The Effects of Anthropogenic Land Use on the Distribution of Butterflies in Negros Oriental, Philippines

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The importance of distributional records for organisms lies in providing supportive documentation as the backbone for conservation planning. A distributional survey of diurnal butterflies was done in the province of Negros Oriental, Philippines to determine the effects of anthropogenic factors on the presence of butterflies in specific localities. One of the most important findings in the survey is that habitats along rivers and lakes provide the last refuge for some species of butterflies. The habitat heterogeneity caused by anthropogenic factors has resulted in the differences in species community and distribution in 16 areas of Negros Oriental examined during this study. The data that were gathered during the survey can be used for preliminary conservation assessments, especially for those species that were distributed in isolated forest patches.

Keywords: Butterflies, Anthropogenic Land Use, Philippines, Distribution

INTRODUCTION

Negros Island (composed of two provinces: Negros Occidental on the western part of the island and Negros Oriental on the eastern part) is located in the Visayas region (Central Philippines) along with other islands. Negros Oriental has a total human population of 1,231,904 (National Statistics Office, August 1, 2007).

It has a total land area of 5,402.30 km2 with 19 municipalities, 6 cities, and 557 barangays (villages or districts). Negros Island shares similar faunistic assemblages with Panay Island located on the western side of the country (PAWB, 1998). Historically, the Negros–Panay faunal region was one large island during the late Pleistocene (Heaney, 1986). It is also one of the areas in Central Philippines which has been designated as a top priority for conservation efforts (Heaney, 1993).

The Philippines is one of the countries in Southeast Asia that is experiencing high rates of deforestation (Achard et al., 2002). Therefore, it is included as a top priority listing for international conservation. Small islands are among the most significant hotspots for biodiversity conservation because of factors such as the rate of habitat loss (Myers, Mittermeier, Mittermeier, da Fonseca, & Kent, 2000). In 1875, the total forest cover of Negros Island was 77%, but this forest was reduced to 48% by 1949, to 24% by 1970, and to only about 3% (39,000 ha) by 1994 (Heaney & Regalado, 1998).

With the increased rates of anthropogenic factors in the Philippines, especially in Negros Oriental, extirpation and extinction of endemic or rare species remain undetectable because of the lack of a local species database and assessment of the current status of the taxa within the island.

Danielsen and Treadaway (2004) identified 14 priority sites for conservation (based on the occurrence of threatened butterfly species) in the Philippines, including Negros; but there is still a need for more areas to be prioritized. Insects like butterflies exceed other organisms in terms of number of species and abundance. There are 927 butterfly species and 939 subspecies in the Philippines, and more than one-third (377 or 40.7%) of them are endemic to this country (Treadaway & Schroeder, 2012). Most of these butterfly species are found on all of the islands, but because of anthropogenic land use, some of the species have limited ranges.

The specialist and territorial species, and their dispersal abilities, are restrained, and their populations are unstable (Fauvelot, Cleary, & Menken, 2006). It is therefore important to locate the areas with a great number of species of different taxa for priority in conservation efforts (Prendergast, Quinn, Lawton, Eversham, & Gibbons, 1993). With the increasing anthropogenic activity, generalist butterflies would tend to increase their populations while the specialist species will decline; the

stability of butterfly populations also depends on other environmental factors such as altitude, habitat fragmentation, and climatic variations (Kitahara, Sei, & Fujii, 2000).

Southeast Asian forests are one of the greatest areas of biodiversity and endemism in the world (Sodhi, Koh, Brook, & Ng, 2004). Dunn (2005) concluded that many insects would become extinct before documentation of the status of each could be accomplished. Since the Philippines is composed of more than 7000 islands with a wide variety of habitats and ecological features, the country requires a comprehensive biodiversity management plan (Alcala, 2004) based on accurate distributional databases. The study aimed to create a database of butterfly species in Negros Oriental and determine how anthropogenic factors affected their distribution, diversity, and abundance. The main objective of this study was to determine the effects of anthropogenic land use on the distribution of butterflies and including some important factors such as temperature. The diversity and richness were correlated against the HTC (Habitat Type Classification) and the distance to the existing priority site, which is the Cuernos de Negros (Mount Talinis).

MATERIALS AND METHODS

Since there are no available data on the distribution of the butterflies on Negros Oriental, it would be difficult to provide a conservation assessment and management plan without a factual base. Species which are observed to occupy different habitats will behave differently, depending on the landscape of the environment (Gardner et al., 2009). The distributional records of butterflies are very important in assessing the effects of urbanization (Hardy & Dennis, 1999), because they can be used in future assessments and comparative analyses. Slade and Turner (2003) made an inventory of butterfly species in North Negros Forest Reserve located in the northern part of Negros Island, but further comparable studies are lacking.

Hence in the present study, the survey and collection of butterflies were carried out in different types of vegetation and landscape by categorizing each site (points collected) using Habitat Type Classifications (HTCs): (1) forested areas, (2) forest fragments including riverbanks and lakeshores, (3) suburban areas, (4) urban areas, and (5) agricultural plantations. The

16 selected study areas were the following: Dumaguete, Tanjay, Bais, Santa Catalina, Siaton, Zamboanguita, Dauin, Bacong, Sibulan, Amlan, San Jose, Manjuyod, Ayungon, Tayasan, Cuernos de Negros (as a separate area), and Valencia (lower elevation sites since Cuernos de Negros is under its vicinity). Every site (specific location in an area or the points) that was surveyed and collected was recorded using Global Positioning System.

Butterfly species identification was initially done in the field, especially for those species that are protected and endangered based on the IUCN Red List of Threatened Species. The specimens that were collected were brought to the McGuire Center for Lepidoptera and Biodiversity, University of Florida, where they were prepared, labeled, and identified. The publications of Treadaway and Schroeder (2012), d'Abrera (1982, 1984, 1986), de Jong and Treadaway (1993, 2007, 2008), Page and Treadaway (2003), Schroeder and Treadaway (2005), Tsukada et al. (1982, 1985), Takanami and Seki (2001), and Okano and Okano (1988–1989) were used to identify collected specimens.

Field surveys and collections were conducted in Negros Oriental, from May to August 2012. These months represent the transitional period as the annual dry season turns to wet season. The duration of the fieldwork also depended on the accessibility of the sites, availability of transportation, and rain; thus, alternative sites were already planned in advance in case other sites were experiencing rain or other unexpected problems.

Butterflies were caught with nets with a 12-h/2-day sampling in each area, and bait traps (pineapple as the bait) were also used for frugivorous butterflies (three bait traps in random places in every area). The difficult part with bait traps is that some of them got stolen. The 12-h fieldwork was affected by distance and time of arrival to the specific field sites. The municipality of Manjuyod was the only area that was surveyed once because of the incoming weather conditions and the availability of field assistants. The landscape of Manjuyod is similar to Bais since these two areas are dominated by sugarcane plantation.

Specimens observed but not collected were recorded, as were endangered and protected species. The temperature readings were recorded by using the Lascar USB-2 Temperature and Humidity Loggers (Lascar Electronics Inc., PA, USA), which was carried during the survey.

Statistical analyses were done using Microsoft Excel 2013 and R

Statistical Software.

RESULTS

Distribution, Dissimilarity Diversity, and Richness

The butterfly distributional records are summarized in Table 1.

Table 1
Presence–Absence data of butterfly species in Negros Oriental. A — Mount Talinis, B — Valencia, C — Sibulan, D — San Jose, E — Amlan, F — Dumaguete, G — Bacong, H — Dauin, I — Zamboanguita, J — Siaton, K — Santa Catalina, L — Tanjay, M — Bais, N — Manjuyod, O — Ayungon, and P — Tayasan.

List of butterfly species recorded during the survey	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Arisbe decolor neozebraica Page 1987				+					+	+						
Arisbe eurypylus gordion Felder & Felder 1864						+										
Chilasa clytia visayensis Okano & Okano 1987				+												
Graphium agamemnon agamemnon Linnaeus 1758		+								+			+			
Graphium sarpedon sarpedon Linnaeus 1758	+	+		+	+						+					
Menelaides polytes ledebouria Eschscholtz 1821		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Menelaides deiphobus rumanzovia Eschscholtz 1821		+	+	+	+	+	+		+	+	+	+	+	+	+	+
Achillides palinurus daedalus Felder & Felder 1861			+							+		+				
Papilio demoleus demoleus Linnaeus 1758			+	+	+	+	+		+	+	+	+	+	+	+	+
Menelaides helenus hystaspes Felder & Felder 1862			+							+						
Troides rhadamantus rhadamantus Lucas 1835		+	+			+				+	+					
Appias phoebe montana Rothschild 1896	+															
Appias olferna peducaea Fruhstorfer 1910			+	+	+	+		+				+	+	+		+
Appias nephele? leytensis? Fruhstorfer 1911		+														

Appias lyncida lepidana Fruhstrofer 1910					+	+	+	+	+	+		+	+	+	+	
Catopsilia pomona pomona Fabricius 1775	+	+		+		+	+	+		+	+		+		+	+
Catopsilia pyranthe pyranthe Linnaeus 1758		+	+	+	+	+	+	+	+	+	+		+	+	+	
Catopsilia scylla asema Staudinger 1885		+		+	+		+		+	+						+
Cepora aspasia rhemia Fruhstofer 1910			+					+								
Cepora boiduvaliana negrosensis Okano & Okano 1991					+											
Delias hyparete luzonensis Felder & Felder 1862	+									+						
Delias henningia henningia Eschscholtz 1821			+				+	+		+						
Eurema alitha jalendra Fruhstorfer 1910		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Eurema hecabe tamiathis Fruhstorfer 1910	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+
Eurema sarilata risa Morishita 1981		+						+				+				
Eurema blanda vallivolans Butler 1883	+	+	+		+		+			+	+			+		
Hebomoia glaucippe boholensis Fruhstorfer 1911						+				+						
Leptosia nina terentia Fruhstorfer 1910		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pareronia boebera arsamota Fruhstorfer 1910		+	+	+	+	+	+	+		+						
Danaus melanippus edmondii Lesson 1837		+								+	+	+	+			
Danaus chrysippus chrysippus Linnaeus 1758			+	+	+	+		+	+	+						+
Cethosia luzonica pariana Semper 1888	+	+	+	+	+	+		+		+	+	+		+	+	
Cethosia biblis insularis Felder & Felder 1861			+			+		+		+						
Charaxes solon lampedo Hübner 1824						+										
Cupha arias arias Felder 1867		+							+	+		+				
Cyrestis maenalis negros Martin 1903	+	+	+	+												
Doleschallia bisaltide philippensis Fruhstorfer 1899										+						
Euploea tulliolus pollita Erichson 1834			+	+	+			+	+	+		+	+	+	+	+

Euploea blossomae corazonae Schroeder 1977	+															
Euploea mulciber kochi Moore 1883		+								+						
Euripus nyctelius sparsus Tsukada 1991		+														
Euthalia lusiada schoenigi Schroeder & Treadaway 1978			+													
Hypolimnas anomala anomala Wallace 1869		+														
Hypolimnas bolina philippensis Butler 1874		+		+	+		+	+	+	+	+	+	+	+	+	+
Hypolimnas misippus Linnaeus 1764				+				+	+			+				+
Ideopsis gaura canlaonii Jumalon 1971	+	+	+													
Ideopsis juventa manillana Moore 1883		+	+	+	+	+		+	+	+	+			+		
Junonia orithya leucasia Fruhstorfer 1912										+	+	+	+	+		
Junonia hedonia ida Cramer 1775	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Junonia atlites atlites Linnaeus 1763			+						+	+						
Junonia almana almanac Linnaeus 1758			+			+			+			+	+	+	+	+
Junonia lemonias janome Tsukada & Kaneko 1985													+	+		
Lasippa illigera hegesias Fruhstorfer 1912	+	+									+					
Lexias panopus ingae Schroeder & Treadaway 1987										+						
Lexias satrapes amlana Jumalon 1970	+		+													
Melanitis leda leda Linnaeus 1758			+						+	+	+			+		
Neptis mindorana ilocana Felder & Felder 1863		+	+	+	+		+	+		+	+					
Pantoporia dama dama Moore 1858											+					
Parantica vitrina oenone Butler 1865	+	+		+												
Parthenos sylvia philippensis Fruhstorfer 1898										+						
Phalanta phalantha phalantha Drury 1773		+		+	+	+		+	+	+		+	+	+	+	
Rhinopalpa polynice panayana Erichson 1834	+		+													

Symbrenthia lilaea semperi Moore 1899	+	+														
Tanaecia lupina howarthi Jumalon 1975	+															
Tirumala limniace orestilla Fruhstorfer 1910				+						+	+		+	+		
Tirumala ishmoides sontinus Fruhstorfer 1911				+						+						
Vindula dejone dejone Erichson 1834					+											
Amathusia phidippus negrosensis Okano & Okano 1986		+			+	+					+					
Faunis phaon carfinia Fruhstorfer 1911	+		+													
Acrophtalmia yamashitai Uémura & Yamaguchi 1982	+	+														
Elymnias sansoni sansoni Jumalon 1975	+	+		+			+	+		+						
Lethe chandica canlaonensis Okano & Okano 1991	+															
Mycalesis tagala mataurus Fruhstorfer 1911	+															
Mycalesis igoleta negrosensis Aoki & Uémura 1982	+	+	+			+	+		+	+	+	+		+	+	+
Mycalesis teatus teatus Fruhstorfer 1911	+	+	+													
Mycalesis mineus philippina Moore 1892							+									
Mycalesis perseus caesonia Wallengren 1860			+							+		+	+	+		
Orsotriaena medus medus Fabricius 1775				+									+	+		
Ptychandra negrosensis Banks, Holloway & Barlow 1976										+						
Ptychandra leucogyne Felder & Felder 1876		+	+													
Ragadia luzonia negrosensis Yamaguchi & Aoki 1982			+													
Ypthima stellera stellera Eschscholtz 1821	+	+	+	+	+	+	+	+		+	+	+	+	+		+
Ypthima sempera sempera Felder & Felder 1863	+	+		+			+	+			+			+		
Zethera musides Semper 1878		+	+		+					+	+	+				
Allotinus fallax negrosensis Schroeder & Treadaway 2000		+		+						+						
Amblypodia narada erichsonii Felder 1865		+														

Catochrysops Strabo luzonensis Tite 1959							+									
Catochrysops panormus exiguus Distant 1886		+								+						
Celarchus hermarchus hermarchus Fruhstorfer 1910		+					+									
Celastrina lavendularis hermesianax Fruhstorfer 1910	+	+														
Chilades mindora Felder & Felder 1865						+		+								
Euchrysops cnejus cnejus Fabricius 1798				+				+		+						
Famegana alsulus Herrich-Schäffer 1869								+								
Freyeria putli gnoma Snellen 1876								+								
Hypolycaena sipylus tharrytas Felder & Felder 1862					+											
Hypolycaena erylus tmolus Felder & Felder 1862														+		
Hypolycaena ithna Hewitson 1869				+												
Jamides cleodus cleodus Felder & Felder 1865			+		+		+		+			+	+	+	+	
Jamides celeno lydanus Fruhstorfer 1910	+	+	+	+			+	+		+						
Jamides alsietus alsietus Fruhstorfer 1915	+							+		+						
Jamides alecto manilana Toxopeus 1930								+			+					
Lampides boeticus Linnaeus 1767		+	+			+	+	+	+			+		+	+	
Logania distanti distanti Semper 1889		+														
Miletus sp.	+	+	+					+								
Miletus drucei drucei Semper 1889								+								
Miletus melanion melanion Felder & Felder 1865		+					+	+								
Nacaduba berenice leei Hsu 1990	+															
Prosotas nora semperi Fruhstorfer 1916										+	+		+			
Rapala manea philippensis Fruhstorfer 1912			+													
Rapala caerulescens Staudinger 1889		+														

Rapala tomokoae takanamii H. Hayashi 1984		+														
Spindasis syama negrita Felder 1862		+														
Tajuria jalajala jalajala Felder 1862			+													
Zizeeria karsandra Moore 1865				+	+	+	+	+					+		+	
Zizina otis oriens Butler 1883		+	+	+	+	+	+	+		+			+	+	+	+
Zizula hylax pygmaea Snellen 1876		+		+	+	+						+	+	+	+	
Aeromachus plumbeola Felder & Felder 1867													+		+	
Aeromachus musca Mabille 1876		+														
Borbo cinnara Wallace 1866		+								+						
Cephrenes acalle chrysozoma Plötz 1883			+									+				
Notocrypta paralysos volux Mabille 1883	+															
Odontoptilum corria De Jong 2006		+														
Prusiana prusias matinus Fruhstorfer 1911		+														
Tagiades japetus titus Plötz 1884									+							
Taractrocera luzonensis luzonensis Staudinger 1889		+				+	+	+				+	+	+	+	
Telicota colon vaja Corbet 1942								+						+		
Telicota ancilla minda Evans 1934						+										
Telicota augias pythias Mabille 1878									+							
Xanthoneura obscurior De Jong & Treadaway 2007	+															

Results in Bray Curtis Dissimilarity tests are summarized in Table 2. Higher percentages mean that both areas are nearly dissimilar in species composition while lower percentages indicate that both areas are similar in species composition. In the case of Negros Oriental, areas located in proximity tend to have lower percentages.

Table 2

Results of Bray Curtis Dissimilarity test in percentage across areas. A — Mount Talinis, B — Valencia, C — Sibulan, D — San Jose, E — Amlan, F — Dumaguete, G — Bacong, H — Dauin, I — Zamboanguita, J — Siaton, K — Santa Catalina, L — Tanjay, M — Bais, N — Manjuyod, and O — Ayungon.

Areas	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Valencia	79%														
Sibulan	76%	67%													
San Jose	88%	54%	57%												
Amlan	89%	67%	51%	47%											
Dumaguete	92%	55%	54%	60%	53%										
Bacong	84%	50%	56%	50%	51%	55%									
Dauin	92%	64%	76%	65%	77%	60%	69%								
Zamboanguita	90%	64%	58%	47%	62%	54%	58%	65%							
Siaton	89%	61%	65%	51%	63%	72%	60%	76%	55%						
Santa Catalina	84%	59%	58%	53%	59%	67%	56%	81%	63%	59%					
Tanjay	90%	68%	64%	58%	56%	59%	70%	77%	63%	72%	56%				
Bais	94%	75%	66%	59%	57%	62%	70%	77%	65%	67%	67%	37%			
Manjuyod	85%	75%	62%	57%	46%	64%	58%	81%	66%	71%	63%	53%	50%		
Ayungon	87%	77%	63%	69%	58%	64%	52%	83%	63%	78%	66%	65%	65%	50%	
Tayasan	91%	78%	58%	65%	61%	63%	60%	86%	62%	77%	66%	67%	67%	58%	53%

Table 3 summarizes the recorded number of species, estimated species richness and Simpson's Reciprocal Index of Diversity (SRI), and the Habitat Type Classification (HTC) for each area.

Table 3

Recorded number of species, Habitat Type Classification, Simpson's Reciprocal Index of Diversity (SRI), and Estimated Species Richness (Bootstrap and Jackknife).

Localities	HTC (Mean)	Num. of Species	SRI	Bootstrap	Jackknife1
Mount Talinis	1.00	33	20.01	61.16	49.78
Valencia	2.32	61	25.22	102.51	90.87
Sibulan	2.52	47	36.05	86.65	68.81
San Jose	3.02	39	19.77	75.23	55.88
Amlan	3.15	31	23.63	60.10	44.85
Dumaguete	3.06	31	10.69	58.91	45.90
Bacong	3.59	31	21.56	58.51	43.88
Dauin	3.05	43	7.61	77.20	57.97

Zamboanguita	3.19	26	13.08	50.73	36.92
Siaton	2.92	54	24.30	99.35	78.87
Santa Catalina	3.15	30	16.91	59.05	41.88
Tanjay	4.28	28	15.21	53.52	34.95
Bais	4.02	33	17.57	62.48	44.92
Manjuyod	3.24	32	30.00	60.05	45.82
Ayungon	3.40	22	20.42	42.27	30.82
Tayasan	2.72	17	9.87	34.00	28.70

For Habitat Type Classification (HTC), 1 — forested, 2 — forest fragments (lakeshores and riverbanks), 3 — suburban, 4 — urban, and 5 — agricultural lands.

There is a significant difference in species richness using Bootstrap and First-Order Jackknife species richness estimators (Bootstrap: X-squared = 81.5005, df = 15, P = 3.71e−11; 95% CL; Jack1: X-squared = 87.2101, df = 15, P = 3.278e−12; 95% CL). Valencia (Bootstrap: 102.51; Jack1: 90.86) has the highest species richness while Tayasan has the lowest (Bootstrap: 34.00; Jack1: 28.70). This is an indication that all 16 areas that were surveyed have different species richness estimates. The reason why Valencia has higher species richness compared with that of Tayasan is that the latter is located distantly from the potential priority site (Cuernos de Negros) and the existing priority site (Mount Canlaon). Valencia is located between Cuernos de Negros and Dumaguete, which makes Valencia act as the corridor between forested areas and urbanized areas and, thus, tend to have a mix of both forest specialist and generalist butterflies.

There is also a significant difference in the species diversity (Table 3) in all areas (X-squared = 43.3083, df = 15, P = 0.000141; 95% CL). Sibulan has the highest in terms of diversity followed by Manjuyod and Valencia. It is expected that Sibulan and Valencia would have the highest diversity because they are closer to Cuernos de Negros and the Balinsasayao Twin Lakes Natural Park (Sibulan). The reason why Manjuyod has higher diversity is because of the number of riparian habitats encountered during the study in the area.

CORRELATION ANALYSIS

Figure 1 is the correlation/regression analysis between numbers of species (NUMSP), Habitat Type Classification (HTC), diversity (DIV), and richness (RICH). The NUMSP is negatively correlated with HTC (−0.30), while positively correlated with DIV and RICH (0.45 and 0.99, respectively). Higher HTC means higher disturbance, which resulted to lower number of species. Higher number of species also means higher species diversity and richness.

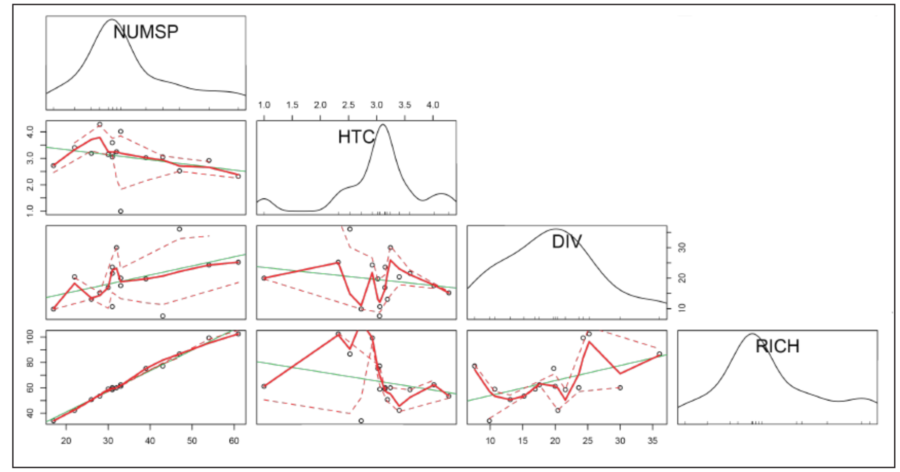

Figure 1. *Correlation analysis between number of species (NUMSP), Habitat Type Classification (HTC), diversity (DIV), and richness (RICH).*

The HTC resulted a negative correlation between DIV and RICH (−0.1924297 and −0.2787387, respectively). Higher disturbances (HTC) caused decline in diversity (DIV) and richness (RICH), while higher species richness generated a higher diversity value.

Figure 2 is the correlation/regression analysis on distance (DIST) from the potential priority site (Cuernos de Negros) against NUMSP, HTC, DIV, and RICH. In this analysis, Cuernos de Negros (or Mount Talinis) will be the factor since this is the potential priority site. The NUMSP is negatively correlated against DIST (−0.6290987), which means that areas that are distant from the potential priority site have lower species number, while those areas that are closer to the potential priority site have higher species number. The diversity (DIV) and richness (RICH) were both negatively correlated with DIST (–0.1089468 and –0.6470634, respectively), which means that areas that are farther/distant to the existing priority site have lower species diversity and richness values.

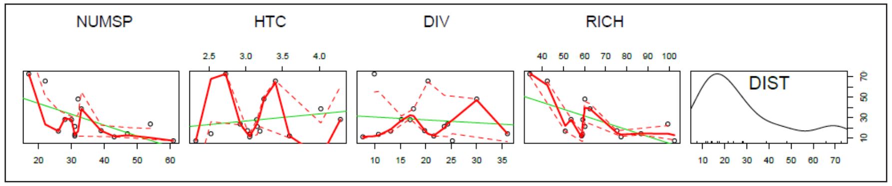

Figure 2. *Correlation analysis on distance from the priority site (DIST) against NUMSP, HTC, DIV, and RICH.*

Habitat Type Classification (HTC) is positively correlated with DIST (0.1779502), which means that areas farther/distant to the priority site have more disturbed habitats (especially agricultural lands and cleared areas).

Butterfly Species Composition

The butterfly species composition in forested areas (including fragment forests along riverbanks and lakeshores) during the survey is completely different from that in the urbanized areas and in the agricultural lands. The species present in the remaining forested areas and fragmented forest riverbanks (riparian) in Negros Oriental are candidates for flagship species in butterfly conservation in the province such as the following: Papilionidae: Menelaides helenus, Troides rhadamantus, and Achillides palinurus; Nymphalidae: Parthenos sylvia, Euploea tulliolus, Euploea mulciber, Danaus melanippus, Ideopsis gaura, Lexias satrapes, Lexias panopus, Faunis phaon, Zethera musides, Acrophtalmia yamashitai, Tirumala limniace, and Tirumala orestilla; and Pieridae: Delias henningia, Delias hyparete, and Appias phoebe (only found in Mount Talinis and Mount Canlaon in Negros Island).

For Lycaenidae and Hesperiidae species, further assessment is required since most of them were only recorded in few areas except for some Lycaenidae species such as Zizina otis, Zizula hylax, Lampides boeticus, and Zizeeria karsandra. For Hesperiidae species, only the Taractrocera luzonensis was recorded in many areas while the other species have limited distribution.

The abovementioned butterfly species found during the survey have limited distribution, and some of them are in isolated fragmented habitats in Negros Oriental. These are candidates for further investigation on their population biology to determine if they are stable or unstable in occurrence.

DISCUSSION

Assessment of specific localities of butterflies during the survey is necessary for preliminary conservation efforts, especially in the case of those species that are isolated and at risk of further habitat loss.

The result of the study on species dissimilarity showed that Cuernos de Negros is the most dissimilar in species composition when compared to other areas, while Valencia and Sibulan showed lower dissimilarity values. Both of these areas are closer to Cuernos de Negros, and Sibulan includes the Balinsasayao Twin Lakes Natural Park, which connects with Mount Talinis. Areas that are distant to Cuernos de Negros (potential priority site) have lower species numbers coupled with higher disturbance level compared with areas that are closer to Cuernos de Negros.

The differences in species diversity across all areas depend on the size of the area being studied (Hardy & Dennis, 1999).

In this study, we omitted the size of the area, which could affect our results. Larger areas mean that more habitat types can be surveyed.

Species richness can be higher in some areas because of historical factors (Ricklefs, Latham, & Qian, 1999). These areas have been preserved for long periods of time with less disturbance and change in their ecological landscape. The vegetation surrounding rivers and lakes (Lakes Balanan and Balinsasayao) and the remaining primary and secondary forests in Negros Oriental have been preserved for many years, and that is why these areas currently contain few special butterfly species, but they are at risk from crop plantation expansion and deforestation. The forested areas in Negros Oriental contain more butterfly species compared with disturbed habitats, and further protection is needed to prevent extirpation.

The survey in Negros Oriental recorded 31 (23.84%) out of 130 butterfly species that are endemic to the Philippines to the subspecies level, while a total of 16 (12.30%) are endemic to the species level. Most of these endemic taxa are found in the forested area of Cuernos de Negros, forest edges of Valencia, Lake Balinsasayao Twin Lakes Natural Park, and Lake Balanan.

The authorities of Lake Balanan in Siaton should consider prioritizing the site to be protected and prevent further habitat loss as well as reforesting its surroundings. It is interesting that some endemic species found at Lake Balinsasayao were not recorded at Lake Balanan, and the latter also has endemic species that are absent at Lake Balinsasayao. These two areas should be protected, preferably by declaration as butterfly refuges or sanctuaries.

Survey analyses can determine areas where species are isolated or range restricted (Hurlbert & White, 2005). This general result was observed in some areas of this study where some species of butterflies were found in very isolated habitats especially the remaining forested areas, lakeshores, and riverbanks in Negros Oriental. The study did not have an average number of points per area survey since we only input points where specimen collection was done. The fewer the points recorded, the fewer specimens were collected.

It is very important to study the survival and reproductive rate of butterfly species, especially in fragmented habitats (Hamer, Hill, Lace, & Langan, 1997). The population stability and reproductive rate of these species still requires further research to determine if some species populations are declining.

Small patches of forested area can also play an important role in butterfly conservation because these areas still hold a significant number of butterfly species (Horner-Devine, Daily, Ehrlich, & Boggs, 2003). Additionally, connecting similar forest patches can enhance biodiversity conservation and maintain viable insect populations (Samways, 2007). Generalist species have dominated the urbanized areas while those that tend to show small home ranges remained isolated. This observation was also similar to the results derived by Cleary et al. (2009) in their studies on Bornean butterflies. Even the presence–absence data for individual insect species are significant for distributional records to use as a basis for conservation initiatives (Miller, 1993).

For the present work, a negative correlation was obtained when butterfly species numbers were correlated with temperatures (Figure 3). The result shows that different geographic locations have varying average temperatures and some butterfly species can have climate preferences. Higher temperature means that the area has more open spaces or less canopy cover, while lower temperature means that this area has sufficient canopy cover (forested). Some organisms are already on the brink of extinction because of changing in climatic conditions (Thomas, Franco, & Hill, 2006).

In the case of Negros Oriental, anthropogenic factors exacerbate the climatic conditions by reducing canopy cover, thus raising air temperatures to levels that are detrimental to some butterflies.

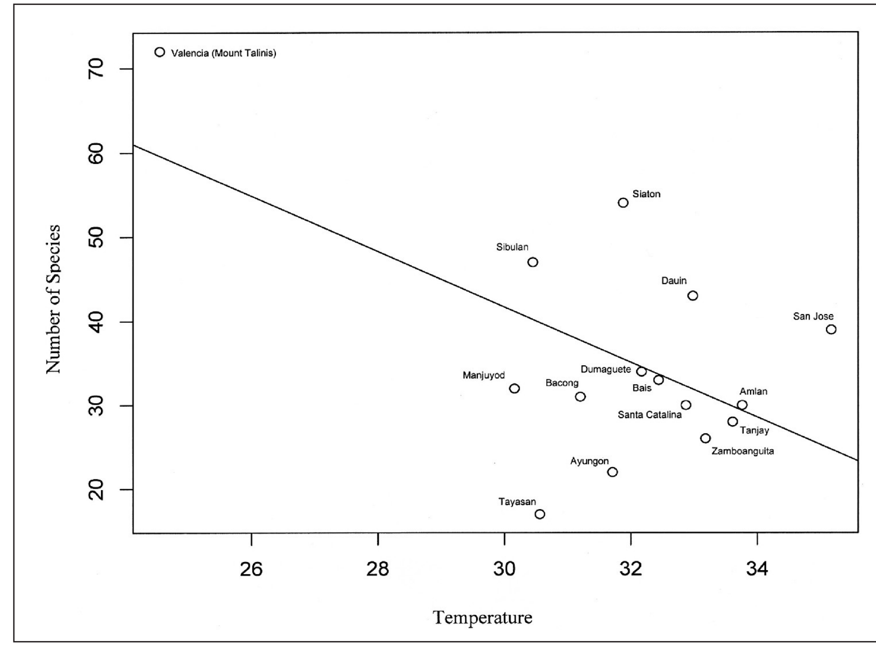

Figure 3. *There is a negative correlation between the numbers of species plotted against the mean temperatures of each area.*

According to Treadaway (pers.comm.), Papilio negrosiana and Deramas sumikat are missing from my list, and these species are probably experiencing population decline or possibly extinct.

Mount Canlaon in the northern part of Negros Island was designated as priority site while Cuernos de Negros (Mount Talinis) was designated as one of the potential priority sites for conservation in the Philippines (Danielsen & Treadaway, 2004). Both areas are also vulnerable to deforestation; therefore, Cuernos de Negros in the southern part of Negros Island should be designated as a priority site. Additional priority sites should also be established in areas distant to these priority sites to prevent further loss in species number in the province.

CONCLUSION

The extent of anthropogenic factors in Negros Oriental has greatly affected the distribution of butterfly species as well as the species richness, diversity, and even the mean temperatures. Areas that are distant from the potential priority area (Cuernos de Negros) tend to have lower species numbers coupled with higher disturbance levels. The remaining fragmented forest habitats and the vegetation surrounding the rivers and lakes provide suitable conditions for specialist/range-restricted species while most of the generalist species dominate the areas with high anthropogenic factors. The canopy cover including nectar sources and hostplants in the understory strata in these remaining fragmented forest areas continue to be excellent habitats to support butterflies.

Sodhi and Posa (2005) found that birds and butterflies were negatively affected by anthropogenic factors in Subic Bay, Luzon, Philippines. Similar results were also obtained by Akite (2008), in which species diversity and richness were found to be negatively affected by anthropogenic factors. Low species richness was observed in areas with high urbanization (Hardy & Dennis, 1999), especially exemplified in areas with wide-area plantation and habitat conversion that resulted in the decline of species numbers. Bonebrake et al. (2010) reviewed the status of tropical butterflies in general and found that habitat loss is the most significant threat to tropical butterfly diversity. There is a need for more priority sites to be established in Negros Oriental to prevent species loss, and this could be done by the participation of the Local Government Units (LGUs) of all the municipalities and cities in the province. From the results I report here, I would recommend that municipality-/city-based conservation initiatives should be promoted and Philippine educational institutions should include environmental education in their new curriculum to increase public awareness on environmental protection and conservation. It is also important that nectaring plants, foodplants/hostplants, and dense vegetation (canopy cover) are well-established for a long period of time to provide adequate time and resources for butterflies to thrive.

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The Undergraduate Psychology Practicum Program: Best Practices in Practicum Supervision

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This study looked into the undergraduate psychology practicum program as experienced by teachers handling the subject. Twelve practicum teacher-supervisors from major universities across the Philippines were interviewed using a qualitative phenomenological approach. Resulting data included their views and feelings about practicum supervision and the challenges and opportunities found in their work. Best practices were found associated with the practicum subject itself, the practicum teacher, the academic institution, partner agencies, and relevant government agencies and professional organizations.

Keywords: Undergraduate psychology practicum program, practicum supervision, practicum teachers, phenomenological approach, supervisory experiences, best practices

INTRODUCTION

Supervision is an essential factor in the overall learning experience of students engaged in practicum work. The roles and responsibilities of those involved in the various stages of practicum are critical because students' understanding of the link between theory and practice hinges on the expertise and competence of supervisors. Supervision is crucial to developing and enhancing students' self-awareness, competence, and sense of professionalism.