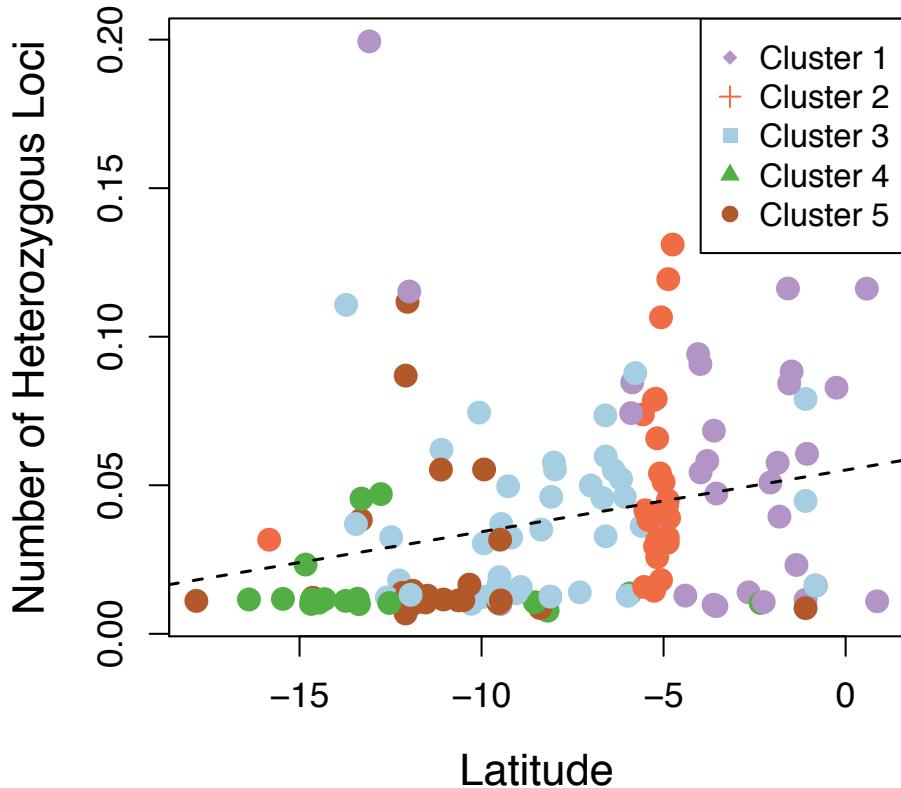
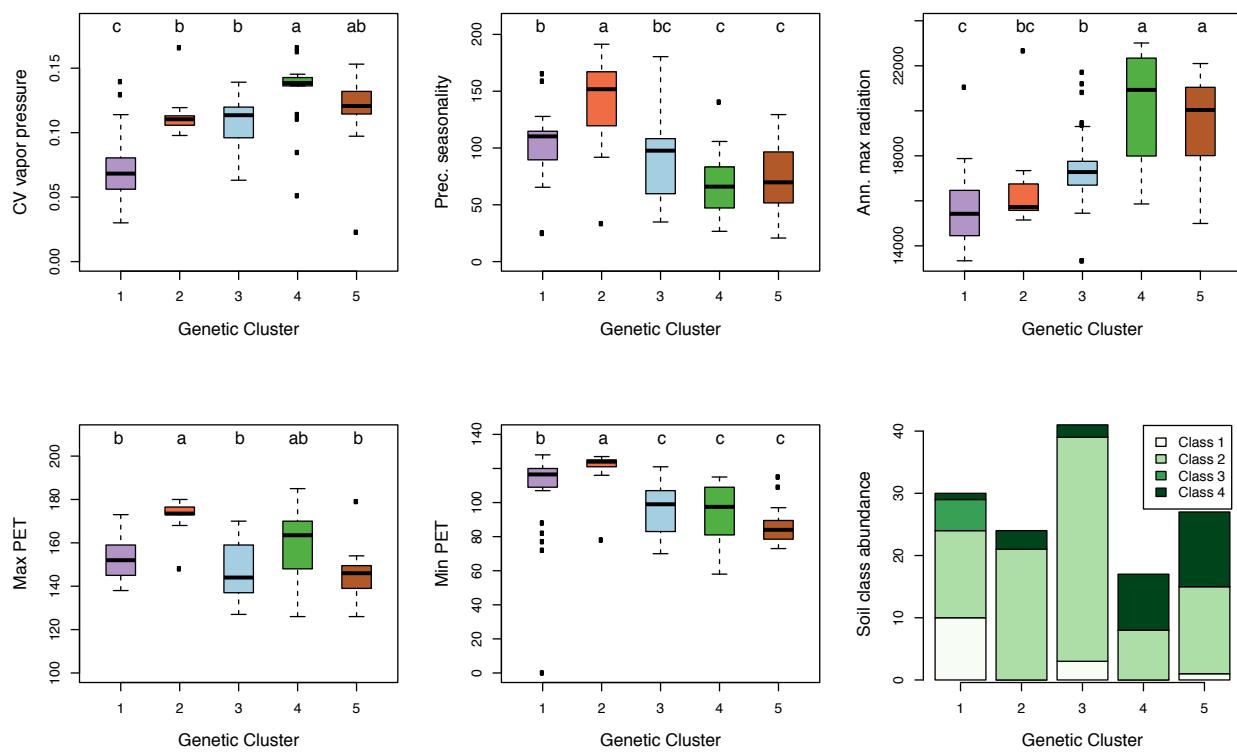


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2 **Figure S1:** Bubble plots of the 10 dbMEM variables identified as significant. Variables 1-4
3 describe broad patterns of spatial structure and variables 5-10 describe fine-scale spatial variation.
4 Color and size of the points correspond to the sign (+ or -) and magnitude of the dbMEM variables,
5 respectively.
6

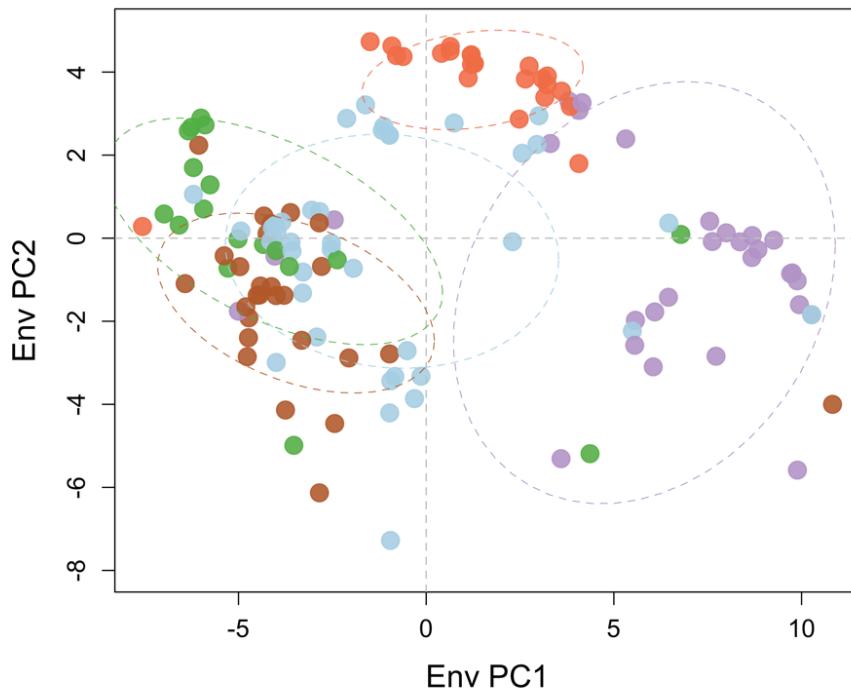


7
8 **Figure S2:** Plot of mean heterozygosity vs latitude. Heterozygosity increased towards the equator,
9 concurrent with the center of the species range. Colors correspond to K-means clusters from PCA
10 shown in Figure 2.
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14 **Figure S3:** Climatic variation by regional genetic cluster. Colors correspond to K-means clusters
15 from PCA shown in Figure 2. All panels were significant based on ANOVA ($P < 1 \times 10^{-8}$). Tukey
16 HSD post-hoc comparison results are shown as letters above each box plot.

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19 **Figure S4:** First two principal components of all 54 environmental variables. Colors correspond
20 to K-means clusters shown in Figure 2.

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Table S1: List of accessions used

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[provided as separate spreadsheet]

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30 **Table S2:** List of all environmental variables included in this study.

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Variable	Database
Annual mean temp	WorldClim
Mean diurnal range	WorldClim
Isothermality	WorldClim
Temperature seasonality	WorldClim
Max temp of warmest month	WorldClim
Min temp of warmest month	WorldClim
Temperature annual range	WorldClim
Mean temp of wettest quarter	WorldClim
Mean temp of driest quarter	WorldClim
Mean temp of warmest quarter	WorldClim
Mean temp of coldest quarter	WorldClim
Annual precipitation	WorldClim
Precipitation of wettest month	WorldClim
Precipitation of driest month	WorldClim
Precipitation seasonality	WorldClim
Precipitation of wettest quarter	WorldClim
Precipitation of driest quarter	WorldClim
Precipitation of warmest quarter	WorldClim
Precipitation of coldest quarter	WorldClim
Annual average radiation	WorldClim
Annual maximum radiation	WorldClim
Annual minimum radiation	WorldClim
Annual variation in solar radiation	WorldClim
Annual average vapor pressure	WorldClim
Annual max vapor pressure	WorldClim
Annual minimum vapor pressure	WorldClim
Annual variation in vapor pressure	WorldClim
Annual average wind speed	WorldClim
Annual max wind speed	WorldClim
Annual minimum wind speed	WorldClim
Annual variation in wind speed	WorldClim
Annual heat:moisture index	Climate South America (CSA)
Degree days above 5 C	Climate South America (CSA)
Degree days below 18 C	Climate South America (CSA)
Degree days above 18 C	Climate South America (CSA)
Number of frost free days	Climate South America (CSA)
Extreme minimum temperature over 30 years	Climate South America (CSA)
Hargreaves reference evaporation	Climate South America (CSA)
Hargreaves climatic moisture deficit	Climate South America (CSA)
Annual aridity	CGIAR
Annual potential evapotranspiration	CGIAR

Annual max potential evapotranspiration	CGIAR
Annual min potential evapotranspiration	CGIAR
Annual variation potential evapotranspiration	CGIAR
Annual Actual evapotranspiration	CGIAR
Annual soil water stress. Mean of months	CGIAR
Annual max soil water stress	CGIAR
Annual min soil water stress	CGIAR
Annual variation soil water stress	CGIAR
Priestley-Taylor Alpha Coefficient	CGIAR
Bulk soil density (fine earth fraction)	SoilGrids
Cation exchange capacity	SoilGrids
pH	SoilGrids
Soil Texture	SoilGrids

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34 **Table S4:** Full summary of SEM model fit
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	Term	Est	SE	z	CI lower	CI upper
Latent	bio_1	1	0	NA	1	1
	bio_2	0.292	0.030	9.514	0.231	0.352
	bio_3	1.724	0.063	26.995	1.599	1.849
	bio_4	1.869	0.067	27.815	1.736	2.000
	bio_5	0.361	0.024	14.606	0.312	0.409
	bio_6	1.568	0.035	43.599	1.497	1.633
	bio_7	1.168	0.046	25.170	1.077	1.259
	bio_8	0.315	0.026	11.745	0.262	0.367
	bio_9	0.749	0.020	37.148	0.709	0.788
	bio_10	0.515	0.019	25.899	0.475	0.553
	bio_11	1.682	0.038	43.795	1.606	1.756
	bio_12	2.766	0.102	26.91	2.564	2.967
	bio_13	2.786	0.103	26.989	2.584	2.988
	bio_14	1.53	0.058	26.35	1.416	1.644
	bio_15	0.671	0.035	18.758	0.600	0.741
	bio_16	2.812	0.105	26.761	2.606	3.019
	bio_17	1.520	0.056	26.749	1.408	1.631
	bio_18	2.594	0.094	27.515	2.409	2.778
	bio_19	1.070	0.049	21.638	0.973	1.166
	ann_avg_rad	1.404	0.053	26.016	1.298	1.509
	ann_max_rad	1.481	0.055	26.829	1.373	1.589
	ann_min_rad	0.260	0.030	8.579	0.201	0.320
	cv_rad	0.325	0.031	10.401	0.263	0.386
	ann_avg_vapr	1.483	0.037	39.459	1.409	1.556
	ann_max_vapr	1.129	0.022	50.454	1.085	1.173
	ann_min_vapr	1.529	0.038	39.324	1.453	1.606
	cv_vapr	2.249	0.079	28.364	2.094	2.405
	ann_avg_wind	1.601	0.070	22.745	1.463	1.739
	ann_max_wind	1.601	0.070	22.822	1.464	1.739
	ann_min_wind	1.399	0.06	21.452	1.271	1.527
	cv_wind	0.563	0.034	16.475	0.496	0.630
	AHM	2.799	0.102	27.217	2.597	3.000
	DD5	1.171	0.023	48.988	1.124	1.218
	DD_18	0.616	0.019	32.072	0.578	0.653
	DD18	1.719	0.055	31.158	1.611	1.827
	NFFD	0.212	0.032	6.638	0.149	0.275
	EMT	0.530	0.020	25.460	0.489	0.570

Eref	0.332	0.027	12.013	0.278	0.387
CMD	1.696	0.060	28.077	1.577	1.814
ann_ai	2.878	0.105	27.164	2.670	3.086
ann_pet	0.477	0.028	16.783	0.421	0.533
max_pet	0.195	0.026	7.280	0.142	0.248
min_pet	0.854	0.035	23.922	0.784	0.924
cv_pet	2.171	0.073	29.465	2.026	2.315
ann_aet	2.878	0.105	27.340	2.671	3.084
ann_swt	1.933	0.075	25.571	1.784	2.081
max_swt	0.663	0.036	18.073	0.591	0.734
min_swt	1.713	0.061	27.659	1.592	1.834
cv_swt	1.133	0.051	22.061	1.032	1.233
ptac	2.594	0.095	27.273	2.408	2.781
bdfe	1.537	0.053	28.761	1.432	1.642
cec	0.617	0.037	16.248	0.542	0.691
swc	0.484	0.032	14.767	0.420	0.548
ph	2.164	0.080	26.896	2.006	2.321
txt.4	1.089	0.050	21.534	0.990	1.188
txt.6	0.564	0.036	15.504	0.492	0.635
txt.7	0.642	0.039	16.441	0.566	0.719
txt.9	0.468	0.036	12.988	0.398	0.539
geo.dist	1	0	NA	1	1
Regressions	gen.dist~env	0.788	0.043	18.066	0.702
	gen.dist~geo	0.17	0.011	14.523	0.150
Covariances	env~geo	0.219	0.010	21.967	0.200
Variances	geo	0.219	0.010	21.967	0.200
	env	0.112	0.008	13.967	0.096
	geo	0.999	0.013	72.773	0.972
	bio_1	0.887	0.042	20.956	0.804
	bio_2	0.990	0.013	75.511	0.964
	bio_3	0.664	0.010	60.748	0.643
	bio_4	0.606	0.008	67.590	0.588
	bio_5	0.985	0.031	30.838	0.922
	bio_6	0.722	0.021	34.341	0.681
	bio_7	0.845	0.014	59.574	0.818
	bio_8	0.988	0.018	52.292	0.951
	bio_9	0.936	0.026	35.641	0.885
	bio_10	0.969	0.033	29.191	0.904
	bio_11	0.680	0.020	33.767	0.641
	bio_12	0.137	0.003	40.948	0.130

bio_13	0.124	0.003	40.062	0.118	0.130
bio_14	0.735	0.014	51.722	0.707	0.763
bio_15	0.949	0.013	69.279	0.922	0.975
bio_16	0.107	0.003	32.742	0.101	0.113
bio_17	0.739	0.010	67.260	0.717	0.760
bio_18	0.240	0.005	43.859	0.230	0.251
bio_19	0.870	0.011	74.274	0.847	0.893
ann_avg_rad	0.777	0.010	71.800	0.756	0.798
ann_max_rad	0.752	0.009	77.481	0.733	0.771
ann_min_rad	0.992	0.015	63.339	0.961	1.022
cv_rad	0.987	0.016	61.618	0.956	1.019
ann_avg_vapr	0.751	0.018	40.139	0.715	0.788
ann_max_vapr	0.855	0.020	37.367	0.811	0.900
ann_min_vapr	0.736	0.019	37.210	0.697	0.774
cv_vapr	0.429	0.006	63.030	0.415	0.442
ann_avg_wind	0.710	0.010	68.549	0.690	0.731
ann_max_wind	0.710	0.010	66.884	0.689	0.731
ann_min_wind	0.779	0.010	73.168	0.758	0.799
cv_wind	0.964	0.015	62.054	0.933	0.994
AHM	0.116	0.003	32.730	0.109	0.123
DD5	0.845	0.016	49.901	0.811	0.878
DD_18	0.957	0.016	56.487	0.923	0.990
DD18	0.666	0.010	65.954	0.646	0.686
NFFD	0.994	0.058	16.986	0.880	1.109
EMT	0.968	0.020	48.004	0.928	1.007
Eref	0.987	0.015	65.433	0.957	1.016
CMD	0.675	0.014	47.645	0.647	0.703
ann_ai	0.065	0.003	16.743	0.057	0.073
ann_pet	0.974	0.014	65.480	0.945	1.003
max_pet	0.995	0.050	19.586	0.895	1.095
min_pet	0.917	0.027	32.907	0.862	0.972
cv_pet	0.468	0.007	65.070	0.454	0.482
ann_aet	0.065	0.003	18.125	0.058	0.072
ann_swt	0.570	0.009	57.975	0.558	0.598
max_swt	0.950	0.012	76.405	0.925	0.974
min_swt	0.668	0.007	89.816	0.654	0.683
cv_swt	0.855	0.011	72.130	0.831	0.878
ptac	0.240	0.004	49.526	0.231	0.250
bdfe	0.733	0.015	48.467	0.703	0.762
cec	0.956	0.017	54.409	0.922	0.991

swc	0.97	0.017	56.028	0.939	1.007
ph	0.471	0.007	65.457	0.457	0.485
txt.4	0.86	0.014	58.721	0.837	0.895
txt.6	0.964	0.004	225.240	0.955	0.972
txt.7	0.953	0.031	30.108	0.891	1.015
txt.9	0.975	0.008	115.088	0.958	0.991
geo.dist	0	0	NA	0	0
gen.dist	0.839	0.013	60.734	0.812	0.866

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38 **Table S5:** Full summary of GDM models

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Model	Null deviance	GDM deviance	Percent deviance explained	Intercept
Environment	863.28	611.06	29.21	0.96
Space	863.28	657.36	23.85	0.95
Environment+Space	863.28	602.45	30.21	0.90

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52 **Table S6:** Variable contributions for environment GDM model. 3-spline fit.

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Predictor	Coefficient 1	Coefficient 2	Coefficient 3
DD18	0	0.692	0
Bio7	0	0	0.065
ann_max_rad	0	0.108	0.130
max_swt	0	0.019	0.014
cv_eind	0.065	0	0
Bio4	0	0	0
ann_avg_wind	0	0	0.112
ann_max_wind	0	0	0
max_pet	0	0	0.067
CMD	0	0	0
cv_vapr	0	0.212	0
EMT	0	0	0
Bio3	0.022	0	0
Bio2	0	0.009	0.003

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56 **Table S7:** Variable contributions for environment + space GDM model. 3-spline fit.

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Predictor	Coefficient1	Coefficient2	Coefficient3
Geographic	0.205	0.168	0.083
DD18	0	0.566	0
Bio7	0	0	0.041
Ann_max_rad	0	0.054	0.057
max_swt	0	0	0.028
cv_eind	0.014	0	0
Bio4	0	0.033	0
ann_avg_wind	0	0	0.092
ann_max_wind	0	0	0
max_pet	0	0	0.038
CMD	0	0	0
cv_vapr	0	0.027	0
EMT	0	0	0
Bio3	0	0.024	0
Bio2	0	0	0.005

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66 **Table S8:** Correlations among PCs, dbMEM variables, and environmental variables. Correlation
 67 coefficients are shown in the lower diagonal. Corrected P-values are shown in the upper
 68 diagonal.

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79 **Table S9:** Full list of outlier SNPs and their annotations

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81 [provided as separate spreadsheet]