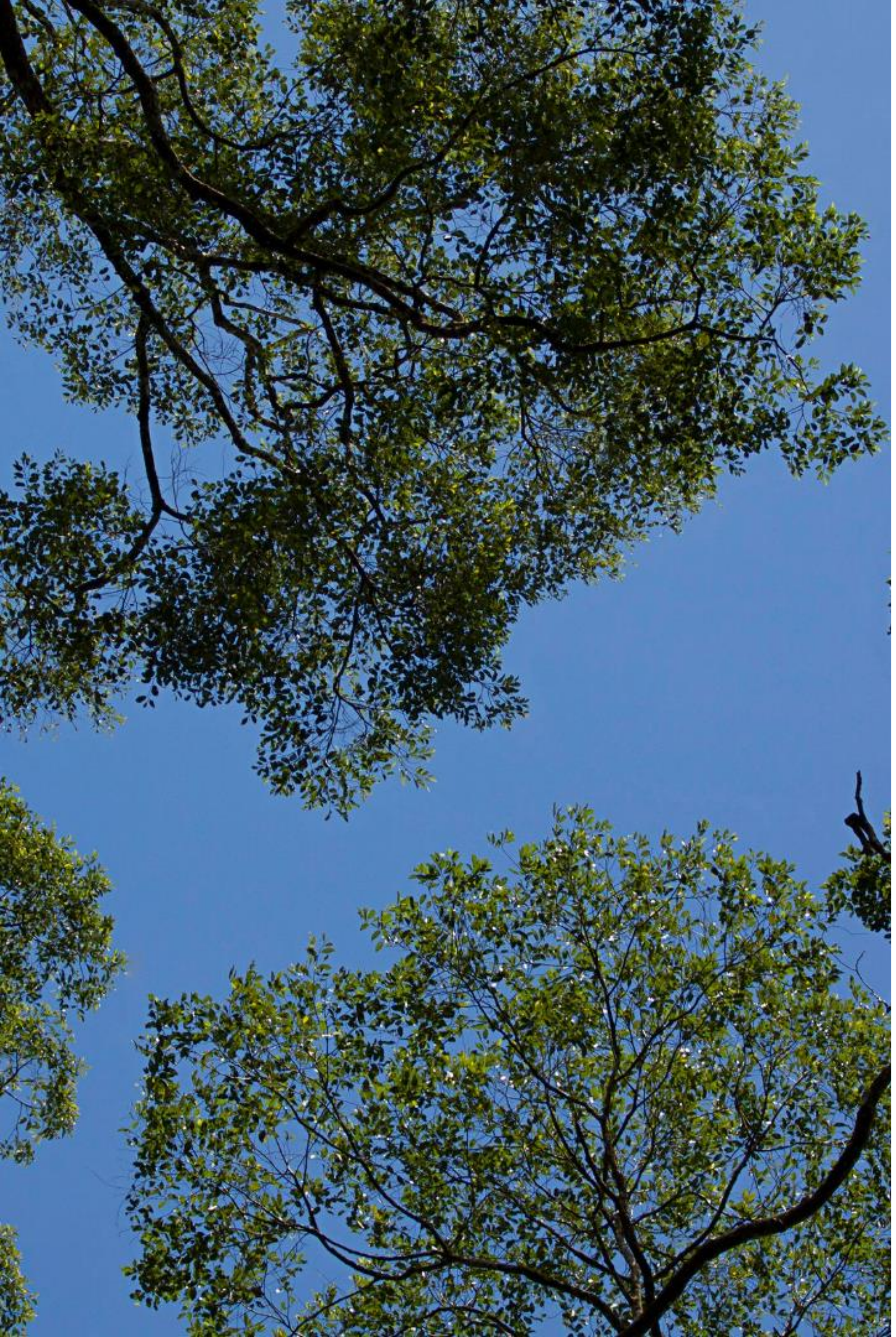

Forestry Carbon Accounting

Forests play a crucial role in carbon sequestration, absorbing CO_2 and storing it in biomass and soil. Understanding forestry carbon accounting is key to mitigating climate change and meeting national and international goals.

Junliang Zou[1,5], Ken Byrne[2], Niall Farrelly[1], Ian Short[1], Dheeraj Singh Rathore[1], Rachel Irwin[1], Mary Ryan[3], Stuart Green[4], Karl Richards[5], Fergus Moore[6], John Redmond[6], Tom Houlihan[1]

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[3] Rural Economy & Development Centre, Teagasc, Athenry;
[4] Agribusiness and Spatial Analysis Dept., REDP, Teagasc;
[5] Climate Centre, Teagasc;
[6] Forest Sector Development, Dept. of Agriculture, Food and the Marine, Wexford

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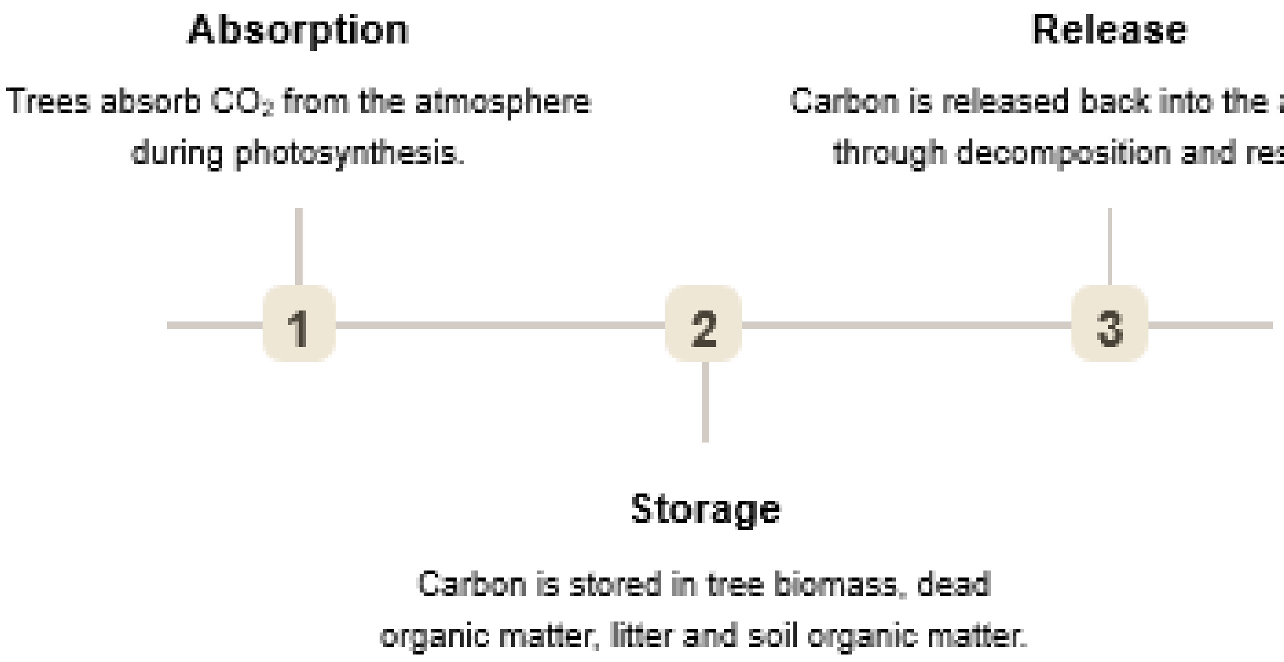
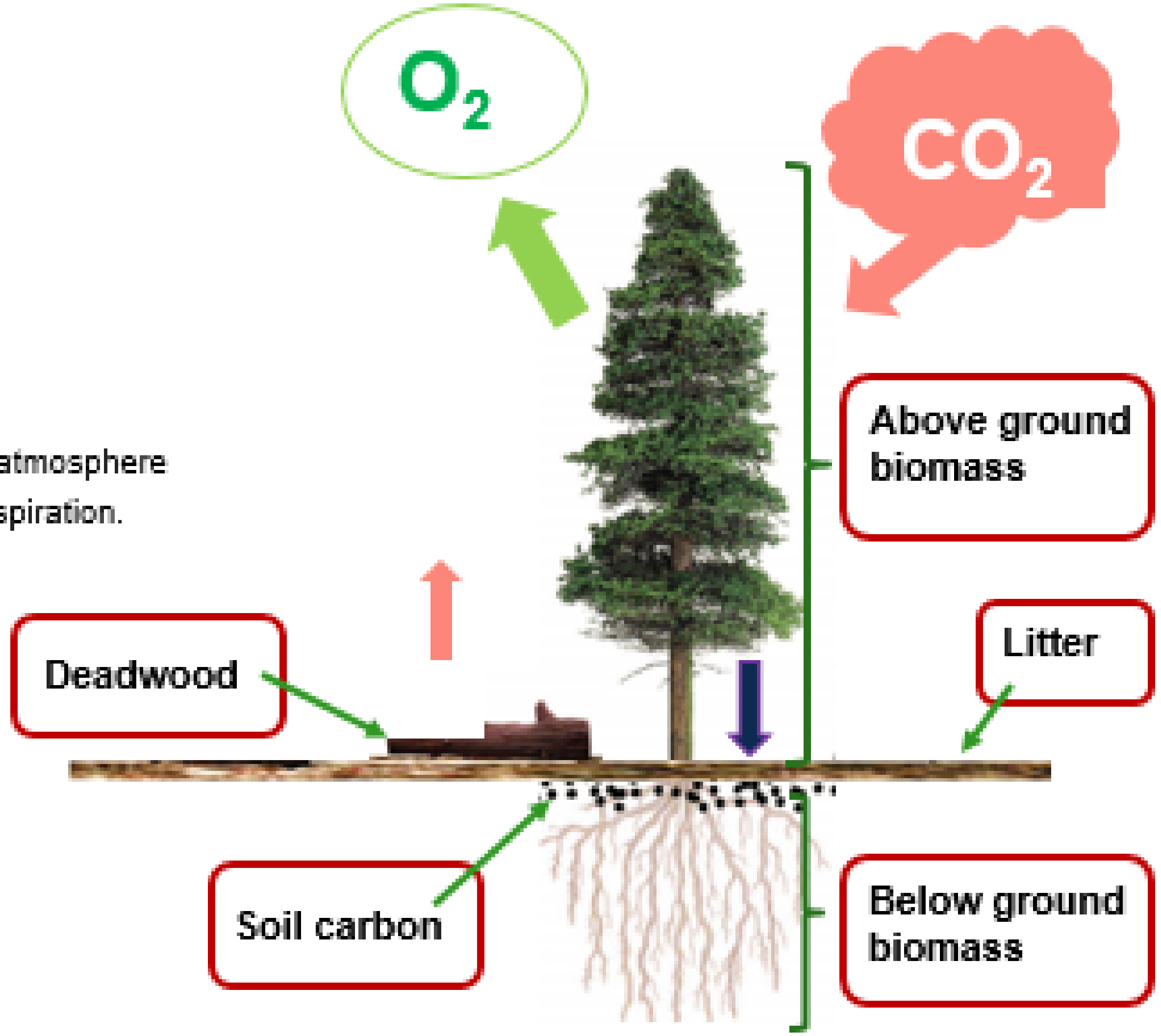
Carbon Cycle in Forests

- **Final output = sum of C stock changes**





Source: Hendrick and Black, 2009

Sequestration Pathways

1. C - Sequestration in growing forest – biomass and soil pools

4. Substitution of energy intensive materials

2. C - Storage in harvested wood products - HWP

Source: www.moelvin.com

3. Substitution of fossil fuels with wood energy

Forestry Commitments in Ireland

National Goals

Ireland’s Forest Strategy 2023-2030 aims to create conditions leading to 18% forest cover. The pace of this will depend on the level of engagement by landowners and stakeholders in demand led afforestation schemes.

Key measures

The Climate Action Plan 2024 identifies key measures in meeting the objectives: afforestation, sustainable management, promotion of the use of long lived harvest wood products.

Climate Alignment

Forestry efforts align with EU ambitions and international agreements, such as the Paris Agreement to limit global warming.

Wood Products and Carbon Storage

Construction

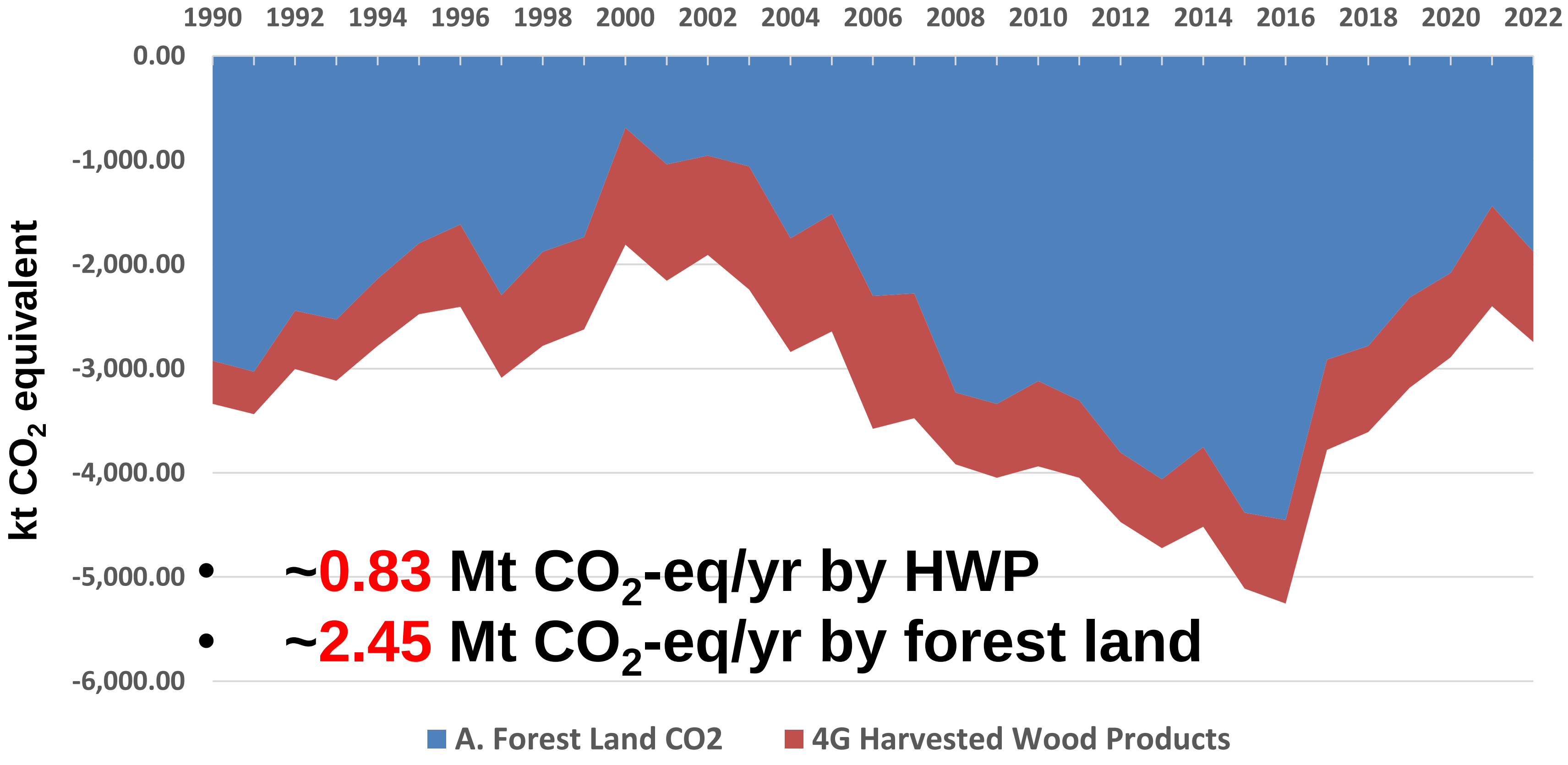
Wood locks away carbon for decades.

Furniture

Wood products extend carbon storage.

Recycling

Reusing wood further prolongs carbon sequestration.



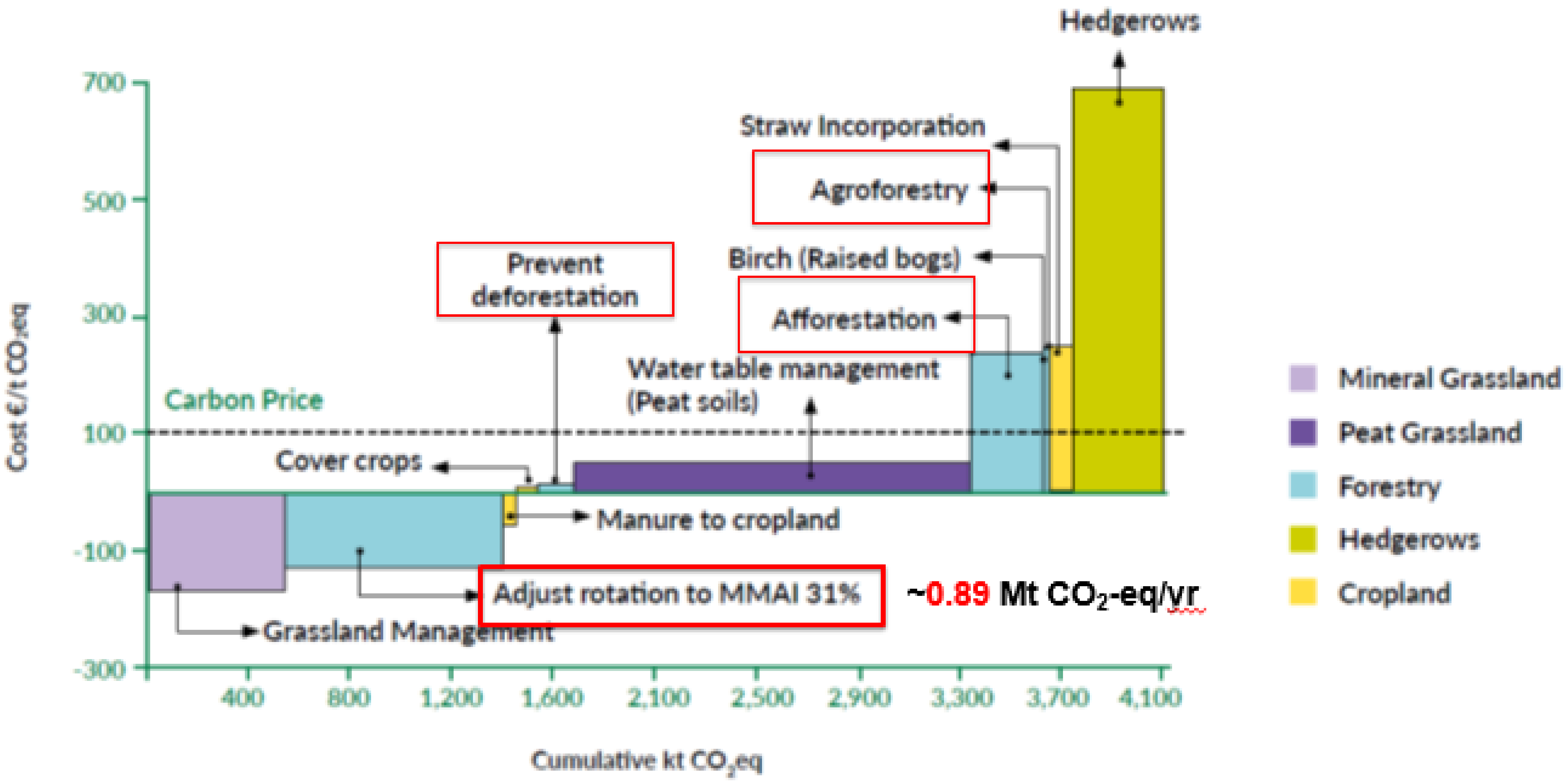
- ~**0.83** Mt CO_2-eq/yr by HWP
- ~**2.45** Mt CO_2-eq/yr by forest land

Source: EPA NIR 2024

Did you know approx. 50% of a tree's dry biomass is carbon?

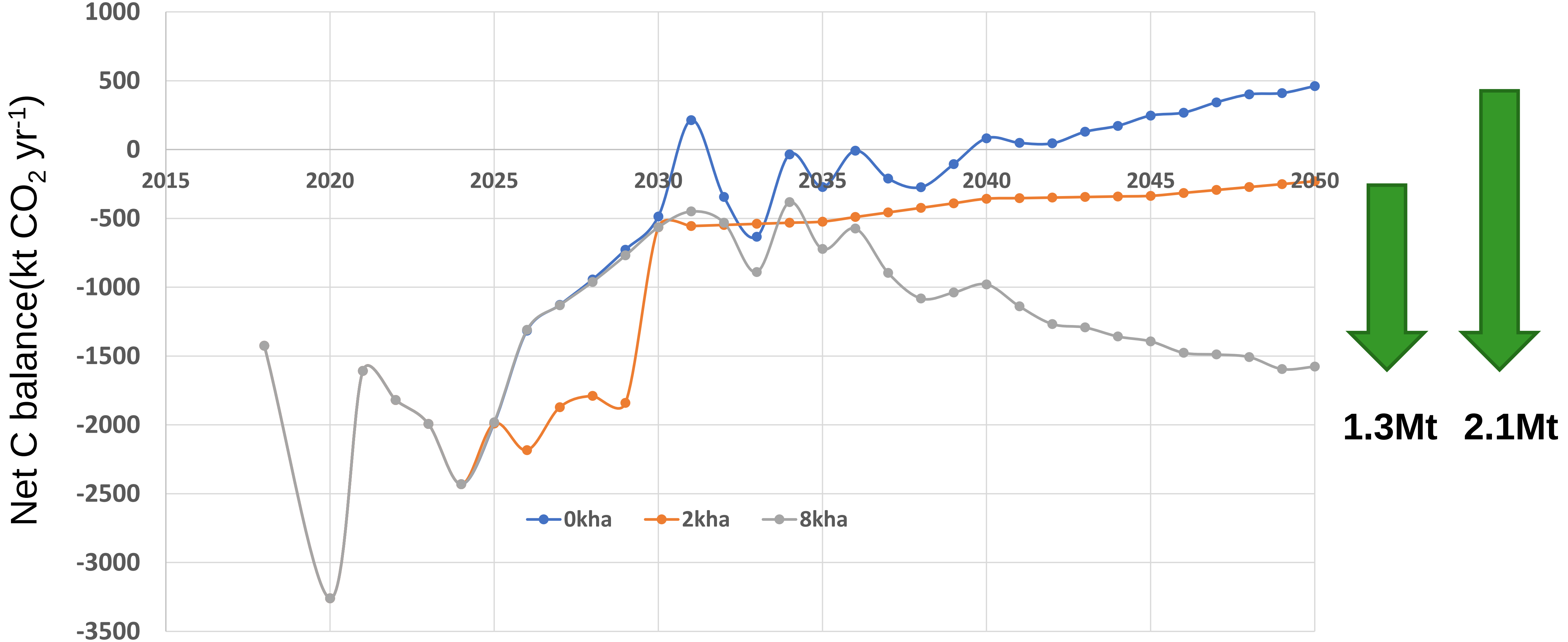
Harvesting trees from the forest to make wood products also creates favourable conditions for the removal of additional carbon dioxide from the atmosphere

Teagasc MACC Analysis to 2030



~0.89 Mt CO_2-eq/yr

Impact of Varying Afforestation Rates Up to 2050

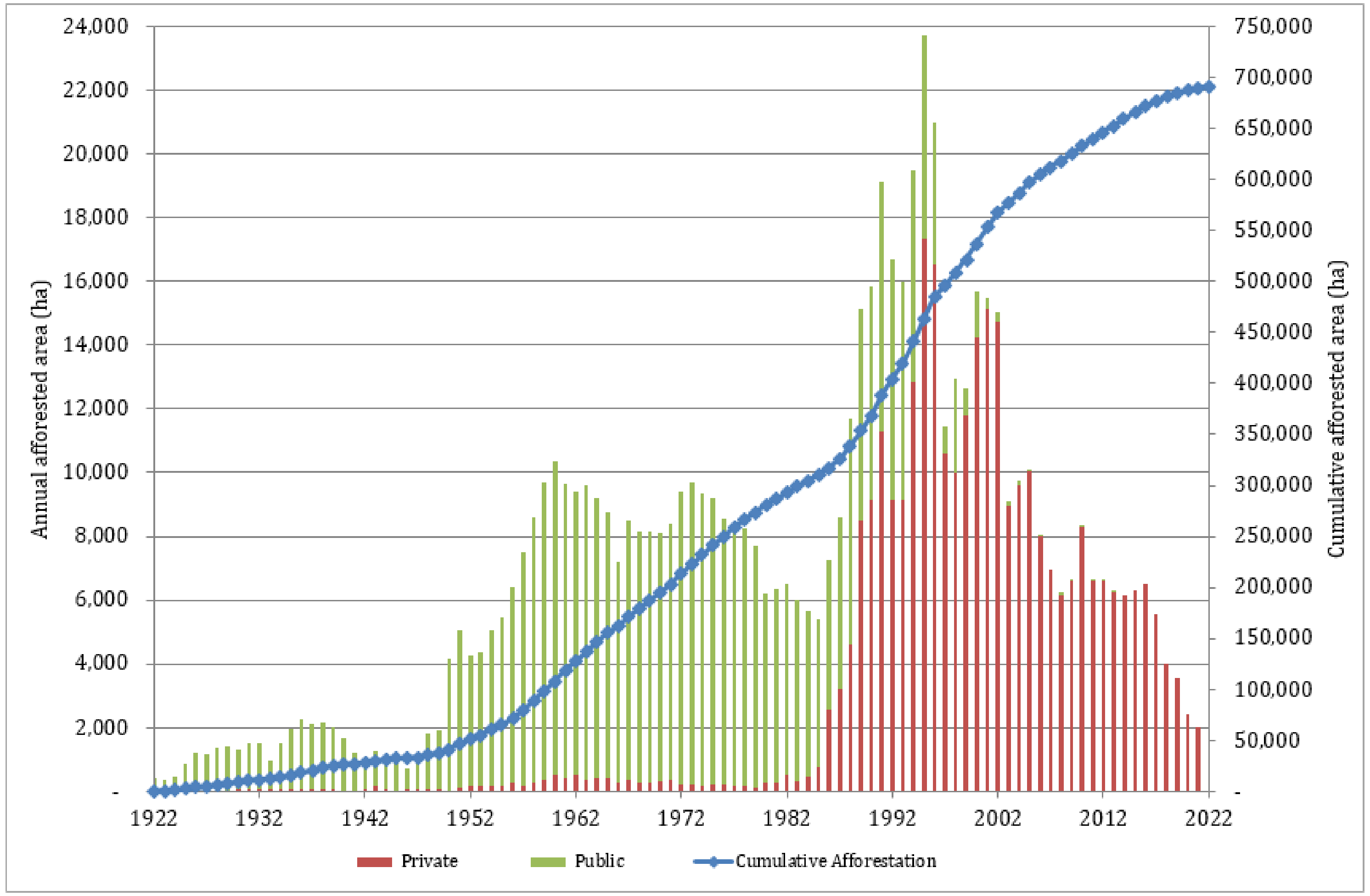


Increasing afforestation to 8000 ha by 2030 and maintaining this rate – (70% conifer 30% broadleaf)
By 2050 the C sink would be 1.3 $MtCO_2$ higher compared to an afforestation rate of 2000 ha per annum
The cumulative extra sequestration from 2024 to 2050 would be over 10 Mt CO_2.

Historical Planting

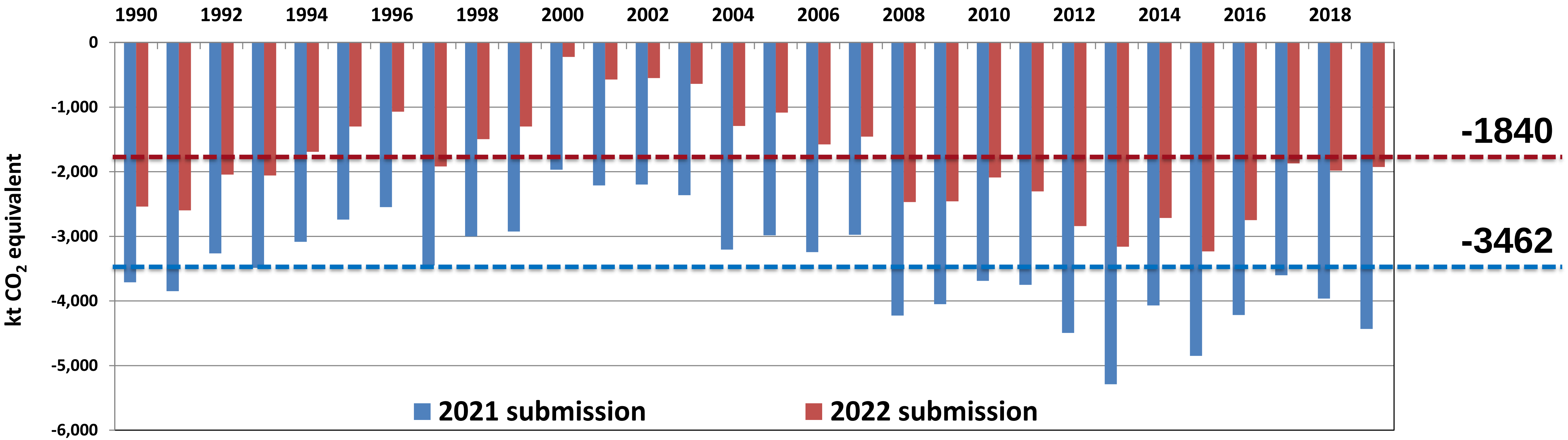
- **Major achievement**
  - Increased forest cover: 1.5% (1920) → 11.6% (2022)
- **Patterns:**
  - Public planting until mid 1990s – mostly on peat soils
  - Private planting increased from early 1990s
- **Challenges:**
  - Planting target: 18%
  - Multiple forest owners: >23,000
  - Low afforestation rates recently

State Planting programmes: Annual Planting



Source: DAFM NFI 2022

Emission factors for drained peats



Source: EPA NIR 2022

- 38% of forests on deep peats (> 40cm depth).
- Updated emission factor of **1.68** tCO_2-C/ha/yr from drained forest peat soils, previous used emission factor of **0.59** tCO_2-C/ha/yr.
- Forest land sequestration reduced by about **50%**.

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Methodologies for Measuring and Monitoring Forest Carbon

1

Remote Sensing

Advanced satellite and aerial imaging techniques analyze forest cover, biomass, and changes over time to quantify carbon stocks.

2

Ground-Based Monitoring

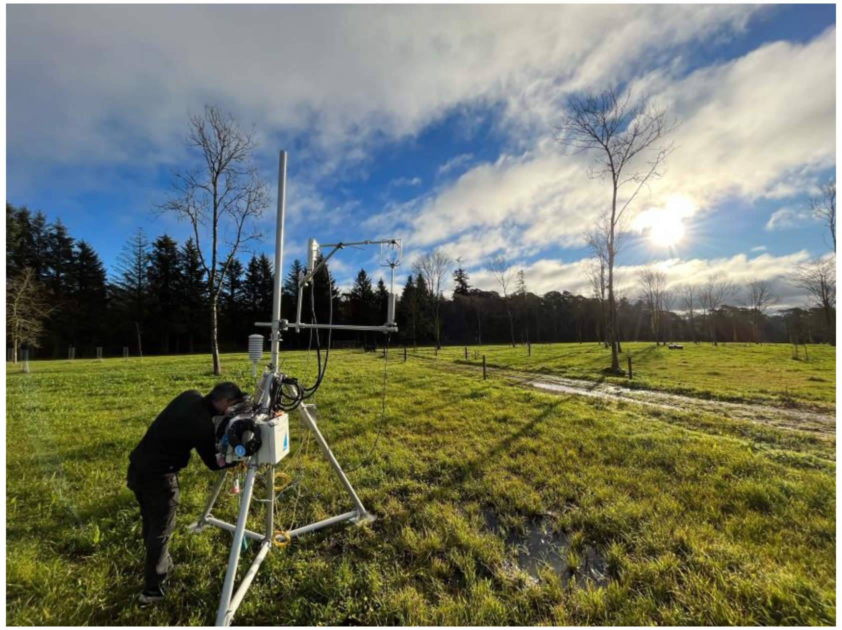
Field surveys and sample plots measure tree size, growth, and other factors to estimate carbon storage in trees, plants, and soil.

3

Inventory Modeling

Sophisticated computer models integrate remote sensing, field data, and other inputs to project forest carbon dynamics at national and regional scales.

Forestry Carbon Monitoring



Agroforestry demonstration plots, Teagasc, Johnstown Castle

Sitka spruce forest (Dooary), UCD, Co. Laois

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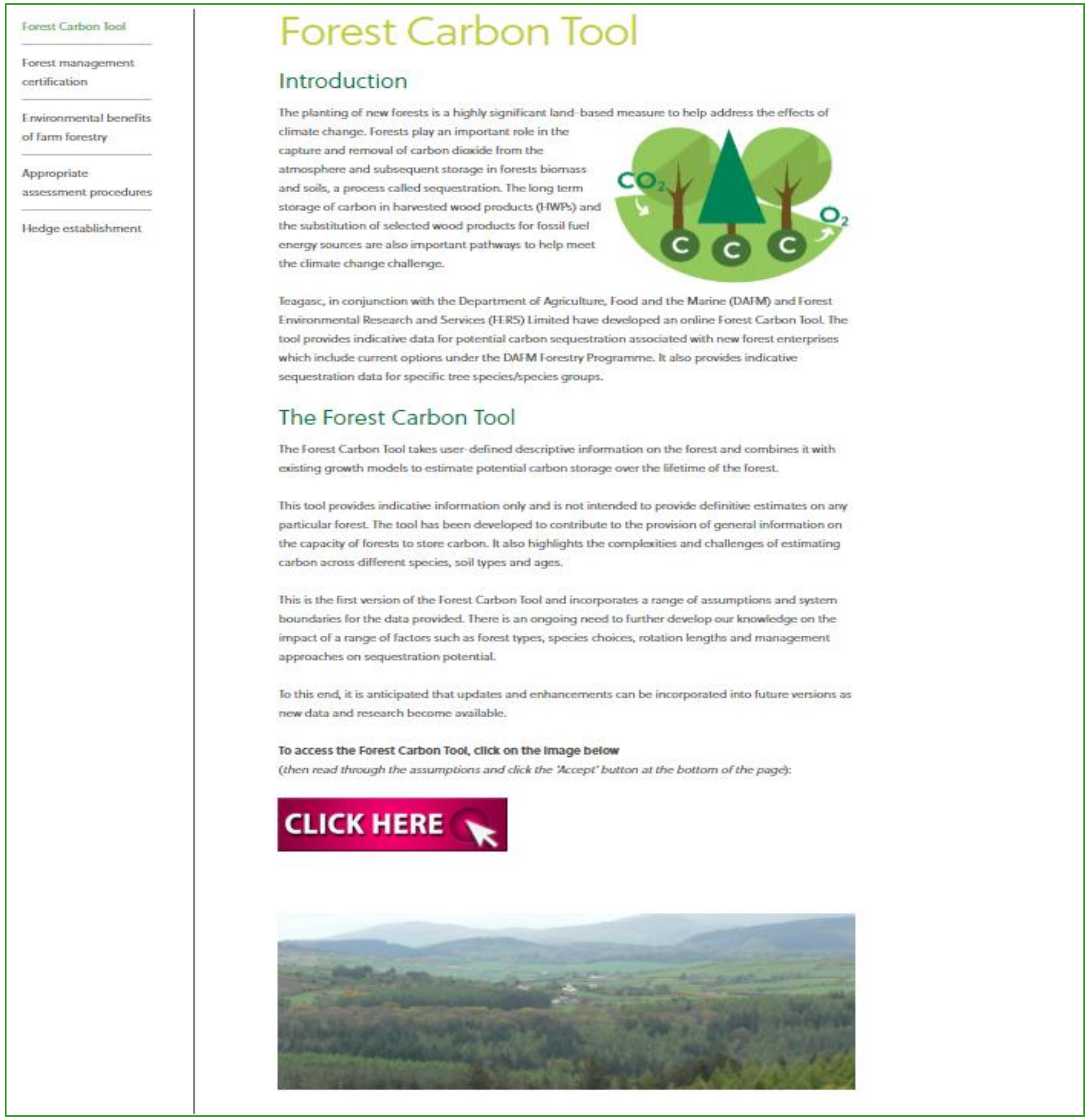
Forest Carbon Tool: www.teagasc.ie/forestcarbontool


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):

CLICK HERE

- **A user-friendly tool**
  - Raise awareness about afforestation's role in climate mitigation
  - Provide up-to-date information on carbon sequestration for various afforestation methods
  - Allow users to compare their effectiveness

What Can Affect the Rate of Carbon Sequestration

- **Forest type**
- **Soil type**
- **Site conditions**
- **Productivity / growth rate**
- **Forest management**

Impact of Forest Types

5.5 – 11+ tCO_2/ha/yr

CAP: ~370 tCO_2/ha
Time: 60 – 100 yrs

Mixed High Forests (FT12)

Fast-growing mainly conifer species with 20% mixture of broadleaf species providing high carbon sequestration rates.

2.5 – 4.5 tCO_2/ha/yr

CAP: ~480 tCO_2/ha
Time: 100 yrs

Native Woodlands (FT1)

Provide biodiversity benefits and moderate carbon sequestration.

1.8 – 4.0 tCO_2/ha/yr

CAP: ~390 tCO_2/ha
Time: 150 – 160 yrs

Other Broadleaf (FT7)

Fast growing broadleaves including birch, alder and sycamore

1.5 – 2.9 tCO_2/ha/yr

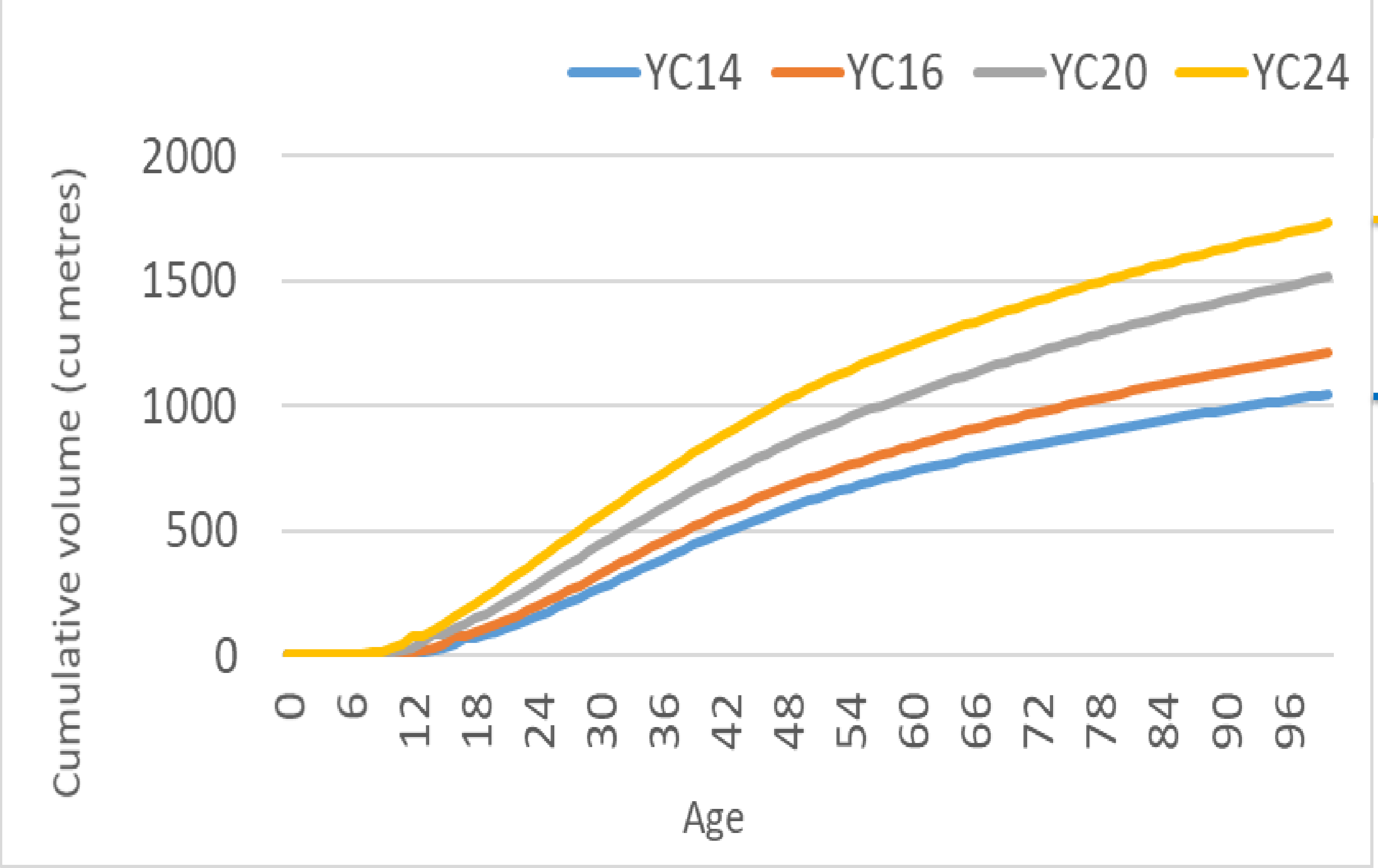
CAP: ~240 tCO_2/ha
Time: 120 – 150 yrs

Agroforestry (FT8)

Combines agriculture and trees on the same land with many co-benefits.

Impact of site conditions

Higher timber yield on better site conditions

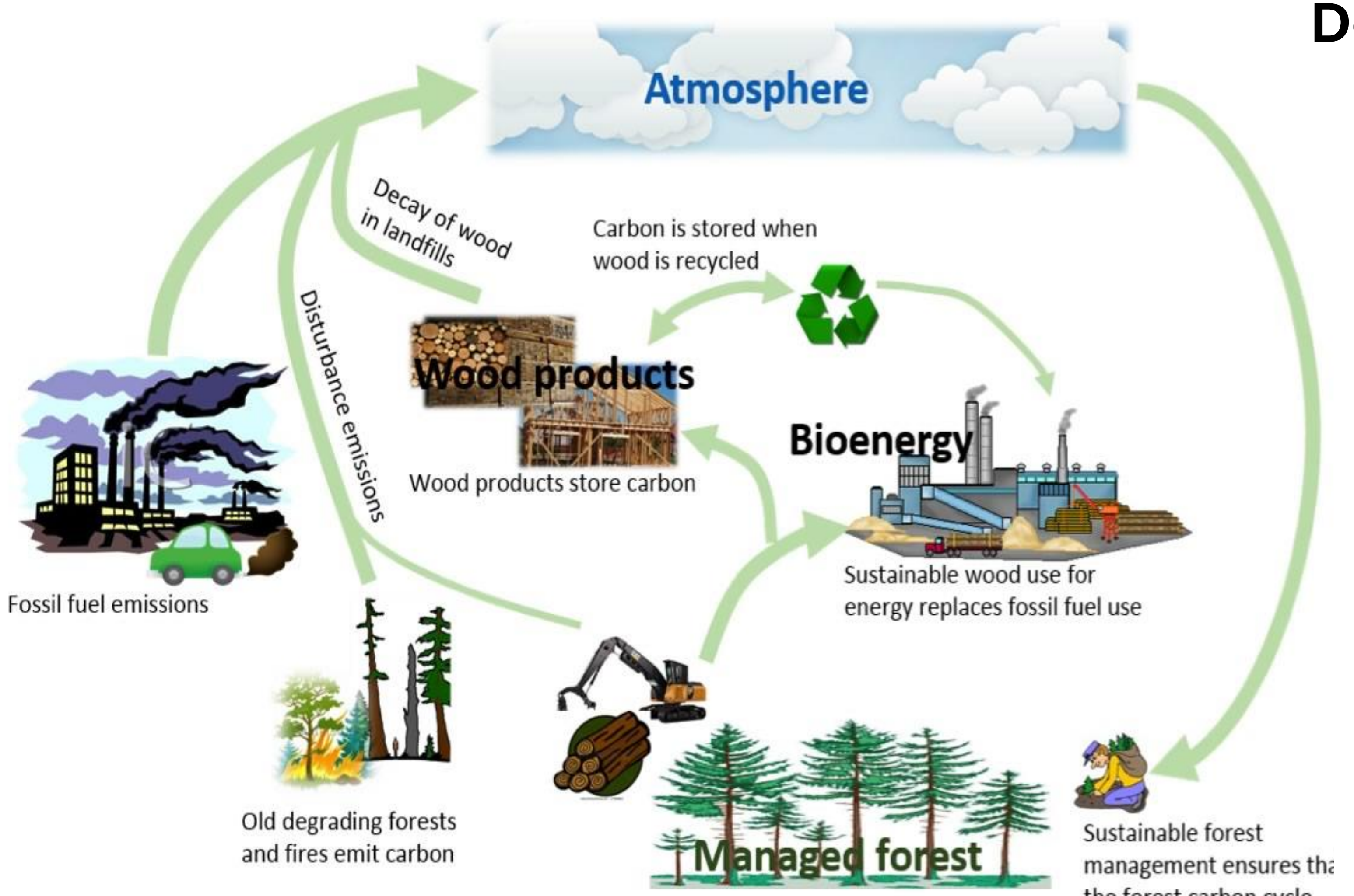


8.3 tCO_2-eq/ha/yr

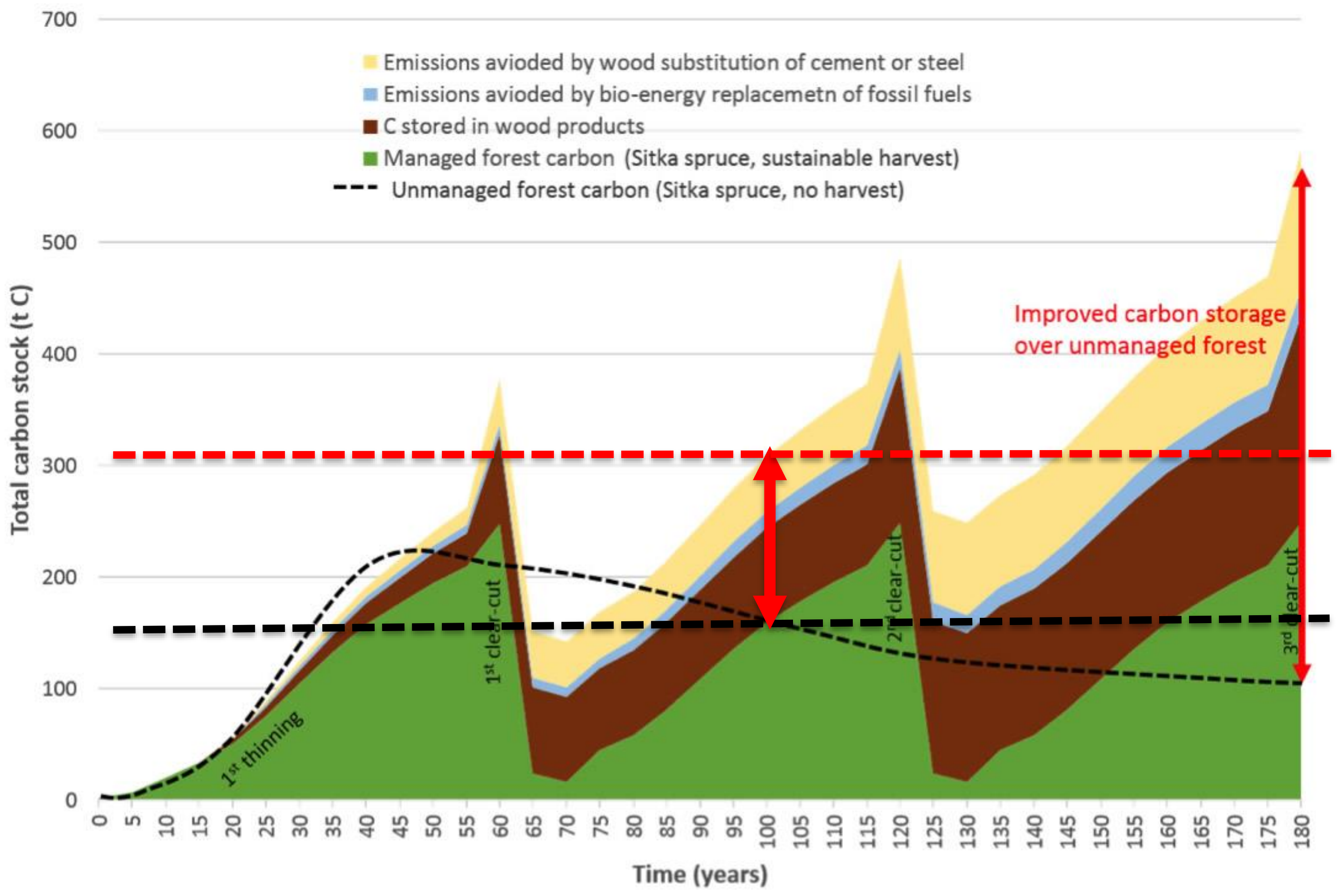
6.6 tCO_2-eq/ha/yr

Sitka spruce Yield Classes (YC)

Impact of Forest Management



Double C stocks for managed forest at 100 years



Adapted from Perez-Garcia et al., 2005

Source: FERS 2024

Key Messages

- Forest creation, appropriate management and use of long lived harvest wood product can significantly contribute to Ireland's carbon emission targets.
- Higher rates of afforestation required to meet climate neutrality targets 2050.
- Need for science based knowledge on forest carbon dynamics.
- Work collaboratively to address identified knowledge gaps.

Forest Management Practices

The effects of different forest management practices (e.g., clear-cutting to continuous cover forest, extended rotations) on carbon sequestration are not fully understood.

The Impact of Natural Disturbances

The impact of natural disturbances and climate change on forests to capture C in the future remains uncertain.

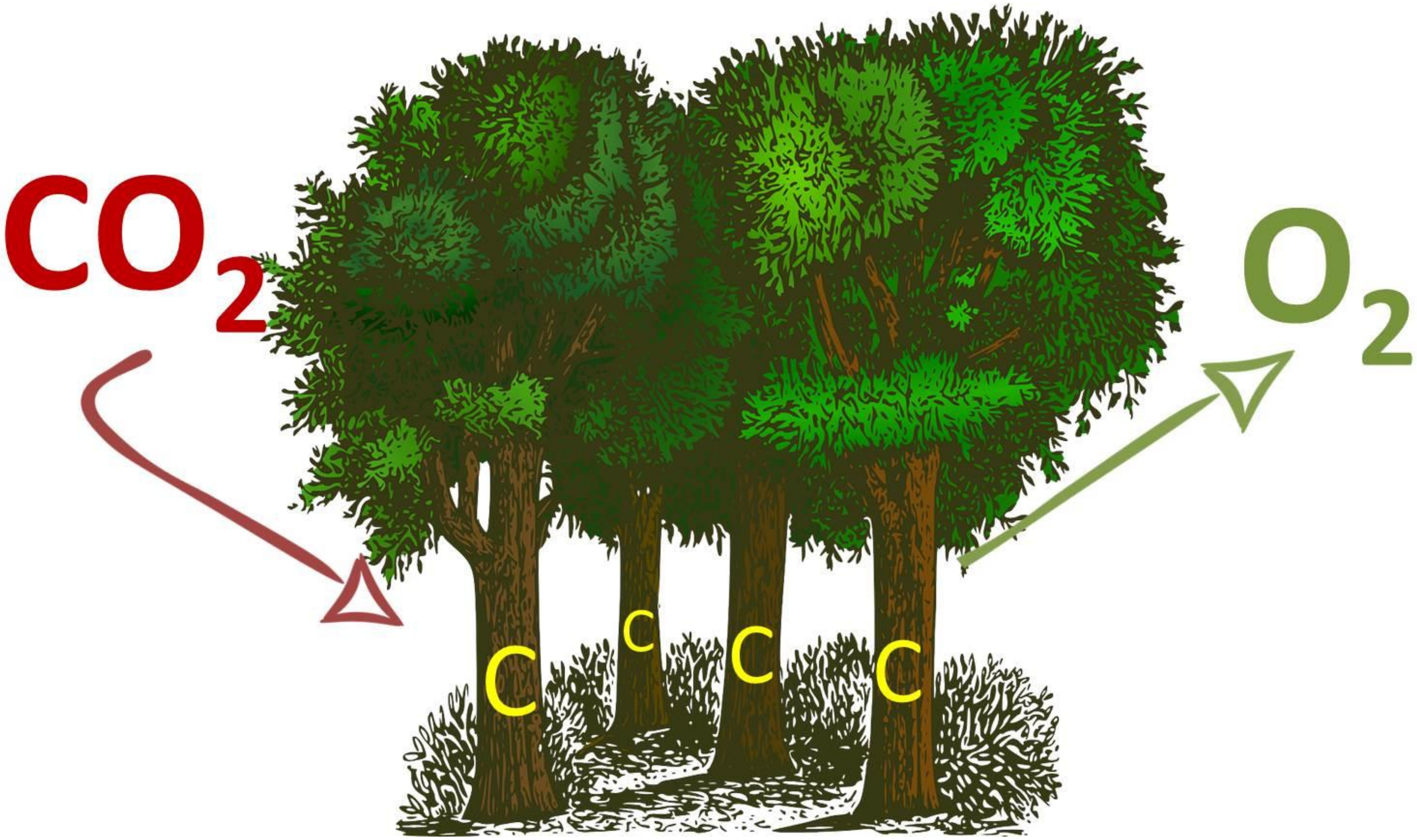
Refine Emissions from Organic Soils

There is a need to refine soil carbon emissions from organic/peat soils, which are significant C pools and can be sources of GHG when disturbed.

Species-Specific Dynamics

Different tree species sequester carbon at different rates and have varying impacts on soil carbon. Detailed studies on species-specific carbon sequestration rates in Ireland are needed.

Thank You for Your Attention!



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