Appendix S1. Information on the selected plots for hits:biomass point-framing data calibration. These plots were deliberately selected to include a large range of biomass for each plant species in the calibrations. A randomly selected 1.0 m^2 area within each plot was located, and a 40 cm x 40 cm square within this 1.0 m^2 area was harvested.

Plot ID	Year of Data Collection	Plot ID	Year of Data Collection
Control for Exclosure 1_1	2009	Low-level nitrogen addition 2_2	2018
Control for Exclosure 1_2	2018	Low-level nitrogen addition 3_1	2011
Control for Exclosure 2_1	2009	Low-level nitrogen addition 3_2	2018
Control for Exclosure 2_2	2018	Low-level nitrogen addition 4	2011
Control for Exclosure 3_1	2009	Low-level nitrogen addition 5	2011
Control for Exclosure 3_2	2018	High-level nitrogen addition 1_1	2011
Control for Exclosure 4	2009	High-level nitrogen addition 1_2	2018
Control for Exclosure 5	2009	High-level nitrogen addition 2_1	2011
Control 1	2011	High-level nitrogen addition 2_2	2018
Control 2	2011	High-level nitrogen addition 3_1	2011
Control 3	2011	High-level nitrogen addition 3_2	2018
Control 4	2011	High-level nitrogen addition 4	2011
Control 5	2011	High-level nitrogen addition 5	2011
Control 6	2018	High-level phosphorus addition 1_1	2011
Control 7	2018	High-level phosphorus addition 1_2	2018
Control 8	2018	High-level phosphorus addition 2_1	2011
Exclosure 1_1	2009	High-level phosphorus addition 2_2	2018
Exclosure 1_2	2018	High-level phosphorus addition 3_1	2011
Exclosure 2_1	2009	High-level phosphorus addition 3_2	2018
Exclosure 2_2	2018	High-level phosphorus addition 4	2011
Exclosure 3_1	2009	High-level phosphorus addition 5	2011
Exclosure 3_2	2018	High-level nitrogen + high-level phosphorus addition 1_1	2011
Exclosure 4	2009	High-level nitrogen + high-level phosphorus addition 1_2	2018
Exclosure 5	2009	High-level nitrogen + high-level phosphorus addition 2_1	2011
Greenhouse 1	2011	High-level nitrogen + high-level phosphorus addition 2_2	2018
Greenhouse 2	2011	High-level nitrogen + high-level phosphorus addition 3_1	2011
Greenhouse 3	2011	High-level nitrogen + high-level phosphorus addition 3_2	2018
Greenhouse 4	2011	High-level nitrogen + high-level phosphorus addition 4	2011
Greenhouse 5	2011	High-level nitrogen + high-level phosphorus addition 5	2011
Low-level nitrogen addition 1_1	2011	Exclosure + Fertilization 1	2018
Low-level nitrogen addition 1_2	2018	Exclosure + Fertilization 2	2018
Low-level nitrogen addition 2_1	2011	Exclosure + Fertilization 3	2018

Appendix S2. Linear and power regression parameters for the hits:biomass calibration. Since the hits and biomass data were collected within a 0.16 m^2 area, the span of these data may not match that used to apply the calibration, which is at 1 m^2 scale. To account for this mismatch, the original hits and biomass data were first converted into density format (i.e. number of hits and biomass at 1 m^2 scale), and models were fitted on these density data. For the linear model, Y = aX+b, where X is hits density and Y is biomass density. For the power model, original equation was $Y = aX^b$; which after taking the natural log of both sides becomes: ln Y = b ln X + ln a; let Y' = ln Y and X' = ln X; linear equation is: Y'= aX' + b. To further check the appropriateness of the linear model, we checked the level of the correspondence of the standard errors resulting from two statistical methods: we computed both the standard linear regression estimates that result from fitting the linear model to the data and the bootstrap standard error estimates (a seed of one was set to this approach so that the results obtained can be reproduced precisely). There is a good correspondence between the standard estimates of SE (Slope) and SE (Intercept) and the bootstrap estimates, confirming that the linear model provides a good fit to the data.

*: The upper row of each SE for the linear model is statistic resulting from fitting the standard linear model to the data, and the lower row is statistic resulting from the bootstrap estimates.

ξ: Polynomial regression with a second-degree is used for species *Eriophorum vaginatum*, as it provides a better fit than the simple linear regression.

	R^2		P		Slope				Intercept			
					Value		1 SE*		Value		1 SE*	
	Linear	Power	Linear	Power	Linear	Power	Linear	Power	Linear	Power	Linear	Power
Betula glandulosa												
Foliar	0.79	0.53	<0.01	<0.01	0.37	0.51	0.03	0.06	7.48	1.24	2.20	0.23
							0.04				2.02	
Stem	0.63	0.47	<0.01	<0.01	0.89	0.40	0.09	0.06	42.29	2.98	6.29	0.17
							0.09				6.47	
Vaccinium uliginosum												
Foliar	0.60	0.55	<0.01	<0.01	0.15	0.39	0.02	0.05	2.08	0.66	0.61	0.15
							0.03				0.47	
Stem	0.15	0.11	<0.01	0.02	0.28	0.22	0.10	0.09	12.34	2.05	2.22	0.22
							0.08				2.30	
Rhododendron subarcticum												
Foliar	0.77	0.59	<0.01	<0.01	0.44	0.65	0.03	0.07	10.30	0.90	2.98	0.28
							0.04				2.85	
Stem	0.45	0.18	<0.01	<0.01	2.65	0.37	0.50	0.10	54.46	2.74	12.30	0.34
							0.46				13.21	
Vaccinium vitis-idaea												
Foliar	0.52	0.76	<0.01	<0.01	0.38	0.71	0.05	0.05	16.32	0.75	4.59	0.21
							0.05				4.22	
Stem	0.67	0.16	<0.01	<0.01	0.17	0.28	0.03	0.09	2.15	1.87	1.61	0.22
							0.03				1.16	
Andromeda polifolia												
Foliar	0.89	0.65	<0.01	<0.01	0.30	0.52	0.02	0.07	5.03	1.04	0.99	0.17
							0.03				1.02	
Stem	0.33	0.21	<0.01	<0.01	0.22	0.29	0.05	0.10	6.43	1.51	1.48	0.20
							0.06				1.57	
Eriophorum vaginatum												
	0.68	0.86	<0.01	<0.01	5.35	5.75	0.80	0.47	2.62	2.76	0.15	0.09
							0.83				0.25	
					-2.85ξ	1.71	0.80	0.47				
							0.52					

Appendix S3. Statistical results of the effects of greenhouse (G), low-level nitrogen addition (LN), high-level nitrogen addition (HN), high-level phosphorus addition (HP), high-level nitrogen + high-level phosphorus addition (HNHP), snowfence (SF), and exclosure (E) treatments on six vascular plant species' aboveground biomass after one year of manipulations in 2005. T-tests were used to compare each treatment with its corresponding control.

Treatments	G		LN		HN		HP		HNHP		SF		E	
Species	t	P	t	P	t	P	t	P	t	P	t	P	t	P
B. glandulosa	-1.56	0.15	0.05	0.96	-0.97	0.36	-0.39	0.71	-1.40	0.23	-0.62	0.56	-0.73	0.49
V. uliginosum	0.79	0.44	-0.63	0.55	0.09	0.93	-1.10	0.32	0.62	0.56	-1.11	0.31	0.23	0.83
R. subarcticum	-0.37	0.72	0.26	0.81	0.22	0.83	0.50	0.63	0.57	0.58	0.90	0.40	0.53	0.63
V. vitis-idaea	0.81	0.43	0.33	0.75	2.04	0.09	-0.36	0.73	0.86	0.42	0.58	0.58	-0.78	0.46
A. polifolia	-0.23	0.82	-0.49	0.64	-0.08	0.94	-1.40	0.22	1.09	0.32	-0.47	0.65	0.26	0.80
E. vaginatum	-0.61	0.55	0.06	0.95	0.03	0.98	1.55	0.16	-1.73	0.15	0.38	0.72	0.84	0.44

Appendix S4. Aboveground biomass of the six major vascular plant species and lichens and mosses in control and greenhouse plots for each of the plot point-framing years (2005, 2011, and 2017; n = 10). Mean values with standard deviation in parentheses are presented. Statistical test results are from post-hoc tests following repeated measures one-way ANOVA on three years. Symbols following z values indicate the significance levels: P ≥ 0.1: no symbol, P < 0.1†, P < 0.05*, P < 0.01**. NA: data are not available. Data were natural log transformed when necessary to perform the statistics to achieve the assumptions of constant variance and normality.

		2005 (g/m^2)	2011 (g/m^2)	2017 (g/m^2)	*z* (11 vs. 05)	*z* (17 vs. 11)	*z* (17 vs. 05)
Control							
B. glandulosa	Total	14.16 (7.27)	15.34 (7.50)	22.77 (12.23)	0.45	2.85*	3.30 **
	Foliar	3.13 (2.35)	4.58 (3.41)	7.93 (5.97)	1.03	2.38 *	3.41 **
	Stem	11.02 (5.08)	10.76 (4.37)	14.84 (7.15)	-0.18	2.74 *	2.56 *
V. uliginosum	Total	2.77 (0.82)	3.11 (1.51)	3.21 (1.55)	1.57	0.45	2.02
	Foliar	0.68 (0.72)	0.89 (1.05)	0.93 (0.98)	2.19 †	0.47	2.66 *
	Stem	2.08 (0.14)	2.22 (0.48)	2.28 (0.67)	0.93	0.37	1.30
R. subarcticum	Total	66.72 (25.58)	70.25 (23.93)	122.89 (85.98)	0.18	2.68 *	2.86 *
	Foliar	19.26 (4.23)	27.57 (5.69)	25.55 (10.26)	3.02 **	-0.74	2.28†
	Stem	47.46 (22.97)	42.68 (20.43)	97.35 (79.19)	-0.26	2.97 **	2.71 *
V. vitis-idaea	Total	13.53 (4.73)	15.98 (5.68)	23.21 (11.61)	0.80	2.36 *	3.16 **
	Foliar	12.95 (4.68)	15.57 (5.65)	22.41 (11.05)	0.88	2.31 †	3.19 **
	Stem	0.57 (0.23)	0.41 (0.12)	0.80 (0.65)	-1.00	2.45 *	1.45
A. polifolia	Total	2.93 (2.47)	2.65 (1.89)	5.74 (4.44)	-0.29	3.17 **	2.88 *
	Foliar	2.56 (1.92)	2.65 (1.89)	5.34 (4.15)	0.10	2.99 **	3.09 **
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	7.25 (1.52)	9.30 (2.75)	14.85 (15.79)	1.30	1.44	2.74 **
Lichen	Total	91.29 (22.71)	76.10 (36.77)	88.28 (48.90)	-1.86	1.49	-0.37
Moss	Total	93.37 (31.03)	92.96 (39.02)	62.55 (36.34)	-0.04	-2.99 **	-3.03 **
Greenhouse							
B. glandulosa	Total	10.27 (3.11)	12.90 (5.56)	25.90 (16.45)	0.75	3.72 **	4.48 **
	Foliar	2.35 (1.59)	3.65 (2.62)	8.49 (6.68)	0.91	3.38 **	4.29 **
	Stem	7.92 (1.57)	9.25 (3.10)	17.41 (10.36)	0.59	3.61 **	4.19 **
V. uliginosum	Total	3.06 (0.87)	2.05 (1.85)	4.34 (2.35)	-1.68	3.95 **	2.27 †
	Foliar	0.81 (0.52)	1.01 (0.98)	1.34 (1.16)	1.02	1.02	2.03
	Stem	2.25 (0.41)	2.08 (0.25)	3.00 (1.34)	-0.68	2.97 **	2.29 †
R. subarcticum	Total	63.45 (11.23)	67.89 (20.78)	154.53 (44.56)	0.37	7.14 **	7.50 **
	Foliar	19.18 (4.36)	28.93 (7.78)	37.01 (14.28)	2.41 *	2.00	4.41 **
	Stem	44.27 (10.33)	38.97 (15.48)	117.51 (42.99)	-0.45	6.67 **	6.22 **
V. vitis-idaea	Total	15.02 (3.47)	23.92 (4.86)	35.42 (12.80)	2.80 *	3.62 **	6.42 **
	Foliar	14.22 (3.05)	23.45 (4.88)	33.87 (11.93)	3.14 **	3.54 **	6.68 **
	Stem	0.80 (0.53)	0.47 (0.14)	1.55 (1.28)	-0.97	3.15 **	2.18 †
A. polifolia	Total	2.69 (2.26)	5.07 (5.91)	10.68 (14.62)	0.78	1.83	2.60
	Foliar	2.17 (1.73)	4.59 (5.13)	9.40 (12.58)	0.89	1.78	2.67 *
	Stem	1.32 (0.12)	NA	4.27 (0.43)	NA	NA	9.45 **
E. vaginatum	Total	6.90 (1.00)	7.68 (1.33)	30.90 (59.60)	0.39	2.49 *	2.88 *
Lichen	Total	100.27 (29.27)	51.30 (16.32)	23.71 (12.15)	-7.35 **	-4.14 **	-11.49 **
Moss	Total	102.08 (39.32)	48.42 (40.35)	42.69 (35.65)	-3.94 **	-0.42	-4.36 **

Appendix S5. Soil ammonium and phosphate fluxes during sequential incubations in the greenhouse plots, the snowfence plots, and their corresponding plots in 2017 growing season in mesic birch hummock tundra vegetation. Flux data were collected using the ion exchange membrane (IEM) *in situ* incubation method. A total of six incubations (R1-R6) were conducted in the greenhouse and their control plots, and a total of five incubations (R1-R5) were conducted in the snowfence and their control plots, with each incubation for nine to 17 days. Mean values with standard deviations in parentheses are presented. Degrees of freedom = 1, 18 (greenhouse effect) and 1, 8 (snowfence effect). Data were natural log transformed when necessary to perform statistics to achieve the assumptions of constant variance and normality. Symbols following *F* values indicate the significance levels: $P \geq 0.1$: no symbol, $P \leq 0.1$†, $P \leq 0.05$*.
B.D.: below detection; N.D: no data collected.

	Incubation round	Control for greenhouse (μg/cm²/d)	Greenhouse (μg/cm²/d)	*F*(greenhouse effect)	Control for snowfence (μg/cm²/d)	Snowfence (μg/cm²/d)	*F* (snowfence effect)
Ammonium flux	R 1	0.120 (0.06)	0.124 (0.10)	0.02	0.139 (0.02)	0.143 (0.03)	0.06
	R 2	0.141 (0.07)	0.145 (0.07)	0.04	0.150 (0.03)	0.151 (0.02)	0.02
	R 3	0.146 (0.08)	0.145 (0.07)	<0.01	0.163 (0.01)	0.163 (0.01)	<0.01
	R 4	0.172 (0.05)	0.172 (0.05)	<0.01	0.141 (0.01)	0.152 (0.02)	1.16
	R 5	0.065 (0.09)	0.030 (0.03)	0.44	B.D.	B.D.	
	R 6	0.032 (0.03)	0.026 (0.02)	0.19	N.D.	N.D.	
	Overall			0.22			0.77
Phosphate flux	R 1	0.050 (0.07)	0.380 (0.89)	1.54	0.023 (0.01)	0.038 (0.01)	10.38*
	R 2	0.043 (0.05)	0.070 (0.13)	0.02	0.053 (0.04)	0.060 (0.02)	0.64
	R 3	0.029 (0.06)	0.127 (0.29)	1.29	0.028 (0.02)	0.027 (0.01)	0.14
	R 4	0.007 (0.01)	0.035 (0.08)	4.81*	0.022 (0.02)	0.020 (0.01)	0.01
	R 5	0.009 (0.003)	0.012 (0.01)	1.52	0.042 (0.05)	0.031 (0.02)	0.03
	R 6	0.021 (0.02)	0.079 (0.15)	4.07	N.D.	N.D.	
	Overall			9.16*			1.36

Note: One major concern with the IEM method is its ability for estimating mineral fluxes in arctic ecosystems where soil nutrient mineralization rates are exceptionally low. To test its efficiency for picking up ammonium, nitrate and phosphate ions in low concentrations, we performed a reagent test in the lab before using this method in the field. We immersed pre-charged IEM membranes in a range of ammonium, nitrate or phosphate solutions of known concentrations for 1 h, then eluted the cations and anions from the membranes with 2 M NaCl in 0.1 M HCl solution for 2 h, and recoveries from the membranes were compared with those known concentrations. Results from this test showed that the membranes were able to accurately determine ammonium ion concentrations above 0.25 μg/cm², and nitrate and phosphate ion concentrations above 0.05 μg/cm². These detection limits were well below the actual amounts accumulated on the membranes in the field for ammonium and phosphate, but not for nitrate, for which about two thirds of the data were below the detection limit (and hence not reported here). Therefore, we conclude that the ammonium and phosphate data shown in this table are trustworthy.

Appendix S6. Aboveground biomass of the six major vascular plant species and lichens and mosses across all of the control plots (i.e. under ambient environmental conditions; n = 25) in mesic birch hummock tundra vegetation for each of the plot point-framing years (2005, 2011, and 2017). See 'Appendix S4' for detailed description of statistics.

		2005 (g/m^2)	2011 (g/m^2)	2017 (g/m^2)	*z* (11 vs. 05)	*z* (17 vs. 11)	*z* (17 vs. 05)
B. glandulosa	Total	14.34 (7.34)	15.25 (7.36)	23.54 (14.09)	0.55	5.04 **	5.60 **
	Foliar	3.95 (3.31)	4.29 (3.10)	7.76 (5.87)	0.48	4.25 **	4.66 **
	Stem	10.39 (4.61)	10.95 (4.47)	15.78 (8.65)	0.63	4.21 **	4.75 **
V. uliginosum	Total	3.45 (1.83)	3.29 (2.59)	4.45 (4.11)	-0.38	2.75 *	2.37 *
	Foliar	1.03 (1.11)	1.39 (1.75)	1.59 (2.07)	2.67 *	-0.16	2.05
	Stem	2.50 (0.83)	2.38 (0.58)	2.86 (2.11)	-1.05	1.58	0.80
R. subarcticum	Total	63.92 (24.12)	58.15 (23.02)	111.18 (61.41)	-0.62	5.70 **	5.08 **
	Foliar	20.93 (6.45)	24.28 (7.44)	27.74 (8.88)	1.95	1.80	3.62 **
	Stem	43.00 (20.34)	33.87 (17.69)	83.44 (55.98)	-1.06	5.56 **	4.55 **
V. vitis-idaea	Total	16.34 (5.75)	18.08 (5.92)	25.83 (9.34)	1.07	4.75 **	5.83 **
	Foliar	15.61 (5.60)	17.61 (5.88)	25.11 (9.00)	1.22	4.32 **	5.47 **
	Stem	0.73 (0.28)	0.48 (0.16)	0.72 (0.47)	-2.94 **	2.91 *	0.06
A. polifolia	Total	2.45 (2.24)	2.67 (2.68)	4.24 (4.01)	0.45	3.59 **	3.15 **
	Foliar	2.15 (1.84)	2.62 (2.60)	4.08 (3.83)	0.95	3.86 **	3.02 **
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.71 (1.12)	7.83 (2.37)	10.38 (10.45)	1.64	1.84	3.49**
Lichen	Total	104.56 (32.61)	85.79 (29.71)	116.46 (54.24)	-2.78 *	4.54 **	1.76
Moss	Total	95.37 (33.46)	96.29 (45.78)	59.66 (36.76)	0.12	-4.86 **	-4.74 **

Appendix S7. Aboveground biomass of the six major vascular plant species and lichens and mosses in control and low-level nitrogen addition (LN), high-level nitrogen addition (HN), high-level phosphorus addition (HP), and high-level nitrogen + high-level phosphorus addition (HNHP) plots for each of the plot point-framing years (2005, 2011, and 2017; n = 5). See 'Appendix S4' for detailed description of statistics.

		2005 (g/m^2)	2011 (g/m^2)	2017 (g/m^2)	*z* (11 vs. 05)	*z* (17 vs. 11)	*z* (17 vs. 05)
Control							
B. glandulosa	Total	10.58 (3.34)	11.71 (4.64)	19.45 (12.70)	0.35	2.38 *	2.73 *
	Foliar	3.28 (2.74)	2.46 (1.57)	5.59 (4.65)	-0.75	2.87 *	2.12 †
	Stem	7.30 (0.79)	9.25 (3.28)	13.86 (8.10)	0.79	1.87	2.66 *
V. uliginosum	Total	2.62 (0.70)	0.51 (0.39)	2.79 (0.68)	-8.07 **	8.71 **	0.65
	Foliar	0.54 (0.46)	0.51 (0.39)	0.60 (0.36)	-0.26	0.78	0.52
	Stem	2.08 (0.25)	NA	2.20 (0.36)	NA	NA	0.59
R. subarcticum	Total	66.03 (20.28)	55.69 (15.36)	120.28 (47.09)	-0.78	4.84 **	4.07 **
	Foliar	23.88 (7.37)	21.50 (6.77)	33.01 (8.49)	-1.03	5.01 **	3.98 **
	Stem	42.15 (13.08)	34.19 (11.04)	87.26 (42.03)	-0.61	4.04 **	3.43 **
V. vitis-idaea	Total	17.71 (8.78)	17.82 (2.10)	25.42 (5.66)	0.03	1.95	1.98
	Foliar	16.91 (8.64)	17.30 (2.10)	24.76 (5.52)	0.10	1.95	2.05
	Stem	0.80 (0.20)	0.52 (0)	0.66 (0.19)	-2.77 *	1.39	-1.39
A. polifolia	Total	1.65 (0.99)	3.23 (3.03)	3.35 (2.71)	1.57	0.14	1.71
	Foliar	1.65 (0.99)	3.23 (3.03)	3.35 (2.71)	1.63	0.45	2.08 †
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.84 (0.50)	7.52 (1.69)	8.82 (2.24)	0.99	1.88	2.86 *
Lichen	Total	119.86 (25.29)	106.17 (23.47)	125.93 (18.06)	-1.05	1.52	0.47
Moss	Total	100.61 (35.19)	89.43 (54.73)	42.48 (32.12)	-0.69	-2.88 *	-3.57 **
LN							
B. glandulosa	Total	10.50 (1.76)	11.86 (5.54)	17.70 (13.69)	0.31	1.31	1.62
	Foliar	2.31 (0.59)	2.61 (2.16)	5.96 (4.75)	0.20	2.26 †	2.46 *
	Stem	8.19 (1.61)	9.25 (3.62)	11.73 (9.19)	0.34	0.79	1.13
V. uliginosum	Total	2.85 (0.39)	3.09 (0.89)	3.45 (1.19)	0.65	0.99	1.65
	Foliar	0.65 (0.19)	1.00 (0.69)	1.03 (0.65)	1.73	0.14	1.88
	Stem	2.20 (0.23)	2.08 (0.25)	2.42 (0.70)	-0.42	1.26	0.84
R. subarcticum	Total	61.54 (33.64)	46.07 (17.46)	86.96 (43.22)	-1.03	2.72 *	1.69
	Foliar	20.45 (9.10)	18.78 (7.70)	28.89 (8.36)	-0.71	4.27 **	3.57 **
	Stem	41.09 (27.09)	27.29 (11.26)	58.07 (37.27)	-0.94	2.10 †	1.16
V. vitis-idaea	Total	16.10 (6.64)	17.51 (6.86)	23.47 (8.76)	0.58	2.44 *	3.02 **
	Foliar	15.30 (6.50)	16.99 (6.87)	22.91 (8.61)	0.72	2.51 *	3.23 **
	Stem	0.80 (0.20)	0.52 (0.12)	0.55 (0.19)	-2.53 *	0.32	-2.21 †
A. polifolia	Total	2.33 (1.59)	3.58 (2.43)	5.29 (2.82)	1.87	2.54 *	4.41 **
	Foliar	1.83 (1.67)	3.04 (1.98)	5.04 (2.89)	2.67 *	4.41 **	7.08 **
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.81 (0.77)	8.03 (1.75)	11.25 (3.26)	1.27	3.35 **	4.62 **
Lichen	Total	117.49 (21.70)	93.81 (15.87)	119.23 (57.13)	-1.46	1.57	0.11
Moss	Total	124.61 (41.62)	93.60 (28.39)	61.27 (39.87)	-2.24 †	-2.34 †	-4.58 **
HN							
B. glandulosa	Total	12.90 (4.17)	13.80 (3.83)	39.03 (15.34)	0.15	4.23 **	4.38 **
	Foliar	3.65 (2.74)	4.55 (2.37)	14.52 (6.70)	0.36	4.06 **	4.42 **
	Stem	9.25 (2.30)	9.25 (1.71)	24.51 (10.29)	0.00	3.91 **	3.91 **
V. uliginosum	Total	2.59 (0.27)	0.51 (0.26)	2.42 (0.26)	-16.04 **	14.75 **	-1.28
	Foliar	0.45 (0.12)	0.51 (0.26)	0.45 (0.26)	0.53	-0.53	0.00
	Stem	2.14 (0.15)	NA	1.97 (0)	NA	NA	-2.45 *
R. subarcticum	Total	61.37 (42.27)	31.34 (10.47)	30.83 (22.12)	-1.69	-0.03	-1.72
	Foliar	19.75 (17.60)	12.02 (4.86)	9.91 (10.91)	-1.00	-0.27	-1.27
	Stem	41.62 (25.01)	19.33 (6.22)	20.92 (11.66)	-2.22 *	0.16	-2.06 *
V. vitis-idaea	Total	8.77 (4.32)	4.00 (1.29)	2.96 (0)	-3.37 **	-0.73	-4.10 **
	Foliar	8.15 (4.20)	4.00 (1.29)	2.61 (0)	-3.02 **	-1.01	-4.03 **
	Stem	0.62 (0.26)	NA	0.34 (0)	NA	NA	-2.36 *
A. polifolia	Total	1.96 (1.33)	1.95 (2.57)	2.06 (2.17)	-0.01	0.16	0.15
	Foliar	1.71 (1.13)	1.95 (2.57)	1.77 (1.53)	0.43	-0.32	0.11
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.82 (0.68)	11.76 (6.14)	26.74 (38.84)	1.31	0.91	2.22 †
Lichen	Total	101.48 (43.42)	53.04 (23.87)	6.11 (4.75)	-3.15 **	-3.05 **	-6.20 **
Moss	Total	122.80 (22.03)	61.07 (57.16)	4.82 (10.78)	-2.72 *	-2.48 *	-5.20 **

Appendix S7 cont'd

		2005 (g/m^2)	2011 (g/m^2)	2017 (g/m^2)	*z* (11 vs. 05)	*z* (17 vs. 11)	*z* (17 vs. 05)
HP							
B. glandulosa	Total	11.41 (3.35)	14.36 (5.89)	15.54 (8.91)	0.96	0.39	1.35
	Foliar	3.58 (2.45)	4.40 (2.73)	4.70 (3.81)	0.58	0.21	0.80
	Stem	7.83 (1.16)	9.96 (3.17)	10.85 (5.16)	1.18	0.49	1.66
V. uliginosum	Total	3.39 (1.42)	3.77 (2.13)	4.76 (3.33)	0.61	1.55	2.16 †
	Foliar	0.86 (0.63)	1.35 (1.41)	1.67 (1.73)	1.27	0.82	2.10 †
	Stem	2.53 (0.81)	2.42 (0.72)	3.08 (1.62)	-0.35	2.10 †	1.75
R. subarcticum	Total	58.90 (24.94)	39.73 (18.05)	97.44 (61.01)	-0.88	2.64 *	1.77
	Foliar	18.34 (6.57)	14.04 (5.16)	22.91 (12.32)	-1.12	2.30 †	1.18
	Stem	40.56 (18.95)	25.70 (13.35)	74.53 (48.98)	-0.82	2.68 *	1.87
V. vitis-idaea	Total	20.01 (11.08)	10.69 (3.65)	14.23 (5.97)	-1.95	0.74	-1.21
	Foliar	19.45 (10.96)	10.69 (3.65)	13.61 (5.85)	-1.86	0.62	-1.24
	Stem	0.55 (0.29)	NA	0.62 (0.23)	NA	NA	0.78
A. polifolia	Total	3.95 (3.05)	2.75 (3.01)	1.72 (1.88)	-1.76	-1.51	-3.26 **
	Foliar	3.41 (3.16)	2.50 (2.45)	1.47 (1.33)	-1.33	-1.51	-2.83 *
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.31 (0.57)	7.83 (1.75)	9.13 (2.05)	2.37 *	2.04	4.41 **
Lichen	Total	123.79 (28.75)	85.72 (35.34)	81.94 (33.36)	-4.81 **	-0.48	-5.29 **
Moss	Total	76.00 (25.45)	68.66 (29.82)	71.81 (22.94)	-0.54	0.23	-0.31
HNHP							
B. glandulosa	Total	18.24 (11.79)	25.80 (16.99)	74.15 (46.88)	0.49	3.16 **	3.65 **
	Foliar	5.44 (4.60)	9.98 (7.49)	30.31 (18.11)	0.86	3.86 **	4.73 **
	Stem	12.80 (7.24)	15.81 (9.78)	43.84 (29.88)	0.29	2.67 *	2.96 **
V. uliginosum	Total	2.42 (0.16)	2.51 (0.45)	2.36 (0.12)	0.54	-0.89	-0.36
	Foliar	0.39 (0.13)	0.48 (0.33)	0.33 (0)	0.84	-1.41	-0.56
	Stem	2.03 (0.12)	2.03 (0.12)	NA	0.00	NA	NA
R. subarcticum	Total	57.83 (24.68)	20.14 (13.62)	20.77 (15.60)	-3.20 **	0.05	-3.15 **
	Foliar	18.87 (8.30)	7.18 (5.85)	6.74 (5.72)	-2.75 *	-0.10	-2.85 *
	Stem	38.97 (17.76)	12.96 (8.09)	14.02 (10.45)	-3.22 **	0.13	-3.09 **
V. vitis-idaea	Total	13.73 (5.46)	3.15 (0.58)	3.88 (1.00)	-5.20 **	0.36	-4.84 **
	Foliar	13.15 (5.48)	3.15 (0.58)	3.53 (1.00)	-4.89 **	0.19	-4.70 **
	Stem	0.59 (0.29)	NA	0.34 (0)	NA	NA	-1.87 †
A. polifolia	Total	1.30 (0.47)	1.29 (0.92)	0.80 (0)	-0.02	-1.28	-1.30
	Foliar	1.05 (0.25)	1.29 (0.92)	0.80 (0)	0.69	-1.39	-0.69
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	8.42 (1.99)	78.33 (80.05)	104.12 (125.15)	3.16 **	0.27	3.42 **
Lichen	Total	107.71 (28.70)	41.73 (18.03)	4.31 (3.84)	-6.00 **	-3.41 **	-9.41 **
Moss	Total	79.48 (46.65)	25.25 (27.18)	28.77 (39.98)	-2.89 *	0.19	-2.70 *

Appendix S8. Aboveground biomass of the six major vascular plant species and lichens and mosses in control and snowfence plots in each of the plot point-framing years (2005, 2011, and 2017; n = 5). See 'Appendix S4' for detailed description of statistics.

		2005 (g/m^2)	2011 (g/m^2)	2017 (g/m^2)	*z* (11 vs. 05)	*z* (17 vs. 11)	*z* (17 vs. 05)
Control							
B. glandulosa	Total	13.73 (3.56)	14.12 (5.24)	18.94 (7.15)	0.17	2.16 †	2.34 †
	Foliar	3.95 (1.31)	3.80 (2.31)	5.96 (3.20)	-0.14	1.38	1.29
	Stem	9.78 (3.05)	10.31 (3.20)	12.98 (4.30)	0.43	1.15	1.37
V. uliginosum	Total	4.65 (2.63)	4.43 (2.38)	5.52 (4.27)	-0.25	1.29	1.04
	Foliar	1.67 (1.51)	1.91 (1.74)	2.05 (1.89)	0.86	0.13	0.34
	Stem	2.97 (1.12)	2.53 (0.68)	3.47 (2.42)	-1.30	0.83	0.44
R. subarcticum	Total	61.37 (24.86)	33.62 (13.85)	68.60 (5.75)	-3.47 **	4.38 **	0.91
	Foliar	19.75 (10.23)	15.88 (6.77)	22.21 (4.17)	-1.41	1.40	0.54
	Stem	41.62 (15.08)	17.74 (7.87)	46.40 (5.10)	-4.63 **	4.49 **	0.75
V. vitis-idaea	Total	17.01 (4.34)	18.29 (7.11)	25.67 (9.60)	0.48	2.77 *	3.25 **
	Foliar	16.14 (3.97)	17.91 (7.10)	25.22 (9.41)	0.70	1.53	1.90
	Stem	0.87 (0.41)	0.38 (0.08)	0.45 (0.23)	-2.80 *	0.40	-2.40 *
A. polifolia	Total	3.48 (3.15)	3.47 (4.68)	4.80 (5.22)	-0.01	1.27	1.26
	Foliar	2.98 (2.77)	3.47 (4.68)	4.80 (5.22)	0.36	0.47	0.64
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.15 (0.50)	6.19 (0.46)	6.72 (0.96)	0.47	1.12	1.20
Lichen	Total	120.88 (21.44)	89.85 (18.76)	158.97 (51.03)	-1.98	4.40 **	2.43 *
Moss	Total	89.93 (42.25)	75.76 (53.11)	55.62 (45.26)	-0.74	-1.05	-1.78
Snowfence							
B. glandulosa	Total	12.25 (4.03)	12.10 (3.95)	15.32 (5.34)	-0.06	1.23	1.18
	Foliar	3.36 (1.89)	3.21 (1.85)	4.47 (1.87)	-0.28	1.07	0.94
	Stem	8.90 (2.31)	8.90 (2.31)	10.85 (3.90)	0.00	0.97	0.97
V. uliginosum	Total	3.19 (1.29)	3.41 (1.26)	3.48 (1.48)	0.49	0.18	0.67
	Foliar	0.83 (0.58)	1.26 (1.03)	1.12 (1.03)	1.58	-0.25	0.50
	Stem	2.36 (0.72)	2.14 (0.37)	2.36 (0.46)	-0.65	0.65	0.00
R. subarcticum	Total	80.81 (41.69)	83.16 (32.12)	73.13 (58.38)	0.11	-0.45	-0.35
	Foliar	22.21 (12.22)	27.74 (13.01)	20.36 (13.61)	1.06	-0.90	-0.22
	Stem	58.60 (30.74)	55.42 (22.95)	52.76 (45.76)	-0.40	-0.11	-0.25
V. vitis-idaea	Total	18.76 (5.17)	21.90 (5.57)	20.09 (12.44)	0.84	-0.49	0.36
	Foliar	17.68 (5.26)	21.45 (5.45)	19.22 (12.02)	1.93	-0.39	0.27
	Stem	1.08 (0.81)	0.45 (0.16)	0.87 (0.58)	-1.91	1.14	-0.57
A. polifolia	Total	2.70 (1.89)	1.41 (0.57)	2.63 (1.87)	-2.51 *	2.36 *	-0.14
	Foliar	1.95 (1.29)	1.41 (0.57)	2.38 (1.74)	-1.28	1.11	0.49
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.35 (1.06)	7.65 (1.99)	12.83 (11.74)	2.52 *	0.98	1.23
Lichen	Total	96.32 (18.62)	68.42 (12.99)	65.36 (42.74)	-1.95	-0.21	-2.16 †
Moss	Total	105.36 (44.13)	144.37 (77.78)	78.62 (42.44)	2.47 *	-4.15 **	-1.69

Appendix S9. Aboveground biomass of the six major vascular plant species and lichens and mosses in control and exclosure plots in each of the plot point-framing years (2005, 2011, and 2017; n = 5). See 'Appendix S4' for detailed description of statistics.

		2005 (g/m^2)	2011 (g/m^2)	2017 (g/m^2)	*z* (11 vs. 05)	*z* (17 vs. 11)	*z* (17 vs. 05)
Control							
B. glandulosa	Total	19.06 (11.59)	19.72 (10.35)	33.77 (21.52)	0.13	2.70 *	2.83 *
	Foliar	6.26 (5.91)	6.04 (3.89)	11.40 (8.23)	-0.24	1.25	1.20
	Stem	12.80 (6.22)	13.68 (6.50)	22.38 (13.37)	0.66	1.32	1.46
V. uliginosum	Total	4.45 (2.48)	5.28 (3.59)	7.53 (7.52)	0.48	1.29	1.76
	Foliar	1.59 (1.49)	2.75 (2.92)	3.45 (3.59)	1.73	0.37	0.99
	Stem	2.86 (1.05)	2.53 (0.71)	4.08 (3.99)	-2.05 *	0.85	0.67
R. subarcticum	Total	58.78 (30.36)	60.95 (18.12)	121.25 (30.03)	0.13	3.56 **	3.69 **
	Foliar	22.47 (5.24)	28.89 (4.07)	32.40 (5.89)	2.97 **	1.07	3.02 **
	Stem	36.31 (28.06)	32.07 (15.17)	88.85 (25.48)	-0.29	3.81 **	3.52 **
V. vitis-idaea	Total	19.90 (3.68)	22.34 (6.99)	31.66 (5.96)	0.71	2.69 *	3.40 **
	Foliar	19.07 (3.65)	21.68 (7.05)	30.75 (5.83)	1.18	2.52 *	3.24 **
	Stem	0.83 (0.15)	0.66 (0.23)	0.90 (0.38)	-1.41	1.39	0.40
A. polifolia	Total	0.99 (0.41)	1.35 (0.75)	1.59 (1.28)	0.79	0.53	1.32
	Foliar	0.99 (0.41)	1.35 (0.75)	1.59 (1.28)	1.46	0.39	0.98
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.07 (0.35)	6.87 (1.90)	6.66 (1.20)	1.19	-0.26	0.72
Lichen	Total	99.49 (54.99)	80.73 (23.36)	120.87 (70.43)	-1.02	2.19 †	1.17
Moss	Total	99.55 (37.72)	130.36 (35.60)	75.09 (36.74)	1.60	-2.86 *	-1.27
Exclosure							
B. glandulosa	Total	14.66 (6.85)	13.24 (3.30)	21.08 (14.91)	-0.36	1.97	1.61
	Foliar	4.70 (4.15)	4.70 (2.57)	5.44 (3.12)	0.00	0.36	0.36
	Stem	9.96 (2.70)	8.54 (0.89)	15.64 (11.95)	-1.41	1.32	1.06
V. uliginosum	Total	4.85 (3.04)	4.90 (3.30)	5.83 (3.35)	0.13	2.19 †	2.31 †
	Foliar	1.88 (2.02)	2.43 (2.77)	2.69 (2.56)	1.35	0.17	0.52
	Stem	2.97 (1.09)	2.47 (0.53)	3.14 (0.82)	-1.56	1.25	0.31
R. subarcticum	Total	65.96 (3.46)	62.15 (22.40)	100.86 (28.79)	-0.29	2.95 **	2.66 *
	Foliar	20.10 (3.35)	22.12 (5.07)	26.86 (6.17)	0.76	1.49	2.12 †
	Stem	45.87 (5.31)	40.03 (21.51)	73.99 (23.18)	-0.50	2.90 *	2.40 *
V. vitis-idaea	Total	17.73 (4.99)	21.38 (3.78)	30.50 (10.92)	0.89	2.23 †	3.12 **
	Foliar	16.68 (4.87)	20.68 (3.79)	29.60 (10.16)	2.66 *	1.83	2.66 *
	Stem	1.04 (0.33)	0.69 (0.35)	0.90 (0.77)	-2.31 *	0.58	-0.39
A. polifolia	Total	1.05 (0.33)	1.89 (0.76)	2.57 (1.67)	1.30	1.03	2.34 †
	Foliar	1.05 (0.33)	1.89 (0.76)	2.32 (1.32)	2.74 *	0.69	2.06 †
	Stem	NA	NA	NA	NA	NA	NA
E. vaginatum	Total	6.43 (0.90)	6.60 (1.41)	7.12 (1.82)	0.67	0.54	0.72
Lichen	Total	88.35 (41.51)	88.10 (22.29)	126.65 (47.07)	-0.01	2.08 †	2.07 †
Moss	Total	95.80 (25.27)	158.90 (39.92)	85.73 (36.88)	4.24 **	-4.91 **	-0.68