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The Species Diversity of Herpetofauna in The Border Area of Gunung Tilu Natural Reserve and Pusat Penelitian (PPTK), Gambung, Mekarsari Village, Ciwidey, West Java

Ahmad Ramadhan Nasution[1], Fadil Maulana[1], Stiza Anindya Fasha[1], Teghes Diva Ramadhine[1]

[1]*Faculty of Biology and Agriculture, Biology Study Program, Nasional University*

Email : stizaanindya2103@gmail.com

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Abstract

The Tea and Quinine Research Center (PPTK), Gambung is located in Mekarsari Village, Pasir Jambu, District, Bandung, West Java. This location borders the Gunung Tilu Nature Reserve in West Java. The lack of information about herpetofauna in this area prompted this research. The study was conducted using the Visual Encounter System (VES) method on three different transects with distinct characteristics: the Situ Kubang transect, which is an area along the riverbank; the Abikarna transect, which is a forest transect along a small stream; and the Kebun transect around the Tea and Coffee Plantations. Data collection was carried out for three days, by recording: encounters of herpetofauna species, as well as their habitat components, including weather, temperature, air humidity, air pH and canopy cover. The results revealed 15 species from 9 families, including 5 amphibian families and 4 reptile families. The species diversity index (H') of herpetofauna across the three transects was categorized as moderate. The Kebun transect had the highest Diversity Index (H') value of 1.90, followed by the Situ Kubang transect with 1.78, and the Abikarna transect with H' = 1.23. The herpetofauna species with the highest number of encounter was *Chalcorana chalconota* with 25 individuals, while other species had low number encounter, with fewer than 3 individuals per species, including *Bronchocela jubata, Takydromus sexlineatus, Pseudocalotes tympanistriga, Gongylosoma baliodeirus, Limnonectes kuhlii, Fejervarya limnocharis, Polypedates leucomystax, Rhacophorus margaritifer, and Microhyla achatina*. The species *Bronchocela jubata, Leptobrachium hasseltii*, and *Chalcorana chalconota* were found on all research transects.

Keyword: Gunung Tilu Nature Reserve, Herpetofauna Habitat, Herpetofauna Diversity, PPTK Gambung-Ciwidey

INTRODUCTION

The existence of herpetofauna species on the island of Java was recorded as 45 species of amphibians (Alhadi et al, 2021). Meanwhile, there are 62 recorded species of reptiles (Wowor, 2010). A conservation area is an area whose function is determined to preserve nature (KLHK, 2016), therefore a conservation area has information regarding the diversity of animal species, especially herpetofauna because herpetofauna has an important role (Irwanto et al, 2019).

Mekarsari Village is a Gambung Tea Plantation Tourism village located in Pasir Jambu District, Bandung Regency, West Java. Tea plantations in Indonesia have large areas of land in each region, especially in the highlands. The area of tea land in Indonesia in 2021 covers a total of 112,053 ha (Manumono and Listiyani, 2022). Having such a total land area can form an ecosystem with many

living creatures that are in symbiosis with each other, both beneficial and detrimental (Maharani et al, 2024).

The location of the Tea and Quinine Research Center (PPTK) is close to the Gunung Tilu Nature Reserve (CA), West Java, which is a primary forest that holds various important biodiversity and some are endemic. The herpetofauna found in Gunung Tilu CA totaled 27 species consisting of 13 types of amphibians from 6 families and 14 types of reptiles from 6 families. The level of amphibian diversity in the Dewata area is 1.68 and the herpetofauna that dominate in Gambung are *Chalcorana chalconota* and *Bronchocela jubata* but in Dewata it is dominated by *Huia masonii* and *Bronchocela cristatella* (Putri, A, 2015).

Some local and external communities may not be aware of the existence of herpetofauna and its role in nature. The Gunung Tilu Nature Reserve is a type of highland rainforest ecosystem with relatively intact mountain forest areas at altitudes between 1,000 and 2,434 meters above sea level. Based on Minister of Agriculture Decree No. 68/Kpts/Um/1978, dated 7 February 1978, the status of the Gunung Tilu Nature Reserve forest as a Nature Reserve with an area of 8,000 ha. At the end of 2012, the boundaries of the Gunung Tilu Nature Reserve were reconstructed by the BPKH and the area area was confirmed to be 7,478 ha, then in 2014 it was determined by the Indonesian Minister of Forestry in Decree Number SK. 1873/Menhut VII/KUH/2014 dated 25 March 2014 covering an area of 7479.8 ha with the function of a nature reserve.

Herpetofauna consists of reptiles and amphibians, these two classes are grouped based on their bodies having backbones (vertebrates) and their body temperature following the environmental temperature (Kusrini, 2008). Herpetofauna is a group of animals that has an important role in maintaining ecosystem balance, and sustainability of the food chain, and also as an environmental bioindicator (Sudirman and Setiawan, 2013). Because these two groups of animals have an important position in ecology, namely as predators or pest controllers (prey on types of mice and insects) (Setiawan, 2013), as well as prey (Zug, 1993), so it is important to study and preserve. Herpetofauna is a type of biodiversity that is rarely known and is not well known to the public, until now there is still a lack of information regarding the protection status of the herpetofauna, both nationally and internationally, such as the International Union for Conservation of Nature (IUCN) and the Convention on International Trade in Endangered Species (CITES).

Considering the occurrence of land conversion events and widespread habitat disturbance, efforts need to be made to protect the herpetofauna (Iskandar and Erdelen, 2006). The diversity of herpetofauna is one of the parameters for the sustainability and balance of the quality of the surrounding environment. Herpetofauna is sensitive to changes in microclimate and is vulnerable to habitat damage and natural disasters because of its narrow range. Globally, the number of endangered herpetofauna species is greater than that of birds and mammals (Baillie et al., 2004).

This herpetofauna research aims to determine the diversity of species, species dominance, and composition of herpetofauna species found on each transect observed in the PPTK Gambung area which borders the Nature Reserve Area, Mekarsari Village.

METHOD

A. Time and Place

This research was conducted on 1-5 May 2024 in the Gambung Tea and Quinine Research Center (PPTK) area, Ciwidey, West Java, which borders the Nature Reserve Area. Data collection was carried out on existing routes based on ecological characteristics, namely in large river basins (Situ Kubang), small watercourses (Abikarna) and gardens (Kebun) (See Figure 1). Data collection was carried out in the morning starting from 07.00-10.00 and in the evening from 19.00-22.00.

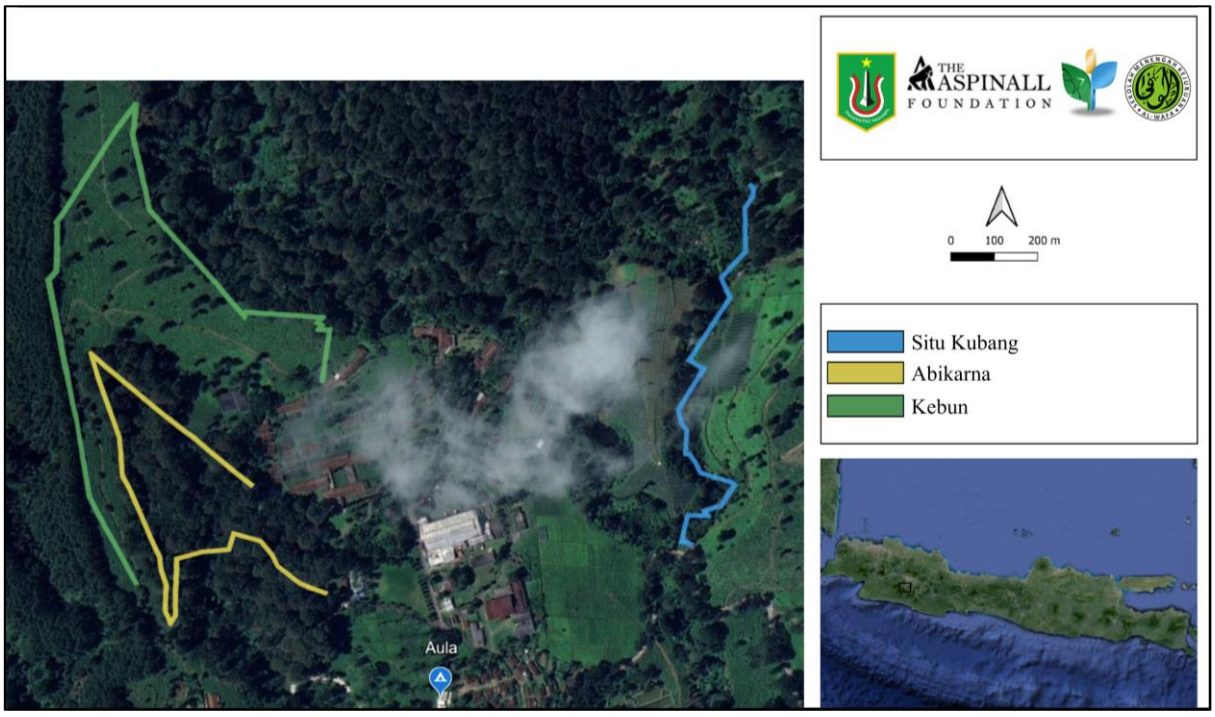

Figure 1. Location map and data collection transect.

B. Research Instruments

The equipment used in this research is lighting equipment (flashlight and head torch), Global Positioning System (GPS), grab stick, thermo-hygrometer, camera (cellphone and digital), counter, boots, reptile bag and box, identification books, data tabulation, stationery, watches, rulers, meters.

C. Data Collection

This research uses the Visual Encounter Survey (VES) method, this method is an active method with opportunities to encounter fauna. This data collection is based on time by walking along the transects on a path with an encounter distance of 5 meters, on both sides of the path, and recording all encounters of herpetofauna species within a 3 hour duration. Data recording, namely: species name, number of individuals, time of encounter, substrate, habitat type, day and date, weather conditions, air temperature and air humidity, and additional information on habitat conditions. Traces of data collection routes and coordinate points of herpetofauna encounters were recorded to create a map of the paths and distribution points of herpetofauna encounters found in the research area. In the process of identifying the species of herpetofauna found, identification books were used according to Das (2015), Alhadi (2021) and Marlon (2014).

D. Data Analysis

Analysis of this research data uses the Shannon-Wienner Diversity Index and Species Dominance Index (D) with the following formula:

1. Shannon-Wienner Diversity Index

The Shannon-Wienner Diversity Index functions to calculate the level of species diversity (Suratissa and Rathnayake, 2016) with the equation:

$$H' = -\sum_{i=1}^{s}(p_i \cdot \ln p_i)$$

The H' value can be used to determine the level of diversity, namely:

H' value ≤1.5 = Low diversity
H' value 1.5 - 3.5 = Medium diversity
H' value ≥3.5 = High diversity

2. Dominance Index

The Dominance Index (D) is calculated using the Simpson formula, which has categories with boundaries, ≤0.50 (low), ≥0.50 - ≤0.75 (moderate), and ≥0.75 (high) with the equation:

$$C = \sum_{i=l}^{n} (pi)^2$$

3. Map of herpetofauna distribution

Based on the recorded path and coordinates of the meeting point using the Global Positioning System (GPS), a map was created using Google Earth and QGIS.

RESULT

1. Habitat Conditions

The Gambung Tea and Quinine Research Center (PPTK) area which borders the Gunung Tilu Nature Reserve has a diversity of habitats that support a diversity of herpetofauna species, this can be said from the results of data collection over three days. This diversity was studied in three transects, namely Situ Kubang, Abikarna, Kebun , each of which has different habitat characteristics. Abiotic conditions can be seen in Table 1.

Table 1. Abiotic parameters in each observation transect.

Transect	Temp. (°C)	Humidity (%)	Water pH	Altitude (m)
Situ Kubang	28°C	72%	5	1.307 - 1.357
Abikarna	25°C	71%	5	1.360 - 1.373
Kebun	23°C	74%	-	1.342 - 1.372

Situ Kubang

It is a river whose upstream originates from Mount Tilu, and is a route for local residents to get to the plantation. The river with a width of 3-5 meters has a fairly heavy water flow, has a height of 1.307 – 1.357 meters above sea level and a path length of 1.02 km. This route is overgrown with riparian vegetation around the observation route (Figures 2 and 3).

Figure 2. River conditions on the Situ Kubang transect.

Figure 3. Habitat conditions in the Situ Kubang transect area.

Abikarna

This transect is an area located not far from a small river, with an area height of 1.360 – 1.373 meters above sea level and a path length of 503.56 m. This path has tree and shrub vegetation. There is human activity such as local residents crossing this route on motorbikes, this is because the Abikarna route is often used by residents to get to plantations (Figures 4 and 5).

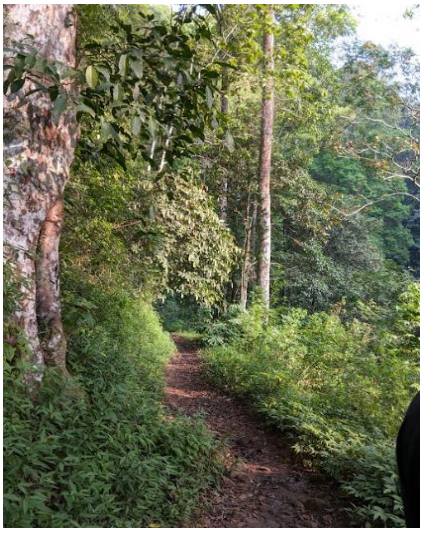

Figure 4. Transect conditions in the Abikarna

Figure 5. Condition of small river flow on the Abikarna transect

Kebun

This transect is an area bordering tea plantations with coffee plants mixed with vegetable gardens and other plants such as pine, at an altitude of 1.342 – 1.372 meters above sea level and the transect is 1.42 km long. This transect is an area far from the river flow. This transect is often used by people (Figures 6 and 7).

Figure 6. Kebun transect conditions on the edge of the tea plantation.

Figure 6. Kebun transect conditions on the edge of the coffee plantation and pine forest transect.

2. Species Composition and Species Distribution

From the Herpetofauna data collection, 15 species of herpetofauna were obtained, consisting of 4 reptile families and 5 amphibian families, with 6 species of reptiles and 9 amphibians (Table 2, Figure 8 and Appendix Figure 1).

Table 2. Composition of herpetofauna species in the three research transects.

Family	Species	Number of ind.	Transects			IUCN Status
			SK	AK	KB	
Agamidae	*Bronchocela jubata*	**2**	2			LC
	Bronchocela cristatella	**8**	4	2	2	LC
	Pseudocalotes tympanistriga	**1**		1		LC
Colubridae	*Gongylosoma baliodeirus*	**1**			1	LC
Lacertidae	*Takydromus sexlineatus*	**2**			2	LC
Scincidae	*Eutropis multifasciata*	**6**	2		4	LC
Dicroglossidae	*Limnonectes kuhlii*	**1**	1			LC
	Fejervarya limnocharis	**1**			1	LC
Megophryidae	*Leptobrachium hasseltii*	**7**	1	1	***5***	LC
Rachoporidae	*Polypedates leucomystax*	**1**			1	LC
	Rhacophorus margaritifer	**2**		2		LC
Ranidae	*Chalcorana chalconota*	**25**	9	***12***	4	LC
	Odorrana hosii	**10**	***10***			LC
	Huia masonii	**4**	4			LC
Microhylidae	*Microhyla achatina*	**1**		1		LC
			Number of Species			
	Total	**72**	**8**	**6**	**8**	

SK = Situ Kubang; **AK =** Abikarna; **KB =** Kebun; ** = The largest number of individuals from each transect , **LC =** *Least Concern*

On the Situ Kubang route, 8 species of herpetofauna can be found, namely; *Bronchocela jubata* (bunglon surai), *Bronchocela cristatella* (bunglon jambul hijau), *Limnonectes kuhlii* (bangkong tuli), *Leptobrachium hasseltii* (katak serasah), *Chalcorana chalconota* (kongkang kolam), *Odorrana hosii* (kongkang racun), *Huia masonii* (kongkang jeram) *and Eutropis multifasciata* (kadal kebun). On the Abikarna transect, 6 species of herpetofauna can be found, namely; *Bronchocela cristatella* (kadal jambul hijau), *Pseudocalotes tympanistriga* (londok moncong), *Leptobrachium hasseltii* (katak serasah), *Rhacophorus margaritifer* (katak parasut jawa), *Chalcorana chalconota* (katak kongkang) and *Microhyla achatina* (percil jawa). On the Kebun transect found 8 species of herpetofauna, namely; *Bronchocela cristatella* (bunglon jambul hijau), *Gongylosoma baliodeirus* (ular tanah bertotol), *Fejervarya limnocharis* (kodok tegalan), *Leptobrachium hasseltii* (katak serasah), *Takydromus sexlineatus* (kadal rumput), *Polypedates leucomystax* (katak pohon bergaris), *Chalcorana chalconota* (kongkang kolam) and *Eutropis multifasciata* (kadal kebun). The species *Bronchocela jubata, Leptobrachium hasseltii*, and *Chalcorana chalconota* were found on all research transects.

Based on the meeting point with the herpetofauna species during the research, it can be seen in Figure 8 below.

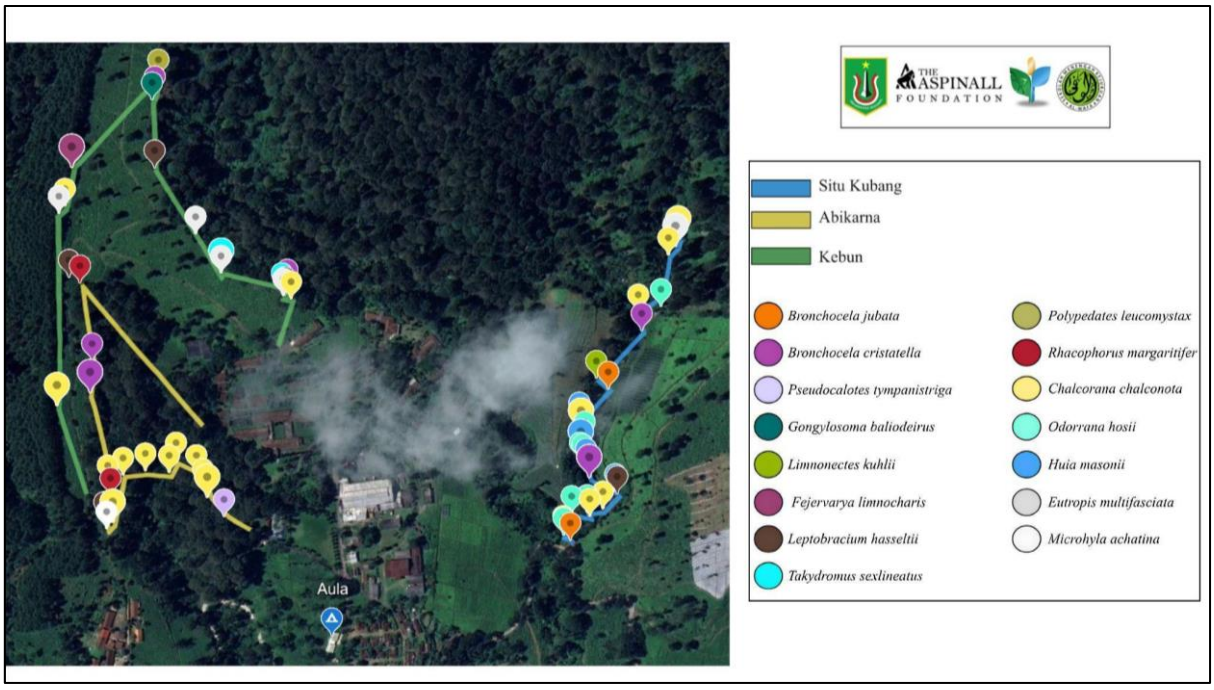

Figure 8. Map of distribution of herpetofauna on the three transects.

3. Species Diversity

The diversity of herpetofauna species on the three transect is in the moderate category, the Kebun transect with the largest Diversity Index, namely H' = 1.90, the Abikarna transect with a Diversity Index of H' = 1.23, and the Situ Kubang transect H' = 1.78 (Figure 9).

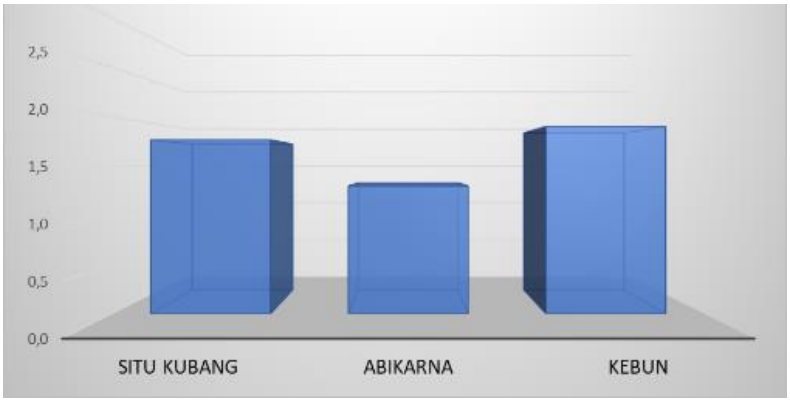

Figure 9. Diversity Index for each observation transect.

4. Dominance Index

The Dominance Index for the three transects was found to be low, namely ≤0.50, which means that there is almost no one species of herpetofauna that dominates each transect found. dominance index at Situ Kubang is 0.2; then next in Abidharma is 0.43; and in Kebun transect is 0.17.

DISCUSSION

Based on habitat conditions, the Kebun transect has more open canopy cover compared to the Situ Kubang and Abikarna transect, so reptiles are more common on the kebun transect. Reptiles are more commonly found in places that have open canopies because more sunlight will enter, this will support the presence of reptiles so they can sunbathe in these locations because reptiles will absorb heat from the warm ground (Ario, 2010) to increase body metabolism (O 'Shea and Taylor, 2004). Kebun habitats are also suitable places for reptiles because tea, coffee, and vegetable plantations are the main food source for insects such as grasshoppers, larvae, and worms, this is the main factor in which reptiles are found more often in plantation habitats.

Meanwhile, amphibians are more commonly found in areas that have water sources or humid areas. Amphibians are generally found at night or during the rainy season. Iskandar (1998) stated that amphibians always live in association with water as their name suggests, namely living in two realms (in water and on land). It was further explained that most amphibians are found living in forest areas because apart from needing water, they also need quite high humidity (75-85%) to protect the body from drying out.

The presence of herpetofauna at the observation location in three different habitat types resulted in different diversity indices being obtained, but all were in the moderate category and there were no dominant species. This is caused by different habitat and vegetation conditions and will affect the number of individuals and diversity of herpetofauna. According to Subeno (2010). According to Alikodra (2010), the geographic location of an area greatly influences the number of types of residents. Meanwhile, Jeffries (1997) said that factors that also influence the level of diversity are area size and habitat diversity.

This diversity in each habitat is because the three habitat types have different levels of heterogeneity which causes differences in species diversity (Ariza et al., 2014). The level of herpetofauna diversity in an area can be influenced by several biotic and abiotic factors. Biotic factors that influence include the diversity of vegetation structure and natural predators, while abiotic (environmental) factors that factor into the high and low diversity index include research time, light intensity, temperature, humidity, altitude and rainfall (Saputra, 2016).

CONCLUSION

In this research, 15 species of Herpetofauna were found, 8 species were on the Situ Kubang transect, 6 species were on the Abikarna transect, and 8 species were on the Kebun transect, three species of which were found on the three transects, including *Chalcorana chalconota* (Kongkang kolam), *Bronchocela cristatella* (Bunglon jambul hijau), *Leptobrachium hasseltii* (Katak serasah). Each location's Species Diversity Index (H') is categorized as moderate, Situ Kubang 1.78, Abikarna 1.23, and Kebun 1.90. The Dominance Index at each location is low, Situ Kubang 0.20, Abikarna 0.43, and Kebun 0.17.

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