Ecography

E5892

Küster, E. C., Bierman, S. M., Klotz, S. and Kühn, I. 2010. Modelling the impact of climate and land use change on the geographical distribution of leaf anatomy in a temperate flora. – Ecography 33: xxx–xxx.

Supplementary material

Table S1. Principal component analysis on climate data in Germany. Eigenvectors with the loadings of the original variables for the first three principal components.

	Principal components		
Climate variables	1	2	3
Mean annual temperature	0.30	**0.41**	**–0.41**
January temperature	0.15	**0.67**	–0.12
July temperature	0.34	–0.04	–0.53
Log10 (annual precipitation)	**–0.46**	0.14	–0.23
Log10 (winter precipitation)	–0.39	0.38	–0.06
Log10 (summer precipitation)	**–0.43**	–0.10	–0.32
Sum of annual potential evapotranspiration	0.03	**–0.45**	**–0.59**
Annual water deficit	**0.47**	–0.07	0.16

Table S2. Relating variation in LARF to variation in environmental variables in Germany. Estimates of the model parameters of full model 1. Significant parameters are in bold.

	Log(scleromorphic/mesomorphic)			Log(hygromorphic/mesomorphic)		
	Mean	2.5%	97.5%	Mean	2.5%	97.5%
Intercept	**–1.543**	**–1.557**	**–1.528**	**–1.821**	**–1.832**	**–1.811**
PC1	**0.013**	**0.002**	**0.024**	**–0.038**	**–0.049**	**–0.027**
PC2	–0.021	–0.061	0.016	0.005	–0.029	0.037
PC3	–0.003	–0.023	0.018	–0.004	–0.023	0.014
Urban area	**0.110**	**0.052**	**0.168**	–0.056	–0.115	0.003
Forest	**0.055**	**0.030**	**0.081**	**0.038**	**0.014**	**0.063**
Grassland	**–0.065**	**–0.110**	**–0.021**	**0.055**	**0.010**	**0.098**

Table S3. Relating variation in LARF to variation in environmental variables in Germany. Estimates of the model parameters of full model 2. Significant parameters are in bold.

	Log(scleromorphic/mesomorphic)			Log(hygromorphic/mesomorphic)		
	Mean	2.5%	97.5%	Mean	2.5%	97.5%
Intercept	**–1.488**	**–1.505**	**–1.471**	**–1.810**	**–1.825**	**–1.795**
PC1	**0.013**	**0.001**	**0.025**	**–0.042**	**–0.052**	**–0.031**
PC2	–0.021	–0.054	0.018	0.002	–0.029	0.030
PC3	–0.002	–0.023	0.018	–0.003	–0.020	0.014
Urban area	0.056	–0.003	0.114	**–0.065**	**–0.123**	**–0.006**
Cropland	**–0.059**	**–0.083**	**–0.036**	0.003	–0.020	0.026
Grassland	**–0.114**	**–0.158**	**–0.070**	**0.049**	**0.004**	**0.094**

Table S4. Relating variation in LARF to variation in environmental variables in Germany. Estimates of the model parameters of the climate only model. Significant parameters are in bold.

	Log(scleromorphic/mesomorphic)			Log(hygromorphic/mesomorphic)		
	Mean	2.5%	97.5%	Mean	2.5%	97.5%
Intercept	**–1.526**	**–1.538**	**–1.514**	**–1.807**	**–1.811**	**–1.804**
PC1	**0.010**	**0.0002**	**0.020**	**–0.044**	**–0.054**	**–0.034**
PC2	–0.017	–0.049	0.013	–0.002	–0.030	0.035
PC3	0.002	–0.015	0.019	–0.006	–0.025	0.013

Table S5. Relating variation in LARF to variation in environmental variables in Germany. Estimates of the model parameters of minimal model 2.

	Log(scleromorphic/mesomorphic)			Log(hygromorphic/mesomorphic)		
	Mean	2.5%	97.5%	Mean	2.5%	97.5%
Intercept	–1.487	–1.506	–1.469	–1.810	–1.824	–1.795
PC1	0.013	0.007	0.019	–0.040	–0.046	–0.034
Urban area	0.052	–0.008	0.113	–0.064	–0.121	–0.006
Cropland	–0.059	–0.083	–0.035	0.003	–0.020	0.025
Grassland	–0.114	–0.159	–0.069	0.049	0.006	0.094

Table S6. Relating variation in LARF to variation in environmental variables in Germany. Estimates of the model parameter of the model with PC1 only.

	Log(scleromorphic/mesomorphic)			Log(hygromorphic/mesomorphic)		
	Mean	2.5%	97.5%	Mean	2.5%	97.5%
Intercept	–1.526	–1.537	–1.514	–1.807	–1.811	–1.804
PC1	0.007	0.002	0.013	–0.041	–0.046	–0.036

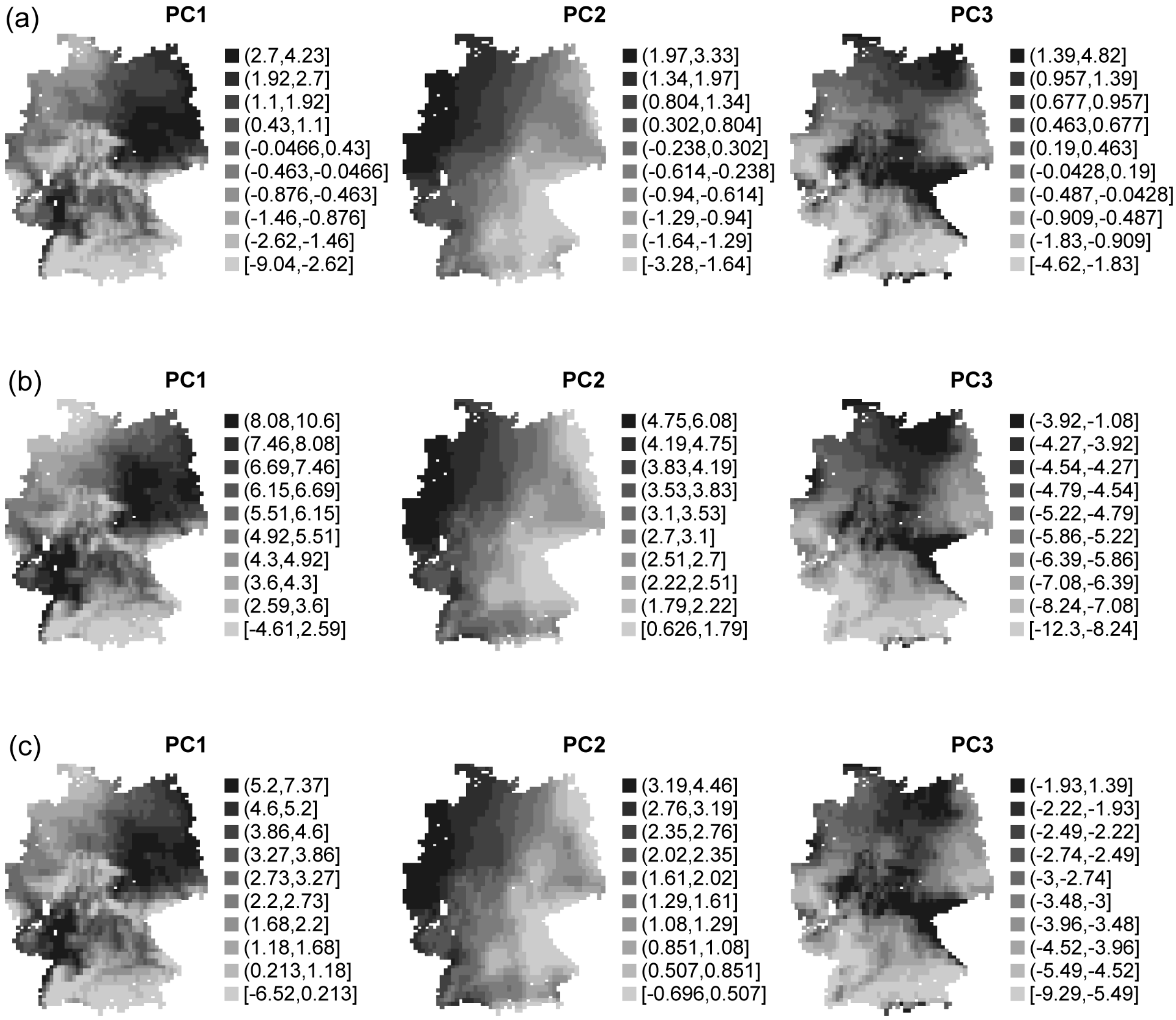

Figure S1. Spatial distributions of the first three principal components for (a) observed climate data in Germany, period averages from 1961–1990, (b) GRAS (A1FI) scenario climate data, period averages from 2051–2080 and (c) SEDG (B1) scenario climate data, period averages from 2051–2080. Principal components were calculated based on the climate data for grid cells used in the calculations. Legends show principal component scores. PC1 reflects a climatic gradient of water availability; sites of high water deficit (large positive values of PC1) vs sites with high precipitation (large negative values of PC1). PC2 reflects winter temperature gradient; sites with milder January temperatures and low annual evapotranspiration in the more oceanic climate (large positive values of PC2) vs sites with low January temperatures and high annual evapotranspiration in the more continental part of the country (large negative values of PC2). PC3 reflects a summer temperature gradient, with lower values on the component the higher July temperature and annual evapotranspiration (for details see method part).

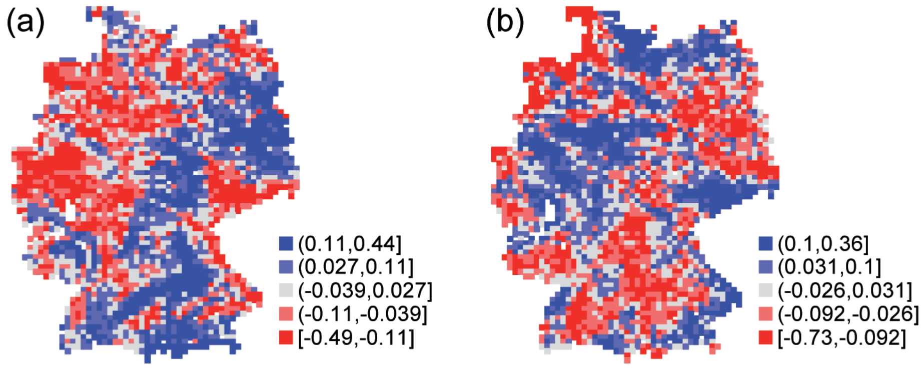

Figure S2. Maps of spatial random effects from minimal model 1 (PC1, land use forest, urban area and grassland) for (a) log(scleromorphic/mesomorphic) and (b) log(hygromorphic/mesomorphic). Units are on the log-ratio scale.

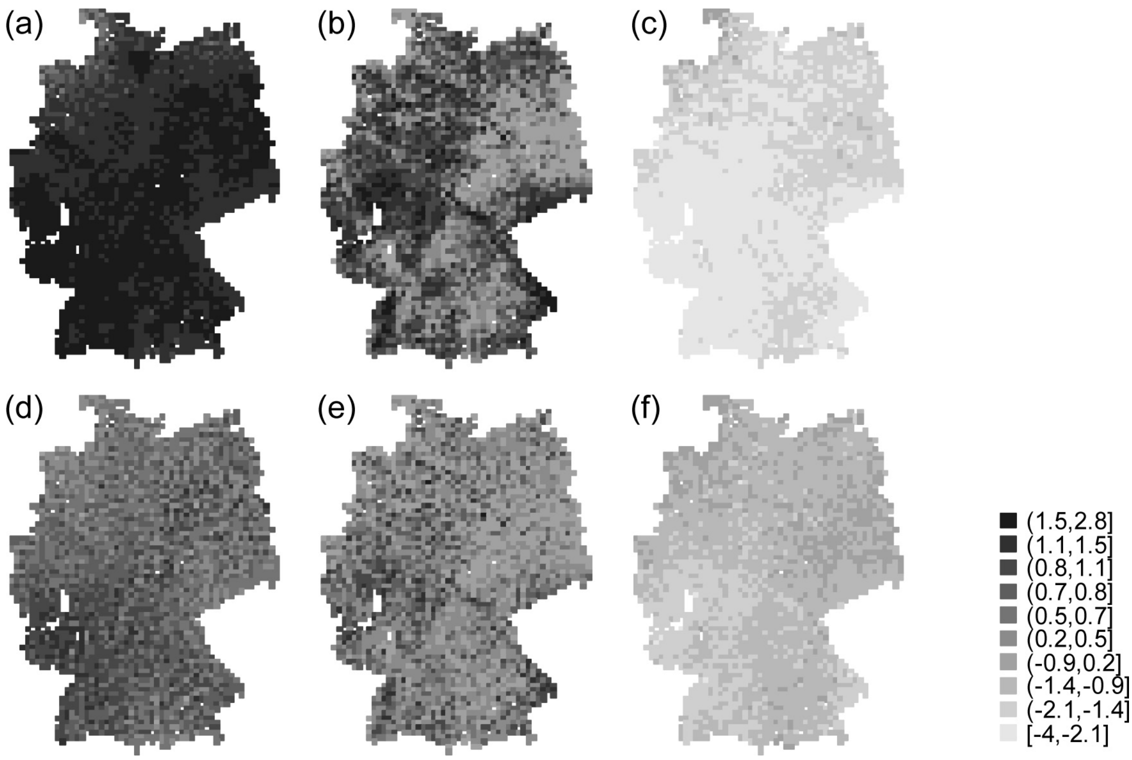

Figure S3. Geographical distribution of absolute change in LARF in Germany projected by minimal model 2 under the GRAS scenario (top row) and SEDG scenario (bottom row) in percent for species with (a, d) scleromorphic leaves, (b, e) mesomorphic leaves and (c, f) hygromorphic leaves in the composition per grid cell in quantiles. Values are depicted for grid cells where data quality was sufficient and that were used in the calculation.

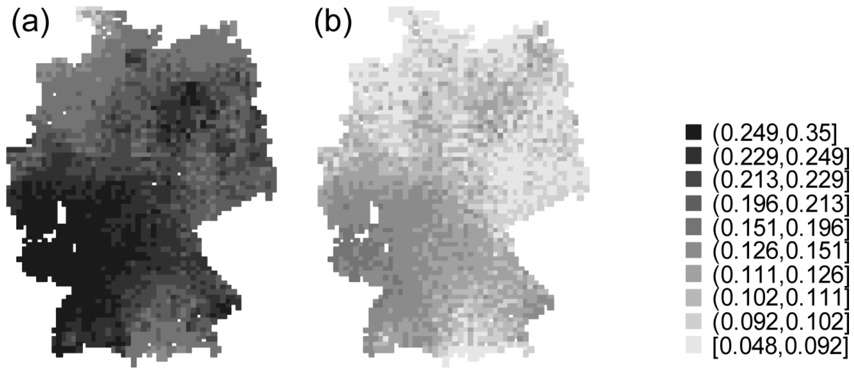

Figure S4. Geographical distribution of functional change in LARF in Germany projected by minimal model 2 under the GRAS scenario (a) and SEDG scenario (b). The amount of change between observed and projected LARF was computed as the norm of the difference composition.

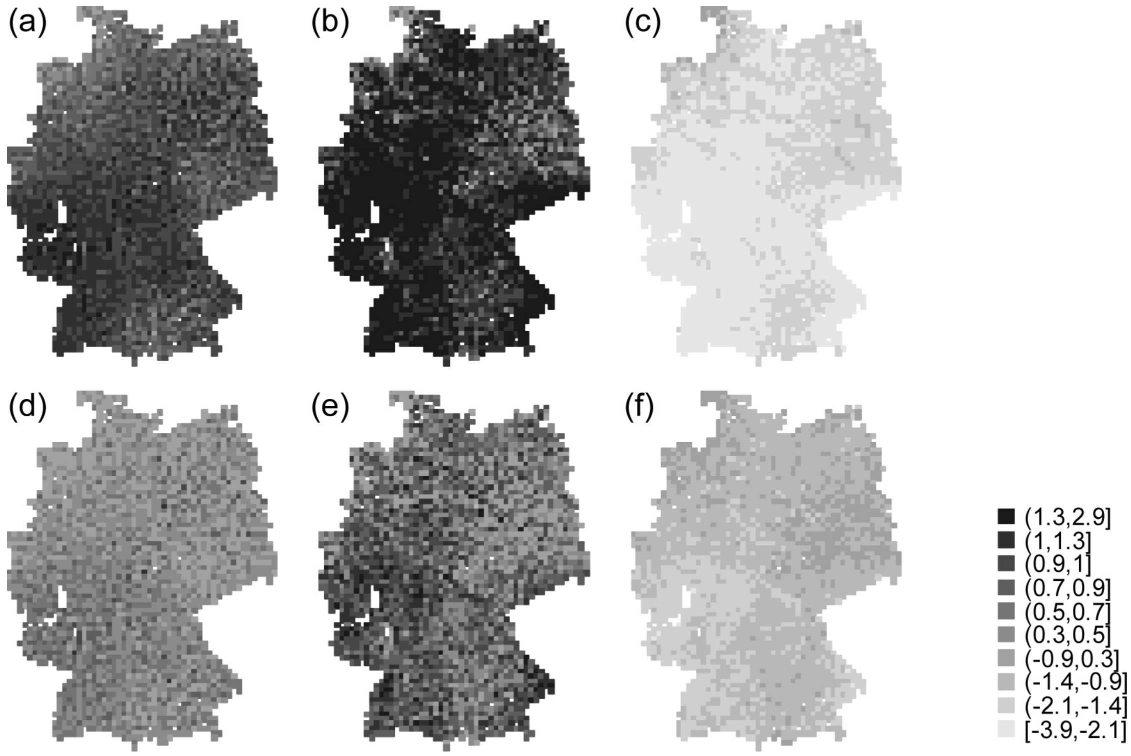

Figure S5. Geographical distribution of absolute change in LARF in Germany projected by the model with PC1 only under the GRAS scenario (top row) and SEDG scenario (bottom row) in percent for species with (a, d) scleromorphic leaves, (b, e) mesomorphic leaves and (c, f) hygromorphic leaves in the composition per grid cell in quantiles. Values are depicted for grid cells where data quality was sufficient and that were used in the calculation.

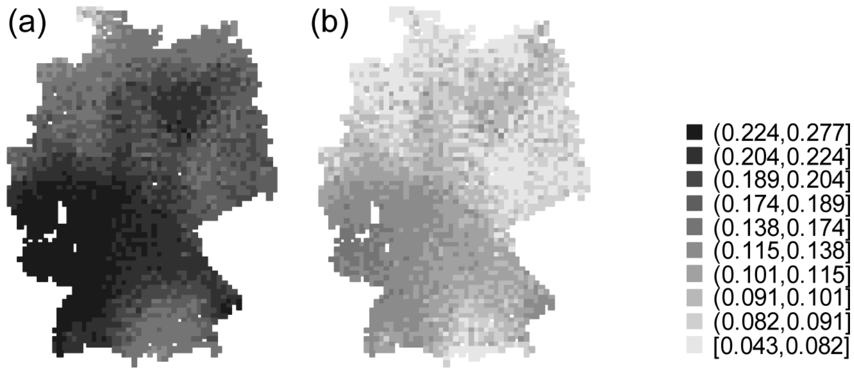

Figure S6. Geographical distribution of functional change in LARF in Germany projected by the model with PC1 only under the GRAS scenario (a) and SEDG scenario (b). The amount of change between observed and projected LARF was computed as the norm of the difference composition.

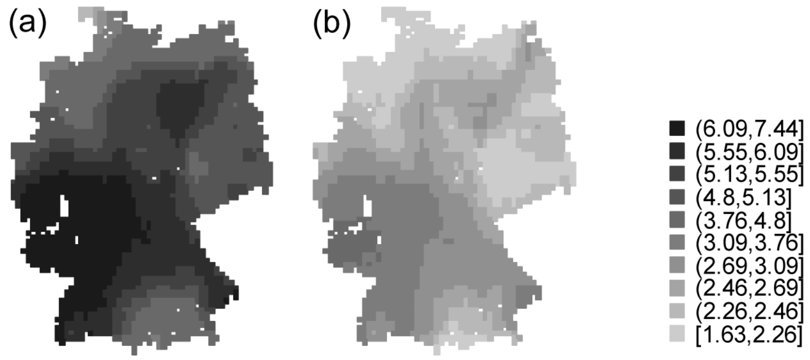

Figure S7. Change in the climatic gradient of water availability (PC1) in Germany under scenario (a) GRAS and (b) SEDG: the higher the values, the higher the increase in water deficit.