



Irish contribution to the review of empirical critical loads for nitrogen

Julian Aherne, Kayla Wilkins and Hazel Cathcart



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We have determined empirical critical loads for 16 habitats



Annex 1 classification used to describe habitats (crosswalk)



Empirical critical loads determined at habitat-scale (no modifying factors)



Table 1 Overview of empirical critical loads of nitrogen deposition ($\text{kg N ha}^{-1} \text{ yr}^{-1}$) to natural and semi-natural ecosystems (column 1), classified according to EUNIS (column 2), as originally established in 2003 (column 3), and as revised in 2010 (column 4). The reliability is qualitatively indicated by ## reliable; # quite reliable and (#) expert judgement (column 5). Column 6 provides a selection of effects that can occur when critical loads are exceeded. Finally, changes with respect to 2003 values are indicated in bold.

Ecosystem type	EUNIS code	2003 $\text{kg N ha}^{-1} \text{ yr}^{-1}$ and reliability	2010 $\text{kg N ha}^{-1} \text{ yr}^{-1}$	2010 reliability	Indication of exceedance
Marine habitats (A)					
Mid-upper salt marshes	A2.53		20-30	(#)	Increase in dominance of graminoids
Pioneer and low-mid salt marshes	A2.54 and A2.55	30-40 (#)	20-30	(#)	Increase in late-successional species, increase in productivity
Mire, bog and fen habitats (D)					
Raised and blanket bogs	D1*	5-10 ##	5-10	##	Increase in vascular plants, altered growth and species composition of bryophytes, increased N in peat and peat water

D1 [raised and blanket bogs]

5–10 $\text{kg N ha}^{-1} \text{ yr}^{-1}$



Where in (outside) the range, e.g., D1 : 5–10 kg N ha⁻¹ yr⁻¹



Change points using Threshold Indicator Taxa ANalysis (TITAN)



Maximum nitrogen critical load from PROPS-CLF



Selection of empirical critical load based on change in biodiversity

biodiversity-based empirical critical loads of nutrient nitrogen for Irish habitats

TITAN community change-point ^c							PROPS-CLF		empirical critical loads		
Annex I Code	Relevés	Species	# z– taxa (# PI)	# z+ taxa (# PI)	sum z– CP	sum z+ CP	CLN _{max} (kg N ha ⁻¹ yr ⁻¹)	Relevés	CL _{emp} N (kg N ha ⁻¹ yr ⁻¹)	IE CL _{emp} N (kg N ha ⁻¹ yr ⁻¹)	EUNIS code
1xxx [§]	1845	65	20 (10)	13 (9)	9.3	12.8	–	–	20–30	<u>10</u> –15	A2.5x
21xx [†]	102	92	6 (5)	1 (1)	9.5*	–	–	–	10–20	<u>10</u> –15	B1.x
4010	231	131	12 (8)	8 (2)	4.9	9.1	5.7	55	10–20	5	F4.11
4030	164	123	19 (0)	6 (1)	4.1	12.0	7.4	56	10–20	<u>5</u> –10	F4.2
4060	97	89	20 (9)	5 (1)	5.5	7.6	4.5	48	5–15	5	F2
5130 [‡]	191	142	26 (12)	22 (0)	4.8	6.5	–	–	(10–20)	<u>5</u> –10	(F4.2)
6210	507	275	67 (7 9) [¥]	38 (4 9)	8.3	8.5	14.1	68	15–25	<u>10</u> –15	E1.26
6230	108	156	15 (0 1)	14 (0 2)	3.9	6.5	15.3	63	10–15	<u>10</u> –15	E1.7
6410	366	182	22 (2 4)	24 (2 5)	6.3	11.9	16.5	200	15–25	<u>15</u> –20	E3.51
6430	77	172	7 (1)	1 (0)	6.5*	–	14.0	22	(5–10)	<u>5</u> –10	(E4.3)
6510	125	105	11 (0 1)	13 (1 2)	7.5	8.7	12.3	30	20–30	<u>10</u> –15	E2.2
7110 [§]	475	15	15 (15)	0 (0)	13.0*	–	–	–	5–10	<u>10</u> –15	D1.1
7130	247	120	22 (15)	7 (0)	4.9	13.7	5.1	50	5–10	5	D1.2
8210	37	92	5 (1)	3 (0)	5.7	6.1	–	–	(5–10)	<u>5</u> –10	(E4.2)
8240	166	112	8 (5)	5 (3)	8.9	10.8	–	–	(5–10)	<u>5</u> –10	(E4.4)
91A0	319	206	65 (18)	10 (1)	8.8	15.2	–	–	10–15	<u>10</u> –15	G1.8

^c See Wilkins K, Aherne J, Bleasdale A, 2016. Atmospheric Environment, 146, 324–331

* No significant community change-points; z– CP set to average of species with z– change-points

[§] Salt marshes [1310, 1330, 1410 Annex 1 codes for Positive Indicator Species]

[†] Sand dunes [2110, 2120, 2130, 2170, 2190, 21A0]

[‡] *Juniperus communis* formations, similar results for acidic and calcareous vegetation groups; note: *Juniperus communis* decreased in abundance, no bryophytes recorded

[¥] Number of high quality indicator species | and high quality plus general indicator species with a significant change in abundance

[§] Species abundance only included 15 indicator species



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