow some preliminary due diligence when considering an investment in forestry. This does not replace a full assessment and advice by a chartered forest manager.

There are six documents in this series

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Financial evaluation of afforestation projects - basic steps

Investing in Afforestation

Afforestation projects can take a number of forms, from planting steep areas or wet corners of a farm to integrating timber trees with agricultural production or establishing plantation woodlands. Some afforestation projects such as commercial plantation woodlands have the potential to produce quality timber products alongside diversifying farm incomes and providing other environmental benefits such as carbon sequestration and flood risk mitigation.

This guidance note introduces the basic steps involved in the financial evaluation of an investment in an afforestation project. More specifically, it is intended to assist with estimating the financial returns of afforestation projects primarily aimed at producing timber, based on simple economic analysis techniques.

Why is financial evaluation important?

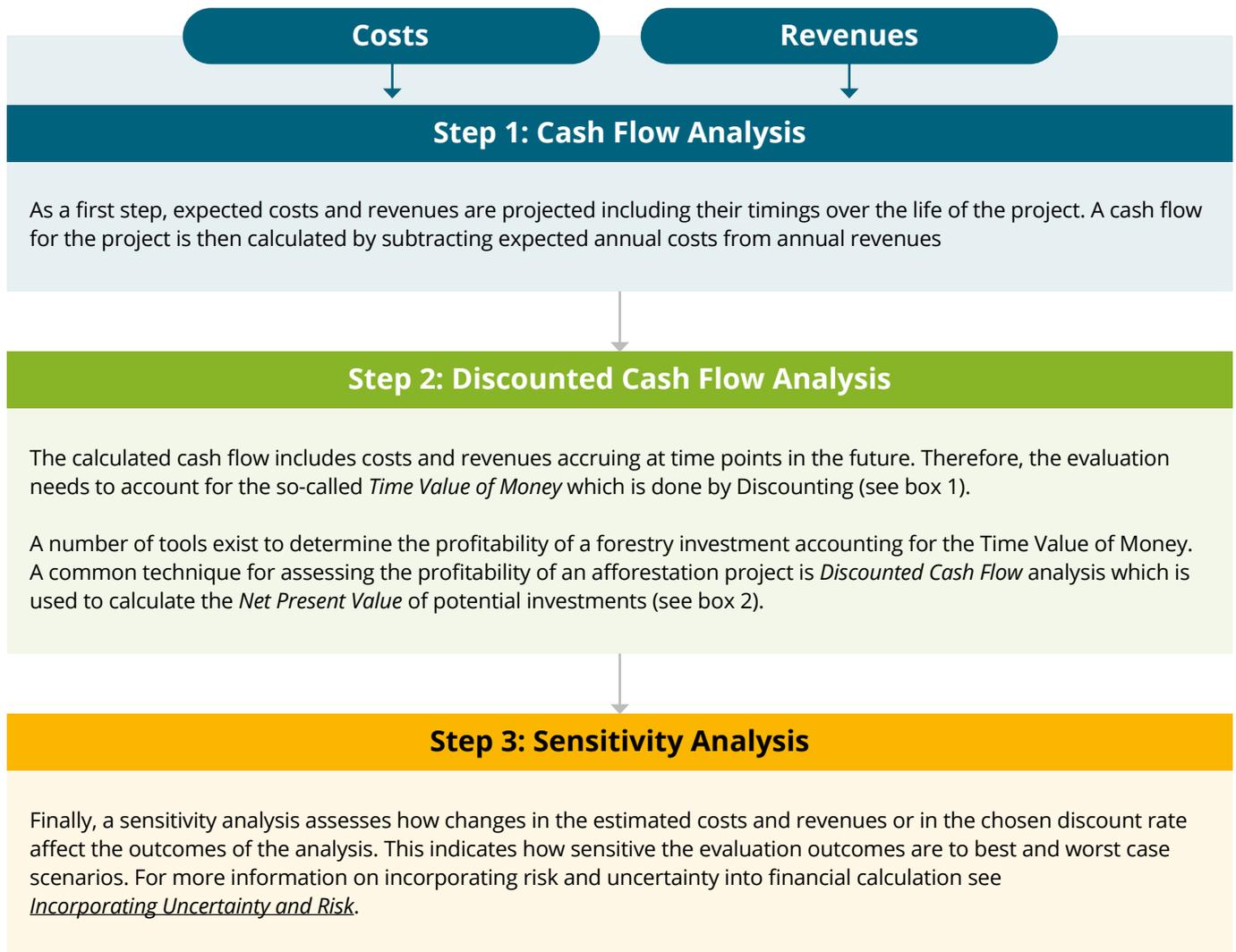
The decision to invest in an afforestation project with the primary aim of producing timber may involve many personal and environmental factors alongside financial considerations. Adoption of a forestry enterprise within a farming unit represents a change in land use and a long-term investment of land, labour and resources. Within the context of other factors influencing such a decision, financial considerations are essential.

Economic analysis, particularly financial evaluation, provides a structured and objective means to inform the decision on whether to go ahead with a project. Specifically, it allows comparison of afforestation with other economic uses of land.

Financial evaluation considers the potential financial costs and revenues of a course of action, such as a plan to establish a woodland. It allows you to:

1. Estimate the expected costs and revenues of a project.
2. Determine the cash flow of the project (i.e., when money goes in or out).
3. Apply investment appraisal techniques to estimate the profitability of the project, so it can be evaluated relative to other investments or land use options.

Basic steps of financial evaluation



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Box 1: Time Value of Money and Discounting

This is based on the principle that, generally, people prefer to receive goods and services now rather than at some point in the future (i.e., a pound today is worth more than a pound in ten years' time).

Discounting reduces the value of future cash flows such as the revenue from harvesting timber in 40 years' time to the present day equivalent based on a defined discount rate (e.g., 3%). For more information on discounting see [Accounting for Time](#).

Box 2: Calculating the Net Present Value

Net Present Value (NPV) is a commonly applied criterion used to evaluate potential investments in forestry. NPVs are a suitable profitability criterion as they indicate:

- If an investment option is profitable (acceptability criterion).
- How relatively profitable each of several alternative investments are (selection criterion)

$$\text{PRESENT VALUE} = \frac{\text{value of future cost/revenue}}{(1+\text{discount rate})^{\text{year into the future}}}$$

When using this formula, the chosen discount rate needs to be expressed as a decimal number, e.g. a discount rate of 3% would be expressed as 0.03. If $\text{NPV} \geq 0$ then the investment option is acceptable.

The NPV does not indicate the scale of the financial returns, e.g. a few hundred versus a few million pounds. It indicates the investment option returns of the specified interest rate, based on the assumed discount rate, plus the present value of additional net revenue. When selecting between a set of alternative afforestation investments, the option with the highest NPV would be the most favourable. See [Basic Concepts in Forest Valuation and Investment Analysis](#) for more information.

For more information on alternative tools see [Alternative Tools for Financial Evaluation of Forestry](#).

A financial evaluation of two hypothetical investment projects.

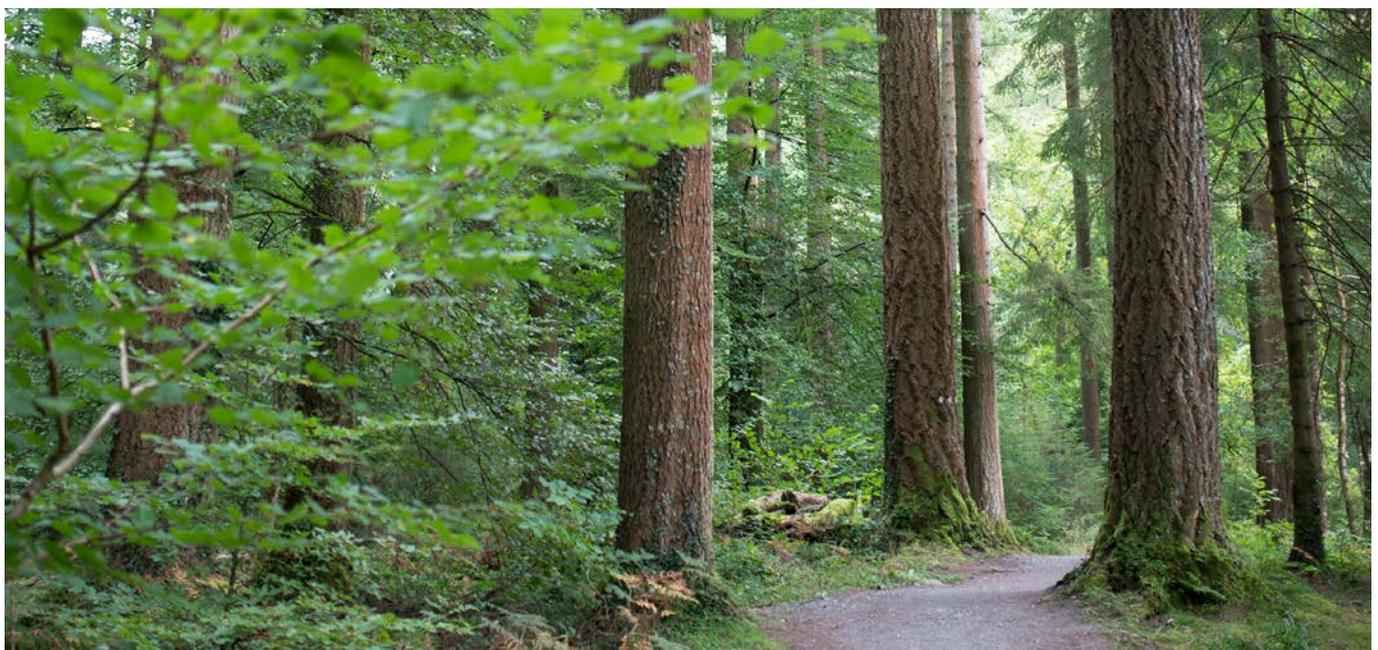
When considering an investment, there are often a wide variety of alternative woodland types and tree species to choose from. For the purpose of this example, the contrast between the options is kept simple: The two afforestation options are indicative of the types of woodland that UK landowners may choose to adopt with the goal of

producing timber on a commercial basis and attracting grant funding. The two woodland options vary primarily by productivity (i.e. yield class) and timescale (i.e. rotation length). Some of the key parameters needed in further calculations are highlighted in table 1.

Table 1: Key Parameters

Option	Description	Yield class	Spacing	Rotation (years) ¹
Upland conifer	Mixed conifers (65%)	14	2.0 m	50
	Mixed broadleaves (25%)	4	2.0 m	Indefinite
	Open Space (10%)	n/a	n/a	n/a
Lowland conifer	Mixed conifers (65%)	16	2.0 m	40
	Mixed broadleaves (25%)	6	2.0 m	Indefinite
	Open Space (10%)	n/a	n/a	n/a

¹ For the purposes of the examples only the coniferous element is harvested.



Step 1: Cash Flow Analysis

The following outlines the typical costs and revenues and their timings associated with establishing woodlands for timber production.

Costs

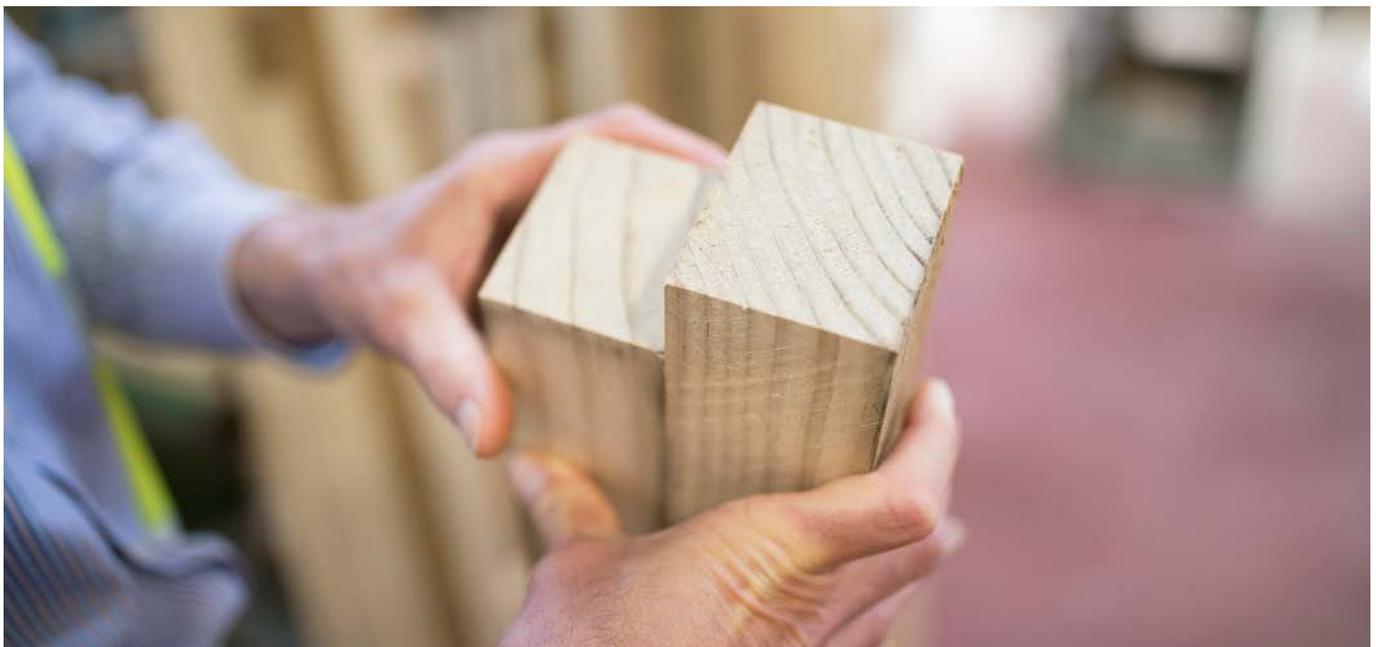
The costs involved in establishing woodlands vary based on location, the type of woodland and the operations that need to be undertaken. Data on forestry costs are difficult

to obtain. Farm budgeting resources such as the *John Nix Pocketbook for Farm Management* and *The Farm Management Handbook* provide reasonable estimates of costs for financial evaluations as used here. Typical costs involved in establishing and maintaining a woodland for timber production and their timings are outlined in Table 2. For more information on costs see [*Evaluating the Financial Costs of Forestry*](#).

Table 2: Costs

Operation ¹	Cost (£)	Timing
Fencing (deer and rabbit)	11.50 per metre	Year 1
Ground preparation (mounding)	400 per hectare	Year 1
Planting (including bare rooted plants)	2,450 per hectare	Year 1
Weeding with herbicide	135 per hectare	Years 1-4
Beating up (replacing dead trees)	370 per hectare	Years 2-3

¹ These examples are not exhaustive, for the purpose of this example, roading and annual costs such as management fees and insurance have been excluded.





Revenues

Timber provides the primary revenue source for nearly all commercial woodlands in the UK.

Predicted timber yields can be estimated using *Forest Yield*, which provides estimates of tree growth for a range of tree species, planting spacings, yield classes and rotation lengths.

Indicative timber prices can be found in the *Forestry Commission Timber Price* Indices. Here, an average price for coniferous standing sales of £27 per m³ is used.

Indicative timber revenues for the two afforestation options are shown in Table 3. Please note: these only include revenues from mixed conifers options. For more information on estimating timber revenues and other alternative revenue streams see *Revenue from Forestry Enterprises*.

Afforestation projects such as these may be eligible for grant funding, which can provide additional income to cover some of the establishment costs. Grant incomes, based on the *Welsh Glastir Woodland Creation Scheme*, are outlined in Table 4.

Table 3: Timber Revenues

Option	Timber yield (m ³ per hectare)	Timber revenues (£ per hectare)		Timing
		Gross	Adjusted ¹	
Upland conifer	594	16,038	10,425	Year 50
Lowland conifer	494	13,338	8,670	Year 40

¹ This accounts for 10% of the area as open space and 25% of the area under unharvested broadleaves.

Table 4: Grant Incomes

Grant element	Payment rate (£)	Timing
New planting payment	3,600 per hectare	Year 1
Annual maintenance payment	60 per hectare	Years 1-12
Annual premium payment	350 per hectare	Years 1-12
Fencing	3.48 per metre	Year 1

Step 2: Discounted Cash Flow Analysis

The Discounted Cash Flow (DCF) for both options and their NPVs are shown in Table 5. All costs and revenues referred to are in GBP.

Yr	Description		Both options		Upland conifer option		Lowland conifer option	
	Costs	Revenues	Costs	PV Costs	Revenues	PV Revenues	Revenues	PV Revenues
1	Fencing, ground prep, planting, weeding	<i>Fencing, planting, maintenance and premium payment</i>	7,585	7,585	5,402	5,402	5,402	5,402
2	Weeding and beating up	<i>Maintenance and premium payment (years 2-12)</i>	505	490	410	398	410	398
3	Weeding and beating up		505	476	410	386	410	386
4	Weeding		135	124	410	375	410	375
5					410	364	410	364
6					410	354	410	354
7					410	343	410	343
8					410	333	410	333
9					410	324	410	324
10					410	314	410	314
11					410	305	410	305
12					410	296	410	296
40		Timber maincrop (lowland option)					8,670	2,658
50		Timber maincrop (upland option)			10,425	2,378		
Total present value of revenues (<i>without grant incomes</i>)					11,642 (2,378)		11,853 (2,658)	
Total present value of costs (<i>without grant incomes</i>)					8,675 (8,675)		8,675 (8,675)	
Net present value (<i>without grant incomes</i>)					2,899 (-6,297)		3,178 (-6,017)	

The DCF is established based on costs and revenues (Tables 2, 3, 4), the present values (see Box 1) and a discount rate of 3%. In this scenario, both the upland and lowland conifer afforestation options would be an acceptable investment for an upland or a lowland farmer. Faced with a decision over which of the two afforestation options to invest in, the lowland conifer option would be the most favourable of the two in this example. See *Alternative Tools for Financial Evaluation of Forestry* for further options.



Step 3: Sensitivity Analysis

The *Net Present Value* (NPV) of both afforestation options was calculated with and without grant incomes and shows as follows:

- **upland conifer option** without grant incomes:
 $2,378 - 8,675 = -£6,297$
- **lowland conifer option** without grant incomes:
 $2,658 - 8,675 = -£6,017$.

Neither of these two options are acceptable if grant incomes are not received. Hence, the profitability of the investment hinges on obtaining such a grant.



Financial evaluation of afforestation projects - basic steps

Practical Guidance & Advice

The three basic steps in undertaking a financial evaluation of an afforestation project are applicable to a wide variety of projects. We hope that this guidance note will help you undertake some preliminary due diligence when considering to adopt a forestry enterprise or invest in an afforestation project. Before making the final decision we recommend seeking further advice and guidance from a *forest manager or agent*.

You can find more detailed information on financial evaluations of forestry investments *here*:

- 01 Financial Evaluation of Afforestation Projects - Basic Steps
- 02 Evaluating the Financial Costs of Forestry
- 03 Revenue from Forestry Enterprises
- 04 Accounting for Time
- 05 Alternative Tools for Financial Evaluation of Forestry
- 06 Incorporating Uncertainty and Risk

Technical Information

Basic concepts in forest valuation and investment analysis: Edition 3.0. 2011. Bullard, S.H. and Straka, T.J. Available at: <http://scholarworks.sfasu.edu/forestry/460%5Cnhttp://scholarworks.sfasu.edu/forestry/460>.

The John Nix Pocketbook for Farm Management, 51st ed. 2020. Redman, G. Agro Business Consultants. Available at <https://www.thepocketbook.co.uk>

The Farm Management Handbook 2020/21. Beattie, A. ed. SAC Consulting 2020. Available at: www.sruc.ac.uk/info/120376/farm_management_handbook

Forest Yield (Forestry Commission) software is available at www.forestresearch.gov.uk/tools-and-resources/forest-yield

Timber Price Indices. Data to September 2020. Forest Research 2020. Available at: www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/timber-statistics/timber-price-indices

Glastir Woodland Creation Scheme: <https://gov.wales/glastir-woodland-creation>



About the author

Ashley Hardaker is an interdisciplinary researcher at Bangor University interested in decision analysis in relation to land use, forestry, agroforestry and agricultural systems. He is particularly interested in research to inform decision making surrounding woodland creation in agricultural systems and how they can be designed to deliver public and private economic benefits. He engages with a range of research disciplines including ecosystem services, GIS, economics and operations research. The author is grateful for contributions to these briefing notes from Prof. John Healey of Bangor University.



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