Frontier Vietnam Environmental Research

REPORT 9

Na Hang Nature Reserve, Tat Ke Sector

Site Description and Conservation Evaluation

Frontier Vietnam
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Tat Ke Sector

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Hill, M and Hallam, D (eds)

Ministry of Agriculture and Rural Development
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Frontier-Vietnam
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FOR MORE INFORMATION

Forestry Protection Department
Block A3, 2 Ngoc Ha, Hanoi, Vietnam
Tel: +84 (0) 4 733 5676
Fax: +84 (0) 4 7335685
E-mail: cites_vn@fpt.vn

Frontier-Vietnam
PO Box 242, GPO Hanoi, 75 Dinh Tien Hoang Street, Hanoi, Vietnam
Tel: +84 (0) 4 868 3701
Fax: +84 (0) 4 869 1883
E-mail: frontier@netnam.vn

Institute of Ecology and Biological Resources
Nghia Do, Cau Glay, Hanoi, Vietnam
Tel: +84 (0) 4 786 2133
Fax: +84 (0) 4 736 1196
E-mail: Lxcanh@ncst.ac.vn

Society for Environmental Exploration
50-52 Rivington Street, London, EC2A 3QP. U.K.
Tel: +44 20 76 13 24 22
Fax: +44 20 76 13 29 92
E-mail: info@frontier.ac.uk
Internet: www.frontier.ac.uk

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EXECUTIVE SUMMARY

This report describes the second phase of study conducted by the Society for Environmental Exploration (S.E.E.) in the Na Hang Nature Reserve, Tuyen Quang Province, Vietnam (22°10'N, 105°24'E). Unlike the first expedition, which was based in the southern (Ban Bung) wilderness zone of the reserve (described in Hill and Kemp, 1996), this work described in this report was almost entirely carried out in the northern (Tat Ke) sector, which is separated from the southern by intensively cultivated lowlands and the town of Na Hang. The work was carried out between 5th July and 9th September 1996.

The aim of the survey was to gather information on the forest structure and biodiversity of the sector in order to complement that gathered by the earlier research period, and compare forest quality, biodiversity, and threats to the conservation value of the protected area in both the southern and northern sectors of the reserve.

The vegetation of the sector was studied, with forest transects in four widely differing forest types surveyed (see Appendices 2 and 3). A list of 918 plant species, belonging to 135 families, was produced (see Appendix 1); twenty-nine of these species are included in the plant Red Data Book for Vietnam (RDB, 1996). However, the forest in the Tat Ke sector differed significantly from that in the southern part of the reserve, with greater disturbance caused by its larger human population.

Invertebrates were collected by sweep-net and pitfall trapping in forest transects and other locations. Pitfall trap assemblages showed relatively high diversity, although traps were situated in secondary vegetation types. However, sweep-net samples from forest vegetation were small.

Butterfly transects were set up in open vegetation and two differing forms of secondary forest. Butterflies were observed in each trasect once each week. In addition, butterflies were collected throughout the reserve, and a total of 94 species were taken (see Appendix 4).

Fish of the streams and rivers in and around the reserve were collected by Dr Nguyen Kiem Son of the Institute for Ecology and Biological Resources, Hanoi. A total of 73 species were recorded in the area (see Appendix 5); eight of the species collected are listed as under threat in Vietnam's Red Data Book (RDB, 1992). Amphibians and reptiles were also collected during the study period, and a list is shown in Appendix 6.

Birds were observed throughout the study period in all the habitats of the Tat Ke sector, and during a short visit to the Ban Bung sector. A total of 153 species were observed (Appendix 7), nine of which are endangered at a national or international level. When combined with the data from the previous survey, a total of 221 species have been recorded from the reserve in 1996.

Mammals were studied by trapping (small mammals and bats) and observation (larger mammals). A total of 21 species were recorded during the phase (see Appendix 8), but the Tonkin Snub-nosed Monkey *Pygathrix avunculus* was not observed.

Socio-economic conditions of the human population of the reserve were investigated by interviews conducted in local villages, and with health workers and forestry officials. Human activity in the Tat Ke sector has had a major impact on forest quality; primary forest is now restricted to the South and West parts of the sector. Although there are plans to reduce the population by resettling Hmong villagers in another area, these seem unlikely to have a major impact on the population pressures which currently exist on the area's forests.

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Fish Expert:	Dr Nguyen Kim Son
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SOCIETY FOR ENVIRONMENTAL EXPLORATION

Managing Director:	Ms. Eibleis Fanning
Research Programme Manager:	Ms. Leigh Stubblefield
Operations Manager:	Ms. Amy Banyard-Smith

Hanoi University

Botanist:	Dr Tran Dinh Nghia

Russian Tropical Centre

Taxonomist:	Dr. Alexander Monastyrskii

FRONTIER-TANZANIA

Research Co-ordinator:	Mr. Michael Hill
Assistant Research Co-ordinators:	Mr. Dan Hallam
Camp Co-ordinator:	Ms. Maysie Harrison
Field Assistants:	Ha Quy Quynh and Tran Quang Ngoc
Research Assistants:	Ms. Emma Segar, Mr. Kevin Bowyer, Mr.Charlie Cox, Mr. John Gilhooley, Jun Kino, Mr. Ross McCleod, Ms. Natasha Ralphs, Ms. Dorit Stumper, Mr. Gero von Hasa-Radlitz, Ms. Allyson Steels, Ms. Alexandra Hamilton, Mr. Steven Hughes and Mr. Mark Kinlon

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1.0 INTRODUCTION

1.1 General description

Na Hang Nature Reserve, Tuyen Quang Province, Vietnam, is made up of two wilderness zones; Tat Ke sector to the North of Na Hang town, and Ban Bung sector to the South (see Figure 1). The southern sector was the site of a biodiversity and socio-economic study by the Society for Environmental Exploration (SEE) in early 1996 (Hill and Kemp, 1996). The aim of SEE-Vietnam's second project in this reserve was to extend the survey work carried out on the biology and sociology of the Ban Bung sector in January to March 1996 to include the northern Tat Ke sector, and this report describes the results of work carried out in the Tat Ke sector only.

1.2 Location

The northern (Tat Ke) sector of the reserve is bounded on the East by the River Gam and a tributary which joins the Gam at Pac Von. To the North, the boundary is formed by the borders of the Con Lon and Yen Hoa districts. In the West, the boundary is formed by the Yen Hoa River (a tributary of the River Nang), and the Na Hang-Con Phay road (in places, little more than a track). In the South, the River Nang is the boundary, and the southernmost point of the sector is at the confluence of the Rivers Nang and Gam (see Figure 3).

Tat Ke has a large human population, and several villages occur within the reserve boundaries (particularly in the northern part of the sector). The largest settlement is Khau Tinh, and the majority of the sector is in the Khau Tinh subdistrict. The are also smaller villages and isolated farmsteads found throughout the sector, although few occur in the South and West of the sector.

1.3 Topography and Geology

The Tat Ke sector, like the southern Ban Bung sector, is made up of steep limestone hills. The majority of the sector, and the reserve as a whole, lies between 300 and 800m above sea level (asl.) The highest mountain in the Tat Ke sector reaches 1,064m asl.(Cox, 1994), and the highest peaks are concentrated in the central part of the sector. The western part of this block is called Nui Khau Tep (Khau Tep Mountain). Two distinctive isolated hills of 926m and 814m asl. lie at the southernmost point of the reserve (see Figure 3). Along the banks of the Rivers Nang and Gam, there are narrow strips of level land which are now almost entirely under cultivation. Several plateaux exist at higher elevations within the reserve, for example, around the village of Khau Tinh. These are also used as arable land, particularly for rice and maize cultivation.

As at Ban Bung, the underlying geology of the Tat Ke sector is limestone. Karstic processes have produced several extensive cave systems, although these are fewer than the Ban Bung sector. Tufa deposits occur at waterfalls and in caves.

In contrast to the Ban Bung sector, where gold-prospecting was widespread (Hill and Kemp, 1996), few signs of disturbance (for example, extensive areas of digging, as found near Nam Trang in the Ban Bung sector) were observed during the study period at Tat Ke. Although gold-prospecting itself is likely to be a seasonal occupation for agricultural workers, the lack of diggings suggests that Tat Ke either possesses less gold, or that its more intensive agricultural use and greater settled population discourages the activities of itinerant gold-prospectors.

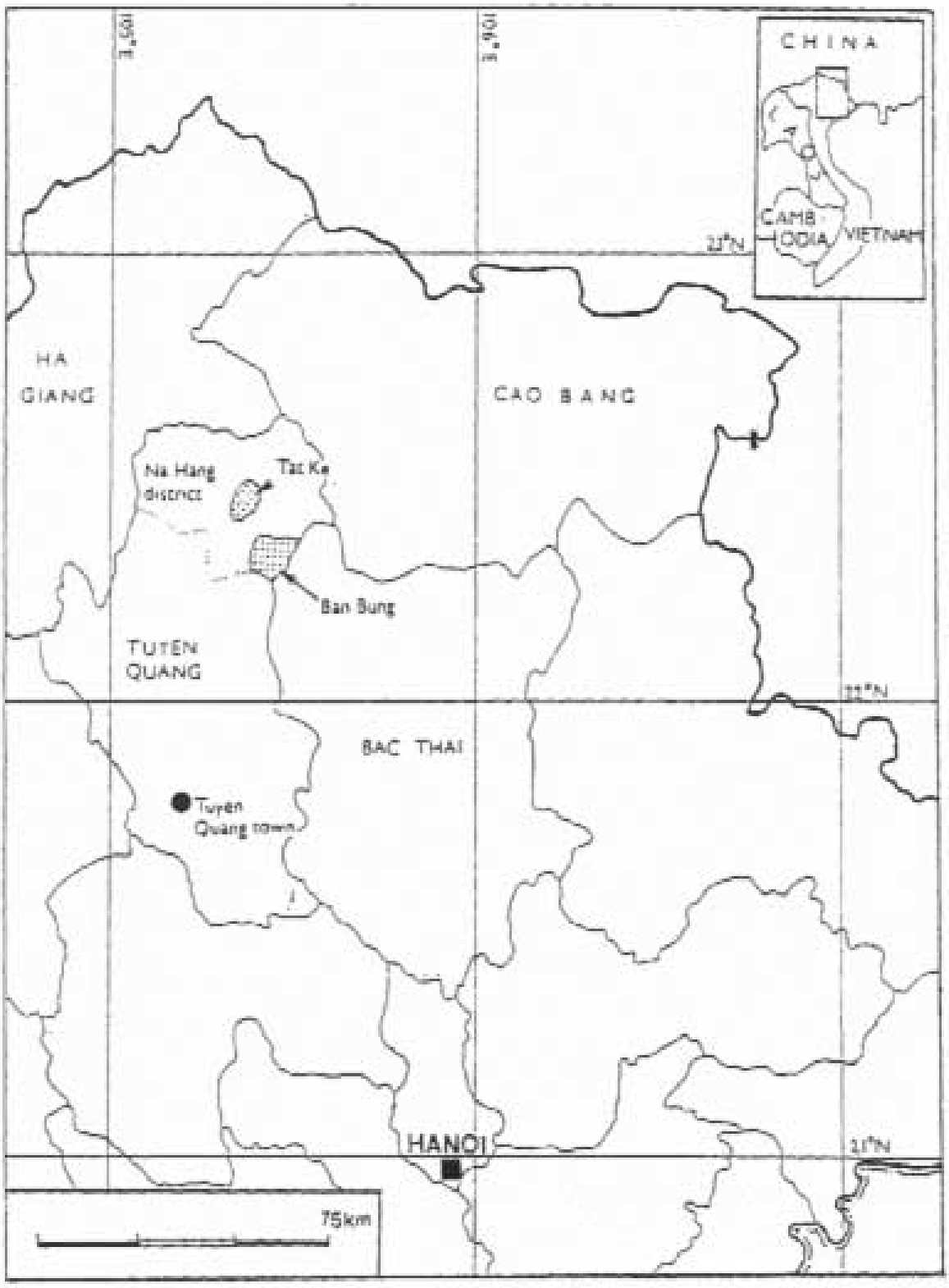


Figure 1. Map of northern Vietnam showing the position of the Na Hang Nature Reserve.

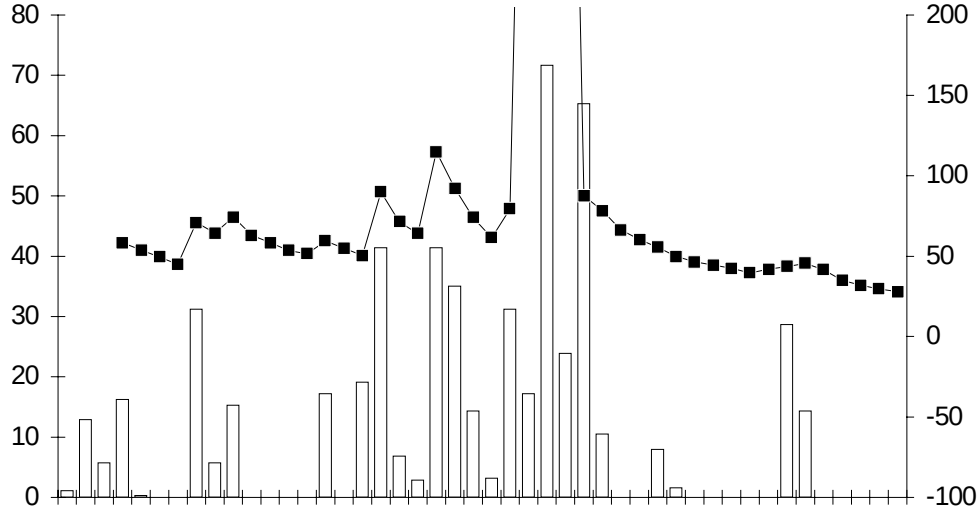
1.4 Climate and Hydrology

The climate of the Na Hang area is strongly seasonal, with cool, dry winters and warm, wet summers. Mean climate data for a ten-year period is given by Cox (1994).

The Tat Ke sector is drained by many small streams, although most of these are seasonal, drying out in the winter dry season. During the survey period in Tat Ke (which coincided with the summer wet season), the levels of streams within the reserve varied greatly with recent precipitation (see below). Around the margins of the reserve, most streams flow directly into the Rivers Nang and Gam, sometimes as steep waterfalls. In the central area, however, many streams (including the Khau Tinh stream) disappear into swallow holes in the limestone. A few of the streams in the sector are said to be permanent, flowing throughout the year, although in the winter villagers find it difficult to maintain an adequate water supply. Many farmers maintain small fish ponds amongst their rice paddies, although these too are usually only seasonal.

During the period of the survey in Tat Ke, rainfall data was collected using a rain gauge, and the water level of a stream close to the camp (Khau Tinh stream) was measured. These data are shown in Figure 2, below.

Figure 2. Daily rainfall (mm) and depth of Khau Tinh stream (mm), July- September, 1996



* = total rainfall not collected

The graph, Figure 2, shows the very short time lag between precipitation and stream flow. On most occasions, stream flow rapidly increased at the onset of rain. Although the forest and the limestone geology of the area act as a buffer to some extent,

regulating stream flow, there is still a large amount of rapid surface flow during the monsoon period. This has been aggravated by forest destruction in many areas of North-West Vietnam, and during the 1996 rainy season, heavier than usual rains caused extensive flooding which destroyed crops. Tuyen Quang Province (including Na Hang District) was badly hit by these floods (Phuong Mai, Vietnam Courier, 5/11/97).

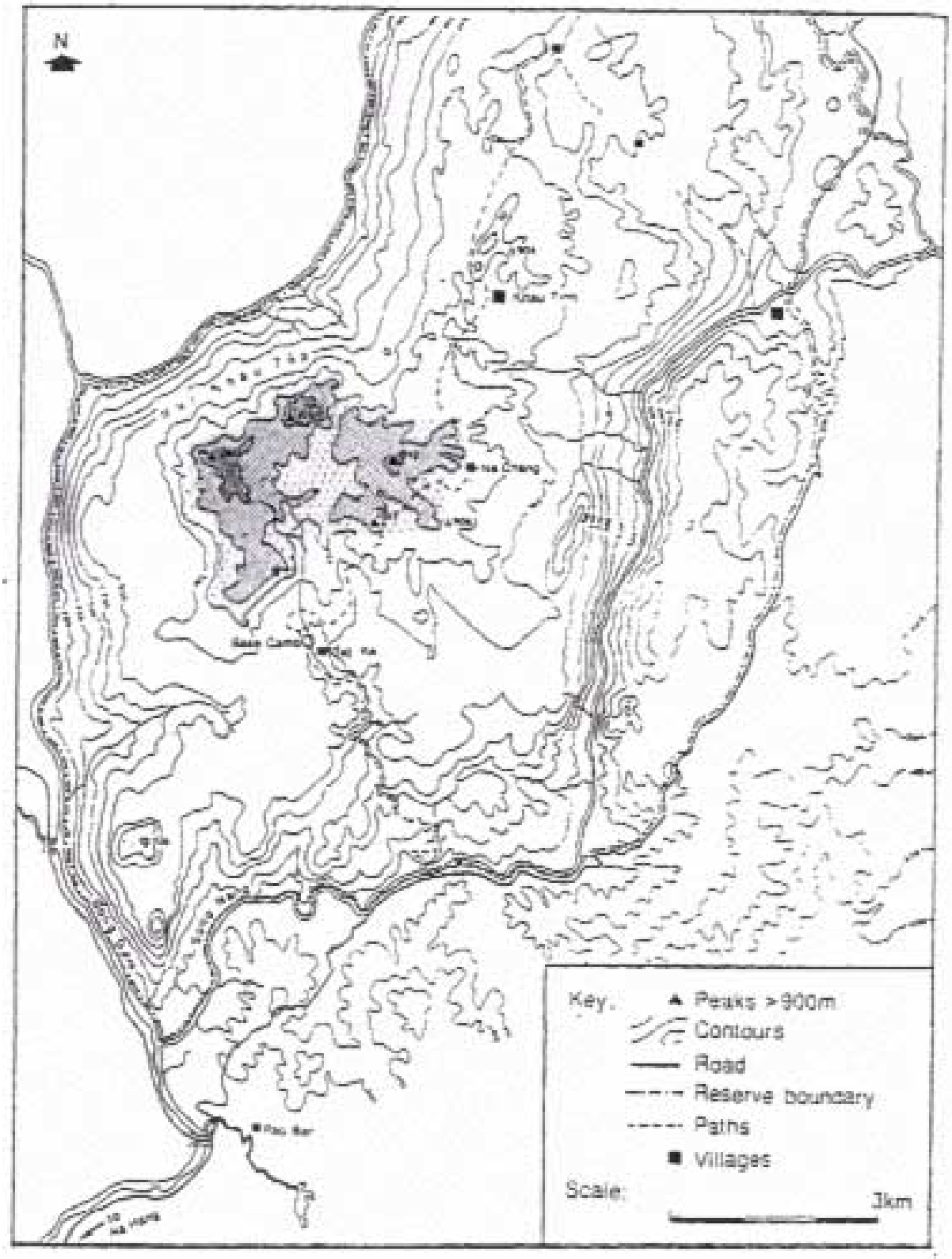


Figure 3. Topographical map of Tat Ke sector, Na Hang Nature Reserve.

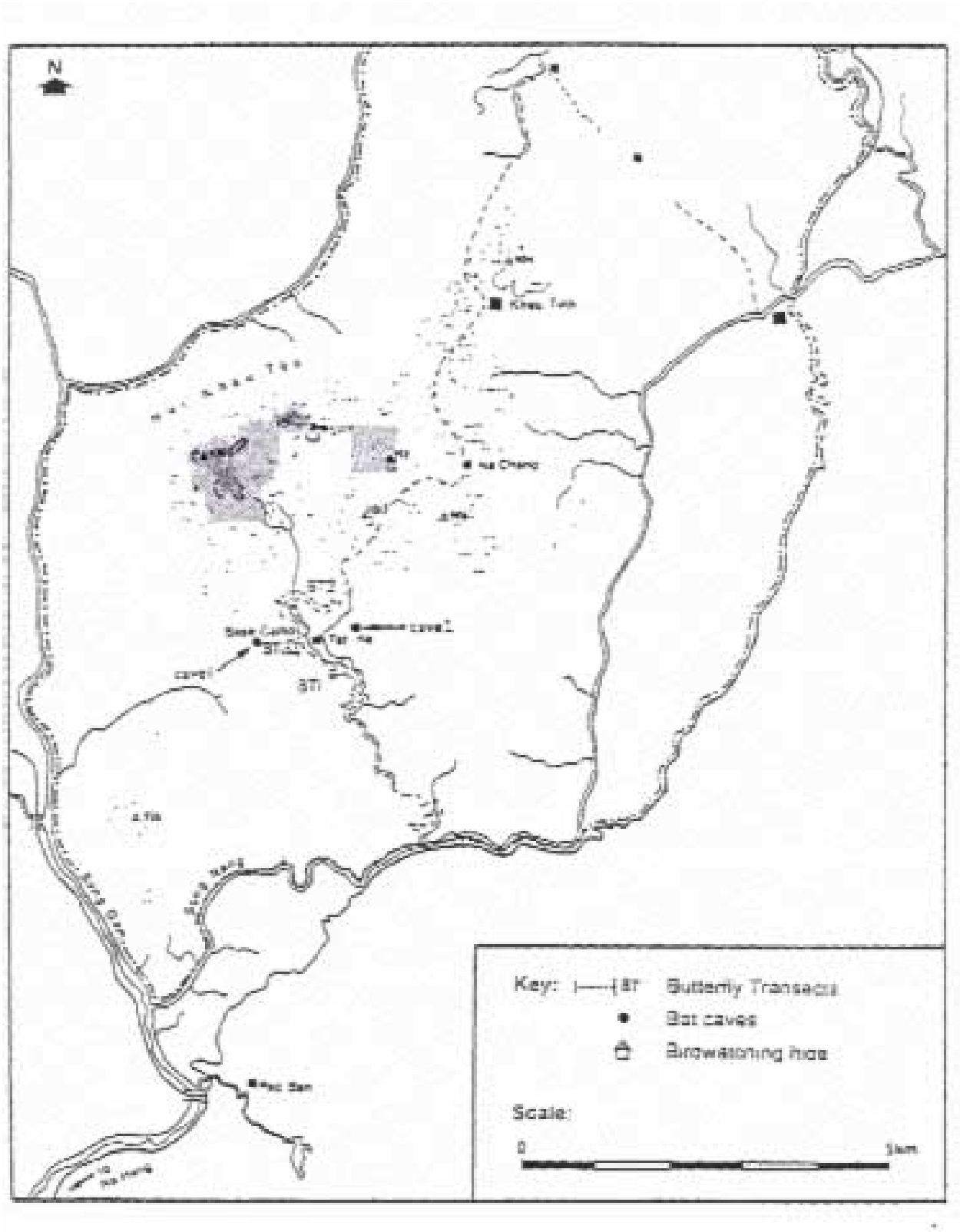


Figure 4. Map of Tat Ke sector, Na Hang Nature Reserve, showing study sites.

2.0 AIMS AND OBJECTIVES

The fauna and flora of the Na Hang region were studied by Dang Huy Huynh and Hoang Minh Khien (1993), and a report on the biodiversity of the area was produced by Cox (1994), which led to the establishment of the nature reserve. Since the reserve was established in 1995, various foreign and Vietnamese biologists have carried out short periods of research in the area. In early 1996, an SEE expedition in the Southern (Ban Bung) sector of the reserve carried out a baseline biodiversity survey and socio-economic work with local populations (Hill and Kemp, 1996).

The aims of the second study period in the Na Hang reserve were to gather data on vegetation, animals and human populations in the northern part of the reserve, to add to the existing body of biological and socio-economic data. In particular, less well-known groups (including butterflies, bats and small mammals) were to be targeted. This would allow conditions in the two wilderness zones to be compared. In addition, seasonal differences in the populations of insects, flowering plants and migratory birds would be observed.

More specific aims of the survey were;

- To identify and map the major vegetation types in Tat Ke, and describe their species composition and structure.
- To assess the species richness and conservation value of major invertebrate and vertebrate groups.
- To analyse human use of, and threats to, the forest vegetation of the Tat Ke area.
- To discuss threats, and potential threats, to the reserve's biodiversity.

3.0 PERIOD OF STUDY AND STUDY SITES

The work described in this report was carried out between the 5th July and 9th September 1996. Survey work was concentrated in the northern (Tat Ke) wilderness zone of the Na Hang reserve (with the exception of a short trip to the southern Ban Bung sector, during which birds were studied). Major study sites are shown in Figure 4; descriptions of these sites can be found in the relevant sections of this report. The position of the base camp (near Tat Ke village) is also shown in Figures 3 and 4.

4.0 WORK UNDERTAKEN

The work carried out in the Tat Ke sector of the Na Hang reserve is listed below. Details of the methodologies used can be found in relevant sections of this report.

- The diversity of the forest flora was assessed by sampling all trees within four plots, each in a different forest type.
  Ground flora and shrubs were sampled in smaller quadrats within the plot.

- The structure of the forest in each study site was assessed. Measurements of DBH, top height, height of bottom of canopy, first branch height, and canopy extent were taken for each tree. Forest transect diagrams were drawn using these data.

- Invertebrate fauna was assessed using pitfall traps and sweep-netting.

- The butterfly fauna of the reserve was sampled by net collection and butterfly trapping.

- The fish fauna of streams and rivers in and around the Tat Ke sector was studied.

- Reptiles and amphibians present in the sector were collected.

- An extensive bird survey was carried out in all the habitats represented at Tat Ke, and measures of abundance and the distribution of species between habitats made.

- A mammal survey was carried out using tracks and signs, sightings, mammal trapping (for small terrestrial mammals) and bat netting, to construct an accurate species list.

- Socio-economic work was carried out to assess the impact of local populations on the forest in Tat Ke.

5.0 VEGETATION SURVEY

5.1 Introduction

Previous studies of the vegetation of the Na Hang nature reserve have included work by Dang Huy Huynh *et al.*(1993), Cox (1994) and an SEE-Vietnam expedition in January to March 1996 (Hill and Kemp, 1996). All have indicated the importance of the forest at Na Hang on a regional and national scale. The latter is the most complete study of Na Hang's vegetation to date. However, work was restricted to the Southern (Ban Bung) sector of the reserve, with no work being carried out in the Tat Ke sector. The aims of this, the second SEE investigation within the Na Hang reserve, were to describe and map major vegetation types, and record species present in the Tat Ke sector in order to supplement the existing data and provide contrasts to the investigations already carried out within the Ban Bung sector of the reserve. Since forest vegetation types dominate in this part of the reserve (as at Ban Bung), detailed vegetation studies were restricted to forest areas.

5.2 Methods

Four sites were chosen to represent a variety of forest habitats present in the sector, which can be classified as described by Nakashizuka and Yusop (1993, for Peninsular Malaysia);

- FT1 Primary transitional (lowland/lower montane) rainforest, 695m asl.
- FT2 Secondary lowland rainforest, on limestone slope. 500m asl.
- FT3 Primary lowland rainforest, in a steep limestone valley. 595m asl.
- FT4 Primary lowland rainforest, on a wet slope, 680m asl.

The positions of the four study sites are shown in Figure 5.
At each study site, the following surveys were carried out;

1) Forest tree survey (all trees over 4.5m high)
2) Ground flora/sapling survey (herbs and trees under 4.5m).

5.2.1 Forest tree survey

In each location, a plot 40m x 40m was marked. Within the plot, all trees (over 4.5m tall) were identified and the DBH (Diameter at Breast Height) of each tree measured. This allows the Basal Area of Wood (BA) to be calculated for each species and family.

In addition, a 60m x 10m transect was laid out alongside the plot. Within the transects, each tree was identified to species. The following measurements were taken; DBH, trunk coordinates (position within transect), canopy extent, height of tree,

height of base of canopy, point of inversion (height of lowest branch). These data were used to plot forest transect diagrams.

5.2.2 Ground flora and sapling survey

Twenty 2m x 2m quadrats were laid out in a diagonal line across the plot (a total of $80m^2$, 5% of the plot area). Within each quadrat, the herbaceous species, shrubs and saplings under 4.5m were recorded. For each species, the number of individual plants and an estimate of percentage cover of the 2m x 2m quadrat were recorded. In addition, the proportion of each quadrat which was bare of vegetation was recorded.

For the ground flora in each site, diversity was indicated by calculating Fisher's α. This measure of diversity takes account both the number of species (here, Recognisible Taxonomic Units or RTUs were used, as many of the taxa such as tree seedlings could not be identified to species level) and individuals in a sample (Fisher *et al*, 1943). Fisher's α is relatively free of bias when describing samples of differing size (see Magurran, 1988).

5.2.3 *Ad lib.* collection

In addition to this detailed work on forest vegetation, plants were collected throughout the habitats represented at Na Hang, in order to compile as accurate a list as possible of the flora of the area and provide a contrast with the available lists for the Ban Bung sector. The habitat preferences of each species were recorded, along with details of any fertile stages present over the study period, and human utilisation of the plants. The plant species list for Tat Ke was largely compiled by Dr Tran Dinh Nghia.

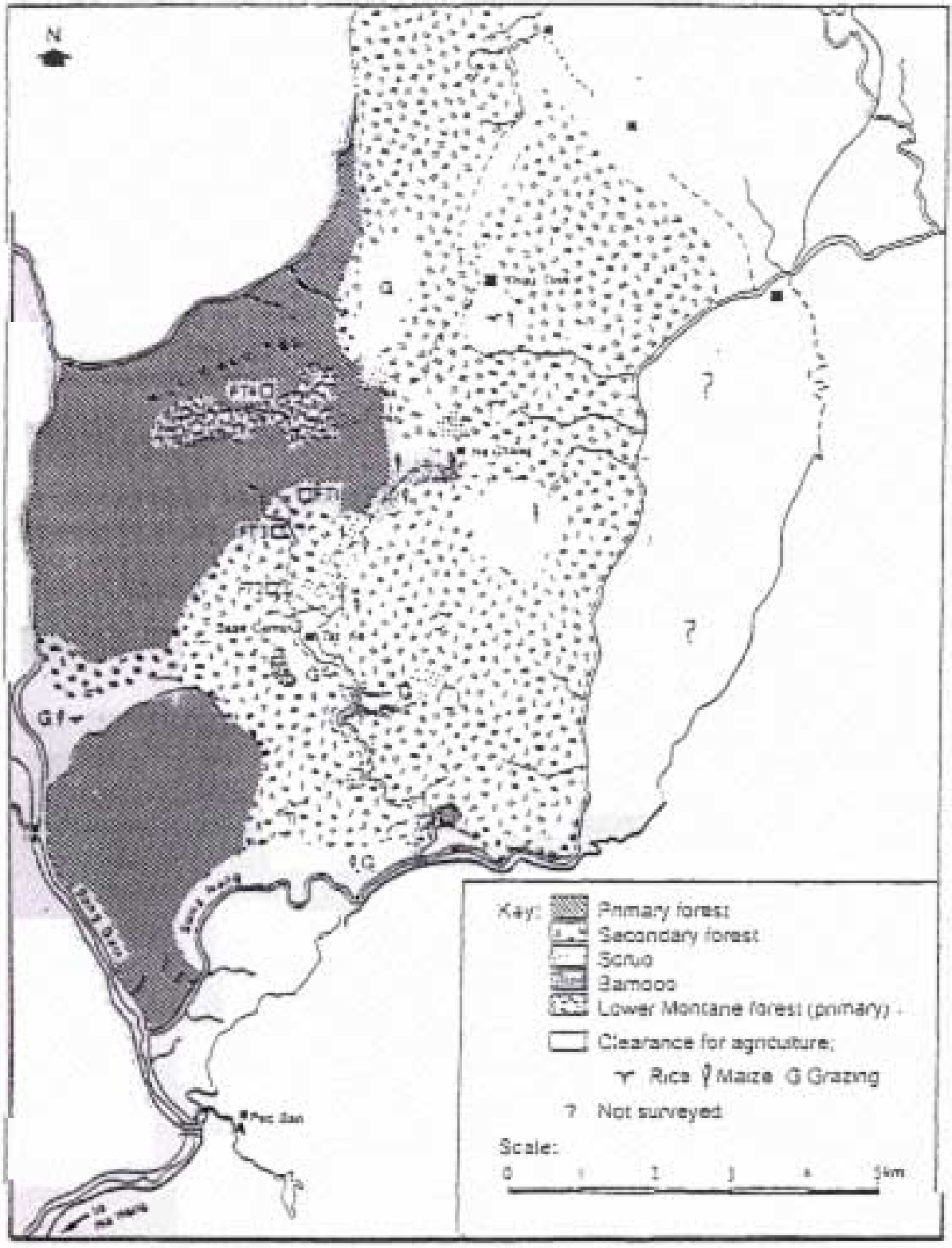


Figure 5. Map of the Tat Ke sector showing major vegetation types

5.3 Results

As shown in Figure 5, the vegetation within the Tat Ke sector was dominated by forest types. However, clearance of land for cultivation (rice and maize), and grazing, was extensive. As a result, forests tended to be restricted to sloping ground. Evergreen lowland forests (primary and secondary) were present on the limestone slopes of the reserve, and montane and sub-montane forests on the higher slopes and mountains (over 700m asl.).
The list of plant species identified in forest transects and through *ad lib.* collection at Tat Ke is shown in Appendix 1. A total of 917 species, belonging to 134 plant families, was found during the period of the study.

5.3.1 Forest tree survey

Transect diagrams for the five forest sites are shown in Appendix 2.

A summary of the data for forest plots is given in the table, Figure 6. The plant families represented in each forest plot are shown in Appendix 3.

Figure 6. Summary of tree data for forest sites

Site	**Altitude** (m asl)	**Number of Familes per plot**	**Number of trees per plot**	**Number of Trees per ha.**	**Total Basal Area of trees** (m^2ha^{-1})
FT1	695	21	103	644	30.00
FT2	500	17	208	1300	50.00
FT3	595	16	132	825	75.02
FT4	580	26	174	1087	26.79

5.3.2 Ground flora and sapling survey

Figure 7 shows a summary of the data for the sites, and Figure 8 shows the total numbers of plants in each ecological class in each location.

Figure 7. Summary of the ground flora data for four sites.

Site	**Mean cover** (% of quadrat)	**Mean number of species** per quadrat	**Mean number of species** m^{-2}	**Fisher's α diversity index**
FT1	81.35	12.65	3.16	46.43
FT2	62.47	9.84	2.46	13.43
FT3	68.40	10.75	2.69	16.51
FT4	42.15	12.00	3.00	45.52

Figure 8. Numbers of ground flora species in each ecological group identified, for four sites.

NI = Number of individual plants NS = Number of species

	HERBS		**CLIMBERS**		**PALMS**		**SHRUBS**		**TREES**	
Site	NI	NS	NI	NS	NI	NS	NI	NS	NI	NS
FT1	183	21	66	12	7	3	127	23	100	44
FT2	6	4	18	5	0	0	109	15	1554	41
FT3	166	18	33	10	0	0	65	18	1697	33
FT4	169	27	34	9	19	3	171	28	83	44

5.3.3 Description of forest sites

5.3.3.1 Forest Transect 1

Forest Transect 1 (FT1) was situated in an area relatively undisturbed by human activity; although the density of trees was the lowest of any of the plots studied, there was no sign of recent felling.

FT1 was the highest altitude plot studied, at 695m above sea level. As a result, the forest showed some similarity with lower montane forest in both its structure (a relatively undifferentiated canopy with few emergent trees), and species composition (the presence of high-altitude taxa such as *Podocarpus neriifolius* (Podocarpaceae),and members of the family Theaceae). However, the plot also showed some similarities with lowland rainforest; the upper canopy reached around 30-35m, and was dominated by members of the family Lauraceae (*Phoebe* sp., *Caryodaphnopsis tonkinensis*), and *Aglaia gigantea* (Meliaceae), which formed butresses 2 or 3 metres high. The main canopy of the plot, at around 20m, was dominated by trees of the families Lauraceae, Clusiaceae (*Garcinia fragraeoides*), and Ebenaceae (*Diospyros pilosella, D. mun*). Trees of *Saraca dives* (Fabaceae) were present in this stratum, and also as smaller trees 10-20m in height alongside freshwater springs in the transect.

Of the tree species recorded for the plot, three were endangered and protected within Vietnam; *Burretiodendron* (Excentrodendron) *hsienmu*, *Madhuca pasqueri*, and *Garcinia fragraeoides* (see section 5.4.1, below).

The ground flora at FT1 was particularly diverse, with 113 taxa present in the quadrats studied. Herbaceous plants and shrubs were abundant; the species most commonly recorded were a herb of the family Urticaceae, and a fern. The most abundant shrub was *Psychotria baviensis* (Rubiaceae). Epiphytes and climbers were also well represented; climbing Araceae (*Pothos scandens* and other species) and lianas were common. Most of the mature canopy trees carried epiphytic ferns (*Aglaeomorpha coronans* and *Asplenium nidus*) and orchids.

Limestone outcrops in FT1 supported a distinctive flora, dominated by *Chirita* sp. (Gesneriaceae) and *Begonia* spp. (Begoniaceae).

5.3.3.2 Forest Transect 2

FT2 was located within one kilometer of Tat Ke village, and it was obvious that intensive (although selective) felling had occurred here in the past. As a result, the character of the forest here was very different from that at all the other sites studied. The main canopy was not high (around 15-20m), and large, buttressed trees were few. However, some larger trees had survived logging; these included *Madhuca pasqueri* (Sapotaceae), *Burretiodendron hsienmu* (Tiliaceae), and *Pterospermum diversifolium* (Sterculiaceae).

The main canopy consisited of an even-aged stand of *Streblus* (Teonongia) *tonkinensis* (Moraceae) (about 80% of the trees in this layer, and 66% of all trees, were *S. tonkinensis*). However, some other trees were present and these included *Symintonia tonkinensis* (Hamamelidaceae), *Phoebe poilanei* (Lauraceae), *Paralbizzia lucida* (Fabaceae), *Reheodendron macrocarpum* (Styracaceae), *Aglaia* aff. *per-viridis* (Meliaceae), *Madhuca* sp. (Sapotaceae), *Choerospondias axillaris* (Anacardiaceae).

The ground flora was heavily dominated by seedlings of *Streblus tonkinensis*. A number of other tree species were represented by seedlings, but by few individuals. The diversity of herbs, shrubs and palms in the field layer was also low, probably as a result of disturbance, and the dense shade cast by the regenerating stand of *Streblus*. The most abundant herbs were the ferns (several species), Liliaceae, and Amaryllidaceae (*Curculigo* sp.).

Several of the plant species recorded at FT2 are listed in the Red Data Book for Vietnam (RDB, 1996), and are protected by the state. The include *Burretiodendron hsienmu*, *Madhuca pasqueri*, and *Phoebe poilanei* (Lauraceae).

Streblus tonkinensis, although not an endangered species, is endemic to Vietnam. It produces small volumes of relatively low quality wood (which is easily attacked by termites) (FIPI, 1996). The bark produces a rubber resin of high quality, but in small quantities which are not economically exploited. Within the forest plot studied, the regeneration of *S. tonkinensis* was so strong that, without thinning, the area would produce small roundwood only suitable for fuel (Nguyen Kim Dao, *pers. comm.*). This strong regeneration of the dominant species from seed also threatens to exclude regeneration of rarer species, resulting in a forest type with low biological diversity or botanical and conservation interest.

5.3.3.3 Forest Transect 3

FT3 was a relatively undisturbed area of primary forest on the slope of a rocky limestone valley at 595m. The riverbed at the bottom of the slope is dry for much of the year but carries water for part of the wet season. Part of the 40 x 40m study plot took in an area of flat, alluvial soils beside the dry riverbed, but the majority was on the steep (30-40^{o}) limestone slope.

In contrast to the forest at FT2, canopy zonation at FT3 was well developed, with a marked emergent layer of tall, buttressed trees. Dominant species in this upper canopy layer included *Burretiodendron hsienmu, Lithocarpus* sp. (Fagaceae), and *Aglaia gigantea* (Meliaceae).

The lower canopy was dominanted by *Streblus tonkinensis* (about 58% of the trees in the plot). Other families present included Bignoniaceae (*Fernandoa serrata*), Lauraceae (*Cinnamomum polyalphum*), Clusiaceae (*Garcinia fragraeoides*), Fabaceae (*Ormosia* sp.), and Ebenaceae (*Diospyros* sp.).

As in FT2, the diversity in the field layer was low. Tree seedlings were the dominant form, with *Streblus tonkinensis* and *Burretiodendron hsienmu* by far the most abundant regenerating woody species. Other trees and shrubs represented in this layer included *Psychotria baviensis* and *Rothmannia vietnamensis* (Rubiaceae), *Garcinia fragraeoides* (Clusiaceae), *Elaeagnus bonii* (Elaeagnaceae), *Albizzia* sp. (Fabaceae), *Reherodendron macrocarpum* (Styracaceae), *Bauhinia* spp. (Fabaceae), and *Neolitsea polycarpa* (Lauraceae).

Herbaceous plants were most abundant on the alluvial soils at the base of the slope; on the slope itself, the ground flora was limited to *Streblus tonkinensis* and *Burretiodendron* seedlings, and a few shade-tolerant species such as ferns (the forest floor was under particularly dense shade on the slope). The pteridophytes were the most abundant and diverse group of herbs, with five species of fern present in the quadrats studied.

5.3.3.4 Forest Transect 4

FT4 was dominated by relatively small trees which were present in large numbers. However, unlike FT2, there were no signs of recent logging. The upper canopy (25-30m), which was incomplete, was dominated by *Chisocheton globulus* (Meliaceae), *Burretiodendron hsienmu* (Tiliaceae), *Castanopsis indica*, *Lithocarpus licentii*, and *L. bacgiangensis* (all Fagaceae), *Phoebe cuneata* and *Caryodaphnopsis tonkinensis* (Lauraceae).

The lower canopy (15-20m) was dominated by the Annonaceae (*Miliusa balansae*, *Polyalthia* sp.), Clusiaceae (*Garcinia multiflora*), Loganiaceae (*Fagraea fragrans*), Magnoliaceae (*Manglieta cuneata*) and Myrtaceae (*Syzygium baviensis*). No *Streblus tonkinensis* was present. Past disturbance was indicated by the presence of members of the Araliaceae (*Trevesia palmata*), Sonneratiaceae (*Duabanga sonneratiodes*) and Euphorbiaceae (*Croton longipes*, *Macaranga* spp.). It is possible that the disturbance was not caused by human intervention, but through, for example, surface flow of water in the rainy season (the area was crossed by several rocky stream beds).

The altitude of FT4 was reflected in the presence of certain taxa characteristic of higher altitude forests, including *Ulmus lancaeifolia* (Ulmaceae), and *Magnolia talammoides* (Magnoliaceae), an the relatively undifferentiated canopy. However, these characteristics were not so marked as at the highest transect studied, FT1.

The herb and shrub layers of FT4 were particularly diverse, the shrub layers dominated by the Rubiaceae (*Wendtlandia glabrata* and other species) and Acanthaceae. The most abundant herbs were *Ophiopogon* spp. (Convallariaceae), and members of the families Liliaceae and Orchidaceae. On limestone outcrops, *Begonia* sp. (Begoniaceae) was abundant. Several palm species were present. Tree seedlings occurred in relatively small numbers, but several species were represented, and there was no clearly dominant species. Woody lianas (for example, *Tetrastigma* sp., Vitaceae) were common.

5.3.4 Other vegetation types at Tat Ke

Although the sector is dominated by forest, and forest habitats were the only vegetation types studied in detail, other vegetation types make up a significant proportion of the land area (see Figure 5). The most important of these are described below.

5.3.4.1 Grazing land and scrub

Large areas of the Tat Ke sector, particularly flat land around villages and towards the edges of the wilderness zone, had been cleared to provide grazing for buffalo. The SEE camp at Tat Ke village was in one such cleared area, which was dominated by grasses, herbs (particularly *Ageratum conyzoides* and *Artemesia* sp., Asteraceae), and the shrubs *Crotalaria* spp. (Fabaceae) and *Clerodendron* sp. (Verbenaceae). In some areas, taller-growing shrubs such as *Alangium* spp. (Alangiaceae), *Mallotus* and *Macaranga* spp. (Euphorbiaceae) were present, but natural regeneration to secondary forest is arrested by continual grazing and repeated clearance of these lands. Both the flora and fauna of these areas are relatively restricted, and the species present widespread and common in northern Vietnam.

5.3.4.2 Arable land

Arable lands were also an important form of land-use in the Tat Ke sector. Around villages such as Tat Ke, Na Chang and Khau Tinh, these took the form of extensive rice paddies, usually providing a single crop a year for local consumption. The paddies were devoid of native vegetation save for semi-aquatic species such as *Sagittaria* and *Marsilea* spp., and weedy herbaceous vegetation on the earth banks surrounding each field.

Large areas of land were used for the production of maize, which gives two crops a year. Unlike rice production, which was restricted to the relatively level areas close to human habitation (largely in the eastern and northern parts of the reserve), maize fields were found throughout the reserve, often in areas remote from human habitation (see map, Figure 5). The fields were often on steep hillsides, and, in some places, clearance of forest for the extension of maize production was still occurring. In some areas, maize fields had been subject to extensive erosion of topsoil.

5.3.4.3 Bamboo Forest

Secondary forest, composed of pioneer plants in the families Euphorbiaceae (*Mallotus* and *Macaranga* spp.), Urticaceae, and Rubiaceae, occurred throughout the reserve, and particularly along paths and roads. In places where disturbance was particularly severe, such as alongside tracks on steep slopes and near villages, such vegetation was replaced by large stands of giant bamboo. This vegetation type was not studied in

detail, as it showed little variation and supported few plant species; the diversity of ground vegetation in these areas was highly restricted.

5.3.4.4 Montane Forest

Lower Montane and Montane forests, characterised by the presence of plant families such as the Aceraceae (*Acer* spp.), Theaceae, and Podocarpaceae, and a simpler structure than the lowland rainforest (Whitmore, 1988), were present on the highest slopes of the Tat Ke sector (from 700m asl. and above). These were among the least disturbed forests in the sector, due to their inaccessibility (these forest types formed small 'islands' on steep slopes and limestone cliffs). Cox (1994) reports that dwarf 'elfin forest' is also present on the highest peaks, but none was observed during the present expedition and, if such forest exists, is is likely to be extremely restricted in distribution.

5.4 Discussion

5.4.1 Rare species

Of the plant species recorded in the Tat Ke sector during the present survey, twenty-nine are listed in the Red Data Book of Vietnam (RDB, 1996) as threatened with extinction on a national scale. The species at greatest risk (Endangered) is *Asarum balansae* (Aristolchiaceae), a terrestrial forest herb used in traditional medicine.

Ten further species are included in the group 'Vulnerable', which includes species less immediately threatened with extinction, but still at risk. Most of these species are timber trees which have been overexploited, or forest herbs gathered for medicinal use. The trees include *Burretiodendron hsienmu* (Tiliaceae), endemic to Southern China and Northern Vietnam (FIPI, 1996), which was found in all forest transects studied at Na Hang. Other similarly endangered trees include *Diospyros mun* (Ebenaceae), *Garcinia fragraeoides* (Clusiaceae), *Manglieta fordiana* (Magnoliaceae), and *Markhamia stipulata* (Bignoniaceae).

Among the forest herb species identified at Tat Ke, several are included in the 'Vulnerable' group, and most of these are species which have been gathered for medicinal use. These include *Codonopsis javanica* (Campanulaceae), *Thalictrum foliosum* (Ranunculaceae), and *Smilax glabra* (Smilacaceae). In addition, the 'Vulnerable' category includes one species of palm, *Calamus platyacanthus* (a rattan palm).

Among species thought to be at lesser risk of extinction, several are of interest, including *Phoebe poilanei* (Lauraceae), which was found in FT2. This species is listed as 'Threatened' in the Red Data Book. However, it is an endemic species to Vietnam, and known previously only from Son La province, so its discovery in the Na Hang reserve is of some significance (Nguyen Kim Dao, *pers. comm.*). It is a medium to

large tree, 15-20m or more in height, producing a hard, heavy aromatic wood used in general construction (FIPI, 1996).

5.4.2 A comparison of the vegetation of the Tat Ke and Ban Bung sectors

In SEE's study of forests in the southern (Ban Bung) sector of the Na Hang reserve (Hill and Kemp, 1996), a total of 607 plant species were identified, and the present work extends this list of plants considerably. However, a comparison of the preferred habitats reveals that the plants in the Tat Ke sector tend to be those of disturbed, rather than pristine forest habitats. This may in part reflect sampling bias, but it was clear that clearance in the Tat Ke sector has been much more extensive than that in the Ban Bung sector. In the northern part of the Ban Bung sector, the dominant vegetation type was relatively undisturbed primary forest, and areas of secondary vegetation were small and isolated.

In contrast, Tat Ke's remaining forests tended to be more disturbed, and it was possible to study one area of regenerating forest in depth (FT2). Until the late 1960s, a logging road to the village of Tat Ke, near the centre of the sector, allowed timber extraction over a wide area. Today, large-scale timber extraction has ceased, but forest clearance for agricultural purposes is still going on. In Ban Bung, mining activities appeared to pose a greater threat to the integrity of extant forests that did agriculture, but this disruption was on a relatively small scale. Agricultural activity within the Tat Ke sector, however, is extensive and expanding.

In the previous study of the Ban Bung sector (Hill and Kemp, 1996), five forest plots were described in detail. Three of these plots were situated below 400m asl., markedly lower than any of the plots described in the current study. In Tat Ke, most of the land at 400m asl. and below had been cleared for agricultural purposes, or was regenerating secondary forest dominated by pioneer species. Primary forest in the Tat Ke sector was restricted to steep slopes on higher ground, and there was no equivalent of the forests on flat alluvial land at 360m, which, although rare, was present in the Ban Bung sector (FT2 in the previous SEE report). As a result, the flora of Tat Ke tends to resemble that of the highest altitude plots in the previous survey, and Tat Ke's forests show less structural- and species-diversity than did those of the southern sector. This is apparent in, for example, the importance of *Burretiodendrion hsienmu* (Tiliaceae) and *Streblus tonkinensis* (Moraceae) in almost all the transects studied at Tat Ke (the single exception being FT4).

It appears likely that, in the future, primary and less-disturbed secondary forests will become restricted even further to the high ground to the South and East of the Tat Ke sector, where the human population is at its lowest. It is essential that these Lower Montane and Montane forests are given adequate protection, as they are now the only remaining areas of undisturbed forest in the sector and are thus crucial to the survival of the area's large mammal populations.

6.0 INVERTEBRATE SURVEY

6.1 Introduction

The aim of the invertebrate survey was to sample the invertebrate communities in a variety of the habitats in the Tat Ke sector of the reserve, and arrive at a measure of the comparative diversities of invertebrate communities in the reserve's major vegetation types. Two methods were used in order to quantitatively sample invertebrates; sweep-netting and pitfall trapping. Both are commonly used methods of insect collection, and the principles and drawbacks associated with each are discussed by Southwood (1978), Biological Survey of Canada (1994), and other authors. Sweep-netting was carried out in the four Forest Transect sites discussed in Chapter 5, above). Pitfall trapping was carried out in a wider range of habitats, from newly cleared areas to the primary forest at FT3.

6.2 Methods

6.2.1 Sweep-netting

The sweep-netting survey was carried out in a three-day period of good weather at the end of the expedition. Sweep-netting was carried out in the four Forest Transects studied. In each case, 300 sweeps were made through the ground layers of vegetation, and the captured invertebrates were gathered using a pooter. The invertebrates were preserved in 70% ethanol. At camp, the insects were sorted to order and morphospecies or RTU. The abundances of RTUs were used to calculate a diversity index (Fisher's α). Dominance was described using the Berger-Parker index (Berger & Parker, 1970; described in Magurran, 1988).

6.2.2 Pitfall trapping

Pitfall traps were laid out in a wide range of habitats, including three of the four vegetation plots (see Figure 9). In each case, traps consisted of small (*c.*15cm diameter) plastic buckets, which were laid out in an array which covered appoximately $3.14m^2$.

Metal strips between the buckets were used to increase the effectiveness of the traps by directing insects to the buckets. In each bucket, a dilute solution of formalin was used as a preservative. Although salt water is recommended by some authors (eg. Biological Survey of Canada, 1994), as it causes less bias in the catch than do other preservatives, it seemed likely that salt-water traps would have to be frequently checked on the Na Hang climate; as the study took place during the summer rainy season, high temperatures and regular heavy rain could cause the dilution of a trap's contents and accelerate decomposition. Instead, a dilute solution of formalin was used in the traps. After six nights in place, the traps were removed and the insect assemblages sorted into RTUs, as for the sweep-net catches.

Figure 9. The five sites at which pitfall trapping was carried out.

Site	Altitude (m asl)	Description
PF1	600	New clearing, bordered by existing maize field and secondary forest. Some regrowth of herbaceous species, such as grasses and *Selaginella* sp.
PF2	600	Secondary forest near PF1.
PF3	400	Scrub near base camp. Vegetation dominated by shrubs (Fabaceae) and grasses.
PF4	500	FT2. Secondary forest, dominated by *Streblus tonkinensis*. (see section 5.4, above, for description)
PF5	595	FT3. Primary Forest.
PF6	695	FT1. Primary Forest.

6.3 Results

6.3.1 Sweep-netting

The numbers of species, number of individuals, α diversity and dominance, *d*, for each sample are given in Figure 10.

Figure 10. Summary of sweep-net samples for four sites.

Site	No. RTUs	No. of Individuals	α	*d*
FT1	55	107	45.86	0.159
FT2	31	45	43.23	0.089
FT3	42	120	22.85	0.392
FT4	75	115	61.11	0.096

Relative abundance of insects varied greatly between the locations; the catch at FT2 was particularly small. None of the samples was large enough to allow detailed statistical analysis, suggesting that future sweep-net sampling should involve larger numbers of sweeps (Janzen, 1973a, used 800-sweep samples in his analysis of tropical vegetation in Central America and the Caribbean). However, a balance must be found between the statistical requirement for samples as large as possible, and the difficulties of sorting large samples, especially in the field.

6.3.3 Pitfall trapping

Fisher's α and the dominance measure *d* were calculated for each sample, and summary data is given in Figure 11.

Figure 11. Table of summary data for five pitfall sites.

Site	No. of RTUs	No. of Individuals	α	*d*
PF1	172	1003	59.76	0.270
PF2	101	463	39.83	0.419
PF3	152	1030	49.23	0.311
PF4	155	724	60.48	0.188
PF5	67	270	28.54	0.267

The percentage of the total catch from each site, in major invertebrate orders, is shown in Figures 12 (by RTU) and 13 (by individuals). In these graphs, the sites have been reordered so that they follow a possible vegetational succession, running from the most disturbed site (PF1), through pioneer vegetation (PF3), secondary forest (PF2 and PF4), to primary forest (PF5). (In reality, it is unlikely that a vegetational succession would proceed along exactly this course throughout the reserve).

Figure 12. Graph showing the percentage of the total number of RTUs caught in pitfall traps at each site, in major invertebrate orders.

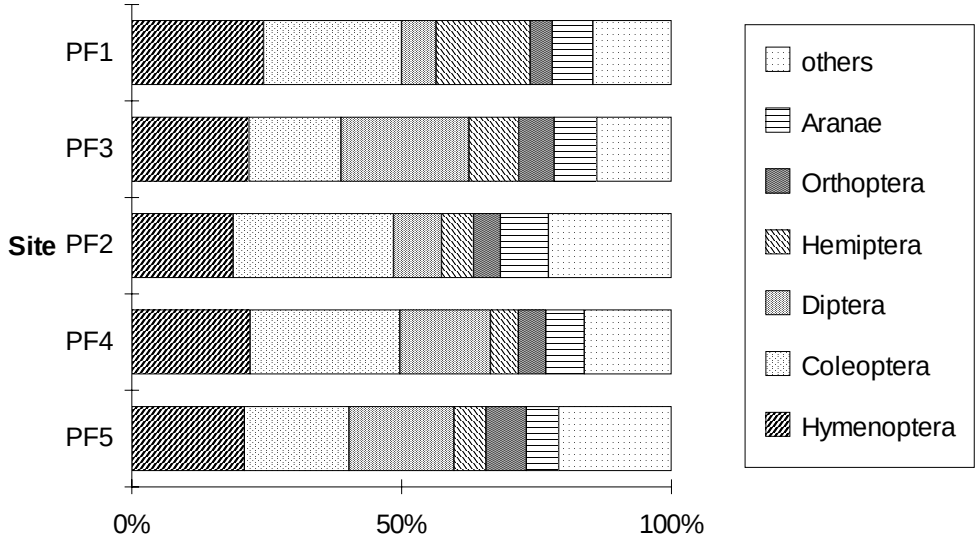
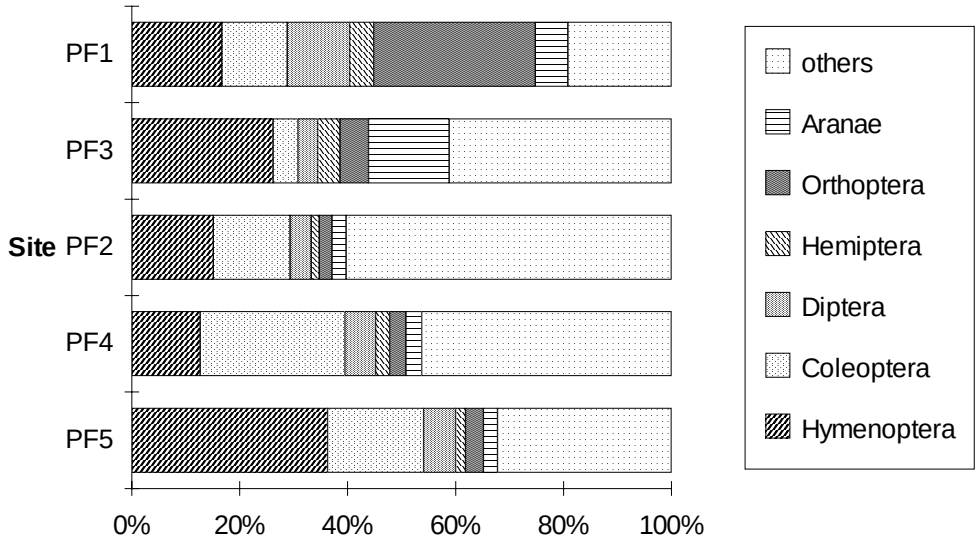


Figure 13. Graph showing the percentage of the total number of individuals caught in pitfall traps at each site, in major invertebrate orders.



6.4 Discussion

6.4.1 Sweep-netting

Although sample sizes were too small to allow statistical analysis of results, general trends in sample size and diversity can be explained, at least in part, by the vegetation of each forest site. The highest diversity of insects are in Forest Transects FT4 and FT1, and these are the sites with the most diverse ground flora. Forest Transect 4 gave a large sample with high diversity, and this is probably a result of its highly diverse herb and shrub layers. In forest Transect 2, where the ground layer was densely shaded by the canopy of young, regenerating trees above, and was itself dominanted by a small number of tree seedlings, the catch was small (although, since most of the individuals caught represented different taxa, the overall diversity index α for this site is relatively high).

On the basis of so few samples, it is impossible to conclude whether the altitude of sites had any effect on invertebrate communities, although previous studies suggest that this would be the case; Holloway (1984) found that the overall diversity of moth communities in Sarawak (sampled by light-trapping) was highest in Lower Montane forests, at around 1000m. In Costa Rica, Janzen (1973b) found that the diversity of sweep-net samples reached a peak at altitudes of around 1,100m. However, these samples were taken from open habitats, and Wolda (1987), who sampled insects of several orders using light-traps in forest habitats of Panama, found a decrease in diversity with altitude, and suggested that the relationship between diversity and altitude differered between different habitat types.

Compared to the sweep-net samples taken in the Ban Bung sector of the Na Hang reserve (Hill and Kemp, 1996), the values of α were all very small. This could be a result of the smaller samples (due to differential sampling effort), but α should be relatively robust to changes in sample size (Magurran, 1988), so the decrease in diversity is likely to be a real effect, caused by the differences in forest structure between the northern and southern sectors of the reserve (and, possibly, by seasonal effects). However, without much more extensive sampling it would be impossible to ascertain the cause of this difference.

6.4.2 Pitfall-trapping

Pitfall trapping gave mixed results, largely because of environmental conditions. During particularly heavy monsoon rains, traps at PF5 and PF6 were flooded. Those at PF5 were re-set, but this was not possible for PF6. Also, due to the constraints of time, it was not possible to attempt pitfall trapping at FT4. However, a complete set of pitfall data were obtained for sites PF1-PF5.

All the samples were relatively large, when compared to the samples taken by sweep-netting. The smallest pitfall samples were at PF5, which contained only 270 individuals, and PF2, with 463 individuals. Both PF5 and PF2 also had relatively low diversity index values α; in the case of the latter site, this is probably because the sample was heavily dominated by its most abundant taxon (a Collembolan species). There was no clear progression, as might be expected, from less diverse early-successional faunas to more diverse forest faunas (indeed, the sample with the lowest α diversity is the forest PF5). This may be because even the early-successional sites PF1 and PF3 were relatively close to forest or scrub which supported relatively diverse invertebrate faunas.

Figures 12 and 13 show that, although the taxa present vary little in importance between sites, there are major differences in the numbers of individuals, particularly in three groups; Hymenoptera, Orthoptera, and 'Others'. In part, these differences can be explained by successional change; thus, the site PF1 had a particularly large proportion of Orthoptera (grasshoppers and crickets). In particular, one cricket species (which was found in all of the sites studied) was extremely abundant here (271 individuals were found). Orthoptera were less abundant in the grassland site PF3 and the forested sites. Although the Orthoptera were found in large numbers at PF1, species diversity was low throughout all the sites. The social nature of many of the Hymenoptera accounts for the variation of this group; if the traps were located near an ant nest, a large catch was guaranteed.

The 'Others' group included the insect orders Collembola, Thysanura, Isoptera, Psocoptera, Blattoidea, Dermaptera, Lepidoptera, Mantoidea, the Isopoda (Crustacea), Oligochaetes, Myriapoda, Chilopoda and Arachnids (excluding spiders). These taxa made up a very small proportion of the total number of RTUs recognised, but were

extremely important in terms of numbers of individuals. In particular, Collembola were an important group. At site PF2, the 'Others' group comprised 60% of the total individuals; 44% were Collembola.

Pitfall trap samples resulted in large catches which were probably more representative of the terrestrial invertebrate communities in the sites studied than were the results of sweep-netting. Diversity index values for these sites were similar to those recorded for low-altitude forest sites in the Ban Bung sector (Hill and Kemp, 1996), although the sites chosen in Ban Bung were all primary forest vegetation, which might have been expected to support greater diversity than the secondary forest and open sites studied in the Tat Ke sector. However, as with the sweep-net samples, seasonal changes and altitude may influence this result.

7.0 BUTTERFLIES (Lepidoptera, Papilionoidea)

7.1 Introduction

There are no butterfly species listed in the Red Data Book for Vietnam (RDB, 1992), but this is due to a lack of sufficient data on butterfly abundances, rather than reflecting the rarity or otherwise of Vietnam's butterfly fauna (A. Monastyrskii, *pers. comm*.). Previously unknown butterfly species have recently been described from Vietnamese specimens (Devyatkin, 1996), and further new taxa are likely to exist, particularly among traditionally less well-known and highly diverse families such as the Hesperiidae and Lycaenidae (Lekagul *et al*., 1977).

The work of the previous SEE expedition in Ban Bung in January-March 1996 was the first study of butterflies in the Na Hang region. However, for much of that period butterflies were scarce; both the number of butterfly individuals and the species diversity increased markedly during the study period, and were continuing to rise at the end of the period, suggesting that a continued study would have resulted in the recording of many more species (Hill and Kemp, 1996). The aim of the butterfly survey on this second expedition to the reserve was to add to the species list of the earlier study, to examine seasonal differences in abundance, as well as comparing habitats and their butterfly faunas in the two sectors of the reserve.

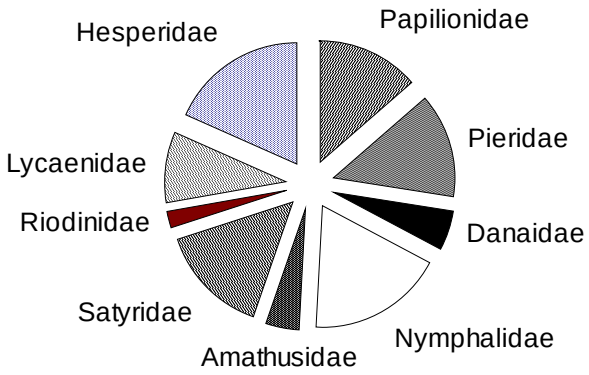
7.2 Methods

Butterflies were collected throughout the Tat Ke sector, but particularly in habitats close to the base camp. Once collected, a preliminary identification of each specimen to genus and 'Recognisible Taxonomic Unit' (RTU) or morphospecies was made, using Lekagul *et al* (1977). Duplicate specimens were released; the aim was to take only one or two specimens of each species observed, although in the case of some highly variable common species (such as the grass yellows, *Eurema* spp.), many specimens were taken. Specimens were identified in Hanoi by A. Monastyrskii of the Russian Tropical Institute, using Corbet and Pendlebury (1978), Pinratana (1977-88), and other works; specimens of the family Hesperiidae were identified in Moscow by A. Devyatkin of Moscow State University.

7.3 Results

A list of the butterfly species caught during the phase is given in Appendix 4. Figure 14 shows the distribution of species caught, between butterfly families.

Figure 14. Pie chart showing the distribution of butterfly species observed at Na Hang, between families.



7.4 Discussion

A total of 93 RTUs (representing 9 families) were taken, or observed, over the study period. Although this does not represent the entire butterfly fauna of the Na Hang region (several taxa were observed but not captured), when combined with the data from the earlier SEE study, a total of 142 species is now known for the reserve.

The most diverse families of butterflies in the Tat Ke sector (in terms of number of species) were the Nymphalidae and Hesperiidae (17 species each); the Nymphalidae were the most abundant in the previous SEE study.

7.4.1 Rare or unusual species

Several of the species taken were new or interesting records. Three specimens of *Papilio castor*, a tailless swallowtail which is found from India to Taiwan, were collected. Although this is not a new record for Vietnam (K. Spitzer, *pers. comm.*), it has been collected here only rarely.

Three unusual satyrids were caught. *Mandarinia regalis* is endemic to North Indochina and the eastern Himalayas, and, at Tam Dao National Park, is confined to undisturbed montane forest (Leps and Spitzer, 1989). Two of the satyrids represent new records for Vietnam; *Zipaetis unipupillata* and *Ypthima similis*. The former species may also be of a new subspecies (A. Monastyrskii, *pers. comm.*)..

7.4.2 Seasonal changes in the butterfly fauna

Although 86 species were recorded in the January to March period in the Ban Bung sector of the Na Hang reserve, and 93 in the present survey, there was relatively little overlap in the species observed; 49 species were found on the first survey (Hill and Kemp, 1996) and not the second (see Appendix 4b). Part of this difference may be due to the differing habitats in the two sectors of the reserve (and hence, butterfly foodplants). However, climatic conditions also differed greatly between the two study periods, and there is little doubt that part of the variation in butterfly faunas can be explained by seasonality.

This may be noticed within individual genera; for example, four species of *Neptis* (Nymphalidae) were noted on the Jan-Mar survey (*N. hylas*, *N. miah*, *N. soma*, and *N. harita*); in the summer period, only one species, *N. nata*, was observed.
The Dragontail Butterfly *Lamproptera curius* (Papilionidae) which was abundant in the first survey, was absent, replaced by the very similar *L. meges* in the summer period at Tat Ke.

In the earlier survey, two species of butterfly in the family Libytheiidae were collected (*Libythea celtis* and *L. myrrha*); at Tat Ke, no libytheiids were observed. However, the Amathusiidae, a group of forest butterflies which were not recorded in the earlier survey, were an important component of the butterfly faunas of some forest habitats in Tat Ke, although only four species were present. The most common species of amathusiid was the Junglequeen Butterfly *Stichophthalma louisa*. *Stichopthalma* populations in North Vietnam are highly seasonal in nature, with imagos present only in the early wet season (Spitzer *et al.,* 1993). *Stichophthalma louisa* is confined to closed forest habitats, and open habitats represent a barrier to its dispersal, but little is known of its feeding ecology or life history (Novotny *et al.,* 1991). It is therefore entirely dependent on the conservation of forest reserves of sufficient size to support long-term populations.

8.0 FISH

8.1 Introduction

Vietnam has a rich freshwater fauna, with at least 60 endemic freshwater fish described (mainly from the North of the country) (Government of SRV, 1994).
The aim of the fish survey carried out at Na Hang was to compile as accurate as possible a list of fish species found within the reserve (and in the rivers bordering the reserve), and to compare the fish fauna of the limestone streams that drain the reserve itself, with that of the larger rivers of the area. The bulk of this work was carried out in the Tat Ke sector of the reserve, but some work was also carried out in the Ban Bung (southern) sector of the reserve, where Pac Ban Reservoir is the only permanent body of standing water in the protected area.

8.2 Methods

Five methods of capture were used:

1. Hand Net
2. Hook and line (by Research Assistants)
3. Electric fishing (by local fishermen)
4. Harpoon guns (by local fishermen)
5. Conical fish traps (by local fishermen).

Collection of fish specimens was concentrated in three main sites;

Site 1 Khau Tinh stream (from FT1 to the base camp)
Site 2 Streams flowing into the River Nang below Tat Ke waterfall
Site 3 Fish from the Rivers Gam and Nang were observed on sale in Na Hang market.

In addition, fish were observed and collected near Chom village (at the western edge of Tat Ke sector), and at Nam Trang, in the southern (Ban Bung) sector of the reserve.

The fish specimens collected were identified using Mai Dinh Yen (1978, 1992). Photographs of fish from this book were shown to fishermen along the Gam and Nang rivers in order to complete the list of fish inhabiting the Rivers Nang and Gam and the Pac Ban reservoir. Local residents were interviewed about fish culture in ponds along streams and rivers.

8.3 Results

A list of the fish species inhabiting streams within the reserve, the Nang and Gam rivers and fish-farming ponds in and around the Nature Reserve of Na Hang is given in Appendix 5. In total, 73 species were recorded in this area. Seven species were

identified in streams in the Ban Bung sector, and 10 in the Tat Ke sector. Thirty-two species were recorded in the largest river in the area, the Gam at Na Hang town. The number of species in the three sites studied in detail are shown in Figure 15.

Figure 15. Number of fish species at two streams in the Tat Ke sector, and the River Gam.

Site	No. Species
Site 1	10
FT1-Base Camp	
Site 2	17
Streams entering River Nang	
River Gam	32

8.4 Discussion

8.4.1 Wild communities

The fish faunas of the three sites studied in detail are quite distinct. Only four fish species are present in both the Khau Tinh stream (Site 1) and the streams flowing into the River Nang (Site 2), and no fishes are present both at Site 1 and the River Gam (see Appendix 5). The River Gam has the highest diversity of fish, the greatest number of species and the largest number of economic species. The sporadic flow of the smaller streams within the reserve limits the range of fish that can survive there; upstream of Forest Transect 1 no fish were found in the Khau Tinh stream (although insect larvae and crustacea were present). Previous logging of the watershed of the Khau Tinh stream may also have had an adverse effect on the aquatic environment, and intensive fishing pressure had occurred in the vicinity of Tat Ke village. The presence of waterfalls near the outflow of the sector's streams into the River Nang (upstream of Site 2) prevent colonisation of the streams by fish from the river.

Seven of the species captured are described as 'Vulnerable' in the Red Data Book of Vietnam: *Onychostoma laticeps, Semilabeo notabilis, Spinibarbus caldwelli, Spinibarbichythys denticulatus, Mylopharyngodon piceus, Cranoglanis sinensis* and *Hemibagrus elongatus*. One species, *Ophiocephalus striatus,* is described as 'Threatened' (RDB, 1992). In most cases, the threats to these species come from overfishing, and the use of unselective or destructive fishing methods such as explosives or fine-meshed nets (Government of SRV, 1994). Although dynamite fishing was not observed during the present survey, it is common in other freshwater habitats in Vietnam (for example, the nearby Ba Be Lake; Kemp *et al*., 1994), and it is likely to occur in the Rivers Nang and Gam. Monofilament nets are widely available.

8.4.2 Aquaculture

Within the Tat Ke sector, fish are cultivated in artificial ponds (200-600m^2 in surface area) and rice-paddies. The species involved include the Common Carp (*Cyprinus carpio*), White Carp (*Hypophthalmichthys molitrix*), *Cirrhina molitorella*, *Spinibarbichthys denticulatus*, Grass Carp (*Ctenopharyngodon idella*), Indian Carp (*Labeo rhohita*, *Labeo mrigala*), and Tilapia (*Tilapia mossambica*). The yield of cultivated fish is about 300-400kg/ha in the rice fields and 1500-2500kg/ha in the ponds, but during the wet season in the Tat Ke sector flash-floods often occur, washing pond fish out to streams and rivers. After these floods only the Common Carp (*C. carpio*) remains in the rice fields; most of the other species are washed away and the yield of cultivated fish decreases. For this reason, Common Carp is now the only species deliberately reared in the rice fields, and Common and Grass Carp are the main species reared in the ponds. Pond-reared Common Carp spawn in the spring (February to March), and young carp from these spawnings are used to stock rice paddies. Sometimes fish are caught from the River Nang and stocked in the ponds. These include *Cirrhina molitorella* and *Spinibarbichthys denticulatus*. The species *Barbatula caudofurca* and *Zacco spilurus* occasionally swim into the irrigation channels which feed the rice fields.

9.0 AMPHIBIANS AND REPTILES

9.1 Introduction

Previous studies of the Na Hang area have resulted in extensive species lists (65 species of reptile and 18 amphibians were recorded by Dang Huy Huynh, 1993). More recently, the reserve has hosted a foreign herpetological research expedition in 1996 (R. Murphy, Royal Ontario Museum, *pers. comm.*). During the previous SEE research in Na Hang's Ban Bung sector (Hill and Kemp, 1996), conditions for the collection of reptiles in particular were poor (cool, damp weather conditions meant that reptile activity was restricted), and relatively few species were taken.

9.2 Methods

At Tat Ke, amphibians and reptiles were collected on sight, and, in the case of snakes, where they had been killed by local people. An effort was made to collect only one specimen of each species, although with certain species (particularly the Oriental Whip Snake or Vine Snake, *Ahaetulla prasina*, which has green and grey-brown colour phases) several specimens were taken. Tortoises were also observed in the wild, and after collection by locals.

Preliminary identification of snakes was carried out in the field using *A Field Guide to the Snakes of South Vietnam* (Campden-Main, 1975), and *The Snakes of Thailand and their husbandry* (Cox, 1991). All specimens were identified in Hanoi by Dr Nguyen Van Sang of IEBR.

9.3 Results

A list of the amphibian and reptile species collected or observed during the phase is given in Appendix 6.
A large number of frogs were collected in pitfall traps set to collect insects (see Chapter 6, above), but these all proved to belong to one species, *Rana limnocharis.*

9.4 Discussion

The most commonly seen reptile was the arboreal snake *Ahaetulla prasina*, which appeared to be common in the scrub and secondary forest close to the base camp. Specimens of six other snake species were collected, and several more were observed in the field but could not be positively identified.

Two of the reptiles collected in the Tat Ke sector are listed as 'Threatened' in the Red Data Book of Vietnam (RDB, 1992). The small arboreal agamid lizard *Acanthosaura lepidogaster* is threatened particularly by forest loss, although widely distributed in Vietnam (particularly the North). The snake *Elaphe moellendorffii* is restricted to

northern Vietnam and southern China, and its known range includes Cao Bang, Bac Thai and Hoa Binh (although not Tuyen Quang) provinces (RDB, 1992).

Overall, the most important threat to reptile species in Vietnam is habitat loss. However, collection of live animals for trade particularly affects certain species (for example, forest tortoises and the Tokay (Tac ke) Gecko, *Gekko gekko*), and occurs even within nature reserves such as Na Hang (see Hill and Kemp, 1996). In addition, snakes are often killed on sight when encountered close to villages or on roads and tracks, although such casual predation probably has the greatest impact on commoner species and therefore causes little long-term damage of more endangered populations. Within reserves, where forest habitat has some protection, it is important that hunting of reptiles is curtailed to allow populations of endangered species in these areas to remain healthy.

10 0 BIRDS

10.1 Introduction

Two previous surveys of bird species in the reserve area have been carried out. The first, by the Institute for Ecology and Biological Research, Hanoi (IEBR) in 1993 (Dang Huy Huyen *et al.*, 1993; Cox et al.,1994), compiled a list including 143 species seen during the survey or known from historical records for the Eastern part of Na Hang district. The second was carried out by The Society for Environmental Exploration (SEE) at the start of 1996 and indentified 171 species in the field (Hill and Kemp, 1996). Together, these surveys give a total of 242 species for the Na Hang area.

The aim of this second phase of survey by SEE-Vietnam was to further increase knowledge of the bird species presently occuring in the Tat Ke sector of the reserve. Specific objectives were:

- To produce a list of all birds identified within the reserve and assess their relative importance to biodiversity at a national and international level
- To provide seasonal data for the summer months at Na Hang, as no information has previously been compiled
- To measure the distribution and relative abundance of all species identified in the reserve
- To record all evidence of breeding within the reserve and note any other interesting behaviour
- To carry out a comparison of the bird fauna in the Tat Ke and Ban Bung sectors.

10.2 Methods

For survey work, all observers used binoculars, and a 27 x 60 telescope with tripod was also available. Sighting information was recorded using a dictophone or note book. In addition to birds seen, birds identified by call, captive birds taken in the Tat Ke sector, and traces of birds (such as feathers) were also recorded. For identification, three field guides were used; *Birds of South-East Asia* (King *et al.*, 1975), *A Guide to the Birds of Thailand* (Lekagul and Round, 1991), and *Birds of Hong Kong and South China*.(Viney *et al.*, 1994). For nomenclature, *Distribution and taxonomy of birds of the world* (Sibley & Monroe, 1990; with supplement, 1993) was used.
Observations were made in all habitat types found in the reserve (primary, secondary and bamboo forest, scrub and agricultural land) and over as much of the area of the Tat Ke sector as possible. Observations were concentrated in the forest areas around

the main campsite, at the 4 vegetation transect sites (FT1-FT4), and at a permanent hide. All areas were visited, but relatively few observations came from the eastern side, the southwest corner and the northern section beyond Khau Tinh. A period of 10 days was spent observing from a fixed hide in montane forest (>1000m asl.) in the less disturbed central part of the sector near Khau Tep Mountain which added considerably to the number of species recorded. Records were also kept of the birds seen in the buffer zones and in a 1 day visit to the Ban Bung sector.

Over 600 man-hours were spent in observation, and considerably more time in the field while carrying out other work. Observations were made throughout the day from dawn until after dusk, while concentrating on the more active periods of morning and early evening, and in all weather conditions including heavy rain. For each sighting, date, time, habitat and numerical abundance were recorded and note made of any interesting behaviour. Special note was made of any behaviour relating to breeding. Nesting, collecting nest material, collecting food and newly fledged dependent young were all taken as evidence of breeding and the presence of birds in juvenile plumages was also recorded.

10.3 Results

The total number of species recorded during the survey period was 153; 140 in the Tat Ke sector, a further 7 in the Ban Bung sector and 6 in the 'buffer zones' (which are delimited in the original report on the reserve by Cox, 1994, but are almost entirely agricultural land; Hill and Kemp, 1996). The full list is shown in Appendix 7, which gives details of habitat types, relative abundance, evidence of breeding and any other points of interest.

Of the species recorded, 7 are described by Collar *et al*.(1994) as 'near-threatened' (not under the risk of extinction in the medium-term, but close to qualifying in a higher-risk category of threat; Collar *et al.*,1994), and a further 2 are endangered within Vietnam (RDB, 1992).

Figure 16. Bird species 'near-threatened' internationally (Collar *et al.*, 1994)

Species	No. of occasions observed	Total no. of individuals observed	Habitat
Pied Falconet *Microhierax melanoleucos*	1	4	Scrub, Ban Bung sector
White-winged Magpie *Urocissa whiteheadi*	4	at least 16	Secondary forest
Grey Laughingthrush *Garrulax maesi*	3	at least 11	Montane forest *c.* 1,000m, Khau Tep Mountain.
Red-tailed Laughingthrush *Garrulax milnei*	2	2	Montane forest *c.* 1,000m, Khau Tep Mountain
Rufous-throated Fulvetta *Alcippe rufogularis*	1	1 adult, 1 juvenile	Secondary forest
Rufous-headed Parrotbill *Paradoxornis ruficeps*	1	2	Secondary forest; observed in mixed flock with *P. atrosuperciliaris*
Green Cochoa *Cochoa viridis*	2	2 juveniles	Montane forest 900-1000m, Khau Tep Mountain

Species endangered in Vietnam:

- *Psarisomus dalhousiae* (Long-tailed Broadbill)
- *Temnurus temnurus* (Ratchet-tailed Treepie)

10.4 Discussion

10.4.1 Comparison with previous surveys

Of the species recorded in this survey 103 were recorded in the SEE winter survey in Ban Bung (Hill and Kemp, 1996). Of the 50 species *not* recorded in Ban Bung, 29 have never been previously recorded for the reserve area. The combined lists from Ban Bung (Hill and Kemp, 1996) and Tat Ke (this report) give a total of 221 species for the Na Hang reserve. There are 34 additional species listed in the report by Cox (1994), giving a total of 255 species.

The marked difference between the species recorded in the two phases is the result both of seasonal variations and of differences between the two sectors of the reserve. During the summer phase many of the winter migrant species of thrushes, Old World flycatchers, warblers and raptors were, as expected, not present. Additionally, the cuckoos and pittas were much less vocal and fewer were identified. Both cuckoos and pittas show seasonal variation in activity, calling particularly during the spring, and are difficult to observe in forest when not calling (King *et al.*, 1975).

There was an increase in the number of accipiters, swifts and drongos recorded. The increase in records for these groups is probably due in part to the time in the breeding cycle, and in part to the more disturbed nature of the Tat Ke sector (more clearings from which these birds could be observed in flight).

The differences in numbers records of owls, hornbills, woodpeckers and pittas reflects the more disturbed nature of the forest in the Tat Ke sector. In the previous phase these groups were all found in primary forest which was more widespread, and less affected by human utilisation and disturbance, than was the forest in this sector.

Other differences reflect the predominantly higher altitude of much of Tat Ke's forest, and variation in the migrant species recorded over the period of each phase.

10.4.2 Range extensions and altitude reductions

Eight records indicate 'range extensions' of species, and 8 records indicate 'altitude reductions' from species ranges and typical altitude distributions recorded by King *et al.* (1975).

Most of the species for which 'altitude reductions' were recorded had also been observed at low altitudes in the previous SEE winter survey for Na Hang, when it was suggested that seasonal migration between habitats at different elevations could account for the observations (Hill and Kemp, 1996). The presence of individuals outside their recognised altitude limits in different seasons suggests that some species at least are normally resident at these altitudes.

10.4.3 Evidence of breeding

Evidence of breeding was recorded for 10 species, and juveniles of another 11 species were seen. The most significant of these records was that juveniles of 3 of the internationally 'near-threatened' species were observed: *Urocissa whiteheadi* (White-winged Magpie), *Alcippe rufogularis* (Rufous-throated Fulvetta), and *Cochoa viridis* (Green Cochoa), which suggests that they breed within the reserve.

10.4.4 Biodiversity value of the reserve

Na Hang Nature Reserve is of major importance nationally and internationally for the conservation of birds. The two study periods in Tat Ke and Ban Bung have recorded 15 species of internationally scare birds (although most of these fall into the 'near-threatened' group, not in imminent danger of extinction) and a further 4 species endangered within Vietnam (see Appendix 7c for full list). The reserve should be managed for its bird conservation value in addition to the protection it gives to the monkeys. There need be little conflict between management for bird and mammal conservation, as both would benefit from a reduction in human use of forest resources.

The high diversity of birds found in the Na Hang reserve make it a very attractive location for special interest bird groups to visit. The birds found here have the potential to bring the type of low impact, high value tourism which would allow the reserve and local people to benefit without damaging the forest or disturbing the population of Tonkin Snub-nosed Monkey (see section 12.3.7 of this report).

11 0 MAMMAL SURVEY

11.1 Introduction

Previous studies of the mammal fauna of Na Hang (by Dang Huy Huyen, 1993, Cox, 1994, and Hill and Kemp, 1996) have positively identified 56 mammal species within the boundaries of the Na Hang reserve, and have provided some information on the status of the most threatened mammal in the area, the Tonkin Snub-nosed Monkey *Pygathrix avunculus*. The Tat Ke sector of the reserve is thought to contain the largest extant population of this primate.

The aims of this, the second SEE-Vietnam mammal survey of the reserve, were to gather further information on the local mammals of the northern wilderness zone of the reserve, and to compare mammal faunas of the two wilderness zones, which isolated from each other by arable land, which acts as a barrier to the movement of many mammal species between the forested wilderness zones.

11.2 Methods

Three survey methods were used to identify mammals in the reserve;

1. Small mammal (rodent) trapping, using Vietnamese live traps.
2. Bat netting at two cave-roosts.
3. Direct observation of mammals, their tracks and signs.

11.2.1 Mammal trapping

Trap-lines of 15 Vietnamese live-traps were laid out in a variety of habitats, using fruit as bait (and, occasionally, peanuts and fish). The traps were laid out for at least 5 nights in each location and checked every day.

11.2.2 Bat netting

Mist nets were erected at the mouths of cave roost sites. Nets were in place by about 5pm and were watched constantly until daybreak the following morning. Bats were identified using *The Mammals of the Indo-Malayan region* (Corbet and Hill, 1992).

11.2.3 Mammal observation

Observation of mammals, their tracks and signs was carried out throughout the reserve. Mammals were identified using *The Mammals of the Indo-Malayan region* (Corbet and Hill, 1992), *Mammals of Thailand* (Lekagul and McNeely, 1988), and the *Preliminary Identification Manual for the Mammals of South Vietnam* (Van Peenen, 1969).

11.3 Results

11.3.1 Mammal trapping

Mammal trapping, using a variety of baits including fruit, peanuts and fish, was carried out in the vegetation plot areas FT1, FT2 and FT3, around the camp at Tat Ke, and at one of the caves where bat netting was carried out. A total of 200 trap-nights was carried out.

No specimens were caught in the traps and, as a result, none of the Muridae (which were observed in the forest, in caves and associated with human settlements in the reserve, on several occasions) could be identified.

Two Shrew species (*Suncus etruscus* and *Crocidura horsfieldi*) were taken in a pitfall trap in a cleared area of forest at around 600m asl.

11.3.2 Bat netting

Two nights of bat-netting were carried out, at two different caves. A total of 180 individuals were caught, measured and released. Not all taxa could be identified in the field (3 species are assigned only to RTUs); however, a total of 8 distinct RTUs were collected. At least 4 species were new records for the reserve.

11.3.3 Observation

A total 13 terrestrial or arboreal mammals were recorded during the survey period (see Appendix 8).

Three of these species are listed in the *1994 IUCN Red List of Threatened Animals* (Groombridge, 1993);

- Pig-tailed Macaque (*Macaca nemestrina*); status 'Commercially Threatened'. A single group of 7 individuals was observed montane forest on Khau Tep mountain. This species was listed as a 'Commercially Threatened' species (one threatened with extinction as a sustainable resource) in 1993 (Groombridge, 1993). In Vietnam, it is threatened more heavily (listed as 'Vulnerable' in RDB, 1992), as there is a flourishing trade in the species for meat, both within Vietnam and for illegally exported specimens in China (Wenjun *et al.*, 1996)

- Asiatic Black Bear (*Selenarctos thibetanus*); status 'Vulnerable'. Clawmarks of large bears were observed on the trees in an undisturbed forest on Khau Tep mountain, but it appears likely that this species is scarce within this sector of the reserve.

- Serow (*Naemorhedus sumatrensis*); status 'Indeterminate'. The droppings of Serow were only observed once at the base of a limestone cliff in less disturbed forest, although suitable habitat for this species appeared to be widespread in the reserve.

Two of these species (the Asiatic Black Bear and the Pig-tailed Macque) are regarded as more heavily threatened within Vietnam than internationally, and are placed in higher threat categories in the RDB (1992) than in the IUCN list (Groombridge, 1993). Another of the mammals, the Barking Deer (*Muntiacus muntjak*) is not internationally threatened, but is regarded as 'Vulnerable' in the *Red Data Book of Vietnam* (RDB, 1992).

11.4 Discussion

In comparison with the earlier survey in Ban Bung (Hill and Kemp, 1996), few mammals were observed in the Tat Ke sector. This is due to a combination of factors: undoubtedly, the presence on the earlier expedition of a skilled Vietnamese mammalogist (Dr Dang Ngoc Can), and knowledgeable local guides, increased the success of the first mammal survey. In addition, seasonal changes in the behaviour of mammals may have influenced the possibility of observing certain species (particularly the Tonkin Snub-nosed Monkey). However, one important factor must be the level of human disturbance in the Tat Ke sector of the reserve, when compared to the relatively undisturbed Ban Bung sector. Throughout the northern sector, clearance for agricultural purposes fragmented the remaining forests and their mammal populations. In addition, hunting pressure appears more intense in Tat Ke, affecting populations of species which are preferentially hunted by man, for example, Wild Boar (*Sus scrofa*) and Barking Deer (*Muntiacus muntjak*).

Four of the species recorded (all of them bats) were previously unrecorded in the reserve, bringing the reserve total to 60 mammal species (and the total for the Na Hang district to 83). One of the new bats, *Murina* sp., was a juvenile collected by a local farmer on a banana plant, the others were collected in the course of bat-netting at cave roosting sites.

This information, combined with that of the survey in Ban Bung sector (Hill and Kemp, 1996), has added considerably to previous work on bats in the region. Collating all previous survey data from the reserve, Na Hang contains at least 24 species of bats.Since new species were still being added during this survey, it is likely that further species exist in the reserve. The combination of limestone geology and good forest cover found at Na Hang are unique in Tuyen Quang province, suggesting that this may be an site of regional or national importance for bat conservation.

The Tonkin Snub-nosed Monkey, *Pygathrix avunculus* was not observed during the expedition, despite an extended satellite camp (of ten days duration) at a hide in montane forest overlooking an area of undisturbed forest, where the monkeys had been seen by a previous visiting group. Local people suggested that sightings of the monkey were more frequent in the winter dry season, when the low availability of water and scarcity of fruiting trees concentrated the population into certain restricted areas. In contrast, during the summer wet season, food supplies are abundant and the troops fragment to breed (Nguyen Kiem Son, *pers. comm.*).

Population estimates arrived at by local people were often considerably lower than the 200 individuals claimed by earlier publications (eg, Cox, 1994).

The major threat to mammals in the Tat Ke sector of the Na Hang reserve appears to be forest destruction for agriculture, which is extensive and continuing. Without an end to this process, it is difficult to believe that viable populations of larger mammals can be sustained. As in other reserve areas of Vietnam, larger carnivores and primates are particularly threatened, the former group due to the large areas needed to sustain viable populations (Government of SRV, 1994), and the latter because of their attractiveness to hunters and perceived role as cropraiders (Nisbett and Ciochon, 1993).

12 0 SOCIO-ECONOMIC STUDY

12.1 Introduction

Vietnam contains 54 ethnic groups and has a population of approximately 75 million. The ethnic minorities, that is those people resident in Vietnam but not sharing Kinh identity, language or other cultural characteristics, account for 13.1% of the total population of Vietnam (VIE/96/010). The population relies heavily on agriculture as a source of income. Agriculture in Vietnam accounts for 72.2% of the labour population (Mekong River Commission Secretariat, 1995).

In addition to agriculture, highland people exploit the forest resource to supplement their income. Ethnic minorities and forests are closely related and "the former are the authentic owners of the latter; the latter are the direct object of the former's exploitation" (Nguyen Van Thang, *in* Rambo *et al.*, 1995).

This chapter assesses socio-economic conditions of minority populations in the Tat Ke sector, in addition to the potential for tourism there, as many tourists seek to travel to natural settings (Ceballos-Lascurain, 1996) with cultural and ecological interest.

12.2 Methods

The methods adopted in the survey were based on the techniques of Participatory Rural Appraisal (Grandstaff *et al.*, 1995). Semi-structured and informal interviews were used to gather information from *Kiem Lam* (Forestry Protection Department), local government officials, village leaders and family heads. Interviews were conducted in Vietnamese and translated to English by an IEBR student.

Not all the villages, or indeed all the families in the sector could be visited due to time constraints. Instead, a village containing each of the ethnic minorities present in the reserve was visited from which a cross section of families (based on wealth) were chosen for interview. However, permission to interview the Hmong ethnic minority could not be obtained although we were allowed to visit the village. The official reasoning behind this restriction was that the village was soon to be moved out of the sector.

12.3 Results

12.3.1 The people and place

The results of the study are outlined in section 12.3-12.6 below.

The Tat Ke sector of Na Hang reserve comes mainly under the jurisdiction of the Khau Tinh subdistrict which contains 15 villages of the ethnic minorities Tay, Dao and Hmong. The subdistrict contains 286 families and a total population of 1735. Population growth is estimated at 2.3% (*Kiem Lam.*, unpublished data). Village populations tend to belong to a single minority, although Tay and Dao sometimes mix. The villages studied were;

12.3.1.1 TAT KE, a Tay minority village

The Tay village of Tat Ke is situated in the valley floor at an elevation of 500m asl. The village now consists of 16 families (population 118) with each family averaging 7.3 members. Prior to 1962 the village consisted of 20 families who were employed by two branches of the commercial forestry service. In 1966, one of these departments closed and ten of the families moved to a site further north of the original village. Both parts of the village became reliant on agriculture rather than forestry. Four families left the area all together. Several families were relocated from the Dao village of Na Tang in 1971.

The majority of the village houses are built on stilts and are constructed of timber and bamboo. The ground beneath is used to store equipment and to house livestock. 87.5% of the families have privately owned hydro-electric generators, the remainder relying on kerosene lamps.

12.3.1.2 NA TANG; a Dao minority village

The Dao village of Na Tang is situated on a plateau at an elevation of 750m asl.

The village is long established although in 1971 the resident Tay minority were relocated by the government to Tat Ke to concentrate the Dao. This was done to preserve the Dao identity and traditions, and to make village management easier. There are 18 families (population 118) with an average family size of 6.5 people.

The houses are constructed of timber and bamboo on mud floors. 66.7 % of the families interviewed had hydro-electric power (H.E.P.) with the remainder using kerosene.

12.3.1.3 LUNG PANG CAMP; a Tay minority hamlet

Lung Pang is a permanent camp situated in a valley at an elevation of approximately 800m asl.

The camp consists of three households which moved to the site from Khau Tinh village in 1990, where their families are still based. The move was precipitated by a lack of agricultural land on which to crop maize.

The houses are typical Tay minority style, and are manned all year round by the third generation of each family. Other family members stay at the camp during busy periods of the agricultural year and also visit to bring supplies. None of the houses have H.E.P., but use kerosene instead.

12.3.1.4 KHUOI BOC; a Hmong minority village

The Hmong village of Khuoi Boc is situated on the hillside at an elevation of 800-900m asl. No families could be interviewed.

The village moved here in 1992 from Ba Be, Cao Bang Province. Authority to relocate the village from Na Hang has been given by the Tuyen Quang Province, although the date of the move depends on when the District Rangers Office can finance the project. Twelve families (population 78) with an average family size of 6.5 members live in the village.

The houses are similar in style to those of the Dao; and only some have H.E.P.

12.3.2 Economic activity

Levels of poverty are much higher among the mountain minority people than among the Kinh ethnic group (Van Cong, Nhan Dan Newspaper, 30/1/92). The majority of the population rely on advanced subsistence farming based on semi-intensive paddy rice production using draft for ploughing, fertilisers and pesticides. This is supplemented by maize, cassava, cotton production grown on slopes surrounding the villages and sugar cane, fruit trees and taro grown in gardens. Official statistics (*Kiem Lam,* unpublished data) state that there are 169 ha of cleared land, of which 76 ha is used to crop rice and 21 ha is used for other crops.

Livestock are kept in a traditional way. The primary function is to provide draft power and manure for crop cultivation as low quality feed supplies restrict animal weights and therefore, the potential for meat. Grazing on common scrubland occurs and the animals are generally fed crop residues.

Fish are also cultivated by some families with small ponds in their gardens.

Agricultural statistics from the families interviewed are given in Figure 17.

Figure 17. Summary agricultural statistics for three villages

Village	Rice			Corn		
	ha	kg/ha	kg/person	ha	kg/ha	kg/person
Tat Ke	4.5	1,671	1000	2.0	8,079	268.3
Na Tang	3.4	4,803	707	2.5	5,658	568.5
Lung Pang	0.5	569	355	0.7	4,367	316.7

12.3.3 Land Tenure

According to the 'Law on Land' (1993) "Land is the property of the people and is subject to the exclusive administration by the state." (UNDP/FAO 1992-93).

Under Decree of the Council of Ministers No. 327, 1992, "Master guidelines and policies to utilize unoccupied land, bare hilly areas, forests, denuded land and beaches and waterfront" (Smith, 1993), Tat Ke has been given the responsibility of protecting areas of forest. Each family interviewed has been assigned an area of forest by *Kiem Lam* for which they receive annual payments. The plots contain natural trees and bamboo in addition to newly planted trees. The families are given permission to collect dead wood and minor forest products from their respective plots. However, some families reported that their plots had been 'raided' by other families.

Permission for residents to create new fields in forested areas is supposed to be sought from *Kiem Lam*. However, *Kiem Lam* reported that this regulation was not always followed and extensions to existing fields were difficult to monitor.

12.3.4 Use of, and dependence on, the forest

Forestry can be defined as "the production and harvesting of forest products generally and not just the exploitation of of timber" (MacKinnon *et al.*, 1986). Unauthorised forestry is illegal within the sector, although small scale domestic use is tolerated by *Kiem Lam*.

12.3.4.1 Hunting and fishing

Gun and cross-bow ownership and the presence of hunting trophies (including barking deer and serow horns, wild pig skulls and silver pheasant feathers), in many of the houses suggest that hunting has occurred in the sector. When the owners were questioned about such matters they told us the guns were used to protect their crops and that such trophies were collected many years previously.

However, we were told by the Tay that it is not uncommon for the Hmong minority to hunt wild animals using packs of dogs. One such case occurred in 1996 when a pack

was seen and heard chasing a deer through the forest. The District Rangers Office confirmed this.

The stream flowing through Tat Ke village has been overfished using the poison leaf of *Momordica cochinchinensis* (Family Cucurbitaceae). Only small fish now populate these waters. The Nang and Gam rivers are fished using net and lines and electric methods. Some explosive fishing is reputably still carried out on a small scale although it was not observed.

12.3.4.2 Food and medicine

The following products were observed to be taken from the forest during the study period:

- Bamboo (Poaceae) shoots were frequently collected during the study period; this was the main season for its harvest.
- *Polygonum hydropiper* (Polygonaceae) is used as a vegetable to stuff bamboo shoots.
- *Arenga pinnata* (Arecaceae) is used by some houses in Lung Pang in the production of rice wine.
- The Hmong villagers use *Dioscoria alata* (Dioscoriaceae) from the forest to supplement their diet when maize reserves are finished.
- Tay villagers at Tat Ke collected *Scoparia dulsis* (Scrophulariaceae) for use as a herbal tea; in addition to domestic use, the herb was dried and sold at Na Hang.
- Herbal medicines are still used for snake bites, skin infections, rashes and other minor ailments. *Ocimum tomentosus* (Lamiaceae) is used in the cure of dermatological problems; *Fibraurea tinctoria* (Menispermaceae) is used as an antibiotic during the treatment of animal bites and cuts. *Alocasia hainanica* (Araceae) is used to reduce swelling around cuts and bruises.

12.3.4.3 Timber

There is no evidence to suggest clear-cut logging for timber occurs at present. Selective logging does occur on a small scale for domestic use, and is carried out using traditional methods. No chainsaws or heavy machinery are used. The practice is monitored and controlled; permission to log timber for the construction of houses has to be obtained from the district committee beforehand. Species used in the construction of houses include:

- Woody plants for the construction of the frame :
  Markhamia stipulata (Bignoniaceae)
  Fagraea fragans (Loganiaceae)
  Erythrophloeum fordii (Fabaceae)
  Artocarpus heterophyllus (Moraceae)
  Burretiodendron hsienmu (Tiliaceae)

Melia azedarach (Meliaceae)
Chukrasia tabularis (Meliaceae)
Shorea stellata (Dipterocarpaceae)
Garcinia tonkinensis (Clusiaceae)
Vatica tonkinensis(Dipterocarpaceae)

- For the walls :
  Bambusa blumeana
  Gigantochloa laevis
  Dendrocalamus membranaceus
  Dendrocalamus latiflorus (all Poaceae)
- For the roof :
  Imperata cylindrica
  Dendrocalamus patellarus
  Dendrocalamus membranaceus (all Poaceae)

12.3.4.4 Other

Dead wood and bamboo is collected from the forests surrounding the villages and is used as the main source of fuel for cooking. The families interviewed estimated that between 1-2 m^3 were used each month, although this is considered to be an underestimate due to their belief that firewood may be taxed in the near future.
Bat guano is collected from local caves and used as fertiliser by some families.

12.3.5 Peoples attitudes to conservation

The Tay people of Tat Ke village appear to have the greatest amount of foresight and respect for the reserve, seeing it as an important source of income. They are keen to be involved with any future plans for development. They are concerned about the amount of erosion occuring in the reserve, which is particularly evident along the path from Tat Ke to the Nang River.

The Dao appear to have little respect for the reserve, and no idea of its present importance. The village leader had no clear plans for the village although he did express concern over the amount of alcohol the local men were drinking. No mention of the forest or reserve was made.

The Hmong lead a very simple lifestyle, and appear content with sufficient food to live on. They are the least affluent of the minorities. They have a strong respect for the ideas of Ho Chi Minh (especially with regards to the environment) although their poverty prevents them from practising these ideals.

12.3.6 Forestry Protection

The sector is managed by *Kiem Lam* who enforce the legal protection of the reserve using laws established by central government in August 1991, managing the reserve to ensure its sustainability.

The overall aims of *Kiem Lam* are:

- To improve the protection of the reserve;
- To decrease population growth rates in the reserve;
- To reforest 80-90% of the areas currently unforested, with the help of local communities and before the year 2000.

In order to achieve these aims, *Kiem Lam* liaises with the provincial, district and subdistrict committees and local communities.

Kiem Lam had an annual budget of 89 million VND (approximately US$8000) in 1995. This is used to run the head quarters in Na Hang, together with five outposts situated in each of the sub-districts contained in the reserve. These are manned by a total of 12 staff who are responsible for patrolling the area, meeting with the sub-district committee and villages, and for reporting to head office once a month. *Kiem Lam* has office equipment, a telephone, and access to a four-wheel drive jeep. It does not have two-way radios or binoculars, items which the head of the Office considered essential equipment which it can not afford. Finance to relocate villages also comes from the budget.

Within the reserve, the following activities are prohibited:

- Forest clearance for agriculture;
- Timber and forest resource collection;
- Hunting animals;
- Disturbing wildlife.

To enforce these rules, *Kiem Lam* has the power of prosecution and confiscation. However, in practice such powers are only used if the misdemeanour is considered large-scale or problematic. It was not established how many prosecutions or cases of misdemeanour have occured.

12.3.7 Ecotourism potential

Tourism is seen as a very lucrative source of foreign investment and is a growing industry in Vietnam. However, at the present time there are no known cases of tourists visiting either sector of the Na Hang reserve. This gives the reserve managers an ideal opportunity to develop its tourist industry in a sustainable way that attracts the optimal numbers of tourists to the area without compromising the quality of the reserve.

Na Hang's current lack of tourism may attract tourists seeking tranquility, remoteness and unspoilt scenery; however, it is similar in character to Cuc Phuong and Cat Ba National Parks (Cox, 1994) which are already well established tour destinations, with good transport links and tourist facilities. At present, the potential for back-packing or sight-seeing tourists at Na Hang appears limited.

However, there is an opportunity to attract special interest groups, such as international ornithological or botany clubs, or dedicated ecotourists. These could provide a valuable source of income for the reserve, providing local employment (for forest guides and workers in services), whilst causing only the minimum of disturbance to the forest itself.

12.3.7.1 Specialist ecotourism; bird groups

Na Hang Nature Reserve has a high diversity of birds, including rare and endemic forms with the potential to attract tourists with a special interest in birds.

In the past years, a small number of specialist bird tour groups have visited Vietnam. They are usually made up of experienced observers and are led by a professional leader.

Bird groups cause little disturbance to an area because they involve small groups and are only resident for short periods of time. Numbers of visitors could be controlled and directed away from prime areas of the reserve, for example, where the Tonkin Snub-nosed Monkey is found.

Among the *Kiem Lam* rangers and local people there are individuals with a good knowledge of both the reserve and its birds. The most experienced could be chosen from both sources to act as guides. Most of the other basic services required by ecotourist groups could be provided in Na Hang town.

The attraction of bird groups would generate revenue for the reserve and local people, which Cox (1994) lists as an overriding priority.

The principle behind attracting special interest bird groups is to attract limited numbers of high value tourists, thus bringing valuable revenue with limited disturbance. For example, Fillon *et al.* (1992) (in Ceballos-Lascurain, 1996) estimated

that bird-related tourism attracted 78 million travellers and generated US$78 billion for the countries they visited.

12.4 Discussion

The communities within the Tat Ke sector of Na Hang reserve lead a traditional lifestyle based on agriculture. They face problems of food and land shortages which tend to create an uneven distribution of wealth between the minorities and within each village as populations grow. There is currently no alternative source of income available to villagers and because the expansion of agricultural land is prohibited, the problems are addressed through the use of new seed strains and agricultural chemicals. However, these are expensive and may only prove to be a short-term solution with serious implications to both the environment and health.

The local people are strongly dependent on the forest resource. If the present rate of encroachment continues, it will have serious implications for the quality and survival of the reserve. Hunting and fishing can have serious ramifications for biodiversity (for example, the elimination of large fish species in the stream by Tat Ke village), and the decline of primate populations in the area is thought to be from hunting and forest encroachment.

The Na Hang reserve appears to fulfil the conditions which would allow a certain amount of tourism, particularly ecotourism by dedicated groups. However, this kind of tourism is relatively new to Vietnam, and there are at present no long-term plans to develop tourism projects in Na Hang. Much of Vietnam's experience with overseas tourism has involved low-budget travellers, whose requirements are very different to those of ecotourist groups. Only when there has been a proper consideration of the impacts of tourists on the reserve, and how this can be minimised, should any visitors be allowed in the reserve.

13 0 CONCLUSIONS

13.1 Tat Ke sector

The Tat Ke sector of the Na Hang nature reserve is an important protected area containing a large number of different habitat types, and particularly forests on limestone. Although this ecotype once covered a large part of northern Vietnam, it is becoming endangered as forests outside protected areas are cleared (MacKinnon, 1990); this process is visible all around Na Hang itself, especially in the more accessible areas near roads and rivers, where very little remains of the former forest cover.

As a result of this destruction, nature reserves become increasingly important as reservoirs of biodiversity, and this is true even of predominantly secondary forest areas such as Tat Ke. Tat Ke's patchwork of habitat types ensures that it supports a particularly high diversity of certain taxonomic groups, including butterflies and birds. Its forest has begun to recover following the cessation of large-scale logging in the Tat Ke area (Nguyen Kim Dao, *pers. comm.*). For other taxonomic groups, however, human disturbance seems to pose a threat to biodiversity. Mammal diversity in the reserve is particularly high, and includes internationally important populations of endangered species (Cox *et al.,* 1994), but this diversity is threatened by hunting. It is interesting that, while there was abundant evidence of mammal species such as *Muntiacus muntjak* and *Sus scrofa* in the Ban Bung sector, the results of this survey suggest that these commonly hunted species were rare in the Tat Ke sector.

13.2 Comparison of the Tat Ke and Ban Bung wilderness zones

The Tat Ke sector contrasts greatly with the southern (Ban Bung) sector of the reserve, which was the subject of an earlier (January-March 1996) study by S.E.E (Hill and Kemp, 1996). Both areas share a similar limestone geology, and in both, the natural vegetation is made up of tropical forest ecotypes, with montane forests towards the peaks of the highest mountains. However, historical factors have led to the differential development of the two areas. While Ban Bung is nearer to the town of Na Hang, access to that part of the reserve has in the past been poor. In Tat Ke, the presence of a logging road has allowed more extensive clearance of natural forests, so that the Ban Bung sector is now dominated by primary forest formations, while, in the Tat Ke sector, secondary forest is predominant. Primary forest in the northern sector is now limited to the West (Nui Khau Tep) and South, where the human population is most sparse. Even in these areas, some disturbance of the forest has occurred. However, these forests still harbour important populations of birds and mammals (including the Asiatic Black Bear and Tonkin Snub-nosed Monkey).

The human population of Tat Ke is large and expanding, although the forestry authorities plan to move certain groups (the Hmong) out of the reserve altogether. Relocation of human populations from reserve areas has been planned in several

places in Vietnam, but rarely carried out successfully; one exception is the core zone of Cuc Phuong National Park (MacKinnon, 1990). At present, people move throughout the Tat Ke sector in order to cultivate maize and other crops. Not only flat land, but also steep slopes have come under cultivation, and settlements are scattered throughout the protected area. Hunting occurs, and the demand for forest products is high.

Despite these problems, Tat Ke's forests have begun to recover from logging. Although this survey shows that regenerating forests are often dominated by a small number of species (particularly *Streblus tonkinensis*, Moraceae), they are usually contiguous with more varied old-growth forests and it is probable that colonisation by further woody species will continue in the future. The resultant patchwork of forest types with varied characteristics could, if relatively undisturbed by hunters, support a high biodiversity; logged areas often provide a greater density of flowering and fruiting trees than primary forests, favouring certain mammals and birds (Johns, 1991; Lambert, 1992).

Tat Ke still supports the largest single population of the Tonkin Snub-nosed Monkey (Cox *et al.*, 1994), although local estimates suggest that this population may have declined in recent years; one forestry protection official suggested that there may be as few as 50 left in the sector, with only around 30 individuals in the Ban Bung sector of the reserve (Le Hong Binh, *pers. comm.*). Although hunting of this species does not appear to be an important problem, habitat loss and degradation, and the presence of humans in the forest present a real threat to the monkey, which avoids humans and is rarely observed, even by the local population (Ratajszczak *et al.*, 1990).

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Appendix 1.

Plants

Plant species identified in Tat Ke sector, Na Hang reserve

Habitat; pf = primary forest, sf = secondary forest , hf = high altitude forests, g = grassland, ar = arable
Fertile stages present; Fl = Flower, Fr = Fruit
Uses & Status; t = timber, m = medicinal plant, e = edible, o = ornamental
∗ = Recorded in the Red Data Book for Vietnam (RDB, 1996).

Species	Habitat	Fertile stages	Uses/Status
LYCOPODIOPHYTA			
LYCOPODIACEAE			
1. *Lycopodium cernuum* (L.) Franco & Vasc.	g, sf		
2. *Lycopodium complanatum* L.	g		
SELAGINELLACEAE			
3. *Selaginella willdenowii* (Desv.) Baker.	pf, sf		
4. *Selaginella sp.*	sf		
POLYPODIOPHYTA			
ADIANTACEAE			
5. *Adiantum caudatum* L.	g		
6. *Adiantum flabellatum* L.	g		
7. *Antrophyum callifolium* Blume	pf		
8. *Antrophyum vittaroides* Bak.	pf, sf		
9. *Cheilanthes farinosa* (Forsk.) Kaulf.	pf		
10. *Onychium lucidum* Spr.	pf, sf		
11. *Pityogramma calomelanos* (L.) Link	sf		
ANGIOPTERIDACEAE			
12. *Angiopteris yunnanensis* Hiern.	pf, sf		
13. *Archangiopteris tonkinensis* (Hay.) Ching	pf		
ASPLENIACEAE			
14. *Asplenium antrophyoides* Chr.	pf, sf		
15. *Asplenium nidus* L.	pf, sf		
16. *Asplenium obscurum* Blume	sf, g		
17. *Asplenium praelongum*	sf, g		
18. *Asplenium unilaterale* Lamk.	pf		
19. *Diplazium subsinuatum* (Hook. & Grev.) Tag.	pf, sf		
BLECHNACEAE			
20. *Blechnum orientale* L.	sf		
CYATHEACEAE			
21. *Cyathea chinensis* Copel.	pf, sf		
22. *Cyathea gigantea* Copel.	pf, sf		
DAVALLIACEAE			
23. *Nephrolepis cordifolia* (L.) Presl.	sf		m
DENNSTAEDTIACEAE			
24. *Lindsaea javanensis* Blume	sf		
25. *Lindsaea lucida* Blume	pf, sf		
26. *Microlepia hookeriana* (Hook.) Presl.	sf		

Species	Habitat	Fertile	Uses/Status stages	
27.	*Microlepia marginata* (Houtt.) C. Chr.	sf		
28.	*Microlepia speluncae* (L.) Moore	sf		
DRYOPTERIDACEAE				
29.	*Arachnoides assamica* (Kuhn.) Ohwi.	g		
30.	*Arachnoides chinensis* (Rosenst.) Ching.	pf, sf		
GLEICHENIACEAE				
31.	*Dicranopteris linearis* (Burm) Underw.	sf		
HYMENOPHYLLACEAE				
32.	*Gonocormus minutus* (Blume) Bosch.	pf		
33.	*Hymenophyllum oxydon* Bak.	pf		
34.	*Trichomanes cystaseiroides* Christ.	pf		
MARSILIACEAE				
35.	*Marsilea quadrifolia* L.	ar		m
POLYPODIACEAE				
36.	*Aglaomorpha coronans* (Mett.) Copel.	pf, sf		
37.	*Colysis wrightii* (Hook) Ching	pf, sf		
38.	*Drynaria bonii* Christ.	pf		m
39.	*Microsorium hancockii* (Bak.) Ching	pf, sf		
40.	*Polypodium fasciatum* (Blume) Presl.	pf, sf		
41.	*Pyrrosia lanceolata* (L.) Farw.	pf, sf		
42.	*Pyrrosia longissimus* (Blume) Pic. & Ser.	pf, sf		
43.	*Pyrrosia subfurfuracea* (Hook.) Ching	pf, sf		
PTERIDACEAE				
44.	*Pteris biaurita* L.	sf		
45.	*Pteris decrescens* Chr.			
46.	*Pteris deltodon* Bak.	sf		
47.	*Pteris ensiformis* Burm. f.	sf		
48.	*Pteris longipes* D. Don	sf		
49.	*Pteris semipinnata* L.	pf, sf		
50.	*Pteris vittata* L.	pf		
SCHIZEACEAE				
51.	*Lygodium conforme* C. Chr.	sf		
52.	*Lygodium japonicum* (Thunb.) Sw.	g, ar		
53.	*Lygodium scandens* (L.) Sw.	g, ar		
THELYPTERIDACEAE				
54.	*Pronephrium megacuspe* (Bak.) Holtt.	ar, sf		
55.	*Thelypteris triphylla* (Sw.) Iwats.	sf		
THYRSOPTERIDACEAE				
56.	*Cibotium barometz* (L.) J. E. Sm.	sf		m, *
PINOPHYTA				
CYCADACEAE				
57.	*Cycas cf. rumphii* Miq.	sf		
PODOCARPACEAE				
58.	*Podocarpus neriifolius* D. Don.	hf		t

Species	Habitat	Fertile stages	Uses/Status
MAGNOLIOPHYTA			
MAGNOLIOPSIDA			
ACANTHACEAE			
59. *Acanthus ilicifolius* L.	sf		
60. *Dipteracanthus repens* (L.) Hassk.	g	Fl	
61. *Hemigraphis brunelloides* (Lam.) Bremek.	sf	Fl	
62. *Justicia aequalis* R. Ben.	ar	Fl	
63. *Justicia gendarussa* Burm. f.	ar	Fl	m
64. *Justicia procumbens* L.	ar	Fl	m
65. *Lepidagathis hyalina* Nees	ar, g		
66. *Lepidagathis incurva* Buch.-Ham. ex D. Don	sf, ar		
67. *Ruellia tuberosa* L.			
68. *Staurogyne hypoleucum* (R. Ben.) R. Ben.	sf	Fl	
69. *Staurogyne petelotii* R. Ben.	sf	Fr	
70. *Strobilanthes apricus* (Hance) T. Anderw.			
71. *Strobilanthes brunescens* R. Ben.	ar	Fl	
72. *Strobilanthes patulus* R. Ben.	sf		
73. *Thunbergia alata* Boj. ex Sims.	ar	Fl	o
74. *Thunbergia fragrans* Roxb.	ar	Fl	o
75. *Thunbergia laurifolia* Lindl.	sf		
76. *Thunbergia grandiflora* (Rottl.) Roxb.	ar	Fl	o
ACERACEAE			
77. *Acer tonkinense* Lec.	sf		
ALANGIACEAE			
78. *Alangium chinense* (Lour.) Rehd.	ar, sf	Fl, Fr	
79. *Alangium kurzii* Craib	ar, sf	Fl, Fr	
AMARANTHACEAE			
80. *Achyranthus aspera* L.	ar	Fr	m
81. *Aerva sanguinolineata* (L.) Blume	ar		
82. *Alternanthera sessilis* (L.) R.Be ex Roem et Schult.f	ar, g	Fl	
83. *Amaranthus hybridus* L.	ar	Fl	o
84. *Amaranthus spinosus* L.	ar	Fl	m
85. *Amaranthus tricolor* L.	ar	Fl	e
86. *Amaranthus viridis* L.	ar		e
87. *Celosia argentea* var. *cristata* L.	ar	Fl, Fr	m, o
88. *Celosia argentea* var.*plumosa* L.	ar	Fl, Fr	m, o
89. *Cyathula prostrata* (L.) Blume	ar		
ANACARDIACEAE			
90. *Allospondias lakonensis* (Koenig & L. f.) Kurz.	sf, ar		t, e
91. *Dracontomelum duperreanum* Pierre	pf		
92. *Gluta wrayi* King	sf, pf	Fr	m
93. *Mangifera foetida* Lour.	sf, ar	Fr	e
94. *Mangifera indica* L.	ar	Fr	t, e
95. *Mangifera longipes* Griff.	sf	Fr	t
96. *Rhus javanica* var. *roxburghii* (DC) Rehd. & Wils.	sf, ar	Fl, Fr	
97. *Rhus verniciflua* Stokes	sf	Fr	
98. *Semecarpus tonkinensis* H. Lec.	sf	Fl	m, t
99. *Toxicodendron succedana* (L.) Mold.	sf		t

Species	Habitat	Fertile stages	Uses/Status
ANNONACEAE			
100. *Annona squamosa* L.	ar	Fr	e, m
101. *Artabotrys hongkongensis* Hance	sf		
102. *Artabotrys petelotii* Merr.	sf		
103. *Desmos chinensis* Lowr.	sf	Fr	
104. *Desmos pedunculosis* (A. DC) Ban	sf, ar	Fr	
105. *Fissistigma balansae* (A. DC) Pham Hoang	ar, sf	Fr	
106. *Fissistigma villosissima* Merr.	ar, sf	Fl	
107. *Miliusa balansae* Fin. & Gagn.	sf, ar		
108. *Mitrella mesyi* (Pierre) Ban	sf, pf	Fr	
109. *Polyalthia jucunda.* (Pierre) Fin. & Gagn.	sf		t
110. *Uvaria calamistrata* Hance	sf, ar		
111. *Uvaria hamiltonii* Hook. f. & Thoms.	sf	Fr	
112. *Uvaria hexapetalus* (L.f.) Bhandare			
APIACEAE			
113. *Anethum graveolens* L.	ar	Fl	e
114. *Centella asiatica* (L.) Urb.	ar	Fl	e, m
115. *Cnidium monnieii* (L.) Cusson.	ar	Fr	m
116. *Coriandrum sativum* L.	ar		e, m
117. *Eryngium foetidum* L.	ar	Fl	e
118. *Hydrocotyle tonkinensis* Tard.	ar, g	Fl, Fr	e
119. *Oenanthe javanica* DC.	ar, g		e
APOCYNACEAE			
120. *Allamanda cathartica* L.			
121. *Alstonia mairei* Levl.	sf		
122. *Alstonia scholaris* (L.) R. Br.	sf		m
123. *Bousingonia mekongense* Pierre ex Pl.	sf		
124. *Kopsia tonkinense* Pit.	pf, sf		
125. *Melodinus monogynus* Roxb.	sf		
126. *Melodinus tournierii* Pierre ex Spire	sf		
127. *Rauvolfia verticillata* (Lour.) Baill.	sf		*
128. *Strophanthus caudatus* (Burm f.) Kurz.	sf	Fl	
129. *Tabernaemontana bovina* Lour	pf	Fl, Fr	
130. *Tabernaemontana divaricata* (L.) R. Br.	ar	Fl	m, o
131. *Thevetia peruviana* (Pers.) Merr.	ar		
ARALIACEAE			
132. *Acanthopanax gracilistylis* W. W. Sm.	ar, g	Fr	*
133. *Aralia armata* Seem.	ar, sf		m
134. *Dendropanax chevalieri* (Vig.) Merr. var. *chevalieri*	pf	Fl, Fr	
135. *Eleutherococcus trifoliatus* (L.) Merr.	ar		
136. *Polyscias fruticosa* (L.) Harms.	ar		e, m
137. *Schefflera hypoleucoides* var. *tomentosa* Grushv. et Skvorts.	sf		
138. *Schefflera octophylla* (Lour.) Harms.	sf	Fl	e, m
139. *Trevesia palmata* (Roxb. ex Lindl.) Vis.	sf		m

Species	Habitat	Fertile stages	Uses/Status
ARISTOLOCHIACEAE			
140. *Aristolochia indica* L.	ar	Fl	m
141. *Asarum balansae* French	ar, sf		
142. *Asarum glabrum* Merr.	pf		
ASCLEPIADACEAE			
143. *Dischidia nummalaria* R. Br.	sf		
144. *Dischidia tonkinensis* Cost.	sf	Fr	
145. *Hoya obovata* Decne	sf		
146. *Streptocaulon juventas* (Lour.) Merr.	g, ar		m
147. *Tylophora koi* Merr.	ar		
148. *Tylophora ovata* (Lindl.) Hook. ex Steud.	sf, g	Fl, Fr	m
ASTERACEAE			
149. *Ageratum conyzoides* L.	ar	Fl, Fr	m
150. *Artemisia vulgaris* L.	g	Fl	m
151. *Bidens pilosa* L.	g	Fl	m
152. *Bidens tripartita* L.	g	Fl, Fr	m
153. *Blumea aromatica* DC.	ar	Fr	
154. *Blumea balsamifera* (L.) DC.	g	Fr	m
155. *Blumea lanceolaria* (Roxb.) Druce	g		m
156. *Centipeda minima* (L.) A. Br. & Aschers.	ar		m
157. *Conyza canadense* (L.) Cronq.	ar		m
158. *Cosmos bipinnatus* Cav.	ar		o
159. *Eclipta prostrata* (L.) L.	ar	Fl, Fr	m
160. *Elephantopus mollis* HBK.	sf, ar	Fl, Fr	
161. *Elephantopus scaber* L.	sf, ar	Fl, Fr	m
162. *Emilia sonchifolia* (L.) DC.	g, ar	Fl, Fr	m
163. *Eupatorium odoratum* L.	ar		m
164. *Eupatorium reevesii* Wall.	sf		
165. *Gnaphalium luteo-album* L.	ar	Fl	
166. *Gynura crepidiodes* Benth.	g, ar	Fl	
167. *Gynura lycopersicifolia* DC.	g, ar		
168. *Lactuca indica* L.	ar, g		m
169. *Lactuca triangulata* Maxim.	g		
170. *Petasites japonicus* (Sieb. & Zucc.) Maxim.	pf		
171. *Thaspis tokinensis* Gagn.	g		
172. *Tagetes erecta* L.	ar	Fl	o
173. *Tagetes patula* L.	ar	Fl	o
174. *Tithonia diversifolia* (Hemsl.) A. Gray	ar	Fl	
175. *Vernonia cinerea* (L.) Less.	ar	Fl	m
176. *Vernonia solanifolia* Benth.	sf		
BALSAMINACEAE			
177. *Impatiens arrensii* (Zoll.) Y. Shimizu	pf		
178. *Impatiens balsamina* L.	ar	Fl, Fr	o
179. *Impatiens bonii* Hook. f.	pf	Fl	
180. *Impatiens yerrucifer* Hook. f.	sf		

Species	Habitat	Fertile stages	Uses/Status
BASELLACEAE			
181. *Basella rubra* L.	ar	Fl, Fr	
BEGONIACEAE			
182. *Begonia aptera* Blume	pf		
183. *Begonia balanseana* Gagn.	pf, sf		
184. *Begonia baviensis* Gagn.	pf, sf		
185. *Begonia lecomtei* Gagn.	pf		
BERBERIDACEAE			
186. *Podophyllum* sp.	sf, ar	Fr	
BIGNONIACEAE			
187. *Fernandoa collignonii* (Dop.) Steen.	pf, sf		t
188. *Fernandoa serrata* (Dop) Steen.	sf	Fl	t
189. *Markhamia stipulata* (Wall.) Seem ex Schum.	pf, sf	Fl	t
190. *Oroxylon indicum* (L.) Vent.	pf, sf	Fl	t
191. *Pauldopia ghorta* (G. Don.) Steen.	sf		t
192. *Stereospermum neuranthum* Kurz.	sf		t
193. *Tecoma stans* (L.) HBK.	ar		o
BOMBACACEAE			
194. *Bombax ceiba* L.	sf, ar	Fr	m
BORAGINACEAE			
195. *Bothriospermum tenellum* Fisch. & Mey.	ar		
196. *Ehretia longifolia* Champ. in Hook.	g, ar		
197. *Heliotropium indicum* L.	ar	Fr	m
198. *Heliotropum strigosum* Willd.	g, ar		
BRASSICACEAE			
199. *Brassica juncea* (L.) Czern.	ar		
200. *Brassica oleracea* L.	ar		
201. *Cardamine hirsuta* L.	ar	Fl	
202. *Rorippa bengalensis* (DC.) Hara.	g, ar		
203. *Rorippa globosa* (Turcz.) Hayek	ar		
204. *Rorippa indica* (L.) Hiern.	ar		m
BROMELIACEAE			
205. *Ananas comosus* (L.) Merr.	ar	Fr	e
BUDDLEIACEAE			
206. *Buddleia asiatica* Lour.	sf, ar	Fl	m
207. *Buddleia officinalis* Max.	g		m
BURSERACEAE			
208. *Bursera tonkinensis* Guill.	pf		t, *
209. *Canarium album* Roensch	pf, sf	Fr	t, e, m
210. *Canarium parvum* Leenh.	sf	Fr	e
211. *Canarium tramdenum* Dai et Yakovl.	pf	Fr	t, e
CAMPANULACEAE			
212. *Codonopsis javanica* (Blume) Hook. f.	sf	Fl	*
213. *Lobelia sinensis* Lour.	ar		m
214. *Pratia nummularia* (Lam.) A. DC.	pf, sf	Fl	

Species	Habitat	Fertile stages	Uses/Status
CAPPARACEAE			
215. *Capparis pubiflora* DC.	sf		
216. *Cleome chelidonii* L. f.	ar	Fl	
217. *Crateva nervala* Buch.-Ham.	g, ar	Fl	
CAPRIFOLIACEAE			
218. *Lonicera japonica* Thunb.	g, ar	Fl	m
219. *Sambucus hookeri* Rehder	g, ar	Fr	m
CARICACEAE			
220. *Carica papaya* L.	ar	Fr	e
CARYOPHYLLACEAE			
221. *Dianthus caryophyllus* L.	ar	Fl	o
222. *Myosoton aquaticum* (L.) Moenth.	ar		
223. *Stellaria vestita* Kurz.	g		
CELASTRACEAE			
224. *Microtropis rhynchocarpa* Merr.	sf		
CHENOPODIACEAE			
225. *Chenopodium polyspermum* L.	ar		
CHLORANTHACEAE			
226. *Chloranthes spicatus* (Thunb.) Makino	ar		m
227. *Chloranthes japonicus* Sieb.	pf, sf		
COMBRETACEAE			
228. *Combretum sundaicum* Miq.	sf		
229. *Quisqualis indica* L.	g, ar	Fl.	m
230. *Terminalia catappa* L.	ar	Fl, Fr	t
CONVULVULACEAE			
231. *Erycibe griffithii* C. B. Cl. ex Hook.	sf	Fl	
232. *Ipomoea aquatica* Forsk.	ar		e
233. *Ipomoea batatas* (L.) Lamk.	ar		e
234. *Ipomoea hederifolia* L.	ar, g		
235. *Ipomoea sinensis* Choisy	ar	Fl	
236. *Ipomoea staphylina* Roem. et Schult.	ar, sf	Fl	
237. *Ipomoea triloba* L.	ar, g	Fl	
238. *Jacquemontia paniculata* (Burm. f.) Hall. f.	g, sf	Fl	
239. *Merremia gemella* (Burm. f.) Hall. f.	g, ar	Fl	
240. *Merremia hederacea* (Burm. f.) Hall. f.	g, ar	Fl	m, e
241. *Merremia hirta* (L.) Merr.	g, ar	Fl	
242. *Xenostegia tridentata* (L.) Austin & Staples	g, ar	Fl	
CLUSIACEAE			
243. *Garcinia fragraeoides* A. Chev.	pf		t, *
244. *Garcinia multiflora* Champ. ex Benth.	pf		
245. *Mesua* sp.	pf		
CURCURBITACEAE			
246. *Actinostemma tenerum* Griff.	ar		*
247. *Benincasia hispida* (Thunb.) Cogn.	ar	Fl, Fr	e
248. *Coccinia grandis* (L.) Voigt.	ar	Fl	e, m
249. *Cucumis sativus* L.	ar	Fr	e, m
250. *Cucurbita maxima* Duch. ex Lam.	ar	Fr	e
251. *Cucurbita pepo* L.	ar	Fr	e
252. *Gymnopetalum cochinchinensis* (Lour.) Kurz.	ar	Fl	e

Species	Habitat	Fertile stages	Uses/Status
253. *Gymnopetalum integrifolium* (Roxb.) Kurz.	ar	Fl	e
254. *Hodgsonia macrocarpa* (Blume) Cogn.	sf	Fr	e
255. *Lagenaria siceraria* (Mol.) Stadley	ar	Fr	e
256. *Luffa cylindrica* (L.) M. J. Roem.	ar	Fl, Fr	e
257. *Momordica cochinchinensis* (Lour.) Spreng.	ar		m, e
258. *Mukia maderaspatana* (L.) M. J. Roem.	sf, ar	Fl	
259. *Neoalsomitra integrifolia* (Cogn.) Hutch.	sf	Fl	
260. *Solena heterophylla* Lour.	ar	Fl	
261. *Thladiahta cordifolia* (Blume) Cogn.	ar, g		
262. *Zehneria indica* (Lour.) Keyr.	ar, g	Fl	
DILLENIACEAE			
263. *Dillenia indica* L.	sf	Fr	
264. *Tetracera sarmentosa* (L.) Vahl. ssp. *asiatica* (Lour.) Hoogl.	sf, ar		
265. *Tetracera scandens* Merr.	sf, ar	Fl, Fr	m
DIPTEROCARPACEAE			
266. *Dipterocarpus retusus* Blume	pf		t
267. *Hopea recopei* Pierre	pf, sf		t
268. *Parashorea chinensis* Wang Hsie	pf	Fr	t, *
269. *Shorea hypochra* Hance	pf		t
270. *Shorea siamensis* Miq.	pf		
271. *Vatica chevalieri* (Gagn.) Smith	pf	Fr	t
EBENACEAE			
272. *Diospyros latisepala* Ridl.	pf, sf	Fr	t
273. *Diospyros mollis* Griff.	sf, ar		t, m
274. *Diospyros mun* Chev.	pf		*
275. *Diospyros subarticulata* Lec.	sf	Fr	
ELAEOCARPACEAE			
276. *Elaeocarpus chinensis* (G. & Ch.) Hook. f.	sf		
277. *Elaeocarpus griffithii* (Wight) A. Gray.	pf, sf	Fr	t
EUPHORBIACEAE			
278. *Aleurites moluccana* Willd.	sf		e
279. *Aleurites cordata* (Thunb.) R. Br. ex Stend.	sf, ar		t
280. *Antidesma bunius* Spring	pf	Fr	e
281. *Antidesma henryi* Pax & Hoffm.	pf	Fr	e
282. *Antidesma montana* Blume	sf, ar		
283. *Aporosa dioica* (Roxb.) Muell. Arg	g	Fl	
284. *Aporosa macrostachyus* (Tul.) Muell. Arg.	g	Fl	
285. *Aporosa yunnanensis* Pax & Hoffm.	g, sf	Fl	
286. *Bischofia javanica* Blume	sf	Fl	t
287. *Breynia fructicosa* (L.) Hook. f.	g	Fl	m
288. *Bridelia balansae* Tutcher.	sf		
289. *Claoxylon indicum* (Blume) Endl. ex Hassk.	sf		m
290. *Cleistanthus petelotii* Merr. ex Croizat	pf	Fr	t, *
291. *Cleistanthus tonkinensis* Jabl.	pf	Fr	
292. *Cnesmone javanica* Blume	g		
293. *Croton argyratus* Blume	pf		t
294. *Croton longipes* Gagn.	pf		
295. *Croton tiglium* L.	sf		m
296. *Deutzianthus tonkinensis* Gagn.	pf		t
297. *Drypetes hoaensis* Gagn.	sf	Fr	t

Species		Habitat	Fertile stages	Uses/Status
298.	*Drypetes perreticulata* Gagn.	pf		t
299.	*Endospermum chinense* Benth.	pf, sf		t
300.	*Glochidion rubrum* Blume	g	Fl	
301.	*Macaranga balansae* Gagn.	sf		
302.	*Macaranga denticulata* (Blume) Muell. Arg.	sf	Fr	t
303.	*Mallotus barbatus* Muell. Arg.	sf, ar	Fr	m
304.	*Mallotus philippensis* (Lam.) Muell. Arg.	sf	Fr	m
305.	*Mallotus metcalfianus* Croiz.	sf	Fl	
306.	*Mallotus paniculatus* (Lam.) Muell. Arg.	sf	Fl	
307.	*Mallotus resinosus* (Blume) Merr.	sf		
308.	*Manihot esculenta* Crantz.	ar		e
309.	*Microdesmis caseariaefolia* Planch.	sf		
310.	*Phyllanthus emblica* L.	g	Fr	e
311.	*Ricinus communis* L.	g, ar	Fl	o, m
312.	*Sapium discolor* (Champ.) Muell. Arg.	g	Fl	m
313.	*Sapium rotundifolia* Hemsl.	sf		
314.	*Sapium sebiferum* Roxb.	g		o, m
315.	*Strophioblachia fimbricalyx* Boerl.	pf		
316.	*Suregada multiflora* (Juss.) Brill.	pf		
317.	*Trewia nudiflora* L.	sf		t
318.	*Trigonostemon stellaris* (Gagn.) Phamh.	pf		
319.	*Vernicia montana* Lour.	sf		
FABACEAE				
320.	*Acacia concinna* (Willd.) A.DC.	sf		
321.	*Acacia megaladina* Desv.	sf	Fl	
322.	*Acacia pennata* (L.) Willd.	sf	Fl	
323.	*Acacia pruinescens* Kurz	sf		
324.	*Acacia tonkinensis* I. Niels.	sf		
325.	*Adenanthera microsperma* Teijim. et Binn.	sf		
326.	*Albizia kalkora* Prain.	pf		t
327.	*Albizia procera* (Roxb.) Benth.	pf		t
328.	*Arachys hypogea* L.	ar		e
329.	*Archidendron chevalieri* (Kost.) I.Niels.	sf	Fr	t
330.	*Archidendron lucidum* (Benth.) I. Niels.	pf	Fr	t
331.	*Archidendron pellitum* (Gagn.) I. Niels.	pf		t
332.	*Archidendron robinsonii* (Gagn.) I. Niels.	pf		t
333.	*Bauhinia cardinale* Pierre ex Gagn.	sf, g	Fl	
234.	*Bauhinia championii* (Benth.) Bents.	g		
335.	*Bauhinia coccinea* (Lour.) A. P. DeCand.	sf, g		
336.	*Bauhinia pyrroclada* Drake del Cast	g, sf		
337.	*Bauhinia variegata* L.	pf, sf	Fl	e, t
338.	*Caesalpinia latisiliqua* (Cav.) Hatt.	pf	Fr	
339.	*Caesalpinia minax* Hance	g, ar	Fr	
340.	*Cassia timoriensis* A. DC.	sf		
341.	*Cassia tora* L.	ar	Fl	m
342.	*Crotalaria acicularis* Buch-Ham.	ar	Fl	
343.	*Crotalaria chinensis* L.	ar, sf, g	Fl	
344.	*Crotalaria pallida* Aiton	ar, g	Fl	
345.	*Crotalaria sessiflora* L.	sf, g	Fl	
346.	*Derris balansae* Gagn.	sf		m
347.	*Desmodium blandum* van Meuwen	ar	Fl, Fr	
Species		**Habitat**	**Fertile**	**Uses/Status**

			stages	
348.	*Desmodium heterophyllum* (Willd.) DC.	ar	Fl	m
349.	*Desmodium longipes* Craib.	g, ar	Fr	
350.	*Desmodium triflorum* DC.	ar, g	Fl	m
351.	*Desmodium triquetum* (L.) DC.	g, ar	Fr	m
352.	*Desmodium velutinum* (Willd.) DC.	g	Fl	
353.	*Erythrophloeum fordii* Oliv.	pf		t
354.	*Gleditsia pachycarpa* Bal. ex Gagn.	pf	Fr	t
355.	*Lycidise rhodostegia* Hamsl.	sf		t
356.	*Milletia cinerea* Benth.	pf, sf		t
357.	*Milletia eriobotrya* Drake	pf		t
358.	*Mimosa invisa* Mart. ex Colla.	g	Fl	
359.	*Mimosa pudica* L.	g, ar	Fl	
360.	*Ormosia balansae* Drake	sf		t
361.	*Ormosia dasycarpa* Jacks.	sf		t
362.	*Peltolophorum dasyrrachis* (Miq.) Kurz	pf, sf	Fl, Fr	t
363.	*Pueraria montana* (Lour.) Merr.	g	Fl	
364.	*Pueraria lobata* (Willd.) Ohwi var. *thomsonii* (Benth.) v. d. Maesn.	g, ar	Fl	m
365.	*Saraca dives* Pierre	pf	Fr	t
366.	*Saraca indica* L.	pf		t
367.	*Tamarindus indica* L.	ar		e
FAGACEAE				
368.	*Castanopsis boisii* Hickl. et Camus	sf	Fl, Fr	t
369.	*Castanopsis echinophora* Cam.	pf		
370.	*Castanopsis indica* (Roxb.) A.DC.	sf, pf	Fr	t, e
371.	*Castanopsis tonkinensis* Scemen ex Tugler.	pf, sf	Fr	t
372.	*Lithocarpus bacgiangensis* Hick. et A.Camus	sf	Fr	t
373.	*Lithocarpus licentii*	sf, pf		t
374.	*Lithocarpus tubulosus* (Hick. et Camus) Camus	pf, sf	Fr	t
FLACOURTIACEAE				
375.	*Bennettiodendron cordatum* Merr.	pf	Fr	*
376.	*Flacourtia rukkam* Zoll. et More	sf, ar	Fl, Fr	t, e
377.	*Casaeria glomerata* Roxb.	sf	Fl	
378.	*Hydnocarpus hainanensis* (Merr.) Steum.	sf		
379.	*Xylosma longifolium* Clos.	sf		
GESNERIACEAE				
380.	*Boeica porosa*	pf		
381.	*Chirita cycnostyla* Burret.	pf		
382.	*Chirita genella* Wood.	pf		
383.	*Chirita pellegriniana* P. I. Burret.	pf		
384.	*Didymocarpus pulchra* C. B. Clarke in DC.	pf		
385.	*Paraboea martinii* (Levl.) Burrett.	pf	Fr	

Species	Habitat	Fertile stages	Uses/Status
HAMAMELIDACEAE			
386. *Symingtonia tonkinensis* (Lec.) VanSteen.	pf		
JUGLANDACEAE			
387. *Engelhardia roxburghiana* Wall.	pf, sf	Fr	t
LAMIACEAE			
388. *Elsholtzia blanda* (Benth.) Benth.	g, ar		
389. *Gomphostema grandiflorum* Doan.	g		
390. *Leonurus sibiricus* L.	g	Fl, Fr	m
391. *Mentha aquatica* L.	ar	Fl	m
392. *Mosla dianthera* (Benth. & Hook.) Maxim.	g, ar	Fl	e, m
393. *Ocimium basilicum* L.	ar		e, m
394. *Orthosiphon spiralis* (Lour.) Merr.	ar	Fl	m
395. *Perilla frutescens* var. *crispa* (Thunb.) Handl.	ar		e, m
396. *Rhabdosia ternifolia* (D. Don.) Hance	g, ar	Fl	
397. *Salvia sapiformis* Hance	g		
LAURACEAE			
398. *Actinodaphne obovata* Blume	pf, sf	Fr	
399. *Caryodaphnosis poilanei* Kost.	pf		t
400. *Caryodaphnosis tonkinensis* (Lec.) Airy Shaw	pf		t
401. *Cinnamomum burmanii* (Ness) Blume	pf		t
402. *Cinnamomum glaucescens* (Buch-Hamilt) Drury	pf, sf		t
403. *Cryptocaria chingii* Ching	pf, sf	Fr	
404. *Lindera glauca* (Sieb. & Zucc.) Blume	sf, g		
405. *Litsea cubeba* (Lour.) Pers.	sf, g	Fr	t, m
406. *Litsea monosepala* (Roxb.) Pers.	sf	Fr	m
407. *Litsea* sp.	sf, g	Fl	
408. *Machilus bonii* Lec.	sf		
409. *Machilus chinensis* (Champ. ex Benth.) Hemsl.	sf	Fl	t
410. *Phoebe cuneata* Blume	pf		t
411. *Phoebe poilanei* Kosterm.	sf		t, *
412. *Phoebe tavoyana* Hook. f.	sf		t
LEEACEAE			
413. *Leea bracteata* C.B. Cl.	g	Fl	
414. *Leea rubra* Blume ex Spreng.	g, sf	Fr	m
LOGANIACEAE			
415. *Fagraea fragrans* Roxb.	pf, sf		t, m
416. *Mitreola reticulata* Tirel.	sf	Fl, Fr	
417. *Strychnos ignatii* Bergius	pf		m
418. *Gelsemium elegans* (Gardn. & Champ.) Benth.	sf, g	Fr	m
LORANTHACEAE			
419. *Helixanthera parasitica* Lour.	sf, ar		
420. *Macrosolena bibracteolatus* (Hance) Dans.	sf		
421. *Taxilus chinensis* (DC) Dans.	pf	Fr	
422. *Viscum ovalifolium* DC.	sf	Fr	
MAGNOLIACEAE			
423. *Magnolia talammoides* Dandy	sf	Fl	o
424. *Magnolia* sp.	pf	Fr	t
425. *Manglietia conifera* Dandy	pf	Fr	t
426. *Manglietia fordiana* (Hemsl.) Oliv.	pf, sf	Fr	t, *
427. *Manglietia glauca* Blume	sf		t
428. *Michelia balansae* (A.DC.) Dandy	sf		t

Species	Habitat	Fertile stages	Uses/Status
429. *Michelia faveolata* Merr.	sf	Fr	t
430. *Michelia tonkinensis* Chev.	pf, sf		t
MALVACEAE			
431. *Abelomoschus moschatus* Medicus	g, ar	Fl	m
432. *Abutilon indicum* (L.) Sweet.	ar, g		m
433. *Gossypium arboreum* L. var. *arboreum*	ar	Fl, Fr	
434. *Hibicus mutabilis* L.	ar	Fl	o
435. *Hibiscus rosa-sinensis* L.	ar	Fl, Fr	o
436. *Hibiscus nitifolius* L.	ar	Fl, Fr	
437. *Malvastrum coromandelianum* (L.) Gurcke	ar	Fl	
438. *Sida cordifolia* L.	ar	Fl	m
439. *Sida rhombifolia* L.	g, ar	Fl	m
440. *Urena lobata* L.	ar, g	Fl	m
MELASTOMATACEAE			
441. *Allomorphia arborescens* Guill.	pf		
442. *Blastus borneensis* Cogn. var. *eberhardtii* (Guill.) C. Hans.	pf, sf	Fr	
443. *Medinilla assamica* (C.B. Cl.) Chen	sf		
444. *Melastoma malabarica* L.	g, sf	Fl	m
445. *Melastoma sanguineum* Sims.	g, ar	Fr	m
446. *Melastoma septemnervium* (Lour.) Merr.	g, ar		
447. *Memecylon edule* Roxb.	g, ar	Fr	
448. *Osbeckia chinesis* L.	ar, sf	Fl	
MELIACEAE			
449. *Aglaia gigantea* (Pierre) Pollegr	pf		t
450. *Aglaia odorata* Lour.	ar	Fr	m
451. *Aglaia roxburghiana* (Wight & Ann.) Mig.	pf		t
452. *Amoora dasyclada* (How. & Chen) C. Y. Wu	pf	Fl	t
453. *Amoora gigantea* Pierre	pf	Fr	t
454. *Chisocheton cochinchinensis* Pierre	pf		t
455. *Chisocheton globulus* Pierre	pf		t
456. *Chisocheton glomeratus* Hiern.	pf		t
457. *Chukrasia tabularis* Juss.	pf		t, *
458. *Dysoxylum cochinchinensis* Pierre	pf		t
459. *Dysoxylum tonkinense* Chev. ex Pell.	pf	Fl	t
460. *Melia azedarach* L.	ar		t, m
461. *Toona chinensis* (Juss.) Roem.	pf		t, e
462. *Toona sureni* (Blume) Merr.	pf		t
463. *Walsura cochinchinensis* Harms.	sf		
MENISPERMACEAE			
464. *Fibraurea tinctoria* Lour.	sf	Fl	m
465. *Stephania japonica* (Thunb.) Miers	sf, g	Fl	m
466. *Stephania rotunda* Lour.	sf, g	Fl	m
467. *Tinospora glabra* (Burm. f.) Merr.	g		

Species	Habitat	Fertile stages	Uses/Status
MORACEAE			
468. *Antiaris toxicaria* (Pers.) Lesch. var. *toxicaria*	pf		t
469. *Artocarpus heterophyllus* Lamk.	ar	Fr	t, e
470. *Artocarpus lakoocha* Roxb.	ar	Fr	t, e
471. *Ficus abelii* Miq.	sf	Fl, Fr	
472. *Ficus benjamina* L.	ar	Fl	o
473. *Ficus callosa* Willd.	sf		
474. *Ficus elastica* Roxb. ex Horn.	sf, ar		t, o
475. *Ficus glaberrima* Bl.	sf, pf		
476. *Ficus hirta* Vahl. var. *roxburghii* (Miq.) King	sf, g	Fl	
477. *Ficus hispida* L.f.	ar, sf	Fl	e
478. *Ficus heterophylla* L. f.	g, ar	Fl	
479. *Ficus sundaica* Blume	sf		
480. *Ficus semicordata* Buch.-Ham. ex J.E. Sm.	sf		
481. *Ficus vasculosa* Wall ex Miq.	pf		
482. *Maclura cochinchinensis* (Lour.) Corn.	g	Fr	m
483. *Morus alba* L.	ar		e, m
484. *Streblus aspera* Lour.	sf, ar	Fr	t
485. *Streblus ilicifolia* (Kurz) Corn.	pf		t
486. *Streblus macrophyllus* Blume	pf		
487. *Streblus tonkinensis* (Eberh. et Dub.) Corner	pf		t
MYRISTICACEAE			
488. *Knema petelotii* Merr.	pf, sf	Fl	t
489. *Knema tonkinensis* (Warb.) de Wilde	pf, sf		t
MYRSINACEAE			
490. *Ardisia arborescens* Wall.	sf		
491. *Ardisia gigantifolia* Stapf.	sf	Fr	m
492. *Ardisia silvestris* Pitard	sf	Fl	*
493. *Ardisia thorelii* Pitard	sf	Fr	
494. *Embelia bonii* Gagn.	sf, pf		
495. *Embelia ferruginea* Wall.	pf		
496. *Embelia indica* Wall.	pf		
497. *Embelia ribes* Burm. f.	sf	Fr	
MYRTACEAE			
498. *Eucalyptus globulus* Labill.	ar	Fl	t, m
499. *Psydium guyava* L.	ar	Fr	e, m
500. *Rhodomyrtus tomentosa* (Air.) Hassk.	sf, g	Fl, Fr	m
501. *Syzygium baviensis* (Gagn.) Merr. & Perry	sf		
502. *Syzygium balsamineum* (Wight.) Walp.	pf, sf		
503. *Syzygium odoratum* (Lour.) DC.	pf	Fr	t
504. *Syzygium jambos* (L.) Alston	ar	Fl, Fr	e
505. *Syzygium petelotii* Merr. & Perr.	pf, sf	Fr	t
506. *Syzygium polyalthum* (L.) DC.	pf, ar		t, m
OLEACEAE			
507. *Jasminum longisepalum* .Merr.	sf, g		
508. *Jasminum sambac* (L.) Ait.	ar	Fl	m
509. *Jasminum tonkinense* Gagn.	sf, g		
510. *Olea dentata* Wall.	pf, sf		
511. *Osmanthus matsumuranus* Hay.	sf	Fr	

Species	Habitat	Fertile stages	Uses/Status
ONAGRACEAE			
512. *Ludwigia ascendens* (L.) Hara	ar	Fl, Fr	
513. *Ludwigia epilobiodes* Maxim., var. *epilobiodes*	ar, g	Fl, Fr	
514. *Ludwigia octovalvis* (Jacq.) Raven, ssp. *octovalvis*	ar	Fl	m
OXALIDACEAE			
515. *Averrhoa carambola* L.	ar	Fr	e
516. *Oxalis corniculata* L.	ar	Fl	m
517. *Oxalis corymbosa* DC.	ar	Fl	m
OPILIACEAE			
518. *Meliantha suavis* Pierre	sf		e, *
519. *Urobotrya latisquamata* (Gagn.) Hiepko	pf	Fl, Fr	
PASSIFLORACEAE			
520. *Passiflora foetida* L.	g, ar		m
PEDALIACEAE			
521. *Sesamum orientale* L.	ar	Fl, Fr	e, m
PIPERACEAE			
522. *Peperomia leptostachya* Hook. & Arn.	pf	Fl	
523. *Peperomia pellucida* Kunth.	ar		e
524. *Piper betle* L	ar		m
525. *Piper bonii* C. DC.	pf		
526. *Piper lolot* L.	pf, ar		e
527. *Piper longum* L.	ar		m
528. *Zippelia begonifolia* Blume	pf		
PLANTAGINACEAE			
529. *Plantago asiatica* L.	g	Fr	
530. *Plantago major* L.	ar, g	Fr	m
POLYGONACEAE			
531. *Polygonum barbatum* L.	ar, g	Fl	e
532 *Polygonum chinensis* L.	g, sf	Fl.	
533. *Polygonum glabrum* Willd.	g, ar		
534. *Polygonum hydropiper* L.	g, ar	Fl	m
535. *Polygonum odoratum* Lour.	ar		e, m
PORTULACACEAE			
536. *Portulaca oleracea* L.	ar	Fl	e, m
537. *Portulaca pilosa* L. subsp. *grandiflora* (Hook.) Gees	ar	Fl	o
538. *Talinum paniculatum* (Jacq.) Gaertn.	ar, g		e, m
PROTEACEAE			
539. *Helicia cauliflora* Merr.	g	Fr	t
540. *Heliciopsis terminalis* (Kurz.) Sleumer	pf		t
RANUNCULACEAE			
541. *Clematis granulata* (L.) Ohwi	g, ar	Fl, Fr	m
542. *Ranunculus pennsylvanicus* L. f.	ar, g		
543. *Thalictrum foliosum* DC.	ar		m
RHAMNACEAE			
544. *Paliurus tonkinensis*	sf	Fr	
545. *Rhamnus crenatus* Sieb. & Zucc., var. *cambodianum* (Pierre) Tard.	sf	Fr	m
546. *Ventilago leiocarpa* Benth.	g		
547. *Ziziphus oenoplia* (L.) Mill.	sf	Fl	

Species		Habitat	Fertile stages	Uses/Status
ROSACEAE				
548.	*Duchnesia indica* (Andr.) Focke	sf, g	Fl, Fr	
549.	*Photinia prunifolia* (H. & A.) Lindl.	pf	Fr	t
550.	*Prunus salicina* Lindl. var. *salicina* Prun.	ar	Fr	e
551.	*Rosa chinensis* Jacq.	ar	Fl	o
552.	*Rosa rubus* Levl. & Van.	sf, g	Fl	
553.	*Rubus alcaeifolius* Poiret.	sf, g	Fl, Fr	m
554.	*Rubus asper* Wall	sf		
555.	*Rubus cochinchinensis* Tratt.	sf, g	Fl, Fr	
556.	*Rubus leucanthus* Hance	sf	Fl	
557.	*Rubus multibracteatus* Levl. & Van.	sf		
558.	*Rubus tamdaoensis* Hiep & Yakolef	sf		
RUBIACEAE				
559.	*Adina pilulifera* (Lam.) Franch.	sf	Fl, Fr	
560.	*Aidia oxydonta* (Drake) Yamazaki	pf, sf	Fl	t
561.	*Aidia pycnantha* (Drake) Tirv.	sf	Fr	
562.	*Canthium horridum* Blume	sf	Fr	m
563.	*Dentella repens* (L.) J. R. & G. Forst.	ar	Fl	
564.	*Gardenia angustifolia* (L.) Merr.	ar, g	Fl	e, m
565.	*Gardenia stenophylla* Pit.	sf		
566.	*Hedyotis biflora* (L.) Lam.	ar	Fl	m
567.	*Hedyotis corymbosa* (L.) Lam.	ar	Fl	m
568.	*Hedyotis crassifolia* A. DC.	ar	Fl	
569.	*Hedyotis diffusa* Wight & Arn.	ar	Fl, Fr	
570.	*Hedyotis petelotii* Merr.	g, ar	Fl, Fr	
571.	*Hedyotis scandens* Roxb.	g, ar	Fr	
572.	*Hedyotis trinervia* (Retz.) Roem. & Schult.	ar		
573.	*Ixora chinensis* Lam.	g, ar	Fl, Fr	
574.	*Ixora coccinea* L.	sf, g	Fl	e, m
575.	*Ixora henryi* Lévl.	pf	Fl	
576	*Knoxia mollis* Wight & Arn.	g, ar.		
577.	*Morinda umbellata* L.	sf		m
578.	*Mussaenda cambodiana* Pierre	g, ar	Fl, Fr	m
579.	*Mussaenda densiflora* Li.	sf, g		
580.	*Mussaenda glabra* Vahl.	sf, g	Fl	
581.	*Mussaenda pilosissima* Vahl.	g		
582.	*Mycetia balansae* Drake	sf		
583.	*Neonauclea sessilifolia* (Hook. f.) Merr.	pf		
584.	*Paederia foetida* L.	ar	Fl	m, e
585.	*Paederia scandens* (Lour.) Merr.	g, ar	Fl	
586.	*Psychotria fleuryi* Pit.	sf	Fr	t
587.	*Psychotria rubra* (Lour.) Poit.	sf	Fl	m
588.	*Psychotria sarmentosa* Blume	sf, g	Fl	
589.	*Psychotria serpens* L.	g, sf		
590.	*Psychotria siamica* (Craib.) Hutch.	g	Fr	
591.	*Urophyllum longifolium* Hook. f., var. *annamensis* Pierre ex Pit.	sf, g		
592.	*Wendlandia glabrata* DC.	sf, pf		t
593.	*Wendlandia paniculata* (Roxb.) DC.	sf	Fr	t

Species	Habitat	Fertile stages	Uses/Status
RUTACEAE			
594. *Clausena excavata* Burm. f.	sf		m
595. *Glycosmis stenocarpa* (Drake) Tan	pf, sf		
596. *Micromelum hirsutum* Oliv.	sf, g		m
597. *Micromelum minutum* (Forst. f.) W. & A.	sf, g		m
598. *Xanthoxylum nitidum* (Lam.) DC.	sf		m
SABIACEAE			
599. *Meliosma henryi* Diels.	pf		t
600. *Meliosma simplicifolia* (Roxb.) Walp. subsp. *fordii* (Forb. & Hemsl.) Bens.	sf		
SAPINDACEAE			
601. *Allophyllus caudatus* Radlk.	pf	Fl	
602. *Cardiospermum halicacabum* L.	g, ar	Fl	m
603. *Lepisanthes senegalensis* (Poir.) Leenh.	sf		
604. *Litchi sinensis* Radlk.	ar		e
605. *Mischocarpus fuscescens* Blume	pf	Fr	t
606. *Mischocarpus sundicus* Blume	pf		
607. *Nephelium* sp.	pf		
608. *Pometia pinnata* Forst.	pf		t
609. *Sapindus saponaria* L.	pf, sf		t
SAPOTACEAE			
610. *Eberhardtia tonkinensis* Lec.	pf	Fr	t
611. *Madhuca pasquieri* (Dub.) H.J. Lam.	pf	Fr	t, *
612. *Madhuca subquiconcialis* H.J. Lam. et Kerpel	pf		t
613. *Sarcosperma kachinense* (K. et Patl.) Exell.	pf, sf		
SAXIFRAGACEAE			
614. *Itea chinensis* Hook. & Arn.	pf		
SCROPHULARIACEAE			
615. *Adenosoma caerulea* R. Br.	sf, ar	Fl	
616. *Adenosoma indica* (Lour.) Merr.	ar, g		
617. *Bacopa floribunda* (R. Br.) Wettst.	ar, g		
618. *Limnophylla chinensis* (Osb.) Merr.	ar, g		
619. *Limnophylla heterophyllum* (Roxb.) Benth.	ar		
620. *Limnophylla repens* (Benth.) Benth.	g, ar		
621. *Lindernia anagallis* (Burm. f.) Pennell	ar	Fl	
622. *Lindernia crustacea* (L.) F. Muell.	ar, g	Fl	
623. *Lindernia ruelloides* (Colsm.) Pennell	ar	Fl	
624. *Mazus pumilus* (Burm. f.) Steen	ar, g		
625. *Pieria fel-terrae* Lour.	sf, ar	Fl	m
626. *Torenia chevalieri* Bon.	sf, ar	Fl	
627. *Torenia concolor Lindl.*	sf, ar		
SOLANACEAE			
628. *Capsicum frutescens* L.	ar	Fl, Fr	e, m
629. *Cestrum nocturnum* L.	ar	Fl	m, o
630. *Lycianthe biflorum* (Lour.) Bitter			
631. *Lycopersicon esculentum* (L.) Mill.	ar		e
632. *Nicotiana tabacum* L.	ar	Fl	m
633. *Physalis angulata* L.	ar, g	Fl, Fr	
634. *Solanum americanum* Mill.	ar	Fl, Fr	m
635. *Solanum thrupii* H. Wight	ar	Fl, Fr	
636. *Solanum torvum* Swartz	ar, g	Fl, Fr	m
637. *Solanum undatum* Poir.	ar, g		e

Species **Habitat** **Fertile** **Uses/Status**

		stages		
SONNERATIACEAE				
638.	*Duabanga grandiflora* (DC.) Walp.	sf		t
STERCULIACEAE				
639.	*Byttneria erosa* Gagn.	sf	Fl	
640.	*Byttneria pilosa* Roxb.	sf, g		
641.	*Commersonia bartramia* (L.) Merr.	sf	Fr	
642.	*Firmannia simplex* (L.) W.F. Wight	sf, pf	Fl	t, m
643.	*Helicteres angustifolia* L.	g, sf		
644.	*Helicteres hirsuta* Lour.	sf, g	Fl, Fr	
645.	*Heritiera macrophylla* Wall.	pf	Fl	t
646.	*Melochia corchorifolia* L.	ar	Fl	
647.	*Pterospermum grandiflorum* Gagn.	sf, pf		
648.	*Pterospermum heterophyllum* Pierre	sf		
649.	*Sterculia foetida* L.	sf, ar	Fr	t, e
650.	*Sterculia parviflora* Roxb.	sf	Fl, Fr	t
651.	*Waltheria americana* L.	ar		
STYRACACEAE				
652.	*Alniphyllum eberhardtii* Guill.	pf		*
653.	*Styrax tonkinensis* (Pierre) Hall. f.	pf, sf		t
SYMPLOCACEAE				
654.	*Symplocos cambodiana* (Pierre) Hall. f.	sf	Fl	t
655.	*Symplocos viridissima* Brand.	sf		
THEACEAE				
656.	*Adinandra milettii* (H. & A.) Benth. & Hook. f.	sf	Fr	t
657.	*Camellia sasanqua* Thunb.	sf, g	Fr	t
658.	*Camellia sinensis* (L.) O. Ktze	ar		e
659.	*Eurya acuminata* DC. var. *euprista* Korth.	pf	Fl	
660.	*Eurya japonica* Thunb.	sf, g		
TILIACEAE				
661.	*Corchorus capsularis* L.	g		
662.	*Corchorus olitorius* L.	*g*		
663.	*Excentrodendron hsienmu* (Chung. & How.) Chiang & Miav.	hf, pf		t, *
664.	*Grewia asiatica* L.	sf, g	Fl	
665.	*Grewia hirsuta* Vahl.	g	Fl	
666.	*Grewia langsoniensis* Gagn.	g		
667.	*Grewia urenaefolia* (Pierre) Gagn.	g, sf		
ULMACEAE				
668.	*Celtis orientalis*	pf, sf		t
669.	*Celtis tetrandra*	pf, sf	Fl	t
670.	*Gironniera cuspidata* (Blume) Pl. ex Kurz.	pf, sf	Fr	t
671.	*Trema cannabina* Lour	g, ar	Fr	
672.	*Trema orientalis* (L.) Blume	g, ar		
673.	*Ulmus lanceaefolia* Roxb. ex Wall.	sf		t

Species	Habitat	Fertile stages	Uses/Status
URTICACEAE			
674. *Boehmeria diffusa* Wedd.	g, ar		
675. *Boehmeria nivea* (L.) Gaud.	ar		
676. *Debregeasia squamata* King	ar, g		
677. *Elatostema atropurpurea* Gagn.	pf, sf	Fl	
678. *Elatostema baviensis* Gagn	g	Fl	
679. *Elatostema dissectum* Wedd.	pf		
680. *Laportea interrupta* (Gaud.) Chew.	ar		
681. *Pellionia macroceras* Gagn.	sf, ar		
682. *Pilea platanifolia* Wight.	sf		
683. *Pouzolzia hirta* Hassk.	ar	Fl	
684. *Pouzolzia pentandra* (Blume) Merr.	ar		
VERBENACEAE			
685. *Callicarpa albida* Blume	g	Fl	
686. *Callicarpa brevipes* Hance	g	Fl	
687. *Callicarpa candicans* (Burm. f.) Hochr.	g, ar		m
688. *Callicarpa longifolia* Lam.	sf, g	Fl	
689. *Clerodendron kaempferi* (Jacq) Sieb. ex Hassk.	ar, g	Fl	m
690. *Clerodendron gaudichandii* P. Dep.	ar, g	Fl	m
691. *Clerodendrum phillipinum* Schaur. f.	ar, g	Fl	m
692. *Gmelina arborea* Roxb.	sf	Fl	t, m
693. *Gmelina lecomtei* P. Dep.	sf	Fl	t
694. *Lantana camara* L.	ar	Fl	o, m
695. *Phryma lepidostachya* L.	sf, ar		
696. *Phyla nodiflora* (L.) Greene	ar		
697. *Premna serratifolia* L.	g, ar	Fl	e, m
698. *Vitex negundo* L.	ar	Fl	m
699. *Vitex peduncularis* Wall.	sf, pf	Fr	t
700. *Vitex quinata* (Lour.) Williams	pf, sf		m, t
VITACEAE			
701. *Ampelopsis heterophylla* Sieb. & Zucc.	sf	Fl	
702. *Cayratia trifolia* (L.) Domino	ar, g	Fr	
703. *Cissus repens* Lamk.	g, ar		
704. *Parthenocissus cuspidifera* Pl.	sf		
705. *Tetrastigma eberhardtii* Gagn.	sf, pf		
706. *Tetrastigma grandidens* Gagn.	sf, pf	Fl	
707. *Tetrastigma longisepalum* Gagn.	g		
708. *Tetrastigma petelotii* Gagn.	sf, pf	Fl	
LILIOPSIDA			
AGAVACEAE			
709. *Dracaena eliptica* Thunb.	pf, sf	Fr	
710. *Poilanthes tuberosa* L.	ar	Fl	o, m
711. *Sanseveria cylindrica* Bojer.	ar		o
712. *Sanseveria hyacinthoides* (L.) Druce	ar		o
ALISMATACEAE			
713. *Sagittaria guyanensis* H. Bk. ssp. *lappula* (D. Don.) Bogn.	ar	Fl	
714. *Sagittaria sagittaefolia* L. ssp. *leucopetala* (Miq.) Hartoz.	ar	Fl	e

Species	Habitat	Fertile stages	Uses/Status
AMARYLLIDACEAE			
715. *Crinum asiaticum* L.	sf, ar	Fl	m
716. *Curculigo gracilis* Wall.	sf, pf	Fl	
717. *Curculigo orchoides* Gaertn.	ar, sf	Fl	m
718. *Curculigo tonkinensis* Gagn.	pf		
ARACEAE			
719. *Acorus gramineus* Soland.	pf-ar		
720. *Acorus tatarinowi* Schott	pf-ar		
721. *Acorus verus* Houtt.	pf-ar		m
722. *Aglaonema modestum* Schott. ex Engler	pf	Fl	
723. *Alocasia hainanica* N. E. Rr.	pf, sf		
724. *Alocasia macrorrhiza* (L.) Schott.	ar	Fl	e
725. *Alocasia odora* C. Koch.	ar		e
726. *Amorphophallus paneoniifolius* (Dennst.) Nicols.	pf		
727. *Amorphophallus tonkinensis* Engler & Gehrm.	sf		
728. *Arisaema balansae* Engler	pf	Fl, Fr	
729. *Arisaema petelotii* Krause	pf	Fl	
730. *Anthurium scherzeanum* Schott.	sf, ar		o
731. *Colocasia esculenta* (L.) Schott.	ar		e
732. *Epipremmum giganteum* Schott.	pf		
733. *Epipremmum pinnatum* (L.) Engler	pf		
734. *Homalomena occulta* (Lour.) Schott.	pf, sf		m
735. *Pothos angustifolius* Presl.	pf, sf	Fl	
736. *Pothos repens* (Lour.) Druce	pf, sf	Fl	
737. *Pothos scandens* L.	pf, sf	Fl	
738. *Raphidophora decursiva* (Roxb.) Schott.	pf, sf	Fl, Fr	m
739. *Raphidophora laichauensis* Gagn.	pf, sf	Fl	
740. *Remusatia vivipara* (Roxb.) Schott.	sf, ar		
ARECACEAE			
741. *Areca catechu* L.	ar	Fl, Fr	m
742. *Arenga pinnata* (Wurmb) Merr.	pf, sf		e
743. *Calamus petreus* Lour.	pf, sf		
744. *Calamus platyacanthus* Warb. ex Becc.	sf		
745. *Calamus tetradactylus* Hance	pf, sf	Fr	
746. *Calamus tonkinensis* Becc.	pf, sf		
747. *Caryota bacsonensis* Magalar	pf		
748. *Caryota mitis* Lour.	ar	Fl	o
749. *Caryota monostachya* Becc.	pf, sf		
750. *Caryota urens* L.	pf, sf		
751. *Chuniophoenix nana* Burrett.	pf		
752. *Licuala bracteata* Gagn.	pf, sf		
753. *Licuala terrata* Griff.	pf, sf		
754. *Licuala tonkinensis* Becc.	pf, sf		
755. *Livistona saribus* (Lour.) Merr ex Chev.	sf, ar		
756. *Livistona tonkinensis* Magalon.	sf		
757. *Rhapis divaricata* Gagn.	pf		
758. *Rhapis laosansis* Becc.	pf, sf		
759. *Rhapis micrantha* Becc.	pf		o
760. *Pinanga* sp.	sf		
761. *Plectocomia elongata* Mart. Bl.	pf		
762. *Plectocomia khaya* Griff.	sf, ar		

Species	Habitat	Fertile stages	Uses/Status
BUTOMACEAE			
763. *Tenagocharis latifolia* (D. Don.) Buch.	ar, g	Fl	
COMMELINACEAE			
764. *Commelina bengalensis* L.	ar, sf	Fl	
765. *Commelina communis* L.	ar	Fl	m
766. *Cyanotis burmanniana* Wight.	sf, ar	Fl	
767. *Murdania versicolor* (Dalz.) Bruckner	ar	Fl	
768. *Pollia hasskarlii* R. Br.	ar		
769. *Pollia thyrsiflora* (Blume) Endl. & Hassk.	ar, g	Fl	
770. *Streptolirion volubile* Edgew.	sf		
CONVALLARIACEAE			
771. *Ophiopogon backianus* Diels.	pf	Fl	
772. *Ophiopogon latifolius* Rodr.	pf	Fl	
773. *Ophiopogon reptans* Hook. f.	pf	Fl	m
774. *Ophiopogon tonkinensis* Rord.	pf	Fl	m
775. *Peliosanthes teeta* Andr.	pf		m
CYPERACEAE			
776. *Carex baccans* Nees.	pf	Fl	
777. *Carex balansae* Franchet	sf		
778. *Carex thomsonii* Boott.	pf, sf		
779. *Cyperus amabilis* Vahl.	ar		
780. *Cyperus articulatus* L.	ar		
781. *Cyperus diffusus* Vahl.	g, sf		
782. *Cyperus pilosus* Vahl.	g, ar		
783. *Cyperus tonkinensis* C. B. Clark	g, ar	Fl	
784. *Eleocharis acutangula* (Roxb.) Schult.	ar		
785. *Eleocharis congesta* D. Don.	ar	Fl	
786. *Eleocharis geniculata* (L.) R. & S.	ar	Fl	
787. *Fimbristylis ferruginea* (L.) Vahl.	ar		
788. *Fimbristylis quinquangularis* (Vahl.) Kunth.	ar		
789. *Fimbristylis salbudia* (Nees.) Kunth.	ar		
790. *Fimbristylis squarrosa* Vahl.	ar, g		
791. *Fimbristylis umbellaris* (Lam.) Vahl.	ar		
792. *Kylinga polycephala* Willd. ex Kunth.	ar		
793. *Rhynchospora corymbosa* (L.) Britton.	ar, g		
794. *Rhynchospora submarginata* Kuk.	ar, g		
795. *Scirpus juncoides* Roxb.	ar, g		
796. *Scirpus petelotii* R. Gross.	ar, g	Fl	
797. *Scleria biflora* Roxb.	ar		
798. *Scleria terrestris* (L.) Fassett	sf, g		
799. *Scleria tonkinensis* C. B. Cl.	sf, g		
DIOSCOREACEAE			
800. *Dioscorea alata* L.	ar	Fl	e
801. *Dioscorea bonii* Prain. & Burk.	ar, sf		
802. *Dioscorea cirrhosa* Prain. & Burk.	ar, sf	Fl	m
803. *Dioscorea collettii* Hook. f.	ar, sf		
804. *Dioscorea depauperata* Prain & Burk	ar, sf		e, m
805. *Dioscorea esculenta* (Lour.) Burk.	ar	Fl	e
806. *Dioscorea kratica* Prain. & Burk.	pf, sf	Fl	e

Species	Habitat	Fertile stages	Uses/Status
ERIOCAULACEAE			
807. *Eriocaulon bonii* Lec.	ar	Fl	
808. *Eriocaulon eberhardtii* Hec.	ar, g	Fl	
LILIACEAE			
809. *Allium ascalonicum* L.	ar		e
810. *Allium fistulosum* L.	ar		e, m
811. *Allium sativum* L.	ar		e, m
812. *Chlorophytum orchidastrum* Lindl.	pf		
813. *Dianella nemorosa* Lam. ex Schiler.	pf	Fl	m
814. *Disporopsis longifolia* Craib.	pf, sf		
815. *Paris delavayi* Franch	pf	Fl	m
816. *Paris polyphylla* ssp. *yunnanensis* (Fr.) H. M.	pf	fl	m, *
817. *Polygonatum odoratum* (Mill.) Druce	pf, sf		
MARANTACEAE			
818. *Donax cannaeformis* (G. Forst.) K. Schum.	pf	Fl	
819. *Phrynium dispermum* Gagn.	pf	Fl	
820. *Phrynium placentarium* (Lour.) Merr.	pf	Fl	
MUSACEAE			
821. *Musa ornata* Roxb.	sf		
822. *Musa paradisiaca* L.	ar	Fl, Fr	e
ORCHIDACEAE			
823. *Anectochilus brevistylus* (Hook. f.) Ridley	pf	Fl	
824. *Anectochilus elwesii* (Hook. f.) King & Prantl.	pf	Fl	
825. *Anectochilus lanceolatus* Lindl.	pf	Fl	
826. *Calanthe clavata* Lindl.	pf	Fl	
827. *Calanthe herbacea* Lindl.	pf	Fl	
828. *Calanthe triplicata* (Willem.) K. & G.	pf	Fl	
829. *Cheirostylis spathulata* J. J. Sm.	pf	Fl	
830. *Corymborchis fumata* Thwaites	pf		
831. *Corymborchis veratrifolia* (Reimx.) Blume	pf, sf		
832. *Dendrobium chryseum* Rolfe	pf	Fl	
833. *Dendrobium chlorostylum* Gagn.	pf	Fl	
834. *Dendrobium devonianum* Paxt.	pf	Fl	
835. *Dendrobium fimbriatum* Hook. f.	pf	Fl	
836. *Goodyera procera* (Ker-Gawl.) Hook.	pf	Fl	
837. *Habernaria acuifera* Wall. ex Lindl.	pf, g	Fl	
838. *Habernaria poilanei* Gagn.	pf	Fl	
839. *Liparis cordifolia* Hook. f.	pf, g	Fl	
840. *Spiranthes sinensis* (Perx.) Ames	g, ar		m
841. *Zeuxine abbreviata* (Lindl.) Hook. f.	pf	Fl	
842. *Zeuxine nervosa* (Lindl.) Benth. ex Clarke	pf, g	Fl	
PANDANACEAE			
843. *Pandanus tonkinesis* Mart. ex. Stone	pf, sf		
POACEAE			
844. *Agrostis micrantha* Steud.	g	Fl	
845. *Arachne racemosa* (Raem. & Sch.) Chwi.	g, ar		
846. *Arundo donax* L.	*g*, sf		
847. *Brachiaria mutica* (Forssk.) Stapf.	ar	Fl	
848. *Chrysopogon aciculatus* (Retz.)Trin.	ar, g	Fl	
849. *Cynodon arcuatus* Presl.	ar, g	Fl	
850. *Cynodon dactylon* (L.) Pers.	ar, g	Fl	
851. *Cyrtococcum accrescens* (Trin.) Stapf.	sf, ar	Fl	
Species	**Habitat**	**Fertile**	**Uses/Status**

			stages	
852.	*Cyrtococcum patens* (L.) A. Camus	sf, ar	Fl	
853.	*Dactyloctenium aegyptiacum* (L.) Willd.	ar	Fl	
854.	*Digitaria abludens* (Roem. & Sch.) Veldk.	ar, g	Fl	
855.	*Digitaria ciliaris* (Retz.) Koel.	ar	Fl	
856.	*Digitaria longiflora* (Retz.) Pers.	ar	Fl	
857.	*Echinochloea colonum* (L.) Link.	ar	Fl	
858.	*Echinochloea crus-galli* (L.) P. Beauvoir	ar		
859.	*Echinochloea crus-pavonis* (H. B. K.) Schult.	ar		
860.	*Eleusine indica* (L.) Gaertn.	ar, g	Fl	
861.	*Eragrostis diarrhena* (Schult.) Steud.	g, ar		
862.	*Eragrostis tenella* (L.) P. Beauv. ex Roem. & Sch.	ar		
863.	*Eragrostis unioloides* (Retz.) Nees ex Steud.	ar, g	Fl	
864.	*Imperata cylindrica* (L.) Beauv.	ar, g		
865.	*Isachne dioica*	sf, pf		
866.	*Isachne polygonoides* Doll. in Mart.	sf, ar		
867.	*Isachne petelotii* A. Camus	sf, ar		
868.	*Miscanthus nepalensis* (Trin.) Hack.	ar, g		
869.	*Miscanthus sinensis* Anders.	ar		
870.	*Oplismenus compositus* (L.) P. Beauv.	ar	Fl	
871.	*Oryza minuta* Presl. var. *silvatica* (Cam.) Veldk.	sf, ar		
872.	*Oryza sativa* (L.)	ar	Fl	e
873.	*Panicum brevifolium* L.	sf		
874.	*Panicum hyraspicum* Edgw.	sf, pf	Fl	
875.	*Panicum miliaceum* L.	ar		e
876.	*Panicum nodosum* Kunth.	sf		
877.	*Panicum repens* L.	ar	Fl	
878.	*Panicum sarmentosum* Roxb.	sf		
879.	*Paspalum conjugatum* Berg.	ar	Fl	
880.	*Paspalum paspaloides* (Michx.) Scribn.	ar	Fl	
881.	*Paspalum scrobiculatum* L.	ar	Fl	
882.	*Paspalum vaginatum* Swartz.	ar		
883.	*Phragmites vallatoria* (L.) Veldk.	ar, sf		
884.	*Pseudoechinochloea polystacha* (H. B. K.) Stapf.	sf, ar	Fl	
885.	*Saccharum officinarum* L.	ar		e
886.	*Saccharum spontaneum* L.	sf, ar		
887.	*Setaria glauca* (L.) P. Beauv.	ar		
888.	*Setaria pallide-fusca* (Schum.) Stapf. & Hubb.	ar		
889.	*Sphaerocaryum malaccense* (Trin.) Pilg.	ar	Fl	
890.	*Thysanolaena maxima* (Roxb.) O. Ktze.	sf, ar		
891.	*Urochloa panicoides* Beauv.	ar		
PONTEDERIACEAE				
892.	*Monochoria cyanea* F. Muell.	ar	Fl	
893.	*Monochoria hastata* (L.) Solm.	ar	Fl	
SMILACACEAE				
894.	*Heterosmilax gaudichaudiana* (Kunth.) Max.	sf		
895.	*Heterosmilax paniculata* Gagnep	sf, ar		
896.	*Smilax aspericaulis* Wall. ex A. DC.	sf, ar		
897.	*Smilax biumbellatum* Koy.	sf, pf		
898.	*Smilax corbularia* Kunth.	sf, ar		e
899.	*Smilax glabra* Roxb.	sf, ar, g		m, *

Species	Habitat	Fertile stages	Uses/Status
STEMONACEAE			
900. *Stemona pierrei* Gagnep	g, ar		
901. *Stemona tuberosa* Lour.	g, ar		m
TACCACEAE			
902. *Tacca charitieri* Andre	pf	Fl	m
903. *Tacca plantaginea* (Hance) Drenth.	pf		m
ZINGIBERACEAE			
904. *Alpinia globosa* (Lour.) Haramnov	pf, sf	Fl	
905. *Alpinia phuthoensis* Gagnep	pf	Fl	
906. *Amomum aculeatum* Roxb.	sf, ar		
907. *Amomum villosum* Lour.	pf	Fr	e, m
908. *Costus speciosus* (Koenig) Smith	pf, sf	Fl	e, m
909. *Curcuma aromatica* Salisb.	ar	Fr	m
910. *Curcuma domestica* Val.	ar	Fl, Fr	e, m
911. *Hedychium coccineum* Hamilt.	pf	Fl	
912. *Hedychium ellipticum* Sm.	pf	Fl	
913. *Kaempferia galanga* L.	sf, ar		m
914. *Kaempferia rotunda* L.	ar		m
915. *Zingiber acuminatum* Valeton	pf, sf	Fl	
916. *Zingiber officinalis* Roscoe	ar		e, m
917. *Zingiber zerumbet* (L.) J. E. Sm.	sf, ar	Fl	m

Appendix 2.

Forest transect diagrams

FOREST TRANSECT 1

Key:

Ac Anacardiaceae; *Spondias pinnata*
Ao Annonaceae
Ar Araliaceae; *Trevesia palmata*
Cl Clusiaceae; *Garcinia fragraeoides*
Co Combretaceae
Di Dilleniaceae; *Dillenia heterosepala*
Eb Ebenaceae; *Diospyros* spp.
Eu Euphorbiaceae
Fa Fabaceae
Ju Juglandaceae; *Engelhardia roxburghiana.*
L1 Lauraceae; *Phoebe* sp.
L2 Lauraceae
Lo Loganiaceae
Me Meliaceae
Mt Myristicaceae
My Myrtaceae; *Syzygium formosum*
Sa Sapotaceae; *Madhuca* aff. *pasqueri*
Sp Sapindaceae; *Sapindus saponaria*
St Sterculiaceae
Ru Rubiaceae; *Psychotria baviensis*
Ul Ulmaceae

FOREST TRANSECT 2

Key:

Fa Fabaceae
Lu Lauraceae; *Phoebe poilanei*
Me Meliaceae
Mo Moraceae; *Teonongia tonkinensis*

FOREST TRANSECT 3

Key:

Cl Clusiaceae; *Garcinia fragraeoides*
Eb Ebenaceae; *Diospyros* spp.
Eu Euphorbiaceae
Fa Fabaceae
Fg Fagaceae; *Lithocarpus* sp.
Me Meliaceae; *Aglaia gigantea*
Moraceae; *Teonongia tonkinensis*
Mo Moraceae sp. 2
Sa Sapindaceae; *Xerospermum* sp.
Sy Styracaceae
Ti Tiliaceae;
Excentrodendron (Burretoidendron) *hsienmu*

FOREST TRANSECT 4

Key:

Ar Araliaceae; *Trevesia palmata*
Ae Arecaceae; *Arenga pinnata*
Ac1 Anacardiaceae; *Dracontomelon duperranum*
Ac2 Anacardiaceae; *Gluta wrayi*
Ao1 Annonaceae; *Miliusa balansae*
Ao2 Annonaceae; *Polyalthia jucunda*
Ap Apocynaceae; *Kopsia tonkinense*
Bu Burseraceae; *Canarium album*
Cl Clusiaceae; *Garcinia multiflora*
Dp Dipterocarpaceae; *Shorea siamensis*
El Elaeocarpaceae; *Elaeocarpus chinensis*
Eu Euphorbiaceae; *Croton longipes*
Fg1 Fagaceae; *Castanopsis indica*
Fg2 Fagaceae; *Castanopsis echinophora*
Lu1 Lauraceae; *Phoebe cuneata*
Lu2 Lauraceae; *Caryodaphnopsis tonkinensis*
Lg Loganiaceae; *Fagraea fragrans*
Ma Magnoliaceae; *Manglietia conifera*
Me1 Meliaceae; *Chisocheton globulus*
Me2 Meliaceae sp. 2.
M1 Moraceae; *Ficus callosa*
M2 Moraceae; *Ficus glaberrima*
My Myrtaceae; *Syzygium baviensis*
So Sonneratiaceae; *Duabanga sonneratioides*
Sp Sapindaceae; *Mischocarpus sundaicus*
St1 Sterculiaceae; *Byttneria pilosa*
St2 Sterculiaceae; *Firmannia simplex*
Ti Tiliaceae; *Excentrodendron* (Burretoidendron) *hsienmu*
Ul Ulmaceae; *Ulmus lancaefolia*

Appendix 3.

Forest plot data

Appendix 3. Plant families found in forest plots FT1-4

Family	FT1			FT2			FT3			FT4		
	NI plot	BA (m^2 ha^{-1})	% total BA	NI plot	BA (m^2 ha^{-1})	% total BA	NI plot	BA (m^2 ha^{-1})	% total BA	NI ha^{-1}	BA (m^2 ha^{-1})	% total BA
Anacardiaceae				1	0.331	0.66	2	2.138	2.85	3	0.150	0.56
Annonaceae				2	0.138	0.28				17	1.200	4.47
Apocynaceae	1	0.112	0.38	1	0.675	1.35				8	0.156	0.58
Araliaceae	2	0.175	0.58							5	0.175	0.65
Bignoniaceae							6	4.325	5.76			
Bombacaceae	1	0.331	1.10									
Burseraceae	7	1.125	3.75							3	0.044	0.16
Clusiaceae	21	5.213	17.37	15	11.063	22.13	7	1.225	1.63	12	0.519	1.93
Combretaceae	2	1.212	4.04				2	0.775	1.03			
Dillenaceae	2	0.162	0.54									
Ebenaceae	5	5.569	18.56	1	0.013	0.03	2	0.037	0.05	2	0.031	0.12
Elaeocarpaceae										5	0.756	2.82
Euphorbiaceae				1	0.194	0.39	2	0.050	0.07	7	0.494	1.84
Fabaceae	11	3.063	9.21	14	4.819	9.64	3	12.019	15.12	14	1.294	4.82
Fagaceae	3	0.431	1.44				5	9.194	12.26	3	0.088	0.33
Icacinaceae				1	0.081	0.16						
Lauraceae	21	8.450	28.18	1	1.706	3.41	1	1.825	2.43	13	5.306	19.78
Loganaceae	1	0.037	0.13							8	0.925	3.45
Lythraceae	1	0.050	0.17									
Magnoliaceae										7	1.294	4.82
Melastomataceae										1	0.012	0.05
Meliaceae	1	0.050	0.17	13	7.719	15.44	11	8.469	11.29	17	2.968	11.06
Moraceae				138	10.350	20.70	78	12.806	17.07	6	1.206	4.50
Myristicaceae	1	0.206	0.69	4	0.275	0.55				2	0.131	0.49

Myrtaceae	4	1.081	3.60							8	1.250	4.66
Rubiaceae										6	1.137	4.40
Sapindaceae							1	0.219	0.29	5	0.300	1.12
Sapotaceae				4	8.950	17.90				4	1.875	6.99
Sonneratiaceae										3	0.144	0.53
Sterculiaceae	5	1.319	4.40	4	0.775	1.55	1	0.219	0.29	4	1.819	6.78
Styracaceae				2	0.488	0.98	5	2.106	2.81			
Theaceae	5	0.125	1.87									
Tiliaceae	3	0.563	0.42	5	1.781	3.56	5	19.438	25.91	8	3.050	11.37
Ulmaceae	5	0.506	1.69	1	0.638	1.28	1	0.175	0.23	3	0.463	1.72
Verbenaceae	1	0.219	0.73									

Appendix 4a.

Butterflies of Tat Ke sector

Papilionidae

1. *Troides helena* L.
2. *Papilio helenus* L.
3. *Papilio nepelus* Boisduval
4. *Papilio castor* Westwood
5. *Papilio memnon* L.
6. *Papilio alcmenor* Westwood
7. *Papilio paris* L.
8. *Papilio demoleus* L.
9. *Papilio polytes* L.
10. *Pathisa antiphates* Cramer
11. *Graphium eurypylus* L.
12. *Graphium doson* C. & R. Felder
13. *Lamproptera meges* Zinken

Pieridae

14. *Delias pasithoe* L.
15. *Pieris canidia* Sparrman
16. *Appias lyncida* Cramer
17. *Appias nero* Fabricius
18. *Appias indra* Moore
19. *Appias albina* Boisduvel
20. *Dercas verhuelli* Hoeven
21. *Eurema brigitta* Stoll
22. *Eurema laeta* Boisduvel
23. *Eurema ada* Distant & Pryer
24. *Eurema hecabe* L.
25. *Eurema blanda* Boisduval
26. *Eurema andersoni* Moore

Danaidae

27. *Danaus genutia* Cramer
28. *Tirumala septentrionalis* Butler
29. *Parantica aglea* Stoll
30. *Ideopsis vulgaris* Butler
31. *Euploea mulciber* Cramer

Nymphalidae

32. *Cethosia biblis* Drury
33. *Cethosia cyane* Drury
34. *Cirrochroa tyche* Felder
34. *Vargans egista* Cramer
35. *Argyreus hyperbius* L.
36. *Phalanta phalantha* Drury
37. *Vindula erota* Fabricius
38. *Junonia almana* L.
39. *Kallima inachis* Boisduvel
40. *Doleschallia bisaltidae* Cramer
41. *Hypolimnas bolina* L.
42. *Neptis nata* subsp. *adipala* Moore
43. *Pantoporia hordonia* Stoll
44. *Tanaecia julii* Moore
45. *Tanaecia ?coelebs* Corbet
46. *Parthenos sylvia* Cramer
47. *Apatura* (Rohana) *parisatis* Moore

Amathusidae

48. *Discophora deo* ?subsp. *fruhstorferi* Stichel
49. *Thaumantis diores* Doubleday
50. *Faunis eumaeus* subsp. *incerta* Staudinger
51. *Stichopthalma louisa* Wood-Mason

Satyridae

52. *Melanitis leda* L.
53. *Melanitis phedima* Cramer
54. *Melanitis zitenius* Herbst
55. *Lethe confusa* Aurivillius
56. *Mycalesis inopia* Fruhstorfer
57. *Mycalesis mineus* L.
58. *Mandarina regalis* subsp. *baronesa* Fruhst.
59. *Coelites notis* subsp. *sylvarum* Fruhst.
60. *Zipaetis unipupillata* Lee
61. *Orsotriaena medus* Fabricius
62. *Ragadia crisilda* Hewitson
63. *Ypthima baldus* Fabricius
64. *Ypthima similis* Elwes & Edwars
65. *Ypthima* sp.

Riodinidae

66. *Zemeros flegyas* Cramer
67. *Laxita* sp.

Lycaenidae

68. *Zeltus amasa* Hewitson
69. *Athene emolus* Godart
70. *Yasoda androconifera* Fruhstorfer
71. *Taraka hamada* Druce
72. *Jamides alceto* Felder
73. *Jamides pura* Moore
74. *Caleta roxus* Godart
75. *Zizina otis* Fabricius
76. *Prosotas* sp.

Hesperiidae

77. *Pseudocoladenia dan* F.
78. *Arnetta atinsoni* Moore
79. *Ochus subvittatus* Feld.
80. *Pithauria murdava* Moore
81. *Isotenion lamprospilus* Feld.
82. *Iambrix salsala* Moore
83. *Koruthaialos sindu* Feld.
84. *Koruthaialos butleri* De Nicev.
85. *Ancistroides nigrita* subsp. *diocles* Moore
86. *Notocrypta clavata* subsp. *theba* Evans
87. *Notocrypta feisthamelii* subsp. *alysos* Moore
88. *Notocrypta paralysos* (Wood-Mason & de Niceville)
89. *Thoressa cerata* (Hewitson)
90. *Thoressa masoni* Moore
91. *Halpe zema* Hew.
92. *Telicota linna* Evans
93. *Polytremis lubricans* H-S.
94. *Parnana guttata* Brem. et Grey

Appendix 4b.

Butterflies recorded at Ban Bung (Jan-Mar 1996), but not at Tat Ke (Jul-Sept 1996)

Papilionidae

1. *Atrophaneura dasarada* (Moore)
2. *Chilasa slateri* (Hewitson)
3. *Papilio polyctor* Boisduval
4. *Papilio protenor* Cramer
5. *Graphium sarpedon* (L.)
6. *Lamproptera curius* (Fabr.)

Pieridae

7. *Delias acalis* Godart
8. *Prioneris thestylis* (Doubleday)
9. *Cepora* sp.
10. *Hebomoia glaucippe* (L.)
11. *Ixias pyrene* L.

Danaidae

12. *Parantica melaneus* Cramer
13. *Parantica sita* Kollar

Satyridae

14. *Erites falcipennis* Wood.-Was & de Nicev.
15. *Mycalesis perseoides* Moore
16. *Mycalesis ?zonata* Matsumura
17. *Neope muirheadi* Felder
18. *Lethe verma* (Kollar)

Nymphalidae

19. *Vindula dejone* Butler
20. *Pseudergolis wedah* (Kollar)
21. *Cyrestris cocles* (Fabr.)
22. *Cyrestris thyodamas* Boisduval
23. *Chersonesia risa* (Doubleday)
24. *Symbrenthia javanus* Staudinger
25. *Symbrenthia hypselis* (Godart)
26. *Kaniska canace* (L.)
27. *Terinos clarissa* Fruhstorfer
28. *Hestina nama* Doubleday
29. *Athyma ranga* Moore
30. *Athyma zeroca* Moore
31. *Vanessa cardui* L.
32. *Neptis hylas* L.
33. *Neptis miah* Moore
34. *Neptis soma* Moore
35. *Neptis harita* Moore
36. *Stibochiona nicea* Gray
37. *Sumalia daraxa* Moore
38. *Polyura arja* (Felder)

Libytheiidae

39. *Libythea celtis* Laicharting
40. *Libythea myrrha* Godart

Riodinidae

41. *Abisara fylla* (Doubleday)

Lycaenidae

42. *Allotinus unicolor* Riley & Godfrey
43. *Celastrina argiolus* L.
44. *Cheritra freja* (Fabr.)
45. *Heliophorus androcles* Riley
46. *Udara dilecta* Moore
47. *Yasoda tripunctata* Hewitson

Hesperiidae

48. *Astictopterus jama* C. & R. Felder
49. *Borbo bevani* Moore

Appendix 5.

Fish species

Key: **P** Species cultivated in rice fields and ponds.
(V) Listed as 'Vulnerable' in the Red Data Book for Vietnam (RDB, 1992).
(T) Listed as 'Threatened' in the RDB for Vietnam.

Distribution: + Observed, at; 1 Site 1
2 Site 2
3 Site 3; River Gam
4 stream near Chom Village (western part of Tat Ke sector; flows into R. Gam)
5 stream at Nam Trang (Ban Bung sector)

Species with no + were *not* collected, but identified in interviews with local fishermen

			Distribution				
			1	**2**	**3**	**4**	**5**
Order: Cypriniformes							
Family: Cyprinidae							
1.	*Cyprinus carpio* Linnaeus	P			+		
2.	*Cyprinus multitaeniata*				+		
3.	*Onychostoma ovalis* Pellegrin & Chevey				+		
4.	*Onychostoma laticeps* Gunther	V		+	+		
5.	*Onychostoma gerlachi* (Peters)						
6.	*Garra orientalis* Nichols				+		
7.	*Garra caudofasciata* (Pellegrin & Chevey)						+
8.	*Garra angulostoma*						
9.	*Semilabeo notabilis* Peters	V			+		
10	*Epalzeorhynchus mutabilis* Linnaeus						
11	*Altigena bibarbata*						
12	*Altigena tetrabarbata*						
13	*Altigena dorsoarcus*						
14	*Osteochilus salsburyi* Nichols and Pope						
15	*Cirrhina molitorella* (Cuiver and Valenciennes)	P			+		
16	*Spinibarbus caldwelli* (Nichols)	V			+		
17	*Spinibarbichthys denticulatus* Oshima	V, P		+	+		
18	*Labeo tonkinensis* (Pellegrin & Chevey)				+		
19	*Cyclocheilichthys iridescens* Nichols and Pope			+			
20	*Lissochilus krempfi* Pellegrin and Chevey						
21	*Lissochilus macrosquamatus*				+		
22	*Crossocheilus elongatus* Pellegrin and Chevey						
23	*Puntias ocellatus*						+
24	*Mylopharyngodon piceus* (Richardson)	V					

			1	2	3	4	5
25	*Opsarichthys uncirostris* (Schlegel)			+	+		+
26	*Rasbora cephalotaenia steineri*						+
27	*Rasbora lineatus* (Pellegrin)						
28	*Zacco spilurus* (Gunther)		+				+
29	*Zacco platypus* (Temminck and Schlegel)		+				
30	*Pseudohemiculter serrata* (Koller)				+		
31	*Erythroculter hypselonotus*				+		
32	*Hemiculter leucisculus* (Basilewski)				+		
33	*Megalobrama macrops affinis* (Vaillant)				+		
34	*Squaliobarbus curriculus* (Richardson)	P			+		
35	*Hypophthalmichthys molitrix* (Sauvage)	P			+		
36	*Rhodeus ocellatus* Kner			+			
37	*Pararhodeus kyphus*			+			
38	*Pararhodeus elongatus*						
39	*Acanthorhodeus tonkinensis* Vailant			+	+		
40	*Acanthorhodeus longibarbatus*						
41	*Squalidus chankaensis vietnamensis* (P. Banarescu and T. Nalbant.)			+			
42	*Microphysogobio labeoides* Nichols and Pope			+	+		
43	*Microphysogobio gigantus*						
44	*Saurogobio dabryi* Bleeker						
45	*Ctenopharyngodon idella*	P			+		
46	*Labeo rhohita*	P			+		
47	*Labeo mrigala*	P			+		
48	*Labeo tonkinensis* (Pellegrin & Chevey)				+		
Family: Cobitidae							
49	*Barbatula caudofurca*		+			+	
50	*Barbatula fasciolata* (Nichols & Pope)		+	+		+	
51	*Botia elongata*						+
52	*Botia gigantea*				+		
Family: Siluridae							
53	*Parasilurus asotus* (Linnaeus)				+		
54	*Parasilurus cochinchinensis* (Cuvier and Valenciennes)		+				+
Family: Bagridae							
55	*Cranoglanis sinensis* Peters	V			+		
56	*Hemibagrus elongatus* (Gunther)	V		+	+		
57	*Hemibagrus vietnamicus*			+			
Family: Clariidae							
58	*Clarias fuscus* (Lacepede)						
Family: Sisoridae							
59	*Bagarius bagarius* Hamilton and Buchanan	V			+		

		1	2	3	4	5
Order: Ophiocephaliformes						
Family: Ophiocephalidae						
60 *Ophiocephalus striatus* Bloch	T			+		
61 *Ophiocephalus maculatus* (Lacepede)						
62 *Ophiocephalus gachua* Hamilton and Buchanan					+	
63 *Channa asiatica* (Linnaeus)						
Order: Synbranchiformes						
Family: Flutidae						
64 *Fluta alba* (Zuiew)			+			
Order: Perciformes						
Family: Serranidae						
65 *Siniperca scherzeri kwangsiensis* Fang and Chong						
66 *Coreoperca whiteheadi* Boulenger		+	+			
Family: Anabantidae						
67 *Anabas testudineus* (Bloch)				+		
68 *Macropodus opercularis* Linnaeus		+	+			
Family: Eleotridae						
69 *Micropercops hotayensis*		+				
Family: Gobiidae						
70 *Rhinogobius hadropterus* (Jordan and Snyder)		+	+			
Family: Cichlidae						
71 *Tilapia mossambica*	P					
Order: Mastacembeliformes						
Family: Mastacembelidae						
72 *Mastacembelus armatus* (Lacepede)			+	+		
73 *Mastacembelus aculeatus* Basilewski						
Total number of species		**10**	**17**	**32**	**2**	**7**

Appendix 6.

Amphibians and Reptiles

Identified by Dr Nguyen Van Sang, IEBR, Hanoi.

Key;

(o) = observed only
NT(T) = Nationally Threatened
(listed as Threatened in the *Red Data Book for Vietnam, Vol 1: Animals*)

6a: Amphibia

Family Ranidae
1. *Rana limnocharis*

6b: Reptilia

Family Emydidae
1. *Cistoclemmys* sp.*(o)*
2. *Geoemyda* sp.*(o)*

Family Agamidae
3. *Acanthosaura lepidogaster* **NT(T)**

Family Scincidae
4. *Mabuya longicaudata*

Family Colubridae
5. *Elaphe moellendorffii* **NT(T)**
6. *Elaphe prasina*
7. *Oligodon chinensis*
8. *Boiga multomaculata*
9. *Ahaetulla prasina*
10. *Pseudoxenodon bambusicola*

Appendix 7.

BIRDS

7a. BIRD SPECIES RECORDED July - Sept. 1996

Key:

A Habitat: pf - Primary forest;
sf - Secondary forest;
b - Bamboo forest;
s - Scrub;
a - Agriculture;
w - rivers, streams and lakes (within above habitat types)

B Abundance: (a) - Abundant
(c) - Common
(f) - Frequent
(o) - Occasional
(r) - Rare

C Notes: *** - listed in *'Birds to Watch 2'* (Collar *et al.*,1994) as **vulnerable**.
** - listed in *'Birds to Watch 2'* (Collar *et al.*,1994) as **near-threatened**.
* - listed in RDB of Vietnam (RDB, 1992) as **threatened** within Vietnam.
V - identified by Voice only
T - traces (e.g. feathers)
C - captive specimen seen
RE - range extension from *'Birds of S.E. Asia'* (King *et al.*,1975).
AR - altitude reduction from that stated in *'Birds of S.E. Asia'* (King *et al.*,1975).
END - 'Restricted Range Species' **endemic** to Indochina, (+H= + Hainan).
B - evidence of breeding
J - juvenile(s) present
BB - Recorded only in Ban Bung sector (*All birds recorded in Tat Ke*)
BZ - Recorded only in Buffer Zones (*sector if not stated otherwise*)

		A	B	C
Phasianidae: Quail, Partridges, Pheasants				
1.	Red Junglefowl (*Gallus gallus*)	sf	(r)	
2.	Silver Pheasant (*Lophura nycthemera*)	pf	(o)	*, V & T
Picidae: Woodpeckers				
3.	White-browed Piculet (*Sasia ochracea*)	sf,b,s	(o)	
4.	Grey-capped Woodpecker (*Dendrocopos canicapillus*)	pf	(r)	
5.	Rufous Woodpecker (*Celeus brachyurus*)	pf	(r)	
6.	Lesser Yellownape (*Picus chlorolophus*)	pf,sf	(o)	
7.	Greater Yellownape (*Picus flavinucha*)	sf	(o)	
8.	Bay Woodpecker (*Blythipicus pyrrhotis*)	pf,sf	(r)	
Megalaimidae: Barbets				
9.	Great Barbet (*Megalaima virens*)	pf,sf,a	(c)	C
10.	Red-vented Barbet (*Megalaima lagrandieri*)	pf,sf	(f)	END
11.	Green-eared Barbet (*Megalaima faiostricta*)	pf,sf,a	(f)	
12.	Golden-throated Barbet (*Megalaima franklinii*)	pf	(f)	
13.	Blue-throated Barbet (*Megalaima asiatica*)	a	(r)	

	A	B	C
Upupipae: Hoopoe			
14. Hoopoe (*Upupa epops*)	s	(r)	
Trogonidae: Trogons			
15. Red-headed Trogon (*Harpactes erythrocephalus*)	sf	(f)	
Alcedinidae: Kingfishers			
16. Common Kingfisher (*Alcedo atthis*)	w	(o)	
Halcyonidae: Kingfishers			
17. White-throated Kingfisher (*Halcyon smyrnensis*)	w	(o)	
18. Black-capped Kingfisher (*Halcyon pileata*)	w	(r)	
Meropidae: Bee-eaters			
19. Blue-bearded Bee-eater (*Nyctyornis athertoni*)	sf	(r)	
Cuculidae: Cuckoos			
20. Large Hawk-Cuckoo (*Cuculus sparverioides*)	pf,bf	(r)	
21. Common Cuckoo (*Cuculus canorus*)	sf	(r)	
22. Plaintive Cuckoo (*Cacomantis merulinus*)	sf	(r)	
23. Asian Koel (*Eudynamys scolopacea*)	pf,sf	(f)	
24. Green-billed Malkoha (*Phaenicophaeus tristis*)	pf,sf,s	(f)	
25. Greater Coucal (*Centropus sinensis*)	s,a	(o)	J
Psittacidae: Parrots			
26. Red-breasted Parakeet (*Psittacula alexandri*)	-	(r)	C, B
Apodidae: Swifts			
27. Himalayan? Swiftlet (*Collocalia ?brevirostris*)	a	(r)	
28. Silver-backed Needletail (*Hirundapus cochinchinensis*)	pf,sf	(f)	RE
29. Brown-backed Needletail (*Hirundapus giganteus*)	pf,sf	(o)	RE
30. Asian Palm Swift (*Cypsiurus balasiensis*)	pf,sf,a	(a)	
31. Fork-tailed Swift (*Apus pacificus*)	pf,sf,a	(c)	
32. House Swift (*Apus affinis*)	sf,a	(o)	
Strigidae: Owls			
33. Mountain Scops-Owl (*Otus spilocephalus*)	pf,sf	(f)	
34. Collared Scops-Owl (*Otus bakkamoena*)	pf	(r)	V, BB
35. Collared Owlet (*Glaucidium brodiei*)	pf,sf	(f)	
36. Brown Hawk-Owl (*Ninox scutulata*)	pf	(r)	V, BB
Columbidae: Pigeons, Doves			
37. Spotted Dove (*Streptopelia chinensis*)	a,sf	(c)	
38. Red Collared-Dove (*Streptopelia tranquebarica*)	sf,a	(r)	
39. Emerald Dove (*Chalcophaps indica*)	sf	(o)	
40. Green Imperial-Pigeon (*Ducula aenea*)	pf	(r)	
41. Mountain Imperial-Pigeon (*Ducula badia*)	pf	(r)	
Scolopacidae: Sandpipiers, Snipe			
42. Common Sandpiper (*Tringa hypoleucos*)	w	(r)	BZ
Charadriidae: Plovers			
43. River Lapwing (*Vanellus duvaucelii*)	w	(r)	BZ
Accipitridae: Kites, Hawks, Eagles			
44. Crested Serpent-Eagle (*Spilornis cheela*)	pf,sf,a	(c)	J
45. Crested Goshawk (*Accipiter trivirgatus*)	pf	(r)	
46. Shikra (*Accipiter badius*)	sf,a	(r)	
47. Besra (*Accipiter virgatus*)	pf,sf,a	(f)	J
48. Black Eagle (*Ictinaetus malayensis*)	sf,a	(r)	
Falconidae: Falcons			
49. Pied Falconet (*Microhierax melanoleucos*)	sf,s	(r)	**, BB
50. Northern Hobby (*Falco subbuteo*)	a	(r)	BZ

	A	B	C
Ardeidae: Herons			
51. Chinese Pond-Heron (*Ardeola bacchus*)	w	(f)	
Eurylaimidae: Broadbills			
52. Silver-breasted Broadbill (*Serilophus lunatus*)	pf	(r)	
53. Long-tailed Broadbill (*Psarisomus dalhousiae*)	pf,sf	(r)	*
Irenidae: Leafbirds			
54. Orange-bellied Leafbird (*Chloropsis hardwickii*)	pf,sf	(c)	J
Laniidae: Shrikes			
55. Tiger Shrike (*Lanius tigrinus*)	s	(r)	RE, J
56. Long-tailed Shrike (*Lanius schach)*	s	(f)	
Corvidae			
Subfamily Corvinae			
Tribe Corvini: Crows, Magpies			
57. Blue Magpie (*Urocissa erythrorhyncha*)	sf,s	(r)	
58. White-winged Magpie (*Urocissa whiteheadi*)	sf	(c)	**, J
59. Green Magpie (*Cissa chinensis*)	pf,sf	(f)	
60. Grey Treepie (*Dendrocitta formosae*)	sf	(o)	
61. Racket-tailed Treepie (*Crypsirina temia*)	sf	(r)	
62. Ratchet-tailed Treepie (*Temnurus temnurus*) (+H)	sf,pf	(f)	* END
63. Large-billed Crow (*Corvus marcorhynchos*)	pf,sf	(r)	
Tribe Artamini: Woodswallows			
64. Ashy Woodswallow (*Artamus fuscus*)	s,a	(f)	BZ
Tribe Oriolinae: Old World Orioles, Cuckooshrikes			
65. Maroon Oriole (*Oriolus traillii*)	pf,sf,a	(f)	
66. Large Cuckooshrike (*Coracina macei*)	sf,a	(o)	
67. Black-winged Cuckooshrike (*Coracina melaschistos*)	pf,sf	(f)	J
68. Scarlet Minivet (*Pericrocotus flammeus*)	pf,sf,a	(c)	
69. Bar-winged Flycatcher-Shrike (*Hemipus picatus*)	sf,a	(f)	
Subfamily Dicrurinae			
Tribe Dicrurini: Drongos			
70. Ashy Drongo (*Dicrurus leucophaeus*)	pf,sf,a	(a)	
71. Crow-billed Drongo (*Dicrurus annectans*)	pf,sf	(a)	
72. Bronzed Drongo (*Dicrurus aeneus*)	sf,pf	(a)	
73. Lesser Racket-tailed Drongo (*Dicrurus remifer*)	sf	(r)	
74. Greater Racket-tailed Drongo (*Dicrurus paradiseus*)	pf,sf	(o)	
Tribe Monarchini: Monarchs			
75. Black-naped Monarch (*Hypothymis azurea*)	sf	(o)	
76. Asian Paradise Flycatcher (*Terpsiphone paradisi*)	pf,sf	(c)	B
Subfamily Aegithininae: Ioras			
77. Common Iora (*Aegithina tiphia*)	pf	(r)	
Subfamily Malaconotinae			
78. Large Woodshrike (*Tephrodornis gularis*)	pf,sf	(c)	B
Muscicapidae			
Subfamily Turdinae: Thrushes			
79. Blue Whistling Thrush (*Myiophonus caeruleus*)	w/pf	(r)	
80. Orange-headed Thrush (*Zoothera citrina*)	pf	(r)	RE, B
81. Scaly Thrush (*Zoothera dauma*)	pf	(r)	
82. Lesser Shortwing (*Brachypteryx leucophrys*)	pf	(r)	

	A	B	C
Subfamily Muscicapinae: Flycatchers			
Tribe Muscicapini			
83. Asian Brown Flycatcher (*Muscicapa dauurica*)	s	(r)	
84. Yellow-rumped Flycatcher (*Ficedula zanthopygia*)	sf	(r)	
85. Slaty-blue Flycatcher (*Ficedula tricolor*)	pf	(r)	
86. Small Niltava (*Niltava macgrigoriae*)	pf	(r)	AR
87. White-tailed Flycatcher (*Cyonris concretus*)	pf,sf	(f)	AR, B
88. Hainan Blue-Flycatcher (*Cyornis hainanus*)	pf,sf,s	(o)	
89. Grey-headed Canary-Flycatcher (*Culicicapa ceylonensis*)	pf,sf	(a)	B
Tribe Saxicolini			
90. Oriental Magpie Robin (*Copsychus saularis*)	a,s	(r)	
91. White-rumped Shama (*Copsychus malabaricus*)	sf	(r)	
92. White-crowned Forktail (*Enicurus leschenaulti*)	pf	(r)	
93. Green Cochoa (*Cochoa viridis*)	pf	(r)	**, AR, J
94. Common Stonechat (*Saxicola torquata*)	a	(o)	
Sturnidae: Starlings, Mynas			
95. Chestnut-tailed Starling (*Sturnus malabaricus*)	sf,a	(r)	RE, BZ
96. White-vented Myna (*Acridotheres grandis*)	a	(c)	
97. Crested Myna (*Acridotheres cristatellus*)	s,a	(c)	
98. Golden-crested Myna (*Ampeliceps coronatus*)	sf,a	(r)	RE, BZ
99. Hill Myna (*Gracula religiosa*)	a	(r)	
Sittidae: Nuthatches			
100. Chestnut-bellied Nuthatch (*Sitta castanea*)	pf,sf	(o)	
101. Velvet-fronted Nuthatch (*Sitta frontalis*)	pf,sf,a	(f)	
Paridae: Tits			
102. Great Tit (*Parus major*)	sf,s	(r)	
103. Sultan Tit (*Melanochlora sultanea*)	pf,sf	(c)	
Hirundinidae: Swallows			
104. Barn Swallow (*Hirundo rustica*)	pf,a	(f)	
Pycnonotidae: Bulbuls			
105. Black-crested Bulbul (*Pycnonotus melanicterus*)	sf	(r)	
106. Red-whiskered Bulbul (*Pycnonotus jocosus*)	sf,s,a	(a)	
107. Sooty-headed Bulbul (*Pycnonotus aurigaster*)	sf,s,a	(a)	
108. Olivaceous Bearded Bulbul (*Alophoixus pallidus*)	pf,sf,b	(a)	B
109. Grey-eyed Bulbul (*Iole propinqua*)	s	(r)	
110. Chestnut Bulbul (*Hemixos castanonotus*)	pf,sf	(o)	
111. Black Bulbul (*Hypsipetes madagascariensis*)	pf,sf,s,a	(a)	J
Cisticolidae: Cisticolas, Prinias			
112. Lesser Brown Prinia (*Prinia rufescens*)	s,a	(o)	B
113. White-browed Prinia (*Prinia atrogularis*)	sf,a	(r)	B
Sylviidae			
Subfamily Acrocephalinae: Old World Warblers			
114. Mountain Tailorbird (*Orthotomus cuculatus*)	pf	(r)	
115. Common Tailorbird (*Orthotomus sutorius*)	s	(o)	
116. Arctic Warbler (*Phylloscopus borealis*)	pf,sf	(r)	
117. Blyth's/White-tailed Leaf Warbler (*Phylloscopus reguloides/davisoni*)		pf,sf	(o)
118. Sulphur-breasted Warbler (*Phylloscopus ricketti*)	pf,sf	(c)	
119. Golden-spectacled Warbler (*Seicercus burkii*)	pf	(f)	
120. Yellow-Bellied Warbler (*Abroscopus superciliaris*)	pf,sf,b	(c)	

	A	B	C
Subfamily Garrulacinae: Laughingthrushes			
121. Masked Laughingthrush (*Garrulax perspicillatus*)	s	(r)	BB
122. White-crested Laughingthrush (*Garrulax leucolophus*)	pf,sf	(o)	
123. Lesser Necklaced Laughingthrush (*Garrulax monileger*)	sf	(r)	
124. Grey Laughingthrush (*Garrulax maesi*)	pf	(f)	**
125. Black-throated Laughingthrush (*Garrulax chinensis*)	pf,sf,s	(f)	
126. Hwamei (*Garrulax canorus*)	s	(r)	
127. Red-tailed Laughingthrush (*Garrulax milnei*)	pf	(r)	**
Subfamily Sylviinae			
Tribe Timalinii: Babblers			
128. Buff-breasted Babbler (*Pellorneum tickelli*)	sf	(r	
129. Puff-throated Babbler (*Pellorneum ruficeps*)	pf	(r)	
130. Red-billed Scimitar-Babbler (*Pomatorhinus ochraceiceps*)	sf	(o)	AR
131. Streaked Wren-Babbler (*Napothera brevicaudata*)	pf,sf	(c)	
132. Eyebrowed Wren-Babbler (*Napothera epilepidota*)	pf	(r)	
133. Golden Babbler (*Stachyris chrysaea*)	pf	(r)	
134. Grey-throated Babbler (*Stachyris nigriceps*)	pf	(o)	J
135. Spot-necked Babbler (*Stachyris striolata*)	pf	(r)	
136. Striped Tit-babbler (*Macronous gularis*)	sf	(o)	
137. White-browed Shrike-Babbler (*Pteruthius flaviscapis*)	pf	(c)	
138. White-hooded Babbler (*Gampsorhynchus rufulus*)	sf,b	(o)	
139. Rufous-throated Fulvetta (*Alcippe rufogularis*)	sf	(r)	**,J
140. Grey-cheeked Fulvetta (*Alcippe morrisonia)*	pf,sf	(f)	
141. Striated Yuhina (*Yuhina castaniceps*)	pf	(c)	
142. Black-chinned Yuhina (*Yuhina nigrimenta*)	pf	(o)	
143. White-bellied Yuhina (*Yuhina zantholeuca*)	pf,sf	(o)	
144. Black-browed Parrotbill (*Paradoxornis atrosuperciliaris*)	sf,b	(o)	
145. Rufous-headed Parrotbill (*Paradoxornis ruficeps*)	sf,b	(r)	**
Nectariniidae			
Subfamily Nectariinae			
Tribe Diceani: Flowerpeckers			
146. Plain Flowerpecker (*Dicaeum concolor*)	sf,s	(o)	
Tribe Nectariini: Sunbirds			
147. Olive-backed Sunbird (*Nectarinia jugularis*)	pf	(r)	RE
148. Fork-tailed Sunbird (*Aethopyga christinae*)	sf/s	(r)	
149. Little Spiderhunter (*Arachnothera longirostra*)	sf	(r)	
150. Streaked Spiderhunter (*Arachnothera magna*)	sf,s,a	(c)	AR
Passeridae			
Subfamily Motacillinae: Wagtails, Pipits			
151. Forest Wagtail (*Dendronanthus indicus*)	sf	(r)	RE
152. Grey Wagtail (*Motacilla cinerea*)	w	(r)	
Subfamily Estriliinae: Waxbills			
153. White-rumped Munia (*Lonchura striata*)	a	(f)	J

7b. Formulation used for the assessment of abundance of bird species recorded in Na Hang nature reserve. (Hill & Kemp, 1996)

Relative abundance of each species within the reserve was calculated from the number of occasions the species was identified and the average flock size of each species. Set out in the table below is the format used for assessing abundance. This formulation is only applicable for the SEE-Vietnam surveys at Na Hang. The abundance rating is weighted more heavily towards the number of occasions each species was recorded, as flock size was more difficult to recorded accurately, especially whilst observing large or mixed flocks.

Average	**No. of Occasions Sighted**					
Flock Size	1	2	3-4	5-8	9-16	>16
1-2	Rare	Rare	Occasional	Frequent	Common	Abundant
3-8	Rare	Occasional	Frequent	Common	Abundant	Abundant
>9	Occasional	Frequent	Common	Abundant	Abundant	Abundant

7c. Endangered Bird Species Recorded in Na Hang Nature Reserve

Endangered Internationally (*Birds to Watch 2*, Collar *et al*. 1994)

Vulnerable

- *Picus rabieri* (Red-collared Woodpecker).

Near-threatened

- *Anorrhinus tickelli* (Brown Hornbill)
- *Treron seimundi* (Yellow-vented Green-Pigeon)
- *Microhierax melanoleucos* (Pied Falconet).
- *Pitta soror* (Blue-rumped Pitta)
- *Pitta elliotti* (Bar-bellied Pitta)
- *Urocissa whiteheadi* (White-winged Magpie)
- *Turdus dissimilis* (Black-breasted Thrush)
- *Niltava davidi* (Fujian Niltava)
- *Cochoa viridis* (Green Cochoa)
- *Garrulax maesi* (Grey Laughingthrush)
- *Garrulax milnei* (Red-tailed Laughingthrush)
- *Xiphirhynchus superciliaris* (Slender-billed Scimitar-Babbler)
- *Alcippe rufogularis* (Rufous-throated Fulvetta)
- *Paradoxornis ruficeps* (Rufous-headed Parrotbill).

Endangered in Vietnam (RDB, 1992)

- *Psarisomus dalhousiae* (Long-tailed Broadbill)
- *Pitta phayrei* (Eared Pitta)
- *Temnurus temnurus* (Ratchet-tailed Treepie)

Appendix 8.

Mammals

Key;

A Identified from:

- T Tracks or traces present
- O Observed
- S Specimen taken

B Threatened Species Categories in Vietnam
(as defined in RDB, 1992):

- E Endangered
- V Vulnerable
- R Rare
- T Threatened / Commercially Threatened

- # New record for Na Hang Nature Reserve

C Threatened Species Categories, International
(as defined in *1994 IUCN Red List of Threatened Animals;* Groombridge, 1993):

- E Endangered
- V Vulnerable
- R Rare
- I Indeterminate
- K Insufficiently Known
- C Commercially Threatened

		A	B	C
Insectivora				
Tupaiidae: Treeshrews				
1.	Common Treeshrew (*Tupaia glis*)	O		
Soricidae: Shrews				
2.	Savi's Pigmy Shrew (*Suncus etruscus*)	S		
3.	South-East Asian White-toothed Shrew (*Crocidura fulignosa*)	S		
Chiroptera				
Microchiroptera				
Rhinolophidae: Horseshoe Bats				
4.	*Rhinolophus affinis*	S,O	#	
5.	*Rhinolophus pearsoni*	S,O		
6.	*Rhinolophus subbadius*	S,O	#	

Hipposideridae: Old World Roundleaf Bats				
7.	*Hipposideros larvatus*	S,O		
8.	*Hipposideros ?pomona*	S,O	#	
9.	*Hipposideros* sp.	S,O		
10.	*Aselliscus stoliczkanus*	S,O		
Vespertilionidae: Evening Bats				
11.	*Murina* sp.	S,O	#	
Primates				
Cercopithecidae: Old World Monkeys				
12.	Pig-tailed Macaque (*Macaca nemestrina*)	O	V	C
Rodentia				
Sciuridae: Squirrels				
13.	Black Giant Squirrel (*Ratufa bicolor hainana*)	O		
14.	Red-bellied Squirrel (*Callosciurus erythraeus*)	O		
15.	Tree Squirrel (*Callosciurus ?inornatus*)	O		
16.	Burmese Striped Tree-squirrel (*Tamiops maclellandi*)		O	
17.	Red-cheeked Squirrel (*Dremomys rufigenis*)	O		
Carnivora				
Ursidae: Bears				
18.	Asiatic Black Bear (*Ursus thibetanus*)	T	E	V
Artiodactyla				
Suidae: Pigs				
19.	Wild Boar (*Sus scrofa*)	T		
Cervidae: Deer				
20.	Barking Deer (*Muntiacus muntjac*)	T	V	
Bovidae: Bovines				
21.	Serow (*Naemorhedus sumatraensis*)	T	V	I

Appendix 9.

List of specimens

Insects (excluding butterflies and moths)

Specimens from sweep-net and pitfall trapping, and collected by hand.
Held in 70% ethanol.
Held by University Museum, Copenhagen, Denmark.

Insects (butterflies and moths)

Dry specimens.
Held by Dr. Alexander Monastrskyii, Russian Tropical Institute, Hanoi.

Fish

In 70% ethanol.
Held by Dr. Nguyen Kiem Son, IEBR, Hanoi.

Reptiles and amphibians

Preserved in Formalin and held in 70% ethanol.
Held at IEBR, Hanoi.

Mammals (excluding bats)

Representative specimens of trapped rodent species.
Preserved in formalin and held in 70% ethanol.
Held at IEBR, Hanoi, by Professor Cao Van Sung.

Mammals (Bats)

Preserved in Formalin and held in 70% alcohol.
Held by Dr P. Jenkins, Natural History Museum, London.