

APPENDIX 1

Table S1: Names, locations and geographic coordinates of study sites where our field work was performed. Each study site included 16 counting points where both bird surveys and vegetation surveys were performed. Sites within the same area were assigned the same level of our grouping factor, to account for spatial autocorrelation associated with location and environmental conditions.

| ID | Area | Forest type | Description | Elevation (m asl) | Starting point coords (S; E) | Sampling period (months/year) |
|----|----------|-------------|--|-------------------|------------------------------|----------------------------------|
| 1 | Wanang | P1 | Pristine rainforest located within the Wanang conservation area, with little to no disturbance from people occupying the nearby Swire research station. | 108 | 5.23163; 145.181116 | January, June, October 2010 |
| 2 | | S1 | Secondary forest created by highly spatially restricted small-scale agriculture near the Wanang village, at the border of the Wanang conservational area, and surrounded by continuous primary forest. | 113 | 5.22733; 145.080583 | January, June, October 2010 |
| 3 | Baitabag | P1 | Primary forest fragment located near the Baitabag village | 80 | 5.14010; 145.775262 | June, October 2010, January 2011 |
| 4 | | S2 | Secondary forest after large-scale deforestation, closely adjacent to the Baitabag forest fragment | 82 | 5.14323; 145.773868 | June, October 2011, January 2012 |
| 5 | Baiteta | P1 | Primary forest fragment located near the Baiteta village | 75 | 4.99825; 145.7522 | June, October 2010, January 2011 |
| 6 | | S2 | Secondary forest after large-scale deforestation, closely adjacent to the Baiteta forest fragment | 66 | 5.008; 145.770366 | June, October 2011, January 2012 |

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|----|-------|----|--|-----|------------------------|----------------------------------|
| 7 | Ohu | P1 | Primary forest fragment located near the Ohu village | 125 | 5.23081; 145.677786 | June, October 2010, January 2011 |
| 8 | | S2 | Secondary forest after large-scale deforestation, closely adjacent to the Ohu forest fragment | 122 | 5.23976; 145.689013 | June, October 2011, January 2012 |
| 9 | Gonua | S2 | Secondary forest after large-scale deforestation, within 1.5 km of primary forest fragment that was not surveyed | 72 | 5.364; 145.6629 | June, October 2011, January 2012 |
| 10 | Yal | S2 | Secondary forest after large-scale deforestation, within 1.5 km of primary forest fragment that was not surveyed | 118 | 5.31558; 145.4897 | June, October 2011, January 2012 |

Table S2: Model parameters for each of our linear mixed-effects (LMM)/ generalized linear mixed-effect models (GLMM). For each model, the dependent variable and model family with the link function are displayed, as well as model parameters and spatial autocorrelation tests. Package lme4 (Bates et al., 2015) was used to fit LMMs, package GLMMLTMB (Brooks et al., 2017) was used to fit GLMMs, package Dharma was used for model diagnostics and spatial autocorrelation tests (Hartig, 2018).

| Dependent variable | Model type | Model family | Link function | AIC | BIC | loglik | deviance | Moran's I | P value Moran Test |
|------------------------------|------------|------------------------|---------------|--------|--------|--------|----------|-----------|--------------------|
| Total Bird species richness | GLMM | Conway-Maxwell Poisson | log | 1031.4 | 1071.3 | -502.7 | 1005.4 | -0.227 | 0.787 |
| Total Bird abundance | LMM | Gaussian | identity | -40.5 | -22.1 | 26.3 | -52.5 | -0.199 | 0.995 |
| Insectivore species richness | GLMM | Conway-Maxwell Poisson | log | 873 | 906.8 | -425.5 | 851 | -0.121 | 0.409 |
| Frugivore species richness | GLMM | Conway-Maxwell Poisson | log | 850.4 | 890.4 | -412.2 | 824.4 | -0.238 | 0.683 |
| Nectarivore species richness | GLMM | Conway-Maxwell Poisson | log | 385.8 | 404.2 | -186.9 | 373.8 | -0.218 | 0.853 |

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|---------------------------|------|------------------------|----------|-------|-------|--------|-------|--------|-------|
| Omnivore species richness | GLMM | Conway-Maxwell Poisson | log | 401.5 | 420 | -194.8 | 389.5 | -0.252 | 0.448 |
| Insectivore density | LMM | Gaussian | identity | 2.7 | 21.2 | 4.6 | -9.3 | -0.323 | 0.099 |
| Frugivore density | LMM | Gaussian | identity | 163.4 | 181.9 | -75.7 | 151.4 | -0.081 | 0.205 |
| Nectarivore density | LMM | Gaussian | identity | 209.6 | 228 | -98.8 | 197.6 | -0.312 | 0.234 |
| Omnivore density | LMM | Gaussian | identity | 234.5 | 253 | -111.3 | 222.5 | -0.277 | 0.370 |

Table references:

Bates, D., M. Maechler, B. Bolker, S. Walker, R.H.B. Christensen, H. Singmann, B. Dai, G., Grothendieck, P. Green. and M.B. Bolker, 2015. Package ‘lme4’. convergence, 12(1), p.2.

Brooks, M.E., K. Kristensen, K.J. van Benthem, A. Magnusson, C.W. Berg, A. Nielsen, et al. 2017. glmmTMB balances speed and flexibility among packages for zero-inflated generalized linear mixed modeling. The R journal 9: 378–400. Technische Universitaet Wien.

Hartig, F. 2018. DHARMA: Residual Diagnostics for Hierarchical (Multi-Level / Mixed) Regression Models. R Package version 020.

Table S3: List of all bird species in our study that entered analyses. We used the 14.1 version of the IOC world bird list as taxonomical authority (Gil et al., 2024), meaning we are displaying all species in this table in the same order as they are in the IOC master list, and we are using the newest IOC nomenclature for both English and scientific names. The code column refers to the species codes displayed in our multivariate analyses. Information on relevant functional traits was taken from sources described in methods section the main document of this paper.

| English name | Scientific name | Code | Feeding guild |
|-----------------------|-----------------------------------|----------|---------------|
| Northern Cassowary | <i>Casuarius unappendiculatus</i> | CasuUnap | Fr |
| Collared Brushturkey | <i>Talegalla jobiensis</i> | TaleJobi | Fr |
| New Guinea Scrubfowl | <i>Megapodius decollatus</i> | MegaDeco | In |
| Barred Owlet-nightjar | <i>Aegotheles bennettii</i> | AegoBenn | In |
| Moustached Treeswift | <i>Hemiprocne mystacea</i> | HemiMyst | In |
| Ivory-billed Coucal | <i>Centropus menbeki</i> | CentMenb | Om |

| | | | |
|-------------------------------|-----------------------------------|----------|----|
| Pheasant Coucal | <i>Centropus phasianinus</i> | CentPhas | In |
| Asian Koel | <i>Eudynamys scolopaceus</i> | EudyScol | Fr |
| Little Bronze Cuckoo | <i>Chrysococcyx minutillus</i> | ChryMinu | In |
| White-crowned Cuckoo | <i>Cacomantis leucolophus</i> | CacoLeuc | In |
| Chestnut-breasted Cuckoo | <i>Cacomantis castaneiventris</i> | CacoCast | In |
| Brush Cuckoo | <i>Cacomantis variolosus</i> | CacoVari | In |
| Amboyna Cuckoo-Dove | <i>Macropygia amboinensis</i> | MacrAmbo | Fr |
| Great Cuckoo-Dove | <i>Reinwardtoena reinwardti</i> | ReinRein | Fr |
| Stephan's Emerald Dove | <i>Chalcophaps stephani</i> | ChalStep | Fr |
| Cinnamon Ground Dove | <i>Gallicolumba rufigula</i> | GallRufi | Fr |
| Victoria Crowned Pigeon | <i>Goura victoria</i> | GourVict | Fr |
| Wompoo Fruit Dove | <i>Ptilinopus magnificus</i> | PtilMagn | Fr |
| Pink-spotted Fruit Dove | <i>Ptilinopus perlatus</i> | PtilPerl | Fr |
| Superb Fruit Dove | <i>Ptilinopus superbus</i> | PtilSupe | Fr |
| Coroneted Fruit Dove | <i>Ptilinopus coronulatus</i> | PtilCoro | Fr |
| Beautiful Fruit Dove | <i>Ptilinopus pulchellus</i> | PtilPulc | Fr |
| Yellow-bibbed Fruit Dove | <i>Ptilinopus solomonensis</i> | PtilSolo | Fr |
| Orange-bellied Fruit Dove | <i>Ptilinopus iozonus</i> | PtilIozo | Fr |
| Purple-tailed Imperial Pigeon | <i>Ducula rufigaster</i> | DucuRufi | Fr |
| Pinon's Imperial Pigeon | <i>Ducula pinon</i> | DucuPino | Fr |
| Zoe's Imperial Pigeon | <i>Ducula zoeae</i> | DucuZoea | Fr |
| Long-tailed Honey Buzzard | <i>Henicopernis longicauda</i> | HeniLong | In |
| Blyth's Hornbill | <i>Rhyticeros plicatus</i> | RhytPlic | Fr |
| Oriental Dollarbird | <i>Eurystomus orientalis</i> | EuryOrie | In |
| Hook-billed Kingfisher | <i>Melidora macrorrhina</i> | MeliMacr | In |
| Common Paradise Kingfisher | <i>Tanysiptera galatea</i> | TanyGala | In |
| Rufous-bellied Kookaburra | <i>Dacelo gaudichaud</i> | DaceGaud | Om |
| Yellow-billed Kingfisher | <i>Syma torotoro</i> | SymaToro | In |
| Papuan Dwarf Kingfisher | <i>Ceyx solitarius</i> | CeyxSoli | In |
| Azure Kingfisher | <i>Ceyx azureus</i> | CeyxAzur | In |
| Palm Cockatoo | <i>Probosciger aterrimus</i> | ProbAter | Fr |
| Sulphur-crested Cockatoo | <i>Cacatua galerita</i> | CacaGale | Fr |

| | | | |
|---------------------------|--------------------------------------|----------|----|
| Buff-faced Pygmy Parrot | <i>Micropsitta pusio</i> | MicrPusi | Fr |
| Papuan King Parrot | <i>Alisterus chloropterus</i> | AlisChlo | Fr |
| Moluccan Eclectus | <i>Eclectus roratus</i> | EcleRora | Fr |
| Red-cheeked Parrot | <i>Geoffroyus geoffroyi</i> | GeofGeof | Fr |
| Blue-collared Parrot | <i>Geoffroyus simplex</i> | GeofSimp | Fr |
| Stella's Lorikeet | <i>Charmosyna stellae</i> | CharStel | Ne |
| Black-capped Lory | <i>Lorius lory</i> | LoriLory | Ne |
| Dusky Lory | <i>Pseudeos fuscata</i> | PseuFusc | Fr |
| Coconut Lorikeet | <i>Trichoglossus haematodus</i> | TricHaem | Ne |
| Large Fig Parrot | <i>Psittaculirostris desmarestii</i> | PsitDesm | Fr |
| Edwards's Fig Parrot | <i>Psittaculirostris edwardsii</i> | PsitEdwa | Fr |
| Double-eyed Fig Parrot | <i>Cyclopsitta diophthalma</i> | CyclDiop | Fr |
| Papuan Pitta | <i>Erythropitta macklotii</i> | ErytMack | In |
| Hooded Pitta | <i>Pitta sordida</i> | PittSord | In |
| White-eared Catbird | <i>Ailuroedus buccoides</i> | AiluBucc | Fr |
| Long-billed Honeyeater | <i>Melilestes megarhynchus</i> | MeliMega | Om |
| Ruby-throated Myzomela | <i>Myzomela eques</i> | MyzoEque | Ne |
| Meyer's Friarbird | <i>Philemon meyeri</i> | PhilMeye | Fr |
| Helmeted Friarbird | <i>Philemon buceroides</i> | PhilBuce | Ne |
| Tawny-breasted Honeyeater | <i>Xanthotis flaviventer</i> | XantFlav | In |
| Mimic Honeyeater | <i>Microptilotis analogus</i> | MicrAnal | In |
| Rusty Mouse-warbler | <i>Origma murina</i> | OrigMuri | In |
| Pale-billed Scrubwren | <i>Aethomyias spilodera</i> | AethSpil | In |
| Yellow-bellied Gerygone | <i>Gerygone chrysogaster</i> | GeryChry | In |
| Green-backed Gerygone | <i>Gerygone chloronota</i> | GeryChlo | In |
| Fairy Gerygone | <i>Gerygone palpebrosa</i> | GeryPalp | In |
| Papuan Babbler | <i>Garritornis isidorei</i> | GarrIsid | In |
| Black Berrypecker | <i>Melanocharis nigra</i> | MelaNigr | Fr |
| Yellow-bellied Longbill | <i>Toxorhamphus novaeguineae</i> | ToxoNova | In |
| Spotted Jewel-babbler | <i>Ptilorrhoa leucosticta</i> | PtilLeuc | In |
| Blue Jewel-babbler | <i>Ptilorrhoa caerulescens</i> | PtilCaer | In |
| Yellow-breasted Boatbill | <i>Machaerirhynchus flaviventer</i> | MachFlav | In |

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|-------------------------------|-------------------------------------|-----------|----|
| Black-breasted Boatbill | <i>Machaerirhynchus nigripectus</i> | MachNigr | Fr |
| Lowland Peltops | <i>Peltops blainvillii</i> | PeltBlai | In |
| Black Butcherbird | <i>Melloria quoyi</i> | MellQuoy | Om |
| Hooded Butcherbird | <i>Cracticus cassicus</i> | CracCass | Om |
| Boyer's Cuckooshrike | <i>Coracina boyeri</i> | CoraBoye | Fr |
| White-bellied Cuckooshrike | <i>Coracina papuensis</i> | CoraPapu | In |
| Common Cicadabird | <i>Edolisoma tenuirostre</i> | EdolTenu | Fr |
| Black Cicadabird | <i>Edolisoma melas</i> | EdolMela | In |
| Black-browed Triller | <i>Lalage atrovirens</i> | LalaAtro | Fr |
| Piping Bellbird | <i>Ornorettes cristatus</i> | OrnoCris | In |
| Rusty Whistler | <i>Pachycephala hyperythra</i> | PachHype | In |
| Grey Whistler | <i>Pachycephala simplex</i> | PachSimp | In |
| Rusty Pitohui | <i>Pseudorectes ferrugineus</i> | PseuFerr | In |
| Arafura Shrikethrush | <i>Colluricincla megarhyncha</i> | CollMega | In |
| Northern Variable Pitohui | <i>Pitohui kirhocephalus</i> | PitoKirh | In |
| Hooded Pitohui | <i>Pitohui dichrous</i> | PitoDich | Fr |
| Brown Oriole | <i>Oriolus szalayi</i> | OrioSzal | Fr |
| Spangled Drongo | <i>Dicrurus bracteatus</i> | DicrBrac | In |
| Northern Fantail | <i>Rhipidura rufiventris</i> | RhipRufiv | In |
| Sooty Thicket Fantail | <i>Rhipidura threnothorax</i> | RhipThre | In |
| Black Thicket Fantail | <i>Rhipidura maculipectus</i> | RhipMacu | In |
| White-bellied Thicket Fantail | <i>Rhipidura leucothorax</i> | RhipLeuc | In |
| Rufous-backed Fantail | <i>Rhipidura rufidorsa</i> | RhipRufi | In |
| Drongo Fantail | <i>Chaetorhynchus papuensis</i> | ChaePapu | In |
| Spot-winged Monarch | <i>Symposiachrus guttula</i> | SympGutt | In |
| Hooded Monarch | <i>Symposiachrus manadensis</i> | SympMana | In |
| Black-winged Monarch | <i>Monarcha frater</i> | MonaFrat | In |
| Golden Monarch | <i>Carterornis chrysomela</i> | CartChry | In |
| Ochre-collared Monarch | <i>Arses insularis</i> | ArsInsu | In |
| Shining Flycatcher | <i>Myiagra alecto</i> | MyiaAlec | In |
| Grey Crow | <i>Corvus tristis</i> | CorvTris | Fr |
| Crinkle-collared Manucode | <i>Manucodia chalybatus</i> | ManuChal | Fr |

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|-------------------------|---------------------------------|-----------|----|
| Magnificent Riflebird | <i>Ptiloris magnificus</i> | PtilrMagn | Fr |
| King Bird-of-paradise | <i>Cicinnurus regius</i> | CiciRegi | Fr |
| Lesser Bird-of-paradise | <i>Paradisaea minor</i> | ParaMino | Fr |
| Black-sided Robin | <i>Poecilodryas hypoleuca</i> | PoecHypo | In |
| Olive Flyrobin | <i>Kempiella flavovirescens</i> | KempFlav | In |
| Metallic Starling | <i>Aplonis metallica</i> | AploMeta | Fr |
| Singing Starling | <i>Aplonis cantoroides</i> | AploCant | Fr |
| Yellow-faced Myna | <i>Mino dumontii</i> | MinoDumo | Fr |
| Golden Myna | <i>Mino anais</i> | MinoAnai | Fr |
| Red-capped Flowerpecker | <i>Dicaeum geelvinkianum</i> | DicaGeel | Fr |
| Black Sunbird | <i>Leptocoma aspasia</i> | LeptAspa | Ne |
| Olive-backed Sunbird | <i>Cinnyris jugularis</i> | CinnJugu | Ne |
| Streak-headed Mannikin | <i>Mayrimunia tristissima</i> | MayrTris | Fr |

Table reference

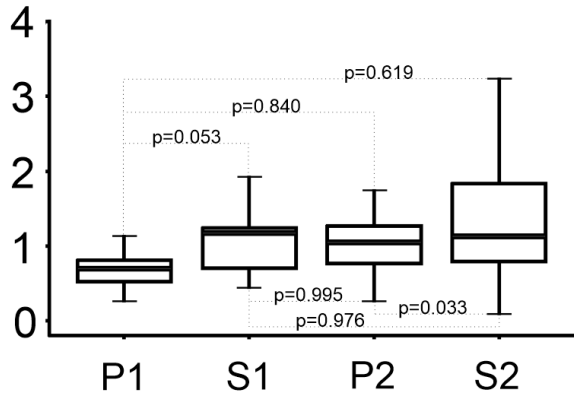
Gill F., D. Donsker and P. Rasmussen (eds). 2024. IOC World Bird List (v14.1). doi: 10.14344/IOC.ML.14.1.

Figure S1: Diagrams describing the variation in omnivore communities among forest types. Post-hoc test results as pairwise comparisons between all types are displayed. Boxplots describe differences in **a)** omnivore density (abundance/ha) Displaying median, boxes = 25 – 75 quartiles, whiskers = non-outlier range. **b)** Results of unconstrained ordination analysis of omnivore community composition using the CANOCO 5 programme (Braak & Smilauer, 2012). Into this PCA ordination, forest type is projected as a supplementary variable (Šmilauer & Lepš, 2014). The first and second ordination axes explained together 84% of all variation, and supplementary variables account for 13 %. Species codes correspond to those listed in Supplementary material, Table S3. Explanation of forest type labels: P1 = continuous primary forest, S1 = secondary forest after subsistence agriculture, P2 = fragmented primary forest, S2 = secondary forest after clear-cutting. **c)** Illustration of a typical omnivore, the Rufous-Bellied Kookaburra (*Dacelo gaudichaud*), as drawn by Anonymized.

Figure references

Šmilauer, P. and J. Lepš. 2014. Multivariate Analysis of Ecological Data using CANOCO 5. Cambridge University Press.

a)



c)



Dacelo gaudichaud

b)

