Ecography

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Supplementary material

APPENDIX 1

1. Detailed description of the field sampling and sample characterization protocols.

In July-September 2003, 99 ponds were sampled for a number of physical and chemical water parameters and cladoceran zooplankton communities. Three neighboring ponds were sampled per sampling day. To uncouple sampling time from geographic location, thirty- three groups of three neighboring ponds were selected prior to the sampling campaign and the sampling sequence of these groups was randomized. In each pond, pH, conductivity, temperature, alkalinity and water transparency were measured in situ as described in De Bie et al. (2012). The percentage cover of the total macrophyte vegetation as well as of the submerged, floating and emergent macrophytes separately was estimated. For the chemical analysis of water quality, a tube sampler (length 1.5 m; diameter 75 mm) was used to collect a depth-integrated sample of pond water in the open water part of each pond. For zooplankton, 6-L water samples were collected using a tube sampler at 8 different locations in the pond, according to a predefined grid (4 samples in the littoral and 4 samples in the open water area). The 8 samples were pooled and samples for crustacean zooplankton were taken by filtering 40 L through a 64-µm conical net, after which the zooplankton samples were stored on formaldehyde. Fish abundances were assessed by applying point abundance sampling with electrofishing. The anode was immersed in each pond at eight randomly chosen locations and fish were collected with a hand net.

Water samples were analyzed for the concentration of chlorophyll a, nutrients (total phosphorus and nitrates), alkalinity and some major ions (calcium, chloride and

sulphate ions, water hardness). Chlorophyll a concentrations were determined spectrophotometrically. Total phosphorus concentration was measured with the ascorbic acid method after perchlorate digestion (Murphy & Riley 1962). Nitrate concentration was determined in GF/F filtered water samples with a Technicon autoanalyser III. Concentrations of sulphates, chlorides, calcium, and alkalinity and hardness were measured following standard methods according to the Hach Water Analysis Handbook (Hach 1992).

2. Molecular-phylogenetic tree reconstruction

We built a molecular-phylogenetic tree for the 35 cladoceran species occurring in the selected metacommunity (91 ponds) according to a recently developed protocol (Roquet et al. 2013). Information on four molecular markers (COI, and 16S, 18S and 28S rDNA) was extracted from Genbank for the 35 species using the browser "Geneious". This was also done for Sida crystallina, which was not present in the metacommunity but was included as an out-group since it is hierarchically ancestral to all the other cladoceran species included in our study (Braband et al. 2002). The sequences were aligned using the EMBL-EBI web-server (http://www.ebi.ac.uk/Tools/webservices/) under six different alignment models (Clustal omega, Clustal W2, Kalign, MAFFT, MUSCLE and PRANK). The quality of the aligned output files was checked in Bioedit. Per genetic marker, the best alignment was chosen using MUMSA (Lassmann & Sonnhammer 2006) (http://msa.sbc.su.se/cgi-bin/msa.cgi). Since all alignments had an AOS score (average overlap score) above 0.5, we used the highest MOS (multiple overlap score) to select the best alignment model for each molecular marker. After selecting the best alignments, the aligned sequences were trimmed using the automated 1 algorithm in

the online software Phylemon2 (Sanchez et al. 2011) (http://phylemon2.bioinfo.cipf.es/). Afterwards a single, concatenated supermatrix with the aligned sequences of all four markers was constructed. For eight species present in our data set no molecular information was yet available in Genbank, and we replaced them by their sister species following recommendations in Helmus et al. (2010) and (Cadotte 2013) (Table A1). Based on literature (Table A2) a constraint tree was constructed [for a similar example of the usage of constraint trees for freshwater zooplankton phylogeny reconstruction see (Helmus et al. 2010)]. This constraint tree is used as the backbone of the phylogeny and constrains the deeper nodes of the tree according to previous information. This allows us to assess species relationships within uncontested groups of species and to estimate branch lengths based on molecular information contained in our supermatrix. The constrained nodes are indicated in Fig. A1. Maximum Likelihood (ML) tree reconstruction and bootstrapping was performed using RAxML (thorough ML searches and rapid bootstrapping algorithm) (http://phylobench.vital-it.ch/raxml-bb/) (Stamatakis 2006). Finally, an ultrametric tree was constructed using the Penalized Likelihood method (Kim & Sanderson 2008) by applying the function chronos in the package **ape** in R (Reference R).

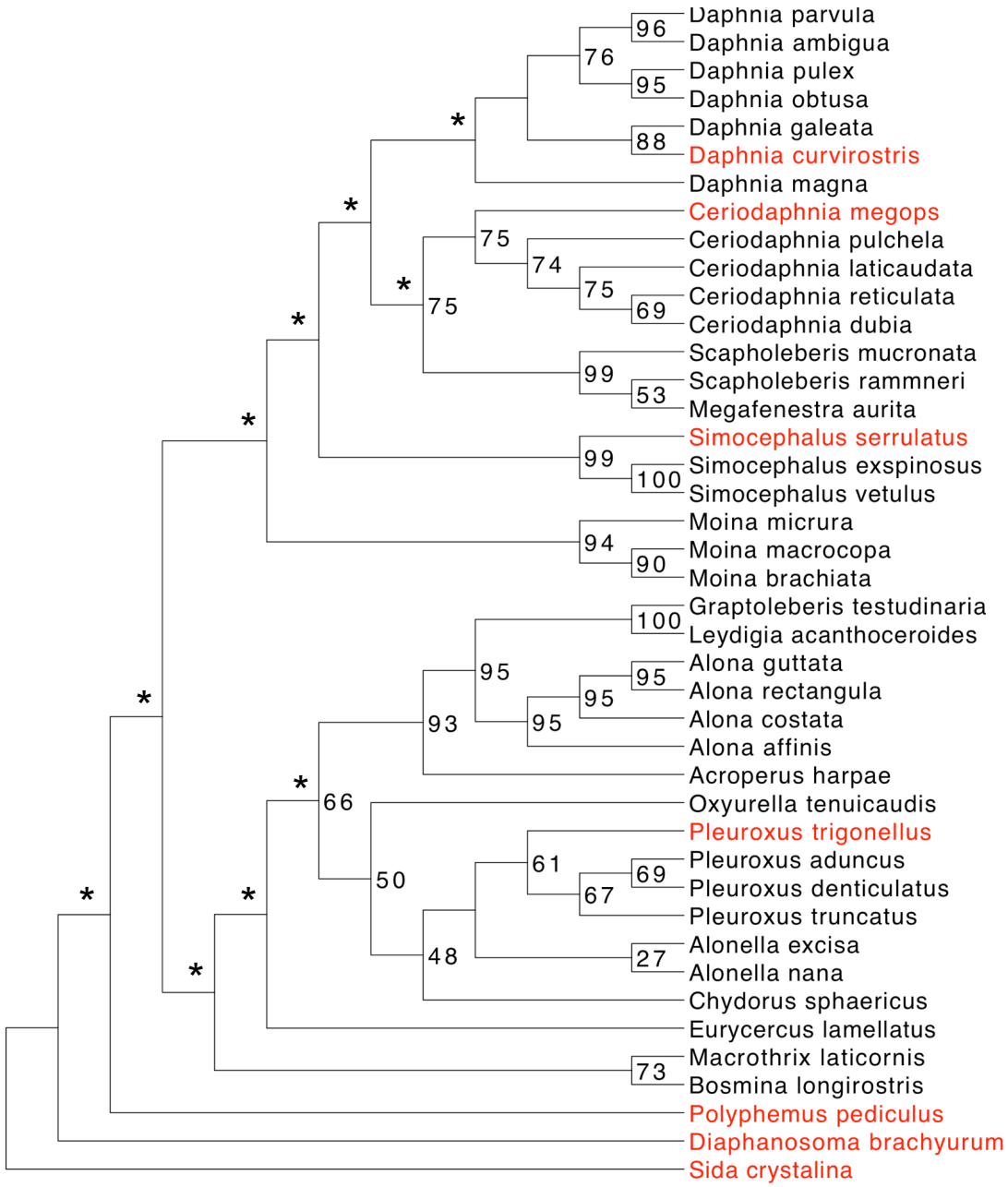

Figure A1. Best-scoring molecular-phylogenetic tree (Maximum Likelihood) showing the evolutionary relationships among 35 cladoceran species recorded in the sampled metacommunity. Bootstrap values are given on the nodes (except for constrained nodes with supporting values lower than 50). Asterisks indicate which nodes were constrained based on previous expert knowledge (Table A2). In red are species that were not present in our dataset but were included in the phylogenetic tree

reconstruction because they are often used in experiments in our group. Those species were dropped from the tree before calculating phylogenetic indices.

Table A1. Species present in our database for which no molecular information was available in Genbank and the species with molecular information that were used to replace the first ones. Note that these are not the same species as marked in red in the phylogenetic tree (those were not in our data-set while the ones in the table below were in our data-set but had no information in Genbank).

Species in our dataset without information in Genbank	**Species with information on Genbank used as representative species**
Alona guttata	Alona glabra
Alona rectangula	Alona pectinata
Alona costata	Alona setulosa
Ceriodaphnia megops	Ceriodaphnia cornuta
Alonella nana	Alonella exigua
Leydigia acantoceroides	Leydigia lousi
Megafenestra aurita	Scapholeberis armata
Pleuroxus trigonelus	Pleuroxus procurvus

Table A2. References used to constrain deep nodes of the phylogeny and thus establish the main relationships among clades.

Family	**References**
Daphnidae	Adamowicz et al. 2009
Moinidae	Braband et al. 2002

Chydoridae	Sacherová & Hebert 2003
Eurycercidae; Bosminidae; Polyphemus sp.; Sididae	Braband et al. 2002; Helmus et al. 2010

3. Trait information

We extracted information on body size and plant association from the literature. Body size values are according to Alonso (1996). Values from the trait plant association were determined mainly based on Barnett et al. (2007) and complemented with information provided by Declerck et al. (2007) and Alonso (1996). Trait values are given in Table A3.

Table A3: List of species recorded in out study and their respective trait values.

Species	Body size (mm)	Plant association
Acroperus harpae	0.8	Littoral (3)
Alona affinis	1	Littoral (3)
Alonella excisa	0.4	Littoral (3)
Alonella exigua	0.35	Littoral (3)
Alona glabra	0.26	Littoral (3)
Alona pectinata	0.4	Littoral (3)
Alona setulosa	0.5	Littoral (3)
Bosmina longirostris	0.6	Pelagic (1)
Ceriodaphnia dubia	1.4	Intermediate (2)
Ceriodaphnia laticaudata	0.9	Intermediate
Ceriodaphnia pulchela	0.8	Intermediate (2)

Species	Body size (mm)	Plant association
Ceriodaphnia reticulata	1.3	Intermediate (2)
Chydorus sphaericus	0.5	Intermediate (2)
Daphnia ambigua	1.3	Pelagic (1)
Daphnia galeata	2	Pelagic (1)
Daphnia magna	4	Pelagic (1)
Daphnia obtusa	2.5	Pelagic (1)
Daphnia parvula	1.3	Pelagic (1)
Dapnia pulex	2.5	Pelagic (1)
Eyrycercus lamellatus	3.3	Littoral (3)
Graptoleberis testudinaria	0.6	Littoral (3)
Leydigia louisi	0.8	Littoral (3)
Macrothrix laticornis	0.6	Littoral (3)
Moina brachiata	1.6	Pelagic (1)
Moina macrocopa	1.5	Pelagic (1)
Moina micrura	1.2	Pelagic (1)
Oxyurella longirostris	0.6	Littoral (3)
Pleuroxus aduncus	0.65	Littoral (3)
Pleuroxus denticulatus	0.6	Littoral (3)
Pleuroxus truncatus	0.65	Littoral (3)
Megafenestra aurita	1.6	Intermediate (2)
Scapholeberis mucronata	1.2	Intermediate (2)
Scapholeberis rammneri	1.35	Intermediate (2)
Simocephalus expinosus	2.8	Littoral (3)
Simocephalus vetulus	2.7	Littoral (3)

4. Selection of response variables: orthogonal eigenvectors describing β-diversity patterns

For β-diversity, the pair-wise output values obtained from Bray-Curtis and COMDIST (see Material & Methods) were synthesized into Principal Coordinate Analysis (PCoA) eigenvectors after Lingoes correction (Borcard et al. 2011; Swenson 2014). In principle, all eigenvectors generated by PCoA could be used as descriptors of β-diversity patterns in subsequent analyses. However, using all of them might introduce confounding effects in the analyses (Anderson & Willis 2003). Since each eigenvector is an orthogonal synthetic variable representing gradients in β-diversity patterns, it is possible that some of these gradients are unexplained by the measured factors, which might introduce confounding effects in posterior analyses. A solution is to select a subset of orthogonal eigenvectors that maximizes the association between patterns of β-diversity (taxonomic or functional-phylogenetic) and a set of explanatory variables (Anderson & Willis 2003). To select how many orthogonal eigenvectors should be retained for subsequent analysis, we applied an approach that is suitable for direct multiple regression analyses (Anderson & Willis 2003) [see also (Duarte et al. 2012)]. The selection procedure consisted of first including a single eigenvector (i.e., the first eigenvector, which captures most of the variation in the original distance matrix) describing β-diversity patterns as our response variable into the variation partitioning approach. Then, we computed the total $_{adj}R^2_{(\mathbf{Y}|\mathbf{X})}$ obtained for this combination of this single eigenvector (the first) as response variable and the selected environmental and spatial descriptors as explanatory variables. Next, we included the first two orthogonal eigenvectors as response variables and repeated the procedure, computing again the $_{adj}R^2_{(\mathbf{Y}|\mathbf{X})}$ for this combination of the first two eigenvectors and the predictor variables. This incremental approach was applied consecutively by including an

increasing number of orthogonal eigenvectors (i.e., 1,2,3,4 and so forth), until we obtained a complete distribution of $_{adj}R^2_{(\mathbf{Y}|\mathbf{X})}$ values for each number of eigenvectors (response variables) included. Finally, we retained as many eigenvectors as needed to maximize $_{adj}R^2_{(\mathbf{Y}|\mathbf{X})}$, which is the exact number that represents the best fit between the response and the explanatory matrices. In other words, when including less than that specific number of eigenvectors this results in a lower $_{adj}R^2_{(\mathbf{Y}|\mathbf{X})}$ because it captures too low variation in the original response matrix. In contrast, including more than that specific number decreases the $_{adj}R^2_{(\mathbf{Y}|\mathbf{X})}$ by adding residuals associated to redundant, meaningless variables [for further details on this selection procedure see also Anderson and Willis (2003) and Duarte et al. (2012)].

5. Exploring the drivers of taxonomic richness and evenness

Similarly to patterns reported in the main text for the exponential of Shannon diversity index (i.e., Shannon entropy; Jost 2006), no environmental or spatial variables were selected in the forward selection procedure (Blanchet et. al 2008) as significant drivers of taxonomic species richness or evenness (i.e., Pielou J evenness index). Additionally, there was a strong correlation between Shannon entropy and species richness ($_{adj}R^2 = 0.445$, $p < 0.001$) as well as between Shannon entropy and evenness ($_{adj}R^2 = 0.527$, $p < 0.001$). Therefore, the information provided by these three taxonomic diversity metrics were redundant and uninformative in our study case and we present in the main text only results obtained for Shannon entropy, because it is a widely used taxonomic diversity metric and because it is more comparable with our abundance-weighed functional-phylogenetic *a*-diversity metrics.

6. R-packages used for specific applications.

Table A4: List of the main R-packages used for specific applications.

R-package	Application
PCNM	Used to generate spatial descriptors
packfor	Forward selection with permutation
ape	Penalized Likelihood method for phylogenetic tree reconstruction
picante	Trait-phylogenetic analyses

6. References in the Appendix.

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Appendix 2.

Series of tables showing the detailed results for integrated trait and phylogenetic analyses of alpha and beta diversity. In each table is given the list of environmental and spatial variables selected, if any, and the amount of explanatory power ($_{adj}R^2$) and associated p-values.

Table A1. Explanatory power provided by environmental and spatial variables to analyses of alpha diversity integrating information on the trait plant association with phylogeny; i.e., alpha_fpd_plant_phylo.

VARIABLES SELECTED	a_value	$_{adj}R^2$_TOTAL	$_{adj}R^2$_ENV	$_{adj}R^2$_shared	$_{adj}R^2$_SPA	p_value_TOTAL	p_value_ENV	p_value_SPA
NO VARIABLE SELECTED	0	0	0	0	0			NO SPATIAL SIGNAL
NO VARIABLE SELECTED	0.01	0	0	0	0			NO SPATIAL SIGNAL
NO VARIABLE SELECTED	0.02	0	0	0	0			NO SPATIAL SIGNAL
NO VARIABLE SELECTED	0.03	0	0	0	0			NO SPATIAL SIGNAL
NO VARIABLE SELECTED	0.04	0	0	0	0			NO SPATIAL SIGNAL
NO VARIABLE SELECTED	0.05	0	0	0	0			NO SPATIAL SIGNAL
NO VARIABLE	0.06	0	0	0	0			NO SPATIAL

SELECTED								SIGNAL
CHAOB;	0.07	0.06279637	0.06279637	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
CHAOB;	0.08	0.06205263	0.06205263	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
CHAOB;	0.09	0.06635382	0.06635382	0	0	0.011 *	0.011 *	NO SPATIAL SIGNAL
CHAOB;	0.1	0.06261138	0.06261138	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
CHAOB;	0.11	0.06311602	0.06311602	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
CHAOB;	0.12	0.06265114	0.06265114	0	0	0.011 *	0.011 *	NO SPATIAL SIGNAL
CHAOB;	0.13	0.06424499	0.06424499	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
CHAOB;	0.14	0.05948382	0.05948382	0	0	0.015 *	0.015 *	NO SPATIAL SIGNAL
CHAOB;	0.15	0.05277398	0.05277398	0	0	0.015 *	0.015 *	NO SPATIAL SIGNAL
CHAOB;	0.16	0.06324625	0.06324625	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
CHAOB;	0.17	0.05927134	0.05927134	0	0	0.01 **	0.01 **	NO SPATIAL SIGNAL
CHAOB;	0.18	0.05823229	0.05823229	0	0	0.014 *	0.014 *	NO SPATIAL SIGNAL
pH;	0.19	0.0602543	0.0602543	0	0	0.011 *	0.011 *	NO SPATIAL SIGNAL
CHAOB;PH	0.2	0.1142721	0.1142721	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH;	0.21	0.05813527	0.05813527	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH;	0.22	0.05631772	0.05631772	0	0	0.013 *	0.013 *	NO SPATIAL SIGNAL
pH;CHAOB	0.23	0.1096639	0.1096639	0	0	0.003 **	0.003 **	NO SPATIAL

								SIGNAL
pH;	0.24	0.06351953	0.06351953	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH;	0.25	0.06688413	0.06688413	0	0	0.015 *	0.015 *	NO SPATIAL SIGNAL
pH;	0.26	0.0551468	0.0551468	0	0	0.014 *	0.014 *	NO SPATIAL SIGNAL
pH;	0.27	0.06577984	0.06577984	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH; NO3	0.28	0.1083244	0.1083244	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH; NO3	0.29	0.1167825	0.1167825	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.3	0.1171414	0.1171414	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.31	0.1149695	0.1149695	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH; NO3	0.32	0.1174853	0.1174853	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH; NO3	0.33	0.1147429	0.1147429	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.34	0.1171701	0.1171701	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.35	0.1183678	0.1183678	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.36	0.1178028	0.1178028	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.37	0.1257434	0.1257434	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; NO3	0.38	0.1270849	0.1270849	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.39	0.1182486	0.1182486	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.4	0.1188276	0.1188276	0	0	0.003 **	0.003 **	NO SPATIAL

								SIGNAL
pH; NO3	0.41	0.1244437	0.1244437	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.42	0.1205433	0.1205433	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.43	0.1196309	0.1196309	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; NO3	0.44	0.1217552	0.1217552	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
NO3;pH	0.45	0.1240246	0.1240246	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.46	0.1306495	0.1306495	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.47	0.1218493	0.1218493	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; NO3	0.48	0.1251179	0.1251179	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.49	0.06107492	0.06107492	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
pH; NO3	0.5	0.1220278	0.1220278	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; NO3	0.51	0.1289775	0.1289775	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.52	0.1264655	0.1264655	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.53	0.1250799	0.1250799	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; NO3	0.54	0.1253428	0.1253428	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.55	0.1217657	0.1217657	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.56	0.1280693	0.1280693	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.57	0.1206618	0.1206618	0	0	0.004 **	0.004 **	NO SPATIAL

								SIGNAL
pH; NO3	0.58	0.1266891	0.1266891	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.59	0.1222397	0.1222397	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; NO3	0.6	0.1195993	0.1195993	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH; NO3	0.61	0.1276152	0.1276152	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.62	0.1259714	0.1259714	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; NO3	0.63	0.1257402	0.1257402	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.64	0.126464	0.126464	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.65	0.115583	0.115583	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH; NO3	0.66	0.1204999	0.1204999	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH; NO3	0.67	0.1251188	0.1251188	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
NO3; FLOAT	0.68	0.1223687	0.1223687	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH; NO3	0.69	0.1294798	0.1294798	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
NO3;	0.7	0.06134253	0.06134253	0	0	0.012 *	0.012 *	NO SPATIAL SIGNAL
NO3; FLOAT	0.71	0.1224327	0.1224327	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
NO3; FLOAT	0.72	0.1216032	0.1216032	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
NO3; FLOAT	0.73	0.1319345	0.1319345	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
NO3; FLOAT	0.74	0.1184208	0.1184208	0	0	0.001 ***	0.001 ***	NO SPATIAL

								SIGNAL
NO3; FLOAT	0.75	0.1222418	0.1222418	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH; NO3	0.76	0.1195948	0.1195948	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
NO3; FLOAT	0.77	0.1175574	0.1175574	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
NO3;	0.78	0.05864956	0.05864956	0	0	0.019 *	0.019 *	NO SPATIAL SIGNAL
NO3;	0.79	0.06160908	0.06160908	0	0	0.012 *	0.012 *	NO SPATIAL SIGNAL
NO3; FLOAT	0.8	0.1179929	0.1179929	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
SHADE; NO3;	0.81	0.1155303	0.1155303	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
NO3; FLOAT	0.82	0.1277354	0.1277354	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
SURFACE;	0.83	0.06211433	0.06211433	0	0	0.01 **	0.01 **	NO SPATIAL SIGNAL
SHADE; NO3;	0.84	0.1164736	0.1164736	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
SHADE; NO3;	0.85	0.115573	0.115573	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
SHADE; NO3;	0.86	0.1174005	0.1174005	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
NO3;	0.87	0.06351991	0.06351991	0	0	0.015 *	0.015 *	NO SPATIAL SIGNAL
SHADE	0.88	0.06501291	0.06501291	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
SHADE; NO3;	0.89	0.1180767	0.1180767	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
SHADE	0.9	0.06220401	0.06220401	0	0	0.01 **	0.01 **	NO SPATIAL SIGNAL
NO3;	0.91	0.06031034	0.06031034	0	0	0.01 **	0.01 **	NO SPATIAL

								SIGNAL
NO3;	0.92	0.06321981	0.06321981	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
SHADE	0.93	0.06323987	0.06323987	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
SHADE	0.94	0.06405797	0.06405797	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
SHADE	0.95	0.0626064	0.0626064	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
SHADE	0.96	0.07038328	0.07038328	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
SHADE	0.97	0.06804145	0.06804145	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
SHADE	0.98	0.06422488	0.06422488	0	0	0.01 **	0.01 **	NO SPATIAL SIGNAL
SHADE	0.99	0.0654725	0.0654725	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
SHADE	1	0.06046434	0.06046434	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL

Table A2: Explanatory power provided by environmental and spatial variables to analyses of alpha diversity integrating information on the trait body size with phylogeny; i.e., alpha_fpd_body size_phylo.

Variables selected	a_value	$_{adj}R^2$_TOTAL	$_{adj}R^2$_ENV	$_{adj}R^2$_shared	$_{adj}R^2$_SPA	p_value_TOTAL	p_value_ENV	p_value_SPA
pH; NO3	0	0.22809	0.09129	0.06192	0.07488	0.001 ***	0.002 **	0.002 **
pH; SNELL	0.01	0.22922	0.09277	0.06495	0.07151	0.001 ***	0.002 **	0.003 **
pH; SNELL	0.02	0.22909	0.09242	0.06575	0.07093	0.001 ***	0.003 **	0.006 **
pH;	0.03	0.19594	0.05573	0.06765	0.07255	0.001 ***	0.011 *	0.006 **
pH;	0.04	0.19642	0.05757	0.06789	0.07097	0.001 ***	0.011 *	0.002 **
pH;	0.05	0.20079	0.06284	0.06936	0.06858	0.001 ***	0.004 **	0.007 **

pH;	0.06	0.19291	0.05853	0.06689	0.06749	0.001 ***	0.014 *	0.003 **
pH;	0.07	0.19856	0.0623	0.06868	0.06759	0.001 ***	0.005 **	0.006 **
pH;	0.08	0.18889	0.05616	0.06561	0.06712	0.001 ***	0.006 **	0.005 **
pH;	0.09	0.1932	0.06179	0.06704	0.06437	0.001 ***	0.008 **	0.003 **
pH;	0.1	0.1889	0.06174	0.06571	0.06145	0.001 ***	0.01 **	0.004 **
pH;	0.11	0.18607	0.05822	0.06482	0.06303	0.001 ***	0.012 *	0.009 **
pH;	0.12	0.17989	0.05512	0.06288	0.06189	0.001 ***	0.007 **	0.003 **
pH;	0.13	0.1196667	0.1196667	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.14	0.1315983	0.1315983	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.15	0.1211542	0.1211542	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.16	0.1164793	0.1164793	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.17	0.18436	0.06492	0.06422	0.05522	0.001 ***	0.007 **	0.012 *
pH;	0.18	0.1163192	0.1163192	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.19	0.1142385	0.1142385	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.2	0.1109672	0.1109672	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.21	0.1181063	0.1181063	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.22	0.17226	0.05959	0.06051	0.05215	0.001 ***	0.005 **	0.009 **
pH;	0.23	0.1162288	0.1162288	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.24	0.11987	0.11987	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.25	0.1165571	0.1165571	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.26	0.1057853	0.1057853	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

pH;	0.27	0.115754	0.115754	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.28	0.1066148	0.1066148	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.29	0.1105883	0.1105883	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.3	0.107191	0.107191	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.31	0.1074301	0.1074301	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.32	0.1156596	0.1156596	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.33	0.1006009	0.1006009	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.34	0.1049245	0.1049245	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.35	0.1029358	0.1029358	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.36	0.09740582	0.09740582	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.37	0.09858535	0.09858535	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.38	0.1030537	0.1030537	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.39	0.09320878	0.09320878	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.4	0.09737471	0.09737471	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.41	0.09379757	0.09379757	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.42	0.09886555	0.09886555	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.43	0.09614035	0.09614035	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL

pH;	0.44	0.0987792	0.0987792	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.45	0.09553847	0.09553847	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.46	0.0915346	0.0915346	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.47	0.09397428	0.09397428	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.48	0.08503299	0.08503299	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH;	0.49	0.08886901	0.08886901	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.5	0.08271267	0.08271267	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.51	0.08823632	0.08823632	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.52	0.08511085	0.08511085	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH;	0.53	0.08775159	0.08775159	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH;	0.54	0.0785089	0.0785089	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
pH;	0.55	0.08205038	0.08205038	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
pH;	0.56	0.07447303	0.07447303	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH;	0.57	0.08033764	0.08033764	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH;	0.58	0.07651788	0.07651788	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH;	0.59	0.07559653	0.07559653	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH;	0.6	0.07375909	0.07375909	0	0	0.014 *	0.014 *	NO SPATIAL SIGNAL

pH;	0.61	0.0749536	0.0749536	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
pH;	0.62	0.07460517	0.07460517	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH;	0.63	0.07357082	0.07357082	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH;	0.64	0.07586656	0.07586656	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH;	0.65	0.07710934	0.07710934	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH;	0.66	0.07403837	0.07403837	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
pH;	0.67	0.06870462	0.06870462	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
pH; NO3	0.68	0.1303325	0.1303325	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH;	0.69	0.07560081	0.07560081	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH;	0.7	0.07103975	0.07103975	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH;	0.71	0.06435445	0.06435445	0	0	0.011 *	0.011 *	NO SPATIAL SIGNAL
pH;	0.72	0.06722092	0.06722092	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH;	0.73	0.06636839	0.06636839	0	0	0.011 *	0.011 *	NO SPATIAL SIGNAL
pH;	0.74	0.06554324	0.06554324	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE; NO3	0.75	0.1200436	0.1200436	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
SHADE;	0.76	0.06281477	0.06281477	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
SHADE; NO3	0.77	0.1181247	0.1181247	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL

SHADE; NO3	0.78	0.1218197	0.1218197	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH;	0.79	0.06595102	0.06595102	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
pH; NO3	0.8	0.1231341	0.1231341	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
NO3	0.81	0.06416309	0.06416309	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
SHADE	0.82	0.06499025	0.06499025	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.83	0.06104969	0.06104969	0	0	0.014 *	0.014 *	NO SPATIAL SIGNAL
SHADE	0.84	0.0639681	0.0639681	0	0	0.012 *	0.012 *	NO SPATIAL SIGNAL
NO3	0.85	0.0597003	0.0597003	0	0	0.013 *	0.013 *	NO SPATIAL SIGNAL
NO3	0.86	0.0637579	0.0637579	0	0	0.013 *	0.013 *	NO SPATIAL SIGNAL
SHADE	0.87	0.06145577	0.06145577	0	0	0.013 *	0.013 *	NO SPATIAL SIGNAL
SHADE	0.88	0.06325014	0.06325014	0	0	0.01 **	0.01 **	NO SPATIAL SIGNAL
SHADE; NO3	0.89	0.1170076	0.1170076	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
SHADE	0.9	0.06416729	0.06416729	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
SHADE	0.91	0.06313525	0.06313525	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.92	0.06190303	0.06190303	0	0	0.013 *	0.013 *	NO SPATIAL SIGNAL
SHADE	0.93	0.0637105	0.0637105	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
SHADE	0.94	0.0613361	0.0613361	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL

SHADE	0.95	0.06712194	0.06712194	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
SHADE	0.96	0.06749487	0.06749487	0	0	0.012 *	0.012 *	NO SPATIAL SIGNAL
SHADE	0.97	0.06606846	0.06606846	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.98	0.0675458	0.0675458	0	0	0.016 *	0.016 *	NO SPATIAL SIGNAL
SHADE	0.99	0.06511792	0.06511792	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
SHADE	1	0.06046434	0.06046434	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL

Table A3: Explanatory power provided by environmental and spatial variables to analyses of alpha diversity integrating information on both traits body size and plant association with phylogeny; i.e., alpha_fpd_body size + plant association_phylo.

Var selected	a_value	$_{adj}R^2$_TOTAL	$_{adj}R^2$_ENV	$_{adj}R^2$_shared	$_{adj}R^2$_SPA	p_value_TOTAL	p_value_ENV	p_value_SPA
CHAOB; pH	0	0.14116	0.14116	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.01	0.1069	0.1069	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.02	0.105061	0.105061	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.03	0.1117093	0.1117093	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.04	0.11918	0.11918	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.05	0.12409	0.12409	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.06	0.1271286	0.1271286	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.07	0.11776	0.11776	0	0	0.001 ***	0.001 ***	NO SPATIAL

								SIGNAL
pH	0.08	0.11946	0.11946	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.09	0.128388	0.128388	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.1	0.11631	0.11631	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.11	0.119257	0.119257	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.12	0.1220801	0.1220801	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.13	0.1267034	0.1267034	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.14	0.1203366	0.1203366	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.15	0.1148813	0.1148813	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.16	0.1131156	0.1131156	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.17	0.1228377	0.1228377	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.18	0.117626	0.117626	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.19	0.121236	0.121236	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.2	0.1109269	0.1109269	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.21	0.1179379	0.1179379	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.22	0.1202355	0.1202355	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.23	0.1151938	0.1151938	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.24	0.115515	0.115515	0	0	0.001 ***	0.001 ***	NO SPATIAL

								SIGNAL
pH	0.25	0.1104854	0.1104854	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.26	0.1127292	0.1127292	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.27	0.11316	0.11316	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.28	0.115176	0.115176	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.29	0.1113358	0.1113358	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.3	0.1139917	0.1139917	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.31	0.1122702	0.1122702	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.32	0.1042466	0.1042466	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.33	0.1042216	0.1042216	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.34	0.1053207	0.1053207	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.35	0.1005879	0.1005879	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.36	0.0944924	0.0944924	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.37	0.1047937	0.1047937	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.38	0.09648336	0.09648336	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.39	0.0917555	0.0917555	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH	0.4	0.08870628	0.08870628	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH	0.41	0.09574949	0.09574949	0	0	0.002 **	0.002 **	NO SPATIAL

								SIGNAL
pH	0.42	0.0865733	0.0865733	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.43	0.08447029	0.08447029	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH	0.44	0.08985734	0.08985734	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH	0.45	0.09183145	0.09183145	0	0	0.002 **	0.002 **	NO SPATIAL SIGNAL
pH	0.46	0.08120664	0.08120664	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.47	0.0846403	0.0846403	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.48	0.07903622	0.07903622	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.49	0.0878959	0.0878959	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.5	0.07928643	0.07928643	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.51	0.08181637	0.08181637	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.52	0.07676442	0.07676442	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.53	0.08177159	0.08177159	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.54	0.08050586	0.08050586	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.55	0.07284112	0.07284112	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
pH	0.56	0.07944269	0.07944269	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
pH	0.57	0.07517763	0.07517763	0	0	0.004 **	0.004 **	NO SPATIAL SIGNAL
pH	0.58	0.07781075	0.07781075	0	0	0.005 **	0.005 **	NO SPATIAL

								SIGNAL
NO3	0.59	0.06780002	0.06780002	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
NO3	0.6	0.07281588	0.07281588	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH	0.61	0.06727437	0.06727437	0	0	0.006 **	0.006 **	NO SPATIAL SIGNAL
pH	0.62	0.0661984	0.0661984	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
pH; NO3	0.63	0.14036404	0.14036404	0	0	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
NO3	0.64	0.06726857	0.06726857	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
pH	0.65	0.06408783	0.06408783	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
pH	0.66	0.07276252	0.07276252	0	0	0.005 **	0.005 **	NO SPATIAL SIGNAL
pH	0.67	0.06849516	0.06849516	0	0	0.007 **	0.007 **	NO SPATIAL SIGNAL
pH	0.68	0.065598	0.065598	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
NO3	0.69	0.06329965	0.06329965	0	0	0.012 *	0.012 *	NO SPATIAL SIGNAL
pH	0.7	0.06379089	0.06379089	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
pH	0.71	0.06263146	0.06263146	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
NO3	0.72	0.0656748	0.0656748	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL
NO3	0.73	0.0634014	0.0634014	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.74	0.06191578	0.06191578	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
pH	0.75	0.06421978	0.06421978	0	0	0.009 **	0.009 **	NO SPATIAL

								SIGNAL
NO3	0.76	0.06545058	0.06545058	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.77	0.05813042	0.05813042	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
NO3	0.78	0.05892543	0.05892543	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.79	0.06716697	0.06716697	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.8	0.059704	0.059704	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.81	0.06395988	0.06395988	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.82	0.05863828	0.05863828	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.83	0.06217037	0.06217037	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.84	0.0621495	0.0621495	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.85	0.0617004	0.0617004	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.86	0.0616965	0.0616965	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.87	0.05850261	0.05850261	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.88	0.06418515	0.06418515	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.89	0.0605697	0.0605697	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
NO3	0.9	0.0603378	0.0603378	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.91	0.06471342	0.06471342	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.92	0.06198178	0.06198178	0	0	0.009 **	0.009 **	NO SPATIAL

								SIGNAL
NO3	0.93	0.06162984	0.06162984	0	0	0.009 **	0.009 **	NO SPATIAL SIGNAL
SHADE	0.94	0.0666576	0.0666576	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
SHADE	0.95	0.06471696	0.06471696	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
SHADE	0.96	0.06059701	0.06059701	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
SHADE	0.97	0.06606286	0.06606286	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
SHADE	0.98	0.06204455	0.06204455	0	0	0.01 *	0.01 *	NO SPATIAL SIGNAL
SHADE	0.99	0.06119802	0.06119802	0	0	0.003 **	0.003 **	NO SPATIAL SIGNAL
SHADE	1	0.0615105	0.0615105	0	0	0.008 **	0.008 **	NO SPATIAL SIGNAL

Table A4: Explanatory power provided by environmental and spatial variables to analyses of beta diversity integrating information on the trait plant association with phylogeny; i.e., beta_fpd_plant association_phylo.

Explanatory variables selected	numer of eigenvectors selected	a_value	$_{adj}R^2$_TOTAL	$_{adj}R^2$_ENV	p_value_TOTAL	p_value_SPA
FLOAT; SUBM; EMERG	1	0	0.4836252	0.4836252	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM; EMERG	1	0.01	0.4836729	0.4836729	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM; EMERG	1	0.02	0.4837299	0.4837299	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM; EMERG	1	0.03	0.4837626	0.4837626	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM; EMERG	1	0.04	0.483766	0.483766	0.001 ***	NO SPATIAL SIGNAL

FLOAT; SUBM; EMERG	1	0.05	0.4837371	0.4837371	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM; EMERG	1	0.06	0.4836733	0.4836733	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM; EMERG	1	0.07	0.4835722	0.4835722	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.08	0.4660074	0.4660074	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM; EMERG	1	0.09	0.4832481	0.4832481	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.1	0.4659108	0.4659108	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.11	0.4658013	0.4658013	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.12	0.4656473	0.4656473	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.13	0.4654459	0.4654459	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.14	0.4651939	0.4651939	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.15	0.4648882	0.4648882	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.16	0.4645252	0.4645252	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.17	0.4641012	0.4641012	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.18	0.4636122	0.4636122	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.19	0.4630541	0.4630541	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.2	0.4624222	0.4624222	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.21	0.4617118	0.4617118	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.22	0.4609178	0.4609178	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.23	0.4600349	0.4600349	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.24	0.4590572	0.4590572	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.25	0.4579788	0.4579788	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.26	0.4567932	0.4567932	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.27	0.4554937	0.4554937	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.28	0.4540732	0.4540732	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.29	0.4691264	0.4691264	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.3	0.4681963	0.4681963	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.31	0.4671536	0.4671536	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.32	0.465991	0.465991	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM	1	0.33	0.4647011	0.4647011	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.34	0.4814355	0.4814355	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.35	0.4795306	0.4795306	0.001 ***	NO SPATIAL SIGNAL

FLOAT; SUBM;FISH_ABUND	1	0.36	0.4599891	0.4599891	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.37	0.4581108	0.4581108	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.38	0.456065	0.456065	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.39	0.4538437	0.4538437	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.4	0.4514389	0.4514389	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.41	0.4488432	0.4488432	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.42	0.4460495	0.4460495	0.001 ***	NO SPATIAL SIGNAL
FLOAT; SUBM;FISH_ABUND	1	0.43	0.4620466	0.4620466	0.001 ***	NO SPATIAL SIGNAL
FLOAT;FISH_ABUND; SUBM; CHAOB	1	0.44	0.4599528	0.4599528	0.001 ***	NO SPATIAL SIGNAL
FLOAT;FISH_ABUND; SUBM; CHAOB	1	0.45	0.4576832	0.4576832	0.001 ***	NO SPATIAL SIGNAL
FLOAT;FISH_ABUND; SUBM; CHAOB	1	0.46	0.4552334	0.4552334	0.001 ***	NO SPATIAL SIGNAL
FLOAT;FISH_ABUND; SUBM; CHAOB	1	0.47	0.4525998	0.4525998	0.001 ***	NO SPATIAL SIGNAL
FLOAT;FISH_ABUND;CHAOB; SNELL	1	0.48	0.457967	0.457967	0.001 ***	NO SPATIAL SIGNAL
FLOAT;FISH_ABUND;CHAOB; SNELL	1	0.49	0.4566654	0.4566654	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SNELL	1	0.5	0.455161	0.455161	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SNELL	1	0.51	0.4534493	0.4534493	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SNELL	1	0.52	0.4515275	0.4515275	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SNELL	1	0.53	0.4493942	0.4493942	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SNELL	1	0.54	0.4470502	0.4470502	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.55	0.4125766	0.4125766	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.56	0.4097382	0.4097382	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.57	0.406731	0.406731	0.001 ***	NO SPATIAL SIGNAL

FLOAT;CHAOB;FISH_ABUND;	1	0.58	0.4035635	0.4035635	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.59	0.4002458	0.4002458	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.6	0.3967894	0.3967894	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.61	0.393207	0.393207	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.62	0.3895123	0.3895123	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.63	0.3857196	0.3857196	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.64	0.3818438	0.3818438	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.65	0.3779002	0.3779002	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.66	0.3739038	0.3739038	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.67	0.3698696	0.3698696	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.68	0.365812	0.365812	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.69	0.3617449	0.3617449	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.7	0.3576813	0.3576813	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.71	0.3536335	0.3536335	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.72	0.3526597	0.3526597	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.73	0.3511218	0.3511218	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.74	0.3495616	0.3495616	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.75	0.3479782	0.3479782	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.76	0.3463707	0.333987	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.77	0.3447381	0.3447381	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.78	0.3430796	0.3430796	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.79	0.3413944	0.3413944	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SUBM; NO3; SNELL	2	0.8	0.3396818	0.3396818	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	2	0.81	0.3379414	0.3379414	0.001 ***	NO SPATIAL SIGNAL

SUBM; NO3; SNELL FLOAT;CHAOB;FISH_ABUND;						
SUBM; NO3; SNELL FLOAT;CHAOB;FISH_ABUND;	2	0.82	0.3361725	0.3361725	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL; SUBM FLOAT;CHAOB;FISH_ABUND;	2	0.83	0.3343749	0.3343749	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL; SUBM FLOAT;CHAOB;FISH_ABUND;	2	0.84	0.3325485	0.3325485	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL; FLOAT;CHAOB;FISH_ABUND;	2	0.85	0.3139237	0.3139237	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL; FLOAT;CHAOB;FISH_ABUND;	2	0.86	0.3124732	0.3124732	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL; FLOAT;CHAOB;FISH_ABUND;	2	0.87	0.3109948	0.3109948	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL; FLOAT;CHAOB;FISH_ABUND;	2	0.88	0.3094882	0.3094882	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL; FLOAT;CHAOB;FISH_ABUND;	2	0.89	0.3079535	0.3079535	0.001 ***	NO SPATIAL SIGNAL
NO3; SNELL;	2	0.9	0.3063908	0.3063908	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.91	0.3103187	0.3103187	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; SNELL;	1	0.92	0.307521	0.307521	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND;	1	0.93	0.3048047	0.3048047	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; NO3;	2	0.94	0.2998714	0.2998714	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; NO3;pH	2	0.95	0.2996089	0.2996089	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; NO3;pH	2	0.96	0.2970893	0.2970893	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; NO3;pH	2	0.97	0.295758	0.295758	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; NO3;pH	2	0.98	0.2944056	0.2944056	0.001 ***	NO SPATIAL SIGNAL

FLOAT;CHAOB;FISH_ABUND; NO3;pH	2	0.99	0.2930333	0.2930333	0.001 ***	NO SPATIAL SIGNAL
FLOAT;CHAOB;FISH_ABUND; NO3;pH	2	1	0.2916423	0.2916423	0.001 ***	NO SPATIAL SIGNAL

Table A5: Explanatory power provided by environmental and spatial variables to analyses of beta diversity integrating information on the trait body size with phylogeny; i.e., beta_fpd_body size_phylo.

SELECTED VARIABLES	N EIGENVECTORS	a_value	$_{adj}R^2$_TOTAL	$_{adj}R^2$_ENV	p_value_TOTAL	p_value_ENV	p_value_SPA
pH; CHAOB	3	0	0.1758665	0.1758665	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	2	0.01	0.1780009	0.1780009	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	3	0.02	0.1780235	0.1780235	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	3	0.03	0.1790472	0.1790472	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	3	0.04	0.1804054	0.1804054	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	3	0.05	0.181575	0.181575	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	3	0.06	0.1989629	0.1989629	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

pH; CHAOB; FISH	3	0.07	0.2026083	0.2026083	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	4	0.08	0.1978853	0.1978853	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	4	0.09	0.1973645	0.1973645	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.1	0.1978925	0.1978925	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.11	0.1989153	0.1989153	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.12	0.1998857	0.1998857	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.13	0.2008033	0.2008033	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.14	0.2016679	0.2016679	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.15	0.2024791	0.2024791	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.16	0.203237	0.203237	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.17	0.2039413	0.2039413	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.18	0.2045921	0.2045921	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.19	0.2051895	0.2051895	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.2	0.2057338	0.2057338	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.21	0.2062255	0.2062255	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB	1	0.22	0.2066649	0.2066649	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FLOAT; FISH	4	0.23	0.2274371	0.2274371	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

pH; CHAOB; FLOAT; FISH	4	0.24	0.2273232	0.2273232	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.25	0.2498628	0.2498628	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.26	0.2504273	0.2504273	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.27	0.250933	0.250933	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.28	0.2513812	0.2513812	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.29	0.251773	0.251773	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.3	0.2521097	0.2521097	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.31	0.2523928	0.2523928	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.32	0.2526238	0.2526238	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.33	0.2528042	0.2528042	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.34	0.2529358	0.2529358	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.35	0.2530201	0.2530201	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.36	0.253059	0.253059	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.37	0.2530542	0.2530542	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.38	0.2530076	0.2530076	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.39	0.2529208	0.2529208	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.4	0.2527957	0.2527957	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

pH; CHAOB; FISH	1	0.41	0.2526341	0.2526341	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.42	0.2524379	0.2524379	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.43	0.2522088	0.2522088	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.44	0.2519485	0.2519485	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.45	0.2516588	0.2516588	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.46	0.2513414	0.2513414	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.47	0.2509979	0.2509979	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.48	0.25063	0.25063	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FISH	1	0.49	0.2502391	0.2502391	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FLOAT; FISH	2	0.5	0.25174	0.25174	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FLOAT; FISH	2	0.51	0.2523	0.2523	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FLOAT; FISH	2	0.52	0.25281	0.25281	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
pH; CHAOB; FLOAT; FISH	2	0.53	0.25328	0.25328	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.54	0.25414	0.25414	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.55	0.25523	0.25523	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.56	0.25627	0.25627	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.57	0.25725	0.25725	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; FISH; NO3	2	0.58	0.258183	0.258183	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.59	0.25906	0.25906	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.6	0.2599	0.2599	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.61	0.2606909	0.2606909	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.62	0.2614399	0.2614399	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.63	0.262149	0.262149	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.64	0.2628202	0.2628202	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3	2	0.65	0.2634556	0.2634556	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;	1	0.66	0.2686881	0.2686881	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;	1	0.67	0.2688035	0.2688035	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;	1	0.68	0.2688998	0.2688998	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;	1	0.69	0.2689778	0.2689778	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;	1	0.7	0.2690384	0.2690384	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;pH	1	0.71	0.2960186	0.2960186	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;pH	1	0.72	0.2956888	0.2956888	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;pH	1	0.73	0.2953504	0.2953504	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;pH	1	0.74	0.2950043	0.2950043	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; FISH;pH	1	0.75	0.294651	0.294651	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;pH	1	0.76	0.2942911	0.2942911	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.77	0.2939253	0.2939253	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH;pH	1	0.78	0.2935541	0.2935541	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.79	0.293178	0.293178	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.8	0.2924782	0.2924782	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.81	0.2925076	0.2925076	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.82	0.2925265	0.2925265	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.83	0.2925354	0.2925354	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.84	0.2925349	0.2925349	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.85	0.2925257	0.2925257	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.86	0.2925083	0.2925083	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.87	0.2924832	0.2924832	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.88	0.2924509	0.2924509	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.89	0.2924118	0.2924118	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.9	0.2923664	0.2923664	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.91	0.292315	0.292315	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; FISH; NO3; pH	2	0.92	0.2922581	0.2922581	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.93	0.292196	0.292196	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.94	0.292129	0.292129	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.95	0.2920576	0.2920576	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.96	0.2919819	0.2919819	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.97	0.2919022	0.2919022	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.98	0.2918189	0.2918189	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.99	0.29173	0.29173	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	1	0.2916423	0.2916423	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

Table A6: Explanatory power provided by environmental and spatial variables to analyses of beta diversity integrating information on both traits body size and plant association with phylogeny; i.e., beta_fpd_body size + plant association_phylo.

var selected	N EIGENV	a_value	$_{adj}R^2$_TOTAL	$_{adj}R^2$_ENV	p_value_TOTAL	p_value_ENV	p_value_SPA
FLOAT; CHAOB; SUBM; FISH	1	0	0.4008	0.4008	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL	1	0.01	0.379496	0.379496	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL	1	0.02	0.3802136	0.3802136	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; SUBM; FISH	1	0.03	0.4013543	0.4013543	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.04	0.4025528	0.4025528	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.05	0.4036333	0.4036333	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.06	0.404607	0.404607	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.07	0.4054804	0.4054804	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.08	0.4062575	0.4062575	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.09	0.4069405	0.4069405	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.1	0.4075306	0.4075306	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SNELL; FISH	1	0.11	0.4095	0.4095	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; pH	1	0.12	0.4099961	0.4099961	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; pH	1	0.13	0.4103973	0.4103973	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.14	0.3817079	0.3817079	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.15	0.3816062	0.3816062	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.16	0.3814235	0.3814235	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.17	0.381159	0.381159	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.18	0.3808156	0.3808156	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.19	0.3834482	0.3834482	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; SUBM; FISH; pH	2	0.2	0.3827719	0.3827719	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.21	0.3820055	0.3820055	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.22	0.3811514	0.3811514	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.23	0.3802121	0.3802121	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.24	0.3791907	0.3791907	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.25	0.37809	0.37809	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.26	0.3769151	0.3769151	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.27	0.3756685	0.3756685	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.28	0.3743547	0.3743547	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.29	0.3729779	0.3729779	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.3	0.3715425	0.3715425	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.31	0.3700526	0.3700526	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.32	0.3685126	0.3685126	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.33	0.3669268	0.3669268	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH; pH	2	0.34	0.3652994	0.3652994	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; SUBM; FISH	1	0.35	0.3637928	0.3637928	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.36	0.3622589	0.3622589	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; FISH	1	0.37	0.3606844	0.3606844	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.38	0.3590725	0.3590725	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.39	0.3574266	0.3574266	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.4	0.3557498	0.3557498	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.41	0.3540455	0.3540455	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.42	0.3523168	0.3523168	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.43	0.3505668	0.3505668	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.44	0.3487985	0.3487985	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.45	0.3470149	0.3470149	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.46	0.3452187	0.3452187	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SUBM; pH; NO3	2	0.47	0.3581623	0.3581623	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH	1	0.48	0.3415995	0.3415995	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SUBM; pH; NO3	2	0.49	0.3555132	0.3555132	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SUBM; pH; NO3	2	0.5	0.3541861	0.3541861	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SUBM; pH; NO3	2	0.51	0.3528588	0.3528588	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SUBM; pH; NO3	2	0.52	0.3502086	0.3502086	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SUBM; pH; NO3	2	0.53	0.3488876	0.3488876	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; FISH; NO3; SUBM; pH	2	0.54	0.3488876	0.3488876	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SUBM; pH	2	0.55	0.3475708	0.3475708	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SUBM; pH	2	0.56	0.3462589	0.3462589	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SUBM; pH	2	0.57	0.3449527	0.3449527	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SUBM; pH	2	0.58	0.3434619	0.3434619	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SNELL; SUBM	2	0.59	0.3421956	0.3421956	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SNELL; SUBM	2	0.6	0.3409343	0.3409343	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SNELL; SUBM	2	0.61	0.3396792	0.3396792	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SNELL	2	0.62	0.3212482	0.3212482	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; SNELL; SUBM	2	0.63	0.3371904	0.3371904	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.64	0.3397567	0.3397567	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.65	0.3379512	0.3379512	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.66	0.3361644	0.3361644	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.67	0.3343969	0.3343969	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.68	0.3326494	0.3326494	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.69	0.3309222	0.3309222	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.7	0.3292159	0.3292159	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; FISH; SNELL	1	0.71	0.3275307	0.3275307	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.72	0.3258669	0.3258669	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.73	0.3242247	0.3242247	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.74	0.3226044	0.3226044	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.75	0.321006	0.321006	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.76	0.3194296	0.3194296	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.77	0.3178752	0.3178752	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.78	0.3163429	0.3163429	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.79	0.3148326	0.3148326	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.8	0.3133443	0.3133443	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.81	0.3118778	0.3118778	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.82	0.310433	0.310433	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.83	0.3032043	0.3032043	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.84	0.3076081	0.3076081	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.85	0.3062275	0.3062275	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.86	0.3010067	0.3010067	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.87	0.3035293	0.3035293	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

FLOAT; CHAOB; FISH; NO3; pH	2	0.88	0.2995785	0.2995785	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.89	0.2988757	0.2988757	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.9	0.2996356	0.2996356	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; SNELL	1	0.91	0.2974926	0.2974926	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.92	0.2968124	0.2968124	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.93	0.2961398	0.2961398	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.94	0.2954747	0.2954747	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.95	0.2948172	0.2948172	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.96	0.2941672	0.2941672	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.97	0.2935247	0.2935247	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.98	0.2928898	0.2928898	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	0.99	0.2922623	0.2922623	0.001 ***	0.001 ***	NO SPATIAL SIGNAL
FLOAT; CHAOB; FISH; NO3; pH	2	1	0.2916423	0.2916423	0.001 ***	0.001 ***	NO SPATIAL SIGNAL

APPENDIX 3

1. Is the correlation between pH and size diversity mediated by a productivity gradient?

We used a Pearson correlation approach (Borcard *et al.* 2011) to test all possible correlations between pairs of environmental variables. Such analyses revealed a strong correlation between pH and many productivity related variables (Fig. A1). Particularly, pH was significantly correlated with chlorophyll a ($r = 0.489$, $p < 0.001$); phosphates ($r = 0.349$, $p < 0.001$); water transparency (i.e., sneller; $r = -0.47$, $p < 0.001$); floating plants cover ($r = -0.505$, $p < 0.001$); and conductivity ($r = 0.211$, $p < 0.05$). We also used a linear model approach to test the correlation between pH and other productivity related variables and results were qualitatively very similar (Fig. A2). We then summarized the more obvious productivity related variables (i.e., pH, phosphorus, chlorophyll a, and turbidity) through a principal component analysis (PCA). Using all these four explanatory variables generated four PCA axes. We then applied forward selection following Blanchet *et al.* (2008), in order to select the ideal number of PCA axes that better explain variation in body size α-diversity. Two PCA axes were selected to explain variation in body size α-diversity (i.e., PCA 2 and PCA 3). The total amount of explanation provided by these two productivity variables was approximately 13% ($_{adj}R^2 = 0.131$, $p = 0.002$). This represents a slight improvement in the explanatory power given by pH alone (i.e., 11%) on variation in body size α-diversity. This supports the idea that pH likely drives body size diversity through collinearity with several productivity related variables.

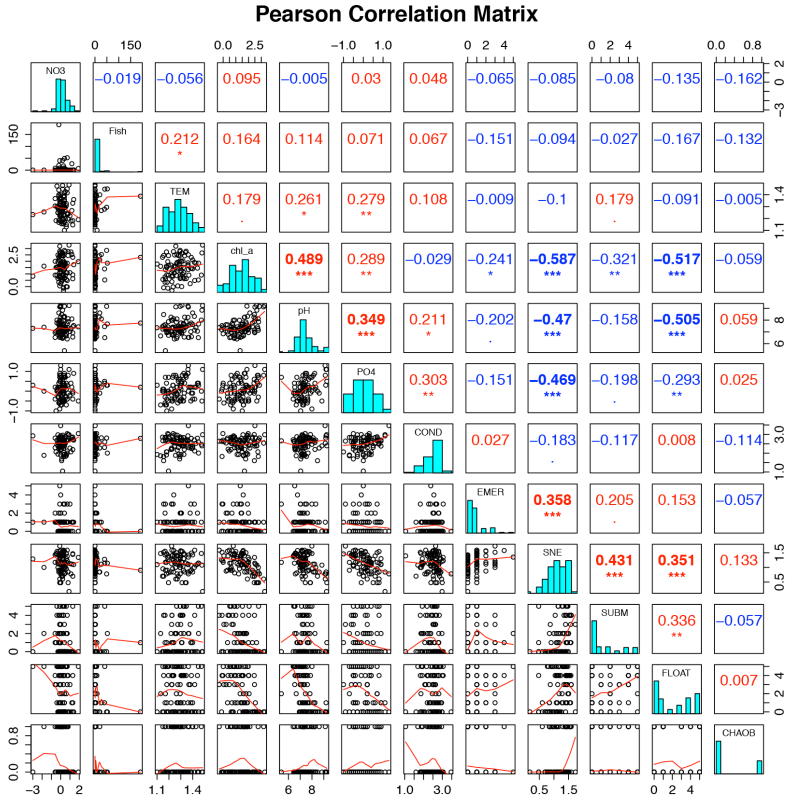

Figure A1: Pearson correlation matrix depicting all possible correlations between pairs of environmental variables. Abbreviations are as follows: NO3 = nitrates; Fish = fish abundance; TEM = temperature; Chl_a = chlorophyll a; PO4 = phosphates; COND = conductivity; EMER = emergent plants; SNE = sneller depth; SUBM = submersed plants; FLOAT = floating plants; CHAOB = presence of the invertebrate predator *Chaoborus sp.*

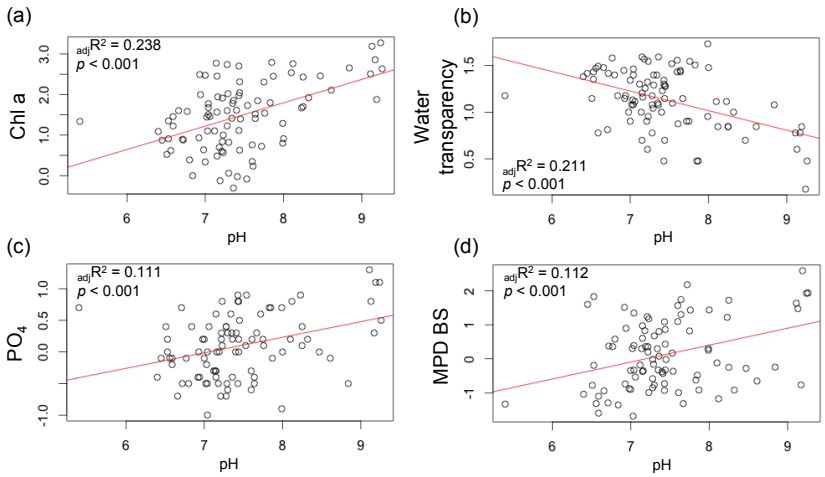

Figure A2. Correlation between pH and (a) Chla, (b) water transparency (c) PO_4 and (d) body size diversity within communities. MPD BS refers to *α-FPD* when $a = 0$, that is, when considering purely information on body size. Note that in (d) negative values correspond to communities in which species tend to overlap more in body size than expected by chance; positive values indicates that species tend to overlap less than expected by chance; and zero correspond to a null expectation. Excluding the pond with the lowest pH, which could represent an outlier, did not impact significantly the results ($_{adj}R^2 = 0.971$, $p = 0.001$ for the correlation between pH and MPD BS).

We also found a positive correlation between pH and average body size within communities (Fig. A3).

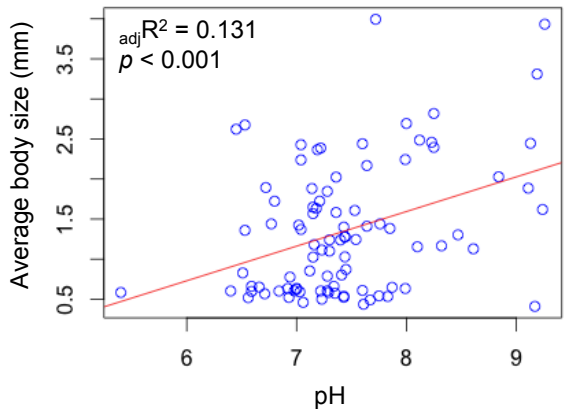

Figure A3. Scatterplot depicting the positive correlation between average body size (weighed by species abundances) within communities and pH. Excluding the pond

with the lowest pH did not impact significantly the results ($_{adj}R^2$ = 0.122, $p < 0.001$ for the correlation between pH and average body size after removing pond with pH = 5.4).

References

1.
Blanchet, F.G., Legendre, P. & Borcard, D. (2008). Forward Selection of Explanatory Variables. *Ecology*, 89, 2623-2632.
2.
Borcard, D., Gillet, F. & Legendre, P. (2011). *Numerical Ecology with R*. Springer New York Dordrecht London Heidelberg.

APPENDIX 4

1. Spatial structure in body size *α*-diversity.

While incorporation of trait and phylogenetic information results in a disappearance of the spatial component in variation partitioning analyses of community turnover (*β*-diversity; Table 1 in the main text), we found similar contributions of pure spatial processes, pure environmental processes and their shared effects on body size *α*-diversity. Pure spatial signal in a metacommunity analysis can result from dispersal limitation *per se* or from unmeasured environmental variables that are spatially structured. We observed that the pattern of size overdispersion within ponds largely correlated with the abundance of the largest species in our data-set (i.e., *Daphnia magna*). We then asked the following question: (1) is the distribution of *D. magna* spatially constrained over the Belgian territory?; (3) is the pure spatial signal on body size *α*-diversity the result of dispersal limitation of *D. magna*?

Results

We found a strong and highly significant positive correlation between the abundance of *D. magna* and patterns of trait alpha diversity (i.e, body size overdispersion) ($_{adj}R^2 = 0.230$, $p < 0.001$). This suggests that *D. magna* is a key interactor affecting community structure in our study system. Moreover, we found that the distribution of this species is strongly constrained in space (Fig. A1). Variation partitioning indicates that the distribution of *D. magna* is affected by

environmental factors, namely pH and phosphorus limitation, but also by pure spatial processes (Fig. A2). Finally, by including *D. magna* abundance as an explanatory variable in the variation partitioning analysis of body size alpha diversity, the overall predictive power of the model increased considerably, while the pure effect of spatial processes was significantly reduced (Fig. A3a). In particular, part of the previous pure spatial effect on body size diversity is now accounted for by the abundance of *D. magna* [see also (Verreydt *et al.* 2012)]. This indicates that the spatially constrained distribution of a key interactor species can, at least in part, explain the observed spatial signal on trait alpha diversity (i.e., body size overdispersion). One important implication of this observation is that, besides the inclusion of abiotic environmental data in studies of trait (and phylogenetic) diversity, biotic information, such as the abundance of ecologically important species, and spatial information may help elucidating patterns of trait clustering versus overdispersion in metacommunities. Moreover, spatial constraints on the distribution of a key interactor species may result in spatial signals that are unrelated to the abiotic environment. Failing to incorporate this information may result in the observation of a pure spatial signal, while in fact the patterns in community characteristics are the consequence of niche-based sorting mediated by a key interactor that is dispersal limited [see also (Verreydt *et al.* 2012)].

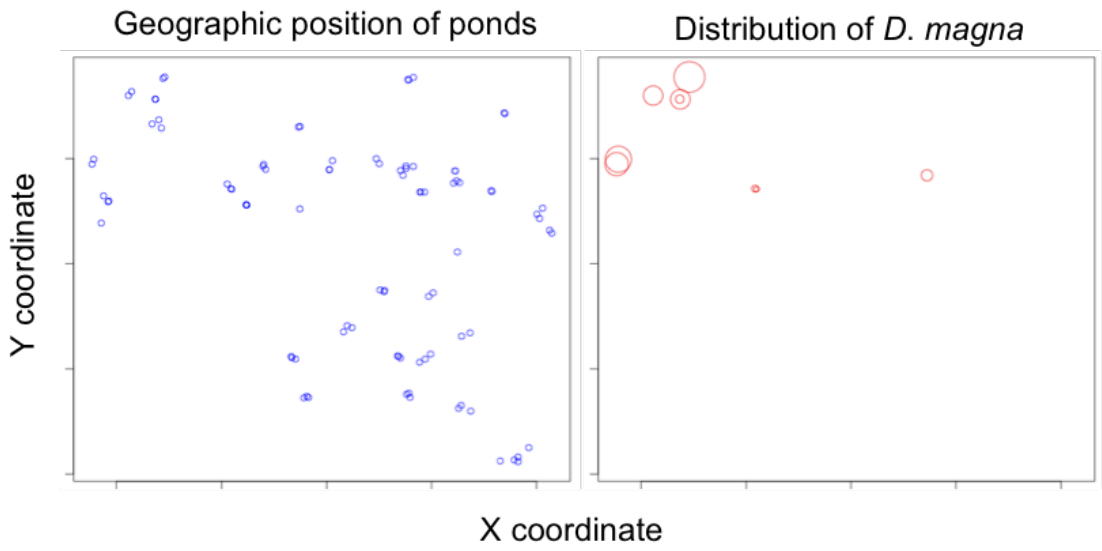

Figure A1: Geographic position of the 91 sampled ponds over the Belgian territory (left). In the right the distribution of *D. magna* is shown. Bubbles size is proportional to abundances.

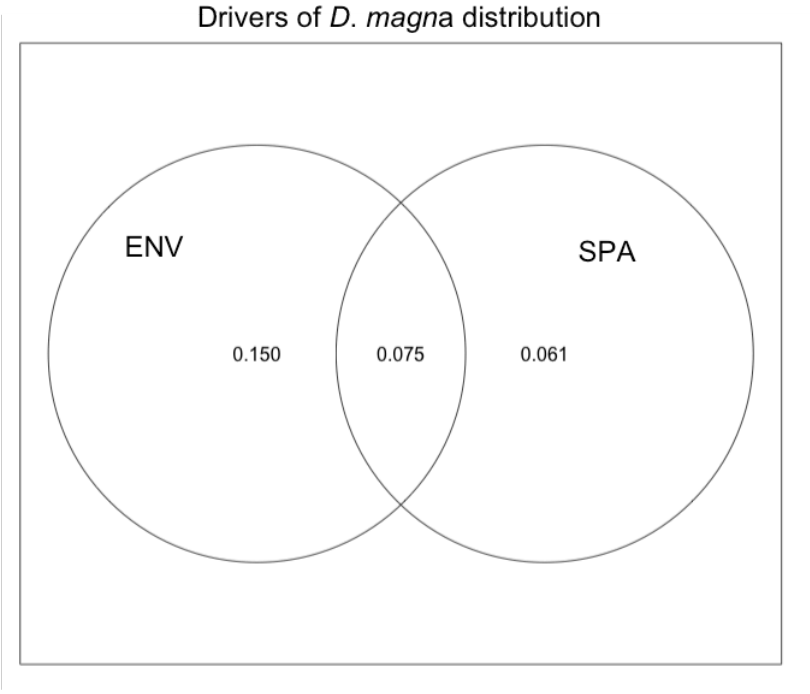

Figure A2: Venn diagrams depicting the drivers of *D. magna* distribution and abundance. ENV = environmental model (i.e., pH and PO^4). SPA = spatial model (i.e., PCNM 3).

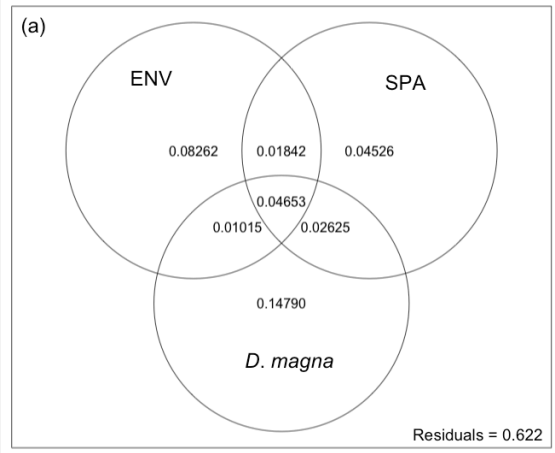

Figure A3: Venn diagrams depicting the abiotic, biotic and spatial drivers of body size alpha diversity. Environmental and spatial variables are the same as used in the analyses presented in the main text. Note that the proportion of explanation previously accounted purely by space is now encompassed by the shared effects between *D. magna* and spatial processes.

References

1.
Verreydt, D., De Meester, L., Decaestecker, E., Villena, M.-J., Van Der Gucht, K., Vannormelingen, P. *et al.* (2012). Dispersal-mediated trophic interactions can generate apparent patterns of dispersal limitation in aquatic metacommunities. *Ecology letters*, 15, 218-226.