Supplementary Materials

Supplementary Table S1: Species data and environmental variables source

Data sources	Website links	Yeas	spatial resolution
A. palmeri occurrence records	GBIF (https://www.gbif.org/, accessed April 2023)		/
	CHV (https://www.cvh.ac.cn/, accessed April 2023)		
	PPBC (http://ppbc.iplant.cn/, accessed April 2023)		
	WOS (https://www.webofscience.com/)		
	CNKI (https://www.cnki.net/)		
19 bioclimatic factors	https://worldclim.org/data/worldclim21.html	1970-2000	
	https://worldclim.org/data/cmip6/cmip6climate.html	2020-2060	2.5 minutes
12 wind speed	https://worldclim.org/data/worldclim21.html	1970-2000	2.5 minutes
Elevation	https://worldclim.org/data/worldclim21.html	2020	2.5 minutes
18 soil factors	https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v12/en/	1971-1981	2.5 minutes
Human footprint index	https://sedac.ciesin.columbia.edu/data/set/wildareas-v3-2009-human-footprint	2009	2.5 minutes

Supplementary Table S2: Environmental variables for the potential geographical distribution of *Amaranthus palmeri*.

Variable	Description	Unit
bio1	Annual mean temperature	℃
bio2	Mean diurnal temperature range	℃
bio3	Isothermality (Bio2/Bio7)×100	-
bio4	Temperature seasonality (standard deviation×100)	℃
bio5	Max temperature of warmest month	℃
bio6	Min temperature of coldest month	℃
bio7	Temperature annual range	℃
bio8	Mean temperature of wettest quarter	℃
bio9	Mean temperature of driest quarter	℃
bio10	Mean temperature of warmest quarter	℃
bio11	Mean temperature of coldest quarter	℃
bio12	Annual precipitation	mm
bio13	Precipitation of wettest month	mm
bio14	precipitation of driest month	mm

bio15	Precipitation seasonality (coeffcient of variation×1	-
bio16	Precipitation of wettest quarter	mm
bio17	Precipitation of driest quarter	mm
bio18	Precipitation of warmest quarter	mm
bio19	Precipitation of coldest quarter	mm
Altitude	Altitude	m
Slope	Slope	
Aspect	Aspect	%
ACC_PROP	Soil Available Water Content Range	-
SWR	Soil water regime	-
T_OC	Topsoil Organic Carbon	% weight
T_bulk	Topsil reference bulk density	$Kg \cdot dm^{-3}$
T_PH_H2O	Topsoil pH (H$_2$O)	$-\log(H+)$
T_sand	Topsoil Sand Fraction	% wt
T_CaCO$_3$	Topsoil calcium carbonate	% weight
T_CaCO$_4$	Topsoil gypsum	% weight
T_cec_clay	Topsoil cec (clay)	$cmol \cdot kg^{-1}$
T_cec_soil	Topsoil cec (soil)	$cmol \cdot kg^{-1}$
T_clay	Topsoil clay fraction	% wt
T_ece	Topsoil salinity (Elco)	$ds \cdot m^{-1}$
T_teb	Topsoil teb	$cmol \cdot kg^{-1}$
T_esp	Topsoil sodicity	%
T_gravel	Topsoil gravel content	% vol
T_silt	Topsoil silt fraction	% wt
T_texture	Topsoil texture	code
T_bs	Topsoil base saturation	%
Wind_1	Wind speed in January	$m \cdot s^{-1}$
Wind_2	Wind speed in February	$m \cdot s^{-1}$
Wind_3	Wind speed in March	$m \cdot s^{-1}$
Wind_4	Wind speed in April	$m \cdot s^{-1}$
Wind_5	Wind speed in May	$m \cdot s^{-1}$
Wind_6	Wind speed in June	$m \cdot s^{-1}$
Wind_7	Wind speed in July	$m \cdot s^{-1}$
Wind_8	Wind speed in August	$m \cdot s^{-1}$
Wind_9	Wind speed in September	$m \cdot s^{-1}$
Wind_10	Wind speed in October	$m \cdot s^{-1}$
Wind_11	Wind speed in November	$m \cdot s^{-1}$
Wind_12	Wind speed in December	$m \cdot s^{-1}$
Human influence index	Human Influence Index	-

	Add_prop	aspect	T_swr	T_bs	T_bulk	T_CaCO_3	T_CaCO_4	T_cec_clay	T_cec_soil	T_clay	T_oc
Add_prop	1.000	0.001	0.010	0.042	0.013	0.061	0.011	0.021	-0.007	0.039	-0.006
aspect	0.001	1.000	-0.001	0.000	0.002	0.000	0.000	0.001	-0.001	-0.001	-0.002
T_swr	0.010	-0.001	1.000	0.040	-0.027	-0.147	-0.033	-0.036	-0.010	0.011	0.038
T_bs	0.042	0.000	0.040	1.000	-0.053	0.086	0.027	0.153	0.067	0.001	0.030
T_bulk	0.013	0.002	-0.027	-0.053	1.000	0.107	0.026	-0.017	-0.759	-0.273	-0.869
T_CaCO_3	0.061	0.000	-0.147	0.086	0.107	1.000	0.280	0.109	-0.010	0.082	-0.103
T_CaCO_4	0.011	0.000	-0.033	0.027	0.026	0.280	1.000	0.021	-0.014	0.021	-0.029
T_cec_clay	0.021	0.001	-0.036	0.153	-0.017	0.109	0.021	1.000	0.227	-0.238	0.031
T_cec_soil	-0.007	-0.001	-0.010	0.067	-0.759	-0.010	-0.014	0.227	1.000	0.347	0.858
T_clay	0.039	-0.001	0.011	0.001	-0.273	0.082	0.021	-0.238	0.347	1.000	0.141
T_oc	-0.006	-0.002	0.038	0.030	-0.869	-0.103	-0.029	0.031	0.858	0.141	1.000
T_ece	0.024	0.000	-0.061	0.038	0.013	0.214	0.311	0.027	-0.005	0.030	-0.031
T_teb	0.017	-0.001	-0.113	0.129	-0.412	0.315	0.043	0.251	0.701	0.464	0.434
T_esp	0.032	0.000	-0.064	0.049	0.065	0.291	0.272	0.006	-0.045	0.076	-0.085
T_gravel	-0.097	0.000	-0.092	-0.099	0.017	0.137	0.005	-0.077	-0.091	-0.119	-0.074
T_sand	0.040	0.000	0.027	-0.050	0.400	-0.111	-0.042	0.068	-0.514	-0.721	-0.263
T_silt	-0.083	0.000	-0.047	0.072	-0.331	0.092	0.043	0.098	0.435	0.209	0.242
T_texture	-0.016	-0.001	0.006	0.010	-0.299	0.080	0.028	-0.201	0.371	0.847	0.148
bio1	0.893	0.001	-0.031	0.076	-0.001	0.008	0.002	0.006	0.002	0.011	0.002
bio2	0.893	0.001	-0.031	0.076	-0.001	0.008	0.002	0.006	0.002	0.011	0.002
bio3	0.167	0.000	0.017	0.053	0.151	0.310	0.084	-0.293	-0.179	0.318	-0.212
bio4	0.039	0.001	-0.088	0.131	-0.083	0.002	-0.011	0.347	0.177	-0.290	0.139
bio5	0.201	-0.001	-0.170	0.056	0.174	0.315	0.100	-0.180	-0.121	0.254	-0.149
bio6	0.045	-0.001	0.009	-0.085	0.120	0.106	0.044	-0.338	-0.175	0.322	-0.156
bio7	0.134	0.001	-0.148	0.152	-0.057	0.049	0.001	0.354	0.166	-0.286	0.123
bio8	0.141	-0.001	-0.040	-0.093	0.126	0.089	0.028	-0.259	-0.110	0.243	-0.095
bio9	0.084	-0.001	-0.072	-0.007	0.131	0.210	0.078	-0.279	-0.160	0.300	-0.157
bio10	0.168	-0.001	-0.132	0.022	0.168	0.290	0.094	-0.228	-0.134	0.282	-0.152
bio11	0.072	-0.001	-0.012	-0.084	0.130	0.120	0.047	-0.334	-0.179	0.316	-0.161
bio12	0.004	-0.001	0.215	-0.134	-0.071	-0.253	-0.073	-0.335	-0.060	0.269	0.020
bio13	0.032	-0.001	0.123	-0.185	-0.016	-0.229	-0.067	-0.347	-0.083	0.267	-0.021
bio14	-0.043	-0.001	0.273	-0.005	-0.122	-0.178	-0.054	-0.102	0.030	0.118	0.083
bio15	0.317	0.000	-0.120	0.106	0.144	0.096	0.053	-0.116	-0.121	0.008	-0.127
bio16	0.030	-0.001	0.132	-0.177	-0.025	-0.238	-0.070	-0.355	-0.082	0.271	-0.014
bio17	-0.038	-0.001	0.273	-0.015	-0.120	-0.185	-0.057	-0.123	0.022	0.133	0.079
bio18	0.050	-0.001	0.241	-0.014	-0.086	-0.258	-0.084	-0.247	-0.027	0.187	0.046
bio19	-0.052	-0.001	0.157	-0.161	-0.066	-0.152	-0.038	-0.214	-0.032	0.191	0.022
dem	0.143	0.000	-0.079	0.035	0.017	0.039	-0.004	-0.011	-0.070	-0.041	-0.086
human	0.897	0.001	0.000	0.076	0.002	0.031	0.004	0.020	0.007	0.025	0.004
slope	0.894	0.001	-0.034	0.074	0.008	0.017	0.003	0.004	0.000	0.013	-0.002

T_pH_H₂O	0.032	0.001	-0.214	0.106	0.243	0.566	0.135	0.303	-0.016	0.068	-0.261
wind1	-0.220	0.000	0.000	0.000	-0.060	0.062	0.003	0.217	0.045	-0.150	0.013
wind2	-0.196	0.001	-0.037	0.047	-0.051	0.118	0.018	0.212	0.045	-0.147	0.006
wind3	-0.186	0.001	-0.074	0.052	-0.047	0.166	0.027	0.237	0.054	-0.170	0.010
wind4	-0.162	0.001	-0.092	0.083	-0.055	0.190	0.028	0.273	0.082	-0.181	0.025
wind5	-0.177	0.001	-0.103	0.070	-0.050	0.191	0.034	0.279	0.092	-0.203	0.032
wind6	-0.221	0.001	-0.117	0.048	-0.025	0.198	0.050	0.259	0.074	-0.198	0.015
wind7	-0.248	0.001	-0.095	0.037	-0.008	0.210	0.069	0.221	0.044	-0.172	-0.012
wind8	-0.265	0.001	-0.071	0.034	-0.024	0.166	0.053	0.217	0.042	-0.172	-0.004
wind9	-0.267	0.001	-0.027	0.036	-0.048	0.105	0.021	0.230	0.052	-0.202	0.022
wind10	-0.270	0.001	-0.005	0.056	-0.080	0.045	-0.006	0.242	0.069	-0.205	0.046
wind11	-0.246	0.001	0.015	0.052	-0.084	0.036	-0.009	0.233	0.061	-0.175	0.037
wind12	-0.237	0.001	0.005	0.037	-0.068	0.038	-0.006	0.216	0.048	-0.163	0.020

	T_ece	T_teb	T_esp	T_gravel	T_sand	T_silt	T_texture	bio1	bio2	bio3	bio4
Add_prop	0.024	0.017	0.032	-0.097	0.040	-0.083	-0.016	0.893	0.893	0.167	0.039
aspect	0.000	-0.001	0.000	0.000	0.000	0.000	-0.001	0.001	0.001	0.000	0.001
T_swr	-0.061	-0.113	-0.064	-0.092	0.027	-0.047	0.006	-0.031	-0.031	0.017	-0.088
T_bs	0.038	0.129	0.049	-0.099	-0.050	0.072	0.010	0.076	0.076	0.053	0.131
T_bulk	0.013	-0.412	0.065	0.017	0.400	-0.331	-0.299	-0.001	-0.001	0.151	-0.083
T_CaCO₃	0.214	0.315	0.291	0.137	-0.111	0.092	0.080	0.008	0.008	0.310	0.002
T_CaCO₄	0.311	0.043	0.272	0.005	-0.042	0.043	0.028	0.002	0.002	0.084	-0.011
T_cec_clay	0.027	0.251	0.006	-0.077	0.068	0.098	-0.201	0.006	0.006	-0.293	0.347
T_cec_soil	-0.005	0.701	-0.045	-0.091	-0.514	0.435	0.371	0.002	0.002	-0.179	0.177
T_clay	0.030	0.464	0.076	-0.119	-0.721	0.209	0.847	0.011	0.011	0.318	-0.290
T_oc	-0.031	0.434	-0.085	-0.074	-0.263	0.242	0.148	0.002	0.002	-0.212	0.139
T_ece	1.000	0.087	0.514	-0.019	-0.044	0.038	0.029	0.002	0.002	0.109	0.002
T_teb	0.087	1.000	0.144	0.083	-0.561	0.412	0.456	0.002	0.002	0.031	0.130
T_esp	0.514	0.144	1.000	-0.008	-0.021	-0.032	0.018	0.006	0.006	0.216	-0.093
T_gravel	-0.019	0.083	-0.008	1.000	-0.055	0.182	-0.004	-0.020	-0.020	0.014	0.050
T_sand	-0.044	-0.561	-0.021	-0.055	1.000	-0.822	-0.845	0.012	0.012	-0.030	-0.020
T_silt	0.038	0.412	-0.032	0.182	-0.822	1.000	0.515	-0.026	-0.026	-0.203	0.269
T_texture	0.029	0.456	0.018	-0.004	-0.845	0.515	1.000	-0.005	-0.005	0.226	-0.193
bio1	0.002	0.002	0.006	-0.020	0.012	-0.026	-0.005	1.000	1.000	0.023	-0.542
bio2	0.002	0.002	0.006	-0.020	0.012	-0.026	-0.005	1.000	1.000	0.023	-0.161
bio3	0.109	0.031	0.216	0.014	-0.030	-0.203	0.226	0.023	0.023	1.000	-0.631
bio4	0.002	0.130	-0.093	0.050	-0.020	0.269	-0.193	-0.542	-0.161	-0.631	1.000
bio5	0.092	0.086	0.240	-0.106	0.055	-0.285	0.095	0.967	0.656	0.122	-0.320
bio6	0.028	-0.072	0.155	-0.074	0.013	-0.285	0.193	0.974	0.492	0.453	-0.710
bio7	0.018	0.152	-0.064	0.037	0.017	0.215	-0.207	-0.365	0.116	-0.558	0.957
bio8	0.028	-0.020	0.104	-0.167	0.050	-0.270	0.093	0.945	0.558	-0.026	-0.300
bio9	0.060	-0.022	0.211	-0.052	0.019	-0.274	0.178	0.918	0.526	0.549	-0.729
bio10	0.084	0.056	0.234	-0.105	0.036	-0.282	0.124	0.977	0.612	0.127	-0.349

bio11	0.034	-0.066	0.162	-0.077	0.029	-0.302	0.183	0.980	0.539	0.459	-0.696
bio12	-0.083	-0.219	-0.110	-0.143	-0.080	-0.112	0.192	0.539	0.021	0.130	-0.555
bio13	-0.074	-0.194	-0.091	-0.116	-0.053	-0.146	0.182	0.541	0.104	0.212	-0.560
bio14	-0.060	-0.117	-0.097	-0.084	-0.088	0.022	0.095	0.313	-0.103	-0.102	-0.282
bio15	0.042	-0.001	0.067	0.079	0.108	-0.158	-0.010	0.285	0.285	0.440	-0.013
bio16	-0.076	-0.206	-0.097	-0.124	-0.055	-0.146	0.186	0.562	0.105	0.193	-0.562
bio17	-0.062	-0.127	-0.097	-0.092	-0.089	0.011	0.105	0.330	-0.107	-0.078	-0.314
bio18	-0.087	-0.182	-0.131	-0.159	-0.066	-0.063	0.138	0.517	0.100	-0.081	-0.355
bio19	-0.050	-0.151	-0.061	-0.060	-0.073	-0.056	0.139	0.315	-0.087	0.127	-0.428
dem	0.009	0.005	-0.005	0.141	0.028	-0.005	0.038	-0.699	-0.156	0.306	0.110
human	0.011	0.015	0.017	-0.058	0.018	-0.043	-0.009	0.983	0.983	0.169	0.058
slope	0.003	0.004	0.007	-0.036	0.016	-0.032	-0.006	0.987	0.987	0.028	0.053
T_pH_H$_2$O	0.161	0.449	0.330	0.209	-0.125	0.127	0.045	0.007	0.007	0.268	0.036
wind1	0.012	0.083	0.054	0.106	-0.003	0.125	-0.093	0.002	0.002	0.000	0.026
wind2	0.025	0.106	0.070	0.124	-0.018	0.142	-0.081	-0.395	-0.373	0.092	0.024
wind3	0.034	0.128	0.074	0.154	-0.020	0.165	-0.094	-0.401	-0.353	0.122	0.061
wind4	0.036	0.161	0.060	0.158	-0.046	0.211	-0.095	-0.412	-0.340	0.107	0.111
wind5	0.037	0.163	0.055	0.182	-0.047	0.229	-0.106	-0.451	-0.355	0.102	0.135
wind6	0.045	0.151	0.080	0.213	-0.033	0.206	-0.102	-0.451	-0.363	0.134	0.109
wind7	0.054	0.135	0.108	0.218	-0.018	0.163	-0.089	-0.524	-0.408	0.184	0.073
wind8	0.044	0.113	0.101	0.194	-0.001	0.138	-0.104	-0.512	-0.408	0.175	0.060
wind9	0.023	0.086	0.066	0.165	0.018	0.136	-0.135	-0.512	-0.399	0.150	0.065
wind10	0.009	0.076	0.033	0.115	0.021	0.134	-0.142	-0.516	-0.430	0.085	0.090
wind11	0.008	0.075	0.036	0.085	0.014	0.119	-0.121	-0.501	-0.432	0.087	0.066
wind12	0.006	0.072	0.039	0.103	0.001	0.128	-0.103	-0.417	-0.414	0.032	0.044

	bio5	bio6	bio7	bio8	bio9	bio10	bio11	bio12	bio13	bio14	bio15
Add_prop	0.201	0.045	0.134	0.141	0.084	0.168	0.072	0.004	0.032	-0.043	0.317
aspect	-0.001	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.000
T_swr	-0.170	0.009	-0.148	-0.040	-0.072	-0.132	-0.012	0.215	0.123	0.273	-0.120
T_bs	0.056	-0.085	0.152	-0.093	-0.007	0.022	-0.084	-0.134	-0.185	-0.005	0.106
T_bulk	0.174	0.120	-0.057	0.126	0.131	0.168	0.130	-0.071	-0.016	-0.122	0.144
T_CaCO$_3$	0.315	0.106	0.049	0.089	0.210	0.290	0.120	-0.253	-0.229	-0.178	0.096
T_CaCO$_4$	0.100	0.044	0.001	0.028	0.078	0.094	0.047	-0.073	-0.067	-0.054	0.053
T_cec_clay	-0.180	-0.338	0.354	-0.259	-0.279	-0.228	-0.334	-0.335	-0.347	-0.102	-0.116
T_cec_soil	-0.121	-0.175	0.166	-0.110	-0.160	-0.134	-0.179	-0.060	-0.083	0.030	-0.121
T_clay	0.254	0.322	-0.286	0.243	0.300	0.282	0.316	0.269	0.267	0.118	0.008
T_oc	-0.149	-0.156	0.123	-0.095	-0.157	-0.152	-0.161	0.020	-0.021	0.083	-0.127
T_ece	0.092	0.028	0.018	0.028	0.060	0.084	0.034	-0.083	-0.074	-0.060	0.042
T_teb	0.086	-0.072	0.152	-0.020	-0.022	0.056	-0.066	-0.219	-0.194	-0.117	-0.001
T_esp	0.240	0.155	-0.064	0.104	0.211	0.234	0.162	-0.110	-0.091	-0.097	0.067
T_gravel	-0.106	-0.074	0.037	-0.167	-0.052	-0.105	-0.077	-0.143	-0.116	-0.084	0.079
T_sand	0.055	0.013	0.017	0.050	0.019	0.036	0.029	-0.080	-0.053	-0.088	0.108
T_silt	-0.285	-0.285	0.215	-0.270	-0.274	-0.282	-0.302	-0.112	-0.146	0.022	-0.158

T_texture	0.095	0.193	-0.207	0.093	0.178	0.124	0.183	0.192	0.182	0.095	-0.010
bio1	0.967	0.974	-0.365	0.945	0.918	0.977	0.980	0.539	0.541	0.313	0.285
bio2	0.656	0.492	0.116	0.558	0.526	0.612	0.539	0.021	0.104	-0.103	0.285
bio3	0.122	0.453	-0.558	-0.026	0.549	0.127	0.459	0.130	0.212	-0.102	0.440
bio4	-0.320	-0.710	0.957	-0.300	-0.729	-0.349	-0.696	-0.555	-0.560	-0.282	-0.013
bio5	1.000	0.888	-0.121	0.970	0.827	0.997	0.901	0.431	0.437	0.253	-0.431
bio6	0.888	1.000	-0.564	0.865	0.955	0.905	0.998	0.607	0.601	0.355	-0.351
bio7	-0.121	-0.564	1.000	-0.126	-0.577	-0.163	-0.535	-0.535	-0.512	-0.313	-0.028
bio8	0.970	0.865	-0.126	1.000	0.756	0.976	0.876	0.472	0.469	0.291	-0.480
bio9	0.827	0.955	-0.577	0.756	1.000	0.839	0.956	0.525	0.527	0.286	-0.278
bio10	0.997	0.905	-0.163	0.976	0.839	1.000	0.916	0.460	0.460	0.278	-0.448
bio11	0.901	0.998	-0.535	0.876	0.956	0.916	1.000	0.589	0.592	0.332	-0.336
bio12	0.431	0.607	-0.535	0.472	0.525	0.460	0.589	1.000	0.913	0.746	-0.332
bio13	0.437	0.601	-0.512	0.469	0.527	0.460	0.592	0.913	1.000	0.476	-0.130
bio14	0.253	0.355	-0.313	0.291	0.286	0.278	0.332	0.746	0.476	1.000	-0.452
bio15	-0.431	-0.351	-0.028	-0.480	-0.278	-0.448	-0.336	-0.332	-0.130	-0.452	1.000
bio16	0.459	0.620	-0.513	0.493	0.541	0.483	0.611	0.937	0.993	0.512	-0.182
bio17	0.262	0.378	-0.345	0.302	0.309	0.288	0.354	0.780	0.510	0.993	-0.466
bio18	0.457	0.527	-0.316	0.529	0.403	0.482	0.521	0.835	0.784	0.621	-0.313
bio19	0.222	0.395	-0.452	0.231	0.371	0.245	0.370	0.761	0.618	0.676	-0.297
dem	-0.736	-0.632	0.043	-0.764	-0.551	-0.754	-0.623	-0.366	-0.319	-0.285	0.562
human	0.113	-0.003	0.118	0.072	0.026	0.087	0.015	-0.016	0.002	-0.037	0.354
slope	-0.004	-0.047	0.096	-0.027	-0.029	-0.019	-0.037	-0.056	-0.040	-0.067	0.285
T_pH_H$_2$O	0.280	0.058	0.094	0.056	0.157	0.240	0.078	-0.442	-0.357	-0.331	0.186
wind1	-0.420	-0.310	-0.087	-0.388	-0.276	-0.407	-0.327	-0.286	-0.335	-0.097	0.001
wind2	-0.451	-0.332	-0.093	-0.426	-0.284	-0.437	-0.348	-0.293	-0.333	-0.122	0.098
wind3	-0.447	-0.349	-0.049	-0.424	-0.292	-0.435	-0.363	-0.320	-0.351	-0.157	0.108
wind4	-0.444	-0.373	0.007	-0.415	-0.320	-0.435	-0.385	-0.335	-0.357	-0.185	0.100
wind5	-0.480	-0.412	0.028	-0.449	-0.352	-0.471	-0.423	-0.360	-0.370	-0.224	0.124
wind6	-0.486	-0.403	-0.004	-0.461	-0.336	-0.477	-0.415	-0.377	-0.380	-0.241	0.165
wind7	-0.578	-0.454	-0.056	-0.559	-0.374	-0.568	-0.469	-0.384	-0.382	-0.262	0.251
wind8	-0.568	-0.440	-0.070	-0.544	-0.368	-0.558	-0.456	-0.370	-0.371	-0.245	0.238
wind9	-0.568	-0.444	-0.061	-0.533	-0.383	-0.558	-0.459	-0.353	-0.364	-0.220	0.206
wind10	-0.567	-0.453	-0.040	-0.526	-0.402	-0.556	-0.468	-0.357	-0.385	-0.202	0.144
wind11	-0.558	-0.434	-0.064	-0.520	-0.385	-0.546	-0.450	-0.343	-0.378	-0.172	0.137
wind12	-0.471	-0.355	-0.081	-0.433	-0.320	-0.457	-0.372	-0.305	-0.356	-0.111	0.067

	bio16	**bio17**	**bio18**	**bio19**	**dem**	**human**	**slope**	**T_pH_H$_2$O**	**wind1**	**wind2**	**wind3**
Add_prop	0.030	-0.038	0.050	-0.052	0.143	0.897	0.894	0.032	-0.220	-0.196	-0.186
aspect	-0.001	-0.001	-0.001	-0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001
T_swr	0.132	0.273	0.241	0.157	-0.079	0.000	-0.034	-0.214	0.000	-0.037	-0.074
T_bs	-0.177	-0.015	-0.014	-0.161	0.035	0.076	0.074	0.106	0.000	0.047	0.052
T_bulk	-0.025	-0.120	-0.086	-0.066	0.017	0.002	0.008	0.243	-0.060	-0.051	-0.047
T_CaCO$_3$	-0.238	-0.185	-0.258	-0.152	0.039	0.031	0.017	0.566	0.062	0.118	0.166

T_CaCO₄	-0.070	-0.057	-0.084	-0.038	-0.004	0.004	0.003	0.135	0.003	0.018	0.027
T_cec_clay	-0.355	-0.123	-0.247	-0.214	-0.011	0.020	0.004	0.303	0.217	0.212	0.237
T_cec_soil	-0.082	0.022	-0.027	-0.032	-0.070	0.007	0.000	-0.016	0.045	0.045	0.054
T_clay	0.271	0.133	0.187	0.191	-0.041	0.025	0.013	0.068	-0.150	-0.147	-0.170
T_oc	-0.014	0.079	0.046	0.022	-0.086	0.004	-0.002	-0.261	0.013	0.006	0.010
T_ece	-0.076	-0.062	-0.087	-0.050	0.009	0.011	0.003	0.161	0.012	0.025	0.034
T_teb	-0.206	-0.127	-0.182	-0.151	0.005	0.015	0.004	0.449	0.083	0.106	0.128
T_esp	-0.097	-0.097	-0.131	-0.061	-0.005	0.017	0.007	0.330	0.054	0.070	0.074
T_gravel	-0.124	-0.092	-0.159	-0.060	0.141	-0.058	-0.036	0.209	0.106	0.124	0.154
T_sand	-0.055	-0.089	-0.066	-0.073	0.028	0.018	0.016	-0.125	-0.003	-0.018	-0.020
T_silt	-0.146	0.011	-0.063	-0.056	-0.005	-0.043	-0.032	0.127	0.125	0.142	0.165
T_texture	0.186	0.105	0.138	0.139	0.038	-0.009	-0.006	0.045	-0.093	-0.081	-0.094
bio1	0.562	0.330	0.517	0.315	-0.699	0.983	0.987	0.007	0.002	-0.395	-0.401
bio2	0.105	-0.107	0.100	-0.087	-0.156	0.983	0.987	0.007	0.002	-0.373	-0.353
bio3	0.193	-0.078	-0.081	0.127	0.306	0.169	0.028	0.268	0.000	0.092	0.122
bio4	-0.562	-0.314	-0.355	-0.428	0.110	0.058	0.053	0.036	0.026	0.024	0.061
bio5	0.459	0.262	0.457	0.222	-0.736	0.113	-0.004	0.280	-0.420	-0.451	-0.447
bio6	0.620	0.378	0.527	0.395	-0.632	-0.003	-0.047	0.058	-0.310	-0.332	-0.349
bio7	-0.513	-0.345	-0.316	-0.452	0.043	0.118	0.096	0.094	-0.087	-0.093	-0.049
bio8	0.493	0.302	0.529	0.231	-0.764	0.072	-0.027	0.056	-0.388	-0.426	-0.424
bio9	0.541	0.309	0.403	0.371	-0.551	0.026	-0.029	0.157	-0.276	-0.284	-0.292
bio10	0.483	0.288	0.482	0.245	-0.754	0.087	-0.019	0.240	-0.407	-0.437	-0.435
bio11	0.611	0.354	0.521	0.370	-0.623	0.015	-0.037	0.078	-0.327	-0.348	-0.363
bio12	0.937	0.780	0.835	0.761	-0.366	-0.016	-0.056	-0.442	-0.286	-0.293	-0.320
bio13	0.993	0.510	0.784	0.618	-0.319	0.002	-0.040	-0.357	-0.335	-0.333	-0.351
bio14	0.512	0.993	0.621	0.676	-0.285	-0.037	-0.067	-0.331	-0.097	-0.122	-0.157
bio15	-0.182	-0.466	-0.313	-0.297	0.562	0.354	0.285	0.186	0.001	0.098	0.108
bio16	1.000	0.547	0.806	0.641	-0.344	0.001	-0.042	-0.382	-0.344	-0.344	-0.363
bio17	0.547	1.000	0.641	0.706	-0.294	-0.035	-0.068	-0.345	-0.093	-0.116	-0.150
bio18	0.806	0.641	1.000	0.419	-0.358	0.018	-0.035	-0.395	-0.341	-0.355	-0.376
bio19	0.641	0.706	0.419	1.000	-0.229	-0.046	-0.057	-0.316	-0.099	-0.102	-0.127
dem	-0.344	-0.294	-0.358	-0.229	1.000	0.096	0.110	0.116	0.194	0.236	0.216
human	0.001	-0.035	0.018	-0.046	0.096	1.000	0.988	0.021	0.002	-0.142	-0.135
slope	-0.042	-0.068	-0.035	-0.057	0.110	0.988	1.000	0.012	0.002	-0.074	-0.069
T_pH_H₂O	-0.382	-0.345	-0.395	-0.316	0.116	0.021	0.012	1.000	0.199	0.236	0.271
wind1	-0.344	-0.093	-0.341	-0.099	0.194	0.002	0.002	0.199	1.000	0.968	0.936
wind2	-0.344	-0.116	-0.355	-0.102	0.236	-0.142	-0.074	0.236	0.968	1.000	0.973
wind3	-0.363	-0.150	-0.376	-0.127	0.216	-0.135	-0.069	0.271	0.936	0.973	1.000
wind4	-0.369	-0.176	-0.377	-0.150	0.206	-0.115	-0.055	0.289	0.899	0.943	0.981
wind5	-0.384	-0.213	-0.406	-0.173	0.220	-0.119	-0.052	0.294	0.859	0.902	0.956
wind6	-0.396	-0.233	-0.431	-0.185	0.230	-0.141	-0.059	0.317	0.854	0.895	0.942
wind7	-0.401	-0.252	-0.457	-0.183	0.314	-0.160	-0.052	0.332	0.825	0.868	0.913
wind8	-0.391	-0.236	-0.441	-0.172	0.298	-0.173	-0.056	0.301	0.845	0.880	0.918

wind9	-0.381	-0.210	-0.415	-0.161	0.300	-0.181	-0.052	0.237	0.869	0.898	0.925
wind10	-0.397	-0.193	-0.410	-0.165	0.272	-0.192	-0.069	0.177	0.901	0.921	0.940
wind11	-0.390	-0.167	-0.398	-0.151	0.280	-0.182	-0.074	0.171	0.940	0.952	0.943
wind12	-0.364	-0.108	-0.359	-0.118	0.216	-0.172	-0.092	0.177	0.978	0.970	0.933

	wind4	wind5	wind6	wind7	wind8	wind9	wind10	wind11	wind12
Add_prop	-0.162	-0.177	-0.221	-0.248	-0.265	-0.267	-0.270	-0.246	-0.237
aspect	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
T_swr	-0.092	-0.103	-0.117	-0.095	-0.071	-0.027	-0.005	0.015	0.005
T_bs	0.083	0.070	0.048	0.037	0.034	0.036	0.056	0.052	0.037
T_bulk	-0.055	-0.050	-0.025	-0.008	-0.024	-0.048	-0.080	-0.084	-0.068
T_CaCO$_3$	0.190	0.191	0.198	0.210	0.166	0.105	0.045	0.036	0.038
T_CaCO$_4$	0.028	0.034	0.050	0.069	0.053	0.021	-0.006	-0.009	-0.006
T_cec_clay	0.273	0.279	0.259	0.221	0.217	0.230	0.242	0.233	0.216
T_cec_soil	0.082	0.092	0.074	0.044	0.042	0.052	0.069	0.061	0.048
T_clay	-0.181	-0.203	-0.198	-0.172	-0.172	-0.202	-0.205	-0.175	-0.163
T_oc	0.025	0.032	0.015	-0.012	-0.004	0.022	0.046	0.037	0.020
T_ece	0.036	0.037	0.045	0.054	0.044	0.023	0.009	0.008	0.006
T_teb	0.161	0.163	0.151	0.135	0.113	0.086	0.076	0.075	0.072
T_esp	0.060	0.055	0.080	0.108	0.101	0.066	0.033	0.036	0.039
T_gravel	0.158	0.182	0.213	0.218	0.194	0.165	0.115	0.085	0.103
T_sand	-0.046	-0.047	-0.033	-0.018	-0.001	0.018	0.021	0.014	0.001
T_silt	0.211	0.229	0.206	0.163	0.138	0.136	0.134	0.119	0.128
T_texture	-0.095	-0.106	-0.102	-0.089	-0.104	-0.135	-0.142	-0.121	-0.103
bio1	-0.412	-0.451	-0.451	-0.524	-0.512	-0.512	-0.516	-0.501	-0.417
bio2	-0.340	-0.355	-0.363	-0.408	-0.408	-0.399	-0.430	-0.432	-0.414
bio3	0.107	0.102	0.134	0.184	0.175	0.150	0.085	0.087	0.032
bio4	0.111	0.135	0.109	0.073	0.060	0.065	0.090	0.066	0.044
bio5	-0.444	-0.480	-0.486	-0.578	-0.568	-0.568	-0.567	-0.558	-0.471
bio6	-0.373	-0.412	-0.403	-0.454	-0.440	-0.444	-0.453	-0.434	-0.355
bio7	0.007	0.028	-0.004	-0.056	-0.070	-0.061	-0.040	-0.064	-0.081
bio8	-0.415	-0.449	-0.461	-0.559	-0.544	-0.533	-0.526	-0.520	-0.433
bio9	-0.320	-0.352	-0.336	-0.374	-0.368	-0.383	-0.402	-0.385	-0.320
bio10	-0.435	-0.471	-0.477	-0.568	-0.558	-0.558	-0.556	-0.546	-0.457
bio11	-0.385	-0.423	-0.415	-0.469	-0.456	-0.459	-0.468	-0.450	-0.372
bio12	-0.335	-0.360	-0.377	-0.384	-0.370	-0.353	-0.357	-0.343	-0.305
bio13	-0.357	-0.370	-0.380	-0.382	-0.371	-0.364	-0.385	-0.378	-0.356
bio14	-0.185	-0.224	-0.241	-0.262	-0.245	-0.220	-0.202	-0.172	-0.111
bio15	0.100	0.124	0.165	0.251	0.238	0.206	0.144	0.137	0.067
bio16	-0.369	-0.384	-0.396	-0.401	-0.391	-0.381	-0.397	-0.390	-0.364
bio17	-0.176	-0.213	-0.233	-0.252	-0.236	-0.210	-0.193	-0.167	-0.108
bio18	-0.377	-0.406	-0.431	-0.457	-0.441	-0.415	-0.410	-0.398	-0.359
bio19	-0.150	-0.173	-0.185	-0.183	-0.172	-0.161	-0.165	-0.151	-0.118
dem	0.206	0.220	0.230	0.314	0.298	0.300	0.272	0.280	0.216

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human	-0.115	-0.119	-0.141	-0.160	-0.173	-0.181	-0.192	-0.182	-0.172
slope	-0.055	-0.052	-0.059	-0.052	-0.056	-0.052	-0.069	-0.074	-0.092
T_pH_H$_2$O	0.289	0.294	0.317	0.332	0.301	0.237	0.177	0.171	0.177
wind1	0.899	0.859	0.854	0.825	0.845	0.869	0.901	0.940	0.978
wind2	0.943	0.902	0.895	0.868	0.880	0.898	0.921	0.952	0.970
wind3	0.981	0.956	0.942	0.913	0.918	0.925	0.940	0.943	0.933
wind4	1.000	0.984	0.966	0.927	0.930	0.934	0.941	0.931	0.899
wind5	0.984	1.000	0.982	0.956	0.948	0.946	0.946	0.914	0.862
wind6	0.966	0.982	1.000	0.968	0.965	0.948	0.941	0.911	0.859
wind7	0.927	0.956	0.968	1.000	0.982	0.965	0.943	0.904	0.834
wind8	0.930	0.948	0.965	0.982	1.000	0.983	0.952	0.915	0.849
wind9	0.934	0.946	0.948	0.965	0.983	1.000	0.969	0.938	0.875
wind10	0.941	0.946	0.941	0.943	0.952	0.969	1.000	0.976	0.922
wind11	0.931	0.914	0.911	0.904	0.915	0.938	0.976	1.000	0.965
wind12	0.899	0.862	0.859	0.834	0.849	0.875	0.922	0.965	1.000

* p<=0.05
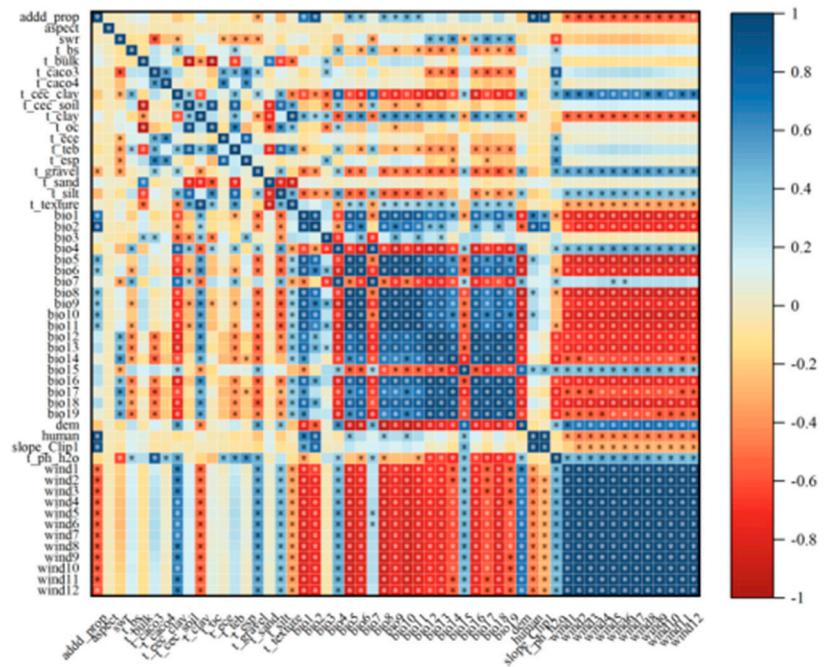
Supplementary Figure S1. Relation between 53 environmental variables

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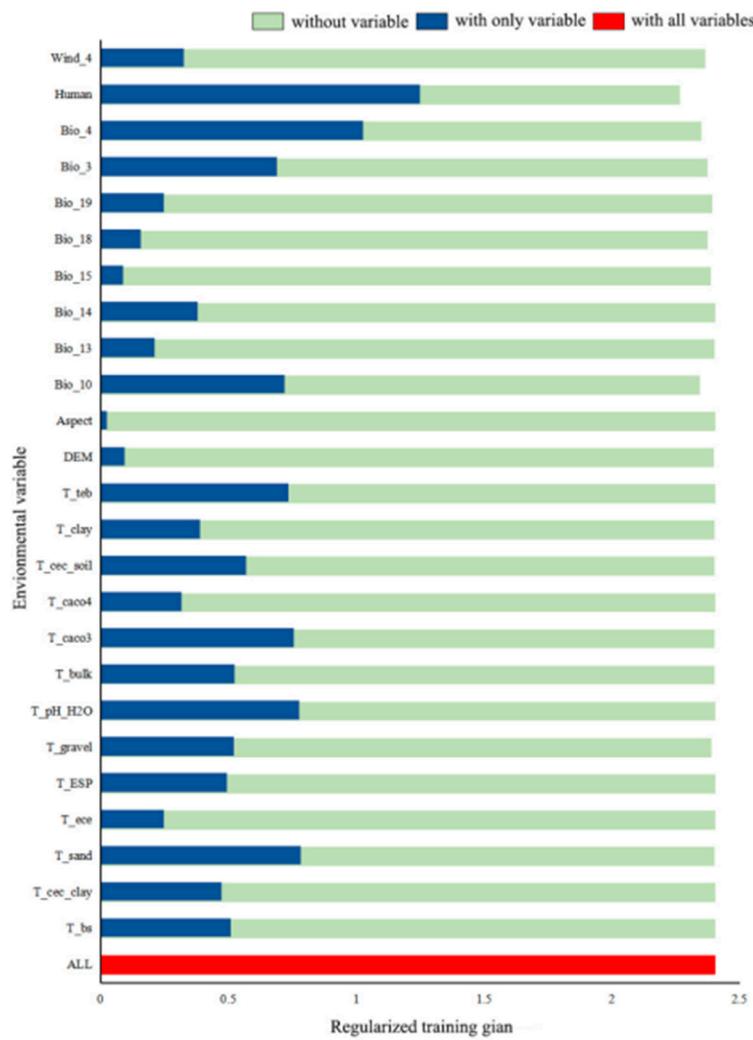
Supplementary Figure S2. Importance of environmental variables of *Amaranthus palmeri* by "Jackknife method"
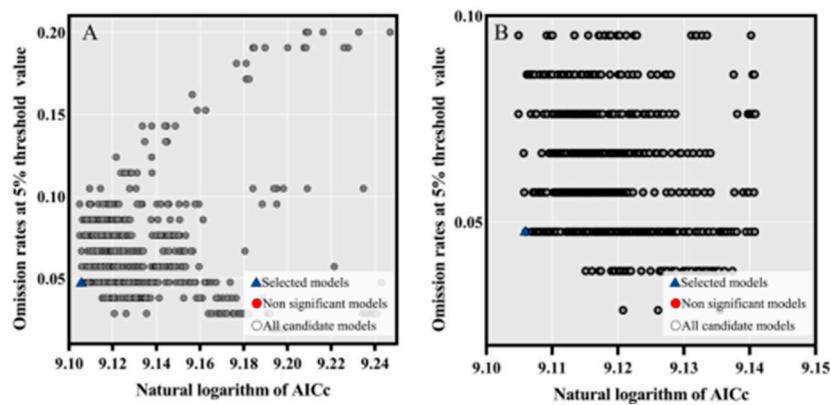
Supplementary Figure S3. The best model was chosen from a pool of 1160 candidate models
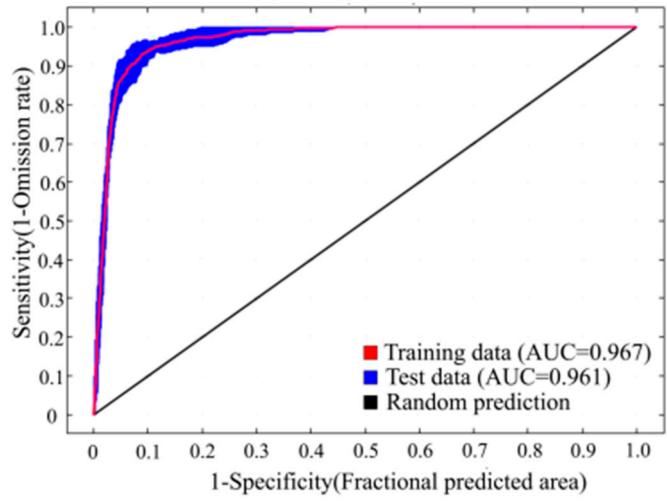
Supplementary Figure S4. The MaxEnt model calibration and AUC of *Amaranthus palmeri*