Supporting Information

Article title: Intraspecific variability of leaf form and function across habitat types

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The following Supporting Information is available for this article:

Note S1. Sensitivity analysis testing the rotation angle and functional diversity metrics in different scenarios.

To check the robustness of our results, we developed a set of further analyses to assess i) how varying the number of individuals influences the estimate of the angle and diversity metrics (i.e., functional richness and divergence), ii) whether growth form (herbaceous *vs* woody) influences this pattern; iii) whether species richness affects angle estimates; (iv) we finally developed a scenario that simulates data downloading from an online database by pooling data across habitat types (i.e., for calculating BTV we used all individuals of a given species irrespective of habitat type).

To test the effect of adding more individuals on the angle (point i), we repeated the framework explained in the main text 199 times increasing the number of individuals (**Fig. S2**). Concerning diversity metrics, we recalculated the metrics for each habitat considering only a subset of species with at least 10 individual replicates and repeating the procedure 50 times (**Fig. S5**). We also checked if woodiness affects the observed patterns by splitting the analysis described in the main text (see Q1 in methods) for woody and herbaceous species (**Fig. S3**). We did this for three up to five habitat types since two of them (i.e., coastal dunes and inland surface waters) were dominated by herbaceous species, **Fig. S1**). We also tested whether habitat species richness affected angle calculations (point iii). In short, we calculated the angle between eigenvectors in each habitat for each richness value after randomly extracting 199 times one individual per species. We started with the simulation from 7 species up to the maximum number of species present in each habitat (**Fig. S4**). Finally, we compared the results presented in the main text about the structure of the trait space with the one obtained aggregating trait values for each species across habitats (**Table S2**). This procedure should emulate a user downloading trait data from public databases such as TRY, whose different replicates, along with trait provenance, are rarely available.

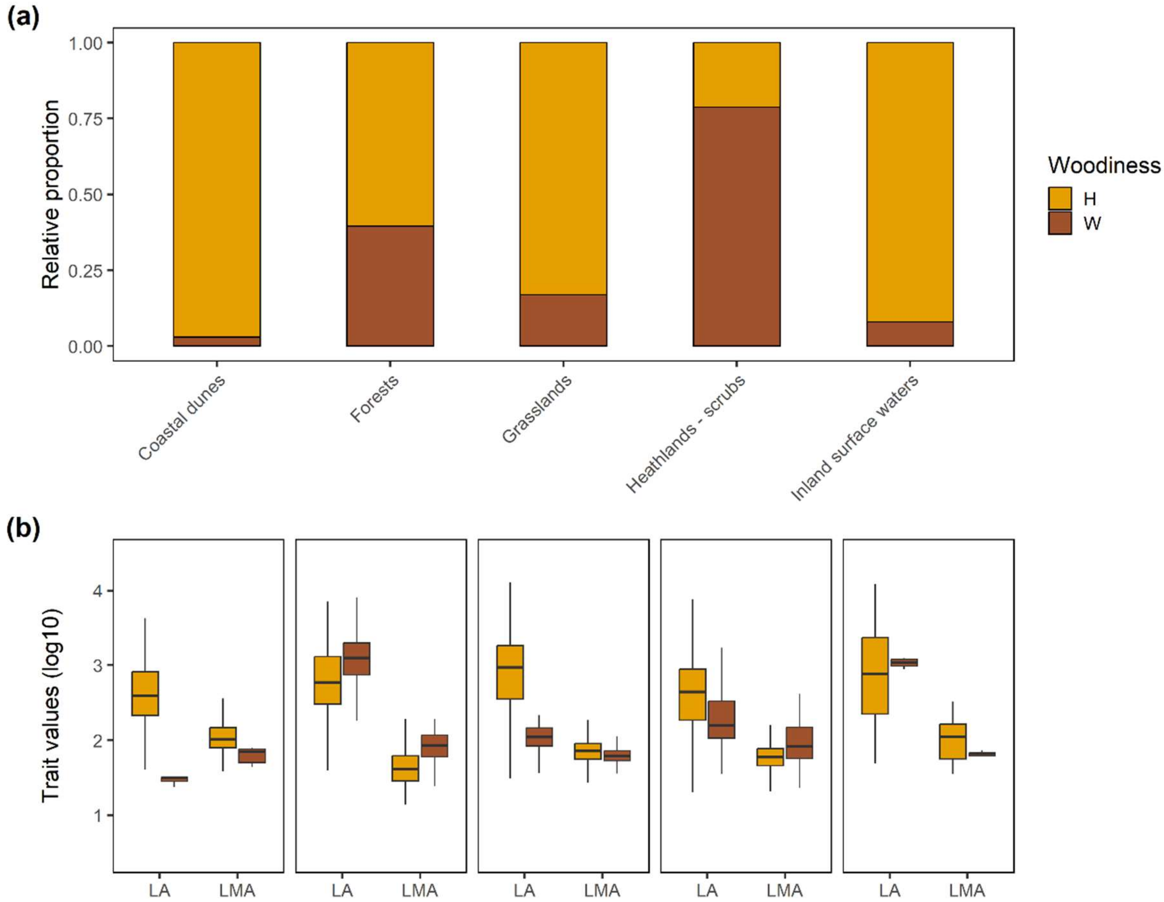

Fig. S1. Herbaceous and woody plants distribution across habitat types. **(a)** Barplots showing the relative proportions of woody and herbaceous species in each habitat. **(b)** Boxplots displaying the variation of LA and LMA across the different habitats.

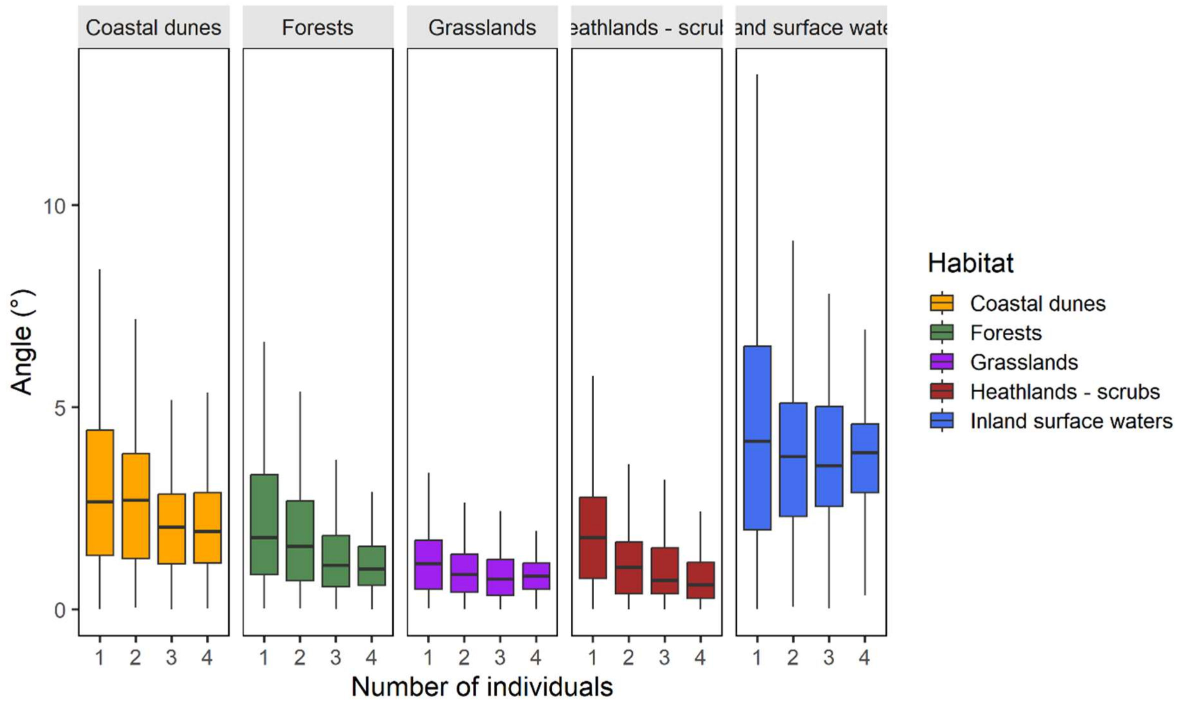

Fig. S2. Effect of the number of individuals selected for angle determination. Boxplots show the variation of angles as a function of the number of individuals across different habitats. For each number of individuals, angle calculations were repeated 199 times.

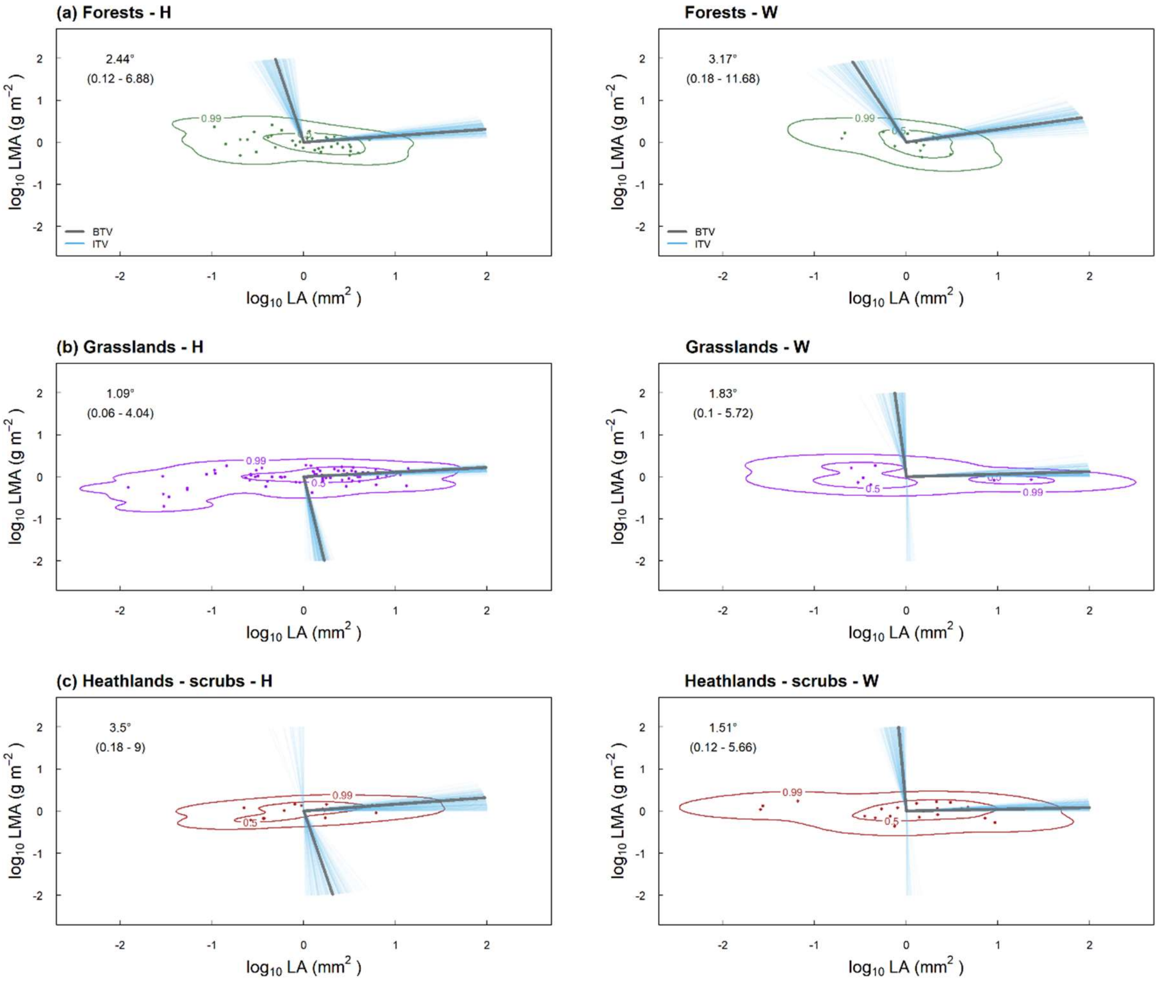

Fig. S3. Trait space rotation by the inclusion of ITV across habitat types by growth form. Trait space rotation refers to the median angle (°) along with its 95% confidence interval (in parentheses) across 199 resampling per habitat (see Methods) between the eigenvectors calculated independently from the trait's covariance matrix at the interspecific (BTV, grey eigenvectors) and at the intraspecific level (ITV, cyan eigenvectors) for herbaceous (H) and woody species (W) in **(a)** forests, **(b)** grasslands, and **(c)** heathlands-scrubs.

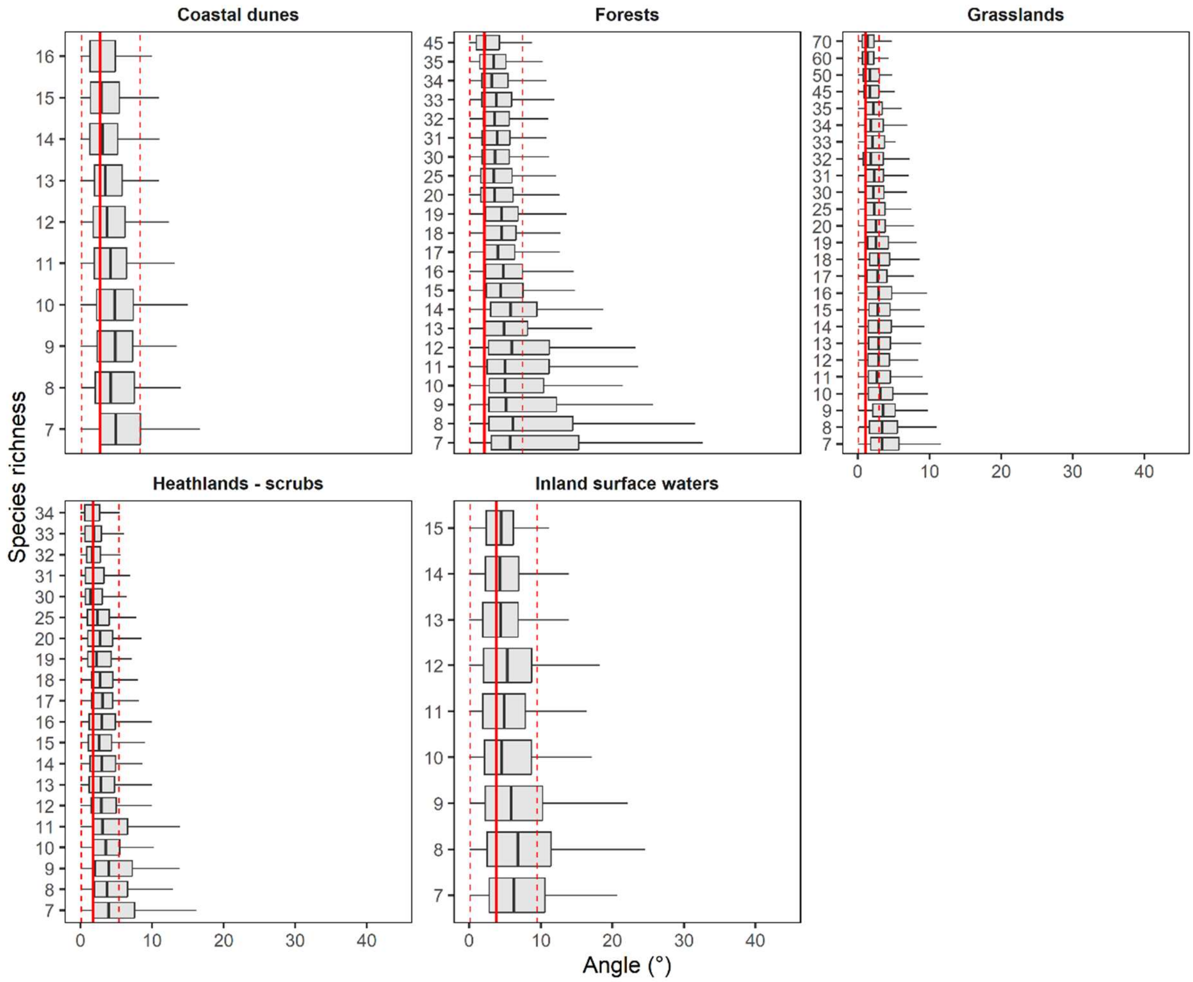

Fig. S4. Effect of species richness on angle estimates across habitat types. Boxplots show the variation of angles (*n*=199) as a function of the number of species considered in the simulation. The solid red line represents the median value reported in Fig. 2 for each habitat, while the dashed lines are the 95% confidence interval.

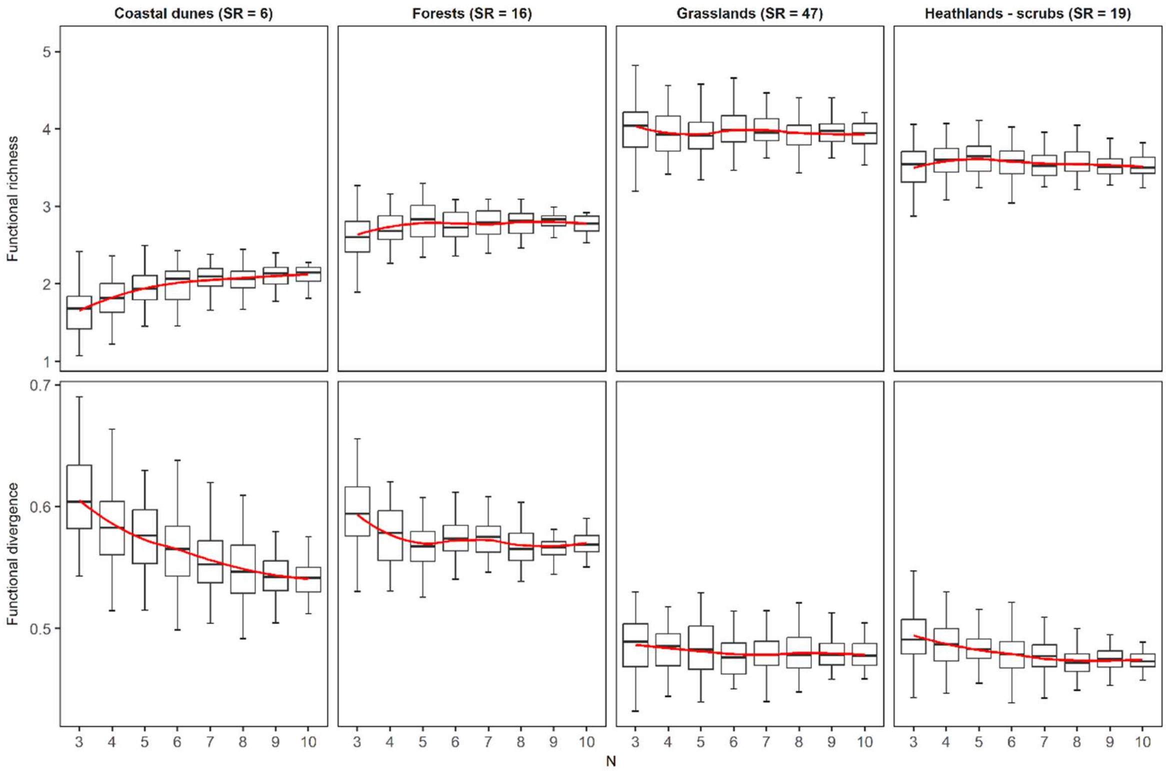

Fig. S5. Effect of sample size on functional diversity metrics. Boxplots show the variation of functional richness (upper panel) and functional divergence (lower panel) as a function of the number of individuals (N) across 50 repetitions. The solid red line represents the trend in the value obtained using LOESS. Note that for each habitat, we considered a subset of species for which we have at least 10 individual replicates.

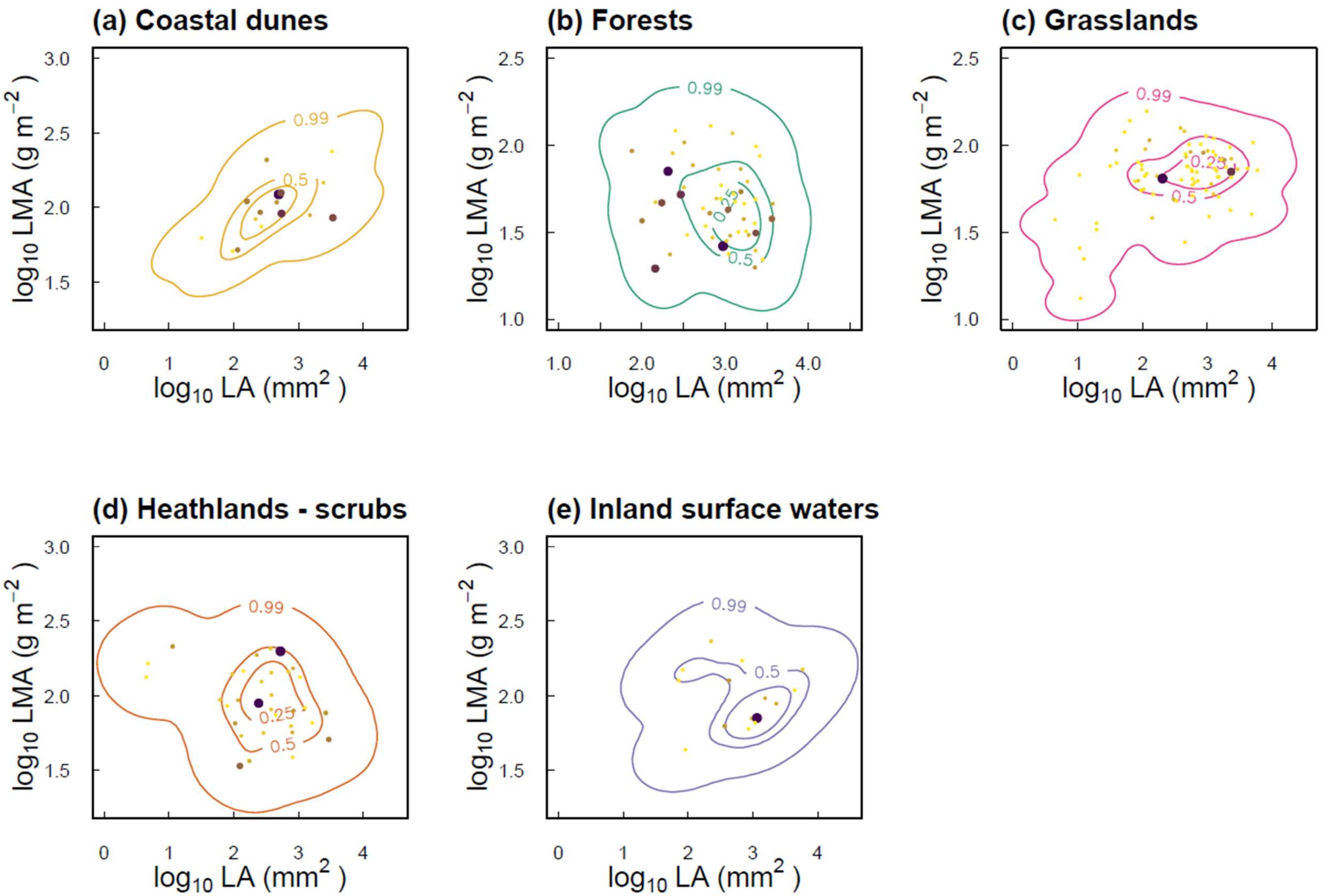

Fig. S6. Map of the variance of leaf area (LA, log10-transformed) per each species by habitat type. Note that variance was rescaled to assume values between 0 and 1 for better visualization and comparison among habitat types. A darker tone indicates greater variance.

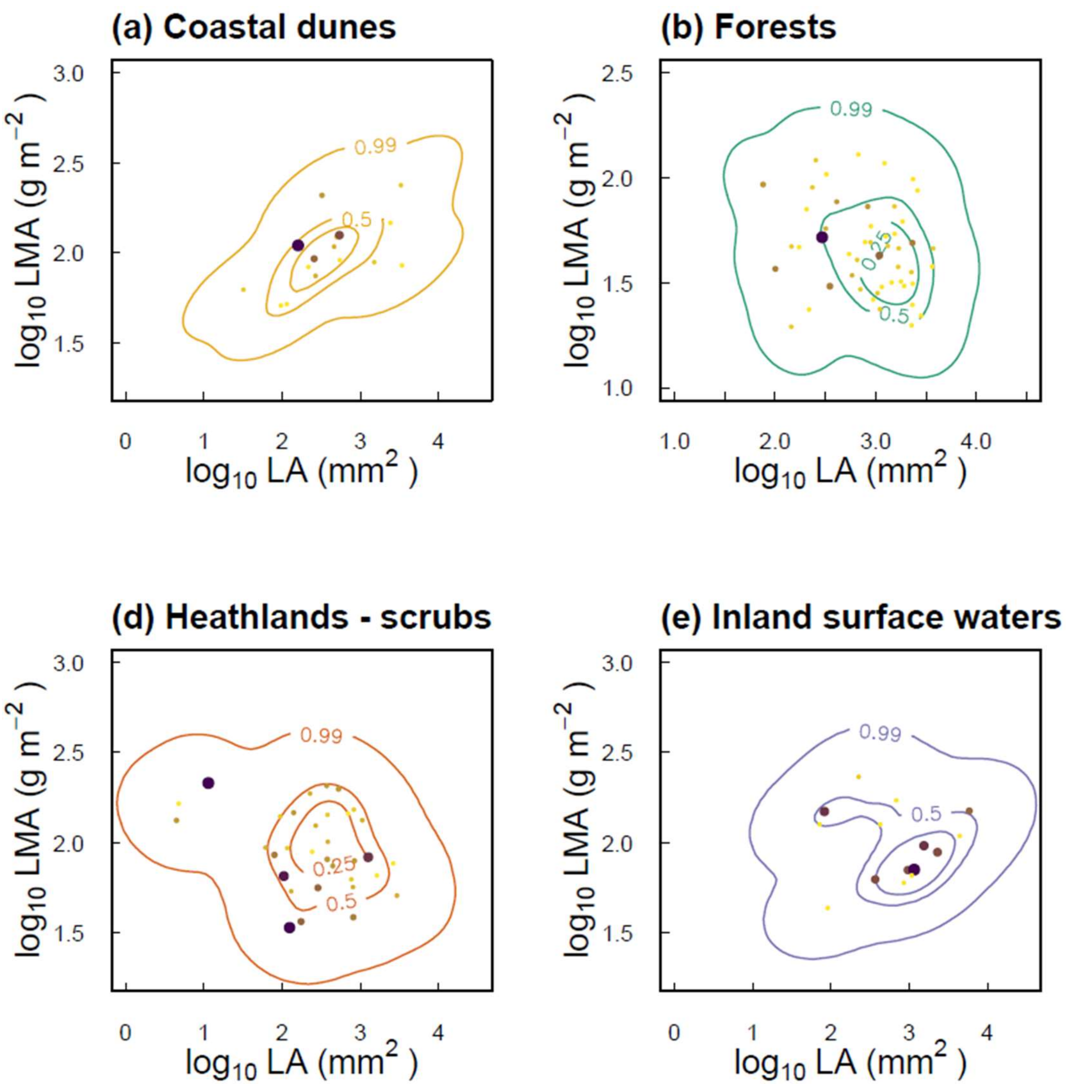

Fig. S7. Map of the variance of leaf mass per unit lead area (LMA, log10-transformed) per each species by habitat type. Note that variance was rescaled to assume values between 0 and 1 for better visualization and comparison among habitat types. A darker tone indicates greater variance.

Table S1. Number of observations across habitat types.

Habitat type	Observations	EUNIS L2	Proportion
Coastal dunes	173	Shifting dunes	7%
		Dune grasslands	93%
Forests	478	Broadleaved deciduous forests	69%
		Broadleaved evergreen forests	31%
Grasslands	1812	Dry grasslands	26%
		Alpine and subalpine grasslands	61%
		Mesic grasslands	12%
		Wet grasslands	0.1%
Heathland-scrub	578	Alpine and subalpine scrubs	60%
		Mediterranean maquis	40%
Inland surface waters	112	Littoral zone of inland surface waterbodies	100%

Number of trait observations available across species in each habitat type corresponding to EUNIS Level 1. The distribution of EUNIS level 2 classification within each habitat type is shown together with the proportion of the total number of observations within each sub-category.

Table S2. Summary of the dissimilarity metrics when accounting for interspecific (BTV) and intraspecific trait variability (ITV) using species trait values pooled across habitats.

Habitat type	Quantile	Nestedness	
Coastal dunes	0.99	0.24 ± 0.055	0.98 ± 0.052
	0.50	0.38 ± 0.124	0.77 ± 0.196
Forests	0.99	0.14 ± 0.021	0.93 ± 0.046
	0.50	0.16 ± 0.063	0.48 ± 0.151
Grasslands	0.99	0.20 ± 0.023	0.98 ± 0.023
	0.50	0.28 ± 0.049	0.99 ± 0.082
Heathlands - scrubs	0.99	0.16 ± 0.038	0.95 ± 0.059
	0.50	0.21 ± 0.045	0.47 ± 0.188
Inland surface waters	0.99	0.29 ± 0.048	0.98 ± 0.034
	0.50	0.44 ± 0.067	0.77 ± 0.219
All data	0.99	0.13 ± 0.022	0.97 ± 0.017
	0.50	0.20 ± 0.033	0.75 ± 0.142