Anuran assemblage on forest edges in Datu Salumay, Davao City, Philippines

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ABSTRACT

Forest fragmentation due to anthropogenic encroachment has been associated with changes in abiotic conditions known as edge effect. This condition plays a major role in the amphibian decline globally. A five-day sampling in a regenerating forest of So. Maharlika, Barangay Datu Salumay, Marilog District, Davao City, Philippines was conducted to test effect of forest edges on a local forest. Visual encounter technique was employed surveying quadrats (10 x 10 meters) established along a main transect (1 km long). The first 500 meters of the main transect served as the edge while the rest constituted the forest interior. Data on canopy cover, termperature, and humidity from each site were contrasted with species endemism and diversity to determine influence of differing edge and forest interior conditions. Eight species of frogs were captured: five belongs to the Family Rhacophoridae and one species each belong to the Families Megophryidae, Microhylidae, and Dicroglossidae. No significant difference was noted of the data on canopy cover, temperature, and humidity in both forest edge and interior. Six anuran species were accounted each in the forest edge and interior, although more endemic species were recorded from the forest interior. Current results maybe suggestive of the possible impact of edges on anuran species although more data is required to validate this claim.

Keywords: *Anurans*, *Edge effects, Habitat Fragmentation, Marilog District.*

INTRODUCTION

Deforestation is identified as the most pervasive and deleterious process resulting to pronounced forest fragmentation and edge (Skole & Tucker, 1993; Murcia,1995; Gascon,Wiliamson, and da Fonseca, 2000). Effects of such activity include susceptibility of forests area to wildfire (Cochrane & Laurance, 2002; Alencar, Solorzano, and Nepstad, 2004) and hastened tree mortality leading to changes in plant and animal species composition (Tabanez & Viana, 2000; Cushman, 2006; Barlow et al., 2007). It plays an impertative role in the persistence of fragmented landscapes (Laurance, 1999) thus has the potential to reduce the amount of suitable 'core' habitat for interior species which could lead them to extinction. Edge effects covers biotic and abiotic changes as a result of the interaction between two different habitat types (Murcia, 1995). Organisms living in forest edges are most suceptible to

changes such as increased wind and solar radiation, frequent fluctuations in temperature, and decreased humidity (Murcia, 1995; Stevens & Husband 1998; Harper et al., 2005).

Changes in vegetation structure and microclimate in forest edges is a significant factor affecting abundance and diversity of diffrent organisms (Schaepfer& Gavin 2001; Jellinek, Driscoll, and Kirkpatrick, 2004; Urbina-Cardona, Olivares-Peres, and Reynoso, 2006) specifically anurans, the focus of this study. Edges can affect anurans due to their sensitive physiological processess which can be easily affected by environmental changes (Vallan, 2000; Lehtinen, Ramanamanjato, and Raveloarison, 2003) given its morphological characteristics, reproductive patterns and selective habitat behavior (Vallan, 2000).

Studies on the impact of forest fragmenation in the Philippines appear to be not a first hand priority for there seems to be scanty data available (Alcala, Alcala, and Dolino, 2004; Gardner, Barlow, and Peres, 2007). Given the high rate of amphibian diversity and the increasing massive threats of forest conversion and fragmentation in this region, there appears to be an urgent need to assess impact of forest edges on anuran diversity , especially endemic species, given their dependence on forest habitats. One potential site to assess impact of forest edges among anuran species is a forest patch in Barangay Datu Salumay, Davao City, situated in the southern part of the Philippines. Published study on effect of forest edges on anurans species in the site is not available. Moreover, anthropogenic activities is quite rampant in the area and so other pertinent information regarding threats to anuras species could possibly be documented.

METHODS

Study site

The survey was conducted in a forest patch of Sitio Maharlika, Brgy. Datu Salumay, Marilog District, Davao City, Philippines (Fig. 1). This area belongs to the 3rd congressional district of the city and about two hours away from downtown area. The sampling was done duringthe first week of January 2014. A Prior Informed Consent was obtained from the Barangay before actual sampling.

Figure 1. Map of Brgy. Datu Salumay, Marilog District, BUDA, Davao, Philippines [Source:wikimapia.org/25926279/Datu-Salumay]

Sampling technique

A 1000-m long transect from the start of the forest, close to the nearest clearing until the entire 1000-m was established. This served as the main transect line for the main quadrat with 90 meters width (45 meters on each side). Ten 10m x 10m quadrats were stationed in the center of the vertical transect line in a 90-meter interval. In each quadrat stationed in the center, two 10m x10m quadrats were stationed in both sides with a 10-meter horizontal distance. A total of 50 quadrats were established in the sampling site, 25 quadrats per area (Fig. 2).

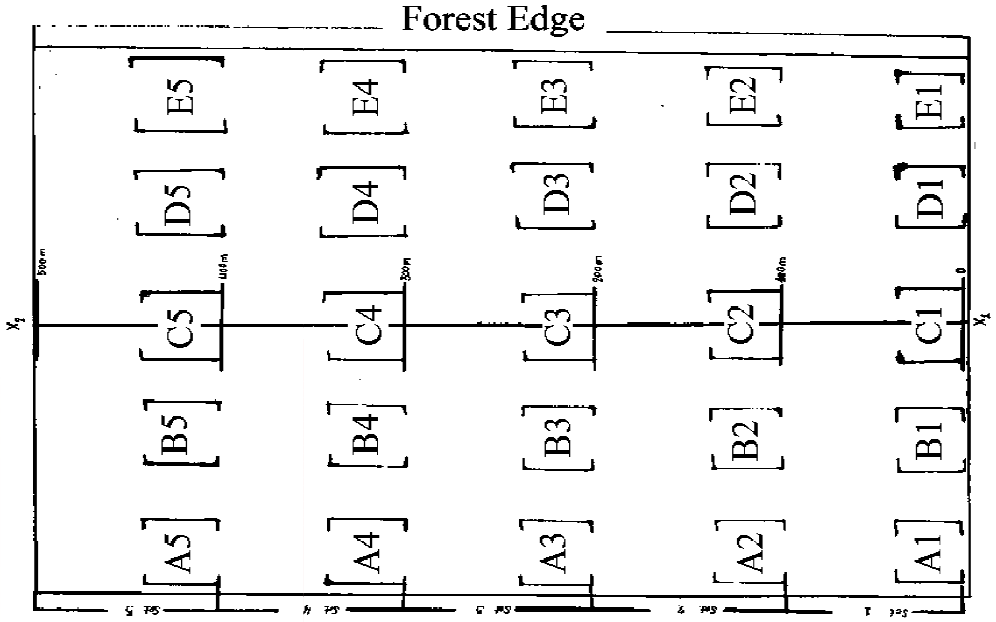

Figure 2. Diagram of transect lines and quadrats that were established in the forest interior and forest edge of sampling site

Humidity, temperature and canopy cover were measured in each 100m of the main transect. Humidity and temperature readings were obtained every 6:00 AM, 12:00 Noon and 8:00 PM. Canopy cover was measured using an improvised densiometer and observations were reported as open canopy (10-39% of the sky is covered with trees), moderately closed canopy (40-69% is covered with trees), and closed canopy (70-100% of the sky is covered with trees). Frog individuals encountered within each of the quadrats were handpicked, biometrics measured, photographed and released after. Simpson's Diversity and Shannon-Weiner Diversity Indices were used to measure diversity in forest edge and interior.

RESULTS AND DISCUSSION

Species composition of frogs in the forest edge and forest interior

Eight species of frogs (49 individuals) were accounted in the area after five days sampling. There were five (5) representative species from Family Rhacophoridae and one representative species from Families Megophyridae, Microhylidae and Dicroglossidae (Table 1). Six species were encountered in the forest edge as well as in the forest interior. Two species: *Philautus* cf

poecilius and *Leptobrachium lumadorum* were encountered only in the forest interior site. Of the 49 individuals, twenty-one (21) were captured within the interior while the remaining twenty-eight (28) individuals were found within the edge. *Philautus acutirostris* was the dominant species captured in both sites followed by *Philautus surdus*. Both species belong to family Rhacophoridae, species under which are found in high elevation forests such as montane and mossy (Biju, Roelants, and Bossuyt, 2008; Hertwig et al., 2012). This is possibly the reason why both areas are dominated by aforementioned species since elevation in the forest edge (1226.032 masl) and forest interior (1230.592 masl) is high. *Philautus acutirostris* was the most encountered species and has the highest number of individuals in edge for the reason that they have an apparent tolerance to disturbance (Delima, Ates, Ibañez, 2006).

Table 1. Species composition, endemism and conservation status of frog species captured in the forest edge and forest interior in Datu Salumay, Davao City, Philippines

SPECIES COMPOSITION

Species	Forest edge	Forest interior	Total
Family Rhacophoridae			
Philautus acutirostris **(VU, PE)**	□□(15)	□□(11)	26
Philautus surdus **(LC, PE)**	□□(8)	□□(3)	11
Philautus cf leitensis	□□(1)	□□(2)	3
Philautus cf worcesteri	□□(1)	□□(3)	4
Philautus cf poecilius	□ x□□	□□(1)	1
Family Megophryidae			
Leptobrachium lumadorum **(DD, PE)**	□ x	□□(1)	1
Family Microhylidae			
Kalophrynus sinesis **(LC, NE)**	□□(2)	X	2
Family Dicroglossidae			
Limnonectes cf magnus	□□(1)	□□x□□	1
Total	28	21	**49**

Legend: □= present; × = absent; ( ) = number of individuals; **Endemism: PE=** Philippine Endemic; **MFRE=** Mindanao Faunal Region Endemic; **NE=** Non-Endemic; **Conservation Status: DD=** Data Deficient; **LC=** Least Concern; **NT=** Near Threatened; **VU=** Vulnerable

More endemic species were recorded in the forest interior (50%) than in the forest edge (33.33%). Current data may support the Philippine's high degree of endemism of about 78.5%, and is likely to increase to about 80% when more new species are described formally, following the lineage species concept (Brown *et al*. 2013). The big difference in the percent endemism of the forest interior with that of the forest edge can be due to the high tolerance of non-endemics to disturbance that are associated with the forest edge (Relox, Leano, and Camino, 2010) and low tolerance of forest dependents and most endemic species to disturbance (Jenkins et al., 2003; Scott et al., 2006).

Physical conditions in the forest edge influencing frog assemblage

About 60% of the canopy in the forest edge was not obstructed by trees compared to the forest interior which was 80% covered. However average readings of humidity and temperature for both sites appear very similar though fluctuations were also observed (Table 2). The bigger section of the forest edge sampled was devoid of tree cover and appears to be a by-product of activities leading to forest fragmentation in the site. The similarity of the temperature and humidity could be attributed to the absence of geographical barrier between the sampling sites.

Table 2. Record of biotic factors in the forest edge and forest interior and computed diversity indices values

Transect Number	Temperature	Humidity	Canopy Cover	Diversity Index (Simpson's Value)	Diversity Index (Shannon-Weiner Value)
Forest Edge	19.5^{0}C	88.9%	Open Canopy	0.37755102	0.53758129
Forest Interior	19.52^{0}C	88.64%	Closed Canopy	0.328798186	0.61173801

Topographical differences can affect distribution by acting as barriers. Mountain terrains, for instance, can limit the spread of animals and plants by separating potential habitats or by the provision of unfavourable climates and substrate. Although species richness value for both forest edge and interior is relatively similar (each site has six species, four species are common to both sites), the diversity values are dissimilar possibly influenced mainly by canopy cover reduction in the forest edge. Forest edge, being close to the highway and thus being acccessible was possibly prone to various anthropogenic activities as evidenced by presence of locals collecting tree branches and twigs for firewood seen during the sampling period, and the input by the local guide that some trails are utilized by other locals during hunting season. All of these activities can contribute to canopy cover reduction which can affect the physiological needs of most anurans (Alcala and Custodio, 1995; Navas, 2002).

RECOMMENDATIONS

To augment data on effect of forest edges, we recommend that future studies must include other abiotic factors like elevation, vegetation type, and leaf litter conditions in the site. Increasing the number of sampling days across dry and wet seasons must also be done to enhance evaluation of edge effects on species diversity. We also suggest that forest fragements with similar conditions must also be surveyed to meliorate data on forest edge effects.

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