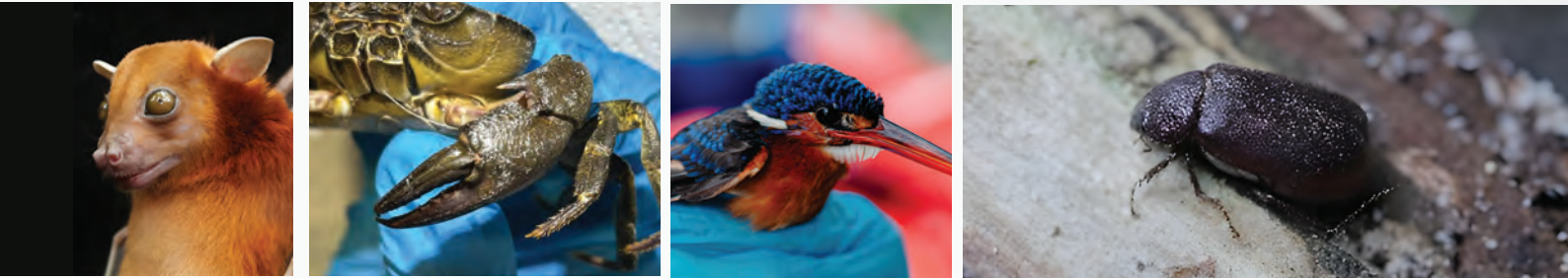
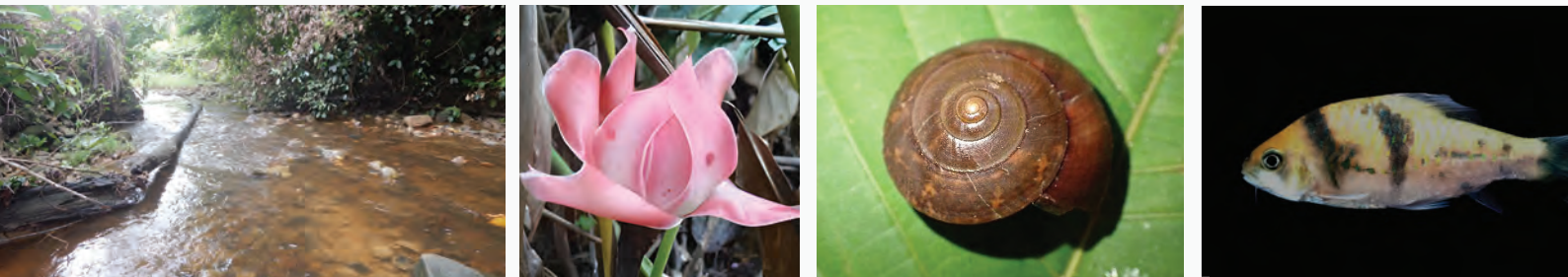


EXPLORING NATURE'S RECOVERY



BIODIVERSITY RESILIENCE



SABAL FOREST RESERVE

Edited By

Mohd Zacaery Khalik, Dayang Nuriza Abang Abdillah, Azahari Omar,
Runi Anak Sylvester Punga, Meekiong Kalu, Faisal Ali Anwarali Khan

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Biodiversity Resilience: Exploring Nature's Recovery Sabal Forest Reserve

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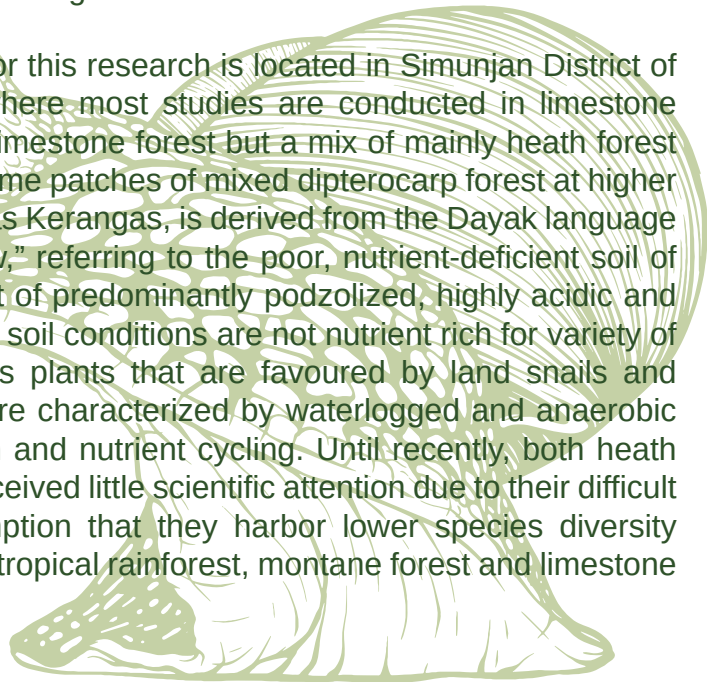
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Land Snails and Slugs

Jie Ying Lee, Amira Fakihin binti Rostam, Irfan Haqqi bin Abd Razak,
Elvina Harry, Al-Faizul Muawizatin & Mohd Zacaery Khalik

Land snails and slugs are the second most prevalent terrestrial invertebrates, surpassed only by insects in abundance and diversity. Yet, published studies on these organisms remain limited despite their ubiquity in terrestrial ecosystems. They are key components of forest ecosystems, playing important roles in litter decomposition and serving as a food source for other organisms such as birds and mammals. Furthermore, their limited mobility and dependence on specific microhabitat conditions make them excellent model organisms for examining the effects of environmental gradients and habitat characteristics on species distribution. In terms of environmental gradients, the distribution and survival of land snails can be influenced by the varying conditions found in different forest types. Different forests exhibit variations in environmental factors such as temperature, humidity, and vegetation structure. Most studies on land snails and slugs have been conducted in limestone forests or areas within the limestone range. This is because the weathering of limestone releases calcium carbonate (CaCO_3), a requisite food source for land snails and slugs.

Sabal Forest Reserve, the study site for this research is located in Simunjan District of Sarawak. Unlike previous research where most studies are conducted in limestone forest, Sabal Forest Reserve is not a limestone forest but a mix of mainly heath forest with a few areas of peat swamp and some patches of mixed dipterocarp forest at higher elevation. Heath forest, locally known as Kerangas, is derived from the Dayak language meaning “land where rice cannot grow,” referring to the poor, nutrient-deficient soil of this forest type. Heath forest is consist of predominantly podzolized, highly acidic and sandy soils, which also means that the soil conditions are not nutrient rich for variety of vegetations, especially for calciphilous plants that are favoured by land snails and slugs. Similarly, peat swamp forests are characterized by waterlogged and anaerobic soils, which slow down decomposition and nutrient cycling. Until recently, both heath forest and peat swamp forests have received little scientific attention due to their difficult accessibility and the common assumption that they harbor lower species diversity compared to mixed dipterocarp forest, tropical rainforest, montane forest and limestone forest.



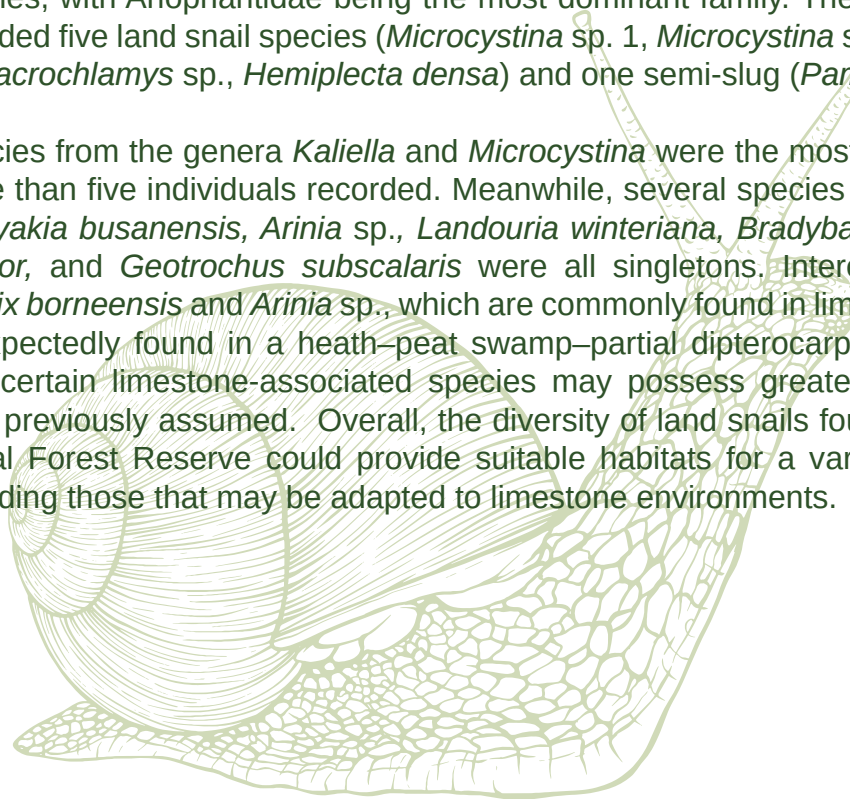
Therefore, there is a lack of specific data on land snail and slug diversity in this mixed forest type, making this research an important step toward understanding biodiversity in such habitats.

This research was conducted during the expedition organized by the Sarawak Forest Department in the Sabal Forest Reserve from 23 November 2024 until 29 November 2024. Land snails and slugs were sampled for 3 to 4 hours daily within a 20 m x 20 m plot to ensure high coverage of the study area. Several 20 m x 20 m plots were established to ensure higher coverage of the study area. All live specimens were collected and preserved in 70% ethanol, while all dead shells were cleaned, dried, and stored in the museum collection.

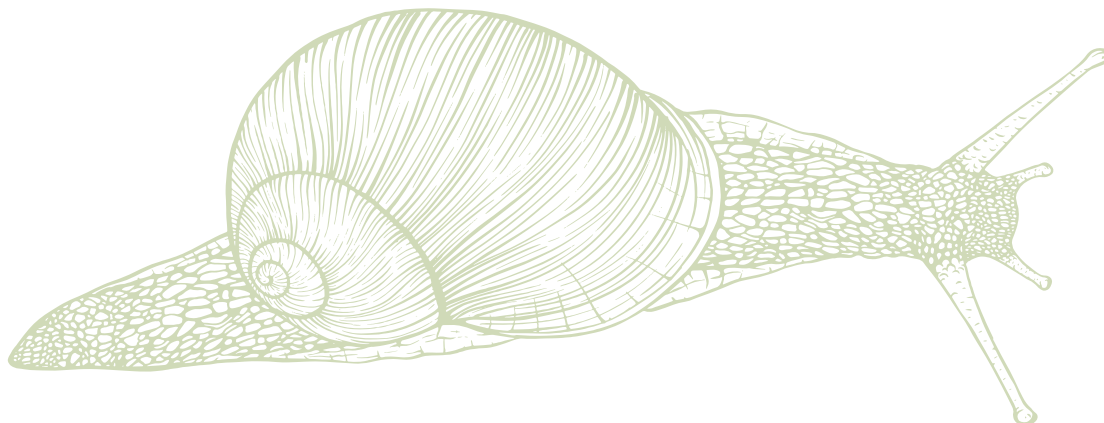
Specimens were searched for in four different microhabitats: leaf litter, vegetation, dead wood logs, and sandstone or limestone (if present). Furthermore, to ensure precise results, passive sampling was also conducted by collecting soil samples from each plot. These soil samples were processed through flotation, drying, and sieving to extract microsnails or other dead shells that may have been missed during active searching. The specimens were identified to the species level, and some only to the genus level.

According to Table 1, there are a total of 15 land snail species, including a slug were recorded from the sampling in Sabal Forest Reserve. These species belong to seven families, with Ariophantidae being the most dominant family. The Ariophantidae family included five land snail species (*Microcystina* sp. 1, *Microcystina* sp. 2, *Microcystina* sp. 3, *Macrochlamys* sp., *Hemiplecta densa*) and one semi-slug (*Pamarion martensi*).

Species from the genera *Kaliella* and *Microcystina* were the most abundant, each with more than five individuals recorded. Meanwhile, several species such as *Everettia* sp. 1, *Dyakia busanensis*, *Arinia* sp., *Landouria winteriana*, *Bradybaena similaris*, *Videna bicolor*, and *Geotrochus subscalaris* were all singletons. Interestingly, *Cyclophorus perdis borneensis* and *Arinia* sp., which are commonly found in limestone habitats, were unexpectedly found in a heath–peat swamp–partial dipterocarp forest. This suggests that certain limestone-associated species may possess greater ecological flexibility than previously assumed. Overall, the diversity of land snails found suggests that the Sabal Forest Reserve could provide suitable habitats for a variety of snail species, including those that may be adapted to limestone environments.



Family	Species Name	Number of Individuals
Dyakiidae	<i>Everettia</i> sp. 1	1
	<i>Dyakia busanensis</i>	1
Diplommatinidae	<i>Arinia</i> sp.	1
Chronidae	<i>Kaliella</i> sp. 1	>5
	<i>Kaliella</i> sp. 2	>5
Chronidae	<i>Landouria winteriana</i>	1
	<i>Bradybaena similaris</i>	1
Trochomorphidae	<i>Videna bicolor</i>	1
	<i>Geotrochus subscalaris</i>	1
Cyclophoridae	<i>Cyclophorus perdix borneensis</i>	3
Trochomorphidae	<i>Microcystina</i> sp. 1	>5
	<i>Microcystina</i> sp. 2	>5
	<i>Microcystina</i> sp. 3	>5
	<i>Macrochlamys</i> sp.	2
	<i>Hemiplecta densa</i>	4
Ariophantidae	<i>Pamarion martensi</i>	4



Land Snails and Slugs



Microcystina sp. 1



Microcystina sp. 1



Microcystina sp. 3



Kaliella sp. 2



Kaliella sp. 1



Bradybaena similaris

Land Snails and Slugs



Geotrochus subscalaris



Hemiplecta densa



Cyclophorus perdix borneensis



Pamarion martensi

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