

Online Resource

Biological nitrogen fixation and *nifH* gene abundance in deadwood of 13 different tree species

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Table S1 BNF rates from the literature and information about phylogenetic clade (a = angiosperms, g = gymnosperms), tree species, age or decay stage of deadwood, location and climate zone, incubation method, and incubation temperature

BNF (ng N g ⁻¹ d ⁻¹)			Clade	Tree Species	Age / Decay Stage	Location	Climate Zone	Method	Incubation Temperature	Reference
Mean	Minimum	Maximum								
0.04	0.00	0.11	g	<i>Abies, Picea</i>	III - V	Canada	subpolar	calibrated ARA	15°C	Benoist et al. 2022
40.5	9.0	139.3	g	<i>Abies, Tsuga</i>	I - V	Canada	temperate	ARA	4 - 14°C	Brunner and Kimmins 2003
0.35	0.25	0.51	g	<i>Pinus, Pseudotsuga</i>	n.a.	USA	temperate	calibrated ARA	26°C	Burgoyne 2007
0.54	0.38	0.64	g	<i>Pinus, Pseudotsuga</i>	decaying	USA	temperate	ARA	26°C	Burgoyne and DeLuca 2009
86.4	17.4	186.0	g	<i>Pinus, Pseudotsuga, Tsuga</i>	6 years	USA	temperate	calibrated ARA	22°C	Chen and Hicks 2003
218.9	176.7	262.3	a	<i>Castanea</i>	less and more decayed	USA	subtropical	ARA	17.5°C	Cornaby and Waide 1973
0.19	0.13	0.24	g	<i>Picea, Pseudotsuga, Thuja</i>	I - V	USA	temperate	ARA	field temperature (fall and spring)	Crawford et al. 1997
0.95	0.36	1.9	g	<i>Pseudotsuga, Thuja</i>	incipient - advanced	Canada	temperate	ARA	field temperature (2 to 17°C)	Cushon and Feller 1987
86.4	3.6	233.2	g	<i>Pinus</i>	n.a.	USA	temperate	ARA	20°C	Fahey et al. 1985
0.94	0.00	2.9	g	<i>Abies, Pseudotsuga, Thuja, Tsuga</i>	fresh	USA	temperate	ARA	15°C	Griffiths et al. 1993
10.3	7.8	13.5	g	<i>Abies, Larix, Pinus, Thuja, Tsuga</i>	incipient - advanced	USA	temperate	ARA	field temperature (summer to autumn)	Harvey et al. 1989
38.5	0.00	153.3	g	<i>Picea, Pinus</i>	6 years	Canada	temperate	ARA	25°C	Hendrickson 1988
102.7	0.00	666.7	a	<i>Acer, Betula, Populus</i>						
34.9	0.00	93.4	g	<i>Abies, Pinus</i>	6 - 8 years	Canada	temperate	ARA	25°C	Hendrickson 1991
161.2	0.00	291.6	a	<i>Acer, Betula, Populus</i>						
4.2	0.14	14.3	g	<i>Abies, Picea</i>	n.a.	USA	temperate	ARA	various (0 to 65°C)	Hicks 2000
1.7	0.58	3.2	g	<i>Picea, Pseudotsuga, Tsuga</i>	I - V	USA	temperate	ARA	15°C	Hicks et al. 2003
27.9	7.1	74.2	g	<i>Pseudotsuga</i>	incipient - advanced	USA	temperate	ARA	field temperature (summer to autumn)	Jurgensen et al. 1984
17.2	5.0	52.1	g	<i>Abies, Pseudotsuga, Picea, Larix, Tsuga</i>	incipient - advanced	USA	temperate	ARA	room temperature	Jurgensen et al. 1987
61.9	16.3	107.4	g	<i>Abies, Pseudotsuga, Thuja</i>	advanced	USA	temperate	ARA	19°C	Jurgensen et al. 1989
0.71	0.56	0.86	g	<i>Abies, Larix, Picea, Pseudotsuga</i>	decayed	USA	temperate	ARA	field temperature (summer to autumn)	Jurgensen et al. 1992
91.0	28.0	168.0	g	<i>Thuja, Tsuga</i>	1 year old	USA	temperate	ARA	field temperature (summer to autumn)	Larsen et al. 1982
4.8	3.6	7.1	g	<i>Picea</i>	7 - 15 years	Finland	temperate to subpolar	ARA	15°C	Mäkipää et al. 2018a
4.8	0.00	10.0	g	<i>Picea</i>	I - V	Finland	temperate	ARA	various (8.7 - 40.1°C)	Mäkipää et al. 2018b
238.0	60.0	550.0	g	<i>Picea</i>	I - V	Finland	temperate	ARA	various (8.7 - 40.1°C)	Rinne et al. 2017
251.3	0.04	570.5	a	<i>Acer, Betula, Fagus, Prunus</i>	various	USA	temperate	ARA	19°C	Roskoski 1980
140.4	30.0	357.7	a	<i>Acer, Betula, Fagus</i>	evidence of decay	n.a.	n.a.	¹⁵ N & ARA	20 - 22°C	Roskoski 1981

Table S1 (continued)

0.01	0.01	0.01	g	<i>Pinus</i>	fresh	n.a.	n.a.	ARA	25°C	Sharp and Millbank 1973
0.01	0.01	0.01	a	<i>Fagus, Quercus</i>						
0.28	0.00	1.8	g	<i>Pseudotsuga, Tsuga</i>	II - V	USA	temperate	ARA	room temperature	Silvester 1989
0.16	0.01	1.3	g	<i>Pseudotsuga, Tsuga</i>	II - V	USA	temperate	15N	22°C	Silvester et al. 1982
0.05	0.01	0.15	g	<i>Pseudotsuga, Thuja, Tsuga</i>	I - IV	USA	temperate	ARA	n.a.	Sollins et al. 1987
38.3	12.2	76.6	g	<i>Pseudotsuga</i>	incipient - advanced	USA	temperate	ARA	field temperature (summer to autumn)	Spano et al. 1982
167.0	37.0	297.0	a	<i>Fagus</i>	< and > 10 years	Czech Republik	temperate	ARA	25°C	Tláškal et al. 2021
133.1	65.4	200.8	a	n.a.	less and more decayed	USA	subtropical	ARA	18°C	Todd et al. 1975
0.11	0.03	0.36	g	<i>Picea, Pinus</i>	2 - 5 years	Finland	temperate	ARA	room temperature	Törmänen and Smolander 2022
0.07	0.03	0.12	a	<i>Betula</i>						
156.9	85.6	263.8	a	<i>Metrosideros</i>	partially decomposed wood	USA (Hawaii)	subtropical	ARA	field temperature	Vitousek 1994
130.8	0.0	299.1	g	<i>Pinus</i>	early and advanced	Canada	temperate	ARA	field temperature (summer)	Wei and Kimmins 1998

Fig. S1 Theory model for the SEM for deadwood logs from 13 tree species after 12 years of decomposition, relating BNF, *nifH* gene abundance, respiration rate, NSC, WC, N, P, and Mo. Single-headed arrows indicate a direct effect of one parameter on the other, whereas double-headed arrows indicate a mutual relationship between both parameters. Numbers next to the arrows indicate the references supporting the connection as follows: 1: Silvester (1989), 2: Hardy et al. (1971), 3: Reed et al. (2011); Zhang et al. (2021), 4: Gavazov et al. (2010), 5: Reed et al. (2011), 6: Hsu and Buckley (2009), 7: Khan et al. (2021), 8: Hoppe et al. (2014); Tláskal et al. (2017), 9: Hendrickson (1991), 11 & 12: Hoppe et al. (2014), 13: Granhall and Lindberg (1978), 10: Hicks (2000), 14: Purahong et al. (2018)

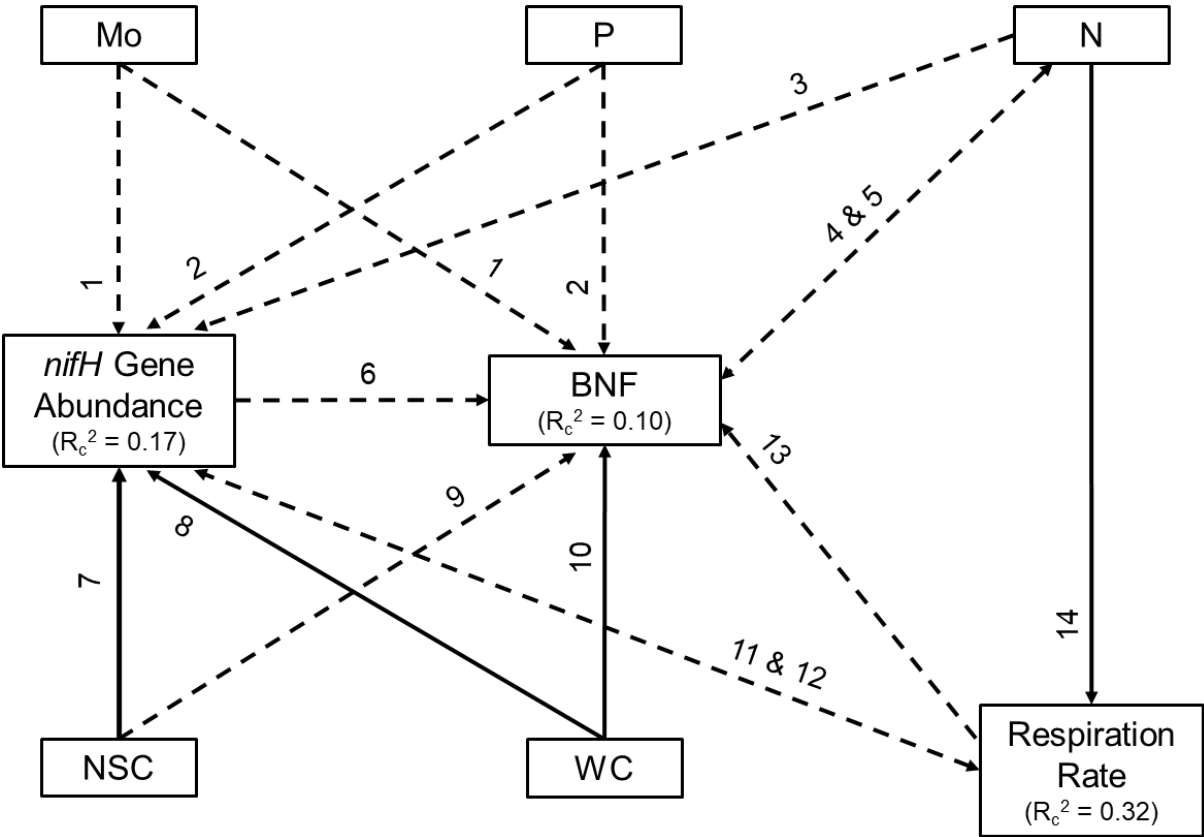


Fig. S2 BNF rate correlated to concentrations of glucose, arabinose, xylose, galactose, total NSC, Mo, Ca, Mg, Mn, K, P, and S, respiration rate, N concentration, and WC. Regression lines are shown as solid lines; R and p-value are given in the graphs

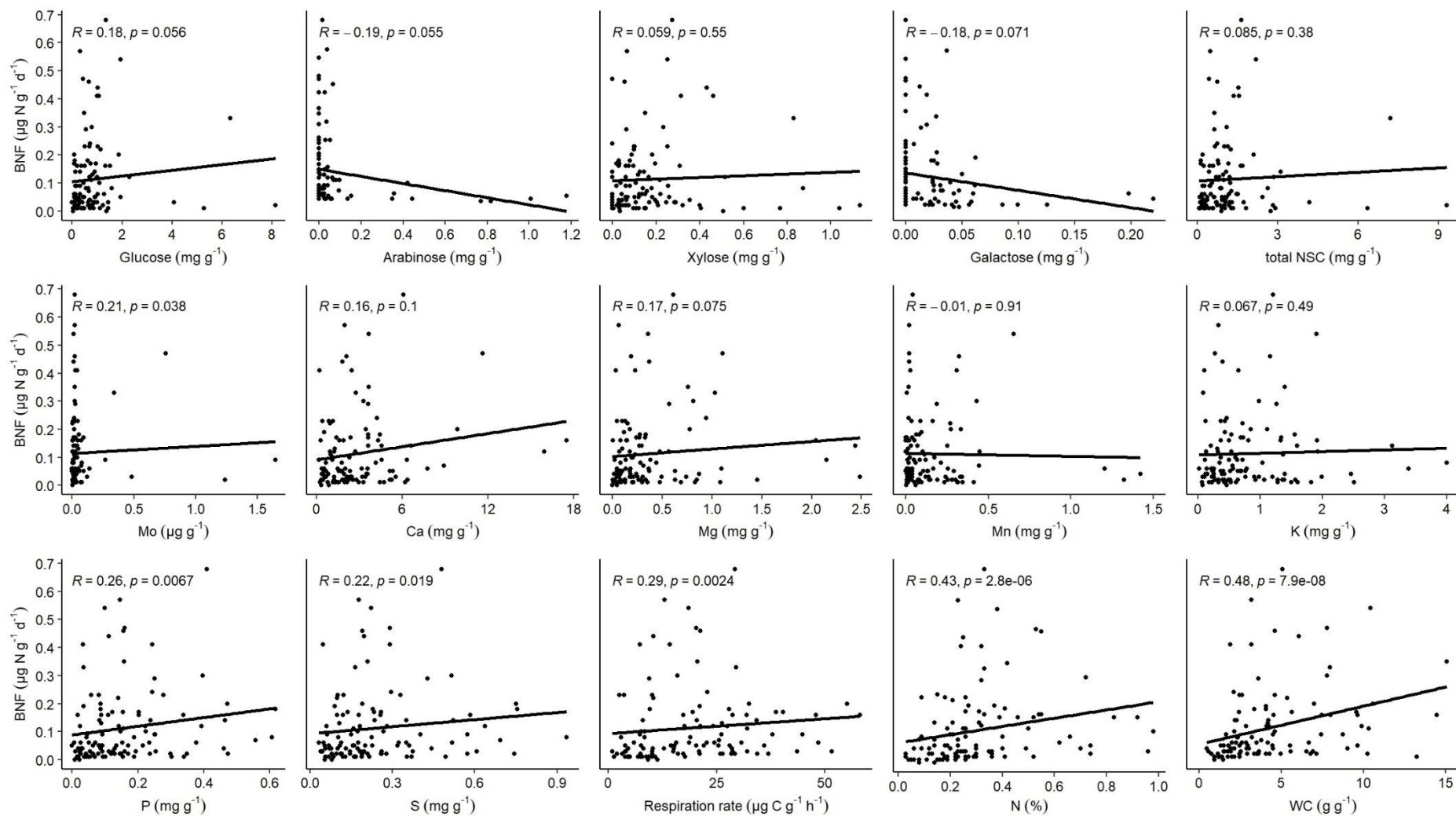
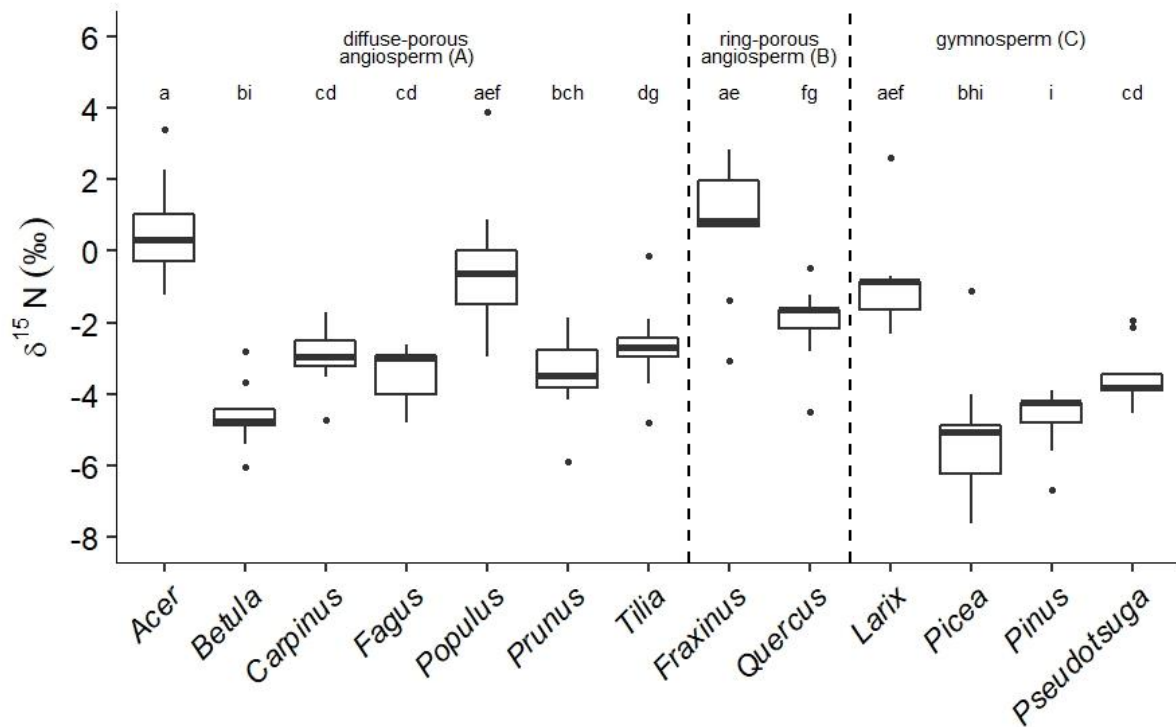


Fig. S3 $\delta^{15}\text{N}$ natural abundance in deadwood after 12 years of decomposition of 13 tree species. Boxplots show the median of the values. Each boxplot's upper and lower edges represent the 25 and 75% quartile, respectively. The whiskers represent the 1.5 x inter-quartile range. Points beyond the whiskers are outliers. Significant differences between phylogenetic clades are denoted as capital letters, between tree species in small letters ($p < 0.05$)



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