Forestry Commission

Corporate and Forestry Support

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STERN REVIEW ON ECONOMICS OF CLIMATE CHANGE – RESPONSE FROM THE FORESTRY COMMISSION

1. Following the invitation to submit evidence for the Stern Review on the Economics of Climate Change, the purpose of this response is to highlight evidence, relevant to the terms of reference for the review, regarding the contribution of forestry to climate change strategies and policies.

The Contribution of Forestry to Climate Change Policies and Strategies

2. Forestry can make a positive contribution to climate change policies and strategies in a number of ways. These include:

- promotion and protection of the role of forests and woodlands in stabilising atmospheric carbon dioxide by sequestering and storing carbon in biomass and soils;
- provision of wood products that provide alternatives to materials such as concrete and steel which involve high energy use in their production;
- development of the use of wood fuel as a renewable source of energy to substitute for fossil fuels.

The Role of Forests in Carbon Sequestration

3. The United Nations Framework Convention on Climate Change and the Kyoto Protocol recognise the role of carbon sinks, such as forests, in offsetting greenhouse gas emissions and impose responsibilities on Parties to protect and enhance carbon sinks. All plants sequester carbon through the process of photosynthesis; trees are particularly effective because of their large biomass and long life. Forestry-related activities can promote and enhance the role of forests in carbon sequestration, via afforestation, reforestation, reducing deforestation and the application of appropriate forest management techniques.

4. Forests cover an area of 2.8 million hectares in the UK, accounting for approximately 11.6% of the total land area. The biomass that constitutes these forests contains about 150 megatonnes of carbon (approximately equal to one year of carbon emissions by the UK). The maximum rate of carbon accumulation, during the fastest growing phase of a forest in the UK is about 10 tonnes of carbon per hectare per year. A realistic average over a full rotation (from planting to harvesting) is estimated to be about 3 tonnes of carbon per hectare per year. The maximum potential for carbon accumulation in woodland is approximately 200 tonnes of carbon per hectare, in old growth woodlands, although once forests reach the old growth phase (after approximately 100 years), net uptake of carbon becomes very slow or ceases altogether. Commercially managed stands can be expected to accumulate an average of approximately 100 tonnes of carbon per hectare (Broadmeadow *et al*, 2003).

5. Carbon sequestration by forests in the UK accounted for around 2.9 megatonnes of carbon per year in 2001, of which 0.4 megatonnes of carbon per year is allowable as an offset under the Kyoto Protocol. This represents the contribution of forests planted after 1990, referred to as "Kyoto forests". Projections to 2010 are for these values to rise to 3.2 and 0.7 2 megatonnes of carbon per year, representing a contribution of respectively 15.5% or 3.4% to the emissions reduction target set for the period 2008 to 2012 under the Kyoto Protocol (Broadmeadow *et al*, 2003).

6. The value of carbon sequestered in British woodland has been estimated by Brainard *et al* (2003), for a report to the Forestry Commission. A range of values is applied for the social cost of carbon, reflecting the different conclusions of research regarding this issue. Applying a value of £6.67 per tonne, Brainard *et al* (2003) estimate the net present value of carbon currently sequestered in woodlands in Britain at approximately £2.68 billion, based on a discount rate of 3.5%. If a value of £14.67 per tonne of sequestered carbon is applied, the net present value is estimated at £5.92 billion, and an average value of £2098 per hectare of woodland is estimated for all GB woodland. Applying a value of £70 per tonne, as the currently accepted value for the social cost of carbon, the net present value of carbon sequestered in woodlands in Britain can be estimated at approximately £28.2 billion, and the average value per hectare of woodland can be calculated at approximately £10,011.

7. Estimated costs of sequestering carbon via forestry have varied considerably reflecting substantial variation in a range of factors including land costs, input prices, and working conditions. For example, the British Government Panel on Sustainable Development (1999) indicated that costs of sequestering carbon via forestry vary from £50 to £80 per tonne of carbon in the UK and substantially less (about £5 per tonne of carbon) for developing countries. Such estimates assume that woodland is created for carbon sequestration alone. However, woodlands in Britain are managed for multi-purpose public benefits, including open-access recreation, biodiversity and landscape. In these circumstances, carbon sequestration might be considered as an additional benefit with minimal marginal costs.

8. It is not feasible for the UK to become "carbon neutral" through afforestation alone. It is estimated that to do this would require creation of some 50 million hectares of forest - approximately twice the land area of the UK. (Broadmeadow *et al*, 2003).

The potential gains from carbon sequestration via forestry are likely to be small relative to total carbon emissions. However, the carbon sink associated with UK forests can make a contribution to the range of policies to reduce greenhouse gas emissions.

9. At a global scale, it has been estimated that the carbon that is contained in the worlds forests, if released, would be enough to raise the carbon dioxide concentration in the atmosphere to over 1000 ppm (parts per million). In turn, this would lead to a rise in average temperatures of 5-8 degrees Celsius. (Broadmeadow *et al*, 2003). At a global scale maintaining the world's woodlands and forests is therefore an essential element of any measure to mitigate climate change.

Wood Products

10. Wood products used in construction, joinery and other end uses, provide a secondary store of carbon sequestered by growing trees. Wood disposed to landfill is another significant store, estimated for the UK to be greater than that associated with wood products in use. At present, wood products in the UK are estimated to contain approximately 80 megatonnes of carbon (just over half that contained in UK forests). This is estimated to be increasing at a rate of 0.44 megatonnes of carbon per year, due to an increasing pool of wood products.

11. Wood products can make a significant further contribution to reducing carbon emissions by substituting for alternative materials with higher energy requirements in their production. Production of wood products is generally a less energy intensive process than the production of materials such as steel or concrete. It has been estimated that, for each cubic metre of timber used to replace a similar volume of concrete or bricks in long-term construction materials, 1 to 2 tonnes of carbon emissions can be avoided (Tipper *et al*, 2005).

12. The increasing importance placed on sustainability principles, sustainable procurement, and on life cycle analysis, has further highlighted the role of wood products. The Forestry Commission is undertaking a wide range of initiatives, in conjunction with the timber processing and construction sectors, and wider society, to promote the use of sustainably produced timber and timber products (for example, Mundy and Livesy (2004)).

Wood Fuel and Bioenergy

13. Wood fuel, like other forms of biomass, can provide a substitute to fossil fuels for some uses. Provided harvested trees are replaced, subsequent crops of trees absorb the carbon released by burning the wood fuel. Although emissions are generated from the energy requirements for transport and processing, use of biomass for energy still represents a substantial saving on emissions generated by use of fossil fuels.

14. It has been estimated that wood fuel output from Scotland's forests alone (which accounts for 47% of total woodland area in the UK) could make an additional contribution of 0.6 to 1.5 million tonnes of carbon in terms of avoided emissions per year (Tipper *et al*, 2005).

The Use of Economic Instruments to Promote Carbon Sequestration

15. The Forestry Commission is currently examining the potential for economic instruments to promote the role of forests in carbon sequestration, including the potential for the establishment of markets in carbon credits for forestry.

16. Markets for forestry-related carbon credits are currently not well developed though a number of voluntary schemes are operating. Certain afforestation and reforestation activities are recognised as certifiable for tradable carbon credits under the Clean Development Mechanism and Joint Implementation articles of the Kyoto protocol. These allow greenhouse gas emissions in industrialised countries to be offset by forestry and clean energy projects established in developing countries. However, forestry does not currently qualify for inclusion in the EU Emissions Trading System (ETS). This exemption is due to be reviewed in 2006 to determine whether or not forestry will be included in the second phase of the EU ETS from 2008 to 2012.

17. There are several uncertainties that remain to be resolved for the establishment of markets for forestry-related carbon credits. Reliable measurement, verification and assurance procedures are required for carbon sequestered in trees. Carbon sequestration is potentially reversible and short-term (through fire or felling, for example), and therefore has risks associated with it. Establishment of markets for carbon sequestered in trees would require establishment of baselines against which specific carbon sequestration projects could be assessed. It will be important to ensure that the carbon sequestration for which credits are allocated is additional to that which would have occurred in the absence of such programmes.

Adaptation to Climate Change

18. While the magnitude and speed of climate change in the long term are highly uncertain, it is anticipated that adaptation will be required in planning and managing UK woodlands. Adaptation will be necessary both to minimise harmful impacts of climate change, and secure potential benefits. Based on UKCIP02 forecasts to the 2050s and 2080s, Broadmeadow *et al* (2005) suggest that a generally warmer climate and a longer growing season are likely to result in increased productivity for forestry in Scotland, Northern England, and parts of Wales. In Southern England, an increase in the frequency and severity of summer droughts suggests that growth rates of many common species will decrease and species suitability will change. Climate change may also increase the likelihood of pest and fire damage, and catastrophic storm damage.

19. The Forestry Commission is working with other parts of UK government and the Devolved Administrations to explore the actions needed to enable the forestry sector to adapt to climate change. Precautionary measures include examining the need for changes to forestry practice (for example, civil engineering specifications, and tree species choice and diversification in vulnerable locations) and ensuring suitable response capacity (for example to pest and disease outbreaks, storm damage, or flooding events). Appropriately managed forests and woodland can also have a positive role in helping society and environment adapt to climate change. This includes flood and erosion control, improving urban environments (for example by providing shade

during heat waves and reducing the demand for air conditioning), assisting species and habitats threatened by change and removing air pollution from the atmosphere.

20. We would be happy to provide further information if required.

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