

Cropland can support high bird diversity in rural tropical landscapes

SHEENA DAVIS

SUPPLEMENTARY TABLE 1: Bird species recorded in the study landscape. A list of species observed in the landscape during the sampling period, this is inclusive of species that were only seen in the landscape but not recorded at any of the sampling points. Number of recordings at each sampling site and threat status of the species has also been included. Eastern Arc Endemic species are shown by the symbol * (Rovero et al, 2014), and range restricted species are denoted by the symbol ^a. Species that were categorised as range restricted are those found only in East Africa (namely Zambia, Malawi, Tanzania, Mozambique, Kenya, Burundi, Rwanda, Uganda, South Sudan, Ethiopia, Eritrea, Djibouti, and Somalia).

| Species name | Family | Diet | Number of sites recorded | Average number of times recorded | Threat Status |
|--|-------------------|--------------|--------------------------|----------------------------------|---------------|
| <i>Accipiter tachiro</i> | Accipitridae | VertFishScav | - | - | LC |
| <i>Acrocephalus baeticatus</i> | Acrocephalidae | Invertebrate | 2 | 1.17 | LC |
| <i>Acrocephalus gracilirostris</i> | Acrocephalidae | Invertebrate | 17 | 8.25 | LC |
| <i>Acrocephalus palustris</i> | Acrocephalidae | Invertebrate | 1 | 0.25 | LC |
| <i>Acrocephalus scirpaceus</i> | Acrocephalidae | Invertebrate | 1 | 0.33 | LC |
| <i>Agricola pallidus</i> | Muscicapidae | Invertebrate | 1 | 0.50 | LC |
| <i>Amandava subflava</i> | Estrildidae | PlantSeed | 19 | 57.58 | LC |
| <i>Amblyospiza albifrons</i> | Ploceidae | Omnivore | 7 | 6.58 | LC |
| <i>Andropadus importunus</i> | Pycnonotidae | FruinEct | 4 | 2.25 | LC |
| <i>Anomalospiza imberbis</i> | Viduidae | PlantSeed | 3 | 2.25 | LC |
| <i>Anthreptes reichenowi</i> | Nectariniidae | Invertebrate | 1 | 0.25 | NT |
| <i>Anthus cinnamomeus</i> | Motacillidae | Invertebrate | 2 | 1.25 | LC |
| <i>Apalis flavida</i> | Cisticolidae | Invertebrate | 15 | 7.33 | LC |
| <i>Apalis melanocephala</i> | Cisticolidae | Invertebrate | 1 | 0.50 | LC |
| <i>Apalis thoracica</i> | Cisticolidae | Invertebrate | - | - | LC |
| <i>Apaloderma narina</i> | Trogonidae | Invertebrate | 5 | 6.50 | LC |
| <i>Apaloderma vittatum</i> | Trogonidae | Invertebrate | 1 | 1.00 | LC |
| <i>Ardea melanocephala</i> | Ardeidae | VertFishScav | 6 | 3.58 | LC |
| <i>Arizelocichla milanjensis</i> ^{*a} | Pycnonotidae | Omnivore | 1 | 1.00 | NT |
| <i>Bostrychia hagedash</i> | Threskiornithidae | Invertebrate | 1 | 0.50 | LC |
| <i>Bradypterus baboecala</i> | Locustellidae | Invertebrate | 19 | 13.17 | LC |
| <i>Buteo buteo</i> | Accipitridae | VertFishScav | 4 | 1.33 | LC |
| <i>Bycanistes brevis</i> | Bucerotidae | FruinEct | 6 | 2.92 | LC |
| <i>Bycanistes bucinator</i> | Bucerotidae | FruinEct | 14 | 12.33 | LC |
| <i>Camaropectera brevicaudata</i> | Cisticolidae | Invertebrate | 22 | 20.08 | LC |
| <i>Campephaga flava</i> | Campephagidae | Invertebrate | 1 | 0.25 | LC |
| <i>Campethera abingoni</i> | Picidae | Invertebrate | - | - | LC |
| <i>Campethera nubica</i> | Picidae | Invertebrate | 1 | 0.75 | LC |

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|---|---------------|--------------|----|-------|----|
| <i>Ceblepyris caesius</i> | Campephagidae | Invertebrate | - | - | LC |
| <i>Cecropis abyssinica</i> | Hirundinidae | Invertebrate | 6 | 29.33 | LC |
| <i>Centropus superciliosus</i> | Cuculidae | Omnivore | 81 | 61.67 | LC |
| <i>Cercotrichas leucophrys</i> | Muscicapidae | Invertebrate | - | - | LC |
| <i>Ceuthmochares australis</i> | Cuculidae | Invertebrate | 4 | 2.00 | LC |
| <i>Chalcomitra senegalensis</i> | Nectariniidae | Omnivore | 2 | 0.50 | LC |
| <i>Chlorocichla flaviventris</i> | Pycnonotidae | Omnivore | 3 | 3.00 | LC |
| <i>Chrysococcyx caprius</i> | Cuculidae | Invertebrate | 14 | 9.67 | LC |
| <i>Chrysococcyx klaas</i> | Cuculidae | Invertebrate | 4 | 1.67 | LC |
| <i>Cichladusa arquata</i> | Muscicapidae | Invertebrate | 6 | 4.08 | LC |
| <i>Cinnyricinclus leucogaster</i> | Sturnidae | FruaNect | 4 | 2.25 | LC |
| <i>Cinnyris bifasciatus</i> | Nectariniidae | Omnivore | 2 | 0.75 | LC |
| <i>Cinnyris rufipennis</i> ^{*a} | Nectariniidae | FruaNect | - | - | VU |
| <i>Cinnyris talatala</i> | Nectariniidae | Invertebrate | - | - | LC |
| <i>Cisticola brachypterus</i> | Cisticolidae | Invertebrate | 9 | 3.92 | LC |
| <i>Cisticola chiniana</i> | Cisticolidae | Invertebrate | 10 | 4.00 | LC |
| <i>Cisticola erythrops</i> | Cisticolidae | Invertebrate | 1 | 0.25 | LC |
| <i>Cisticola marginatus</i> | Cisticolidae | Invertebrate | 20 | 8.33 | LC |
| <i>Cisticola natalensis</i> | Cisticolidae | Invertebrate | 5 | 1.58 | LC |
| <i>Coccyzygia quartinia</i> | Estrildidae | PlantSeed | - | - | LC |
| <i>Colius striatus</i> | Coliidae | FruaNect | 15 | 10.75 | LC |
| <i>Columba livia</i> | Columbidae | PlantSeed | 1 | 1.50 | LC |
| <i>Coracias caudatus</i> | Coraciidae | Omnivore | 4 | 2.08 | LC |
| <i>Coracias garrulus</i> | Coraciidae | Invertebrate | 2 | 0.75 | LC |
| <i>Corvus albus</i> | Corvidae | VertFishScav | 3 | 1.75 | LC |
| <i>Corvus splendens</i> | Corvidae | VertFishScav | 5 | 4.25 | LC |
| <i>Corythornis cristatus</i> | Alcedinidae | VertFishScav | 6 | 2.58 | LC |
| <i>Cossypha heuglini</i> | Muscicapidae | Invertebrate | 31 | 15.58 | LC |
| <i>Cossypha natalensis</i> | Muscicapidae | Invertebrate | 14 | 10.00 | LC |
| <i>Crithagra mozambica</i> | Fringillidae | PlantSeed | 16 | 10.08 | LC |
| <i>Crithagra xanthopygia</i> ^a | Fringillidae | PlantSeed | 1 | 0.75 | LC |
| <i>Cryptolybia olivacea</i> ^{*a} | Lybiidae | FruaNect | - | - | LC |
| <i>Cuculus clamosus</i> | Cuculidae | Invertebrate | 2 | 1.00 | LC |
| <i>Cuculus solitarius</i> | Cuculidae | Invertebrate | 1 | 0.25 | LC |
| <i>Cyanomitra olivacea</i> | Nectariniidae | FruaNect | 9 | 5.25 | LC |
| <i>Cypsiurus parvus</i> | Apodidae | Invertebrate | 7 | 5.33 | LC |
| <i>Dendropicops fuscescens</i> | Picidae | Invertebrate | 1 | 0.50 | LC |
| <i>Dicrurus adsimilis</i> | Dicruridae | Invertebrate | 9 | 3.25 | LC |
| <i>Dicrurus ludwigii</i> | Dicruridae | Invertebrate | 12 | 7.75 | LC |
| <i>Dryoscopus cubla</i> | Malaconotidae | Omnivore | 29 | 14.33 | LC |
| <i>Egretta ardesiaca</i> | Ardeidae | VertFishScav | - | - | LC |
| <i>Elanus axillaris</i> | Accipitridae | VertFishScav | 4 | 2.67 | LC |
| <i>Estrilda astrild</i> | Estrildidae | PlantSeed | 31 | 56.42 | LC |
| <i>Estrilda erythronotos</i> | Estrildidae | PlantSeed | - | - | LC |
| <i>Euplectes albonotatus</i> | Ploceidae | PlantSeed | 15 | 10.67 | LC |
| <i>Euplectes axillaris</i> | Ploceidae | PlantSeed | 50 | 95.17 | LC |

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|--|----------------|--------------|----|--------|----|
| <i>Elminia albonotata</i> | Stenostiridae | Invertebrate | - | - | LC |
| <i>Euplectes capensis</i> | Ploceidae | PlantSeed | 6 | 2.50 | LC |
| <i>Euplectes macroura</i> | Ploceidae | PlantSeed | 1 | 0.75 | LC |
| <i>Euplectes nigroventris</i> ^a | Ploceidae | PlantSeed | 76 | 188.67 | LC |
| <i>Euplectes orix</i> | Ploceidae | Omnivore | 16 | 23.08 | LC |
| <i>Eurystomus glaucurus</i> | Coraciidae | Invertebrate | 2 | 1.50 | LC |
| <i>Falco biarmicus</i> | Falconidae | VertFishScav | 5 | 2.25 | LC |
| <i>Gallirex porphyreolophus</i> | Musophagidae | FruNect | 8 | 5.50 | LC |
| <i>Guttera pucherani</i> ^a | Numididae | Omnivore | - | - | LC |
| <i>Gypohierax angolensis</i> | Accipitridae | FruNect | 6 | 3.17 | LC |
| <i>Halcyon albiventris</i> | Alcedinidae | Invertebrate | 12 | 4.67 | LC |
| <i>Halcyon chelicuti</i> | Alcedinidae | Invertebrate | 9 | 3.42 | LC |
| <i>Hedydipna collaris</i> | Nectariniidae | Invertebrate | 8 | 4.50 | LC |
| <i>Hippolais icterina</i> | Acrocephalidae | Invertebrate | 1 | 0.33 | LC |
| <i>Hirundo rustica</i> | Hirundinidae | Invertebrate | 15 | 42.58 | LC |
| <i>Hirundo smithii</i> | Hirundinidae | Invertebrate | 1 | 0.67 | LC |
| <i>Indicator indicator</i> | Indicatoridae | FruNect | 2 | 1.00 | LC |
| <i>Ispidina picta</i> | Alcedinidae | Invertebrate | 1 | 0.25 | LC |
| <i>Kaupifalco monogrammicus</i> | Accipitridae | Invertebrate | 1 | 0.25 | LC |
| <i>Lagonosticta rubricata</i> | Estrildidae | PlantSeed | 19 | 16.00 | LC |
| <i>Lagonosticta senegala</i> | Estrildidae | PlantSeed | 5 | 2.83 | LC |
| <i>Laniarius aethiopicus</i> | Malaconotidae | Omnivore | 39 | 23.42 | LC |
| <i>Lonchura cucullata</i> | Estrildidae | NA | 34 | 111.92 | LC |
| <i>Lophaetus occipitalis</i> | Accipitridae | VertFishScav | 2 | 0.58 | LC |
| <i>Lophoceros alboterminatus</i> | Bucerotidae | Omnivore | 15 | 11.42 | LC |
| <i>Lybius torquatus</i> | Lybiidae | FruNect | 1 | 0.50 | LC |
| <i>Macronyx croceus</i> | Motacillidae | Invertebrate | 2 | 1.00 | LC |
| <i>Malaconotus blanchoti</i> | Malaconotidae | VertFishScav | 5 | 2.58 | LC |
| <i>Melocichla mentalis</i> | Macrosphenidae | Invertebrate | 12 | 6.00 | LC |
| <i>Merops albicollis</i> | Meropidae | Invertebrate | 7 | 20.50 | LC |
| <i>Merops apiaster</i> | Meropidae | Invertebrate | 1 | 2.00 | LC |
| <i>Merops bullockoides</i> | Meropidae | Invertebrate | 1 | 3.50 | LC |
| <i>Merops persicus</i> | Meropidae | Invertebrate | 2 | 8.00 | LC |
| <i>Merops pusillus</i> | Meropidae | Invertebrate | 15 | 12.92 | LC |
| <i>Milvus migrans</i> | Accipitridae | VertFishScav | 6 | 5.75 | LC |
| <i>Motacilla aguimp</i> | Motacillidae | Invertebrate | 2 | 1.00 | LC |
| <i>Muscicapa adusta</i> | Muscicapidae | Invertebrate | 1 | 0.33 | LC |
| <i>Muscicapa striata</i> | Muscicapidae | Invertebrate | 1 | 0.25 | LC |
| <i>Nicator gularis</i> | Nicatoridae | Invertebrate | 3 | 2.50 | LC |
| <i>Notopholia corusca</i> | Sturnidae | FruNect | - | - | LC |
| <i>Numida meleagris</i> | Numididae | PlantSeed | 2 | 4.67 | LC |
| <i>Oriolus larvatus</i> | Oriolidae | Omnivore | 5 | 4.50 | LC |
| <i>Passer domesticus</i> | Passeridae | PlantSeed | 2 | 8.08 | LC |
| <i>Passer griseus</i> | Passeridae | PlantSeed | 5 | 3.00 | LC |
| <i>Phoeniculus purpureus</i> | Phoeniculidae | Invertebrate | 4 | 6.00 | LC |
| <i>Phyllastrephus cabanisi</i> | Pycnonotidae | Invertebrate | - | - | LC |

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|---|----------------|--------------|----|--------|-----------|
| <i>Phyllastrephus debilis</i> ^a | Pycnonotidae | Invertebrate | - | - | LC |
| <i>Phyllastrephus fischeri</i> ^a | Pycnonotidae | Invertebrate | 4 | 5.50 | LC |
| <i>Phyllastrephus terrestris</i> | Pycnonotidae | Omnivore | 4 | 1.83 | LC |
| <i>Platysteira peltata</i> | Platysteiridae | Invertebrate | 1 | 0.25 | LC |
| <i>Ploceus burnieri</i> ^a | Ploceidae | PlantSeed | 17 | 14.33 | VU |
| <i>Ploceus intermedius</i> | Ploceidae | Invertebrate | 2 | 6.75 | LC |
| <i>Ploceus melanocephalus</i> | Ploceidae | Omnivore | 2 | 1.00 | LC |
| <i>Ploceus ocularis</i> | Ploceidae | Invertebrate | 32 | 21.50 | LC |
| <i>Ploceus reichardi</i> ^a | Ploceidae | PlantSeed | - | - | LC |
| <i>Pogoniulus bilineatus</i> | Lybiidae | FruaNect | 1 | 0.50 | LC |
| <i>Pogoniulus pusillus</i> | Lybiidae | FruaNect | 7 | 3.00 | LC |
| <i>Pogoniulus simplex</i> ^a | Lybiidae | FruaNect | - | - | LC |
| <i>Pogonornis melanopterus</i> | Lybiidae | Omnivore | 1 | 1.00 | LC |
| <i>Poicephalus cryptoxanthus</i> | Psittacidae | PlantSeed | 1 | 1.00 | LC |
| <i>Polemaetus bellicosus</i> | Accipitridae | VertFishScav | 1 | 0.50 | VU |
| <i>Prinia subflava</i> | Cisticolidae | Invertebrate | 50 | 29.50 | LC |
| <i>Prionops plumatus</i> | Vangidae | Invertebrate | 1 | 3.00 | LC |
| <i>Psaldiprocne pristoptera</i> | Hirundinidae | Invertebrate | 2 | 0.75 | LC |
| <i>Pternistis afer</i> | Phasianidae | PlantSeed | 8 | 3.83 | LC |
| <i>Pycnonotus barbatus</i> | Pycnonotidae | FruaNect | 93 | 147.75 | LC |
| <i>Quelea erythropus</i> | Ploceidae | PlantSeed | 3 | 5.50 | LC |
| <i>Quelea quelea</i> | Ploceidae | PlantSeed | 2 | 15.00 | LC |
| <i>Rhinopomastus cyanomelas</i> | Phoeniculidae | Invertebrate | 1 | 0.50 | LC |
| <i>Sarothrura elegans</i> | Rallidae | Invertebrate | 1 | 0.25 | LC |
| <i>Schoenicola brevirostris</i> | Locustellidae | Invertebrate | 1 | 0.25 | LC |
| <i>Scopus umbretta</i> | Scopidae | VertFishScav | 5 | 3.25 | LC |
| <i>Scotopelia peli</i> | Strigidae | VertFishScav | 1 | 3.00 | LC |
| <i>Smithornis capensis</i> | Calyptomenidae | Invertebrate | 1 | 1.00 | LC |
| <i>Spermestes bicolor</i> | Estrildidae | PlantSeed | 20 | 46.83 | LC |
| <i>Spermestes fringilloides</i> | Estrildidae | PlantSeed | 2 | 1.50 | LC |
| <i>Stactolaema leucotis</i> | Lybiidae | FruaNect | - | - | LC |
| <i>Stephanoaetus coronatus</i> | Accipitridae | VertFishScav | - | - | NT |
| <i>Streptopelia capicola</i> | Columbidae | PlantSeed | 10 | 7.50 | LC |
| <i>Streptopelia semitorquata</i> | Columbidae | PlantSeed | 65 | 47.92 | LC |
| <i>Tauraco livingstonii</i> | Musophagidae | FruaNect | - | - | LC |
| <i>Tchagra senegalus</i> | Malaconotidae | Invertebrate | 11 | 5.08 | LC |
| <i>Terpsiphone viridis</i> | Monarchidae | Invertebrate | - | - | LC |
| <i>Tockus erythrorhynchus</i> | Bucerotidae | Omnivore | 2 | 2.50 | LC |
| <i>Treron calvus</i> | Columbidae | FruaNect | 3 | 3.25 | LC |
| <i>Trochocercus cyanomelas</i> ^a | Monarchidae | Invertebrate | 2 | 0.75 | LC |
| <i>Turdoides jardineii</i> | Leiotrichidae | Invertebrate | 23 | 20.25 | LC |
| <i>Turtur afer</i> | Columbidae | PlantSeed | 59 | 37.58 | LC |
| <i>Turtur chalcospilos</i> | Columbidae | PlantSeed | 1 | 0.50 | LC |
| <i>Turtur tympanistria</i> | Columbidae | PlantSeed | 1 | 0.50 | LC |
| <i>Tychaedon quadrivirgata</i> | Muscicapidae | Invertebrate | 2 | 1.00 | LC |
| <i>Upupa epops</i> | Upupidae | Invertebrate | - | - | LC |

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|-------------------------------|--------------|-----------|----|-------|----|
| <i>Uraeginthus angolensis</i> | Estrildidae | PlantSeed | 20 | 16.42 | LC |
| <i>Vidua chalybeata</i> | Viduidae | PlantSeed | 1 | 1.00 | LC |
| <i>Vidua funerea</i> | Viduidae | PlantSeed | 5 | 5.33 | LC |
| <i>Vidua macroura</i> | Viduidae | PlantSeed | 27 | 15.33 | LC |
| <i>Zosterops senegalensis</i> | Zosteropidae | FruiNect | 1 | 0.25 | LC |

SUPPLEMENTARY TABLE 2: Dietary category grouping. A sample of the categorisation process used to group species by dietary preference.

| Species name | Diet. Inv | Diet. Vend | Diet. Vect | Diet. Vfish | Diet. Vunk | Diet. Scav | Diet. Fruit | Diet. Nect | Diet. Seed | Diet. Plant | Diet Type |
|------------------------------------|-----------|------------|------------|-------------|------------|------------|-------------|------------|------------|-------------|--------------|
| <i>Acrocephalus baeticatus</i> | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Invertebrate |
| <i>Acrocephalus gracilirostris</i> | 80 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Invertebrate |
| <i>Acrocephalus palustris</i> | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | Invertebrate |
| <i>Acrocephalus scirpaceus</i> | 70 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 10 | 10 | Invertebrate |
| <i>Agricola pallidus</i> | 80 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | Invertebrate |
| <i>Amandava subflava</i> | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 20 | PlantSeed |
| <i>Amblyospiza albifrons</i> | 40 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 30 | 0 | Omnivore |
| <i>Andropadus importunus</i> | 30 | 0 | 0 | 0 | 0 | 0 | 70 | 0 | 0 | 0 | FruiNect |

SUPPLEMENTARY TABLE 3: Regression coefficients for single predictor Generalised Linear Models.

| Regression Coefficients | | | | | | | |
|---|-------------------------------|------------------------------|-----------|------------|-------|--------------------|-------|
| Response variable | Predictive Variable | Value | Std.Error | P.value | df | Deviance explained | |
| <i>Overall species richness</i> | Percentage canopy closure | -0.00421 | 0.001344 | 0.00174 ** | 123 | 0.031 | |
| | Distance to forest | 8.75E-05 | 5.70E-05 | 0.125 | 123 | 0.000 | |
| | Distance to rivers | -9.42E-07 | 4.26E-05 | 0.982 | 123 | 0.000 | |
| | Distance to plantation | -6.21E-06 | 6.90E-06 | 0.368 | 123 | 0.002 | |
| | Distance to small-holder farm | -5.42E-05 | 6.89E-05 | 0.431 | 123 | 0.002 | |
| | Distance to human settlement | 3.48E-05 | 4.01E-05 | 0.385 | 123 | 0.002 | |
| | Distance to road | 4.68E-05 | 4.00E-05 | 0.242 | 123 | 0.004 | |
| <i>Invertebrate eating species richness</i> | Percentage canopy closure | -0.00482 | 0.00241 | 0.0456 * | 123 | 0.019 | |
| | Distance to forest | 6.73E-05 | 1.02E-04 | 0.511 | 123 | 0.002 | |
| | Distance to rivers | -2.16E-05 | 7.61E-05 | 0.777 | 123 | 0.000 | |
| | Distance to plantation | -5.14E-07 | 1.22E-05 | 0.966 | 123 | 0.000 | |
| | Distance to small-holder farm | | | | | | |
| | | | -1.47E-04 | 1.29E-04 | 0.253 | 123 | 0.006 |
| | | Distance to human settlement | -3.61E-05 | 7.26E-05 | 0.619 | 123 | 0.001 |
| | Distance to road | 5.80E-05 | 7.07E-05 | 0.412 | 123 | 0.003 | |
| <i>Seed/plant eating species richness</i> | Percentage canopy closure | -0.00347 | 0.002277 | 0.128 | 123 | 0.008 | |
| | Distance to forest | 1.54E-04 | 9.45E-05 | 0.102 | 123 | 0.009 | |
| | Distance to rivers | 6.72E-05 | 7.14E-05 | 0.347 | 123 | 0.003 | |
| | Distance to plantation | -1.88E-05 | 1.20E-05 | 0.118 | 123 | 0.009 | |
| | Distance to small-holder farm | 7.16E-05 | 1.10E-04 | 0.516 | 123 | 0.001 | |
| | Distance to human settlement | 1.72E-04 | 6.65E-05 | 0.00987 ** | 123 | 0.022 | |
| | Distance to road | 4.00E-05 | 6.88E-05 | 0.561 | 123 | 0.001 | |
| <i>Fruit eating species richness</i> | Percentage canopy closure | -0.00232 | 0.003769 | 0.538919 | 123 | 0.003 | |
| | Distance to forest | -0.00023 | 0.0001933 | 0.243 | 123 | 0.013 | |
| | Distance to rivers | -0.00013 | 0.0001282 | 0.313696 | 123 | 0.009 | |
| | Distance to plantation | 1.54E-05 | 1.94E-05 | 0.4279 | 123 | 0.005 | |
| | Distance to small-holder farm | -0.00029 | 0.0002255 | 0.203 | 123 | 0.016 | |
| | Distance to human settlement | -0.00018 | 0.0001232 | 0.138 | 123 | 0.020 | |
| | Distance to road | 1.36E-05 | 1.17E-04 | 0.90772 | 123 | 0.000 | |
| <i>Vertebrate eating species richness</i> | Percentage canopy closure | -1.68E-02 | 9.05E-03 | 0.06367. | 123 | 0.031 | |
| | Distance to forest | 6.06E-04 | 2.42E-04 | 0.0122 * | 123 | 0.039 | |
| | Distance to rivers | -1.42E-05 | 2.33E-04 | 0.951 | 123 | 0.000 | |
| | Distance to plantation | -6.35E-05 | 4.11E-05 | 0.122734 | 123 | 0.019 | |
| | Distance to small-holder farm | 0.000225 | 0.0003229 | 0.487 | 123 | 0.003 | |
| | Distance to human settlement | 0.000205 | 0.0002095 | 0.328 | 123 | 0.007 | |
| | Distance to road | 5.75E-05 | 2.17E-04 | 0.791 | 123 | 0.001 | |

SUPPLEMENTARY TABLE 4: Regression coefficients for multi predictor Generalised Linear Models.
Regression coefficients for each predictive variable included in the multi-predictor models for Overall species richness, invertebrate feeding species richness and seed/plant eating species richness. The best fitting model that explained total species richness in the landscape included the variable; percentage canopy closure within a 150m buffer. The best fitting model that explained invertebrate feeding species richness in the landscape included the variable percentage canopy closure within a 150m buffer. The best fitting model that explained seed/plant feeding species richness in the landscape included the variable, distance from human settlement.

| Response variable | Predictive Variable | Regression Coefficients | | |
|---|--|-------------------------|-----------|---------|
| | | Value | Std.Error | P.value |
| <i>Overall species richness</i> | Percentage canopy closure | -3.72E-03 | 2.04E-03 | 0.068 |
| | Distance to forest | 3.03E-04 | 1.58E-04 | 0.0547 |
| | Distance to rivers | -3.10E-05 | 4.50E-05 | 0.4904 |
| | Distance to plantation | -7.02E-06 | 9.81E-06 | 0.4744 |
| | Distance to small-holder farm | -3.67E-04 | 3.64E-04 | 0.3128 |
| | Distance to human settlement | 6.16E-05 | 9.79E-05 | 0.5291 |
| | Distance to road | 6.39E-05 | 5.33E-05 | 0.2307 |
| | Distance to forest: Distance to human settlement | -2.64E-07 | 1.48E-07 | 0.0752 |
| | Distance to plantation: Distance to human settlement | 2.08E-09 | 1.96E-08 | 0.9155 |
| | Distance from small holder farms: Distance to human settlement | 2.71E-07 | 2.26E-07 | 0.2301 |
| <i>Invertebrate eating species richness</i> | Percentage canopy closure | -2.96E-03 | 3.62E-03 | 0.414 |
| | Distance to forest | 3.14E-04 | 2.71E-04 | 0.247 |
| | Distance to rivers | -7.19E-05 | 8.04E-05 | 0.371 |
| | Distance to plantation | -7.59E-06 | 1.72E-05 | 0.659 |
| | Distance to small-holder farm | -3.31E-04 | 6.47E-04 | 0.609 |
| | Distance to human settlement | -1.21E-04 | 1.79E-04 | 0.497 |
| | Distance to road | 1.41E-04 | 9.12E-05 | 0.123 |
| | Distance to forest: Distance to human settlement | -8.02E-08 | 2.67E-07 | 0.764 |
| | Distance to plantation: Distance to human settlement | 5.14E-09 | 3.56E-08 | 0.885 |
| | Distance from small holder farms: Distance to human settlement | 1.19E-07 | 4.02E-07 | 0.767 |
| <i>Seed/plant eating species richness</i> | Percentage canopy closure | -4.70E-03 | 3.52E-03 | 0.18086 |
| | Distance to forest | 4.53E-04 | 2.69E-04 | 0.09234 |

| | | | |
|--|-----------|----------|------------|
| Distance to rivers | 7.29E-05 | 7.64E-05 | 0.34001 |
| Distance to plantation | 7.92E-07 | 1.74E-05 | 0.96367 |
| Distance to small-holder farm | -2.00E-04 | 6.14E-04 | 0.74471 |
| Distance to human settlement | 4.83E-04 | 1.61E-04 | 0.00270 ** |
| Distance to road | -8.73E-05 | 9.66E-05 | 0.3661 |
| Distance to forest: Distance to human settlement | -6.26E-07 | 2.42E-07 | 0.00969 ** |
| Distance to plantation: Distance to human settlement | -2.00E-08 | 3.29E-08 | 0.543 |
| Distance from small holder farms: Distance to human settlement | 3.17E-07 | 3.77E-07 | 0.3994 |

SUPPLEMENTARY TABLE 6: *Detection efficiency of bird species across the study landscape.*

| Land use | Mean detection | Standard deviation of the mean | Maximum detection | Pairwise Wilcoxon |
|------------------|-----------------------|---------------------------------------|--------------------------|--|
| Cropland | 9.5 | 3.46 | 20 | No significant difference between land use types |
| Forest | 7 | 3.3 | 18 | No significant difference between land use types |
| Grassland | 8 | 2.48 | 14 | No significant difference between land use types |
| Human Settlement | 10 | 0 | 15 | No significant difference between land use types |

SUPPLEMENTARY TABLE 7: Comparison of species listed on the GBIF checklist against those observed during the sampling period. The downloaded GBIF species list for the study area showed a total of 576 bird species. Of these 576 species 131 were observed during the sampling period, while 17 were observed in the study area but were not listed on the GBIF species list.

| Species present on the GBIF list but not observed during this study | Species present on the GBIF list and observed during this study | Species observed during this study but not present on the GBIF list |
|--|--|--|
| <i>Accipiter badius</i> | <i>Acrocephalus baeticatus</i> | <i>Acrocephalus palustris</i> |
| <i>Accipiter melanoleucus</i> | <i>Acrocephalus gracilirostris</i> | <i>Corythornis cristatus</i> |
| <i>Accipiter minullus</i> | <i>Acrocephalus scirpaceus</i> | <i>Crithagra xanthopygia</i> |
| <i>Accipiter ovampensis</i> | <i>Agricola pallidus</i> | <i>Euplectes capensis</i> |
| <i>Accipiter tachiro</i> | <i>Amandava subflava</i> | <i>Euplectes macroura</i> |
| <i>Acrocephalus arundinaceus</i> | <i>Amblyospiza albifrons</i> | <i>Gallirex porphyreolophus</i> |
| <i>Acrocephalus schoenobaenus</i> | <i>Andropadus importunus</i> | <i>Hippolais icterina</i> |
| <i>Actitis hypoleucos</i> | <i>Anomalospiza imberbis</i> | <i>Ispidina picta</i> |
| <i>Actophilornis africanus</i> | <i>Anthreptes reichenowi</i> | <i>Muscicapa striata</i> |
| <i>Agapornis personatus</i> | <i>Anthus cinnamomeus</i> | <i>Phyllastrephus fischeri</i> |
| <i>Alcedo cristata</i> | <i>Apalis flavida</i> | <i>Phyllastrephus terrestris</i> |
| <i>Alcippe abyssinica</i> | <i>Apalis melanocephala</i> | <i>Pogonornis melanopterus</i> |
| <i>Alopochen aegyptiaca</i> | <i>Apaloderma narina</i> | <i>Pternistis afer</i> |
| <i>Amadina fasciata</i> | <i>Apaloderma vittatum</i> | <i>Sarothrura elegans</i> |
| <i>Anaplectes rubriceps</i> | <i>Ardea melanocephala</i> | <i>Scotopelia peli</i> |
| <i>Anas sparsa</i> | <i>Arizelocichla milanjensis</i> | <i>Spermestes cucullata</i> |
| <i>Anastomus lamelligerus</i> | <i>Bostrychia hagedash</i> | <i>Tychaedon quadrivirgata</i> |
| <i>Anthoscopus caroli</i> | <i>Bradypterus baboecala</i> | |
| <i>Anthreptes longuemarei</i> | <i>Buteo buteo</i> | |
| <i>Anthreptes neglectus</i> | <i>Bycanistes brevis</i> | |
| <i>Anthreptes rubritorques</i> | <i>Bycanistes bucinator</i> | |
| <i>Anthus caffer</i> | <i>Camaroptera brachyura</i> | |
| <i>Anthus nyassae</i> | <i>Campephaga flava</i> | |
| <i>Anthus similis</i> | <i>Campethera nubica</i> | |
| <i>Apalis alticola</i> | <i>Cecropis abyssinica</i> | |
| <i>Apalis binotata</i> | <i>Centropus superciliosus</i> | |
| <i>Apalis chapini</i> | <i>Ceuthmochares australis</i> | |
| <i>Apalis chariessa</i> | <i>Chalcomitra senegalensis</i> | |
| <i>Apalis cinerea</i> | <i>Chlorocichla flaviventris</i> | |
| <i>Apalis thoracica</i> | <i>Chrysococcyx caprius</i> | |
| <i>Apus affinis</i> | <i>Chrysococcyx klaas</i> | |
| <i>Apus apus</i> | <i>Cichladusa arquata</i> | |
| <i>Apus barbatus</i> | <i>Cinnyricinclus leucogaster</i> | |
| <i>Apus caffer</i> | <i>Cinnyris bifasciatus</i> | |
| <i>Aquila nipalensis</i> | <i>Cisticola brachypterus</i> | |
| <i>Aquila pomarina</i> | <i>Cisticola chiniana</i> | |
| <i>Aquila rapax</i> | <i>Cisticola erythrops</i> | |
| <i>Aquila spilogaster</i> | <i>Cisticola marginatus (galactotes)</i> | |
| <i>Arcanator orostruthus</i> | <i>Cisticola natalensis</i> | |

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| <i>Ardea alba</i> | <i>Colius striatus</i> |
| <i>Ardea cinerea</i> | <i>Columba livia</i> |
| <i>Ardea goliath</i> | <i>Coracias caudatus</i> |
| <i>Ardea purpurea</i> | <i>Coracias garrulus</i> |
| <i>Ardeola idae</i> | <i>Corvus albus</i> |
| <i>Ardeola ralloides</i> | <i>Corvus splendens</i> |
| <i>Ardeola rufiventris</i> | <i>Cossypha heuglini</i> |
| <i>Arizelocichla chlorigula</i> | <i>Cossypha natalensis</i> |
| <i>Arizelocichla masukuensis</i> | <i>Crithagra mozambica</i> |
| <i>Arizelocichla neumanni</i> | <i>Cuculus clamosus</i> |
| <i>Arizelocichla nigriceps</i> | <i>Cuculus solitarius</i> |
| <i>Artisornis metopias</i> | <i>Cyanomitra olivacea</i> |
| <i>Asio capensis</i> | <i>Cypsiurus parvus</i> |
| <i>Atimastillas flavicollis</i> | <i>Dendropicos fuscescens</i> |
| <i>Aviceda cuculoides</i> | <i>Dicrurus adsimilis</i> |
| <i>Batis crypta</i> | <i>Dicrurus ludwigii</i> |
| <i>Batis minor</i> | <i>Dryoscopus cubla</i> |
| <i>Batis mixta</i> | <i>Elanus axillaris (caeruleus)</i> |
| <i>Batis molitor</i> | <i>Estrilda astrild</i> |
| <i>Batis soror</i> | <i>Euplectes albonotatus</i> |
| <i>Bias musicus</i> | <i>Euplectes axillaris</i> |
| <i>Bocagia minuta</i> | <i>Euplectes nigroventris</i> |
| <i>Bradornis fuliginosus</i> | <i>Euplectes orix</i> |
| <i>Bradornis microrhynchus</i> | <i>Eurystomus glaucurus</i> |
| <i>Bradypterus barratti</i> | <i>Falco biarmicus</i> |
| <i>Bradypterus cinnamomeus</i> | <i>Gypohierax angolensis</i> |
| <i>Bradypterus lopezi</i> | <i>Halcyon albiventris</i> |
| <i>Bubalornis niger</i> | <i>Halcyon chelicuti</i> |
| <i>Bubo africanus</i> | <i>Hedydipna collaris</i> |
| <i>Bubo lacteus</i> | <i>Hirundo rustica</i> |
| <i>Bubulcus ibis</i> | <i>Hirundo smithii</i> |
| <i>Bucorvus abyssinicus</i> | <i>Indicator indicator</i> |
| <i>Bucorvus leadbeateri</i> | <i>Kaupifalco monogrammicus</i> |
| <i>Bugeranus carunculatus</i> | <i>Lagonosticta rubricata</i> |
| <i>Buphagus africanus</i> | <i>Lagonosticta senegala</i> |
| <i>Buphagus erythrorhynchus</i> | <i>Laniarius aethiopicus</i> |
| <i>Burhinus capensis</i> | <i>Lophaetus occipitalis</i> |
| <i>Burhinus vermiculatus</i> | <i>Lophoceros alboterminatus</i> |
| <i>Buteo oreophilus</i> | <i>Lybius torquatus</i> |
| <i>Butorides striata</i> | <i>Macronyx croceus</i> |
| <i>Calamonastes undosus</i> | <i>Malaconotus blanchoti</i> |
| <i>Calidris ferruginea</i> | <i>Melocichla mentalis</i> |
| <i>Calidris minuta</i> | <i>Merops albicollis</i> |
| <i>Campephaga phoenicea</i> | <i>Merops apiaster</i> |
| <i>Campethera abingoni</i> | <i>Merops bullockoides</i> |
| <i>Campethera bennettii</i> | <i>Merops persicus</i> |

| | |
|--------------------------------------|------------------------------------|
| <i>Campethera cailliautii</i> | <i>Merops pusillus</i> |
| <i>Caprimulgus clarus</i> | <i>Milvus migrans</i> |
| <i>Caprimulgus europaeus</i> | <i>Motacilla aguimp</i> |
| <i>Caprimulgus fossii</i> | <i>Muscicapa adusta</i> |
| <i>Caprimulgus natalensis</i> | <i>Nicator gularis</i> |
| <i>Caprimulgus pectoralis</i> | <i>Numida meleagris</i> |
| <i>Caprimulgus ruwenzorii</i> | <i>Oriolus larvatus</i> |
| <i>Cecropis daurica</i> | <i>Passer domesticus</i> |
| <i>Cecropis senegalensis</i> | <i>Passer griseus</i> |
| <i>Centropus cupreicaudus</i> | <i>Phoeniculus purpureus</i> |
| <i>Centropus grillii</i> | <i>Platysteira peltata</i> |
| <i>Cercococcyx montanus</i> | <i>Ploceus burnieri</i> |
| <i>Ceryle rudis</i> | <i>Ploceus intermedius</i> |
| <i>Ceuthmochares aereus</i> | <i>Ploceus melanocephalus</i> |
| <i>Ceyx pictus</i> | <i>Ploceus ocularis</i> |
| <i>Chalcomitra amethystina</i> | <i>Pogoniulus bilineatus</i> |
| <i>Charadrius asiaticus</i> | <i>Pogoniulus pusillus</i> |
| <i>Charadrius marginatus</i> | <i>Poicephalus cryptoxanthus</i> |
| <i>Charadrius pecuarius</i> | <i>Polemaetus bellicosus</i> |
| <i>Charadrius tricollaris</i> | <i>Prinia subflava</i> |
| <i>Chlorophoneus nigrifrons</i> | <i>Prionops plumatus</i> |
| <i>Chlorophoneus sulfureopectus</i> | <i>Psalidoprocne pristopectera</i> |
| <i>Chroicocephalus cirrocephalus</i> | <i>Pycnonotus barbatus</i> |
| <i>Chrysococcyx cupreus</i> | <i>Quelea erythroptus</i> |
| <i>Cichladusa guttata</i> | <i>Quelea quelea</i> |
| <i>Ciconia abdimii</i> | <i>Rhinopomastus cyanomelas</i> |
| <i>Ciconia ciconia</i> | <i>Schoenicola brevirostris</i> |
| <i>Ciconia episcopus</i> | <i>Scopus umbretta</i> |
| <i>Cinnyris erythrocerus</i> | <i>Smithornis capensis</i> |
| <i>Cinnyris loveridgei</i> | <i>Spermestes bicolor</i> |
| <i>Cinnyris ludovicensis</i> | <i>Spermestes fringilloides</i> |
| <i>Cinnyris mariquensis</i> | <i>Streptopelia capicola</i> |
| <i>Cinnyris moreaui</i> | <i>Streptopelia semitorquata</i> |
| <i>Cinnyris pulchellus</i> | <i>Tchagra senegalus</i> |
| <i>Cinnyris rufipennis</i> | <i>Tockus erythrorhynchus</i> |
| <i>Cinnyris shelleyi</i> | <i>Treron calvus</i> |
| <i>Cinnyris venustus</i> | <i>Trochocercus cyanomelas</i> |
| <i>Circaetus cinereus</i> | <i>Turdoides jardineii</i> |
| <i>Circaetus fasciolatus</i> | <i>Turtur afer</i> |
| <i>Circaetus pectoralis</i> | <i>Turtur chalcospilos</i> |
| <i>Circus aeruginosus</i> | <i>Turtur tympanistria</i> |
| <i>Circus macrourus</i> | <i>Uraeginthus angolensis</i> |
| <i>Circus pygargus</i> | <i>Vidua chalybeata</i> |
| <i>Circus ranivorus</i> | <i>Vidua funerea</i> |
| <i>Cisticola aridulus</i> | <i>Vidua macroura</i> |
| <i>Cisticola cantans</i> | <i>Zosterops senegalensis</i> |

Cisticola chubbi
Cisticola fulvicapilla
Cisticola juncidis
Cisticola nana
Cisticola nigriloris
Cisticola njombe
Cisticola robustus
Clamator jacobinus
Clamator levaillantii
Coccopygia melanotis
Coccopygia quartinia
Columba arquatrix
Columba delegorguei
Columba guinea
Columba larvata
Coracias naevius
Coracias spatulatus
Coracina caesia
Coracina pectoralis
Corvus albicollis
Cossypha anomala
Cossypha caffra
Coturnix delegorguei
Creatophora cinerea
Crithagra hyposticta
Crithagra melanochroa
Crithagra mennelli
Crithagra reichardi
Crithagra reichenowi
Crithagra sulphurata
Crithagra whytii
Cryptospiza reichenovii
Cuculus gularis
Cursorius temminckii
Cyanomitra verticalis
Delichon urbicum
Dendrocygna viduata
Dendroperdix sephaena
Dioptornis chocolatinus
Egretta ardesiaca
Egretta garzetta
Egretta intermedia
Elminia albonotata
Emberiza cabanisi
Emberiza flaviventris
Ephippiorhynchus senegalensis

Eremomela icteropygialis
Eremomela scotops
Eremopterix leucopareia
Erythrocercus livingstonei
Erythropygia leucophrys
Erythropygia quadrivirgata
Estrilda erythronotos
Estrilda paludicola
Estrilda perreini
Estrilda rhodopyga
Euplectes ardens
Euplectes hartlaubi
Euplectes hordeaceus
Euplectes psammacromius
Eurillas virens
Eurocephalus ruppelli
Falco ardosiaceus
Falco chicquera
Falco cuvierii
Falco dickinsoni
Falco naumanni
Falco peregrinus
Falco subbuteo
Falco tinnunculus
Francolinus afer
Francolinus coqui
Francolinus hildebrandti
Francolinus squamatus
Fraseria caerulescens
Fraseria plumbea
Gallinula chloropus
Geokichla gurneyi
Glareola pratincola
Glaucidium capense
Glaucidium perlatum
Guttera pucherani
Gymnoris superciliaris
Gyps africanus
Gyps rueppellii
Halcyon leucocephala
Halcyon senegalensis
Haliaeetus vocifer
Hieraaetus pennatus
Hieraaetus wahlbergi
Himantopus himantopus
Hippolais languida

Hirundo angolensis
Hirundo ruficauda
Hyliota flavigaster
Hypargos niveoguttatus
Iduna natalensis
Iduna pallida
Iduna similis
Illadopsis rufipennis
Indicator minor
Indicator variegatus
Ixobrychus minutus
Jynx ruficollis
Lagonosticta nitidula
Lagonosticta rhodopareia
Lamprotornis chalybaeus
Lamprotornis chloropterus
Lamprotornis hildebrandti
Lamprotornis superbus
Lamprotornis unicolor
Laniarius ferrugineus
Laniarius fuelleborni
Laniarius major
Laniarius sublacteus
Lanius cabanisi
Lanius collaris
Lanius collurio
Lanius humeralis
Lanius isabellinus
Lanius minor
Lanius phoenicuroides
Leptoptilos crumenifer
Linurgus olivaceus
Lissotis melanogaster
Lonchura cucullata
Lonchura nigriceps
Lophoceros nasutus
Lophoceros pallidirostris
Lophotis gindiana
Luscinia megarhynchos
Lybius melanopterus
Macheiramphus alcinus
Macronyx fuelleborni
Macrosphenus kretschmeri
Megaceryle maxima
Melaenornis fischeri
Melaenornis pammelaina

Melaniparus griseiventris
Melaniparus rufiventris
Melierax metabates
Melierax poliopterus
Melittophagus pusillus
Merops boehmi
Merops nubicus
Merops oreobates
Microcarbo africanus
Micronisus gabar
Milvus aegyptius
Mirafra rufocinnamomea
Modulatrix stictigula
Monticola angolensis
Motacilla capensis
Motacilla clara
Motacilla flava
Mycteria ibis
Myrmecocichla aethiops
Neafrapus boehmi
Necrosyrtes monachus
Nectarinia famosa
Nectarinia kilimensis
Neotis denhami
Nilaus afer
Notopholia corrusca
Nycticorax nycticorax
Oena capensis
Oenanthe isabellina
Oenanthe oenanthe
Oenanthe pileata
Onychognathus morio
Onychognathus tenuirostris
Onychognathus walleri
Oriolus auratus
Oriolus chlorocephalus
Otus senegalensis
Pachycoccyx audeberti
Parus rufiventris
Passer diffusus
Passer eminibey
Passer suahelicus
Pelecanus onocrotalus
Pelecanus rufescens
Pentholaea arnotti
Pernis apivorus

Phalacrocorax carbo
Philomachus pugnax
Phyllastrephus cabanisi
Phyllastrephus cerviniventris
Phyllastrephus flavostriatus
Phyllastrephus placidus
Phyllastrephus strepitans
Phylloscopus ruficapilla
Phylloscopus trochilus
Platalea alba
Plectropterus gambensis
Plegadis falcinellus
Plocepasser mahali
Ploceus baglafecht
Ploceus bertrandi
Ploceus bicolor
Ploceus capensis
Ploceus cucullatus
Ploceus jacksoni
Ploceus nicolli
Ploceus nigricollis
Ploceus reichardi
Ploceus subaureus
Ploceus velatus
Ploceus xanthops
Ploceus xanthopterus
Poeyoptera kenricki
Pogoniulus chrysoconus
Pogoniulus leucomystax
Pogoniulus simplex
Pogonocichla stellata
Poicephalus meyeri
Poicephalus robustus
Polihierax semitorquatus
Poliocephalus ruficollis
Polyboroides typus
Porphyrio alleni
Porphyrio porphyrio
Prinia erythroptera
Prionops retzii
Prionops scopifrons
Prodotiscus zambesiae
Psalidoprocne holomelaena
Pseudaethe fuelleborni
Pseudhirundo griseopyga
Psophocichla litsitsirupa

Ptilopsis granti
Ptyonoprogne fuligula
Pycnonotus tricolor
Pyrenestes minor
Pytilia afra
Pytilia melba
Quelea cardinalis
Rhinopomastus minor
Rhinoptilus chalcopterus
Riparia paludicola
Riparia riparia
Rostratula benghalensis
Rynchops flavirostris
Sarkidiornis melanotos
Saxicola torquatus
Scepomycter rubehoensis
Scepomycter winifredae
Schoutedenapus myoptilus
Setophaga striata
Sheppardia aurantiithorax
Sheppardia lowei
Sheppardia sharpei
Sporaeginthus subflavus
Stactolaema leucotis
Stactolaema olivacea
Stephanoaetus coronatus
Sterna nilotica
Streptopelia decipiens
Streptopelia senegalensis
Strix woodfordii
Swynnertonia swynnertoni
Sylvia abyssinica
Sylvia borin
Sylvia lugens
Sylvia nisoria
Sylvietta rufescens
Sylvietta whytii
Tachymarptis aequatorialis
Tauraco livingstonii
Tauraco persa
Tauraco porphyreolophus
Tchagra australis
Telacanthura ussheri
Telophorus cruentus
Terathopius ecaudatus
Terpsiphone viridis

Threskiornis aethiopicus
Tmetothylacus tenellus
Tockus alboterminatus
Tockus deckeni
Tockus flavirostris
Tockus ruahae
Torgos tracheliotos
Trachyphonus vaillantii
Tricholaema lacrymosa
Trigonoceps occipitalis
Tringa glareola
Tringa nebularia
Tringa ochropus
Tringa stagnatilis
Turdoides hypoleuca
Turdoides sharpei
Turdus abyssinicus
Turdus libonyana
Tyto alba
Upupa epops
Uraeginthus bengalus
Uraeginthus cyanocephalus
Urocolius macrourus
Vanellus albiceps
Vanellus armatus
Vanellus coronatus
Vanellus crassirostris
Vanellus lugubris
Vanellus senegallus
Vanellus spinosus
Vidua hypocherina
Vidua obtusa
Vidua paradisaea
Vidua purpurascens
Xenoperdix udzungwensis
Zapornia flavirostra
Zosterops anderssoni
Zosterops poliogastrus

SUPPLEMENTARY MATERIAL

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# Cropland can support high bird diversity in rural tropical landscapes
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# ###(1) read in relevant packages/functions -----  
-----
```

```
necessary.packages<-c("devtools","XML","httr","rvest","MASS","pixmap",  
                     "ggplot2","MuMIn","VennDiagram",  
                     "tseries","raster","graphics",  
                     "rtiff","jpeg","gamlss",  
                     "Kendall","R.utils","plyr","reshape","stringr",  
                     "rgdal","sp","leaflet","maptools",  
                     "rredlist","taxize","gplots",  
                     "FD","RColorBrewer", "tidyr", "ggplot2","dplyr")
```

```
already.installed<-necessary.packages%in%installed.packages()[,  
'Package'] #asks if the necessary packages are already installed in  
the library?
```

```
if (length(necessary.packages[!already.installed])>=1) { #if any are  
NOT installed, download them now.
```

```
  install.packages(necessary.packages[!already.installed],dep=T) #are  
the dependencies really necessary (there are lots!)?
```

```
}
```

```
sapply(necessary.packages,function(p)  
{require(p,quietly=T,character.only=T)})
```

```
library(pixmap)
```

```
library(png)
```

```
stderr <- function(x, na.rm=FALSE) {  
  if(is.matrix(x))  
    apply(x,2,stderr,na.rm=rm)  
  else if(is.vector(x))  
    sqrt(var(x,na.rm=na.rm)/length1(x))
```

```

else if(is.data.frame(x))
  sapply(x,stderr,na.rm=na.rm)
else sqrt(var(as.vector(x),na.rm=na.rm)/length1(x))
}

remove_outliers <- function(x, na.rm = TRUE, ...) {
  qnt <- quantile(x, probs=c(.25, .75), na.rm = na.rm, ...)
  H <- 1.5 * IQR(x, na.rm = na.rm)
  y <- x
  y[x < (qnt[1] - H)] <- NA
  y[x > (qnt[2] + H)] <- NA
  y
}

perbar=function(xx){
  q=ggplot(data=data.frame(xx),aes(x=xx))+
    geom_bar(aes(y = (..count..)),width=.5,fill="orange")
  q=q+ geom_text(aes(label =
scales::percent((..count..)/sum(..count..))),
stat="bin",colour="darkgreen",vjust=0.35) +xlab("Species Response")
  q=q+ theme(axis.text=element_text(size=12,angle=45),
axis.title=element_text(size=12,face="bold"))
  q=q+theme(axis.title.x=element_text(vjust=-
0.35),axis.title.y=element_text(vjust=+0.35))
  q=q+ylab("Count")
  q
}

readinteger <- function()
{
  n <- readline(prompt="Enter an integer: ")
  return(as.integer(n))
}

length1 <- function (x) {

```

```

length(!is.na(x)[!is.na(x)=="TRUE"])
}

Dsquared <- function(model = NULL,
                     obs = NULL,
                     pred = NULL,
                     family = NULL, # needed only when 'model' not
provided
                     adjust = FALSE,
                     npar = NULL) { # needed only when 'model' not
provided
  # version 1.4 (31 Aug 2015)

  model.provided <- ifelse(is.null(model), FALSE, TRUE)

  if (model.provided) {
    if (!(("glm" %in% class(model))) stop ("'model' must be of class
'glm'.")
    if (!is.null(pred)) message("Argument 'pred' ignored in favour of
'model'.")
    if (!is.null(obs)) message("Argument 'obs' ignored in favour of
'model'.")
    obs <- model$y
    pred <- model$fitted.values

  } else { # if model not provided
    if (is.null(obs) | is.null(pred)) stop ("You must provide either
'obs' and 'pred', or a 'model' object of class 'glm'.")
    if (length(obs) != length(pred)) stop ("'obs' and 'pred' must be of
the same length (and in the same order).")
    if (is.null(family)) stop ("With 'obs' and 'pred' arguments (rather
than a model object), you must also specify one of two model family
options: 'binomial' or 'poisson' (in quotes).")
    else if (!is.character(family)) stop ("Argument 'family' must be
provided as character (i.e. in quotes: 'binomial' or 'poisson').")
    else if (length(family) != 1 | !(family %in% c("binomial",
"poisson"))) stop ("'family' must be either 'binomial' or 'poisson' (in
quotes).")

```

```

    if (family == "binomial") {
      if (any(!(obs %in% c(0, 1)) | pred < 0 | pred > 1)) stop
      ("'binomial' family implies that 'obs' data should be binary (with values
      0 or 1) and 'pred' data should be bounded between 0 and 1.")
      link <- log(pred / (1 - pred)) # logit
    } # end if binomial

    else if (family == "poisson") {
      if (any(obs %%1 != 0)) stop ("'poisson' family implies that 'obs'
      data should consist of whole numbers.")
      link <- log(pred)
    } # end if poisson

    model <- glm(obs ~ link, family = family)
  } #end if model not provided

D2 <- (model$null.deviance - model$deviance) / model$null.deviance

if (adjust) {
  if (model.provided) {
    n <- length(model$y)
    #p <- length(model$coefficients)
    p <- attributes(logLik(model))$df
  } else {
    if (is.null(npar)) stop ("Adjusted D-squared from 'obs' and 'pred'
    values (rather than a model object) requires specifying the number of
    parameters in the underlying model ('npar').")
    n <- length(na.omit(obs))
    p <- npar
  } # end if model.provided else

  D2 <- 1 - ((n - 1) / (n - p)) * (1 - D2)
} # end if adjust

return (D2)
}

```

####