

Supporting Information

Table S1 Correlates of bird-mediated seed dispersal, arthropod control, and pollination in tropical ecosystems.

Bird community attribute (x)	Ecosystem function (y)	Relationship (R^2)
Frugivore abundance	Dispersed seed richness	$\hat{y} = 0.876x - 5.070$ (0.95)*
	Dispersed seed abundance	$\hat{y} = 0.202x - 2.408$ (0.71)*
Migrant insectivore richness	% Reduction in total arthropod abundance	$\hat{y} = 10.029x - 40.785$ (0.64)†
	% Reduction in large arthropod abundance	$\hat{y} = 8.7336x - 8.3759$ (0.68)†
Nectarivore abundance	Quantity and quality of flower pollination	na‡

* Pejchar et al. (2008) *Biol Conserv* **141**, 536–544.

† van Bael et al. (2008) *Ecology* **89**, 928–934.

‡ No study has yet related attributes of avian nectarivore communities to pollination functions. We use nectarivore abundance rather than species richness because vertebrate pollination networks are characterized by low dependency.

Table S2 Local restoration effects on avian community attributes. Significant differences ($\alpha = 0.05$) from Wilcoxon rank sum tests with Bonferroni corrections are denoted by ^{AB}.

	Control	Island	Plantation	X ²	<i>p</i>
Frugivores (detections/observation)	3.3 ± 0.4 ^A	6.8 ± 0.5 ^B	9.7 ± 0.5 ^B	16.4	<0.001
Nectarivores (detections/observation)	1.4 ± 0.2 ^A	3.0 ± 0.3 ^B	4.4 ± 0.4 ^B	19.0	<0.001
Migrant insectivores (observed species richness)	1.7 ± 0.4 ^A	4.9 ± 0.6 ^B	6.2 ± 0.5 ^B	19.6	<0.001
Similarity to old-growth (QS)	0.12 ± 0.01 ^A	0.18 ± 0.01 ^A	0.23 ± 0.02 ^B	18.8	<0.001

Table S3 Maximum likelihood model selection for bird community attributes.

Response variable	Model (fixed effects)	K	ΔAIC_c	w_i
Similarity to reference forest	int + treatment	5	2.87	0.24
	int + treatment + tree cover	6	4.88	0.87
	int + treatment × tree cover	8	0.00	1.00
Frugivore abundance	int + treatment	5	3.31	0.19
	int + treatment + tree cover	6	0.00	1.00
	int + treatment × tree cover	8	1.41	0.49
Migrant insectivore richness	int + treatment	5	0.00	1.00
	int + treatment + tree cover	6	2.62	0.27
	int + treatment × tree cover	8	2.15	0.34
Nectarivore abundance	int + treatment	5	2.19	0.34
	int + treatment + tree cover	6	0.00	1.00
	int + treatment × tree cover	8	0.62	0.73

Table S4 Maximum likelihood tests for significance of fixed factors explaining bird community attributes

Response variable	Hypothesis	Δ AIC	X^2	p
Similarity to reference forest	$\beta(\text{treatment}) = 0$	-32.0	40.0	<0.001
	$\beta(\text{tree cover}) = 0$	-5.8	11.8	0.008
	$\beta(\text{interaction}) = 0$	-7.8	11.8	0.003
Frugivore abundance	$\beta(\text{treatment}) = 0$	-114.0	118.0	<0.001
	$\beta(\text{tree cover}) = 0$	-2.7	4.7	0.029
Migrant insectivore richness	$\beta(\text{treatment}) = 0$	-33.0	37.0	<0.001
Nectarivore abundance	$\beta(\text{treatment}) = 0$	-78.3	82.3	<0.001
	$\beta(\text{tree cover}) = 0$	-2.3	4.3	0.039

Table S5 Individual trends for the ten most abundant bird species in each group (frugivores, nectarivores, migrant insectivores, and species found in old-growth forest). Taxonomy follows the American Ornithologists' Union (2007) and its supplements. Species are ordered by group and by the number of detections or by the number of occurrences in old-growth forest plots (Old-growth forest species).

Group	Family	Species	Detections (N)	% Detections in group (%)	Sites with greater observations in plantations than controls / sites where species occurred	Trend in abundance with increasing tree cover
Frugivore	Thraupidae	<i>Ramphocelus costaricensis</i>	273	15.0	7/13	none
	Parulidae	<i>Basileuterus rufifrons</i>	134	7.4	10/11	none
	Incertae Sedis	<i>Saltator maximus</i>	124	6.8	8/13	none
	Turdidae	<i>Catharus ustulatus</i>	120	6.6	11/13	none
	Turdidae	<i>Catharus aurantiirostris</i>	108	6.0	8/13	none
	Thraupidae	<i>Thraupis episcopus</i>	96	5.3	6/12	none
	Parulidae	<i>Oreothlypis peregrina</i>	95	5.2	13/13	none
	Incertae Sedis	<i>Saltator striatipectus</i>	89	4.9	3/12	none
	Tyrannidae	<i>Zimmerius vilissimus</i>	75	4.1	7/12	none
	Thraupidae	<i>Tangara larvata</i>	72	4.0	11/12	none
Nectarivore	Trochilidae	<i>Amazilia tzacatl</i>	211	26.0	12/13	none
	Incertae Sedis	<i>Saltator maximus</i>	122	15.0	8/13	none
	Thraupidae	<i>Thraupis episcopus</i>	96	11.8	6/13	none
	Parulidae	<i>Oreothlypis peregrina</i>	92	11.3	13/13	none
	Emberizidae	<i>Chlorospingus ophthalmicus</i>	65	8.0	3/4	none
	Incertae Sedis	<i>Coereba flaveola</i>	46	5.7	7/11	none
	Trochilidae	<i>Phaethornis guy</i>	39	4.8	9/11	none
	Picidae	<i>Melanerpes rubricapillus</i>	36	4.4	9/9	slight decrease
	Trochilidae	<i>Amazilia Edward</i>	30	3.7	3/9	none
	Icteridae	<i>Psarocolius decumanus</i>	20	2.5	1/3	none
Migrant insectivore	Turdidae	<i>Catharus ustulatus</i>	120	25.2	11/13	none
	Parulidae	<i>Setophaga pensylvanica</i>	99	20.8	12/12	none
	Parulidae	<i>Oreothlypis peregrina</i>	92	19.3	13/13	slight decrease

	Parulidae	<i>Geothlypis philadelphia</i>	67	14.1	7/11	none
	Parulidae	<i>Cardellina pusilla</i>	29	6.1	7/12	none
	Parulidae	<i>Setophaga fusca</i>	19	4.0	7/9	none
	Icteridae	<i>Icterus galbula</i>	13	2.7	5/6	none
	Parulidae	<i>Mniotilta varia</i>	11	2.3	4/6	none
	Parulidae	<i>Setophaga petechia</i>	8	1.7	3/5	none
	Cardinalidae	<i>Piranga rubra</i>	7	1.5	2/5	slight increase
Old-growth forest species	Formicariidae	<i>Formicarius analis</i>	4 (12)	0.2	2/2	increase
	Vireonidae	<i>Hylophilus decurtatus</i>	7 (12)	0.3	1/4	none
	Troglodytidae	<i>Henicorhina leucosticta</i>	34 (12)	1.5	5/6	increase
	Emberizidae	<i>Arremon aurantirostris</i>	1 (11)	0.0	0/1	none
	Emberizidae	<i>Chlorospingus ophthalmicus</i>	65 (10)	2.8	3/4	increase
	Tyrannidae	<i>Zimmerius vilissimus</i>	73 (10)	3.2	7/12	none
	Tyrannidae	<i>Lophotriccus pileatus</i>	30 (10)	1.3	10/10	increase
	Pipridae	<i>Corapipo altera</i>	3 (10)	0.1	2/2	increase
	Turdidae	<i>Turdus assimilis</i>	9 (10)	0.4	4/5	none
	Momotidae	<i>Momotus momota</i>	15 (9)	0.6	5/9	none

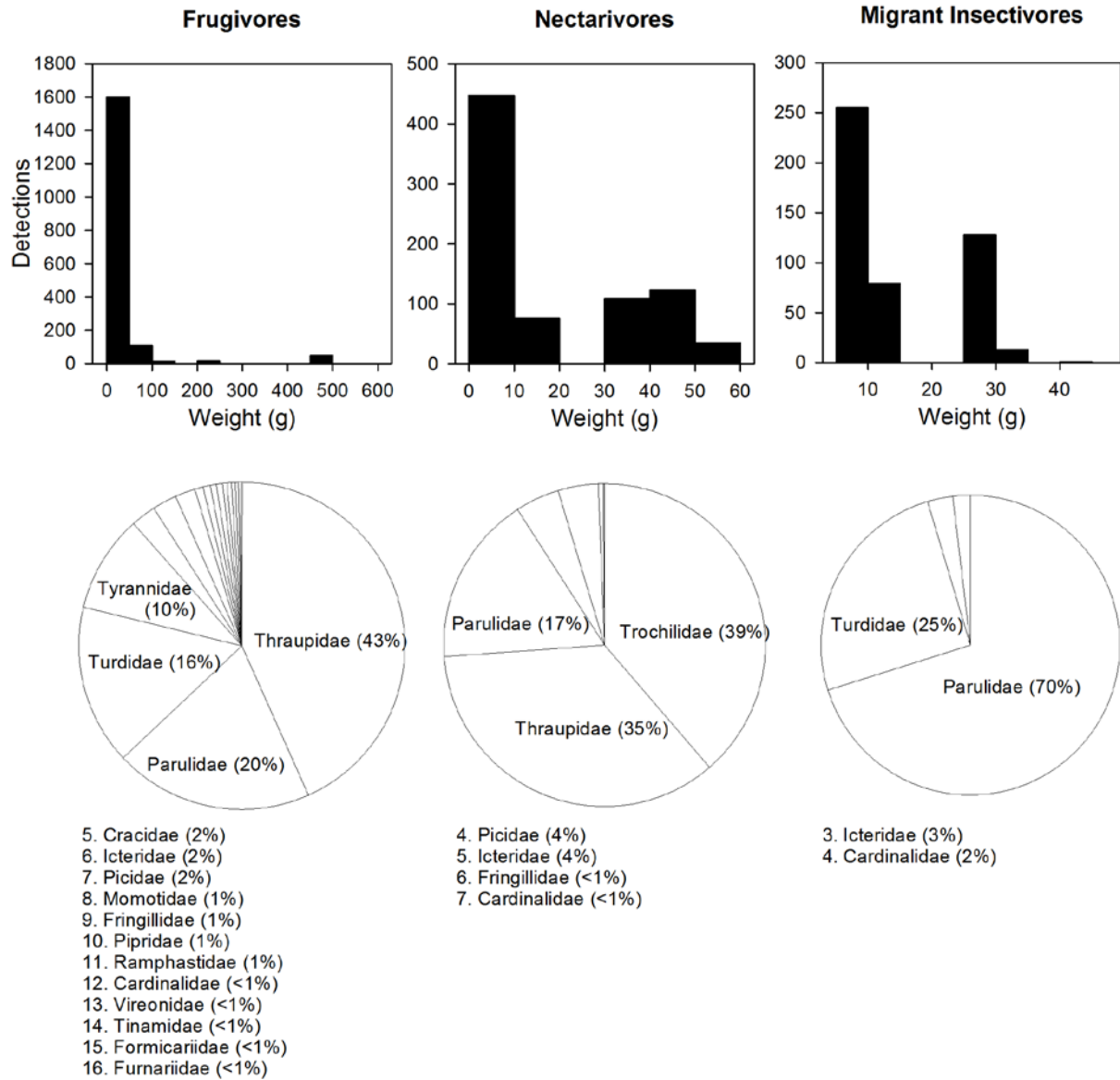


Figure S1 Weights and family composition of bird species detected in restoration sites in southern Costa Rica. Weights are from Stiles and Skutch (1989). One large frugivore, *Psarocolius decumanus* (20 detections), is not shown.

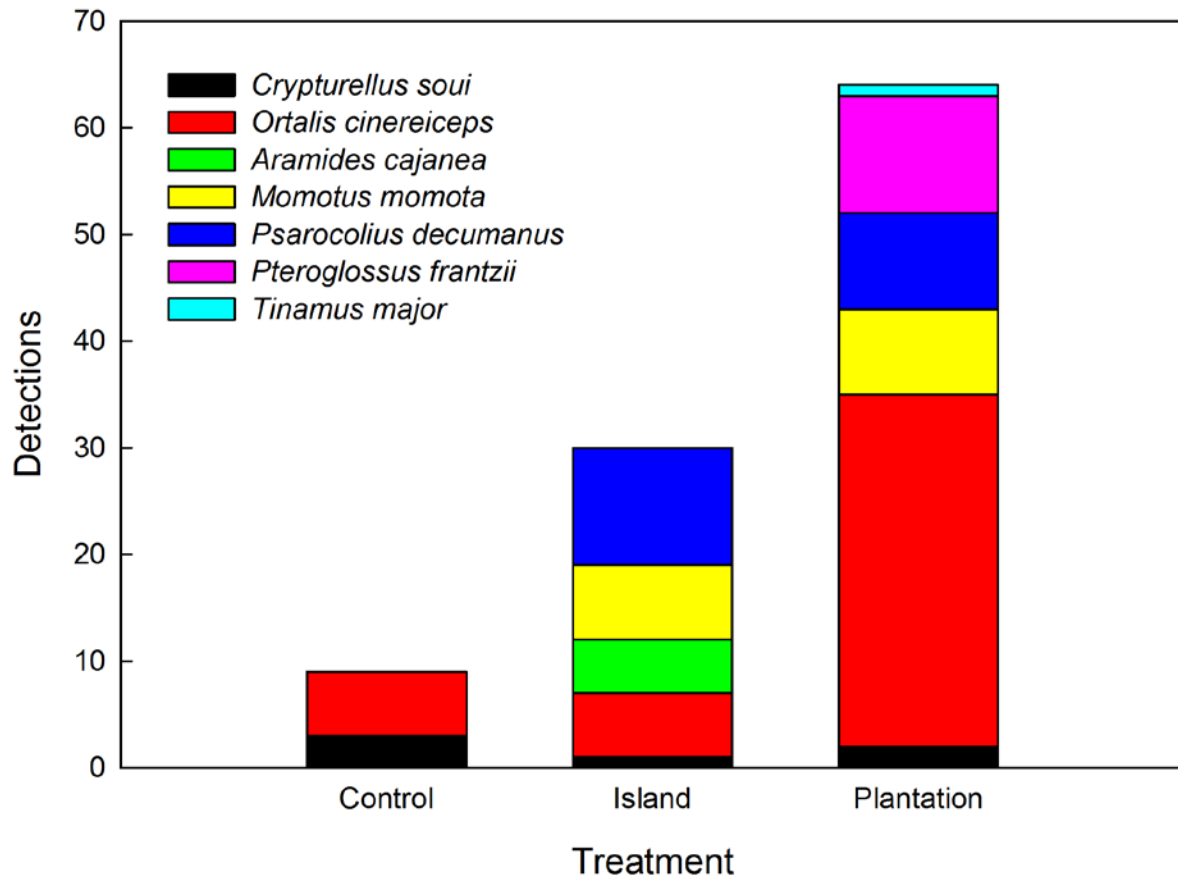


Figure S2 Detections and composition of large frugivores (>100 g) in restoration sites in southern Costa Rica.