



# Climate Mitigation Options through Afforestation: An introduction to the Forest Carbon Tool

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AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY



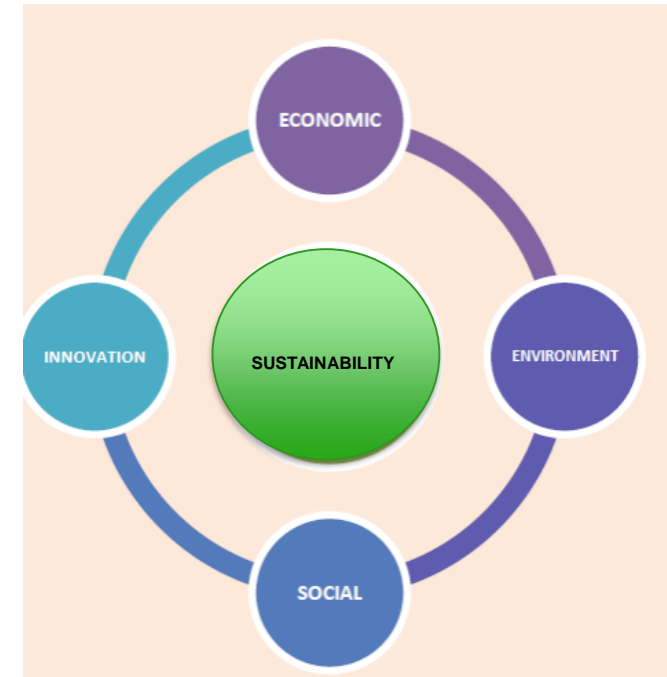
# Topics

- **Introduction**
- **Forest mitigation pathways**
  
- **Afforestation scenarios to mid-century**
- **Concepts**
- **Assumptions and caveats**
- **System boundaries**
- **Methods**
- **Validation of models**
- **Results / summary**
  
- **Using the Forest Carbon Tool**
- **Take home points**

# Climate Change Mitigation - role of afforestation

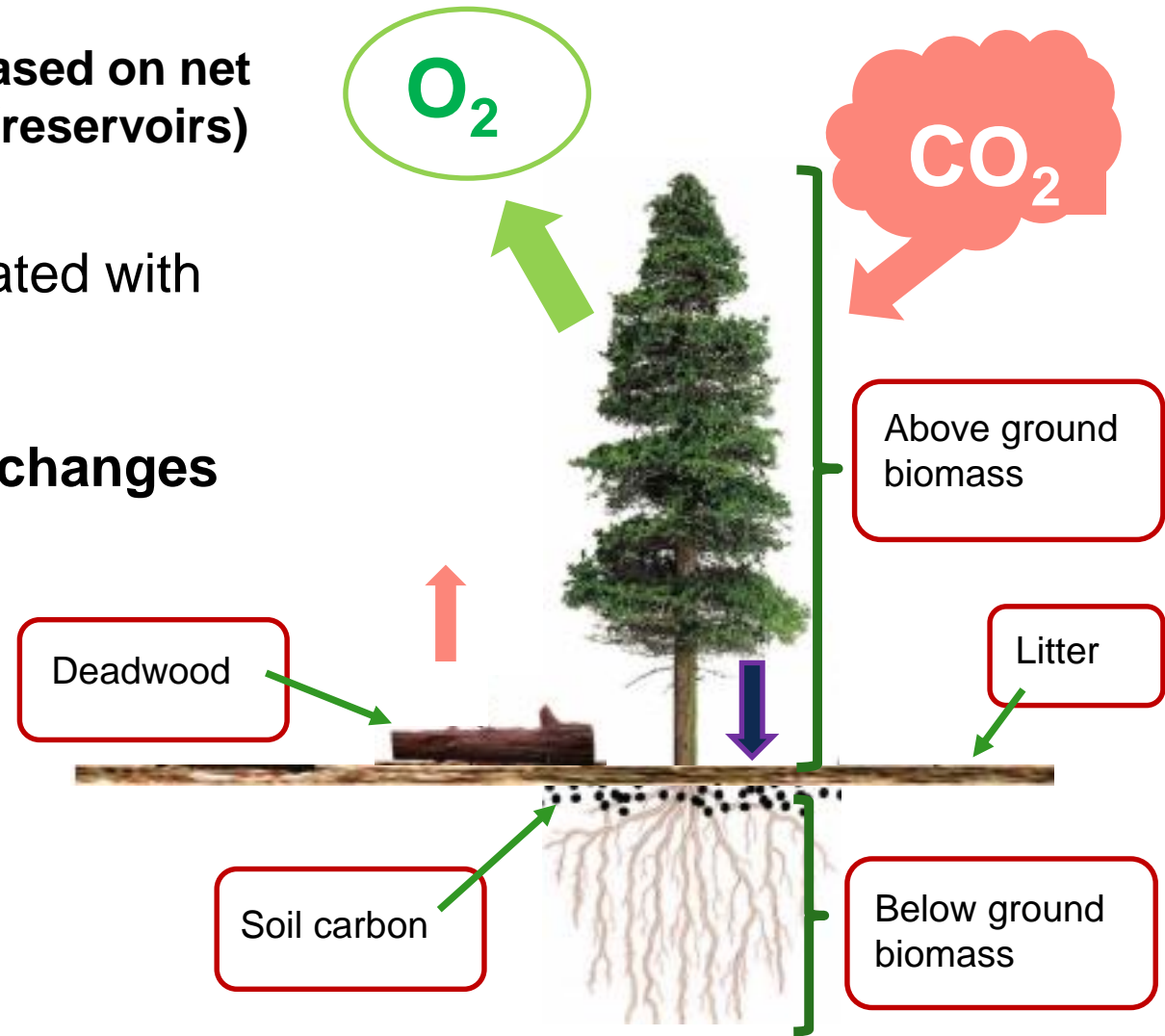
- Climate challenges...
  - **Afforestation has a highly significant role to play**
- Assisting in climate change mitigation is not the only reason for expanding our forest resource

**Balanced approach → range of benefits**



# Forest Carbon (C) Pools

- At forest level, Carbon balances based on net emissions/removals from 5 pools (reservoirs)
- Carbon transfers (fluxes) associated with these C pools
- **Final output = sum of C stock changes**



Source: Hendrick and Black, 2009

# Sequestration Pathways

1. C - Sequestration in growing forest -pools



2. C - Storage in harvested wood products - **HWP**



3. Substitution of fossil fuels with wood energy



4. Substitution of energy intensive materials (not in current system boundaries)



Source: [www.moelvin.com](http://www.moelvin.com)

# Forest Carbon Tool: [www.teagasc.ie/forestcarbontool](http://www.teagasc.ie/forestcarbontool)

- Raise awareness of the importance of climate mitigation through afforestation options
- Provide up-to-date information on carbon sequestration trends for a range of afforestation options on a user friendly interface
- Allow comparisons of the relative merits of varying afforestation scenarios from a carbon sequestration perspective
- **NB: This tool is for the above purposes and not intended to provide absolute data on any particular forest carbon valuation or potential trading platforms.**

Forest Carbon Tool

Forest management certification

Environmental benefits of farm forestry

Appropriate assessment procedures

Hedge establishment

## Forest Carbon Tool

### Introduction

The planting of new forests is a highly significant land-based measure to help address the effects of climate change. Forests play an important role in the capture and removal of carbon dioxide from the atmosphere and subsequent storage in forests biomass and soils, a process called sequestration. The long term storage of carbon in harvested wood products (HWPs) and the substitution of selected wood products for fossil fuel energy sources are also important pathways to help meet the climate change challenge.



Teagasc, in conjunction with the Department of Agriculture, Food and the Marine (DAFM) and Forest Environmental Research and Services (FERS) Limited have developed an online Forest Carbon Tool. The tool provides indicative data for potential carbon sequestration associated with new forest enterprises which include current options under the DAFM Forestry Programme. It also provides indicative sequestration data for specific tree species/species groups.

### The Forest Carbon Tool

The Forest Carbon Tool takes user-defined descriptive information on the forest and combines it with existing growth models to estimate potential carbon storage over the lifetime of the forest.

This tool provides indicative information only and is not intended to provide definitive estimates on any particular forest. The tool has been developed to contribute to the provision of general information on the capacity of forests to store carbon. It also highlights the complexities and challenges of estimating carbon across different species, soil types and ages.

This is the first version of the Forest Carbon Tool and incorporates a range of assumptions and system boundaries for the data provided. There is an ongoing need to further develop our knowledge on the impact of a range of factors such as forest types, species choices, rotation lengths and management approaches on sequestration potential.

To this end, it is anticipated that updates and enhancements can be incorporated into future versions as new data and research become available.

To access the Forest Carbon Tool, click on the image below

(then read through the assumptions and click the 'Accept' button at the bottom of the page):



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## Forestry

Teagasc's Forestry Development Department provides advice, training and research on farm forestry and related matters.



### News

Read the latest news updates here.



### Events

Chronological overview of all our upcoming forestry events.



### Staff / Contact Us

Contact details including advisory areas, research interests and travel directions for research, advisory and education forestry staff.



### Advice

Objective, technical advice on the establishment, management and harvesting of forests including information on felling regulations, timber prices and much more!



### Grants

Detailed information on forestry grants and premiums, application procedures, interaction with other agricultural schemes, etc.



### Research

The focus of our research is on the management of broadleaves and conifers, tree improvement, site classification and forest policy.



### What's New

- Upcoming events: Virtual Forest Walks from 12 to 21 April. *Registration is required.*
- Basic Payment Scheme 2021 and Forestry
- Forest Carbon Tool
- How to apply for your forestry premium? Find the answer here: [Online forestry premium applications](#)



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(then read through the assumptions and click the "Accept" button at the bottom of the page):

[CLICK HERE](#)





### The Forest Carbon Tool - Assumptions

Forests play an important role in the capture and removal of carbon dioxide (CO<sub>2</sub>) from the atmosphere, a process called sequestration. Sequestered carbon is accumulated in the form of forest biomass, deadwood, litter and in forest soils. The rate of carbon uptake is affected by many factors, such as tree species, productivity (yield class), forest age, soil type, tree stocking levels, forest management activities and previous land use. Carbon is also released from forest ecosystems resulting from natural processes (e.g. respiration by trees and decomposition of soil organic matter) as well as from planned activities such as timber harvesting. Forests are deemed to be 'carbon sinks' when the rate of carbon uptake exceeds the rate of carbon loss. The long term storage of carbon in harvested wood products (HWP) and the substitution of selected wood products for fossil fuel energy sources are also important carbon mitigation pathways.

This Forest Carbon Tool provides indicative carbon sequestration trends for **Grant and Premium Category (GPC) planting options** available under the Forestry Programme 2014-2020. It also provides indicative carbon sequestration values for a range of selected **species/species groups**. The tool uses an internationally recognised modelling framework (CFS CBM) which has been calibrated for Irish forestry conditions. Data gaps exist for certain forest scenarios and categories. In this regard, updates and enhancements will be incorporated into future iterations of the tool subject to the availability and validation of appropriate data sources.

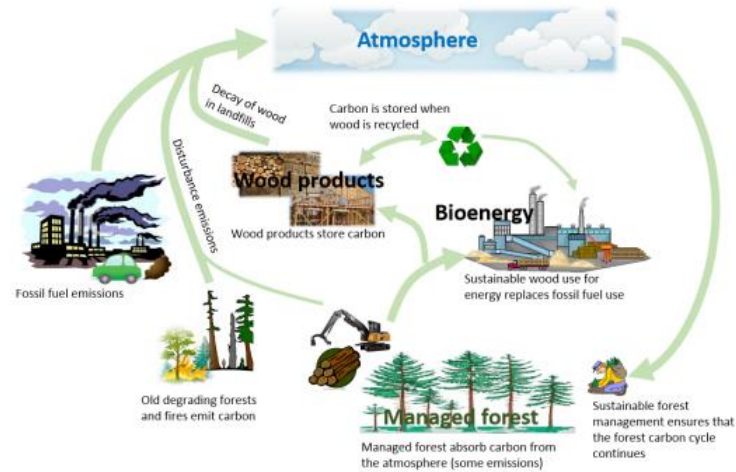


**Please note: The Forest Carbon Tool is not appropriate for or intended to be used as a standard for carbon trading platforms.**  
 It is an awareness-raising and decision support tool, providing indicative sequestration values for varying forest scenarios. Carbon sequestration is one of a range of important services (e.g. timber production, water quality protection, landscape and biodiversity enhancement) provided by sustainably managed forests. Factors such as owner's objectives, species choices and forest management approaches are central to determining the specific mix of services a forest will provide.

## Methodology and system boundaries

- The Forest Carbon Tool **does not include a full life cycle analysis**. It includes carbon sequestration in above ground biomass, litter, deadwood and soils. Indicative carbon sequestration values assume the relevant species/species groups, growth rates, and data validation processes used please [click here](#).

Carbon sequestration values assume the relevant species/species groups, growth rates, and data validation processes used please [click here](#).



## THE FOREST CARBON TOOL

Accept Assumptions:

# Calculator Page



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Food and the Marine



The Forest Carbon Tool provides indicative carbon sequestration values associated with forest planting options. Users can select from a dropdown list of Grant and Premium Categories which include eligible conifers, broadleaf species, agroforestry and forestry for fibre options (click [here](#) for more details).

Alternatively, a range of approved species/species groups may be selected.

[Link to Table 1 \(Grant & Premium Categories\)](#)

[Link to Table 2 \(Approved Species\)](#)

Choose **Grant & Premium Categories** or **Approved Species** for a list of options

Grant & Premium Categories  SPP (Approved Species)

Close

# Choose category – grant and premiums



The Forest Carbon Tool provides indicative forest planting options. Users can select from Categories which include eligible conifers and fibre options (click [here](#) for more details). Alternatively, a range of approved species

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Choose **Grant & Premium Categories** or **Approved Species** for a list of options

Grant & Premium Categories  SPP (Approved Species)

Choose Category

Please select a **Grant & Premium Category**

Choose Soil Type

Please select a **Soil Type**

Calculate

Close

GPC 8 - Alder / Birch (Higher productivity)

Choose Category

GPC 1 - Unenclosed (Lower productivity)

GPC 1 - Unenclosed (Higher productivity)

GPC 2 - Sitka Spruce / Lodgepole pine

GPC 3 - 10% Diverse Conifer / Broadleaf e.g. Sitka spruce and 10% broadleaves (Lower productivity)

GPC 3 - 10% Diverse Conifer / Broadleaf e.g. Sitka spruce and 10% broadleaves (Higher productivity)

GPC 4 - Diverse Conifer e.g. Norway spruce, Douglas fir

GPC 5 - Broadleaf e.g. Sycamore (Lower productivity)

GPC 5 - Broadleaf e.g. Sycamore (Higher productivity)

GPC 6 - Oak (Lower productivity)

GPC 6 - Oak (Higher productivity)

GPC 7 - Beech (Lower productivity)

GPC 7 - Beech (Higher productivity)

GPC 8 - Alder / Birch (Lower productivity)

**GPC 8 - Alder / Birch (Higher productivity)**

GPC 9 - Native Woodland Establishment - Will be available subject to further data analysis and validation.

GPC 10 - Native Woodland Establishment - Will be available subject to further data analysis and validation.

GPC 11 - Agroforestry (Oak)

GPC 11 - Agroforestry (Fast Growing Broadleaves e.g. Sycamore)

GPC 12 - Forestry for Fibre (Eucalyptus nitens)

Mineral

Choose Soil Type

**Mineral**

Peaty Mineral

Eligible Peat Soils



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Grant & Premium Categories  SPP (Approved Species)

GPC 8 - Alder / Birch (Higher productivity)

Mineral



### GPC 8: Alder/Birch

- Mineral soil
- Yield class 8
- Thinned
- Rotation 75 years

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#### Mean annual/cumulative CO<sub>2</sub> removals

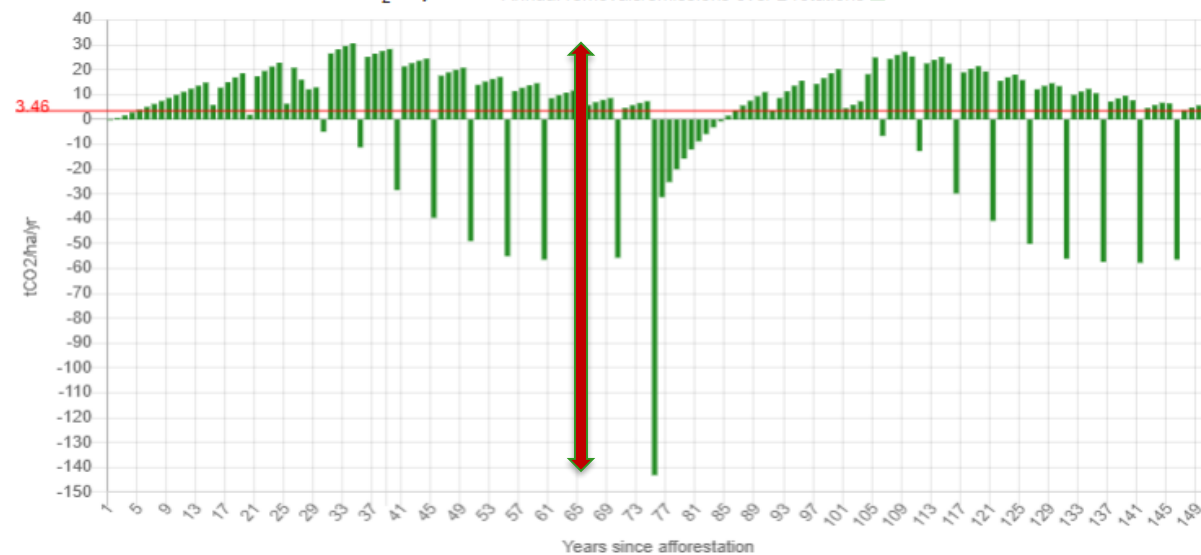
Forest site sequestration	1.9
Harvested wood products	1.25
Energy substitution	0.31

**Mean sequestration rate (tCO<sub>2</sub>/ha/year) 3.46**

**CAP (tCO<sub>2</sub>/ha) 471.72**

Annual removals/emissions over 2 rotations

tCO<sub>2</sub>/ha/year ■ Annual removals/emissions over 2 rotations ■



Graph: While the table presents average carbon sequestration, this graph shows how the rate of sequestration varies over the forest cycle/timeline.

Choose **Grant & Premium Categories** or **Approved Species** for a list of options

Grant & Premium Categories  SPP (Approved Species)

GPC 3 - 10% Diverse Conifer / Broadleaf e.g. Sitka spruce

Mineral

Calculate



**GPC 3: 15% Diverse Conifer/Broadleaf**

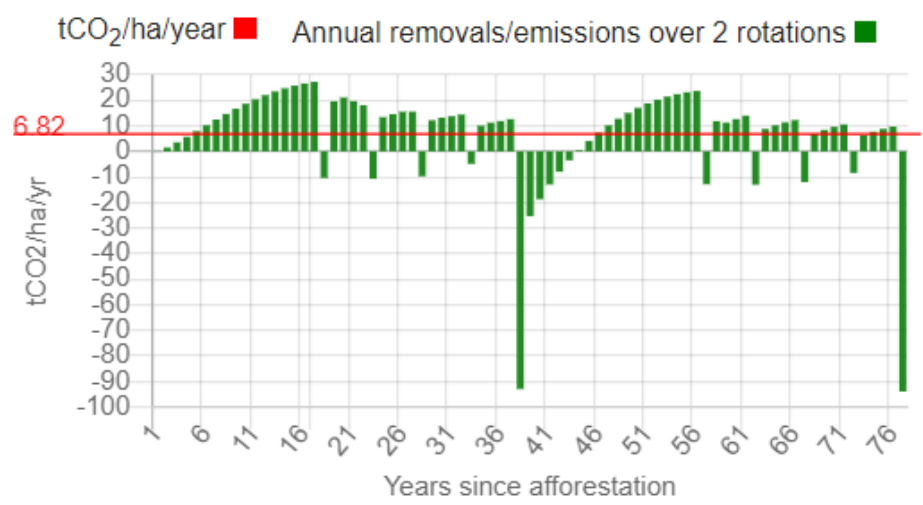
- Mineral soil
- Yield class 24
- Thinned
- Rotation 38 years

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**i** Mean annual/cumulative CO<sub>2</sub> removals

Forest site sequestration	3.13
Harvested wood products	3.26
Energy substitution	0.43
<b>Mean sequestration rate (tCO<sub>2</sub>/ha/year)</b>	<b>6.82</b>
<b>CAP (tCO<sub>2</sub>/ha)</b>	<b>357</b>

Annual removals/emissions over 2 rotations



Graph: While the table presents average carbon sequestration, this graph shows how the rate of sequestration varies over the forest cycle/timeline.

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Choose **Grant & Premium Categories** or **Approved Species** for a list of options

Grant & Premium Categories  SPP (Approved Species)

GPC 11 - Agroforestry (Fast Growing Broadleaves e.g. Sycamore)

Mineral

For GPC 11 categories please select the Livestock and Livestock per Hectare (Ha) from the dropdowns below. If livestock are not present please select "None".

Choose Livestock

Please select **Livestock** type

Choose Livestock per Ha

Please select a **Livestock per Ha** value

Calculate

Close

**Warnings**

**Note:** This tool provides indicative carbon sequestration values for relevant Grant and Premium Categories (GPCs) of the DAFM Forest Programme 2014 - 2020.

While the Forestry Programme (2006 - 2013) contained similar categories (GPC 1 to GPC 7 and native woodland establishment options) there were also some differences (e.g. in relevant land types, areas for biodiversity enhancement and setback requirements) that would require adjustments to current carbon sequestration values.

Future planting options and categories may also be subject to change and indicative carbon values will be updated accordingly.

**Sources: EPA, O'Brien, 2020**

Choose Livestock		
Choose Livestock		
Sheep	0.169 tCO <sub>2</sub> -eq/head	(5 - 12 head/ha)
Dairy Cattle (0-1 years)	1.30 tCO <sub>2</sub> -eq/head	(1.7 - 3.3 head/ha)
Drystock (1-2 years)	1.87 tCO <sub>2</sub> -eq/head	(1 - 2 head/ha)
Chickens	0.0053 tCO <sub>2</sub> -eq/head	(500 - 1000 per ha)
None		

Choose Livestock	Sheep
Choose Livestock per Ha	12
	5
	7
	9
	12

Print/PDF

i Mean annual/cumulative CO<sub>2</sub> removals

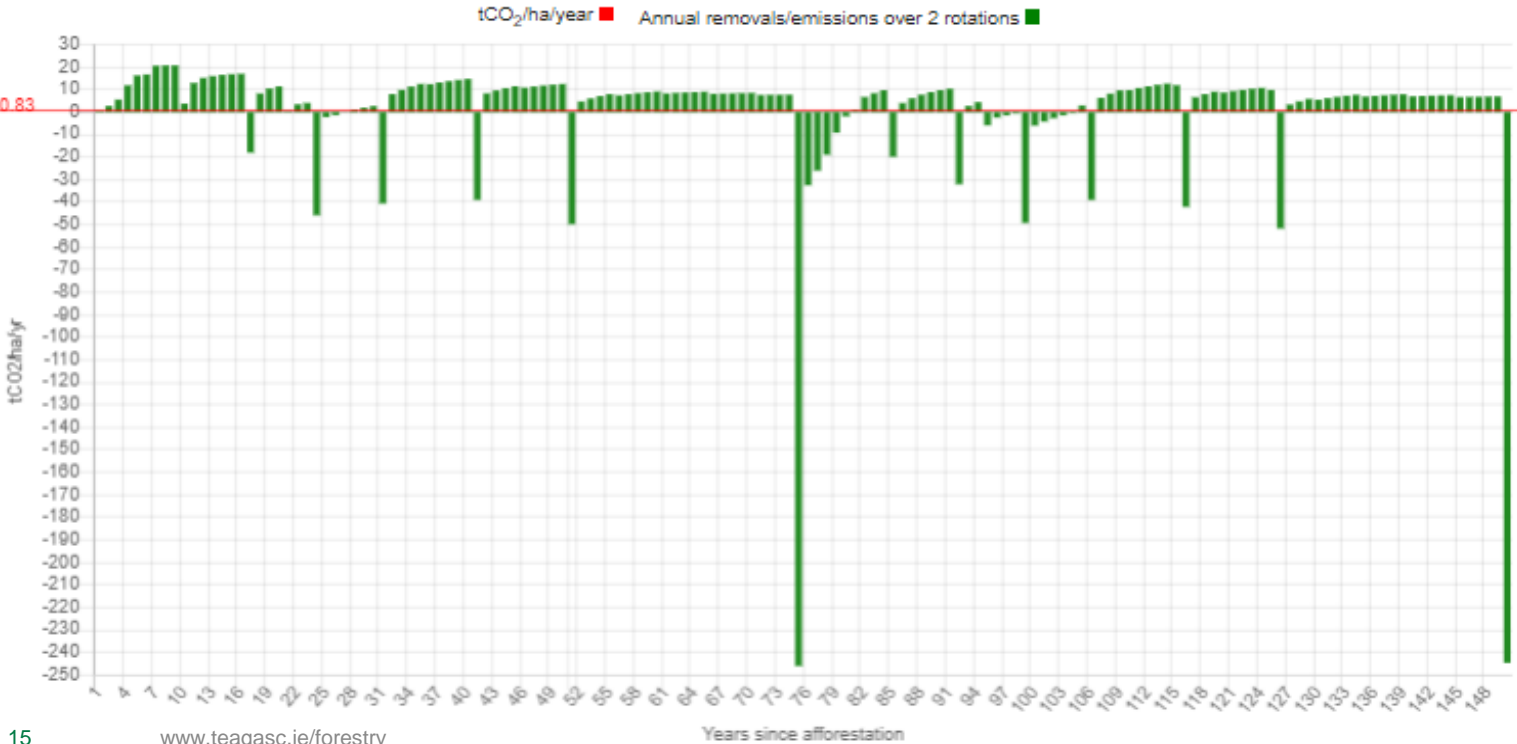
Forest site sequestration	1.94
Harvested wood products	0.87
Energy substitution	0.05
Agriculture emissions	-2.03
<b>Mean sequestration rate (tCO<sub>2</sub>/ha/year)</b>	<b>0.83</b>
<b>CAP (tCO<sub>2</sub>/ha)</b>	<b>187.4</b>



Forest sequestration 1.94 + 0.87 + 0.05 = 2.86 tCO<sub>2</sub>-eq/ha/yr  
Agricultural emissions - 2.03 tCO<sub>2</sub>-eq/ha/yr

0.83 tCO<sub>2</sub>-eq/ha/yr

Annual removals/emissions over 2 rotations



Graph: While the table presents average carbon sequestration, this graph shows how the rate of sequestration varies over the forest cycle/timeline.

# 3 take home messages

1. Progression towards achieving forest planting targets is essential if we wish to have a significant future carbon sink
2. A range of forest types and approaches are necessary and can deliver a different range of ecosystem services.
  - Dependent on owner objectives
  - Use of the Forest Carbon Tool can be a useful support mechanism to inform decision making
3. The potential of materials substitution (e.g. concrete, steel) combined with sustainable increases harvesting levels can have a high potential future impact





THANK  
YOU

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