
**A PROGRAM FOR CONSERVATION OF BIODIVERSITY AND ENDEMISM
OF BATS IN SCATTERED FORESTS AND CAVE COMPLEX
IN NORTH WESTERN, VIETNAM
(RGS 10259-2)**



Prepared by:
Vuong Tan Tu, tuvuongtan@gmail.com
Institute of Ecology and Biological Resources
18 Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam



Institute of Ecology and Biological Resources
18 Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam



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Clockwise order of bat pictures in cover page: Rhinolophus paradoxolophus, Hypsugo pulveratus, Scotomanes ornatus and Megaderma spasma

All bat pictures in this report were taken by Vuong Tan Tu

1. Introduction

North Western, Vietnam (NW) is located in the transition zone of Greater Annamitices Ecoregion (Figure 1), one of WWF global 200 ecoregions, which are characterized by its outstanding biodiversity values (Tordoff et al 2012). Currently, almost remaining forest areas herein have belonged to protected areas, however, due to low management capacity and low conservation awareness of poor local communities (mainly ethnic minority groups) in and around of protected areas, regions' biodiversity has been very likely continued to be reduced/degraded for shifting agricultural cultivation, forest products and food (Ministry of Natural Resources and Environment 2008). In spite of the fact that little forest remains in low elevations, NW retains arge forest areas and cave complexes scattered mainly on tops of limestone mountains, which supports many nationally and internationally endangered species. Of which, bats, a remaining mammalian group, play a key role in local ecosystem by providing many ecological services such as plant pollination, seed dispersal and insect control.

However, like most regions' fauna and flora, bats are most threatened by the habitat loss and degradation, yet its current status still remains poorly studied in terms of bioconservation (Furey, Mackie, and Racey 2010). Therefore, a comprehensive conservation program was conducted to evaluate the level of diversity of this important component and other needs to strengthen wildlife conservation and habitat management in the region.

Under the framework of the project, the project team has conducted a series of project activities. While qualitative analysis of data derived from field studies of the project is very time-consuming, this report, therefore, aimed to summarize the activities and its preliminary achievements during the period from March 2012 to the March 2013, as follows:

- **Conservation research activities:** A series of fieldworks have been taken place in the project areas. Together with field inventories, the project team has examined the bat collections in some institutes/universities in Vietnam. As a result, NW and adjacent territories are home to a. 60 bat species. Interestingly, some captured bats containing some morphological characters which might represent unknown species, but further morphological and molecular examinations are conducting to confirm their taxonomic status. In addition, a comprehensive investigation of phylogeny and phylogeography of Vietnamese bats including sampling from NW is also developing to evaluate their evolutionary relationship and demographic history.

- **Awareness-raising activities:** During the project, a number of training courses and seminars for local authors or children were taken place at project areas. The project recruited three post-graduating students from IEBR and 3 graduating students from Tay Bac University who participated as project members/students to develop their thesis or parts of their field studies. A series of awareness materials including T-shirts, brochures and posters has also been developed and distributed to local communities to enhance their knowledge of bioconservation.

- **Publications:** To date, the project team has completed some publications including Bsc and Msc thesis and reports. Some research articles are being developed and will be submitted to some scientific journals.

2. Project activities

2.1. Conservation research

Vietnam has long been recognized as a hotspot for global biodiversity (Sterling and Hurley 2005). Currently, over 120 bat species have been recorded in Vietnam, accounting nearly 30% of national mammal species (Dang, et al. 2008) and 10% of global bat diversity (Simmons 2005). The high level of bat diversity herein correlated to its long and complex biogeographical history. As the result, Vietnam comprises a variety of habitats/landscapes which are home to many bat species including vulnerable or newly described or undiscovered taxa. Despite receiving much attention in recent years, many areas which were considered as centre for national biodiversity but has not surveyed comprehensively and NW is one of those. That is reason why the biological assessment of Vietnamese bats is still underestimating and very little is known regarding their phylogeography or ecological factors promoting its diversification. In addition, due to containing high level of species richness and cryptic diversity, the taxonomic systematic of many Vietnamese bat species retain problematic (Francis et al. 2010; Francis and Eger 2012; Csorba et al. 2011; Thong, Puechmaille, Denzinger, Bates, et al. 2012; Hendrichsen et al. 2001) and therefore many taxa are needed to be revised.

The NW covers an area which is situated in the transition zone between the Annamite range and Xishuangbanna area in southwest China. Topologically, the region comprises mostly of mountainous and hilly terrain with the highest mountain in French Indochina, Mount Fansipan (3143 m.a.s.l). The complex topology and climate of the region support a variety of vegetation types ranging from low montane evergreen forest at the altitude less than 1000 masl to medium and high montane evergreen forest at the altitude from over 1000 masl. In the last decades, almost land areas of NW was covered by forests ranging from lowland to highland evergreen forest and

limestone karst forests. For that reason, the NW was recognized as one of four centers for national biodiversity (Sterling and Hurley 2005). Nevertheless, in recent years, as the result of high rate of increasing population and unsustainable economic development, almost regional forest areas has been degraded/altered and fragmented (Ministry of Natural Resources and Environment 2008). Despite most forest areas are scattered and occur with small fragments at high altitudes, these remaining forest areas and cave systems which found mainly in karst areas still support many species, including bats, yet almost nothing is known of its biodiversity and geographic distribution. In order to access the status and current trends of regional biodiversity, bats were chosen as they are a biological index that reflex the status of entirely biodiversity.

2.1.1. Bat inventory

In this project, a series of field expeditions were taken placed in different studied sites mainly belonging to protected areas within NW (see figure 1). Field surveys studied in a variety of habitats ranging house gardens, forest edges, and secondary forest to limestone forest and limestone caves. The examinations of bat specimens housed in local institutions or universities and literature surveys were also performed in order to get additional information of the regional bat diversity.

During field studies, a number of captured bats which were accidentally injured or not be able to identify in the field or contained some distinctively morphological characters were kept as specimens to confirm its identification. A tissue collection of almost captured bats or specimens were sampled. For living bats, tissues samples were collected from punching of a small piece of wing membranes of living bats which were regarded as less harmful to bats. Tissue samples were preserved in absolute alcohol and were then sent to Museum National d'Histoire Naturelle, Paris, France for genetic analysis.

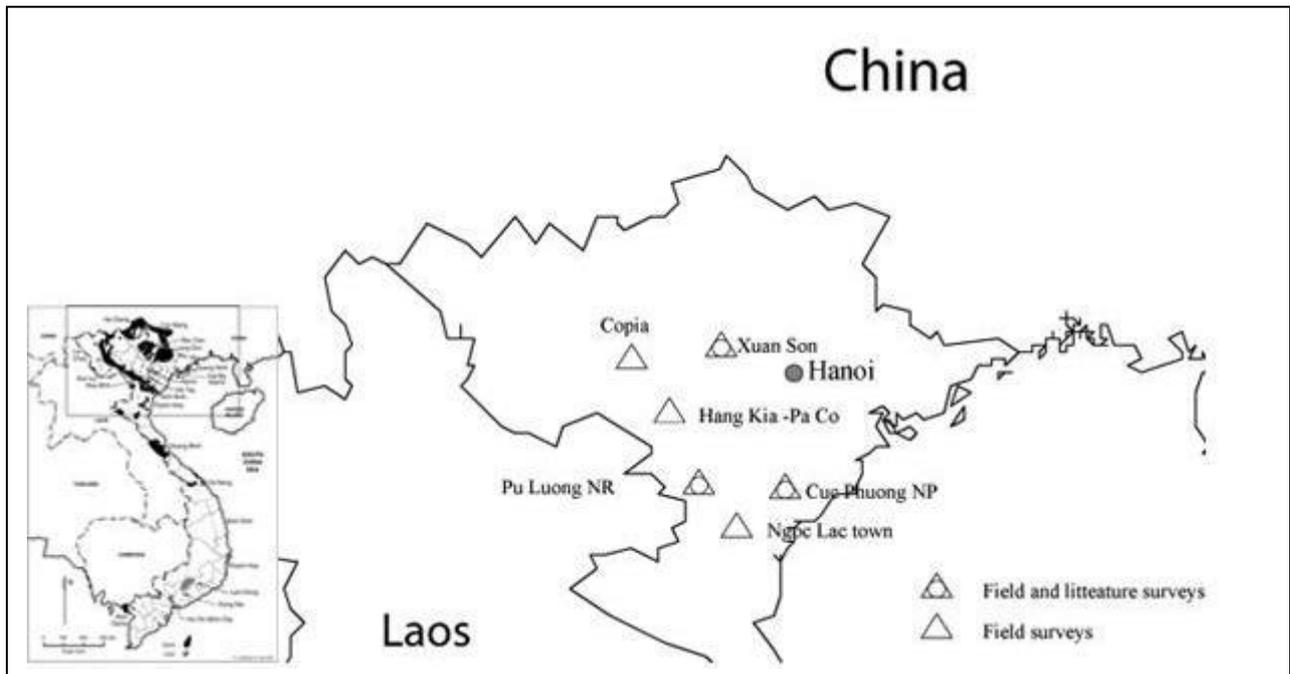


Figure 1: Studied sites within Northwestern and adjacent territories in Vietnam

Bats were identified initially in the field basing on field guidance (Borisenko and Kruskop 2003; Francis 2008) and then be corrected based on the comparison with the specimens preserved in the museums or detail descriptions found in bat monographs (Bates and Harrison 1997; Corbet and Hill 1992). In addition, bat identification through DNA barcoding approach was also applied but the complete result of DNA sequence analysis is not available, so that it was not presented in this report.

Based on the preliminary results of morphological examinations, NW and adjacent territories are home to a. 61 bat species of 7 families, accounting approximately a half of national bat diversity (Table 1). In the Table 1, a large number of recorded bat species are widespread species, but there are also some rarely captured species such as *R. luctus*, *R. paradoxolophus*, *Scotomanes ornatus* and some captured bats marked as cf. as their identification need to be re-examined. Especially, there were some captured bats containing some distinctively morphological characters that did not corresponded to Vietnamese recent known species (sp). These individuals

might be news for science or Vietnamese bat fauna, but further examinations using both morphological and molecular analysis is needed to confirm its taxonomic status.

Table 1: Checklist of recent known bat species recorded in Northwestern Vietnam and adjacent territories

#	Scientific name	CP	XS	PL	NL	Copia	HK-PC	IUCN
I	PTEROPODIDAE							
1	<i>Cynopterus sphinx</i>	X	x	x	x		x	LC
2	<i>Eonycteris spelea</i>	X	x		x		x	LC
3	<i>Macroglossus sobrinus</i>	X						LC
4	<i>Megaerops niphanae</i>	X						LC
5	<i>Rousettus leschenaultia</i>	X	x	x	x		x	LC
6	<i>Spherias blanfordi</i>	X						LC
II	EMBALLONURIDAE							
9	<i>Taphozous melanopogon</i>	X						LC
III	MEGADERMATIDAE							LC
10	<i>Megaderma lyra</i>	X			x			LC
11	<i>Megaderma spasma</i>	X						LC
IV	RHINOLOPHIDAE							
12	<i>Rhinolophus affinis</i>	X	x	x		x		LC
13	<i>Rhinolophus cf.lepidus</i>	X						LC
14	<i>Rhinolophus luctus</i>					x	x	LC
15	<i>Rhinolophus macrotis</i>	X	x	x				LC
16	<i>Rhinolophus malayanus</i>	X			x			LC
17	<i>Rhinolophus marshalli</i>	X	x			x		LC
18	<i>Rhinolophus paradoxolophus</i>	X	x		x	x		LC
19	<i>Rhinolophus pearsoni</i>	X	x	x	x	x	x	LC
20	<i>Rhinolophus pusillus</i>	X	x					LC
21	<i>Rhinolophus stheno</i>				x			LC
22	<i>Rhinolophus thomasi</i>	X	x	x	x	x	x	LC
V	HIPOSIDERIDAE							
23	<i>Aselliscus stoniczkanus</i>	X	x		x		x	LC

24	<i>Coelops frithi</i>	X						LC
25	<i>Hipposideross alongensis</i>	X						LC
26	<i>Hipposideross armiger</i>	X	x	x	x	x	x	LC
27	<i>Hipposideross cineraeus</i>	X		x	x			LC
28	<i>Hipposideross larvatus</i>	X	x	x	x	x	x	LC
29	<i>Hipposideross lylei</i>	X						LC
30	<i>Hipposideross pomona</i>	X	x	x	x			LC
VI	VESPERTILIONIDAE							
31	<i>Eptersicus serotinus</i>					x		LC
32	<i>Harpiocephalus harpia</i>			x				LC
33	<i>Hypsugo cardonea</i>	X						LC
34	<i>Hypsugo pulveratus</i>	X	x	x	x	x	x	LC
35	<i>Ia io</i>	X	x					LC
36	<i>Kerivoula cf. hardwicki</i>	X		x				LC
37	<i>Kerivoula kachinensis</i>			x				LC
38	<i>Kerivoula picta</i>	X						LC
39	<i>Murina cyclotis</i>	X	x		x			LC
40	<i>Murina cf. feae</i>	X	x	x				LC
41	<i>Murina harrisoni</i>		x					LC
42	<i>Murina sp</i>		x	x				LC
43	<i>Myotis chinensis</i>	X	x	x	x			LC
44	<i>Myotis formosus</i>	X						LC
45	<i>Myotis laniger</i>		x			x		LC
46	<i>Myotis muricola</i>	X		x	x			LC
47	<i>Myotis siligorensis</i>	X	x			x	x	LC
48	<i>Myotis sp</i>					x		LC
49	<i>Pipistrellus abramus</i>	X	x		x			LC
50	<i>Pipistrellus coromandra</i>	X		x				LC
51	<i>Pipistrellus javanicus</i>	X						LC
52	<i>Pipistrellus paterculus</i>	X						LC
53	<i>Pipistrellus tenuis</i>	X			x			LC
54	<i>Scotomanes ornatus</i>	X				x		LC
55	<i>Scotophilus heathli</i>	X			x		x	LC
56	<i>Scotophilus kuhli</i>			x		x		LC

57	<i>Tylonycteris pachipus</i>	X						LC
58	<i>Tylonycteris robustula</i>	X				x	x	LC
VII	MINIOPTERIDAE							
59	<i>Miniopterus fuliginosus</i>	X	x			x		LC
60	<i>Miniopterus magnater</i>	X	x					LC
61	<i>Miniopterus pusillus</i>	X	x			x		LC
	Total	49	27	20	21	18	13	

Legend:

CP: Cuc Phuong National Park;

XS: Xuan Son National Park, Phu Tho Province;

PL: Pu Luong Nature Reserve, Thanh Hoa Province;

NL: Ngoc Lac town, Ngoc Lac district, Thanh Hoa Province;

Copia: Copia Nature Reserve, Son La province;

HK-PC: Hang Kia – Pa Co Nature Reserve, Hoa Binh province;

IUCN category: LC – Least concern;

cf. captured bats were identified but need to be reexamined;

sp. captured bats were not identifiable

The preliminary results derived from this project indicated the bat fauna found in NW contain high level of species richness. However, some areas within the region were regarded as hot spot for national biodiversity and endemism such as the upland mountainous forest around Mount Fansipan or limestone karst forest along the borders between Vietnam-China and Vietnam-Laos, but have not been surveyed in this project. These areas might support additional bat species, but the field expedition in these areas is facing many difficulties due to the high field expenses and unfavorable weather conditions.

In comparing the level of biodiversity found in different areas within NW and adjacent territories, there was a strong correlation between the number of recorded bat species and habitat features and level of surveyed coverage (Table 1). For instance, despite taxonomic status of some recorded species is undebated, Cuc Phuong and Xuan Son national parks which were regarded retaining many habitat types ranging from lowland evergreen

primary forest to limestone forest and cave systems within core zones and receiving much attention in recent years, are home to a. 49 and a. 27 bat species, respectively. While in other areas where their habitats have been heterogeneously degraded/altered and were not surveyed comprehensively, the levels of bats decrease from 21 (Ngoc Lac town), 20 (Pu Luong nature reserve), 18 (Copia nature reserve) to 13 (Hang Kia – Pa Co nature reserve).

In comparing the bat composition between different studied sites, the bat species of 2 families Rhinolophidae and Hipposideridae are dominant in all studied sites (Table 1). These are because of almost of these species are cave-dwellers and therefore they can root in the caves existing frequently in the studied sites. In the areas that its habitats were less disturbed (Cuc Phuong and Xuan Son), bat communities contain higher number of interior forest species, while in other disturbed habitats (Ngoc Lac town, Pu Luong NR, Hang Kia - Pa Co NR, Copia NR) open-space bats were found dominantly. Moreover, the comparison of bat capture effort in different habitats also showed the decreasing number of captured bats was correlated largely to the level of habitat disturbances.

2.1.2. Bat reproduction

The impacts of disturbance during the breeding period was regarded as critical threats to bats, especially to cave-dwelling bats as its roots are limited to closed space. In order to gather the information of breeding season of regional bat species, almost captured bats were checked its reproductive status. The captured bats, which were pregnant, or carrying its offspring were handled with care to avoid its harmful and released immediately after taking photographed and measurements.

As the result, almost adult females of almost species captured in the end of March to April were late pregnant or lactating and the post-lactating period was found from late of July to August. These results were similar to

the findings of Furey et al (2010) as the breeding season of all bat species were positively correlated with rainfall and temperature and food ability with weaning occurring during the mid-wet season (May-July). These also showed an adaptive evolution of bat species and regional biogeography.

2.1.3. Problems of taxonomic systematic of regional bats

Based on the literature revisions and analysis data derived from morphological and molecular examinations, the taxonomic systematic of many taxa, including common widespread species, found not only in NW but also in other territories of Vietnam are not debated and needed to revised (Francis et al. 2010; Thong et al. 2012a,b). These taxa including some regional bat species of family Vespertilionidae or Hipposidaridae which were previously misidentified due to lacks of comparison with type specimens or similar morphology and are recently regarded as cryptic species complexes (Francis et al. 2010). In order to evaluate the taxonomic status and evolutionary relationship of these taxa, an investigation integrating among morphological and molecular approaches is conducting at MNHN, Paris. The detail results of these analyses will be developed and published in the form of research papers in some journals in coming time.

2.1.4. Phylogeography of regional bats

As present above, the bat assemblages of NW play important patterns of Vietnamese bat diversity, yet almost nothing is known of its demographical history. Based on preliminary results of molecular analysis of samplings from Vietnam including NW, some taxa contain genetic structures corresponding to its geographical distributions. Therefore, the investigation of the factors driving its diversification might be useful to evaluate the effects of recently habitat disturbance to the level of bat diversity within NW.

2.1.5. Threats to regional bats

As presented above, the level of bat diversity correlate largely to its habitat features, but NW was identified containing highest rate of habitat loss/disturbance in Vietnam. Although almost remaining forest areas and cave systems surveyed are belonging to protected areas, but the management effectiveness therein are extremely weak due to low capacities both in qualitative and quantitative of manager boards. Moreover, local people living around these areas are predominantly ethnic minorities and their livelihood still depends largely on forest exploitation, including hunting bats and other wildlife for food. They are also poorest communities in Vietnam and lack of awareness of biodiversity conservation. Therefore, the bat fauna and other nature herein are most vulnerable.

2.1.6. Conclusion and perspective

Due to the restriction of the time scale and finance, however, the preliminary results indicated that the level of diversity of regional bat is underestimating and new findings are expected with the extension of field expeditions in project area, especially in unsurveyed sites. Whereas taxonomic systematic of many taxa is undebated, the phylogeography of Vietnamese bats including NW bats is also ambiguous. Therefore, further investigations need to be taken place in order to address the above questions. These works will also provide critically ecological information for the policy makers to develop productive solutions to conserve regional bats and other nature as well as their entire habitats.

2.2. Capacity building

During the project period, three graduating students from Faculty of Agriculture and Forestry of Tay Bac University (Son La province) and three

Msc students of Institute of Ecology and Biological Resources (IEBR) have joined the project to develop their thesis or exchange their experiences in field/lab work, networking, etc.

- Mr. Le Quang Tuan, Msc student of IEBR has just completed his thesis in term of “Applying GIS technology to monitor the distributions of rare mammal in some protected areas, northern Vietnam. Now, Tuan is applying for a PhD scholarship to continue his study;

- Miss. Phung Thi Hong Luong, Msc student of IEBR has just completed her thesis, namely “Biodiversity of spider fauna (Araneae) in Xuan Son National Park, Phu Tho province”. After post-graduated, Luong is focusing on the investigation the diversity and endemism of cave spider fauna in Vietnam and applying for a PhD scholarship to continue her work.

- Mr. Dang Van An, a Msc student of IEBR is developing his Msc research on the level of biodiversity of cave invertebrate fauna in karst areas within Northern Vietnam.

- Other three students of Tay Bac University had graduated and are now working in the field of biological conservation or environmental protection. Two of them are working as forest rangers in Pu Luong NR, Thanh Hoa province and Forest Management Board, Binh Phuoc province and the rest is working in the department of Agriculture and Forestry, Thuan Chau district, Son La Province.

- Currently, the project investigator, Mr. Vuong Tan Tu is conducting his PhD research entitled “Assessment of biodiversity and endemism of bats (Mammalia, Chiroptera) within Annamite Range” at Muséum national d’Histoire naturelle (MNHN), Paris.

The above results ensure that the impact of the projects capacity-building works will continue and certainly some new investigations on Vietnamese bats and cave fauna will be developed to improve national nature conservation and management.

2.3. Activities to strengthen local awareness

As mentioned above, the local residents living in or around protected areas within NW are mostly ethnic minority people, lived in a self-sufficient economy. Their livelihood depends largely on forest logging and which shifting cultivation. Therefore, in order to strengthen their understanding of the important of bioconservation, during the project, project team had collaborated with local agencies, mainly Youth Union authors, to develop a series of educational events for children and local authors to strengthen their knowledge of bioconservation and habitat management. These events contained a variety of activities such as seminars, training course... with aims to equip participants with some basic knowledge as follows:

- The important of bat and other native biodiversity within region;
- Principle and methodology for biodiversity assesment and its implications for local habitat management;
- Practice and exchange their experience in their knowledge learnt from training event.

2.4. Wider awareness

During the project period, a range of activities has been taken place to raise wider awareness of the importance and gaps in studying of regional bats and its implications for habitat management. These included conference/exhibition presentations, distribution of awareness materials, details for which are given below.

An oral presentation entitled “*Cave-Dwelling Bats in Vietnam: Conservation Status, Threats and Needs*”, was presented in the 2012 SEABCRU Workshops, organized by the Southeast Asian Bat Conservation Research Unit and the Prince of Songkla University, held in Hat Yai, Thailand, 7-8th of July, 2012.

A series of awareness materials including Rufford logo have been

developed and delivered, detail as the table below:

Table 2: Awareness materials were developed and distributed

#	Item	Quantity
1	Poster “Bat Conservation for our life” (A1, full colour)	800 units were made and delivered to local communities, schools
2	Leaflet: Bat conservation of Northwestern: Full colour, six pages	3000 units were made and delivered to local communities, schools
3	T-shirt: Love bats!	300 units distributed to community leaders and local children

2.5. Report and Publication

With the data generated from the project, project member have completed or are developing some academic papers or reports to submit to national journal/conference/ mainstream media as listed below:

- Vuong Tan Tu, 2012, *Cave-Dwelling Bats in Vietnam: Conservation Status, Threats and Needs*, (oral), 2012 SEABCRU Workshops, organized by the Southeast Asian Bat Conservation Research Unit and the Prince of Songkla University, held in Hat Yai, Thailand, 7-8th of July, 2012.

- Vuong Tan Tu, Nguyen Van An, Le Quang Tuan, 2012. *Assesment of bat diversity within Hang Kia – Pa Co, Hoa Binh province*. Report to Manager board of Hang Kia - Pa Co and IEBR, Hanoi, Vietnam (in Vietnamese);

- Pham Thai Tinh, 2012, *Assesment of bat diversity within Ngoc Lac town, Thanh Hoa province*. These submitted for Bsc degree of Tay Bac university, Son La province (in Vietnamese);

- Pham Van Hoanh, 2012, *Assesment of bat diversity within Pu Luong Nature Reserve, Thanh Hoa province*. These submitted for Bsc degree of Tay Bac university, Son La province (in Vietnamese);

- Lo Van Trong, 2012, *Assesment of bat diversity within Copia Nature Reserve, Son La province*. These submitted for Bsc degree of Tay Bac university, Son La province (in Vietnamese);

- The project team are developing other manuscripts of research papers to submit to scientific journals/conferences in near future. In which, the Rufford Foundation will be cited in our publications as sponsor and update information will be sent to Rufford in later dates.

3. Financial Summary

During the project period (March 2012 to March 2013), total expenditure spent on the project activities was £11,765, exceeding the original estimate (£11,265) due to increase in prices over time in Vietnam. Fortunately, the IEBR accepted to support this exceeding amount. Accordingly, the table below summarized the summary the expenses of the project, including funding sponsored by the Rufford (£5990) (all items are GBP).

Project Expenditure	TOTAL	Rufford	Secured
Field Equipment & Materials			
Field equipment for Project Officers (7 sets @ £40 per set)	280	0	280
Literature for Project Officers (2 sets @ £45 per set)	90	90	0
2 Harp traps (@ £120 each)	240	0	240
10 mist nets (@ £95 each)	950	0	950
1 D240x bat detector (@ £1160)	1160	0	1160
1 Digital Camera (@ £260)	260	0	260
Miscellaneous equipment	40	40	0
Equipment maintenance	30	30	0
Medical supplies (3 units @ £15 per unit)	45	0	45
Chemical and glassware	100	50	50
Field consumables (batteries, tapes, maps)	150	150	0
Misc. field kit (tarpaulin, utensils, groundsheets)	100	0	100
Field Inventory			
Team travel expenses (public transport to field sites) (4 indiv. @ 12 trips @ £20 each)	560	560	0
En-route Accommodation/food (12 trips @ £30 per trip)	360	200	160
Administrative cost (12 trips @ £25 per trip)	300	0	300
Officer per-diems (3 pers. x 180 days @ £3 per day)	1620	860	760
Field porters (4 indiv.s @ 30 days @ £2.5 per day)	300	300	0
Local field guider (1 indiv. @ 180 days @ £2.5 per day)	450	450	0
Accommodation/food for team members in the field (12 trips @ £70 per trip)	740	590	150
Forest subsistence (12 trips @ £20 per trip)	240	240	0
Training program (4 x 5 day events @ 15 indiv.)			
Assist trainer/ translator (16 days @ £10 per day)	160	80	80
Venue hire & preparation (16 days @ £5 per day)	80	20	60
Literature and handouts (20 sets @ £5 per set)	100	50	50
LCD projector hire (20 days @ £10 per day)	200	0	200

Accommodation (15 indiv. x 20 days @ £2 per day)	600	450	150
Travel (60 participants @ £5 each)	300	0	300
"Bat party" for children (10 events in local schools)			
Assist trainer/ translator (10 days @ £10 per day)	100	60	40
Literature and stationary (10 events @ £20 per event)	200	140	60
Presents for participants (10 events @ £60 per event)	250	150	150
Awareness Materials			
Payment for designer	100	100	0
Conservation leaflets full colours (3000 units @ £0.15 each)	450	450	0
Conservation posters/calendars (800 units @ £0.40 each)	320	320	0
Conservation t-shirts (300 units @ £2 each)	600	510	90
Miscellaneous			
Report printing / photocopying	50	50	0
Communications	50	50	0
Stationary	40	0	40
Contingency	150	0	150
TOTAL	11,765	5,990	5,825

(1£ converted to 33,300 VND)

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APPENDIX

Appendix 1: Field surveys during the project period



Mistnetting in the field



A captured bat on the mistnet



An investigation of cave within Copia NR, Son La province



Mr. Vuong Tan Tu (middle) and two students (Pham Thai Tinh and Lo Van Trong) of Tay Bac University were setting up a harp trap

**Appendix 2: Photos of some bat species recorded within
Northwestern, VN during the project**



Rousettus leschenaultii

Eonycteris spelaea



Cynopterus sphinx

Rhinolophus luctus



Rhinolophus pearsoni

Rhinolophus thomasi



Hipposideros armiger

Hipposideros larvatus



Scotomanes ornatus



Myotis siligorensis



Hypsugo pulveratus



Tylonycteris robustula

Appendix 3: Threats to bat fauna of Northwestern, VN



Forest clearance for shifting cultivation in Hang Kia Pa Co Nature (photo at 1000m)



Tree cutting for timber or shifting cultivation



Traffic development destroyed a large area of natural forest



Local people are very poor (Photo in Hang Kia - Pa Co NR)

Appendix 4: Some awareness material generated from the project



Poster “Bat Conservation for our life”



Leaflet: Bat conservation of Northwestern



T-shirt “Love bat”

Appendix 5: Photos of some training activities during the project



“Bat talking” with local children in the secondary school in Copia NR



Teaching the local people to identify the bats in Hang Kia Pa Co NR



Showing student how to examine bat morphology



Participants in a training event organized by local Youth Union and project team in Copia Nature Reserve



A local author of Youth Union joined a field training event



Mr Le Quang Tuan, project's student/member, is recording the GPS information in the field