

Species richness and composition differ in response to landscape and biogeography

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Online Resource

Investigating collinearity between explanatory variables included in this study.

Table 1 Pearson product moment correlation coefficient for all seven explanatory variables included in this study: island area, island height, distance to mainland (Dist to mainl), structural connectivity at local landscape scale (Conn 100 m), at landscape scale (Conn 1000 m), at extended landscape scale (Conn 4000 m), habitat heterogeneity (Habitat heterog), and residualized habitat heterogeneity (Habitat resid.).

	Island area	Island height	Dist to mainl	Conn 100 m	Conn 1000 m	Conn 4000 m	Habitat heterog	Habitat resid.
Island area	1							
Island height	0.85	1						
Dist to mainl	0.10	0.01	1					
Conn 100 m	-0.09	-0.06	0.002	1				
Conn 1000 m	-0.27	-0.23	0.11	0.26	1			
Conn 4000 m	0.01	0.10	-0.57	0.02	0.21	1		
Habitat heterog	0.78	0.74	0.11	-0.07	-0.27	-0.07	1	
Habitat resid.	2E-16	0.12	0.06	-0.001	-0.09	-0.13	0.62	1
VIF	1.14	Excl.	1.71	1.08	1.36	1.75	Excl.	1.02

Investigating differential effects of landscape and biogeographic variables on the species richness and composition of different species groups.

Species richness

When the species were divided according to life form (forbs, graminoids, shrubs, and trees), the patterns were very similar compared to the results for total species richness (Table 2). Richness of forbs was positively influenced by island area and the connectivity at both local (100 m buffer radius) and extended landscape scale (4000 m), just as total species richness. Graminoid and shrub species richness were not influenced by the extended landscape (4000 m), but otherwise the results were consistent. In contrast, richness in trees was only associated with distance to mainland, with fewer different tree species on islands further from the mainland. This is in accordance with island biogeography theory, and only apparent for tree species possibly due to the longer time taken for trees to colonise islands, whereas the comparatively close proximity to the mainland means that this effect was not evident in the other species groups.

Table 2 Variables explaining species richness divided into groups depending on life form (forbs, graminoids, shrubs, and trees) on 112 islands in the Baltic Sea archipelago. Total species richness is also included (All species) for comparison. The GLMM show the fixed predictors present in the final generalized linear mixed-effects models for each group that also contained island group as a random factor.

	Forbs, AIC=807.5			Graminoids, AIC=556.0			Shrubs, AIC=443.5			Trees, AIC=411.8			All species, AIC=879.1		
	estimate	standard error	p-value	estimate	standard error	p-value	estimate	standard error	p-value	estimate	standard error	p-value	estimate	standard error	p-value
Island area	3.80	0.17	<0.001	4.19	0.19	<0.001	4.80	0.24	<0.001	4.29	0.29	<0.001	3.99	0.29	<0.001
Connectivity 100 m	0.19	0.12	0.11	0.26	0.16	0.10	0.29	0.18	0.11				0.24	0.11	0.03
Connectivity 4000 m	1.04	0.33	0.002										0.81	0.32	0.01
Distance to mainland										-0.60	0.34	0.07			

Species composition

Different species groups generally exhibited similar responses to landscape and biogeographical variables with regard to species composition. Although there were some differences in the strengths of association, all groups were affected in the same direction by island area, especially evident for forbs. The residualized habitat heterogeneity measure did only respond when including the total species community. For the measures of connectivity, forbs, graminoids, and shrubs were influenced by connectivity at the local landscape scale (100 m), but only forbs at the landscape and extended landscape scale. Trees was not influenced by connectivity at any scale but was the only group responding to distance to mainland. All effects were in the same direction evident when comparing medians with the exception for forbs and shrubs in respect to local landscape connectivity when comparing means.

Table 3 Species was divided into group depending on life form. Species scores for axis one for each significant environmental variable and each species group was analysed separate in a pCCA, with the effect of island group removed. Mean value (± 1 standard deviation) and median (in italic) for species scores are reported, non-significant (n.s.) values are not reported.

	All	Forb	Graminoid	Shrub	Tree
Island area	-0.97 $\pm$ 1.26 <i>-1.17</i>	-0.99 $\pm$ 1.26 <i>-1.17</i>	-0.92 $\pm$ 1.24 <i>-1.13</i>	-0.94 $\pm$ 1.19 <i>-1.07</i>	-0.82 $\pm$ 1.20 <i>-0.87</i>
Habitat heterogeneity (residualized)	1.0 $\pm$ 1.81 0.90	n.s.	n.s.	n.s.	n.s.
Connectivity 100 m	-0.01 $\pm$ 2.32 <i>-0.06</i>	0.04 $\pm$ 2.32 <i>-0.03</i>	-0.17 $\pm$ 2.14 <i>-0.04</i>	0.15 $\pm$ 2.42 <i>-0.18</i>	n.s.
Connectivity 1000 m	0.93 $\pm$ 1.85 <i>0.65</i>	0.92 $\pm$ 1.93 <i>0.68</i>	n.s.	n.s.	n.s.
Connectivity 4000 m	0.23 $\pm$ 2.48 <i>0.22</i>	0.13 $\pm$ 2.62 <i>0.22</i>	n.s.	n.s.	n.s.
Distance to mainland	n.s.	n.s.	n.s.	n.s.	-0.75 $\pm$ 1.30 <i>-0.38</i>