SECTION 1

Key activities & Results

Key activities and results for 2002-2003

Land Use Change and Forestry: The 2001 UK Greenhouse Gas Inventory and projections to 2020

- The Removal of atmospheric CO_2 to Woody Biomass Stocks caused by expanding UK forests in 2001 was estimated to be 6846 Gg with an additional sink of 1298 Gg to forest products. In 1990 5731 Gg were removed to Woody Biomass stocks and 1573 Gg to forest products.
- For 2001 the net Emission of CO_2 from soils due to land use change was estimated to be 11640 Gg compared to 14186 Gg in 1990.
- The Land Use Change and Forestry Sector of the UK is estimated in 2001 to have been an overall emitter of carbon dioxide of 3219 Gg due to Emissions of 14835 Gg offset by 11616 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.
- It is noted that scenarios of future afforestation now nee to be made in consultation with the Scottish, English and Welsh offices of the Forestry Commission and the Northern Ireland Forest Service.
- A new method, based on the Monte Carlo approach, is proposed for estimating Emissions and Removals of carbon due to land use change.

Comparison of the C-Flow and CARBINE carbon accounting models

- Cross comparison was made of the structure and output of the two models applied to UK afforestation.
- Comparison was made with field data from sample plots.
- The models were generally in agreement with each other in their predictions of carbon stocks of Beech, Sitka spruce and other species.
- Comparison with field data from single plots showed some differences, particularly for deciduous species, but field plot to plot variation was thought to be much greater than the differences between the models.

Field Measurements of Carbon Loss Due to Ploughing

- Measurements began over unploughed field in March 2002.at Poldean Farm.
- Field ploughed on 5 June 2002
- Flux measurements for the site for period after ploughing are discussed and the pattern of cumulative carbon loss until January 2003 is presented.
- The cumulative loss was 0.3 kgC m^{-2} (3 tC ha^{-1}), equivalent to about 2% of the pre-ploughing stock of carbon in the top 15cm of soil.

Adding Vegetation Carbon to the RothC Soil Carbon Model

- An approach to using the plant carbon components of the Biota ecosystem model to enhance the RothC soil carbon model is presented.
- The basic timestep of the proposed integrated model will be monthly, but daily data will be generated within the model to drive the plant components.
- The model will be able to run in an unchanged RothC mode as well as with that with the enhanced plant components used to provide litter inputs to the soil components.
- Plant and management types to be modelled are listed.

- Most of the code for the new model has been completed.
- Final parameterisation and testing remains to be done.

Mapping of carbon fluxes for British afforestation and land use change

- Improved estimates from the C-Flow model of carbon exchange for the woodland in each 20 km x 20 km grid-cell of Great Britain are presented.
- The Yield Class of Sitka spruce and beech for different 20 km grid-cells was estimated by summarising information from the Forest Enterprise Sub-Compartment Database against ITE/CEH Land Classes
- Comparison of estimates of carbon uptake for forests of Great Britain made at a) using national forest planting history, b) different planting history for each 20 km grid-cell but fixed Yield Class and c) different planting history and Yield Class for each 20 km grid-cell are presented.
- It is shown that for Sitka spruce the assumptions about yield Class have a significant effect on total carbon uptake suggesting that the fixed Yield Class used in national calculations may not be accurate.
- The effect of Yield Class assumption of beech forest carbon uptake is shown to be small.
- Broadleaf forest areas from the NIWT, used for the grid-cell approach, show significant differences to national planting histories.
- An approach is presented for construction of land use change matrices, between six broad land types, for each 1 km grid-cell in Great Britain.
- This approach uses 25 m pixel land cover/use data from the Land Cover Maps of 1990 and 2000.
- Field data from Countryside Surveys 1990 and 2000 are used to guide choice of an averaging block size for the data of the Land Cover Maps in order to smooth out classification errors before calculation of land use change matrices for a 1 km grid-cell.

Deforestation rates in the United Kingdom

- Independent estimates of the total GB forest deforestation rate have now been obtained from several sources but with significant variation, ranging from 500 to 18000 ha y^{-1}.
- More information has been obtained on Unconditional Felling licenses for GB from the Forestry Commission and on land use change in England from The Ordnance Survey.
- Over the last decade the average rate of deforestation in GB resulting in rural land uses is estimated to have been 449 ha y^{-1} based on Felling Licences and for non-rural uses 926 ha^{-1} from OS data.
- In the absence of better information, our best estimate of the GB deforestation rate is the sum of these i.e. 1375 ha y^{-1}.

Modelling the impact of climate change and nitrogen deposition on carbon sequestration of UK plantation forests.

- The Edinburgh Forest model has been used to investigate variation in past and present growth of Sitka spruce and speech at different locations in Great Britain.
- Changes in the three primary driving forces for forest growth, namely N deposition rates, atmospheric CO_2 concentration and climate change have had and will continue to have a significant impact on NPP in the UK.
- The influence of atmospheric CO_2 concentrations on future NPP values will be greater than that of nitrogen deposition.

- For Sitka spruce the increase in NPP across six sites will be similar (averaging around 12.5 %) although the relative importance of each environmental driving variable differs.
- The response of Beech varied according to site, with the largest response estimated to be at Cardigan Bay (16 %). At the two most southerly sites growth response will be smaller due to changes in climate, particularly precipitation, patterns.

Remote Sensing and LULUCF carbon inventories in the UK

- The usefulness of and the uncertainties in a range of remote sensing methods for LULUCF carbon inventories is discussed
- The cost of images or data to cover the United Kingdom for each method is provided and is found to vary from about £25k for low spatial resolution optical images (~1 km AVHRR) to £125M for active LIDAR data.
- Recommendations are made on future research and other work on land cover, biomass and biomass change to support the production of LULUCF carbon inventories
- An introduction to the work of the Centre for Terrestrial Carbon Dynamics is presented.

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

- Existing networks of forest monitoring sites in Great Britain are summarised.
- Proposals are made for the structure of a system to provide regular estimates of carbon stocks and changes in British forests.
- The primary module of the system would be based on a coupling of an enhanced carbon accounting model to a new national forest Geographical Information System.
- Additional modules would provide broad-scale verification of carbon stock from field data and information to improve the basic carbon accounting model.

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