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The Biodiversity of Bac Huong Hoa Nature Reserve, Quang Tri Province, Vietnam



**Conservation Report
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The Biodiversity of Bac Huong Hoa Nature Reserve, Quang Tri Province, Vietnam

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Cover Photo

Forest near Cup village in Bac Huong Hoa Nature Reserve.

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Conventions Used

Plant names, and species limits follow Anon (2007). Mammal names (common) follow Wilson and Reeder (2005) and (scientific) IUCN (2007), sequence follow Wilson and Reeder (2005) and species limits follow IUCN (2007), with scientific names given at first mention and in Appendix 2. Bird names (common and scientific), sequence and species limits follow BirdLife International (2008), with scientific names given at first mention and in Appendix 3. Reptile and amphibian names, sequence and species limits follow Nguyen Van Sang and Ho Thu Cuc (1996), with scientific names given in Appendix 4. Diacritical marks are omitted from Vietnamese names due to typographical limitations and the restricted understanding of international readers.

Glossary of Terms

Endemic Bird Area (EBA) refers to an area supporting at least two restricted-range bird species. A restricted range bird species is one with a global breeding range of less than 50,000 km². Globally threatened species refers to a species assigned a category of threat in the IUCN Red Lists of Threatened Animals and Plants (IUCN 2007); the term excludes species listed as Near Threatened or Data Deficient. Indochina refers to the biogeographic region of Cambodia, Laos and Vietnam.

Abbreviations and Acronyms Used

EBA - Endemic Bird Area
IBA – Important Bird Area
FIPI - Forest Inventory and Planning Institute, Hanoi
FPD - Forest Protection Department
IEBR - Institute of Ecology and Biological Resources
IUCN - World Conservation Union
MARD - Ministry of Agriculture and Rural Development
NTFP - Non-timber forest products
WWF – World Wildlife Fund
VRDB – Vietnam Red Data Book 2007
CR – Critically Endangered
EN – Endangered
VU – Vulnerable
DD – Data Deficient
NT – Near Threatened

Executive Summary

Prior to their designation as a nature reserve, the forests of Bac Huong Hoa, together with adjacent forest in Quang Binh Province, represented the largest block of unprotected forest in the Central Annamites. The establishment of the nature reserve presents an opportunity to conserve a significant area of forest, with a fauna representative of the Greater Truong Son Landscape. This

report brings together biological information relevant to Bac Huong Hoa Nature Reserve, to enable effective management.

BHH NR covers 25,200 hectares, including 20,646.2 hectares of natural forest. These forests support a fauna representative of the Central Annamites and the Greater Truong Son Landscape. The reserve supports globally threatened mammal species such as the Saola *Psuedoryx nghetinhensis* and Red-shanked Douc Langur *Pygathrix nemaeus*, and four of the seven restricted-range bird species which define the Annamese Lowlands Endemic Bird Area. Site Support Groups set up by BirdLife to monitor populations of key mammal and bird species also report the continued existence of the globally Endangered Edwards's Pheasant *Lophura edwardsi* in the nature reserve. Due to the populations of threatened and restricted-range species it supports, BHH NR forms part of the Truong Son IBA.

Although it is of global importance due to the species and habitats it protects, in recent years the biodiversity value of BHH NR may have been considerably reduced due to intensive commercial hunting for the wildlife trade. A number of teams of professional hunters from Quang Binh Province operate in the nature reserve and a very high density of traps has been observed. The trade in wildlife is likely to have been facilitated by the construction of the Ho Chi Minh Highway.

BHH NR therefore presents a management challenge and a significant conservation opportunity. This report recommends that effective management must be established at BHH NR, in order to protect the globally important biodiversity attributes of the Central Annamites. Professional hunting must be eradicated quickly and surveys of species representative of the Greater Truong Son Landscape need to be conducted, to inform management decisions. Traditional projects to improve management of protected areas in the Central Annamites have been limited in their success. Due to the intensity of threat processes at Bac Huong Hoa Nature Reserve, the same is likely to be true there. The recent establishment of this protected area presents an opportunity to pursue innovative forms of management. New management strategies which work within established national frameworks may be the most effective way to manage Bac Huong Hoa Nature Reserve and the species of global importance it protects. This innovative approach could provide a successful alternative model for conservation of protected areas throughout Vietnam.

Executive Summary VN

Trước khi xây dựng khu bảo tồn, rừng ở khu vực Bắc Hương Hóa và phía giáp tỉnh Quảng Bình là vùng rừng rộng lớn nhất miền trung Trường Sơn còn chưa được bảo vệ. Thành lập khu bảo tồn thiên nhiên ở đó là một cơ hội tốt để bảo vệ khu rừng quan trọng với đại diện của nhiều loài động vật của dãy Trường Sơn hùng vĩ. Báo cáo này nhằm cung cấp thông tin về đa dạng sinh học của

khu bảo tồn thiên nhiên Bắc Hương Hóa và tạo cơ sở quản lý hiệu quả nguồn tài nguyên sinh vật trong khu bảo tồn.

Khu bảo tồn thiên nhiên Bắc Hương Hóa có diện tích là 25.200 ha, trong đó rừng tự nhiên là 20.646,2 ha. Khu rừng này là môi trường sống của nhiều loài động vật đại diện miền Trung Trường Sơn cũng như của dãy Trường Sơn rộng lớn. Cụ thể, nó là môi trường sống của nhiều loài thú đang bị đe dọa ở mức toàn cầu như Sao la (*Pseudoryx nghetinhensis*), Voọc vá chân nâu (*Pygathrix nemaeus*) và của năm trong số bảy loài chim có vùng phân bố hẹp tại Vùng chim đặc hữu đất thấp Trường Sơn. Các nhóm tuần tra giám sát do Tổ chức Birdlife thành lập nhằm giám sát số lượng của các loài chim và thú quan trọng, đặc biệt là của loài Gà lôi lam mào trắng (*Lophura edwardsi*) trong khu bảo tồn. Khu bảo tồn Bắc Hương Hóa là một phần của vùng chim quan trọng trong dãy Trường Sơn vì nó có quần thể của các loài phân bố hẹp và đang bị đe dọa.

Mặc dù có tầm quan trọng toàn cầu vì rừng ở Bắc Hương Hóa là môi trường sống của nhiều loài động thực vật và sinh cảnh quan trọng, nhưng những năm gần đây, giá trị đa dạng sinh học trong khu bảo tồn thiên nhiên Bắc Hương Hóa đã bị suy giảm nghiêm trọng do việc săn bắn và buôn bán động vật hoang dã trái phép. Có rất nhiều nhóm thợ săn chuyên nghiệp từ tỉnh Quảng Bình đang ráo riết hoạt động trong khu bảo tồn và sử dụng rất nhiều bẫy khác nhau. Việc xây dựng đường Hồ Chí Minh cũng tạo thêm điều kiện cho việc buôn bán, vận chuyển động vật hoang dã.

Vì vậy, Khu bảo tồn thiên nhiên Bắc Hương Hóa đang phải đối mặt với những thách thức trong quản lý nhưng lại có cơ hội để thực hiện sứ mệnh bảo tồn. Để bảo vệ giá trị đa dạng sinh học của miền trung Trường Sơn, cần phải thành lập ban quản lý khu bảo tồn và thực hiện các hoạt động có hiệu quả tại khu bảo tồn thiên nhiên Bắc Hương Hóa, ngăn chặn các hoạt động săn bắn trái phép và tiến hành điều tra bổ sung thông tin về các loài đại diện của dãy Trường Sơn để làm cơ sở quản lý hiệu quả hơn nữa. Với mức độ đe dọa đến khu bảo tồn thiên nhiên Bắc Hương Hóa như vậy, thì rất có thể kết quả quản lý khó được như mong muốn. Những khu bảo tồn được thành lập trong thời gian gần đây có thể có cơ hội để thực hiện những biện pháp quản lý mới nhằm bảo vệ các loài có tầm quan trọng toàn cầu và đó có thể sẽ là mô hình quản lý bảo tồn phù hợp cho các khu bảo vệ trên toàn lãnh thổ Việt Nam.

1. Introduction

1.1 Conservation in Vietnam

The Socialist Republic of Vietnam is a relatively narrow strip, running north-south along the eastern coast of the Indochinese Peninsula. The population of Vietnam is approximately 85 million (CIA Sourcebook 2008). Vietnam is currently undergoing an economic transition towards

a more market-oriented economy. The country's annual per capita gross national product (GNP) has been growing rapidly for the past decade. Economic growth, infrastructure development, population growth, protracted wars, and the development of agriculture, forestry and fishing industries, have resulted in over-exploitation of Vietnam's natural resources. The environment in Vietnam has largely been compromised: gross deforestation has been accompanied by degradation of arable land; soil erosion; destruction of water catchments; diminished groundwater sources; siltation and ecological degradation of coastal and submerged areas; and a loss of overall biodiversity within Vietnam.

Due to a rapidly expanding population and an economic growth rate which has now reached over 8%, there is increasing pressure on land and resources in Vietnam. The national conservation movement now faces its greatest challenge yet: conserving biodiversity in the face of these mounting pressures. Forest is being lost due to the agricultural needs of the rural poor, whilst high value timber trees are now targeted wherever they occur, to manufacture high quality furniture for the expanding rich middle class. A concurrent trend has been the equally rapid commercialisation and expansion of wildlife trade, facilitated by an increasingly efficient transport and communications network and driven by new found wealth and a growing demand for wildlife products (WCS/FPD 2008).

The government of Vietnam recognised the need for conserving and rehabilitating the natural environment at the end of the 1970s. However, it was not until the 1990s that the conservation emphasis moved towards protecting endangered habitats and species. Vietnam's forests are divided into three categories, of which nature reserves fall under the designation Special-use Forests (Protected Areas) and are managed by the Ministry of Agriculture and Rural Development (MARD). A countrywide analysis of protected area coverage conducted by the BirdLife International Vietnam Programme and the Forest Inventory and Planning Institute of MARD, was published in 1999 as a response to the government's strategy to expand the Special-use Forest system from one million to two million hectares (Wege *et al.* 1999). As a result of achievement of this policy goal, the Vietnamese government considers their protected area system complete, and BHH NR is likely to be last protected area designated in Vietnam.

1.2 The Annamese Lowlands Endemic Bird Area

Initial surveys conducted by BirdLife International identified 218 centres of bird endemism world-wide, termed Endemic Bird Areas (EBAs) (Stattersfield *et al.* 1998). EBAs are areas which support at least two restricted-range bird species (species with a global range of less than 50,000 km²), and are considered to be priority areas for conservation (Stattersfield *et al.* 1998). Three EBAs were initially identified in Vietnam: the Southern Vietnamese Lowlands, the Da Lat Plateau, and the Annamese Lowlands.

The Annamese Lowlands EBA covers the level lowlands and foothills of north-central Vietnam (in southern Ninh Binh, Thanh Hoa, Nghe Anh, Ha Tinh, Quang Binh, Quang Tri and Thu Thien Hue provinces) and part of adjacent central Laos, up to an elevation of 1,000 m. As such, much of the forest at BHH NR falls into this IBA. The natural vegetation of this EBA, is tropical lowland evergreen and semi-evergreen rain forest below c.1,000 m. This adjoins tropical mid-montane rain forest above this altitude. Habitat loss in this EBA has been severe, the coastal

lowlands have been almost entirely deforested since 1945, and the forest in the foothills is now highly fragmented and degraded, with few substantial areas of good quality forest remaining (Statterfield *et al.* 1998).

The EBA was defined by the ranges of nine species, although of these, one is now considered a hybrid taxon (Imperial Pheasant *Lophura imperialis*) and another (Annam Partridge *Arborophila merlini*), is now regarded by BirdLife International as a subspecies of the more widespread Chestnut-necklaced Partridge *Arborophila chaltonii*. Of the remaining seven species, the range of Crested Argus *Reinardia ocellata* also extends upwards into montane forest, and White-cheeked Laughingthrush *Garrulax vassali* is principally a lower montane species of only marginal occurrence in this EBA. Sooty Babbler *Stachyris herberti* is a localised species with a distribution confined to forest on limestone outcrops. The Annamese Lowlands also support a number of widespread Near Threatened species, such as Red-collared Woodpecker *Picus rabieri* and Blyth's Kingfisher *Alcedo hercules*.

Deforestation in this EBA has been intense; the only remaining good quality lowland forest is in small valleys and on the lower slopes of the hills. Causes of deforestation in the past include clearance for agriculture to feed a rapidly increasing population, warfare and logging. The remaining forests are subject to commercial logging, further clearance for permanent agriculture and settlements and degradation as a result of fuelwood collection, shifting agriculture and fire (Collins *et al.* 1991, Eames *et al.* 1992).

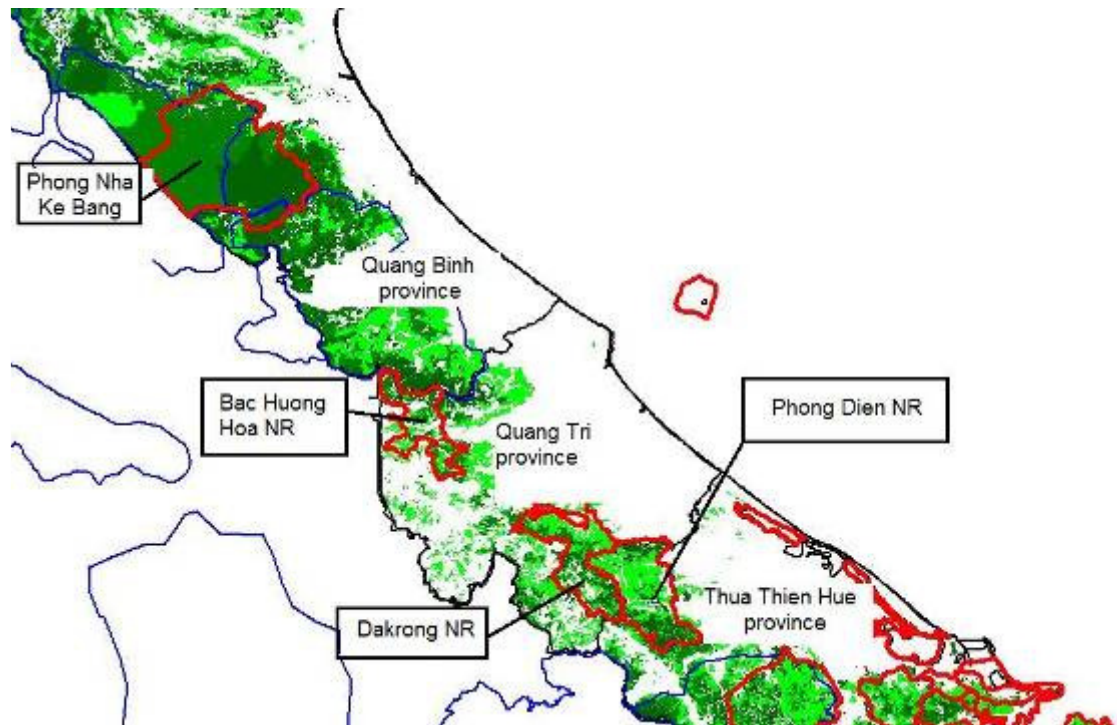
There are 13 protected areas in the Annamese Lowlands EBA in Vietnam, which protect blocks of forest along the eastern edge of the Annamite Range and the coastal lowlands. Approximately 50 kilometres to the south of Bac Huong Hoa are the Dakrong and Phong Dien nature reserves, which support 40,526 and 41,548 hectares respectively. Nearly 70 kilometres to the north, Phong Nha Ke Bang protects 85,745 hectares of lowland broad-leaf evergreen and limestone karst forest. Together with adjacent forest in Quang Binh Province, the forests of Bac Huong Hoa constituted the largest area of unprotected lowland evergreen forest in the Central Annamites Landscape. As such, its addition to the protected area network represents an important contribution to conservation in the region.

2. Characteristics of Bac Huong Hoa Nature Reserve

2.1 Location

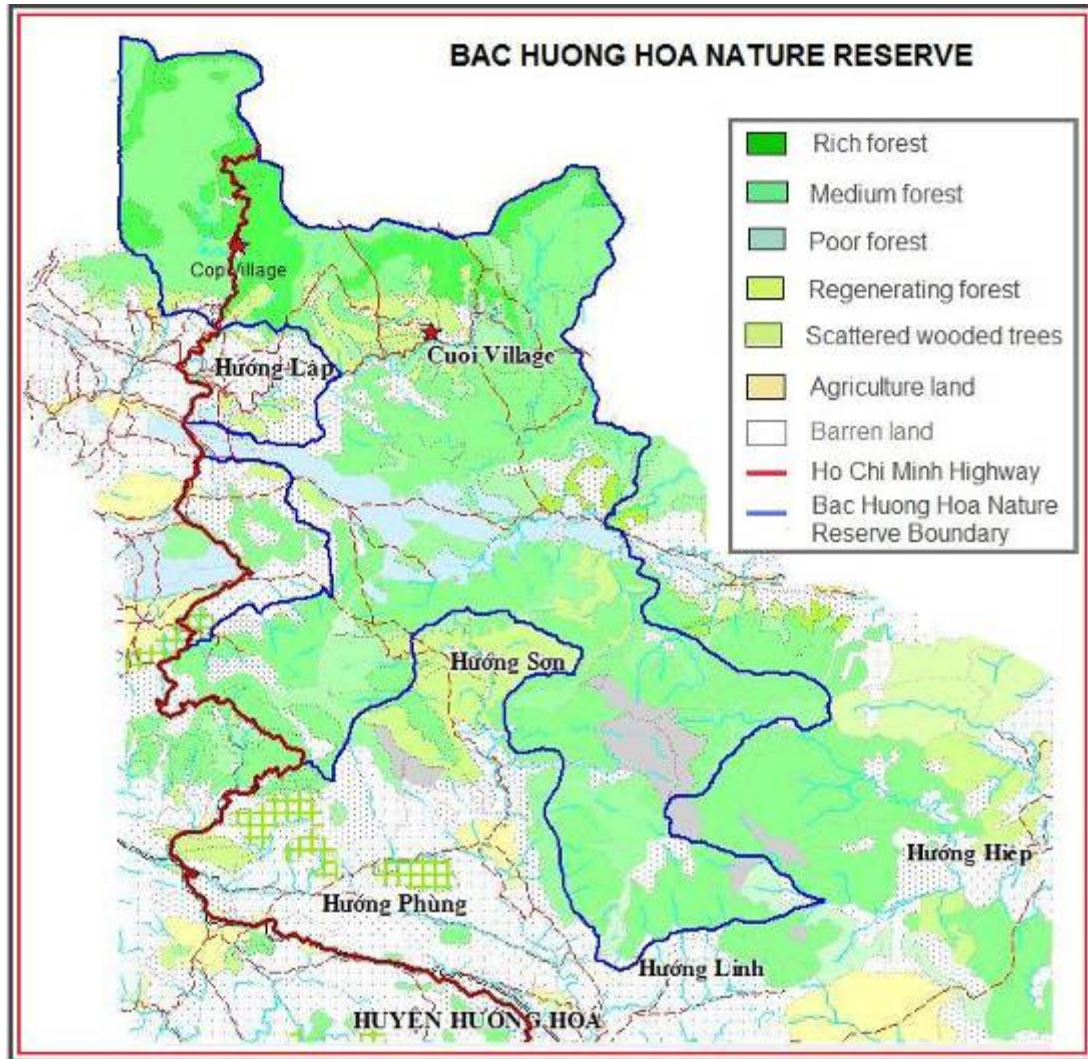
Bac Huong Hoa Nature Reserve encompasses an area of lowland and mid-montane evergreen forest in central Vietnam, adjacent to the international border with Laos (Map 1.). It covers 25,200 hectares, including 20,646.2 hectares of natural forest. It is located in the north of Huong Hoa District, Quang Tri Province, 50 km north-west of Khe San town, and 120 km west of Dong Hai town. The nature reserve is bisected by the Ho Chi Minh Highway. It encompasses the territory of five communes, namely Huong Linh, Huong Son, Huong Phung, Huong Viet and Huong Lap (Map 2). To the north, it is bordered by Quang Binh Province and to the east it is bordered by three districts, Vinh Linh, Gio Linh and Dakrong. The nature reserve is bounded by the coordinates 16043'22'' to 16059'55'' N and 106033'00'' to 106047'03''E. Within the boundary of BHH NR, there are two villages with c. 30 households, of which 12 households

belong to Cuoi village and 18 households belong to Cop village. Both villages are in the Huong Lap Commune.



Map 1. The location of Bac Huong Hoa Nature Reserve.

Note: Darkness of green indicates richness of forest. Areas enclosed in red are protected areas.



Map 2. Bac Huong Hoa Nature Reserve (Quang Chi FPD)

2.2 Demographics

The residents of Cop and Cui villages are an indigenous ethnic minority group, the Van Kieu. They have a low economic status, 83% of households in the nature reserve are classified as poor and the remainder rank as average. The Van Kieu in the nature reserve have three main sources of income, namely: cattle, small-scale agriculture and forest resource exploitation. On average, these people obtain 40% of their income from exploitation of forest resources and this percentage is increasing due to the activities of wildlife traders.

2.3 Biogeographical location

The nature reserve is just beyond the northern limit of Priority Landscape CA1, of the Greater Truong Son Landscape (Tordoff *et al.* 2003). However, it is included in the Central Annamites Landscape, which is bounded by the coordinates 14°00' to 17°30'N and 106°00' to 109°00'E and the Greater Annamite Ecoregion (Baltzer *et al.* 2001). Biogeographically, this region is

characterized by a species community typical of the Central Annamite chain. BHH NR is also situated in the Annamese Lowlands EBA (Stattersfield *et al.* 1998), since it supports a number of the restricted-range bird species which characterise the EBA.

BHH NR forms the southernmost part of the Truong Son IBA (Tordoff *et al.* 2002). This IBA, and the forests of BHH, support a fauna typical of the Annamese lowlands. The site qualified as an IBA under criteria A1, due to the presence of globally threatened species (at the time of assessment a number of species found in the nature reserve, such as Crested Argus, were considered globally threatened); A2, due to the presence of restricted-range species; and A3, due to the presence of biome restricted species. It is also a Key Biodiversity Area (KBA), part of a globally important network of sites for conservation, due to the presence of Saola *Pseudoryx nghetinhensis* and Edwards's Pheasant *Lophura edwardsi*.

BHH NR also lies within the Indo-Burma Biodiversity Hotspot (Djik *et al.* 1999). This large designation covers all of the Indochinese subregion, including the Central Annamites and the Annamese lowlands.

2.4 History of Bac Huong Hoa Nature Reserve

Following the first field surveys in the region, BirdLife designated the forests of Bac Huong Hoa as an IBA, recognising the global importance of the area (Tordoff *et al.* 2002). BirdLife has continued its interest in and commitment to the forests of Bac Huong Hoa, through two MacArthur Foundation funded projects. The first of these projects conducted biodiversity surveys in the area and established two Site Support Groups (SSGs) in Bac Huong Hoa, in Cup and Cuoi villages. These were established in August 2004 with the purpose of monitoring populations of key bird and mammal species and increasing law enforcement. The second project (of which this report forms a part) aimed to consolidate BirdLife's involvement in the area through the designation of a nature reserve, continued support to SSGs and promotion of synergies with other relevant local stakeholders, to facilitate more effective forest protection.

BirdLife was successful in its efforts to establish a nature reserve in Bac Huong Hoa. The proposal for the establishment of Bac Huong Hoa Nature Reserve was prepared by Quang Tri Forest Protection Department (FPD), with technical assistance from BirdLife and was appraised by the Ministry of Agriculture and Rural Development (MARD). On 14th March 2007, Quang Tri Provincial People's Committee issued Decision no. 479/QD-UBND, approving the Investment Plan for Bac Huong Hoa Nature Reserve. The Investment Plan for the nature reserve was appraised by Quang Tri Provincial People Committee.

2.5 History of Biological Research

BHH NR has received limited contemporary biological research. The first surveys in modern times were conducted by Le Manh Hung *et al.* (2002) in July 2002, for BirdLife International Vietnam Programme, as part of the DANIDA funded project entitled: "Improved conservation planning through institutional strengthening in Cambodia, Laos and Vietnam". The primary aim of this seven day rapid field survey was to assess whether forests in Huong Hoa district qualified

as an Important Bird Area (IBA). This survey used interviews and opportunistic fieldwork to investigate the occurrence of IBA trigger species.

Recognising the importance of the forests of BHH, a second week long survey was conducted in February 2004, focussing on the most intact areas of forest, those close to Khe Cuoi and Ban Cup villages (Le Manh Hung *et al.* 2004 and Dan Ngoc Can 2004). The aim of this survey was to create a more complete inventory of the bird and mammal species of the forests of Bac Huong Hoa and to collect status and distribution data on globally and nationally threatened species.

In April and May 2004, experts from IEBR conducted herpetological surveys in the forests of Bac Huong Hoa, again focussing survey effort on the well forested areas close to Khe Cuoi and Ban Cup villages. These surveys recorded 61 species of reptile and amphibian, including one frog species *Philautus truongsensis*, which they described as new to science (Orlov and Ho Thu Cuc 2005). This remains the most comprehensive herpetological survey of the forests of Bac Huong Hoa but the results were not widely published.

Le Trong Trai conducted biodiversity surveys in Bac Huong Hoa in mid 2005 in preparation for the creation of an investment plan for BHH NR. The results of this survey were published in the investment plan for the nature reserve (Anon 2005). During this survey, a number of additional species were recorded for the first time and includes the only comprehensive plant survey of the area. Although this survey focused on only one relatively small area close to Cup village, 920 plant species were recorded. As part of the 2005 surveys, Jeremy Holden conducted one month of camera trapping with nine cameras in the forests of Bac Huong Hoa (Holden 2005). However, no mammals or birds were recorded (Le Trong Trai pers. com.), although this may in part have been because ideal locations for cameras were all already taken by snare traps set by hunters.

In 2006 a rapid survey of reptiles and amphibians in Quang Tri Province was conducted, which included a short survey in the forests of Bac Huong Hoa (Cao Tien Trung *in prep.*). A wildlife trade survey was conducted in 2006 in 10 villages and three towns in or close to BHH NR (Dang Ngoc Can *et al.* 2006). This survey recorded a small number of mammal species not previously reported from the nature reserve.

Since the establishment of the nature reserve, monitoring of key mammal and bird species has been conducted by Site Support Groups (SSGs) set up by BirdLife. Monitoring by these groups has yielded data on most of the key species through a series of short surveys in 2004 and 2005. However, the quality of the data is variable and difficult to quantify (Wilkinson and Nguyen Thanh Van 2006); apparent trends in populations are equally likely to relate to trends in observer skills or behavior.

BHH NR has been visited briefly by other ornithologists on a number of occasions, for instance, Andrew Tordoff visited in January 2005, Nicolas Wilkinson in 2006 and Jonathan C. Eames and Simon Mahood in May 2008. Unpublished incidental observations made during their visits have been incorporated into this report.

No data on fish, small mammals, bats or invertebrates have ever been recorded in BHH NR.

2.6 Physical characteristics of Bac Huong Hoa Nature Reserve

2.6.1 Topography

BHH NR encompasses low lying land to the south of the northern section of the Annamite Range, and a ridge of 1,000 m which runs in a northwest-southeast direction along the boundary between the provinces of Quang Binh and Quang Tri (Anon 2005). The forest on the Quang Binh side of this ridge is dominated by low lying areas with slopes of 15 to 25 degrees, although there are some steeper areas. On the other side of the ridge in BHH NR, low-lying land and a number of limestone peaks are present, such as Sa Mu Cave at 1,550 m and Lying-down Elephant Mountain, so named due to its shape, at 1,771 m. Although predominately low in elevation, the land is hilly and slopes are steep. Another limestone ridge runs in a west-east direction, on the boundary between Huong Lap and Huong Viet communes and near the center of Huong Viet Commune and a further runs in a south-north direction.

2.6.2 Soils

BHH NR is characterised by the following soil types (taken from Anon 2005):

- On hills and low mountains there is yellow-brown feralite. This soil is composed of broken down rock, in particular mica-schist, which gives it a silky texture.
- Other hills are dominated by a yellowish feralite soil. It is similar to yellow-brown feralite but has a higher sand content and consequently a coarse texture.
- On small and medium-sized mountains there is red-yellow humus feralite. Like yellow-brown feralite, this soil has a silky texture but contains more organic matter.
- Riverine areas are characterized by alluvial deposits.

2.6.3 Hydrology

Rivers in BHH NR are mostly short and relatively steep. They flow from the Central Annamites to the South China Sea in an east or northeast direction. The following are the main rivers of the area:

- The Ben Hai river is located in the northeast of BHH NR from where it flows into the sea at the Cua Tung estuary. All streams which have their origins in the eastern side of the nature reserve flow into the Ben Hai river.
- In the north-east and south of the nature reserve is the Xe Pang Hieng river. It flows into Laos and down to the Mekong river.
- The Cam Lo river has its source on the northern slope of Lying-down Elephant Mountain. It flows into the sea at the Cua Viet estuary;
- The Rao Quan river flows from the southern part of the nature reserve out to the Thach Han river (Anon 2005). A hydropower plant is being constructed on the Rao Quan river.

2.6.4 Meteorology

BHH NR is located in a region with a tropical monsoon climate (Anon 2005). It is hot in summer and cooler in winter. Since the central Annamite range which runs along the western edge of BHH NR is relatively high and orientated almost perpendicular to the north-east and south-west

monsoons, the nature reserve receives a considerable amount of rain. There are rains in summer and autumn-winter; the dryer period lasts only 2-3 months. Most rain falls during August, September and October. The nature reserve also receives the “Phon”, a warm dry wind originating in Laos, during the months of March-June.

Temperature

The average annual temperature is 24-25°C, however monthly temperature variation is considerable. December and January are the coolest months when temperatures drop to 20 and sometimes as low as 15 in areas above 500 m. In contrast, in June and July temperatures average 29 and regularly reach 39 when the Phon is blowing.

Sunshine

There are on average 4.5 hours of sunshine per day. July is the sunniest month, with an average of 6.7 hours per day, and February is the cloudiest, with an average of 2.3 hours of sunshine each day.

Rainfall

Annual rainfall totals for BHH NR are between 2400 and 2800 mm. There are two main rainy seasons, the first lasts from August to November and accounts for nearly 50% of the annual rainfall. The second rainy season lasts from April to August and is characterised by less heavy rain. Between February and March there is light rain and December to January is the driest period.

High levels of rainfall on unstable slopes lead to frequent landslides in BHH NR, particularly along the Ho Chi Minh Highway. Low lying areas also receive occasional partial flooding.

Humidity

In the context of humidity, there are two seasons. The humid season lasts from August to May, during these months the humidity is 85-90%. In June and July the Phon causes the humidity to decrease, sometimes to less than 30%.

2.7 Threats to Bac Huong Hoa Nature Reserve

Although BHH NR has a small human population, the newly established protected area faces a number of threats. Some of the problems the reserve faces originate from the residents of the nature reserve, but the majority, and the most severe, are presented by people from outside of the nature reserve (Le Manh Hung *et al. in prep.*). The construction of the Ho Chi Minh Highway through the nature reserve has facilitated a rapid increase in negative pressures acting on BHH NR. The road enables illegally extracted forest products, including timber and wildlife, to be rapidly transported to towns such as Khe San.

Hunting

Hunting is probably the most significant threat to the biological integrity of BHH NR. Circumstantial evidence indicates that hunting has intensified in recent years, probably following the construction of the Ho Chi Minh Highway but also as part of a nationwide trend which has seen the wildlife trade network become increasingly commercial. Local residents have always

hunted forest animals in BHH for their subsistence needs. However, rapid commercialisation of the wildlife trade has brought large economic incentives for exploiting wildlife and has encouraged teams of professional hunters to exploit the wildlife of the nature reserve (Dang Ngoc Can *et al.* 2006).

Since the reduction in the number of guns in the BHH NR area, most hunting is done with wire snare traps (Le Manh Hung *et al. in prep.*). Hunters construct low fences of brush wood with gaps at five metre intervals in which they place wire snare traps made of bicycle brake cable. These catch any animals that attempts to pass through the gaps in the fence. Trap lines can be over one kilometre in length and contain hundreds of traps. They are placed on ridgelines or up the side of hills to block the passage of animals. Traps are also placed on paths leading to streams.

There are three types of hunters in BHH NR, professional, semi-professional and opportunistic. Professional hunters obtain all of their income from hunting. In BHH NR, professional hunters come from outside the nature reserve, often from Quang Binh Province. They operate in teams and have huge numbers of traps in the forest. All of the animals they catch are either caged or processed in the forest and the then sold directly to traders in towns such as Khe San, either for local consumption or for transport to other provinces.

Semi-professional hunters obtain only part of their income from hunting. They usually also farm rice, cassava or corn, and also harvest NTFPs. During the rainy season when their crops require less attention, they hunt animals in the forest, which they sell into the wildlife trade. Semi-professional hunters don't usually have direct connections with traders in towns, instead they sell the animals they catch to middlemen, who collect the animals from villages and sell them on to traders in towns such as Khe San. Nearly half of the households in the villages in BHH NR have at least one semi-professional hunter (Dang Ngoc Can *et al.* 2006).

Opportunistic hunters are people who work in the fields or forest where they collect NTFPs or take part in farming. When they encounter an animal that is easily caught, such as a pangolin or a turtle, they catch it and sell it on to the middlemen who visit their village (Dang Ngoc Can *et al.* 2006).

Although evidence is patchy, it appears that the hunting intensity in BHH NR is very high. In 2005, when selecting sites for camera trapping, all suitable sites were already taken by snare traps (Holden 2005). During that time, trap lines were found on all ridgelines in the Cha Ly area. In September 2006, members of the Cuoi SSG reported that three groups of professional hunters from Le Thuy and Bo Trach districts, Quang Binh Province, were operating in the forest area close to the village. One group of four men operated in Khe Ta Nia where they had about 1,500 traps, another group of six men operated in Khe Tan Nap with about 2,000 traps, and another group of four men operated in Khe Xa Gi with about 2,000 traps. In addition, residents of Tria village reported that three or four groups of professional hunters, also from Quang Binh Province, were operating in their area with thousands of traps (Dang Ngoc Can *et al.* 2006).

It is highly likely that hunting is causing the rapid decline of mammals and terrestrial birds in BHH NR. The effects of hunting on populations of threatened and priority species is difficult to quantify, because their abundance in the nature reserve has always been poorly known. Such

intense hunting activity is likely to lead to significant reductions in the populations of hunted species, as it has in other protected areas in Vietnam. Incidental trapping of species such as Edwards's Pheasant will continue even when they have very low population sizes, because trapping is indiscriminate and setting traps for commoner species such as Silver Pheasant *Lophura nycthemera* will still be economically viable (BirdLife International 2001).

Logging

The forests of BHH NR were selectively logged after 1975 and some selective logging continues in BHH NR. For instance, in November 2007 three groups of men from Quang Binh Province stayed for one month in Cup village to log timber and sell it to villagers and people from outside the area. Selective logging is likely to continue to pose a significant threat to the continued existence of some species which require large trees for nesting (e.g. Austen's Brown Hornbill), or feeding (e.g. Red-collared Woodpecker). Additionally, logging roads constructed along rivers have caused considerable damage to riparian vegetation.

Gold mining

Deep pits in the forest, particularly to the north and west of Cuoi village, are clear evidence of gold mining activities (Le Manh Hung *et al.* 2002 and 2004). Chemical washing of the soil to extract the gold has led to severe contamination in the streams in this area (Le Manh Hung *et al. in prep.*). Additionally, gold miners hunt animals with guns and snares, leading to local population declines of many species, particularly large and obvious mammals.

Rattan exploitation

Rattan collection has been intense in the forests around Cuoi village between 2000 and 2005 (Le Manh Hung *et al. in prep.*). Since then rattan supplies have been exhausted and rattan collection has declined. Rattan collectors usually also set snares in the area in which they are operating, to provide meat for food. This extra pressure on terrestrial animal populations is likely to have caused them to decline.

Fragrant oil extraction

A few species of *Cinnamomum* tree produce fragrant oil with many commercial uses. This oil commands a high price and is therefore extracted from trees in the forest by well organised groups. Oil is found in all woody parts of the trees but the highest concentrations are in the roots. Consequently, the entire tree is felled, typically using a chainsaw and the roots are dug up. The woody parts are distilled in large pots which require constant heating. In similar locations, up to 20 medium-sized trees have been felled daily to feed the fires which heat the pot and teams have operated in the same area for up to one month (Eames *et al.* 1994). In BHH NR, most fragrant oil extraction now takes place in remote forested areas, such as east of Cuoi village (Le Manh Hung *et al. in prep.*). Groups of up to thirty people originating from Quang Binh and Ha Tinh provinces have been recorded in BHH NR collecting fragrant oil. The felling of trees for fuel and hunting to feed the large teams required for this activity are likely to be significantly negatively affecting the biological integrity of BHH NR.

Iron collection

The forests of the Central Annamites still contain a large quantity of iron from the American War. The opening of the Ho Chi Minh Highway has facilitated the easy transport of iron to Khe San. Many young people from the villages in the nature reserve, particularly from villages along

the Ho Chi Minh Highway, regularly go to the forest to collect iron. Of greater concern is that professional iron collectors from outside the local area have moved in to exploit the iron (Le Manh Hung *et al. in prep.*). These people first clear the forest by burning, to make finding and collecting the iron easier, causing severe environmental degradation.

Destructive fishing methods

Fishing for subsistence use is common in BHH NR. Most fishing is conducted with nets but people also catch fish using mines and other explosives. This is not only dangerous (one child in Cuoi village lost a hand from fishing with mines in 2001) but is also damaging to aquatic life (Le Manh Hung *et al. in prep.*).

Deforestation

Approximately 15% of BHH NR had already been completely cleared before the nature reserve was established. Forest loss continues at a gradual rate and is likely to further reduce the area of forest of high conservation value in the nature reserve, particularly close to new settlements along the Ho Chi Minh Highway. The effects of defoliant spraying and bombing can be seen clearly in satellite images of central highland provinces taken in 1969. However, such areas are not diagnosably different from surrounding land in recent satellite images and it is not conclusive as to whether or not the present forest conditions can be attributed to the use of defoliants. There are a number of factors that may have influenced how present forest cover is affected by past defoliant use, including: the number of times the area was sprayed; what kind of defoliant was used; whether or not the area was also bombed or napalmed; the topography; the relative susceptibility of the forest community to the defoliants; and, perhaps most importantly, how the defoliated area was subsequently used by people (Koy *et al.* 2006).

2.8 Habitat types at Bac Huong Hoa Nature Reserves

The original vegetation cover of BHH NR is evergreen forest. Below 600 m the land supports tropical lowland evergreen forest and above 600 m the forest is classified as subtropical mid-montane evergreen forest. Almost 85% of the nature reserve still retains natural forest cover, of various degrees of quality (Table 1.). Quality in this analysis refers to a classification based on timber yield. All forest in BHH NR has been affected to some degree by logging, shifting cultivation and wars, especially through the use of chemical defoliants.

Table 1. Land cover of BHH NR

Land cover	Area (ha)	Proportion (%)
High quality evergreen forest	1,923	8
Medium quality evergreen forest	14,158	56
Poor quality evergreen forest	983	4
Regenerating forest	2,268	9
Bamboo forest	3	0.01
Limestone karst forest	1,311	5
Natural forest (all types)	20,646	82
Land with scattered trees	2,224	9

Land cover	Area (ha)	Proportion (%)
Grass and scrub	861	3
Rocky mountains without forest	889	4
Other land uses*	580	2
Total area	25,200	100

*Other land uses includes agriculture, residential and water bodies

2.8.1 High quality forest

Although there is no primary forest in BHH NR, forest with a structure unaltered since 1975 is classified as rich forest and is broadly analogous to primary lowland forest in terms of species composition and structure. This forest type makes up less than 10% of BHH NR. It is distributed in the north of the nature reserve in two blocks situated close to Cup and Cuoi villages, close to the Ho Chi Minh Highway.

Tropical lowland evergreen forest

Below 600 m on soils with a low sand content, tropical lowland evergreen forest supports a diverse flora composed of broadleaf evergreen trees with large crowns and thick trunks. Trees in this habitat are from the families Meliaceae, Sapindaceae, Burceraceae, Eleocarpaceae, Myrtaceae, Ebenaceae, Annonaceae, Fabaceae, Fagaceae, Euphorbiaceae, Lauraceae, Simplicaceae, Sterculiaceae, Apocynaceae, Flacoutiaceae, Araliaceae, Rubiaceae and Moraceae. These forests support many large lianas, some up to 30 metres long and 10 cm in diameter. These are typically of the families Apocynaceae, Annonaceae, Fabaceae, Vitaceae, Aslepiadaceae and Arecaceae. Under the forest canopy small trees and bushes of the families Rubiaceae, Acanthaceae, Melastomataceae, Araliaceae, Arecaceae and Cyatheaceae are found. On the forest floor there are ferns from the families Polypodyophyta, Araceae, Urticaceae, Pandanaceae, Maranthaceae, Zingiberaceae, Commelinaceae and Myrsinaceae; and in light gaps flowers from the families Rubiaceae, Poaceae, Asteraceae and Begoniaceae grow. The layers in this forest type in BHH NR are detailed below:

Emergent layer: This layer is characterised by large trees which can reach a height of 30 metres, although they are typically no more than 20-25 metres. Trees in this layer exhibit diameters of 40-80 cm, although some reach up to 120 cm. However, these large trees are relatively scarce and despite their size, this layer accounts for just 15-20% of the total area. Typical species on this layer are: *Canarium subulatum*, *Canarium album*, and trees from the family Burceraceae.

Canopy layer: The canopy layer is dominated by trees of 10-15 metres. These trees are relatively uniform in height; they have round canopies and trunks of 30-40 cm in diameter. There is high species diversity in this layer and depending on location; the dominant families may be: Fagaceae, Lauraceae, Fabaceae, Meliaceae or Sapindaceae.

Mid-story: This layer is dominated by small tree species of 7-10 m in height, and young specimens from the canopy and emergent layers. Typically, species are of the families Apocynaceae, Rubiaceae, Lauraceae, Euphorbiaceae, Myrtaceae, Araliaceae, Moraceae, Sapindaceae, Eleocarpaceae, Fagaceae, Flacourtiaceae, Annonaceae, Meliaceae, Rutaceae,

Ebenaceae, Fabaceae, Simplicaceae and Myristicaceae. In moist valleys, trees from the families Cyathea, Ficus, Moraceae, Actinidiaceae, Dillenia and Dilleniaceae are found.

Understory: This layer is composed of small shrubs and saplings of taller species below five metres in height. These species are predominantly shade tolerant species, or species which require shady conditions. Typical species are from the families Melastomataceae, Acanthaceae, Rubiaceae and Arecaceae.

Ground flora: This layer is composed of ferns and herbaceous plants, typically of the families Polypodiophyta, Araceae, Zingiberaceae, Maranthaceae, Urticaceae, Commelinaceae and Poaceae. High quality forest is relatively stable in structure and very little light reaches the forest floor. As a consequence, this layer is relatively sparse and ground flora is mainly found in areas where light can reach the forest floor, such as at the edge of streams.

Evergreen forest on limestone karst.

On limestone karst, vegetation cover is distinctly different to that growing on soils. There is only a very thin soil layer on these hills and although the forest it supports still exhibits the same five layers, it has a more open canopy and trees are shorter in stature. Typically, the forest is dominated by trees of 10-15 metres in height and 50 cm in diameter. Karst vegetation is dominated by species which can tolerate dry soil conditions and species which can grow on bare rock. Typical tree species and families are: Pterospermum, Sterculiaceae, Syzygium, Myrtaceae, Diospyros, Ebenaceae, Garcinia, Guttiferae, Spondias, Allospondias, Choerospondias, Semecarpus, Anacardiaceae, Vitex, Verbenaceae, Ulmaceae, Celtis, Tiliaceae, Sonneratiaceae, Caryota, Arecaceae, Rhapis, *Duabanga sonneratoides* and *Caryota bacsensis*. On limestone karst, lianas are represented by individuals from the families Araceae, Urticaceae and Piperaceae, and the species: *Dendrocnide urentissima*, *Laportea interrupta* and *Laportea thorelli*. On bare limestone cliffs *Ficus* grow and in more humid places than or with? *Schefflera* and *Araliaceae* species.

Mid-montane evergreen forest

This is the natural vegetation cover on land above 600 m, on soil with a low sand content. It has a variable forest structure dependant on the angle of slope. In valleys or flat land it has the same five 5 layer structure as lowland evergreen forest, on steep slopes and ridges there are no emergents and therefore has only four layers. On high mountain tops where the soil layer is thin and there is strong sunlight and winds, plant diversity is low and the community is dominated by species which can tolerate these harsh conditions. In these areas the forest only has three layers and is dominated by the family Poaceae and the species *Miscanthus floridulus*, *Thysanoloena maxima* and *Sinarundinaria griffithiana*. In areas with less harsh conditions, members of the family Fagaceae account for up to 60% of the population and trees like *Podocarpus neriifolius*, *Dacrycarpus imbricatus*, *Podocarpus pilgeri* are found. Other families strongly represented in this vegetation type are species from the families Aceraceae, Engelhardtia, Juglandaceae, Hamamelidaceae and Theaceae, as well as the species *Symingtonia populnea*, *Sinarundinaria griffithiana*, *Michelia faveolata*, *Paramichella baillonii*, *Madhuca pasquieri* and *Paphiopedilum amabile*.

2.8.2 Medium quality forest

Just over half of BHH NR is covered in medium quality forest. Lowland evergreen forest and mid-montane evergreen forest habitats in BHH NR have been strongly and negatively affected by people. Lowland evergreen forest has been extensively logged for high value timber and because it occupies the most productive agricultural land, it has also been cleared for shifting cultivation. Mid-montane evergreen forest has also experienced some selective logging and in common with lowland forest, it was affected by aerial spraying of chemical defoliants during the American War. Faunal and floral diversity of medium quality forest is considerably lower than that of high quality forest types.

Secondary forest following shifting cultivation

This is the dominant forest type on land below 600 m. In Bac Huong Hoa, short stature secondary forest develops 8-10 years after shifting cultivation. The plant composition, structure and appearance of this forest type, are completely different from primary forest. There are very few lianas in secondary forest, fern diversity is low and orchids and arboreal ferns are typically absent. It is generally very dense and chaotic in structure, with no defined layers; however, the following four layers can sometimes be defined.

Upper canopy layer: This layer is characterised by light-demanding tree species which have grown up from stumps or from the seed bank, following a cessation of farming activities. These trees typically have a height of 8-10 m and a diameter of between 10 and 15 cm. Typically, species from the families Litsea, Machilus, Lindera, Lauraceae, Euphorbiaceae, Rutaceae, Ulmaceae, Fabaceae, Moraceae, Sapindaceae, Anacardiaceae and the genera *Macaranga*, *Mallotus*, *Sapium*, *Bridelia*, *Canarium*, and *Ficus* are found; as well as the species *Endospermum sinensis*, *Euodia melifolia*, *Acronychia pedunculata*, *Gironniera subaequalis*, *Trema orientalis* and *Centis sinensis*.

Lower canopy layer: This layer is characterised by smaller trees, often similar to those in the upper canopy layer, and shrubs with a height of 5-7 metres. The families most often recorded in this layer are Rubiaceae, (especially *Camellia* spp. and *Eugenia* spp), Theaceae (especially *Grewia* spp.) and Tilliaceae.

Mid-story: This layer consists of small trees and shrubs. Typically, species from this layer include representatives from the families Melastomataceae, Rubiaceae, Verbenaceae and Arecaceae and in particular, *Rapis excelsa*.

Understory: This layer is usually composed of ferns and grasses from the families Zingiberaceae and Araceae. In areas where light penetrates to the ground, members of the family Poaceae are often found and members of the Rubiaceae, Hydeotis and Acanthaceae families occur in humid places.

2.8.3 Low quality forest and non-forest habitats

Bamboo forest

At elevations of 700-1200 m, degraded land is colonised by the large bamboo species *Arundinaria peteloti*. It reaches 3-5 metres in height and grows in dense stands. Interspersed with

the bamboo are small trees from the families Fagaceae, Theaceae, Styraceae, Aquifoliaceae, Eleocarpaceae, Magnoliaceae and Aeraceae.

Scrub and grassland

BHH NR has fairly extensive tracts of anthropogenic scrub and grassland, both below and above 600m. There are four main reasons behind the formation of scrubland, namely: shifting cultivation, forest fires, spraying of chemical defoliants and the use of land by armies for bases during the American War. Structure and species composition of the habitat is determined by the reason for the loss of original forest cover and the land use since.

Dense scrub

On land which received heavy spraying with chemical defoliants and subsequent repeated burning, scrub usually reaches less than 1.5 metres in height. This habitat is usually dominated by stunted individuals of a small number of species normally found in dry or poor soil areas. Typically, these species are of the family Poaceae, and include *Misclanthus floridulus*, *Thysanolaena maxima*, *Imperata cylindrical* and *Imperata conferta*. Other species from the families Fagaceae, Juglandaceae, Theaceae, Aquifoliaceae, Lauraceae and Eleocarpaceae are sometimes found.

Light scrubby grassland

This habitat has a predictable structure consisting of grass 1-2 metres high, with shrubs and small trees of 5-8 metres high scattered throughout. Grass cover typically reaches 70-80 %. Dominant grass species are usually of the Poaceae family, such as: *Misclanthus floridulus*, *Thysanolaena maxima*, *Saccharum spontaneum*, *Imperata cylindrical* and *Imperata conferta*.

Grazed areas

Habitat structure and species composition of this habitat is determined by grazing intensity. In lightly grazed areas, shrub diversity can be relatively high; species from the families Rubiaceae, Acanthaceae, Asteraceae, Verbenaceae and Melastomataceae are usually well represented. Grass typically reaches only 70-80 cm in height and includes members of the Paspalum family such as *Imperata cylindrical*, and various *Cymbopogon* spp., *Eragrostis* spp. *Isachne* spp. and *Sertaria* spp. In heavily grazed areas, low bushes such as *Stachytarpheta jamaicensis* and other members of the Verbenaceae and Scrophuliaceae families are found. The grasses are represented by *Digitaria* spp., *Cynodon dactylon*, *Chrysopogon aciculatus* and *Paspalum* spp.

3. Faunal and floral diversity

3.1 Floral diversity

Field surveys in BHH NR have recorded 920 plant species in 518 genera and 130 families (Appendix 1). A significant proportion of these species have economic value to local residents; 125 tree species are used for timber, 161 species are sources of traditional medicine, 44 species are used for ornamental purposes and 89 species provide food.

Of the 920 species currently recorded at BHH NR, 21 are classified as threatened at a national level and nine are threatened at a global level (Table 2.). These species are almost all threatened due to overexploitation. Most of these are trees with high value timber, such as the *Dipterocarpus*

spp., although others are exploited for other purposes. *Cinnamomum* spp. and *Aquilaria crassna* are heavily exploited for use in the perfume industry.

Table 2. Globally and nationally threatened plant species recorded in BHH NR

Scientific name	VRDB	IUCN
<i>Cephalotaxus manii</i>	VU	VU
<i>Amoora dasyclada</i>		VU
<i>Aquilaria crassna</i>	EN	CR
<i>Ardisia silvestris</i>	VU	
<i>Chukrasia tabularis</i>	VU	
<i>Cinnamomum balansae</i>	VU	EN
<i>Cinnamomum parthenoxylon</i>	CR	DD
<i>Coscinium fenestratum</i>	VU	
<i>Croton touranensis</i>	VU	VU
<i>Dalbergia entadoides</i>		DD
<i>Dipterocarpus grandiflorus</i>	VU	CR
<i>Dipterocarpus hasseltii</i>		CR
<i>Dipterocarpus kerrii</i>		CR
<i>Erythrophleum fordii</i>		EN
<i>Melientha suavis</i>	VU	
<i>Sindora tonkinensis</i>		DD
<i>Anoectochilus cetaceus</i>	EN	
<i>Dendrobium amabile</i>	EN	
<i>Dendrobium farmeri</i>	VU	
<i>Livistona tonkinensis</i>		DD
<i>Asarum balansae</i>	EN	
<i>Cirsium japonicum</i>	VU	
<i>Lithocarpus fenestratus</i>	VU	
<i>Lithocarpus haemispherica</i>	VU	
<i>Strychnos ignatii</i>	VU	
<i>Paramichelia baillonii</i>	VU	
<i>Fagerlindia depauperata</i>	VU	
<i>Madhuca pasquieri</i>	EN	

3.2 Mammal Diversity

The mammal community of BHH NR is typical of the Central Annamites. A total of 47 mammal species (not including bats) have been recorded in Bac Huong Hoa NR (Appendix 2). Of these, the presence of 29 is confirmed and 17 are only known from interview data with hunters. Confirmed records here include all species directly sighted or reliably identified through field signs or vocalisations and species recorded in the illegal wildlife trade which are known to have come from BHH NR. The species recorded include just over half of the priority mammal taxa for the Central Truong Son Landscape (Tordoff *et al.* 2003), including Saola, one of only three mammal taxa to be assigned the highest priority score by Tordoff *et al.* (2003), in their assessment of the Central Truong Son Landscape.

No attempt to survey the small mammals (e.g. Rodentia and Insectivora) or the bats (Chiroptera) of BHH NR has been made. One small mammal species, Indomalayan Leopoldamys *Leopoldamys sabanus*, was opportunistically recorded, found in a snare trap set by a hunter (Holden 2005). Additionally, subterranean tunnels thought to have been made by a mole species were seen in bare ground between Cup and Cuoi villages in May 2008 (Eames and Mahood pers. obs).

Of the 47 species reported from the nature reserve, 21 species are considered globally threatened, Near Threatened or Data Deficient (IUCN 2007) (Table 3.). This constitutes nearly half of the documented mammal fauna of the nature reserve. 26 species are considered threatened or Near Threatened at a national level (Anon 2007). Taken together, this means that over half of the mammal species of Bac Huong Hoa NR are of conservation concern.

Table 3. Nationally and globally threatened and near-threatened mammals reported from BHH NR

English name	Scientific name	VRDB	IUCN
Slow Loris	<i>Nycticebus coucang</i>	VU	
Pygmy Slow Loris	<i>Nycticebus pygmaeus</i>	VU	VU
Stump-tailed Macaque	<i>Macaca arctoides</i>	VU	VU
Northern Pig-tailed Macaque	<i>Macaca leonina</i>	VU	VU
Rhesus Monkey	<i>Macaca mulatta</i>	NT	NT
Red-shanked Douc Langur	<i>Pygathrix nemaeus</i>	EN	EN
Hatinh Langur	<i>Trachypithecus hatinhensis</i>	EN	VU
Northern White-cheeked Gibbon	<i>Nomascus leucogenis</i>	EN	DD
Black Giant Squirrel	<i>Ratufa bicolor</i>	VU	
Malayan Porcupine	<i>Hystrix brachyura</i>		VU
Annamite Striped Rabbit	<i>Nesolagus timminsi</i>	EN	DD
Sunda Pangolin	<i>Manis javanica</i>	EN	NT
Asian Golden Cat	<i>Catopuma temminckii</i>	EN	VU
Clouded Leopard	<i>Neofelis nebulosa</i>	EN	VU
Leopard	<i>Panthera pardus</i>	CR	
Binturong	<i>Arctictis binturong</i>	EN	
Dhole	<i>Cuon alpinus</i>	EN	EN
Sun Bear	<i>Helarctos malayanus</i>	EN	DD
Asian Black Bear	<i>Ursus thibetanus</i>	EN	VU
Oriental Small-clawed Otter	<i>Aonyx cinereus</i>	VU	NT
European Otter	<i>Lutra lutra</i>	VU	NT
Lesser Mouse-deer	<i>Tragulus kanchil</i>	VU	
Large-antlered Muntjac	<i>Muntiacus vuquangensis</i>	VU	DD
Sambar	<i>Cervus unicolor</i>	VU	
Gaur	<i>Bos frontalis</i>	EN	VU
Saola	<i>Pseudoryx nghetinhensis</i>	EN	CR
Chinese Serow	<i>Capricornis sumatraensis</i>	EN	VU

The following species accounts detail all records of species of conservation concern, recorded in Bac Huong Hoa NR.

Slow Loris *Nycticebus coucang*

Local residents provided credible information on the occurrence of this species in the forests of Cup and Cuoi areas (Dang Ngoc Can 2004 and 2006).

Pygmy Slow Loris *Nycticebus pygmaeus*

Local people provided credible information on the occurrence of this species in the forests of Cup and Cuoi areas (Dang Ngoc Can 2004). A caged individual said to have come from the study area was recorded by Dang Ngoc Can *et al.* (2006).

Stump-tailed Macaque *Macaca arctoides*

Based on survey results this species appears to be relatively common in Bac Huong Hoa NR. During one week of survey near Cup and Cuoi villages in February 2004 it was recorded three times: one group of about 15 individuals was observed in forest near Cuoi village (16°55'24"N, 106°39'15"E); fresh droppings were found at 870 m asl. on the top of an unnamed limestone hill near Cup village (16°55'38"N, 106°35'36"E) and near to a stream at 16°53'49"N, 106°39'04"E (Dang Ngoc Can 2004). In October 2005, surveys found three troops, one on the trail between the Ho Chi Minh Highway and the Lao border at milestone 25, consisted of about 30 individuals (Anon 2005). The other two troops, one recorded on the same trail as the large troop and the other at the upper end of Cop stream, numbered three individuals each. Caged individuals have also been recorded in villages in and close to Bac Huong Hoa NR (Dang Ngoc Can *et al.* 2006)

Northern Pig Tailed Macaque *Macaca leonina*

A caged individual in Huong Son Commune was said to have come from the study area (Dang Ngoc Can *et al.* 2006). This species has not been recorded on field surveys and is presumably scarce in the study area.

Rhesus Monkey *Macaca mulatta*

A caged individual in Huong Son Commune was said to have come from the study area (Dang Ngoc Can *et al.* 2006). This species has not been recorded on field surveys and is presumably scarce in the study area.

Red-shanked Douc Langur *Pygathrix nemaeus*

According to Site Support Group data this species is relatively common in Bac Huong Hoa NR (Wilkenson and Van 2006). During the February 2004 survey, one troop of five individuals was seen from the trail between Cup and Cuoi villages (16°55'43"N, 106°35'45"E) (Dang Ngoc Can 2004). In 2005 a troop containing three individuals was seen on the trail between the Ho Chi Minh Highway and the Laos border (Anon 2005). In 2006 one troop was seen in forest near Cuoi village. Site Support Groups recorded a troop of 30 individuals on 17th October 2004 at Doc Mang and another troop of 10 individuals at Rao Thep on 14th November 2004. In May 2008 this species was also reported by local residents from ridges at least half a day's walk from Cuoi village (Eames and Mahood unpubl.).

Hatinh Langur *Semnopethicus francoisi*

This species is associated with limestone outcrops and as such it has a localised distribution in Bac Huong Hoa NR. The subspecies in the nature reserve is *S. f. hatinhensis*, sometimes regarded as a separate species. Following information from local people, a troop of 12 individuals was found in early November 2005 (Anon 2005). Local people from Cup village report that they also occur near Tri village, where there is a small troop numbering 2 or 3 individuals, which sometimes visit gardens near to the village (Anon 2005).

Northern White-cheeked Gibbon *Nomascus leucogenis*

This species was at least formerly common in Bac Huong Hoa NR; however it may have declined in recent years. In 2008, residents of Cuoi village reported that it was only found in forest over one day's walk from the village (Eames and Mahood unpubl.) One group was heard in the forest between Cuoi and Cup in February 2004 and in November 2005 a group of three was seen near Cup village at 0670237 N, 1872190 E (Dang Ngoc Can 2004, Anon 2005). Another group was heard near to Cuoi in August 2006 (Wilkinson and Nguyen Thanh Van 2006). Local residents report that there are at least three groups near Cup, two west of the Ho Chi Minh Highway and one to the east (Anon 2005). It was also listed for Huong Hoa District by Le Manh Hung *et al.* (2002). Site Support Groups reported seeing one group of two individuals near Khe Suot in October 2004, and another with three individuals in the same area in November of the same year.

Black Giant Squirrel *Ratufa bicolor*

Hunters reported the presence of this species in Bac Huong Hoa NR (Dang Ngoc Can 2004). Two individuals were seen in forest near Cuoi in August 2006 (Wilkinson and Nguyen Thanh Van 2006). There is little information on the status of this species at Bac Huong Hoa Nature Reserve, not because it is uncommon but because it has only recently been added to the Vietnamese Red List. Consequently, little information on its status has been gathered.

Malayan Porcupine *Hystrix brachyura*

Tracks, quills and a captive individual of this species indicate its presence in Bac Huong Hoa NR (Dang Ngoc Can 2004 and 2006, Anon 2005). Its populations are probably much reduced as a result of trapping for the illegal wildlife trade.

Annamite Striped Rabbit *Nesolagus timminsi*

This poorly known species is probably common in Bac Huong Hoa NR. A team of hunters operating in the area between Cup and Cuoi reported catching four individuals in 20 days between 10th and 30th April 2005 (Dang Ngoc Can *et al.* 2006). Another hunter in Cup village reported hunting the species and it has been trapped near Cuoi village (Dang Ngoc Can 2004 and 2006). Additionally, a single Annamite Striped Rabbit was seen from the Ho Chi Minh Highway just after sunset near the Sa Mu Pass on 20 January 2005 (Tordoff pers. obs.)

Sunda Pangolin *Manis javanica*

Scales belonging to this species were found in a hunter's house in Cuoi village, Huong Lap commune (Dang Ngoc Can *et al.* 2006). Freshly-dug pangolin burrows were observed in the Cup area (16°55'39"N, 106°35'29"E) on 11 February 2004 (Dang Ngoc Can 2004). Local people report that this species occurs in the mountainous area between Cup and Cuoi villages (Dang Ngoc Can 2004).

Golden Cat *Catopuma temminckii*

Hunters from Cup village provided credible descriptions of this species, which they report is present in the forests of the area (Dang Ngoc Can 2004).

Clouded Leopard *Pardofelis nebulosa*

Hunters from Cuoi and Cup villages reported the occurrence of this species in forest near the border with Quang Binh Province (Dang Ngoc Can 2004).

Leopard *Panthera pardus*

Hunters reported that this species occurs in the area but considered it to be very rare (Dang Ngoc Can 2004). Mr. Ho Tinh from Cup village reported sighting one Leopard in November 2003 (Dang Ngoc Can 2004).

Binturong *Arctictis binturong*

Hunters reported that this species occurs in the primary evergreen forests of Huong Lap commune (Dang Ngoc Can 2004).

Dhole *Cuon alpinus*

Residents of Cup and Cuoi report the presence of this species in Bac Huong Hoa NR. Two hunters reported that one Dhole that was trapped in the Cuoi area in 2002 (Dang Ngoc Can 2004).

Sun Bear *Ursus malayanus*

Local residents provided credible information on the occurrence of this species in the forests of Cup and Cuoi areas (Dang Ngoc Can et al. 2004). However, they all stated that Sun Bear is rarer than Asian Black Bear.

Asian Black Bear *Ursus thibetanus*

Probably occurs at a low density throughout Bac Huong Hoa. In February 2004, claw-marks were found on a tree at 16°55'51"N, 106°35'22"E, and claw-marks and fresh droppings thought to belong to this species were found in primary forest close to Cup (16°55'40"N, 106°35'46"E) (Dang Ngoc Can 2004). Local residents reported that a hunter from Cup village killed one Asian Black Bear of about 100 kg in the Cup area in December 2003 (Dang Ngoc Can 2004).

Oriental Small-clawed Otter *Aonyx cinerea*

Footprints identified as belonging to this gregarious species were found on the banks of the Se Vang Hieng River in February 2004 (Dang Ngoc Can 2004). The low number of footprints indicates that there is only a small group of this species in the area. In addition, one foot belonging to an Oriental Small-clawed Otter was found in a house in Cup village in 2005 (Anon 2005).

European Otter *Lutra lutra*

Local residents reported the presence of this species in both the Cup and Cuoi areas (Dang Ngoc Can 2004). They stated that it is now rare as a result of hunting for trade.

Lesser Mouse-deer *Tragulus kanchil*

Hunters reported the presence of this species in Bac Huong Hoa NR (Dang Ngoc Can 2004).

Large-antlered Muntjac *Megamuntiacus vuquangensis*

Hunters regard this species as fairly common in evergreen forest in Bac Huong Hoa NR. One was shot near Cup village in 2003 and another near Cuoi village the same year (Dang Ngoc Can 2004). Three sets of antlers of hunted individuals were found in hunters' houses in Khe Cup, Xa Ly and Cuoi villages (Dang Ngoc Can 2004). A freshly killed individual of this species was seen in Huong Lap Commune in a village adjacent to Bac Huong Hoa NR (Dang Ngoc Can *et al.* 2006).

Gaur *Bos frontalis*

Local hunters from both Cup and Cuoi villages reported the occurrence of Gaur in the Cuoi area (Dang Ngoc Can 2004). However, all hunters stated that this species is very rare and data from Site Support Groups indicates that there may only be three individuals in the area. These three are sometimes seen singly, and sometimes in one group. In October and November 2004, the Site Support Groups reported one male near Khe Cuoi, one individual in Doc Mang and one in Ta Lap.

Saola *Pseudoryx nghetinhensis*

All hunters in Cup and Cuoi villages can accurately describe this enigmatic species and report that it still occurs in forest close to both Cup and Cuoi villages (Dang Ngoc Can 2004). It was also recorded by Site Support Groups at both Cup and Cuoi in 2004 and 2005 (Wilkinson and Nguyen Thanh Van 2006). One Saola (c. 70 kg) was trapped near Cup village in 2003 and another Saola (c. 100 kg) was shot in the Cuoi area in November 2003 (Dang Ngoc Can 2004). One hunter from Cuoi reported that he has killed a total of three Saola in the Khe Ta Nap river during hunting trips with dogs (Dang Ngoc Can 2004). In December 2005, fresh footprints and feeding evidence were found along a dry stream bed in Khe Rao Thep (Le Trong Trai pers obs.).

Chinese Serow *Capricornis sumatraensis*

Records suggest that this species is common in Bac Huong Hoa NR. In 2004, one individual was seen at 16°55'33"N 106°35'21"E near Cup and the fresh droppings and footprints of this species were found on several occasions in the Cuoi area (Dang Ngoc Can 2004). Three frontlets with horns were seen in hunter's houses in Cup and Cuoi villages (Dang Ngoc Can 2004). Site Support Groups reported the species at Rao Thep, where one was seen in October 2004 and two were seen a month later. Another was seen by Site Support Groups at Dan Chu in November 2004. Footprints and fresh faeces belonging to this species were regularly recorded in Sa Mu Cave in November 2005 (Anon 2005).

3.3 Bird diversity

The avifauna of BHH NR is typical of the Annamese Lowlands EBA. To date, 207 species of birds have been recorded in Bac Huong Hoa NR (Appendix 3). Of these, one species is considered threatened at a global level and nine species are considered Near Threatened at a global level (IUCN 2008) (Table 4). Eight species are considered threatened at a national level (Anon 2007). Four of the seven restricted-range species which define the Annamese Lowlands EBA, have been recorded from Bac Huong Hoa NR. The nature reserve also supports 10 of the 28 priority bird taxa for the Central Truong Son Landscape.

Table 4. Threatened, Near Threatened and Restricted-range bird species of Bac Huong Hoa Nature Reserve

English name	Scientific name	IUCN	VRDB
Chestnut-necklaced Partridge	<i>Arborophila charltoni</i>	NT	
Edwards's Pheasant	<i>Lophura edwardsi</i>	EN, RRS	EN
Siamese Fireback	<i>Lophura diardi</i>	NT	VU
Crested Argus	<i>Rheinardia ocellata</i>	NT	VU
Lesser Fish Eagle	<i>Ichthyophaga humilis</i>	NT	VU
Coral-billed Ground Cuckoo	<i>Carproccocyx renauldi</i>		VU
Blyth's Kingfisher	<i>Alcedo hercules</i>	NT	
Crested Kingfisher	<i>Megaceryle lugubris</i>		VU
Austen's Brown Hornbill	<i>Anorrhinus austeni</i>	NT	VU
Great Hornbill	<i>Buceros bicornis</i>	NT	VU
Red-collared Woodpecker	<i>Picus rabieri</i>	NT, RRS	
Short-tailed Scimitar Babbler	<i>Jabouilleia danjoui</i>	NT, RRS	
Grey-faced Tit-babbler	<i>Macronous kelleys</i>	RRS	
White-cheeked Laughingthrush	<i>Garrulax yassali</i>	RRS	

The following species accounts detail all the species of conservation interest, either threatened, Near Threatened or Restricted Range species, recorded from Bac Huong Hoa Nature Reserve. In addition to these species, it is likely that the Near Threatened restricted-range species, Sooty Babbler *Stachyris herberti*, occurs in suitable habitat at BHH NR. A specialist of forest on limestone, this species has been recorded in suitable habitat in forests to the north and in Dakrong Nature Reserve to the south (Nguyen Cu and Le Manh Hung 2004).

Chestnut-necklaced Partridge *Arborophila charltoni merlini*

This taxon has often been treated as a distinct species, Annam Partridge (e.g. Sibley & Monroe 1990, 1993) and afforded Endangered status. However, following BirdLife International (2008) it is treated as a subspecies of Chestnut-necklaced Partridge and classified as Near Threatened. Chestnut-necklaced Partridge is locally common in lowland evergreen forest in BHH NR. It has been recorded in forest close to the Cha Ly stream, between there and the Laos border (Anon 2005), and in forest near Cuoi village (Wilkinson and Nguyen Thanh Van 2006).

Edwards's Pheasant *Lophura edwardsi*

Not yet confirmed as recorded in Bac Huong Hoa Nature Reserve. This species is uncommon in lowland evergreen forest below 600 m and perhaps only common on gently undulating ground below 300 m. First reported in the forests of Huong Hoa District in November 1923 when a male was collected; it was reported again in February 1924, when another male was collected (BirdLife International 2001). Despite substantial search effort, there were no records between 1935 and 1996 and it was thought to perhaps be extinct. However, following its rediscovery in Phon Dien District in 1996, it was found near Kreng village, Huong Hiep Commune at (16035'N; 107005'E), where local hunters trapped a pair (Le Trong Trai, et al, 1999). The female of this pair died and the male was transferred to Hanoi Zoo. This area is just outside the nature reserve boundary but suitable habitat extends from there into the nature reserve. It is the most frequently reported *Lophura* species by the Cuoi SSG, but the SSG at Cup report it very rarely and record

other *Lophura* much more often. This may reflect genuine trends; Wilkinson and Nguyen Thanh Van (2006) assessed identification skills of SSG members and felt that they were of a high quality. However, in 2008 residents of Cuoi village only reported Silver Pheasant *Lophura nycthemera* and did not know of a black or blue pheasant in their area (Eames and Mahood 2008 unpubl). Unlike other pheasant species known to exist in BHH NR, no physical evidence of this species has been found in hunters' camps, or in residents' houses. Its presence in the nature reserve still requires confirmation.

Siamese Fireback *Lophura diardi*

Fairly common in broadleaf lowland evergreen and lower montane forest of Bac Huong Hoa NR. It was recorded in Huong Lap and Huong Son communes during surveys in 2002 and 2004 (Le Manh Hung et al 2002 and Le Manh Hung et al 2004). The report from the latter survey pertained to a dried head of a male bird in a hunter's house in Cuoi village.

Crested Argus *Rheinardia ocellata*

Formerly common in Bac Huong Hoa, this species has declined markedly in recent years due to widespread snaring. It was recorded in Huong Lap and Huong Son communes during surveys in 2002 and 2004 (Le Manh Hung et al 2002; Le Manh Hung et al 2004) and feathers of this species were found in hunting camps in 2005. Data from Site Support Groups indicate that it is scarce. There was only one record from near Cuoi and four records from near Cup between 2004 and 2005.

Lesser Fish Eagle *Ichthyophaga humilis*

A scarce resident on large rivers in BHH NR. A single bird was seen on 11 Feb 2004, flying over the forest canopy to the west of Cup village and another bird was recorded on the 14 and 16th February 2004 near to the Khe Cuoi (a large stream), near Cuoi village (Le Manh Hung *et al* 2004).

Coral-billed Ground Cuckoo *Carproccyx renauldi*

Probably uncommon in BHH NR. Recorded by Le Trong Trai in 2005 (Anon 2005).

Blyth's Kingfisher *Alcedo hercules*

Fairly common on rivers and large streams surrounded by good forest in BHH NR. In February 2004, one bird was seen daily on a large stream inside the forest, west of Cup village and other individuals were seen along large streams to the west and north of Cuoi village (Le Manh Hung *et al.*, 2004). Similarly, in May 2008, individuals were seen along the river between Cup and Cuoi villages, and along a large stream north of Cuoi village (Eames and Mahood 2008 unpubl).

Crested Kingfisher *Megaceryle lugubris*

Occurs on the larger rivers in the nature reserve. Recorded by Le Manh Hung *et al.* (2004), and at least one pair seen between Cup and Cuoi villages in May 2008 (Eames and Mahood 2008 unpubl.).

Austen's Brown Hornbill *Anorrhinus austeni*

Uncommon in lowland evergreen forest in Bac Huong Hoa Nature Reserve. A flock of 30 individuals was recorded in the Dan Chu area of Bac Huong Hoa in 2005 (Anon 2005).

Great Hornbill *Buceros birconis*

Now a very scarce resident of lowland and mid-montane evergreen forest in Bac Huong Hoa Nature Reserve. Recorded by Le Trong Trai only from the remote border area between Quang Binh and Quang Tri provinces (Anon 2005). During surveys no more than three individuals were seen in any one flock. Its persistence in forest along the international border with Laos is reported by hunters (Le Manh Hung *et al.*, 2002).

Red-collared Woodpecker *Picus rabieri*

Scarce resident in lowland evergreen forest in BHH. Recorded in February 2004 to the west of Cuoi at 350 m asl, at 16°55' 16''N 106°37'54''E; a singleton was seen actively feeding in a large tree (Le Manh Hung *et al.*, 2004).

Short-tailed Scimitar Babbler *Jabouilleia danjoui*

Probably uncommon in BHH NR. Recorded by Le Trong Trai in 2005 and heard calling in mid-montane forest close to the Ho Chi Minh Highway in May 2008 (Eames and Mahood unpubl. 2008).

Grey-faced Tit Babbler *Macronous kelleyi*

Fairly common in lowland evergreen forest in BHH NR. Recorded by Le Trong Trai (Anon 2005) and fairly commonly heard in lowland evergreen forest near Cup and Cuoi villages.

White-cheeked Laughingthrush *Garrulax vassali*

Fairly common in mid-montane forest in Bac Huong Hoa NR (Le Manh Hung *et al. in prep.*).

3.4 Reptiles and Amphibians

To date, at least 61 species of reptile and amphibian have been identified in BHH NR (Anon 2005). Survey work by Ho Thu Cuc *et al.* in 2005, constituted the most comprehensive survey of the amphibians and reptiles of BHH NR. Unfortunately, a complete species list from this survey is not available; therefore the species list presented in Appendix 4 is incomplete and contains only species recorded in subsequent surveys.

One frog species, *Philautus truongsoneis*, was described as new to science in Bac Huong Hoa NR. The type series was collected in lowland evergreen forest at 400 m elevation near to Cup village, Huong Hoa District (Orlov and Ho Thu Cuc 2005). This species has subsequently been found at other sites in the central highlands including Ban a National Park, Danang Province, Bach Ma National Park, Thua Thien Hue Province and Phong Nha-Ke Bang National Park, Quang Binh Province (Orlov and Ho Thu Cuc 2005).

Of the species listed for BHH NR in this report, five are considered threatened at a global level and 11 are considered threatened at a national level (IUCN 2007, Anon 2007) (Table 5.). It should be noted that assessment of threat has not been undertaken at a global scale for any reptiles except turtles. The Indochina region shows high levels of diversity in freshwater turtles and BHH NR has a number of species representative of central Vietnam.

Table 5. Preliminary list of reptile and amphibian species of conservation concern from Bac Huong Hoa Nature Reserve

English name	Scientific name	VRDB	IUCN
Annam Spadefoot Toad	<i>Brachytarsophrys intermedia</i>		VU
Wallace's Flying Frog	<i>Rhacophorus nigropalmatus</i>	VU	
Tokay	<i>Gekko gekko</i>	VU	
Indochinese Water Dragon	<i>Physignathus cocincinus</i>	VU	
Water monitor	<i>Varanus salvator</i>	EN	
Burmese Python	<i>Python molurus</i>	CR	NT
Common Rat Snake	<i>Pytas mucosus</i>	EN	
Banded Krait	<i>Bungarus fasciatus</i>	EN	
Indochinese Cobra	<i>Naja naja</i>	EN	
King Cobra	<i>Ophiophagus hannah</i>	CR	
Indochinese Box Turtle	<i>Cuora galbinifrons</i>	EN	CR
Chinese three-striped Box Turtle	<i>Cuora trifasciata</i>	CR	CR
Keeled Box Turtle	<i>Pyxhidea mohotti</i>		EN
Four-eyed Turtle	<i>Sacalia quadriocellata</i>		EN

The following species accounts provide a brief indication of the source of information for the occurrence of threatened reptiles and amphibians in BHH NR and details of their status where possible.

Annam Spadefoot Toad *Brachytarsophrys intermedia*

Listed for BHH NR by Cao Tien Trung (*in prep.*). Known only from a small area of central Vietnam where it inhabits forest close to streams (van Dijk 2004).

Wallace's Flying Frog *Rhacophorus nigropalmatus*

Listed for BHH NR by Cao Tien Trung (*in prep.*).

Tokay Gecko *Gekko gekko*

In Bac Huong Hoa NR, found primarily in primary and secondary lowland and mid-montane evergreen forest (Cao Tien Trung *in prep.*). Although elsewhere it is often found in human habitation, collection for trade is likely to have eliminated it from this habitat in BHH NR (Cox *et al.* 2006).

Indochinese Water Dragon *Physignathus cocincinus*

In BHH NR, usually found perched on overhanging branches along streams. A density of 2.8 individuals per kilometre of stream has been recorded (Cao Tien Trung *in prep.*).

Water Monitor *Varanus salvator*

Provisionally listed for BHH NR on the basis of individuals found in trade near the nature reserve (Dang Ngoc Can *et al.* 2006). Found in forested areas up to 1,300 m, where it forages close to water (Cox *et al.* 2006).

Burmese Python *Python molurus*

Provisionally listed for BHH on the basis of hunters' reports (Dang Ngoc Can *et al.* 2006). It inhabits forested areas up to 900 m (Cox *et al.* 2006).

Common Rat Snake *Ptyas mucosus*

Provisionally listed for BHH on the basis of hunters' reports (Dang Ngoc Can *et al.* 2006). Found in a wide variety of habitats up to 1,000 m (Cox *et al.* 2006).

Banded Krait *Bungarus fasciatus*

Provisionally listed for BHH on the basis of hunters' reports (Dang Ngoc Can *et al.* 2006). Found primarily in the forested lowlands, but it has been found over 2,000 m.

Indochinese Cobra *Naja naja*

Provisionally listed for BHH on the basis of hunters' reports (Dang Ngoc Can *et al.* 2006). It inhabits the forested lowlands (Cox *et al.* 2006).

King Cobra *Ophiophagus hannah*

Provisionally listed for BHH on the basis of hunters' reports (Dang Ngoc Can *et al.* 2006). It inhabits forested areas up to at least 2,000 m and appears to be more common close to streams (Cox *et al.* 2006).

Indochinese box turtle *Cuora galbinifrons*

Live individuals collected by hunters have been recorded in BHH NR (Dang Ngoc Can *et al.* 2006), probably of the subspecies *C. g. bourreti*, which is endemic to the central highlands of Vietnam (Peter Paul van Dijk *pers. comm.*).

Chinese three-striped box turtle *Cuora trifasciata*

Live individuals collected by hunters have been recorded in BHH NR (Dang Ngoc Can *et al.* 2006).

Keeled box turtle *Pyxhidea mohotti*

Live individuals collected by hunters have been recorded in BHH NR (Dang Ngoc Can *et al.* 2006).

Four-eyed Turtle *Sacalia quadriocellata*

Live individuals collected by hunters have been recorded in BHH NR (Dang Ngoc Can *et al.* 2006 and Cao Tien Trung *et al.* 2008).

4. Biodiversity Evaluation

4.1 Habitat Types

BHH NR supports a mosaic of habitats, including 17,392 hectares of forest of high conservation importance (as defined by Tordoff *et al.* 2003). Most importantly, this includes some lowland evergreen forest below 300 m, which may be of critical importance for Edwards's Pheasant. Less

than 20% of the nature reserve is non-forest habitat, and with appropriate management, much of this land may be rehabilitated. In general, the level of forest disturbance appears to decrease with increasing altitude, reflecting both the greater accessibility of forests at low altitudes and the greater abundance of valuable forest products at low elevation. Lowland evergreen forest, particularly below 300 metres, should be the highest priority for conservation efforts in the nature reserve.

4.2 Globally Threatened Species, Restricted Range Species and Priority Taxa

One globally threatened bird species, 21 globally threatened mammal species and at least five globally threatened amphibian species have been recorded from BHH NR. These include Saola, classified as Critically Endangered globally and potentially also Edwards’s Pheasant, classified as Endangered globally. Two Critically Endangered turtles occur in the nature reserve and two Endangered species. Of these, the Critically Endangered Indochinese box turtle *Cuora galbinifrons* is represented by a race endemic to the central highlands of Vietnam, which is often considered a separate species (Peter Paul van Dijk *pers. com*). In addition, nine globally threatened plant species have been recorded, including four Critically Endangered species.

BHH NR supports a high proportion of the bird species which define the Annamese Lowlands EBA. Of the three species which do not occur, Edwards’s Pheasant and Sooty Babbler are likely to be found in the nature reserve in the future and Vietnamese Pheasant *Lophura hatinhensis* is largely allopatric with Edwards’s Pheasant and may indeed be the conspecific with it (Birdlife International 2001). BHH NR compares favourably with other sites in the Annamese Lowlands EBA, only Phuong Dien has more species. BHH NR therefore is of high importance for the conservation of the species which define this EBA.

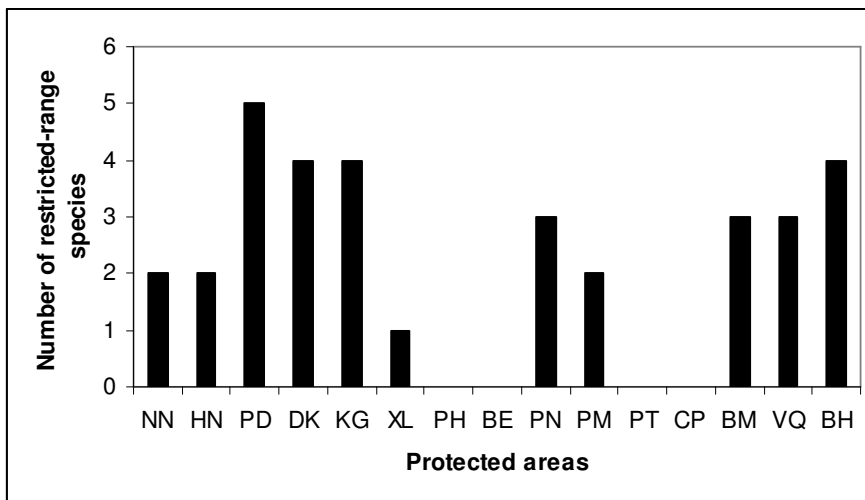


Figure 1. The number of restricted-range bird species in protected areas in the Annamese Lowlands EBA.

NN = Nakai Nam Theun; HN = Hin Nammo; PD = Phong Dien; DK = Dakrong; KG = Ke Go; XL = Xuan Lien; PH = Pu Huong; BE = Ben En; PN = Phong Nha; PM = Pu Mat; PT = Pu Hoat; CP = Cuc Phoung; BM = Bach Ma; VQ = Vu Quang; BH = Bac Huong Hoa.

Note: data for protected areas other than Bac Huong Hoa Nature Reserve taken from Eames *et al.* (2001).

BHH NR also compares favorably with protected areas of Priority Landscape CA1 in the Greater Truong Son Ecoregion (Figures 2-4.), in terms of the number of priority taxa it supports. For instance, BHH NR supports 21 of the priority bird taxa and 10 of the priority mammal taxa of the Priority Landscape. Consequently, BHH NR ranks second out of all of the protected areas in Priority Landscape CA1, regarding its number of priority mammal and bird taxa. BHH NR ranks relatively low in terms of the number of priority reptile taxa, although this may reflect the difficulty of accessing reptile data rather than actual trends. These rankings should be treated with caution since data were taken from a 2003 publication. In addition, the biodiversity of the other protected areas in the analysis is now likely to be better known and therefore, many of them may rank as highly as Bac Huong Hoa Nature Reserve. However, although this means that the forests of Bac Huong Hoa may be relatively less important than the analysis suggests, it does not affect the conclusion that BHH NR is of high conservation importance for the priority taxa of Priority Landscape CA1.

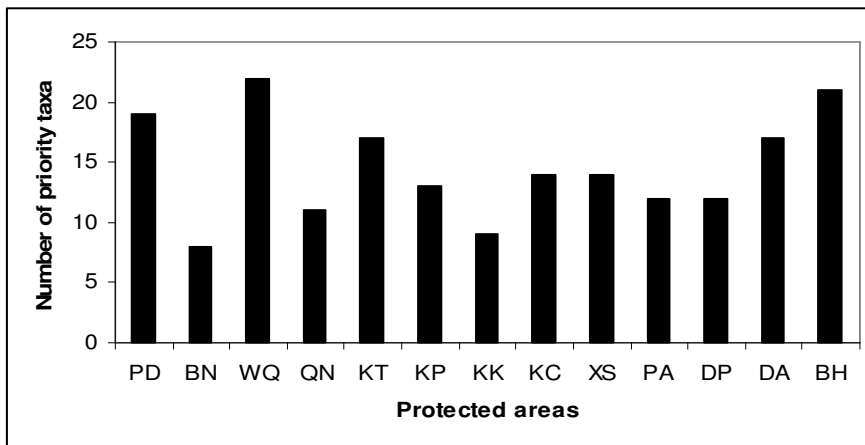


Figure 2. Number of priority mammal taxa in protected areas in Priority Landscape CA1.

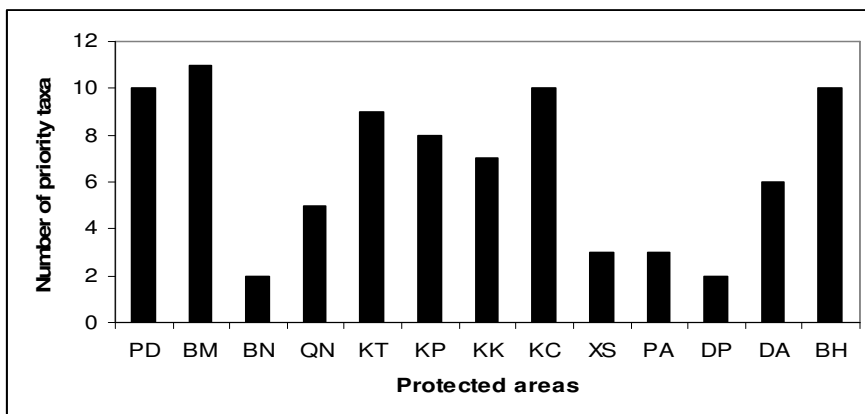


Figure 3. Number of priority bird taxa in protected areas in Priority Landscape CA1.

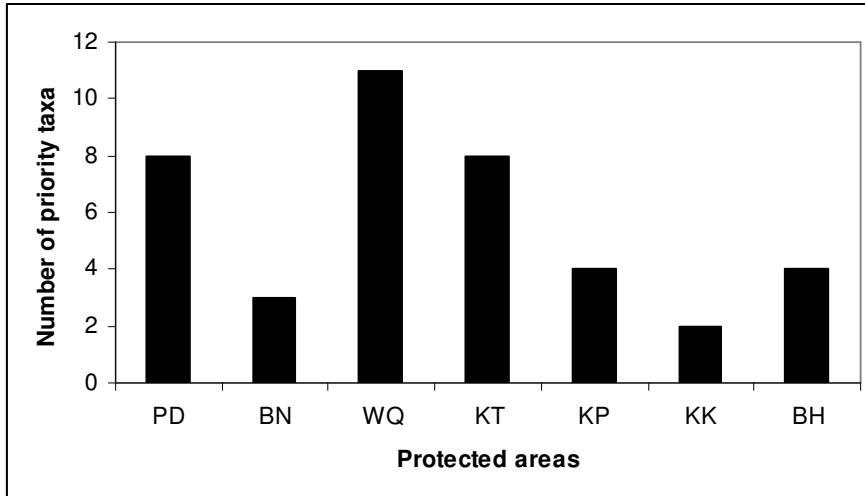


Figure 4. Number of priority reptile and amphibian taxa in protected areas in Priority Landscape CA1.

Site: PD = Phon Dien and Dak Rong; BM = Bach Ma; BN = Ba Na; WQ = western Quang Nam Province; QN = Ngoc Linh (Quang Nam); KT = Ngoc Linh (Kon Tum); KP = Kon Plong; KK = Kon Ka Kinh; KC = Kon Cha Rang; XS = Xe Sap; PA = Phou Ahyon; DP = Dakchung Plateau; DA = Dong Ampham
 Note: data for protected areas other than Bac Huong Hoa Nature Reserve were taken from Tordoff *et al.* (2003).

4.3 Overall Levels of Biodiversity

Due to wide variation in survey effort between protected areas and variation in level of habitat heterogeneity, it is difficult to make meaningful comparisons of overall diversity between sites. The species lists for BHH NR are undoubtedly incomplete and rely on comparatively little fieldwork. However, BHH NR exhibits a similar range of habitats and elevations as other sites in the Annamese Lowlands EBA and probably supports a similar diversity of species.

4.4 Management recommendations

BHH NR is of global significance due to the species and habitats that it protects. An urgent priority is the establishment of a competent and enthusiastic management board. BHH NR faces a number of threats which, when it is established, the management board of the nature reserve should seek to address. The most important threats are hunting, forest clearance and selective logging. These threats are typical of protected areas in the Annamese Lowlands and indeed throughout Vietnam. The following management recommendations address conservation priorities in BHH NR.

Determine distribution of key taxa

Surveys should be conducted to determine the distribution of key taxa, to facilitate priority setting in BHH NR. These surveys should concentrate on threatened species representative of central Vietnam, with a high susceptibility to hunting or habitat degradation. With regards to birds, the priority is to determine whether Edwards's Pheasant occurs in the nature reserve. These surveys

should be conducted in forest below 400 m near to Cuoi village and most importantly in the south-east, close to where the birds were caught in 1999. For mammals, the surveys should determine which forest areas are still inhabited by Saola, White-cheeked Gibbon, Red-shanked Douc Langur and HatinhLangur. Regarding reptiles, surveys should be conducted to determine which streams still support freshwater turtles.

Development of hunting regulations

Appropriate regulations should be developed and enforced. This should be achieved through involvement of SSGs. Regulations and enforcement should focus on preventing hunting in areas which are found to support populations of Edwards's Pheasant, Saola, White-cheeked Gibbon, Red-shanked Douc Langur and HatinhLangur. The nature reserve should be zoned using the results of biodiversity surveys and enforcement should be concentrated in areas where professional hunters are known to operate and areas which still hold populations of key species. The nature reserve management should strengthen support to SSGs and seek synergies with other agencies operating in the area, to facilitate more effective enforcement of hunting regulations.

Control human settlement along the Ho Chi Minh Highway

Policies should be developed and enforced which strictly control settlement along the Ho Chi Minh Highway in BHH NR (Tordoff *et al.* 2002). New settlement adjacent to medium or high quality forest or within five kilometres of forest which supports populations of key species should not be permitted.

Rehabilitation of poor quality forest and barren land

Even within BHH NR forest cover is fragmented. Poor quality forest and barren land in the centre of the nature reserve and elsewhere should be the focus of a reforestation programme, using only trees native to the nature reserve. The feasibility of reconnecting blocks of high and medium quality forest, with a minimum number of corridors should first be evaluated. Reforested areas should form corridors linking existing areas of medium and good quality forest to facilitate dispersal of species.

Support to community based conservation initiatives

A rattan-growing model has been employed by BirdLife in communities in BHH NR. This should be evaluated, and if appropriate, expanded to other communities in the nature reserve.

Management approach

Like other protected areas in Vietnam, the efforts of the reserve management board are likely to be thwarted by inadequate law enforcement from relevant agencies, limited and poorly directed funding and a lack of interest in biodiversity conservation in relevant local stakeholders. Traditional approaches to protected area management in the central highlands of Vietnam may be inadequate to achieve these conservation priorities. Innovative approaches to protected area management offer the chance to source novel areas of funding and trial different methods of achieving conservation aims. Since it is newly established, BHH NR does not suffer from the inertia of poor past management practices, nor is there any precedent amongst local stakeholders for interaction with a protected area. BHH NR is likely to be last protected area gazetted in Vietnam and therefore it offers the last chance to trial innovative management approaches on a protected area, with no previous management history.

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Appendix 1. Plant species list for Bac Huong Hoa Nature Reserve

Data from (Anon 2006), the results of surveys conducted by Le Trong Trai.

1. Lycopodiaceae	
1	<i>Lycopodium cernua</i> (L.) Franco & Vasc
2. Selaginellaceae	
2	<i>Selaginella doderleini</i> Hieron.
3	<i>S. involvens</i> (Sw.) Spring.
4	<i>S. petelotii</i> Aston
5	<i>S. repanda</i> (Desv.) Spring
6	<i>S. delicatula</i> (Desv.) Alst.
LYCOPODIOPHYTA	
3. Equisetaceae	
7	<i>Equisetum ramosissimum</i> Devs.
PLYPODIOPHYTA	
4. Adiantaceae	
8	<i>Adiantum flabellulatum</i> L.
9	<i>A. philippense</i> L.
10	<i>A. induratum</i> Chr.
11	<i>A. diaphanum</i> Bl.
12	<i>Antrophyum annamensis</i> Chr. & Tard.
13	<i>A. coriaceum</i> (D. Don) Wall.
14	<i>Cheilanthes tenuifolia</i> (Burm. f.) Sw.
15	<i>Onychium siliculosum</i> (Desv.) C. Chr.
16	<i>Pityrogramma culomelanos</i> (L.) Link.
17	<i>Pteris biaurita</i> L.
18	<i>P. ensiformis</i> Burm.f.
19	<i>P. grevilleana</i> Wall. ex Ag.
20	<i>P. linearis</i> Poir.
21	<i>P. decrescens</i> Chr.
22	<i>P. finotii</i> Chr.
5. Angiopteridaceae	
23	<i>Angiopteris annamensis</i> C. Ch & Tard.
24	<i>A. cochinchinensis</i> de Vriese
25	<i>A. evecta</i> (Forst.) Hoffm.
26	<i>A. palmaeformis</i> (Cav.) Chr.
27	<i>A. repandula</i> de Vriese
28	<i>Archangiopteris cadieri</i> Tard. & Christ
6. Aspleniaceae	
29	<i>Asplenium cheilosorum</i> O. Kuntze ex Mett
30	<i>A. varians</i> Wall ex Hook. & Grew.
31	<i>A. ensiforme</i> Wall. Ex Hook. f.
32	<i>A. nidus</i> L.
33	<i>A. colaniae</i> Tard.-Blot.

34	<i>A. antrophyoides</i> Chr.
35	<i>A. loriceum</i> Chr.
36	<i>A. saxicola</i> Rosenst
37	<i>A. crinicaule</i> Hance
38	<i>A. hainanense</i> Ching.
39	<i>Diplazium pinnatifido-pinnatum</i> (Hook.) Moore
40	<i>D. conterminum</i> Christ
41	<i>D. polypodiodes</i> Bl.
7. Blechnaceae	
42	<i>Blechnum orientale</i> L.
8. Cyatheaceae	
43	<i>Cyathea cotaminans</i> (Hook.) Copel.
44	<i>C. latebrosa</i> (Hook.) Copel.
45	<i>C. gigantea</i> (Hook.) Holtt.
9. Dennstaedtiaceae	
46	<i>Dennstaedtia seabra</i> (Hook.) Moore
47	<i>Lindsaea ensiformis</i> L.
48	<i>Microlepia marginata</i> (Houtt.) C. Chr.
49	<i>M. strigosa</i> (Thunb.) Presl.
50	<i>Pteridium aquilinum</i> (L.) Kuhn.
10. Gleicheniaceae	
51	<i>Dicranopteris linearis</i> (Burzm.) Underw.
52	<i>D. dichotoma</i> (Thunb.) Bernh.
11. Grammitidaceae	
53	<i>Grammitis dorsipila</i> (Chr.) C. Chr. & Tard.
54	<i>Loxogramme acroscopa</i> (Chr.) C. Chr.
12. Marsileaceae	
55	<i>Marsilea quadrifolia</i> L.
56	<i>M. crenata</i> Prese.
13. Polypodiaceae	
57	<i>Alaomorpha coronans</i> (Mett.) Copel.
58	<i>Colysis pothifolia</i> (D. Don) Presl.
59	<i>Drynaria bonii</i> Christ.
60	<i>Leptochilus axillaris</i> (Cav.) Kaulf.
61	<i>Lemmaphyllum micropophyllum</i> C. Chr.
62	<i>Microsorium hancockii</i> (Back.) Ching
63	<i>M. punctatum</i> (L.) Copel.
64	<i>Phymatorus nigrescens</i> (Bl.) Pic.Ser.
65	<i>Platynerium coronarium</i> (Koen.) Desv.
66	<i>P. grande</i> A. Cunn. ex J. Sm.
67	<i>P. lingua</i> (Thunb.) Farw.
68	<i>Pyrosia longifolia</i> (Burm.) Morton.
14. Schizeaceae	
69	<i>Lygodium auriculatum</i> (Willd.) Alst
70	<i>L. conferme</i> C. Chr.

71	<i>L. flexuosum</i> (L.) Sw.
72	<i>L. japonicum</i> (Thunb.) Sw.
73	<i>L. microstachyum</i> Desv.
74	<i>L. salicifolium</i> Presl.
GYMNOSPERMAE	
15. Cycadaceae	
75	<i>Cycas immersa</i> Craib.
16. Gnetaceae	
76	<i>Gnetum gnemonoides</i> Brongn.
77	<i>G. leptostachyum</i> Bl.
78	<i>G. montanum</i> Margf.
79	<i>G. formosum</i> Margf.
17. Podocarpaceae	
80	<i>Dacrycarpus imbricatus</i> (Bl.) de Laub.
81	<i>Podocarpus neriifolius</i> D. Don.
82	<i>P. pilgeri</i> Foxw.
83	<i>Nageia wallichiana</i> (C. Presl.) O. Kuntze
18. Cephalotaxaceae	
84	<i>Cephalotaxus manii</i> Hook. f.
ANGIOSPERMAE	
Magnoliopsida (Dicotyledones)	
19. Acanthaceae	
85	<i>Asystasia gangetica</i> (L.). T.
86	<i>Clinacanthus nutans</i> (Burm.f.) Lindau.
87	<i>Dipteracanthus repens</i> (L.) Hassk.
88	<i>Isoglossa inermis</i> (R. Ben) B. Hans.
89	<i>J. ventricosa</i> Wall.
90	<i>Justica fragilis</i> Wall.
91	<i>Staurogyne bella</i> Brem.
92	<i>Strobilanthes tonkinensis</i> Lind.
93	<i>Thunbergia alata</i> Boy ex Sims
20. Actinidiaceae	
94	<i>Saurauja roxburghii</i> Wall.
95	<i>S. nepalensis</i> DC.
21. Alangiaceae	
96	<i>Alangium salviifolium</i> Wargern.
97	<i>A. chinensis</i> (Lour.) Harm
22. Amaranthaceae	
98	<i>Amaranthus spinosus</i> L.
99	<i>A. tricolor</i> L.
100	<i>A. viridis</i> L.
101	<i>Achyranthes aspera</i> L.
102	<i>A. bidentata</i> Bl.
103	<i>Alternanthera paronychioides</i> A. St. Hilaire.
104	<i>Celosia argentea</i> L.

23. Anacardiaceae	
105	<i>Allospodias lakonensis</i> (Pierre) Stap.
106	<i>Dracuntomelon schmidii</i> Tard.
107	<i>Gluta gracilis</i> Evr.
108	<i>Mangifera foetida</i> Lour.
109	<i>M. indica</i> L.
110	<i>Rhus javanica</i> L.
111	<i>Semecarpus anacardiopsis</i> Evr. & Tard.
112	<i>Toxicodendron succedana</i> (L.) Mold.
24. Ancistrocladaceae	
113	<i>Ancistrocladus tectorius</i> (Lour.) Merr.
25. Annonaceae	
114	<i>Annona squamosa</i> L.
115	<i>A. muricata</i> L.
116	<i>Desmos cochinchinensis</i> Lour.
117	<i>Goniothalamus multiovulatus</i> Ast.
118	<i>Fissistigma oldhami</i> (Heml.) Merr.
119	<i>Meiogyne subsessilis</i> (Ast.) Sincl.
120	<i>Polyalthia clemensorum</i> Ast.
121	<i>P. jucunda</i> (Pierre) Fin. & Gagn.
122	<i>Uvaria cordata</i> (Dun.) Wall. ex Alston
123	<i>U. lurida</i> Hook. f. & Thoms.
124	<i>Xylopia vielana</i> Pierre ex Fin & Gagn.
26. Apiaceae	
125	<i>Centella asiatica</i> (L.) Urb.
126	<i>Cnidium monnieri</i> (L.) Cusson
127	<i>Eryngium foetidum</i> L.
128	<i>Hydnocotyle sibthorpioides</i> Lamk.
129	<i>Trachyspermum roxburghianum</i> (DC.) Crai.
27. Apocynaceae	
130	<i>Alstonia scholaris</i> (L.) R. Br.
131	<i>Alyxia racemosa</i> Pit.
132	<i>Bousingonia makongense</i> Pierre in Pl.
133	<i>Holarrhena pubescens</i> (Buch.-Ham) Wall. ex G. Don
134	<i>H. curtisii</i> King & Gamble
135	<i>Hunteria zeylanica</i> (Retz.) Gardn. & Thw.
136	<i>Kopsia harmandiana</i> Pierre ex Pit.
137	<i>Melodinus annamense</i> Pit.
138	<i>Parabarium micranthum</i> (A. DC.) Pierre ex Spire
139	<i>Pottsia indora</i> Pit.
140	<i>Rauvolfia cambodiana</i> Pierre ex Pit
141	<i>Tabernaemontana bovina</i> Lour.
142	<i>Wrightia annamensis</i> Eb. & Dub.
28. Aquifoliaceae	
143	<i>Ilex cochinchinensis</i> (Lour.) Loesen

144	<i>I. crenata</i> Thunb.
145	<i>I. tonkiniana</i> Loesen
146	<i>I. triflora</i> Bl.
29. Araliaceae	
147	<i>Aralia armata</i> Seem.
148	<i>Brassaiopsis glomerulata</i> (Bl.) Regel.
149	<i>Dendropanax poilanei</i> Bai
150	<i>Macropanax dispermus</i> (Bl.) Kuntz.
151	<i>Schefflera octophylla</i> (Lour.) Harms.
152	<i>S. vidaliana</i> Shang.
153	<i>Treevesia palmata</i> (Roxb. & Lindl.) Visiani
30. Aristolochiaceae	
154	<i>Aristolochia piperrei</i> H. Lec
155	<i>A. tagala</i> Chamiss
156	<i>Asarum balansae</i> Franch in Morot.
31. Asclepiadaceae	
157	<i>Criptolepsis buchananii</i> Roem & Sch.
158	<i>Streptocaulon juvenus</i> (Lour.) Merr.
159	<i>Telosma cordata</i> (Burm.f.) Merr.
32. Asteraceae (Compositae)	
160	<i>Ageratum conyzoides</i> L.
161	<i>Bidens bipinnata</i> L.
162	<i>Blumea lanceolata</i> (Roxb.) Druce
163	<i>Cirsium japonicum</i> Maxim
164	<i>Eclipta prostrata</i> (L.) L.
165	<i>Eupatorium odoratum</i> L.
166	<i>Grangea maderaspatann</i> (L.) Poir.
167	<i>Sigesbeckia orientalis</i> L.
168	<i>Tithonia diversifolia</i> (Hemsl.) A. Gray
169	<i>Vernonia cinerea</i> (L.) Less
170	<i>V. macrachaenia</i> Gagn.
33. Begoniaceae	
171	<i>Begonia aptera</i> Bl.
172	<i>B. boisiana</i> Gagn.
173	<i>B. eberhardtii</i> Gagn.
34. Betulaceae	
174	<i>Carpinus viminea</i> Lindl. in Wall.
35. Bignoniaceae	
175	<i>Oroxylon indicum</i> (L.) vent
176	<i>Rademachera eberhardtii</i> Dop.
177	<i>R. sinica</i> (Hance) Hemsl.
178	<i>Stereospermum colais</i> (Dillw.) Mabb
179	<i>S. neuranthum</i> Kurz.
36. Bombacaceae	
180	<i>Bombac ceiba</i> L.

181	<i>Ceiba pentandra</i> (L.) Gagn.
37. Boraginaceae	
182	<i>Cordia grandis</i> Roxb.
183	<i>Cynoglossum zeylanicum</i> (Vahl.) Thunb ex Lehm
184	<i>Heliotropium indicum</i> L.
185	<i>Tournefortia gaudichaudii</i> Gagn.
38. Brassicaceae	
186	<i>Brassica intergrifolia</i> (West.) O. B. Schultz
187	<i>B. junca</i> (L.)
188	<i>B. oleracea</i> L. var. <i>capitata</i>
189	<i>Raphanus sativus</i> var. <i>longipinnatus</i> Bail.
190	<i>Rorippa dubia</i> (Pers) Hara.
39. Burceraceae	
191	<i>Burcera serrata</i> Wall. ex Colebr.
192	<i>B. subulatum</i> Guill.
193	<i>Canarium album</i> (Lour.) Raeusch ex DC.
194	<i>C. bengalense</i> Roxb.
195	<i>C. parvum</i> Leenh.
40. Campanulaceae	
196	<i>Lobelia zeylanica</i> L.
197	<i>L. sinensis</i> Lour.
198	<i>Wahlenbergia marginata</i> (Thunb.) A. DC.
41. Capparaceae	
199	<i>Capparis cantoniensis</i> Lour.
200	<i>C. pyrifolia</i> Lamk.
201	<i>C. radula</i> Gagn.
202	<i>Cleome chelidonii</i> L. f.
203	<i>C. gynandra</i> L.
204	<i>C. viscosa</i> L.
205	<i>Crateva magna</i> (Lour.) DC.
206	<i>C. nurvala</i> Buch. Ham
207	<i>Stixis scandens</i> Lour.
42. Caprifoliaceae	
208	<i>Lonicera japonica</i> Thunb.
209	<i>L. macrantha</i> (D. Don) Sprengel
210	<i>Sambucus simpsonii</i> Rehder.
211	<i>S. hookeri</i> Rehder
212	<i>Vibrum punctatum</i> Buch. Ham ex D. Don
43. Celastraceae	
213	<i>Euonymus javanicus</i> Bl.
214	<i>E. laxiflorus</i> Champ. in B & H
215	<i>Gymnosporia chevalieri</i> Tard.
216	<i>Maytenus stylosa</i> (Pierre) Lob. Callen
217	<i>Salacia pallens</i> Pierre
218	<i>Siphonodon annamensis</i> (Lec.) Merr.

44. Clusiaceae (Guttiferae)	
219	<i>Calophyllum dryobalanoides</i> Pierr.
220	<i>Cratoxylon cochinchinensis</i> (Lour.) Bl.
221	<i>C. maingayi</i> Dyers in Hook. f.
222	<i>Garcinia cochinchinensis</i> (Lour.) Choiw.
223	<i>G. fusca</i> Pierr.
224	<i>G. oblongifolia</i> Champ. ex Benth.
225	<i>G. planchonii</i> Pierr.
45. Chloranthaceae	
226	<i>Chloranthus crectus</i> (Benth. & Hook.f.) Verdc.
46. Combretaceae	
227	<i>Quiqualis indica</i> L.
47. Connaraceae	
228	<i>Connarus paniculatus</i> Roxb.
229	<i>Roureopsis stenopetala</i> (Griff.) Schellenb.
230	<i>Rourea minor</i> (Gaertn.) Aubl.
48. Convolvulaceae	
231	<i>Hewittia scandens</i> (Milne) Mabberly
232	<i>Ipomoea aquatica</i> Forssk
233	<i>I. batatas</i> (L.) Lamk
234	<i>Jacmontia paniculata</i> (Burm. f.) Hall.f.
235	<i>Merremia hederacea</i> (Burm. f.) Hall. f.
236	<i>M. hirta</i> (L.) Merr.
237	<i>M. vitifolia</i> (Burm. f.) Hall. f.
238	<i>Prana volubilis</i> Burm. f.
239	<i>Xenostegia tridentata</i> (L.) Austin & Staples
50. Cucurbitaceae	
240	<i>Benincasia hispida</i> (Thunb.) Cogn.
241	<i>Coccinia grandis</i> (L.) Voigt
242	<i>Cucurbita maxima</i> Duch. ex Lam
243	<i>C. moschata</i> Duch. ex Lam
244	<i>C. pepo</i> L.
245	<i>Cucurmis sativus</i> L.
246	<i>C. sativus</i> var. <i>conomon</i> (Thunb.) Mak
247	<i>Diplocyclos palmatus</i> (L.) Jeffrey
248	<i>Gymnopetalum cochinchinensis</i> (Lour.) Kurz.
249	<i>G. integrifolium</i> (Roxb.) Kurz.
250	<i>Hogsonia macrocarpa</i> (Bl.) Cogn
251	<i>Luffa acutangula</i> (L.) Roxb.
252	<i>L. cylindrica</i> (L.) M. J. Roem
253	<i>Momordia charantia</i> L.
254	<i>M. cochinchinensis</i> (Lour.) Spreng
255	<i>Mukia maderaspatana</i> (L.) M. J. Roem
256	<i>Solena heterophylla</i> Lour.

257	<i>Trichosanthes tricuspidata</i> Lour.
258	<i>Zehneria indica</i> (Lour.) Keyr.
51. Dilleniaceae	
259	<i>Dillenia pentagyna</i> Roxb.
260	<i>D. turbinata</i> Fin & Gagn.
261	<i>Tetracera sarmentosa</i> (L.) Vahl
262	<i>T. scandens</i> (L.) Merr.
52. Dipterocarpaceae	
263	<i>Dipterocarpus grandiflorus</i> Blco
264	<i>D. hasseltii</i> Bl.
265	<i>D. kerrii</i> King.
53. Ebenaceae	
266	<i>Diospyros kaki</i> L.f.
267	<i>D. cauliflora</i> Bl.
268	<i>D. lancaefolia</i> Roxb.
269	<i>D. longebracteata</i> Lec
270	<i>D. martabarica</i> C. B. Cl.
271	<i>D. moi</i> Lec
272	<i>D. pilosula</i> (A. DC.) Hiern.
273	<i>D. rufogemmata</i> Lec
54. Elaeocarpaceae	
273	<i>Elaeocarpus grandiflorus</i> J. E. Smith.
274	<i>E. griffithii</i> (Wight.) A. Gray
275	<i>E. hainamensis</i> Oliv.
276	<i>E. limitanus</i> Hand. Mazz
277	<i>E. petiolatus</i> (Jack.) Wall. ex Kurz.
278	<i>E. stipulatus</i> Bl.
279	<i>E. angustifolius</i> Bl.
55. Euphorbiaceae	
280	<i>Alchornia rugosa</i> (Lour.) Muell.-Arg.
281	<i>A. tiliaefolia</i> (Benth.) Muell.-Arg.
282	<i>Aleurites cordata</i> (Thumb.) R. Br. ex Steu
283	<i>Antidesma bunius</i> Spreng.
284	<i>A. ghaesembilla</i> Gaertn
285	<i>A. hainanensis</i> Merr.
286	<i>A. yunnanensis</i> Pax & Hoffm.
287	<i>Aporosa ficifolia</i> H. Baillon
288	<i>A. sphaerospermum</i> Gagn.
289	<i>Baccaurea silvestris</i> Lour.
290	<i>Bischofia javanica</i> Bl.
291	<i>Breynia angustifolia</i> Hook.f.
292	<i>B. fruticosa</i> (L.) Hook.f.
293	<i>Bridelia monoica</i> (Lour.) Merr.
294	<i>Bridelia ovata</i> Dcne.
295	<i>Claoxylon longifolium</i> (Bl.) Endl. ex Hassk.

296	<i>Croton touranensis</i> Gagn.
297	<i>Endospermum chinense</i> Benth.
298	<i>Euphorbia hirta</i> L.
299	<i>E. indica</i> Lamk.
300	<i>E. orbiculata</i> Miq.
301	<i>E. pulcherrima</i> Jacq.
302	<i>E. thymifolia</i> L.
303	<i>Glochidion rubrum</i> Bl.
304	<i>G. zaylanicum</i> A. Jus
305	<i>Homonoia riparis</i> Lour.
306	<i>Macaranga balansae</i> Gagn.
307	<i>M. denticulata</i> (Bl.) Muell.-Arg
308	<i>M. henricorum</i> Hemsl.
309	<i>Mallotus apelta</i> Muell.-Arg.
310	<i>M. barbatus</i> Muell.-Arg.
311	<i>M. floribundus</i> (Bl.) Muell.-Arg
312	<i>M. macrostachyus</i> (Miq.) Muell.-Arg.
313	<i>M. paniculata</i> (Lamk.) Muell.-Arg.
314	<i>M. phillippensis</i> (Lamk.) Muell.-Arg.
315	<i>M. repandus</i> (Willd.) Muell.-Arg.
316	<i>M. tetracoccus</i> (Roxb.) kurz.
317	<i>Manihot esculanta</i> Crantz.
318	<i>Phyllanthus debilis</i> Klein ex Willd.
319	<i>P. emblica</i> L.
320	<i>P. reticulata</i> Poir.
321	<i>P. rubeus</i> Spreng.
322	<i>P. urinaria</i> L.
323	<i>Sapium discolor.</i> (Benth.) Muell.-Arg.
324	<i>S. rotundifolium</i> Hemsl.
325	<i>S. sebiferum</i> (L.) Roxb.
326	<i>Sauropus androgynus</i> (L.) Merr.
327	<i>Securinega vilosa</i> (Willd.) Pax & Hoffm.
56. Fabaceae	
Ceasalpinioideae	
328	<i>Bauhinia bracteata</i> (Benth.) Baker
329	<i>B. clemensiorum</i> Merr.
330	<i>B. curtisii</i> Prain.
331	<i>B. lakhonensis</i> Gagn.
332	<i>Bauhinia viridescens</i> Desv.
333	<i>B. hirsuta</i> Weimann.
334	<i>B. saccocalyx</i> Pierre.
335	<i>Caesalpinia bonduc</i> (L.) Roxb.
336	<i>C. latisilliqua</i> (Cav.) Hatt
337	<i>C. mimax</i> Hance
338	<i>C. mimosoides</i> Lamk.

339	<i>Cassia alrata</i> L.
340	<i>Dialium cochinchinensis</i> Pierre
341	<i>Erythrophleum fordii</i> Oliv
342	<i>Peltophorum dasyrrachis</i> (Miq.) Kurz.
343	<i>P. pterocarpum</i> (A.P.de Cand.) Back. ex Heyrne
344	<i>Saraca indica</i> L.
345	<i>Sindora tonkinensis</i> A. Chev. ex K. & S. S. Lars.
Mimosoideae	
346	<i>Acacia concinna</i> (Willd.) A. DC.
347	<i>Albizia chinensis</i> (Osb.) Merr.
348	<i>A. corniculata</i> (Lour.) Pruce
349	<i>A. lucidior</i> (Steud.) I. Niels.
350	<i>Archidendron balansae</i> (Oliv.) I. Niels.
351	<i>A. bauchei</i> . (Gagn.) I. Niels
352	<i>A. chevalieri</i> (Kost.) I. Niels.
353	<i>A. robinsonii</i> (Gagn.) I. Niels.
354	<i>Entada phaseoloides</i> (L.) Merr.
355	<i>Mimosa diplotricha</i> C. Wright ex Sauvalle
356	<i>M. pudica</i> L.
Papilionoideae	
357	<i>Arachis hypogea</i> L.
358	<i>Bowringia calicarpa</i> Champ.
359	<i>Crotalaria incana</i> L.
360	<i>C. bialata</i> Schrank
361	<i>Dalbergia entadoides</i> Pierre ex Gagn.
362	<i>D. polyadelpa</i> Prain.
363	<i>D. rimosa</i> Roxb.
364	<i>Deris acuminata</i> (Grah.) Benth.
365	<i>D. indica</i> Benn. Nim
366	<i>Desmodium pulchellum</i> (L.) Benth.
367	<i>D. triflorum</i> DC.
368	<i>D. zonantum</i> Miq.
369	<i>Erythrina fusca</i> Lour.
370	<i>E. variegata</i> L.
371	<i>Indigofera hirsuta</i> L.
372	<i>I. trifolia</i> L.
373	<i>Milletia ichthyotona</i> Drake
374	<i>M. ebehardtii</i> Gagn.
375	<i>Ormosia laosensis</i> Niyodham.
376	<i>Pueraria phaseoloides</i> (Roxb.) Benth.
377	<i>Tephrosia purpurea</i> (L.) Prers.
378	<i>Vigna radiata</i> (L.) Wilczek.
379	<i>V. unguiculata</i> (L.) Walp.
57. Fagaceae	
380	<i>Castanopsis armata</i> Spach.

381	<i>C. ceratacantha</i> Rehd. & Wils.
382	<i>C. dongchoensis</i> Hiek & Cam.
383	<i>C. indica</i> (Roxb.) A.D.C. in Seem.
384	<i>C. quangtriensis</i> Hick & Cam.
385	<i>C. teheponensis</i> Hick & Cam.
386	<i>C. nebulorum</i> A. Cam.
387	<i>Lithocarpus ahabdostachya</i> (Hick. & Cam.) A. Cam.
388	<i>L. dinhensis</i> (Hick. & Cam) Barn.
389	<i>L. fenestratus</i> (Roxb.) Rehd.
390	<i>L. microsperma</i> A. Cam.
391	<i>L. ailaoensis</i> A. Cam
392	<i>L. corneus</i> (Lour.) Rehd.
393	<i>L. haemispherica</i> (Drake) Cam.
394	<i>L. jacksoniana</i> A. Cam.
395	<i>L. pachylepis</i> A. Cam.
396	<i>Q. arbutifolia</i> Hick. & Cam.
397	<i>Q. bambusaefolia</i> Hance in Seem
398	<i>Q. gomeziana</i> A. Cam.
58. Flacourtiaceae	
399	<i>Casearia balansae</i> Gagn.
400	<i>C. gromerata</i> Roxb.
401	<i>C. membranacea</i> Hance.
402	<i>Flacourtia rukkam</i> Zoll. & Morr.
403	<i>Homalium ceylanicaum</i> (Gardn.) Benth.
404	<i>H. myrandrum</i> Merr.
405	<i>Hydnocarpus annamensis</i> (Gagn.) Lese. & Sleum.
406	<i>H. ilicifolia</i> King
407	<i>H. kurzii</i> (King) Warb.
59. Hamamelidaceae	
408	<i>Liquidambar formosana</i> Hance
409	<i>Rhodoleia championii</i> Hook.f.
410	<i>Symingtonia populnea</i> (Griff.) Steem.
60. Icacinacea	
411	<i>Gomphadra tetrandra</i> (Wall.) Sleum
412	<i>Iodes cirrhosa</i> Turcz
61. Jugladaceae	
413	<i>Engelhardia roxburghiana</i> Wall.
414	<i>E. spicata</i> Lesch. ex Bl.
415	<i>E. serrata</i> Bl.
416	<i>Pterocarya stenoptera</i> C. DC.
62. Lamiaceae	
417	<i>Coleus scutellaroides</i> (L.) Benth.
418	<i>Leucas aspera</i> (Willd.) Link
419	<i>Mentha quatica</i> L.
420	<i>Pogostemon auricularia</i> Phamhoang

421	<i>Orthosiphon spiralis</i> (Lour.) Merr.
422	<i>Perilla frutescens</i> (Thunb.) Hand.-Mazz.
423	<i>Salvia plebeia</i> R. Br.
63. Lauraceae	
424	<i>Alsecodaphne tonkinensis</i> Liouho
425	<i>Beilschmiedia ferruginea</i> Liouho
426	<i>Caryodapnopsis tonkinensis</i> (Lec.) A. Shaw
427	<i>Cassytha filiformis</i> L.
428	<i>Cinnamomum glaucescens</i> (Buch. Hamilt.) Drury
429	<i>C. scalarinervium</i> Kost
430	<i>C. parthenocylon</i> Meissn.
431	<i>C. bejolgota</i> (Buch.-Ham.) Sweet.
432	<i>C. camphora</i> (L.) J. S. Prest
433	<i>C. balansae</i> Lec.
434	<i>Cryptocarya annamensis</i> Allen.
435	<i>C. ferrea</i> Bl.
436	<i>C. petelotii</i> Kost.
437	<i>Dehaasia triandra</i> Merr.
438	<i>Ediandra rubescens</i> (Bl.) Mi
439	<i>Lindera chunii</i> Merr.
440	<i>Litsea balansae</i> Lec.
441	<i>L. cubeba</i> (Lour.) Pers.
442	<i>L. glutinosa</i> (Lour.) Rob.
443	<i>Machilus platycarpa</i> Chun.
444	<i>Neolitsea chunii</i> Merr.
445	<i>Persea velutina</i> (Champ.) Kost.
446	<i>Phoebe attenuata</i> Necc.
447	<i>P. shearereri</i> Gamble
64. Leaceae	
448	<i>Leea indica</i> (Burm.f.) Merr.
449	<i>L. thorelli</i> Gagn.
450	<i>L. manillensis</i> Walp.
451	<i>L. rubra</i> Bl. ex Spreng.
65. Lecythidaceae	
452	<i>Barringtonia acutangula</i> (L.) Gaertn.
453	<i>B. eberhardtii</i> Gagn.
454	<i>B. macrocarpa</i> Hassk.
66. Loganiaceae	
455	<i>Gelsemium elegans</i> (Gardn. & Champ.) Benth.
456	<i>Fagraea fragrans</i> Roxb.
457	<i>F. auriculata</i> Jack.
458	<i>Strychnos angustifolia</i> Benth.
459	<i>S. ignatii</i> Bergius
460	<i>S. ovata</i> Hill
461	<i>S. vanpruckii</i>

67. Loranthaceae	
462	<i>Dendrophthoe pentandra</i> (L.) Miq.
463	<i>Ginallia siamica</i> Crai
464	<i>Macrosolen robinsonii</i> (Gamble) Dance
465	<i>Taxillus chinensis</i> (DC.) Dance
466	<i>Viscum liquidambaricum</i> Hay
68. Lythraceae	
467	<i>Lagerstroemia ovalifolia</i> Teijsm & Binn.
468	<i>L. duperreana</i> Pierre ex Gagn.
469	<i>L. tomentosa</i> Presl.
69. Magnoliaceae	
470	<i>Michelia mediocris</i> Dandy
471	<i>M. faveolata</i> Merr. ex Dandy
472	<i>Paramichelia baillonii</i> (Pierre) Hu. kuidui
70. Malvaceae	
473	<i>Abemoschatus moschatus</i> Medicus
474	<i>Hibiscus grewiaefolius</i> Hassk.
475	<i>H. rosa-sinensis</i> L.
476	<i>H. surattensis</i> L.
477	<i>Sida cordifolia</i> L.
478	<i>S. ocuta</i> Burm.f.
479	<i>S. rhombifolia</i> L.
480	<i>Urena lobata</i> L.
71. Melastomataceae	
481	<i>Allomorpha subsessilis</i> Craib.
482	<i>Blastus borneensis</i> Cogn
483	<i>B. cochinchinensis</i> Lour.
484	<i>Medinilla assamica</i> (C. B. Cl.) Chen
485	<i>Melastoma bauchei</i> Guill.
486	<i>M. eberhartii</i> Guill.
487	<i>M. normale</i> D. Don
488	<i>Memecylon edule</i> Roxb.
489	<i>M. scutellatum</i> (Lour.) Naud.
490	<i>Osbeckia chinensis</i> L.
491	<i>O. stellata</i> Buch.-Ham ex D. Don
492	<i>Otanthera annamica</i> (Guill.) C. Hance
493	<i>Phyllagathis prostrata</i> C. Hance
494	<i>Pseudodissochaeta lanceolata</i> Nayar.
72. Meliaceae	
495	<i>Aglaiia annamensis</i> Pell.
496	<i>Amoora dasyclada</i> (How & Chen) C.V.Wu
497	<i>A. gigantea</i> Pierre
498	<i>A. oligosperma</i> (Pierre) Pell.
499	<i>Chukrasia tabularis</i> A. Jus.
500	<i>Cipadessa baccifera</i> Pell.

501	<i>Dysoxylum juglans</i> (Hance) Pell.
502	<i>Melia azedarach</i> . L.
503	<i>Sandoricum binectariferum</i> Hook.f.
73. Menispermaceae	
504	<i>Coscinium fenestratum</i> (Gagn.) Colebr.
505	<i>Diploclisia glaucescens</i> (Bl.) Diel
506	<i>Fibraurea tinctoria</i> Lour.
507	<i>Limacia scandens</i> Lour.
508	<i>Pycnarrhena poilanei</i> (Gagn.) Forman.
509	<i>Stephania japonica</i> (Thunb.) Miers.
510	<i>S. rotunda</i> Lour.
74. Moraceae	
511	<i>Artocarpus borneensis</i> Merr.
512	<i>A. melinoxyla</i> Gagn.
513	<i>A. nitida</i> Trec
514	<i>Broussonetia papyrifera</i> (L.) L` . Her ex Vent.
515	<i>Ficus altissima</i> Bl.
516	<i>F. auriculata</i> Lour.
517	<i>F. benjamina</i> L.
518	<i>F. fulva</i> Reinw. ex Bl.
519	<i>F. glaberrima</i> Bl.
520	<i>F. heterophylla</i> L.f.
521	<i>F. hispida</i> L.f.
522	<i>F. nervosa</i> Heyne ex Roth.
523	<i>F. pandurata</i> Hance
524	<i>F. pumila</i> L.
525	<i>F. subpyrifomis</i> Hook & Arn.
526	<i>F. sumatrana</i> Miq.
527	<i>F. vasculosa</i> Wall. ex Miq.
528	<i>F. virens</i> Ait.
529	<i>Maclura cochinchinensis</i> (Lour.) Corner.
530	<i>Pleicospermum andamanicum</i> King
531	<i>Streblus taxoides</i> (Heyne) Kurz.
532	<i>S. laxiflorus</i> (Hutch.) Corn.
533	<i>S. zeylanicus</i> (Thw) Kurz.
534	<i>Taxotrophis caudata</i> Hutch.
75. Myristicaceae	
535	<i>Horsfieldia thorelii</i> Lec.
536	<i>Knema elegans</i> Warb.
537	<i>K. erratica</i> (Hook.f.th) Sincl.
538	<i>K. globularia</i> (Lamk.) Warb.
76. Myrsinaceae	
539	<i>Ardisia colorata</i> Roxb.
540	<i>A. expansa</i> Pit.
541	<i>A. gigantifolia</i> Stapf.

542	<i>A. harmandii</i> Pierre
543	<i>A. lecomtei</i> Pit
544	<i>A. miniata</i> Pit
545	<i>A. quiquegona</i> Bl.
546	<i>A. racemosa</i> Mez.
547	<i>A. silvestris</i> Pit.
548	<i>A. stellifera</i> Pit
549	<i>A. tinctoria</i> Pit.
550	<i>A. aciphylla</i> Pit
551	<i>Embelia ribes</i> Burm.f.
552	<i>E. ferruginea</i> Wall.
553	<i>Maesa perlarius</i> (Lour.) Merr
554	<i>M. ramentacea</i> Wall.
555	<i>M. sinensis</i> A.DC.
556	<i>M. indica</i> Wall. in Roxb.
557	<i>M. membranacea</i> A.DC.
77. Myrtaceae	
558	<i>Cleistocalyx nervosum</i> DC.
559	<i>Psidium guajava</i> L.
560	<i>Rhodomyrtus tomentosa</i> (Ait.) Hacck.
561	<i>Syzygium abotivum</i> (Gagn.) Merr & Perry
562	<i>S. bullockii</i> (Hance) Merr. Perry
563	<i>S. levinii</i> (Merr.) Merr. & Perry
564	<i>S. oblatum</i> (Roxb.) A.M. & J.M Cowan
565	<i>S. polyanthum</i> (Wight.) Walp.
566	<i>S. jambos</i> (Gagn.) Merr & Perry
567	<i>S. zeylanicum</i> (L.) DC.
568	<i>S. wightianum</i> Wall.
78. Ochnaceae	
569	<i>Gomphia striata</i> (V. Tiegh.) C.F. Wei
570	<i>G. serrata</i> (Gaertn.) Kanis
571	<i>Ochna integerrimum</i> (Lour.) Merr.
79. Onagraceae	
572	<i>Ludwigia adscendens</i> (L.) Hara
573	<i>L. octovalvis</i> (Jacq.) Raven
574	<i>L. perennis</i> L.
80. Opiliaceae	
575	<i>Melientha suavis</i> Pierre
81. Oxalidaceae	
576	<i>Averrhoa calambola</i> L.
577	<i>Biophytum sensitivum</i> (Lour.) DC.
578	<i>Oxalis corymbosa</i> DC.
82. Passifloraceae	
579	<i>Passiflora foetida</i> L.
83. Piperaceae	

580	<i>Peperomia pullucida</i> Kunth.
581	Pipe betle L.
582	<i>P. lolot</i> . C. DC.
583	<i>P. nigrum</i> L.
584	<i>P. saxicola</i> C. DC.
84. Plantaginaceae	
585	<i>Plantago asiatica</i> L.
85. Polygalaceae	
586	<i>Polygala brachystachya</i> DC.
587	<i>P. erioptera</i> DC.
588	<i>P. laotica</i> Gagn.
589	<i>Solomonina cantoniensis</i> Lour.
590	<i>Xanthophyllum glaucum</i> Wall.
591	<i>X. silvestre</i> Gagn.
86. Polygonaceae	
592	<i>Polygonum barbatum</i> L.
593	<i>P. glabrum</i> Will.
594	<i>P. persicaria</i> Meissn.
595	<i>P. tomentosum</i> Willd.
87. Portulacaceae	
596	<i>Portulaca pilosa</i> L.
597	<i>P. oleracea</i> L.
88. Proteaceae	
598	<i>Helicia cochinchinensis</i> Lour.
599	<i>H. longepetiolata</i> Merr & Chun
600	<i>H. nilagirica</i> Bedd.
601	<i>H. obovatifolia</i> Merr. & Chunn.
602	<i>H. petiolaris</i> Benn.
603	<i>Heliciopsis terminalis</i> (Kurz.) Sleumer
89. Ranunculaceae	
604	<i>Anemone poilanei</i> Gagn.
605	<i>A. sumatrana</i> De Vriese
606	<i>Clematis chinensis</i> Retz.
607	<i>C. smilacifolia</i> Wall.
90. Rhamnaceae	
608	<i>Berchemia loureiriana</i> Lec.
609	<i>Gouania javanica</i> Miq.
610	<i>Sagerelia theezan</i> (L.) Brogn.
611	<i>Ventilago hermandiana</i> Pierre
612	<i>Zizyphus cambodiana</i> Pierre
613	<i>Z. oenoplia</i> (L.) Mill.
614	<i>Z. rugosus</i> Lamk.
615	<i>Z. maurantiana</i> Lamk.
91. Rhizophoraceae	
616	<i>Carallia brachiata</i> (Lour.) Merr.

617	<i>C. suffruticosa</i> Ridl.
92. Rosaceae	
618	<i>Photinia prunifolia</i> (H & A.) Lindl.
619	<i>Prunus arborea</i> (Hook.f.) Kalm.
620	<i>Raphiolepis indica</i> (L.) Lindl. ex ker.
621	<i>Rubus asper</i> Wall. ex Don
622	<i>R. cochinchinensis</i> Card.
623	<i>R. moluccanus</i> (Bl.) Kalm.
624	<i>R. multibracteatus</i> Levl. & Van
625	<i>R. niveus</i> Thunb.
626	<i>R. pavifolius</i> L.
93. Rubiaceae	
627	<i>Canthium grabrum</i> Bl.
628	<i>Fagerlindia depauperata</i> (Drake) Tirv.
629	<i>Gardenia angustifolia</i> (L.) Merr.
630	<i>Hedyotis biflora</i> (L.) Lam
631	<i>H. corymbosa</i> (L.) Lam
632	<i>H. diffusa</i> Willd.
633	<i>H. grandis</i> (Pit.)
634	<i>H. vestica</i> R. Br. ex G. Don
635	<i>Ixora chinensis</i> Lam.
636	<i>I. finlaysoniana</i> Wall.
637	<i>Lasianthus condorensis</i> Pierre ex Pit
638	<i>Morinda citifolia</i> L.
639	<i>Mussaenda aptera</i> Pit.
640	<i>M. cambodiana</i> Pierre.
641	<i>Neonauclea purpurea</i> (Roxb.) Merr
642	<i>Oxyceros vidalii</i> Tirw.
643	<i>Paederia scandens</i> (Lour.) Merr.
644	<i>Psychotria rubra</i> (Lour.) Poit.
645	<i>P. samentosa</i> Bl.
646	<i>Randia canthioides</i> Champ.
647	<i>R. spinosa</i> Bl.
648	<i>Saposma annamense</i> Pierre
649	<i>Uncaria homomalla</i> Miq
650	<i>Wendlandia paniculata</i> (Roxb.) DC
94. Rutaceae	
651	<i>Acronychia pedunculata</i> (L.) Miq.
652	<i>Atalantia sessiliflora</i> Guill.
653	<i>Citrus aurantifolia</i> (Chritm.) Sw.
654	<i>C. deliciosa</i> Ten
655	<i>C. grandis</i> (Lour.) Osb.
656	<i>C. limonia</i> Osb.
657	<i>C. nobilis</i> Lour
658	<i>Clausena indica</i> (Dez.) Oliv.

659	<i>Euodia lepta</i> (Spreng) Merr
660	<i>E. melifolia</i> Benth.
661	<i>Glycosmis cyanocarpa</i> (Bl.) Spr.
662	<i>G. ovoidae</i> Pierre
663	<i>G. sapindoides</i> Lindl ex Oliv
664	<i>Luvunga sarmentosa</i> (Bl.) Kurz
665	<i>Micromelum minutum</i> (Forst.) W.&A
666	<i>Murray paniculata</i> (L.) Jack
667	<i>Severinia monophylla</i> (L.) Tan
668	<i>Zanthoxylum aviceniae</i> (Lamk.) DC
669	<i>Z. nitidum</i> (Lamk.) DC
95. Sapindaceae	
670	<i>Amesiodendron chinense</i> (Merr.) Hu
671	<i>Arytera littoralis</i> Bl.
672	<i>Cardiospermum halicacabum</i> L.
673	<i>Dimocarpus fumatus</i> (Bl.) Leenh.
674	<i>D. longan</i> Lour.
675	<i>Litchi sinensis</i> Radlk.
676	<i>Mischocarpus poilanei</i> Gagn.
677	<i>Nephelium milliferum</i> Gagn.
678	<i>Paviesia annamensis</i> Pierre
679	<i>Pometia pinnata</i> J. R.& Forst.
96. Sapotaceae	
680	<i>Donella lanceolata</i> (Bl.) Aubr.
681	<i>Madhuca pasquieri</i> (Dub.) H.J.Lam
682	<i>Planchonella annamensis</i> Pierre ex Dub.
683	<i>Xantolis dongnaiensis</i> (Dub.) Aubr.
97. Schisandraceae	
684	<i>Kadsura roxburghiana</i> Arnott.
98. Simaroubaceae	
685	<i>Ailanthus triphysa</i> (Dennst.) Alst
686	<i>Brucea javanica</i> (L.) Merr.
687	<i>Eurycoma harmandiana</i> Pierre
688	<i>Harrisonia perforata</i> (Bl.) Merr
99. Smilacaceae	
689	<i>Smilax bauhinioides</i> Kunth.
690	<i>S. corbularia</i> Kunth.
691	<i>S. ganepainii</i> Koy.
692	<i>S. glabra</i> Roxb.
693	<i>S. lanceifolia</i> Roxb.
694	<i>S. paniculata</i> Gagn.
695	<i>S. riparia</i> A.&C.DC
100. Solanaceae	
696	<i>Capsicum frutescens</i> L.
697	<i>Physalis angulata</i> L.

698	<i>Solanum americanum</i> Midl.
699	<i>S. procumbens</i> Lour.
700	<i>S. torvum</i> Swartz.
701	<i>S. trilobatum</i> L.
702	<i>S. undatum</i> Poir.
703	<i>S. melogena</i> L.
704	<i>S. erianthum</i> D. Don
101. Sonneratiaceae	
705	<i>Duabanga grandiflora</i> (DC.) Walp.
102. Sterculiaceae	
706	<i>Byttneria pilosa</i> Roxb.
707	<i>B. andamensis</i> Kurz.
708	<i>Helicteres angustifolia</i> L.
709	<i>H. angustifolia</i> Pierre.
710	<i>H. hirsuta</i> Lour.
711	<i>H. viscida</i> Bl.
712	<i>Helitiera cochinchinensis</i> (Pierre) Kost.
713	<i>Pterospermum diversifolium</i> Bl.
714	<i>P. heterophyllum</i> . Hance
715	<i>P. truncatolobatum</i> Gagn.
716	<i>Sterculia alata</i> Roxb.
717	<i>S. hymenocalyx</i> K. Schum
718	<i>S. hyposticta</i> Miq.
719	<i>S. lanceolata</i> Cav.
103. Symplocaceae	
720	<i>Symplocos adenophylla</i> Wall. ex O. Don
721	<i>S. anomala</i> Brand.
722	<i>S. cochinchinensis</i> (Lour.) Nooteb.
723	<i>S. disepala</i> Guill.
724	<i>S. lanceolata</i> Sieb. & Zucc
725	<i>S. paniculata</i> (Thunb.) Druce
726	<i>S. pendula</i> Wight.
104. Theaceae	
727	<i>Adinandra annamensis</i> Gagn.
728	<i>A. rubropunctata</i> Merr. & Chun
729	<i>Camellia assimilis</i> Champ. ex Benth.
730	<i>C. dormoyana</i> (Pierr.) Senly
731	<i>C. sinensis</i> (L.) O. Ktze
732	<i>Eurya cerasifolia</i> (D. Don) Kob.
733	<i>E. annamensis</i> Gagn.
734	<i>E. cerasifolia</i> (D. Don.) Kob.
735	<i>E. tonkinensis</i> Gagn.
736	<i>Godonia tonkinensis</i> Pit.
737	<i>Pyrenaria poilaneana</i> Gagn.
738	<i>Schima wallichii</i> DC. Korth.

739	<i>Ternstroemia japonica</i> Thunb.
105. Thymeleaceae	
740	<i>Aquilaria crassna</i> Pierre ex Lec
741	<i>A. baillonii</i> Pierre. ex Lec.
742	<i>Wikstroemia poilanei</i> Leandri
106. Tiliaceae	
743	<i>Corchorus nestuans</i> L.
744	<i>Grewia bulot</i> Gagn.
745	<i>G. eberhardtii</i> H. Lec.
746	<i>G. paniculata</i> Roxb. ex DC
747	<i>Triumfetta pseudocana</i> Spragua & Craib.
748	<i>T. bactramia</i> L.
107. Ulmaceae	
749	<i>Gironniera cuspidata</i> (Bl.) Pl. ex Kurz.
750	<i>G. subequalis</i> Pl.
751	<i>G. orientalis</i> Thunb.
752	<i>Trema cannabina</i> Lour.
753	<i>T. orientalis</i> (L.) Bl.
108. Urticaceae	
754	<i>Boemeria tonkinensis</i> Gagn.
755	<i>Debregeasia squamata</i> King.f.
756	<i>Dendrocnide urentissima</i> (Gagn.) Chev.
757	<i>Elatostema cuneatum</i> Wight.
758	<i>E. dissectum</i> Wedd.
759	<i>Laportea interrupta</i> (Gauld.) Chew.
760	<i>L. thorelii</i> Gagn.
761	<i>Pellonia eberhardtii</i> Gagn.
762	<i>P. cristulata</i> Gagn.
763	<i>Poikilospermum suaveolens</i> (Bl.) Merr.
764	<i>Pouzolzia zeylanica</i> (L.) Benn.
765	<i>P. hirta</i> Hassk.
766	<i>Villebrunea tonkinensis</i> Gagn.
767	<i>V. frutescens</i> Bl.
109. Verbenaceae	
768	<i>Callicarpa acutidens</i> Schauer
769	<i>C. longifolia</i> Lam
770	<i>Clerodendrum cyrtophyllum</i> Turz
771	<i>C. paniculatum</i> L.
772	<i>C. schmidtii</i> C.B.Cl.
773	<i>Gmelia arborea</i> Roxb.
774	<i>G. asiatica</i> L.
775	<i>Lantana camara</i> L.
776	<i>Premna balansae</i> Dop.
777	<i>P. serratifolia</i> L.
778	<i>Tsoongia axillariflora</i> Merr.

779	<i>Vitex pierreana</i> P. Dop.
780	<i>V. sumatrana</i> King & Gamble
781	<i>V. negundo</i> L.
782	<i>V. trifolia</i> (O. Ktze) Mold
783	<i>Verbena officinalis</i> L.
110. Vitaceae	
784	<i>Ampelopsis annamensis</i> Gagn.
785	<i>A. cantiniensis</i> Planch.
786	<i>Cayratia palmata</i> Gagn.
787	<i>C. trifolia</i> (L.) Domino
788	<i>Cissus astrotricha</i> Gagn.
789	<i>C. hastata</i> Pl.
790	<i>C. hexangularis</i> Thor. ex Gagn.
791	<i>C. modeccoides</i> Pl.
792	<i>Vitis balanseana</i> Pl.
LILIOPSIDA (MONOCOTYLEDONES)	
111. Agavaceae -Họ Agao	
793	<i>Dracaena cochinchnensis</i> (Lour.) Merr.
794	<i>D. gracilis</i> Wall.
795	<i>D. cambodia</i> Pierre ex Gagn.
796	<i>Sansevieria hyacinthoides</i> (L.) Druce
112. Amaryllidaceae	
797	<i>Curculigo disticha</i> Gagn.
798	<i>C. gracilis</i> Wall.
113. Araceae	
799	<i>Acorus tatarinowi</i> Schott.
800	<i>Alocasia cuspidata</i> Engler.
801	<i>A. decumbens</i> Buchet.
802	<i>Amorphophyllus mekongensis</i> Engler. & Gegerm
803	<i>Homalonema occulta</i> (Lour.) Schott.
804	<i>Pothos augustifolius</i> Presl.
805	<i>P. gigantipes</i> Buchet
806	<i>P. repens</i> (Lour.) Druce
807	<i>P. scandens</i> L.
808	<i>P. yunanensis</i> Engler
809	<i>Raphidophora decursiva</i> (Roxb.) Schot.
114. Araceae	
810	<i>Arenga pinnata</i> (Wurmb.) Merr.
811	<i>Calamus poilanei</i> Conr.
812	<i>C. tetradactylus</i> Hance
813	<i>Caryota urens</i> L
814	<i>C. bacsonensis</i> Magalon
815	<i>Daemonorops pierreanus</i> Becc
816	<i>Licuala elegans</i> Magalon
817	<i>L. grandis</i> Wendl.

818	<i>L. radula</i> Gagn.
819	<i>Livistona tonkinensis</i> Magalon
820	<i>Pinanga duperreana</i> Pierre ex Gagn.
821	<i>Rhapis excelsa</i> (Thunb.) Henry ex. Rehd.
115. Bromeliaceae	
822	<i>Ananas comosus</i> (L.) Merr.
116. Commelinaceae	
823	<i>Amischolotus mollissima</i> (Bl.) Hassk.
824	<i>Commelina bengalensis</i> L.
825	<i>C. communis</i> L.
826	<i>Cyanotis axillaris</i> L.
827	<i>Dictyospermum ovalifolium</i> Wight
828	<i>Floscopa glabratus</i> Hassk
829	<i>F. scandens</i> Lour.
830	<i>Murdannia spectabilis</i> (Kurz) Faden
831	<i>M. spirata</i> (L.) Bruckner.
832	<i>Tradescantia discolor</i> L'Herit .
117. Costaceae	
833	<i>Costus speciosus</i> (Koenig ex Retz.) J. E. Smith.
118. Cyperaceae	
834	<i>Carex spatiosa</i> Boott
835	<i>Cyperus dubius</i> Rottb.
836	<i>C. halpan</i> L.
837	<i>C. rottundus</i> L.
838	<i>C. pumilus</i> L.
839	<i>C. trialatus</i> (Boeck) Kern
840	<i>Fimbristylis miliacea</i> (L.) Vahl.
841	<i>Kyllinga nemoralis</i> (J.R. & G.Forst) Dandy ex Hutch. & Dalz
842	<i>Scirpus juncooides</i> Roxb.
843	<i>S. massfeldianus</i> Kuk.
844	<i>S. siamensis</i> (C.B.Clarck.) Kern.
119. Dioscoreaceae	
845	<i>Dioscorea alata</i> L.
846	<i>D. cirrhosa</i> Prain. & Burk.
847	<i>D. glabra</i> Roxb.
120. Flagellariaceae	
848	<i>Flagellaria indica</i> L.
121. Hemodoraceae	
848	<i>Liriope spicata</i> Lour.
849	<i>Ophiopogon reptans</i> Hook.f.
850	<i>O. longifolius</i> Dene
851	<i>O. peliosanthoides</i> W & Arn.
122. Iridaceae	
852	<i>Belamcandra chinensis</i> (L) DC.
853	<i>Eleutheria bulbosa</i> (Mill.) Urban.

123. Liliaceae	
854	<i>Dianella nemorosa</i> Lam. ex Schiller.f
855	<i>Disporum trabeculatum</i> Gagn.
856	<i>Oligobotrya henryi</i> Bak.
857	<i>Paris polyphylla</i> Sm.
124. Maranthaceae	
858	<i>Calathea clossoni</i> Hort.
859	<i>Phrynium dispernum</i> Gagn.
125. Musaceae	
860	<i>Musa aucuminata</i> Colla.
126. Orchidaceae	
861	<i>Aerides falcata</i> Lindl.
862	<i>Agrostophyllum planicaule</i> (Lindl.) Reichb.f.
863	<i>Anoectochilus cetaceus</i> Blume
864	<i>A. lylei</i> Rolfe ex Downies
865	<i>Anoectochilus roxburghii</i> (Wall.) Lindl.
866	<i>Arundina graminifolia</i> (D.Don) Hochr.
867	<i>Bulbophyllum poilanei</i> Gagn.
868	<i>Calanthe triplicata</i> (Willem.) Ames.
869	<i>Coelogyne mooreana</i> Sander ex Rolfe
870	<i>Corymborkis veratrifolia</i> (Reinw.) Bl.
871	<i>Cymbidium banaense</i> Gagn.
872	<i>Dendrobium amabile</i> (Lour.) O'brien
873	<i>D. farmeri</i> Paxt.
874	<i>D. lindleyi</i> Steudel.
875	<i>D. parciflorum</i> Reichb.f.ex Lindl
876	<i>D. thysiflorum</i> Reichb.f.
877	<i>Eria amica</i> Reichb.f.f
878	<i>E. corneri</i> Reichb.f.
879	<i>Erythrorchis ochobiensis</i> (Hary.) Gray
880	<i>Herbenaria dentata</i> (Sw.) Schltr.
881	<i>H. viridiflora</i> (Sw.) R.Br.
882	<i>Paphiopedilum amabile</i> Hall. f.
883	<i>Podochilus intermedius</i> Aver.
884	<i>Renanthera coccinea</i> Lour.
885	<i>Rhynchostylis retusa</i> (L.) Bl.
886	<i>Trichotosia pulvinata</i> (Lindl.) Kraenzl.
127. Pandanaceae	
887	<i>Pandanus tonkinensis</i> Mart. ex Stone
888	<i>P. affinis</i> Kurz.
128. Poaceae	
889	<i>Bambusa balcoa</i> Roxb.
890	<i>B. blumeana</i> Schultes
891	<i>Centotheca lappacea</i> (L.) Desv.
892	<i>Chrysopogon aciculatus</i> (Retz) Trin

893	<i>Coix lacryma Jobi</i> L.
894	<i>Cynodon dactylon</i> (L.) Pers
895	<i>Dendrocalamus patellaris</i> Gamble
896	<i>D. sinuata</i> (Gamble) Holtt.
897	<i>Echinochloa colonum</i> (L.) Link
898	<i>Eleusine indica</i> (L.) Gaertn
899	<i>Erianthus arundinaceus</i> (Retz.) Jeswiet
900	<i>Imperata cylindrica</i> (L.) P.Beauv.
901	<i>Isachne dispa</i> Trin
902	<i>Miscanthus floridulus</i> (Labill.) Warb. ex Schum & Lauterb.
903	<i>Oryza sativa</i> L.
904	<i>Paspalum scrobiculatum</i> L.
905	<i>Phragmites vallatoria</i> (L.) Veldk.
906	<i>Saccharum officinarum</i> L.
907	<i>S. spontaneum</i> L.
908	<i>Setaria pumila</i> (Poir.) Roem. & Schult.
909	<i>Sinarundinaria griffithiana</i> (Munro) Chalo & Rens
910	<i>Thysanolaena maxima</i> (Roxb.) O. Ktze.
911	<i>Zea mays</i> L.
129. Stemonaceae	
912	<i>Stemona tuberosa</i> Lour.
130. Taccaceae	
913	<i>Tacca chantrieri</i> Andre
914	<i>T. plantaginea</i> (Hance) Drenth
915	<i>T. intergrifolia</i> Ker.-Gawl.
131. Zingiberaceae	
916	<i>Alpinia chinensis</i> (Retz.) Rosacoe
917	<i>Alpinia officina</i> Hance
918	<i>Catimbium bracteatum</i> Rox
919	<i>Globba pendula</i> Roxb.
920	<i>Hedychium stenopetalum</i> Lodd.

Appendix 2. Mammal species list for Bac Huong Hoa Nature Reserve

English Name	Scientific Name	2002 ¹	2004 ²	2005 ³	2006 ⁴
	Scandenta				
	Tupaiaidae				
Northern Treeshrew	<i>Tupaia belangeri</i>		O	X	
	Primates				
	Loricidae				
Slow Loris	<i>Nycticebus coucang</i>		I		
Pygmy Slow Loris	<i>Nycticebus pygmaeus</i>		I		O
	Cercopithecidae				
Stump-tailed Macaque	<i>Macaca arctoides</i>		O	X	O
Northern Pig Tailed Macaque	<i>Macaca leonina</i>				O
Rhesus Monkey	<i>Macaca mulatta</i>				O
Red-shanked Douc Langur	<i>Pygathrix nemaeus</i>	I	O	X	I
Hatinh Langur	<i>Trachypithecus hatinhensis</i>			X	I
	Hylobatidae				
Northern White-cheeked Gibbon	<i>Nomascus leucogenis</i>	I	I, Ca	X	I
	Rodentia				
	Sciuridae				
Black Giant Squirrel	<i>Ratufa bicolor</i>		I		
Indian Giant Flying Squirrel	<i>Petaurista philippensis</i>		I		O
Pallas's Squirrel	<i>Callosciurus erythraeus</i>		O	X	O
Asian Red-cheeked Squirrel	<i>Dremomys rufigenis</i>		O	X	O
Cambodian Striped Squirrel	<i>Tamiops rodolphii</i>		O	X	
	Muridae				
Indomalayan Bamboo Rat	<i>Rhizomys sumatrensis</i>		I, T	X	
Indomalayan Leopoldamys	<i>Leopoldamys sabanus</i>				
	Hystriidae				
Asiatic Brush-tailed Porcupine	<i>Atherurus macrourus</i>				O
Malayan Porcupine	<i>Hystrix brachyura</i>		R, T	X	O
	Lagomorpha				
	Leporidae				

English Name	Scientific Name	2002 ¹	2004 ²	2005 ³	2006 ⁴
Burmese Hare	<i>Lepus peguensis</i>		I		
Annamite Striped Rabbit	<i>Nesolagus timminsi</i>	O	O	X	O
	Manidae				
Sunda Pangolin	<i>Manis javanica</i>		I, R	X	O
	Carnivora				
	Felidae				
Asian Golden Cat	<i>Catopuma temminckii</i>		I		I
Leopard Cat	<i>Prionailurus bengalensis</i>		I, T	X	O
Clouded Leopard	<i>Neofelis nebulosa</i>		I		
Leopard	<i>Panthera pardus</i>		I		
	Viverridae				
Binturong	<i>Arctictis binturong</i>		I		O
Masked Palm Civet	<i>Paguma larvata</i>		I, Dr	X	O
Common Palm Civet	<i>Paradoxurus hermaphroditus</i>				O
Spotted Linsang	<i>Prionodon pardicolor</i>				O
Large Indian Civet	<i>Viverra zibetha</i>		Dr, T	X	I
Small Indian Civet	<i>Viverricula indica</i>		R	X	O
	Canidae				
Dhole	<i>Cuon alpinus</i>		I		
	Ursidae				
Sun Bear	<i>Helarctos malayanus</i>		I		I
Asian Black Bear	<i>Ursus thibetanus</i>		I, T	X	I
	Mustelidae				
Oriental Small-clawed Otter	<i>Aonyx cinereus</i>		I, T	X	
European Otter	<i>Lutra lutra</i>		I		
Hog Badger	<i>Arctonyx collaris</i>		T, Dr	X	
Yellow-throated Martin	<i>Martes flavigula</i>		I		
	Artiodactyla				
	Suidae				
Wild Boar	<i>Sus scrofa</i>	I	T, I	X	O
	Tragulidae				
Lesser Mouse-deer	<i>Tragulus kanchil</i>		I		
	Cervidae				
Red Muntjac	<i>Muntiacus muntjak</i>	I	T, I	X	O
Large-antlered Muntjac	<i>Muntiacus vuquangensis</i>		T, R	X	O
Sambar	<i>Cervus unicolor</i>	I	T, Dr	X	O
	Bovidae				
Gaur	<i>Bos frontalis</i>		O	X	O

English Name	Scientific Name	2002 ¹	2004 ²	2005 ³	2006 ⁴
Saola	<i>Pseudoryx nghetinhensis</i>	I	I, R	X	I
Chinese Serow	<i>Capricornis sumatraensis</i>	I	Dr, T	X	O

¹Le Manh Hung *et al.* 2002

²Dang Ngoc Can 2004

³Surveys by Le Trong Trai 2005

⁴Dang Ngoc Can *et al.* 2006

Records are coded as follows: O = field observation; R = specimen or parts of specimen recorded; C = heard only; T = tracks recorded only (footprints, droppings, scratch marks); I = Interview.

Appendix 3. Bird species list for Bac Huong Hoa Nature Reserve

Scientific Name	Common Name	2004 ¹	2005 ²	<i>In prep.</i> ³
Galliformes				
Phasianidae				
<i>Francolinus pintadeanus</i>	Chinese Francolin	X	X	X
<i>Arborophila brunneopectus</i>	Bar-backed Partridge		X	X
<i>A. chloropus</i>	Scaly-breasted Partridge	X	X	X
<i>A. charltonii</i>	Chestnut-necklaced Partridge		X	
<i>Gallus gallus</i>	Red Junglefowl	X	X	X
<i>Lophura nycthemera</i>	Silver Pheasant	[X]	X	X
<i>L. edwardsi</i>	Edward's Pheasant		[X]	
<i>L. diardi</i>	Siamese Fireback	[X]	[X]	X
<i>Polyplectron bicalcaratum</i>	Grey Peacock Pheasant	X	X	X
<i>Rheinardia ocellata</i>	Crested Argus	[X]	[X]	X
Ardeidae				
<i>Ixobrychus sinensis</i>	Yellow Bittern	X	X	X
<i>Dupetor flavicollis</i>	Black Bittern	X	X	X
<i>Butorides striata</i>	Striated Heron		X	X
<i>Ardeola bacchus</i>	Chinese Pond-heron		X	
Falconidae				
<i>Microhierax melanoleucos</i>	Pied Falconet		X	X
Accipitridae				
<i>Pernis ptilorhynchus</i>	Oriental Honey Buzzard	X	X	X
<i>Ichthyophaga humilis</i>	Lesser Fish Eagle	X	X	X
<i>Spilornis cheela</i>	Crested Serpent Eagle	X	X	X
<i>Accipiter trivirgatus</i>	Crested Goshawk	X	X	X
<i>A. badius</i>	Shikra	X	X	X
<i>A. gularis</i>	Japanese Sparrowhawk			X
<i>Butastur indicus</i>	Grey-faced Buzzard	X	X	X
<i>Ictinaetus malayensis</i>	Black Eagle	X	X	X
<i>Hieraaetus kienerii</i>	Rufous-bellied Eagle			X
<i>S. nipalensis</i>	Mountain Hawk Eagle			X
Gruiformes				
Rallidae				
<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	X	X	X
Turniciformes				
Turnicidae				
<i>Turnix suscitator</i>	Barred Buttonquail			X
Ciconiiformes				
Scolopacidae				
<i>Scolopax rusticola</i>	Eurasian Woodcock	X	X	X
Columbiformes				

Scientific Name	Common Name	2004 ¹	2005 ²	In prep. ³
Columbidae				
<i>Streptopelia tranquebarica</i>	Red Collared-dove		X	
<i>Streptopelia orientalis</i>	Oriental Turtle-dove		X	
<i>Streptopelia chinensis</i>	Spotted Dove	X	X	X
<i>Chalcophaps indica</i>	Emerald Dove	X	X	X
<i>Macropygia unchall</i>	Barred Cuckoo-dove		X	
<i>Treron bicinctus</i>	Orange-breasted Green Pigeon			X
<i>Treron curvirostra</i>	Thick-billed Green-pigeon		X	
<i>Treron apicauda</i>	Pin-tailed Green Pigeon		X	
<i>Ducula badia</i>	Mountain Imperial-pigeon		X	X
Psittaciformes				
Psittacidae				
<i>Loriculus vernalis</i>	Vernal Hanging-parrot		X	
Cuculiformes				
Cuculidae				
<i>Cuculus sparveroides</i>	Large Hawk Cuckoo		X	
<i>Cuculus micropterus</i>	Indian Cuckoo		X	
<i>Cacomantis merulinus</i>	Plaintive Cuckoo	X	X	X
<i>Surniculus lugubris</i>	Drongo Cuckoo		X	X
<i>Eudynamys scolopaceus</i>	Asian Koel		X	
<i>Phaenicophaeus tristis</i>	Green-billed Malkoha	X	X	X
<i>Carproccocyx renauldi</i>	Coral-billed Ground-cuckoo		X	
Centropodidae				
<i>Centropus sinensis</i>	Greater Coucal	X	X	X
<i>C. bengalensis</i>	Lesser Coucal	X	X	X
Strigiformes				
Strigidae				
<i>Otus spilocephalus</i>	Mountain Scops Owl	X	X	X
<i>O. bakkamoena</i>	Collared Scops Owl		X	X
<i>Glaucidium brodiei</i>	Collared Owlet		X	X
<i>G. cuculoides</i>	Asian Barred Owlet		X	X
Apodiformes				
Apodidae				
<i>Hirundapus cochinchinensis</i>	Silver-backed Needletail	X	X	X
<i>Cypsiurus balasiensis</i>	Asian Palm Swift	X	X	X
<i>Apus affinis</i>	House Swift		X	X
Trogoniformes				
Trogonidae				
<i>Harpactes erythrocephalus</i>	Red-headed Trogon	X	X	X
Coraciiformes				
Coraciidae				

Scientific Name	Common Name	2004 ¹	2005 ²	<i>In prep.</i> ³
<i>Eurystomas orientalis</i>	Asian Dollarbird		X	
Halcyonidae				
<i>Halycon coromanda</i>	Ruddy Kingfisher		X	
<i>Halcyon smyrnensis</i>	White-throated Kingfisher	X	X	X
Alcedinidae				
<i>Ceyx erythacus</i>	Black-backed Kingfisher	X	X	X
<i>Alcedo hercules</i>	Blyth's Kingfisher	X	X	X
<i>Alcedo atthis</i>	Common Kingfisher	X	X	X
Cerylidae				
<i>Megaceryle lugubris</i>	Crested Kingfisher		X	
Meropidae				
<i>Nyctyornis athertoni</i>	Blue-bearded Bee-eater		X	X
<i>Merops philippinus</i>	Blue-tailed Bee-eater		X	
<i>Anorrhinus austeni</i>	Brown Hornbill		X	X
<i>Anthracoceros albirostris</i>	Oriental Pied Hornbill	X	X	X
<i>Buceros bicornis</i>	Great Hornbill	[X]	X	X
Megalaimidae				
<i>Megalaima lagrandieri</i>	Red-vented Barbet	X	X	
<i>M. lineata</i>	Lineated Barbet	X		
<i>M. faiostriata</i>	Green-eared barbet		X	
<i>M. franklinii</i>	Golden-throated Barbet	X	X	
Piciformes				
Picidae				
<i>Picumnus innominatus</i>	Speckled Piculet		X	X
<i>Sasia ochracea</i>	White-browed Piculet		X	X
<i>Celeus brachyurus</i>	Rufous Woodpecker			X
<i>Picus chlorolophus</i>	Lesser Yellownape		X	
<i>Picus flavinucha</i>	Greater Yellownape	X	X	X
<i>Picus rabieri</i>	Red-collared Woodpecker	X	X	X
<i>Blythipicus pyrrhotis</i>	Bay Woodpecker		X	X
Eurylamyidae				
<i>Psarisomus dalhousiae</i>	Long-tailed Broadbill	X	X	X
<i>Serilophus lunatus</i>	Silver-breasted Broadbill		X	X
Passeriformes				
Pittidae				
<i>Pitta soror</i>	Blue-rumped Pitta		X	X
<i>P. elliotii</i>	Bar-bellied Pitta		X	X
Artamidae				
<i>Artamus fuscus</i>	Ashy Woodswallow	X	X	X
Aegithinidae				
<i>Aegithina lafresnayeii</i>	Great Iora		X	

Scientific Name	Common Name	2004 ¹	2005 ²	<i>In prep.</i> ³
Prionopidae				
<i>Tephrodornis gularis</i>	Large Woodshrike		X	
Campephagidae				
<i>Coracina macei</i>	Large Cuckooshrike		X	X
<i>C. melaschistos</i>	Black-winged Cuckooshrike		X	
<i>Pericrocotus divaricatus</i>	Ashy Minivet		X	
<i>Pericrocotus flammeus</i>	Scarlet Minivet	X	X	X
<i>Hemipus picatus</i>	Bar-winged Flycatcher-shrike		X	
Laniidae				
<i>Lanius schach</i>	Long-tailed Shrike	X	X	X
Monarchidae				
<i>Hypothymis azurea</i>	Black-naped Monarch		X	X
<i>Terpsiphone paradise</i>	Asian Paradise-flycatcher		X	
Oriolidae				
<i>Oriolus traillii</i>	Maroon Oriole		X	X
Dicruidae				
<i>Dicrurus macrocercus</i>	Black Drongo	X	X	X
<i>D. leucophaeus</i>	Ashy Drongo	X	X	X
<i>D. annectans</i>	Crow-billed Drongo	X	X	X
<i>D. aeneus</i>	Bronzed Drongo		X	
<i>D. remifer</i>	Lesser Racket-tailed Drongo	X	X	X
<i>D. hottentus</i>	Hair-crested Drongo		X	
<i>D. paradiseus</i>	Greater Racket-tailed Drongo	X	X	X
Rhiphiduridae				
<i>Rhipidura albicollis</i>	White-throated Fantail		X	
Corvidae				
<i>Urocissa whiteheadi</i>	White-winged Magpie		X	X
<i>Cissa hypoleuca</i>	Yellow-breasted Magpie		X	X
<i>Crypsirina temia</i>	Racket-tailed Treepie	X	X	
<i>Temnurus temnurus</i>	Ratchet-tailed Treepie	X	X	X
<i>Corvus macrohynchos</i>	Large-billed Crow		X	X
Paridae				
<i>Melanochlora sultanea</i>	Sultan Tit	X	X	X
Hirundinidae				
<i>Hirundo rustica</i>	Barn Swallow			X
<i>H. daurica</i>	Red-rumped Swallow		X	X
<i>Delichon dasypus</i>	Asian House Martin			X
Cisticolidae				
<i>Prinia flaviventris</i>	Yellow-bellied Prinia		X	

Scientific Name	Common Name	2004 ¹	2005 ²	In prep. ³
<i>P. inornata</i>	Plain Prinia			X
Pycnonotidae				
<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	X	X	X
<i>P. aurigaster</i>	Sooty-headed Bulbul	X	X	X
<i>Iole propinqua</i>	Grey-eyed Bulbul		X	
<i>Alophoixus pallidus</i>	Puff-throated Bulbul	X	X	X
<i>Hypsipetes mccllellandii</i>	Mountain Bulbul			X
<i>H. leucocephalus</i>	Asian Black Bulbul		X	
Sylviidae				
<i>Orthotomus sutorius</i>	Common Tailorbird	X	X	X
<i>O. atrogularis</i>	Dark-necked Tailorbird	X	X	X
Sylviidae				
<i>Urosphena squameiceps</i>	Asian Stubtail			X
<i>Phylloscopus armandii</i>	Yellow-streaked Warbler			X
<i>P. inornatus</i>	Inornate Warbler			X
<i>P. borealis</i>	Arctic Warbler		X	
<i>P. reguloides</i>	Southern Blyth's Leaf-warbler			X
<i>Abroscopus affinis</i>	White-spectacled Warbler		X	X
<i>A. superciliaris</i>	Yellow-bellied Warbler			X
Timaliidae				
<i>Pellorheum albiventris</i>	Spot-throated Babbler		X	
<i>P. ruficeps</i>	Puff-throated Babbler		X	
<i>Trichostoma tickelli</i>	Buff-breasted Babbler		X	X
<i>Malacopteron cinereum</i>	Scaly-crowned Babbler		X	X
<i>Pomatorhinus hypoleucos</i>	Large Scimitar Babbler		X	X
<i>P. schisticeps</i>	White-browed Scimitar-babbler		X	
<i>P. ruficollis</i>	Streak-breasted Scimitar Babbler			X
<i>P. ocharaciceps</i>	Red-billed Scimitar Babber			X
<i>Jabouilleia danjoui</i>	Short-tailed Scimitar-babbler		X	
<i>Napothera brevicaudata</i>	Streaked Wren-babbler		X	
<i>N. epilepidota</i>	Eyebrowed Wren-babbler		X	
<i>Stachyris ruficeps</i>	Rufous-capped Babbler		X	
<i>S. chrysea</i>	Golden Babbler		X	X
<i>S. nigriceps</i>	Grey-throated Babbler		X	X
<i>Stachyris striolata</i>	Spot-necked Babbler	X	X	
<i>Macronous gularis</i>	Pin-striped Tit Babbler	X	X	X
<i>Macronous kelleyi</i>	Grey-faced Tit-babbler		X	
<i>Timalia pileata</i>	Chestnut-capped Babbler	X		X
<i>Garrulax leucolophus</i>	White-crested	X	X	X

Scientific Name	Common Name	2004 ¹	2005 ²	In prep. ³
	Laughingthrush			
<i>G. monileger</i>	Lesser Necklaced Laughingthrush	X	X	X
<i>G. castanotis</i>	Rufous-cheeked Laughingthrush		X	X
<i>G. chinensis</i>	Black-throated Laughingthrush	X	X	X
<i>G. vassali</i>	White-cheeked Laughingthrush	X	X	X
<i>Pteruthius flaviscapis</i>	White-browed Shrike-babbler			X
<i>P. melanotis</i>	Black-eared Shrike-babbler			X
<i>Gampsorhynchus torquatus</i>	Collared Babbler			X
<i>Minla cyanouroptera</i>	Blue-winged Minla			X
<i>Alcippe peracensis</i>	Mountain Fulvetta		X	
<i>Alcippe grotei</i>	Black-browed Fulvetta			X
<i>Alcippe morrisonia</i>	Grey-cheeked Fulvetta	X	X	X
<i>Yuhina zantholeuca</i>	White-bellied Yuhina	X	X	X
Zosteropidae				
<i>Zosterops palpebrosus</i>	Oriental White-eye		X	
Irenidae				
<i>Irena puella</i>	Asian Fairy Bluebird	X	X	X
Sittidae				
<i>Sitta frontalis</i>	Velvet-fronted Nuthatch			X
Sturnidae				
<i>Gracula religiosa</i>	Hill Myna		X	X
<i>Acridotheres tristis</i>	Common Myna		X	X
<i>A. cinereus</i>	White-vented Myna	X	X	X
<i>A. cristatellus</i>	Crested Myna	X	X	X
<i>S. sinensis</i>	White-shouldered Starling			X
<i>Sturnus nigricollis</i>	Black-collared Starling	X	X	X
Muscicapidae				
<i>Myophonus caeruleus</i>	Blue Whistling Thrush	X	X	X
<i>Luscinia sibilans</i>	Rufous-tailed Robin			X
<i>Tarsiger cyanurus</i>	Orange-flanked Bush Robin			X
<i>Copsychus saularis</i>	Oriental Magpie Robin	X	X	X
<i>C. malabaricus</i>	White-rumped Shama		X	
<i>Enicurus schistaceus</i>	Slaty-backed Forktail	X	X	X
<i>Enicurus leschenaulti</i>	White-crowned Forktail		X	X
<i>Saxicola torquatus</i>	Common Stonechat		X	
<i>Saxicola ferrea</i>	Grey Bushchat			X
<i>Monticola solitarius</i>	Blue Rock-thrush		X	X

Scientific Name	Common Name	2004 ¹	2005 ²	<i>In prep.</i> ³
<i>Muscicapa daurica</i>	Asian Brown Flycatcher	X	X	X
<i>Ficedula mugimaki</i>	Mugimaki Flycatcher			X
<i>F. parva</i>	Red-breasted Flycatcher		X	
<i>F. monileger</i>	White-gorgeted Flycatcher		X	X
<i>Eumyias thalassina</i>	Verditer Flycatcher			X
<i>Cyornis concretus</i>	White-tailed Flycatcher		X	
<i>C. hainanus</i>	Hainan Blue-flycatcher		X	
<i>C. banyumas</i>	Hill Blue-flycatcher		X	
<i>Culicicapa ceylonensis</i>	Grey-headed Canary Flycatcher	X	X	
Chloropseidae				
<i>Chloropsis cochinchinensis</i>	Blue-winged Leafbird	X	X	X
<i>C. hardwickii</i>	Orange-bellied Leafbird		X	X
Nectariniidae				
<i>D. concolor</i>	Plain Flowerpecker		X	
<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker			X
<i>Hypogramma hypogrammicum</i>	Purple-naped Sunbird		X	
<i>Nectarinia jugularis</i>	Olive-backed Sunbird		X	X
<i>Aethopyga gouldiae</i>	Gould's Sunbird			X
<i>A. christinae</i>	Fork-tailed Sunbird		X	X
<i>A. saturata</i>	Black-throated Sunbird			X
<i>Aethopyga siparaja</i>	Crimson Sunbird			X
<i>Arachnothera longirostra</i>	Little Spiderhunter	X	X	X
<i>A. magna</i>	Streaked Spiderhunter	X	X	X
Passeridae				
<i>Passer montanus</i>	Eurasian Tree Sparrow	X	X	X
Estrilidae				
<i>Lonchura striata</i>	White-rumped Munia		X	
Motacillidae				
<i>Motacilla alba</i>	White Wagtail	X	X	X
<i>M. cinerea</i>	Grey Wagtail	X	X	X
<i>Anthus richardi</i>	Richard's Pipit		X	X
<i>A. hodgsoni</i>	Olive-backed Pipit		X	

Note: records in brackets are not seen or heard, but only from interviews and traded parts

¹ Nguyen Cu and Le Manh Hung (2004)

² Anon (2006) Combined list of birds listed by Nguyen Cu and Le Manh Hung (2004) and those recorded on surveys conducted by Le Trong Trai in 2005

³ Listed by Le Manh Hung *et al. in prep.*

Appendix 4. Reptile and Amphibean species list for Bac Huong Hoa Nature Reserve

Scientific Name	English Name	2006 ¹	2007 ²
Amphibia			
Anura			
Megophryidae			
<i>Brachytarsophrys intermedia</i> (Smith, 1921)	Annam Spadefoot Toad		X
Rhacophoridae			
<i>Philautus truongsoneis</i> (Orlov, 2005)			
<i>Rhacophorus nigropalmatus</i> (Boulenger, 1895)	Wallace's Flying Frog		X
Reptilia			
Squamata			
Gekkonidae			
<i>Gekko gecko</i> (Linnaeus, 1758)	Tokay		X
<i>Hemidactylus frenatus</i> (Schlegel, in D. Et) Bib.,	Spiny-tailed House Gecko		X
Agamidae			
<i>Calotes emma</i> (Gray, 1845)	Emma Lizard		X
<i>Physignathus cocincinus</i> (Cuvier, 1829)	Indochinese Water Dragon	X	X
Scincidae			
<i>Emoia laobaoensis</i>	Laobao Skink		X
<i>Mabuya multifasciata</i> (Kuhl, 1820)	Flower Skink		X
<i>Mabuya macularia</i> (Blyth, 1853)	Spotted Skink		X
Varanidae			
<i>Varanus salvator</i> (Laurenti, 1768)	Water Monitor	X	
Boidae			
<i>Python molurus</i> (Linnaeus, 1758)	Burmese Python	X	
Colubridae			
<i>Dryocalamus davisoni</i> (Blanford, 1878)	David Snake		X
<i>Enhydryis plumbea</i> (Boie, 1827)	Chinese Water Snake		X
<i>Oligodon cyclurus</i> (Cantor, 1839)	Long-tailed Kukri Snake		X
<i>Ptyas korros</i> (Schlegel, 1837)	Indochinese Rat Snake	X	
<i>Ptyas mucosus</i>	Common Rat Snake	X	
<i>Elaphe radiata</i>	Radiated Rat Snake	X	
<i>Rhabdophis subminiatus</i> (Schlegel, 1837)	Green Keelback		X
<i>Xenochrophis piscator</i> (Schneider, 1799)	Black Water Snake		X
Elapidae			
<i>Bungarus fasciatus</i> (Schneider, 1801)	Banded Krait	X	
<i>Calliophis macclellandi</i> (Reinhardt, 1884)	Common Leaf Snake		X
<i>Naja naja</i> (Linnaeus, 1758)	Indochinese Cobra	X	
<i>Ophiophagus hannah</i> (Cantor, 1836)	King Cobra	X	
Testudinata			
Emydidae			
<i>Cuora galbinifrons</i> (Bourret, 1939)	Indochinese Box Turtle	X	

Scientific Name	English Name	2006 ¹	2007 ²
<i>Cuora trifasciata</i> (Bell, 1825)	Chinese Three-striped Box	X	
<i>Pyxhidea mouhoti</i> (Gray, 1862)	Keeled Box Turtle	X	
<i>Sacalia quadriocellata</i> (Siebenrock, 1903)	Four-eyed Turtle	X	X

¹Dang Ngoc Can *et al.* (2006)

²Cao Tien Trung *in prep.*

