

CLI-MIT

CARBIFOR II**Carbon sequestration by Irish forest ecosystems****PROJECT TEAM**

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BACKGROUND

The overall objective of CARBiFOR II is to provide information for quantifying the influence of disturbance, land use change, soil type and forest age on carbon budgets that are relevant to the Land Use, Land Use Change and Forestry (LULUCF) reporting requirements under the Kyoto Protocol of the Climate Change Convention. The CARBiFOR II project builds directly on the achievements of CARBiFOR, by extending the time span of flux measurements to include an analysis of stand age, as well as the influence of disturbance caused by afforestation and thinning operations. The project will also attempt to characterise changes in biomass, decomposition, CO₂ and non-CO₂ greenhouse gas (GHG) flux associated with different soils and tree species, providing a more comprehensive assessment of the total greenhouse gas budget of Irish forest ecosystems. The project intends to study four chronosequences (a series of sites representing the development of forest plantations):

Chronosequence 1: Sitka spruce growing in a mineral soil;

Chronosequence 2: Sitka spruce growing in a peat soil;

Chronosequence 3: Ash growing in a mineral soil;

Chronosequence 4: Oak growing in a mineral soil.

OBJECTIVES

- Biomass allocation and stock measurements;
- Above- and below-ground coarse-wood decomposition study;

- Using ground penetrating radar to estimate below-ground biomass.
- Measuring the surface exchange of CO₂, H₂O and turbulent energy over several forest age classes using permanent and mobile eddy covariance towers;
- Estimation of C losses associated with thinning, associated vegetation and land use change;
- Measurement of non-CO₂ greenhouse gas emissions associated with land use change and forest stand age;
- Assessment of C stock changes associated with afforestation;
- Project chronosequence soil characterisation and C stocks;
- Soil sampling of national forest inventory plots and chronosequence sites;
- C inputs and parameters for CENW model.

PROGRESS

Sampling has begun and has included both nursery and forest stock assessments. Nursery stock is being sampled to create a baseline or starting point for estimating growth curves and biomass expansion factors (BEFs). The nursery species sampled include alder, ash, Douglas fir, lodgepole pine, oak, Scots pine and Sitka spruce. Alder and larch have also been sampled from 6-year-old forest sites.

To examine the effect of thinning, a final survey at the end of the 2008 growing season will complete a series of surveys covering growth over four years and two thinning events (first and second).



Figure 1: Hemispherical photographs will be used to analyse changes in stand canopy structure before and after thinning events.



Figure 2: CO₂ and trace gas measurements being measured using a photoacoustic analyser on brash lines after the second thinning at Doory (20-year-old stand).

A series of replicated trenched experiments have been set up at the main eddy covariance (EC) site at Doory to examine below-ground decomposition of coarse roots. The results of the first sampling are being analysed. Sampling of coarse wood debris (CWD) has also begun. Respiration measurements from brash have begun and will encompass a period before and after the second thinning at Doory.

EC measurements are being made over a range of forest age classes, and a semi-natural grassland (prior to afforestation), through to a 20-year-old stand. The permanent tower is located at a 20-year-old stand and has been operational since 2003; this site has also undergone two thinning events. A mobile EC tower is being used to investigate both the impact of land use change and forest age on carbon fluxes. The mobile tower moves on a weekly basis between a semi-natural grassland, and a 6- and 14-year-old Sitka spruce stand.

In association with the EC flux towers, measurements of soil respiration and non-CO₂ greenhouse gas fluxes (methane and nitrous oxide) are being made using static chambers at the chronosequence sites.

Litter inputs, litter decomposition and fine root turnover are being measured.

The definitive selection of sites will be ongoing as it requires site visits to ensure the availability of appropriate paired plots. Where sites have not been appropriate, backup sites were selected from a reserve list. Initially the sampling of mineral and peaty mineral soils was prioritised over peat soils until a detailed sampling protocol was agreed with University College Cork in December (2008). Peat sampling equipment has been purchased in conjunction with University College Cork with a view to sharing this equipment for analyses in the coming months.

ACTIVITIES PLANNED

- Complete identification of chronosequences 2-4;
- Sampling of above- and below-ground CWD decomposition;
- Resurvey of the thinning experiment (following the second thinning);

- Continue litter collection, biomass surveys and sampling, and brash respiration measurements;
- Continue roving the mobile EC tower between all chronosequence 1 sites at Doory forest;
- Continuous soil respiration and canopy profile CO₂ measurements;
- Decomposition, litterfall and fine root turnover experiments will be continued;
- Continue measurements of N₂O and CH₄;
- Continuation of NFI paired plot sampling and processing;
- Commencement of analysis of samples.

OUTPUTS

Meetings/conference attendance:

Olajuyigbe, S., Gardiner, P., Tobin, B. and Nieuwenhuis, M. 2008. *Stump survival in commercial plantations in Ireland*. Poster presented at COST Action E38, Woody roots and Ecosystem services, 16 to 20 May 2008, Lisbon, Portugal.

COFORD Conference on Proceedings of Site Classification in Ireland, June 2008, Tullamore: Participation in the presentation on CLIMADAPT.

Tene, A., Tobin, B., Black, K., Ray, D., and Nieuwenhuis, M. 2008. *Adaptation of forest species to climate change*. Poster presented at Dendro-ecology fieldweek, Birmensdorf Switzerland, 14 to 20 September 2008.

IMECC Annual Meeting, 3-5 March 2008, Jena, Germany.

Irish Plant Scientists Meeting, 26-28 March 2008, NUI Maynooth. Oral presentation.

COST Action 639, Greenhouse gas budget of soils under changing climate and land use (BurnOut), 27-29 April 2008, Rostock, Germany. Poster Presentation.

EPSO (European Plant Science Organisation) meeting, 22 – 26 June 2008, Toulon, France. Invited speaker.

Trends in Plant Ecophysiology and Ecosystem Ecology Research conference, 23 – 27 June 2008, Palermo, Italy. Poster Presentation.

CarboEurope-IP Trace gas chamber calibration workshop, 21-28 September 2008, University of Helsinki, Forestry Research Station, Hyttiala, Finland.

6th Annual CarboEurope-IP Project Meeting, 29 September – 3 October 2008, Jena, Germany. Oral and poster presentation.

1st Expert Meeting on Data for the IPCC Database on Greenhouse Gas Emission Factors. 17-19 November 2008, Buenos Aires, Argentina.

Tene, A., Tobin, B., Black, K., Ray, D. and Nieuwenhuis, M. 2008. *Adaptation of forest species to climate change*. Poster presentation at the Nancy 2008 International Scientific Conference. The European Forest-Based Sector: Bio-Responses to Address New Climate and Energy Challenges? 6-8 November 2008, Nancy, France.