Quarter Update (4th Quarter, 2024)

The Shannon's and Simpson's diversity indices were used to reflect the species diversity richness and distribution evenness, respectively, of native terrestrial mammals utilizing human pathways and adjacent areas across five study sites in Western Sabah. These indices were estimated based on the number of independent sighting of each native species observed within the sampling area of each site. Differences in species diversity richness and distribution evenness between particular pairs of study sites were subsequently examined using the diversity t-test. The overall camera trapping surveys yielded high values for Shannon's (H' = 2.828) and Simpson's (1-D = 0.9254) diversity indices, indicating a diverse range of native species utilizing these sampling areas (1.5 < H' < 3.5) with a relatively even distribution (1-D > 0.5). However, the indices differed among the five study sites, with significant variations noted between specific site pairs. Among these study sites, the Inobong Substation within the Crocker Range Biosphere Reserve (CRBR) recorded the highest H' (2.465) and 1-D (0.8783) values, followed by the Tenghilan Community Forest (TCF: H' = 2.264; 1-D = 0.8664), Kinaurt Eco Forest Park (KEFP: H' = 1.821; 1-D = 0.8042), Kawang Forest Reserve (KFR: H' = 1.816; 1-D = 0.7181), and the urban forest of Universiti Malaysia Sabah (UMS: H' = 1.3662; 1-D = 0.6036) (See **Picture 1).** These findings highlight that native species using the sampling area in CRBR showed the highest diversity richness and even distribution, which closely mirrored the overall survey results, followed by TCF, KEFP, KFR, and UMS. Moreover, only the native species at UMS exhibited low diversity richness (H' < 1.5).



Picture 1. The Shannon's and Simpson's diversity indices, which reflect species diversity richness and distribution evenness, respectively, for the five study sites and Western Sabah as a whole (Overall)

The diversity t-test validated significant variations in species diversity richness and distribution evenness among pairs of the five study sites (p < 0.05), except for the comparisons between TCF and CRBR or KEFP (p > 0.05), plus between KFR and UMS or KEFP (p > 0.05) (See Table 1). CRBR, which documented the highest H' and 1-D values, exhibited significant differences in species distribution evenness and diversity richness compared to UMS (H': t = 5.922, p < 0.001; 1-D: t = -3.426, p = 0.001), KEFP (H': t = 7.521, p < 0.001; 1-D: t = -3.798, p < 0.001), and KFR (H': t = 3.714, p < 0.001; 1-D: t = -2.885, p = -2.885= 0.005). Nonetheless, no significant variability was observed between CRBR and TCF (H': t = 1.424, p = 0.160; 1-D: t = -0.410, p = 0.683), likely due to the similar H' and 1-D values at TCF. Furthermore, the low H' and 1-D values at UMS and KFR also resulted in no significant variability between these two sites (H': t = 1.855, p = 0.067; 1-D: t = -1.187, p = 0.239). In contrast, TCF showed significantly higher than KFR (H': t = -2.128, p = 0.036; 1-D: t = 2.433, p = 0.017) and UMS (H': t = 4.089, p < 0.001; 1-D: t = -3.128, p = 0.003). The H' and 1-D values at KEFP were intermediate, positioned between the high values found at CRBR and TCF and the lower values at UMS and KFR. Subsequently, species distribution evenness and diversity richness at KEFP were significantly higher compared to UMS (H': t = -2.407, p = 0.019; 1-D: t = -2.469, p = 0.017), but not significantly different from those of KFR (H': t = 0.028, p = 0.978; 1-D: t = -1.509, p = 0.136). Additionally, the 1-D value of KEFP did not differ significantly from TCF (t = 1.955, p = 0.054), but its H' value did (t = -3.047, p = 0.036). This indicates that significant variation between KEFP and TCF was observed in diversity richness (H'), but not in distribution evenness (1-D).

Study	Shannon's Diversity Index (H')				Simpson's Diversity Index (1-D)			
Site	CRBR	UMS	KFR	KEFP	CRBR	UMS	KFR	KEFP
UMS	5.922 (<0.001)	-	-	-	-3.426 (0.001)	-	-	-
KFR	3.714 (<0.001)	1.855 (0.067)	-	-	-2.885 (0.005)	-1.187 (0.239)	-	-
KEFP	7.521 (<0.001)	2.407 (0.019)	0.028 (0.978)	-	-3.798 (<0.001)	-2.469 (0.017)	-1.509 (0.136)	-
TCF	1.424 (0.160)	4.089 (<0.001)	-2.128 (0.036)	-3.047 (0.036)	-0.410 (0.683)	-3.128 (0.003)	2.433 (0.017)	1.955 (0.054)

Table 1. Results of the diversity t-test examining the significance of variations in species

 diversity richness and distribution evenness among the five study sites

Note: CRBR = Crocker Range Biosphere Reserve; TCF = Tenghilan Community Forest; KEFP = Kinarut Eco Forest Park; KFR = Kawang Forest Reserve; and, UMS = Universiti Malaysia Sabah The values above the brackets indicate the t-statistic values from the diversity t-test, while the values inside the brackets represent the p-value (significant level: p = 0.05; 2-tailed)