

## Description of Additional Supplementary Information

Title: Supplementary Data 1.

Description: PCA loadings: Functional traits. Principal Component Analysis (PCA) loadings for 25 functional traits describing life history pace, body size, reproductive strategy, and vertical foraging niche across Peruvian forest birds. Loadings, squared cosine ( $\cos^2$ ), and contributions are reported for the first four axes.

Title: Supplementary Data 2.

Description: PCA loadings for life history traits. Shown are loadings,  $\cos^2$ , and variable contributions for the first four axes.

Title: Supplementary Data 3.

Description: PCA loadings for species-level vulnerability and exposure to major anthropogenic threats, including IUCN category, population trend, and nine threat classes. Shown are loadings,  $\cos^2$ , and variable contributions for the first four axes.

Title: Supplementary Data 4.

Description: PCA loadings for dummy-coded taxonomic identity (order and family) of forest-dependent Peruvian birds. Loadings,  $\cos^2$ , and contributions highlight major phylogenetic gradients in community structure.

Title: Supplementary Data 5.

Description: Stage 1 model selection: Functional traits (environmental predictors only,  $\Delta AICc < 2$ ). All candidate models within  $\Delta AICc < 2$  of the best environmental baseline model are shown. Highlighted row (blue) = top-ranked baseline model carried forward to Stage 2.

Title: Supplementary Data 6.

Description: Stage 2 model selection: Functional traits (FFG terms added to fixed environmental predictors from Stage 1 baseline model,  $\Delta AICc < 2$ ). Blue row = baseline

model (Stage1 best) shown for direct AICc comparison; green row = top-ranked FFG model. Environmental predictor coefficients are identical across rows as they are fixed.

Title: Supplementary Data 7.

Description: Stage 1 model selection: Life history/ecology traits (environmental predictors only,  $\Delta AICc < 2$ ). Highlighted row (blue) = top-ranked baseline model carried forward to Stage 2.

Title: Supplementary Data 8.

Description: Stage 2 model selection: Life history/ecology traits (FFG terms added to fixed environmental predictors from Stage 1,  $\Delta AICc < 2$ ). Blue row = baseline model reference; green row = top FFG model.

Title: Supplementary Data 9.

Description: Stage 1 model selection: Vulnerability/threat traits (environmental predictors only,  $\Delta AICc < 2$ ). Highlighted row (blue) = top-ranked baseline model carried forward to Stage 2.

Title: Supplementary Data 10.

Description: Stage 2 model selection: Vulnerability/threat traits (FFG terms added to fixed environmental predictors from Stage 1,  $\Delta AICc < 2$ ). Blue row = baseline model reference; green row = top FFG model.

Title: Supplementary Data 11.

Description: Stage 1 model selection: Taxonomy (environmental predictors only,  $\Delta AICc < 2$ ). Highlighted row (blue) = top-ranked baseline model carried forward to Stage 2.

Title: Supplementary Data 12.

Description: Stage 2 model selection: Taxonomy (FFG terms added to fixed environmental predictors from Stage 1,  $\Delta AICc < 2$ ). Blue row = baseline model reference; green row = top FFG model.

Title: Supplementary Data 13.

Description: Summaries of top-ranked Stage 2 models (see Supplementary Data 6, 8, 10, 12 for model selection tables). Shown are coefficient estimates, standard errors, 95% confidence intervals, and P-values for all predictors in the top-ranked model for each response variable. Bold rows indicate statistically significant predictors ( $P < 0.05$ ).

Title: Supplementary Data 14.

Description: Variance partitioning of  $R^2$  from two-stage model selection across 16 response variables representing four trait dimensions (functional morphology, vulnerability, life history, and taxonomy).  $R^2$  (env baseline) = marginal  $R^2$  of the best environmental-only model (Stage 1).  $R^2$  (with FFG) = marginal  $R^2$  of the top-ranked Stage 2 model. % improvement over baseline =  $(R^2 \text{ with FFG} - R^2 \text{ env baseline}) / R^2 \text{ env baseline} \times 100$ .