

VARIOUS VEGETATION MODIFIES THE DIVERSITY OF HERPETOFAUNA IN WONOSOBO AGRICULTURAL LANDSCAPE

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ABSTRACT

Human population growth has rapidly conversed the natural environment into agricultural and plantation area in Indonesia. This phenomenon resulted a reduction and fragmentation habitats, and led to the loss of biodiversity. By exploring Wonosobo, we were able to analyse the herpetofauna composition on three different habitat, including river, salak plantation [*Salacca zalacca* (Gaert.) Voss], and paddy fields. We identified 17 species (60,7%) from river, 15 species (53,6%) from paddy field, and 13 species (46,4%) from salak plantation. Shannon-wiener index diversity (H') categorized herpetofauna diversity in all three habitats as medium. Meanwhile, the evenness index (E) showed that herpetofauna community in river classified as unstable ($E=0.7302$). River was predicted be functioned as transit area for herpetofauna to hunt. There were no herpetofauna species predominating all three habitats, and this indicating that the ecosystem balance was well preserved. This study revealed that agriculture and plantation area affected the herpetofauna composition, yet it still able to maintain the diversity well. In addition, the water bodies, including river and irrigation in agriculture and plantation area, should be maintained its quality as it plays an important part in herpetofauna conservation.

Keywords: *fragmentation, herpetofauna composition, habitat*

1. INTRODUCTION

Human activities are proven to give a profound impact on the environment. Many natural environments have been converted into urban or rural area, and for infrastructure and

agricultural development, and consequenced on the survival rate of organisms. An intensive and massive agriculture aimed at fulfilling a larger scale production will result an area fragmentation and vegetation reduction. Therefore, agriculture is now estimated to be the main causes of biodiversity loss (Foley et al., 2005).

Indonesia is known to be one of the largest agricultural country, hence the society depends their life on the agriculture and plantation yields. On the other hand, land clearing aimed for agricultural and plantation development becomes a profound problem for the diversity of animals and plants. Previous studies has been conducted to analyse the impact of land conversing by human towards biodiversity. However, study on herpetofauna diversity affected by land conversing is still rarely conducted (Driscoll, 2004; Berry et al., 2005; Ribeiro et al., 2009), most studies focused on birds (Donald et al., 2001; Verhuist et al., 2004, Atkinson et al., 2005, Wretengerger et al., 2006) or mammals (Smith et al., 2005; Heroldová et al., 2007).

Amphibians and reptiles are distributed widely in the tropical area. It has a high density and an important ecological role (Whitfield and Donnelly, 2006). Moreover, some species of amphibians and reptiles could also be bioindicator of environmental change as they are generally more sensitive to environmental change compared to mammals and birds, although some of them are known to be highly tolerant (Stuart et al., 2004). However, there is a current trend of global declining on herpetofauna diversity (Lips et al., 2005). Therefore, the main objective of this study is to explore the diversity and abundance of

amphibians and reptiles in 3 different habitats: river irrigation, salak plantation, and paddy fields.

2. METHODS

Study was conducted on 3-8 October 2015 in Wonosobo Regency, Central Java Province. Visual Encounter Survey (VES) was applied on three different habitats: (1) river, irrigation area with vegetation grows along its track; (2) salak plantation [*Salacca zalacca* (Gaert.) Voss] which has silk tree (locally known as sengan tree), *Albizia chinensi* (Osbeck) Merrill, and lots of litter; and (3) paddy field adjacents to plantation and settlement area. Identification and determination of amphibian's taxonomy followed Iskandar (1998), while for reptiles followed Das (2015) and Iskandar and Coljin (2001). The observation data was analyzed using Shannon-wiener diversity index (Magurran, 1988), evenness index, simpson diversity index, and dominance. Furthermore, data was analyzed using PAST software to determine the habitat

preference of each snake species.

3. RESULTS AND DISCUSSION

This study recorded fifteen herpetofauna families, which was consisted of 5 amphibian families and 10 reptile families, with 28 species (13 amphibians and 15 reptiles). According to the observation result, river area has the highest species richness value (17 species; 60,7%), followed by paddy field (15 species; 53,6%), and salak plantation (13 species; 46,4%). This study showed that river has the highest species richness due to its variation of habitat types compared to the other two sites. This result was in accordance with those stated by Riyanto (2010) that there is a decrease in species richness in line with the canopy openness and homogenous habitat.

Some species of frogs were recorded on the banks of streams, such as *Huia masonii*, *Hylarana chalconota*, *Hylarana nicobariensis*, *Polypedates leucomystax*, *Limnonectes*

Table 1. List of herpetofauna observed in Wonosobo agricultural landscape. Keys: S=River, SK=Salak Plantation, SW=Ricefields. We configure the species conservation status by IUCNredlist.org. Key: V=Vulnerable

Family	Scientific name	S	SK	SW
Ranidae	Javan Torrent Frog <i>Huia masonii</i> V	2	3	2
	White-lipped Frog <i>Hylarana chalconota</i>	17	1	1
	Cricket Frog <i>Hylarana nicobariensis</i>			1
Bufonidae	Rough Toad <i>Phrynoides aspera</i>	5		
Dicroglossidae	Pointed-tongued Floating Frog <i>Occidozyga lima</i>			6
	Pygmy Creek frog <i>Limnonectes microdiscus</i>	2		
	Large-headed Frog <i>Limnonectes kuhlii</i>	3		
	Stone Creek Frog <i>Limnonectes macrodon</i> V	3		2
	Rice Field Frog <i>Fejervarya cancrivora</i>		1	2
	Indian Rice Frog <i>Fejervarya limnocharis</i>		3	3
	Javan Chorus Frog <i>Microhyla achatina</i>		5	2
Microhylidae	Palmated Chorus Frog <i>Microhyla palmipes</i>		1	1
Rhacophoridae	White-lipped Tree Frog <i>Polypedates leucomystax</i>	2	1	2
Scincidae	Javan Sun Skink <i>Eutropis multifasciatus</i>	4		3
	Christmas Island Grass-skink <i>Lygosoma bowringii</i>	4	1	1
	Rough Mabuya <i>Eutropis rudis</i>		2	
Lacertidae	Six-striped Long-tailed Lizard <i>Takydromus sexlineatus</i>		1	
Agamidae	Maned Forest Lizard <i>Bronchocela jubata</i>	4	4	
	Chameleon forest dragon <i>Gonocephalus chamaeleonticus</i>	2		
Gekkonidae	Tokay gecko <i>Gecko gekko</i>	1		
Colubridae	Marbled bow fingered gecko <i>Cyrtodactylus marmoratus</i>	4		
	Indonesian Bronze-back <i>Dendrelaphis pictus</i>	1	3	
	Oriental Whip Snake <i>Ahaetulla prasina</i>	3		
Natricinae	Checkered Keelback <i>Xenochrophis piscator</i>	3		2
Xenodermatidae	Rough-backed Litter Snake <i>Xenodermus javanicus</i>	1		
Elapidae	Banded krait <i>Bungarus fasciatus</i>		1	
Viperidae	White-lipped pit viper <i>Cryptelytrops albolabris</i>			1
Calamariidae	Red-headed Reed Snake <i>Calamaria schlegeli cuvieri</i>			1

macrodon, *Limnonectes kuhlii*, and *Limnonectes microdiscus*. While the other species were found at paddy field and salak plantation, including *Fejervaria limnocharis*, *Fejervaria cancrivora*, *Occidozyga lima*, *Microhyla achatina* and *Microhyla palmipes*. This finding was in line with Iskandar and Mumpuni (2004) who stated that *Microhyla achatina* and *Microhyla palmipes* are usually found at the paddy field and plantation area located near water resources. On the other hand, *Fejervaria cancrivora* and *Occidozyga lima* are known to live at the paddy fields and rarely found in the river area, although it usually can be found not far from the river (Kusrini, 2013).

Several reptiles, such as *Eutropis multifasciata*, *Lygosoma bowringii*, *Eutropis rudis*, and *Takydromus sexlineatus*, were mostly found on the forest floor, yard of houses and gardens covered by leaf litter. Therefore, reptiles were mostly found in the salak plantation area during the observation. Gekkonidae family, such as *Gekko gecko* and *Cyrtodactylus marmoratus*, was found in forests and on stones near the river. Other reptiles, such as *Dendrelaphis pictus*, *Ahaetulla prasina*, *Xenochropis piscator*, and *Xenodermus javanicus*, were commonly found at the river area.

The differences in the number of species and abundance in each region were predicted to be affected by the differences in environmental conditions and the surrounding vegetation. Abiotic factors, such as water, have an important role in maintaining the humidity that benefits several species of herpetofauna, such as amphibians. Frog fertilization is generally accomplished externally or outside the female's body, so the presence of water is important during the reproduction process. Therefore, most species of frogs require water for embryonic and tadpoles development (Riyanto and Trilaksono, 2012). For example, *Microhyla achatina* lays eggs at the puddle, slow-flowing streams, and pond edges (Iskandar and Mumpuni, 2004).

The differences in the index values in each site indicated that there is a differences in the species and abundance of each species (Table 2). Species diversity shows the number of species and abundance of individual of each species found in the location. Generally,

species diversity (H') is represented by diversity and evenness index ϵ . According to the Shannon-Wiener diversity index, paddy field has the highest diversity index value (2,546), followed by river site (2,519) and salak plantation (2,375). This result indicates that the diversity index value of amphibians

Table 2. Diversity index in each habitat

Index	S	SK	SW
Shannon-Wiener Diversity Index (H')	2,519	2,375	2,546
Evenness (E)	0,7302	0,8269	0,8503
Simpson Diversity Index	0,8836	0,8916	0,9067
Dominance (d)	0,1164	0,1084	0,0933

and reptiles in agricultural wonosobo is categorized as moderate. This category indicates that the species of amphibians and reptiles lived in those area are able to adapt in different habitats.

The dominance index value of river, salak plantation, and paddy field sites were 0,1164; 0,1084, and 0,0933; respectively. This value represents a low dominance in all three sites and indicates an evenly distributed species abundance.

In contrary, the evenness value of river site was categorized as unstable (0,7302), while salak plantation and paddy field sites have a stable evenness values (0,8269 and 0,8503, respectively). An unstable condition indicates that species lived in that area is not native or just temporarily transit to search for food.

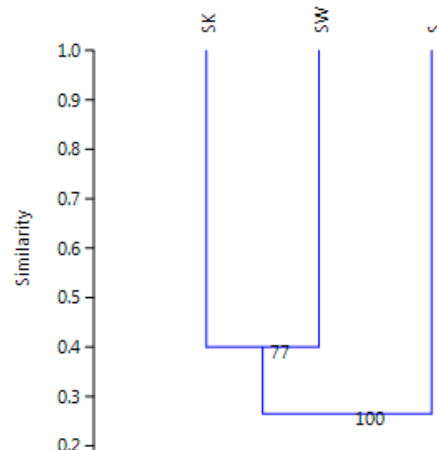


Figure 1. Sites similarity based on Jaccard Index with UPGMA.

The result of sites similarity based on the presence of herpetofauna species indicating that river site was separated from the paddy field and salak plantation area. The fauna composition between salak plantation and paddy field has greater similarity compared to river site. This is probably the result of different environmental condition, such as water and air temperature, and vegetation types in each region.

3. CONCLUSION

The species richness, especially amphibians and reptiles, in a habitat were mostly affected by the presence of water bodies. Therefore, maintaining the quality of water flow, both small stream or irrigation system in the agricultural and plantation area, is essential for the community stability and ecosystem balance.

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