**Loss of cultural and functional diversity associated with birds across the urbanization gradient in a tropical city**

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Supplementary material

Supplementary Table 1. Functional traits of each bird species in Campo Grande city. Bm = body mass (g); frug = frugivore; necta = nectarivore; gran = granivore; oniv = omnivore; carn = carnivore; insect = insectivore; canop = canopy; subcan = sub-canopy; indep = independent; art = artificial; monog = monogamy; poly = polygamy; prom = promiscuous;

|  | Bm | diet | habitat | nesting | mating | flock |
| --- | --- | --- | --- | --- | --- | --- |
| *Alipiopsitta xanthops* | 300 | frug | canop | plants | monog | present |
| *Amazilia fimbriata* | 4.8 | necta | canop | indep | poly | absent |
| *Amazona aestiva* | 451 | frug | canop | plants | monog | present |
| *Ammodramus humeralis* | 16 | gran | ground | plants | poly | absent |
| *Ara ararauna* | 1125 | frug | canop | plants | monog | present |
| *Ara chloropterus* | 1214 | frug | canop | plants | monog | present |
| *Aramides cajaneus* | 397 | oniv | subcan | ground | monog | absent |
| *Aramus guarauna* | 1080 | carn | ground | ground | poly | absent |
| *Athene cunicularia* | 150 | carn | ground | ground | monog | absent |
| *Brotogeris chiriri* | 61.6 | frug | canop | plants | monog | present |
| *Butorides striata* | 226 | carn | ground | plants | monog | absent |
| *Caracara plancus* | 1348 | oniv | ground | plants | monog | absent |
| *Cariama cristata* | 1400 | carn | ground | plants | monog | absent |
| *Cathartes aura* | 1430 | carn | ground | indep | monog | present |
| *Chloroceryle americana* | 37.5 | carn | subcan | ground | monog | absent |
| *Chlorostilbon lucidus* | 3.7 | necta | canop | plants | poly | absent |
| *Clibanornis rectirostris* | 48 | insect | subcan | ground | monog | absent |
| *Coereba flaveola* | 10.1 | frug | ground | indep | poly | absent |
| *Colaptes campestris* | 158 | insect | ground | plants | monog | present |
| *Colaptes melanochloros* | 127 | insect | subcan | plants | monog | absent |
| *Columba livia* | 350 | gran | ground | art | monog | present |
| *Columbina picui* | 47 | gran | ground | plants | monog | present |
| *Columbina squammata* | 52.9 | gran | ground | plants | monog | present |
| *Columbina talpacoti*  | 46.5 | gran | ground | plants | monog | present |
| *Crotophaga ani* | 97.4 | oniv | ground | plants | prom | present |
| *Cyanerpes cyaneus* | 14 | oniv | canop | plants | monog | present |
| *Cyclarhis gujanensis* | 28.8 | insect | subcan | plants | monog | absent |
| *Diopsittaca nobilis* | 151 | frug | canop | plants | monog | present |
| *Elaenia flavogaster* | 24.8 | oniv | subcan | plants | poly | absent |
| *Empidonomus varius* | 27.1 | insect | subcan | indep | poly | absent |
| *Eupetomena macroura* | 9 | necta | canop | indep | poly | absent |
| *Euphonia chlorotica* | 11 | frug | subcan | plants | monog | absent |
| *Eupsittula aurea*  | 84.65 | frug | canop | plants | monog | present |
| *Falco sparverius* | 115.5 | carn | canop | plants | monog | absent |
| *Forpus xanthopterygius* | 31 | frug | canop | plants | monog | present |
| *Furnarius rufus* | 57.4 | insect | ground | indep | monog | absent |
| *Gnorimopsar chopi* | 65.9 | oniv | ground | indep | monog | present |
| *Griseotyrannus aurantioatrocristatus* | 33 | insect | ground | plants | poly | absent |
| *Guira guira* | 141 | oniv | ground | plants | prom | present |
| *Herpsilochmus longirostris* | 12.8 | insect | subcan | plants | monog | absent |
| *Hylocharis chrysura* | 4.5 | necta | canop | plants | poly | absent |
| *Icterus cayanensis* | 31.8 | oniv | subcan | plants | monog | present |
| *Leptotila verreauxi* | 161 | gran | ground | plants | monog | absent |
| *Megaceryle torquata* | 323 | carn | ground | ground | monog | absent |
| *Melanerpes candidus* | 108 | insect | canop | plants | monog | present |
| *Mimus saturninus* | 63.7 | oniv | ground | plants | monog | present |
| *Molothrus bonariensis* | 40 | oniv | ground | indep | monog | present |
| *Myiarchus ferox* | 27.5 | insect | canop | plants | monog | absent |
| *Myiodynastes maculatus* | 43.2 | oniv | canop | plants | monog | absent |
| *Myiothlypis flaveola* | 13.1 | insect | subcan | ground | monog | absent |
| *Myiozetetes cayanensis* | 25.9 | insect | canop | plants | monog | present |
| *Nannopterum brasilianus* | 1165 | carn | ground | plants | monog | present |
| *Passer domesticus* | 27.7 | gran | ground | art | prom | present |
| *Patagioenas cayennensis* | 229 | gran | ground | plants | monog | absent |
| *Patagioenas picazuro* | 279 | gran | ground | plants | monog | present |
| *Philohydor lictor* | 25.5 | insect | canop | plants | monog | absent |
| *Piaya cayana* | 102 | oniv | subcan | plants | monog | absent |
| *Picumnus albosquamatus* | 11.9 | insect | subcan | plants | monog | absent |
| *Pitangus sulphuratus* | 61 | oniv | canop | indep | monog | absent |
| *Primolius maracana* | 256 | frug | canop | plants | monog | present |
| *Progne chalybea* | 42.9 | insect | canop | indep | monog | present |
| *Progne tapera* | 32 | insect | canop | indep | monog | present |
| *Psittacara leucophthalmus* | 158 | frug | canop | plants | monog | present |
| *Pteroglossus castanotis* | 273 | oniv | canop | plants | monog | present |
| *Ramphastos toco* | 618 | oniv | canop | plants | monog | present |
| *Rupornis magnirostris* | 269 | carn | canop | plants | monog | absent |
| *Sicalis flaveola* | 19.7 | gran | ground | art | prom | present |
| *Sporophila leucoptera* | 15.5 | gran | ground | plants | monog | present |
| *Stelgidopteryx ruficollis* | 16.1 | insect | ground | ground | monog | present |
| *Tangara cayana* | 18 | frug | canop | plants | monog | absent |
| *Tangara palmarum* | 39 | frug | canop | plants | monog | absent |
| *Tangara sayaca* | 32 | frug | canop | plants | monog | absent |
| *Taraba major* | 59.2 | insect | subcan | plants | monog | absent |
| *Tersina viridis* | 29 | frug | canop | plants | monog | absent |
| *Thamnophilus doliatus* | 27 | insect | subcan | plants | monog | absent |
| *Theristicus caudatus* | 1726 | carn | ground | ground | monog | absent |
| *Thlypopsis sordida* | 17 | insect | canop | plants | poly | absent |
| *Troglodytes musculus* | 12 | insect | subcan | indep | monog | absent |
| *Turdus amaurochalinus* | 57.9 | oniv | canop | plants | poly | absent |
| *Turdus leucomelas* | 69.1 | oniv | subcan | plants | poly | absent |
| *Turdus rufiventris* | 69.5 | oniv | canop | indep | poly | absent |
| *Tyrannus albogularis* | 37.1 | oniv | subcan | plants | monog | absent |
| *Tyrannus melancholicus*  | 37.4 | oniv | canop | plants | monog | absent |
| *Vanellus chilensis* | 327 | carn | ground | ground | monog | absent |
| *Veniliornis passerinus* | 32.1 | insect | subcan | plants | monog | absent |
| *Volatinia jacarina* | 9.7 | gran | ground | plants | monog | present |
| *Zenaida auriculata* | 136 | gran | ground | indep | monog | present |
| *Zonotrichia capensis* | 20.4 | gran | ground | plants | monog | absent |

Supplementary Table 2. Cultural traits of each bird species in Campo Grande city. These cultural traits are the number of times each bird species was represented in different aspects of human culture, including football teams, music, poetry, city flags and anthems and folklore tales.

|  | Football teams | Music and poetry | City flags and anthems | Folklore tales |
| --- | --- | --- | --- | --- |
| *Alipiopsitta xanthops* | 6 | 7 | 12 | 1 |
| *Amazilia fimbriata* | 0 | 14 | 1 | 3 |
| *Amazona aestiva* | 6 | 8 | 12 | 1 |
| *Ammodramus humeralis* | 0 | 6 | 0 | 0 |
| *Ara ararauna* | 2 | 3 | 9 | 1 |
| *Ara chloropterus* | 3 | 2 | 9 | 1 |
| *Aramides cajaneus* | 0 | 2 | 0 | 1 |
| *Aramus guarauna* | 0 | 3 | 0 | 0 |
| *Athene cunicularia* | 5 | 6 | 1 | 4 |
| *Brotogeris chiriri* | 18 | 5 | 12 | 0 |
| *Butorides striata* | 0 | 7 | 0 | 0 |
| *Caracara plancus* | 11 | 8 | 0 | 3 |
| *Cariama cristata* | 0 | 7 | 0 | 0 |
| *Cathartes aura* | 2 | 44 | 2 | 8 |
| *Chloroceryle americana* | 0 | 8 | 0 | 0 |
| *Chlorostilbon lucidus* | 0 | 14 | 1 | 3 |
| *Clibanornis rectirostris* | 0 | 2 | 0 | 0 |
| *Coereba flaveola* | 0 | 1 | 0 | 0 |
| *Colaptes campestris* | 3 | 5 | 0 | 1 |
| *Colaptes melanochloros* | 3 | 5 | 0 | 1 |
| *Columba livia* | 0 | 7 | 4 | 1 |
| *Columbina picui* | 0 | 10 | 0 | 0 |
| *Columbina squammata* | 0 | 4 | 0 | 0 |
| *Columbina talpacoti*  | 0 | 10 | 0 | 0 |
| *Crotophaga ani* | 0 | 4 | 0 | 0 |
| *Cyanerpes cyaneus* | 0 | 14 | 0 | 3 |
| *Cyclarhis gujanensis* | 0 | 1 | 0 | 0 |
| *Diopsittaca nobilis* | 1 | 3 | 4 | 1 |
| *Elaenia flavogaster* | 0 | 1 | 0 | 0 |
| *Empidonomus varius* | 0 | 1 | 0 | 0 |
| *Eupetomena macroura* | 0 | 14 | 1 | 3 |
| *Euphonia chlorotica* | 0 | 1 | 1 | 0 |
| *Eupsittula aurea*  | 18 | 5 | 5 | 0 |
| *Falco sparverius* | 0 | 1 | 0 | 0 |
| *Forpus xanthopterygius* | 0 | 1 | 0 | 0 |
| *Furnarius rufus* | 1 | 4 | 0 | 2 |
| *Gnorimopsar chopi* | 0 | 4 | 0 | 0 |
| *Griseotyrannus aurantioatrocristatus* | 0 | 1 | 0 | 0 |
| *Guira guira* | 0 | 7 | 0 | 0 |
| *Herpsilochmus longirostris* | 0 | 0 | 1 | 0 |
| *Hylocharis chrysura* | 0 | 14 | 1 | 3 |
| *Icterus cayanensis* | 0 | 0 | 2 | 0 |
| *Leptotila verreauxi* | 0 | 8 | 1 | 0 |
| *Megaceryle torquata* | 0 | 8 | 0 | 0 |
| *Melanerpes candidus* | 3 | 4 | 0 | 1 |
| *Mimus saturninus* | 0 | 39 | 0 | 0 |
| *Molothrus bonariensis* | 0 | 2 | 0 | 0 |
| *Myiarchus ferox* | 0 | 1 | 0 | 0 |
| *Myiodynastes maculatus* | 1 | 17 | 0 | 0 |
| *Myiothlypis flaveola* | 10 | 13 | 0 | 0 |
| *Myiozetetes cayanensis* | 0 | 17 | 0 | 0 |
| *Nannopterum brasilianus* | 0 | 7 | 1 | 0 |
| *Passer domesticus* | 0 | 12 | 0 | 0 |
| *Patagioenas cayennensis* | 0 | 7 | 2 | 1 |
| *Patagioenas picazuro* | 0 | 7 | 2 | 1 |
| *Philohydor lictor* | 1 | 17 | 0 | 0 |
| *Piaya cayana* | 0 | 0 | 0 | 1 |
| *Picumnus albosquamatus* | 3 | 4 | 0 | 1 |
| *Pitangus sulphuratus* | 1 | 17 | 0 | 1 |
| *Primolius maracana* | 1 | 5 | 4 | 1 |
| *Progne chalybea* | 0 | 26 | 1 | 0 |
| *Progne tapera* | 0 | 26 | 1 | 0 |
| *Psittacara leucophthalmus* | 18 | 5 | 4 | 1 |
| *Pteroglossus castanotis* | 0 | 2 | 2 | 0 |
| *Ramphastos toco* | 0 | 1 | 1 | 1 |
| *Rupornis magnirostris* | 0 | 12 | 1 | 3 |
| *Sicalis flaveola* | 0 | 12 | 0 | 0 |
| *Sporophila leucoptera* | 0 | 1 | 0 | 0 |
| *Stelgidopteryx ruficollis* | 0 | 26 | 1 | 0 |
| *Tangara cayana* | 0 | 2 | 3 | 0 |
| *Tangara palmarum* | 0 | 4 | 4 | 0 |
| *Tangara sayaca* | 0 | 4 | 4 | 0 |
| *Taraba major* | 0 | 0 | 2 | 0 |
| *Tersina viridis* | 0 | 8 | 0 | 2 |
| *Thamnophilus doliatus* | 0 | 0 | 1 | 0 |
| *Theristicus caudatus* | 0 | 2 | 0 | 0 |
| *Thlypopsis sordida* | 10 | 14 | 0 | 0 |
| *Troglodytes musculus* | 0 | 6 | 0 | 0 |
| *Turdus amaurochalinus* | 0 | 39 | 0 | 0 |
| *Turdus leucomelas* | 0 | 39 | 0 | 0 |
| *Turdus rufiventris* | 0 | 39 | 0 | 0 |
| *Tyrannus albogularis* | 0 | 1 | 0 | 0 |
| *Tyrannus melancholicus*  | 0 | 1 | 0 | 0 |
| *Vanellus chilensis* | 2 | 14 | 0 | 1 |
| *Veniliornis passerinus* | 3 | 5 | 0 | 0 |
| *Volatinia jacarina* | 0 | 1 | 0 | 0 |
| *Zenaida auriculata* | 0 | 7 | 1 | 1 |
| *Zonotrichia capensis* | 0 | 6 | 0 | 0 |



Supplementary Figure 1. Diagnostic plots of linear assumptions (homogeneity and normality) of bird cultural richness (FRic) as a function of impervious surface cover in Campo Grande city.



Supplementary Figure 2. Diagnostic plots of linear assumptions (homogeneity and normality) of bird cultural divergence (RaoQ) as a function of impervious surface cover in Campo Grande city.



Supplementary Figure 3. Diagnostic plots of linear assumptions (homogeneity and normality) of bird functional richness (FRic) as function of impervious surface cover in Campo Grande city.

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Supplementary Figure 4. Diagnostic plots of linear assumptions (homogeneity and normality) of bird functional divergence (RaoQ) as a function of impervious surface cover in Campo Grande city.