

EPA-Funded Research: Climate Change

Reports from completed projects are available on the EPA website at www.epa.ie/downloads/pubs/research/climate/

During the ERTDI Programme 2000-2006, 33 research projects were funded in the area of Climate Change, including:

- 4 Capability development projects
- 1 Centre of Excellence
- 1 Contributory scholarship
- 5 Doctorate projects
- 10 Fellowship projects
- 10 Large-scale studies
- 2 Small-scale studies

33 Total projects

33 EPA (2000 – 2006) Projects indexed by

Year and Content

Lead Organisation

Project Leader

Year and Content:

- 2000-LS-5.1.1.-M1 [Greenhouse Gas Emissions and Climate Change - Methane and Nitrous Oxide Emission Factors](#)
- 2000-LS-5.1.2a-M1 [Greenhouse Gas Emissions and Climate Change - Impact of Land Use and Land-Use Change on Carbon Emission/Fixation](#)
- 2000-LS-5.1.2b-M1 [Greenhouse Gas Emissions and Climate Change - Modelling Carbon Fluxes from Irish Peatlands, Based on Extending PORTACH and PEATSAT Including the Development of a National Carbon Fluxes Inventory for Irish Peatlands](#)
- 2000-LS-5.1.3a-M1 [Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆](#)
- 2000-LS-5.1.3b-M1 [Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆](#)
- 2000-LS-5.2.1-M1 [Greenhouse Gas Emissions and Climate Change - Assessment of the Impacts of Climate Change in Ireland](#)
- 2000-LS-5.2.2-M1 [Greenhouse Gas Emissions and Climate Change - Establishment of Indicators of Climate Change in Ireland](#)
- 2000-LS-5.3.1a-M1 [Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species](#)
- 2000-LS-5.3.1b-M1 [Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species](#)

- 2000-LS-5.3.2-M1 [Greenhouse Gas Emissions and Climate Change - Study of the Composition, Sources and Radioactive Properties of Aerosols at a West Coast Location](#)
- 2001-CD-C1-M1 [Accounting for Greenhouse Gas Sources and Sinks in Major Irish Land-Use Categories: Establishment of a Co-ordinating Centre for FLUX Measurements \(CCFLUX\).](#)
- 2001-CD-C2-M1 [CELTICFLUX - Measurement and Modelling of GHG Fluxes from Grasslands, Forests and Peatlands in Ireland.](#)
- 2001-CD-C3-M1 [Climate Change in Ireland: Refining the Impacts](#)
- 2001-CD-C4-M2 [Community Climate Change Consortium for Ireland \(C41\)](#)
- 2001-CS-8-M1 [Detection of Climate Change in Ireland](#)
- 2001-PHD-1-M2 [Assessing the Applicability of an Emissions Trading Regime in a Small Open Economy](#)
- 2002-CC-FS3-M4 [Climate Change Data Management](#)
- 2002-PHD2-14 [Long-term Environmental Change in Lower Lough Corrib and its Catchment: a Multidisciplinary Palaeoecological Study](#)
- 2002-PHD2-46 [Greenhouse Gas Fluxes in Blanket Peatland](#)
- 2002-PHD2-47 [Modelling of N₂O Fluxes from Grasslands and CH₄ Fluxes from a Blanket Peatland](#)
- 2002-PHD-51 [Climate Change and Health in Ireland: A National Vulnerability Assessment](#)
- 2003-FS-CD-LS-12 [Study of the Composition, Sources and Radiative Properties of Aerosols at a West Coast Location.](#)
- 2003-FS-CD-LS-13 [Climate Change: Refining the Impacts](#)
- 2003-FS-CD-LS-15 [Accounting for Greenhouse Gas Sources and Sinks in Major Irish Land-use Categories: Contributing to a Coordinating Centre for FLUX Measurements \(CCFLUX\)](#)
- 2003-FS-CD-LS-16 [Modelling Carbon Fluxes from Irish Peatlands Based on Extending PORTACH and PEATSAT Including the Development of a National Carbon Fluxes Inventory for Irish Peatlands](#)
- 2003-FS-CD-LS-17 [CELTICFLUX - Measurement and Modelling of GHGs from Grasslands and Peatland](#)
- 2004-CoE-MS-25-M [Climate Change - Developing National Understanding](#)
- 2005-FS-29-M1 [Elucidating the Impact of Aerosols on Cloud Physics and the North Atlantic Regional Climate \(EIRE-Climate\)](#)
- 2005-FS-33-M1 [Coping with Uncertainties in Climate Modelling for Ireland](#)

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- 2005-FS-GC-27-M4 [Global Climate Change Observing System \(GCOS\), Hydrological, Terrestrial and Related Activities](#)
- 2006-FS-GO36-M4 [GEO Fellowship](#)
- 2006-SS-46-M1 [The Simile Modelling Framework - Modelling of Nitrous Oxide Emissions from Irish Agriculture](#)
- 2006-SS-58 [Analysis and Interpretation of Historical Sea Surface Temperatures in Irish Coastal Waters](#)

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Lead Organisation:

Athlone Institute of Technology

2002-CC-FS3-M4 [Climate Change Data Management](#)

2006-FS-GO37-M4 [GEO Fellowship](#)

Clean Technology Centre

2000-LS-5.1.3a-M1 [Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆](#)

Marine Institute

2006-SS-58 [Analysis and Interpretation of Historical Sea Surface Temperatures in Irish Coastal Waters](#)

Met Éireann

2001-CD-C4-M2 [Community Climate Change Consortium for Ireland \(C41\)](#)

NUI Galway

2000-LS-5.3.1a-M1 [Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species](#)

2000-LS-5.3.1b-M1 [Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species](#)

2000-LS-5.3.2-M1 [Greenhouse Gas Emissions and Climate Change - Study of the Composition, Sources and Radioactive Properties of Aerosols at a West Coast Location](#)

2002-PHD2-14 [Long-term Environmental Change in Lower Lough Corrib and its Catchment: a Multidisciplinary Palaeoecological Study](#)

2003-FS-CD-LS-12 [Study of the Composition, Sources and Radiative Properties of Aerosols at a West Coast Location.](#)

2005-FS-29-M1 [Elucidating the Impact of Aerosols on Cloud Physics and the North Atlantic Regional Climate \(EIRE-Climate\)](#)

NUI Maynooth

2000-LS-5.2.1-M1 [Greenhouse Gas Emissions and Climate Change - Assessment of the Impacts of Climate Change in Ireland](#)

2000-LS-5.2.2-M1 [Greenhouse Gas Emissions and Climate Change - Establishment of Indicators of Climate Change in Ireland](#)

2001-CD-C3-M1 [Climate Change in Ireland: Refining the Impacts](#)

2001-CS-8-M1 [Detection of Climate Change in Ireland](#)

NUI Maynooth (continued)

- 2002-PHD-51 [Climate Change and Health in Ireland: A National Vulnerability Assessment](#)
- 2003-FS-CD-LS-13 [Climate Change: Refining the Impacts](#)
- 2004-CoE-MS-25-M [Climate Change - Developing National Understanding](#)
- 2005-FS-33-M1 [Coping with Uncertainties in Climate Modelling for Ireland](#)

Queen's University, Belfast

- 2000-LS-5.1.2a-M1 [Greenhouse Gas Emissions and Climate Change - Impact of Land Use and Land-Use Change on Carbon Emission/Fixation](#)

Teagasc

- 2006-SS-46-M1 [The Simile Modelling Framework - Modelling of Nitrous Oxide Emissions from Irish Agriculture](#)

Trinity College Dublin

- 2001-CD-C1-M1 [Accounting for Greenhouse Gas Sources and Sinks in Major Irish Land-Use Categories: Establishment of a Co-ordinating Centre for FLUX Measurements \(CCFLUX\).](#)
- 2003-FS-CD-LS-15 [Accounting for greenhouse gas sources and sinks in major Irish land-use categories: contributing to a coordinating centre for FLUX measurements \(CCFLUX\)](#)

University College Cork

- 2001-CD-C2-M1 [CELTICFLUX - Measurement and Modelling of GHG Fluxes from Grasslands, Forests and Peatlands in Ireland.](#)
- 2002-PHD2-46 [Greenhouse Gas Fluxes in Blanket Peatland](#)
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- 2003-FS-CD-LS-17 [CELTICFLUX - Measurement and Modelling of GHGs from Grasslands and Peatland](#)
- 2005-FS-GC-27-M4 [Global Climate Change Observing System \(GCOS\), Hydrological, Terrestrial and Related Activities](#)

University College Dublin

- 2000-LS-5.1.1-M1 [Greenhouse Gas Emissions and Climate Change - Methane and Nitrous Oxide Emission Factors](#)
- 2000-LS-5.1.2b-M1 [Greenhouse Gas Emissions and Climate Change - Modelling Carbon Fluxes from Irish Peatlands, Based on Extending PORTACH and PEATSAT including the Development of a National Carbon Fluxes Inventory for Irish Peatlands](#)

University College Dublin (continued)

2001-PHD-1-M2 [Assessing the Applicability of an Emissions Trading Regime in a Small Open Economy](#)

2003-FS-CD-LS-16 [Modelling Carbon Fluxes from Irish Peatlands Based on Extending PORTACH and PEATSAT Including the Development of a National Carbon Fluxes Inventory for Irish Peatlands](#)

University of Bristol

2000-LS-5.1.3b-M1 [Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆](#)

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Project Leader

Convery, Prof. Frank

2001-PHD-1-M2 [Assessing the Applicability of an Emissions Trading Regime in a Small Open Economy](#)

Cunningham, Mr Dermot

2000-LS-5.1.3a-M1 [Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆](#)

Dwyer, Dr Ned

2005-FS-GC-27-M4 [Global Climate Change Observing System \(GCOS\), Hydrological, Terrestrial and Related Activities](#)

Fealy, Dr Rowan

2005-FS-33-M1 [Coping with Uncertainties in Climate Modelling for Ireland](#)

Flanagan, Dr Robert J

2005-FS-29-M1 [Elucidating the Impact of Aerosols on Cloud Physics and the North Atlantic Regional Climate \(EIRE-Climate\)](#)

Hyde, Dr Bernard

2006-SS-46-M1 [The Simile Modelling Framework - Modelling of Nitrous Oxide Emissions from Irish Agriculture](#)

Jennings, Prof. S Gerard

2000-LS-5.3.1a-M1 [Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species](#)

2000-LS-5.3.2-M1 [Greenhouse Gas Emissions and Climate Change - Study of the Composition, Sources and Radioactive Properties of Aerosols at a West Coast Location](#)

2003-FS-CD-LS-12 [Study of the Composition, Sources and Radiative Properties of Aerosols at a West Coast Location.](#)

Jones, Prof. Michael

2001-CD-C1-M1 [Accounting for Greenhouse Gas Sources and Sinks in Major Irish Land-Use Categories: Establishment of a Coordinating Centre for FLUX Measurements \(CCFLUX\).](#)

2003-FS-CD-LS-15 [Accounting for Greenhouse Gas Sources and Sinks in Major Irish Land-Use Categories: Contributing to a Coordinating Centre for FLUX Measurements \(CCFLUX\)](#)

Kelly, Dr Brendan

2002-CC-FS3-M4 [Climate Change Data Management](#)

Kiely, Prof. Gerard

2001-CD-C2-M1 [CELTICFLUX - Measurement and Modelling of GHG Fluxes from Grasslands, Forests and Peatlands in Ireland.](#)

2002-PHD2-46 [Greenhouse Gas Fluxes in Blanket Peatland](#)

2002-PHD2-47 [Modelling of N₂O fluxes from Grasslands and CH₄ Fluxes from a Blanket Peatland](#)

2003-FS-CD-LS-17 [CELTICFLUX - Measurement and Modelling of GHGs from Grasslands and Peatland](#)

McElwain, Ms Laura

2001-CS-8-M1 [Detection of Climate Change in Ireland](#)

McGrath, Dr Ray

2001-CD-C4-M2 [Community Climate Change Consortium for Ireland \(C41\)](#)

Nøklegaard, Ms Tone T

2006-SS-58 [Analysis and Interpretation of Historical Sea Surface Temperatures in Irish Coastal Waters](#)

O'Connell, Prof. Michael

2002-PHD2-14 [Long-term Environmental Change in Lower Lough Corrib and its Catchment: A Multidisciplinary Palaeoecological Study](#)

O'Doherty, Dr Simon

2000-LS-5.1.3b-M1 [Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆](#)

O'Mara, Dr Frank

2000-LS-5.1.1-M1 [Greenhouse Gas Emissions and Climate Change - Methane and Nitrous Oxide Emission Factors](#)

Roddy, Dr. Aodhagan

2000-LS-5.3.1b-M1 [Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species](#)

Sweeney, Dr John

2000-LS-5.2.1-M1 [Greenhouse Gas Emissions and Climate Change - Assessment of the Impacts of Climate Change in Ireland](#)

2000-LS-5.2.2-M1 [Greenhouse Gas Emissions and Climate Change - Establishment of Indicators of Climate Change in Ireland](#)

2001-CD-C3-M1 [Climate Change in Ireland: Refining the Impacts](#)

2002-PHD-51 [Climate Change and Health in Ireland: A National Vulnerability Assessment](#)

Sweeney, Dr John (continued)

2003-FS-CD-LS-13 [Climate Change: Refining the Impacts](#)

2004-CoE-MS-25-M [Climate Change - Developing National Understanding](#)

Tomkins, Dr Paul

2006-FS-GO37-M4 [GEO Fellowship](#)

Tomlinson, Dr Roy

2000-LS-5.1.2a-M1 [Greenhouse Gas Emissions and Climate Change - Impact of Land Use and Land-Use Change on Carbon Emission/Fixation](#)

Ward, Prof. Shane

2000-LS-5.1.2b-M1 [Greenhouse Gas Emissions and Climate Change - Modelling Carbon Fluxes from Irish Peatlands, Based on Extending PORTACH and PEATSAT Including the Development of a National Carbon Fluxes Inventory for Irish Peatlands](#)

2003-FS-CD-LS-16 [Modelling Carbon Fluxes from Irish Peatlands Based on Extending PORTACH and PEATSAT Including the Development of a National Carbon Fluxes Inventory for Irish Peatlands](#)

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - Methane and Nitrous Oxide Emission Factors (2000-LS-5.1.1-M1)

LEAD ORGANISATION

University College Dublin

01/11/2000

STATUS

Completed (ERTDI Reports 46 & 56)

CONTACT

Dr Frank O'Mara

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

644,841.56

START DATE

PROJECT DESCRIPTION

Estimates of greenhouse gas emissions from Irish agriculture amounted to 32% of national emissions in 1998. The main sources of the agricultural emissions are enteric fermentation (50%), agricultural soils (35%) and manure management (11%). The main gases involved are methane and nitrous oxide (58 and 38% of total emissions, respectively). The methane originates mostly from enteric fermentation in ruminants, while the nitrous oxide originates mostly from agricultural soils. The national inventory for methane from enteric fermentation is calculated using animal numbers and emission factors for the quantity of methane produced per animal per year. Currently international default emission factors published by the Intergovernmental Panel on Climate Change (IPCC, 1996) are used, as no specific national information is available. Emission rates are affected by diet and thus, the use of the IPCC default values can result in errors in Ireland's inventory.

A first objective of this research project is to establish more precise emission factors for enteric fermentation of Irish ruminants. A national farm survey will be carried out to establish the diets of farm animals and waste management practices. These data will be used to establish an improved inventory of annual emissions rates for the national herd.

A second objective of the project is to evaluate the range of measures that might be used to reduce emissions per animal. For example, the effectiveness of strategic use of concentrate feedstuffs, type of oil added to the diet, and the addition of substances such as fumaric acid to the diet will be investigated. Nitrous oxide emissions arise naturally from soils and from the application of inorganic and organic nitrogen. Some European studies have shown that grassland has higher emissions per unit of nitrogen fertiliser added than arable land. The few measurements made of nitrous oxide emissions from Irish grazed pasture showed increases in nitrous oxide emissions as nitrogen fertiliser inputs increase. As grassland soils account for over 90% of land use in Ireland, they are an important contributor to Ireland's nitrous oxide inventory. The inventory calculation is based on factors published by IPCC (1996) that again may not accurately reflect the actual situation in Ireland.

A third objective of the project is to provide more precise data on nitrous oxide emissions from grazed grassland with particular emphasis on the effect of nitrogen fertiliser inputs. The IPCC defaults values will then be evaluated in the light of data

generated. In conclusion, this project will provide more accurate inventories of a significant proportion of Ireland's greenhouse gas emissions, and will investigate strategies for reducing the quantities of these gases emitted.

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - Impact of Land Use and Land-Use Change on Carbon Emission/Fixation (2000-LS-5.1.2a-M1)

LEAD ORGANISATION

Queen's University Belfast

START DATE

01/11/2000

CONTACT

Dr Roy Tomlinson

STATUS

Completed (**ERTDI Report 47**)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

153,954.47

PROJECT DESCRIPTION

Understanding greenhouse gas emissions from anthropogenic and natural sources as well as sequestration of carbon from the atmosphere into 'sinks', is an important factor in assessment of the national contribution to reducing such emissions. Soils store more carbon than vegetation, but plants are the conduits through which CO₂ is taken from the atmosphere and soil carbon stores are changed. In order to protect, maintain and where practical increase carbon stores it is essential to know the carbon stocks and fluxes of land cover types and land-cover/soil combinations.

The Revised IPCC Guidelines for National Greenhouse Gas Inventories 1996, demonstrate that inventories of carbon stocks in vegetation (biomass) require knowledge of the extent of land cover types in Ireland and the carbon density (tonnes C/ha) of each cover type. In this research, the extent of cover types is being taken from the CORINE Land Cover database for 1990 and, later, will be taken from that for 2000. Carbon density for each cover type is being derived using a variety of sources, including annual agriculture statistics, and following established methodology.

Forests account for a large proportion of biomass carbon stocks and additional methods of estimating their contribution are being pursued. Inventory of soil carbon stocks requires maps of soil types, property data for those soil types and land cover on them, so that soil carbon densities (tonnes C/ha) can be calculated. The project is compiling a database containing the dominant soil in each 2km by 2km grid square, the property data for those soils and the dominant land cover (in 1990 and 2000) on each dominant soil. Peat is a major soil carbon store and particular attention is being paid to estimates of carbon densities for peat of different depths.

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - Modelling Carbon Fluxes from Irish Peatlands, Based on Extending PORTACH and PEATSAT including the Development of a National Carbon Fluxes Inventory for Irish Peatlands (2000-LS-5.1.2b-M1)

LEAD ORGANISATION

University College Dublin

START DATE

01/11/2000

CONTACT

Prof. Shane Ward

STATUS

Completed (ERTDI Report 53)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

134,592.24

PROJECT DESCRIPTION

Ireland has a large peat resource, covering some 17% of its total land area. Peat lands contribute significantly to the national fluxes in greenhouse gases (GHG). Estimated methane emissions from peat lands (*ca.* 0.4 Mt/annum) rank alongside those from ruminant animals (*ca.* 0.49 Mt/annum) as the main sources of methane emissions in Ireland. Therefore, any inventory of Ireland's GHG fluxes should take account of those associated with peat lands. Young peat lands actively sequester atmospheric carbon (as CO₂), while old mature bogs emit considerable quantities of methane. There are several peat land-use policies that influence carbon fluxes (emissions/sequestration); hence, effective management of peat lands can impact on national GHG fluxes. Given the extent of peat lands and their carbon fluxes, it is necessary to quantify the national peat land resource, classify it, assess the GHG fluxes associated with each class and hence estimate the contribution of peat lands to the total national GHG fluxes.

This project will address these by:

1. Using satellite imagery to quantify and classify the national peat resource;
2. Modelling the GHG fluxes associated with each class;
3. Interfacing the satellite imagery with the GHG fluxes models to produce an inventory of the total national GHG fluxes associated with peat lands and peat land-use change (*e.g.* afforestation, wetlands, agriculture).

The study will produce an assessment of the significance of GHG fluxes from peat lands, based on both current land-use and future change projections. It will enable the significance of various peat land-use options to be assessed and will position their significance in a national context. Current estimates indicate that changes in peat land-use can make a tangible contribution towards reducing Ireland's GHG emissions (*ca.* a 2% to 5% reduction).

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆ (2000-LS-5.1.3a-M1)

LEAD ORGANISATION

Clean Technology Centre

START DATE

01/11/2000

CONTACT

Mr Dermot Cunningham

STATUS

Completed (**ERTDI Report 10**)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

41,892.47

PROJECT DESCRIPTION

An inventory of emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) was estimated for Ireland for 1998 in this study. Such inventories are required to be reported under the United Nations Framework Convention on Climate Change (UNFCCC).

This inventory has been compiled through data obtained from relevant sectors and in accordance with UNFCCC guidelines. Each of the industrial gases has a different global warming potential. Therefore, overall estimates are reported in terms of kilo tonnes of carbon dioxide equivalent.

Estimates in terms of tonnes of gas are also included within the final report. The estimated industrial gas emissions account for 0.2% to 0.3% of all greenhouse gas emissions in Ireland in 1998. The usage (potential emissions) and actual emissions figures are broken down into the individual sources in the main report. The major users of the gases in Ireland in 1998 in terms of carbon dioxide equivalent are the refrigeration and air conditioning industry, the semiconductor manufacturing industry, electricity utilities, and in certain manufacturing industry for leak detection.

It was found that none of the industrial gas source categories are key source categories, *i.e.* when all source categories for the six gases are summed together in descending order of magnitude, the threshold of 95% of total greenhouse gas emissions is reached before the industrial gas source categories are reached. Therefore, Tier 1 methodologies are sufficient according to IPPC but Tier 2 is encouraged. Tier 2 methodologies have in fact been used in the estimation of emissions for the majority of sources.

Changes in the use of industrial gases since 1998 include increased usage in refrigeration, in metered dose inhalers and an increase in semiconductor production with a corresponding increase in gas usage. Issues in relation to the use of industrial gases in Ireland are the absence of tracking of usage of the gases, the difficulty in obtaining usage and emissions data from companies (although it should be noted that several companies were very forthcoming with useful information in this study), the need to increase collection rates of the spent gases, issues in relation to export of the spent gases for recovery or destruction, and isolated reports of deliberate gas release. The latter two issues are also relevant to HCFCs and CFCs, not just HFCs.

The elimination of the use of the industrial gases in certain non-essential applications should be considered - silly string and claxons for non-marine safety applications.

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - Emission Inventories for HFC, PFC and SF₆ (2000-LS5.1.3b-M1)

LEAD ORGANISATION

University of Bristol

START DATE

01/11/2000

CONTACT

Dr Simon O'Doherty

STATUS

Completed (**ERTDI Report 10**)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

40,631.62

PROJECT DESCRIPTION

This project covers the verification of emissions calculated conventionally against those derived from statistical analysis of atmospheric concentrations measured at Mace Head, Co. Galway, and back trajectories [the Nuclear Accident dispersion model (NAME)]. The conventional emissions inventory is 'top-down' and uses definitive European data on the sales activity of these substances within Europe - coupled with rigorously tested emission functions to calculate

European emissions:

The European emissions inventory can be verified against the emissions calculated for Europe using the NAME model. Further subdivision into emissions from each EU member state is accomplished partly with the data that these countries submitted to the UNFCCC and partly using national econometrics to piece together a homogeneous data set that is consistent with the total European data. Finally, in order to assist with the back trajectory dispersion modelling, the emissions are distributed geographically within a member state, based on population density. It is intended that the process is iterative, with verification leading to improvements in both modelling processes so that uncertainties can be significantly reduced. The results described in the project correspond to the first iteration in this process, between a calculated Irish inventory and that derived from measurements using NAME.

European emissions calculated from activity data and emission functions have been verified against those calculated from atmospheric analyses and back-trajectory calculations using the NAME model.

Project conclusions:

Emissions from Ireland have been calculated as a subset of the European emissions and distributed geographically by population density. The Irish emissions inventory has been verified against that calculated using NAME. On average, there is very little difference between the two (2%) but this hides substantial differences for individual compounds. Nevertheless, it is clear that the absolute values of these emissions are placed in similar categories of size by both methods. In view of the wide differences in methodology, this adds confidence to the estimates. It has been demonstrated that using the NAME Lagrangian model it is possible to determine the fraction of air arriving at Mace Head from different regions (on a European scale) at different times over a 6 year period.

Using this matrix of data along with observations of a range of pollutants at Mace Head, it is possible, using the best-fit algorithm called simulated annealing, to derive

estimates of emissions over Western Europe. The algorithm starts from a randomly generated emission map and iterates towards the best solution, the process is repeated many times to build up an ensemble of different solution possibilities, all local minima to the equations. The errors due to inaccuracies in the modelled meteorology and dispersion and the observations are difficult to quantify and vary from species to species. The contributions from Ireland to European emissions of HFCs, PFCs and SF₆ are very small. The HFC contribution in both 1995 and 1998 was 0.8% of the total emission of manufactured HFC (*i.e.* excluding HFC-23). Similarly, the SF₆ contribution was 0.2% of the total. These results show a small growth in PFC emissions, from 0.25% to 0.33%, but the increase is not significant.

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - Assessment of the Impacts of Climate Change in Ireland (2000-LS-5.2.1-M1)

LEAD ORGANISATION

NUI Maynooth

START DATE

01/11/2000

CONTACT

Dr John Sweeney

STATUS

Completed (**ERTDI Report 15**)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

164,535.20

PROJECT DESCRIPTION

Statistical downscaling techniques have enabled climatic scenarios to be generated for Ireland for 2055 to 2075 at a resolution of 10km². These suggest a mean January temperature in the range 6-7.5°C by mid-century over much of the southern half of Ireland, and 7.5 – 9°C along southern coasts. A general increase of approximately 1.5°C will be apparent by 2055.

By mid-century, winters in Northern Ireland and in the north Midlands will be similar to those of Cork/Kerry during the 1961-1990 period. Mean July temperatures of 16.5-18°C are indicated for as far north as coastal Co. Antrim and Co. Derry by mid-century. General summer increases of approximately 2°C are apparent with highest values to be found inland away from north and west facing coasts. Winter increases in precipitation will on average amount to 11% by mid-century, and up to 20% in the northwest. Summer reductions are of the order of 25% in the south and east.

Modelling the agricultural impact of these changes produces changes in the types of crops grown and the pattern of agricultural land use. Maize will become a major crop and soybean will become a viable specialist crop in many areas. Yields of many crops will be linked closely to water availability during the summer months. Some, such as potatoes, will be viable only with irrigation. Considerable investment in infrastructure to store winter rain may be necessary in eastern parts. Grass will be seen to suffer drought loss over large parts of the south and east of the country and grass silage may be replaced by maize as a forage crop in livestock systems. Increased problems with slurry storage and spreading in the wetter western part of the country may emerge.

The HYSIM model was used to predict water resource changes. This suggested that there will be a reduction in annual run-off that will be most marked in the east and southeast of country. Winter runoff is predicted to increase in the west. All areas will experience a decrease in summer runoff, with the greatest reductions in the east of the country. *Per capita* water availability in this region is only 12% of that applying in the west and northwest.

Significant changes in the natural environment and in biodiversity are also anticipated *e.g.*

- Increases and changes in distribution of migrant species;
- Changes in the phenological processes of plants and insects;
- Changes in decomposition, productivity and in competitive interactions between plants;

- Increased numbers of generations of many insects;
- Greater winter survival rates of invertebrates;
- Changes in migration, hatching, development and spawning of freshwater fish;
- Increased competition for niche space, *e.g.* Arctic Char and other species;
- Changes in bird migration patterns with greater numbers over wintering;
- Earlier breeding of birds and larger and more numerous clutch sizes, and
- Changes in the life cycle of bats.

Increased warming is expected to have significant adverse effects on peat land systems. There is likely to be an increase in decomposition, a reduction in peat formation, more erosion, changes in species composition, loss of carbon storage potential, increases in CO₂ emissions, a possible increase in CH₄ emissions, and an increase in the release of pollutants. Prolonged periods of higher summer temperatures may lead to deoxygenation of water in some rivers and lakes. Increasing temperatures may also increase decomposition of organic soils and weathering of rock, resulting in an increase in pH in some water bodies. Species compositions of various habitats are also likely to change in response to higher CO₂.

In terms of sea-level changes, areas in the south of the country are likely to feel the effects first, particularly, low lying coastal locations with little or no natural protection and located on 'soft' or easily erodible material. Coastal floodplains are especially at risk on occasions when a high tide and storm surge couple with a period of intense rainfall leading to a breach in the carrying capacity of the drainage network. Sea-level rise is projected as a serious problem where there is infrastructure at risk of inundation. In Ireland, the impacts of sea level rise will be most apparent in the major cities of Cork, Limerick, Dublin and Galway. 'Hard' engineering of the coastline should however be then viewed as a last resort and only if the benefits outweigh the loss of land.

Climate change in Ireland poses threats in some key areas, but also offers opportunities in others. Successfully addressing the issues of adaptation to climate change in Ireland also addresses wider issues of sustainable development and equity at both a local and national scale.

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - Establishment of Indicators of Climate Change in Ireland (2000-LS-5.2.2-M1)

LEAD ORGANISATION

NUI Maynooth

01/11/2000

STATUS

Completed (ERTDI Report 2)

CONTACT

Dr John Sweeney

TOTAL BUDGET (€)

63,941.47

PROJECT TYPE

Large-scale study

START DATE

PROJECT DESCRIPTION

Primary indicators of climate change were investigated using the Irish meteorological monitoring network supported by Met Éireann. Temperature records indicate that global trends have been largely replicated in Ireland. Cooling to the end of the 1970s followed warming from the first decade of the 20th century to the mid-1940s. Thereafter, rapid warming occurred which continues to the present.

A stronger warming trend was apparent in Ireland in the 1930s and 1940s than globally. Similarly, mid-century cooling continued somewhat later in Ireland and only since the 1990s has warming ahead of the global mean resumed. The 1990s have been the warmest decade in the Irish instrumental record. Most warming has occurred in winter and maxima appear to be increasing more than minima during this season. For spring, summer and autumn, minima are increasing more quickly than maxima. Stronger indicators of ongoing climate change are in evidence when the number of 'hot' and 'cold' days is examined. A 'hot' day was defined as one when the mean daily temperature exceeds 14°C whereas a 'cold' day had a mean below 0°C. A clear trend exists in both these parameters. In midland locations such as Birr and Kilkenny, the number of cold days has halved over the past 50 years while the number of hot days has roughly doubled.

The frequency of days with minima below 0°C shows significant decreases of approximately 10 days per annum at some locations. At present, the Irish climate appears to be warming by slightly over 0.25°C per decade. Significant increases in annual rainfall have occurred in northern parts. Malin Head has shown a 10-year moving average increase of over 40% during the 20th century, with 4 out of its 5 wettest years occurring in the 1990s. Locations further south, such as Birr or Rosslare, show decreased receipts. A more pronounced precipitation gradient appears to be becoming established over Ireland. Some of the annual changes in annual reflect divergences in seasonal precipitation receipt with wetter winters in the west and north contrasting strongly with drier summers in the south and east. Much of the change in temperature and precipitation appears related to the North Atlantic Oscillation (NAO). This index explains 50% of the Valencia winter temperature variance and 30% of that at Malin Head. This suggests that quasi-cyclical changes in 'westerliness' still exerts a dominant control on year-to-year variations in many climatic parameters in Ireland and these may be masking some of the forcing due to anthropogenic influences.

Secondary indicators comprise phenomena, especially in the biological environment, which might be expected to show a response to changes in primary climatic

parameters. A wide range of possible indicators was assessed. Some likely future indicators did emerge, such as changes in the production area of warm weather crops such as forage maize and vines. More detailed phenological investigations would be desirable should agricultural indicators be employed. Butterflies and bats were found to have more potential, especially since many species of butterfly are at their ecological limits in Ireland and would be highly sensitive to climate change. While some data sources presently exist for butterflies, these are not adequate to serve as reliable indicators.

Bird activity provided one of the most successful secondary indicators. The little egret, reed warbler, pied flycatcher, bearded tit, Mediterranean gull, goosander, lesser whitethroat, and blackcap are just some of the new species which have arrived since 1980, possibly in response to warmer conditions. The displacement of some cold-tolerant species has been less dramatic and more data is needed, especially on seabird population changes. Arrival dates for migratory species have been meticulously recorded for some species such as the swallow and here a good indicator seems to exist. It is not clear why such a strong response to temperature changes appears to be occurring. Further work is required to identify the role of climate change in source areas and along the migratory route. Records from the four phenological gardens in Ireland indicated that the beginning of the growing season was occurring earlier at all locations for a number of the indicator tree species. An increase of temperature in spring of 1°C is associated with leaf unfolding occurring 5-8 days earlier.

Leaf fall, on the other hand, has shown little change since 1970, except in the southwest where it has become later. The length of the growing season has become longer, especially in the southwest. An increase in the growing season by 9 days for *Betula*, 3 days for *Fagus*, and 7 days for *Tilia* is indicated per 1°C rise in annual temperature. Investigations of socio-economic data as indirect indicators of climate change were also undertaken. These sources included changes in energy consumption, insurance claims for weather-related damage, changes in domestic tourism. However, the appropriate data was not easily accessible and confounding factors, such as economic growth, restricts the usefulness of such approaches. Clearly Irish climate is changing. However, the indicators examined in this study suggest that despite a maritime location buffered by the Atlantic from extremes of climate, Ireland is mirroring, albeit somewhat belatedly the trends apparent at a global scale.

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species (2000-LS5.3.1a-M1)

LEAD ORGANISATION

NUI Galway

START DATE

01/11/2000

CONTACT

Prof. S. Gerard Jennings

STATUS

Completed (**ERTDI Report 35**)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

76,184.28

PROJECT DESCRIPTION

The potential consequences of global climate change are outlined in the recent Third Assessment Report (Working Group I) of the International Panel on Climate Change established by the World Meteorological Organisation (IPCC, 2001). This document provides guidance to Governments on the causes and impacts of climate change. Various aerosol climate effects are highlighted in this Report. The Report shows that uncertainty in estimates of aerosol effects, *i.e.* direct reflection of sunlight and indirect altering cloud reflectivity and life time, provide the greatest uncertainties in current understanding anthropogenic impacts on radiative forcing and thereby climate. This problem has been compounded by the lack of quantitative data. This study of composition, sources and radiative properties of aerosols is therefore making an important contribution to understanding of aerosol climate interactions.

The main objectives of this work are:

- To develop progressively measurements of aerosol chemical and physical properties at the primary maritime background atmospheric research station in western Europe, at Mace Head;
- To deploy complementary instrumentation to provide aerosol radiative measurements. It is envisaged that validated measurement data will be made available, subject to protocols, to the World Aerosol Data Centre at the EU Joint Research Centre, Ispra, Italy.

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PROJECT TITLE

Greenhouse Gas Emissions and Climate Change - An Assessment of the Measurements of Radiatively Active Species Carried out in Ireland and of Radiometric Species (2000-LS-5.3.1b-M1)

LEAD ORGANISATION

NUI Galway

START DATE

01/11/2000

CONTACT

Dr Aodhagan Roddy

STATUS

Completed (Report pending)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

76,184.28

PROJECT DESCRIPTION

The aim of the project is to get detailed information on Irish data of importance to studies of radiative forcing. The main data concern anthropogenically enhanced levels of greenhouse gases (responsible for global warming). These include carbon dioxide, methane, nitrous oxide and industrial gases such as replacement chlorofluorocarbons introduced following the Montreal Protocol. Aerosol particles also play important roles in determining atmospheric reflectivity and can influence cloud reflectivity and cloud lifetimes. The aerosol effects are considered to have a cooling influence, which may in part counterbalance warming due to enhanced greenhouse gases.

Expert subcontractors are contributing to the work by preparing reports on:

- (a) isotopic data which are important for source identification and
- (b) data on atmospheric aerosols which can counteract global warming.

Ireland also has a long history of meteorological and other scientific observations, which can be used to study factors influencing radiative forcing. While some of this work has been well documented and is accessible via international databases other work is less well known and some valuable and unique data sets may be overlooked. A comprehensive review of ongoing and historic work will be prepared. This review will identify work which contributes to better understand both natural and anthropogenic impacts on the radiative balance.

It is intended, through a broad range of contacts in Ireland and abroad, to cast a wide but efficient net in the search for relevant databases. Information on data collected by remote sensing from satellites and aircraft will be obtained. The aim is to provide an avenue to improve the use of diverse data sets through integration with related work. A report will be prepared on the potential development of a national archive of the data mentioned above. Also, further tasks, which could be used to improve current work, will be identified.

This information is important for research on climate change and for public policy formulation with regard to climate change issues, such as the implementation of the Kyoto Agreement.

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PROJECT TITLE

**Greenhouse Gas Emissions and Climate Change - Study of the Composition, Sources and Radioactive Properties of Aerosols at a West Coast Location
(2000-LS-5.3.2-M1)**

LEAD ORGANISATION

NUI Galway

START DATE

01/11/2000

CONTACT

Prof. S. Gerard Jennings

STATUS

Completed (Report pending)

PROJECT TYPE

Large-scale study

TOTAL BUDGET (€)

241,250.23

PROJECT DESCRIPTION

The aim of the project is to provide improved knowledge on chemical and physical characteristics of aerosols at a west of Ireland location. Such data are of use in studies of long range transport of aerosols/particulates and their impacts on the regional radiation balance.

The potential consequences of global climate change are outlined in the recent Third Assessment Report (Working Group I) of the International Panel on Climate Change established by the World Meteorological Organisation (IPCC, 2001). This document provides guidance to Governments on the causes and impacts of climate change. Various aerosol climate effects are highlighted in this Report. The Report shows that uncertainty in estimates of aerosol effects, *i.e.* direct reflection of sunlight and indirect altering cloud reflectivity and life time, provide the greatest uncertainties in current understanding anthropogenic impacts on radiative forcing and thereby climate. This problem has been compounded by the lack of quantitative data. This study of composition, sources and radiative properties of aerosols is therefore making an important contribution to understanding of aerosol climate interactions.

The main objectives of this work are to

- (i) to develop progressively measurements of aerosol chemical and physical properties at the primary maritime background atmospheric research station in western Europe, at Mace Head;
- (ii) to deploy complementary instrumentation to provide aerosol radiative measurements.

It is envisaged that validated measurement data will be made available, subject to protocols, to the World Aerosol Data Centre at the EU Joint Research Centre, Ispra, Italy.

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PROJECT TITLE

**Accounting for Greenhouse Gas Sources and Sinks in Major Irish Land-Use Categories: Establishment of a Co-ordinating Centre for FLUX Measurements (CCFLUX)
(2001-CD-C1-M1)**

LEAD ORGANISATION

Trinity College Dublin

START DATE

01/12/2001

CONTACT

Prof. Michael Jones

STATUS

Completed (Report pending)

PROJECT TYPE

Capability development

TOTAL BUDGET (€)

794,853.38

PROJECT DESCRIPTION

In support of the European post-Kyoto policy, the CCFLUX project will measure at the field-scale greenhouse gas (GHG) fluxes from major land-use categories to calculate the net global warming potential (GWP) associated with Irish land-use ecosystems.

The three key objectives of for CCFLUX are:

- i) To provide the EPA with a balance sheet detailing GHG emissions by sources and removal by sinks for selected major Irish land-use categories;
- ii) To furnish scientists with the process knowledge required to model GHG fluxes, and
- iii) To develop rational mitigation strategies to reduce national GHG emissions.

Whilst much attention to date has focused on greenhouse gas sources and sinks associated with forested landscapes, less attention has been directed towards agricultural, particularly arable and grassland, ecosystems.

There is considerable potential for enhancing carbon sinks in agricultural soils through various management practices. In order to achieve its objectives, CCFLUX will:

- i) Measure and model GHG fluxes at the field scale for arable systems with contrasting management regimes *e.g.* conventional versus reduced tillage,
- ii) To integrate data from other funded projects on GHG flux measurement in Ireland *i.e.* grasslands and forest ecosystems, and
- iii) To contribute to the production of a regional distribution map of GHG fluxes (sources and sinks) for Ireland.

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PROJECT TITLE

CELTICFLUX - Measurement and Modelling of GHG Fluxes from Grasslands, Forests and Peatlands in Ireland (2001-CD-C2-M1)

LEAD ORGANISATION

University College Cork

START DATE

01/12/2001

CONTACT

Prof. Gerard Kiely

STATUS

Completed (Report pending)

PROJECT TYPE

Capability development

TOTAL BUDGET (€)

907,889.39

PROJECT DESCRIPTION

We are measuring the CO₂ flux from grassland in County Cork since July 2001. From May/June 2002, we will be measuring the CO₂ flux from a peat land in County Cork and also from managed grassland at Johnstown Castle. Over the project period, we will have five years of continuous CO₂ fluxes, which will give us an understanding of the seasonal and inter-annual variation. For one year, at the peat land site we will also be measuring the CH₄ flux. For one year at each of the two grassland sites we will be measuring the NO₂ flux. Both the CH₄ and NO₂ concentrations are determined using a tunable diode laser absorption spectrophotometer.

All gas concentration measurements are made at 10Hz. We are currently developing models at the plant and field scale to model the GHG fluxes from the two different ecosystems. The goal of the project is to help Ireland to estimate its GHG sequestration from the different ecosystems.

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PROJECT TITLE

***Climate Change in Ireland: Refining the Impacts
(2001-CD-C3-M1)***

LEAD ORGANISATION

NUI Maynooth

START DATE

01/12/2001

CONTACT

Dr John Sweeney

STATUS

Completed (Report pending)

PROJECT TYPE

Capability development

TOTAL BUDGET (€)

697,598.67

PROJECT DESCRIPTION

An initial exercise in statistical downscaling suggests a mean January temperature in the range 6-7.5°C by mid-century over much of the southern half of Ireland, and 7.5-9°C along southern coasts. Mean July temperatures of 16.5-18°C are indicated for as far north as coastal Co. Antrim and Co. Derry. Precipitation scenarios suggest that winter increases averaging 11% will be observed over most of Ireland by the same time combined with summer reductions of the order of 25%. These changes, if realised, can be expected to have significant impacts in the areas of agriculture, water resources, biodiversity, the marine environment and sea level.

This project seeks to refine the above projections and explore the likely impacts of climate change in Ireland in greater detail. To do this an enhanced temporal resolution of daily input data will be employed which will enable extreme events to be better characterised. Agricultural impacts will be examined in a holistic manner encompassing growing season, forage supply, field accessibility, soil damage, pollution potential, waste storage and disposal requirements. Water resource changes will be modelled on a catchments basis using the HYSIM model.

Comparative analysis of key urban and rural catchments will be undertaken to elucidate the policy implications of climate change for water resource management, in particular, the return period for design floods and droughts. In the area of natural ecosystems, spatial aspects of habitat change arising from projected climate changes will be examined as will the response of selected Irish species to ongoing climate change using phenological records.

The statistical downscaling approach being undertaken here to drive impact models in various areas will enable synergism to be achieved with the regional climate modelling approach being undertaken in another project in the RTDI programme. This will aid verification of suggested climate change scenarios. As a result of the project, the requirements of the sub-programme's aims to "develop practical methods for the integration of environmental considerations into policies and programmes of the main economic sectors" should be assisted.

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PROJECT TITLE

**Community Climate Change Consortium for Ireland (C4I)
(2001-CD-C4-M2)**

LEAD ORGANISATION

Met Éireann

START DATE

15/12/2001

CONTACT

Dr Aodhagan Roddy

STATUS

Completed (**ERTDI Report 36**)

PROJECT TYPE

Capability development

TOTAL BUDGET (€)

1,270,000.00

PROJECT DESCRIPTION

The overall objective of C4I is to consolidate and intensify the national effort in climate change research, by building a capability for carrying out regional climate modelling in Ireland, and putting in place a framework and a mechanism whereby the entire community of environmental scientists in Ireland can benefit from a Regional Climate Modelling and Prediction Facility. Greater opportunities for participation in upcoming European and other international research programmes will be created.

The C4I consortium will greatly improve our chances of attracting substantial European funding for ongoing research.

Specific targets of the Project include the following:

- A consolidated consortium of climate change researchers in Ireland;
- A Regional Climate Analysis, Modelling and Prediction Centre (RCAMPC);
- A user interface between the modelling centre and Irish researchers;
- A computer network interfacing RCAMPC to users;
- A powerful educational facility for students of environmental science;
- Greatly improved opportunities for participation in European research programmes, and
- A comprehensive plan for continuation of the consortium.

The Regional Climate Analysis, Modelling and Prediction Centre, based at the HQ of Met Éireann in Glasnevin, will be a focus of excellence in climate change, with a critical mass of expertise in climatology, dynamical meteorology, numerical analysis and advanced parallel computing. The Regional Climate Model (RCM) to be implemented will be based on the HIRLAM model (High Resolution Limited Area Model). The Centre will provide a vital service to climate and environmental scientists throughout the country. It will provide substantial assistance to scientists studying climate change, to assist them in utilizing the climate model output for their analysis, to interface their applications models to the main RCM and to carry out integrations with appropriate configurations of the RCM.

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PROJECT TITLE

*Assessing the applicability of an emissions trading regime in a small open economy
(2001-PHD-1-M2)*

LEAD ORGANISATION

University College Dublin

START DATE

01/10/2002

CONTACT

Prof. Frank Convery

STATUS

Completed

PROJECT TYPE

Doctorate

TOTAL BUDGET (€)

76,184.28

PROJECT DESCRIPTION

Emissions' trading has emerged as an important 'flexible mechanism' in the context of meeting Greenhouse Gas Emission targets under the Kyoto Protocol. The European Commission has proposed a draft directive for a EU-wide emissions trading scheme.

This project will develop modalities showing how a small open economy such as Ireland can maximise the benefits of participation in emissions' trading, both as regards climate change and as a means of addressing other environmental challenges. The methodology will involve a review of both theory and practice in other countries, and interviews with key potential 'players' in Ireland and at EU level.

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PROJECT TITLE

**Climate Change Data Management
(2002-CC-FS3-M4)**

LEAD ORGANISATION

Athlone Institute of Technology

START DATE

02/10/2002

CONTACT

Dr Brendan Kelly

STATUS

Completed (Report pending)

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

429,014.95

PROJECT DESCRIPTION

The main objectives of the work programme for the Climate Change data integration project are as follows:

1. To bring about practical co-ordination of research work through the provision of a data management and integration service for EPA supported Climate Change research projects in Phase 1 and 2 of the ERTDI programme;
2. To create an interface between research activities and projects;
3. To implement electronic data exchange standards;
4. Provide a data integration focal point for Climate Change researchers in Ireland;
5. To create an integrated data archive;
6. To synthesise and analyse data produced by research groups;
7. To report findings to assist policy development, and
8. To facilitate user and stakeholder participation in, and access to, climate change research at an international level.

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PROJECT TITLE

Long-term Environmental Change in Lower Lough Corrib and its Catchment: a Multidisciplinary Palaeoecological Study (2002-PHD2-14)

LEAD ORGANISATION

NUI Galway

START DATE

01/01/2003

CONTACT

Prof. Michael O'Connell

STATUS

Ongoing

PROJECT TYPE

Doctorate

TOTAL BUDGET (€)

75,000.00

PROJECT DESCRIPTION

The project represents the first serious attempt to document long-term changes – both natural and anthropogenic – in the Lough Corrib catchments area, the largest freshwater body in the Republic of Ireland. It involves pollen and macrofossil analyses, and stable isotope investigations on thick marl and peat deposits in the lower Corrib basin with a view to investigating, as comprehensively as possible, palaeoenvironmental change over the course of the post-glacial era. Limnic changes, including lake levels and trophic status, will be documented, and the effects of climate change and human activity on the limnic and terrestrial environments will be critically studied.

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PROJECT TITLE

***Greenhouse Gas Fluxes in Blanket Peatland
(2002-PHD2-46)***

LEAD ORGANISATION

University College Cork

START DATE

19/05/2003

CONTACT

Prof. Gerard Kiely

STATUS

Completed

PROJECT TYPE

Doctorate

TOTAL BUDGET (€)

75,000.00

PROJECT DESCRIPTION

Peat lands are important stores and sinks of greenhouse gases. Despite this very little is known about greenhouse gas (GHG) balances in Irish peat lands. This project will measure fluxes of carbon dioxide and methane in intact blanket peat land using chamber methods. These techniques have been widely used internationally and have been tested under Irish conditions. The project also provides information about the relationship of GHG fluxes to environmental and climatic variables. Modelling will be used to develop annual GHG budgets. These annual budgets will be compared to those developed using flux tower measurements at the same site.

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PROJECT TITLE

Modelling of N₂O fluxes from Grasslands and CH₄ Fluxes from a blanket peatland (2002-PHD2-47)

LEAD ORGANISATION

University College Cork

START DATE

01/08/2003

CONTACT

Prof. Gerard Kiely

STATUS

Ongoing

PROJECT TYPE

Doctorate

TOTAL BUDGET (€)

75,000.00

PROJECT DESCRIPTION

We are measuring CO₂ fluxes at Cork grassland for the past year. We have started to measure CO₂ fluxes at a further two sites: Wexford grassland and a Kerry peat land. We have just started to use a Tunable Diode Laser Absorption Spectrophotometer (TDLAS) and a 3D sonic anemometer at a farmed grassland site (County Cork) to measure N₂O fluxes (for one year) and will move the TDLAS to managed grassland (nutrients application control) for the second year.

In year three, we will set up the TDLAS at the peat land site in County Kerry to measure fluxes of CH₄. The 10Hz obtained generates 33MB of raw data per day or 1,200MB per year. The new TDLAS is the first of its kind in Europe. Data will be used to develop models at the leaf, canopy and field scale. Data will also be used to develop models that can predict how climate perturbations such as increased N₂O/CH₄, increased precipitation and a rise in temperature alter the NEE or the terrestrial carbon sink.

The data will include generalisations and extrapolations of annual balances of fluxes over the national estate of grassland (peat land) to provide policy makers with estimates of the source/sinks associated with these two dominant Irish land covers. A database will be updated regularly in a public domain web page and end products will be transferred to policy makers so that mitigation strategies can be developed.

This proposal compliments ongoing flux chamber work at the Agricultural Research Station in Wexford and CH₄ microbiological work by Dr. Flaherty (University College Galway) and geochemical analysis by Professor Hayes (University of Limerick)

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PROJECT TITLE

*Climate Change and Health in Ireland: A National Vulnerability Assessment
(2002-PHD-51)*

LEAD ORGANISATION

NUI Maynooth

START DATE

01/10/2002

CONTACT

Dr John Sweeney

STATUS

Ongoing

PROJECT TYPE

Doctorate

TOTAL BUDGET (€)

71,000

PROJECT DESCRIPTION

Climatic controls on the incidence of a range of environmentally related human health problems will be examined under present climate conditions in Ireland. These will include both direct (*e.g.* heat/cold stress) and indirect (*e.g.* asthma, food poisoning) acts. The use of spatially detailed climate scenarios for the middle and end of the century will then be used to model changes in likely incidence at a spatial resolution of 10km². This will be aggregated to Health Board areas and ultimately to a national scale to provide a national vulnerability assessment. Key vulnerable sub-groups will be identified for priority monitoring.

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PROJECT TITLE

*Study of the Composition, Sources and Radiative Properties of Aerosols
at a West Coast Location
(2003-FS-CD-LS-12)*

LEAD ORGANISATION

NUI Galway

START DATE

15/12/2003

CONTACT

Prof. S Gerard Jennings

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

141,000.00

PROJECT TITLE

*Climate Change: Refining the Impacts
(2003-FS-CD-LS-13)*

LEAD ORGANISATION

NUI Maynooth

START DATE

13/12/2003

CONTACT

Dr John Sweeney

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

103,274.00

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PROJECT TITLE

Accounting for Greenhouse Gas Sources and Sinks in Major Irish Land-Use Categories: Contributing to a Co-ordinating Centre for FLUX Measurements (CCFLUX) (2003-FS-CD-LS-15)

LEAD ORGANISATION

Trinity College Dublin

START DATE

01/12/2003

CONTACT

Prof. Mike Jones

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

139,824.00

PROJECT TITLE

Modelling Carbon Fluxes from Irish Peatlands Based on Extending PORTACH and PEATSAT Including the Development of a National Carbon Fluxes Inventory for Irish Peatlands (2003-FS-CD-LS-16)

LEAD ORGANISATION

University College Dublin

START DATE

15/12/2003

CONTACT

Prof. Shane Ward

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

110,383.20

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PROJECT TITLE

**CELTICFLUX - Measurement and Modelling of GHGs from Grasslands and Peatland
(2003-FS-CD-LS-17)**

LEAD ORGANISATION

University College Cork

START DATE

15/12/2003

CONTACT

Prof. Gerard Kiely

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

126,879.84

PROJECT TITLE

**Climate Change - Developing National understanding
(2004-CoE-MS-25-M)**

LEAD ORGANISATION

NUI Maynooth

START DATE

04/01/2005

CONTACT

Dr John Sweeney

STATUS

Completed

PROJECT TYPE

Centre of Excellence

TOTAL BUDGET (€)

133,681.37

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PROJECT TITLE

***Elucidating the Impact of Aerosols on Cloud Physics and the North Atlantic Regional Climate (EIRE-Climate)
(2005-FS-29-M1)***

LEAD ORGANISATION

NUI Galway

START DATE

03/01/2006

CONTACT

Dr Robert J Flanagan

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

125,163.75

PROJECT DESCRIPTION

In terms of climate predictions and radiative forcing, the largest uncertainty lies with the aerosol effect and, in particular, with the aerosol indirect effect. Notwithstanding the role of dynamics, the major source of this uncertainty is related to the difficulties in quantifying the effect of organics on cloud droplet number and size. It is proposed to further develop the existing aerosol-cloud-chemistry process model at NUI, Galway to improve our capability to model aerosols containing complex organic compounds. Based on model results multi-component aerosol-cloud-chemistry parameterisations will be implemented in a Regional Climate Model (RCM) to quantify the effect of organics on and provide better climate predictions for the North Atlantic and Western European regional climate.

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PROJECT TITLE

*Coping with uncertainties in climate modelling for Ireland
(2005-FS-33-M1)*

LEAD ORGANISATION

NUI Maynooth

START DATE

01/07/2006

CONTACT

Dr Rowan Fealy

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

175,098.92

PROJECT DESCRIPTION

A range of climate scenarios, from multiple GCMs, based on the four key SRES marker emissions scenarios, which account for approximately 80% of projected future emissions, will be obtained for the grid domain representing Ireland. The GCMs will be selected on the basis that they are included for assessment in the IPCC Fourth Assessment Report and that they adequately sample the future range of climate sensitivities. The range of future climate scenarios and model sensitivities will be stochastically sampled, employing Monte Carlo sampling techniques, in order to produce probabilistic estimates of future climate change for Ireland.

Increasingly the use of probabilities in climate change impact assessments are becoming more widely accepted. As researchers move from employing single trajectory, top-down approaches towards the use of multiple scenarios from multiple GCMs to climate impact assessments, attributing likelihoods to outcomes becomes increasingly important, particularly if the outcomes are to be relevant to policymakers.

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PROJECT TITLE

Global Climate Change Observing System (GCOS), Hydrological, Terrestrial and Related Activities (2005-FS-GC-27-M4)

LEAD ORGANISATION

University College Cork

START DATE

01/12/2005

CONTACT

Dr Ned Dwyer

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

158,136.00

PROJECT DESCRIPTION

The fellowship will analyse data availability and needs in relation to Ireland's required input to the UN Framework Convention on Climate Change adequacy reports. Moreover, a prototype data management and exchange information system will be put in place to improve access to relevant data. Analysis of data availability, trends and changes will be carried out on individual *in situ* and remotely sensed data sets as well as linked analyses to determine dependencies and redundancies. Costed plans will be drawn up for the resources required to develop and maintain appropriate systems to meet climate change data requirements. These activities will lead towards the development of a national strategy for environmental observations.

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PROJECT TITLE

**GEO Fellowship
(2006-FS-GO37-M4)**

LEAD ORGANISATION

Athlone Institute of Technology

START DATE

22/05/2006

CONTACT

Dr Paul Tomkins

STATUS

Ongoing

PROJECT TYPE

Fellowship

TOTAL BUDGET (€)

204,982.96

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Small-Scale Studies:

PROJECT TITLE

The Simile Modelling Framework - Modelling of Nitrous Oxide Emissions from Irish Agriculture (2006-SS-46-M1)

LEAD ORGANISATION

Teagasc

PROJECT TYPE

Small-scale study

CONTACT

Dr Bernard Hyde

TOTAL BUDGET (€)

6,300.00

PROJECT TITLE

Analysis and Interpretation of Historical Sea Surface Temperatures in Irish Coastal Waters (2006-SS-58)

LEAD ORGANISATION

Marine Institute

START DATE

05/02/2007

CONTACT

Ms Tone T Nøklegaard

STATUS

Ongoing

PROJECT TYPE

Small-scale study

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Contributory Scholarship:

PROJECT TITLE

*Detection of Climate Change in Ireland
(2001-CS-8-M1)*

LEAD ORGANISATION

NUI Maynooth

START DATE

17/12/2001

CONTACT

Ms Laura McElwain

STATUS

Ongoing

PROJECT TYPE

Contributory scholarship

TOTAL BUDGET (€)

7,618.43

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End of EPA Climate Change projects listing (2000-2006)