

## **DIVERSITY AND DISTRIBUTION OF HERPETOFAUNA IN INSTITUT TEKNOLOGI SUMATERA CAMPUS AREA**

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### **ABSTRACT**

*Land use change of rubber plantation into ITERA campus area has led to changes in the ecology of the area. Amphibians and reptiles, referred as Herpetofauna, are categorized as wild animals that are sensitive to environmental changes and are considered as bio-indicators. Wild conservation activities including herpetofauna is an essential part to the forest campus concept in ITERA. The objective of the study is to analyze the diversity and distribution of herpetofauna. This applied Visual Encounter Survey (VES) with Time Constraint Method and Glue Trap technique. This research was carried out on six observation path and 180 traps. The ecological index analysis consisted of species diversity, evenness, richness, abundance, and community similarity. Twenty-two herpetofauna species were found, including nine amphibians (5 families) and 13 reptiles (9 families). There was one reptile species with vulnerable conservation status and 3 reptile species included in CITES appendix II. The diversity index value ( $H'$ ) was 2.29; species evenness ( $E$ ) value was 0.74; and species richness value was 3.33. Amphibian species with the highest abundance was *Fejervarya cancrivora* 1.78 individual/hour of observer, while from the reptile species was *Hemidactylus frenatus* 0.35 individual/hour of observer. There were 550 herpetofauna encounters, where 8 species could be found on all transects and 6 species could only be found on one transect. This research showed that the condition of ITERA habitat currently supported herpetofauna's life and needed conservation activities to maintain herpetofauna diversity.*

Key words: distribution, diversity, herpetofauna, ITERA

### **INTRODUCTION**

Institut Teknologi Sumatera (ITERA) campus is an area with rapid development at the current moment. Land conversion happened in a place that was once a 275 ha rubber plantation but turned into an office area in 2012 and continued to present. As a new campus that promotes the Smart, Friendly, and Forest Campus concept, conservation programs are needed to support the concept itself. One of the programs is the biodiversity conservation program in ITERA. Land use change is indicated to cause biodiversity composition change. Ecology study learns organism interaction in order to survive in an area by considering the environmental conditions (Hortal et al. 2009). There is an interdependency relationship between biotic and abiotic factors that influence organism species composition within a region (Stein et al. 2014).

Herpetofauna is a group of wildlife inhabiting ITERA area. Herpetofauna spreads in each habitat type, from forests, deserts, and grasslands. However, some types of herpetofauna are only found in certain specific habitats, so it is good to use it as the bio-indicator of environmental change (US Department of Agriculture 2006). Sumatera is rich in biodiversity. According to LIPI, there are at least 254 reptile species and 116 amphibian species in Sumatera. Herpetofauna is a group of reptiles and amphibians that are very vulnerable toward environmental changes (Kusrini 2009). Larson (2014) states that herpetofauna is known to be very vulnerable to environmental change compared to other

animalia taxa. Qurniawan (2015) states that herpetofauna ecology is significantly influenced by microclimate of specific habitat. There are countless human activities that could degrade the wealth and abundance of reptile and amphibian species, such as agricultural land clearing and illegal logging (Wanger et al. 2009).

The land conversion in ITERA and the development of forest campus require biodiversity conservation activity, one of which is herpetofauna. The study and planning of biodiversity hotspot in ITERA campus is not yet carried out. Hence, a study of herpetofauna diversity and distribution in ITERA Campus for biodiversity database development is needed. This study could be the basic data (time series) to assess the process of campus development that is in concordance to forest campus concept. Therefore, this study aims to analyze the data of biodiversity and herpetofauna community distribution in ITERA campus.

### **RESEARCH METHOD**

This study was conducted in ITERA area by 275 ha in August-October 2020. This study was conducted based on six transects (Figure 1). The data were collected from 07.00-10.00 WIB (Western Indonesia Time) and 19.30-21.30 WIB. The research instruments were headlamp, syringe, surgical instrument, specimen boxes, tally sheet, snake tong, calico pouch, GPS, and camera. The materials were: mouse glue trap, cooking oil, alcohol 90%, battery, clear plastics, and 30 plywood (40x40cm).

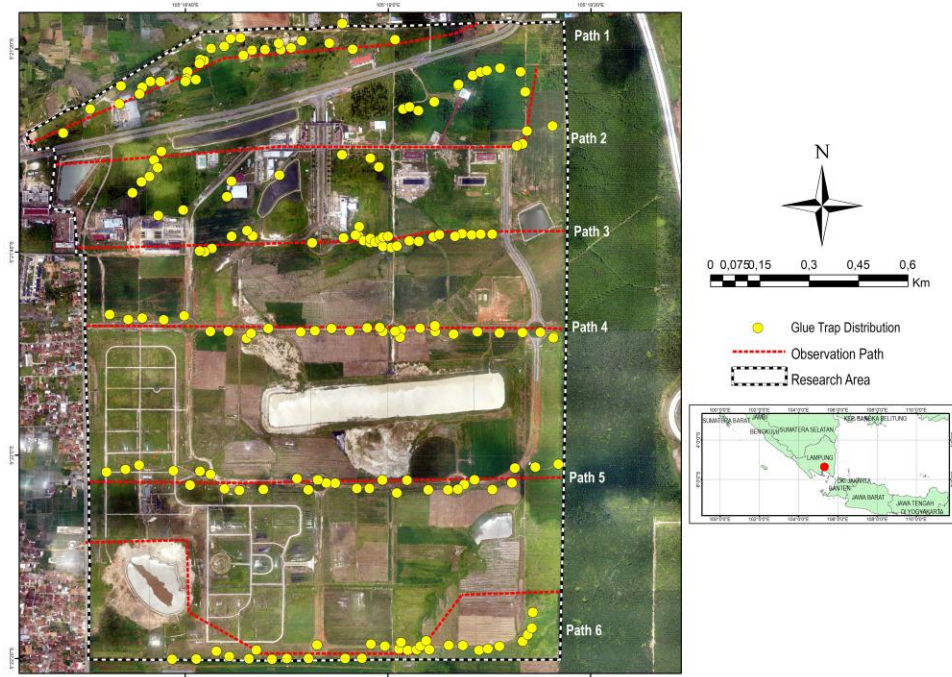


Figure 1 ITERA Campus area, observation path, and trap distribution

The study used two data collection methods, i.e., Visual Encounter Survey (VES) With Time Constraint Method and Glue Trap. VES method is a direct encounter method in the observation path (Kusrini 2019). The observation was done by slowly walking down through the transect to find reptiles and amphibians within two hours (19.30-21.30 WIB). The repetition was done on the following day for as many as two repetitions. The data recording was carried out the collected species, activity, substrate, and coordinates.

Trap method was applied to get herpetofauna that were difficult to catch actively (Kusrini 2019). Glue trap was used to trap several lizards that were hard to catch (Fitch 1992). The glue trap was 40x40cm plywood covered with glue and was displayed when the sun rose and was checked before noon. The glue traps were put along the observation path in which the location was possible to be in concordance with the microhabitat of most reptiles active during the day. Thirty traps were distributed on each transect; so there were 180 traps were spread all over the available transects. The trap installation was repeated twice on each transect.

The analysis of herpetofauna distribution was done by analyzing coordinate point with Arc-Map processed program license organizational account of Lea\_Itera and organization name of Esri Indonesia Smart Community. Ecology index analysis includes species diversity, species evenness, Margalef species richness, Jackknife species richness, species abundance, and community similarity. Species diversity is an expression that connects number of species to the number of individuals, while evenness index is to identify the community evenness (Kusrini 2019).

- a. Shannon-Wiener Species Diversity Index (Magguran 1988)

$$H' = - \sum pi \ln pi$$

Description:

H' = species diversity index;  
pi = Abundance value (ni/Ni)

- b. Species Evenness Index (Magguran 1988)

$$E = \frac{H'}{\ln S}$$

Description:

E= Degree of species evenness;  
S = Number of species found

- c. Species richness index (Magguran 1988)

$$Dmg = \frac{S - 1'}{\ln N}$$

Description:

Dmg= Margalef species richness index;  
N= Number of individuals found

- d. Jackknife species richness index (Heltse and Foster 1983)

This index is used to estimate the total richness in observation location.

$$S = s + \left( \frac{n - 1}{n} \right) (k)$$

Description:

S= Jackknife species richness index;  
s= number of species found;  
n= number of observation path;  
k=number of species found only in one observation path.

e. Species abundance

$$K = \frac{ni}{pi \times ti}$$

Description:

K= species abundance;

ni= number of individual type-I;

pi= number of observers;

ti= length of observation time.

f. Community similarity

The composition similarity of herpetofauna community was calculated by applying the Jaccard similarity index using the PAST 3.14 program.

## RESULT AND DISCUSSION

### 1. Species Composition and Herpetofauna Species Diversity

This study found 22 herpetofauna species that consist of 9 amphibian species and 13 reptile species (Table 1). The amphibian found was 441 individual of 5

families. As much as 109 individuals from 9 families of reptiles were found in this study. Most IUCN conservation status of herpetofauna species is Least Concern (LC) and Not Evaluated (NE) which meant it still had a safe population. Only one reptile was determined to have Vulnerable (VU) and Appendix II CITES conservation status, i.e., *Siebenrockiella crassicollis*. According to Fauzi et al. (2020) *S. crassicollis* species is one of three freshwater turtles exploited in large-scale in South Sumatera and Central Kalimantan to be consumed, processed into medicine, and to be kept as pet. The other two species with CITES II trading status were *Naja sumatrana* and *Malayopython reticulatus*. *N. sumatrana* was included into CITES appendix II trading list because it was mostly for its skin and as live specimens (UNEP WCMC 2007). According to Murray-Dickson et al. (2017), *M. reticulatus* is the most traded species for fashion industry needs and therefore it is included into CITES appendix II.

Table 1 Herpetofauna species in ITERA campus area.

No.	Name of species	Family	IUCN	CITES	Number of individuals found
<b>Amphibian</b>					
1	<i>Duttaphrynus melanostictus</i>	Bufonidae	LC	-	119
2	<i>Ingerophrynus biporcatus</i>	Bufonidae	LC	-	7
3	<i>Fejervarya wasl</i>	Dicroglossidae	NE	-	12
4	<i>Occidozyga lima</i>	Dicroglossidae	LC	-	11
5	<i>Kaloula baleata baleata</i>	Mycrohylidae	NE	-	2
6	<i>Bijurana nicobariensis</i>	Ranidae	LC	-	84
7	<i>Fejervarya cancrivora</i>	Ranidae	LC	-	128
8	<i>Hylarana erythraea</i>	Ranidae	LC	-	55
9	<i>Polypedates leucomystax</i>	Rhacophoridae	LC	-	23
<b>Reptile</b>					
1	<i>Calotes versicolor</i>	Agamidae	NE	-	19
2	<i>Ahaetula prasina</i>	Colubridae	LC	-	4
3	<i>Dendrelaphis pictus</i>	Colubridae	NE	-	12
4	<i>Lycodon capucinus</i>	Colubridae	LC	-	2
5	<i>Ptyas korros</i>	Colubridae	NE	-	1
6	<i>Bungarus candidus</i>	Elapidae	LC	-	2
7	<i>Naja sumatrana</i>	Elapidae	LC	II	1
8	<i>Hemidactylus frenatus</i>	Gekkonidae	LC	-	25
9	<i>Siebenrockiella crassicollis</i>	Geoemydidae	VU	II	1
10	<i>Takydromus sexlineatus</i>	Lacertidae	LC	-	20
11	<i>Malayopython reticulatus</i>	Pythonidae	LC	II	1
12	<i>Eutropis multifasciata</i>	Scincidae	LC	-	19
13	<i>Varanus salvator</i>	Varanidae	LC	-	2

Description: Least Concern (LC), Not Evaluated (NE), Vulnerable (VU)

The results showed that the dominant family in amphibian class was Ranidae and Bufonidae (Figure 2). There were 267 individuals from Ranidae class. Iskandar (1998); and Irham et al. (2012) state that Ranidae is the widespread family in Indonesia, hence, many of it are found in ITERA area. Bufonidae was the second dominant family from amphibian class found in research location, which was 126 individuals. This is in accordance with the research conducted by Kurniati (2008) which states that Bufonidae family can be found in places interrupted by human activities.

The dominant families of the reptile class that were successfully found were Gekkonidae and Lacertidae. Gekkonidae is a dominant family from reptile class with 25 individual species. This also supports the statement of Eprilurahman (2012) who says that Gekkonidae family is a cosmopolite family and can be found around the area of human activity. Lacertidae family is family with 20 individuals. Lacertidae family are widely found because this species lives in plantation and shrubs (Mistar 2008). This suits the habitat condition in ITERA which is dominated by shrubs, and some parts of the habitat are the community's plantation.

The herpetofauna species diversity (H') in ITERA area was 2.29; species evenness (E) was 0.74; and species richness was 3.33. The index of species diversity, evenness, and richness was the first data taken from ITERA area and could be used to compare other results of time series research in the future. Any kind of construction in ITERA would affect the habitat. Kusri (2009) says that species richness can increase by the increased habitat diversity. The herpetofauna species abundance (individual/hour of observer) in ITERA is

shown in Figure 3. The amphibian class with the highest species abundance was *Fejervarya cancrivora* by 1.78 individual/hour of observer. While the highest species abundance in reptile class was *Hemidactylus frenatus* by 0.35 individual/hour of observer.

*F. cancrivora* has high abundance because this species is highly tolerant and adaptive to disturbance (Kurz et al. 2016). Iskandar (1998) agrees that *F. cancrivora* is a frog species often found in paddy field and swamp ecosystems, also near rivers and distributed from lowland to high land by 900 height above sea level. This species is also often found in paddy fields and swamps (Kurniati and Sulistyadi 2017). Paddy fields can be found in some locations in ITERA, especially in path 1. There are also swamps in this area that support the existence of this species.

*Hemidactylus frenatus* was reptile with the highest abundance found in the research area. *H. frenatus* was found in ITERA area on trees and usually trapped in glue trap. A research conducted by McKay et al. (2009) finds a similarity that *H. frenatus* species is often found on trees. This species spreads in tropical and subtropical area, including Asia (Goris and Maeda 2004).

The VES method research took 12 days. The data analysis results of addition of species from 12 observations could be seen in Figure 4. Species addition graphic at the beginning of the study tended to increase constantly to day-9 and stuck at day-12. This showed that no more species was found in the research location (ITERA). By calculating the number of species estimation using the Jackknife, the number of herpetofauna in ITERA was 27 species. This still allows the addition of species in ITERA campus area

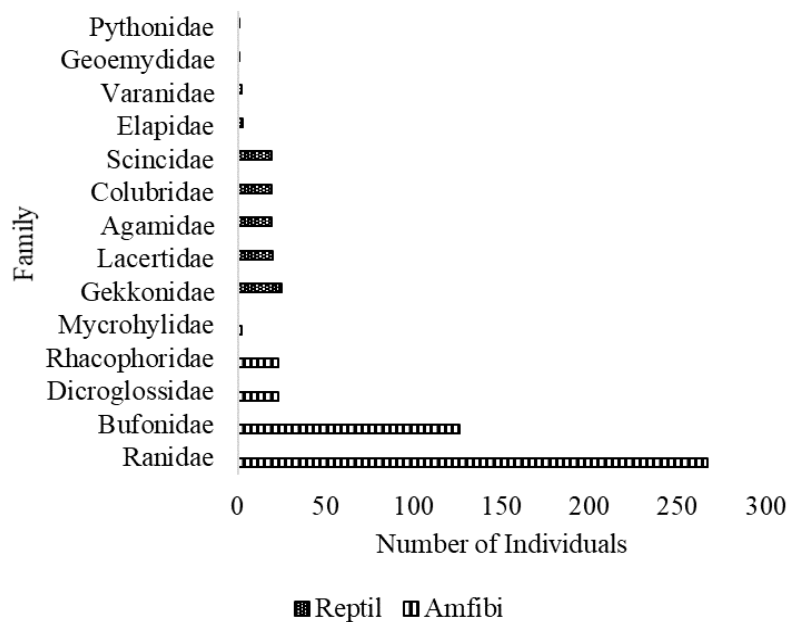


Figure 2 Comparison of the number of individuals of each family

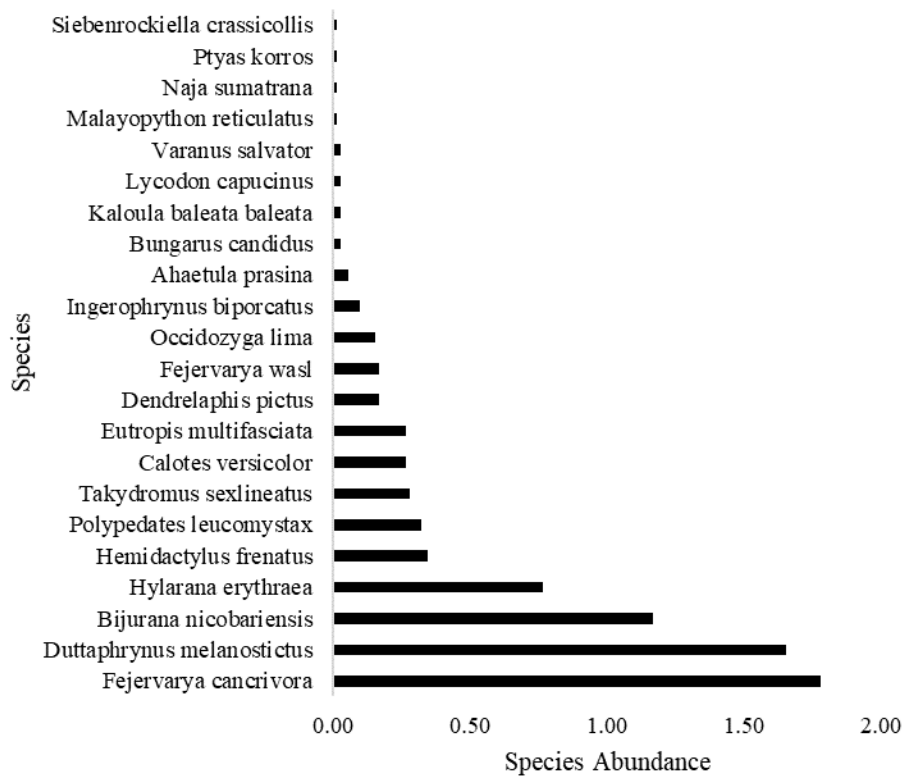


Figure 3 Herpetofauna species abundance (Individual/hour of observer)

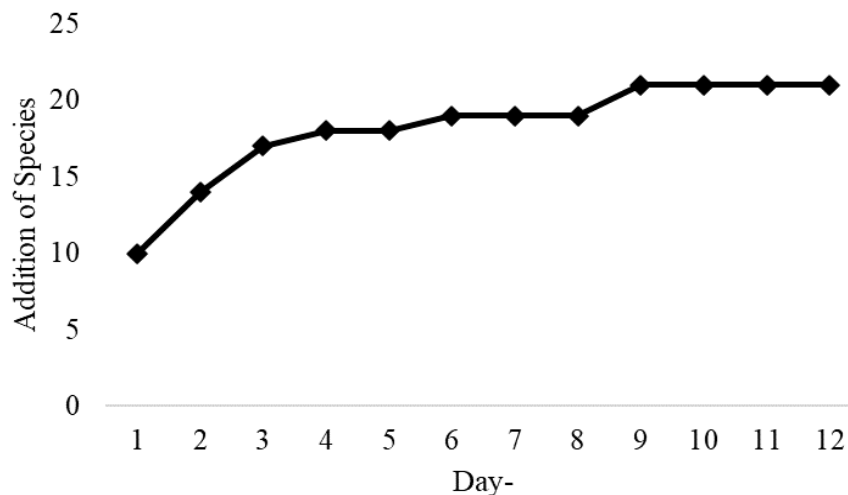


Figure 4 Addition of herpetofauna per-observation day

**2. Herpetofauna Distribution on Each Observation Path**

The ITERA area has open habitat condition. There are six permanent transects that are utilized to monitor the wildlife in ITERA, including herpetofauna. Path 1 is bordering the community's plantation, rivers, paddy fields, swamps, and mixed garden. Path 2 is high in activity and comes with arboretum forest and swamp areas. Path 3 has the most swamps, river flow, and

shrubs. Path 4 and 5 have similar condition which are dominated by road access area and come with only one swamp on each path. Path 6 is located in the research area border; it has river flow, swamp, and shrubs. The herpetofauna research results in all paths found 550 individuals (Figure 5).

The analysis results of species distribution on each observation path showed that path 1 had the most species by 15 species. Path 3 and 5 had 14 species, path 2, 4, and 6 had 13 species (Figure 6). The difference of species



distribution on each path is insignificant; this indicates that the habitat condition in ITERA tends to be the same and supports the herpetofauna distribution. Path 1 comes with the most species as it is the only path with diverse combinations, such as river, paddy field, swamp, shrubs, and mixed garden. In addition, it also has the least human activity.

There were eight herpetofauna (3 reptiles and 5 amphibians) found in all paths (Figure 6). The reptile species that could be found in all observation paths were *Eutropis multifasciata*, *Takydromus sexlineatus*, and *Hemidactylus frenatus*. *E. multifasciata* and *T. sexlineatus* were often found in shrubs area in ITERA and often caught in glue trap. These two types are cosmopolite and can live in open and disturbed area (Qurniawan et al. 2012). *H. frenatus* is the most found

reptile and often found on trees and in shrubs that support their live (McKay et al. 2009).

This study found six species that could only be found in one observation path. *Malayopython reticulatus* and *Naja sumatrana* (path 1); *Kaloula baleata* (path 2); *Siebenrockiella crassicollis* (path 3); *Bungarus candidus* and *Ptyas korros* (path 5). If seen through community similarity index analysis between paths using Jaccard index, path 4 and 5 had the highest community similarity level, which was by 80% (Figure 7). Path 4 and 5 had the highest community similarity because both paths had relatively similar habitat condition, which was dominated by road access with 1 swamp. Path 1 had the least similarity index because it came with diverse habitat condition compared to other paths. Thus, the herpetofauna was more varied than the other paths.

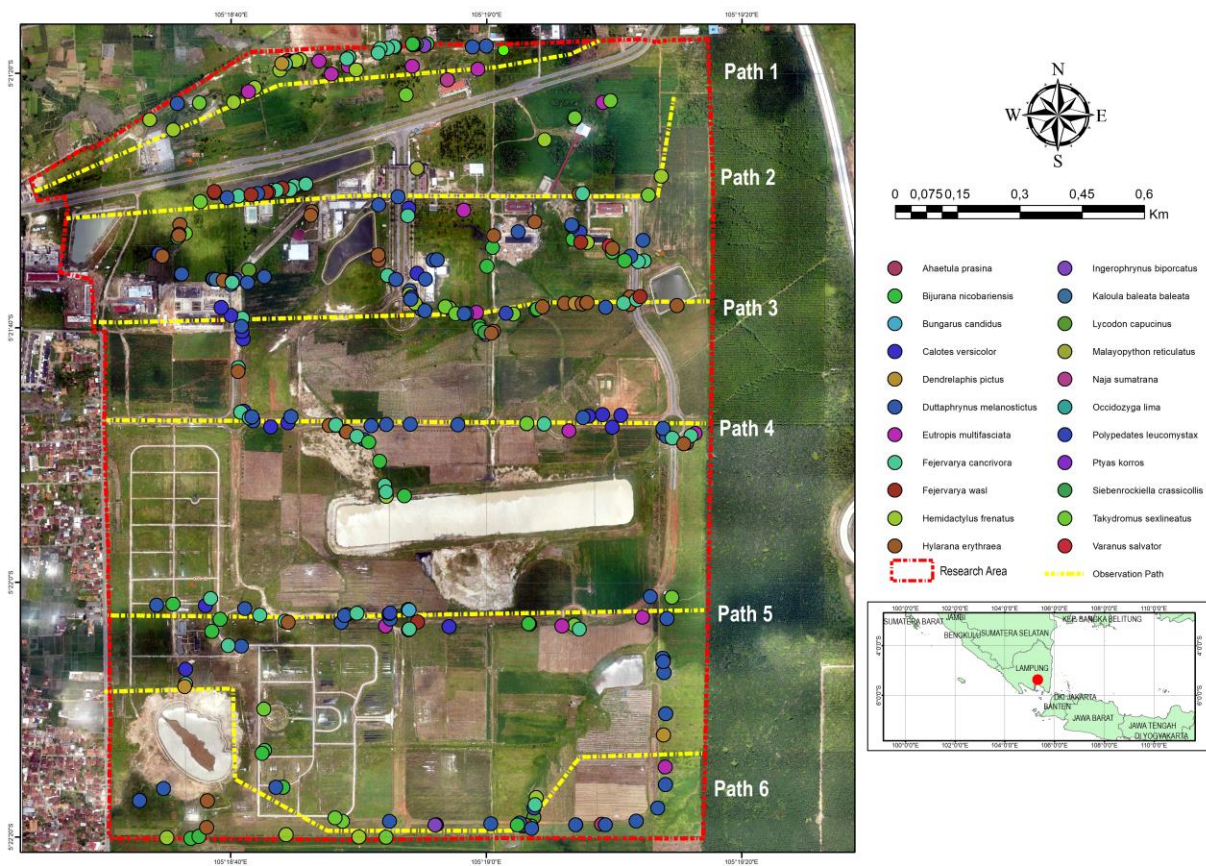


Figure 5 Distribution of herpetofauna encounters in ITERA area



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