ADDENDUM :
THE STATUS OF UK CRITICAL LOAD EXCEEDANCES

APRIL 2004

UK National Focal Centre
CEH Monks Wood

CEH Monks Wood
Abbots Ripton
Huntingdon
PE28 2LS

Report prepared for Defra and the Devolved Administrations under Defra contract EPG1/3/185.

Copies available from the UK National Focal Centre web site:
http://critloads.ceh.ac.uk

Version 1 (April 23rd 2004)

This report is compiled by the UK's National Focal Centre for Critical Loads, in collaboration with a range of experts, listed below.

UK National Focal Centre, CEH Monks Wood
Jane Hall
Jackie Ullyett
Liz Heywood
Rich Broughton
Joseph Fawehinmi

Collaborators
Mark Broadmeadow, Forest Research
Louise Calver, University of York
Malcolm Cresser, University of York
Chris Curtis, University College London
Bridget Emmett, CEH Bangor
David Fowler, CEH Edinburgh
Mike Hughes, University College London
Simon Langan, Macaulay Institute
Brian Reynolds, CEH Bangor
Richard Smart, University of York
Ron Smith, CEH Edinburgh

CONTENTS

EXECUTIVE SUMMARY

This document provides an assessment of critical load exceedances for acidity and nutrient nitrogen based on the updated critical loads data presented in the 2004 Status Report (http://critloads.ceh.ac.uk) and the latest (March 2004) version of deposition data for the years 1995-97. These exceedances are compared with the previous (February 2003) results published in the 2003 Addendum.

The changes in the calculated exceedances between 2003 and 2004 presented in this report are due only to changes in the scientific assessment of the critical load values and deposition values, and NOT to actual changes in air quality or emissions.

The main changes in the exceedance results are summarised below:

- For acidity, the area of habitats exceeded in the UK has increased by 17.8% to 72.6%. This increase is due to updates to both the critical loads and the deposition maps for 1995-97.
- Increases in the area of freshwater habitats exceeded for acidity are mainly due to the large increase in the number and area of freshwater sites included in the February 2004 critical loads update.
- For nutrient nitrogen, the area of habitats exceeded in the UK has increased by 4.7% to 66.5%. This increase is mainly due to updates in the deposition maps for 1995-97 and also to minor updates to some critical load habitat distribution maps.
- Wales has the highest percentage area of habitats exceeded both for acidity and nutrient nitrogen and Scotland has the lowest.

This report also summarises the changes made to UK critical loads and deposition data for this 2004 update, to explain the reasons for the changes in the exceedance results. For further information on the updates to critical loads please refer to the 2004 Status Report on the UK National Focal Centre web site (http://critloads.ceh.ac.uk).

Critical load exceedances have also been calculated using mean deposition data for the years 1998-2000 and 1999-2001, and these are presented in Annexes 1 and 2 of this report.

1. Introduction

This report is an Addendum to the February 2004 Update to the Status of UK Critical Loads (Hall *et al.*, 2004), prepared by the UK National Focal Centre for Critical Loads (NFC). It presents an assessment of the exceedance of critical loads of acidity and nutrient nitrogen, based on the updated critical loads maps described in the 2004 Update. It also compares the exceedance results with those presented in the 2003 Addendum (Hall *et al.*, 2003a).

The exceedance is the amount of deposition (here, of acidity or nitrogen) above the critical load. By overlaying maps of acid or nitrogen deposition on critical load maps, the NFC generates 'exceedance maps'. These maps highlight the areas receiving excess deposition, and the amount of deposition above the critical load. In addition, the NFC quantifies the areas of sensitive habitats associated with critical loads exceedances. These exceedance maps and statistics are used by Defra and other bodies to guide policy development on the control of air pollutants.

It must be emphasised that the changes in the calculated exceedances between 2003 and 2004 are due only to changes in the scientific assessment of the critical load values and deposition, and NOT due to actual changes in air quality or emissions. The critical load exceedances have been calculated using deposition averaged over the years 1995-97, to permit a comparison between the previous (2003) Status Report and this Update (2004). Critical load exceedances have also been calculated using deposition averages for 1998-2000 and 1999-2001, and these are presented in Annexes 1 and 2. A separate report on the trends in critical load exceedances, to 2010, will be published on the Critical Loads website (http://critloads.ceh.ac.uk) on 21st May 2004.

Reducing the area and amount of critical load exceedance continues to be a major driver of Government policy on reducing emissions of acidic and nitrogen-containing air pollutants (sulphur dioxide, nitrogen oxides and ammonia). The latest international agreements, the UNECE Gothenburg Protocol and EC National Emission Ceilings Directive, contain commitments to further reduce emissions of these pollutants by 2010. Both these agreements are expected to be internationally reviewed in 2005-6. Critical loads will continue to be used as a policy tool to support the negotiations, to identify the areas of ecosystems at risk under a range of possible emission control options.

2 Calculating critical load exceedances

Critical loads are compared with acidifying or eutrophying deposition to determine the excess deposition above the critical load, ie, the exceedance.

Exceedance = Deposition – Critical Load

For eutrophication, the exceedance is calculated using total nitrogen deposition (derived from nitrogen oxides and ammonia). For acidification, the contribution of both sulphur and nitrogen compounds must be taken into account, and this is done using the Critical Loads Function (CLF). The CLF was developed in Europe (Posch *et*

al., 1999; Posch & Hettelingh, 1997; Posch *et al.*, 1995; Hettelingh *et al.*, 1995). It defines separate acidity critical loads in terms of sulphur and nitrogen, referred to as the "minimum" and "maximum" critical loads of sulphur and nitrogen (Figure 2.1). It is these "minimum" and "maximum" critical loads that are used in the calculation of critical loads exceedance for acidity (Figure 2.2).

Exceedances for the terrestrial habitats are calculated using 1km grid resolution critical loads data (Section 4.5) and 5km resolution deposition data (Section 5), by assuming that the deposition values remain constant across all 1km grid squares in each 5km grid square. The freshwater exceedance results presented in this report are based on the critical loads for the site (based on the site catchment data) and catchment-weighted deposition values derived from the 5km deposition data.

In addition to the exceedance values, the areas of sensitive habitats associated with the exceedances are also calculated. By summing the exceedance values for these habitat areas, the "accumulated exceedance" (AE) is determined, ie,

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

Therefore, the AE is a measure of exceedance that takes into account ***both the magnitude of exceedance and the habitat area exceeded.***

The exceedance maps and statistics are presented in Section 6.

3 Exceedance and Damage

The critical loads data on which exceedance calculations are currently based, are derived from empirical or steady-state mass balance methods, which are used to define ***long-term*** critical loads for systems at ***steady-state***. Therefore, exceedance is an indication of the ***potential*** for harmful effects to systems at steady-state, and a habitat that is currently exceeding its critical load is not necessarily already showing the signs of damage. In addition, reducing deposition to below the critical load does not mean the ecosystems immediately recover. There are time lags before chemical recovery takes place, and further delays before biological recovery. The timescales for both chemical and biological recovery could be very long, particularly for the most sensitive ecosystems.

4 Critical loads data

The methods and data used to map sensitive UK habitats and calculate critical loads of acidity and nutrient nitrogen are discussed in detail in the 2003 Status Report (Hall *et al.*, 2003b) and will not be repeated here. The 2004 Update (Hall *et al.*, 2004) describes the changes made in the last year to the data and methods used to calculate UK critical loads. The main changes and the impact on the critical loads values are summarised below; for further information refer to the 2004 Update (Hall *et al.*, 2004).

4.1 Habitat mapping

Managed woodlands
Minor revisions have been made to the habitat maps for managed woodlands, as it became apparent that there were some areas of managed broadleaved woodland mapped in grid squares dominated by peat soils. Forest Research (FR) considered this unlikely and had arisen due to a discrepancy in the mapping and classification of young trees. FR therefore recommended that these woodland areas be removed from the managed broadleaved category and added to the managed coniferous woodland class. This led to a 5.1% increase in the area of managed coniferous woodland and a 1.4% decrease in the area of managed broadleaved woodland; it did not give equal increases and decreases to the areas of each managed woodland habitat due to the mapping procedure used that incorporates both CEH Land Cover Map 2000 and FR forestry data (Hall *et al.*, 2003b).

Calcareous grassland
The area of calcareous grassland mapped for acidity critical loads has decreased by 0.2%. This is because some of the 1km calcareous grassland square mapped for nutrient nitrogen coincide with 1km squares that have low empirical soil critical loads (ie, below 2.0 keq ha^{-1} $year^{-1}$). The soil acidity critical loads are based on the dominant soil type in each 1km grid square; soils derived from base-poor rocks are more acid and result in low critical loads. Calcareous grassland may occur in 1km grid squares that have a low acidity critical load, but is unlikely to be found on the acid soil determining the low critical load. Changes to the acidity critical loads map for peat soils have resulted in more squares where the critical load value would be inappropriate for calcareous grassland, and hence the area of this habitat mapped for acidity has been reduced.

4.2 Mapping acidity critical loads for peat soils

The method used to calculate acidity critical loads for peat soils in the UK is applicable to upland and lowland acid peat soils, but not to the lowland/arable fen peats, which are less sensitive to acidification. Critical load values for lowland/arable fen areas are re-set to a higher critical load value (4.0 keq ha^{-1} $year^{-1}$ – the upper end of the range of critical loads applied to UK soils). The methods used to identify and map areas of lowland/arable fen have been revised and therefore the number of 1km squares requiring the critical load to be re-set to 4.0 keq ha^{-1} $year^{-1}$ has been reduced. Subsequently the mean acidity critical load for UK peat dominated-squares across the UK was reduced from 1.1 keq ha^{-1} $year^{-1}$ to 0.8 keq ha^{-1} $year^{-1}$. This has also reduced the acidity critical loads where terrestrial habitats occur on peat soils (Sections 4.3 and 4.4).

4.3 Calculating acidity critical loads for woodlands on different soil types

The methods used to calculate acidity critical loads for woodland habitats differs according to the soil type dominant in the 1km grid square in which the woodland occurs. For mineral soils, critical loads are based on the Simple Mass Balance (SMB) equation and a critical molar ratio of calcium to aluminium (equal to 1.0) in soil

solution. In February 2003 critical loads for the soil types classified as "organic" were calculated using a criterion of the critical soil solution pH of 4.0. However, a review by UK experts in December 2003 agreed that these "organic" soils were really "organo-mineral" soils, ie, mineral soils with a peaty top. It is therefore more appropriate to use the critical molar ratio of calcium to aluminium criterion and so this approach was applied to woodlands on organo-mineral soils. The change in the critical chemical criterion has led to changes in the critical load values. The SMB equation based on a Ca:Al ratio is sensitive to base cation weathering (ANC_w) and the SMB equation based on critical pH is also sensitive to ANC_w, but additionally to runoff. Therefore changing the criterion has led to both increases and decreases in the critical load values due to the interactions between ANC_w and runoff in the SMB equation:

- In areas with high runoff, critical loads based on Ca:Al tend to be lower than those based on critical pH irrespective of the ANC_w value.
- Where ANC_w is low and runoff is low, critical loads based on Ca:Al tend to be lower than those based on critical pH
- Where ANC_w is medium/high and runoff is low critical loads based on Ca:Al tend to be higher than those based on critical pH

The method for woodlands occurring on peat soils remained unchanged, with the exception of changes to the lowland/arable fen map described in Section 4.2 above.

In this 2004 Update, the application of phosphate and potassium fertilisers (primarily rock phosphate and muriate of potash) as a contribution to the base cation budget to managed woodlands has been taken into account in the calculation of acidity critical loads for managed woodlands on organo-mineral and peat soils. This has increased the base cation inputs to the critical load calculations and hence the critical load values, especially for peat soils where the additions of fertiliser are greater. However, as other revisions have also been made to the data and methods used, the critical load values for managed woodlands on organo-mineral and peat soils will not necessarily be greater than the previous (2003) values for all grid squares.

The mean acidity critical load values for the woodland habitats on different soil types are compared in Table 4.1 below. These data show that although the largest decreases in critical loads were for woodlands occurring on peat soils, the areas of woodland occurring on peat soils are smaller than the areas of woodland occurring on other soil types, ie 18% of managed conifer, 4.6% of managed broadleaved and 0.8% of unmanaged woodland occurring on peat soils.

Other minor changes to the data used in the calculations are described in the 2004 Update (Hall *et al.*, 2004).

Table 4.1. Comparison of previous (February 2003) and updated (February 2004) mean acidity critical values by soil type for woodland habitats.

Woodland habitat	**Soil type**	**Percentage area of woodland habitat occurring on different soil types[1]**		**Acidity critical load values (keq ha^{-1} year^{-1})**		**Difference between 2003 and 2004 mean critical load values[2]**
		2003	**2004**	**2003 mean**	**2004 mean**	
Managed coniferous	Mineral	45.3%	43.1%	2.20	2.19	0.5% decrease (0.01 keq ha^{-1} year^{-1})
	Organo-mineral	40.8%	38.8%	1.66	1.58	4.8% decrease (0.08 keq ha^{-1} year^{-1})
	Peat	13.8%	18.0%	1.43	0.85	40.6% decrease (0.58 keq ha^{-1} year^{-1})
	All soils			2.03	1.94	4.4% decrease (0.09 keq ha^{-1} year^{-1})
Managed broadleaved	Mineral	94.1%	95.4%	2.91	2.91	No change
	Organo-mineral	4.6%	4.6%	1.63	1.36	16.6% decrease (0.27 keq ha^{-1} year^{-1})
	Peat	1.4%	0.0% (not mapped)	2.38	Not mapped	-
	All soils			2.81	2.78	1.1% decrease (0.03 keq ha^{-1} year^{-1})
Unmanaged	Mineral	88.3%	88.3%	3.20	3.19	0.3% decrease (0.01 keq ha^{-1} year^{-1})
	Organo-mineral	11.0%	11.0%	1.82	1.94	6.6% increase (0.12 keq ha^{-1} year^{-1})
	Peat	0.8%	0.8%	2.07	0.33	84.1% decrease (1.74 keq ha^{-1} year^{-1})
	All soils			3.04	3.02	0.7% decrease (0.02 keq ha^{-1} year^{-1})

[1] Minor changes to the percentage areas of woodland habitats on different soil types in 2003 and 2004 due to revisions to managed woodland habitat maps.

[2]An increase or decrease in the mean critical load values does not necessarily mean that all values for that habitat have increased or decreased, some may have increased in value and others decreased in value.

4.4 Critical loads of acidity for freshwaters

For the February 2004 Update the number of freshwater sites in acidified regions for which acidity critical loads are calculated and mapped was increased using new survey information. In addition, following the Stakeholder Review of ANC_{crit} (see Appendix 2 in Hall *et al.* 2004), the threshold of ANC used in the calculation of acidity critical loads for UK freshwaters has been changed from zero to 20μeql^{-1} for all sites, except those naturally acidic sites where data suggest that the pre-industrial value was lower than 20μeql^{-1}, in which case ANC_{crit} 0μeql^{-1} was applied. Table 4.2 below provides a summary of the number and area of freshwater sites across the UK and the ANC_{crit} value applied. The largest increase in the number and area of freshwater sites for this update was in Wales.

Table 4.2. Summary of numbers and areas of freshwater sites in the UK mapping data sets for the February 2003 and February 2004 updates, and the ANC_{crit} values applied to sites in 2004.

Site information	Site statistics by country and for the UK				
	England	Wales	Scotland	NI	UK
Number sites 2003	268	116	660	119	1163
Total area (km^2) 2003	660	179	1430	149	2417
Number sites 2004	395	344	856	127	1722
No. sites ANC 0μeql^{-1}	21	2	15	5	43
No. sites ANC 20μeql^{-1}	374	342	841	122	1679
Total area (km^2) 2004	1042	1225	5338	186	7791

A summary of the changes in the mean freshwater critical load values ($CL_{max}S$, $CL_{min}N$ and $CL_{max}N$) is provided in Table 4.3 in Section 4.5.

4.5 Maximum and minimum critical loads of sulphur and nitrogen

Section 2 briefly describes the maximum critical loads of sulphur ($CL_{max}S$) and minimum and maximum critical loads of nitrogen ($CL_{min}N$ and $CL_{max}N$) used in the calculations of acidity exceedances. These critical loads are based on the empirical and mass balance acidity critical loads described in Sections 4.2 and 4.3 and in Hall *et al.* (2004). The derivation of the minimum and maximum critical loads is described in more detail by Hall *et al.* (2003b and 2004). The exceedance statistics provided in Section 6 of this report are based on the 1km maps of $CL_{max}S$, $CL_{min}N$ and $CL_{max}N$ for each habitat, with the exception of the freshwater exceedances, where the calculations are performed at the catchment scale.

Since changes in these critical loads values may have an impact on the magnitude of exceedance, the mean critical load values for each habitat for the February 2003 and February 2004 updates are presented in Table 4.3 below.

The results in Table 4.3 show that for most habitats changes in the mean values of $CL_{max}S$ and $CL_{max}N$ are less than 0.1 keq ha^{-1} year^{-1}. There are larger reductions in the mean critical load values for the bog habitat as a result of the changes to the acidity critical loads for peat-dominated grid squares. Increases to the broadleaved woodland mean critical loads are due to updating the habitat map and removing areas of this woodland habitat from squares dominated by peat soils (Section 4.1). The

mean critical load values for the freshwater habitats have decreased because of the updates to the number of sites and revisions to the methods outlined in Section 4.4.

Table 4.3.
Summary of changes in the mean values of $CL_{max}(S)$, $CL_{min}(N)$ and $CL_{max}(N)$

Broad habitat[1]	Previous (Feb 2003) mean value (keq ha^{-1} $year^{-1}$)	Updated (Feb 2004) mean value (keq ha^{-1} $year^{-1}$)	Difference between previous and updated means[2]
$CL_{max}S$			
Acid grassland	0.82	0.73	-11.0% (-0.09 keq ha^{-1} $year^{-1}$)
Calcareous grassland	3.92	4.01	+2.3% (+0.09 keq ha^{-1} $year^{-1}$)
Dwarf shrub heath	0.84	0.75	-10.7% (-0.09 keq ha^{-1} $year^{-1}$)
Coniferous woodland (managed)	1.97	1.94	-1.5% (-0.03 keq ha^{-1} $year^{-1}$)
Broadleaved woodland (managed)	2.66	2.79	+4.9% (+0.13 keq ha^{-1} $year^{-1}$)
Unmanaged woodland	3.24	3.19	-1.5% (-0.05 keq ha^{-1} $year^{-1}$)
Bogs	0.90	0.63	-30.0% (-0.27 keq ha^{-1} $year^{-1}$)
Montane	0.56	0.48	-14.3% (-0.08 keq ha^{-1} $year^{-1}$)
Freshwaters	3.64	3.26	-10.4% (-0.38 keq ha^{-1} $year^{-1}$)
$CL_{min}N$			
Acid grassland	0.37	0.37	No change
Calcareous grassland	0.89	0.89	No change
Dwarf shrub heath	0.85	0.85	No change
Coniferous woodland (managed)	0.48	0.48	No change
Broadleaved woodland (managed)	0.66	0.66	No change
Unmanaged woodland	0.25	0.25	No change
Bogs	0.34	0.34	No change
Montane	0.32	0.32	No change
Freshwaters	0.31	0.29	-6.5% (-0.02 keq ha^{-1} $year^{-1}$)
$CL_{max}N$			
Acid grassland	1.19	1.10	-7.6% (-0.09 keq ha^{-1} $year^{-1}$)
Calcareous grassland	4.81	4.89	+1.7% (+0.08 keq ha^{-1} $year^{-1}$)
Dwarf shrub heath	1.70	1.60	-5.9% (-0.10 keq ha^{-1} $year^{-1}$)
Coniferous woodland (managed)	2.44	2.42	-0.8% (-0.02 keq ha^{-1} $year^{-1}$)
Broadleaved woodland (managed)	3.32	3.45	+3.9% (+0.13 keq ha^{-1} $year^{-1}$)
Unmanaged woodland	3.49	3.43	-1.7% (-0.06 keq ha^{-1} $year^{-1}$)
Bogs	1.24	0.97	-21.8% (-0.27 keq ha^{-1} $year^{-1}$)
Montane	0.87	0.80	-8.0% (-0.07 keq ha^{-1} $year^{-1}$)
Freshwaters	5.31	4.65	-12.4% (-0.66 keq ha^{-1} $year^{-1}$)

[1]The "broadleaved, mixed and yew woodland" broad habitat is separated into "broadleaved woodland (managed)" and "unmanaged (ancient & semi-natural) coniferous and broadleaved woodland" abbreviated to "Unmanaged woodland" above; the latter includes Atlantic oak woods and unmanaged coniferous woodland.
[2]An increase or decrease in the mean critical load values does not necessarily mean that all values for that habitat have increased or decreased, some may have increased in value and others decreased in value.

4.6 Critical loads for combined habitat critical load exceedance maps

The exceedance statistics (Section 6) are calculated via a suite of C programs using the individual critical loads data for each habitat type (Section 4.5) in conjunction with appropriate deposition data (Section 5). Maps of critical loads exceedances can also be generated for individual habitat types using these data. However, to summarise the critical loads for all habitats, and hence exceedances, into fewer maps, a statistic of the critical loads data is required. A commonly used statistic is the 5^{th}-percentile critical load; this is the critical load that will protect 95% of the habitat area

in any given grid square. These 5th-percentile values are defined by ranking the 1km critical load values (from smallest to largest) for all habitats together with their respective habitat areas and generating a cumulative frequency distribution of the habitat areas; where the habitat area is equal to or greater than 5% of the total habitat area in a 1km grid square, the corresponding 5th-percentile critical load can be set. For example:

Critical loads (keq ha^{-1} $year^{-1}$) (ranked low to high)	Habitat area (ha)	Habitat
0.2	2	Bog
0.3	5	Acid grassland
0.5	3	Montane
0.75	45	Dwarf shrub heath
0.75	25	Coniferous woodland

Total habitat area = 80ha
5% of 80 = 4ha
Critical load where area >=4ha is 0.3 keq ha^{-1} $year^{-1}$
Therefore the 5th-percentile critical load is 0.3 keq ha^{-1} $year^{-1}$ and is based on a combination of data for bog and acid grassland habitats.

This procedure is carried out to generate 5th-percentile maps of $CL_{max}S$, $CL_{min}N$ $CL_{max}N$ and $CL_{nut}N$. It should be noted that the habitat(s) determining the 5th-percentile critical load values may not be same for all maps. For the exceedance maps presented in Section 6, 5th-percentile critical loads were generated of both the previous (February 2003) and updated (February 2004) data. The 5th-percentile maps based on data for all terrestrial habitats, are presented in Figures 4.1, 4.2, 4.3 and 4.4. The maps of $CL_{min}N$ and $CL_{nut}N$ are virtually identical for both 2003 and the 2004 update, with just minimal changes in the woodland areas used in the calculations. The 5th-percentile maps of $CL_{max}S$, show lower critical loads in some areas for the 2004 update, particularly in Scotland; this is due to the updates made to the acidity critical loads. However, the $CL_{max}N$ maps are similar for 2003 and the 2004 update.

The freshwater critical load exceedance maps are presented separately in Section 6 and are based on the $CL_{max}S$, $CL_{min}N$ and $CL_{max}N$ values for each site.

5 Deposition data

The national deposition data sets are calculated and mapped to a 5km grid covering the UK and provide values that are the sum of wet, dry and cloud deposition. In addition, separate deposition values are supplied which are based on habitat-specific dry deposition velocities. These deposition data are overlaid on maps of critical loads to calculate critical load exceedances. When calculating critical load exceedances for individual habitats, the deposition values for low-growing vegetation (grassland, moorland) are used for the non-woodland terrestrial habitats, and deposition values for woodland are applied to the woodland habitats. For freshwater habitats, average deposition values for all vegetation types are used. However, when calculating exceedances of 5th-percentile critical loads the average deposition values are used,

because data for a combination of habitat types can define the 5th-percentile values (Sections 4.6 and 6).

The exceedance statistics and maps presented in Section 6 are based on mean deposition data for the years 1995-97. However, the February 2003 critical load exceedances are based on an earlier version of the 1995-97 deposition data than that used for the exceedances of the February 2004 critical loads. A summary of the changes in the procedures used for calculating and mapping deposition is provided in Section 5.1 below.

Maps of the latest (March 2004) versions of the average, moorland and woodland total acid deposition (ie, non-marine sulphur plus oxidised and reduced nitrogen) and total nitrogen deposition (ie, oxidised plus reduced nitrogen) are shown in Figures 5.1 and 5.2 respectively.

5.1 Changes in procedures for calculating and mapping deposition

There have been a large number of changes since these models were first used to estimate deposition for critical loads for the period 1995-1997 and most of these have not had a substantial effect on the estimated deposition. Examples of these changes include an improved land use classification, improvements in interpolating the meteorological inputs, a new rainfall model implemented at the UK Meteorological Office, revision of the wet surface uptake parameterisation of SO_2, and a different calculation of the effect of urban sources of SO_2.

One change was expected to have an important effect and that was the inclusion of deposition of nitric acid, now possible since the establishment of the nitric acid monitoring network, with data available since 1999. In UK terms, nitric acid deposition accounts for 30% of the deposition of oxidised nitrogen but the deposition is highest in England, particularly towards the southeast.

The other change which has been important was a revision of the method used to produce the NH_3 concentration map. The major part of the variability in NH_3 concentration is provided by the output from an atmospheric transport model (FRAME), since the local scale variability in NH_3 emissions is a major cause of changes in concentration. The NH_3 monitoring network started in mid 1997 and there were therefore few data to cover the period 1995-1997, so the modelled concentrations were the primary data source. It has become clear since then that an adjustment is required to bring together the measurements from the NH_3 monitoring network and the model output concentrations, and this adjustment is now in place. There is one problem that the adjustment introduces, and that is that the NH_3 gas concentration now predicted for a 5 x 5 km square is only applicable if the particular ecosystem of concern is not close to a source of NH_3. As NH_3 concentrations drop substantially within 1 km of a source, this concentration is appropriate for most of the 25 x 1 km squares in a 5 km x 5km square. However there will be areas within many UK 5 km x 5 km squares where the NH_3 concentration, and hence nitrogen deposition, is substantially underestimated by using this typical value for the whole of the 5 km x 5 km square. This can only be resolved by either introducing more local

concentration monitoring or running a local scale model within the 5 km x 5 km square.

To separate the changes due to changes in the model rather than by changes over time, maps of deposition for 1995-1997 using the current models have been provided. The ratio comparison of the latest version (March 2004) of the 1995-1997 deposition against the previous version of the 1995-1997 deposition for total acidity and nitrogen are shown (Figure 5.3) to indicate where changes have resulted from improvements to the models. Therefore the latest (March 2004 version) 1995-1997 acidity and nitrogen depositions include nitric acid deposition from 2000 as an initial step towards correcting for the omission of nitric acid in the previous 1995-1997 data.

The comparison between the previous and updated (March 2004) models for 1995-1997 acidity deposition shows most areas reporting changes of less than 20%, and the main increases outside that range appear to be associated with urban areas. The acidity map does highlight an improvement in the method of estimating the extra rainfall over hills, which has affected the mountain areas in the Outer Hebrides and the very northwest of the Scottish mainland on either side of the Minch. The newer method should be more consistent when there are major offshore islands, as in this case. The increases in nitrogen deposition are primarily a reflection of the inclusion of nitric acid deposition, although changes over most of the country are again less than 20%. The main areas of increase are, as expected, in England. The increased deposition of nitrogen in the Scottish mountain areas is a combination of the above change in estimation of wet deposition along with an assumed very rapid rate of deposition of nitric acid, even at low concentration, to forests.

It should be noted that the estimates of nitrogen deposition are likely to increase as methodologies are revised to include aerosol deposition, which is currently the subject of Defra research[1].

[1] For further information on the methods used to calculate and map deposition maps refer to RGAR (1997), NEGTAP (2001), Smith & Fowler (2001), Smith *et al.* (2001) and Smith *et al.* (1997).

6 Assessment of critical load exceedances

This section presents and compares the exceedance results from the 2003 Addendum (Hall *et al.*, 2003a) with exceedance maps and statistics based on the 2004 updated critical loads and deposition data. Three sets of results are presented:
(i) UK exceedance maps based on 5th-percentile critical loads for terrestrial habitats
(ii) UK exceedance maps for freshwaters
(ii) UK exceedance statistics by habitat
(iii) Exceedance statistics by country and habitat

6.1 UK exceedance maps based on 5th-percentile critical loads for terrestrial habitats

Section 4.6 describes the derivation of the 5th-percentile critical loads ($CL_{max}S$, $CL_{min}N$, $CL_{max}N$, $CL_{nut}N$). For acidity, exceedance maps were generated using Critical Load Functions of the 1km 5th-percentile maps of $CL_{max}S$, $CL_{min}N$ and $CL_{max}N$ and 5km deposition data (Section 5). The average deposition values for all habitat types are used in these calculations because the 5th-percentile critical loads are based on combinations of habitat critical loads data. For nutrient nitrogen, the 5th-percentile critical load values were subtracted from the average nitrogen deposition values to give the exceedance values. As the exceedance maps presented below are based on average (rather than habitat-specific) deposition, the exceedance values may be underestimated in some areas, particularly those areas dominated by woodland habitats.

The exceedance maps based on the previous (February 2003) data are compared with the updated (February 2004) data in Figures 6.1 (acidity) and 6.2 (nutrient nitrogen). Both the previous and the updated maps show the same general trends across the country, for acidity and for nutrient nitrogen. However, both the updated maps show larger areas of higher exceedances than the previous (2003) maps. For acidity this is due to a combination of a reduction in critical load values and an increase in deposition values. For nutrient nitrogen this is due to an increase in deposition values, as the critical loads values have remained unchanged in this update. Changes to the acidity critical loads are described in Section 4 and changes to the deposition values in Section 5.

6.2 Exceedances for UK freshwaters

The updates to the freshwater critical loads data are outlined in Section 4.4. Exceedances have been calculated at the catchment scale using the critical loads data for each site and average deposition data as described in earlier sections. Figure 6.3 compares the previous exceedance map from the 2003 Addendum (Hall *et al.*, 2003a) with the updated 2004 exceedance map. Note that for the 2003 map, freshwater critical loads and exceedances were mapped on a 10km grid, each square representing a single site within the square. The updated map is based on an additional 559 sites, and as there may now be more than one site in a 10km grid square, the data are presented in dot format. However, the previous and the updated maps show the same general trends in exceedances across the country.

The increase in the number of sites included in the data set has increased the habitat area (ie, the total of all catchment areas) from 2417 km^2 to 7791km^2 in the UK (Table 6.1). Not surprisingly, this increase in habitat area, has led to large increases in the exceeded area and accumulated exceedances. However, the proportion of the habitat area exceeded is similar for both the previous 2003 (23%) and updated 2004 (29.2%) data set. Summary statistics of the previous (February 2003) exceedances and the updated 2004 exceedances for each country and the UK are given in Table 6.1 below. These results are also included in Tables 6.2(a),(b),(c) and in Section 6.4.1 to provide complete statistics for all sensitive habitats considered in the UK.

Table 6.1. Exceedance statistics for freshwaters by county and for the UK

Parameter	Year[(i)]	England	Wales	Scotland	NI	UK
Habitat area (km^2)	2003	660	179	1430	149	2417
	2004	1042	1225	5338	186	7791
Exceeded area (km^2)[(i)]	2003	265	83	199	7.5	555
	2004	535	724	981	38	2278
% area exceeded[(i)]	2003	40.1%	46.4%	13.9%	5.1%	23.0%
	2004	51.3%	59.1%	18.4%	20.4%	29.2%
AE (keq $year^{-1}$)[(i)]	2003	45650	6261	15666	473	68050
	2004	116074	60783	84754	5810	267421

[(i)] Reference to data set used:
2003 = February 2003 critical loads and 1995-97 deposition available at the time (as in 2003 Addendum)
2004 = February 2004 updated critical loads and the latest (March 2004) version of 1995-97 deposition data.

6.3 UK exceedance statistics by habitat

In addition to the maps presented above, exceedance statistics for each habitat have also been produced by the NFC. These are based on the 1km critical load maps ($CL_{max}S$, $CL_{min}N$, $CL_{max}N$ for acidity, $CL_{nut}N$ for nutrient nitrogen) for each habitat and habitat-specific deposition applied as described in Section 5. The tables in this Section and Section 6.4 contain the following statistics:

- The mapped habitat area
- The exceeded habitat area
- The percentage of habitat exceeded
- The Accumulated Exceedance (AE - see Section 2)

In addition, comparisons are made between the February 2003 results and the updated (February 2004) exceedance results, with percentage changes given in each of the tables.

Acidity exceedance statistics for the UK

Tables 6.2(a), 6.2(b) and 6.2(c) summarise the UK statistics for acidity critical loads exceedances. The exceedance statistics for freshwaters are considered separately in Section 6.2 above. These tables highlight changes made to the habitat maps and the increases observed in the total area of habitats exceeded and in the AE values as a result of changes in critical load values and deposition values. These increases tend to be the greatest for:

- dwarf shrub heath: 25% increase in exceeded area, 18% increase in AE

- bog: 23% increase in exceeded area, 21% increase in AE
- montane: 11% increase in exceeded area, 34% increase in AE

These are mainly as a result of the reductions in the acidity critical loads map for peat soils (Section 4.2), since all these habitats may occur in areas dominated by peat soils. Changes are also apparent for the woodland habitats due to updating the acidity critical load methods applied to UK woodlands:

- managed conifer: 15% increase in exceeded area, 16% increase in AE
- unmanaged woodland: 15% increase in exceeded area, 13% increase in AE.

Overall, 13.4% of the changes in habitat area exceeded are due to updates to the critical loads and 4.5% to updates in the deposition data. For AE 7.5% of the overall increase is due to critical load updates and 7% to deposition data updates. The latter appears to have the greatest effect on the upland habitats (dwarf shrub heath, bog, montane) and the woodland habitats.

Table 6.2(a). UK statistics on habitat areas and exceeded areas for acidity

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	15291	15334	0.3	13203	14135	7.1
Calcareous grassland	1812	1808	-0.2	0	0	0
Dwarf shrub heath	24703	24703	0	13829	17299	25.1
Bog	5463	5463	0	3954	4856	22.8
Montane	3054	3054	0	2647	2926	10.5
Coniferous woodland (managed)	7971	8377	5.1	5849	6695	14.5
Broadleaved woodland (managed)	7554	7452	-1.4	5607	5645	0.7
Unmanaged woodland	4011	4011	0	2436	2807	15.2
Freshwaters	2417	7791	222.3*	555	2278	310.5*
All habitats	72275	77993	7.9	48080	56641	17.8

Table 6.2(b). UK statistics on the percentage of habitat area exceeded for acidity

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	86.4	92.2	5.80
Calcareous grassland	0	0	0
Dwarf shrub heath	56	70	14
Bog	72.4	88.9	16.5
Montane	86.7	95.8	9.1
Coniferous woodland (managed)	73.4	79.9	6.5
Broadleaved woodland (managed)	74.2	75.8	1.6
Unmanaged woodland	60.7	70	9.3
Freshwaters	23.0	29.2	6.2
All habitats	66.5	72.6	6.1

Table 6.2(c). UK statistics on the Accumulated Exceedances (AE) for acidity

Broad Habitat	AE (keq $year^{-1}$)		% change
	v2003	v2004	
Acid grassland	1662130	1773066	6.7
Calcareous grassland	0	0	0
Dwarf shrub heath	94927	1121456	18.1
Bog	349753	421371	20.5
Montane	185044	247060	33.5
Coniferous woodland (managed)	825158	955336	15.8
Broadleaved woodland (managed)	915274	892102	-2.5
Unmanaged woodland	311489	350958	12.7
Freshwaters	68050	267421	293.0*
All habitats	5266325	6028770	14.5

Legend to Tables 6.2(a), 6.2(b), 6.2(c):
v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall *et al.*, 2003)
v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.
* The percentage changes to the freshwater habitat areas, the exceeded areas and AE values are large due to the large increase in the number and area of sites mapped for this (February 2004) update.

Nutrient nitrogen exceedance statistics for the UK

The UK statistics for nutrient nitrogen exceedances are summarised in Tables 6.3(a), 6.3(b) and 6.3(c). The only changes due to the critical loads update are the result of revisions to the woodland habitat maps (Section 4.1), since the nutrient nitrogen critical load values remain unchanged in this update. Updates made to the 1995-97 deposition data result in a 5% increase in the area of habitats exceeded and an 8% increase in AE. The main changes resulting from the updated deposition data are to:

- montane: 17% increase in exceeded area, 39% increase in AE
- Atlantic oak: 16% increase in exceeded area, 12% increase in AE
- Calcareous grassland: 7% decrease in exceeded area, 19% decrease in AE

For some other habitats changes in the exceeded area were relatively small, but changes in the AE more significant:

- Managed coniferous woodland: 16% increase in AE
- Unmanaged woodlands and Atlantic oak: 12% increase in AE
- Supralittoral sediments (dune grasslands): 33% reduction in AE

These changes are the result of an increase in N deposition to montane areas and woodland habitats and a decrease in N deposition to areas of calcareous grassland (particularly in England and Wales). The N deposition in coastal regions appears to have decreased around GB but increased in NI. [Ron to comment on these statements].

Table 6.3(a). UK statistics on habitat areas and exceeded areas for nutrient nitrogen

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	15241	15241	0	10241	10546	3.0
Calcareous grassland	3577	3577	0	2763	2582	-6.6
Dwarf shrub heath	24820	24820	0	8627	9365	8.6
Bog	5541	5541	0	2526	2756	9.1
Montane	3129	3129	0	2580	3024	17.2
Coniferous woodland (managed)	7979	8385	5.09	7415	7998	7.9
Broadleaved woodland (managed)	7584	7482	-1.34	7418	7363	-0.7
Unmanaged wood (ground flora)	3296	3296	0	3152	3183	1.0
Atlantic oak (epiphytic lichens)	822	822	0	694	803	15.7
Supralittoral sediments	2128	2128	0	1114	1089	-2.2
All habitats	74118	74422	0.41	46531	48707	4.7

Table 6.3(b). UK statistics on the percentage of habitat area exceeded for nutrient nitrogen

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	67.2	69.2	2
Calcareous grassland	77.2	72.2	-5
Dwarf shrub heath	34.8	37.7	2.9
Bog	45.6	49.7	4.1
Montane	82.5	96.7	14.2
Coniferous woodland (managed)	92.9	95.4	2.5
Broadleaved woodland (managed)	97.8	98.4	0.6
Unmanaged wood (ground flora)	95.6	96.6	1
Atlantic oak (epiphytic lichens)	84.5	97.6	13.1
Supralittoral sediments	52.4	51.2	-1.2
All habitats	62.8	65.5	2.7

Table 6.3(c). UK statistics on the Accumulated Exceedances (AE) for nutrient nitrogen

Broad Habitat	AE (keq $year^{-1}$)		% change
	v2003	v2004	
Acid grassland	544794	548422	0.7
Calcareous grassland	96160	77713	-19.2
Dwarf shrub heath	406862	438432	7.8
Bog	188505	199131	5.6
Montane	88953	123957	39.4
Coniferous woodland (managed)	869392	1004782	15.6
Broadleaved woodland (managed)	1224371	1309795	7.0
Unmanaged wood (ground flora)	484608	540151	11.5
Atlantic oak (epiphytic lichens)	74317	83410	12.2
Supralittoral sediments	30865	20684	-33.0
All habitats	4008826	4346477	8.4

Legend to Tables 6.3(a), 6.3(b), 6.3(c):
v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall *et al.*, 2003)
v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.

6.4 Exceedance statistics by country and habitat

This section summarises the key changes in critical load exceedances by country and habitat, first for acidity and second for nutrient nitrogen. For further information on the updates to critical loads and deposition data referred to below, please see Sections 4 and 5 of this report.

In the results presented below it should be noted that:
(i) The area exceeded may not change but the magnitude of exceedance (AE) may increase or decrease.
(ii) The area exceeded may increase and be accompanied by an increase or a decrease in the AE.
(iii) The area exceeded may decrease and be accompanied by an increase or a decrease in the AE.
Hence, in the sections below the effects on area exceeded and magnitude of exceedance (AE) are referred to separately.
(iv) Changes are due to changes in the science and not due to a change in air quality itself.

6.4.1 Acidity exceedance statistics by country and habitat

England
Tables E1(a), E1(b), E1(c) below summarise the acidity exceedance statistics for England. The key changes are:

- Increases in the area exceeded and AE, particularly for unmanaged woodland (16% increase in exceeded area, 14% increase in AE), managed conifer (8% increase in exceeded area, 15% increase in AE) and bog (7% increase in exceeded area, 10% increase in AE) and to a lesser extent for dwarf shrub heath and acid grassland.
- Increases in the area exceeded and AE for bog, dwarf shrub heath and acid grassland mainly due to the reductions in acidity critical loads for peat soils.
- Increases in the area exceeded for managed coniferous woodland mainly due to updates in acidity critical load methods.
- Increases in AE for managed conifer and unmanaged woodland mainly due to changes in acid deposition.

Table E1(a). Habitat areas and exceeded areas for acidity

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	2625	2669	1.7	2509	2586	3.1
Calcareous grassland	1718	1714	-0.2	0	0	0
Dwarf shrub heath	2462	2462	0	2281	2350	3.0
Bog	1006	1006	0	934	999	7.0
Montane	1.9	1.9	0	1.9	1.9	0
Coniferous woodland (managed)	1702	1716	0.8	1463	1572	7.5
Broadleaved woodland (managed)	5632	5565	-1.2	4150	4234	2.0
Unmanaged woodland	2392	2392	0	1533	1779	16.1
Freshwaters	660	1042	57.9*	265	535	101.9*
All habitats	18198	18568	2.0	13137	14057	7.0

Table E1(b). Percentage of habitat area exceeded for acidity

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	95.6	96.9	1.3
Calcareous grassland	0	0	0
Dwarf shrub heath	92.6	95.5	2.9
Bog	92.8	99.3	6.5
Montane	100	100	0
Coniferous woodland (managed)	86.0	91.6	5.6
Broadleaved woodland (managed)	73.7	76.1	2.4
Unmanaged woodland	64.1	74.4	10.3
Freshwaters	40.1	51.3	11.2
All habitats	72.2	75.7	3.5

Table E1(c). Accumulated Exceedances (AE) for acidity

Broad Habitat	AE (keq $year^{-1}$)		% change
	v2003	v2004	
Acid grassland	492337	503991	2.4
Calcareous grassland	0	0	0
Dwarf shrub heath	336098	350610	4.3
Bog	191789	209927	9.5
Montane	576	565	-1.9
Coniferous woodland (managed)	275420	315662	14.6
Broadleaved woodland (managed)	720376	719266	-0.2
Unmanaged woodland	210475	240418	14.2
Freshwaters	45650	116074	154.3*
All habitats	2272722	2456513	8.1

Legend to Tables E1(a), E1(b), E1(c):
v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall *et al.*, 2003)
v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.
* The percentage changes to the freshwater habitat areas, the exceeded areas and AE values are large due to the large increase in the number and area of sites mapped for this (February 2004) update.

Wales

Tables W1(a), W1(b), W1(c) below summarise the acidity exceedance statistics for Wales. The key changes are:

- Relatively small increases and decreases in the habitat areas exceeded; the largest increase is for the bog habitat (6%) due to reductions in the acidity critical loads for peat soils.
- Reductions in the area exceeded (4%) and AE (8%) for managed broadleaved woodland due to re-classifying the woodland types occurring in peat dominated areas.
- Increases in AE for managed conifer (14%) and unmanaged woodland habitats (5%) mainly due to changes in acid deposition.
- Decreases in AE for montane (5%) mainly due to changes in acid deposition, however, the total montane habitat area mapped in Wales is fairly small at 18 km^2.

Table W1(a). Habitat areas and exceeded areas for acidity

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	3143	3143	0	3101	3109	0.3
Calcareous grassland	45	45	0	0	0	0
Dwarf shrub heath	1078	1078	0	1049	1044	-0.5
Bog	56	56	0	52	55	5.8
Montane	18	18	0	18	18	0
Coniferous woodland (managed)	1039	1048	0.9	1011	1027	1.6
Broadleaved woodland (managed)	793	790	-0.4	709	683	-3.7
Unmanaged woodland	395	395	0	350	353	0.9
Freshwaters	179	1225	584.4*	83	724	772.3*
All habitats	6745	7798	15.6	6373	7013	10.0

Table W1(b). Percentage of habitat area exceeded for acidity

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	98.7	98.9	0.2
Calcareous grassland	0	0	0
Dwarf shrub heath	97.2	96.9	-0.3
Bog	93.1	98.4	5.3
Montane	100	100	0
Coniferous woodland (managed)	97.3	98.1	0.8
Broadleaved woodland (managed)	89.4	86.4	-3.0
Unmanaged woodland	88.6	89.4	0.8
Freshwaters	46.4	59.1	12.7
All habitats	94.5	89.9	-4.6

Table W1(c). Accumulated Exceedances (AE) for acidity

Broad Habitat	AE (keq $year^{-1}$)		% change
	v2003	v2004	
Acid grassland	498012	491297	-1.4
Calcareous grassland	0	0	0
Dwarf shrub heath	130049	132380	1.8
Bog	9308	9903	6.4
Montane	4505	4277	-5.1
Coniferous woodland (managed)	172126	195471	13.6
Broadleaved woodland (managed)	111966	103517	-7.6
Unmanaged woodland	49110	51500	4.9
Freshwaters	6261	60783	870.8*
All habitats	981337	1049128	6.9

Legend to Tables W1(a), W1(b), W1(c):

v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall *et al.*, 2003)

v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.

* The percentage changes to the freshwater habitat areas, the exceeded areas and AE values are large due to the large increase in the number and area of sites mapped for this (February 2004) update.

Scotland

Tables S1(a), S1(b), S1(c) below summarise the acidity exceedance statistics for Scotland. The key changes are:

- Increases in the area exceeded and AE for all habitats except managed broadleaved woodland (3% decrease in exceeded area, 16% decrease in AE) and calcareous grassland (not exceeded).
- Largest increases to dwarf shrub heath (33% increase in exceeded area, 32% increase in AE), bog (27% increase in exceeded area, 30% increase in AE), montane (11% increase in exceeded area, 35% increase in AE), managed conifer (22% increase in exceeded area and AE) and unmanaged woodland (28% increase in exceeded area and 29% increase in AE).
- Increases in exceeded area and AE for non-woodland habitats mainly due to reductions in the acidity critical loads for peat soils.
- Increases in exceeded area and AE for woodland habitats mainly due to updates in acidity critical load methods.
- Decrease in exceeded area and AE for managed broadleaved woodland mainly due to re-classifying the woodland types occurring in peat dominated areas.
- Changes in acid deposition also contribute to the increases/decreases in AE values and to a lesser extent to the area exceeded.

Table S1(a). Habitat areas and exceeded areas for acidity

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	8336	8336	0	6683	7388	10.6
Calcareous grassland	6.9	6.9	0	0	0	0
Dwarf shrub heath	20190	20190	0	9824	13083	33.2
Bog	3959	3959	0	2659	3377	27.0
Montane	3034	3034	0	2627	2906	10.6
Coniferous woodland (managed)	4724	5111	8.2	3025	3683	21.8
Broadleaved woodland (managed)	1130	1096	-3.0	748	728	-2.7
Unmanaged woodland	1016	1016	0	433	553	27.7
Freshwaters	1430	5338	273.3*	199	981	393.0*
All habitats	43825	48087	9.7	26198	32699	24.8

Table S1(b). Percentage of habitat area exceeded for acidity

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	80.2	88.6	8.4
Calcareous grassland	0	0	0
Dwarf shrub heath	48.7	64.8	16.1
Bog	67.2	85.3	18.1
Montane	86.6	95.8	9.2
Coniferous woodland (managed)	64.1	72.1	8.0
Broadleaved woodland (managed)	66.2	66.4	0.2
Unmanaged woodland	42.6	54.4	11.8
Freshwaters	13.9	18.4	4.5
All habitats	59.8	78.0	8.2

Table S1(c). Accumulated Exceedances (AE) for acidity

Broad Habitat	AE (keq year^{-1})		% change
	v2003	v2004	
Acid grassland	590686	672265	13.8
Calcareous grassland	0	0	0
Dwarf shrub heath	430403	568119	32.0
Bog	121909	157835	29.5
Montane	179962	242218	34.6
Coniferous woodland (managed)	319427	390201	22.2
Broadleaved woodland (managed)	82932	69319	-16.4
Unmanaged woodland	33295	42780	28.5
Freshwaters	15666	84754	441.0*
All habitats	1774281	2227491	25.5

Legend to Tables S1(a), S1(b), S1(c):
v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall *et al.*, 2003)
v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.
* The percentage changes to the freshwater habitat areas, the exceeded areas and AE values are large due to the large increase in the number and area of sites mapped for this (February 2004) update.

Northern Ireland

Tables NI1(a), NI1(b), NI1(c) below summarise the acidity exceedance statistics for Northern Ireland. The key changes are:

- Increases in the area exceeded and AE, particularly for bog (38% increase in exceeded area, 63% increase in AE), dwarf shrub heath (22% increase in exceeded area, 33% increase in AE) and acid grassland (16% increase in exceeded area, 30% increase in AE).
- Increases in exceeded area and AE for non-woodland habitats mainly due to reductions in the acidity critical loads for peat soils.
- Increase in the area exceeded for managed coniferous woodland (18%) and to a lesser extent unmanaged woodland (3%), mainly due to updates in the acidity critical load methods. However, there is a reduction in the AE values for these habitats (7% for managed conifer, 13% for unmanaged woodland) mainly due to changes in the acid deposition data.

Table NI1(a). Habitat areas and exceeded areas for acidity

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	1187	1187	0	910	1053	15.7
Calcareous grassland	42	42	0	0	0	0
Dwarf shrub heath	973	973	0	676	821	21.5
Bog	442	442	0	309	425	37.5
Montane	0	0	0	0	0	0
Coniferous woodland (managed)	506	503	-0.6	349	413	18.3
Broadleaved woodland (managed)	0	0	0	0	0	0
Unmanaged woodland	208	208	0	119	122	2.5
Freshwaters	149	186	24.8*	7.5	38	406.7*
All habitats	3507	3541	1.0	2371	2872	21.1

Table NI1(b). Percentage of habitat area exceeded for acidity

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	76.7	88.7	12.0
Calcareous grassland	0	0	0
Dwarf shrub heath	69.5	84.4	14.9
Bog	70.0	96.1	26.1
Montane	0	0	0
Coniferous woodland (managed)	69.0	82.2	13.2
Broadleaved woodland (managed)	0	0	0
Unmanaged woodland	57.4	58.7	1.3
Freshwaters	5.1	20.4	15.3
All habitats	67.6	81.1	13.5

Table NI1(c). Accumulated Exceedances (AE) for acidity

Broad Habitat	AE (keq $year^{-1}$)		% change
	v2003	v2004	
Acid grassland	81095	105512	30.1
Calcareous grassland	0	0	0
Dwarf shrub heath	52877	70347	33.0
Bog	26747	43706	63.4
Montane	0	0	0
Coniferous woodland (managed)	58184	54002	-7.2
Broadleaved woodland (managed)	0	0	0
Unmanaged woodland	18608	16260	-12.6
Freshwaters	473	5810	1128.3*
All habitats	237984	295637	24.2

Legend to Tables NI1(a), NI1(b), NI1(c):
v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall *et al.*, 2003)
v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.
* The percentage changes to the freshwater habitat areas, the exceeded areas and AE values are large due to the large increase in the number and area of sites mapped for this (February 2004) update.

6.4.2 Nutrient nitrogen exceedance statistics by country and habitat

The nutrient nitrogen critical load values remain unchanged from February 2003. There are minor differences to the woodland habitat areas as a result of revising the woodland habitat maps (Section 4.1). Therefore the changes in the exceedance results referred to below are the result of changes in nitrogen deposition data only.

England
Tables E2(a), E2(b), E2(c) below summarise the nutrient nitrogen exceedance statistics for England. The key changes are:

- Generally small differences in the area exceeded, but a 11% increase for supralittoral sediments and a 6% decrease for calcareous grassland.
- Increases in AE, particularly for the woodland habitats (15% for managed conifer and unmanaged woodland, 9% for managed broadleaved woodland) and to a lesser extent for dwarf shrub heath and bog.
- Substantial reductions in AE for supralittoral sediments (30%) and calcareous grassland (18%), and smaller reductions for acid grassland and montane.

Table E2(a). Habitat areas and exceeded areas for nutrient nitrogen

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	2620	2620	0	2590	2610	0.8
Calcareous grassland	3312	3312	0	2615	2466	-5.7
Dwarf shrub heath	2466	2466	0	2442	2459	0.7
Bog	1007	1007	0	1007	1007	0
Montane	109	109	0	1.9	1.9	0
Coniferous woodland (managed)	1704	1719	0.9	1704	1719	0.9
Broadleaved woodland (managed)	5654	5588	-1.2	5654	5588	-1.2
Unmanaged wood (ground flora)	2252	2252	0	2252	2252	0
Atlantic oak (epiphytic lichens)	150	150	0	150	150	0
Supralittoral sediments	1183	1183	0	741	822	10.9
All habitats	20351	20299	-0.3	19157	19075	-0.4

Table E2(b). Percentage of habitat area exceeded for nutrient nitrogen

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	98.9	99.6	0.7
Calcareous grassland	79.0	74.5	-4.5
Dwarf shrub heath	99.0	99.7	0.7
Bog	100	100	0
Montane	100	100	0
Coniferous woodland (managed)	100	100	0
Broadleaved woodland (managed)	100	100	0
Unmanaged wood (ground flora)	100	100	0
Atlantic oak (epiphytic lichens)	100	100	0
Supralittoral sediments	62.6	69.6	7.0
All habitats	94.1	94.0	-0.1

Table E2(c). Accumulated Exceedances (AE) for nutrient nitrogen

Broad Habitat	AE (keq $year^{-1}$)		% change
	v2003	v2004	
Acid grassland	213951	207214	-3.2
Calcareous grassland	90183	73782	-18.2
Dwarf shrub heath	171535	173261	1.0
Bog	109569	114174	4.2
Montane	359	351	-2.2
Coniferous woodland (managed)	271638	313514	15.4
Broadleaved woodland (managed)	996588	1086699	9.0
Unmanaged wood (ground flora)	371134	428371	15.4
Atlantic oak (epiphytic lichens)	29437	31043	5.5
Supralittoral sediments	22000	15328	-30.3
All habitats	2276395	2443737	7.4

Legend to Tables E2(a), E2(b), E2(c):

v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall et al., 2003)

v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.

Wales

Tables W2(a), W2(b), W2(c) below summarise the nutrient nitrogen exceedance statistics for Wales. The key changes are:

- Decreases in the area exceeded especially for supralittoral sediments (28%) and calcareous grassland (24%), and a small decrease for acid grassland. Changes in the areas exceeded for other habitats minimal or no change.
- Decreases in AE, particularly for supralittoral sediments (43%) and calcareous grassland (37%), with smaller decreases for montane (7%) and acid grassland (5%).
- Increases in AE for the remaining habitats, particularly for managed conifers (15%).

Table W2(a). Habitat areas and exceeded areas for nutrient nitrogen

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	3146	3146	0	3088	3022	-2.1
Calcareous grassland	171	171	0	134	102	-23.9
Dwarf shrub heath	1094	1094	0	1089	1084	-0.5
Bog	56	56	0	56	56	0
Montane	18	18	0	18	18	0
Coniferous woodland (managed)	1043	1052	0.9	1043	1052	0.9
Broadleaved woodland (managed)	801	798	-0.4	801	798	-0.4
Unmanaged wood (ground flora)	228	226	-0.9	226	226	0
Atlantic oak (epiphytic lichens)	171	171	0	171	171	0
Supralittoral sediments	369	369	0	255	185	-27.5
All habitats	7098	7102	0.1	6881	6715	-2.4

Table W2(b). Percentage of habitat area exceeded for nutrient nitrogen

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	98.2	96.1	-2.1
Calcareous grassland	78.0	59.5	-18.5
Dwarf shrub heath	99.5	99.1	-0.4
Bog	100	100	0
Montane	100	100	0
Coniferous woodland (managed)	100	100	0
Broadleaved woodland (managed)	100	100	0
Unmanaged wood (ground flora)	99.3	100	0.7
Atlantic oak (epiphytic lichens)	100	100	0
Supralittoral sediments	68.9	50.2	-18.7
All habitats	96.9	94.5	-2.4

Table W2(c). Accumulated Exceedances (AE) for nutrient nitrogen

Broad Habitat	AE (keq year^{-1})		% change
	v2003	v2004	
Acid grassland	196509	187476	-4.6
Calcareous grassland	5730	3596	-37.2
Dwarf shrub heath	83359	84022	0.8
Bog	5354	5496	2.7
Montane	3006	2787	-7.3
Coniferous woodland (managed)	169907	196092	15.4
Broadleaved woodland (managed)	130157	132278	1.6
Unmanaged wood (ground flora)	39859	41378	3.8
Atlantic oak (epiphytic lichens)	28399	29628	4.3
Supralittoral sediments	6145	3494	-43.1
All habitats	668424	686245	2.7

Legend to Tables W2(a), W2(b), W2(c):
v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall *et al.*, 2003)
v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.

Scotland

Tables S2(a), S2(b), S2(c) below summarise the nutrient nitrogen exceedance statistics for Scotland. The key changes are:

- Decreases in the areas exceeded and AE for supralittoral sediments (42% reduction in exceeded area, 53% reduction in AE) and calcareous grassland (64% reduction in exceeded area, 98% reduction in AE), though it should be noted that the total area of calcareous grassland mapped in Scotland is small at 24 km^2.
- Increase in exceeded area (18%) and decrease in AE (2%) for bog.
- Small decrease in AE for managed broadleaved woodland (7%).
- Increases in the areas exceeded and AE for all remaining habitats, especially Atlantic oak (29% increase in exceeded area, 38% increase in AE), montane (17% increase in exceeded area, 41% increase in AE), dwarf shrub heath (14% increase in exceeded area, 15% increase in AE) and managed coniferous woodland (13% increase in exceeded area, 20% increase in AE).

Table S2(a). Habitat areas and exceeded areas for nutrient nitrogen

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	8283	8283	0	3735	3921	5.0
Calcareous grassland	24	24	0	4.2	1.5	-64.3
Dwarf shrub heath	20284	20284	0	4337	4949	14.1
Bog	4005	4005	0	1042	1226	17.7
Montane	3109	3109	0	2560	3005	17.4
Coniferous woodland (managed)	4724	5111	8.2	4167	4724	13.4
Broadleaved woodland (managed)	1130	1096	-3.0	964	977	1.4
Unmanaged wood (ground flora)	570	570	0	427	457	7.0
Atlantic oak (epiphytic lichens)	501	501	0	373	482	29.2
Supralittoral sediments	547	547	0	105	61	-41.9
All habitats	43177	43530	0.8	17715	19802	11.8

Table S2(b). Percentage of habitat area exceeded for nutrient nitrogen

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	45.1	47.3	2.2
Calcareous grassland	17.1	6.1	-11.0
Dwarf shrub heath	21.4	24.4	3.0
Bog	26.0	30.6	4.6
Montane	82.4	96.6	14.2
Coniferous woodland (managed)	88.2	92.4	4.2
Broadleaved woodland (managed)	85.3	89.1	3.8
Unmanaged wood (ground flora)	75.0	80.1	5.1
Atlantic oak (epiphytic lichens)	74.5	96.1	21.6
Supralittoral sediments	19.1	11.1	-8.0
All habitats	41.0	45.5	4.5

Table S2(c). Accumulated Exceedances (AE) for nutrient nitrogen

Broad Habitat	AE (keq year^{-1})		% change
	v2003	v2004	
Acid grassland	104349	112774	8.1
Calcareous grassland	81	2	-97.5
Dwarf shrub heath	115825	133612	15.4
Bog	50346	49604	-1.5
Montane	85588	120820	41.2
Coniferous woodland (managed)	356108	428088	20.2
Broadleaved woodland (managed)	97625	90819	-7.0
Unmanaged wood (ground flora)	34944	37500	7.3
Atlantic oak (epiphytic lichens)	16481	22739	38.0
Supralittoral sediments	2518	1178	-53.2
All habitats	863866	997135	15.4

Legend to Tables S2(a), S2(b), S2(c):
v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall et al., 2003)
v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.

Northern Ireland

Tables NI2(a), NI2(b), NI2(c) below summarise the nutrient nitrogen exceedance statistics for Scotland. The key changes are:

- Increases in the areas exceeded for all habitats mapped in NI, particularly for supralittoral sediments (33%), calcareous grassland (26%), acid grassland (20%), dwarf shrub heath (15%) and bog (11%). However, the total areas of supralittoral sediment and calcareous grassland mapped in NI are small.
- Increases in the AE for all habitats except unmanaged woodland (15% decrease) and managed conifer (7% decrease). Largest increases for supralittoral sediments (240%) and calcareous grassland (102%), followed by acid grassland (37%), dwarf shrub heath (32%) and bog (28%).

Table NI2(a). Habitat areas and exceeded areas for nutrient nitrogen

Broad Habitat	Mapped habitat area (km^2)		% change	Habitat area (km^2) exceeded by deposition data for 1995-97		% change
	v2003	v2004		v2003	v2004	
Acid grassland	1192	1192	0	827	993	20.1
Calcareous grassland	69	69	0	9.5	12	26.3
Dwarf shrub heath	976	976	0	760	873	14.9
Bog	473	473	0	421	466	10.7
Montane	0	0	0	0	0	0
Coniferous woodland (managed)	508	504	-0.8	500	504	0.8
Broadleaved woodland (managed)	0	0	0	0	0	0
Unmanaged wood (ground flora)	247	247	0	246	247	0.4
Atlantic oak (epiphytic lichens)	0	0	0	0	0	0
Supralittoral sediments	29	29	0	15	20	33.3
All habitats	3495	3491	-0.1	2779	3116	12.1

Table NI2(b). Percentage of habitat area exceeded for nutrient nitrogen

Broad Habitat	% habitat area exceeded		% change
	v2003	v2004	
Acid grassland	69.4	83.3	13.9
Calcareous grassland	13.7	17.6	3.9
Dwarf shrub heath	77.9	89.5	11.6
Bog	89.1	98.6	9.5
Montane	0	0	0
Coniferous woodland (managed)	98.5	100	1.5
Broadleaved woodland (managed)	0	0	0
Unmanaged wood (ground flora)	99.3	100	0.7
Atlantic oak (epiphytic lichens)	0	0	0
Supralittoral sediments	51.2	68.6	17.4
All habitats	79.5	89.3	9.8

Table NI2(c). Accumulated Exceedances (AE) for nutrient nitrogen

Broad Habitat	AE (keq $year^{-1}$)		% change
	v2003	v2004	
Acid grassland	29985	40959	36.6
Calcareous grassland	165	334	102.4
Dwarf shrub heath	36143	47537	31.5
Bog	23236	29856	28.5
Montane	0	0	0
Coniferous woodland (managed)	71739	67087	-6.5
Broadleaved woodland (managed)	0	0	0
Unmanaged wood (ground flora)	38670	32903	-14.9
Atlantic oak (epiphytic lichens)	0	0	0
Supralittoral sediments	201	684	240.3
All habitats	200141	219360	9.6

Legend to Tables NI2(a), NI2(b), NI2(c):

v2003: results based on the areas of habitats mapped, critical loads and deposition data as in the February 2003 Addendum (Hall et al., 2003)

v2004: results based on updated (February 2004) areas of habitats mapped and critical loads and the latest (March 2004) deposition data.

7 Conclusions

The main conclusions are presented below under separate headings
(i) critical load updates.
(ii) exceedance results (based on updated February 2004 critical loads and the latest (March 2004) version of deposition data for 1995-97)
(iii) comparing the critical load exceedance statistics from the February 2003 Addendum with the results in (ii) above.

(i) Critical load updates:

- Updates to the acidity critical loads for peat soils have reduced the mean critical load for peat-dominated squares from 1.1 keq ha^{-1} $year^{-1}$ to 0.8 keq ha^{-1} $year^{-1}$.
- Updates to the acidity critical loads for woodland habitats have decreased the mean critical load values by:
    - 4.4% (from 2.03 keq ha^{-1} $year^{-1}$ to 1.94 keq ha^{-1} $year^{-1}$) for managed coniferous woodland
    - 1.1% (from 2.81 keq ha^{-1} $year^{-1}$ to 2.78 keq ha^{-1} $year^{-1}$) for managed broadleaved woodland
    - 0.7% (from 3.04 keq ha^{-1} $year^{-1}$ to 3.02 keq ha^{-1} $year^{-1}$) for unmanaged woodland
- The largest reductions in acidity critical loads ($CL_{max}S$ and $CL_{max}N$) are for the bog, montane, acid grassland and dwarf shrub heath habitats, due to updates in the acidity critical loads for peat soils.
- The freshwater habitat area (catchment areas of selected standing waters and streams) has increased by 5374km^2 as a result of increasing the number of sites in the data set from 1163 to 1722.
- The mean acidity critical loads for freshwaters have decreased by 10.4% for $CL_{max}S$, 6.5% for $CL_{min}N$ and 12.4% for $CL_{max}N$. These reductions are due to (a) changes in the ANC threshold applied to some sites; (b) the increase in the number of sites in the data set.
- The critical loads for nutrient nitrogen for all habitats remain unchanged from those for February 2003.

(ii) Exceedance results, based on the updated February 2004 critical loads and the latest (March 2004) version of deposition data for 1995-97:

- 72.6% of UK habitats are exceeded for acidity and 66.5% for nutrient nitrogen.
- Wales has the highest percentage area of habitats exceeded both for acidity and nutrient nitrogen and Scotland has the lowest.
- The largest habitat area and exceeded habitat area for both acidity and nutrient nitrogen is either acid grassland or dwarf shrub heath in all countries except England, where it is managed broadleaved woodland.
- For acidity, the accumulated exceedance is greatest for acid grassland in all countries except England, where it is managed broadleaved woodland.
- For nutrient nitrogen, the accumulated exceedance is greatest for managed coniferous woodland in all countries except England, where it is managed broadleaved woodland.

(iii) Comparison of exceedance results: 2003 Addendum vs 2004 update

- For acidity, the area of habitats exceeded in the UK increased by 17.8%. Of this, 13.4% of the change is due to updates in critical loads and the remaining 4.5% due to updates in deposition maps for 1995-97. However, the values for individual habitats and/or countries may differ from these numbers. For example, the area of dwarf shrub heath exceeded has increased by 25.1%, with 17.8% of this increase due to updates in critical loads and 7.3% due to updates in deposition data.
- For nutrient nitrogen, the area of habitats exceeded in the UK increased by 4.7%. Of this, 0.5% of the change is due to updates in the critical load habitat maps only and the remaining 4.2% due to updates in deposition data. However, the values for individual habitats and/or countries may differ from these numbers. For example, the area of montane habitat exceeded has increased by 17.2% due to updates in deposition data alone.
- The methodologies to estimate and map deposition have recently been revised. The main change resulting from this revision is an increase in nitrogen deposition in some areas.

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Annex 1: Exceedance statistics based on deposition data for 1998-2000

The tables in this annex provide the exceedance statistics based on February 2004 critical loads data and the latest (March 2004) version of 1998-2000 deposition data. Results are provided by country and habitat as well as totals for the UK.

Acidity exceedance statistics for 1998-2000

Table E-9800A. England

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	2669	2550	95.6	371500
Calcareous grassland	1714	0	0.0	0
Dwarf shrub heath	2462	2283	92.7	253369
Bog	1006	997	99.1	163713
Montane	2	2	99.8	365
Coniferous woodland (managed)	1716	1502	87.5	237379
Broadleaved woodland (managed)	5565	3915	70.3	552590
Unmanaged woods	2392	1497	62.6	171875
Freshwaters	1042	505	48.5	84226
All habitats	18568	13251	71.4	1835017

Table W-9800A. Wales

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	3143	3033	96.5	336173
Calcareous grassland	45	0	0.0	0
Dwarf shrub heath	1078	979	90.8	78690
Bog	56	55	97.7	6442
Montane	18	18	100.0	3583
Coniferous woodland (managed)	1048	1002	95.7	105071
Broadleaved woodland (managed)	790	585	74.0	59146
Unmanaged woods	395	298	75.5	27957
Freshwaters	1225	475	38.8	29669
All habitats	7798	6445	82.6	646731

Table S-9800A. Scotland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	8336	6494	77.9	449784
Calcareous grassland	7	0	0.0	0
Dwarf shrub heath	20190	8148	40.4	281176
Bog	3959	2895	73.1	96898
Montane	3034	2769	91.3	168861
Coniferous woodland (managed)	5111	3079	60.3	202499
Broadleaved woodland (managed)	1096	601	54.8	40628
Unmanaged woods	1016	408	40.2	24226
Freshwaters	5338	819	15.3	51240
All habitats	48087	25213	52.4	1315312

Acidity exceedance statistics for 1998-2000

Table NI-9800A. Northern Ireland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance ($keq\ year^{-1}$)
Acid grassland	1187	960	80.9	70247
Calcareous grassland	42	0	0.0	0
Dwarf shrub heath	973	703	72.3	37248
Bog	442	400	90.6	27670
Montane	0	0	0.0	0
Coniferous woodland (managed)	503	305	60.6	27105
Broadleaved woodland (managed)	0	0	0.0	0
Unmanaged woods	208	106	51.2	12102
Freshwaters	186	32	17.2	3136
All ecosystems	3541	2506	70.8	177508

Table UK-9800A. United Kingdom

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance ($keq\ year^{-1}$)
Acid grassland	15334	13038	85.0	1227704
Calcareous grassland	1808	0	0.0	0
Dwarf shrub heath	24703	12113	49.0	650484
Bog	5463	4346	79.6	294723
Montane	3054	2789	91.3	172809
Coniferous woodland (managed)	8377	5888	70.3	572054
Broadleaved woodland (managed)	7452	5100	68.4	652364
Unmanaged woods	4011	2311	57.6	236160
Freshwaters	7791	1831	23.5	168271
All habitats	77993	47416	60.8	3974569

Nutrient nitrogen exceedance statistics for 1998-2000

Table E-9800N. England

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	2620	2485	94.8	140318
Calcareous grassland	3312	2429	73.3	74953
Dwarf shrub heath	2466	2306	93.5	127260
Bog	1007	1007	100.0	94090
Montane	2	2	100.0	237
Coniferous woodland (managed)	1719	1719	100.0	267488
Broadleaved woodland (managed)	5588	5588	100.0	1003306
Unmanaged woods (ground flora)	2252	2252	100.0	394797
Atlantic oak (epiphytic lichens)	150	150	100.0	24835
Supralittoral sediment	1183	695	58.7	14365
All habitats	20299	18631	91.8	2141650

Table W-9800N. Wales

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	3146	2545	80.9	92586
Calcareous grassland	171	43	24.8	1439
Dwarf shrub heath	1094	995	90.9	45436
Bog	56	53	95.1	3224
Montane	18	18	100.0	2258
Coniferous woodland (managed)	1052	1052	100.0	131422
Broadleaved woodland (managed)	798	798	100.0	93097
Unmanaged woods (ground flora)	226	226	100.0	30128
Atlantic oak (epiphytic lichens)	171	171	100.0	20969
Supralittoral sediment	369	84	22.7	1155
All habitats	7102	5985	84.3	421714

Table S-9800N. Scotland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	8283	2663	32.2	54808
Calcareous grassland	24	0	0.0	0
Dwarf shrub heath	20284	3111	15.3	61692
Bog	4005	825	20.6	29191
Montane	3109	2976	95.7	95027
Coniferous woodland (managed)	5111	4343	85.0	288641
Broadleaved woodland (managed)	1096	903	82.4	68615
Unmanaged woods (ground flora)	570	422	74.1	28804
Atlantic oak (epiphytic lichens)	501	438	87.5	15546
Supralittoral sediment	547	28	5.0	281
All habitats	43530	15709	36.1	642605

Nutrient nitrogen exceedance statistics for 1998-2000

Table NI-9800N. Northern Ireland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	1192	685	57.5	18113
Calcareous grassland	69	8	11.7	236
Dwarf shrub heath	976	698	71.5	22458
Bog	473	420	88.7	16999
Montane	0	0	0.0	0
Coniferous woodland (managed)	504	486	96.5	40829
Broadleaved woodland (managed)	0	0	0.0	0
Unmanaged woods (ground flora)	247	241	97.3	27078
Atlantic oak (epiphytic lichens)	0	0	0.0	0
Supralittoral sediment	29	16	55.4	446
All ecosystems	3491	2555	73.2	126160

Table UK-9800N. United Kingdom

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	15241	8378	55.0	305826
Calcareous grassland	3577	2480	69.3	76629
Dwarf shrub heath	24820	7109	28.6	256846
Bog	5541	2305	41.6	143503
Montane	3129	2996	95.8	97522
Coniferous woodland (managed)	8385	7600	90.6	728381
Broadleaved woodland (managed)	7482	7289	97.4	1165018
Unmanaged woods (ground flora)	3296	3142	95.3	480807
Atlantic oak (epiphytic lichens)	822	759	92.4	61350
Supralittoral sediment	2128	822	38.6	16247
All habitats	74422	42879	57.6	3332129

Annex 2: Exceedance statistics based on deposition data for 1999-2001

The tables in this annex provide the exceedance statistics based on February 2004 critical loads data and the latest (March 2004) version of 1999-2001 deposition data. Results are provided by country and habitat as well as totals for the UK.

Acidity exceedance statistics for 1999-2001

Table E-9901A. England

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	2669	2551	95.6	356923
Calcareous grassland	1714	0	0.0	0
Dwarf shrub heath	2462	2276	92.4	241404
Bog	1006	997	99.1	157390
Montane	2	2	99.8	339
Coniferous woodland (managed)	1716	1510	88.0	235987
Broadleaved woodland (managed)	5565	3948	70.9	566858
Unmanaged woods	2392	1514	63.3	177561
Freshwaters	1042	506	48.6	77800
All habitats	18568	13304	71.6	1814262

Table W-9901A. Wales

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	3143	3036	96.6	325679
Calcareous grassland	45	0	0.0	0
Dwarf shrub heath	1078	968	89.8	73340
Bog	56	55	97.7	5918
Montane	18	18	100.0	3055
Coniferous woodland (managed)	1048	1008	96.2	104821
Broadleaved woodland (managed)	790	593	75.1	61361
Unmanaged woods	395	302	76.5	29334
Freshwaters	1225	455	37.1	25924
All habitats	7798	6435	82.5	629432

Table S-9901A. Scotland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	8336	6478	77.7	425416
Calcareous grassland	7	0	0.0	0
Dwarf shrub heath	20190	7725	38.3	268746
Bog	3959	2748	69.4	86783
Montane	3034	2832	93.3	176523
Coniferous woodland (managed)	5111	3080	60.3	205793
Broadleaved woodland (managed)	1096	610	55.7	41853
Unmanaged woods	1016	427	42.0	26208
Freshwaters	5338	816	15.3	46502
All habitats	48087	24716	51.4	1277824

Acidity exceedance statistics for 1999-2001

Table NI-9901A. Northern Ireland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	1187	955	80.5	68817
Calcareous grassland	42	0	0.0	0
Dwarf shrub heath	973	694	71.4	36668
Bog	442	399	90.3	27514
Montane	0	0	0.0	0
Coniferous woodland (managed)	503	304	60.5	28006
Broadleaved woodland (managed)	0	0	0.0	0
Unmanaged woods	208	106	51.2	12286
Freshwaters	186	30	16.1	3216
All ecosystems	3541	2488	70.3	176507

Table UK-9901A. United Kingdom

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	15334	13020	84.9	1176834
Calcareous grassland	1808	0	0.0	0
Dwarf shrub heath	24703	11664	47.2	620158
Bog	5463	4199	76.9	277606
Montane	3054	2852	93.4	179917
Coniferous woodland (managed)	8377	5903	70.5	574608
Broadleaved woodland (managed)	7452	5151	69.1	670072
Unmanaged woods	4011	2349	58.6	245388
Freshwaters	7791	1807	23.2	153442
All habitats	77993	46945	60.2	3898025

Nutrient nitrogen exceedance statistics for 1999-2001

Table E-9901N. England

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	2620	2498	95.3	145988
Calcareous grassland	3312	2464	74.4	80834
Dwarf shrub heath	2466	2311	93.7	133522
Bog	1007	1007	100.0	97606
Montane	2	2	100.0	238
Coniferous woodland (managed)	1719	1719	100.0	276542
Broadleaved woodland (managed)	5588	5588	100.0	1044727
Unmanaged woods (ground flora)	2252	2252	100.0	410472
Atlantic oak (epiphytic lichens)	150	150	100.0	25936
Supralittoral sediment	1183	744	62.9	15171
All habitats	20299	18734	92.3	2231035

Table W-9901N. Wales

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	3146	2437	77.5	96754
Calcareous grassland	171	60	35.3	1839
Dwarf shrub heath	1094	968	88.5	45011
Bog	56	53	94.5	3076
Montane	18	18	100.0	1958
Coniferous woodland (managed)	1052	1052	100.0	137229
Broadleaved woodland (managed)	798	798	100.0	98135
Unmanaged woods (ground flora)	226	226	100.0	31947
Atlantic oak (epiphytic lichens)	171	171	100.0	22055
Supralittoral sediment	369	88	23.7	1556
All habitats	7102	5871	82.7	439562

Table S-9901N. Scotland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance (keq $year^{-1}$)
Acid grassland	8283	2708	32.7	55304
Calcareous grassland	24	0	0.0	0
Dwarf shrub heath	20284	3470	17.1	70300
Bog	4005	863	21.6	28811
Montane	3109	3018	97.1	110396
Coniferous woodland (managed)	5111	4520	88.5	310718
Broadleaved woodland (managed)	1096	934	85.2	72751
Unmanaged woods (ground flora)	570	437	76.7	31413
Atlantic oak (epiphytic lichens)	501	465	92.7	18430
Supralittoral sediment	547	24	4.4	290
All habitats	43530	16439	37.8	698413

Nutrient nitrogen exceedance statistics for 1999-2001

Table NI-9901N. Northern Ireland

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance ($keq\ year^{-1}$)
Acid grassland	1192	757	63.5	19264
Calcareous grassland	69	8	11.7	220
Dwarf shrub heath	976	741	75.9	24131
Bog	473	420	88.7	17926
Montane	0	0	0.0	0
Coniferous woodland (managed)	504	490	97.2	43308
Broadleaved woodland (managed)	0	0	0.0	0
Unmanaged woods (ground flora)	247	242	97.9	27992
Atlantic oak (epiphytic lichens)	0	0	0.0	0
Supralittoral sediment	29	16	55.7	534
All ecosystems	3491	2674	76.6	133374

Table UK-9901N. United Kingdom

Broad Habitat	Habitat Area (km^2)	Exceeded Area (km^2)	Percentage Area Exceeded	Accumulated Exceedance ($keq\ year^{-1}$)
Acid grassland	15241	8399	55.1	317310
Calcareous grassland	3577	2532	70.8	82893
Dwarf shrub heath	24820	7489	30.2	272963
Bog	5541	2343	42.3	147419
Montane	3129	3038	97.1	112593
Coniferous woodland (managed)	8385	7781	92.8	767797
Broadleaved woodland (managed)	7482	7320	97.8	1215614
Unmanaged woods (ground flora)	3296	3158	95.8	501824
Atlantic oak (epiphytic lichens)	822	786	95.6	66421
Supralittoral sediment	2128	872	41.0	17551
All habitats	74422	43717	58.7	3502384