

## **APPENDIX 2. Report on UK dynamic model scenario assessments submitted to the CCE in response to the 2006/07 call for data**

### **UNITED KINGDOM**

This document forms the third part of the UK response to the call for data, March 2007. It describes how the data were prepared. Dynamic modelling for freshwater habitats was carried out using MAGIC version 777. Dynamic modelling for terrestrial habitats was carried out using the version of the VSD model supplied by Jaap Slootweg on 18<sup>th</sup> January 2007.

Ed Rowe, Jane Hall & Chris Evans, 16<sup>th</sup> March 2007.

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#### ***Introduction***

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In response to this call the UK are submitting dynamic modelling outputs for 310 surface water sites and, for the first time, outputs for 7 terrestrial habitats. Dynamic modelling for the surface water habitats was carried out using MAGIC (version 777) and for the terrestrial habitats VSD-Access (version as supplied by the CCE 18<sup>th</sup> January 2007).

No changes have been made to the steady-state critical loads for the surface water or terrestrial habitats. Updates have only been made to the tables submitted to reflect changes to the "DM status"; methods and inputs for calculating the steady-state critical loads remain unchanged from those submitted to the CCE in 2004 (Hall et al, 2004). Although the VSD also generates modelled values of nutrient nitrogen critical loads, these have not been submitted, since further work is required in the UK to discuss and agree critical nitrogen concentrations for the different habitat types under consideration. The nutrient nitrogen critical loads submitted to the CCE in 2004, based on empirical values for non-woodland habitats and unmanaged woodland, and based on mass balances for managed woodlands, remain valid. In addition, the UK submitted empirical critical loads of nutrient nitrogen for feature habitats of Special Areas of Conservation to the CCE in February 2007.

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## Methods and data sources

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### *Dynamic modelling of surface water habitats*

For surface waters, the MAGIC model was applied to 310 previously calibrated UK lakes and streams, covering acid sensitive regions of Wales (Snowdonia and Cambrian Mountains), England (Lake District and South Pennines), Scotland (Galloway and Cairngorms) and Northern Ireland (Mourne Mountains). These sites were previously used to calculate target loads, and the methods and data sources used to calibrate the model were described in detail in the 2005 CCE progress report (Hall et al, 2005). For the present call, a set of region-specific forecast scenarios was calculated as the average proportional change (relative to a 2000 base year) in SO<sub>4</sub>, NO<sub>x</sub> and NH<sub>y</sub> deposition for all EMEP squares covering that region. A single forecast scenario was run through to 2010, with the range of 27 scenarios specified in the call applied thereafter. For each site, all forecasts were run for all successful MAGIC calibrations (between 1 and 10 per site), and the median predicted value of each variable used in the data submission.

### *Dynamic modelling of terrestrial habitats*

For each of the 7 terrestrial habitats, results were calculated for all UK 1 km<sup>2</sup> grid squares which contained 1 ha or more of the habitat. Parameters for running VSD for terrestrial habitats are listed in three main locations:

1. The Access form (CalcDM) used to set up a batch run (see Table 1)
2. The inputs table within the Access database (see Table 2)
3. The deposition tables within the Access database. EMEP values as supplied by the CCE were used.

Values were assigned to some parameters on the basis of soil type alone, or habitat and soil type. Soil type was defined as the dominant soil type within the 1 km<sup>2</sup> and parameters assigned according to soil group, subgroup, or broad soil class (mineral, organomineral or peat) (Hall et al 2004). Different methods were applied to the calculation of acidity critical loads for non-woodlands and woodlands on mineral, organomineral and peat soils (Hall et al 2004). Woodland type was categorised as managed coniferous, managed broadleaved, and unmanaged (broadleaved and coniferous) (Hall et al 2004). For assigning values to soil parameters, all unmanaged woodlands were assumed to be broadleaved.

**Table 1. Parameters in the CalcDM form.**

Parameter	Value used	Data source and notes
Oliver constant (1)	4.5	default value supplied by CCE
Oliver constant (2)	0	as above
Oliver constant (3)	0	as above
sea salt corr.	0	no seasalt correction
Exchange kinetics	Gapon	Gaines-Thomas preferred, but not functioning in VSD
CNrat_max	a) 43.6 gC/gN b) 20.8 gC/gN	Upper leaching thresholds for a) conifer/heathland and b) deciduous / grassland (Rowe et al, 2006)
CNrat_min	7.5 gC/gN	Lower leaching threshold (Rowe et al, 2006)

**Table 2. Parameters in the “inputs” table.**

Parameter	Value used	Notes
SiteID		Unique 1 km site codes assigned by UK NFC
EmpSiteID	= SiteID	as above
Lon	-	from NFC data
Lat	-	from NFC data
I50	-	from NFC data
J50	-	from NFC data
EcoArea	0 – 1	Proportion of the grid square under this habitat (km <sup>2</sup> km <sup>-2</sup> )
CLmaxS	-	As previously calculated (Hall <i>et al</i> , 2004)
CLminN	-	as above
CLmaxN	-	as above
CLnutN	-	not used
nANCrit	-	As previously calculated (Hall <i>et al</i> , 2004)
cNacc	-	Critical concentrations not yet agreed in UK, so data withheld
crittype	-	soil / habitat dependent (Hall <i>et al</i> , 2004)
critvalue	-	soil / habitat dependent (Hall <i>et al</i> , 2004)
thick	0.5	Assumed 0.5
bulkdens	-	From NSRI data: mean for the soil <i>group</i> (e.g. 61 brown podzol)
Cadep	-	FRAME model estimates (total Ca deposition from all sources) (Dore <i>et al</i> , 2003)
Mgdep	-	FRAME model estimates (total base cation deposition minus total Ca deposition) (Dore <i>et al</i> , 2003)
Kdep	-	Assumed in constant ratio of 0.019 x Cldep
Nadep	-	Assumed in constant ratio of 0.86 x Cldep
Cldep	-	FRAME model estimate (Dore <i>et al</i> , 2003)
Cawe	-	Soil type dependent - see Hall <i>et al</i> (2004)
Mgwe	-	Assumed 1/3 of (total base cation weathering – Ca weathering) (Hall <i>et al</i> , 2004)
Kwe	-	Assumed 1/3 of (total base cation weathering – Ca weathering) (Hall <i>et al</i> , 2004)
Nawe	-	Assumed 1/3 of (total base cation weathering – Ca weathering) (Hall <i>et al</i> , 2004)
Caupt	-	Assumed 0 - see Hall <i>et al</i> (2004)
Mgupt	-	Assumed 0 - see Hall <i>et al</i> (2004)
Kupt	-	Assumed 0 - see Hall <i>et al</i> (2004)
Qle	-	see Hall <i>et al</i> (2004)
lgKAlox	-	Set by soil broad class: mineral soils 8.5; organomineral soils 7.6; peats 6.5
expAl	-	Assumed 3
pCO2fac	-	Set by soil broad class: mineral soils 40; organomineral soils 100; peats 100
cOrgacids	-	Set by soil broad class: mineral soils 25; organomineral soils 32; peats 65
Nimacc	-	Assigned by soil <i>group</i> (e.g. 61 brown podzol)(Hall <i>et al</i> , 2004)
Nupt	-	see Hall <i>et al</i> (2004)
fde	-	Recalculated from Nde values (Hall <i>et al</i> , 2004) to prevent VSD crashes. Assumed equal to Nde / (N_deposition + Nupt + Nimacc), where N_deposition is total N deposition for the broad habitat class i.e. woodland deposition for woodland habitats, moorland deposition for moorland, grassland, bog and montane habitats.
Nde	-	set to null to prevent VSD crashes
CEC	-	1
bsat	-	1
yearsbsat	2004	1
lgKAIBc	-	From NSRI data: mean for the soil <i>group</i> (e.g. 61 brown podzol)
lgKHBc	-	Assumed 2.3
Cpool	-	From NSRI data: mean for the soil <i>group</i> (e.g. 61 brown podzol)
CNrat	-	1
yearCN	2004	1
DMstatus	-	
EUNIScode	-	
CC	-	

<sup>1</sup> From Evans and Helliwell (2005): mean for the combination of soil *subgroup* (e.g. 611 typical brown podzol) and broad habitat (grassland, heathland, deciduous woodland or coniferous woodland). Grassland values used for montane habitats. Heathland values used for bog habitats.

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