

**CRITICAL LOADS AND DYNAMIC MODELLING
FOR ACIDITY AND NITROGEN**

**OPTION I:
COMPARISON OF EMEP AND NATIONAL ECOSYSTEM-SPECIFIC
DEPOSITION DATA AND THEIR IMPACT ON
CRITICAL LOAD EXCEEDANCES**

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1 INTRODUCTION

Comparisons have previously been made between critical load exceedances based on UK-scale and EMEP-scale deposition (Hall *et al.*, 2004). The EMEP deposition data available at the time were at 150km resolution and were not ecosystem-specific. These data showed different patterns and percentage areas exceeded to results based on UK data alone. For example, results of calculations at the European scale (ie, RAINS model) showed UK habitat areas exceeded of 9.2% for acidity and 1.3% for nutrient nitrogen in 2010, compared to results of UK work at the time showing the exceeded habitat areas to be 44% for acidity and 28% for nutrient nitrogen.

EMEP are now using a unified Eulerian model at 50km resolution and generating ecosystem-specific deposition. Results from the RAINS model (ref?) show large increases in the areas exceeded using these new data. National Focal Centres (NFCs) are being encouraged by the UNECE International Cooperative Programme on Modelling and Mapping (ICPMM) to compare the new EMEP deposition data with national data. Fowler *et al.* (2004) have already compared the EMEP grid-average deposition maps with maps of deposition based on UK measurements and models. This report compares:

- (a) Ecosystem-specific and grid square average deposition from the UK at 5km resolution for the years 1999-2001 with deposition from EMEP at 50km resolution for the year 2000.
- (b) Critical load exceedance statistics based on the latest (February 2004) acidity and nutrient nitrogen critical loads and the deposition fields identified in (a).

2 COMPARISON OF DEPOSITION

UK deposition data are mapped for the 5x5 km grid squares of the Ordnance Survey grid for Great Britain and the EMEP data are mapped on a 50x50 km grid; however, the two grids are not parallel to one another. For this comparison the EMEP coordinates of the centre point of each 1x1 km grid square have been used to assign the appropriate deposition values to each grid square of the UK. The UK data provide “grid square average” values for all vegetation types, as well as ecosystem-specific deposition values for “moorland” and for “woodland”. The UK data used in this comparison exercise are the mean values for the years 1999-2001, calculated as the sum of wet, dry and cloud droplet deposition. The UK deposition data will be referred to as UKdep to distinguish the term from references made to UK as the country. The EMEP data are for the year 2000 and also consist of three sets of values: “grid-average”, “semi-natural vegetation” and “woodland”. The EMEP category “semi-natural vegetation” is the same as the UK category “moorland”, and represents general low-growing rough vegetation (ie, grassland, heathland) with no fertiliser input. EMEP deposition is calculated as the sum of wet, dry and aerosol deposition is generally equivalent to the UKdep estimates.

The UKdep and EMEP deposition have been compared in two ways:

- (i) Visual comparison of the spatial patterns of the mapped data.
- (ii) Calculating the deposition budgets by pollutant and country.

Figures 2.1, 2.2 and 2.3 show the maps of non-marine sulphur, oxidised nitrogen and reduced nitrogen deposition respectively. The maps show there are considerable differences between the spatial patterns of the UKdep and EMEP deposition data. For instance, the UKdep maps clearly show the “hot spots” of deposition whereas the coarser resolution of the EMEP data generally doesn’t pick these up. This is especially noticeable on the maps of reduced nitrogen (Figure 2.3) and non-marine sulphur (Figure 2.1) deposition. In general the EMEP model gives the highest deposition values across England, particularly eastern areas in respect of oxidised nitrogen and non-marine sulphur deposition. The UKdep data also show high values across this region, but also higher deposition of oxidised nitrogen and non-marine sulphur across the north and west of Britain, associated with areas of higher rainfall. However, the EMEP data appear to underestimate deposition in these upland areas of north and west Britain, which is consistent with the lack of orographic enhancement over upland areas within the EMEP model structure.

To quantify the differences between the UKdep and EMEP data, the total deposition budgets by pollutant and country have been calculated (Tables 2.1 and 2.2). Both data sets have the highest deposition to woodland habitats, due to the enhanced scavenging by trees. For the UKdep the deposition to moorland is lowest for non-marine sulphur and oxidised nitrogen, as this vegetation type has a low canopy height reducing its scavenging ability and does not as active growth as agricultural crops or fertilised grassland. The lowest values for reduced nitrogen are the average deposition values, as crop areas have either low net deposition of ammonia or can be local sources of emissions. The grid-average and semi-natural EMEP deposition are similar to one another, as generally was the case for UKdep, but, since the EMEP model operating at a 50km scale does not adjust for local sources of ammonia, it does

not predict the lower average deposition for reduced nitrogen compared to semi-natural vegetation seen in the UKdep data.

The differences between the EMEP and UKdep data have also been compared by expressing the EMEP deposition as a percentage of the UKdep deposition (Table 2.3). The results overall show the best correspondence between the UKdep and EMEP deposition data for non-marine sulphur, with the EMEP data ranging from 81% (average) to 116% (woodland) of the UKdep deposition values across the UK as a whole. The poorest results for non-marine sulphur are seen in Scotland, where the EMEP model predicts between 59% and 71% of the UKdep values. However, across England (moorland and woodland deposition) and Northern Ireland (woodland deposition) the EMEP model predicts higher rates of non-marine sulphur deposition than the UKdep data.

The correspondence between UKdep and EMEP oxidised nitrogen deposition values are lower, with EMEP predicting generally between 50 and 75% of the UKdep values, with only Northern Ireland giving 100% agreement for oxidised nitrogen to woodland. The largest differences are in Scotland, with EMEP predicting ~50% of the UKdep estimates for average and moorland.

The poorest correspondence between UKdep and EMEP deposition is for reduced nitrogen deposition to semi-natural and woodland areas, with EMEP values typically between 40 and 56% of the UKdep values for all countries. As for the other pollutants the largest differences are for deposition across Scotland. Results are better for the grid-average reduced nitrogen deposition, especially across England (82%) and Northern Ireland (107%).

In virtually all cases the EMEP model significantly underestimates deposition to Scotland, closely followed by Wales.

Table 2.1. UKdep deposition budgets for the year 1999-2001 by pollutant and country

Country	Deposition budgets (in kT S or N per year) by pollutant and country								
	Non-marine sulphur			Oxidised nitrogen			Reduced nitrogen		
	Average	Moorland	Woodland	Average	Moorland	Woodland	Average	Moorland	Woodland
England	138	136	154	134	113	231	100	195	305
Wales	21	20	23	18	15	30	19	25	37
Scotland	64	63	72	51	48	82	49	62	88
NI	11	11	12	7	6	10	12	23	36
UK	233	230	262	209	183	353	180	305	466

Table 2.2. EMEP deposition budgets for the year 2000 by pollutant and country

Country	Deposition budgets (kT S or N per year) by pollutant and country								
	Non-marine sulphur			Oxidised nitrogen			Reduced nitrogen		
	Average	Semi-natural	Woodland	Average	Semi-natural	Woodland	Average	Semi-natural	Woodland
England	129	147	219	79	80	178	82	92	145
Wales	14	14	21	9	9	20	11	11	17
Scotland	38	38	51	25	25	58	25	25	36
NI	8	8	13	4	4	10	12	13	19
UK	189	207	305	118	118	265	131	141	217

Table 2.3. EMEP deposition expressed as a percentage of the UKdep deposition values, by pollutant and country

Country	EMEP deposition as a percentage of UKdep deposition by pollutant and country								
	Non-marine sulphur			Oxidised nitrogen			Reduced nitrogen		
	Average	Moorland*	Woodland	Average	Moorland*	Woodland	Average	Moorland*	Woodland
England	94%	108%	142%	59%	71%	77%	82%	47%	48%
Wales	68%	70%	90%	51%	57%	67%	61%	45%	46%
Scotland	59%	61%	71%	50%	52%	70%	51%	41%	41%
NI	74%	79%	109%	64%	71%	100%	107%	56%	51%
UK	81%	90%	116%	56%	64%	75%	73%	46%	47%

* Calculated as EMEP deposition to semi-natural divided by UKdep deposition to moorland.

3. COMPARISON OF EXCEEDANCE

The impact of the UKdep and EMEP deposition data sets on acidity and nutrient nitrogen critical loads exceedances have been examined by calculating the area and percentage area of habitats exceeded and accumulated exceedances (AE) by habitat and country. The AE takes into account both the magnitude of the exceedance and the area exceeded:

$$AE \text{ (keq year}^{-1}\text{)} = \text{exceeded habitat area (ha)} * \text{exceedance value (keq ha}^{-1}\text{ year}^{-1}\text{)}$$

It should be noted that in comparing the habitat areas exceeded by the different deposition data sets, the exceeded areas may not coincide due to the different patterns of deposition. Therefore the comparisons below simply compare the total area exceeded for each habitat or country (which may be in completely different areas of the UK for UKdep and EMEP); the areas of the habitats or countries that are exceeded by both, by one or by neither deposition estimate have not been quantified in this study.

Detailed tables of the exceedance statistics are given in Appendix 1 and the key results are summarised in the sections below.

3.1 Acidity

- Table 3.1 shows the total area of sensitive habitats exceeded in the UK is 28.9% lower when based on EMEP deposition compared to UKdep data and the EMEP AE is only 29.6% of the UKdep AE value.
- The poorest correspondence is for Scotland, with EMEP deposition resulting in 34.7% less habitat area exceeded and the AE being only 13.3% of the UKdep value. This reflects the lower deposition observed across Scotland on the EMEP deposition maps.
- The best correspondence is for England, with a 15.1% difference in the total area exceeded and the EMEP AE value being 43.7% of the UKdep value. This reflects the higher deposition patterns observed across England on the EMEP deposition maps.
- Although the highest areas exceeded are observed across Wales when using UKdep data, this is not reflected in the EMEP data results, where deposition to the area appears to be underestimated.

Table 3.1. Comparison of the percentage area of habitats exceeded and Accumulated Exceedance (AE) for acidity, by country and for the UK.

Country	% area of habitats exceeded by following deposition data:		EMEP AE expressed as a percentage of UKdep AE
	UKdep	EMEP	
England	71.6%	56.6%	43.7%
Wales	82.5%	51.4%	20.6%

Scotland	51.4%	16.7%	13.3%
NI	70.3%	52.7%	35.2%
UK	60.2%	31.3%	29.6%

Table 3.2 shows the UK results by habitat; key features are:

- Exceedances based on UKdep give higher areas exceeded for all habitats than calculations based on EMEP deposition data.
- The UKdep data gives the highest percentage areas exceeded for the more upland habitats: montane, acid grassland and bog, closely followed by managed woodlands. This is consistent with the higher deposition to the north and west of Britain in areas of higher altitude and higher rainfall.
- Using UKdep the montane habitat has the highest percentage area exceeded at 93.4%. By comparison using the EMEP deposition data only about one-third of the montane habitat is exceeded and the AE value is only 9.8% of the UKdep value.
- The EMEP deposition gives the highest percentage areas exceeded for acid grassland and the managed woodlands. However, it also results in less exceedance of some of the more upland habitats, particularly (a) dwarf shrub heath where the percentage habitat exceeded is only 30.6% of UKdep estimate; (b) montane (see above); and (c) freshwaters where many of the sites are in the uplands of north and west Britain. These results reflect the lower deposition the EMEP model predicts across Wales and Scotland. The EMEP AE values for these upland habitats are significantly lower at 9.8% to 27.7% of the UKdep values.
- The calcareous grassland habitat is not exceeded using either deposition data set.

Table 3.2. Acidity exceedances for the UK: percentage habitat areas exceeded and accumulated exceedance (AE) based on UKdep and EMEP deposition data, and EMEP results also expressed as a percentage of the UKdep results.

Habitat	Percentage area of habitats exceeded by following deposition data:		Habitat area exceeded EMEPA/UKdep (%)	AE calculated using following deposition data:		AE EMEPA/UKdep (%)
	UKdep	EMEPA		UKdep	EMEPA	
Acid grassland	84.9%	54.0%	63.6%	1176834	244384	20.8%
Calcareous grassland	Not exceeded	Not exceeded	Not exceeded	Not exceeded	Not exceeded	Not exceeded
Dwarf shrub heath	47.2%	14.5%	30.6%	620158	93591	15.1%
Bog	76.9%	35.2%	45.8%	277606	76898	27.7%
Montane	93.4%	32.6%	34.9%	179917	17692	9.8%
Conifers (managed)	70.5%	44.9%	63.7%	574608	235486	41.0%
Broadleaved (managed)	69.1%	49.9%	72.1%	670072	346341	51.7%
Unmanaged woodland	58.6%	38.4%	65.6%	245388	112386	45.8%
Freshwaters	23.2%	8.1%	34.9%	153442	28211	18.4%
All habitats	60.2%	31.3%	52.0%	3898025	1154989	29.6%

3.2 Nutrient nitrogen

- Table 3.3 shows the total area of sensitive habitats exceeded in the UK is 33.4% lower when based on EMEP deposition compared to UKdep deposition. The total AE for the UK based on the EMEP deposition is only 31.9% of the UKdep AE value.
- Poor correspondences are seen for Wales and Scotland. In Wales the area exceeded by EMEP deposition (32.4%) is 50.3% less than the percentage exceeded by UKdep (82.7%) and the EMEP AE value only 22.6% of the UKdep value. In Scotland although there is a smaller difference in the percentage habitat exceeded (27.1%), the EMEP AE is only 16.4% of the UKdep value. These results reflect the lower nitrogen deposition to Wales and Scotland on the EMEP maps (Table 2.3).
- The total habitat area exceeded is the smallest in Scotland using both deposition data sets.
- Both deposition data sets give the largest areas of habitat exceeded across England.

Table 3.3. Comparison of the percentage area of habitats exceeded and Accumulated Exceedance (AE) for nutrient nitrogen, by country and for the UK.

Country	% area of habitats exceeded by following deposition data:		EMEP AE expressed as a percentage of UKdep AE
	UKdep	EMEP	
England	92.3%	53.2%	38.5%
Wales	82.7%	32.4%	22.6%
Scotland	37.8%	10.7%	16.4%
NI	76.6%	32.0%	33.1%
UK	58.7%	25.3%	31.9%

Table 3.4 shows the UK results by habitat; key features are:

- The highest percentages of habitat areas exceeded using either UKdep or EMEP deposition are for managed broadleaved woodland (both over 90% exceeded). However, the EMEP AE value is only 44.5% of the UKdep value.
- The calcareous grassland and supralittoral sediment habitats are not exceeded using the EMEP deposition set but are significantly exceeded (70.8% and 41% respectively) using the UKdep deposition.
- The EMEP deposition gives the larger areas of exceedance for the woodland habitats, reflecting the higher deposition values to woodland. However, it appears that the nitrogen deposition to the non-woodland habitats is underestimated, particularly for the grassland and montane habitats, where the exceedances (and AE values) are very small compared to the UKdep results.

Table 3.4. Nutrient nitrogen exceedances for the UK: percentage habitat areas exceeded and accumulated exceedance (AE) based on UKdep and EMEP deposition data, and EMEP results also expressed as a percentage of the UKdep results.

Habitat	Percentage area of habitats exceeded by following deposition data:		Habitat area exceeded EMEP/UKdep (%)	AE calculated using following deposition data:		AE EMEP/UKdep (%)
	UKdep	EMEP		UKdep	EMEP	
Acid grassland	55.1%	0.25%	0.5%	317310	35	0.01%
Calcareous grassland	70.8%	0.0%	0.0%	82893	0	0.0%
Dwarf shrub heath	30.2%	0.95%	3.2%	272963	2474	0.9%
Bog	42.3%	22.7%	53.7%	147419	19737	13.4%
Montane	97.1%	2.3%	2.3%	112593	300	0.3%
Conifers (managed)	92.8%	78.9%	85.0%	767797	290010	37.8%
Broadleaved (managed)	97.8%	94.6%	96.7%	1215614	541231	44.5%
Unmanaged woodland (ground flora)	95.8%	92.0%	96.0%	501824	240994	48.0%
Atlantic oak (epiphytic lichens)	95.6%	63.9%	66.9%	66421	21421	32.3%
Supralittoral sediments	41.0%	0.002%	0.006%	17551	0.07	<0.001%
All habitats	58.7%	25.3%	43.1%	3502384	1116201	31.9%

4. CONCLUSIONS

The key conclusions are summarised below:

Deposition data

- The EMEP maps for sulphur, oxidised nitrogen and reduced nitrogen deposition all show substantially different spatial patterns of deposition from those generated by UKdep.
- The EMEP non-marine sulphur deposition budgets are 81% (average) to 116% (woodland) of the UKdep values.
- The EMEP oxidised nitrogen deposition budgets are 56% (average) to 75% (woodland) of the UKdep values.
- The EMEP reduced nitrogen deposition budgets are 46% (moorland) to 73% (average) of the UKdep values.
- In general there is a better correspondence between EMEP and UKdep for England and Northern Ireland, and a poorer correspondence across Wales and Scotland.
- Deposition is highest to woodland habitats in all countries for both deposition data sets.

Acidity exceedances

- The area of habitats exceeded across the UK is 28.9% less when based on EMEP deposition compared to UKdep and the total AE is only 29.6% of the UKdep AE value.
- There is a better correspondence between EMEP and UKdep exceedance results for England and Northern Ireland than for Wales and Scotland, reflecting the spatial patterns and magnitude of the EMEP deposition.
- The habitat areas exceeded by EMEP deposition are less than those exceeded by UKdep for all habitat types.
- The EMEP deposition gives smaller areas of exceedance for the more upland habitats found in the north and west of Britain, where the EMEP deposition is also lower.
- There is a better correspondence between EMEP and UKdep exceedance results for the woodland habitats where the deposition values are higher.

Nutrient nitrogen exceedances

- The area of habitats exceeded across the UK is 33.4% less when based on EMEP deposition compared to UKdep and the total AE is only 31.9% of the UKdep AE value.
- There are poor correspondences between the EMEP and UKdep exceedance results, especially for Wales (in terms of area exceeded) and Scotland (in terms of AE).
- There is a better correspondence in the results for England reflecting the higher deposition the EMEP model predicts across this part of the country.
- Both the EMEP and UKdep deposition data result in over 90% of the managed broadleaved woodland habitat being exceeded; however, the EMEP AE is only 44.5% of the UKdep value.
- UKdep deposition results in exceedance of 70.8% of the calcareous grassland habitat and 41% of the supralittoral sediment habitat; neither habitat is exceeded

by EMEP deposition, reflecting the spatial patterns and lower magnitude of the EMEP nitrogen deposition.

Policy implications

At the national scale, UK data indicate that 60.2% of sensitive habitats are exceeded for acidity and 58.7% for nutrient nitrogen, based on deposition for the years 1999-2001. By comparison, using EMEP data for the year 2000, only 31.3% of sensitive habitats would be exceeded for acidity and 25.3% for nutrient nitrogen.

EMEP deposition data are used in the calculation and mapping of critical load exceedances at the European scale by the Coordination Centre for Effects (CCE). These data are subsequently used in integrated assessment modelling (IAM) under the UNECE Task Force on IAM, where the potential impacts of emission and deposition scenarios are assessed at the European scale. It is therefore of concern that the use of EMEP deposition data suggest that the habitat areas potentially at risk from the adverse effects of acidification and eutrophication in the UK are significantly smaller than predicted using national scale data.

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APPENDIX 1

Acidity and nutrient nitrogen exceedance statistics by habitat and country, based on UKdep 1999-2001 and EMEP 2000 deposition data and February 2004 national critical loads data.

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1.1 UK – acidity exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	15334	13020	8275
Calcareous grassland	1808	0	0
Dwarf shrub heath	24703	11664	3573
Bog	5463	4199	1923
Montane	3054	2852	996
Coniferous woodland (managed)	8377	5903	3758
Broadleaved woodland (managed)	7452	5151	3717
Unmanaged woodland	4011	2349	1541
Freshwaters	7791	1807	631
All habitats	77992	46945	24414

(b). Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	84.9	54.0
Calcareous grassland	0	0
Dwarf shrub heath	47.2	14.5
Bog	76.9	35.2
Montane	93.4	32.6
Coniferous woodland (managed)	70.5	44.9
Broadleaved woodland (managed)	69.1	49.9
Unmanaged woodland	58.6	38.4
Freshwaters	23.2	8.1
All habitats	60.2	31.3

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	1176834	244384
Calcareous grassland	0	0
Dwarf shrub heath	620158	93591
Bog	277606	76898
Montane	179917	17692
Coniferous woodland (managed)	574608	235486
Broadleaved woodland (managed)	670072	346341
Unmanaged woodland	245388	112386
Freshwaters	153442	28211
All habitats	3898025	1154989

1.2 UK – nutrient nitrogen exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	15241	8399	38
Calcareous grassland	3577	2532	0
Dwarf shrub heath	24820	7489	237
Bog	5541	2343	1258
Montane	3129	3038	71
Coniferous woodland (managed)	8385	7781	6617
Broadleaved woodland (managed)	7482	7320	7078
Unmanaged woodland (ground flora)	3296	3158	3031
Atlantic oak (epiphytic lichens)	822	786	526
Supralittoral sediment	2128	872	0
All habitats	74422	43717	18856

(b) Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	55.1	0.3
Calcareous grassland	70.8	0
Dwarf shrub heath	30.2	1.0
Bog	42.3	22.7
Montane	97.1	2.3
Coniferous woodland (managed)	92.8	78.9
Broadleaved woodland (managed)	97.8	94.6
Unmanaged woodland (ground flora)	95.8	92.0
Atlantic oak (epiphytic lichens)	95.6	63.9
Supralittoral sediment	41.0	0
All habitats	58.7	25.3

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	317310	35
Calcareous grassland	82893	0
Dwarf shrub heath	272963	2474
Bog	147419	19737
Montane	112593	300
Coniferous woodland (managed)	767797	290010
Broadleaved woodland (managed)	1215614	541231
Unmanaged woodland	501824	240994
Atlantic oak (epiphytic lichens)	66421	21421
Supralittoral sediment	17551	0
All habitats	3502384	1116201

2.1 England – acidity exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	2669	2551	2184
Calcareous grassland	1714	0	0
Dwarf shrub heath	2462	2276	1700
Bog	1006	997	925
Montane	2	2	2
Coniferous woodland (managed)	1716	1510	1260
Broadleaved woodland (managed)	5565	3948	2965
Unmanaged woodland	2392	1514	1076
Freshwaters	1042	506	404
All habitats	18568	13303	10516

(b). Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	95.6	81.8
Calcareous grassland	0	0
Dwarf shrub heath	92.4	69.1
Bog	99.1	91.9
Montane	100	100
Coniferous woodland (managed)	88	73.4
Broadleaved woodland (managed)	70.9	53.3
Unmanaged woodland	63.3	45.0
Freshwaters	48.6	38.8
All habitats	71.6	56.6

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	356923	106807
Calcareous grassland	0	0
Dwarf shrub heath	241404	67141
Bog	157390	52370
Montane	339	54
Coniferous woodland (managed)	235987	139708
Broadleaved woodland (managed)	566858	312600
Unmanaged woodland	177561	92647
Freshwaters	77800	21924
All habitats	1814261	793253

2.2 England – nutrient nitrogen exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	2620	2498	38
Calcareous grassland	3312	2464	0
Dwarf shrub heath	2466	2311	142
Bog	1007	1007	922
Montane	2	2	2
Coniferous woodland (managed)	1719	1719	1718
Broadleaved woodland (managed)	5588	5588	5575
Unmanaged woodland (ground flora)	2252	2252	2251
Atlantic oak (epiphytic lichens)	150	150	150
Supralittoral sediment	1183	744	0
All habitats	20299	18734	10797

(b) Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	95.3	1.5
Calcareous grassland	74.4	0
Dwarf shrub heath	93.7	5.8
Bog	100	91.5
Montane	100	100
Coniferous woodland (managed)	100	100
Broadleaved woodland (managed)	100	99.8
Unmanaged woodland (ground flora)	100	99.9
Atlantic oak (epiphytic lichens)	100	99.9
Supralittoral sediment	62.9	0
All habitats	92.3	53.2

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	145988	35
Calcareous grassland	80834	0
Dwarf shrub heath	133522	1772
Bog	97606	14081
Montane	238	38
Coniferous woodland (managed)	276542	131896
Broadleaved woodland (managed)	1044727	491464
Unmanaged woodland	410472	208701
Atlantic oak (epiphytic lichens)	25936	9868
Supralittoral sediment	15171	0
All habitats	2231035	857855

3.1 Wales – acidity exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	3143	3036	2380
Calcareous grassland	45	0	0
Dwarf shrub heath	1078	968	364
Bog	56	55	47
Montane	18	18	9
Coniferous woodland (managed)	1048	1008	532
Broadleaved woodland (managed)	790	593	375
Unmanaged woodland	395	302	184
Freshwaters	1225	455	117
All habitats	7798	6436	4009

(b). Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	96.6	75.7
Calcareous grassland	0	0
Dwarf shrub heath	89.8	33.8
Bog	97.7	84.5
Montane	100	50.8
Coniferous woodland (managed)	96.2	50.8
Broadleaved woodland (managed)	75.1	47.5
Unmanaged woodland	76.5	46.5
Freshwaters	37.1	9.6
All habitats	82.5	51.4

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	325679	64895
Calcareous grassland	0	0
Dwarf shrub heath	73340	7473
Bog	5918	1377
Montane	3055	152
Coniferous woodland (managed)	104821	24470
Broadleaved woodland (managed)	61361	19819
Unmanaged woodland	29334	8630
Freshwaters	25924	2848
All habitats	629431	129664

3.2 Wales – nutrient nitrogen exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	3146	2437	0
Calcareous grassland	171	60	0
Dwarf shrub heath	1094	968	43
Bog	56	53	17
Montane	18	18	18
Coniferous woodland (managed)	1052	1052	1046
Broadleaved woodland (managed)	798	798	778
Unmanaged woodland (ground flora)	226	226	226
Atlantic oak (epiphytic lichens)	171	171	170
Supralittoral sediment	369	88	0
All habitats	7102	5871	2297

(b) Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	77.5	0
Calcareous grassland	35.3	0
Dwarf shrub heath	88.5	3.9
Bog	94.5	31.1
Montane	100	100
Coniferous woodland (managed)	100	99.4
Broadleaved woodland (managed)	100	97.3
Unmanaged woodland (ground flora)	100	99.7
Atlantic oak (epiphytic lichens)	100	99.7
Supralittoral sediment	23.7	0
All habitats	82.7	32.4

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	96754	0
Calcareous grassland	1839	0
Dwarf shrub heath	45011	42
Bog	3076	102
Montane	1958	107
Coniferous woodland (managed)	137229	46120
Broadleaved woodland (managed)	98135	32360
Unmanaged woodland	31947	11995
Atlantic oak (epiphytic lichens)	22055	8787
Supralittoral sediment	1556	0
All habitats	439562	99514

4.1 Scotland – acidity exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	8336	6478	2903
Calcareous grassland	7	0	0
Dwarf shrub heath	20190	7725	1220
Bog	3959	2748	578
Montane	3034	2832	985
Coniferous woodland (managed)	5111	3080	1665
Broadleaved woodland (managed)	1096	610	377
Unmanaged woodland	1016	427	200
Freshwaters	5338	816	94
All habitats	48086	24717	8023

(b). Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	77.7	34.8
Calcareous grassland	0	0
Dwarf shrub heath	38.3	6.0
Bog	69.4	14.6
Montane	93.3	32.5
Coniferous woodland (managed)	60.3	32.6
Broadleaved woodland (managed)	55.7	34.4
Unmanaged woodland	42	19.7
Freshwaters	15.3	1.8
All habitats	51.4	16.7

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	425416	47901
Calcareous grassland	0	0
Dwarf shrub heath	268746	13254
Bog	86783	11093
Montane	176523	17486
Coniferous woodland (managed)	205793	57936
Broadleaved woodland (managed)	41853	13922
Unmanaged woodland	26208	5413
Freshwaters	46502	2980
All habitats	1277824	169985

4.2 Scotland – nutrient nitrogen exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	8283	2708	0
Calcareous grassland	24	0	0
Dwarf shrub heath	20284	3470	0
Bog	4005	863	0
Montane	3109	3018	51
Coniferous woodland (managed)	5111	4520	3353
Broadleaved woodland (managed)	1096	934	726
Unmanaged woodland (ground flora)	570	437	308
Atlantic oak (epiphytic lichens)	501	465	205
Supralittoral sediment	547	24	0
All habitats	43530	16439	4644

(b) Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	32.7	0
Calcareous grassland	0	0
Dwarf shrub heath	17.1	0
Bog	21.6	0
Montane	97.1	1.6
Coniferous woodland (managed)	88.5	65.6
Broadleaved woodland (managed)	85.2	66.3
Unmanaged woodland (ground flora)	76.7	54.1
Atlantic oak (epiphytic lichens)	92.7	41.0
Supralittoral sediment	4.4	0
All habitats	37.8	10.7

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	55304	0
Calcareous grassland	0	0
Dwarf shrub heath	70300	0
Bog	28811	0
Montane	110396	155
Coniferous woodland (managed)	310718	87964
Broadleaved woodland (managed)	72751	17407
Unmanaged woodland	31413	6436
Atlantic oak (epiphytic lichens)	18430	2766
Supralittoral sediment	290	0
All habitats	698413	114728

5.1 Northern Ireland – acidity exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	1187	955	808
Calcareous grassland	42	0	0
Dwarf shrub heath	973	694	288
Bog	442	399	373
Montane	0	0	0
Coniferous woodland (managed)	503	304	301
Broadleaved woodland (managed)	0	0	0
Unmanaged woodland	208	106	80
Freshwaters	186	30	16
All habitats	3540	2489	1866

(b). Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	80.5	68.1
Calcareous grassland	0	0
Dwarf shrub heath	71.4	29.6
Bog	90.3	84.4
Montane	0	0
Coniferous woodland (managed)	60.5	59.8
Broadleaved woodland (managed)	0	0
Unmanaged woodland	51.2	38.7
Freshwaters	16.1	8.6
All habitats	70.3	52.7

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	68817	24781
Calcareous grassland	0	0
Dwarf shrub heath	36668	5722
Bog	27514	12057
Montane	0	0
Coniferous woodland (managed)	28006	13372
Broadleaved woodland (managed)	0	0
Unmanaged woodland	12286	5696
Freshwaters	3216	459
All habitats	176508	62087

5.2 Northern Ireland – nutrient nitrogen exceedance statistics

Broad Habitat	Mapped Habitat area (km ²)	Habitat area (km ²) exceeded by deposition data for:	
		UK	EMEP
Acid grassland	1192	757	0
Calcareous grassland	69	8	0
Dwarf shrub heath	976	741	52
Bog	473	420	319
Montane	0	0	0
Coniferous woodland (managed)	504	490	500
Broadleaved woodland (managed)	0	0	0
Unmanaged woodland (ground flora)	247	242	246
Atlantic oak (epiphytic lichens)	0	0	0
Supralittoral sediment	29	16	0
All habitats	3491	2674	1117

(b) Percentage habitat area exceeded.

Broad Habitat	Percentage habitat area exceeded by deposition data for:	
	UK	EMEP
Acid grassland	63.5	0
Calcareous grassland	11.7	0
Dwarf shrub heath	75.9	5.3
Bog	88.7	67.6
Montane	0	0
Coniferous woodland (managed)	97.2	99.1
Broadleaved woodland (managed)	0	0
Unmanaged woodland (ground flora)	97.9	99.5
Atlantic oak (epiphytic lichens)	0	0
Supralittoral sediment	55.7	0
All habitats	76.6	32.0

(c) Accumulated exceedance

Broad Habitat	Accumulated Exceedance (keq year ⁻¹) by deposition data for:	
	UK	EMEP
Acid grassland	19264	0
Calcareous grassland	220	0
Dwarf shrub heath	24131	659
Bog	17926	5554
Montane	0	0
Coniferous woodland (managed)	43308	24030
Broadleaved woodland (managed)	0	0
Unmanaged woodland	27992	13861
Atlantic oak (epiphytic lichens)	0	0
Supralittoral sediment	534	0
All habitats	133374	44104