Oikos

OIK-07501
Ibanez, B., Keppel, G., Baider, C., Birkinshaw, C., Florens, V. F. B., Laidlaw, M., Menkes, C., Parthasarathy, N., Rajkumar, M., Ratovoson, F., Rasingam, L., Reza, L., Aiba, S., Webb, E. L., Zang, R. and Birnbaum, P. 2020. Tropical cyclones and island area shape species abundance distributions of local tree communities. – Oikos doi: 10.1111/oik.07501

Supplementary material

Appendix 1

Mean annual temperature (MAT) and mean annual precipitation (MAP) were extracted for each plot location from CHELSA (http://chelsa-climate.org/, Karger et al., 2017) at a spatial resolution of 30 arc-seconds (≈ 1 km). CHELSA incorporates topoclimate (e.g., orographic rainfall and wind fields), which is highly relevant for islands. Most studied plots receive MAP > 1500 mm. Only plots located on the island of Hainan receive 1409 mm of MAP according to the CHELSA climatology but the actual MAP are likely higher (1677 mm reported in Lu et al., 2014). MAT ranged between 21°C in plots located on the Grande Terre of New Caledonia to 27°C on plots located on Middle Andaman.

MAP was significantly correlated to all others explanatory variables (Table A1), i.e., island area (Area), isolation (Dist), cyclone regime (power dissipation index, PDI), and MAT, but these correlations were relatively weak (Spearman's Rho < 0.70). MAT was negatively correlated with PDI (Spearman's Rho = 0.55, $P < 0.05$). Variations in MAT and MAP were poorly associated with variations in the shape parameter (α) of SADs, the standardized shape parameter (α_{stand}), the number of trees (N), and the number of species (R). Only MAT had a substantial significant effect on N ($R^2 = 0.24$, $P < 0.001$ on average, Fig. A1.1). This effect was however relatively low compared to the effect cyclone regime (power dissipation index, PDI) on N ($R^2 = 0.46$, $P < 0.001$, Fig. 5). As expected, when included in multivariate models (Fig. A1.2), MAT and MAP had poor effects on α and α_{stand} compared to cyclone regime (PDI), or island area (Area) and isolation (Dist). MAT has substantial negative effects on the number of

trees and species but these effects were smaller or less consistent that the effect of cyclone regime (PDI), island area (Area), or isolation (Dist).

References

Karger, D.N., Conrad, O., Böhner, J., Kawohl, T., Kreft, H., Soria-Auza, R. W., … Kessler, M. (2017). Climatologies at high resolution for the earth's land surface areas. *Scientific Data*, 4, 170122. https://doi.org/10.1038/sdata.2017.122

Lu, X., Zang, R., Ding, Y., Letcher, S.G., Long, W., & Huang, Y. (2014). Variations and trade-offs in functional traits of tree seedlings during secondary succession in a tropical lowland rain forest. *Biotropica*, *46*(4), 404 – 414. https://doi.org/10.1111/btp.12125

Table A1 Correlation between explanatory vor ariables. Lower left entries indicate Spearman's Rho and upper right entries indicate associated p values. Bold values are significant correlations.

	Area	Dist	PDI	MAT	MAP
Area		**0.0049**	0.5954	0.0569	**0.0052**
Dist	**-0.60**		0.2251	0.4233	**0.0469**
PDI	-0.13	0.28		**0.0112**	**0.0714**
MAT	-0.43	0.19	**-0.55**		**0.0052**
MAP	**-0.61**	**0.45**	**-0.41**	**0.61**	

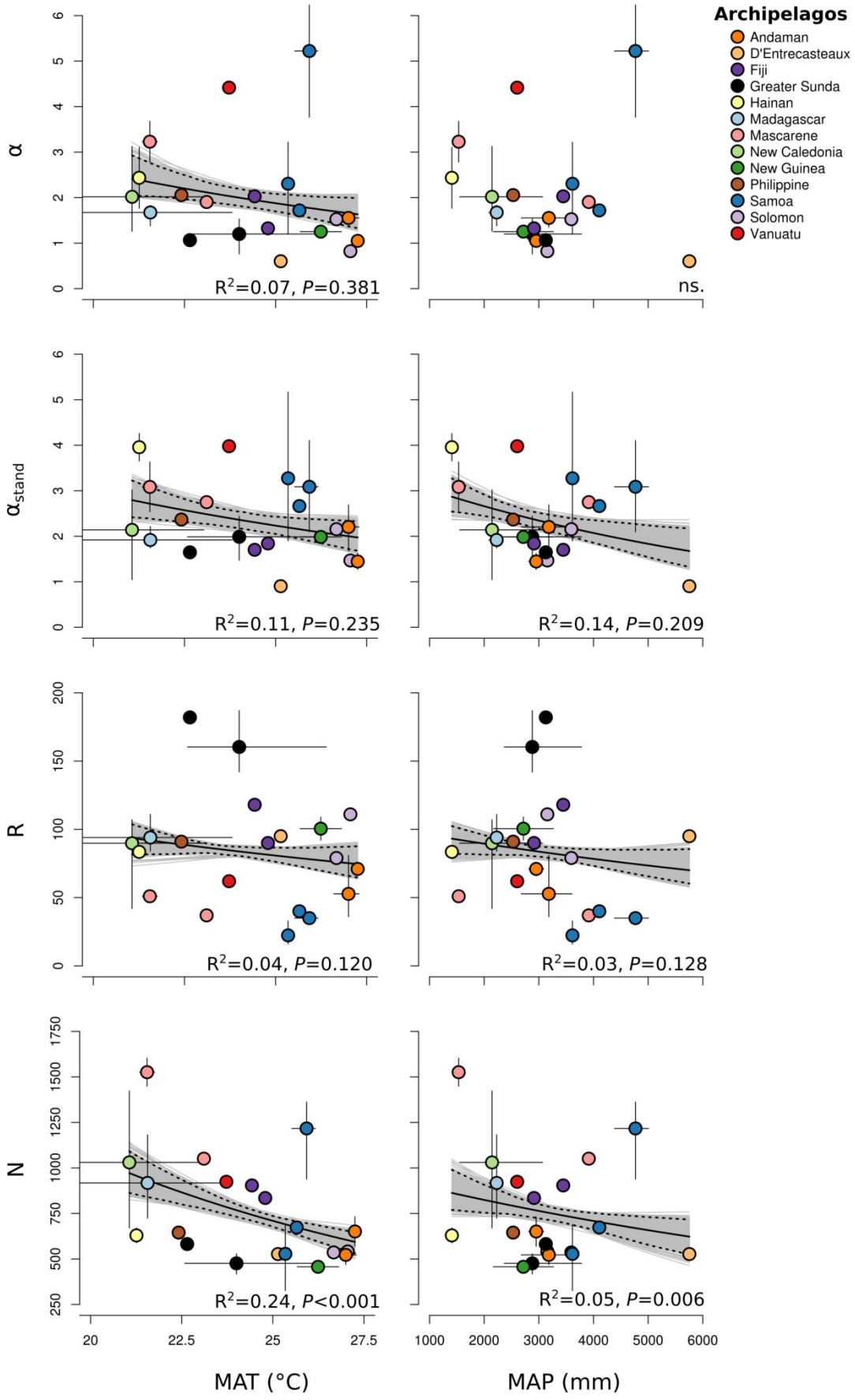
Archipelagos
Andaman
D'Entrecasteaux
Fiji
Greater Sunda
Hainan
Madagascar
Mascarene
New Caledonia
New Guinea
Philippine
Samoa
Solomon
Vanuatu
α
α_{stand}
R
N
R^2=0.07, P=0.381
ns.
R^2=0.11, P=0.235
R^2=0.14, P=0.209
R^2=0.04, P=0.120
R^2=0.03, P=0.128
R^2=0.24, P<0.001
R^2=0.05, P=0.006
MAT (°C)
MAP (mm)

Figure A1.1 Relationships between mean annual temperature (MAT), mean annual precipitation (MAP), and the shape parameter (α) of SADs, the standardized shape parameter (α_{stand}), the number of trees (N), and the number of species (R). Points represent the average value per island, bars the minimal and maximal values. Grey trend lines represent the fits of generalized linear models with 500 iterations. Solid black trend lines represent the average fits with averaged R^2 and *P* values (distributions of R^2 and *P* values are available in Appendix 2). Dotted black trend lines represent the 95% confident intervals around the average trend lines. Trend lines where only showed when at least one iteration resulted in a significant relationship ($P < 0.05$).

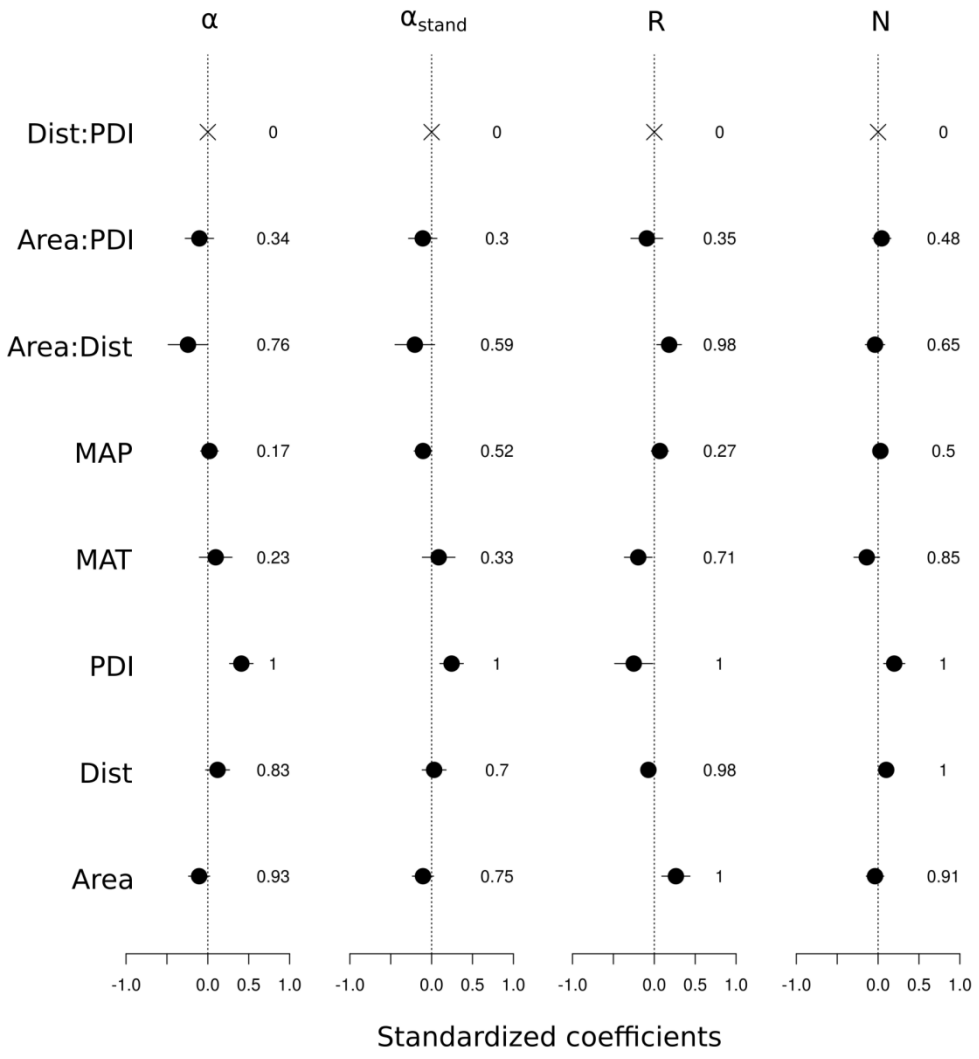

Figure A1.2 Effects of cyclone power dissipation index (PDI), island area (Area, log-transformed), island isolation (Dist., log-transformed), mean annual temperature (MAT), and mean annual precipitation (MAP) on the shape parameter (α) of SADs, the standardized shape parameter (α_{stand}), the number of trees (N), and the number of species (R). Points represent the average effect and bars represent 95% confidence intervals. Values on the right represent the proportion of iterations (among 500 iterations) where the variable has been retained in best model sets.

Appendix 2

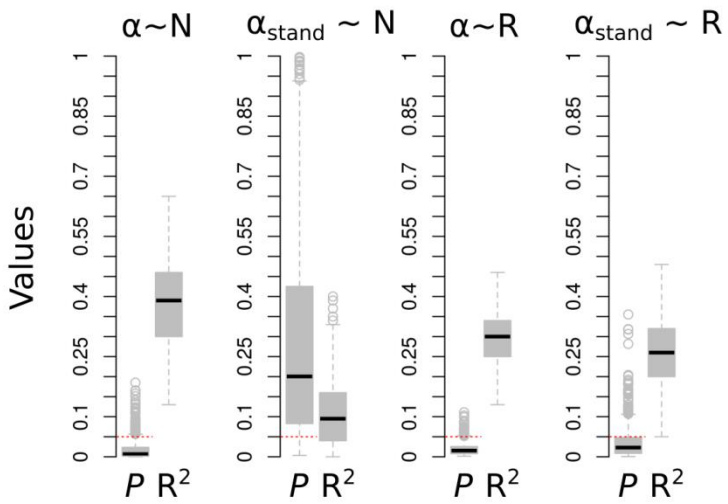

Figure A2.1 Distribution of *P* and R^2 values (500 iterations) for the relationships between the shape parameter of SADs (non-standardised [α] and standardized [α_{stand}]) and the number of trees (N) and species (R). Red dotted lines represent the significance threshold ($P < 0.05$).

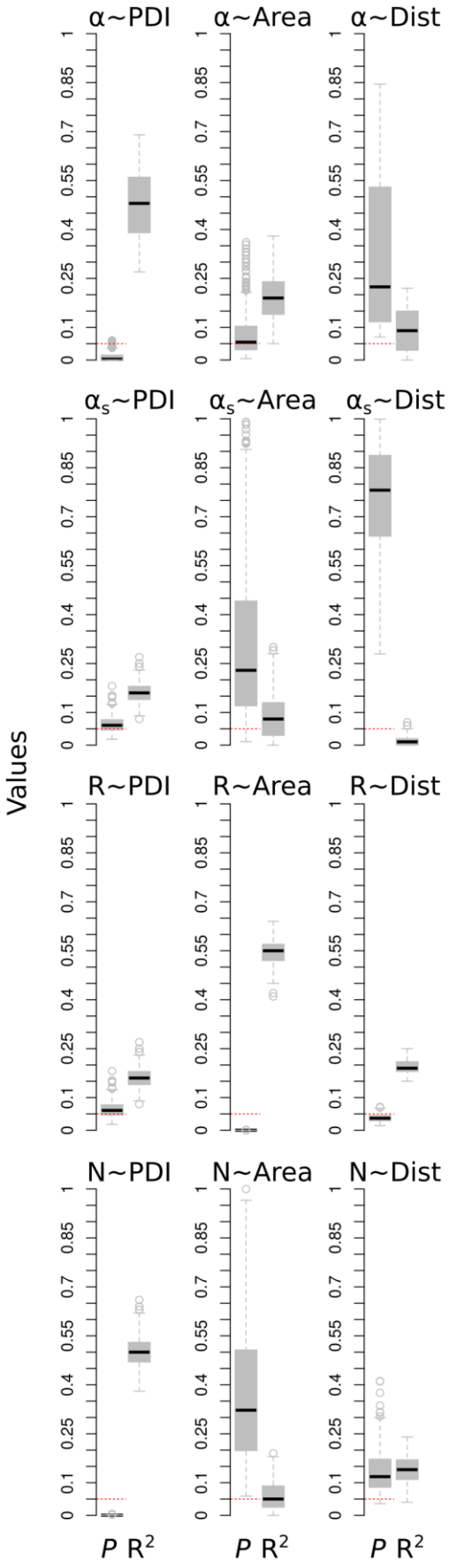
α~PDI
α~Area
α~Dist
αs~PDI
αs~Area
αs~Dist
R~PDI
R~Area
R~Dist
N~PDI
N~Area
N~Dist
Values
0
0.1
0.25
0.4
0.55
0.7
0.85
1
P
R2

Figure A2.2 Distribution of P and R2 values (500 iterations) for the relationships between the cyclone power dissipation index (PDI), island area (Area, log-transformed), island isolation (Dist., log-transformed), and the shape parameter (α) of SADs, the standardized shape parameter (α_{stand}), the number of trees (N), and the number of species (R). Red dotted lines represent the significance threshold ($P < 0.05$).

Appendix 3: Dataset (Alpha = α gambin, R = number of species, N = number of trees, Area = island area, Dist = distance to the mainland, MAT = mean annual temperature in °C, MAP = mean annual precipitation in mm, PDI = cyclones power dissipation index)

Archipelago	Island	Year	Alpha	R	N	Area	Dist	MAT	MAP	PDI
Andaman Islands	Little Andaman	2006	1.47	58	491	710	610	26.98	3055	40
Andaman Islands	Little Andaman	2006	1.35	81	469	710	610	26.60	3608	50.9
Andaman Islands	Little Andaman	2006	1.70	36	565	710	610	27.29	2680	40
Andaman Islands	Little Andaman	2006	1.70	36	565	710	610	27.14	3388	50.9
Andaman Islands	Middle Andaman	2006	1.06	66	570	2781	260	27.33	2813	52.6
Andaman Islands	Middle Andaman	2006	1.05	76	732	2781	260	27.18	3091	52.6
Bismarck Archipelago	Normanby	2008	0.60	95	527	1040	900	25.14	5754	2.84
Fiji Islands	Vanua Levu	2005	1.33	90	835	5587	2900	24.79	2911.75	109
Fiji Islands	Viti Levu	2007	2.03	118	904	10531	2700	24.43	3446.5	124
Greater Sunda Islands	Borneo	1995	1.53	152	483	748168	550	22.58	2492	7.49
Greater Sunda Islands	Borneo	1995	1.31	142	528	748168	550	23.03	2367	7.49
Greater Sunda Islands	Borneo	1995	0.76	187	417	748168	550	26.39	3782	6.26
Greater Sunda Islands	Sumatra	2004	1.07	182	582	443066	60	22.65	3128	0.263
Hainan	Hainan	2004	3.11	86	588	33210	20	21.26	1409	198

Hainan	Hainan	2004	1.77	81	671	33210	20	21.26	1409	198
Madagascar	Madagascar	NA	1.38	87	724	587713	370	23.81	2300	88.9
Madagascar	Madagascar	NA	1.81	84	847	587713	370	23.81	2300	88.9
Madagascar	Madagascar	NA	1.83	111	1182	587713	370	17.08	2086	116
Mascarene Archipelago	La Reunion	1990	1.90	37	1051	2535	1200	23.11	3914	179
Mascarene Archipelago	Mauritus	2006-2008	2.78	48	1449	1874	1800	21.76	1454	216
Mascarene Archipelago	Mauritus	2006-2008	3.68	54	1603	1874	1800	21.34	1613	216
New Caledonia	Grande Terre	2013-2017	1.26	105	1374	16648	1200	21.41	2110	203
New Caledonia	Grande Terre	2013-2017	2.21	84	1423	16648	1200	19.30	2401	157
New Caledonia	Grande Terre	2013-2017	2.61	107	1125	16648	1200	20.73	2423	157
New Caledonia	Grande Terre	2013-2017	1.81	87	670	16648	1200	19.56	1946	157
New Caledonia	Grande Terre	2013-2017	2.09	100	923	16648	1200	20.51	1552	156
New Caledonia	Grande Terre	2013-2017	1.62	95	1014	16648	1200	20.33	2098	157
New Caledonia	Grande Terre	2013-2017	1.75	101	881	16648	1200	20.70	1950	157
New Caledonia	Grande Terre	2013-2017	1.47	42	804	16648	1200	22.33	1733	157
New Caledonia	Grande Terre	2013-2017	2.69	99	1223	16648	1200	21.66	2378	115
New Caledonia	Grande Terre	2013-2017	2.31	91	1004	16648	1200	22.05	2416	157

New Caledonia	Grande Terre	2013-2017	1.70	75	812	16648	1200	20.00	3070	157
New Caledonia	Grande Terre	2013-2017	3.12	96	1246	16648	1200	22.22	2089	157
New Caledonia	Grande Terre	2013-2017	1.61	86	896	16648	1200	23.03	1705	156
New Guinea	New Guinea	1999-2000	1.26	109	452	785753	155	26.81	3267	0.561
New Guinea	New Guinea	1999-2000	1.25	92	462	785753	155	25.68	2168	6.64
New Hebrides	Erromango	2006	4.42	62	924	888	1100	23.73	2604	250
Philippine Islands	Negros	1996-1998	2.06	91	645	13075	1450	22.42	2530	179
Samoa Islands	Ta_u	2004	3.22	16	326	46	3900	25.34	3615	79.8
Samoa Islands	Ta_u	2004	2.80	17	408	46	3900	25.34	3615	79.8
Samoa Islands	Ta_u	2004	2.18	33	570	46	3900	25.34	3615	79.8
Samoa Islands	Ta_u	2004	2.54	28	689	46	3900	25.34	3615	79.8
Samoa Islands	Ta_u	2004	1.20	19	554	46	3900	25.34	3615	79.8
Samoa Islands	Ta_u	2004	1.89	21	622	46	3900	25.34	3615	79.8
Samoa Islands	Tutuila	1998	5.75	36	1314	142	3900	26.09	4384	98.3
Samoa Islands	Tutuila	1998	7.44	34	938	142	3900	25.93	4860	98.3
Samoa Islands	Tutuila	1998	3.93	31	1254	142	3900	25.53	5007	98.3
Samoa Islands	Tutuila	1998	3.77	39	1362	142	3900	26.17	4821	98.3

Samoa Islands	Upolu	2006	1.72	40	673	1125	3800	25.65	4106.5	98.3
Solomon Islands	Choiseul	2006	0.82	111	541	2971	1600	27.05	3155.5	9.11
Solomon Islands	Kolombangara	2006	1.53	79	536	688	1500	26.67	3594.75	20.7