WOODFUEL - WHAT THE FUTURE MAY HOLD

Gabriel Hemery questions whether it is right to put all our faith in woodfuel, or whether there are better ways in which forestry can help provide energy supplies and reduce greenhouse gas emissions.

One planet living, climate change, green energy, halting the loss of biodiversity, rural economic development, green space, access for all, nature's classroom; these mega-issues steer our working lives and occupy Government. How do these relate to woodfuel now and how might they in the future? The simple answer to these questions is that woodfuel is now seen as a central pillar and the saviour of UK forestry. Are we right to put so much faith in woodfuel and what is the big picture for UK energy and forestry?

Setting the scene

Worldwide concern about climate change and the need to develop energy supplies and reduce greenhouse gas (GHG) emissions has led to increasing interest in biofuels. The under-exploitation of forests in the developed world has provided an additional incentive to manage the forest resource and stimulated interest in wood for energy, heating and transport fuels.

The EU has ambitious targets to increase the share of renewables in total energy consumption, from 5% in 1997 to 12% by 2010. The EU Biomass Action Plan (CEC, 2005) assumes that the 12% target will be met by a combination of bio-heating and bio-electricity from biomass and co-generation. In March 2007 the EU heads of government agreed a new target of 20% by 2020. In Sweden 25% of energy needs and the majority of heating needs are currently provided by biofuels.

In the UK interest in biofuels is gathering pace although we have been left at the starting line. In contrast to most northern European countries where biomass energy contributed at least 10% to heat generation, it provided only 1% to the UK in 2003 (Lindner et al., 2007). With the publication of a woodfuel strategy for England (Forestry Commission England, 2007), the Government has set an ambitious target to harvest an additional 2 million tonnes of wood each year for the woodfuel market by 2020.

Wood for fuel or timber?

There is unprecedented interest and huge expectations for the role of woodfuel in shaping the forestry sector's development in the 21st century. It seems clear that any new market that may stimulate the management of our existing under-managed woods is to be welcomed. However, are we right to have such a strong focus on burning the products from our woodlands?

There is huge potential for increasing the use of wood in construction. In general, energy

"The transition to a low-emissions global economy will open many new opportunities across a wide range of industries and services. Markets for low carbon energy products are likely to be worth at least $500bn per year by 2050, and perhaps much more. Individual companies and countries should position themselves to take advantage of these opportunities"

(Chapter 12: Stern, 2006).

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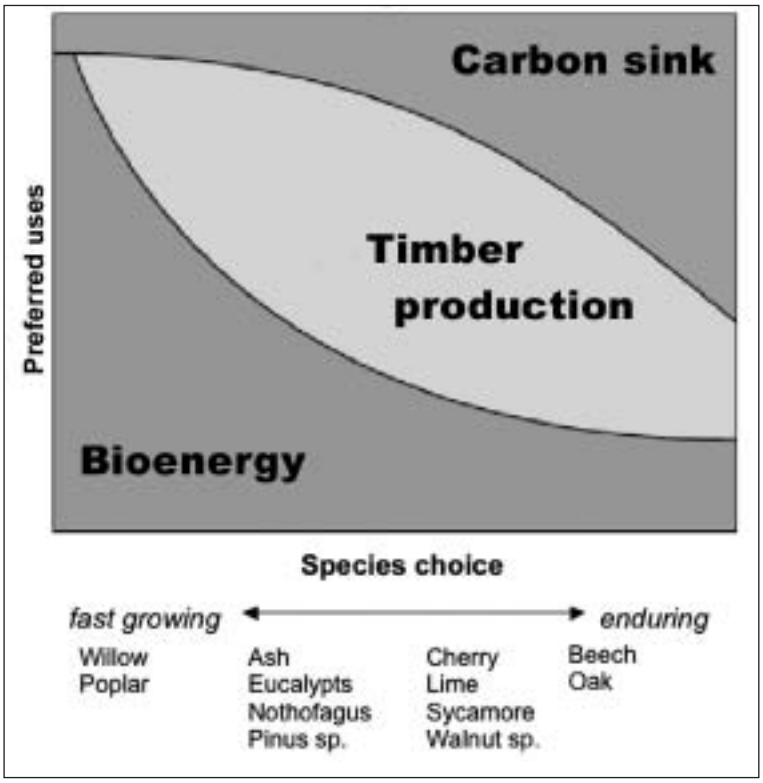

Figure 1.Options for selection of crops and tree species to meet different objectives (adapted from Matthews and Robertson, 2005).

production has less associated GHG benefit than material substitution (Greig, 2007) and more research in this area should be encouraged. One study indicated that an 86% reduction in GHG emissions could be achieved by maximising the use of timber in buildings (Edinburgh Centre for Carbon Management, 2006). Product substitution for carbon-rich materials (e.g. brick, concrete, plastic) can make substantial carbon savings. For example, currently in England only around 10% of new buildings are built with timber framed techniques compared to 80% in Sweden or 55% in Scotland. Timber and wood products are carbon-lean (not quite carbon neutral) and therefore can directly and indirectly contribute to reducing carbon emissions.

If we were to concentrate on the production of timber from existing woodlands (including those currently unmanaged woodlands) we could produce a significant volume of woodfuel as a by-product. Furthermore, the financial incentive arising from such a market would encourage woodland managers to thin and prune their tree crops to produce quality timber. A significant proportion (46%) of arboricultural arisings arise from non-stem wood elements (i.e. branch wood, wood chips, foliage) (Forestry Commission England, 2007). It is worthwhile noting that some older valuable literature exists concerning management of woodlands for timber and energy production. The recommendations of Crockford et al., (1987), including establishment of cooperatives, demonstration woodlands and research trials ring true today, 20 years later. Corbyn et al. (1988) provide useful information on estimating the branchwood component of broadleaved forests.

The silvicultural options arising from any decision relating to whether we grow trees for timber and/or fuel are currently unclear (Figure 1). In addition, the affect of climate change on forest management needs to be considered carefully. Evidence points towards the need for robust mixtures, both in terms of genetic origin (and quality) and species (Broadmeadow et al., 2005). With the focus for research and practice during the 1990s and 2000s being directed towards native planting, local origin and single species silviculture, the sector is in danger of being out of step with the needs of 21st century forestry if we are to deliver 'robust' woodlands.

In the future, second generation biofuel technologies such as 'Treethanol' (Bacon, 2007) may provide new opportunities for the use of wood products to contribute to transport fuel needs, supplementing or even competing with the first generation markets associated with heat and energy.

Trade in carbon and wood resources

Dependent on the future development of prices for energy and carbon emission credits,

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substantial market changes could occur until 2030. This could lead to the re-allocation of wood resources, especially from board manufacturers as well as the pulp and paper industries to the bio-energy sector (Lindner et al., 2007).

The development of carbon markets is likely to continue, in both the compliance (e.g. EU ETS) and voluntary markets. However, the outlook beyond 2012 (the end of the current Kyoto commitment) is difficult to predict (Carbon Trust, 2006). Some envisage that a common standard may be introduced post-2012, providing much needed credibility in the voluntary market. A new international climate change agreement may also force radical changes to the carbon market.

The implications for the UK in the marketing and international trade of woody biomass are not yet clear. International logistics lead to higher costs and additional energy losses compared to local or regional utilisation (Schlamadinger et al., 2006). Marine transport is generally thought to have a low carbon footprint but one Scottish study suggests that once the road legs and associated handling are factored in for each end of a sea transit of timber (note not woodfuel), then marine transport has only marginal benefits over road, and is less efficient than rail (Spaven et al., 2006). This suggests that stronger domestic strategies (at national, regional and local levels) would be prudent. However, with the lower costs associated with land and labour in developing countries, their potential for export of woody biomass is likely to increase.

Energy outlook

Some believe the world is moving inextricably towards energy deficit, although fossil energy is predicted to remain dominant to 2030 (World Energy Outlook, 2006). Conventional wisdom predicts that demand will be driven by China, India and other emerging economies where supplies will be heavily dependent on oil, gas and coal, with renewables making only a small contribution overall. However, this 'business as usual' outlook may overlook other mega-trends:

- Energy demand may increase less than predicted; market forces and Government support for research and development may accelerate energy-saving technologies, leading to increased efficiency in energy use. Energy innovation may be expedited.
- Carbon-capture, hydrogen fuel cells and in the longer-term, solar-space and fusion. "Global public energy research and development funding should double, to around $20 billion, for the development of a diverse portfolio of technologies" (Chapter 16: Stern, 2006).
- Increased political concerns about energy security. Reducing reliance on others is likely to be a key priority for current consuming nations, and for emerging economies, ensuring supplies for their rapid development. Concerns may also drive development of alternative technologies.

Production of heat or energy at small scales from a low-carbon source, close to where the demand lies, makes both economic and environmental sense. The selling of excess energy back to the grid makes these technologies attractive to consumers/producers. Therefore, the gradual decentralisation of energy supplies with an increasing shift to micro-generation seems to be continuing unabated and this suits the development of woodfuel. Pathfinders such as TV Energy (www.tvenergy.org) in southern England are leading the way with concepts such as the 'Tree Station' and by pioneering partnerships and small-scale local schemes.

Resolving the energy – food – water trilogy

Water shortages already plague many developing countries, whilst under a changing climate water management is likely to be increasingly important in the UK and other developing countries. The electricity generating industry may find it increasingly difficult to acquire the water it needs for cooling and other purposes. Electricity generation accounts for some 39% of fresh water withdrawals in the United States, only slightly behind agricultural irrigation. Nuclear power stations in France went off line during the heat waves of 2003, when the water

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drawn from rivers for cooling was too warm. Land use will play an important role in flood management and must adapt to increased summer drought conditions.

Will energy crops be developed at the expense of food crops? The growing of large-scale mono-species is often seen as the economic way forward for biofuels. However, if high energy prices make large-scale biomass and other energy crops financially attractive, will farmers switch out of food production? This would push up the price of food, adding to the distress of poor people in some areas of the world. Many predict rising consumption linked to rising world population and increasing affluence. Recent debate in the agricultural sector has considered whether the UK might have to accept more intensive or GM farming technologies to avoid food shortages. Chief Executive of the Scottish Agricultural College recently stated that food production will need to double in the next 25 years, requiring more land for food production in the UK (BBC Today Programme: 0814, 18th April 2007).

Can we reduce Greenhouse Gas emissions more by growing and using timber from our forests, rather than burning it?

Agriculture's role in the global economy will be strengthened, and stretched, as it attempts to service a vast, virtually unlimited market for transport fuel. Tropical and subtropical countries that can produce sugarcane or palm oil will be able to fully exploit their year-round growing conditions, giving them a strong comparative advantage in the world market. The impetus for biodiesel production with the EU arises from the European Union's goal of meeting 5.75% of automotive fuel needs with biofuels by 2010. Biofuels in Europe are exempted from the hefty taxes levied on gasoline and diesel. Both Germany and France are market leaders, using rapeseed as the main fuel source.

Therefore, competition for economic land use and environmental protection are likely to compete with strategies to convert agricultural land to new woodfuel resources.

Woodfuel and the environment

Lack of management of the UK's woodlands is widely recognised as a contributory factor in the decline of woodland biodiversity. The potential for encouraging more woodland management in the light of global timber market forces is currently taxing the UK Conservation Agencies (Lawson and Hemery, 2007). Encouragement of woodland management is a central pillar of England's woodfuel strategy (Forestry Commission England, 2007).

Most forest residues (branches, tops etc.) are left in the forest and the volume of roundwood extracted for other uses is significantly less than its volume growth in Europe. Lindner et al. (2007) considered the ecological constraints on greater utilisation of forest biomass in the EU, concluding that there is a potential to increase the utilisation of forests for bioenergy in EU21 (EU25 without Cyprus, Greece, Luxembourg and Malta) to achieve 46 Mtoe in 2010, 45 Mtoe in 2020 and 59 Mtoe in 2030. However, the implementation of environmental constraints resulted in a 40% decrease in the energy potential compared to the estimated technological potential (Lindner et al., 2007).

Short rotation forestry (SRC), as opposed to coppice (SRC), was identified in a recent report as having no serious issues relating to biodiversity, environment or landscape, providing that further guidance can be developed for potential growers by the FC (LTS International, 2006).

Any increased management activity in our woodlands must be carefully monitored. If the woodfuel market develops as hoped, and woodland owners manage their woodlands more intensively to realise the targeted additional 2 Mt of woodfuel (Forestry Commission England, 2007), potential negative impacts include damage to woodland soils, inadequate regeneration due to deer, reduction of deadwood and loss of 'old growth' conditions, landscape impacts, increased heavy vehicles on rural roads.

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Further policy levers may be required to encourage appropriate management of woodlands and the woodfuel industry.

The EU's 2020 - 20% target seems to be out of reach without suffering detrimental environmental impact or without disrupting existing timber markets. Current estimates do not add up and therefore point to a future shortage of wood resource in Europe (Lawson and Hemery, 2007).

Challenges for UK forestry

- Forestry must integrate more closely with agriculture, environmental conservation, energy, transport and social agendas (Lawson and Hemery, 2007).
- A growing skills shortage in forestry and related disciplines.
- Lack of public understanding, including 'nature deficit disorder' amongst young people.
- Rebuilding the disjointed woodchain, from resource, procurement, marketing to end-use.
- Potential shortage of woody biomass.
- Growing domestic (national, regional and local) markets and systems.
- Target R&D to meet new silvicultural needs (e.g. species, genetics, systems, technologies, marketing etc.).
- Bringing more woodland into better management, without detriment to the environment.

Summary

The forestry sector clearly needs to quickly capitalise on emerging opportunities. Key amongst these is its contribution to a carbon-lean society. The most effective role for wood in the future appears unclear. Greater GHG emission savings may be realised by utilising wood more as a substitute to carbon-rich construction materials, than by its burning. Further research in this area would be welcome, as would promotion of wood as a construction material through existing projects such as 'Wood for Good' (www.woodforgood.com) and research by BRE (www.bre.co.uk/).

The EU has ambitious targets for wood biofuel consumption in its member states but these appear un-obtainable without significant impacts on the environment and on availability of timber for conventional markets. This can only drive up prices and more so if methanol production from woods becomes economically viable. The UK will face similar shortage of woody-biomass.

Competition for land due to predicted food shortages and biofuel production may make the growing of woodfuel through new afforestation projects (e.g. SRC and/or SRF) unviable. Given the need to manage our existing woodlands, and the public good values derived from sustainable forest management of this resource, perhaps we should prioritise efforts towards the growing of quality timber for a range of markets while aiming to harvest the arising forest residues for woodfuel. We may need to develop or revisit silvicultural systems, species choices (native and non-native) and woodland management technologies before too long.

References

Bacon, D. (2007) 'Woodstock revisited'. *The Economist*. pp. 16-17.

Broadmeadow, M., Ray, D. and Samuel, C. (2005) Climate change and the future for broadleaved tree species in Britain. *Forestry*, **78**, 145-161.

Carbon Trust (2006) 'The Carbon Trust three stage approach to developing a robust offsetting strategy'. Carbon Trust, www.CarbonTrust.co.uk, pp. 24.

CEC (2005) 'EU Biomass Action Plan'. Commission of the European Communities, Brussels.

Corbyn, I.N., Crockford, K.J. & Savill, P.S. (1988) The estimation of the branchwood component of broadleaved woodlands. *Forestry*, **61**, 193-204.

Crockford, K., Corbyn, I. & Savill, P. (1987) 'An evaluation of the methodology for managing

Hemery GE. (2007) Woodfuel - what the future may hold. Quarterly Journal of Forestry. 101:207-212.

existing broadleaved and coniferous woodlands for timber and energy production'. A report prepared for the Energy Technology Division, UK Atomic Energy Authority. Agreement No. E/5A/CON/1156/1166. Oxford Forestry Institute, Oxford, pp. 223.

Edinburgh Centre for Carbon Management (2006) 'FC Scotland greenhouse gas emissions comparison - carbon benefits in timber construction'. ECCM Report 196. http://www.forestry.gov.uk/pdf/Carbonbenefitsoftimberinconstruction.pdf/$FILE/Carbonbenefitsoftimberinconstruction.pdf, pp. 26.

Forestry Commission England (2007) 'A woodfuel strategy for England'. http://www.forestry.gov.uk/england-woodfuel, pp. 7.

Greig, S. (2007) Carbon issues in UK forestry. *Quarterly Journal of Forestry*, **101**, 128-134.

Lawson, G. & Hemery, G. 2007 'World timber trade and implementing sustainable forest management in the UK'. Report to the Woodland Policy Group. pp. 86.

Lindner, M., Eggers, J., Zanchi, G., Moiseyev, A., Tröltzsch, K. & Eggers, T. (2007) 'Environmentally compatible bio-energy potential from European forests'. European Environment Agency, http://biodiversity-chm.eea.europa.eu/information/database/forests/EEA_Bio_Energy_10-01-2007_low.pdf/download, pp. 54.

LTS International (2006) 'A review of the potential impacts of short rotation forestry'. A report for the Forestry Commission and Defra. http://www.forestry.gov.uk/pdf/SRFFinalreport27Feb.pdf/$FILE/SRFFinalreport27Feb.pdf, pp. 168.

Matthews, R. & Robertson, K. (2005) 'Answers to ten frequently asked questions about bioenergy, carbon sinks and their role in climate change'. IEA Bioenergy. Task 38. http://www.ieabioenergy-task38.org/publications/faq/, pp. 8.

Schlamadinger, B., Faaij, A., Junginger, M., Woess-Gallasch, S. & Daugherty, E. (2006) 'Options for trading bioenergy products and services'. Tasks 38 and 40. IEA Bioenergy, http://www.ieabioenergy-task38.org/publications/T38-40-biotrade.pdf, pp. 12.

Spaven, D., Elder, D. & McCrossan, D. (2006) 'Business opportunities for the marine transport of timber in Scotland'. Final Report. Scottish Enterprise, http://www.forestryscotland.com/pages/download.asp?file=Marine%20Transport%20of%20Timber%20in%20Scotland%20(March%202006).pdf, pp. 80.

Stern, N. (2006) 'Stern review: the economics of climate change'. http://www.hm-treasury.gov.uk.

World Energy Outlook (2006), http://www.worldenergyoutlook.org/summaries2006/English.pdf

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