

Detailed Statistical Analysis

All statistical analyses and data visualisations were conducted in R version 4.2.2. To assess differences in overall and diel activity between management phases, we compared overall and diel Relative Abundance Indices (RAIs) using Multi-Response Permutation Procedures (MRPP) via the *vegan* package (Oksanen et al., 2025). Spatial distributions of station-level RAI in each management phase were mapped using the *ggplot2* (Wickham, 2016) and *sf* packages (Pebesma, 2018). These maps provided descriptive landscape context and were not used to formally test spatial shifts between phases. Inference concerning predictors of banteng habitat use was based primarily on the GLMM analysis.

For the Generalised Linear Mixed Models (GLMMs), variance inflation factors (VIFs) were calculated for main effects prior to model fitting to assess potential collinearity among predictor variables. This was performed using the *performance* package (Lüdtke et al., 2021). All VIF values were strictly below 5, indicating low correlation among predictors. Given the nature of camera-trap data, which often contains a high proportion of zeros, the GLMMs were fitted with a Tweedie distribution and a log link function using the *glmmTMB* package (Brooks et al., 2017) to properly account for zero inflation and overdispersion.

For models of banteng habitat use, the full model included percentage canopy cover (*canopy_rf*), tree basal area (*BA_rf*), tree density (*tree_rf*), slope (*slope*), distance to the nearest water source (*water_DIS*), Euclidean distance to the nearest village (*village_DIS*) and distance to patrol roads (*patrol_DIS*). Anthropogenic disturbance variables included *RAI_villager*, *RAI_ranger* and *RAI_researcher*. Survey month (*month_char*) was included to account for seasonality, and camera-trap station (*Station*) was treated as a random effect to account for repeated measures. Two-way and three-way interaction effects among anthropogenic pressures were evaluated because NTFP collection, research activities and ranger patrols may overlap spatially and temporally, such that the association between one activity and banteng habitat use could depend on the presence of other activities.

For models predicting banteng habitat use and NTFP collector activity, fixed effects included the covariates described above, including distance to patrol roads and seasonal variables. Incidence rate ratios (IRRs) were derived from model coefficients to quantify effect sizes. Model diagnostics, including tests for spatial and temporal autocorrelation in the residuals, were performed using the DHARMA package (Hartig, 2022). For banteng habitat-use models, backward elimination began with full models containing main effects and two-way and three-way interactions among anthropogenic activities. At each step, a reduced model obtained by removing one term was compared with the current model using a likelihood ratio test implemented through the anova function in R. Comparisons were made between nested models fitted to the same dataset with the same random-effects structure. Terms were removed when their exclusion did not significantly reduce model fit ($p \geq 0.10$), and the reduced model was used for the next comparison. Lower-order terms were allowed to be removed while associated higher-order interactions remained in the model. AIC values were reported using the bbmle package (Bolker, 2023) to compare models representing the main research questions, alongside the null and final selected models. Term removal was determined by likelihood ratio tests rather than AIC differences.

Table S1. Descriptions and characteristics of all predictor variables used in the Generalised Linear Mixed Models (GLMMs) for banteng habitat use and villager intrusion.

Variables	Code	Unit	Level of Measurement	Source
<u>Environmental factors</u>				
Percentage of canopy cover	canopy_rf	Percentage	Ratio	Pongpattananurak <i>et al.</i> , (2020)
Tree basal area	BA_rf	m ² /ha	Ratio	Pongpattananurak <i>et al.</i> , (2020)
Tree density	tree_rf	tree/ha	Ratio	Pongpattananurak <i>et al.</i> , (2020)
Slope	slope	degrees	Ratio	Pongpattananurak <i>et al.</i> , (2020)
Distance to the nearest water source	DIS_water	meter	Ratio	Pongpattananurak <i>et al.</i> , (2020)
<u>Spatial Accessibility factors</u>				
Distance to the nearest village	village_DIS	meter	Ratio	Pongpattananurak <i>et al.</i> , (2020)
Distance to patrol roads	patrol_DIS	meter	Ratio	Pongpattananurak <i>et al.</i> , (2020)
<u>Seasonal factor</u>				
Time periods	month_char	time	Nominal	This study
<u>Anthropogenic Disturbance</u>				
RAI of non-timber forest product (NTFP) collectors	RAI_villager	Detections/100 trap nights	Ratio	This study
RAI of research team personnel	RAI_researcher	Detections/100 trap nights	Ratio	This study
RAI of ranger patrols	RAI_ranger	Detections/100 trap nights	Ratio	This study

References

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