Appendix

TABLE A1. Studies used in meta-analysis of simulated N deposition effects on leaf nutrient responses.

Study	Reference	Location	Litter or foliage[†]	Tree species
1	McNulty et al. 2005	Vermont, USA	foliage	*Picea rubens*
2	Berg and Tamm 1991	Sweden	litter	*Picea abies*
3	Kishchuk et al. 2002	Britisch Columbia, Canada	foliage	*Pinus contorta*
4	Högberg et al. 2006	Sweden	foliage	*Pinus sylvestris*
5	Hobbie and Vitousek 2000	Hawaii	litter	*Metrosideros*
6	White et al. 1999	Maine, USA	foliage	*Picea rubens*, *Fagus grandifolia*, *Acer saccharum*, *A. rubrum*
7	Elvir et al. 2006	Maine, USA	foliage	*Picea rubens*, *Fagus grandifolia*, *Acer saccharum*
8	Moore and Houle, 2009	Canada	foliage	*Acer saccharum*
9	Unpublished data; Michigan Gradient Study (contact: L.T.A. van Diepen)	Michigan, USA	foliage	*Acer saccharum*

10	Elvir et al. 2005	Maine, USA	foliage	*Picea rubens*, *Fagus grandifolia*, *Acer saccharum*
11	Lovett et al. 2013 & unpublished data; Catskill Mountains (contact: Mary A. Arthur)	New York, USA	litter	*Acer saccharum*, *Fagus grandifolia*, *Betula alleghaniensis*, *Tsuga canadensis*, *Quercus rubra*
12	This study	Massachusetts, USA	litter	*Quercus velutina*, *Q. rubra*
13	Minocha et al. 2000, 2015 & unpublished data (contact: R. Minocha)	Massachusetts, USA	foliage[§]	*Pinus resinosa*, *Quercus velutina*, *Q. rubra*, *Acer rubrum*
14	Schaberg et al. 1997	Vermont, USA	foliage	*Picea rubens*
15	Moore and Houle, 2013	Canada	foliage	*Acer saccharum*
16	Unpublished data; Cary Institute of Ecosystem Studies (contact: Gary M. Lovett)	New York, USA	litter	*Quercus rubra*, *Q. prinus*

[†] Foliage refers to green leaves collected before abscission, and litter refers to senesced leaves collected in litter traps after abscission.

[§] Data collected represents exchangeable nutrients based on fresh weight instead of total nutrient concentration based on dry weight.

TABLE A2. Decay parameters, moisture, chemistry, and potential microbial enzyme activities associated with oak litter following one year of decomposition at the Chronic Nitrogen Amendment Study. Values are means (n = 5) with standard errors in parentheses.

	N decay environment								
	N0			N50			N150		
Litter origin	N0	N50	N150	N0	N50	N150	N0	N50	N150
Mass loss (%)	34.71	32.84	40.93	41.57	35.33	37.21	38.88	35.89	23.07
	(2.92)	(2.12)	(5.08)	(3.23)	(4.41)	(2.02)	(7.08)	(6.79)	(2.63)
Decay rate (*k*)	0.50	0.47	0.63	0.63	0.51	0.54	0.61	0.55	0.31
	(0.05)	(0.04)	(0.11)	(0.06)	(0.08)	(0.04)	(0.16)	(0.14)	(0.04)
Moisture (%)	52.68	47.83	53.93	54.09	42.53	50.76	53.84	49.57	43.86
	(2.29)	(2.93)	(2.90)	(4.72)	(5.35)	(2.83)	(7.82)	(9.30)	(4.93)
Nitrogen (%)	1.65	1.71	2.15	1.87	1.93	2.18	1.81	1.86	1.83
	(0.04)	(0.07)	(0.06)	(0.04)	(0.05)	(0.08)	(0.11)	(0.10)	(0.09)
Nitrogen net change (mg)	16.80	17.32	11.22	18.29	25.69	20.87	16.71	20.13	25.75
	(4.33)	(5.48)	(8.15)	(6.51)	(7.47)	(1.63)	(8.01)	(9.79)	(8.68)
Nitrogen net change (%)	19.96	18.84	10.40	21.73	28.03	19.36	19.85	21.96	23.85
	(5.14)	(5.95)	(7.56)	(7.75)	(8.10)	(1.52)	(9.52)	(10.70)	(8.04)
Carbon (%)	53.91	55.82	55.03	54.24	54.63	55.69	55.36	56.38	56.48
	(0.57)	(0.38)	(0.56)	(0.29)	(0.40)	(0.66)	(0.70)	(0.64)	(0.66)
C:N	32.77	32.86	25.72	29.11	28.44	25.73	31.20	30.68	31.21
	(1.05)	(1.54)	(0.89)	(0.70)	(0.95)	(1.03)	(2.18)	(1.98)	(2.02)

LAP (nmol h^{-1} g^{-1})†	20.91	11.95	27.88	88.30	27.13	67.36	24.51	28.94	15.17
	(4.70)	(4.74)	(9.06)	(45.71)	(9.89)	(22.60)	(11.93)	(11.06)	(6.25)
CBH (µmol h^{-1} g^{-1})†	2.51	2.30	3.71	5.15	2.70	3.61	3.25	3.81	3.09
	(0.39)	(0.52)	(0.72)	(1.65)	(0.74)	(0.46)	(0.77)	(0.65)	(0.71)
BG (µmol h^{-1} g^{-1})†	6.31	6.29	7.49	11.34	7.11	6.77	8.67	6.61	5.58
	(1.11)	(1.59)	(0.93)	(3.63)	(2.19)	(0.30)	(2.53)	(1.32)	(0.95)
PHOS (µmol h^{-1} g^{-1})†	12.02	12.51	16.71	20.46	17.20	20.64	18.35	14.94	14.76
	(1.16)	(3.23)	(3.13)	(3.14)	(4.36)	(1.33)	(3.03)	(3.68)	(2.59)
NAG (µmol h^{-1} g^{-1})†	2.82	2.22	3.67	4.60	1.91	3.20	3.08	3.42	2.90
	(0.48)	(0.40)	(1.09)	(1.59)	(0.25)	(0.52)	(1.02)	(1.41)	(0.77)
OX1 (µmol h^{-1} g^{-1})†	8.92	7.07	10.00	10.38	8.09	12.01	12.28	10.31	0.64
	(2.89)	(2.21)	(2.82)	(3.59)	(1.63)	(3.91)	(6.27)	(3.92)	(0.44)
OX2 (µmol h^{-1} g^{-1})†	58.31	90.35	29.73	75.70	32.50	31.06	64.73	34.17	24.33
	(12.73)	(45.88)	(6.41)	(18.67)	(10.84)	(8.90)	(22.70)	(12.17)	(8.33)
PER1 (µmol h^{-1} g^{-1})†	15.33	5.53	9.21	36.07	7.56	12.55	26.79	9.74	6.87
	(6.20)	(2.39)	(3.70)	(7.65)	(2.13)	(3.52)	(12.28)	(2.74)	(3.05)
PER2 (µmol h^{-1} g^{-1})†	23.94	20.84	11.72	36.03	11.23	10.48	25.78	13.75	9.31
	(4.84)	(6.66)	(3.08)	(8.16)	(2.40)	(2.86)	(10.84)	(5.72)	(5.16)

†Abbreviations for enzymes: LAP, leucine aminopeptidase; CBH, cellobiohydrolase; BG, ß-glucosidase; PHOS, acid phosphatase; NAG, N-acetyl-ß-glucosaminidase; OX1, phenol oxidase (L-DOPA as substrate); OX2, phenol oxidase (ABTS as substrate); PER1, gross peroxidases; (L-DOPA+ H_2O_2 as substrate) PER2, peroxidase (TMB + H_2O_2 as substrate).

TABLE A3. Decay parameters, moisture, chemistry, and potential microbial enzyme activities associated with oak litter following two years of decomposition at the Chronic Nitrogen Amendment Study. Values are means (n = 5) with standard errors in parentheses.

	N decay environment								
	N0			N50			N150		
Litter origin	N0	N50	N150	N0	N50	N150	N0	N50	N150
Mass loss (%)	69.16	65.02	60.90	70.91	68.34	64.20	63.37	51.78	57.01
	(2.54)	(1.86)	(3.24)	(1.87)	(2.99)	(2.94)	(3.17)	(4.54)	(3.65)
Decay rate (*k*)	0.62	0.55	0.50	0.65	0.61	0.54	0.53	0.39	0.45
	(0.04)	(0.03)	(0.04)	(0.03)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)
Moisture (%)	59.06	60.52	57.98	66.92	61.28	60.70	66.29	57.27	66.70
	(4.15)	(2.21)	(2.74)	(2.59)	(1.08)	(1.20)	(3.92)	(4.62)	(2.17)
Nitrogen (%)	2.02	2.18	2.33	2.25	2.24	2.34	2.17	2.16	2.34
	(0.03)	(0.03)	(0.02)	(0.09)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)
Nitrogen net change (mg)	-21.77	-15.10	-16.61	-18.24	-19.92	-24.17	-4.61	13.45	-7.46
	(4.58)	(3.49)	(8.01)	(5.94)	(7.53)	(5.42)	(6.35)	(11.14)	(7.58)
Nitrogen net change (%)	-25.87	-16.58	-15.40	-21.66	-21.70	-22.40	-5.45	14.65	-6.92
	(5.44)	(3.83)	(7.43)	(7.05)	(8.17)	(5.03)	(7.54)	(12.16)	(7.02)
Carbon (%)	52.01	53.50	54.59	53.65	54.06	54.21	53.48	54.56	55.15
	(0.41)	(0.39)	(0.29)	(0.58)	(0.28)	(0.60)	(0.46)	(0.39)	(0.19)
C:N	25.73	24.61	23.48	24.04	24.13	23.15	24.63	25.31	23.64
	(0.57)	(0.33)	(0.33)	(1.20)	(0.54)	(0.11)	(0.36)	(0.55)	(0.64)

LAP (nmol h^{-1} g^{-1})†	5.47	8.97	3.39	13.09	3.03	17.57	20.75	15.68	32.87
	(3.65)	(3.78)	(2.67)	(8.41)	(3.03)	(17.57)	(7.31)	(8.36)	(24.04)
CBH (µmol h^{-1} g^{-1})†	1.43	0.77	0.82	1.49	0.73	0.93	2.11	1.34	1.81
	(0.24)	(0.31)	(0.36)	(0.29)	(0.11)	(0.20)	(0.42)	(0.28)	(0.40)
BG (µmol h^{-1} g^{-1})†	5.85	2.96	3.66	3.58	2.73	3.02	4.56	4.91	4.81
	(0.66)	(0.75)	(1.25)	(0.40)	(0.51)	(0.57)	(0.67)	(1.03)	(1.02)
PHOS (µmol h^{-1} g^{-1})†	4.47	3.34	5.56	8.51	6.37	7.98	7.88	9.70	10.70
	(0.36)	(1.13)	(1.90)	(4.63)	(2.57)	(2.60)	(0.89)	(2.49)	(2.99)
NAG (µmol h^{-1} g^{-1})†	0.73	0.59	1.10	1.55	1.40	1.40	1.47	0.91	1.49
	(0.15)	(0.17)	(0.12)	(0.39)	(0.18)	(0.34)	(0.59)	(0.12)	(0.40)
OX1 (µmol h^{-1} g^{-1})†	12.48	13.61	1.42	13.87	10.74	6.28	0.17	0.56	0.72
	(7.54)	(6.76)	(1.42)	(7.10)	(4.56)	(4.86)	(0.15)	(0.56)	(0.72)
OX2 (µmol h^{-1} g^{-1})†	95.12	75.84	48.06	44.44	23.31	36.62	74.24	36.82	38.95
	(15.52)	(11.64)	(7.33)	(18.07)	(10.51)	(7.53)	(21.39)	(8.56)	(14.74)
PER1 (µmol h^{-1} g^{-1})†	24.74	22.73	11.32	17.62	10.67	4.68	6.50	3.13	6.52
	(6.35)	(6.53)	(2.88)	(9.59)	(2.05)	(1.57)	(2.85)	(1.71)	(2.66)
PER2 (µmol h^{-1} g^{-1})†	79.30	65.84	42.64	59.81	61.11	47.85	81.25	35.30	43.01
	(15.11)	(7.46)	(9.56)	(6.79)	(13.64)	(10.38)	(30.66)	(7.09)	(10.22)

†Abbreviations for enzymes: LAP, leucine aminopeptidase; CBH, cellobiohydrolase; BG, ß-glucosidase; PHOS, acid phosphatase; NAG, N-acetyl-ß-glucosaminidase; OX1, phenol oxidase (L-DOPA as substrate); OX2, phenol oxidase (ABTS as substrate); PER1, gross peroxidases; (L-DOPA+ H_2O_2 as substrate) PER2, peroxidase (TMB + H_2O_2 as substrate).

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