Final Report

Butterfly Community Structure in Bukit Barisan Selatan National Park, Sumatera

Nur Hasanah, Heri Tabadepu, Bandung Sahari, Damayanti Buchori

PEKA INDONESIA
Center for Conservation and Insect Studies
PEKA-CCIS

WILDLIFE CONSERVATION SOCIETY

July 2006

ACKNOWLEDGMENTS

This work was a joint collaboration between Peduli Konservasi Alam (Peka) Indonesia Foundation (Center for Conservation and Insect Studies) and Wildlife Conservation Society-Indonesia Program (WCS IP). We thank Department of Plant Protection Bogor Agricultural University which permitted us to use laboratory facilities for sorting and identification. Special thank is also extended to Ahmad Rizali who has helped us in providing statistical analyses and valuable graphs. We would especially like to thank the Bukit Barisan Selatan National Park Officers who have assisted in this survey. Finally, we thank local community who helped us during insect collection in the field.

Summary

Butterfly community structure in Bukit Barisan Selatan National Park was investigated between September 2005 and May 2006. Ecological research was conducted at five different locations covering two different habitats: primary forest and secondary forest . Butterflies were surveyed by conducting transect walks. Specimens that could not be designated to species in the field were caught with a sweep net and identified subsequently in the laboratory. We found 1825 individuals belonging to 185 species at BBSNP. Family Nymphalidae was commonly found in all location and forest type, and it dominates butterfly communities with its individual number that covers more than 50% of all collected specimen. Two endangered species *Trogonoptera brookiana* (Kupu Trogon/ Rajah Brook's Birdwing) and *Troides* near *vandepolli* were found only in a very limited number. Species richness in secondary forest was found to be higher than in primary forest. The findings from different sites at BBSNP showed that species composition of butterfly communities significantly related to habitat type. Our analyses indicated that forest transformation significantly affects the structure of Butterfly communities but not for species richness. Our data indicated that there is a site-specific species composition of butterfly communities and forest transformation that may contribute significantly to the presence of single species.

Introduction

Background

Tropical rainforest harbors the highest diversity of life in terrestrial habitats (e.g. Wilson 1988), unfortunately this evidence will not stay longer since this ecosystem is highly threatened by habitat destruction. In fact, human activities, for example, logging, landuse change, and landscape modification have been widely identified as the main cause of disturbance to tropical forests (Kruess & Tscharntke 1994; Andren 1997; Steffan-Dewenter & Tscharntke 1999; Kruess & Tscharntke 2000; Rogo & Odulaja 2001; Klein *et al*. 2002). Indonesia, has been widely recognized as megadiversity tropical country in the world, that is now facing those kind of threats that may be capable of causing extensive biodiversity loss. This is particularly true for many areas, for example Java and Sumatera, in which many parts of these areas are modified and converted, for example to agricultural land-use, industries, and houses. Today, only a small fraction of the terrestrial environment is represented by undisturbed tropical rainforest and the remaining forests are only patchily distributed in most tropical landscapes (Rogo & Odulaja 2001).

Bukit Barisan Selatan National Park (BBSNP) is one of the few last remaining forested areas in Indonesia that is now facing a tremendous threat of forest conversion activities that increase from year to year. As one of the largest protected area in Sumatera (see O'brien *at al.*1998), BBSNP holds a very important and strategic position in the conservation of many species living in and around it, including butterfly. Biodiversity inventory is the first step that has to be conducted as a baseline study to provide all information needed to determine the status of species in ecosystem. Several records and research on higher animal, for example Asian elephant and tiger were established (O'brien *at al.* 1998, 2003 and Hedges *et al.* 2005), but no record on arthropod community from BBSNP has yet been made, for example butterfly.

Butterflies play a very important role in maintaining and conserving ecosystem functions, as well as providing many critically important services through numerous mechanisms such as pollination, herbivory and as key taxon group for many species of parasitic wasp, predator arthropod, birds, small reptiles and many others which depend their life on it. Many butterflies specialize on specific plant species for oviposition or feeding (Ehrlich 1984, Oostermeijer and van Swaay 1998), consequently, they are very sensitive to changes in floral diversity, vegetation structure, and structural component of the habitat. With this behaviour, butterfly can be used as ecological indicator species for habitat destructions. The rapid destruction of natural habitats may cause the extinction of many species of butterfly. In fact, this condition may lead to the situation where extinction preceeds discovery by humans.

Unfortunately, today, there is a very limited information on butterfly species richnes and diversity availabe in Indonesia and no study on butterfy has been conducted in BBSNP. As such, baseline information on butterfly community structure with respect to habitat type can provide insights into effective conservation strategies for the maintenance of butterfly diversity. In this report, we present findings regarding the butterly community

of the BBSNP in Lampung Province, Sumatra.

Objectives:

1. Inventory of butterfly diversity in BBSNP
2. To study the structure of butterfly community with respect to habitat type
3. To evaluate conservation value of secondary forest in maintaining species diversity of butterfly

Method

Study Area and Study Sites

The study was carried out in Southern part of Sumatera at the Bukit Barisan National Park. The BBSNP is very important protected area in Indonesia since it has been widely established as the third largest protected area (3,568 km2) in Sumatra (O'brien *at al.* 1998). The National Park is located in the extreme south west of Sumatra (4° 5' to 5° 57' S and 103° 34' to 104° 43' E), the park be astride the Provinces of Bengkulu (in the southern part) and Lampung (in the western part), extending 720 km in a narrow band along the Barisan mountain range from Tanjung Belimbing northward (see O'brien *at al* 1998, 2003). The park's long shape results in a 700 km boundary, and extensive development activity, especially small scale agriculture and logging, is occurring on the boundary and within the park (O'brien *at al* 1998, 2003). Rainfall is seasonal and completely high ranging from 3000 mm to more than 4000 mm per year, meanwhile temperature ranges from 22°C to 35 °C. (see O'brien *at al* 1998, 2003). A dry season used to two to four months that occurs between May and October (Hedges *et al.* 2005). The border of the margin of the national park is characterized by extensively managed agricultural systems.

Butterfly samplings were conducted in five different selected locations of BBSNP, Kubu Perahu, Linau, Ranau, Way Sepuntih, and Way Canguk. At each selected location, two different habitat types, primary and secondary forest were picked out for insect samplings. Butterfly observations were conducted along transect line that is situated inside the forest area. There were two transect lines for each forest type.

Butterfly sampling

Field research was conducted between September 2005 and January 2006. Butterflies were surveyed by conducting transect walks along 1800 m. Each transect line was divided into 18 point, and the distance between points was about 100 m. At each selected site, transect walk were replicated for six times. Overall, there were 120 transect units (2 transect lines x 2 forest types x 5 locations x 6 six times replication). The surveys were restricted to condition where the weathers were most favorable for flight. Butterflies were collected using a time-constrained area search during peak flight periods (09.00 to 15.00 hours). Specimens that could not be designated to species in the field were caught with a sweep net and identified subsequently in the laboratory. All specimens that were brought into the laboratory were handled and mounted using conventional procedures. Identification was conducted by reffering to standart references including Morrel (1968), Tsukada (1981), Tsukada (1982), Tsukada (1985), dan Tsukada (1991).

Data Analyses

To calculate ACE estimates, we used the computer program of Colwell (2000) by not shuffling individuals among samples within species and randomizing samples 50 times. Spearman rank correlations, multidimensional scaling, Scheffé test and one-way ANOVA were performed using Statistica 6.0 (StatSoft 2001). The computed ANOVA was always of a one-way type. Means are given with standard deviation if not mentioned otherwise. Scheffé test was used for multiple comparisons of means. If necessary, data were log- or square root-transformed to achieve normal distribution.

Result

Butterfly communities in BBSNP

In total we sampled 1825 butterfly specimens belonging to 185 species and five families by sampling 81 transect units from five selected locations in BBSNP (due to several factors such as rainy days, limited sampling period of time, we only sampled 81 transect units not 120 transect units as the original design, see Table 1). All species found in each family, from hand netting in 20 transect lines are shown in the appendix. Summary of species and families caught in each location is shown in appendix.. Nympalidae was mostly common family found in every habitat and location with highest species number. This survey also found two species *Trogonoptera brookiana* (Kupu Trogon/ Rajah Brook's Birdwing) and *Troides* near *vandepolli* that are recognized as endangered species. Both of them are member of family Papilionidae.

The most abundant and species rich butterfly family was Nymphalidae with 1331 individuals (72.93 % of total speciment) and 107 species (57.84%), and the rest represented only a minor fraction of the total number of collected butterfly specimens (not more than 8 % of total specimen). Proportion of individual number was close to similar for three families, Papilionidae, Pieridae and Lycaenidae. Family Hesperiidae was recorded to have the lowest number of the total specimens, and lowest number of species was found in the family Pieridae (see Fig. 2). Abundance and species richness of transect lines of Butterfly were highly correlated (Fig. 1). This indicates that the species assemblages are still very incompletely surveyed.

Table 1. Number of transect units sampled for butterfly in five selected locations.

Location	Forest Type	Line	Number of transect unit
Kubu Perahu	Primary forest	Line-1	4
		Line-2	3
	Secondary forest	Line-1	6
		Line-2	6
Linau	Primary forest	Line-1	3
		Line-2	3
	Secondary forest	Line-1	3
		Line-2	3
Ranau	Primary forest	Line-1	3
		Line-2	4
	Secondary forest	Line-1	3
		Line-2	4
Way Canguk	Primary forest	Line-1	3
		Line-2	4
	Secondary forest	Line-1	6
		Line-2	3
Way Sepuntih	Primary forest	Line-1	6
		Line-2	5
	Secondary forest	Line-1	5
		Line-2	4
Total			81

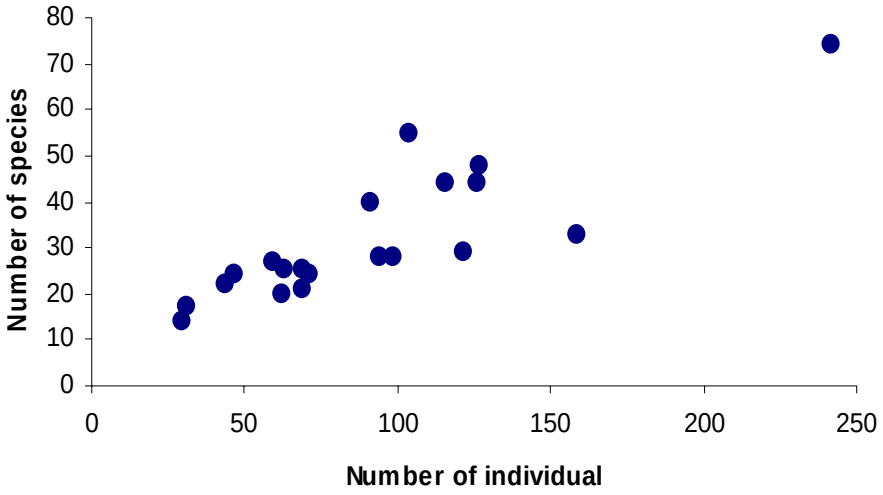

Fig. 1. Relationship between abundance and species richness of transect lines of Butterfly sampled in individual cacao plantations. Spearman rank correlation: R=0.88, n=20, p<0.0001.

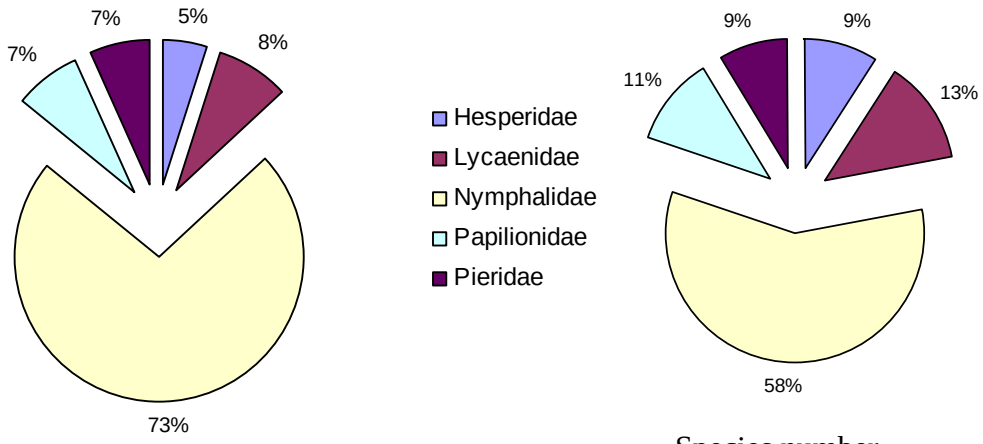

Fig. 2. Relative abundance and species numbers of individual families of butterfly collected at Bukit Barisan Selatan National Park by conducting transect walks in five different locations covering two different habitats, primary forest and secondary forest.

Based on the data, we formulated species accumulation curve to test the effectiveness of sampling efforts with respect to species richness of the BBSNP area. According to statistical count, we have recorded approximately 86.69% of the total butterfly species estimated to exist in BBSNP. From species accumulation curve calculated for all samples, the species inventories are still incomplete. This can be seen from the curve of recorded species did not reach saturation. Not only are the numbers of recorded species still increasing but also the total number of species estimated by ACE still showed a pronounced increase (Fig. 2).

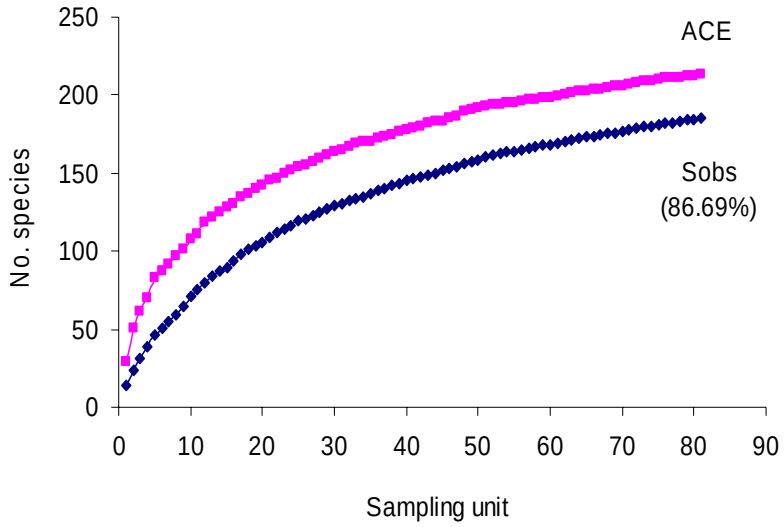

Fig.3. Species accumulation curve (recorded species /Sobs) and ACE estimates on the total number of expected species for the assemblage of Butterfly species in the study area.

Spatial dynamic of species diversity and abundance.

Species number and abundance of Butterfly in spatial scale are quite different for different location. Number of species and abundance were found to be higher in Way Sepuntih than other locations. In contrast, number of species recorded in Linau was found to be lowest, and species accumulation curve approaching saturation. In four other locations, the number of species showed a pronounced increase with increasing number of transect units (see Fig 4). High number of individual specimen was not always followed by high number of species. This can be seen from total number of collected specimen in Linau and Way Canguk. In Way Canguk, there was 349 specimens and 80 recorded species, but different fact was found in Linau, where from 354 (higher than in Way Canguk), there was only 55 species recorded.

Table 2. Ratios between number of species and abundance in each location

Locations	Species/abundance	No. Transect unit
Kubu perahu	0.25	19
Linau	0.15	12
Ranau	0.22	14
Way canguk	0.23	16
Way Sepuntih	0.21	20

Table 3. A summary of butterfly sampling results in each selected location.

Items	Kubu Perahu	Linau	Ranau	Way Canguk	Way Sepuntih	Total
Families	5	5	5	5	5	5
Species	81	55	61	80	106	185
Number of individu	324	354	282	349	516	1825
H (Shannon index)	3.687	3.597	3.467	3.953	3.864	4.420
E (Evenness)	0.840	0.898	0.843	0.902	0.829	0.847

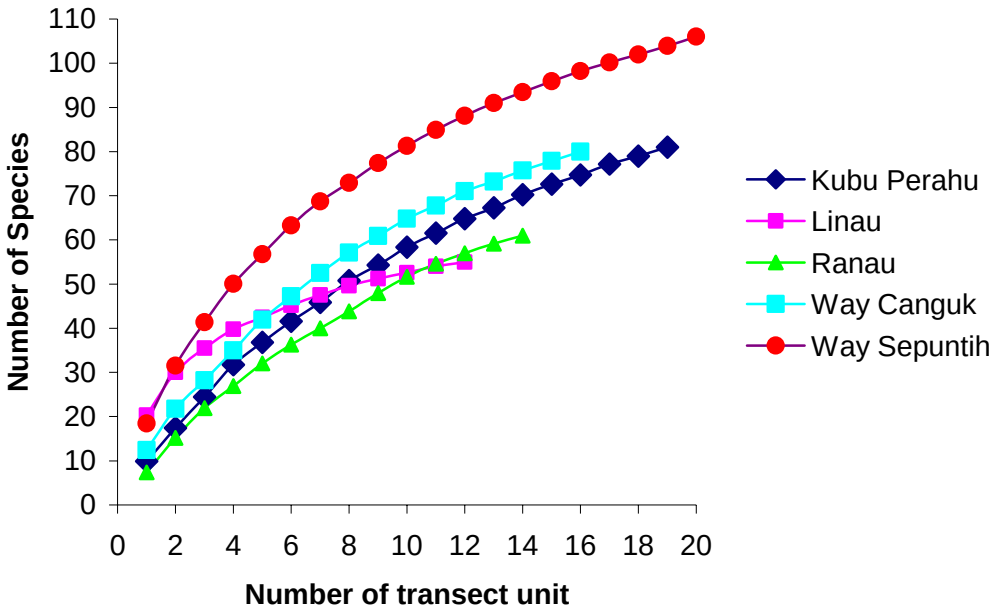

Fig 4. Species accumulation curve on the total number of recorded species for the assemblage of Butterfly species in five selected locations of BBSNP.

Butterfly Species Richness: Primary forest versus secondary forest

Species accumulation curve calculated for both secondary and primary forest is indicating that numbers of recorded species still increasing (See Fig 5). Total number of butterfly species recorded in primary forest was found to be lower than in secondary forest. This was also confirmed by one-way ANOVA testing for effects of habitat type on species richness. Mean of species number in secondary forest was recorded to be higher than primary forest, but it did not prove to differ significantly affected between habitat types.

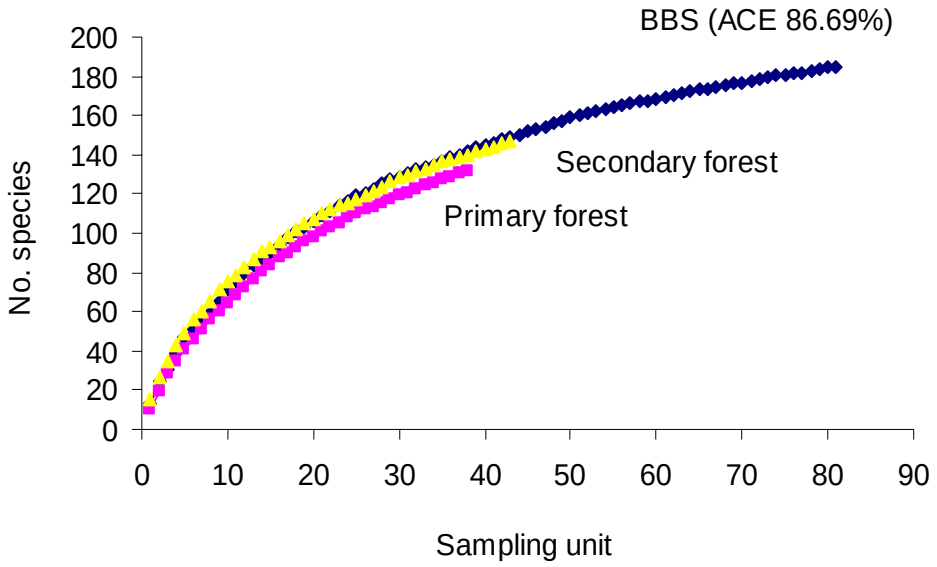

Fig.5 Species accumulation curve on the total number of recorded species for the assemblage of Butterfly species in primary forest and secondary forest.

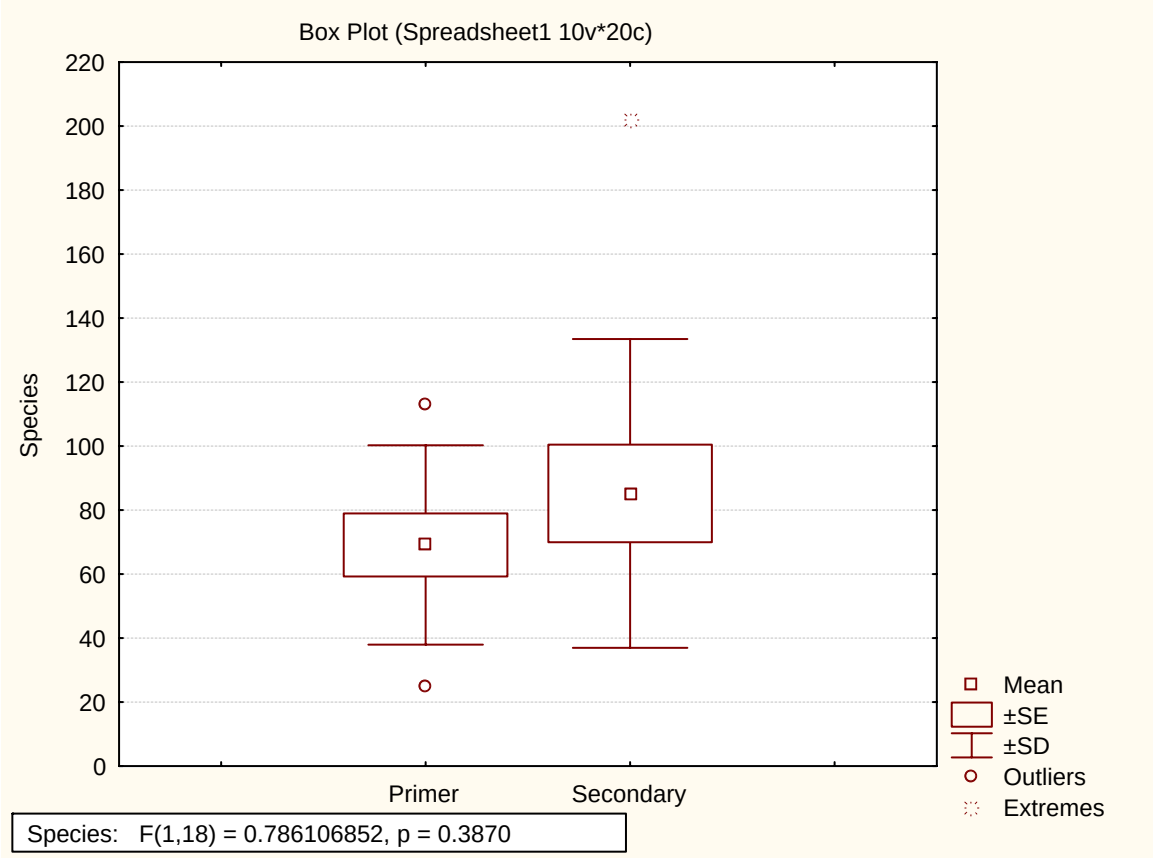

Fig. 6. Means of species number for transect lines situated primary forest and secondary demonstrating effects of habitat type on species richness of butterfly assemblages.

Structure of Butterfly Communities: Location or habitat specific pattern?

Sørensen indices were used to quantify the similarity of species composition between transect lines. Based on Sørensen values, we performed non-linear multidimensional scalling. The resulting two-dimensional MDS plot is indicating that the community structure of butterfly in BBSNP is strongly influenced by habitat type but not by location of transect lines (Fig 7 and 8). The dynamic of community structure was defined by the change of species composition. The two-dimensional scaling plot based on these Sørensen indices is indicating a pronounced change of the species composition between primary forest and secondary forest (Fig 8). In contrast, locations covering a complex habitat may not be used to define the dynamic of community structure since it was strongly affected by habitat type.

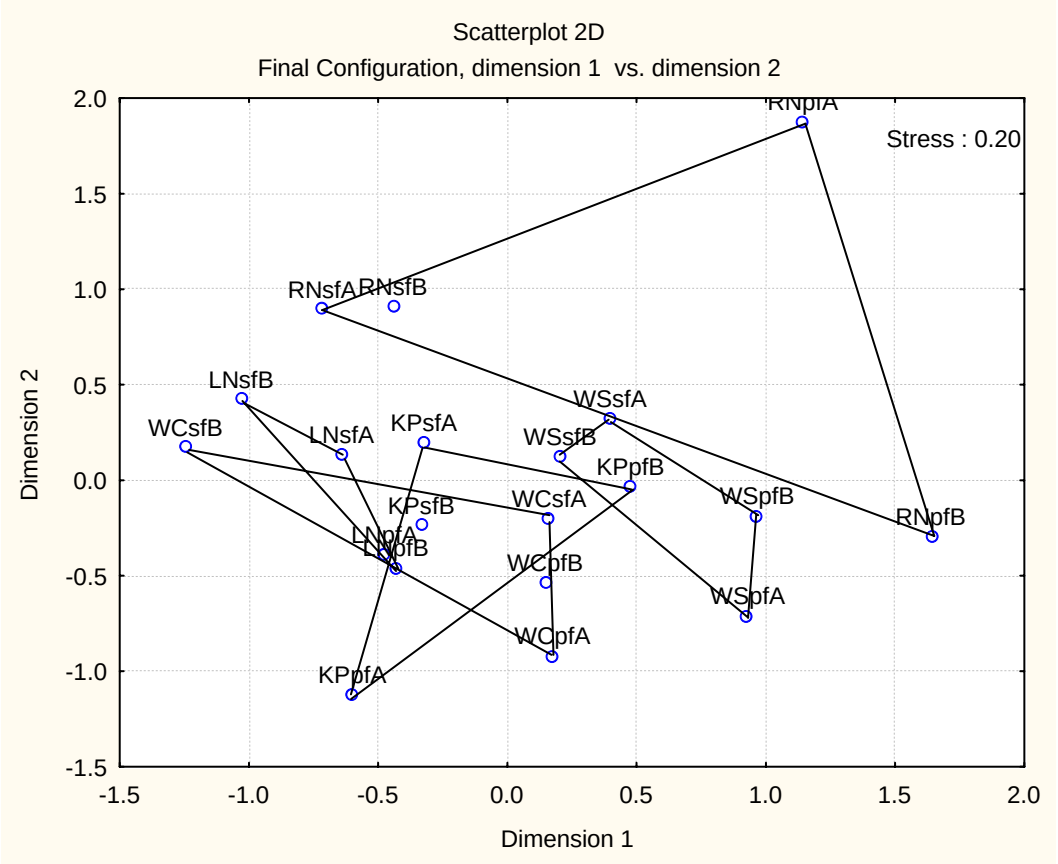

Fig 7.Two-dimensional scaling plot based on Soerensen indices for measuring similarity of species composition between single transect lines. KP=Kubu Perahu, LN = Linau, RN = Ranau, WC = Way Canguk, WS = Way Sepuntih, pf = primary forest, sf = secondary forest A = transect in site A, B = transect in site A. Connecting lines indicates defined groups of habitats

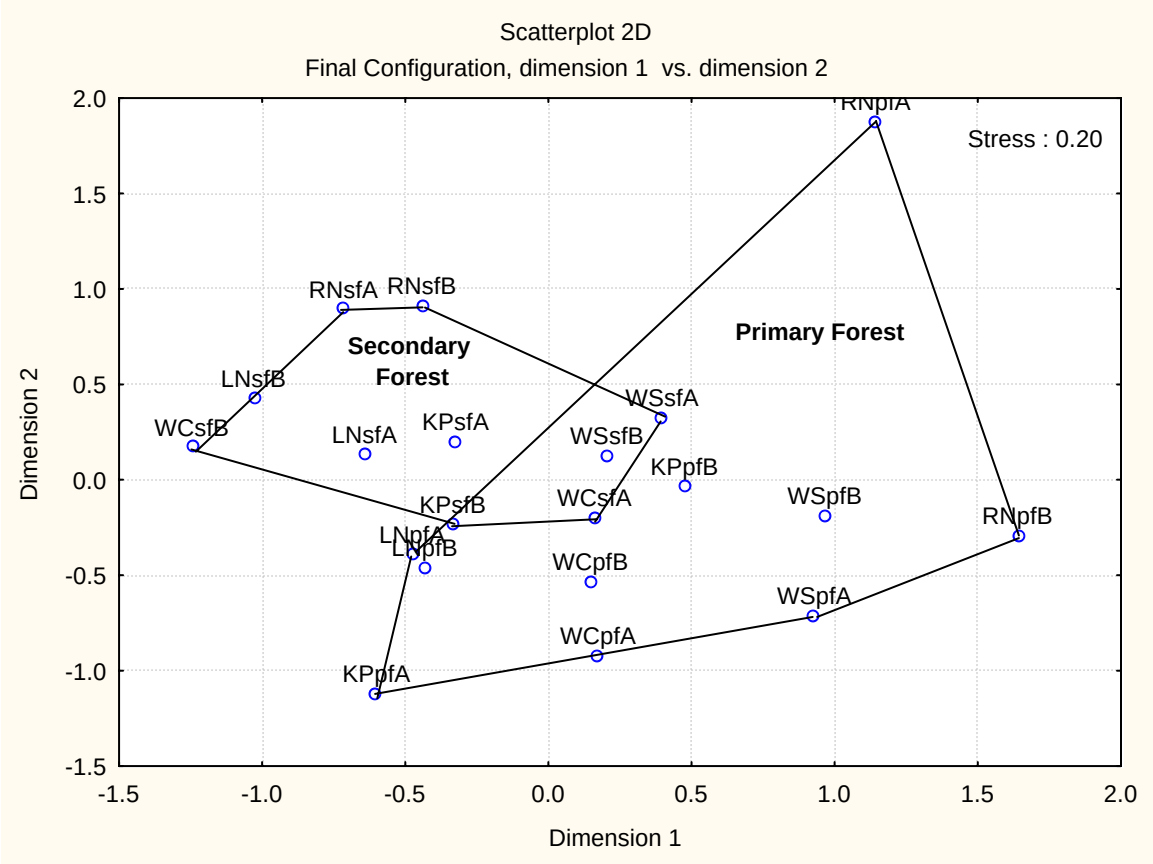

Fig 8. Two-dimensional scaling plot based on Soerensen indices for measuring similarity of species composition between single transect lines. Kubu Perahu, LN = Linau, RN = Ranau, WC = Way Canguk, WS = Way Sepuntih, pf = primary forest, sf = secondary forest A = transect in site A, B = transect in site A. Connecting lines indicates defined groups of habitats

Discussion

Butterflies are a group of insects with high incidence of vulnerability (Saarinen 2002). Only few studies so far quantified species richness and community structure of Butterfly in Indonesia. In our samples from Bukit Barisan Selatan National Park, Nymphalidae represented the most abundant and the most speciose family of Butterfly, in Contrast Papilionidae and Pieridae were recorded to be very rare in several primary forest sites. Similar pattern was also documented by Baltazar (1991) who recorded that Nymphalidae and Lycaenidae dominated butterfly community in Philippines, and also Boonvanno *et al*. (2000) in Thailand. However, Suharto *et al.* (2005) found a different pattern in Bromo-Tengger-Semeru National Park, where they recorded that Papilionidae was the dominant family of the butterfly community. Those different results indicated that pattern of family composition of butterfly community may be different for different geographic area. This may be related to several factors, for example sampling efforts and habitat complexity. High number of species of Nymphalidae was recorded in many places in the world means that this family is worldwide distributed across habitats and countries. Primark (1998) confirmed that nymphalid butterflies are cosmopolitan with high number of species and individual distributed across many region of the world and inhabit various type of habitats. Those butterflies are polyphagous insect that have high capability to survive.

Our surveys failed to reach a high completeness of the species inventory. Even after 20 transect lines of sampling in different habitats the accumulative number of Butterfly species is still showing a pronounced increase with increasing sampling effort. This study recorded approximately 185 butterfly species, however since the accumulative number of species still increasing, it can be predicted that actual number of species existing in BBSNP more than that has been recorded. In several places of South East Asia, a survey for 26 months in Makiling Mountain Philippines only recorded 145 butterfly species (Cayabyab 2000), survey in Bromo-Tengger-Semeru National Park only documented 31 species (Suharto *et al.* 2005), and butterfly study in Ton Nga-Chang Wildlife Sanctuary, Thailand only identified 147 butterfly species (Boonvanno *et al*. 2000). This means that BBSNP was higher in butterfly species richness than in other places of South East Asia. In this study, two endangered species were documented with very small abundance. The occurrence of those endangered species may provide important information for conservation, but a more accurate and rapid assessment of the condition of the habitat may be obtained by monitoring a carefully selected group of locally common species (Boonvanno *et al*. 2000).

At the spatial scale, one location, for example Linau area showed a poor number of butterfly species, in contrast, Way Canguk and Way Sepuntih were recorded to have a high number of butterfly species. This may be related to the condition of Linau area which is fragmented from other forested areas. Most of the margin of the remaining forest in Linau have been destructed and converted into open areas (by illegal logging), coffe plantations, and other plantations. However, with respect to species composition, two dimensional scalling plot did not show a clear change of butterfly community structure. This result confirmed that species composition of butterfly community was not affected by location.

Comprehensive studies covering a wide variety of taxonomic groups clearly documented that generally forest modification and transformation to land-use systems have a negative effect on diversity and species richness (Lawton *et al.* 1998), although changes in species richness of single taxonomic groups do not reflect such anthropogenic disturbance (e.g. Schulze & Fiedler 2003). The data for Butterfly showed an effect of anthropogenic disturbance on community structure. This can be seen from a pronounced change of species composition and species richness of butterfly communities between secondary and primary forest. In this case, habitat type which is characterized by specific structural plant complexity may be responsible for alteration of butterfly community structure. Beck *et al.* (2002) documented that a decrease of plant diversity has a high potential to predict changes of moth diversity along a gradient of habitat disturbance.

Our analyses also indicated that number of butterfly species recorded in primary forest was lower than in secondary forest. Wootton (1998) stated that habitat disturbance at a certain level may increase species richness. This result means that secondary forest may contribute to the maintenance large number of butterfly species. *Ragadia makuta* (Nymphalidae) was the most common butterfly species that can be found in every location and in both secondary and primary forest. Several species may only be found in one habitat type with large number of individual, in contrast, at the other one, it can not be found. Our survey indicated that forest transformation may result in species loss, conversely, new species would replace (species turn over). This can also be interpreted that secondary forest may contribute to the conservation of many species, but, it can not work to preserve several species that only can live in a certain habitat, for example primary forest. Monitoring a common species, for example *Ragadia makuta* may be important as a means to assess and predict habitat condition that would be important for conservation efforts.

References

Andren H. 1997. Effects of habitat fragmentation on birds and mammals in landscapes with different proportion of suitable habitat: A review. *Oikos* 71:355-366.

Baltazar CR. 1991. *An Inventory of Philippine Insects. II. Order Lepidoptera (Rhopalocera).* University of the Philippines at Los Banos, Laguna.

Beck J, Schulze CH, Linsenmair KE, Fiedler K. 2002. From forest to farmland: diversity of geometer moths along two habitat gradients on Borneo. *J Trop Ecol* 8:33-51

Boonvanno K, Watanasit S, Permkam S. 2000. Butterfly Diversity at Ton Nga-Chang Wildlife Sanctuary,Songkhla Province, Southern Thailand. ScienceAsia 26: 105-110

Cayabyab BF. 2000. A Survey of the Lopharocera of Mt. Makiling, Laguna, Philippines. ThePhilippines Entomology **14(2)** : 106-119

Hedges S, Tyson MJ, Sitompul AF, Kinnaird MF, Gunaryadi D, Aslan. 2005. Distribution, status, and conservation needs of Asian elephants (Elephas maximus) in Lampung Province, Sumatra, Indonesia. Biological Conservation 124: 35–48

Klein A-M, Steffan-Dewenter I, Tscharntke T. 2002. Predator-prey ratios on cocoa along a land-use gradient in Indonesia. *Biodiv Conserv* 11:683-693.

Kruess A, Tscharntke T. 1994. Habitat fragmentation, species loss, and biological control. *Science* 264:1581-1584.

Kruess A, Tscharntke T. 2000. Species richness and parasitism in a fragmented landscape: experiments and field studies with insects on *Vicia sepium*. *Oecologia* 122: 129-137.

Lawton JH, Bignell DE, Bolton B, Bloemers GF, Eggleton P, Hammond PM, Hodda M, Holt RD, Larsen TB, Mawdsley NA, Stork NE, Srivastava DS, Watt AD. 1998. Biodiversity inventories, indicator taxa and effects of habitat modification in tropical forest. *Nature* 391:72-76.

Morrel R. 1982. *Malaysian Nature Handbooks*: *Common Malayan Butterflies*. Logman Malaysia SDN. Berhad, Kuala Lumpur: xii + 64 hlm

O'Brien TG, Kinnaird MF, Sunarto, Dwiyahrehni AA, Rimbang WM, Anggraini K. 1998. Effects of the 1997 Fires on the Forest and Wildlife of the Bukit Barisan Selatan. National Park, Sumatra. Working Paper No. 13. Wildlife Conservation Society, New York NY. 16 pp.

O'Brien TG, Kinnaird MF, Wibisono HT. 2003. Crouching tigers, hidden prey: Sumatran tiger and prey populations in a tropical forest landscape. Animal Conservation. 6:131-139.

Primack RB *et al*. 1998. Biologi Konservasi. Jakarta: Yayasan Obor Indonesia

Rogo L, Odulaja A. 2001. Butterfly populations in two forest fragments at the Kenya coast. *Afr J Ecol* 39:266-275.

Saarinen K. 2002. Butterfly communities in relation to changes in the management of agricultural environments. [PhD Report]. Findland: University of Joensuu.

Schulze CH, Fiedler K. 2003. Hawkmoth diversity in Northern Borneo does not reflect the influence of anthropogenic habitat disturbance. *Ecotropica* 9:99-102

StatSoft. 2001. Statistica for Windows, 6.0. StatSoft Inc., Tulsa

Steffan-Dewenter I, Tscharntke T. 1999. Effects of habitat isolation on polinator communities and seed set. *Oecologia* 121:432-440.

Suharto, Wagiyana, Zulkarnain R. 2005. A Survey Of The Butterflies (Rhopalocera: Lepidoptera) In Ireng-Ireng ForestOf Bromo Tengger Semeru National Park. Jurnal ILMU DASAR 6 (1): 62-65

Tsukada, E. 1981. *Butterflies Of The South East Asian Islands*. Part II. Plapac Co., Ltd.

Tsukada, E. 1982. *Butterflies Of The South East Asian Islands*. Part III. Plapac Co., Ltd.

Tsukada, E. 1985. *Butterflies Of The South East Asian Islands*. Part IV. Plapac Co., Ltd.

Tsukada, E. 1991. *Butterflies Of The South East Asian Islands*. Part V. Plapac Co., Ltd.

Wilson EO. 1988. Biodiversity. Washington D.C.: National Academy Press.

Wootton T. 1998. Effects of disturbance on species diversity: A multithropic perspective. *Am Nat* 152:803-825.

Appendix 1. A Summary of Species richness of Butterfly Families for each Location and habitat.

Families	Kubu Perahu		Linau		Ranau		Way Canguk		Way Sepuntih	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
Hesperidae	10	7	4	3		13	9	26	2	8
Lycaenidae	19	9	13	3		15	19	17	3	30
Nymphalidae	100	104	141	91	57	90	89	82	141	215
Papilionidae	8	7	3	16	18	14	12	8	1	30
Pieridae	6	9	4	16	6	5	25	16	1	18

Appendix 2. List of Butterfly species recorded from 81 transect units at five selected locations in Bukit Barisan Selatan National Park covering primary forest and secondary forest.

Famili	Species	Kubu Perahu	Linau	Ranau	Way Canguk	Way Sepuntih	Total
Hesperiidae	*Ampittia dioserides*	0	1	0	0	0	1
	Arhopala epimuta	0	0	0	1	0	1
	Arhopala sp.01	1	0	0	1	0	2
	Hesperiidae sp.01	8	3	4	4	1	20
	Hesperiidae sp.02	3	0	0	3	3	9
	Hesperiidae sp.03	0	1	0	1	0	2
	Hesperiidae sp.04	0	0	1	5	0	6
	Hesperiidae sp.05	0	1	0	1	0	2
	Hesperiidae sp.06	5	1	7	12	0	25
	Hesperiidae sp.07	0	1	1	1	1	4
	Hesperiidae sp.08	0	0	1	0	0	1
	Hesperiidae sp.09	1	0	0	0	1	2
	Hesperiidae sp.10	0	0	0	9	3	12
	Hesperiidae sp.11	0	0	0	2	0	2
	Hesperiidae sp.12	0	0	0	2	0	2
	Tagiades sp.01	1	0	0	0	0	1
	Tagiades sp.02	0	0	0	0	1	1
Lycaenidae	*Abisara geza*	0	0	0	2	0	2
	Allotinus drumila	0	0	3	0	0	3
	Allotinus fallax	0	0	10	0	0	10
	Arrophaneura sycorax	1	0	0	0	0	1
	Castalius sp.01	0	0	0	0	1	1
	Discolampa ethion	2	0	0	0	6	8
	Drupadia ravindra	0	0	0	5	3	8
	Drupadia rufotaenia	0	0	0	9	2	11
	Drupadia sp.01	4	1	0	2	6	13
	Drupadia sp.02	6	0	0	2	4	12
	Drupadia theda	0	0	0	4	0	4
	Eooxylides sp.01	4	0	0	0	5	9
	Jamides parasaturata	1	0	1	3	4	9
	Jamides philatus	0	0	0	0	1	1
	Laxita thuisto	1	0	1	1	2	5
	Lycaenidae sp.01	2	1	1	3	1	8
	Lycaenidae sp.02	2	0	0	0	0	2
	Lycaenidae sp.03	0	2	0	0	0	2
	Paralaxita damajanti	5	15	0	0	0	20
	Paralaxita telesia	0	0	0	3	1	4
	Pithecops corvus	1	0	0	0	0	1
	Pithecops fulgens	1	0	0	0	2	3
	Stiboges nymphidia	0	0	1	5	0	6
	Taxila haquinus	0	0	0	1	0	1
Nymphalidae	*Amathuxidia amythaon*	0	0	6	0	1	7

	Amnosia decora	0	0	4	0	0	4
	Athyma cama	0	0	0	0	1	1
	Athyma kanwa	0	2	0	0	0	2
	Athyma perius	1	0	0	0	0	1
	Cethosia hypsea	1	8	0	0	0	9
	Charaxes bernandus	0	0	1	0	5	6
	Chersonesia peraka	0	0	2	10	6	18
	Chersonesia rahria	3	0	0	1	1	5
	Cirrochroa clagia	0	0	0	0	1	1
	Cirrochroa thyce	0	0	0	0	3	3
	Cupha erymantis	3	17	3	19	1	43
	Cupha orissa	0	0	3	12	1	16
	Cupha sp.01	0	0	0	2	0	2
	Cyllogenes suradeva	3	0	0	0	2	5
	Cyrestis nivea	1	0	0	0	0	1
	Cyrestis sp.01	1	0	0	1	1	3
	Cyrestis themire	0	0	0	2	0	2
	Danaus genutia	0	9	0	0	0	9
	Danaus melanipus	0	2	0	0	1	3
	Danaus sp.01	8	14	0	0	0	22
	Doleschallia bisaltida	0	1	2	28	3	34
	Elymnias kamara	0	2	0	0	1	3
	Elymnias panthera	0	1	0	0	0	1
	Erites medura	0	0	0	0	1	1
	Euploea caramalzeman	0	0	0	0	1	1
	Euploea mulciber	4	1	2	0	0	7
	Euploea phanaerata	1	0	0	0	0	1
	Euploea radamanthus	1	0	0	0	7	8
	Euthalia monina	0	1	0	0	1	2
	Faunis canens	13	8	11	10	13	55
	Faunis gracilis	0	0	0	3	2	5
	Faunis kirata	0	6	0	0	3	9
	Faunis phoon	3	5	1	4	4	17
	Faunis sp.01	0	0	0	0	6	6
	Hypolimnas missipus	0	0	0	0	2	2
	Idea stolli	10	0	0	1	7	18
	Ideopsis sp.01	0	0	1	0	0	1
	Ideopsis vulgaris	2	8	1	0	4	15
	Junonia almana	4	2	0	0	0	6
	Junonia atlites	0	0	0	0	9	9
	Junonia iphita	6	1	0	0	0	7
	Junonia orithya	0	0	0	0	1	1
	Kallima paralecta	3	0	0	1	1	5
	Lasippa tiga	1	0	0	5	3	9
	Leptosia nina	1	0	0	1	0	2
	Lethe confusa	0	0	0	0	4	4
	Lethe darena	0	0	3	1	0	4
	Lethe sp.01	0	0	1	0	0	1

	Lexias dirtea	2	7	0	8	7	24
	Lexias pardalis	2	7	2	5	12	28
	Melanitis leda	5	0	0	0	26	31
	Melanitis sp.01	1	0	0	0	3	4
	Melanitis sp.02	0	2	0	0	0	2
	Melanitis ziterius	0	0	0	1	0	1
	Mycalesis arseus	0	0	0	0	3	3
	Mycalesis fuscum	9	14	12	0	0	35
	Mycalesis horsfieldi	0	2	0	0	0	2
	Mycalesis janardana	0	0	0	0	1	1
	Mycalesis maianeus	1	0	0	1	4	6
	Mycalesis mineus	0	0	4	0	3	7
	Mycalesis moorei	0	0	0	0	15	15
	Mycalesis orange	0	0	4	0	0	4
	Mycalesis orseis	4	0	0	0	14	18
	Mycalesis parseus	0	3	5	0	6	14
	Mycalesis pitana	0	0	9	2	0	11
	Mycalesis sp.01	6	0	1	0	0	7
	Neorina chrisna	2	0	1	0	0	3
	Neozephrus sp.01	0	0	0	2	0	2
	Neptis duryodana	0	0	0	0	8	8
	Neptis hylas	2	15	3	3	12	35
	Neptis ida	0	0	0	0	1	1
	Neptis muala	0	0	0	8	0	8
	Nymphalidae sp.01	0	0	1	1	1	3
	Nymphalidae sp.02	1	0	0	0	0	1
	Nymphalidae sp.03	2	0	0	0	0	2
	Orsotriaena medus	4	18	4	1	5	32
	Parantica aspasia	3	2	2	5	5	17
	Parantica pseudomelanus	0	2	0	0	0	2
	Pareronia valena	0	0	0	0	1	1
	Polyura athamas	0	0	0	0	1	1
	Prothoe franck	4	0	0	1	2	7
	Ragadia makuta	70	7	7	15	106	205
	Stibochiona coresia	2	0	0	0	0	2
	Symbrenthia hypatia	0	0	1	0	4	5
	Symbrenthia sp.01	1	0	0	0	2	3
	Tanaecia aruna	4	15	0	1	24	44
	Tanaecia cocytina	1	0	0	0	0	1
	Tanaecia gondartii	1	2	0	0	3	6
	Tanaecia iapis	16	14	0	7	7	44
	Tanaecia palguna	0	0	0	0	2	2
	Tanaecia pelea	2	2	0	1	1	6
	Taxila sp.01	0	0	0	0	5	5
	Terinos clarissa	0	2	0	0	0	2
	Terinos sp.01	0	0	0	3	0	3
	Terinos terpander	0	6	0	6	0	12
	Thaumantis odana	2	0	6	2	6	16

	Vindula dejone	2	0	4	0	1	7
	Vindula egista	0	0	0	0	1	1
	Xanthotaenia busiris	13	15	3	13	14	58
	Xanthotaenia sp.01	2	0	0	0	1	3
	Ypthima baldus	1	20	27	0	0	48
	Ypthima iarba	0	0	0	4	3	7
	Ypthima pandocus	9	27	50	2	6	94
	Ypthima philomela	0	7	14	0	0	21
	Ypthima savara	0	0	0	0	1	1
	Zeadixia amethystus	0	0	0	2	0	2
Papilionidae	*Graphium agamemnon*	5	6	0	1	1	13
	Graphium aristeus	0	0	0	0	1	1
	Graphium evemon	0	2	7	0	1	10
	Graphium sarpedon	1	0	11	6	3	21
	Lamproptera meges	0	0	1	0	0	1
	Losaria coon	0	0	0	0	2	2
	Pachliopta aristolochiae	1	11	0	2	1	15
	Papilio demolion	0	0	1	6	2	9
	Papilio helenus	0	0	6	0	3	9
	Papilio karna	0	0	2	0	2	4
	Papilio lampacus	0	0	4	0	0	4
	Papilio memnon	3	5	1	5	8	22
	Papilio nephelus	0	0	1	0	2	3
	Papilio paris	0	0	2	0	0	2
	Papilio peranthus	1	0	0	0	0	1
	Papilio polytes	0	0	0	1	0	1
	Papilio sp.01	0	0	1	0	0	1
	Papilio sp.02	2	0	0	0	0	2
	Papilio sp.03	0	0	1	1	0	2
	Trogonoptera brookiana	0	0	0	0	2	2
	Troides sp.01	3	0	0	1	6	10
Pieridae	*Appias indra*	1	0	0	4	0	5
	Appias leptis	0	0	0	8	0	8
	Appias libythea	0	0	0	2	0	2
	Appias sp.01	0	0	0	0	2	2
	Cepora iudit	1	0	0	0	0	1
	Delias belisama	0	0	7	0	0	7
	Delias hyparate	0	0	1	0	0	1
	Eurema andersonii	0	11	0	0	2	13
	Eurema blanda	0	0	0	1	0	1
	Eurema hecabe	2	0	0	0	8	10
	Eurema lacteola	1	0	0	0	0	1
	Eurema sari	4	4	0	1	0	9
	Eurema sp.01	1	11	3	13	4	32
	Eurema sp.02	5	0	1	3	1	10
	Eurema tilaha	0	0	0	9	0	9
	Gandaca harina	0	0	0	8	3	11