Ecography

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Supplementary material

Appendix 1 Information about the original sources for the global dataset of 21 plant-frugivorous bird networks.

ource Name	Reference
aird	Baird, J.W. 1980. The selection and use of fruit by birds in an eastern forest. Wilson Bull. 92: 63–73.
arlo	Carlo, T. A. et al. 2003. Avian fruit preferences across a Puerto Rican forested landscape: pattern consistency and implications for seed removal. Oecol. 134: 119–131.
ehling, San Pedro	Dehling, D. M. et al. 2014. Functional relationships beyond species richness patterns: trait matching in plant–bird mutualisms across scales. Global Ecol. Biogeogr. 23: 1085–1093.
ehling, Wayqecha	Dehling, D. M. et al. 2014. Functional relationships beyond species richness patterns: trait matching in plant–bird mutualisms across scales. – Global Ecol. Biogeogr. 23: 1085–1093.
adini	Fadini, R. F. and De Marco Jr, P. 2004. Interação entre aves e plantas em um fragmento de mata atlântica de Minas Gerais. – Ararajuba 12: 97–103.
austino	Faustino, T. C. and Machado, C. G. 2006. Frugivoria por aves em uma área de campo rupestre na Chapada Diamantina, BA. – Rev Bras Ornitol 14: 137–143.
rost	Frost, P. G. H. 1980. – In: Acta XVII Congressus Internationalis Ornithologici, R. Noring, pp. 1179–1184.
aletti	Galetti, M. and Pizo, M. A. 1996. Fruit eating by birds in a forest fragment in southeastern Brazil. – Ararajuba 4: 71–79.
orchov	Gorchov, D. L. et al. 1995. Dietary overlap between frugivorous birds and bats in the Peruvian Amazon. – Oikos 74: 235–250.
ovestadt	Hovestadt, T. 1997. Doctoral thesis. – University of Würzburg, Germany.
ordano	Rezende, E. L. et al. 2007. Non-random coextinctions in phylogenetically structured mutualistic networks. – Nature 448: 925–928.
antak	Kantak, G. E. 1979. Observations on some fruit-eating birds in Mexico. – Auk 96: 183–186.
lein	Plein, M. et al. 2013. Constant properties of plant–frugivore networks despite fluctuations in fruit and bird communities in space and time. – Ecology

	94: 1296–1306.
oulin	Poulin, B. et al. 1999. Interspecific synchrony and asynchrony in the fruiting phenologies of congeneric bird-dispersed plants in Panama. – J. Trop. Ecol. 15: 213–227.
aavedra	Saavedra, F. et al. 2014. Functional importance of avian seed dispersers changes in response to human-induced forest edges in tropical seed-dispersal networks. – Oecol. 176: 837–848.
chleuning	Schleuning, M. et al. 2011. Specialization and interaction strength in a tropical plant–frugivore network differ among forest strata. – Ecology 92: 26–36.
ilva	Silva, G. B. M. and Pedroni, F. 2014. Frugivoria por aves em área de cerrado no município de Uberlândia, Minas Gerais. – Rev Árvore 38: 433–442.
now, Arima	Snow, B. K. and Snow, D. W. 1972. Feeding niches of hummingbirds in a Trinidad valley. – J. Anim. Ecol. 41: 471–485.
now, Ayles	Snow, B. K. and Snow, D. W. 1988. Birds and Berries: a study of an ecological interaction. – T & AD Poyser, Calton.
orensen	Sorensen, A. E. 1981. Interactions between birds and fruit in a temperate woodland. – Oecol. 50: 242–249.
tiebel	Stiebel, H. and Bairlein, F. 2008. Frugivorie mitteleuropäischer Vögel I: Nahrung und Nahrungserwerb. – Vogelwarte 46: 1–23.

Appendix 2 Response and predictor variables for the global dataset of 21 plant-frugivorous bird networks. For each network, we provide the geographic coordinates of the sampling location, and report the sampling effort (i.e. time-span of the sampling period, sampling intensity, and sampling completeness) and the proportion of obligate frugivorous birds. Additionally, for each of the network metrics (*H_2'*, <*d'*>, *Q*) we report: (1) observed value, obs; (2) Patefield Null model, delta transformation, Δ-PA; (3) Vázquez Null model, delta transformation, Δ-VA; (4) Patefield Null model, z transformation, z-PA; and (5) Vázquez null model, z-transformation, z-VA. Note that some networks receive very high z-score values. The references for each of the networks are presented in Appendix 1.

	Geographic coordinates		Sampling effort			Avian Diet	H_2'					Q				
ource Name	latitude	longitude	Time span (#days)	Sampling intensity	Sampling completeness	% obligate frugi-vores	obs	Δ-PA	Δ-VA	z-PA	z-VA	obs	Δ-PA	Δ-VA	z-PA	z-VA
aird	40.30	-74.70	180	2.11	71.43	0.05	0.48	0.44	0.36	68.67	16.18	0.38	0.30	0.26	25.07	18.41
arlo	18.30	-66.60	240	0.79	56.88	0.08	0.39	0.30	0.25	47.75	22.79	0.42	0.29	0.27	33.71	17.63
ehling, San Pedro	-13.10	-71.60	365	1.21	78.64	0.49	0.30	0.25	0.21	96.58	45.47	0.21	0.15	0.14	57.29	29.01
ehling, Wayqecha	-13.20	-71.60	365	0.94	83.96	0.33	0.34	0.27	0.20	66.87	21.25	0.34	0.23	0.20	33.90	18.68

adini	-20.75	-42.88	365	0.50	52.27	0.14	0.24	0.08	0.02	3.76	0.55	0.37	0.08	0.04	2.80	2.07
austino	-12.99	-41.34	365	0.87	90.42	0.11	0.46	0.30	0.13	7.12	1.89	0.38	0.16	0.09	6.05	1.87
rost	-29.00	31.80	365	4.95	99.44	0.63	0.25	0.24	0.20	171.06	31.05	0.31	0.27	0.25	66.58	42.32
aletti	-22.80	-47.10	365	0.63	63.91	0.21	0.36	0.22	0.12	20.58	6.16	0.40	0.19	0.13	19.09	8.25
orchov	-4.90	-73.80	365	0.54	52.03	0.29	0.28	0.07	0.02	0.02	0.69	0.30	0.03	0.01	1.70	0.50
ovestadt	9.00	-3.60	365	3.60	94.92	0.28	0.18	0.17	0.16	316.92	114.51	0.23	0.21	0.20	135.00	85.70
ordano	37.60	-2.50	365	2.91	83.55	0.00	0.36	0.34	0.32	241.12	78.27	0.30	0.27	0.26	106.21	67.90
antak	18.50	-89.50	90	6.41	87.76	0.26	0.32	0.31	0.27	282.13	40.69	0.25	0.22	0.20	65.05	38.41
lein	50.30	8.70	130	1.75	82.12	0.00	0.33	0.30	0.27	137.75	64.94	0.34	0.29	0.27	67.15	58.66
oulin	9.20	-79.70	365	1.20	73.50	0.15	0.23	0.15	0.11	15.46	6.88	0.26	0.15	0.13	14.64	9.79
aavedra	-16.40	-67.50	365	0.54	68.10	0.36	0.45	0.32	0.20	32.23	9.81	0.47	0.26	0.22	24.94	10.52
chleuning	0.40	34.90	90	1.00	81.76	0.13	0.29	0.23	0.20	78.93	39.22	0.33	0.25	0.24	46.68	27.72
ilva	-19.00	-48.31	365	0.47	48.94	0.23	0.23	0.08	0.01	3.09	0.38	0.41	0.06	0.03	3.90	1.48
now, Arima	10.70	-61.20	365	1.75	86.00	0.57	0.30	0.25	0.20	81.10	26.53	0.30	0.22	0.19	4.61	32.00
now, Ayles	51.80	-0.80	365	6.02	90.17	0.00	0.30	0.30	0.29	817.48	210.06	0.33	0.31	0.31	179.15	148.64
orensen	51.80	-1.30	220	6.95	93.88	0.00	0.47	0.46	0.44	428.85	103.29	0.23	0.22	0.21	96.67	63.56
tiebel	51.20	9.00	365	2.66	88.51	0.00	0.40	0.39	0.34	342.86	64.88	0.42	0.38	0.35	137.14	63.40

Appendix 2, continued.

	<*d'*>				
Source Name	obs	Δ-PA	Δ-VA	z-PA	z-VA
Baird	0.35	0.33	0.28	91.57	16.76
Carlo	0.41	0.33	0.28	59.42	27.50
Dehling, San Pedro	0.13	0.11	0.10	103.05	52.63
Dehling, Wayqecha	0.32	0.25	0.19	73.64	20.29
Fadini	0.22	0.05	0.02	4.45	0.87
Faustino	0.33	0.20	0.09	6.66	1.53
Frost	0.23	0.23	0.20	199.47	32.69
Galetti	0.33	0.20	0.11	21.62	5.80
Gorchov	0.27	0.05	-0.01	1.98	-0.15

Hovestadt	0.15	0.14	0.14	428.83	145.08
Jordano	0.18	0.18	0.17	316.78	92.18
Kantak	0.13	0.13	0.12	327.24	45.38
Plein	0.31	0.29	0.28	200.71	95.50
Poulin	0.17	0.12	0.09	16.08	7.76
Saavedra	0.35	0.24	0.17	35.99	10.95
Schleuning	0.22	0.18	0.16	93.11	43.96
Silva	0.29	0.07	0.02	3.19	0.73
Snow, Arima	0.27	0.23	0.18	83.61	30.40
Snow, Ayles	0.29	0.29	0.28	1123.93	259.18
Sorensen	0.21	0.21	0.20	526.71	101.20
Stiebel	0.35	0.34	0.30	420.24	69.23

Appendix 3. Latitudinal patterns in biotic specialization for weighted plant-frugivore networks. For <*d'*>, we calculated both observed (obs) and null model corrected specialization (Δ and z), using both the Patefield (PA) and Vázquez (VA) null models. We used ordinary least squares regression to evaluate the association between specialization and latitude: (a) without including sampling effort, (b) controlling for sampling intensity (Intensity), (c) controlling for sampling completeness (Complet.), (d) controlling for sampling intensity and time span (number of days), and (e) controlling for sampling completeness and time span (number of days). Associations are reported as standardized regression coefficients. For each model, we also report the coefficient of determination (R^2_{adj}). See Table 1 for similar calculations using H_2' and Q.

		Avian complementary specialization (<*d'*>)				
		obs	Δ-PA	Δ-VA	z-PA	z-VA
(a)	Latitude	$+0.23^{NS}$	$+0.56^{**}$	$+0.64^{**}$	$+0.63^{**}$	$+0.54^{*}$
	R^2_{adj}	0.05	0.32	0.42	0.39	0.29
(b)	Latitude	$+0.65^{**}$	$+0.56^{*}$	$+0.53^{*}$	$+0.29^{NS}$	$+0.23^{NS}$
	Intensity	-0.76^{**}	$+0.00^{NS}$	$+0.21^{NS}$	$+0.60^{**}$	$+0.55^{*}$
	R^2_{adj}	0.42	0.28	0.42	0.62	0.48

(c)	Latitude	+0.36^{NS}	+0.51*	+0.57**	+0.51**	+0.43*
	Complet.	-0.43^{NS}	+0.18^{NS}	+0.26^{NS}	+0.38*	+0.38^{NS}
	R^2_{adj}	0.18	0.31	0.45	0.50	0.39
(d)	Latitude	+0.65**	+0.56*	+0.53*	+0.29^{NS}	+0.23^{NS}
	Intensity	-0.78**	-0.04^{NS}	+0.15^{NS}	+0.65**	+0.59*
	Time span	-0.06^{NS}	-0.16^{NS}	-0.20^{NS}	+0.18^{NS}	+0.15^{NS}
	R^2_{adj}	0.40	0.27	0.42	0.64	0.47
(e)	Latitude	+0.37^{NS}	+0.49*	+0.54**	+0.52**	+0.43*
	Complet.	-0.43^{NS}	+0.18^{NS}	+0.25^{NS}	+0.39*	+0.38^{NS}
	Time Span	+0.08^{NS}	-0.15^{NS}	-0.22^{NS}	+0.07^{NS}	+0.04^{NS}
	R^2_{adj}	0.14	0.30	0.47	0.48	0.36

$^{**}P<0.01$; $^{*}P<0.05$; ^{NS}non-significant.