

Short Communication

First Attempt to Survey Montane Bird Species Using Camera Traps in Cameron Highlands, Peninsular Malaysia

Marina Mohd. Top @ Mohd. Tah^{1,2*}, Nur Syakirah Baharudin¹,
Aqilah Amni Azizan¹ and Chong Leong Puan^{3,4}

¹Department of Biology, Faculty of Science, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

²Center for Foundation Studies in Science of Universiti Putra Malaysia, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

³Faculty of Forest and Environment, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

⁴Institute of Tropical Forestry and Forest Products (INTROP), Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

ABSTRACT

The use of camera traps to record tropical forest bird diversity is uncommon. In 2020, over 200 active camera trap days, ten camera traps were deployed at three selected forest reserves, namely Terla A, Bertam and Bukit Bujang Forest Reserves in Cameron Highlands, Peninsular Malaysia, to assess the potential of recording montane bird species at lower strata using camera traps. *Enicurus schistaceus*, *Arborophila campbelli* and *Rhipidura albicollis* were the most recorded camera trap images. This survey recorded 16 diurnal and one nocturnal bird species. These preliminary findings demonstrated the potential of using a non-invasive method to assess understory bird species in montane habitats, which may complement other survey methods.

Keywords: Activity patterns, biodiversity, birds, habitat change, photo trapping

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E-mail addresses:

marinamohd@upm.edu.my (Marina Mohd. Top @ Mohd. Tah)

kierahbaharudin@gmail.com (Nur Syakirah Baharudin)

aqilahamniazizan@gmail.com (Aqilah Amni Azizan)

chongleong@upm.edu.my (Chong Leong Puan)

* Corresponding author

INTRODUCTION

At an elevation of more than 1,200 m, Malaysia's highlands comprise submontane and montane habitats that support a distinctive biotic community, especially montane specialists. In Peninsular Malaysia, Cameron Highlands, Fraser's Hill, and Maxwell Hill are popular hill stations in fragile and vulnerable forested highlands (Chan, 2019). Cameron Highlands hosts

over 700 plant species, 145 endemic, including 32 orchid species (Chan, 2019). A total of 56 mammals, 199 birds, 58 reptiles and 14 amphibian species have also been recorded in Cameron Highlands (Chan, 2019). These mountainous highlands are home to various bird species specialising in montane habitats (Wikramanayake, 2002) with colder temperatures and relatively higher precipitation at higher altitudes. Montane species generally are less resilient to heavy human activities and land development (Soh et al., 2021), many of which, such as the Mountain Peacock-pheasant (*Polyplectron inopinatum*) and Malayan Whistling-thrush (*Myophonus robinsoni*), are listed in the International Union for Conservation of Nature (IUCN) Red List (Baharudin et al., 2023).

Camera-trapping is a non-invasive approach widely utilised in wildlife ecological studies for decades to record the presence and behaviour of wildlife, especially rare and elusive ones, without human intervention (Bondi et al., 2010; Smith & Coulson, 2012). Furthermore, photos and videos captured using a camera trap allow additional information pertaining to the phenotype appearance of animals, such as body size, colour, and condition, to be captured (Kühl & Burghardt, 2013). Camera trapping has been demonstrated to be one of the more cost-efficient sampling methods for faunal assessments, although it requires a large initial monetary investment (Bondi et al., 2010). Specifically, it is an exceptionally pragmatic method for monitoring mammals of medium-large body size (Rendall et al., 2014) because of its practicality in producing large amounts of information and recording the presence of target and non-target species.

In avian ecological research, camera traps have been progressively used. A study by Tanwar et al. (2018) in Germany demonstrated the effectiveness of different camera trap models on birds. At the Nanling National and Chebaling National Nature Reserves, Guangdong, China, based on the surveys made from 2011 to 2016, it was found that 47 bird species were recorded by camera traps, with only six species caught (Zhang et al., 2018). Elsewhere in Southeast Asia, camera trapping was carried out to survey birds in Indonesia (Brooks et al., 2018; Dinata et al., 2008; O'Brien & Kinnaird, 2008), Myanmar (Naing et al., 2015), Thailand (Pla-ard et al., 2021; Suwanrat et al., 2015), and Malaysia (Samejima et al., 2012; Jambari et al., 2015). A survey on terrestrial vertebrates using camera traps by Jambari et al. (2015) managed to capture 777 (9.30% out of the total) images of birds. Previous studies utilised camera traps targeting mostly mammals, inadvertently capturing images and videos of birds nearby. While most studies in the past were performed in lowland forests, this study assesses the potential of recording montane bird species at lower strata of a montane forest, namely Cameron Highlands, using camera traps.

MATERIALS AND METHODS

A survey was conducted at Cameron Highlands, comprising an area of 712.18 km² in the north-western of the Pahang state (Figure 1), namely in Terla A Forest Reserve (9.34 ha)

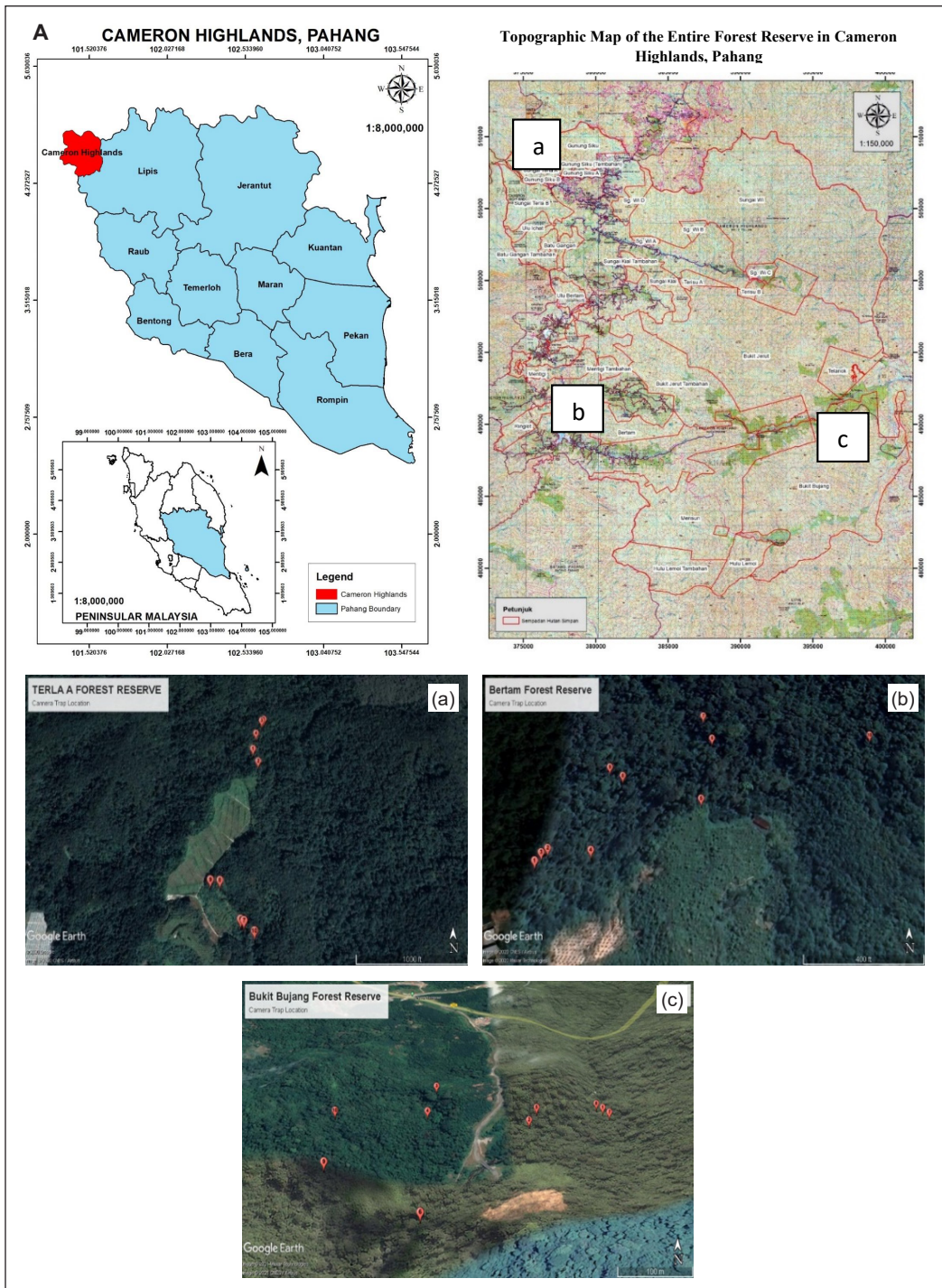


Figure 1. (A) The location of Cameron Highlands, Pahang. (Adapted from the Forestry Department of Peninsular Malaysia, 2020), and the distributions of camera traps at (a) Terla Forest Reserve, (b) Bertam Forest Reserve and (c) Bukit Bujang Forest Reserve

(04°35'36.6" N, 101°22'54.7" E) with an elevation of 1300–1500 m, Bertam Forest Reserve (15.4 ha) (04°25' 15.0" N, 101°26' 41.4" E) with an elevation of 1200-1300 m and Bukit Bujang Forest Reserve (0.50 ha) (04°24' 07.06" N, 101°35'37.28" E) with an elevation of 400-500 m. The camera-trapping method was conducted for five days at each site based on two sampling phases between August 2020 and January 2021. These forests were chosen because there was minimal human interference.

At each site, ten units of camera traps were mounted over 40 cm from the ground on trees or poles (Jambari et al., 2015; Mohd Azlan et al., 2018) and marked using Global Positioning System (GPS). Bird images or videos captured on camera traps were identified in detail based on appearance and by consulting experts—other cues, such as movements and behaviour captured via videos, aided species identification. The activity time of birds was categorised into daytime (0601 hr to 1800 hr) and nighttime (1801 hr to 0600 hr). Rarefaction curves were derived from interpolating limited smaller samples and estimating species richness at each site.

RESULTS AND DISCUSSION

A total of 96 photos or videos of birds (17 genera, 10 families, 17 species), most of which are montane specialists, were recorded at the three forest reserves. There is one species, *Pterorhinus mitratus*, recorded as Near Threatened (NT) and another species, Mountain Peacock-pheasant, as Vulnerable (VU) (IUCN, 2021). Most birds captured are classified as Totally Protected (TP) in Wildlife Conservation Act (WCA) (2010) except for *Pterorhinus mitratus*, *Anthipes solitarius*, and *Cyornis whitei*, which are not on the list. According to Soh et al. (2021), higher altitudinal specialists are also at risk of local extirpations in some mountain tops. In Peninsular Malaysia, such vulnerable species include the montane specialists such as the Mountain Peacock-pheasant, which deserves closer conservation attention. Generally, Terla A Forest Reserve caught the highest number of photos (43; Figure 2) on camera traps than Bertam and Bukit Bujang Forest Reserves that is 30 and 23 photos, respectively.

From Table 1, the highest number of photos were captured for *Enicurus schistaceus*, with 15 photos captured, while 14 photos were taken for *Alcippe peracensis*. *Myiomela leucura* *Niltava grandis* and Mountain Peacock-pheasant had the same number of photos captured that is three photos.

The activity time of birds was categorised into daytime (0601 hr to 1800 hr) and nighttime (1801 hr to 0600 hr), as shown in Table 2. Fifteen species were detected at 0700 hr to 1700 hr. Four species of diurnal birds, namely *Alcippe peracensis*, *Cyornis whitei*, *Myiomela leucura* and *Niltava grandis*, were detected to be active after dusk; they were likely on their way to roost. *Alcippe peracensis* were the most recorded species during the day as nine photos were captured, and only two photos of the species were captured in

the late evening when they returned to roost. This study demonstrated that camera traps can capture diurnal and nocturnal bird species (Daniel et al., 2016). Findings showed that cameras set near the rivers, streams, and waterlogged areas captured a higher number of bird species. It should be noted in the case of Bukit Bujang Forest Reserves, even though it is a

Table 1

List of bird species recorded at Terla A, Bertam and Bukit Bujang Forest Reserves in Cameron Highland using camera traps

Family	Conservation status (IUCN, 2021)	WCA (2010)	Numbers of photos (P) / video (V) captured			N
			Terla A	Bertam	Bukit Bujang	
Alcippeidae						
<i>Alcippe peracensis</i> (Sharpe, 1887)	LC (IUCN, 2021)	TP	10(V)	1(V)	3(P)	14
Leiothrichidae						
<i>Pterorhinus mitratus</i> (S. Müller, 1836)	NT (IUCN, 2021)	-	-	5(P,V)	-	5
Muscicapidae						
<i>Anthipes solitaris</i> (S. Müller, 1836)	LC (IUCN, 2021)	-	1(V)	-	-	1
<i>Cyornis whitei</i> Harrington, 1908	LC (IUCN, 2021)	-	4(V)	-	-	4
<i>Enicurus schistaceus</i> (Hodgson, 1836)	LC (IUCN, 2021)	TP	-	6(V)	9(P,V)	15
<i>Larvivera cyane</i> (Pallas, 1776)	LC (IUCN, 2021)	TP	7(V)	-	-	7
<i>Myiomela leucura</i> (Hodgson, 1845)	LC (IUCN, 2021)	TP	2(V)	1(V)	-	3
<i>Niltava grandis</i> (Blyth, 1842)	LC (IUCN, 2021)	TP	1(V)	2(V)	-	3
Nectariniidae						
<i>Aethopyga saturate</i> (Hodgson, 1836)	LC (IUCN, 2021)	TP	1(V)	-	-	1
Pellorneidae						
<i>Pellorneum tickelli</i> (Blyth, 1859)	LC (IUCN, 2021)	TP	2(V)	-	-	2
Phasianidae						
<i>Arborophila campbelli</i> (Robinson, 1904)	LC (IUCN, 2021)	TP	5(V)	-	6(V)	11
<i>Polyplectron inopinatum</i> (Rothschild, 1903)	VU (IUCN, 2021)	TP	3(P)	-	-	3
Pnoepygidae						
<i>Pnoepyga pusilla</i> Hodgson, 1845	LC (IUCN, 2021)	TP	2(V)	-	-	2
Pycnonotidae						
<i>Alophoixus ochraceus</i> (Moore, 1854)	LC (IUCN, 2021)	TP	-	6(V)	-	6
<i>Ixos mcclllandii</i> (Horsfield, 1840)	LC (IUCN, 2021)	TP	-	6(V)	-	6
Rhipiduridae						
<i>Rhipidura albicollis</i> (Vieillot, 1818)	LC (IUCN, 2021)	TP	5(P)	2(V)	5(V)	12
Strigidae						
<i>Otus spilocephalus</i> (Blyth, 1846)	LC (IUCN, 2021)	TP	-	1(V)	-	1
Total number of photos captured (N)			43	30	23	96

Note. N=number of photos captured; - = Not Available; IUCN=International Union for Conservation of Nature; WCA=Wildlife Conservation Act; LC =Least Concern; NT=Near Threatened; VU=Vulnerable

hill dipterocarp forest, there were still montane species (for example, *Alcippe peracensis* and *Enicurus schistaceus*) that extend their range into this lower elevation and captured by our camera traps. Rarefaction of species accumulation curves obtained for the three sites was found to vary, probably due to differences in habitat quality. Nonetheless, Terla A and Bukit Bujang Forest Reserves seemed to have reached asymptote, but not Bertam Forest Reserve (Figure 3). However, due to low sampling effort, we propose a prolonged survey to better estimate species richness.

Table 2
The time during which bird species were recorded on camera trap

Species	Daytime		Photo/Video
	0601 hr to 1800 hr	1801 hr to 0600 hr	
<i>Aethopyga saturata</i>	1	-	V
<i>Alcippe peracensis</i>	9	2	V
<i>Alophoixus ochraceus</i>	6	-	V
<i>Anthipes solitaris</i>	1	-	V
<i>Arborophila campbelli</i>	2	3	V
<i>Cyornis whitei</i>	3	1	V
<i>Enicurus schistaceus</i>	6	-	V
<i>Ixos maclellandii</i>	6	-	V
<i>Larvivora cyane</i>	7	-	V
<i>Myiomela leucura</i>	2	1	V
<i>Niltava grandis</i>	2	1	V
<i>Otus spilocephalus</i>	-	1	V
<i>Pellorneum tickelli</i>	2	-	V
<i>Pnoepyga pusilla</i>	-	2	V
<i>Polyplectron inopinatum</i>	3	-	P
<i>Pterorhinus mitratus</i>	5	-	2V, 3P
<i>Rhipidura albicollis</i>	7	-	4V, 3P

Note. - = Not Available

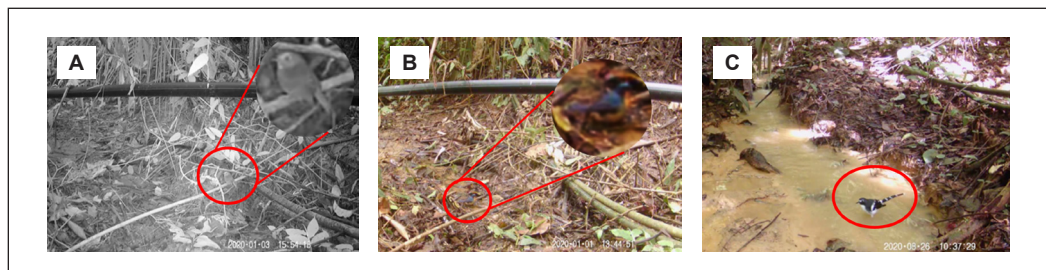


Figure 2. Seventeen species were caught by camera trapping in Cameron Highlands, Pahang. (A) *Anthipes solitaris* (Rufous-browed Flycatcher); (B) *Cyornis whitei* (Hill-blue Flycatcher); (C) *Enicurus schistaceus* (Slaty-backed Forktail)

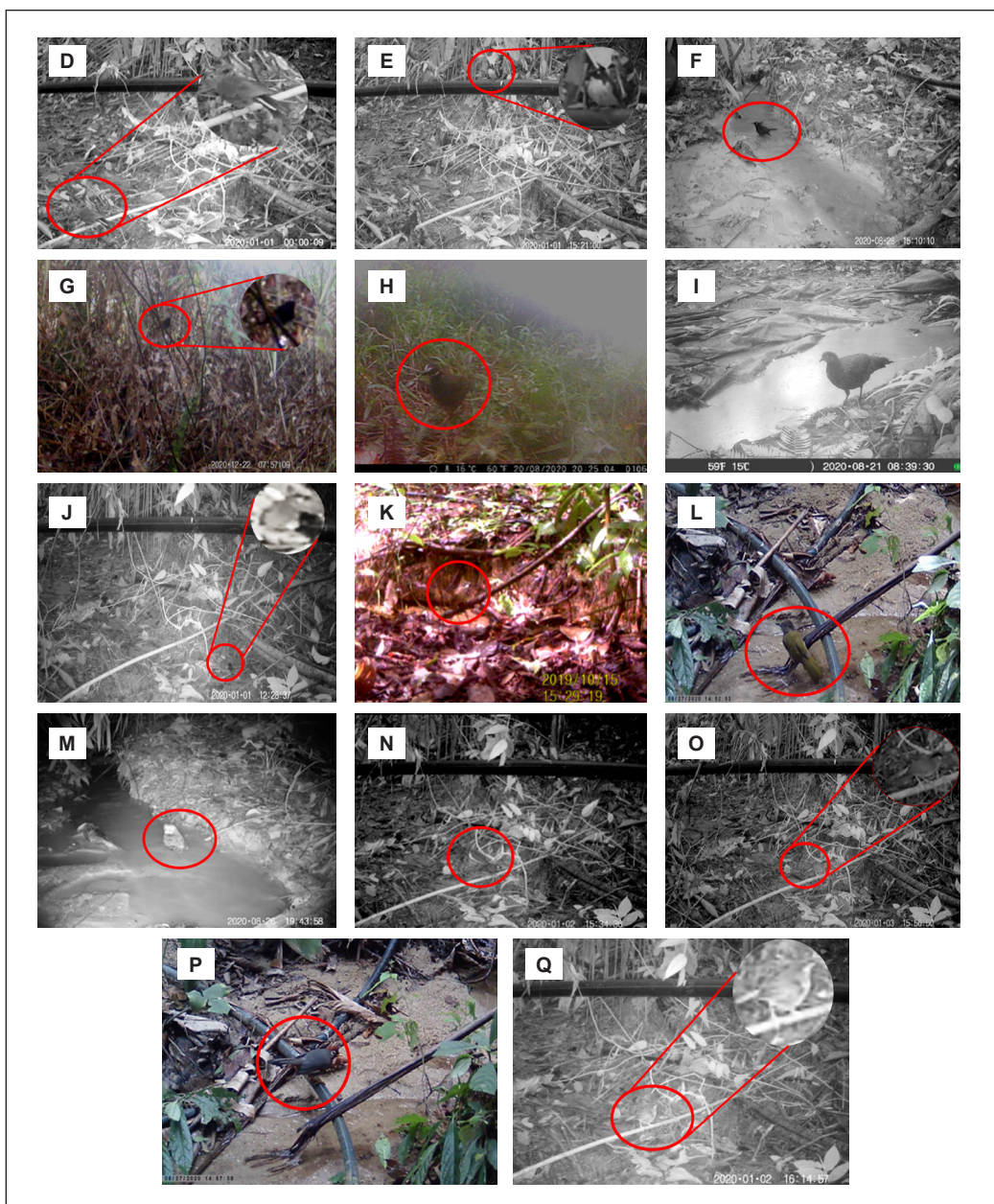


Figure 2 (continue). Seventeen species were caught by camera trapping in Cameron Highlands, Pahang. (D) *Myiomela leucura* (White-tailed Robin); (E) *Larvivora cyane* (Siberian Blue Robin); (F) *Niltava grandis* (Large Niltava); (G) *Aethophyyga saturate* (Black-throated Sunbird); (H) *Arborophila campbelli* (Malayan Partridge); (I) *Polyplectron inopinatum* (Mountain Peacock-Pheasant); (J) *Pnoepyga pusilla* (Pygmy Cunwing); (K) *Alophoixus ochraceus* (Ochraceous Bulbul); (L) *Ixos maclellandii* (Mountain Bulbul); (M) *Otus spilocephalus* (Mountain Scops Owl); (N) *Rhipidura albicollis* (White-throated Fantail); (O) *Alcippe perancensis* (Mountain Fulvetta); (P) *Pterorhinus mitratus* (Chestnut-capped Laughingthrush); (Q) *Pellorneum tickelli* (Buff-breasted Babbler)

CONCLUSION

The study was the first attempt to survey bird species using camera traps conducted in Peninsular Malaysia. Our study showed that setting up camera traps close to water bodies may increase the capture rate and examine their behaviour or activity period. Besides terrestrial birds, many arboreal bird species were also detected at a lower stratum in the montane forest, while some extend their range into lower elevations. Although the number of species detected may be less than that of other sampling methods such as direct observation and mist-netting, camera traps may be complementary to detect elusive birds, especially during twilight and night.

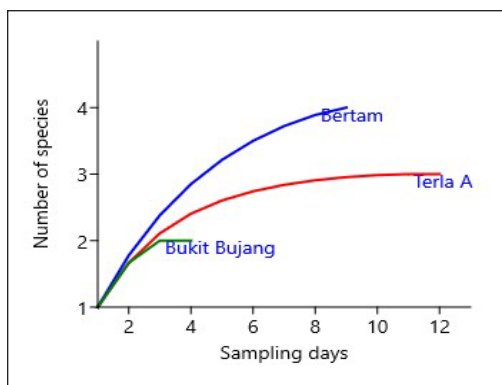


Figure 3. Rarefaction of bird species accumulation curves derived for the three forest reserves in Cameron Highlands

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