Section 1

Key Activities and Results for 2003 – 2004

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Land Use Change and Forestry: The 2002 UK Greenhouse Gas Inventory and projections to 2020

- The Removal of atmospheric CO_2 to Woody Biomass Stocks caused by expanding UK forests in 2002 was estimated to be 7722 Gg with an additional sink of 722 Gg to forest products. Removals to Woody Biomass increased from 5731 Gg in 1990 to a peak of 7605 Gg in 1995, fell to 7271 in 1996 but have now reached a new peak. Removals to products fell from 1573 Gg in 1990 to 913 Gg in 1995 and were varying around 1200 Gg from 1996 to 2001 before the fall to the present 722 Gg
- For 2002 the Emission of CO_2 from soils due to land use change is estimated to be 10934 Gg compared to 14186 Gg in 1990.
- The Land Use Change and Forestry Sector of the UK is estimated, in 2002, to have continued to be an overall emitter of carbon dioxide with a value of 1903 Gg due to Emissions of 13585 Gg offset by 11682 Gg of Removals.
- UK specific Sectoral Background Tables for the Land Use Change and Forestry Sector under the Common Reporting Format are presented.
- Projections of Removals and Emissions for the Land Use Change and Forestry Sector up to the year 2020 are presented. The trends for the effects of application of lime to agricultural soil, peat extraction in Scotland and England and the effect of land use change in Northern Ireland are now based on straight lines fitted to data fro 1990 to 2002.
- Estimated removals of atmospheric carbon by post-1990 afforestation are presented

Field Measurements of Carbon Loss Due to Ploughing

- Eddy covariance measurements of CO_2 flux over ploughed and unploughed fields at Poldean Farm, begun in March 2002, were ended in April 2004. Data analysis is almost complete.
- Soil cores were taken for direct measurement of carbon stocks in November 2003. Chemical analysis of these samples is ongoing.
- Flux measurements for the site for the period to December 2003 are presented.
- The cumulative loss was 0.3 kg C m^{-2} in the first six months, equivalent to 2 % of the carbon stock in the top 15cm of soil. Over 20 months, the rate of carbon loss averaged 3.7 % per year.
- There were no significant differences in the CH_4 and N_2O fluxes in the ploughed and the unploughed areas.

Adding Vegetation Carbon to the RothC Soil Carbon Model

- Further development of the use of the plant carbon components of the Biota ecosystem model to enhance the RothC soil carbon model is presented.
- A new parameter file structure has been developed to include data on monthly, event and harvest litter production.

- The code for the model has been completed and its output has been compared with output from the original RothC calculations for unmanaged grass.
- Additional parameter sets for a range of plant types are being developed to allow further testing of the new model.

Development of a MATLAB/Simulink version of the UK LULUCF GHG Inventory for quality control and other purposes

- A review of the LULUCF GHG Inventory procedure at CEH has been carried out as part of a quality assurance and quality control exercise.
- A system is being developed in which the LULUCF GHG Inventory is represented as a Matlab/Simulink Model.
- The Simulink model system encourages models, data and documentation to be assembled and analysed in one place making the process more transparent and accessible for all users.
- Some of the methods used to import the raw data, extract the appropriate values and process the data to the required format are described. Work is underway to extend the model and accommodate the new submission formats.

Development of an improved version of the soil carbon inventory for the UK LULUCF GHG Inventory

- Revised information for soil carbon in the UK is introduced
- Assuming each grid cell in Great Britain could be described by its dominant land use/cover and dominant soil type the total soil carbon to 1m depth was 4,555 Mt compared to 5,671 Mt estimated from the previous version of the data.
- The effect of utilising data on sub-dominant land use/cover and sub-dominant soil type will be considered.
- Methods will be extended to include data for Northern Ireland.

Using RothC with climate and land use change at the 1 km scale.

- The aim of the 1km RothC scale modelling module in this project is to build upon the modelling techniques developed under the DEFRA-funded project CC0242 towards their potential use for GHG Inventory purposes.
- The RothCUK model approach considered up to 36 land use changes for each of the 234,951 one km squares in the soil and land use database.
- The RothCUK system was also used to estimate the impact of climate change from 2000-2099 on SOC stocks in GB and NI, using the 1km soils and land use database, and long-term averaged 1961-1990 climate data and climate change scenario data.
- The research described in this report would suggest that both LUC and climate change in GB have the potential to decrease SOC stocks; currently no1km land use change matrices are available for NI although climate change could both increase or decrease SOC stocks in NI.

Survey methods for Kyoto Protocol monitoring and verification of UK forest carbon stocks

- This report details progress that has been made in the development of inventory-based methods for Kyoto Protocol monitoring of forestry activities within LUCF.
- A detailed methodology is given for estimating carbon stocks associated with British forests, which are fully compatible with Landcover Map 2000.
- The current consultation over protocol development relevant to assessing woodland carbon stocks is also described, together with the implications for reporting carbon stocks and stock changes in woodland.

Estimating land cover specific Carbon fluxes from Flux Tower measurements and Earth Observation data

- Methods of measuring the exchanges of GHGs between the UK land surface and the atmosphere are discussed; the available technologies are based on remote sensing, models, tall towers and inventory data.
- Sources of data and models are outlined and some preliminary results shown.
- The approaches listed are all actively being developed and can be combined to provide a best-possible estimate for the C-budget of the UK.
- The optimal method of combining the separate measurements (i.e. the tower and EO estimates of carbon fluxes) is to assimilate them into models.