

Supplementary Material

Title: Climate drove taxonomic, functional, and phylogenetic bird diversity in an elevational gradient in eastern Brazil

Journal: Biodiversity and Conservation

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Tables

Table S1 Variance Inflation Factor (VIF) values for the environmental predictor variables included in the models.

Predictor variables	VIF
Annual mean temperature	1.84
Annual mean precipitation	1.67
Florest height	1.45
Roughness	1.38

Table S2 Bird records along an elevational gradient in the Chapada Diamantina National Park. The 'Elevation' columns indicate species occurrence across sampling areas, where 1 denotes presence and 0 denotes absence. The 'Status' column describes each species' occurrence in Brazil, using the following acronyms: RE = Resident or reproductive migrant; VI(S) = Non-reproductive seasonal visitor from the South (S); VI(N) = Non-reproductive seasonal visitor from the North (N); En = Endemic species of Brazil; * Endemic to the Chapada Diamantina (CRBO, 2021). The 'IUCN 2025-1' column provides information on extinction risk, with EN = Endangered; VU = Vulnerable; N = Near Threatened; LC = Least Concern. The 'MMA' column presents extinction risk according to the classification of the Ministry of the Environment of Brazil, with EN = Endangered; VU = Vulnerable.

Family/ Species	400-500	600-700	Elevation 800-900	1000-1100	1200-1300	STATUS	IUCN 2025-1	MMA
TINAMIDAE								
<i>Crypturellus zabele</i>	1	1	0	0	0	En	-	VU
<i>Crypturellus parvirostris</i>	0	1	1	1	1	RE	LC	-
<i>Rynchotus rufescens</i>	0	0	1	1	1	RE	LC	-
CRACIDAE								
<i>Ortalis araucuan</i>	0	1	1	1	1	En	LC	-
<i>Penelope superciliaris</i>	1	1	0	0	0	RE	LC	-
PODICIPEDIDAE								

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Tachybaptus dominicus</i>	0	0	1	0	0	RE	LC	-
COLUMBIDAE								
<i>Columbina minuta</i>	0	0	1	0	0	RE	LC	-
<i>Columbina picui</i>	0	1	0	0	0	RE	LC	-
<i>Columbina squammata</i>	1	1	1	0	0	RE	LC	-
<i>Columbina talpacoti</i>	1	1	1	1	0	RE	LC	-
<i>Geotrygon montana</i>	1	0	0	0	0	RE	LC	-
<i>Leptotila rufaxilla</i>	1	0	0	0	0	RE	LC	-
<i>Leptotila verreauxi</i>	1	1	1	0	1	RE	LC	-
<i>Patagioenas cayanensis</i>	1	1	0	1	1	RE	LC	-
CUCULIDAE								
<i>Crotophaga ani</i>	0	1	1	0	0	RE	LC	-
<i>Piaya cayana</i>	1	1	1	1	1	RE	LC	-
<i>Tapera naevia</i>	1	1	0	1	0	RE	LC	-
CAPRIMULGIDAE								
<i>Hydropsalis longirostris</i>	0	1	0	0	1	RE	LC	-
APODIDAE								
<i>Cypseloides senex</i>	0	0	0	1	0	RE	LC	-
<i>Streptoprocne biscutata</i>	0	1	1	1	1	RE	LC	-
TROCHILIDAE								
<i>Augastes lumachella</i>	0	0	1	1	1	En*	NT	EN
<i>Chionomesa fimbriata</i>	1	1	1	1	0	RE	LC	-
<i>Chionomesa lactea</i>	0	0	0	1	0	RE	LC	-
<i>Chlorostilbon lucidus</i>	1	1	1	1	1	RE	LC	-
<i>Chrysolampis mosquitus</i>	0	1	1	1	1	RE	LC	-
<i>Chrysuronia versicolor</i>	0	1	1	0	0	RE	LC	-

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Colibri delphinae</i>	0	0	1	1	1	En*	LC	EN
<i>Colibri serrirostris</i>	0	1	1	1	1	RE	LC	-
<i>Eupetomena macroura</i>	0	1	1	1	0	RE	LC	-
<i>Heliomaster squamosus</i>	0	0	0	1	0	En	LC	-
<i>Phaethornis pretrei</i>	1	1	1	1	1	RE	LC	-
<i>Phaethornis ruber</i>	1	0	0	0	0	RE	LC	-
<i>Thalurania glaucopis</i>	1	1	1	1	0	RE	LC	-
RALLIDAE								
<i>Rufirallus viridis</i>	0	0	0	1	0	RE	LC	-
CATHARTIDAE								
<i>Cathartes aura</i>	0	0	0	0	1	VA(N)	LC	-
ACCIPITRIDAE								
<i>Geranoaetus melanoleucus</i>	0	0	0	0	1	RE	LC	-
<i>Rupornis magnirostris</i>	1	1	1	1	0	RE	LC	-
STRIGIDAE								
<i>Glaucidium brasilianum</i>	1	1	0	0	0	RE	LC	-
<i>Megascops choliba</i>	0	1	0	0	0	RE	LC	-
TROGONIDAE								
<i>Trogon surrucura</i>	1	1	1	0	0	RE	LC	-
ALCEDINIDAE								
<i>Megaceryle torquata</i>	1	0	0	0	0	RE	LC	-
GALBULIDAE								
<i>Galbula ruficauda</i>	1	1	1	1	0	RE	LC	-
BUCCONIDAE								
<i>Nonnula rubecula</i>	1	0	0	0	0	RE	LC	-
<i>Nystalus chacuru</i>	0	0	0	1	0	RE	LC	-

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Nystalus maculatus</i>	1	1	0	1	1	En	LC	-
PICIDAE								
<i>Celeus ochraceus</i>	1	0	0	0	0	En	LC	-
<i>Colaptes melanochloros</i>	1	0	0	0	0	RE	LC	-
<i>Piculus chrysochloros</i>	1	1	0	0	0	RE	LC	-
<i>Picumnus pygmaeus</i>	1	1	1	1	1	En	LC	-
<i>Veniliornis passerinus</i>	1	0	0	0	0	RE	LC	-
CARIAMIDAE								
<i>Cariama cristata</i>	1	0	0	0	0	RE	LC	-
FALCONIDAE								
<i>Caracara plancus</i>	1	1	1	1	0	RE	LC	-
<i>Falco rufigularis</i>	0	1	1	0	0	RE	LC	-
<i>Herpetotheres cachinnans</i>	1	1	0	1	0	RE	LC	-
<i>Micrastur ruficollis</i>	1	0	1	0	0	RE	LC	-
<i>Milvago chimachima</i>	1	1	1	1	1	RE	LC	-
PSITTACIDAE								
<i>Eupisittula cactorum</i>	1	1	1	0	0	En	LC	-
<i>Pyrrhura frontalis</i>	1	0	0	0	1	RE	LC	-
THAMNOPHILIDAE								
<i>Formicivora grantsaui</i>	0	0	1	1	1	En*	EN	EN
<i>Formicivora melanogaster</i>	0	1	1	1	0	RE	LC	-
<i>Pyriglena leucoptera</i>	1	0	0	0	0	RE	LC	-
<i>Radinopsyche sellowi</i>	0	0	1	1	0	En	LC	-
<i>Taraba major</i>	1	0	1	1	0	RE	LC	-
<i>Thamnophilus caerulescens</i>	0	1	1	1	1	RE	LC	-
<i>Thamnophilus pelzelni</i>	1	1	1	0	0	En	LC	-

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Thamnophilus torquatus</i>	0	1	1	1	1	RE	LC	-
MELANOPAREIIDAE								
<i>Melanopareia torquata</i>	0	0	0	1	1	RE	LC	-
CONOPOPHAGIDAE								
<i>Conopophaga cearae</i>	0	0	0	1	0	En	LC	EN
RHINOCRYPTIDAE								
<i>Scytalopus diamantinensis</i>	0	0	0	1	1	En*	EN	EN
DENDROCOLAPTIDAE								
<i>Dendrocolaptes platyrostris</i>	1	0	0	0	0	RE	LC	-
<i>Dendroplex picus</i>	1	0	0	0	0	RE	LC	-
<i>Lepidocolaptes angustirostris</i>	0	1	1	0	0	RE	LC	-
<i>Sittasomus griseicapillus</i>	1	0	0	0	0	RE	LC	-
<i>Xiphorhynchus fuscus</i>	1	0	0	0	0	RE	LC	-
XENOPIIDAE								
<i>Xenops rutilans</i>	1	0	0	0	0	RE	LC	-
FURNARIIDAE								
<i>Furnarius rufus</i>	1	0	0	0	0	RE	LC	-
<i>Pseudoseisura cristata</i>	0	1	0	0	0	En	LC	-
<i>Synallaxis albescens</i>	0	1	0	0	0	RE	LC	-
<i>Synallaxis frontalis</i>	1	1	1	1	0	RE	LC	-
<i>Synallaxis scutata</i>	1	0	0	0	0	RE	LC	-
<i>Synallaxis spixi</i>	0	1	1	1	1	RE	LC	-
PIPRIDAE								
<i>Antilophia galeata</i>	1	1	0	0	0	RE	LC	-
<i>Chiroxiphia pareola</i>	1	1	0	0	0	RE	LC	-
<i>Manacus manacus</i>	1	1	0	0	0	RE	LC	-

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Neopelma pallescens</i>	0	1	0	0	0	RE	LC	-
TITYRIDAE								
<i>Pachyramphus polychopterus</i>	1	0	0	0	0	RE	LC	-
<i>Pachyramphus viridis</i>	1	0	0	0	0	RE	LC	-
<i>Tityra cayana</i>	1	0	0	0	0	RE	LC	-
<i>Tityra inquisitor</i>	1	0	0	0	0	RE	LC	-
ONYCHORHYNCHIDAE								
<i>Myiobius barbatus</i>	1	0	0	0	0	RE	LC	-
PLATYRINCHIDAE								
<i>Platyrinchus mystaceus</i>	1	0	0	0	0	RE	LC	-
RHYNCHOCYCLIDAE								
<i>Hemitriccus margaritaceiventer</i>	1	1	1	1	0	RE	LC	-
<i>Hemitriccus striaticollis</i>	1	0	0	0	0	RE	LC	-
<i>Leptopogon amaurocephalus</i>	1	0	0	0	0	RE	LC	-
<i>Poecilotriccus plumbeiceps</i>	1	0	0	0	0	RE	LC	-
<i>Todirostrum cinereum</i>	1	0	0	0	0	RE	LC	-
<i>Tolmomyias flaviventris</i>	1	1	1	0	0	RE	LC	-
TYRANNIDAE								
<i>Camptostoma obsoletum</i>	1	1	1	1	1	RE	LC	-
<i>Capsiempis flaveola</i>	1	0	0	0	0	RE	LC	-
<i>Elaenia chiriquensis</i>	1	1	1	1	1	VI(S)	LC	-
<i>Elaenia cristata</i>	1	1	1	1	1	RE	LC	-
<i>Elaenia flavogaster</i>	1	0	1	0	0	RE	LC	-
<i>Elaenia obscura</i>	1	1	1	1	1	RE	LC	-
<i>Elaenia spectabilis</i>	1	0	1	0	0	RE	LC	-
<i>Fluvicola nengeta</i>	1	0	0	0	0	RE	LC	-

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Hirundinea ferruginea</i>	1	1	1	0	1	RE	LC	-
<i>Knipolegus nigerrimus</i>	0	1	1	1	1	En	LC	-
<i>Megarynchus pitangua</i>	1	1	1	0	0	RE	LC	-
<i>Myiarchus ferox</i>	1	1	0	1	0	RE	LC	-
<i>Myiodynastes maculatus</i>	1	0	0	0	0	RE	LC	-
<i>Myiopagis caniceps</i>	1	1	0	0	0	RE	LC	-
<i>Myiopagis viridicata</i>	1	1	0	0	0	RE	LC	-
<i>Myiophobus fasciatus</i>	1	1	1	1	1	RE	LC	-
<i>Myiozetetes similis</i>	1	1	1	0	0	RE	LC	-
<i>Phaeomyias murina</i>	0	0	1	0	0	RE	LC	-
<i>Phyllomyias fasciatus</i>	0	1	0	0	0	RE	LC	-
<i>Pitangus sulphuratus</i>	1	1	1	1	1	RE	LC	-
<i>Polystictus superciliaris</i>	0	0	0	0	1	En	LC	-
<i>Tyrannus melancholicus</i>	1	1	1	1	1	RE	LC	-
VIREONIDAE								
<i>Cyclarhis gujanensis</i>	1	1	1	1	1	RE	LC	-
<i>Hylophilus amaurocephalus</i>	0	0	0	1	0	RE	LC	-
<i>Vireo chivi</i>	0	1	0	0	0	RE	LC	-
CORVIDAE								
<i>Cyanocorax cyanopogon</i>	1	1	1	0	1	En	LC	-
HIRUNDINIDAE								
<i>Progne tapera</i>	1	1	0	0	0	RE	LC	-
<i>Pygochelidon cyanoleuca</i>	0	1	0	0	0	RE	LC	-
<i>Stelgidopteryx ruficollis</i>	1	0	0	1	1	RE	LC	-
TROGLODYTIDAE								
<i>Cantorchilus longirostris</i>	1	1	1	0	0	En	LC	-

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Pheugopedius genibarbis</i>	1	1	1	1	1	RE	LC	-
<i>Troglodytes musculus</i>	1	1	1	1	1	RE	LC	-
POLIOPTILIDAE								
<i>Polioptila atricapilla</i>	1	1	1	0	0	En	LC	-
TURDIDAE								
<i>Turdus amaurochalinus</i>	1	1	1	1	0	RE	LC	-
<i>Turdus leucomelas</i>	1	1	1	1	1	RE	LC	-
<i>Turdus rufiventris</i>	1	1	1	1	1	RE	LC	-
MOTACILLIDAE								
<i>Anthus chii</i>	0	0	0	0	1	RE	LC	-
FRINGILLIDAE								
<i>Euphonia chlorotica</i>	1	1	1	1	1	RE	LC	-
<i>Spinus yarrellii</i>	0	0	0	1	0	En	VU	VU
PASSERELLIDAE								
<i>Zonotrichia capensis</i>	0	1	1	1	1	RE	LC	-
ICTERIDAE								
<i>Cacicus haemorrhous</i>	1	0	0	0	0	RE	LC	-
<i>Gnorimopsar chopi</i>	1	1	1	0	1	RE	LC	-
<i>Icterus jamaicaii</i>	1	1	1	0	0	En	LC	-
<i>Molothrus bonariensis</i>	0	1	0	0	0	RE	LC	-
PARULIDAE								
<i>Basileuterus culicivorus</i>	1	1	0	1	1	RE	LC	-
<i>Geothlypis aequinoctialis</i>	0	1	1	1	1	RE	LC	-
<i>Myiothlypis flaveola</i>	1	1	0	1	0	RE	LC	-
CARDINALIDAE								
<i>Cyanoloxia brissonii</i>	1	1	1	1	0	RE	LC	-

Family/ Species	Elevation					STATUS	IUCN 2025-1	MMA
	400-500	600-700	800-900	1000-1100	1200-1300			
<i>Piranga flava</i>	0	1	1	1	0	RE	LC	-
THRAUPIDAE								
<i>Coereba flaveola</i>	1	1	1	1	1	RE	LC	-
<i>Conirostrum speciosum</i>	1	1	0	0	0	RE	LC	-
<i>Compsothraupis loricata</i>	1	1	0	0	0	En	LC	-
<i>Coryphospingus pileatus</i>	0	1	1	0	0	RE	LC	-
<i>Dacnis cayana</i>	1	1	1	1	0	RE	LC	-
<i>Emberizoides herbicola</i>	0	0	1	1	1	RE	LC	-
<i>Embernagra longicauda</i>	0	0	1	1	1	En	LC	-
<i>Hemithraupis guira</i>	1	1	0	0	0	RE	LC	-
<i>Nemosia pileata</i>	1	1	0	0	0	RE	LC	-
<i>Paroaroa dominicana</i>	1	1	1	0	0	RE	LC	-
<i>Saltator similis</i>	1	1	1	1	1	RE	LC	-
<i>Saltatricula atricollis</i>	0	1	1	0	1	RE	LC	-
<i>Schistochlamys ruficapillus</i>	0	1	1	1	1	RE	LC	-
<i>Sicalis citrina</i>	0	1	1	0	1	RE	LC	-
<i>Sporophila albogularis</i>	0	0	1	0	0	En	LC	-
<i>Sporophila leucoptera</i>	1	1	0	0	0	RE	LC	-
<i>Sporophila lineola</i>	0	1	0	0	0	RE	LC	-
<i>Sporophila nigricollis</i>	1	1	1	1	1	RE	LC	-
<i>Stilpinia cayana</i>	1	1	1	1	0	RE	LC	-
<i>Tachyphonus rufus</i>	1	1	1	1	1	RE	LC	-
<i>Tangara cyanoventris</i>	0	0	0	1	0	En	LC	-
<i>Thraupis palmarum</i>	1	1	1	0	0	RE	LC	-
<i>Thraupis sayaca</i>	1	1	1	1	0	RE	LC	-
<i>Volatinia jacarina</i>	0	1	1	0	0	RE	LC	-

Table S3 Representation of species richness and family distribution across different elevational zones

Elevation	Species richness	Families
400-500	112	36
600-700	108	32
800-900	88	28
1000-1100	77	28
1200-1300	59	29

Table S4 Results of polynomial regression models assessing the relationship between elevation and indices of taxonomic, phylogenetic, and functional diversity. Species richness (Richness), phylogenetic diversity (PD), mean nearest taxon distance (MNTD), functional richness (FRic), and functional divergence (FDiv) were modeled as a function of elevation using linear (Elevation¹), quadratic (Elevation²), and cubic (Elevation³) terms. For each model, we report the estimated regression coefficient (β), standard error (SE), t-value (t), and p-value (p). Statistically significant effects ($p < 0.05$) are indicated.

	β	SE	<i>t</i>	<i>p</i>
Richness				
Elevation ¹	-48.33	7.70	-6.27	< .001
Elevation ²	-11.18	7.70	-1.4	0.15
Elevation ³	-16.42	7.70	-2.13	0.03
PD				
Elevation ¹	-1501.82	240.68	-6.24	< .001
Elevation ²	-184.48	240.68	-0.76	0.44
Elevation ³	-606.63	240.68	-2.52	0.01
MNTD				
Elevation ¹	11.30	8.01	1.41	0.16
Elevation ²	8.24	8.01	1.02	0.30
Elevation ³	2.57	8.01	0.32	0.74
FRic				
Elevation ¹	-0.65	0.15	-4.15	< .001
Elevation ²	-0.001	0.15	-0.009	0.99
Elevation ³	-0.27	0.15	-1.71	0.09
FDiv				
Elevation ¹	-0.02	0.03	-0.96	0.34
Elevation ²	-0.02	0.03	-0.94	0.35
Elevation ³	0.03	0.03	1.16	0.25

Figures

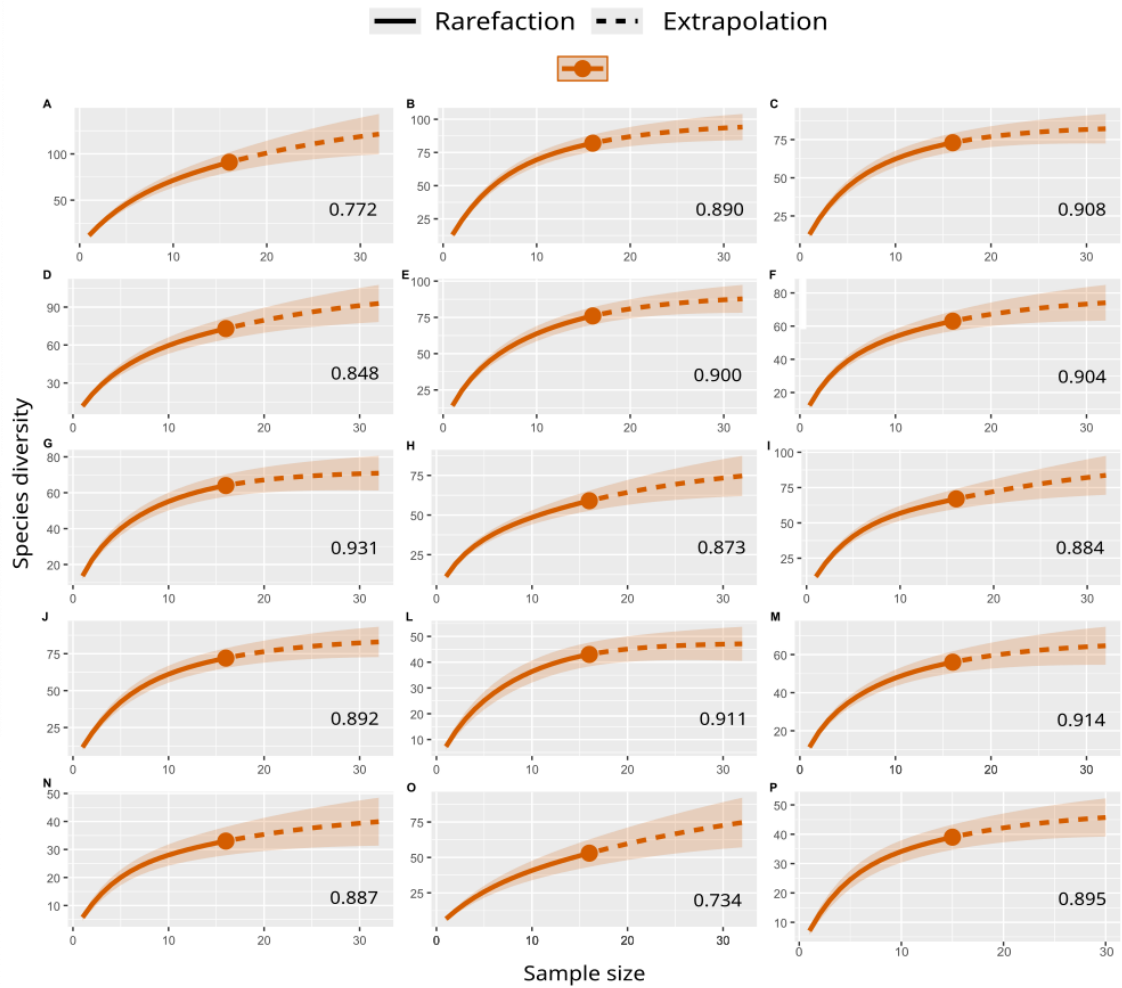


Fig. S1 Rarefaction and extrapolation curves of bird species along the elevational gradient in Chapada Diamantina. The solid line indicates the relationship between sampling units and the number of recorded species. The dashed line shows the expected number of species extrapolated to double the sampling effort. The y-axis represents species diversity, and the x-axis represents sample size. Panels A, B, and C represent the replicates at the 400-500 m elevation band; D, E, and F represent the replicates at the 600-700 m elevation band; G, H, and I represent the replicates at the 800-900 m elevation band; J, L, and M represent the replicates at the 1000-1100 m elevation band; N, O, and P represent the replicates at the 1200-1300 m elevation band. The value shown in the lower right corner corresponds to the sample coverage