APPENDIX 1: TABLES

Table A1. Observed numbers of native seed and spore plant species, genera and families in the archipelagos and on single islands used as reference data and mean simulated species numbers in different simulation scenarios (obs. – observed, hab. – habitats, conf. – configuration).

	OBSERVED SEED			**SIMULATED**						**OBSERVED SPORE**		
	Obs. species	**Obs. genera**	**Obs. families**	**Hab.1, conf. real**	**Hab. 0, conf. real**	**Hab. 1, conf. convex hull**	**Hab. 0, conf. convex hull**	**Hab. 1, conf. circle**	**Hab. 0, conf. circle**	**Obs. species**	**Obs. genera**	**Obs. families**
Hawaii (Imada 2012)	**1033**	**213**	**85**	**191**	**145**	**190**	**142**	**192**	**146**	**188**	**57**	**25**
Big Island	381	182	80	149	115	148	116	149	114	137	53	24
Maui	486	196	83	78	61	78	61	76	61	148	53	24
Oahu	452	184	82	67	56	67	57	66	56	144	52	24
Kauai	486	198	84	62	45	62	53	61	49	147	51	23
Lanai	253	149	71	27	23	27	23	26	18	109	49	23
Molokai	368	181	81	42	37	41	36	40	31	121	50	24
Niihau	90	70	42	13	11	13	14	13	11	5	5	4
Kahoolawe	59	45	25	10	10	10	10	10	8	5	3	3
Galapagos (Jaramillo Díaz and Guézou 2013)	**414**	**225**	**77**	**150**	**126**	**149**	**124**	**150**	**126**	**121**	**51**	**18**
Isabela	282	189	69	115	87	115	91	114	89	92	45	17
Santa Cruz	323	197	73	41	37	39	40	39	39	103	48	18
Fernandina	145	116	49	39	29	36	31	37	31	33	23	12
Santiago	237	163	61	35	30	34	31	33	30	64	35	16
San Cristóbal	241	169	68	29	27	31	31	31	29	61	34	14
Floreana	210	154	63	16	13	16	15	16	13	33	20	11
Marchena	50	39	22	12	10	12	11	12	11	6	5	4
Pinta	142	107	46	9	6	10	8	9	7	46	28	13
Española	105	80	37	6	6	7	8	7	8	1	1	1
Santa Fe	72	56	29	5	5	5	5	5	5	4	4	4
Pinzón	107	84	43	5	4	5	4	5	4	8	6	5
Genovesa	49	39	22	4	3	4	4	4	4	0	0	0

	OBSERVED SEED			SIMULATED						OBSERVED SPORE		
	Obs. species	**Obs. genera**	**Obs. families**	**Hab.1, conf. real**	**Hab. 0, conf. real**	**Hab. 1, conf. convex hull**	**Hab. 0, conf. convex hull**	**Hab. 1, conf. circle**	**Hab. 0, conf. circle**	**Obs. species**	**Obs. genera**	**Obs. families**
Canary Islands (Izquierdo et al. 2004)	**885**	**317**	**86**	**152**	**129**	**152**	**127**	**153**	**130**	**47**	**25**	**17**
Tenerife	585	282	85	86	57	85	58	85	55	41	25	17
Fuerteventura	330	193	63	71	53	72	54	70	54	15	9	7
Gran Canaria	499	265	83	70	46	70	46	70	47	34	22	16
Lanzarote	310	186	61	42	35	42	36	40	34	13	10	8
La Palma	380	229	80	50	30	51	32	50	30	35	22	16
La Gomera	395	236	82	33	21	33	21	33	20	37	24	16
El Hierro	310	201	75	30	16	30	18	30	17	30	18	13
Cape Verde (Arechavaleta et al. 2005)	**212**	**135**	**45**	**119**	**100**	**119**	**100**	**119**	**101**	**33**	**24**	**18**
Santiago	138	103	36	51	29	53	33	51	32	14	12	12
Santo Antão	149	112	41	50	26	50	29	50	27	28	21	16
Boa Vista	92	66	29	27	24	26	24	26	24	3	3	3
Fogo	114	86	33	37	19	38	21	38	19	24	19	14
São Nicolau	110	85	34	34	17	35	20	34	19	21	17	15
Maio	83	63	27	14	14	15	15	15	14	1	1	1
São Vicente	114	85	33	20	13	21	13	21	13	14	11	11
Sal	72	53	29	13	14	15	15	15	14	0	0	0
Brava	79	63	29	11	6	11	6	11	6	13	11	11
Santa Luzia	47	38	22	7	6	7	6	7	5	1	1	1
Azores (Silva et al. 2005)	**166**	**108**	**53**	**108**	**87**	**108**	**86**	**108**	**85**	**48**	**31**	**19**
São Miguel	138	92	46	55	32	56	31	56	30	38	24	16
Pico	134	91	49	43	23	43	23	43	21	45	29	18
Terceira	131	91	46	33	20	34	20	33	20	41	27	19
São Jorge	119	85	45	36	20	36	18	36	17	35	23	15
Faial	130	89	46	22	13	22	12	22	10	40	26	17
Flores	123	81	44	15	8	15	8	14	7	42	28	18
Santa Maria	108	76	45	13	9	13	9	13	8	28	20	14
Graciosa	72	52	34	9	6	9	6	10	6	19	11	8
Corvo	94	67	41	4	3	4	3	4	3	31	20	14

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Table A2. Minimum, mean and maximum correlations between real and simulated species richness and compositional dissimilarity between the islands, based on 600 simulation replications.

		Correlation mean [min; max]	
		Spermatophytes	**Pteridophytes**
Species richness on islands	Hawaii	0.88[0.71; 0.95]	0.85[0.67; 0.93]
	Galapagos	0.78[0.62; 0.89]	0.71[0.50; 0.87]
	Canary Islands	0.56[-0.14; 0.87]	-0.07[-0.62; 0.42]
	Cape Verde	0.83[0.24; 0.98]	0.39[-0.30; 0.78]
	Azores	0.73[0.39; 0.88]	0.55[0.14; 0.76]
Compositional dissimilarity between the islands (Jaccard index)	Hawaii	0.61[-0.10; 0.86]	0.67[-0.07; 0.86]
	Galapagos	0.18[-0.23; 0.60]	0.34[-0.21; 0.68]
	Canary Islands	0.03[-0.47; 0.56]	-0.01[-0.55; 0.60]
	Cape Verde	0.29[-0.44; 0.71]	0.25[-0.44; 0.77]
	Azores	0.45[-0.34; 0.89]	0.29[-0.33; 0.82]

Table A3. Results of post hoc pairwise comparisons (R- package “lsmeans”) between scenarios with and without habitat diversity.

Contrast: HABITAT DIVERSITY 0 – 1; df=2978									
Archipelago	**Species group**	**Species richness**				**Compositional dissimilarity between the islands**			
		Estimate	**Std.Error**	**t-ratio**	**p-value**	**Estimate**	**Std.Error**	**t-ratio**	**p-value**
All archipelagos analysed together	pteridophytes	-0.177	0.006	-31.7	**<0.001**	-0.240	0.007	-35.4	**<0.001**
	spermatophytes	-0.211	0.006	-37.8	**<0.001**	-0.229	0.007	-33.8	**<0.001**
Hawaii	pteridophytes	-0.075	0.012	-6.4	**<0.001**	-0.139	0.014	-9.7	**<0.001**
	spermatophytes	-0.110	0.012	-9.3	**<0.001**	-0.127	0.014	-9.0	**<0.001**
Galapagos	pteridophytes	-0.043	0.012	-3.7	**<0.001**	-0.109	0.014	-7.7	**<0.001**
	spermatophytes	-0.077	0.012	-6.6	**<0.001**	-0.098	0.014	-6.9	**<0.001**
Canary Islands	pteridophytes	-0.231	0.012	-19.6	**<0.001**	-0.195	0.014	-13.7	**<0.001**
	spermatophytes	-0.264	0.012	-22.5	**<0.001**	-0.184	0.014	-12.9	**<0.001**
Cape Verde	pteridophytes	-0.458	0.012	-39.0	**<0.001**	-0.361	0.014	-25.4	**<0.001**
	spermatophytes	-0.492	0.012	-41.9	**<0.001**	-0.350	0.014	-24.6	**<0.001**
Azores	pteridophytes	-0.079	0.012	-6.7	**<0.001**	-0.395	0.014	-27.8	**<0.001**
	spermatophytes	-0.113	0.012	-9.6	**<0.001**	-0.384	0.014	-27.0	**<0.001**

Table A4. Results of post hoc pairwise comparisons (R- package "lsmeans") between real configuration and randomization scenarios. df=2978.

	Estimate	**Std.Error**	**t-ratio**	**p-value**	**Estimate**	**Std.Error**	**t-ratio**	**p-value**
Pteridophytes								
All archipelagos								
circle-real	-0.023	0.007	-3.4	**0.002**	-0.025	0.008	-3.0	**0.007**
convex-real	-0.012	0.007	-1.7	0.194	-0.022	0.008	-2.6	**0.023**
Hawaii								
circle-real	-0.031	0.014	-2.1	0.083	-0.058	0.017	-3.3	**0.003**
convex-real	-0.011	0.014	-0.7	0.745	-0.040	0.017	-2.3	0.055
Galapagos								
circle-real	-0.022	0.014	-1.6	0.264	-0.003	0.017	-0.2	0.986
convex-real	-0.004	0.014	-0.3	0.966	0.015	0.017	0.9	0.653
Canary Islands								
circle-real	-0.014	0.014	-1.0	0.604	-0.030	0.017	-1.7	0.188
convex-real	-0.026	0.014	-1.8	0.173	-0.067	0.017	-3.9	**<0.001**
Cape Verde								
circle-real	-0.018	0.014	-1.2	0.440	0.008	0.017	0.5	0.881
convex-real	-0.001	0.014	-0.1	0.995	0.005	0.017	0.3	0.950
Azores								
circle-real	-0.0302	0.014	-2.1	0.090	-0.043	0.017	-2.5	**0.035**
convex-real	-0.0179	0.014	-1.2	0.428	-0.023	0.017	-1.3	0.390
Spermatophytes								
All archipelagos								
circle-real	-0.008	0.007	-1.2	0.460	-0.023	0.008	-2.7	**0.018**
convex-real	0.002	0.007	0.4	0.934	-0.009	0.008	-1.1	0.491
Hawaii								
circle-real	-0.016	0.014	-1.1	0.509	-0.055	0.017	-3.2	**0.004**
convex-real	0.004	0.014	0.3	0.964	-0.028	0.017	-1.6	0.249

	Estimate	Std.Error	t-ratio	p-value	Estimate	Std.Error	t-ratio	p-value
Galapagos								
circle-real	-0.008	0.014	-0.5	0.857	0.000	0.017	0.0	1.000
convex-real	0.011	0.014	0.7	0.741	0.028	0.017	1.6	0.248
Canary Islands								
circle-real	0.001	0.014	0.1	0.997	-0.028	0.017	-1.6	0.246
convex-real	-0.011	0.014	-0.8	0.704	-0.055	0.017	-3.1	**0.005**
Cape Verde								
circle-real	-0.003	0.014	-0.2	0.980	0.011	0.017	0.6	0.806
convex-real	0.013	0.014	0.9	0.646	0.018	0.017	1.0	0.564
Azores								
circle-real	-0.015	0.014	-1.1	0.534	-0.041	0.017	-2.3	0.051
convex-real	-0.004	0.014	-0.3	0.965	-0.010	0.017	-0.6	0.824

Table A5. Results of post hoc pairwise comparisons (R- package "lsmeans") between the species groups.

Contrast: SPECIES GROUP pteridophytes – spermatophytes; df=1993								
Archipelago	**Species richness**				**Compositional dissimilarity between the islands**			
	Estimate	**Std.Error**	**t-ratio**	**p-value**	**Estimate**	**Std.Error**	**t-ratio**	**p-value**
Hawaii	-0.127	0.005	-26.9	**<0.001**	0.111	0.006	19.1	**<0.001**
Galapagos	-0.152	0.005	-32.0	**<0.001**	0.174	0.006	29.8	**<0.001**
Canary Islands	-0.732	0.005	-154.5	**<0.001**	-0.048	0.006	-8.2	**<0.001**
Cape Verde	-0.857	0.005	-180.9	**<0.001**	-0.038	0.006	-6.6	**<0.001**
Azores	-0.315	0.005	-66.4	**<0.001**	-0.218	0.006	-37.4	**<0.001**

Table A6. Results of post-hoc pairwise comparisons (R- package "multcomp") between the archipelagos.

	Species richness				Compositional dissimilarity between the islands			
Linear Hypothesis	**Estimate**	**Std.Error**	**z-value**	**p-value**	**Estimate**	**Std.Error**	**z-value**	**p-value**
Cape Verde – Azores == 0	0.082	0.008	10.1	**<0.001**	-0.128	0.010	-12.9	**<0.001**
Galapagos – Azores == 0	0.190	0.008	23.2	**<0.001**	-0.147	0.010	-14.8	**<0.001**
Hawaii – Azores == 0	0.539	0.008	65.9	**<0.001**	0.368	0.010	37.2	**<0.001**
Canary Islands– Azores == 0	-0.490	0.008	-60.0	**<0.001**	-0.410	0.010	-41.5	**<0.001**
Cape - Canary == 0	0.572	0.008	70.1	**<0.001**	0.282	0.010	28.5	**<0.001**
Galap - Canary == 0	0.680	0.008	83.2	**<0.001**	0.264	0.010	26.7	**<0.001**
Hawaii - Canary == 0	1.028	0.008	125.9	**<0.001**	0.778	0.010	78.7	**<0.001**
Galap - Cape == 0	0.108	0.008	13.2	**<0.001**	-0.019	0.010	-1.9	0.331
Hawaii - Cape == 0	0.456	0.008	55.8	**<0.001**	0.496	0.010	50.2	**<0.001**
Hawaii - Galap == 0	0.349	0.008	42.7	**<0.001**	0.514	0.010	52.0	**<0.001**

APPENDIX 2: FIGURES

Figures have been uploaded as separate jpg-files.

FIGURE CAPTIONS

Figure A1. (A) Dispersal kernel for species with 2 “Z” letters in its genome; (B) dispersal kernel for species with 5 “Z” letters in the genome.

Figure A2. Total archipelago species richness during the 500 simulation cycles in the five archipelagos, based on the mean values of all simulation replications with habitat diversity and real configuration (100 replications for each archipelago). Single island species numbers and compositions of the final 50 cycles (at the right side of the dotted line) were used for the analyses.

Figure A3. Results of sensitivity analyses. For every parameter set, species richness in all archipelagos and on single islands is plotted through simulation time.

Figure A4. Results of sensitivity analyses. For every parameter set, mean compositional dissimilarity (Jaccard index) of every island is plotted through simulation time.

Figure A5. Results of sensitivity analyses. Histogram represents Z-transformed correlations between real and simulated species richness of 100 simulation replications (real configuration, habitat diversity) which were used in the study. Blue points represent the correlations of simulation results with varied parameter values. If varied value gave a significantly stronger correlation than the standard parameter set (standardized effect size test, SES>1.96), parameter name, value and SES value are given (“repr” – reproduction, “dist” – disturbance).

Figure A6. Results of sensitivity analyses. Histogram represents Z-transformed correlations between real and simulated species richness of 100 simulation replications (real configuration, habitat diversity) which were used in the study. Blue points represent the correlations of simulation results with varied parameter values. No simulation with varied value gave a significantly stronger correlation (standardized effect size test, SES>1.96) than the standard parameter set.

APPENDIX 3: SENSITIVITY ANALYSES

Methods

We multiplied and divided all parameter values by two, one parameter at a time. As a result, the following parameter values were used (standard value in bold): immigration (0.05, **0.1**, 0.2), reproduction (0.2, **0.4**, 0.8), disturbance **(**0.05, **0.1**, 0.2), species pool (50, **100**, 200), speciation (0.0005, **0.001**, 0.002). We conducted one replication (with habitat diversity and real island configuration) for each parameter set for each archipelago, including an extra replication with the standard parameter set (used in the study) – altogether 75 additional simulations. We examined species richness and mean Jaccard dissimilarity index through simulation duration in all islands in all archipelagos. We also correlated simulation results to the reference data, applied Fisher's z-transformation to the correlations and calculated standardized effect size between the results of simulations with standard and varied parameter sets (SES= (Z_varied_set – mean(Z_standard_set_100_replications)) / sd(Z_standard_set_100_replications)). If SES was >1.96, we designated the correlation given by a varied set significantly stronger than correlations achieved with the standard set.

Results

We found our simulation to be relatively robust to parameterization and a change in any of the parameters alone did not destabilize the simulation (Figure A3). We found larger species pools to increase total species richness as well as single island species numbers in all archipelagos. Higher speciation rates increase archipelago species richness in all archipelagos but not the single island species numbers. By contrast, higher reproduction rates decrease single island species numbers but not total archipelago species richness. Higher immigration rate increases species richness on medium sized islands in Galapagos and Cape Verde. Higher disturbance decreases total species richness in Hawaii, Galapagos, Canary Islands and Cape Verde, whereas lower disturbance rates decrease single island species numbers in Azores. In addition, lower immigration and disturbance rates and higher reproduction and speciation rates make islands less similar in species composition (Figure A4). Larger species pools have a similar effect. Tests of standardized effect size tests suggest that in most cases, correlation strength between real and simulated species richness is not significantly affected by a change in a single parameter value. In single cases, varied parameter values gave significantly stronger correlations with real species richness (higher reproduction – pterdiophytes in Hawaii and Cape Verde; lower reproduction – spermatophytes in Hawaii; higher disturbance - spermatophytes in Hawaii; lower disturbance - pteridophytes in Canary Islands), but no consistent patterns emerge for general preferring of a higher or lower value (Figure A5, Figure A6).

APPENDIX 4: R-SCRIPTS

Scripts have been uploaded as separate txt-files.

4.1. SIMULATION FUNCTIONS

4.2. SAMPLE SIMULATION. HAWAII WITH HABITATS AND REAL CONFIGURATION

4.3. SCRIPT FOR RANDOMIZATION OF ISLAND CONFIGURATION