

PeAtland properties inflUencing greenhouse Gas Emissions and Removals AUGER Project

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The EPA-funded AUGER project (2016-2019) aims at identifying the major drivers of peatland degradation in Ireland while investigating the characteristics of peatlands under various land uses and assessing the impact of management options on the C stock and greenhouse gas (GHG) dynamics of these ecosystems. Data from a nationwide survey will form the basis for a comparative multivariate assessment of a range of edaphic and hydro-ecological parameters. Within the project we use the ECOSSE model to assess the potential C-loss of the different peatland-land use combinations, and to compare the impact of management on carbon dynamics of land use on peatland in the Republic of Ireland.

Background

Peatlands constitute around 20% of the land area of the Republic of Ireland and bare significant benefits and potentials in the form of several important ecosystem services. However they are prone to fast degradation when made available for other land use. The climate footprint of peatlands has been found to be strongly dependent on their management (Wilson et al., 2016a and 2016b; Renou-Wilson et al., 2016). The sustainable management of Ireland's peat soils is an environmental challenge but represent a significant opportunity as these soils can be managed to their strengths to benefit the society at large.

Objectives, outputs and components

- A database of field observations (C and N, Bulk density, peat depth, pH and nutrients) from representative peatland types, as a basis for a robust and representative national peatland database
- Further development of GHG-modeling capacities to assess the response of peatlands to changes in management and climate on a national scale
- Identification of a suitable model for estimation of the impact of anthropogenic interventions on peatlands
- Establishment of a long-term GHG monitoring site (with high resolution eco-hydrological monitoring) on drained and rewetted peatland sites
- Review for recommendations for further development of monitoring sites throughout Ireland
- Stakeholder engagement and workshop on measurement, monitoring and modeling of peatlands in Ireland

Methodological framework & methods

Peatland Survey

Integrate soil and vegetation data from previous national peatland research Soil, vegetation and ecohydrological characteristics of most prevalent peatland site types in Ireland

Site type = Peatland Category + Land Use Category + specific management

Database with soil, vegetation, ecohydrology and GHG measurement data of different site types

Multistage design-based approach:

- ➢ Stratification of site types with number of sampling locations per site type proportional to total site type area → 13 site types for three peatland categories:
- Most important site types are Domestic extraction, Grassland & Forestry on Raised bog, Lowland Atlantic Blanket Bog and Mountainous Blanket Bog;

Empirical relationships

Data exploration & empirical models:

- A data exploratory approach helps to assess how soil, vegetation and eco-hydrological properties relate to each other (PCA, CCA);
- Identification of vertical profile-based relationships to inform the mapping of site types, similar to site typespecific pedo-transfer and carbon depth- distribution functions.

Simulation outputs expected to allow climate and management impact evaluation of land use on peatlands; Improved GHG modeling capacity of Irish EPA for tier 3 National Inventory Reporting

Knowledge about vertical distributions of soil parameters and empirical models to be used in followup spatial mapping and process-based modelling

C-modelling ECOSSE

Process-based modeling (ECOSSE) of carbon stock changes and GHG-emissions of site types

- > Uncertainty analysis and comparison of current ECOSSE model (Smith et al., 2010a and 2010b) with existing soil and GHG datasets
- Sensitivity analysis and development of ECOSSE model for testing suitability to predict carbon stock changes and GHG-emission simulation of Irish peat-soil responses;
- Water table monitoring of selected sites and data retrieved in the survey are used to model potential GHG emissions (CO₂, CH₄) of different site types, allowing the assessment of climate impacts of land use systems on peatlands in Ireland;
- > Simulation of a change of management (e.g. rewetting) of different land use categories (i.e. site types) and associated GHG emissions.

Wilson, D. et al. (2016a) Multi-year greenhouse gas balances at a rewetted temperate peatland. Global Change Biology 22, 4080-4095. Wilson, D. et al. (2016b) Greenhouse gas emission factors associated with rewetting of organic soils. Mires and Peat 17, Article 04, 01–28. Renou-Wilson, F. et al. (2016) To graze or not to graze? Four years GHG balances and vegetation composition from a drained and a rewetted organic soil under grassland. Agriculture, Ecosystem and the Environment 222, 156-170.

Smith, J. et al. (2010a) Estimating changes in Scottish soil carbon stocks using ECOSSE. I. Model description and uncertainties. Climate Research 45, 179-192.

Smith, J. et al (2010b) Estimating changes in Scottish soil carbon stocks using ECOSSE. II. Application. Climate Research 45, 193-205.

