Marginal Abatement Cost Curves (MACCs) for UK forestry

Comparing the cost-effectiveness of different climate change mitigation measures is essential in minimising the cost of meeting national greenhouse gas (GHG) reduction targets.

The costs of different measures and their potential to reduce emissions or sequester atmospheric GHGs can be depicted using a Marginal Abatement Cost Curve (MACC). This seeks to rank measures from the cheapest to the most expensive.

Background

Climate change mitigation is a top policy priority of the UK government, arguably being considered the greatest challenge facing the world at present. In collaboration with other governments, the UK is seeking to limit global average temperature rise to below 2°C in order to prevent 'dangerous climate change'. Adverse impacts associated with exceeding the 2°C threshold are envisaged to include extinction of around 20% of species. The urgency of climate change mitigation is further underlined by those scientists who consider the existing atmospheric concentration of over 390 ppm of CO_2 too high to sustain if the 2°C threshold is not to be exceeded, and who recommend rapid reduction to no higher than 350 ppm of CO_2.

Objectives

This research aimed to:

o   review previous studies estimating MACCs covering UK forestry options
o   compare previous approaches and underlying assumptions
o   summarise the current approach to cost-effectiveness analysis for policy appraisal and evaluation recommended in UK government guidance
o   provide recommendations for future studies.

Methods

o   This work comprised a desk-based literature review.

Findings

The literature search identified three primary studies estimating MACCs which include UK forestry measures. Estimates from these studies (see table), suggest that forestry measures are generally highly cost-effective by comparison with government estimates of the social value of carbon that includes a central estimate for 2011 of £52 per tCO_2e (£190 per tC) at 2009 prices. Estimates are sensitive to a range of factors including: the species planted; the forest management regime; environmental conditions; co-benefits and methodology adopted; as well as the level of

agricultural opportunity costs assumed. Comparisons are hampered by the different approaches used, which are not always specified in detail.

Table: Cost-effectiveness of UK forestry measures.

	Radov *et al.* (2007)	Moran *et al.* (2008)	ADAS (forthcoming)
Time period(s) covered	i) 2009–12 ii) 2009–17 iii) 2009–22	to 2022	i) to 2022 ii) to 2050
Baseline land use	Arable	Sheep	Rough grazing/uncultivated
Carbon benefits covered	Seq	a) Seq b) SeqSbm c) SeqSbf	a) Seq b) SeqSbm(m) c) SeqSbm(h)
Tree species and yield class options considered	2	1	14
Woodland creation cost-effectiveness ($£/tCO_2e$)	~£20 to ~£40	a) -£7 b) -£2 c) -£6	a) -£61 to £103 b) -£61 to £73
Forestry management cost-effectiveness ($£/tCO_2e$)	Not considered	b) £1 c) £12 [¶]	c) -£52 [Ψ]

Notes: Carbon benefits covered: Seq carbon sequestration; SeqSbm carbon sequestration and materials substitution; (m) 'medium' materials substitution; (h) 'high' materials substitution benefits; SeqSbf carbon sequestration and fossil fuel substitution benefits in energy generation; Seqd carbon sequestration and displacement (including carbon storage in harvested wood products and fossil fuel substitution benefits in materials and energy generation).

[¶]Assumes shortened rotation length (59 years to 49 years).

[Ψ]Assumes increased management of currently under-managed woodland.

Recommendations

o   To ensure replicability of MACC estimates, assumptions need to be clearly stated and references to data sources used provided.

o   Future studies should justify the approach that they use to agricultural opportunity costs and where estimates are available, sensitivity analysis should take into account variations in these costs between and within farms.

o   Any estimated land value impacts used should account for loss of option value due to replanting requirements after felling, while avoiding double-counting capitalised values of agricultural opportunity costs.

o   It is strongly recommended that other ecosystem service benefits apart from carbon (and also any disbenefits) are included in estimating the cost-effectiveness of forestry measures where associated marginal value estimates exist.