Oikos

OIK-07257

van Zuijlen, K., Roos, R. E., Klanderud, K., Lang, S. I., Wardle, D. A. and Asplund, J. 2020. Decomposability of lichens and bryophytes from across an elevational gradient under standardized conditions. – Oikos doi: 10.1111/oik.07257

Appendix 1

Table A1. Temperature parameters for each elevation (m a.s.l.) from 6 September 2016 to 21 August 2017. Mean ± SE of mean annual temperature (MAT, °C), temperature at coldest day (MinT, °C), temperature at warmest day (MaxT, °C), number of diurnal freeze-thaw cycles (FTC), mean January temperature (JanT, °C), mean July temperature (JulyT, °C), and growing degree days (GDD; number of days when average temperature exceeded 5 °C). Values are averaged over the plots (n=4 or n=5) per elevation. Data from Roos et al. (2019).

Elevation	n	MAT	MinT	MaxT	FTC	JanT	JulyT	GDD
1120	5	1.2 ±0.03	-18.5 ±0.27	16.1 ±0.33	138 ±1.58	-5.6 ±0.01	10.4 ±0.07	119 ±0.75
1240	4	1.4 ±0.11	-16.1 ±0.29	15.7 ±0.19	122 ±5.12	-3.8 ±0.27	9.4 ±0.08	106 ±0.91
1360	5	0.9 ±0.25	-15.0 ±1.47	15.5 ±0.35	103 ±9.83	-4.5 ±0.83	8.6 ±0.12	97 ±0.80
1480	5	-0.7 ±0.05	-17.0 ±0.30	14.2 ±0.13	90 ±9.55	-7.0 ±0.08	7.3 ±0.12	81 ±0.89
1600	4	-0.4 ±0.43	-14.1 ±3.34	14.1 ±0.07	65 ±4.85	-4.6 ±1.23	6.7 ±0.08	65 ±1.04

Table A2. Correlation matrix (across n = 25 plots) of elevation, community-weighted functional traits of cryptogams (nitrogen (N) and phosphorus (P) concentration, N:P ratio, pH, and water holding capacity (WHC)), the cover of bryophytes relative to total cryptogam cover (BRYO), and community-weighted decomposability of cryptogams. Values denote Spearman's rho correlation coefficients and those in bold denote significant effects at $p < 0.05$.

	Elevation	N	P	N:P	pH	WHC	BRYO
N	0.38						
P	**-0.62**	0.37					
N:P	**0.90**	0.25	**-0.74**				
pH	0.01	**0.55**	**0.55**	-0.12			
WHC	**-0.65**	-0.01	**0.65**	**-0.67**	0.24		
BRYO	-0.18	**0.60**	**0.69**	-0.33	0.38	**0.48**	
Decomposability	0.29	0.37	-0.07	0.27	-0.11	-0.29	-0.21

Table A3. Mean (± SE) of lichen and bryophyte decomposability (decay rate k (90 day^{-1})) and relative cover (% of total cover) of species and species groups from each of five different elevations (m a.s.l.). If cover and/or decay rate are only available for one plot at a given elevation, no standard error is given.

	1120	1240	1360	1480	1600
Alectoria ochroleuca					
Relative cover (%)	–	–	–	3.31 (± 1.33)	–
Decomposability	–	–	–	0.52 (± 0.04)	–
Cetraria spp.					
Relative cover (%)	4.80 (± 0.95)	3.48 (± 2.00)	7.72 (± 3.02)	20.31 (± 4.75)	21.12 (± 6.86)
Decomposability	0.38 (± 0.03)	0.31 (± 0.05)	0.29 (± 0.02)	0.40 (± 0.03)	0.46 (± 0.03)
Cladonia arbuscula					
Relative cover (%)	31.96 (± 7.68)	50.20 (± 6.19)	55.21 (± 6.67)	17.68 (±12.51)	3.89 (± 0.69)
Decomposability	0.24 (± 0.01)	0.22 (± 0.01)	0.19 (± 0.02)	0.19 (± 0.02)	0.18 (± 0.01)
Cladonia gracilis					
Relative cover (%)	1.13 (± 0.07)	0.83 (± 0.06)	0.80 (± 0.06)	1.05 (± 0.13)	2.71 (± 0.48)
Decomposability	0.25 (± 0.01)	0.29 (± 0.02)	0.16 (± 0.00)	0.19 (± 0.01)	0.26 (± 0.02)
Cladonia rangiferina/stygia					
Relative cover (%)	26.41 (± 9.06)	13.81 (± 1.73)	12.13 (± 3.04)	3.62 (± 2.57)	–
Decomposability	0.22 (± 0.01)	0.20 (± 0.01)	0.15 (± 0.01)	0.17 (± 0.00)	–
Cladonia spp.					
Relative cover (%)	–	–	–	–	15.51 (± 7.89)
Decomposability	–	–	–	–	0.28 (± 0.02)
Cladonia uncialis					
Relative cover (%)	–	0.43 (± 0.23)	1.25 (± 0.17)	1.98 (± 0.45)	6.99 (± 3.14)
Decomposability	–	0.17 (± 0.03)	0.12 (± 0.00)	0.16 (± 0.01)	0.16 (± 0.01)
Dicranum spp.					
Relative cover (%)	3.85 (± 1.47)	0.75 (± 0.14)	9.31 (± 5.93)	2.04 (± 1.12)	11.62 (± 5.88)
Decomposability	0.17 (± 0.01)	0.20 (± 0.00)	0.18 (± 0.01)	0.14 (± 0.02)	0.15 (± 0.02)
Flavocetraria cucullata					
Relative cover (%)	–	1.16 (± 0.80)	1.61 (± 0.96)	1.85 (± 0.81)	–
Decomposability	–	0.30	0.47	0.50 (± 0.01)	–

Table S1 continued

	1120	1240	1360	1480	1600
Flavocetraria nivalis					
Relative cover (%)	6.56 (± 2.03)	–	–	37.02 (± 9.43)	7.68 (± 2.89)
Decomposability	0.33 (± 0.02)	–	–	0.36 (± 0.03)	0.39 (± 0.03)
Hylocomium splendens					
Relative cover (%)	4.47 (± 2.61)	0.25	0.50 (± 0.12)	–	–
Decomposability	0.15 (± 0.01)	0.14 (± 0.00)	0.15 (± 0.00)	0.14 (± 0.01)	–
Paraleucobryum enerve					
Relative cover (%)	–	–	–	0.26 (± 0.01)	2.57 (± 0.87)
Decomposability	–	–	–	0.15	0.17 (± 0.00)
Pleurozium schreberi					
Relative cover (%)	14.43 (± 6.88)	23.60 (± 5.68)	8.49 (± 2.57)	–	–
Decomposability	0.19 (± 0.01)	0.22 (± 0.01)	0.20 (± 0.01)	0.18 (± 0.01)	–
Polytrichum alpinum					
Relative cover (%)	–	–	–	3.44 (± 2.12)	8.79 (± 4.55)
Decomposability	–	–	–	0.32 (± 0.03)	
Polytrichum hyperboreum					
Relative cover (%)	–	–	–	9.08 (± 5.83)	15.28 (± 5.03)
Decomposability	–	–	–	0.28 (± 0.03)	0.30 (± 0.04)
Polytrichum piliferum					
Relative cover (%)	–	–	–	1.33 (± 0.44)	–
Decomposability	–	–	–	0.27	–
Polytrichum strictum					
Relative cover (%)	–	0.50	2.11 (± 1.31)	–	–
Decomposability	–	0.17	0.18 (± 0.01)	–	–
Ptilidium ciliare					
Relative cover (%)	8.61 (± 2.21)	0.56 (± 0.15)	1.28 (± 0.20)	1.10 (± 0.84)	–
Decomposability	0.25 (± 0.01)	0.22 (± 0.01)	0.21 (± 0.03)	0.26 (± 0.01)	–

Table S1 continued

	1120	1240	1360	1480	1600
Racomitrium lanuginosum					
Relative cover (%)	–	–	–	–	21.16 (± 8.94)
Decomposability	–	–	–	–	0.14 (± 0.01)
Racomitrium microcarpon					
Relative cover (%)	–	–	–	–	3.09
Decomposability	–	–	–	–	0.25
Stereocaulon sp.					
Relative cover (%)	–	6.22 (± 2.09)	–	1.00 (± 0.07)	9.05 (± 4.75)
Decomposability	–	0.39 (± 0.06)	–	0.48 (± 0.01)	0.42 (± 0.01)

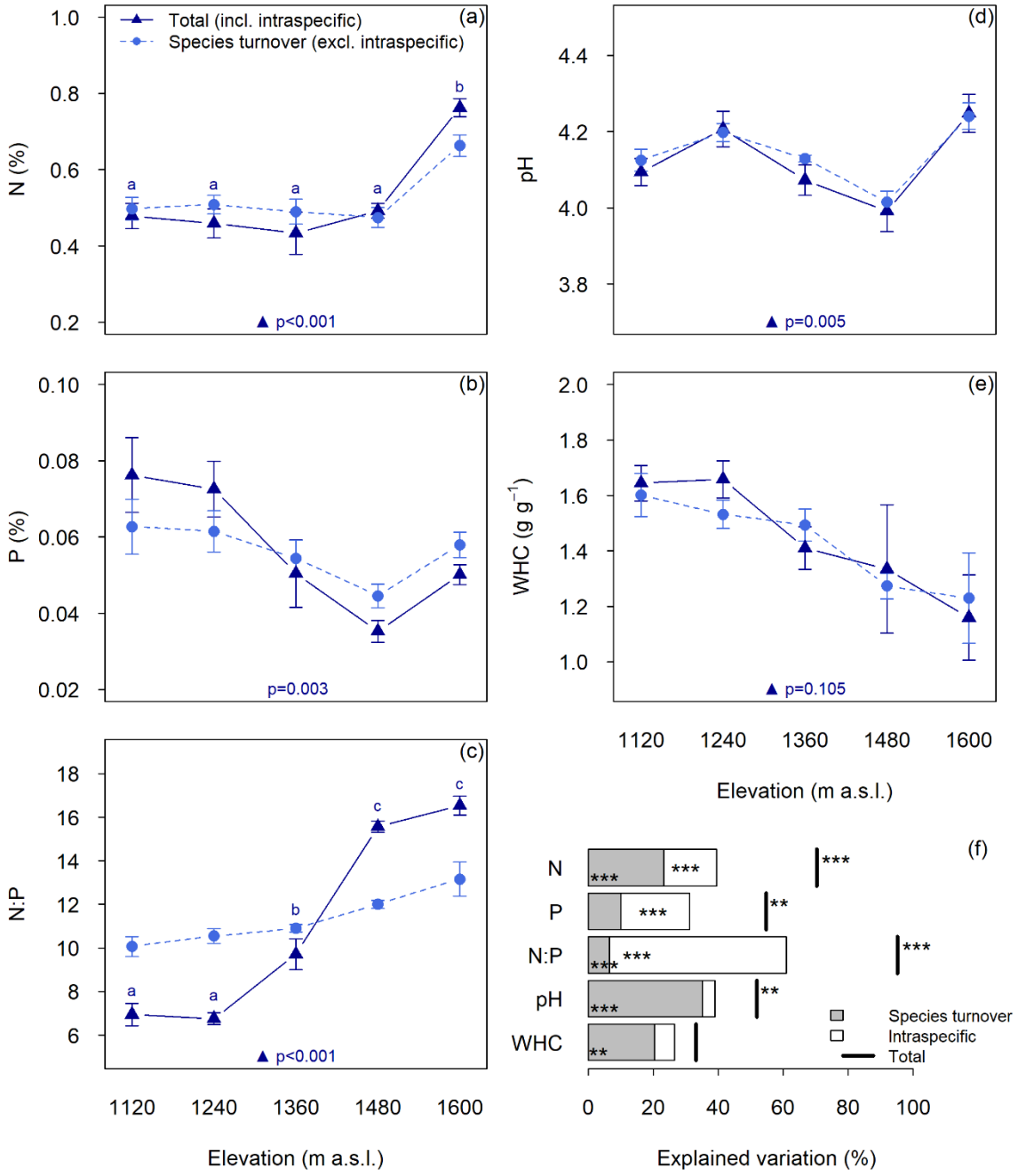

Figure A1. Community weighted mean functional traits of lichens and bryophytes across elevation, calculated from data presented in Roos et al. (2019): (a) nitrogen (N), (b) phosphorous (P), (c) N:P ratio, (d) pH and (e) water holding capacity (WHC). The solid line with triangles denote total variation, the dotted line with circles denote species turnover effects only (species turnover and changes in species abundance). Different letters indicate significant differences in total trait variation between elevation levels at $\alpha = 0.05$, using pairwise permutation tests. The variation explained by elevation is shown in (f): grey parts of the columns correspond to species turnover effects, white parts correspond to intraspecific variability effects and black bars denote the total variation, i.e. the sum of species turnover and intraspecific variability and their covariation. Significant differences are denoted with ** ($p<0.01$) and *** ($p<0.001$).

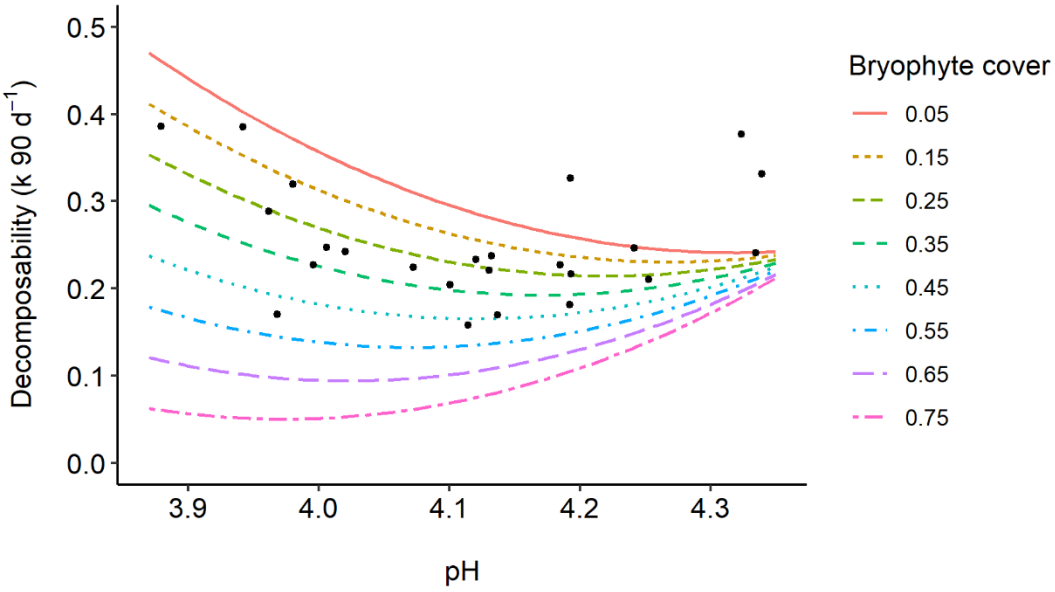

Figure A2. Community-weighted mean decomposability (decay rate k (90 day^{-1})) of total cryptograms (lichens and bryophytes) explained by community-weighted mean pH. Black dots denote the actual measurements at plot-level, while lines denote model predictions of the regression model presented in Table 1. Different lines represent predictions with different covers of bryophytes as a proportion of total cryptogam cover. Model predictors not shown in the figure (i.e. nitrogen and phosphorous) were set to mean values.

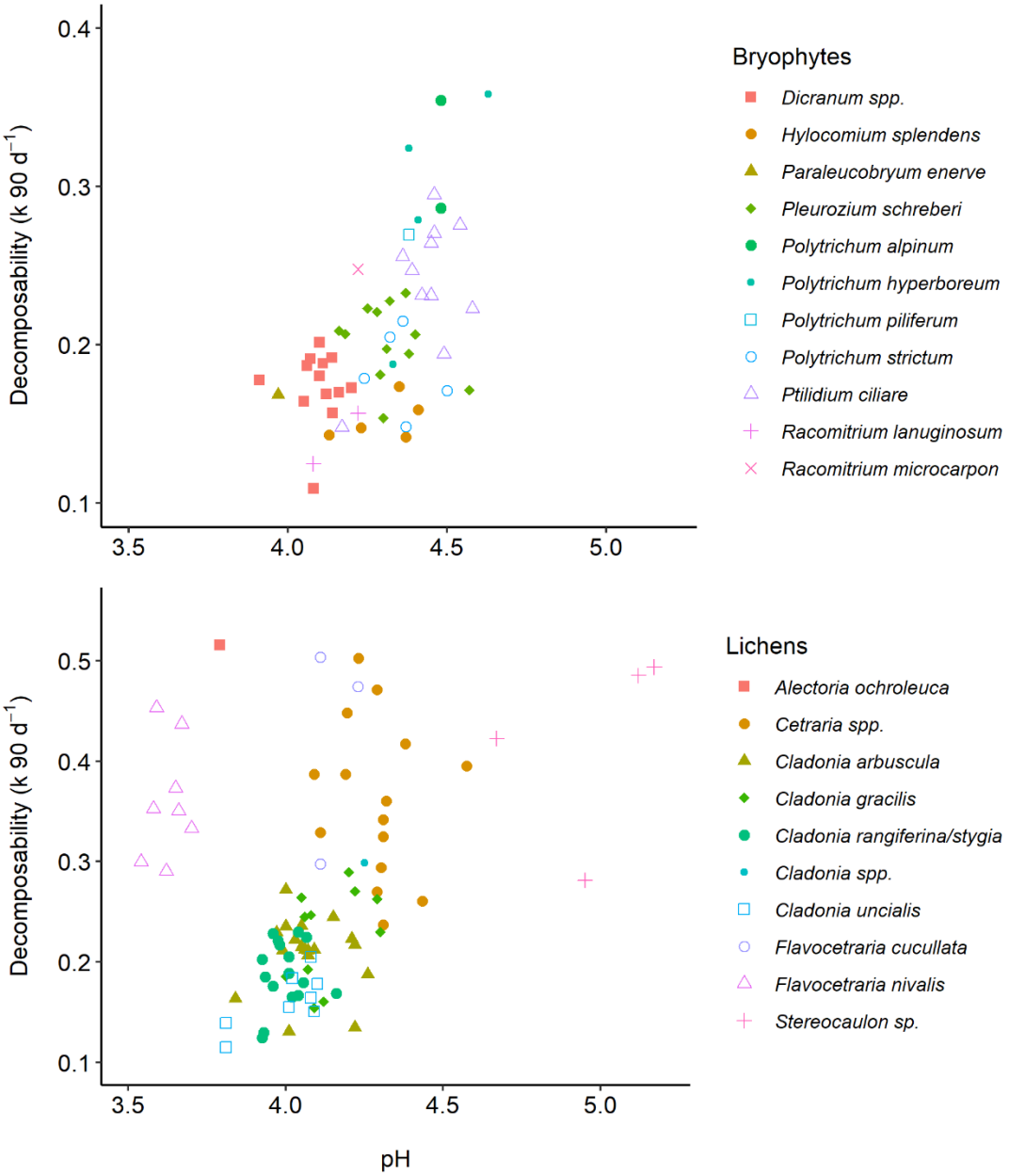

Figure A3. Decomposability (decay rate k (90 day^{-1})) as a function of pH of bryophytes (upper panel) and lichens (lower panel). Different symbols and colours indicate different species.

References

Roos, R. E. et al. 2019. Contrasting drivers of community-level trait variation for vascular plants, lichens and bryophytes across an elevational gradient. - Funct. Ecol. 33: 2430–2466.