Appendix X

APIS Indicative Critical Load Values: downloaded from:

http://www.apis.ac.uk/sites/default/files/downloads/APIS%20critical_load_range_document.pdf

Supporting Deadline 3 response by RHS Wisley

APIS indicative critical load values:
Recommended values within nutrient nitrogen critical load ranges for use in air pollution impact assessments

Introduction

Critical load values for nutrient nitrogen deposition are provided by the UNECE as a range (e.g. 10-20 kgN/ha/yr for dry heaths[1]). This table provides indicative values within the critical load range, by habitat type, for use in detailed impact assessments in the UK. The minimum of the range should always be used for initial screening. The principles of the approach behind this table are explained in Annex 1.

Recommended values

Habitat type (EUNIS code)	Critical load (CL) range (kgN/ha/yr)	Modifying factors from UNECE expert workshop	Recommended value for use in detailed impact assessment (kgN/ha/yr)	Explanation
Marine habitats				
Mid-upper saltmarshes (A2.53)	20-30	None identified	20	Effects are most likely to be found in the tall vegetation of the closed upper marsh communities where inter-specific competition is at its greatest. Therefore it is suggested that the value of 30 kgN/ha/yr is applied to most of the marsh with the lower level of 20 kgN/ha/yr being applied to the more densely vegetated upper marsh and to areas of marsh subjected to direct run-off from adjacent catchments[2].
Pioneer & low-mid saltmarshes (A2.54 and A2.55)	20-30	None identified	30	
Coastal habitats				
Shifting coastal dunes (B1.3)	10-20	None identified	10	Use minimum of range. Targeted survey in UK[3] supports the range but is not able to define a value within it.
Coastal stable dune grasslands (grey dunes) (B1.4)	8-15	For acid dunes use 8-10 kgN/ha/yr range; for calcareous dunes use the 10-15 kgN/ha/yr range.	Acid dunes: 8 Calcareous dunes: 10	Apply modifying factor then use minimum of that part of the range. UK mapping value is set at mid-point as a default value due to insufficient evidence to precisely determine the value within the range. See Annexes 2 and 3 for further information.
Coastal dune heaths (B1.5)	10-20	None identified	10	Use minimum of the range. No information on modifiers.

Moist to wet dune slacks (B1.8)	10-20	Use the lower end of the range with low base availability; use the higher end of the range with high base availability.	Low base availability: 10 High base availability: 15	Apply modifying factor. Use minimum of range for sites with low base availability. Use 15kgN/ha/yr with high base availability, as UK study[4] showed effects above this value. See Annex 4 for further information.
Inland surface waters				
Softwater lakes (permanent oligotrophic waters) (C1.1)	3-10	Critical load should only be applied to oligotrophic waters with low alkalinity with no significant agricultural or other human inputs. Use lower end of range for boreal and alpine lake types; use the higher end of the range for Atlantic softwater lake types.	Seek site specific advice	No definition of these boreal/alpine/Atlantic types is given in the critical load expert workshop report[1]. The UK Statutory Nature Conservation Bodies (SNCBs[*]) are of the opinion that some UK lakes are "alpine lakes", not Atlantic lakes in this context, and that to apply a simple altitudinal cut off is not appropriate. Site specific advice should be sought from the relevant SNCB, as to which part of the range is relevant. If there are no survey data available for a site, a precautionary approach may have to be taken and the lower end of the range applied. Note that for Annex I habitat type H3110 the relevant critical load is 5-10 kgN/ha/yr. Note that the critical load should only be applied to oligotrophic waters with low alkalinity with no significant agricultural or other human inputs. See Annex 5.
Dune slack pools (permanent oligotrophic waters) (C1.16)	10-20	None identified	10	Use minimum of critical load range to apply caution in the absence of any UK studies.
Permanent dystrophic lakes, ponds and pools (C1.4)	3-10	Critical load should only be applied to waters with low alkalinity with no significant agricultural or other direct human inputs. Use lower end of range for boreal and alpine dystrophic lakes.	Seek site specific advice	Only apply to sites with low alkalinity and no significant agricultural inputs. Seek advice from the relevant SNCB[*], as above. See Annex 5.

[*] Natural England, Natural Resources Wales, Scottish Natural Heritage and Northern Ireland Environment Agency.

Mire, bog and fen habitats				
Raised & blanket bogs (D1)	5-10	Use the high end of the range with high precipitation and the low end of the range with low precipitation; use the high end of the range for systems with a low water table, and the high end of the range for systems with a high water table. Note that water table can be modified by management.		Use the minimum of the range in the first instance. Then apply guidance and seek site-specific advice if necessary.
Valley mires, poor fens and transition mires (D2)	10-15	For quaking fens and transition mires, use lower end of the range.	10	Use minimum of the range with quaking fens and transition mires. Use minimum of the range with poor fens and valley mires in the absence of any evidence to support use of a higher value.
Rich fens (D4.1)	15-30	For high latitude systems use lower end of the range.	15	Use minimum of the range with all rich fens in the first instance in the absence of any UK evidence to support use of a higher value.
Montane rich fens (D4.2)	15-25	For high latitude systems use lower end of the range.	15	Use minimum of the range in the absence of any UK evidence to support use of a higher critical load.

Grasslands and tall forb habitats				
Sub-atlantic semi-dry calcareous grassland (E1.26)	15-25	None identified	15	Use minimum of the range (based on UK data and consistent with UK mapping value[4,5] (Annex 2)).
Non-Mediterranean dry acid and neutral closed grassland (E1.7)	10-15	Use the lower end of the range with low base availability; use the higher end of the range with high base availability.	10	Use minimum of CL range (based on UK data and consistent with revised mapping value[4,5] (Annex 2)).
Inland dune pioneer grasslands (E1.94)	8-15	Use the lower end of the range with low base availability; use the higher end of the range with high base availability.	Acid dunes: 8 Calcareous dunes: 10	Critical load based on dry dunes, therefore apply same approach as coastal stable dune grasslands.
Inland dune siliceous grassland (E1.95)	8-15	Use the lower end of the range with low base availability; use the higher end of the range with high base availability.	Acid dunes: 8 Calcareous dunes: 10	Critical load based on dry dunes, therefore apply same approach as coastal stable dune grasslands.
Low and medium altitude hay meadows (E2.2)	20-30	None identified	20	Use minimum of the range in the absence of any data on modifying factors.
Mountain hay meadows (E2.3)	10-20	None identified	10	Use minimum of the range in the absence of any data on modifying factors.
Moist & wet oligotrophic grasslands:				
Molinia caerulea meadows (E3.51)	15-25	None identified	15	Use minimum of the range in the absence of any data on modifying factors.

Heath (*Juncus*) meadows & humid (*Nardus Stricta*) swards (E3.52)	10-20	None identified	10	Use minimum of the range in the absence of any data on modifying factors.
Moss & lichen dominated mountain summits (E4.2)	5-10	None identified	7	Use 7 kgN/ha/yr. UK mapping value set at 7 as although chemical changes may occur below this value, the evidence suggests that habitat degradation is not seen below 7kgN/ha/yr [4]. See Annex 2.
Alpine and subalpine acid grasslands (E4.3)	5-10	None identified	5	Use minimum of range in the absence of any data on modifying factors.
Alpine and subalpine calcareous grasslands (E4.4)	5-10	None identified	5	Use minimum of range in the absence of any data on modifying factors.
Heathland, scrub & tundra				
Arctic, alpine and subalpine scrub habitats (F2)	5-15	None identified	5	Use minimum of the range in the absence of any data on modifying factors.
Northern wet heaths (F4.11) • U' *Calluna*-dominated wet heath (upland moorland)	10-20	Use the high end of the range with high precipitation and the low end of the range with low precipitation; use the low end of the range for systems with a low water table, and the high end of the range for systems with a high water table. Use the high end of the	10	Use minimum of range based on UK data[5] on impacts and to be consistent with UK mapping value[4] (Annex 2). Unable to quantify the suggested management modifier at this time.

		range when sod cutting has been practices; use the lower end of the range with low intensity management.		
• 'L' *Erica tetralix* dominated wet heath (lowland)	10-20	As above (re precipitation and management)	10	Use minimum of range based on UK data[5] and to be consistent with UK mapping value[4] (Annex 2).
Dry heaths (F4.2)	10-20	As above (re precipitation and management)	10	Use minimum of range based on UK data[5] and to be consistent with UK mapping value[4] (Annex 2).
Forest habitats (general) Use if not one of specific forests in section below				*Note - if the site is designated for other features, such are rare plants in woodland rides, it may also be necessary to apply a critical load representative of that habitat (e.g. a grassland or heathland critical load).*
Broadleaved woodland (G1)	10-20	None identified	10	Not appropriate to use UK mapping value (Annex 2) as it does not distinguish between broadleaf and coniferous forest and is a default value not based on UK evidence[4]. Use the minimum of the range when considering impacts at the site level.
Coniferous woodland (G3)	5-15	None identified	10 unless lichens are considered important at site	Not appropriate to use UK mapping value (Annex 2) as it does not distinguish between broadleaf and coniferous forest and is a default value not based on UK evidence[4]. Use 10kgN/ha/yr to protect trees, mycorrhiza, ground vegetation and soil processes. Consider using lower value if lichens are an integral part of the site.
Mixed woodland	-	None identified	10	UK mapping value is a default value, set to protect the woodland ground flora. It is based on the 2003 critical load range for all forests of 10-15 kgN/ha/yr and retained in the 2011 national mapping report[4] as it falls within other woodland CL ranges (10-20 kgN/ha/yr). Use the minimum of the two recommended values for broadleaved and coniferous when considering impacts at the site level.

Forest habitats (specific)				*Note - if the site is designated for other features, such are rare plants in woodland rides, it may also be necessary to apply a critical load representative of that habitat (e.g. a grassland or heathland critical load).*
Fagus woodland (beech) (G6.1)	10-20	None identified	15	Use middle of the range based on UK data and to be consistent with UK mapping value[4] (Annex 2).
Acidophilous *Quercus*-dominated woodland (oak) (G1.8)	10-15	None identified	10	Use minimum of the range based on UK data and to be consistent with UK mapping value[4] (Annex 2).
Meso- and eutrophic *Quercus* woodland (G1.A)	15-20	None identified	15	No UK mapping value or UK evidence to support applying anything other than the minimum of the range.
Pinus sylvestris woodland south of the taiga (G3.4)	5-15	None identified	12	Use middle of the range based on UK data and to be consistent with UK mapping value[4] (Annex 2).

References

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3. UK Research on The Eutrophication and Acidification of Terrestrial Ecosystems. http://ukreate.defra.gov.uk/

4. Hall, J., Emmett1, B., Garbutt, A., Jones, L., Rowe, E., Sheppard, L., Vanguelova, E., Pitman, R., Britton, A., Hester, A., Ashmore, M., Power, S., Caporn, S. (2011). UK Status Report July 2011: Update to empirical critical loads of nitrogen. Report to Defra under contract AQ801 Critical Loads and Dynamic Modelling. http://cldm.defra.gov.uk/PDFs/UK_status_report_2011_finalversion_July2011_v2.pdf

5. Emmett, B.A., Rowe, E.C., Stevens, C.J., Gowing, D.J., Henrys, P.A., Maskell, L.C. & Smart, S.M. (2011). Interpretation of evidence of nitrogen impacts on vegetation in relation to UK. JNCC Report 449. http://jncc.defra.gov.uk/page-5895.

6. Rodwell, J.S. (ed.) 2000. British plant communities. Volume 5. Maritime communities and vegetation of open habitats. Cambridge University Press.

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Annexes

Annex 1: Principles of the approach

The table above is based on the following principles, agreed by the APIS partners (environment agencies and statutory nature conservation bodies):

- For sensitive habitats, a critical load should be selected from within the appropriate critical load range (i.e. those adopted and published by the UNECE[1]).

- The minimum of the critical load range should be applied during the screening assessment stage to ensure a precautionary and efficient approach. Any modifying factors should be considered and applied at the detailed assessment stage.

- In a very few cases (e.g. Crymlyn Bog in Wales), published site-specific research has been used to derive a critical load for the site and this must be taken into consideration at the detailed assessment stage. However, critical load allocation should not be based on site 'condition' information. Where no site-specific critical load research has been published (in the majority of cases), the UK evidence on nitrogen impacts must be used to guide the choice of critical load.

    - Where the UK mapping value (see Annex 2) is set at a certain point in the critical load range based on UK evidence then this value should also be adopted in detailed impact assessments.

    - Where the UK mapping value is set at the mid-point or other part of the critical load range as a default, i.e. because there is no UK evidence to define a more precise mapping value, then the lower end of the critical load range should be applied in detailed impact assessments in order to apply the necessary level of precaution and site protection.

    - Where there is no mapping value with which to compare, then the minimum of the critical load range should be applied in detailed impact assessments, unless the critical load expert report[1] has identified modifying factors that need to be taken into consideration (e.g. for inland surface waters).

    - Where modifying factors have been identified for a critical load range, these should be applied in detailed impact assessments wherever possible, taking into account the available site specific information. For example, for stable dune grasslands, the pH of the dune should be taken into account where it is known. Note – for other modifying factors, it may be difficult to quantify their effect making it not possible to apply them. This is reflected in the table above. The critical load expert report[1] concludes that in cases where it was not possible to reach agreement on how to quantify modifying factors for use in assessments, the minimum value of the critical load range should be used.

Annex 2: UK mapping value

The Coordination Centre for Effects (CCE) in the Netherlands (www.rivm.nl/cce) is responsible for compiling European scale maps of critical loads and critical load exceedance. Member states that submit critical loads exceedance data to the Co-ordination Centre of Effects of ICP on Modeling and Mapping, under the Convention on Long-Range Transboundary Air Pollution, have to determine which critical load value within the range to use with their national habitat maps. In the UK this is known as a 'mapping value'.

The mapping value may be based on country-specific evidence or, in the absence of such information, set as a default value within the range. In the absence of evidence, the UK uses a default value of the mid-point in the range for UK reporting purposes. It is however acknowledged that site specific applications of critical loads may use a different part of the critical load range from those used for national mapping purposes, depending on the site and policy context (Hall *et al.,* 2011[4]).

The Coordination Centre for Effects (CCE) produces European scale maps of critical loads and exceedances. These maps combine critical loads for countries that submit national data, with critical loads based on European background databases for countries that have not submitted national data. Where it is necessary to use the background databases for maps of nitrogen critical loads, the CCE will apply the empirical values at the lower end of each habitat critical load range, based on the precautionary principle, and will not apply any modifying factors.

Annex 3: Coastal stable dunes grasslands

The critical load range for coastal stable dune grasslands (grey dunes) depends on whether the dune is acid or non-acid. Any dunes with soil pH below 6.5 can be considered to be acid in this context and the lower part of the critical load range applied to it. The vegetation communities on the site may also indicate whether the dune is acidic or calcareous (Rodwell, 2000[6]). It is important to remember that there may be both acidic and calcareous parts on the same site (e.g. sites that are predominantly calcareous but where the older soils have started to decalcify) and so a different critical load value may need to be used depending on the part of the site in question.

Annex 4: Moist to wet dune slacks

The critical load range for moist to wet dune slacks comes with a modifying factor of base availability. Base availability in dune slacks comes either from the dune sand itself or from the groundwater which provides geochemical buffering. There has been very little hydrological or hydrochemical work on dune slacks in the UK and this makes it difficult to assess base availability. It might be possible to use vegetation community as a guideline, with SD17 *Potentilla anserina–Carex nigra* or mire communities suggesting acid conditions with low base availability. All other dune slack types are likely to have high base availability. However, as with grey dunes, it is likely to find base-rich and more acidic (SD17) slacks on the same site, particularly in the north of UK.

Annex 5: Inland surface waters

Alkalinity is a measure of the buffering capacity of water, or the capacity of bases to neutralize acids. Alkalinity does not refer to pH, but instead refers to the ability of water to resist change in pH. Waters with low alkalinity are very susceptible to changes in pH; waters with high alkalinity are able to resist major shifts in pH.

'Dystrophic' is a term used to describe natural lakes and ponds with brown tinted water due to peat and humic acids, generally on peaty soils in bogs or in heaths with natural evolution toward bogs. The pH is often low (pH 3 to 6). EUNIS factsheet (http://eunis.eea.europa.eu/habitats/10068).

An oligotrophic lake is a lake with low primary productivity, the result of low nutrient content. Also waterbodies with a low nutrient (nitrogen and phosphorus) content, mostly acid (pH 4-6). EUNIS factsheet (http://eunis.eea.europa.eu/habitats/722).