



Institute of
Chartered Foresters

Carbon Lean UK. A Role for our Trees, Woods and Forests?



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Produced by Gabriel Hemery MICFor
with assistance from Sandy Greig FICFor

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Preface

Shireen Chambers MICFor, Executive Director

Our 2008 conference saw a record number of delegates gathered in the University of Edinburgh's Pollock Halls to exchange ideas about the role of trees, woods and forests in a carbon-lean society.

The Institute last held a conference on climate change and trees eight years ago in Glasgow and while the year 2000 may not seem that long ago, scientific thinking and public attitudes have changed considerably. Back then we talked about possible changes to future climate induced as a result of human activity, and heard speakers describing developments in the emerging wood fuels market. Today we talk of mitigating strategies and do so with a much greater sense of urgency.

In the past year we have seen the publication of two major reports on climate change, the Intergovernmental Panel on Climate Change Fourth Assessment and the Stern Review on the economics of climate change. Both have made much of the role that forests have to play in mitigating the effects of climate change.

The scientific community has responded to the urgency and has advanced our research knowledge in the fields of energy accounting and carbon sequestration as we heard at our conference from both UK and European scientists. From this has developed a market for carbon forestry trading. Speakers described the huge opportunities for the forestry sector in carbon trading but also outlined the current difficulties including the lack of voluntary standards in the UK. The role that wood products can play in contributing to our carbon-lean society was illustrated by architects and building research scientists. This research is now informing policy as we heard from speakers from Defra and the Scottish Government Minister for the Environment. In particular, government policy is driving the increase of woodland creation and the use of wood as a substitute for fossil fuels in energy production.

Carbon management is a complex subject and one that needs continued research support. This conference highlighted that there is a clear role for forestry in a carbon-lean future and that opportunities are there if the sector is bold enough to grasp them. I believe that the Institute has made a start in doing this.

A handwritten signature in grey ink, appearing to read 'Shireen'.



Keynote Speech

Michael Russell, Minister for the Environment, Scottish

The Scottish environment minister was unable to attend the opening of the conference in person but he sent his keynote speech to delegates via a video recording. Below is a transcript.

I am sorry not to be able to join you personally, but I am pleased to have the opportunity to talk to you about this very important subject. I'm equally sorry not to be at tonight's reception but I'm pleased that Fergus Ewing will be welcoming you to Edinburgh castle.

I have now been in post for a year. I have been very impressed by evidence of the sector's ability to deliver a wide range of economic, social and environmental benefits to society. The new Government is keen to work with the sector to further develop the sector and its contribution to the delivery of key Government objectives.

I am particularly pleased that this year's conference is looking at ways in which the forestry sector can contribute to developing a low carbon economy in the UK. Climate change is a major global issue and tackling the impact of global warming is high on the agenda of the Scottish Government. Only last month I launched a consultation on a draft forestry sector Climate Change Action Plan for Scotland. We want to use this to get buy-in to further development of the many ways in which the sector can help to reduce the amount of carbon in the atmosphere and help the process of adaptation to cope with the impacts of global warming.

The key focuses for our efforts in relation to mitigation are:

- Increasing the rate of carbon sequestration through new woodland creation. We have set an ambitious target of 10,000 ha of new woodland creation each year and are working with colleagues throughout the UK to develop a better understanding of the impact of different forest management practices on the carbon balance. I am also keen that we make progress on establishing a responsible approach to the business of carbon offsetting.
- Increasing the role of wood as a substitute for fossil fuels in renewable energy production and as a substitute for more carbon intensive building materials in construction projects. Earlier this year I set up a taskforce to look at ways of increasing the volume of woody material available for renewable energy production while minimising the impact on established wood-using business. We are now taking forward the recommendations of this group and through publications and seminars we are actively promoting greater use of wood in sustainable construction.

I know that you will be discussing these and other related matters over the next two days. The sector has a wonderful opportunity to demonstrate that it can make a very significant contribution to an issue which is of vital importance to this and future generations. I urge you therefore to be bold and imaginative in your thinking and to use your professionalism and your expertise to further develop and promote a soundly based case which allows Governments throughout the UK and beyond to support and assist the sector in achieving its goals.

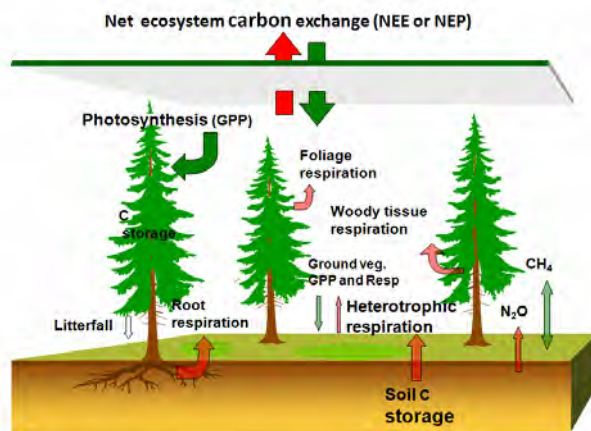
I hope that you have a successful conference and I look forward to hearing the results of your deliberations.



The road to carbon forestry

*Paul Jarvis FICFor, Professor Emeritus,
School of Geosciences, University of Edinburgh*

Carbon sequestration is a question of balance between photosynthesis and respiration. There is diurnal variation in CO₂ exchange, with photosynthesis dominant during daylight hours, and flux in the seasons. Carbon storage in forest soils and trees varies with latitude, where the carbon soil:tree ratio is typically 1:1 in the tropics, 4:1 in temperate regions and 8:1 in boreal forests.



Net Ecosystem Production (NEP) is the balance between influx and efflux (Figure 1). Five year measurements in a Sitka Spruce plantation, Griffin Forest in Perthshire, revealed a NEP of 6.6 tonnes C per ha over five years (Figure 2).

First results of the Griffin thinning experiment, where a standard line thinning took place in 2004, removing 30% of trees, revealed that within two years the annual NEP was back to the pre-thinning amount.

Figure 1 Forest greenhouse gas fluxes

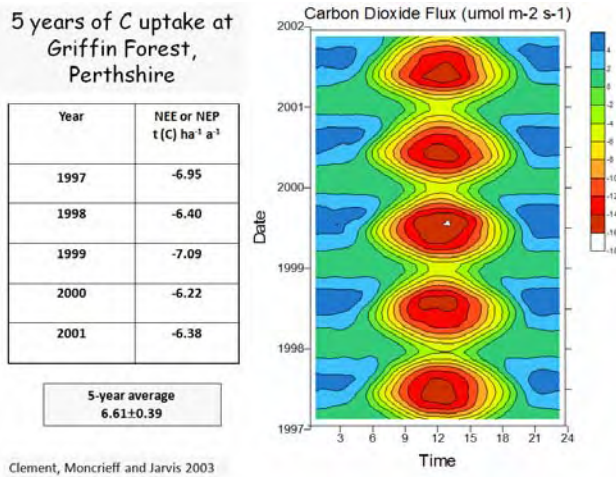


Figure 2 Five years of carbon uptake at Griffin Forest, Perthshire

Soil carbon is highly important. Forest management activities such as thinning, brashing and stump removal have a significant effect on soil carbon. For example, brash mats can protect the soil and facilitate C transfer into the soil. Stump removal is a contentious issue, as on one hand it can support fossil fuel substitution but can also lead to high soil carbon emissions. In thinning operations (lop and top removal), current concern lies in loss of the C and N in the debris, as carbon emissions from the soil during the first rotation are not likely to be replaced. Nitrogen in the debris required to build the leaf area during the following rotation will be lost. There is a need for a full life-cycle analysis, where measurements of C and N budgets can be made for different forest operations, evaluated and considered fully.

Nitrogen, N & N₂O, is the big enigma! How can large spruce trees be grown without addition of N fertiliser? Nitrogen is also a big concern from the perspective of biofuel production. Agricultural crops need annual fertiliser applications up to 300 kg N/ha. N₂O generated in the soil is a greenhouse gas *300 times* more potent than CO₂ in the atmosphere. Therefore, nitrogen emissions are a big problem for agricultural biofuel production but not a problem for wood biofuel.

We have established a carbon conveyor belt with overlapping cycles of *Site prep – Plant – Grow – Thin – Harvest*. Tree planting between 1950 and 1990 in the UK averaged 25,000ha per yr, afforesting approximately 1Mha in 40 years. In order to retain current levels, 2.5 % must be harvested and replanted each year – i.e. approximately 25 000 ha/year. We should aim for carbon to be funnelled into the soil and the soil carbon stock maintained or increased. Products and co-products are available for manufacturing and for bio-fuel, whilst no fertiliser applications of N are required in our forests, *if* the soil is conservatively managed. The standing stock of tree carbon is more or less constant over time.

Wood is the ideal biofuel, having the highest carbon to nitrogen ratios (500:1 to 400:1) compared to many other crops (agricultural crops 40:1 to 20:1, soils 100:1 to 25:1, leaves /needles 40:1 to 25:1, fine roots 50:1 to 30:1). Innovation is likely to bring new opportunities. For example, cars can be driven on bio-petrol made from ligno-cellulose spruce pellets, as in northern Sweden today.

Carbon forestry must mean the sustainable management of our forests. We must aim for the following:

- To enhance removal of CO₂ from the atmosphere
- To avoid emitting other greenhouse gasses into the atmosphere, particularly N₂O
- To avoid '*mining*' the soil carbon
- To maintain and increase the standing stock of carbon within forests – in both trees and soil
- To produce products that can substitute for fossil fuels, *without generating C debts*
- To produce other innovative chemical products



Stabilising greenhouse gases – Kyoto and beyond

Jim Penman, Head of Response Strategies, Defra

It is clear that we must avoid dangerous climate change. The EU aim to limit global average temperature increase $\Delta T < 2C$. The Stern Review recognised the need to balance the risk of climate change against the cost, stabilising at 450-550ppm CO₂. The Intergovernmental Panel on Climate Change (IPCC) fourth assessment report (AR4) identified the most ambitious scenario, quantified stabilising CO₂ at 450-500 ppm, consistent with ΔT 2-2.4C; with developing countries reducing emissions 25% to 40% below 1990 levels by 2020. It is clear that current commitments under the Kyoto Protocol are not nearly enough and that we must agree new commitments in Copenhagen, 2009.

So, what deal can be expected at Copenhagen in 2009?

We seek agreement on a framework for adequate mitigation action by all Parties: e.g. ambitious commitments from developed countries consistent with 25% to 40% absolute emissions reduction below 1990 by 2020 (EU has offered 20% unilaterally or 30% in the context of a global agreement). Also, developing country commitments must be consistent with a departure from emissions trend from the Business As Usual (BAU) scenario.

But is it technically feasible? Yes; mitigation potential exceeds effort required. Land Use, Land Use Change and Forestry (LULUCF) and agriculture represents 30% of the mitigation potential identified in AR4 so we cannot progress without these sectors, which should be considered together to deliver the optimal contribution from sequestration, materials substitution and energy to meeting UNFCCC Article 2 (above).

There may be difficulties however. Land-use change and forestry (LUCF, subsequently LULUCF) was very difficult to negotiate in Kyoto in 1997. Countries wanted a) flexibility from LULUCF to meet commitments already agreed, but b) had concerns about LULUCF – the code words were *scale, uncertainty, and risk*. Resolving the tension between a) and b) produced entry into force, but it took three years of negotiation, and the result is complicated. Will these ghosts haunt the path to Copenhagen?

Scale is an important factor in the negotiations. In 1997 the Kyoto LULUCF contact group agreed to take account of afforestation, reforestation minus deforestation (ARD) since 1990. We felt these activities were well defined, quantifiable and likely to be relatively small in magnitude. Another issue in relation to scale is 'factoring out'. The risk of unforeseen uptakes entering the system are much reduced by better understanding of what drives forestry emissions and removals, whilst better inventory data can be linked to projections. This causal understanding is essential to negotiating forest management as uncapped in future agreements.

Uncertainty is a key aspect. LULUCF inventories were very underdeveloped at the time of Kyoto. There have been major advances since then with a) agreement of IPCC Good Practice Guidance for LULUCF (2003), the 2006 Guidelines, and b) development of inventory systems and review under KP reporting requirements - LULUCF data now much improved. We need to continue to apply IPCC methods in a consistent fashion and maintain the UNFCCC/KP review system.

United Nations Framework Convention on Climate Change (UNFCCC) Article 2.

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Risk (i.e. permanence risk) is not an issue where there is long term responsibility for carbon stocks, which is the case for developed country commitments. In a legally binding regime this translates *permanence risk* into *compliance risk*. Carbon stocks vary e.g. due to fire incidence or pest attack.

These are predictable, on average. But they produce *statistical fluctuations* in national inventory totals that are potentially a problem for compliance

Reduced emissions from deforestation and degradation (REDD) was a hot issue at Bali and continues to be a priority. In terms of harvested wood products, so far it has proved impossible to agree how these should be accounted. We need to avoid a) treating emissions from HWP as fossil fuel emissions, and b) crediting HWP stocks from unsustainable activities. A simple decay method may be a way forward.

The future of the Clean Development Mechanism (CDM) needs to be considered. Currently it includes afforestation and reforestation activities, but not activities to reduce deforestation. There has been very little take-up. A way forward may be to extend REDD approach to afforestation and reforestation.

In summary, solutions exist. We can have full coverage, proper incentives to optimise the contribution from sequestration, materials substitution and energy. LULUCF helped catalyse Kyoto Protocol entry into force, and may well help catalyse the Copenhagen agreement, which will, we hope, appear more rational to the sector. The ghosts of the past need not haunt the future.



Life cycle analysis – embodied energy and energy accounting

Gerry Lawson MICFor, Research Councils UK/Natural Environment Research

Energy accounting was first proposed by ‘Technocracy Inc’ in the 1930s. The ‘Technate’ would use information of all available natural resources, industrial capacity and citizen’s purchasing habits to determine how much of any good or service was being consumed by the populace, so that it could match production with consumption! In a ‘High Tech’ society, to ensure stability and continuity, it will be necessary to institute measurement and control of the economy by energy units instead of monetary units (money), and management of the economy by energy budgets instead of money budgets, at all levels, including consumer credits. “Due to Peak Oil and Global Warming this need is here and ‘Technocracy’ provides an energy efficient design for survival”. Books written following the first Oil Crisis (e.g. Gerald Leach & Malcolm Slessor) deserve to be revisited.

Embodied energy, or the energy used to produce timber is massively less than for other materials. For example a steel beam requires more than 10 times the production energy of equivalent timber beam, and aluminium frames use over 50 times the energy. On a weight for weight basis manufacture of steel consumes 300% and aluminium 1500% more than their timber equivalent. Brick cladding for houses uses significantly more energy than timber cladding. Much of the energy in timber kilns is waste wood whereas most of the energy in extraction and processing of alternatives is non-renewable. Timber stores 15 times the amount of CO₂ released during its manufacture. Steel making liberates 2 tonnes of CO₂ for every tonne of steel produced. A steel framed house accounts for the release of 3.5 tonnes of carbon, but an equivalent timber framed house stores 3.1 tonnes of carbon

Life cycle assessment is one method that is used to measure the environmental impacts of building products. Alternative terms for a life cycle assessment include cradle to grave analysis, eco-balance, product lifecycle analysis, and resource and environmental profile analysis. The aim of a life cycle assessment is to identify, quantify and assess the impact of the energy and materials used and wastes released to the environment throughout the life of a building product (Figure 3).

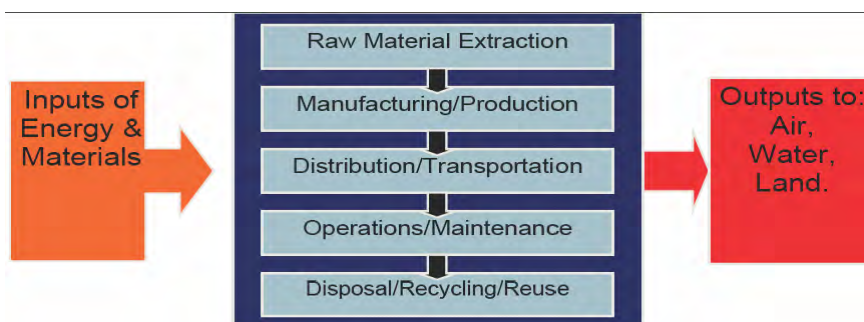


Figure 3 Life cycle stages

There are many life cycle assessment methodologies and the models vary in their complexity. They range from full life cycle assessments (used for publications, policy decisions and marketing claims) to streamlined approaches (used for comparisons and usually with the aid of a software tool) to guidelines and checklists. Typically, there will be several stages that are considered. By allowing for comparison between various building products, a life cycle assessment can assist in making an informed decision about the choice of building materials. Because this type of assessment can also be used as a marketing tool to support the use of one material over another, it is important to view the environmental assessment critically and consider other factors such as structural, economic and aesthetic performance.

Due to the number of methods available to conduct a life cycle assessment, making meaningful comparisons can be difficult. International organisations such as the International Standards Organisation are working towards standardising the process. Life cycle assessments take time to carry out and require detailed information. Access to life cycle information on a range of building products is not yet readily available. Market demand for this information together with further development and refinement of the assessment tools should improve the availability of information. The BRE Ecopoints System is an excellent example of this approach.

Energy accounting could provide the new 'lingua franca' for land use and investment decisions. Embodied energies generally favour timber and timber products. Life Cycle Analysis requires consistent methodology, but ISO standards and databases are now available, and most results significantly favour timber construction.

Further information on financial, socio-economic and energy accounting in Forestry is available in a report, entitled *World Timber Trade, implementing sustainable forest management in the UK*. The report considers the issues discussed here in relation to the UK forestry sector, and is available on the Land Use Policy Group webpage: <http://www.lupg.org.uk/default.aspx?page=4> .

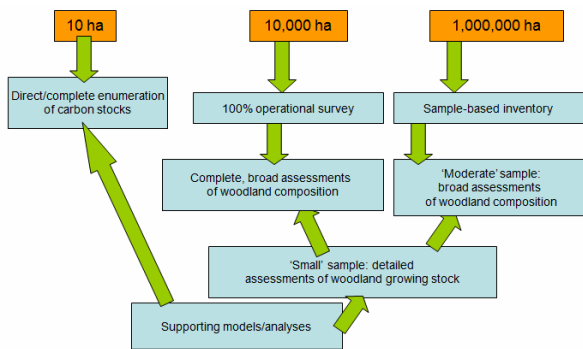
UK Research Councils have a budget of £319m for energy research in the current spending round with a significant proportion related to bioenergy, including a call for establishment of a Bioenergy Research Centre. BBSRC have undertaken a review of Bioenergy Research (http://www.bbsrc.ac.uk/organisation/policies/reviews/scientific_areas/0603_bioenergy.pdf) .



Context and methods for producing estimates of carbon sequestration in UK forests

Robert Matthews, Coordinator of Forest Resources Evaluation Group, Forest Research

Assessments of carbon stocks and carbon sequestration need to be transparent, verifiable, consistent with additionality, demonstrate permanence, take account of risk, and underpin accounting systems.



There are three main methods for measuring forest carbon stocks and carbon sequestration: measurement of flux, direct measurement of stocks (plot based), and model-based methods. These go hand-in-hand with baseline assessments/forest soils. Direct measurement of stocks builds on established methods, where methods must be matched to scale (Figure 4).

Figure 4 Linked protocols for different scales

In small woodlands (up to 10ha), complete enumeration is possible, where you can identify the woodland area, enumerate trees and measure dbh, measure stem wood of thinnings and standing trees, measure height of dominant trees, analyse stem height and dbh, and produce summary data (Figure 5).

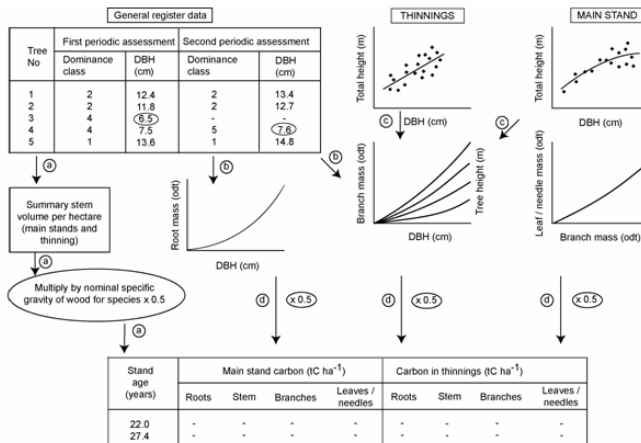


Figure 5 Complete enumeration in a small woodland

For larger woodlands (up to 10,000ha) broad survey methods are feasible, where sample plots are used in combination with operation surveys. For large woods (1Mha), sample-based methods are applied using a grid-based method. These inventory models need verifying by conducting field work.

A model-based method, C-flow, has been developed to calculate the carbon stock components of a forest and can be applied to the inventory data gathered using the methods described previously (Figure 6). Exploring sensitivity of carbon calculations using C-flow can be revealing. There are

simple assumptions in the current model where all conifers are Sitka spruce (Yield class 12 or 14), all broadleaves are beech (yield class 6), and forest planted before 1920 is in carbon balance. We should question how the species planted and their productivity vary over space and time, explore differences between public and private forest management, and attempt to model older forests. A key question might be: what effect do these variables have on forest carbon stocks and fluxes? Probably more work is required to disseminate this information to the forestry sector.

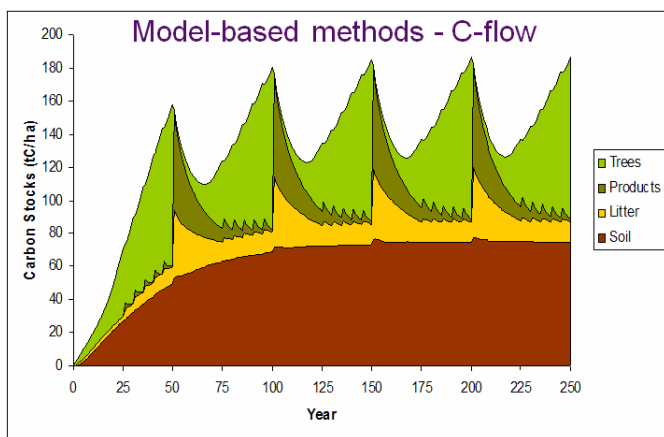


Figure 6 Carbon storage cycles for different forest components over 250 years

We face several challenges in estimating carbon sequestration in our forests. Forest soils are by far the largest carbon pool but can be difficult to model. Different accounting systems complicate decision making and the debate as to the best methodology continues.

In conclusion, carbon sequestration is a real process. It is possible to measure it but we need the right system for specific circumstances. We must remember that carbon stocks can go down as well as up and that we need to balance against other carbon benefits. The devil could be in the accounting details.



Soil carbon management

Mats Olsson, Soils Professor, Swedish University of Agricultural Sciences

Where forest soils are untouched by man, the O horizons can reach 30cm or more, as evidenced by soils north of the Arctic Circle. Is this desirable?

Why manage soil carbon? Soil properties and fertility are important factors in forest management. Water run-off is affected by soil management both in terms of water quantity and retention. Soils are also closely allied to biodiversity. Of new interest today is the role of soils in climate change mitigation



Figure 7 Drainage leads to peat oxidation and loss, Sweden.

What factors affect soil carbon sequestration? The production level of the forest has a big impact due to the amount of litter supplied to the soil. The quality of the litter in terms of lignin and N content also varies. Soil properties also affect sequestration with stabilisation occurring through aggregates and binding but these are affected by soil moisture conditions and temperature. Many of these factors are management dependent. Other forest management activities have a direct impact including harvest levels and disturbances such as scarification and fires.

Our management aims in response to the challenge of managing soils for carbon sequestration should seek to maintain or increase soil carbon stocks. We should focus on stabilised carbon and attempt to get carbon down deep into the soil profile. Our management options in achieving these management aims should include groundwater regulation (ditching), choice of tree species, site preparation (eg scarification), thinning regimes and rotation length, fertilisation, and forest health.

Groundwater regulation is also important. For example, excessive drainage can lead to severe peat loss, of 1m or more in 100 years (Figure 7). In well drained afforested peatlands in Sweden, studies revealed mean annual values for emission rates of CO₂ and N₂O to be 90 - 370 g C eqv/m², biomass uptake of C 80 – 300 g C eqv/m², with the net flux to atmosphere being 10 – 70 g C eqv/m². Blocking ditches may decrease CO₂ emission but may increase methane emission. For example, a nutrient poor bog in Sweden may take up 15 g C eqv per m² as CO₂ but may emit 40 g C eqv as CH₄.

In upland mineral soils the production level is a main factor affecting soil carbon stocks, where fertilised forests (production 10 m³ ha yr⁻¹) intensive management forests (7.7 m³ ha yr⁻¹), and traditional management forests (7.3 m³ ha yr⁻¹) have long term running mean carbon stocks of around 81, 60 and 57 tonnes C per hectare respectively. Quality is also important as indicated by linear relationships between lignin concentration in decomposing Scots pine needle litter and annual litter mass loss. Tree species influence the amount of litter added to the soil from litter fall and from root litter. Degradability of litter varies with species as does litter quality. Fine roots could be more important than realised as a carbon stock.

The overall goal in emission mitigation must be to maximize the reduction in greenhouse-gas emissions with respect to both the sink effect and the substitution, i.e. high forest production and a maintained or increased soil C stock. Harvesting and replanting is better than leaving the forest untouched. Long term reduction in net CO₂ emissions will be greater from intensively managed forestry, compared to non-managed forests.



Carbon trading – the UK and wider development of standards and protocols

*Dr Richard Tipper, Technical Director,
Edinburgh Centre for Carbon Management*

There is a big role for carbon trading in the future. There are many international policy constraints affecting various sectors, for example industrial energy efficiency regulations and programmes, building standards and energy efficiency programmes, waste regulations and recycling and methane capture (the Clean Development Mechanism). However, there are far fewer restrictive policies for forestry and agriculture globally despite their combined influence on GHG emission reductions being very important. There is a gaping policy gap for forestry.



Why are standards required for carbon forestry? We need to provide clarity for buyers and be able to issue a certificate denoting an environmental benefit (no physical product) and providing evidence of quality (Figure 8).

Figure 8 Desirable attributes of a certificate for carbon forestry

There are currently five standards in operation. The Clean Development Mechanism (CDM) is the official programme of the Kyoto Protocol, and covers afforestation and reforestation in developing countries on land deforested prior to 1990. The CCB Alliance standard is run by a group of NGOs and companies, led by Conservation International, and covers all types forestry projects and all countries. The Gold Standard is run by a Swiss NGO covering renewable and e-efficiency (but no forestry). The Voluntary Carbon Standard (VCS) is run by a collaborative group convened by Climate Group and has interest in all types of forestry projects and all countries. Plan Vivo is a UK-based scheme run by the Plan Vivo Foundation and concerns community-based agroforestry, forest restoration and conservation in developing countries.

The five schemes take different approaches to the attributes identified in Figure 8 which can make comparisons difficult. Plan Vivo takes an approach which is practical for implementation and which encourages participants while CDM provides high consumer protection but also has a high barrier to entry. The other schemes lie between these two in terms of these attributes. Overall, outcomes from these schemes have been disappointing. Huge investment in registration time in the Government-backed CDM has so far only led to one small project in China.

The lessons for the UK are that Carbon Standards define the product. It is still early days but good standards should help consumers get something of value and give producers a clear frame in which to work. However we should be careful what you wish for, if standards are too high this may limit their effectiveness, and we must be aware of trade-offs. In the end, the projects define the standard.



Carbon offset initiatives – international carbon markets

Jan Fehse, Principal Consultant, Head of Forestry Services, EcoSecurities

Why should carbon markets be developed? The philosophy is that if we are doing environmental good and it becomes profitable, more people will do it. The search for profit results in actions where regulation would be too cumbersome, and can achieve targets more cost-effectively. More importantly carbon revenue can leverage further investment.

Under the Kyoto Protocol industrialised countries have committed to a 5% reduction in emissions, compared to 1990, by 2012. Commitments can be reached through member states’ domestic measures, or through the use of flexible mechanisms, including:

- *Clean Development Mechanism (CDM)*: emission reduction projects in developing countries;
- *Joint Implementation (JI)*: emission reduction projects in industrialised countries;
- *Emissions Trading*: selling and buying surplus carbon credits between Annex-I countries.

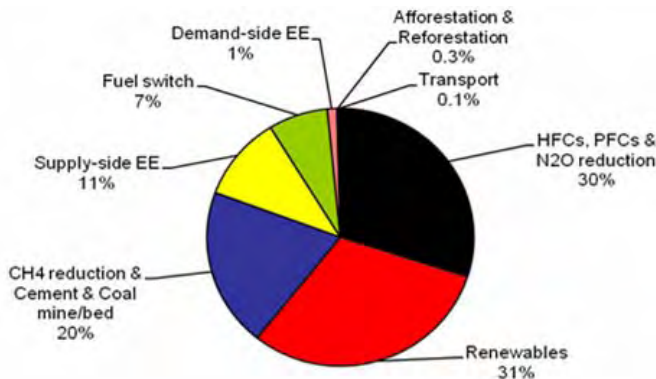
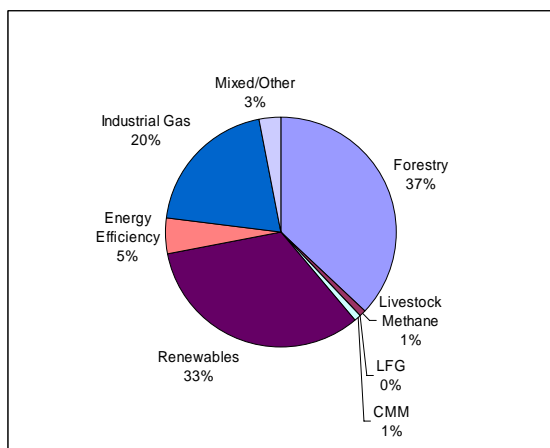


Figure 9 Share in expected CERs until 2012

Current forestry projects in the pipeline under the CDM (only tree planting) and JI include one registered project, 7 under validation, and 30 with detailed information. Compared overall with wider projects there are over 3000 with CDM, so forestry represents a tiny proportion of projects (Figure 9). Overall 13.6m t CO₂ equivalent should be secured before 2012 (from 30 projects).

Why has forestry been a failure in CDM and JI? Forestry is suffering from an historical image problem, and of course was excluded from the EU Emissions Trading Scheme. The EU Commission is

proposing further exclusion from 2013 to 2020, meanwhile the only plausible buyers are some EU governments and Japan. Temporary CERs are not fungible with other credits; a better approach would be permanent credits that are insured. There is a window of opportunity until 2012 but it is closing fast (though CERs also fit for voluntary markets) and high transaction costs are likely to be restrictive.



In terms of outlook for voluntary market demand, we predict a more than four fold increase in MMT CO₂ equivalent in the next four years. Forestry is likely to continue to feature strongly and indeed dominate in comparison to other sectors (Figure 10).

Figure 10 Voluntary transactions by sector

However, voluntary markets are not (yet) standardised and relatively opaque. The price of credits and quality vary greatly and we need to ensure that an offset really is an offset (i.e. address additionality, monitoring etc.). There is a general trend towards more stringent criteria and verification as non-credible offsets are a reputational risk for companies.

Several initiatives are developing standards for Verified Emission Reductions (VERs) whilst there is broad industry support for the Voluntary Carbon Standard (VCS). The CDM remains the benchmark for high quality.

In terms of forestry in voluntary markets, there has been considerable criticism with a general critique of voluntary markets often directed at forestry, and examples of poor quality forestry projects cited (incl. non-permanence issue). We should, however, have a positive general outlook, as there are indications of increasing buyer interest. After all there is high appeal of the sector, particularly for projects that can sell a story (biodiversity, community benefits etc.). Forest conservation is increasingly important (pushed by avoided deforestation discussions).

In summary, CDM and JI appear to have been a failure globally. However, they may be successful for individual projects. They are likely to be the benchmark standard accepted post 2012 but a redesign of rules and procedures is required post 2012. Voluntary markets with sound quality standards seem to be way forward for now as they have less bureaucracy, broader scope, and more flexible rules. Their lower transaction costs are attractive with little or no price differential with CDM.



Carbon offset initiatives – does forestry have a role in carbon trading?

Mike Mason, Founder and Chairman, Climate Care

There appears to be simple thesis: forests soak up CO₂, this is good, please pay!

The potential buyers are Government (on the basis that change in carbon inventory over 2008-2012 adds to Kyoto achievements), the compliance market (but no mechanism to trade the UK credits) and the voluntary market (there have been sales but could they provide what’s needed?). There is no mechanism for woodland owners to trade credits in the UK within the compliance market.

However there are problems in the compliance market. Namely permanence (possibly forests but certainly not trees), land take and leakage (UK emissions for 1 year = afforesting an area equal to Devon + Cornwall), timing (the voluntary market has moved to simultaneous offset whilst trees start very slowly). There are also political issues (Government already accounts for it and is unwilling to separate UK projects of any form from national account, and already pays the bulk of planting costs through forestry grants) and a strong market risk (customers will not buy because of reputation risks). Fundamentally, as Greenpeace stated, the problem is that you cannot sequester the lithosphere in the biosphere.

The voluntary market value is also beset with problems. There is an increasing trend towards accounting only when delivered and forestry delivers nothing much in the early years. The price is low with the market price for quality renewable and efficiency credits at only £4/tonne. Therefore, if only 20 tonnes are produced in the first 20 years, only £80 value is created. Forestry must compete with others. For example there is a large peat bog based scheme in Kalimantan delivering 100Mt over 20 yrs. With a marginal cost well under £4/tonne and fast to deliver it is very attractive to consumers.

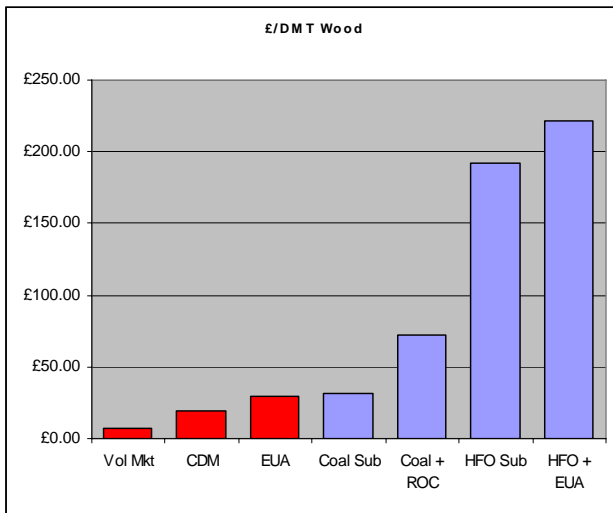


Figure 11 Relative value of wood in carbon markets and as a bioenergy source

The real potential role for forestry lies in bioenergy. In the future all biomass will be burned for energy, as biomass is more valuable as an energy source than a carbon store, particularly if we can use it as a substitute for heavy fuel oil (HFO), worth nearly £200 per tonne (Figure 11). How wood is used is critical however. The raw material is not practical as a fuel as it is difficult to handle, expensive to transport, and combustion expensive. On the other hand, pellets are a regular material, high density, easy to handle and transport, and a strong liquid market is emerging.

So, has forestry no role in carbon markets? No, forestry has a huge role to play. If you

look beyond the executive summary of the Stern Review, it is stated that for long term sustainability we must cut emissions by 80%.

We have to start preparing for a 100% cut in GHG emissions now. Biomass has a hugely important role in the new world. So forestry does have an important role in the carbon market but don't even think about carbon credits!



Managing forests for carbon

Sandy Greig FICFor, Sandwood Enterprise Ltd

Carbon is stored in above-ground forest biomass, forest soils and wood products: increasing the size of these stores reduces atmospheric CO₂ and can be considered a “carbon gain”. In addition gains can result from the substitution of fossil fuel by renewably grown woodfuel and the substitution of high embedded energy materials such as concrete, brick and steel by wood products. On the debit side we need to consider CO₂ (and other greenhouse gas) emissions associated with forest management activities. A model of the CO₂ reductions over four 75 year rotations of Norway spruce is shown in Figure.

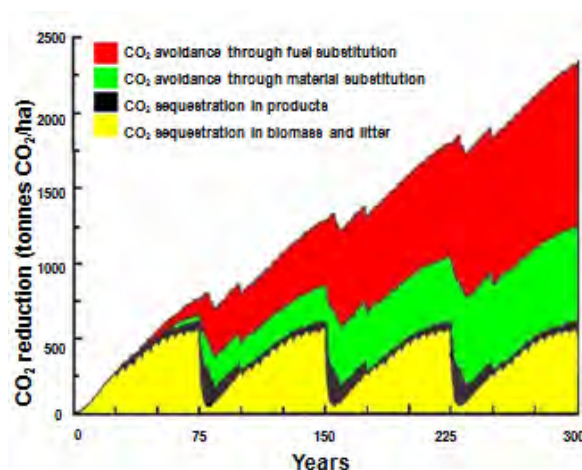


Figure 12 CO₂ reductions over four 75 year rotations of Norway Spruce (after Nabuurs 1996)

In a study for the Forestry Commission in 2006 I calculated carbon storage and carbon emissions for Kielder Forest (39,869 ha) and East Anglia Forest District (25,178 ha) (Table 1).

Table 1 Carbon storage estimates for Kielder Forest and East Anglia Forest District

Source	Kielder Tonnes carbon	East Anglia Tonnes carbon
Above ground carbon	1,696,000	618,000
Soil carbon	11,562,000	1,913,000
Annual sequestration (trees)	81,700	38,100
Annual removals (wood products)	79,000	26,500
Total stored in wood products	1,532,000	256,000

(Note that the soil carbon estimates are based on single research plots and should be treated with considerable caution. The estimates of long term storage in wood products include assumptions about product mix, future levels of production and product life.)

The annual material substitution gains were estimated at 30,076 and 15,057 tonnes of carbon for Kielder and East Anglia respectively. The annual woodfuel gain for East Anglia was 6,600 tonnes carbon (no woodfuel production at Kielder) (Table 2).

Table 2 Annual emission estimates for Kielder Forest and East Anglia Forest District

Source	Kielder Tonnes carbon	East Anglia Tonnes carbon
Harvesting operations	759	265
Timber haulage	633	94
FM operations	137	35
Operators/supervision	68	52
Roads	191	15
Office energy	24	16
Deer (C equivalent)	97	249
Recreation visitors	375	722
TOTAL	2284	1448
Total per hectare (kg)	57.3	57.5

Carbon accounts of the type calculated for Kielder and East Anglia allow for a more objective consideration of how forests can be managed for carbon gain. It is vital that forests are resilient against future climate change and that productive capacity is maintained: the threat of losses through fire, pest, disease and wind is predicted to increase. As soil carbon levels exceed those in above-ground biomass, careful soil management is essential. Maximising wood production, within the context of sustainable forest management, and bringing unmanaged woods into production is desirable. In terms of utilisation long lived wood products with low embedded energy and high material substitution gain are best. With transport, managers should aim to reduce haulage distances or use lower energy forms of transport. While opportunities should be taken to reduce them, carbon emissions from forest management operations are very low compared to the potential for carbon gains through improved carbon storage in trees, soils and wood products.



Sustainable timber transportation and influence on future markets

David Spaven, Principal, Deltix Transport Consulting

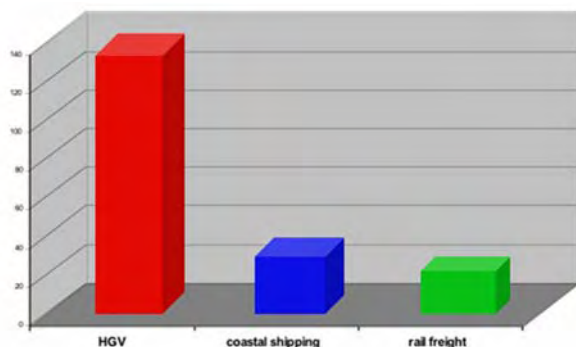


Figure 13 Cross-modal CO2 performance (CO2 grams per tonne-kilometre)

was 137km compared to 86km for all freight and the road mode is very dominant, which can lead to rural road damage and community impacts. There are also real increased costs of timber haulage due to the Working Time Directive, oil price trends and driver shortages.

Public policy is to use technology to reduce adverse impacts with key transport policy objectives being to reduce road congestion, secure environmental benefits, and develop multi-modal freight hubs as economic drivers. However, policy objectives can be contradictory: for example environmental benefits versus more road-building. There needs to be a consistent EU / UK approach and encouragement for mode switch from road to rail, and road to sea.

There are some financial incentives available. The Freight Facilities Grant for rail / sea switch can provide up to 75% of capital costs although grant aid cannot exceed environmental benefits. The Waterborne Freight Grant provides start-up revenue. The Rail Environmental Benefit Procurement Scheme could be better utilised. The Scottish Strategic Timber Transport Fund provides for innovative long-term solutions delivering community, social and environmental benefits whilst reducing impacts on public roads.

EU regulations have long aimed to reduce air pollutants from lorries e.g. NOx. Ironically these can *increase* CO₂ emissions for example the Euro 6 air pollution standard may carry a 4-7% fuel efficiency penalty. There is market and Government pressure to improve fuel efficiency, for example in Scotland the Safe and Fuel Efficient Driving scheme aims for an average 10% improvement in miles per gallon, thereby reducing 8,420 tonnes of CO₂ emissions. However, we should recognise the limits of greater road haulage fuel efficiency.

Timber transport by rail saw a 1990s expansion followed by a contraction due to price and service issues. In 2007 a new timber haulier, Colas, stimulated interest in rail transportation, as evidenced by rail tonnage growing again. Rail needs volume and long hauls to be efficient as the costs lie in road collection and delivery. In addition we have the legacy of Victorian railheads with new railheads being costly and complex to develop in the modern era.

In the transport sector sustainability and carbon are important factors. There are growing CO₂ emissions from transport and whilst globalisation continues, supply chains continue to grow longer. Transport is relatively cheap compared to other production factors. At least 95% of transport fuel is oil but how long until Peak Oil? Concern about this may act as a pressure for mode switch: from road to rail, and from road to sea (Figure 13).

In relation to timber transport in the UK, timber tonne kilometres by road grew 74% from 1991-2005. The average haul length



Figure 14 Mode switch from road to sea could have many benefits



Figure 15 A Freight Multiple Unit in operation in Germany

A new solution has been pioneered in Germany as the Freight Multiple Unit (FMU) (Figure 15). It is a light-weight train with control cabs at each end and fixed train formation. It has fast acceleration whilst terminal shunting is eliminated. It runs 'little & often' with 200t payloads. It needs intensive utilisation to be efficient. There was a successful trial in Wales during 2006 between Aberystwyth and the Kronospan plant in Chirk. There is a chance that the first UK FMU railhead may be in place at Barrhill. An in-forest railhead would be created, fed by forest haul roads. A £5m Freight Facilities Grant was awarded in 2006 but in 2006-7 there was a Forest Enterprise / Network Rail impasse over 'wayleave', and in 2007 the preferred railhead operator withdrew. A revised scheme is currently under consideration.

Other innovations are in development that may reduce the need for costly railheads and network changes. One is the 'non-intrusive rail

crossover' (NICS) that allows the connection of a siding line without cutting into main line rails using a hinged 'temporary' track, with no interference with signalling. Designed in Scotland by NICSCo, it is currently on trial by the West Coast Main Line awaiting Network Rail approval.

Rail needs to achieve critical mass by creating a network of existing rail-connected mills, developing rail-connectable mills (NICS) and rail-connectable mills (conventional), and also exploiting markets in South East England and the continent.

Sea flows currently represent a 2-3% share of the domestic timber market. Where there are coast-located forests, and mills such as Corpach / Troon / Workington, it is logical to exploit the sea, and the ABP domestic Timberlink service currently handles 250,000 tonnes pa. It is natural to use the sea to export timber. There are limits to sea competitiveness however, including road legs at both end of sea transit, peaking / double handling at piers, vessel utilisation is often poor (1/3rd of time loading, 1/3rd of time unloading, 1/3rd of time on passage in the case of Timberlink), and most coastwise flows need grant aid. Is there scope for greater efficiency, for example by using barges?

In terms of future markets and sustainability, we should be positive. As a recent newspaper article stated: "*the ensuing credit crunch could lead to a complete redrawing of the financial map and may even herald the end of globalisation*" (The Guardian, April 8 2008). With the combined effects of the credit crunch, climate change and peak oil, will localisation become a key future driver?

The key questions the transport sector must address are:

1. How far can we take mode switch for timber transport?
2. Will growing transport costs / carbon pressures lead to decentralisation / localisation of processing?
3. Will the geographical extent of markets shrink?
4. What will be the impacts on supply chains?
5. Will we end up with *less* transport?



Wood for material substitution – construction with wood

*Dr Ed Suttie, Director of Timber Research,
Building Research Establishment*

The UK construction industry is worth £80bn and 10% of GDP, employing 1.4m people. Annually 420m tonnes of materials are used, including 10m tonnes of timber, whilst 94m tonnes of demolition waste is produced. Timber framing represents 20% of the new housing market. We spend 90% of our time in the products of construction, and we “shape our buildings and afterwards our buildings shape our lives”.

The use of concrete in construction is responsible for 5% of annual anthropogenic CO₂ (the CO₂ is a product of the cement reaction) and is widely used (2bn tonnes per annum and rising). 800kg CO₂ is produced per tonne of concrete. However, “Sustainable Concrete” has recently challenged the industry to both celebrate the advantages of concrete and identify opportunities to improve environmental credentials. Some of the advantages of concrete include thermal mass, fire performance, energy efficient buildings, recycling reuse, and CO₂ absorption (30% of total emitted).

Steel represents 10-15% of CO₂ emissions in China, Brazil, South Africa and India. Steel construction uses old inefficient technologies, burning coke or charcoal as fuel. However, 30-50% of primary energy input can be saved, and there is predicted to be a 20% reduction in CO₂ emissions by 2020 compared with 1990. “Energy consumed to produce 1 tonne of steel has fallen by 11% since 2000 to 50% of that required 40 years ago”. Some of the advantages of steel include its flexibility and deconstruction built in, long span capability, low waste, and high strength to weight ratio.

Timber use in construction brings many benefits, including being a renewable resource and its use supporting rural communities, and as a material it is lightweight, a good thermal insulator, highly aesthetic, versatile, adaptable, and has good energy recovery. We should focus on the renewable nature of the resource and the sequestration of CO₂: after all by substituting 1m³ concrete/red brick with timber we save 1 tonne of CO₂. Timber buildings can achieve negative net CO₂ emissions, and the average CO₂ kg/m² emitted by building area for timber (1.4) is vastly lower than for concrete (11.1) and steel (5.2). For a typical house 20 t CO₂ is emitted during construction, whilst if timber use was maximised in the same house, only 2.4 t CO₂ would be emitted.

Material substitution has strong sustainability benefits. Half of all energy generated is used in operating buildings. For the buildings we should focus on reducing primary heat loss, reducing cooling loads, introduce energy saving measures (e.g. appliances), integrating micro-renewable energy generation, improving natural lighting. Design should be driven by materials and their functional units with particular focus on thermal efficiency, air-tightness, off site manufacture, and refurbishment. The instruments for sustainable construction include the BREEAM Ecohomes standard, the Code for Sustainable Homes, and the Green Guides. We should also consider cradle-to-grave Life Cycle Assessments (LCA) which cover a holistic assessment of raw material production, manufacture, distribution, use and disposal including all intervening transportation steps. LCA underpins Environmental Profiles, which feed into the Green Guides to enable selection of low impact products.

Challenges and opportunities for the future point strongly towards Government policy for sustainable communities. Big projects such as the 2012 Olympics will help raise the profile. Improvements in housing (zero carbon, affordable, offsite construction) will be influential. The Construction Products Directive (CE marking, emissions to indoor air, health of workers e.g. REACH, VOC directives) will also steer construction development. Meanwhile the industry must be seen to be demonstrating sustainability with schemes such as Ecohomes that have sustainable timber credits and include a code for responsible sourcing of materials.

There are tremendous opportunities for wood, particularly in certified wood products, products that work "service life", environmental profiles, innovative systems, solutions not products, new build innovation, and refurbishment. New high value end uses are emerging, as are innovations for using timber in foundations and increased energy efficiency in wood processing. The timber industry must aim for continuous improvement across the whole life cycle, from forest, to reducing energy and emissions in processing, developing innovative products, to recycling and fuel options.

It is vital that forest products form part of construction in the future. Other materials sectors have focussed on improving their sustainability dramatically. For timber the carbon storage potential is considerable but we require a step change in forest area delivering products into construction. Opportunities for material substitution will be limited by robust LCA data and environmental profiles, functionality and service life information. Innovative solutions will lead to new timber uses.

The actions required by the timber industry are:

- Define and agree priorities;
- Be ambitious but realistic - wood cannot substitute all materials!
- Support R&D for new technologies;
- Develop service life prediction;
- Demonstrate the sustainable benefits in an unequivocal, impartial and credible format used by other materials thus *"providing the sound case for Government support of timber"*;
- Use LCA to drive continuous improvement in environmental profiles for wood products;
- Provide the tools and training to enable use of timber;
- Actively engage in CSH credits for responsible sourcing of all materials;
- Robust data on LCA and integrating it into 'the tools' will make the substitution of materials choice clear.



Wood for material substitution – inspiring architectural design

Matt McGrory, Director, London Office, Glenn Howells Architects

Glenn Howell Architects were commissioned to design an environmentally friendly building using locally sourced materials for the Savill Gardens; in the grounds of Windsor. The steps we went through in designing, sourcing materials and erecting the building serve as a useful example for the use of timber in architectural innovation.

The key design principles were for locally sourced wood (from the estate), to have low energy use in the buildings once operational (e.g. through shading and aspect), and to use a natural venting system. A gridshell design was chosen and Green Oak Carpentry engaged in constructing the building. The building is 90m long and 30m wide, being 10m high at its highest point.

Larch was chosen to construct the gridshell, and was felled in winter when moisture content was low (to save energy in drying). The very best quality timber was required with a total absence of knots. The best grades were used in the beams, and grade 2 for other sections. Finger-jointed beams up to 90m long were constructed, 80x50mm in section, so that they were flexible yet inherently strong (Figure 16). The gridshell was loosely bolted together, initially in 4000 sections, and then lowered until in met with the preformed steel structure. The sections were lowered very slowly to prevent beam failure.



Figure 16 A flexible finger-jointed beam



Figure 17 The gridshell construction team

Being innovative increases the workload for architects, in many different ways and at different stages of construction, as well as increasing costs for the customer. For example, local oak was sourced for the floor. All was sourced within one mile of the construction site but we had to transport it 200 miles each way as there were no local sawmills! So there were real supply chain issues. Also, there were huge additional costs as we disrupted an outside mill system. From being initially being a 'free' material sourced from the estate, the oak eventually cost £250 m².

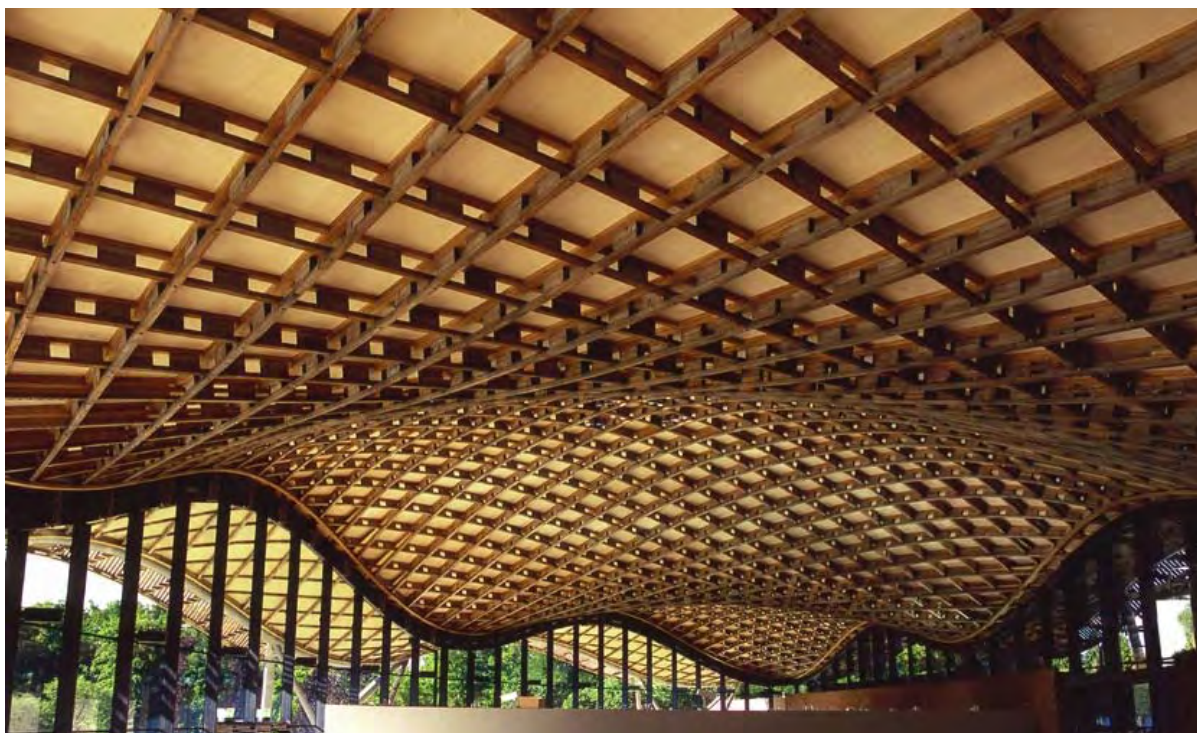


Figure 18 The finished gridshell roof from inside the Savill Building



Figure 19 The completed Savill Building



Forestry and renewable energy

Gail Taylor, School of Biological Sciences, University of Southampton

The Government's Energy Whitepaper set targets to achieve 10% of supply from renewables by 2010, and an even more ambitious target was set by the EU for 20 % of supply from renewables by 2020. The Stern Review suggested that a 60% reduction was required from 1990 emission levels by 2050, and this should be seen as an economic imperative. The Biofuels Directive sets out a 5.75% replacement of liquid transport fuels by 2010, and a 10% replacement by 2020.

Meanwhile there is rapid demand in growth projected for all sectors, including transport, power, industry and buildings. Greater than 60% increase in global energy demand is projected to 2030.

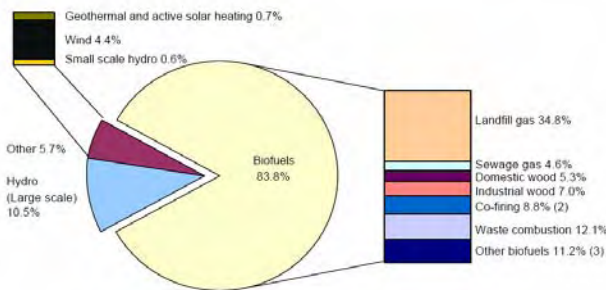


Figure 20 Bioenergy market shares

So, why biofuel? Plants are the ultimate source of renewable energy. Plants can convert the energy of the sun into simple carbohydrates (sugars and starches) and include complex carbohydrates (cellulose, wood and lignocellulose). Biomass accounted for more than 80% of renewable power generation in 2004, with landfill gas and municipal waste combustion dominant (Figure 20).

In the UK current biomass production is 30 million tonnes annually. Very little of this is recovered for energy when you consider the potential: 10 million tonnes food waste, 3 million tonnes of wheat straw, 6 million tonnes waste wood, 2 million tonnes dry cattle slurry. The Forestry Commission has set a target for 1 million tonnes of woody biomass in England woodfuel strategy – is it feasible?

The technology roadmap for liquid biofuels is rapidly emerging from Europe and the USA. We need a step-change in understanding if we are to improve the conversion of ligno-cellulose to biofuel. We need to develop designer plants and better enzymes.

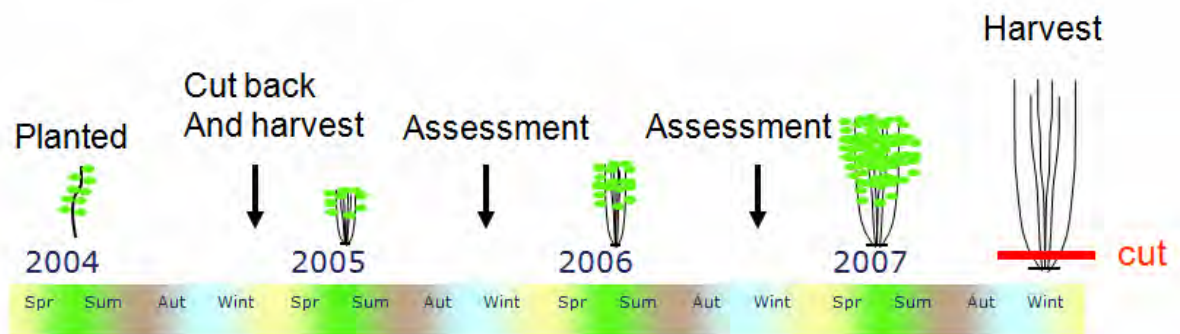


Figure 21 A glimpse into the future?

To advance we need to improve biomass quantity, aiming for more biomass per hectare while limiting N and water inputs. Together with improved biomass quality (lignin, cellulose, hemicellulose, saccharification and fermentation), this should help achieve sustainability (e.g. GHG balance, biodiversity, water use).

In the future, the UK will be a biofuel economy. This is why genetic modification (GM) trials are currently being initiated and replanted, and interest is being rekindled in new gene discovery. We need to improve both the quality and quantity of biomaterials, aiming for low-lignin trees. Combined with fast growth the improvement in quality will make woody energy crops viable (Figure 21, previous page). If bioenergy in the UK is to increase in future more feedstock is required. Liquid biofuels may be sourced 50:50 from UK and imports. Estimates vary, but wood as a feedstock may be an important part of the bioenergy mix, even one of our largest sources of biomass. It is likely that there will be an increase in the use of second generation dedicated wood crops.



The UK's domestic offsetting policy

Paul Irving, Public Engagement Team, Defra

Offsetting allows businesses, individuals and Governments the opportunity to balance their unavoidable emissions by purchasing an equivalent amount of emission reduction 'credits'. It sits within a hierarchy of actions that consumers should take to tackle climate change – calculate, avoid, reduce and finally offset emissions. The offsetting market has expanded substantially in the last few years, both the compliance and non-compliance markets. There are currently at least sixty UK based offsetting providers, from large multinational companies selling thousands of credits to small organisations selling three or four credits. It is an international market by its nature.

Regular six monthly surveys into public attitudes to climate change are carried out by Defra. These show a high level of awareness of offsetting amongst individuals (65%), but only a few of these will actually consider offsetting (7%). It is clear from anecdotal research and from press coverage that consumers remain confused about offsetting. This situation is not helped by the variety of terms used, e.g: VER, CER, Kyoto compliant Registry, CDM, JI, EAU, ERU, EU ETS, tCER and LCER. Defra commissioned research to get a better idea of consumer attitudes to offsetting. The research examines both the attitudes of individual consumers and that of businesses (as potential consumers of offsets). The report will soon be available on the Defra website. However, initial results indicate that:

- there is an extremely high level of confusion about offsetting;
- often seen as taking action to benefit the environment to counterbalance action that has damaged it. In this context many saw recycling as a type of offset;
- even when they had researched offsetting, individuals still remained confused;
- some who had seen news programmes or articles of offsetting associated it with a financial transaction;
- there was a high level of suspicion about offsetting and in particular in relation to the probity of some suppliers and products on offer;
- there was also concern about the location of projects - in countries "far away that nobody had heard off";
- this led many people to think that they did not have enough information to make a decision on whether to offset with confidence.

In summary whilst the concept of offsetting was contentious, it is much less so if it is clearly presented as something that follows action, that is, you do everything you can to reduce emissions first, then you offset.

A code of best practice on carbon offsetting has been developed following public consultation, and is due to be launched in July 2008. Government identified that consumers had no way of identifying a "good quality" offset and explored a number of options to tackle this. The purpose of the Code is to educate consumers about offsetting and its role in addressing climate change, to enable consumers to make active choices about offsetting and to increase consumer confidence in the integrity and value for money of the offset products available to them. It was also important that it was consistent with international policy.

Initially the Code will only include Kyoto compliant credits. There was a lot of support for including 'good quality' credits from the voluntary market (VERs) and this is being considered. The Code will be reviewed on an annual basis.

Some key requirements under the code:

- offset providers will provide general information about climate change and the importance of reducing a carbon footprint to consumers;
- offset providers will provide explanatory information to consumers about the role of offsetting in contributing to tackling climate change;
- clear and transparent pricing should as a minimum be provided at the point of sale.
- Offsets must be calculated using emissions factors included in the Code;
- Certain types of forestry credits (those that are Kyoto compliant) can be accredited provided there is a guarantee that they will be replaced or renewed once they expire.

A quality mark has been developed for the code of best practice. Only accredited offsets will be permitted to display the quality mark, which will be copyrighted and only those offset providers licensed to use it can do so. Offset providers will be required to distinguish between accredited and non-accredited products. The Government is likely to establish an Industry Panel to help with the operation of the Code. This is likely to have a role in advising the accreditation body on the ongoing development of the market and provide feedback on the effectiveness of the Code.

Many stakeholders were keen that VERs be included under the Code. Government recognises that VERs are a potential source of innovation for credits and products operating outside the compliance market. They can also act as a testing ground for new projects before they enter the compliance market. However VER projects have some draw-backs. There is no agreed standard or definition of a VER making it hard to identify 'good quality' products. There are also questions of additionality, transparency and independent verification. Defra's Secretary of State has set a challenge to industry to demonstrate that VER credits can meet the same high standard that CER credits currently meet. If industry can demonstrate this then VERs could be accredited under the Code.

There remain some important issues to resolve, including the status of UK projects, forestry and land-use projects, cost of accreditation, and auditing procedures. We need to continue to work on communication and publicity. Communications will focus on the role of offsetting within the hierarchy of actions. Publicity will be under the banner of *Act on CO2* in England. Discussions are ongoing about promotion in Scotland, Wales and Northern Ireland. It is also likely that the Government will carry out further consumer research.

Key points:

1. Offsetting sits within a hierarchy of actions - calculate, avoid, reduce and finally offset.
2. High level of confusion exists about offsetting amongst consumers about offsetting and its benefits.
3. Code of Best Practice will help consumers who wish to offset make more informed decisions.



An action plan for the forest sector

*Tim Rollinson FICFor, Director General & Deputy Chairman,
Forestry Commission (GB)*

We have heard over the last two days about some of the key issues.

About the threats, our weaknesses and strengths, and thankfully, some real opportunities to both contribute and to gain. Some of this has been quite technical so I'm going to ask you to stand back a little now and look at the big picture again.

At the Forestry Commission's *Forests and Climate Change* conference at the end of last year we set up six points for action. They were:

- Protect our forests and manage what we already have
- Reduce deforestation
- Restore the world's forest cover
- Use wood for energy
- Replace other materials with wood
- Plan to adapt to our changing climate.

There was broad consensus that this list was right, that we have the knowledge to see what needed to be done, and have the skills and the technology to do it. What we needed was the willpower to make it happen. These conclusions hold both for the UK and internationally.

At the same time that we were hosting our event in London, the Intergovernmental Panel on Climate Change published its fourth Assessment Report. This is the authoritative statement of current scientific understanding on climate change.

Chapter 9 looked at Forestry and we were more than a little interested to find that the IPCC experts' list of options or actions mirrored our own very closely. I would urge you all to read it.

What was equally interesting in the IPCC assessment is a quote in the Forestry section: "Forestry can make a very significant contribution to a low-cost global mitigation portfolio that provides synergies with adaptation and sustainable development."

It went on to say: "However, this opportunity is being lost in the current institutional context and lack of political will to implement and has resulted in only a small portion of this potential being realised at present."

A pre-requisite to delivering on any of the action points is to bring together authoritative information on how forestry can help in climate change mitigation and in helping society adapt to a changing climate. At present, our knowledge is incomplete, inconsistent, and sometimes confusing. Finding authoritative sources of information can be difficult. And the good intelligence we do have is not always communicated effectively.

I'm going to explain now what we can do to change that. There are four core elements:

1. Assessment of Forestry's Contribution to Tackling Climate Change

We will be commissioning a major assessment of the contribution of forestry in the UK to tackling climate change. This will be our own version of the IPCC review – our own authoritative statement of current scientific understanding.

As we have heard here, there is a wealth of expertise developing in the UK and beyond. However, we need to draw together the science and knowledge that is currently available. We need to analyse this information, consider the strength of the evidence, and make an informed assessment of the mitigation and adaptation potential of UK forestry. At the same time, we will be able to identify areas where we need to improve on existing, or obtain new, knowledge. The Assessment will form the keystone to all our other actions. It will therefore be vital to our success.

2. Forestry and Climate Change Centre

Compiling and creating authoritative information is an important first step. But it will not be enough. In this rapidly changing area, we will need to continually refresh our knowledge base. We need to pose and seek answers to the key questions.

1. What does climate change mean for our trees, woods and forests?
2. How can forestry play its full part?
3. How will we have to change what we do and how we do it?

To focus and direct our efforts the Forestry Commission is setting up a Centre for Forestry and Climate Change.

The new Centre will be key to making all this happen. It will bring together expertise on forestry and climate, assemble and disseminate accessible and authoritative information and identify information gaps and research needs, and take steps to fill them. It will facilitate strategic actions to support forestry's contribution to tackling climate change and extend and strengthen working relationships across the range of stakeholders.

The Centre will help to steer development of regulations and standards, science and monitoring, business management and communication. It will have analytical capability and will develop position statements on forestry and climate change and ensure that actions on climate change integrate with wider aspects of sustainable forest management. It will offer financial support for research on forestry and climate change and lever resources to take forward work to fill knowledge gaps and develop solutions. At its heart, the Centre will be a knowledge hub on forestry and climate change.

To give you a measure of how seriously we are taking this, I have asked my staff to look at how we can re-focus the work of our Forest Research Agency as a Centre for Forestry and Climate Change – with a new and fresh remit to drive forward our knowledge, analysis and action on forestry and climate change.

3. Framework for Woodland Carbon Management and Emissions Offsetting

The benefits that forests and woodlands can provide in reducing carbon emissions through sequestration is recognised in the forestry strategies in England, Scotland and Wales. As we have heard already at this Conference, there is potential for voluntary offsetting and the industry is challenged to establish an industry-agreed standard. There are also increasing demands from organisations and individuals for emission offsets to help them reach or get closer to carbon neutrality. The voluntary market for woodland-based carbon offsets is attracting significant investments due in part to the multiple benefits that woodlands provide in addition to climate change mitigation. But, as we know, confidence among customers and consumers of such products can be undermined by low quality schemes and associated negative reporting. There are similar concerns over global markets and carbon trading schemes.

To address these issues, we are currently working on three key areas of carbon management:

Standards and Guidelines: Forest Carbon Standards and Climate Change Guidelines, within the UK Forestry Standard, will provide over-arching principles of good carbon management and standards for the industry. These will provide a clear statement of climate change policy in relation to forestry activities and will be supported by more detailed guidance, based on scientific evidence. This might include extending the UK Woodland Assurance Standard to cover the assessment of forestry practice for carbon management, in much the same way as it includes other aspects of sustainable forest management.

Protocols for Carbon Assessment and Monitoring: We must have an agreed approach to calculating changes in carbon stocks and for estimating emissions of greenhouse gases in forest projects that are accurate, consistent, repeatable and transparent. There is a plethora of alternative carbon calculators out there. So we need scientifically rigorous protocols for woodland carbon management that address the current high levels of uncertainty in the sector.

Code of Practice for Woodland Offsetting Schemes: We will develop a means of verifying the quality of voluntary carbon offsetting schemes. This will mean creating criteria to provide a benchmark against which voluntary offset certification schemes involving domestic tree planting can be accredited or endorsed. Working through a group of stakeholders representing the offsetting industry, woodland managers and NGOs we can establish a draft code of practice closely linked to the Defra Code of Practice for the voluntary offset market.

4. Forests and Climate Change Network

Taken together, the new Centre, the Assessment of Forestry's Contribution to Tackling Climate Change and the new Framework for Woodland Carbon Management and Emissions Offsetting represent a major shift of emphasis of resources and policy development within the Forestry Commission and the wider forest sector. To develop and support these initiatives we will set up a new Forests and Climate Change Network of interested parties to provide expert advice, exchange views and expertise and to take forward the various actions that I have outlined today. Following on from our London Conference in November we will host a networking event next month.

Conclusion

I have called my talk "An Action Plan for the Forest Sector" deliberately. It will mean action from across the whole sector – seeking out the evidence base, challenging long held beliefs and practices, taking the new opportunities and not being afraid to change. We will only realise the benefits if the whole sector plays its part, scientists developing the evidence base, practical foresters managing forests sustainably, arboriculturists promoting town trees and urban woods, timber engineers helping wood replace less sustainable materials.

Looking back to my concluding remarks at the last ICF conference on climate change in 2000, much of the uncertainty has now been removed. There is no dispute among the world's scientists about what is happening. Climate change is real and the biggest challenge we face. Our knowledge of forests and climate change has grown, although sometimes only to reveal bigger and more profound questions. In my concluding remarks, I said, "We will not be practising single-purpose forestry – whether for carbon fixing or any other purpose – at the expense of sustainable forest management. The underlying principles of multi-purpose forestry and sustainability become even more important as a strategy for responding to a changing world." Today, I'm more convinced of this than ever before.

ICF DEBATE: forestry has a positive role in providing carbon offsets

The case for the motion was eloquently put by James Hepburne Scott before Professor Pete Smith countered with an equally stirring opposition speech. Chairman Tim Rollinson then opened the debate for contributions from the floor, engaging delegates in lively discussion before a brief summing up by the proposer and opposer and the all important vote.



Proposer

James Hepburne Scott, Director, Alba Trees

1. **Carbon value.** At current standing timber prices and carbon trading prices the value of the carbon in a given volume of timber is approximately equal to the value of the timber itself.
2. **A forest example.** This means that for an owner planning a mainly Sitka plantation, 38 year rotation, or a native wood that will grow and stand for 100 years, sale of carbon credits could yield a potential additional income of approximately £1200 per hectare at the outset.
3. **Limitation.** Such a transaction would only be possible for a wood for which it can be demonstrated that planting could not take place without the additional income (the principle of additionality).
At present buying capacity is limited and best quality (in terms of location, public benefit etc) will sell most readily.
4. **Buyers.** There are active buyers in this UK voluntary market at present who include businesses and organisations which are already reducing emissions by all practicable means and now wish to off-set the remaining hard core emissions in order to impress their, customers, shareholders and staff.
When the forestry sector can offer an appropriate voluntary regulation this market this will grow.
5. **Benefits.** A range of benefits will flow from the significantly increased level of afforestation which would result, including:
 - UK public and UK wildlife. The Newcastle University report 2002, for FC, valued the non-timber benefits of UK forests at over £1bn/ year, of which the carbon element was approximately 10%. *i.e.* for every £ invested in a carbon credit, £9 in additional public benefit could accrue over time;
 - Timber for sustainable construction and wood for fuel. Both are facing a short-fall in supply.
6. **Reliance on grants.** Recent experience has shown that it is not safe or sensible to rely on grants alone to ensure that the level of new planting proposed, for example by the Scottish Government, can take place without significant third-party funding.
7. **Carbon funding.** It is therefore essential that the forest sector can “capture this carbon cash” in order to:
 - Complement grant funding where available;
 - Enable grant funding to go further;
 - Replace grant funding where not available.
8. **Proposal.** I therefore propose that UK forestry has a positive role to play in providing carbon offsets and needs a regulated voluntary market to provide the public benefits that will result.

ICF DEBATE: forestry has a positive role in providing carbon offsets



Opposer

*Pete Smith, Professor of Soils and Global Change,
School of Biological Sciences, University of Aberdeen*

1. Introduction:

- “The carbon offset market is booming. In the first three quarters of 2006, about EUR 89 million were sold to companies and individuals all over the world, up 300 per cent from 2005. It is predicted that the voluntary offsets market will be worth EUR 450 million in three years time” (D Adam, “Can planting trees really give you a clear carbon conscience?,” *The Guardian*, 7 October 2006 – in Carbon Trade Watch 2007)

2. Scientific objections:

- Whether biological timescales are comparable with the geological timescales of fossil carbon,
- Saturation of the carbon sink – a short term solution compared to emission reduction
- Permanence of the C store in trees, leakage / displacement, verification issues, total effectiveness relative to emission reduction targets

3. Ethical objections:

- Do forest carbon offsets encourage GHG reducing behaviours in people or encourage business-as-usual emissions (or even increases)?
- Yes – we can make money out of it – but does that make it the right thing to do? This does not make it a climate friendly practice.
- Lots of reasons for afforestation, improved forest management and avoided deforestation – (carbon, biodiversity, sustainable development, equity etc.) but these should be used in addition to, not instead of, emission reduction.
- Forestry offsets are a distracting side show from genuine greenhouse gas emission controls and are diverting attention from the real problem – and allowing people to continue business-as-usual with climate damaging consequences.
- Forestry C offsets are no more than “Greenwash” for high emitting companies and individuals

Results of the vote

	count	percentage
for	81	73%
against	20	18%
abstentions	10	9%



Conference summary

Gabriel Hemery MICFor, Director Forestry Horizons & 2008 ICF National Conference Technical Coordinator

Over the two days of this conference I have been impressed by the breadth of knowledge and state of thinking revolving around trees and carbon. The science of forest carbon need not be viewed as complicated. Already we have good knowledge. We must, of course, be aware of knowledge gaps and challenge practitioners and scientists to find 'no regrets' options for the active management of woods to deliver high carbon stocks in combination with attaining usual high standards of sustainable forest management, while also conserving soil carbon.

In contrast, the accounting systems and rules are incredibly complex. Essentially we need to develop a mechanism that must be simple to operate and easy to understand. It is understandable that Government is cautious about leading or encouraging initiatives involving carbon management. However, the vacuum of reliable and authoritative guidance is now causing confusion in the sector. With the perceived threat of reputational risk – time is of the essence if we are to make good progress as a sector.

We have attempted, over two days, to review the role for trees, woods and forests in a carbon-lean future. It seems to me that we have much to feel rather optimistic about. After all, forestry really is unique in ticking so many boxes for so many different interests. I do feel we need to recognise the need for:

1. Clear guidance;
2. Leadership;
3. Continued support for research and innovation;
4. Be BOLD as a sector;
5. More flagship projects and beacons for the sector, to demonstrate the way forward and inspire confidence;
6. Finally, to recognise that carbon management is yet another arrow in the quiver of the forester. We must ensure that this arrow flies straight and true – and therein lies a role for our Institute.



ICF President's closing remarks

Richard Ogilvy FICFor

Any strategy for reducing carbon footprints requires three processes: 1) avoid e.g. woodfuel; 2) reduce e.g. substitution (replacing one cubic meter of concrete or brick with one cubic meter of timber saves around one tone of CO₂; and, 3) only after fully exploiting the first two can offsetting options be contemplated.

We have heard much on the complexity of calculating the offsetting potential of forestry. I can only think that when you consider the once extensive forest covering the UK is now represented by CO₂ in the air around us that it must make sense to put this atmospheric CO₂ back into the trees from whence it came, especially when considered against the multiple benefits forests confer.

What can the ICF contribute? This conference shows just what the Institute can do in applying intellectual and scientific rigour to a complex subject.

Tim Rollinson, the Forestry Commission Director General stated, 'as we have heard here, there is a wealth of expertise developing in the UK and beyond. We need to draw together the science and knowledge that is currently available. We need to analyse this information, consider the strength of the evidence and make an informed assessment of the mitigation and adaptation potential of UK forestry.' The Institute has a small group, led by Vice President Bill MacDonald, which is examining how the ICF can best contribute to establishing a respected and robust system to give credibility and acceptance to the role of forests in mitigating climate change.

Before closing the conference, I would like to quote Martin Black, Head of Corporate Social Responsibility and Sustainability for the Royal Mail: 'Royal Mail supports forestry as part of its carbon offset programme to help with its target of becoming carbon neutral by 2015. I call for the Institute of Chartered foresters, in its drive to bring clarity and credibility to the forests' role in carbon sequestration to help create an agreed voluntary standard for carbon offsetting by forestry in the UK.' A fine quote upon which to close what I feel has been a memorable conference. The professionalism displayed in all aspects of the conference is a splendid demonstration of what the ICF is about and it makes me proud to be a member.